

FALL  
EDITION

CITIZENS

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# Radio Call Book Magazine

and Scientific Digest



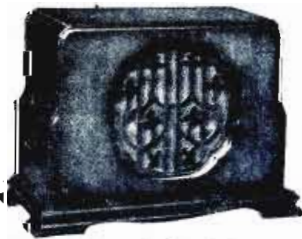
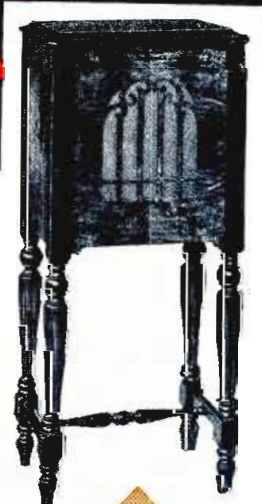
RADIO-TELEVISION-MECHANICS

# MAGNAVOX *Dynamic* SPEAKERS



### *Aristocrat Model*

Beautiful butt burl walnut cabinet finished in two tones.  
For A-Battery Operation . . . \$70  
For AC Operation . . . . . \$85



### *Beverly Model*

Gracefully proportioned cabinet finished in light mahogany.  
For A-Battery Operation . . . \$55  
For AC Operation . . . . . \$70

Other floor and table models up to \$175.  
Units only; DC \$35; AC \$50.



*Dynamic realism* is radio's newly acknowledged refinement . . . originally sponsored by Magnavox. Every tone rich, full and vivid . . . over entire audible range. A cascade of volume . . . without distortion. America's finest radio sets are made with Magnavox Speakers as built-in equipment.

**THE MAGNAVOX COMPANY**

Oakland, California Chicago, Illinois

# 7

*Reasons why*  
**YOU**  
*should use*  
**CECO**  
**TUBES**

- 1 Because the exclusive process of evacuation results in a more sensitive, clearer and longer life tube.
- 2 Because they make any Radio set perform better giving greater clarity in reproduction, a marked increase in sensitivity (so noticeable on distance reception) and better volume.
- 3 Because many inspection tests assure absolute uniformity.
- 4 Because the leading Radio experts use and endorse them.
- 5 Because you can secure "special purpose tubes" from CeCo not obtainable elsewhere.
- 6 Because there is a CeCo Tube for every Radio set. There are millions in use.
- 7 Because they are made by the largest exclusive Radio Tube Manufacturers in the world.

# LONGER LIFE



**RMA**

PRONOUNCED  
**SEE - CO**

# Radio Tubes

**W**HEN you install a set of CeCo Tubes in your Radio, you will immediately notice a greater clarity of reproduction, a marked increase in sensitivity (so noticeable on distance reception) and better volume, but your greatest satisfaction will be in the longer life they give, making them truly the most economical tubes to buy. These outstanding features are characteristics of all CeCo Tubes both in the A.C. and battery types and are partially due to the exclusive method of evacuation.

With these tubes (the heart of your Radio) there is no substitute for quality—it pays to buy proven performance as demonstrated by CeCo Radio Tubes.

*Write for a copy of our booklet  
"Getting the Most Out of Your  
Radio." CeCo Tubes are for sale  
by the best dealers everywhere.*

**CeCo MANUFACTURING COMPANY, Inc.**  
702 Eddy Street, Providence, R. I.

# Aluminum Contributes to Radio

## —Lightness, Beauty, Finer Results

**M**ANUFACTURERS of the finest sets are using Aluminum in constantly increasing quantities. Their tests have demonstrated that Aluminum is the *one* metal that most efficiently meets the widely differing conditions encountered in radio design.

Its lightness; its permanent beauty; the fact that it does not rust or corrode; its high electrical conductivity; its efficient shielding quality; its "workability"—all are advantages that combine to make Aluminum the ideal metal for radio.

**I**N many of the most advanced receiving sets Aluminum Shields are used to achieve better tone quality, greater selectivity, closer tuning—in short, finer reception.

Aluminum shielding reduces interference. It eliminates electrostatic and electro-magnetic interaction between various stages of radio-frequency amplification. It eliminates modulation of radio frequency stages by feed-back from audio-fre-

quency amplifier. It makes possible more compact design.

Aluminum performs these functions efficiently and adds less to the weight of the set than any substitute metal. Moreover, it is easily worked into special shield shapes—cans, boxes or casings. Thus it presents few limitations of size and shape.

It allows the engineer great freedom to design his shielding to meet, ideally, the various requirements of his set.

**A**LUMINUM is widely used for variable condenser blades. Aluminum Company of America produces special sheet Aluminum for this purpose that is accurate and uniform beyond anything hitherto attained. Gauge tolerance in thickness is  $\pm .001$  inch and the *total* variation within one sheet is limited to .0005 inch.

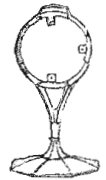
Aluminum Company of America also makes finished condenser blades from this highly accurate and uniform sheet.

**T**HE leading manufacturers of foil and paper fixed condensers now use Aluminum foil because of its high electrical conductivity and its great covering area (a pound of Aluminum foil .0003 inch thick covers 34,000 square inches). Terminals can readily be soldered to Aluminum foil condensers by a process recently developed by Aluminum Company of America.



**A**LUMAC Die Castings of Alcoa Aluminum combine lightness, strength, accuracy and high conductivity. They have equal strength with *less than half the weight* of other casting materials. They are used with complete success for loud speaker frames and bases, condensers and condenser frames, drum dials, chasses—and even for cabinets.

There is a fund of information on the use of Aluminum in radio, and on radio in general, in the new edition of "Aluminum for Radio." Your copy of this interesting book will be mailed on request.



## ALUMINUM COMPANY OF AMERICA

ALUMINUM IN EVERY  COMMERCIAL FORM  
2465 Oliver Building  Pittsburgh, Pa.

# ALUMINUM

## *The mark of Quality in Radio*

# Another huge achievement by FROST-RADIO

Frost-Radio has scored another of its characteristic achievements in bringing out a number of new items to supplement its already famous line of parts. Frost now offers the finest and most complete line of radio parts of any manufacturer in the

field. Whether you build sets for yourself or for others you will find in this great line practically all of the vital and important parts you require. Your favorite dealer can supply you. Why not get in touch with him today?



**Frost-Radio Variable High Resistances**

Offer marvelous control of volume and oscillation. Roller contact arm is practically frictionless. Bakelite case and dust cover. \$2.00 and \$2.25.



**Equipped with Approved AC Switch**

Underscriven approved AC snap switch fitted to our Variable High Resistance makes ideal combination. Switch is tested to carry 250 volts at 3 amp. \$2.75 and \$3.00.



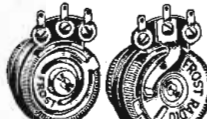
**Frost-Radio Variable High Resistance with DC Switch**

Another combination of the Frost Variable High Resistance with quick-operating switch having positive "off" position, for use only with battery operated sets. Switch has sterling silver contacts, and Bakelite insulation is used. \$2.35.



**Frost Gem Variable High Resistance**

Identical with our larger Resistance Units except in size. The Gem is housed in Bakelite case measuring 1 1/2 x 1/2 in. \$2.25 and \$2.50.



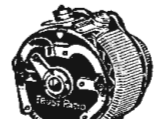
**Frost-Radio Gem Rheostats**

Mighty good little rheostats, built to give long service and stand the gaff. Take up but little space, are single hole mounting and are easy to solder to. Supplied plain or with DC switch. Plain type, 75c. With switch, \$1.00.



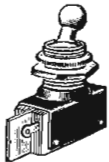
**Frost-Radio Bakelite Rheostats**

The original air-cooled Bakelite rheostat with one-piece molded frame and resistance wire wound on threaded flexible Bakelite strip. \$1.00. Potentiometers, \$1.25 to \$1.85.



**Frost-Radio Bakelite Rheostat with Switch**

Battery operated sets find wonderful service in these Frost Rheostats with switch mounted on Bakelite panel. Switch has positive "off" position, and springs are German silver with sterling silver contacts, 2 to 75 ohms, \$1.35.



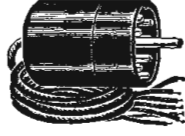
**Frost-Radio AC Snap Switch**

Approved AC Switch, 3 amp., 250 v., 75c.



**Frost-Radio Hum Balancer**

Ideal for smoothing the ripple out of AC current. Easy to regulate. \$1.00.



**Frost-Radio Bakelite Cable Plug**

A remarkable achievement in an all-Bakelite Cable Plug. Terminals are spun into sockets and cannot work loose even when overheated in soldering. Color code molded into Bakelite. Plug is equipped with 5-ft. seven wire braid covered cable with best rubber insulation on individual wires. Plug and cord only. \$2.25. Baseboard or sub-panel socket, 75c.



**Frost-Radio Molded Mica Condensers**

Finely made and extremely accurate. Guaranteed to within 10%. Unaffected by moisture or climatic changes. Molded Bakelite, with finest quality mica dielectric. Neat, small, easy to attach. 45c to 90c.

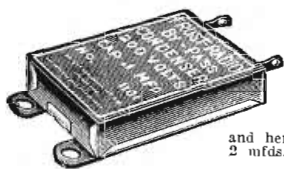


**Frost-Radio Fixed Resistances**

Windings are on die cut flexible Bakelite strip, with firmly staked terminals. 4 to 1000 ohms. Also as center tapped resistances to provide grid return in AC sets, 6 to 64 ohms, 15c to 50c.

**FROST-RADIO UNIVERSAL RESISTANCE KIT**

Consists of four 2000 ohm potentiometers, three 2000 ohm fixed resistors and one 1500 ohm fixed resistor. Supplies voltages 0 to 30, 30 to 50, 50 to 70, 90, 135 and 180. Resistors fitted with sliding connections. Complete kit (not illustrated), \$9.00.



**Frost-Radio By-Pass Condensers**

Accurate capacities and conservative voltage ratings distinguish these new Frost Condensers. Built of best materials, thoroughly seasoned, vacuum impregnated and hermetically sealed. .1 to 2 mfd. 80c to \$2.00.



**Frost-Radio Hook-Up Wire**

Simply push back the braid for soldering, and slide it back over the soldered joint. No 18 double cotton covered, impregnated wire. 50 ft. roll, 80c.



**Frost-Radio Convenience Outlets**



**Frost-Radio 210 "B" Blocks**

Built to give super-service, with conservative voltage ratings. Every item of material used in their construction is the very best obtainable. Enclosed in hermetically sealed cases of gold-bronze lacquered metal, with tinned terminals. The best "B" Blocks money can buy. \$18.00.

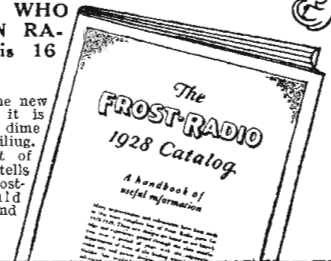


**Frost-Radio Heavy Duty Filter Condensers**

Like our "B" Blocks, Frost Filter Condensers are a quality product, made of the finest linen paper and highest grade foil. Conservatively rated. Will give long service. .5 to 2 mfd., \$1.40 to \$7.00.

**"WORTH MANY TIMES 10c TO ANYONE WHO IS INTERESTED IN RADIO"**—Send for this 16 page book today.

Those who have sent for the new Frost Data Book tell us it is worth many times the dime asked for postage and mailing. It contains a vast amount of valuable information—tells also about the complete Frost-Radio line—YOU should have a copy. Fill out and mail coupon today.



**HERBERT H. FROST, INC.**  
Main Office and Factory: **ELKHART, IND.**

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**HERBERT H. FROST, Inc.**  
160 No. La Salle Street, Chicago

Send me your new Frost Data Book, containing not only valuable radio information, but also facts about your new line. I enclose 10c.

(Are you a professional set builder?.....)

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

# Orders! Orders! Orders! At last Prompt deliveries

# SCOTT

## ATTENTION! Custom Set Builders

Our unique business building plan will triple your Custom Set business this season. Ask your jobber, or check coupon below for full particulars



"The great demand for the new Scott Shield Grid 9, which taxed our laboratory beyond its capacity and made it necessary for us to double our facilities, is simply visible proof of the statement I made at the announcement of this new set—Here is unquestionably the most powerful receiver available today. I extend a most cordial invitation to all set builders to visit our new laboratory and to see and hear our laboratory models and observe first hand the precision and care taken in matching and testing all parts of this wonderful set."

*E.A. Scott*

## Now... the finest of all reception!

Here is the successor to a line of famous World's Record Receivers! Three years ago the first Scott SUPER broke all world's records on distance reception. It was followed by a line of SUPERS each of which was better and more powerful than its predecessor, and incorporated still more recent radio developments. And now—the greatest of all, the new Scott Shield Grid Nine, with new circuit—new shield grid tubes—and new intermediate amplifier! Such unprecedented demand followed the announcement of this new set, that an immediate doubling of our laboratory facilities was required. The amazing success predicted for this new receiver was realized before we could prepare for the flood of orders which it precipitated. But now we have caught up with the demand. Already hundreds of the new Scott Shield Grid Nines have been built, operated, tested and approved by radio builders everywhere. All agree that this new set is years ahead—and that it will maintain for years to come the traditions of this famous series of World's Record receivers.



**NEW Beautiful Console combines RADIO and phonograph**

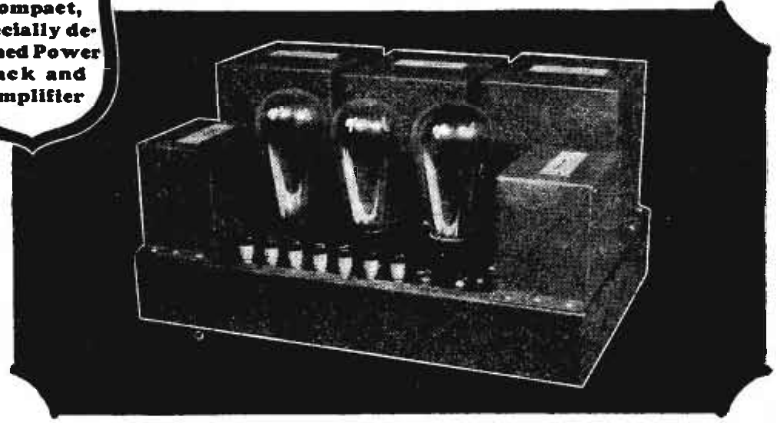
The Beautiful Scott Tasman Console—one of the three finely built cabinet models especially designed for the Scott Shield Grid Nine.

### New Exclusive Console Designs

A new beautiful Tasman Console Cabinet of Burl Walnut has been designed especially for the Scott Shield Grid Nine, combining both phonograph and radio into one unit. By means of a simple switch, the broadcast program may be varied by music from records. No tubes to pull out or adaptors to adjust. The Power Amplifier *electrically* reproduces record music, giving unbelievably life-like quality.

Another new, especially designed console model without phonograph compartment, strikingly beautiful in detail and craftsmanship, is also obtainable—as well as the new standard table type cabinet. Coupon brings full particulars. Mail today!

**Compact, specially designed Power Pack and Amplifier**

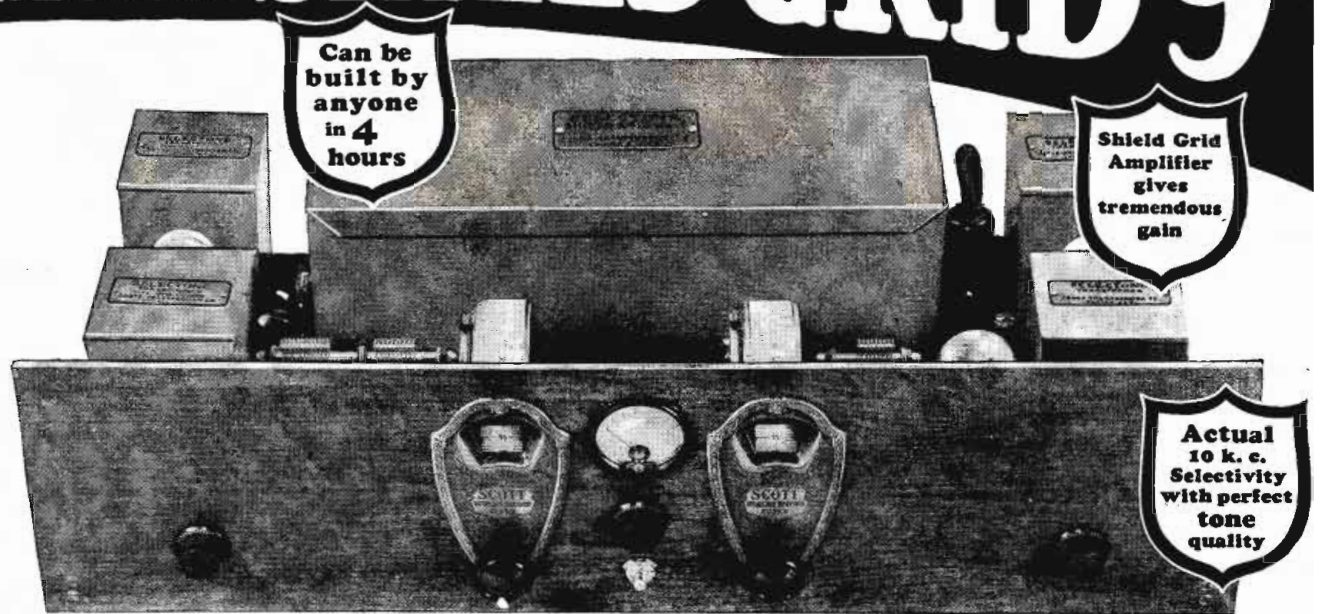


### Scott Power Pack and Amplifier

This Scott unit is especially designed to supply B current for the Scott World's Record Shield Grid Nine, and also has incorporated in it the second stage of audio, using a 250 power tube. Note compact, fully shielded construction.

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

# *We have caught up with the demand now assured on the amazing* **NEW** **WORLD'S RECORD SHIELD GRID 9**



## **Challenges the whole Radio World to any test of Distance · Volume · Selectivity and Tone**

The Scott Shield Grid Nine and Power Amplifier is a standing challenge to the entire world of radio to match its superb performance. In range it is practically *unlimited*—due to the tremendous amplification of the *Shield Grid* long range amplifier employed. In amazing volume, selectivity, and life-like tonal purity, it is absolutely unrivaled.

### **Shielded Grid Tubes in Improved New Circuit**

Perhaps the greatest single factor in increasing the efficiency of this new Scott receiver is the use of the new *Shield Grid Tubes*, in a new improved circuit. This gives many times the amplification obtainable from an ordinary circuit using 201A tubes, making this receiver more powerful than any other existing receiver known to us.

### **Perfect Matching of Parts Gives Enormous Gain**

To further increase efficiency in the new Scott receiver, not only are the tubes shielded, but the transformers as well. The extreme care taken in matching and testing the transformers is another reason for the amazing volume obtained from far distant stations. All parts throughout are especially designed and painstakingly matched with precision equipment. The special *Selectone Two-Gang* condenser, for instance, matches the inductances of the antenna and R. F. coils so perfectly that they line

up throughout the entire scale and afford astonishing selectivity with maximum amplification all the way from the lowest to the highest wave lengths.

### **One Spot Reception**

The Scott Shield Grid Nine is a one spot Super. Stations come in at one point only on the dials. A further improvement is evidenced in the fact that both dials track practically together, making tuning extremely easy. The Scott Power Amplifier, used with receiver, makes it possible to secure immense volume without the slightest distortion. This volume is so completely under control that the turning of one knob covers the entire range from merest whisper to full auditorium volume—always with life-like clarity and beauty.

### **Low Operating Cost**

The Scott Shield Grid Nine can be economically operated with dry batteries if desired. The eight tubes incorporated in the receiver draw only 29 mls. and will give ample volume for the average home. Where A.C. current is available, the special new Scott Power Pack and Amplifier, with the ninth tube for the second stage of audio, is used. This is the latest 250 power tube, giving great volume with matchless tone quality.

### **Easy to Build — Results Guaranteed**

Although the Scott Shield Grid Nine is one of the most highly perfected sets ever designed, it is an amazingly simple one to build. Anyone can assemble it in four hours. Both panel and sub-panel are drilled to receive each part and the shielded grid amplifier unit comes to you fully wired and tested—ready to be connected into the circuit as simply as hooking-up a transformer. No adjustments are required of the builder and you can't go wrong on the assembly.

We positively guarantee that you will get the same results we obtain from our own laboratory models.

For the small cost of the Scott Shield Grid Nine you can get all that could be desired of radio—the very newest, finest developments of the day. Why not enjoy World's Record performance when you can have it at less cost than inferior reception? Why not have a receiver that provides actual 10 kilocycle selectivity? Why not listen in on a radio that gives you the whole world—the only range limit being the atmospheric noise level! Build the Scott Shield Grid Nine and enjoy the ultimate in radio—NOW! Mail the coupon TODAY!

## **FREE Circuit Diagram and Particulars**

Write at once for full particulars. Let us send you FREE the Scott Circuit Diagram. Examine it yourself. See with your own eyes why it affords unequalled performance—limitless range—tremendous power—matchless tone. Proof will be sent you FREE. Also copies of 6000 and 9000 mile reception verifications and other astonishing records. Clip coupon and mail today. Do this NOW!

### **Clip this now and mail**

**SCOTT TRANSFORMER CO.**  
4448 Ravenswood Ave., CHICAGO, ILL.

Please send me FREE circuit diagram, records, and full particulars of the new Scott Shield Grid Nine.

I am interested in your proposition to professional set builders.

Name .....

Street .....

Town ..... State .....

**SCOTT TRANSFORMER CO., 4448 Ravenswood Ave., Chicago**

*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

# Citizens Radio Call Book Magazine

## AND SCIENTIFIC DIGEST

Established 1921

C. O. STIMPSON, President  
E. H. JAUDON, Vice-President  
D. H. BELL, Secretary-Treasurer  
H. ANHEISER, Assistant Treasurer

Executive Offices:  
508 So. Dearborn St., Chicago, Ill.

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M. R. HARRIS, Circulation Manager

Member Audit Bureau of Circulations

SEPTEMBER, 1928

Vol. 9, No. 3

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### In This Issue

IN keeping with the desires of our readers, as expressed by their answers to the questionnaire which we published in the last issue, we are adding to this month's issue a Digest of Science department, in which are chronicled the latest scientific, mechanical and electrical ideas. The response in favor of this particular department was so overwhelming that we feel sure it will be read with interest by all.

Sensing the extreme interest of our radio enthusiasts on the subject of television, we have blazed the way in this issue for a television section by printing the first authoritative article on practical television. The theoretical considerations have been left for those interested in that particular line, but our major interest was in telling readers how they can receive television images with the least monetary outlay and in the shortest time. This television section will be a part of our magazine henceforth and in it will be found accurate constructional and operating notes covering the more popular systems of reception.

Quite a departure has been made by the manufacturers in the presentation of their receivers in semi-assembled and assembled kits, all of the leading jobs being completely shielded and all of them taking advantage of the amplification possibilities of the 222 tube. There is further indication that the manufacturers are producing their lines of merchandise this season in such a manner as to encourage the professional set builder to build sets for sale to customers. It is worthy of note that the professional set builders' section in this issue is chock-full of interesting and profitable ideas for the set constructor.

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Citizens Radio Call Book Magazine is published four times a year and is on sale approximately the first of January, March, September and November. Subscription price \$1.75 per year in U. S. A. Canada and Foreign \$2.00 per year, payable in advance. Single copies 50 cents. Remit by check, draft or P. O. order. No foreign stamps or coins accepted. Mail subscriptions to 508 So. Dearborn Street, Chicago. We will not be responsible for cash sent for subscriptions unless registered.

Citizens Radio Call Book Magazine is for sale on all newsstands in the United States and Canada; also Department Stores and Book Stores; also can be purchased in most radio stores. Paris, France, Brentanos, Ave de L'Opera. England, R. A. Rothermel, Ltd., 24-26 Maddox St., Regent St., London, and W. H. Smith & Sons, London. Australia, McGills Agency, 179 Elizabeth St., Melbourne.

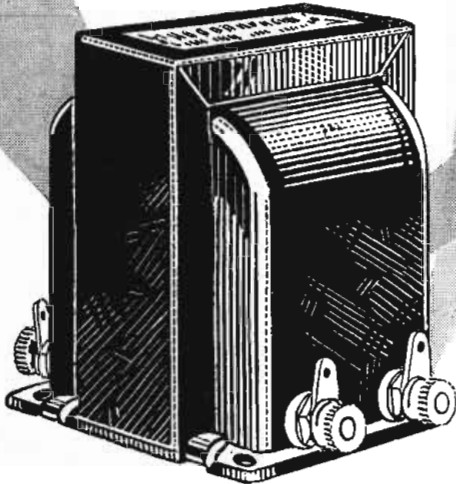
### Advertising Representatives:

Chicago—A. B. Mills, J. D. Cole, 508 So. Dearborn St. Wabash 1901.  
New York—(Branch Office)—35 W. 33rd St. Columbus 4693.

Entered as second class matter March 17, 1927, at the Postoffice at Chicago, Illinois, under the act of March 3, 1879



# A NEW NOTE IN AUDIO AMPLIFICATION



## THORDARSON R-300 AUDIO TRANSFORMER

**S**UPREME in musical performance, the new Thordarson R-300 Audio Transformer brings a greater realism to radio reproduction. Introducing a new core material, "DX-Metal" (a product of the Thordarson Laboratory), the amplification range has been extended still further into the lower register, so that even the deepest tones now may be reproduced with amazing fidelity.

The amplification curve of this transformer is practically a straight line from 30 cycles to 8,000 cycles. A high frequency cut-off is provided at 8,000 cycles to confine the amplification to useful frequencies only, and to eliminate undesirable scratch that may reach the audio transformer.

When you hear the R-300 you will appreciate the popularity of Thordarson transformers among the leading receiving set manufacturers. The R-300 retails for \$8.00.

**THORDARSON ELECTRIC MANUFACTURING CO.**  
*Transformer Specialists Since 1895*  
**WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS**  
*Huron and Kingsbury Streets — Chicago, Ill. U.S.A.*

### Power Supply Transformers

These transformers supply full wave rectifiers using two UX-281 tubes, for power amplifiers using either 210 or 250 types power amplifying tubes as follows: T-2098 for two 210 power tubes, \$20.00; T-2900 for single 250 power tube, \$20.00; T-2950 for two 250 tubes, \$29.50.



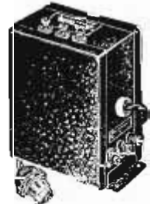
### Double Choke Units

Consist of two 30 henry chokes in one case. T-2099 for use with power supply transformer T-2098, \$14; T-3099 for use with transformer T-2900, \$16; T-3100 for use with transformer T-2950, \$18.



### Power Compacts

A very efficient and compact form of power supply unit. Power transformer and filter chokes all in one case. Type R-171 for Raytheon rectifier and 171 type power tube, \$15.00; Type R-210 for UX-281 rectifier and 210 power tube, \$20.00; Type R-280 for UX-280 rectifier and 171 power tube, \$17.00.



### Speaker Coupling Transformers

A complete line of transformers to couple either single or push-pull 171, 210 or 250 power tubes into either high impedance or dynamic speakers. Prices from \$6.00 to \$12.00.



### Screen Grid Audio Coupler

The Thordarson Z-Coupler T-2909 is a special impedance unit designed to couple a screen grid tube in the audio amplifier into a power tube. Produces excellent base note reproduction and amplification vastly in excess of ordinary systems. Price, \$12.00.



**THORDARSON ELECTRIC MFG. CO.**  
500 W. Huron St., Chicago, Ill. 3583-A

Gentlemen: Please send me your constructional booklets on your power amplifiers. I am especially interested in amplifiers using.....tubes.

Name.....

Street and No.....

Town.....

# American Broadcasting Stations

As we go to press, the American broadcasting list contains 122 stations whose licenses have been extended for thirty days by the Radio Commission, so that further time could be given to determining whether such stations will be re-licensed by the Commission. The next issue of this magazine will contain such changes as the Federal Radio Commission may make up to the time of going to press.



## KDKA

950 kc, 315.6 m, East Pittsburgh, Pa., Westinghouse E. & M. Co., 50,000 w, E.

## KDLR

1300 kc, 230.6 m, Devils Lake, N. D., Radio Electric Co.

## KDYL

1160 kc, 258.5 m, Salt Lake City, Utah, Inter-mountain Broadcasting Corp., 100 w, M, "On The Air, Goes Everywhere."

## KEJK

1190 kc, 252.0 m, Los Angeles, Calif., Freeman Lang, 250 w, P.

## KELW

1310 kc, 228.9 m, Burhank, Calif., Earl L. White, 250 w, P, "The White Spot of the San Fernando Valley."

## KEX

1080 kc, 277.6 m, Portland, Ore., Western Broadcasting Co., 2500 w, P, "A Public Service Necessity."

## KFAB

940 kc, 319 m, Lincoln, Neb., Nebraska Buick Automobile Co., 5000 w, C, "Home, Sweet Home."

## KFAD

930 kc, 322.4 m, Phoenix, Ariz., Electric Equipment Co., 500 w, M, "Phoenix, Where Winter Never Comes."

## KFAU

1050 kc, 285.5 m, Boise, Idaho, Independent School Dist., 2000 w daytime, night 400 w, P.

## KFBB

1090 kc, 275.1 m, Havre, Mont., F. A. Buttrey Co., 50 w, M.

## KFBC

1210 kc, 247.8 m, San Diego, Calif., Dr. Arthur W. Yale, 100 w.

## KFBI

1470 kc, 204.0 m, Portable, Flying Broadcasters, Inc., 50 w.

## KFB

Kimball, California."

## KFBL

1340 kc, 223.7 m, Everett, Wash., Leese Bros., 50 w, P, "The Voice of Puget Sound."

## KFBU

620 kc, 483.6 m, Laramie, Wyo., Bishop N. S. Thomas, 500 w, M, "The Top of the World."

## KFCB

1230 kc, 243.8 m, Phoenix, Ariz., Nielsen Radio Supply Co., 250 w, M, "Kind Friends Come Back."

## KFCR

1420 kc, 211.1 m, Santa Barbara, Calif., Santa Barbara Broadcasting Co., 100 w, P.

## KFDM

620 kc, 483.6 m, Beaumont, Tex., Magnolia Petroleum Co., 500 w, C, "Call for Dependable Magnolene."

## KFDX

1270 kc, 236.1 m, Shreveport, La., First Baptist Church, 250 w, C.

## KFDY

550 kc, 545.1 m, Brookings, S. D., State College, 500 w, C.

## KFEC

1400 kc, 214.2 m, Portland, Ore., Meier & Frank Co., 50 w, P, "Known for Every Courtesy."

## KFEL

1320 kc, 227.1 m, Denver, Colo., Eugene P. O'Fallon, Inc., 250 w, M, "The Argonaut Station."

## KFEQ

1300 kc, 230.6 m, St. Joseph, Mo., Scroggin & Co., 1000 w night, 2000 w, daytime, C.

## KFEY

1290 kc, 232.4 m, Kellogg, Idaho, Union High School, 10 w, P, "The Voice of the Coeur d'Alenes"

## KFGQ

1430 kc, 209.7, Boone, Iowa, Boone Biblical College, 10 w, C.

## KFH

1220 kc, 245.8 m, Wichita, Kan., Hotel Lassen, 500 w, C, "Kansas' Finest Hotel, in the Very Heart of God's Country."

## KFHA

1200 kc, 249.9 m, Gunnison, Colo., Western State College of Colorado, 50 w, M, "Where the Sun Shines Every Day."

## KFI

640 kc, 468.5 m, Los Angeles, Calif., Earl C. Anthony, Inc., 5000 w, P, "National Institution."

## KFIF

1310 kc, 228.9 m, Portland, Ore., Benson Polytechnic School, 50 w, P.

## KFIO

1220 kc, 245.8 m, Spokane, Wash., North Central High School, 100 w, P.

## KFIU

1330 kc, 225.4 m, Inneau, Alaska, Alaska Electric Light & Power Co., 10 w, "A Voice From the Far North."

## KFJB

1210 kc, 247.8 m, Marshalltown, Iowa, Marshall Electric Co., 100 w night, 250 w daytime, C, "Marshalltown, the Heart of Iowa."

## KFJF

1100 kc, 272.6 m, Oklahoma City, Okla., National Radio Mfg. Co., 5000 w, C, "Radio Headquarters of Oklahoma."

## KFJI

1200 kc, 249.9 m, Astoria, Ore., Geo. Kincaid, 50 w, P.

## KFJM

900 kc, 333.1 m, Grand Forks, N. D., University of North Dakota, 100 w, C.

## KFJR

1250 kc, 239.9 m, Portland, Ore., Ashley C. Dixon & Son, 500 w, P.

## KFJY

1290 kc, 232.4 m, Ft. Dodge, Iowa, C. S. Tunwal, 100 w, C.

## KFJZ

1200 kc, 249.9 m, Ft. Worth, Texas, Henry Clay Allison, 50 w, C.

## KFKA

1200 kc, 249.9 m, Greeley, Colo., Colorado State Teachers College, 500 w, M.



*Takes The Guess  
Out of  
Eliminator  
Building*

# ELECTRAD TRUVOLT DIVIDER

U. S. Patent 1,676,869 and Patents Pending

*A Universal Voltage Separator*

**ELECTRAD'S** Newest Radio Achievement! A Complete Truvolt All-Wire Resistance Unit for the Construction of Eliminators. It Is So Arranged with Adjustable Contacts That Proper Voltages Can Be Obtained with Any Receiver or Eliminator Combination.

The Truvolt Divider makes the building of an eliminator or power pack extremely simple. Even those who are not versed in the technical side of radio can construct a high grade unit in a fraction of the time required when separate, unrelated resistances are used.

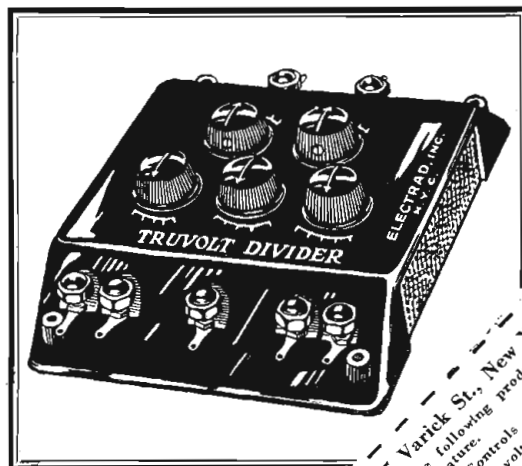
By dividing the filter voltage into usable values, it eliminates all necessity of mathematical calculations in constructing a power pack. It does away with a great deal of wiring and the need of voltage regulator tubes. It makes it possible to build a power supply device which is universal in its application.

The Truvolt Divider provides the missing link in power plant construction and any power pack can be built around it. It is designed to take care of any desirable load with a generous factor of safety. Case made of genuine bakelite, it will add a smart appearance to any unit. Five potentiometer type control knobs show values on a scale of high visibility. Can be mounted on baseboard or sub-panel, or used as the front panel on a metal cabinet, at the same time providing binding posts for all B and C voltages.

**Price \$12.50**

*Electrad, Inc. Specializes in a Complete Line of Resistance Controls for All Radio Purposes.*

*They are on Sale at Dealers Everywhere.*



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AND MAIL  
THIS COUPON**

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Please send me descriptive circulars on the following products and put me on your mailing list for similar literature:

General Circular \_\_\_\_\_ Tonarol Volume Controls \_\_\_\_\_ Phasatrols  
 "Electrad Variable Resistors \_\_\_\_\_ Truvolt Divider  
 "What B Eliminator Shall I Build?" (Enclose 10c. for mailing)  
 I am particularly interested in \_\_\_\_\_  
 Name \_\_\_\_\_ Address \_\_\_\_\_

# ELECTRAD

Inc

**KFKB**

1240 kc, 241.8 m, Milford, Kan., Dr. J. R. Brinkley, 1500 w, C, "The Sunshine Station in the Heart of the Nation."

**KFKU**

1180 kc, 254.1 m, Lawrence, Kan., University of Kansas, 500 w, C, "Up at Lawrence on the Kaw."

**KFKX**

570 kc, 526.0 m, Chicago, Ill., Westinghouse E. & M. Co., 2500 w.

**KFKZ**

1330 kc, 225.4 m, Kirksville, Mo., Northeast Missouri State Teachers College, 15 w, C, "Kirksville, the Home of Osteopathy."

**KFLV**

1120 kc, 267.7 m, Rockford, Ill., Swedish Evan. Mission Church, 100 w, C.

**KFLX**

1110 kc, 270.1 m, Galveston, Texas, Geo. Roy Clough, 100 w, C.

**KFMX**

1270 kc, 236.1 m, Northfield, Minn., Carleton College, 500 w, C.

**KFNF**

650 kc, 461.3 m, Shenandoah, Iowa, Henry Field Seed Co., 2000 w, C, "Known for Neighborly Folks."

**KFOA**

670 kc, 447.5 m, Seattle, Wash., Rhodes Department Store, 1000 w, P.

**KFON**

1240 kc, 241.8 m, Long Beach, Calif., Nichols & Warriner, Inc., 500 w, P, "Where Your Ship Comes In."

**KFOR**

1380 kc, 217.3 m, Lincoln, Neb., Howard A. Shuman, 100 w, C.

**KFPL**

1090 kc, 275.1 m, Dublin, Texas, C. C. Baxter, 15 w, C, "Baxter's Place."

**KFPM**

1300 kc, 230.6 m, Greenville, Texas, The New Furniture Co., 15 w, C, "Biggest Little Ten Watts on the Air."

**KFPW**

1140 kc, 263.0 m, Cartersville, Mo., Rev. Lannie W. Stewart, 50 w.

**KFPY**

1220 kc, 245.8 m, Spokane, Wash., Symons Investment Co., 250 w, P.

**KFQA**

1280 kc, 234.2 m, St. Louis, Mo., The Principia, 50 w.

**KFQB**

900 kc, 333.1 m, Ft. Worth, Texas, W. B. Fishburn, Inc., 1000 w, C.

**KFQD**

870 kc, 344.6 m, Anchorage, Alaska, Anchorage Radio Club, 100 w.

**KFQU**

1360 kc, 220.4 m, Holy City, Calif., W. E. Riker, 100 w, P.

**KFQW**

1380 kc, 217.3 m, Seattle, Wash., KFQW, Inc., 100 w, P, "Gateway to Alaska and the Orient."

**KFQZ**

1290 kc, 232.4 m, Hollywood, Calif., Tait Radio & Broadcasting Co., Inc., 250 w, P.

**KFRC**

660 kc, 454.3 m, San Francisco, Calif., Don Lee, Inc., 1000 w, P.

**KFRU**

1200 kc, 249.9 m, Columbia, Mo., Stephens College, 500 w, C, "Where Friendliness is Broadcast Daily."

**KFSD**

680 kc, 440.9 m, San Diego, Calif., Airian Radio Corp., 500 w, P.

**KFSG**

1190 kc, 252.0 m, Los Angeles, Calif., Echo Park Evan. Assn., 500 w, P, "The Church of the Air."

**KFUL**

1160 kc, 258.5 m, Galveston, Texas, Thomas Goggin & Bros., 500 w, C, "The City of Perpetual Sunshine."

**KFUM**

620 kc, 483.6 m, Colorado Springs, Colo., W. D. Corley, 1000 w, M, "Known for Unsurpassed Mountain Scenery."

**KFUO**

550 kc, 545.1 m, Clayton, Mo., Concordia Theological Seminary, 1000 w, C, "The Gospel Voice."

**KFUP**

1320 kc, 227.1 m, Denver, Colo., Fitzsimmons General Hospital, 100 w, M.

**KFUR**

1330 kc, 225.4 m, Ogden, Utah, Peery Building Co., 50 w, M.

**KFVD**

1390 kc, 215.7 m, Venice, Calif., W. J. McWhinnie, 250 w, P.

**KFVI**

1260 kc, 238.0 m, Houston, Texas, Headquarters Troop, 56th Cavalry, 50 w, C.

**KFVS**

1340 kc, 223.7 m, Cape Girardeau, Mo., Hirsch Battery & Radio Co., 50 w, C, "The City of Opportunity."

**KFWB**

850 kc, 352.7 m, Los Angeles, Calif., Warner Bros. Broadcasting, 1000 w, P.

**KFWC**

1210 kc, 247.8 m, Ontario, Calif., Lawrence E. Wall, 100 w, P, "The Voice of the Orange Empire."

**KFWF**

1400 kc, 214.2 m, St. Louis, Mo., St. Louis Truth Center, Inc., 250 w.

**KFWI**

1120 kc, 267.7 m, San Francisco, Calif., Radio Entertainments, Inc., 500 w, P.

**KFWM**

1270 kc, 236.1 m, Oakland, Calif., Oakland Educational Society, 500 w, P, "The Most Good to the Most People."

**KFWO**

1000 kc, 299.8 m, Avalon, Calif., Lawrence Mott, 250 w, P, "Catalina for Wonderful Outings."

**KFXD**

1470 kc, 204.0 m, Jerome, Idaho, Service Radio Co., 15 w, M.

**KFXF**

1060 kc, 282.8 m, Denver, Colo., Pikes Peak Broadcasting Co., 250 w, M, "The Voice of Denver."

**KFXJ**

1430 kc, 209.7 m, Edgewater, Colo., R. G. Howell, 50 w, M, "America's Scenic Center."

**KFXR**

1340 kc, 223.7 m, Oklahoma City, Okla., Exchange Avenue Baptist Church, 50 w, C.

**KFXY**

1460 kc, 205.4 m, Flagstaff, Ariz., Mary M. Costigan, 100 w, M.

**KFYO**

1420 kc, 211.1 m, Breckenridge, Texas, Kirksey Bros. Battery & Elec. Co., 100 w, C, "Breckenridge, the Dynamo of West Texas."

**KFYR**

1200 kc, 249.9 m, Bismarck, N. D., Hoskins-Meyer, 250 w, C.

**KGA**

1150 kc, 260.7 m, Spokane, Wash., Northwest Radio Service Co., 2000 w, P.

**KGAR**

1280 kc, 234.2 m, Tucson, Ariz., Citizen's Publishing Co., 100 w, M, "Way Out on the Desert."

**KGB**

1210 kc, 247.8 m, San Diego, Calif., Dr. Arthur W. Yale, 100 w, P, "Music For the Sick."

**KGBU**

750 kc, 399.8 m, Ketchikan, Alaska, Alaska Radio & Service Co., 500 w.

**KGBX**

1040 kc, 288.3 m, St. Joseph, Mo., Foster-Hall Tire Co., 100 w.

**KGBY**

1350 kc, 222.1 m, Columbus, Neb., Ervin Taddiken, 50 w.

**KGBZ**

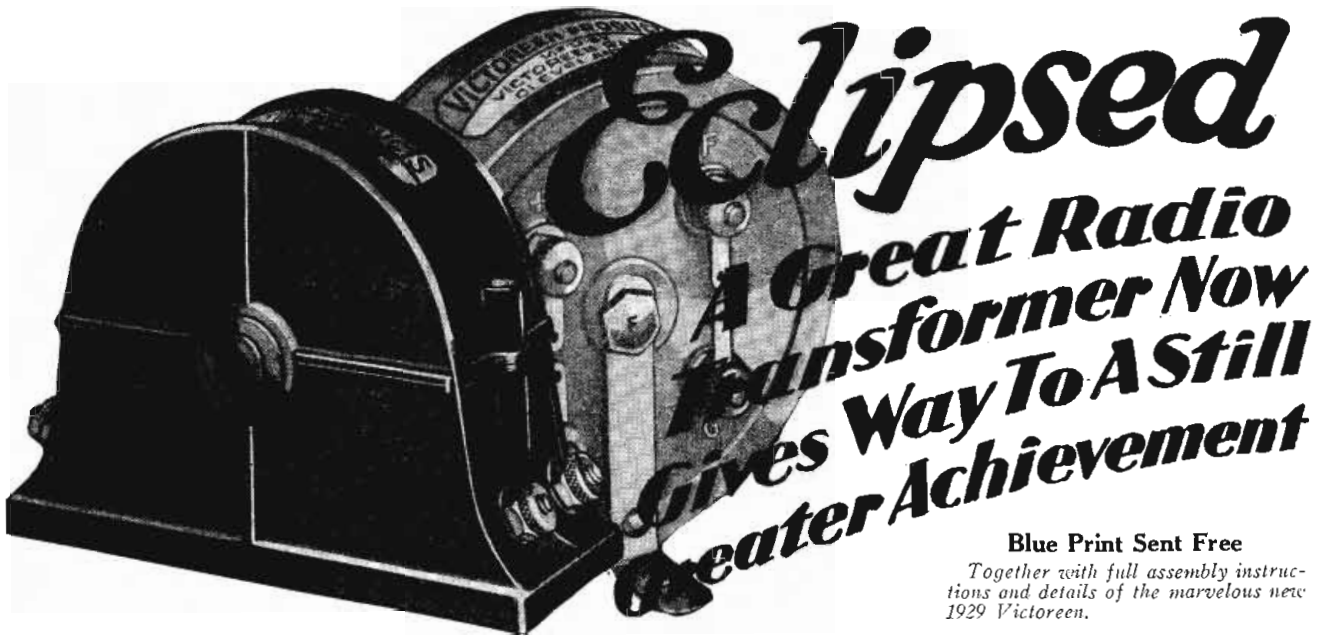
1410 kc, 212.6 m, York, Nebr., Federal Live Stock Remedy Co., 100 w, C, "The Swine and Poultry Station."

**KGCA**

1210 kc, 247.3 m, Decorah, Iowa, Chas. W. Greenley, 10 w.

**KGCB**

1390 kc, 215.7 m, Oklahoma City, Okla., Wallace Radio Inst., 50 w, C.



**Eclipsed**  
**A Great Radio Transformer Now Gives Way To A Still Greater Achievement**

**Blue Print Sent Free**

*Together with full assembly instructions and details of the marvelous new 1929 Victoreen.*

**“Responsibility” — “keeping faith”**—truly the honestly earned recognition of merit which radio fans have come to associate with Victoreen radio products. Each year new announcements from the Victoreen Laboratory are hailed as progressive steps in the development of quality radio reception.

—and for 1929 the word goes out of a redesigned and new radio frequency transformer. After long and particular exacting tests the new Victoreen Super transformer is now announced as a radically different and better product—literally years ahead of its time in its many exclusive and vital improvements.

The new Victoreen transformer will be as outstanding in its superiority during the 1929 season as the previous type has been in years past.

**Now—A New Ease of Construction**

So easy to build—so simple to operate—factors so vital today in radio construction—the new Victoreen radio frequency transformers have been designed with special attention to ease in wiring and assembling—and offer to novice as well as to seasoned builder the assurance of quality results.

**Set builders and fans**—you can now assemble a Super Receiver, using the new Victoreen hookup and transformers, which is an outstanding achievement in radio development—a receiver uniquely alone in quality performance—a receiver which rises to the crest of radio engineering.

**The 1929 Victoreen A. C. Circuit**

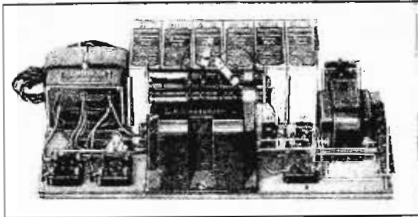
Using the new Victoreen Transformers, this perfected circuit represents the last word in receiving set construction. Its tone quality and selectivity is unsurpassed—its freedom from frills and complications, its ease of assembly and the sureness of results, make it a receiver that will satisfy the most exacting critic.

**The Victoreen B Power Supply**

The new Victoreen power supply is designed to furnish 45, 90, 180 and 450 volts and is intended for use with either a UX 210 or a UX 250 power tube in the last stage. It is not intended for loads greater than 100 mils DC. This power supply contains two voltage regulator tubes so that the 90, 180 volt taps are supplied with a constant volt potential.

The following is the list of recommended parts required for use in the Victoreen Power Supply:

- 1—No. 117 Victoreen Power Transformer
- 1—No. 216 Victoreen Choke
- 1—No. 115 Victoreen Output
- 2—2 MFD Parvolt condensers
- 2—4 MFD Parvolt condensers
- 2—1 MFD by-pass condensers
- 1—2 MFD by-pass condenser
- 5—UX type sockets
- 7—Eby binding posts
- 1—5000 Ohm Electrad fixed resistor
- 1—10000 Ohm Truvolt variable resistor



**Blue Print of Any Victoreen Circuit FREE Upon Request**

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 MERCHANDISERS OF VICTOREEN RADIO PRODUCTS  
 2825 CHESTER AVENUE CLEVELAND, OHIO

# Victoreen

*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

**KGCH**

1020 kc, 293.9 m, Wayne, Neb., S. A. Lutgen. M. D., 250 w.

**KGCI**

1360 kc, 220.4 m, San Antonio, Texas, Liberto Radio Sales, 250 w, C. "Radio Sam at San Antonio."

**KGCL**

1300 kc, 230.6 m, Seattle, Wash., Archie Taft, 100 w, P, "Splitdorf Radio Center."

**KGCN**

1440 kc, 208.2 m, Concordia, Kan., Concordia Broadcasting Co., 50 w.

**KGCR**

1440 kc, 208.2 m, Brookings, S. D., Cutler's Radio Broadcasting Service, Inc., 15 w.

**KGCU**

1250 kc, 239.9 m, Mandan, N. D., Mandan Radio Association, 100 w, M, "The Voice of the West."

**KGCX**

1230 kc, 243.8 m, Vida, Mont., First State Bank of Vida, 10 w, M.

**KGDA**

1180 kc, 254.1 m, Dell Rapids, S. D., Home Auto Co., 15 w.

**KGDE**

1460 kc, 205.4 m, Barrett, Minn., Jaren Drug Co., 50 w, C.

**KGDM**

1380 kc, 217.3 m, Stockton, Calif., E. F. Pepper, 10 w.

**KGDP**

1340 kc, 223.7 m, Pueblo, Colo., Boy Scouts of America, 10 w, M.

**KGDR**

1450 kc, 206.8 m, San Antonio, Texas, Joe B. McShane, 15 w, C.

**KGDW**

1020 kc, 293.9 m, Humboldt, Neb., Frank J. Rist, 100 w.

**KGEF**

1140 kc, 263.0 m, Los Angeles, Calif., Trinity Methodist Church, 1000 w, P.

**KGEK**

1140 kc, 263.0 m, Yuma, Colo., Beehler Elec. Equip Co., 50 w, M.

**KGEM**

1330 kc, 225.4 m, El Centro, Calif., E. R. Irey, 15 w, P.

**KGEO**

1460 kc, 205.4 m, Grand Island, Neb., Hotel Yancey, 100 w.

**KGFR**

1390 kc, 215.7 m, Long Beach, Calif., C. Merwin Dobyms, 100 w, P, "The Service Club of the Air."

**KGES**

1470 kc, 204.0 m, Central City, Neb., Central Radio Elec. Co., 10 w.

**KGEW**

1370 kc, 218.8 m, Ft. Morgan, Colo., City of Ft. Morgan, 100 w, P.

**KGEZ**

1020 kc, 293.9 m, Kalispell, Mont., Flathead Broadcasting Association, 100 w, M, "Located in the Switzerland of America—The Beautiful Flathead Valley."

**KGFF**

1460 kc, 205.4 m, Alva, Okla., Earl E. Hampshire, 25 w, C.

**KGFG**

1390 kc, 215.7 m, Oklahoma City, Okla., Full Gospel Church, 50 w, C. "The Whole Gospel to the Whole World."

**KGFH**

1140 kc, 263.0 m, La Crescenta, Calif., Frederick Robinson, 250 w, P.

**KGFI**

1360 kc, 220.4 m, San Angelo, Texas, M. L. Eaves, 15 w, C, "The Voice of West Texas."

**KGFL**

1410 kc, 212.6 m, Los Angeles, Calif., Ben S. McGlashan, 100 w, P, "Keep Good Folks Joyful."

**KGFK**

1340 kc, 223.7 m, Hallock, Minn., Kittson County Enterprise, 50 w, C.

**KGFL**

1350 kc, 222.1 m, Raton, N. Mex., N. L. Cotter, 50 w, M.

**KGFO**

1470 kc, 204.0 m, Portable, Brant Radio Power Co., 100 w.

**KGFW**

1010 kc, 296.9 m, Ravenna, Neb., Otto F. Sothman, 10 w.

**KGFX**

1180 kc, 254.1 m, Pierre, S. D., Dana McNeil, 200 w, C.

**KGGF**

1450 kc, 206.8 m, Picher, Okla., D. L. Connell, M. D., 100 w, C.

**KGGH**

1410 kc, 212.6 m, Cedar Grove, La., Bates Radio & Electric Co., 50 w, C.

**KGHA**

1430 kc, 209.7 m, Pueblo, Colo., Geo. H. Sweeney, 500 w, M.

**KGHB**

1320 kc, 227.1 m, Honolulu, Hawaii, Radio Sales 250 w.

**KGHF**

1430 kc, 209.7 m, Pueblo, Colo., Philip G. Lasky, 250 w, M.

**KGHP**

1140 kc, 263.0 m, Hardin, Mont., Hardin Post No. 8, American Legion, 50 w, M.

**KGQ**

780 kc, 384.4 m, Oakland, Calif., General Electric Co., 5000 w, P.

**KGRC**

1360 kc, 220.4 m, San Antonio, Texas, Gene Roth & Co., 100 w, C.

**KGRS**

1230 kc, 243.8 m, Amarillo, Texas, Gish Radio Service, 250 w, C.

**KGTT**

1360 kc, 220.4 m, San Francisco, Calif., Glad Tidings Temple, 50 w, P, "Voice of Glad Tidings."

**KGU**

1110 kc, 270.1 m, Honolulu, Hawaii, Marion Mulrony, 500 w, "In the Land of Sunshine, the Future Playground of America."

**KGW**

610 kc, 491.5 m, Portland, Ore., Oregonian Pub. Co., 1000 w, P, "Keep Growing Wiser."

**KGY**

1220 kc, 245.8 m, Lacey, Wash., St. Martins, College, 50 w, P, "Out Where the Cedars Melt the Sea."

**KHJ**

750 kc, 399.8 m, Los Angeles, Calif., Don Lee, Inc., 500 w, P, "Kindness, Happiness, Joy."

**KHMC**

1270 kc, 236.1 m, Harlingen, Texas, Harlingen Music Co., 100 w, C.

**KHQ**

810 kc, 370.2 m, Spokane, Wash., Louis Wasmer, Inc., 1000 w, P, "In the Friendly City."

**KICK**

930 kc, 322.4 m, Atlantic, Iowa, Atlantic Automobile Co., 100 w.

**KJBS**

1220 kc, 245.8 m, San Francisco, Calif., Julius Brunton & Sons Co., 100 w, P, "The Voice of the Storage Battery."

**KJR**

860 kc, 348.6 m, Seattle, Wash., Northwest Radio Service Co., 2500 w, P.

**KKP**

1100 kc, 272.6 m, Seattle, Wash., City of Seattle, 15 w, P.

**KLCN**

1050 kc, 285.5 m, Blytheville, Ark., Daily Courier-News, 50 w, C.

**KLDS**

1110 kc, 270.1 m, Independence, Mo., Midland Broadcasting Co., 1500 w, C, "The Station Dedicated to Knowledge, Liberty, Divinity and Service."

**KLIT**

1500 kc, 199.9 m, Portland, Ore., Lewis Irvine Thompson, 10 w.

**KLS**

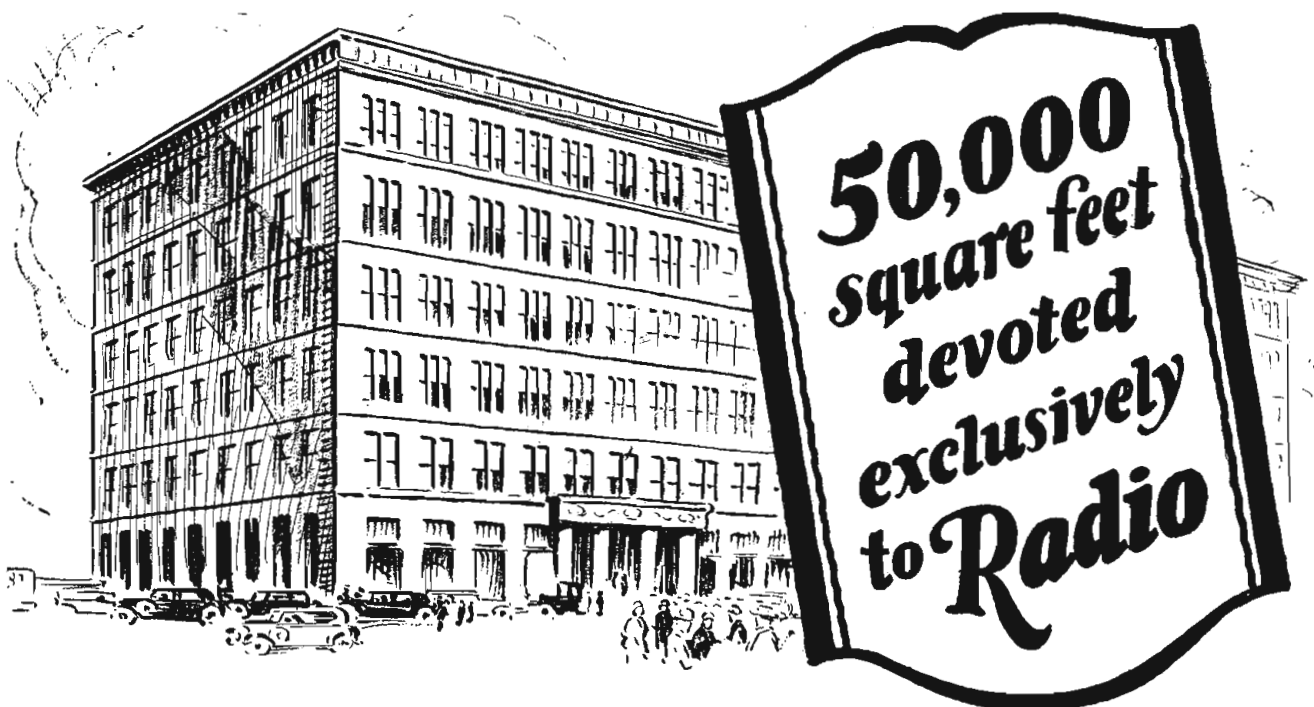
1220 kc, 245.8 m, Oakland, Calif., Warner Bros., 250 w, P, "The City of Golden Opportunity."

**KLX**

590 kc, 508.2 m, Oakland, Cal., Tribune Pub. Co., 500 w, P, "Where Rail and Water Meet."

**KLZ**

850 kc, 352.7 m, Dupont, Colo., Reynolds Radio Co., Inc., 1000 w, M, "The Pioneer Station of the West."



### Set Builders

Set Builders and experimenters will welcome an association here where tremendous stocks of practically all of the nationally advertised lines are carried—coupled with an organization trained to serve. Immediate shipments are assured. Silver-Marshall—Hammarlund-Roberts—Aero—Tyrman and practically all of the latest kits and parts are available. Your orders, large or small, will be handled with a promptness and dispatch that will prove a revelation to you in Radio Service.

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Allied Radio Corporation is composed of a large corps of trained men who have had years and years of experience in radio. They know how to get results. Their great fund of experience is now available for your benefit. They know the newest improvements, the up-to-the-minute demands of the trade and are ready to give you personal, helpful service.

#### 50,000 FEET OF RADIO

50,000 square feet of floor space in a large modern building is devoted exclusively to radio. Floor after floor is filled with a tremendous stock of every variety that is exceptionally complete in kits, parts and sets of every description. Here are found the latest improved designs and styles in radio equipment.

#### NEW A. C. SETS AND KITS

New A.C. sets priced as low as \$37.95. Also a wonderful array of beautiful consoles ranging in price from as low as \$12 up to \$200. A complete assortment of the famous Silver-Marshall parts and kits—in stock ready for your call. Practically all of the nationally advertised lines in parts and kits are available here for immediate shipment. New A.C. Sets, Power Dynamic Speakers—all the latest and newest in Radio is here at prices that actually defy competition.

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#### IMMEDIATE SHIPMENTS

The Allied organization is trained to service. Real team work from executives and department managers to stock clerks and office boys—all animated by a desire to serve—to make Allied service Radio's most dependable service.

Send for Large, Free, New, Illustrated Catalog "C"

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Wholesale Radio Distributors

711 West Lake Street - - - Chicago, Illinois

**KMA**

750 kc, 394.5 m, Shenandoah, Iowa, May Seed & Nursery Co., 1000 w, C, "Keeps Millions Advised."

**KMBC**

1110 kc, 270.1 m, Independence, Mo., Midland Broadcasting Co., 1500 w, C.

**KMED**

1110 kc, 270.1 m, Medford, Ore., W. J. Virgin, 50 w, P, "See Crater Lake."

**KMIC**

1340 kc, 223.7 m, Inglewood, Calif., James R. Fouch, 250 w, P.

**KMJ**

820 kc, 365.6 m, Fresno, Calif., The Fresno Bee, 50 w, P.

**KMMJ**

1050 kc, 285.5 m, Clay Center, Neb., The M. M. Johnson Co., 250 w, C, "The Old Trusty Station."

**KMO**

1180 kc, 254.1 m, Tacoma, Wash., KMO, Inc., 500 w, P.

**KMOX**

1000 kc, 299.8 m, Kirkwood, Mo., Voice of St. Louis, Inc., 5000 w, C.

**KMTR**

580 kc, 516.9 m, Los Angeles, Calif., KMTR Radio Corp., 500 w, P, "Your Friend in Hollywood."

**KNRC**

800 kc, 374.8 m, Santa Monica, Calif., Clarence B. Juneau, 500 w, P, "The Station With a Smile."

**KNX**

890 kc, 336.9 m, Hollywood, Calif., Western Broadcast Co., 5000 w, P, "The Voice of Hollywood."

**KOA**

920 kc, 325.9 m, Denver, Colo., General Electric Co., 5000 w, M.

**KOAC**

1110 kc, 270.1 m, Corvallis, Ore., Oregon State Agricultural College, 500 w, P, "Science for Service."

**KOB**

760 kc, 394.5 m, State College, N. M., N. M. College of Agri. & Mech. Arts, 5000 w, M, "The Sunshine State of America."

**KOCH**

1160 kc, 258.5 m, Omaha, Neb., Central Radio School, 250 w, C.

**KOCW**

1190 kc, 252.0 m, Chickasha, Okla., Oklahoma College for Women, 250 w, C.

**KOIL**

940 kc, 319 m, Council Bluffs, Iowa, Mona Motor Oil Co., 5000 w, C, "The Hilltop Studio."

**KOIN**

940 kc, 319 m, Portland, Ore., KOIN, Inc., 1000 w, P, "The Station of the Hour."

**KOMO**

970 kc, 309.1 m, Seattle, Wash., Fisher's Blend Station, Inc., 1000 w, P.

**KORE**

1500 kc, 199.9 m, Eugene, Ore., Eugene Broadcast Station, 50 w, P.

**KOW**

1370 kc, 218.8 m, Denver, Colo., Associated Industries, Inc., 250 w, M, "The KOW Station Away Out West."

**KPCB**

1300 kc, 230.6 m, Seattle, Wash., Pacific Coast Biscuit Co., 100 w, P.

**KPJM**

1400 kc, 214.2 m, Prescott, Ariz., Frank Wilburn, 15 w, M.

**KPLA**

1040 kc, 288.3 m, Los Angeles, Calif., Pacific Development Radio Co., 500 w, P.

**KPO**

710 kc, 422.3 m, San Francisco, Calif., Hales Bros. & The Chronicle, 1000 w, P, "The City of the Golden Gate."

**KPOF**

1490 kc, 201.6 m, Denver, Colo., Pillar of Fire, Inc., 500 w, M.

**KPPC**

950 kc, 315.6 m, Pasadena, Calif., Pasadena Presbyterian Church, 50 w, P.

**KPRC**

1020 kc, 293.9 m, Houston, Texas, Houston Printing Co., 1000 w, C, "Kotton Port Rail Center."

**KPSN**

950 kc, 315.6 m, Pasadena, Calif., Pasadena Star-News, 1000 w, P.

**KQV**

1110 kc, 270.1 m, Pittsburgh, Pa., Doubleday-Hill Elec. Co., 500 w, E, "The Smoky City Station."

**KQW**

1010 kc, 296.9 m, San Jose, Calif., First Baptist Church, 500 w, P, "For God and Country."

**KRAC**

1360 kc, 220.4 m, Shreveport, La., Caddo Radio Club, 50 w, C.

**KRE**

1300 kc, 230.6 m, Berkeley, Calif., First Congregational Church, 100 w, P.

**KRLD**

650 kc, 461.3 m, Dallas, Texas, KRLD, Inc., 500 w, C, "Down Where the Blue Bonnets Grow."

**KRSC**

1100 kc, 272.6 m, Seattle, Wash., Radio Sales Corp., 50 w, P.

**KSAC**

900 kc, 333.1 m, Manhattan, Kan., Kansas State Agricultural College, 500 w, C.

**KSBA**

1120 kc, 267.7 m, Shreveport, La., W. G. Patterson 1000 w, C, "Keep Shreveport Before America."

**KSCJ**

1230 kc, 243.8 m, Sioux City, Iowa, Perkins Bros. Co., 500 w, C.

**KSD**

550 kc, 545.1 m, St. Louis, Mo., Pulitzer Pub. Co., 500 w, C.

**KSEI**

900 kc, 333.1 m, Pocatello, Idaho, KSEI Broadcasting Association, 250 w, M, "Kummuny Southeast Idaho."

**KSL**

990 kc, 302.8 m, Salt Lake City, Utah, Radio Service Corp., 1000 w, M, "The Voice of the Intermountain Empire."

**KSMR**

1100 kc, 272.6 m, Santa Maria, Calif., Santa Maria Valley R. R. Co., 100 w, P, "The Valley of Gardens."

**KSO**

1320 kc, 227.1 m, Clarinda, Iowa, Berry Seed Co., 500 w, C, "Keep Serving Others."

**KSOO**

1430 kc, 209.7 m, Sioux Falls, S. D., Sioux Falls Broadcasting Assn., 250 w, C.

**KSTP**

1360 kc, 220.4 m, Westcott, Minn., National Battery Broadcasting Co., 2000 w, C.

**KTAB**

1070 kc, 280.2 m, Oakland, Calif., Associated Broadcasters, 500 w, P, "Knowledge, Truth and Beauty."

**KTAP**

1310 kc, 228.9 m, San Antonio, Texas, Robert B. Bridge, 250 w, C, "The World's Biggest Little Station."

**KTBI**

1090 kc, 275.1 m, Los Angeles, Calif., Bible Institute of Los Angeles, 1000 w, P.

**KTBR**

1310 kc, 228.9 m, Portland, Ore., M. E. Brown, 500 w, P.

**KTHS**

600 kc, 499.7 m, Hot Springs, Ark., Arlington Hotel Co., 1000 w, C, "Kum to Hot Springs."

**KTNT**

1170 kc, 256.3 m, Muscatine, Iowa, Norman Baker, 2000 w, C, "The Voice of the Iowa Farmers' Union."

**KTSA**

1130 kc, 265.3 m, San Antonio, Texas, Alamo Broadcast Co., 2000 w, C.

**KTUE**

1410 kc, 212.6 m, Houston, Texas, Uhalt Electric, 5 w, C.

**KTW**

760 kc, 394.5 m, Seattle, Wash., First Presbyterian Church, 1000 w, P.

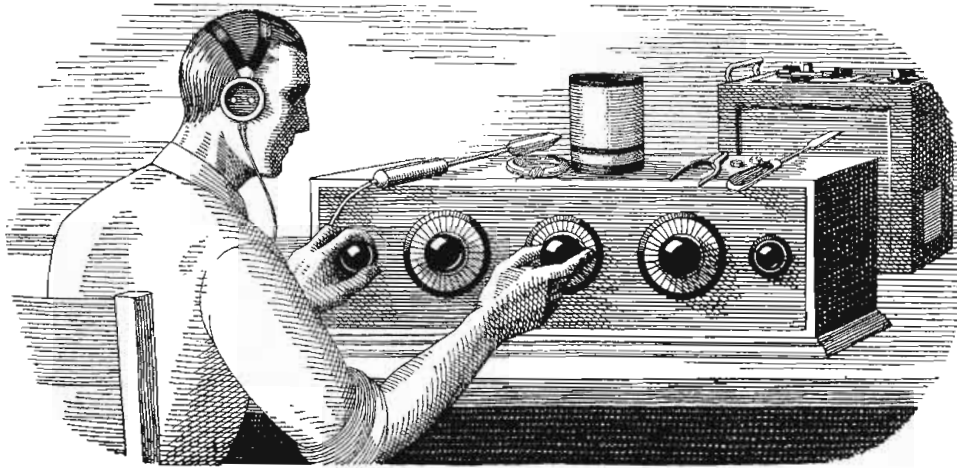
**KUJ**

1500 kc, 199.9 m, Seattle, Wash., Puget Sound Radio Broadcasting Co., 10 w, P.

**KUOA**

1010 kc, 296.9 m, Fayetteville, Ark., University of Arkansas, 500 w, C.





*If all the Radio sets I've "fooled" with in my time were piled on top of each other, they'd reach about half-way to Mars. The trouble with me was that I thought I knew so much about Radio that I really didn't know the first thing. I thought Radio was a plaything—that was all I could see in it for me.*

# I Thought Radio Was a Plaything

*But Now My Eyes Are Opened, And I'm Making Over \$100 a Week!*

\$50 a week! Man alive, just one year ago a salary that big would have been the height of my ambition.

Twelve months ago I was scrimping along on starvation wages, just barely making both ends meet. It was the same old story—a little job, a salary just as small as the job—while I myself had been dragging along in the rut so long I couldn't see over the sides.

If you'd told me a year ago that in twelve months' time I would be making \$100 and more every week in the Radio business—whew! I know I'd have thought you were crazy. But that's the sort of money I'm pulling down right now—and in the future I expect even more. Why, only today—

But I am getting ahead of my story. I was hard up a year ago because I was kidding myself, that's all—not because I had to be. I could have been holding then the same sort of job I'm holding now, if I'd only been wise to myself. If you've fooled around with Radio, but never thought of it as a serious business, maybe you're in just the same boat I was. If so, you'll want to read how my eyes were opened for me.

When broadcasting first became the rage, several years ago, I first began my dabbling with the new art of Radio. I was "nuts" about the subject, like many thousands of other fellows all over the country. And no wonder! There's a fascination—something that grabs hold of a fellow—about twirling a little knob and suddenly listening to a voice speaking a thousand miles away! Twirling it a little more and listening to the mysterious dots and dashes of steamers far at sea. Even today I get a thrill from this strange force. In those days, many times I stayed up almost the whole night trying for DX. Many times I missed supper because I couldn't be dragged away from the latest circuit I was trying out.

I never seemed to get very far with it, though. I used to read the Radio magazines and occasionally a Radio book, but I never understood the subject very clearly, and lots of things I didn't see through at all.

So, up to a year ago, I was just a dabbler—I thought Radio was a plaything. I never realized what an enormous, fast growing industry Radio had come to be—employing thousands and thousands of trained men. I usually stayed home in the evenings after

work, because I didn't make enough money to go out very much. And generally during the evening I'd tinker a little with Radio—a set of my own or some friend's. I even made a little spare change this way, which helped a lot, but I didn't know enough to go very far with such work.

And as for the idea that a splendid Radio job might be mine, if I made a little effort to prepare for it—such an idea never entered my mind. When a friend suggested it to me one year ago, I laughed at him.

"You're kidding me," I said.  
"I'm not," he replied. "Take a look at this ad."

He pointed to a page ad in a magazine, an advertisement I'd seen many times but just passed up without thinking, never dreaming it applied to me. This time I read the ad carefully. It told of many big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. Well, it was a revelation to me. I read the book carefully, and when I finished it I made my decision.

What's happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months, I've had a Radio business of my own. At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare for you. And to think that until that day I sent for their eye-

opening book, I'd been wailing, "I never had a chance!"

Now I'm making, as I told you before, over \$100 a week. And I know the future holds even more, for Radio is one of the most progressive, fastest growing businesses in the world to-day. And it's work that I like—work a man can get interested in.

Here's a real tip. You may not be as bad off as I was. But think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years—making the same money? If not, you'd better be doing something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Department 9D, Washington, D. C.

J. E. SMITH, *President*,  
NATIONAL RADIO INSTITUTE,  
DEPT. 9D, WASHINGTON, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation and that no salesman will call on me.

Name.....  
Address.....  
Town..... State.....  
Occupation.....

*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

**KUOM**

670 kc, 461.3 m, Missoula, Mont., State University of Montana, 500 w, M.

**KUSD**

620 kc, 483.6 m, Vermilion, S. Dak., University of South Dakota, 250 w, C.

**KUT**

1290 kc, 232.4 m, Austin, Texas, University of Texas, 500 w, C, "Come to University of Texas."

**KVI**

1060 kc, 282.8 m, Tacoma, Wash., Puget Sound Radio Broadcasting Co., 250 w, P. "Puget Sound Station."

**KVL**

1480 kc, 202.6 m, Seattle, Wash., Arthur C. Dailey, 100 w.

**KVOO**

860 kc, 348.6 m, Bristow, Okla., Southwestern Sales Corp., 5000 w, C, "The Voice of Oklahoma."

**KVOS**

1430 kc, 209.7 m, Bellingham, Wash., L. Kessler, 250 w, M.

**KWBS**

1500 kc, 199.9 m, Portland, Ore., Schaeffer Radio Co., 15 w, P.

**KWCR**

1250 kc, 239.9 m, Cedar Rapids, Iowa, Harry F. Paar, 250 w.

**KWEA**

1410 kc, 212.6 m, Shreveport, La., William E. Antony, 250 W, C.

**KWG**

870 kc, 344.6 m, Stockton, Calif., Portable Wireless Tel Co., 100 w, P.

**KWJJ**

1200 kc, 249.9 m, Portland, Ore., Wilbur Jerman, 50 w, P, "The Voice From Broadway."

**KWK**

1280 kc, 234.2 m, St. Louis, Mo., Greater St. Louis Broadcasting Corp., 1000 w, C.

**KWKC**

1350 kc, 222.1 m, Kansas City, Mo., Wilson Duncan Broadcasting Co., 100 w.

**KWKH**

760 kc, 394.5 m, Shreveport, La., W. K. Henderson, 3500 w, C.

**KWLC**

1210 kc, 247.8 m, Decorah, Iowa, Luther College, 50 w, C.

**KWSC**

760 kc, 394.5 m, Pullman, Wash., State College of Washington, 500 w, P, "The Voice of the Cougars."

**KWTC**

1100 kc, 272.6 m, Santa Ana, Calif., Dr. John Wesley Hancock, 100 w, P, "Kum West to California."

**KWUC**

1230 kc, 243.8 m, Le Mars, Iowa, Western Union College, 1500 w.

**KWWG**

1080 kc, 277.6 m, Brownsville, Texas, Chamber of Commerce, 500 w, C, "Good Night, World."

**KXA**

560 kc, 535.4 m, Seattle, Wash., American Radio Tel Co., 500 w, P.

**KXL**

1360 kc, 220.4 m, Portland, Ore., KXL Broadcasters, Inc., 100 w, P, "The Voice of Portland."

**KXRO**

1340 kc, 223.7 m, Aberdeen, Wash., KXRO, Inc., 50 w.

**KYA**

850 kc, 361.2 m, San Francisco, Calif., Seattle Broadcasting Corp., 1000 w, P.

**KYW**

570 kc, 526.0 m, Chicago, Ill., Westinghouse E. & M. Co., 2500 w, C.

**KZM**

1300 kc, 230.6 m, Oakland, Calif., Preston D. Allen, 100 w, P.

**NAA**

690 kc, 434.5 m, United States Navy Department, D. C., 1000 w, "Where the Time Signals Originate," E.

**NAA**

12,045 kc, 25.0 m; 8030 kc, 37.3 m; 4015 kc, 74.7 m; 2780 kc, 112 m; 690 kc, 434.5 m, United States Navy, Radio Station, Arlington, Va., E.

**WAAD**

1300 kc, 230.6 m, Cincinnati, Ohio, Ohio Mechanics Institute, 25 w, E.

**WAAF**

770 kc, 389.4 m, Chicago, Ill., Drivers Journal Pub. Co., 500 w, C.

**WAAM**

1120 kc, 267.7 m, Newark, N. J., WAAM, Inc., 250 w, E, "Sunshine Station."

**WAAT**

1220 kc, 245.8 m, Jersey City, N. J., Bremer Broadcasting Corp., 300 w.

**WAAW**

680 kc, 440.9 m, Omaha, Neb., Omaha Grain Exchange, 500 w, C, "Pioneer Market Station of the West."

**WABC**

970 kc, 309.1 m, Richmond Hill, N. Y., Atlantic Broadcasting Corp., 2500 w, E.

**WABF**

1460 kc, 205.4 m, Kingston, Pa., Markle Broadcasting Corp., 250 w, E, "The Voice of Wyoming Valley."

**WABI**

770 kc, 389.4 m, Bangor, Maine, First Universalist Church, 100 w, E, "The Pine Tree Wave."

**WABO**

1180 kc, 254.1 m, Rochester, N. Y., Hickson Electric Co., Inc., 250 w, E.

**WABY**

1210 kc, 247.8 m, Philadelphia, Pa., J. Magaldi, Jr., 50 w.

**WABZ**

1260 kc, 238.0 m, New Orleans, La., Coliseum Place Baptist Church, 50 w, C.

**WADC**

1260 kc, 238.0 m, Akron, Ohio, Allen T. Simmons, 1000 w, E, "Watch Akron Develop Commercially."

**WAFD**

1300 kc, 230.6 m, Detroit, Mich., Albert B. Parfet Co., 100 w, E.

**WAGM**

1330 kc, 225.4 m, Royal Oak, Mich., Robert L. Miller, 50 w, E.

**WAIU**

1060 kc, 282.8 m, Columbus, Ohio, American Insurance Union, 5000 w, E, "The Radio Voice of the American Insurance Union."

**WAIZ**

1320 kc, 227.1 m, Appleton, Wis., Irving Zuelke, Inc., 100 w.

**WALK**

1490 kc, 201.2 m, Willow Grove, Pa., Albert A. Walker, 50 w, E.

**WAMD**

1350 kc, 222.1 m, St. Paul, Minn., National Battery Co., 500 w, C, "The Call of the North."

**WAPI**

880 kc, 340.7 m, Auburn, Ala., Alabama Polytechnic Institute, 1000 w, C.

**WASH**

1100 kc, 256.3 m, Grand Rapids, Mich., Baxter Laundries, Inc., 250 w, C.

**WATT**

1490 kc, 201.2 m, Portable, Edison Elect. Illum. Co., 100 w.

**WBAA**

1100 kc, 272.6 m, Lafayette, Ind., Purdue University, 500 w, C.

**WBAK**

1000 kc, 299.8 m, Harrisburg, Pa., Pennsylvania State Police, 500 w, E, "The Voice of Pennsylvania."

**WBAL**

1050 kc, 285.5 m, Glen Morris, Md., Consolidated Gas, Elec. Co., 5000 w, E, "The Station of Good Music."

**WBAO**

1120 kc, 267.7 m, Decatur, Ill., James Milliken University, 100 w.

**WBAP**

600 kc, 499.7 m, Ft. Worth, Tex., Carter Publications, Inc. (WOAI), 5000 w, C.

**WBAW**

1250 kc, 239.9 m, Nashville, Tenn., Waldrum Drug Co., 5000 w, C.

**WBAX**

1200 kc, 249.9 m, Wilkes-Barre, Pa., John H. Stenger, Jr., 100 w, E, "In Wyoming Valley, Home of the Anthracite."

**WBBC**

1320 kc, 227.1 m, Brooklyn, N. Y., Brooklyn Broadcasting Corp., 500 w.

# H.F.L. STARTLES THE RADIO ENGINEERS OF TWO CONTINENTS

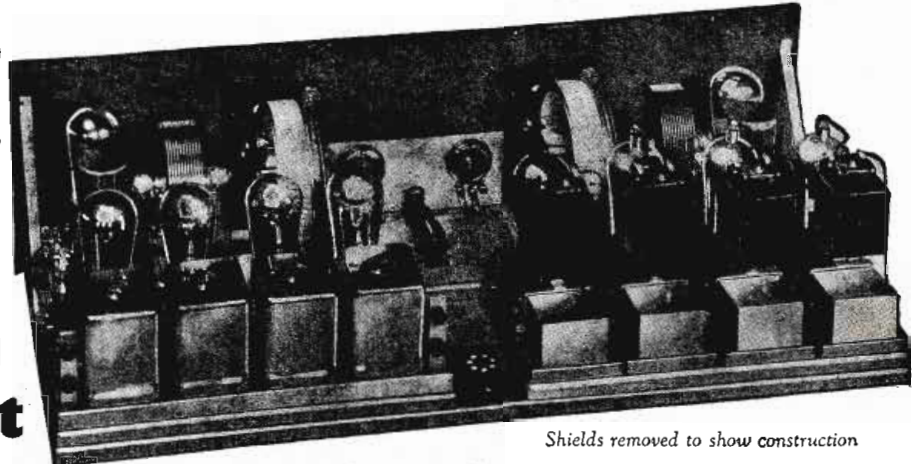
*with the most sensitive and powerful radio phonograph ever designed*

THE NEW MODEL 10

**Screened Grid**

**ISOTONE**

**Custom built**



Shields removed to show construction

**From Factory-wired Units — in One Hour**

53

**PROCLAIMED** by dozens of famous radio engineers to be the most sensational development since the beginning of radio, the ISOTONE has amazed all who have seen and heard it perform. Already this receiver has shattered the long distance records of its predecessors.

Those who have heard the ISOTONE have marveled at the uncanny way it reaches out over the American continent, bringing in stations from the farthest corners of the land—Cuba, Mexico, Canada—with full loud speaker volume.

This is the brain child of two of the greatest designing radio engineers in the world. This is the receiver on which H. F. L. has worked for over two years. The ISOTONE incorporates every modern improvement and over a dozen entirely new features which are not used in any other receiver in existence today.

**Highly Selective Great Distance Range**

Here is a receiver which will stir your imagination. Here, at last, is a receiver that will thrill to your slightest touch—an instrument that will enable you to listen to stations on the four corners of the globe. Here, at last, is radio perfection.

Never—never before in the history of radio development has any one instrument been designed which is so versatile—which contains so many new features—which is so miraculous in performance, as this, the ISOTONE.

The ISOTONE will bring the voices of the earth to you. Interference, with this receiver, is unknown. In actual laboratory tests made in the City of Chicago, the most congested broadcasting center of the world, the ISOTONE tuned to a ten kilocycle band, cut through tremendous local interference and brought in stations broadcasting foreign tongues and tunes.

**3 Stage Screened Grid Amplifier**

This is undoubtedly the first time that screened grid tubes have been used to their greatest advantage.

**Simply Fill in the Coupon and Mail Today**

The sensitivity of the ISOTONIC three stage screened grid amplifier is inconceivable. Each stage of the amplifier can be hand tuned by the operator for the absolute maximum in sensitivity and selectivity. This is unquestionably the greatest achievement in sensitivity that the world will ever see. No more sensitive receiver will ever be designed, for no more sensitive one can be used.

**New Audio System Balanced Transformers**

The word ISOTONE means perfect balance of tone and this instrument will reveal the true beauty of music. From the shrill whistle of the flute to the low and resonant rumbling of the kettle drum, the ISOTONE will respond magnificently to every musical frequency.

The special ISOTONIC push pull audio transformers are perfectly balanced and center tapped for resistance, capacity, inductance and impedance. Four power tubes in the audio amplifier and one in the detector circuit allow the faithful reproduction of notes which are utterly beyond all amplifiers of present existing types.

**Natural Tonal Quality Radio or Phonograph**

Few people will realize the hidden beauty of music until they have heard their favorite selections recreated through an ISOTONIC audio amplifier. Whether it be radio or phonograph music, the same profusion of exquisite shades and tones bursts into life at the touch of the tiny button which automatically controls the greatest musical instrument of our time.

This is the receiver that we have promised to you. This is our greatest achievement. It is so far

**FREE Circuit Diagram And All Information**

advanced—it is so radically different—its new features are so numerous that pages would be required for an accurate description.

**Can Be Constructed by Anyone**

There is nothing complicated about the construction of an ISOTONE. Each of the three units is assembled, wired and laboratory tested at our factory. All you have to do in order to reproduce these wonderful results for yourself is to take a standard kit of ISOTONE parts and assemble the instrument with a few nuts, bolts and only ten wires. There is nothing to go wrong. Each piece fits together with absolute precision, and in less than an hour you can realize what is acclaimed by women as the most beautiful receiver of the day—and admitted, beyond a question of doubt, by radio engineers as the most efficient radio phonograph ever designed.

**Absolute Guarantee**

Every ISOTONE kit and each ISOTONIC unit is fully guaranteed. All H. F. L. items must be mechanically and electrically perfect. Each instrument must test up to the standard set by our laboratories. Any unit that does not operate perfectly will be immediately replaced at no charge. No arguments—no lengthy correspondence—your ISOTONE must be right or we will make it right. Our guarantee gives you absolute protection. **BUILD YOUR ISOTONE NOW** and have the finest receiver in your neighborhood. Send for full particulars TODAY.

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Gentlemen: Without obligation, please send complete information on the ISOTONE receiver and the ISOTONIC A. C. power supply.

Name.....

Address.....

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

(Please print plainly)

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

**WBBL**

1280 kc, 234.2 m, Richmond, Va., Grace Covenant Presbyterian Church, 100 w, E, "Richmond, the Gateway North and South."

**WBBM**

770 kc, 389.4 m, Glenview, Ill., Atlas Investment Co., 5000 w, C.

**WBBR**

1170 kc, 256.3 m, Rossville, N. Y., People's Pulpit Association, 1000 w, E, "Watch Tower."

**WBBW**

1270 kc, 236.1 m, Norfolk, Va., Ruffner Junior High School, 100 w, E.

**WBBY**

1200 kc, 249.9 m, Charleston, S. C., Washington Light Infantry, 75 w, E, "The Seaport of the Southeast."

**WBBZ**

1470 kc, 204.0 m, Portable, C. L. Carrell, 100 w.

**WBCN**

1040 kc, 288.3 m, Chicago, Ill., Great Lakes Radio Broadcasting Corp., 250 w.

**WBET**

1040 kc, 288.3 m, Medford, Mass., Boston Transcript Co., 500 w, E.

**WBIS**

650 kc, 461.3 m, Boston, Mass., The Shepard Stores, 500 w, E.

**WBKN**

1500 kc, 199.9 m, Brooklyn, N. Y., Arthur Faske, 100 w.

**WBMH**

1420 kc, 211.1 m, Detroit, Mich., Braun's Music House, 100 w, E.

**WBMS**

1500 kc, 199.9 m, Union City, N. J., WBMS Broadcasting Corp., 100 w.

**WBNY**

1270 kc, 236.1 m, New York, N. Y., Baruchrome Corp., 500 w, E, "The Voice of the Heart of New York."

**WBOQ**

970 kc, 309.1 m, Richmond Hill, N. Y., Atlantic Broadcasting Corp., 500 w, E.

**WBOW**

1440 kc, 208.2 m, Terre Haute, Ind., Banks of Wabash Broadcasting Assn., 100 w, C, "On the Banks of the Wabash."

**WBRC**

990 kc, 302.8 m, Birmingham, Ala., Birmingham Broadcasting Co., 250 w, C, "The Biggest Little Station in the World."

**WBRE**

1200 kc, 249.9 m, Wilkes-Barre, Pa., Louis G. Baltimore, 100 w, E.

**WBRL**

1290 kc, 232.4 m, Tilton, N. H., Booth Radio Laboratories, 500 w, E.

**WBRS**

1420 kc, 211.1 m, Westchester Broadcasting Corp., Greenville, N. Y., 250 w, E.

**WBSO**

780 kc, 384.4 m, Wellesley Hills, Mass., Babson's Statistical Org., Inc., 100 w, E.

**WBT**

1160 kc, 258.5 m, Charlotte, N. C., C. C. Coddington, 1000 w, E, "The Queen City of the South."

**WBZ**

900 kc, 333.1 m, East Springfield, Mass., Westinghouse E. & M. Co., 15,000 w, E, "The Broadcasting Station of New England."

**WBZA**

900 kc, 333.1 m, Boston, Mass., Westinghouse E. & M. Co., 500 w, E.

**WCAC**

560 kc, 535.4 m, Storrs, Conn., Connecticut Agricultural College, 500 w, E, "Voice From the Nutmeg State."

**WCAD**

1230 kc, 243.8 m, Canton, N. Y., St. Lawrence University, 500 w, E, "The Voice of the North Country."

**WCAE**

650 kc, 461.3 m, Pittsburgh, Pa., Kautman & Baer Co., 500 w, E, "Where Prosperity Begins."

**WCAH**

1280 kc, 234.2 m, Columbus, Ohio, C. A. Entrekln, 250 w, E.

**WCAJ**

790 kc, 379.5 m, Lincoln, Neb., Nebraska Wesleyan University, 500 w, C.

**WCAL**

1050 kc, 285.5 m, Northfield, Minn., St. Olaf College, 500 w, C, "The College on the Hill."

**WCAM**

1340 kc, 223.7 m, Camden, N. J., City of Camden, 500 w, E.

**WCAO**

1230 kc, 243.8 m, Baltimore, Md., Monumental Radio, Inc., 250 w, E, "The Gateway of the South."

**WCAP**

1250 kc, 239.9 m, Asbury Park, N. J., Radio Industries Broadcast Co., 500 w, E.

**WCAT**

1210 kc, 247.8 m, Rapid City, S. D., South Dakota State School of Mines, 100 w, M.

**WCAU**

1150 kc, 260.7 m, Philadelphia, Pa., Universal Broadcasting Co., 500 w, E, "Where Cheer Awaits U."

**WCAX**

1180 kc, 254.1 m, Burlington, Vt., University of Vermont, 100 w, E, "The Voice of the Green Mountains."

**WCAZ**

1200 kc, 249.9 m, Carthage, Ill., Carthage College, 50 w.

**WCBA**

1350 kc, 222.1 m, Allentown, Pa., Charles W. Heimbach, 100 w, E.

**WCBD**

870 kc, 344.6 m, Zion, Ill., Wilbur Glen Voliva, 5000 w, C.

**WCBE**

1320 kc, 227.1 m, New Orleans, La., Uhalt Radio, 250 w, C, "Second Post. U. S. A."

**WCBM**

1330 kc, 225.4 m, Baltimore, Md., Hotel Chateau, 100 w.

**WCBR**

1490 kc, 201.2 m, Portable, Charles H. Messter, 100 w.

**WCBS**

1430 kc, 209.7 m, Springfield, Ill., Harold L. Dewing, 250 w.

**WCCO**

740 kc, 405.2 m, Anoka, Minn., Washburn-Crosby Co., 5000 w, C, "Service to the Northwest."

**WCDA**

1420 kc, 211.1 m, Cliffside Park, N. J., Italian Educational Broadcasting Co., 250 w.

**WCFL**

620 kc, 483.6 m, Chicago, Ill., Chicago Federation of Labor, 1500 m, C, "The Voice of Labor."

**WCGU**

1370 kc, 218.8 m, Coney Island, N. Y., Chas. G. Unger, 500 w.

**WCLB**

1500 kc, 199.9 m, Long Beach, Long Island, N. Y., Arthur Fask, 100 w, E, "The Voice of Community Service."

**WCLS**

1390 kc, 215.7 m, Joliet, Ill., WCLS, Inc., 150 w.

**WCMA**

1150 kc, 260.7 m, Culver, Ind., Culver Military Academy, 500 w, C, "The Voice of Culver."

**WCOA**

1200 kc, 249.9 m, Pensacola, Fla., City of Pensacola, 500 w, E, "Wonderful City of Advantages."

**WCOC**

1300 kc, 230.6 m, Columbus, Miss., Crystal Oil Co., 500 w, C.

**WCOT**

1330 kc, 225.4 m, Providence, R. I., Jacob Conn, 100 w.

**WCRW**

1340 kc, 223.7 m, Chicago, Ill., Clinton R. White, 500 w.

**WCSH**

820 kc, 365.6 m, Portland, Me., Congress Square Hotel Co., 500 w, E, "The Voice From Sunrise Land."

**WCSS**

1170 kc, 256.3 m, Springfield, Ohio, Wittenberg College, 500 w, E.

**WCWK**

1400 kc, 214.2 m, Ft. Wayne, Ind., Chester W. Keen, 250 w.

# The Standard Radio Insulation!

**S**INCE broadcasting began radio set builders have preferred Formica as panel, tube and insulating material.

It has an excellent finish, good working qualities and the highest quality as an insulator for long or short wave equipment.

*Good radio jobbers everywhere  
carry stocks*

**THE FORMICA INSULATION COMPANY**  
4666 SPRING GROVE AVENUE  
CINCINNATI, OHIO

**FORMICA**  
Made from Anhydrous Bakelite Resins  
**SHEETS TUBES RODS**

**WCWS**

1130 kc, 265.3 m, Danbury, Conn., Danbury Broadcasting Station, 100 w, E.

**WCX**

680 kc, 440.9 m, Pontiac, Mich., WJR, Inc., and Detroit Free Press, 5000 w, E.

**WDAD**

1330 kc, 225.4 m, Nashville, Tenn., Life & Casualty Ins. Co., 1000 w, C, "Where Dollars Are Doubled."

**WDAE**

1120 kc, 267.7 m, Tampa, Fla., Tampa Publishing Co., 500 w, E, "WDAE," the Voice of the Times at Tampa."

**WDAF**

810 kc, 370.2 m, Kansas City, Mo., Kansas City Star Co., 1000 w, C, "Enemies of Sleep."

**WDAG**

1140 kc, 263.0 m, Amarillo, Texas, J. Lawrence Martin, 1000 w, C, "Where Dollars Always Grow."

**WDAH**

1280 kc, 234.2 m, El Paso, Tex., Trinity Methodist Church, 100 w, M.

**WDAY**

550 kc, 545.1 m, Fargo, N. D., Radio Equipment Corp., 250 w, C.

**WDBJ**

1300 kc, 230.6 m, Roanoke, Va., Richardson-Wayland Elec. Corp., 250 w, E, "The Magic City."

**WDBO**

1040 kc, 288.3 m, Orlando, Fla., Rollins College, Inc., 500 w, E, "Down Where the Oranges Grow."

**WDEL**

1010 kc, 296.9 m, Wilmington, Del., WDEL, Inc., 100 w, E, "First City of the First State."

**WDGY**

1050 kc, 285.5 m, Minneapolis, Minn., Dr. Geo. W. Young, 500 w, C.

**WDOD**

1230 kc, 243.8 m, Chattanooga, Tenn., Chattanooga Radio Co., Inc., 500 w, C.

**WDRG**

1060 kc, 282.8 m, New Haven, Conn., Doolittle Radio Corp., 500 w, E.

**WDFW**

1210 kc, 247.8 m, Cranston, R. I., Dutee W. Flint, 250 w, E.

**WDZ**

1080 kc, 277.6 m, Tuscola, Ill., James L. Bush, 100 w.

**WEAF**

610 kc, 491.5 m, Bellmere, N. Y., National Broadcasting Co., Inc., 50,000, w, E.

**WEAM**

1140 kc, 263.0 m, North Plainfield, N. J., Borough of North Plainfield, 250 w, E.

**WEAN**

1090 kc, 275.1 m, Providence, R. I., The Shepard Co., 500 w, E, "We Entertain a Nation."

**WEAO**

1060 kc, 282.8 m, Columbus, Ohio, Ohio State University, 750 w, E.

**WEAR**

750 kc, 399.8 m, Cleveland, Ohio, Willard Storage Battery Co., 1000 w, E.

**WEBC**

1240 kc, 241.8 m, Superior, Wis., Head of The Lakes Broadcasting Co., 250 w nighttime, 1000 w daytime- C.

**WEBE**

1210 kc, 247.8 m, Cambridge, Ohio, Roy W. Walter, 10 w, E.

**WEBH**

820 kc, 365.6 m, Chicago, Ill., Edgewater Beach Hotel Co., 500 w, C, "Where Everybody's Happy."

**WEBQ**

1340 kc, 223.7 m, Harrisburg, Ill., Tate Radio Co., 15 w.

**WEBR**

1240 kc, 241.8 m, Buffalo, N. Y., H. H. Howell, 200 w, E, "We Extend Buffalo's Regards."

**WEBW**

1160 kc, 258.5 m, Beloit, Wis., Beloit College, 500 w.

**WEDC**

1240 kc, 241.8 m, Chicago, Ill., Emil Denmark, Inc., 500 w.

**WEDH**

1440 kc, 208.2 m, Erie Dispatch-Herald, Erie, Pa., 50 w, E.

**WEEI**

590 kc, 508.2 m, Boston, Mass., Edison Elec. Illum. Co., 500 w, E, "The Friendly Voice."

**WEHS**

1390 kc, 215.7 m, Evanston, Ill., Victor C. Carlson, 100 w.

**WEMC**

620 kc, 483.6 m, Berrien Springs, Mich., Emmanuel Missionary College, 1000 w, C, "The Radio Light-house."

**WENR**

1040 kc, 288.3 m, Chicago, Ill., Great Lakes Radio Broadcasting Co., 500 w, C, "Voice of Service."

**WEPS**

1010 kc, 296.9 m, Gloucester, Mass., Matheson Radio Co., Inc., 100 w, E.

**WEVD**

1220 kc, 245.8 m, Woodhaven, N. Y., Debs Memorial Radio Fund, 500 w.

**WEW**

850 kc, 352.7 m, St. Louis, Mo., St. Louis University, 1000 w, C.

**WFAA**

550 kc, 545.1 m, Dallas, Texas, Dallas Morning News, 500 w, C, "Working for All Alike."

**WFAN**

1340 kc, 223.7 m, Philadelphia, Pa., Keystone Broadcasting Co., Inc., 500 w, E.

**WFBC**

1280 kc, 234.2 m, Knoxville, Tenn., First Baptist Church, 50 w.

**WFBE**

1220 kc, 245.8 m, Cincinnati, Ohio, Park View Hotel, 250 w.

**WFBG**

1120 kc, 267.7 m, Altoona, Pa., William F. Gable Co., 100 w, E, "The Original Gateway to the West and We Wish You All the Very Best."

**WFBJ**

1100 kc, 272.6 m, Colleegeville, Minn., St. Johns University, 100 w, C, "In the Heart of the Landscape Paradise."

**WFBL**

1160 kc, 258.5 m, Syracuse, N. Y., The Onondaga Co., Inc., 750 w, E, "When Feeling Blue, Listen."

**WFBM**

1090 kc, 275.1 m, Indianapolis, Ind., Indianapolis Power & Light Co., 1000 w, C, "The Crossroads of America."

**WFBZ**

1230 kc, 243.8 m, Baltimore, Md., Baltimore Radio Show, Inc., 250 w, E, "Home of the Star Spangled Banner."

**WFBI**

1240 kc, 241.8 m, Pawtucket, R. I., Frank Crook, Inc., 100 w, E, "The City of Diversified Industries."

**WFDF**

1100 kc, 272.6 m, Flint, Mich., Frank D. Fallain, 100 w, E.

**WFI**

740 kc, 405.2 m, Philadelphia, Pa., Strawbridge & Clothier, 500 w, E.

**WFIW**

1150 kc, 260.7 m, Hopkinsville, Ky., The Acme Mills, Inc., 1000 w, C.

**WFJC**

1320 kc, 227.1 m, Akron, Ohio, W. F. Jones Broadcasting, Inc., 500 w, E.

**WFKD**

1210 kc, 247.8 m, Frankford, Pa., Foulkrod Radio Eng. Co., 50 w, E.

**WFLA**

580 kc, 516.9 m, Clearwater, Fla., Clearwater Chamber of Commerce, 750 w, E, "Inviting the World to the Springtime All the Time City."

**WGAL**

1190 kc, 252.0 m, Lancaster, Pa., Lancaster Elec. Sup. & Const. Co., 15 w, E, "World's Gardens at Lancaster."

**WGBB**

1220 kc, 245.8 m, Freeport, N. Y., Harry H. Cayman, 150 w, E, "The Voice of the Sunrise Trail."

**WGBC**

1310 kc, 228.9 m, Memphis, Tenn., First Baptist Church, 15 w, C.

**WGBF**

1270 kc, 236.1 m, Evansville, Ind., Finke Furniture Co., 250 w, E, "Gateway to the South."



Total Price Only  
**\$14.95** *On Easy Payments*

**Radio Cabinet and Bench**

**\$1.00 down**

**Free Trial!**

Only \$1.00 with coupon below brings this handsome, massive, pure Period design console radio cabinet, with bench to match, to your home on 30 days

Just the thing you need to give your radio the appearance of a costly set and to beautify the room with a

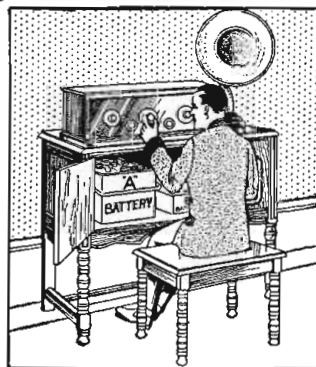
touch of elegance. Ample space inside of cabinet for all batteries, chargers and eliminators. Keep all unsightly accessories out of sight in this splendid piece of furniture. Made of well seasoned, selected hardwood in **Handsome Walnut Finish**. Two large, French style swinging doors at front with ornamental brass knobs. Front panels of doors in carved panel effects and legs of both cabinet and bench are neatly turned. Edge of top neatly bevelled. Cabinet has lower cross brace to insure rigidity. Top is 33 1/4 x 18 inches, height inside 11 1/2 inches. Full height 33 inches. Bench is 18 inches high.

**\$1.50 a Month**

After 30 days trial if not satisfied, send Cabinet and bench back at our expense and we'll refund your \$1.00 plus all transportation charges you paid. Or keep them and pay only \$1.50 a month till you've paid our smashed cut price for this sale—only \$14.95. Our credit price beats cash prices anywhere. Order by No. B182A. Shpg. wgt. about 70 lbs.

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**FREE Catalog**  
of home furnishings sent with or without order. See coupon.

**Straus & Schram, Dept. R1516 Chicago**

Enclosed find \$1. Ship Walnut Finish Radio Cabinet and Bench. I am to have 30 days free trial. If I keep the cabinet and bench I will pay you \$1.50 monthly. If not satisfied, I am to return them at your expense and you are to refund my money and any freight or express charges I paid.  
**Radio Cabinet and Bench No. B182A, \$14.95**

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Married or Single..... Nationality or Color.....

If you want only our free catalog of home furnishings, mark X here

**WGBI**

1300 kc, 230.6 m, Scranton, Pa., Scranton Broadcasters, Inc., 250 w, E.

**WGBS**

860 kc, 348.6 m, Astoria, L. I., N. Y., Gimbel Bros., Inc., 500 w, E.

**WGCM**

1350 kc, 222.1 m, Gulfport, Miss., Gulf Coast Music Co., Inc., 15 w, C.

**WGCP**

1120 kc, 267.7 m, Newark, N. J., May Radio Broadcast Corp., 250 w.

**WGES**

1240 kc, 241.8 m, Chicago, Ill., Oak Leaves Broadcasting Corp., 500 w, C. "World's Greatest Entertainment Service."

**WGHP**

1080 kc, 277.6 m, Fraser, Mich., George Harrison Phelps, Inc., 750 w, E.

**WGL**

1020 kc, 293.9 m, Secaucus, N. J., International Broadcasting Corp., 1000 w.

**WGMS**

1220 kc, 245.6 m, Minneapolis, Minn., University of Minnesota, 500 w, C.

**WGMU**

1490 kc, 201.2 m, Portable, Atlantic Broadcasting Corp., 100 w.

**WGN**

720 kc, 416.4 m, Chicago, Ill., Tribune Co., 500 w, C.

**WGR**

990 kc, 302.8 m, Buffalo, N. Y., Federal Radio Corp., 750 w, E. "Key City of Industry."

**WGST**

1110 kc, 270.1 m, Atlanta, Ga., Georgia School of Technology, 500 w, E. "The Southern School with the National Reputation."

**WGWB**

1110 kc, 270.1 m, Milwaukee, Wis., Evening Wisconsin Co., 250 w.

**WGY**

790 kc, 379.5 m, South Schenectady, N. Y., General Electric Co., 50,000 w, E.

**WHA**

900 kc, 333.1 m, Madison, Wis., University of Wisconsin, 750 w, C.

**WHAD**

1110 kc, 270.1 m, Milwaukee, Wis., Marquette University, 500 w, C.

**WHAM**

1070 kc, 200.2 m, Rochester, N. Y., Stronberg-Carlson Tel. Mfg. Co., 5000 w, E.

**WHAP**

1270 kc, 236.1 m, Carlstadt, N. J., Defenders of Truth Society, Inc., 1000 w, E.

**WHAS**

930 kc, 322.4 m, Louisville, Ky., The Courier Journal Co., 500 w, C.

**WHAZ**

980 kc, 305.9 m, Troy, N. Y., Rensselaer Polytechnic Institute, 500 w, E.

**WHB**

880 kc, 340.7 m, Kansas City, Mo., Sweeney Automobile School Co., 500 w, C. "Kansas City, Mo., the Heart of America."

**WHBA**

1150 kc, 260.7 m, Oil City, Pa., C. C. Shaffer, 10 w, E.

**WHBC**

1270 kc, 236.1 m, Canton, Ohio, St. John's Catholic Church, 10 w.

**WHBD**

1350 kc, 222.1 m, Bellefontaine, Ohio, Chamber of Commerce, 100 w, E. "Ohio's Highest Point."

**WHBF**

1350 kc, 222.1 m, Rock Island, Ill., Beardsley Specialty Co., 100 w.

**WHBL**

1470 kc, 204.0 m, Sheboygan, Wis., Press Pub. Co., 250 w, C.

**WHBM**

1490 kc, 201.2 m, Portable, C. L. Carrell, 100 w.

**WHBP**

1310 kc, 228.9 m, Johnstown, Pa., Johnstown Automobile Co., 250 w, E. "The Voice of the Friendly City."

**WHBQ**

1290 kc, 232.4 m, Memphis, Tenn., WHBQ, Inc., 100 w, C.

**WHBU**

1360 kc, 220.4 m, Anderson, Ind., Citizens Bank, 15 w, C. "First Hoosier Bank on the Air."

**WHBW**

1360 kc, 220.4 m, Philadelphia, Pa., D. R. Kienzle, 100 w, E.

**WHBY**

1200 kc, 249.9 m, West De Pere, Wis., St. Norbert's College, 50 w.

**WHDI**

1220 kc, 245.6 m, Minneapolis, Minn., Wm. Hood Dunwoody Ind. Inst., 500 w, C.

**WHEC**

1180 kc, 254.1 m, Rochester, N. Y., Hickson Electric Co., Inc., 250 w, E.

**WHFC**

1390 kc, 215.7 m, Chicago, Ill., Goodson & Wilson, Inc., 200 w.

**WHK**

1130 kc, 265.3 m, Cleveland, Ohio, Radio Air Service Corp., 500 w, E. "Cleveland's Pioneer Station."

**WHN**

760 kc, 394.5 m, New York, N. Y., George Schueler, 500 w, E. "Voice of the Great White Way."

**WHO**

560 kc, 535.4 m, Des Moines, Iowa, Bankers Life Co., 5000 w, C. "W-H-O. Who? Banker's Life, Des Moines."

**WHPP**

1450 kc, 206.8 m, Englewood Cliffs, N. J., Bronx Broadcasting Co., 10 w.

**WHT**

980 kc, 305.9 m, Deerfield, Ill., Radiophone Broadcasting Corp., 5000 w.

**WIAD**

1040 kc, 288.3 m, Philadelphia, Pa., Howard R. Miller, 100 w, E.

**WIAS**

930 kc, 322.4 m (6 to 6 only), Ottumwa, Iowa, Poling Electric Co., 100 w.

**WIBA**

1250 kc, 239.9 m, Madison, Wis., Capital Times-Strand Theater Station, 100 w.

**WIBG**

680 kc, 440.9 m, Elkins Park, Pa., St. Paul's P. E. Church, 50 w, E.

**WIBJ**

1490 kc, 201.2 m, Portable, C. L. Carrell, 100 w.

**WIBM**

1490 kc, 201.2 m, Portable, C. L. Carrell, 100 w.

**WIBO**

980 kc, 305.9 m, Chicago, Ill., WIBO, Inc., 5000 w, C.

**WIBR**

1200 kc, 249.9 m, Steubenville, Ohio, Thurman A. Owings, 50 w, E. "Where Investments Bring Results."

**WIBS**

1470 kc, 204.0 m, Elizabeth, N. J., New Jersey Broadcasting Corp., 250 w.

**WIBU**

1380 kc, 217.3 m, Poynette, Wis., The Electric Farm, 20 w.

**WIBW**

1470 kc, 204.0 m, Topeka, Kan., C. L. Carroll, 250 w, C. "Topeka--Where Investment Brings Wealth."

**WIBX**

1260 kc, 238.0 m, Utica, N. Y., WIBX, Inc., 150 w, E.

**WIBZ**

1300 kc, 230.6 m, Montgomery, Ala., Alexander D. Trum, 15 w, C. "We Interest Business Zeal."

**WICC**

1130 kc, 265.3 m, Easton, Conn., Bridgeport Broadcasting Station, Inc., 500 w, E. "The Industrial Capital of Connecticut."

**WIL**

1160 kc, 258.5 m, St. Louis, Mo., Benson Radio Broadcasting Co., 250 w, C. "A Wave Length Ahead."

**WIOD**

1210 kc, 247.8 m, Miami Beach, Fla., Carl G. Fisher Co., 1000 w, E. "Wonderful Isle of Dreams."

**WIP**

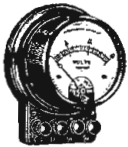
860 kc, 348.6 m, Philadelphia, Pa., Gimbel Bros. Inc., 500 w, E. "Watch Its Progress."





**Pattern No. 199**

The Jewell service set that all dealers are buying this year. Its many handy and advanced test features present a worth easily recognized. If your dealer uses this test equipment, you are assured of good service.



**Pattern No. 77**

A portable, triple range, A. C. instrument, moderate in price, but very effective for making the various alternating current tests required in the adjustment of filament and line voltage.



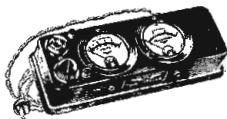
**Pattern No. 139**

High resistance voltmeter of the reliable D'Arsonval moving coil type, suitable for use by the individual in checking and adjusting B eliminator voltages. The range of 0-300 volts covers all ordinary requirements.



**Pattern No. 190**

Flush type, panel mounting A. C. instrument for panel control of A. C. tube filament voltage and for line voltage checking. Its numerous available ranges enable a choice to cover any requirements. Case diameter, 2 inches.



**Pattern No. 150**

A new A. C. tube checker for dealer use that is very simple. Merely plug the attachment cord into a light socket and it is ready to operate. Tests all tubes, from the 199 up to the 210.

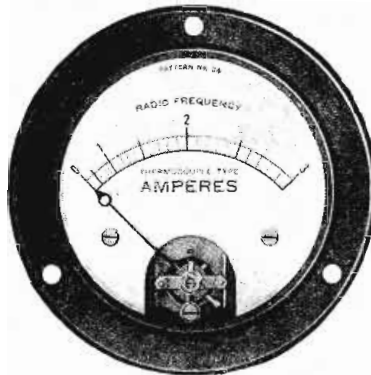


# Your Radio Investment Is Safe—if protected by JEWELL Instruments

In the new alternating current set you have a fairly large investment, especially in the high priced A. C. tubes, which are commonly burned out by variations in voltage of house lighting currents. Most sets carry a compensating arrangement, which tells nothing, however, of the voltage received by the filaments of the tubes.

Right there you can make your investment safe by purchasing a suitable voltmeter, which will enable you to keep your tube filament voltage in correct adjustment.

Jewell has instruments for every radio purpose. Instruments for dealers, for the set owner, for the manufacturer, for the amateur, and for the set builder. Ask your dealer about them or write to us direct. Write for a copy of our 15-C catalog, which covers our instruments in detail.



**Pattern No. 64**

Radio Frequency Ammeters for Amateurs—excellent for short wave work.

The loss in the instrument is less than 1/2 of the minimum required by the Navy.

## THE JEWELL TRIO

For Amateurs and Experimenters

The Jewell Trio of amateur broadcasting instruments, Patterns Nos. 54, 64, and 74, are still making radio history. Many of the recent successful pioneering airplane ventures have been guided by Jewell instruments. Where success and life have been trusted to their reliability, they have proven their worth. Every amateur and experimenter should use them. The Pattern No. 64 above illustrates their general appearance, as they are uniform in size. Case diameter, 3 inches. Flange diameter, 3 3/4 inches.

### Pattern No. 54

Used for measuring plate voltage in transmitting sets as well as for general laboratory work, they are available in direct current ranges, running to relatively high voltages, and also in various ammeter and milliammeter ranges.

### Pattern No. 64

A thermo couple type radio frequency ammeter. It is extremely accurate and has a guaranteed overload capacity of 50%. The losses are very low, being less than one-half the Navy minimum.

### Pattern No. 74

This A. C. instrument is widely used for filament control of power tubes. The movement is a rugged moving vane type of proven worth. It perfectly matches the appearance of both Patterns Nos. 54 and 64.

The Jewell Trio is described in detail in our Radio Instrument Catalog No. 15-C.

**"28 Years Making Good Instruments"**

# Jewell Electrical Instrument Co.

1650 Walnut St., Chicago, Ill.

**WISN**

1110 kc, 270.1 m, Milwaukee, Wis., Evening Wisconsin Co., 250 w, C.

**WIVA**

1430 kc, 209.7 m, Norfolk, Va., Radio Corporation of Virginia, 100 w, E.

**WJAD**

900 kc, 333.1 m, Waco, Texas, Frank P. Jackson, 500 w, C, "Waco, Texas, All Around It."

**WJAG**

1050 kc, 285.5 m, Norfolk, Neb., Norfolk Daily News, 250 w, C, "Home of the Printer's Devil."

**WJAK**

1280 kc, 234.2 m, Kokomo, Ind., J. A. Kautz, 50 w.

**WJAM**

1250 kc, 239.9 m, Cedar Rapids, Iowa, D. M. Perham, 250 w, C.

**WJAR**

620 kc, 483.6 m, Providence, R. I., The Outlet Co., 500 w, E, "The Southern Gateway of New England."

**WJAS**

1110 kc, 270.1 m, Pittsburgh, Pa., Pittsburgh Radio Supply House, 500 w, E.

**WJAX**

880 kc, 340.7 m, Jacksonville, Fla., City of Jacksonville, 1000 w, E, "WJAX—W for Wonderful, JAX for Jacksonville."

**WJAY**

1320 kc, 227.1 m, Cleveland, Ohio, Cleveland Radio Broadcasting Corp., 500 w, E.

**WJAZ**

1140 kc, 263.0 m, Mt. Prospect, Ill., Zenith Radio Corp., 5000 w, C.

**WJBA**

1210 kc, 247.0 m, Joliet, Ill., D. H. Lentz, Jr., 50 w.

**WJBB**

1260 kc, 238.0 m, Sarasota, Fla., Financial Journal, Inc., 250 w, E, "The Pioneer Semi-Tropical Business Journal."

**WJBC**

1320 kc, 227.1 m, LaSalle, Ill., Hummer Furniture Co., 100 w.

**WJBI**

1140 kc, 263.0 m, Red Bank, N. J., Robt. S. Johnson, 250 w.

**WJBK**

1360 kc, 220.4 m, Ypsilanti, Mich., Ernest F. Goodwin, 15 w, C.

**WJBL**

1410 kc, 212.6 m, Decatur, Ill., Wm. Gushard Dry Goods Co., 250 w.

**WJBO**

1140 kc, 263.0 m, New Orleans, La., Valdemar Jensen, 100 w, C.

**WJBT**

770 kc, 389.4 m, Chicago, Ill., J. S. Boyd, Inc., 500 w, C.

**WJBU**

1400 kc, 214.2 m, Lewisburg, Pa., Bucknell University, 100 w, E, "In the Heart of the Keystone State."

**WJBW**

1260 kc, 238.0 m, New Orleans, La., C. Carlsen, Jr., 30 w, C, "The Serve You Broadcasting Station at New Orleans."

**WJBY**

1280 kc, 234.2 m, Gadsden, Ala., Electric Cons. Co., 50 w, C.

**WJDD**

820 kc, 365.6 m, Mooseheart, Ill., Loyal Order of Moose, 1000 w, C, "Every Child Is Entitled to a High School Education and a Trade."

**WJKS**

1290 kc, 232.4 m, Gary, Ind., Johnson-Kennedy Radio Corp., 500 w, C.

**WJPW**

1440 kc, 208.2 m, Ashtabula, Ohio, J. P. Wilson, 30 w.

**WJR**

680 kc, 440.9 m, Pontiac, Mich., WJR, Inc., and Detroit Free Press, 5000 w, E, "The Good Will Station."

**WJZ**

660 kc, 454.3 m, Boundbrook, N. J., Radio Corporation of America, 30,000 w, E.

**WKAQ**

930 kc, 322.4 m, San Juan, Porto Rico, Radio Corp. of Porto Rico, 500 w, E, "Porto Rico, The Island of Enchantment in the Caribbean Sea."

**WKAR**

1080 kc, 277.6 m, East Lansing, Mich., Michigan State College, 500-1000 w, E.

**WKAU**

1340 kc, 223.7 m, Laconia, N. H., Laconia Radio Club, 50 w, E, "The Voice of the Winnepesaukee Lake Region."

**WKBB**

1390 kc, 215.7 m, Joliet, Ill., Sanders Bros., 150 w.

**WKBC**

1370 kc, 218.8 m, Birmingham, Ala., H. L. Ansley, 10 w, C.

**WKBE**

1310 kc, 228.9 m, Webster, Mass., K. & B. Electric Co., 100 w, E.

**WKBK**

1190 kc, 252.0 m, Indianapolis, Ind., Noble Butler Watson, 250 w, C, "We Keep Building Friendships."

**WKBG**

1490 kc, 201.2 m, Portabel, C. L. Carrell, 100 w.

**WKBH**

1360 kc, 220.4 m, LaCrosse, Wis., Callaway Music Co., 500 w.

**WKBI**

1390 kc, 215.7 m, Chicago, Ill., Fred L. Schoenwolf, 50 w.

**WKBL**

1460 kc, 205.4 m, Monroe, Mich., Monrona Radio Mfg. Co., 15 w, E, "The Most Powerful 15-Watt Station in the World."

**WKBN**

1400 kc, 214.2 m, Youngstown, Ohio, W. P. Williams, Jr., 50 w, E.

**WKBO**

1370 kc, 218.8 m, Jersey City, N. J., Carnith Corp., 500 w.

**WKBP**

1410 kc, 212.6 m, Battle Creek, Mich., Enquirer-News Co., 50 w, E.

**WKBQ**

1370 kc, 218.8 m, New York, N. Y., Standard Cahill Co., Inc., 500 w.

**WKBS**

1380 kc, 217.3 m, Galesburg, Ill., Permil N. Nelson, 100 w.

**WKBT**

1190 kc, 252.0 m, New Orleans, La., First Baptist Church, 50 w, C.

**WKBV**

1380 kc, 217.3 m, Brookville, Ind., Knox Battery & Electric Co., 100 w, C.

**WKBW**

1380 kc, 217.3 m, Buffalo, N. Y., Churchill Evangelistic Assn., Inc., 5000 w, E, "Well Known Bible Witness."

**WKBZ**

1500 kc, 199.9 m, Ludington, Mich., K. L. Ashbacher, 15 w.

**WKEN**

1470 kc, 204.0 m, Kenmore, N. Y., WKEN, Inc., 250 w, E.

**WKJC**

1190 kc, 252.0 m, Lancaster, Pa., Kirk Johnson & Co., 50 w, E.

**WKRC**

1220 kc, 245.6 m, Cincinnati, Ohio, Kodel Radio Corp., 500 w, E, "WKRC, K—Kodel, R—Radio, C—Corporation."

**WKY**

1040 kc, 288.3 m, Oklahoma City, Okla., WKY Radiophone Co., 150 w, C.

**WLA C**

1330 kc, 225.4 m, Nashville, Tenn., Life & Casualty Ins. Co., 5000 w, C, "The Thrift Station."

**WLAP**

1120 kc, 267.7 m, Louisville, Ky., L. W. Benedict, 30 w, C.

**WLB**

1220 kc, 245.6 m, Minneapolis, Minn., University of Minnesota, 500 w, C.

**WLBC**

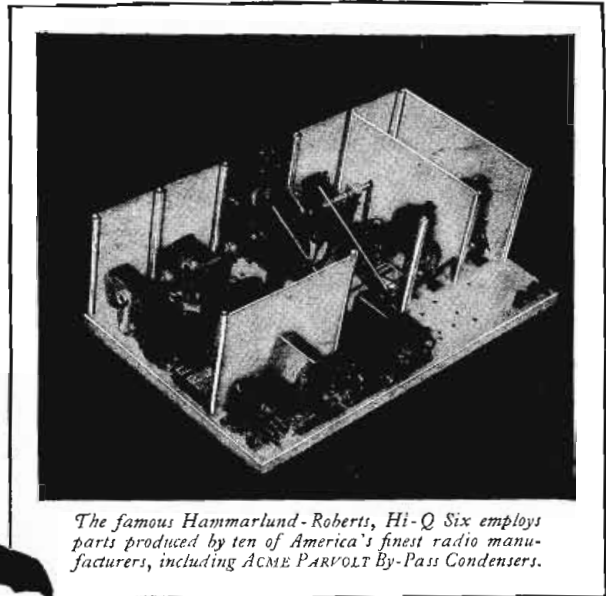
1430 kc, 209.7 m, Muncie, Ind., Donald A. Burton, 50 w.

# Don't Take Chances with Condenser Breakdown!

"The man who tries to save a few cents by buying cheap condensers is always in danger of having to pay out many dollars for replacement parts. A cheap condenser is expensive when it breaks down."



*Leslie G. Biles*



The famous Hammarlund-Roberts, Hi-Q Six employs parts produced by ten of America's finest radio manufacturers, including ACME PARVOLT By-Pass Condensers.

# Play Safe with PARVOLTS!

THE rapidly increasing use of by-pass and filter condensers in modern A.C. operated circuits demands the greatest caution against poor quality, inaccuracy of rating and non-uniformity in condensers.

Nothing can do so much harm to impair radio reception or effect such costly losses in assembled parts as defective or inaccurate condensers.

It is of vital importance to use condensers of proper ratings, and to know the ratings actually ARE as stated and that all stated ratings are UNIFORM.

It is vital to use condensers whose ratings are based upon CONTINUOUS DUTY.

It is vital to use condensers that

are made with AT LEAST the overload factor of safety demanded by the R.M.A. and N.E.M.A.

Condensers which possess these qualities not only aid quality reception, but overcome the possibility of break-down and heavy losses from ruined tubes, transformers and other parts... All ACME

PARVOLT Condensers are made and tested to standards of the R.M.A. and N.E.M.A. They are used and recommended by leading radio engineers, designers, service men and custom-builders everywhere. Play safe with PARVOLTS! Made by THE ACME WIRE CO., New Haven, Conn., manufacturers of magnet and enameled wire, varnished insulations, coil windings, insulated tubing and radio cables.



ACME PARVOLT FILTER CONDENSERS are supplied in all standard mfd. capacities for 200, 400, 600, 800, 1000, and 1500 Volt D. C. requirements. Uniform height and width for easy stacking. Supplied singly or in complete housed blocks for the important power supply units such as Thordarson, Samsen and others.

ACME PARVOLT BY-PASS CONDENSERS are supplied in all standard mfd. capacities and for all the required working voltages.

# ACME PARVOLT CONDENSERS

Made by the Manufacturers of

# ACME CELATSITE HOOK-UP WIRE

### ENAMELED AERIAL WIRE

Enameled copper wire in both stranded and solid types. Also Acme Lead-ins, Battery Cables, Indoor and Loop Aerial Wire.

### CELATSITE FLEXIBLE and SOLID

For all types of radio wiring. High insulation value; non-inflammable. 10 colors.

### ACME SPAGHETTI

A superior cambric tubing for all practical radio and other electrical requirements. Supplied in 10 colors.

**WLBF**

1430 kc, 209.7 m, Kansas City, Mo., Everett L. Dillard, 50 w, C, "Where Listeners Become Friends."

**WLBG**

1400 kc, 214.2 m, Petersburg, Va., Robert Allen Gamble, 500 w, E.

**WLBH**

1290 kc, 232.4 m, Farmingdale, N. Y., Joseph J. Lombardi, 30 w.

**WLBL**

900 kc, 333.1 m, Stevens Point, Wis., Wisconsin Department of Markets, 1000 w, C, "Wisconsin. Land of Beautiful Lakes."

**WLBN**

1470 kc, 204.0 m, Arkansas Broadcasting Co., Little Rock, Ark., 50 w.

**WLBV**

1450 kc, 206.2 m, Mansfield, Ohio, Mansfield Broadcasting Association, 50 w, E.

**WLBW**

1020 kc, 293.9 m, Oil City, Pa., Petroleum Telephone Co., 500 w, E.

**WLBX**

1470 kc, 204.0 m, Long Island City, N. Y., John N. Brahy, 250 w.

**WLBZ**

1440 kc, 208.2 m, Dover-Foxcroft, Me., Thompson L. Guernsey, 250 w, E.

**WLCI**

1210 kc, 247.8 m, Ithaca, N. Y., Lutheran Assn. of Ithaca, 50 w, E.

**WLEX**

1390 kc, 215.7 m, Lexington, Mass., Lexington Air Station, 50 w, E.

**WLIT**

740 kc, 405.2 m, Philadelphia, Pa., Lit Brothers, 500 w, E, "The Quaker City Siren."

**WLOE**

1420 kc, 211.1 m, Chelsea, Mass., William S. Pote, 100 w.

**WLS**

870 kc, 344.6 m, Crete, Ill., Sears-Roebuck & Co., 5000 w, C, "World's Largest Store, 'Work Better, Live Better, Sell Better.'"

**WLSI**

1210 kc, 247.8 m, Cranston, R. I., Dutee W. Flint, 250 w, E.

**WLTH**

1170 kc, 256.3 m, Brooklyn, N. Y., Voice of Brooklyn, Inc., 250 w, E.

**WLW**

700 kc, 428.3 m, Harrison, Ohio, Cresley Radio Corp., 5000 w, E.

**WLW**

700 kc, 428.3 m, Cincinnati, Ohio, Cresley Radio Corp., 500 w, E.

**WLWL**

810 kc, 370.2 m, Kearny, N. J., Missionary Society of St. Paul, 5000 w, E.

**WMAC**

1330 kc, 225.4 m, Casenovia, N. Y., Olive B. Meredith, 500 w, E, "Voice of Central New York."

**WMAF**

700 kc, 428.3 m, South Dartmouth, Mass., Round Hills Radio Corp., 500 w, E.

**WMAK**

550 kc, 545.1 m, Martinsville, N. Y., WMAK Broadcasting System, Inc., 750 w, E.

**WMAL**

1240 kc, 241.8 m, Washington, D. C., M. A. Leese Co., 500 w, E.

**WMAN**

1280 kc, 234.2 m, Columbus, O., W. E. Heskitt, 50 w, E.

**WMAQ**

670 kc, 447.5 m, Chicago, Ill., Chicago Daily News, Inc., 1000 w, C.

**WMAY**

1280 kc, 234.2 m, St. Louis, Mo., Kingshighway Presbyterian Church, 100 w.

**WMAZ**

1110 kc, 270.1 m, Macon, Ga., Mercer University, 500 w, E, "Watch Mercer Attain Zenith."

**WMBA**

1470 kc, 204.0 m, Newport, R. I., LeRoy Joseph Beebe, 100 w, E.

**WMBC**

1230 kc, 243.8 m, Detroit, Mich., Michigan Broadcasting Co., Inc., 100 w, E.

**WMBD**

1460 kc, 205.4 m, Peoria Heights, Ill., Peoria Heights Radio Laboratory, 250 w.

**WMBF**

780 kc, 384.4 m, Miami Beach, Fla., Fleetwood Hotel Corp., 500 w, E, "Wonderful Miami Beach Fleetwood."

**WMBG**

1360 kc, 220.4 m, Richmond, Va., Havens & Martin, Inc., 15 w, E, "The Daytime Station."

**WMBH**

1470 kc, 204.0 m, Joplin, Mo., Edwin Dudley Aber, 100 w, C, "Where Memories Bring Happiness."

**WMBI**

1140 kc, 263.0 m, Addison, Ill., Moody Bible Institute, 5000 w, C, "The West Point of Christian Service."

**WMBJ**

1290 kc, 232.4 m, McKeesport, Pa., Rev. John W. Sproul, 50 w, E.

**WMBL**

1310 kc, 228.9 m, Lakeland, Fla., Benford's Radio Studios, 100 w, E, "Lakeland—The City of Heart's Desire."

**WMBM**

1430 kc, 209.7 m, Memphis, Tenn., Seventh Day Adventist Church, 10 w, C.

**WMBO**

1360 kc, 220.4 m, Auburn, N. Y., Radio Service Laboratories, 100 w, E.

**WMBQ**

1470 kc, 204.0 m, Brooklyn, N. Y., Paul J. Gollhofer, 100 w.

**WMBR**

1190 kc, 252.0 m, Tampa, Fla., F. J. Reynolds, 100 w, E, "WMBR. Everything for Radio at Tampa, Fla."

**WMBS**

1280 kc, 234.2 m, Lemoyne, Pa., Mack's Battery Co., 250 w, E.

**WMBW**

1400 kc, 214.2 m, Youngstown, Ohio, Youngstown Broadcasting Co., Inc., 50 w, E.

**WMC**

580 kc, 516.9 m, Memphis, Tenn., Memphis Commercial Appeal, Inc., 5000 w, C, "WMC, Memphis, Down in Dixie."

**WMCA**

810 kc, 370.2 m, Hoboken, N. J., Greeley Square Hotel Co., 500 w, E, "Where the White Way Begins."

**WMES**

1420 kc, 211.1 m, Boston, Mass., Massachusetts Educational Society, 50 w.

**WMPC**

1280 kc, 234.2 m, Lapeer, Mich., First Methodist Protestant Church, 30 w, E, "Where Many Preach Christ."

**WMRJ**

1450 kc, 206.8 m, Jamaica, N. Y., Peter J. Prinz, 10 w, E, "The Gateway of the Sunrise Trail."

**WMSG**

1270 kc, 236.1 m, New York, N. Y., Madison Square Garden Broadcast Co., 500 w, E.

**WNAC**

650 kc, 461.3 m, Boston, Mass., The Shepard Stores, 500 w, E.

**WNAD**

1250 kc, 239.9 m, Norman, Okla., University of Oklahoma, 500 w, C, "The Voice of Soouerland."

**WNAL**

1160 kc, 238.5 m, Omaha, Neb., R. J. Rockwell, 250 w.

**WNAT**

1040 kc, 288.3 m, Philadelphia, Pa., Lennig Brothers Co., 100 w, E, "Where Are Never Tired."

**WNAX**

990 kc, 302.8 m, Yankton, S. Dak., Gurney Seed & Nursery Co., 1000 w, C.

**WNBA**

1440 kc, 208.2 m, Forest Park, Ill., Michael T. Rafferty, 200 w.

**WNBK**

1450 kc, 206.8 m, Endicott, N. Y., Howitt-Wood Radio Co., 50 w, E, "The Voice of the Triple Cities."

**WNBH**

1150 kc, 260.7 m, New Bedford, Mass., New Bedford Broadcasting Co., 250 w, E, "The Gateway to Cape Cod."



# EARN \$75<sup>00</sup> a week — in Your Spare Time

JOINING the Radio Association enables you to cash in on Radio *now!* Follow its success-proven plans and you can earn \$3 an hour, in your spare time, from the very first. Over \$600,000,000 is being spent yearly for sets, supplies, service. You can get your share of this business and, at the same time, fit yourself for the big-pay opportunities in Radio.

### Founded on a New Idea

Members of the Association do not wait for months before they make money out of Radio. Without quitting their jobs, our members are earning \$25 to \$75 a week spare time by building "tailored" radio sets, serving as "radio doctors," selling ready built sets and accessories, or following one of the many profit-making plans of the Association.

### Earned \$500 in Spare Hours

Hundreds earn \$3 an hour as "radio doctors." Lyle Follick, Lansing, Mich., has already made \$500 in spare time. Werner Eichler, Rochester, N. Y., is earning \$50 a week for spare time. F. J. Buckley, Sedalia, Mo., is earning as much in spare time as he receives from his employer.

*We will start you in business.* Our cooperative plan gives the ambitious man his opportunity to establish himself. Many have followed this plan and established radio stores. Membership in the Association has increased the salaries of many. Scores are now connected with big radio organizations. Others have prosperous stores.

A year ago Claude De Grave knew nothing about Radio. Today he is on the staff of a famous radio manufacturer and an associate member of the Institute of Radio Engineers. He attributes his success to joining the Association. His income now is 350% more than when he joined.

### Doubled Income in Six Months

"I attribute my success entirely to the Radio Association," writes W. E. Thon, Chicago, who was clerk in a hardware store before joining. We helped him secure the managership of a large store at a 220% increased salary.

"In 1922 I was a clerk," writes K. O. Benzing, McGregor, Ia., "when I enrolled. Since then I have built hundreds of sets—from 1-tube Regenerative to Superheterodynes. I am now operating my own store and my income is 200% greater than when I joined the Association. My entire success is due to the splendid help it gave."

### Easiest Way Into Radio

If ambitious to become a Radio Engineer, to fit yourself for the \$3,000 to \$10,000 opportunities in Radio, join the Association. It gives you a comprehensive practical and theoretical training and the benefit of our Employment Service. You earn while you learn. You have the privilege of buying radio supplies at wholesale. You have the Association behind you in carrying out your ambitions.

### ACT NOW—if You Wish Special Membership Plan

To a limited number of ambitious men, we will give Special Memberships that may not—need not—cost you a cent. To secure one, write today. We will send you details and also our book, "Your Opportunity in the Radio Industry." It will open your eyes to the money-making possibilities of Radio. Write today.

### What a Membership Can Do for You

- 1—Enable you to earn \$3 an hour upwards in your spare time.
- 2—Train you to install, repair and build all kinds of sets.
- 3—Start you in business without capital, or finance an invention.
- 4—Train you for the \$3,000 to \$10,000 big-pay radio positions.
- 5—Help secure a better position at bigger pay for you.
- 6—Give you the backing of the Radio Association.

**A MEMBERSHIP NEED NOT COST YOU A SINGLE CENT**

RADIO ASSOCIATION OF AMERICA  
4513 Ravenswood Ave.  
Chicago, Ill.

RCB-9

Gentlemen:

Please send me by return mail full details of your Special Membership Plan and also copy of your book, "Your Opportunity in the Radio Industry."

Name.....

Address.....

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

**WNBK**

1450 kc, 206.8 m, Knoxville, Tenn., Lonsdale Baptist Church, 50 w, C.

**WNBO**

1420 kc, 211.1 m, Washington, Pa., John Brown-Lee Spriggs, 15 w, E, "The Voice of Washington, Pa."

**WNBQ**

1460 kc, 205.4 m, Rochester, N. Y., Gordon P. Brown, 15 w, E.

**WNBR**

1310 kc, 228.9 m, Memphis, Tenn., John Ulrich, 100 w, C.

**WNBW**

1500 kc, 199.9 m, Carbondale, Pa., Home Cut Glass & China Co., 5, w, E.

**WNBX**

1240 kc, 241.8 m, Springfield, Vt., First Congregational Church, Inc., 10 w, E.

**WNBZ**

1290 kc, 232.4 m, Saranac Lake, N. Y., Smith & Mace, 10 w, E.

**WNJ**

1120 kc, 267.7 m, Newark, N. J., Radio Investment Co., 250 w, E, "The Voice of Newark."

**WNOX**

1130 kc, 265.3 m, Knoxville, Tenn., People's Tel. & Tel. Co., 1000 w, C, "Smoky Mountain Station."

**WNRC**

1340 kc, 223.7 m, Greensboro, N. C., Wayne M. Nelson, 250 w, E.

**WNYC**

570 kc, 526.0 m, New York, N. Y., Department of Plant & Structures, 500 w, E, "Municipal Broadcasting Station of the City of New York."

**WOAI**

1070 kc, 280.2 m, San Antonio, Texas, Southern Equipment Co. (WBAP), 5000 w, C, "The Winter Playground of America."

**WOAN**

1250 kc, 239.9 m, Lawrenceburg, Tenn., Church of the Nazarene, 500 w, C, "Watch Our Annual Normal."

**WOAX**

1250 kc, 239.9 m, Trenton, N. J., Franklyn J. Wolff, 500 w, E, "Trenton Makes, the World Takes."

**WOBR**

1470 kc, 204.0 m, Portable, Harl Smith, 10 w.

**WOBT**

1460 kc, 205.4 m, Union City, Tenn., Tittsworth's Radio & Music Shop, 15 w, C.

**WOBU**

1120 kc, 267.7 m, Charleston, W. Va., Charleston Radio Broadcasting Co., 250 w, E.

**WOC**

800 kc, 374.8 m, Davenport, Iowa, Palmer School of Chiropractic, 5000 w, C.

**WOCL**

1340 kc, 223.7 m, Jamestown, N. Y., A. E. Newton, 25 w, E.

**WODA**

1020 kc, 293.9 m, Paterson, N. J., Richard E. O'Dea, 1000 w, E, "The Voice of the Silk City."

**WOI**

1130 kc, 265.3 m, Ames, Iowa, Iowa State College, 2500 w, C.

**WOKO**

1390 kc, 215.7 m, Peekskill, N. Y., Harold E. Smith, 500 w, E.

**WOMT**

1350 kc, 222.1 m, Manitowoc, Wis., Mikado Theater, 100 w.

**WOO**

860 kc, 348.6 m, Philadelphia, Pa., John Wanamaker, 500 w, E.

**WOOD**

1150 kc, 260.7 m, Farnwood, Mich., Walter B. Stiles, Inc., 500 w, C, "The Voice of the Whispering Pines."

**WOQ**

880 kc, 340.7 m, Kansas City, Mo., Unity School of Christianity, 500 w, C.

**WOR**

710 kc, 422.3 m, Kearny, N. J., L. Bamberger & Co., 5000 w, E.

**WORD**

1190 kc, 252.0 m, Batavia, Ill., People's Pulpit Association, 5000 w, C, "The Watch Tower—Radio WORD."

**WOS**

710 kc, 422.3 m, Jefferson City, Mo., State Marketing Bureau, 500 w, C, "Watch Our State."

**WOW**

590 kc, 508.2 m, Omaha, Neb., Woodmen of the World, 1000 w, C, "The Omaha Station."

**WOWO**

1310 kc, 228.9 m, Ft. Wayne, Ind., Main Auto Supply Co., 2500 w, C.

**WPAP**

760 kc, 394.5 m, Cliffside, N. J., Cavalry Baptist Church, 500 w, E.

**WPCC**

1340 kc, 223.7 m, Chicago, Ill., North Shore Congregational Church, 500 w, C.

**WPCH**

920 kc, 325.9 m, Ifoboken, N. J., Concourse Radio Corp., 500 w.

**WPG**

1100 kc, 272.6 m, Atlantic City, N. J., Municipality of Atlantic City, 5000 w, E.

**WPOR**

1270 kc, 236.1 m, Norfolk, Va., Reliance Electric Co., Inc., 500 w, E.

**WPRC**

1430 kc, 209.7 m, Harrisburg, Pa., Wilson Printing & Radio Co., 100 w, E.

**WPSC**

1000 kc, 299.8 m, State College, Pa., Pennsylvania State College, 500 w, E, "The Voice of the Nittany Lion."

**WPSW**

1450 kc, 206.8 m, Philadelphia, Pa., Philadelphia School of Wireless Telegraphy, 50 w, E, "First Wireless School in America."

**WPTF**

550 kc, 545.1 m, Raleigh, N. C., Durham Life Insurance Co., 1000 w, E.

**WQAM**

780 kc, 384.4 m, Miami, Fla., Electrical Equipment Co., 750 w, E.

**WQAN**

1300 kc, 230.6 m, Scranton, Pa., Scranton Times, 250 w, E.

**WQAO**

760 kc, 394.5 m, Cliffside, N. J., Cavalry Baptist Church, 500 w, E, "The Bible, The Whole Bible and Nothing But the Bible."

**WQBA**

1260 kc, 238.0 m, Tampa, Fla., Amore College, 250 w, E.

**WQBC**

1390 kc, 215.7 m, Utica, Miss., I. R. Jones, 225 w, C.

**WQBJ**

1250 kc, 239.9 m, Clarksburg, W. Va., John Raikes, 65 w, E.

**WQBZ**

1200 kc, 249.9 m, Vierton, W. Va., J. H. Thompson, 60 w, E.

**WQJ**

670 kc, 477.5 m, Chicago, Ill., Calumet Broadcasting Co., 500 w.

**WRAF**

1440 kc, 208.2 m, La Porte, Ind., The Radio Club, Inc., 100 w.

**WRAC**

1370 kc, 218.8 m, C. R. Cummins, Erie, Pa., 30 w, E.

**WRAW**

1260 kc, 238.0 m, Reading, Pa., Avenue Radio & Electric Shop, 100 w, E, "The Schuylkill Valley Echo."

**WRAX**

1410 kc, 212.6 m, Philadelphia, Pa., Berachah Church, Inc., 250 w, E.

**WRBC**

1260 kc, 238.0 m, Valparaiso, Ind., Immanuel Lutheran Church, 250 w, C, "World Redeemed by Christ."

**WRC**

640 kc, 468.5 m, Washington, D. C., Radio Corporation of America, 500 w, E, "The Voice of the Capital."

**WREC**

1200 kc, 249.9 m, Whitehaven, Tenn., WREC, Inc., 100 w.

**ONLY**  
**\$99** for this **PACKARD!**  
**SUPER 8—\$250 A. C.**  
**ELECTRIC RADIO SET!**

**Direct From Our Factory**

Today's greatest radio! A truly sensational offer! The Eight-tube PACKARD A. C. Electric Radio — a regular \$250 set — shipped to any home in the U. S. at direct from factory price of only \$99. And to prove our claims we will ship this set to your home on

**\$5000.00**  
**CASH BOND**  
**to Back Our**  
**GUARANTEE**



**The PACKARD Engineers**

have invented this most unusual, powerful SUPER-Eight Tube Radio. Astonishing volume and tone quality. Remarkable selectivity and long-distance reception. Leading radio engineers unanimously agree that there is no better radio made — regardless of price.

Let us prove this by shipping a set to your home on 30 days' trial. Examine the set from A to Z. Let the most exacting critics pass on its merits. And if, after the 30 day trial period, you are convinced that the Packard Eight-tube Electric is fully the equal of any console radio set selling up to \$250—then, and only then, need you decide to keep it at our factory price of only \$99—otherwise, return it.

This marvelous set combines every new scientific development in receiving sets—possessing beauty, refinement, durability. Gets everything on the air from coast to coast—from Mexico into Canada, loudly, clearly, and distinctly. Only one dial to tune in all stations.

**You Save the Jobbers', Dealers' and Salesmen's Profits**

The PACKARD Radio is shipped direct from our factory. All the in-between profits are deducted from the price of the set and instead of paying \$250 you pay only \$99. Quantity production, economy in selling, and only a small profit for the manufacturer makes this astounding offer possible.

**MAIL COUPON NOW FOR 30 days' free trial offer**

Don't miss this opportunity. Mail coupon at once for complete information about the PACKARD A. C.—8 TUBE ELECTRIC RADIO and our liberal 30 days' free trial offer. No obligation on your part. Our \$5,000.00 cash bond backs up our guarantee.

**PACKARD RADIO CO.**  
**2323 Milwaukee Ave. Dept. 355 Chicago, Ill.**



**WORLD'S GREATEST RADIO**  
**Genuine Walnut Console Cabinet**

Eight powerful A. C. tubes and one genuine full-wave rectifying tube—nine tubes in all. Supreme quality throughout. Simple to operate. Connect the plug to electric socket and turn switch. Only one dial to tune. One hundred per cent electric. Handsome walnut cabinet—two-tone genuine DUCO finish. Metal trimming finished in old gold. Marvelous built-in, powerful speaker. Size of cabinet is 54 inches high, 27 inches wide.

**Packard Radios are also made for BATTERY OPERATION PRICED AS LOW AS \$53**

**Packard Radio Company**  
**2323 Milwaukee Ave., Dept. 355 Chicago, Ill.**

I am interested in Packard Radios and your \$5,000.00 Bonded 30 days' free trial offer and guarantee. Send full details.

Name.....

Address.....

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

**WREN**

1180 kc, 254.1 m, Lawrence, Kan., Jenny Wren Co., 750 w, C.

**WRHF**

930 kc, 322.4 m, Washington, D. C., American Broadcasting Co., 150 w, E.

**WRHM**

1150 kc, 260.7 m, Fridley, Minn., Rosedale Hospital Co., Inc., 1000 w, C, "Welcome Rosedale Hospital, Minneapolis."

**WRK**

1460 kc, 205.4 m, Hamilton, Ohio, S. W. Doron & John C. Sladc, 100 w, E, "The Voice of Hamilton."

**WRM**

1100 kc, 272.6 m, Urbana, Ill., University of Illinois, 500 w, C.

**WRNY**

920 kc, 325.9 m, Coteysville, N. J., Experimenter Pub. Co., 500 w, E.

**WRR**

650 kc, 461.3 m, Dallas, Texas, City of Dallas, 500 w, C.

**WRRS**

1210 kc, 247.8 m, Racine, Wis., Racine Wis., Racine Broadcasting Corp., 50 w, C.

**WRST**

1420 kc, 211.1 m, Bayshore, N. Y., Radiotel Mfg. Co., 150 w, E, "The Garden Spot of Long Island."

**WRUF**

1480 kc, 202.6 m, Gainesville, Fla., University of Florida, 5000 w, E.

**WRVA**

1180 kc, 254.1 m, Richmond, Va., Larus Bros. & Co., Inc., 1000 w, E, "Carry Me Back to Old Virginia."

**WSAI**

830 kc, 361.2 m, Mason, Ohio, U. S. Playing Card Co., 5000 w, E, "The Gateway to Dixie."

**WSAJ**

1340 kc, 223.7 m, Grove City, Pa., Grove City College, 250 w, E.

**WSAN**

1350 kc, 222.1 m, Allentown, Pa., Allentown Call Pub. Co., Inc., 100 w, E, "We Serve Allentown Nationality."

**WSAR**

1410 kc, 212.6 m, Fall River, Mass., Doughty & Welch Electrical Co., Inc., 250 w, E.

**WSAZ**

1200 kc, 249.9 m, Huntington, W. Va., McKellar Electric Co., 100 w, E.

**WSB**

430 kc, 475.9 m, Atlanta, Ga., Atlanta Journal Co., 1000 w, E, "The Voice of the South."

**WSBC**

1290 kc, 232.4 m, Chicago, Ill., World Battery Co., Inc., 500 w.

**WSBF**

1160 kc, 258.5 m, St. Louis, Mo., Mississippi Valley Broadcasting Co., 250 w, C.

**WSBT**

750 kc, 399.8 m, South Bend, Ind., South Bend Tribune, 500 w, C.

**WSDA**

1320 kc, 227.1 m, Brooklyn, N. Y., Amateur Radio Specialty Co., 500 w.

**WSEA**

1140 kc, 263.0 m, Virginia Beach, Va., Virginia Beach Broadcasting Co., Inc., 500 w, E, "The Voice of Tidewater Virginia."

**WSIX**

1200 kc, 249.9 m, Springfield, Tenn., 638 Tire & Vulcanizing Co., 150 w, C.

**WSKC**

1100 kc, 272.6 m, Bay City, Mich., World's Star Knitting Co., 250 w, E, "Where the Summer Trail Begins."

**WSM**

890 kc, 336.9 m, Nashville, Tenn., National Life & Accident Ins. Co., 5000 w, C, "We Shield Millions."

**WSMB**

1010 kc, 296.9 m, New Orleans, La., Saenger Theaters, Inc., 750 w, C, "America's Most Interesting City."

**WSMK**

1010 kc, 296.9 m, Dayton, Ohio, Stanley M. Krohn, Jr., 200 w, C, "The Home of Aviation."

**WSPD**

1250 kc, 239.9 m, Toledo, Ohio, Toledo Broadcasting Co., 250 w, E.

**WSRO**

1270 kc, 236.1 m, Middletown, Ohio, Harry W. Fahrlander, 100 w, C, "We Sell Radio Only."

**WSSH**

1040 kc, 288.3 m, Boston, Mass., Tremont Temple Baptist Church, 100 w, E, "Stranger's Sunday Home."

**WSUI**

630 kc, 475.9 m, Iowa City, Iowa, State Univ. of Iowa, 500 w, C, "The Old Gold Studio."

**WSUN**

580 kc, 516.9 m, Clearwater, Fla., Clearwater Chamber of Commerce, 750 w, E, "Sunshine City."

**WSVS**

1470 kc, 204.0 m, Buffalo, N. Y., Seneca Vocational School, 50 w, E, "Watch Seneca Vocational School."

**WSYR**

1020 kc, 293.9 m, Syracuse, N. Y., Olive B. Meredith, 500 w, E.

**WTAD**

1270 kc, 236.1 m, Quincy, Ill., Illinois Stock Medicine Broadcasting Corp., 250 w, 500 6 to 7.

**WTAG**

580 kc, 516.9 m, Worcester, Mass., Worcester Telegram Pub. Co., Inc., 250 w, E, "The Voice From the Heart of the Commonwealth."

**WTAM**

750 kc, 399.8 m, Cleveland, Ohio, Willard Storage Battery Co., 3500 w, E, "The Voice From the Storage Battery."

**WTAQ**

1180 kc, 254.1 m, Eau Claire, Wis., Clyde S. Van Gordon, 500 w, C.

**WTAR**

1270 kc, 236.1 m, Norfolk, Va., Reliance Electric Co., Inc., 500 w, E, "Way Down in Old Virginia."

**WTAS**

1090 kc, 275.1 m, Elgin, Ill., Illinois Broadcasting Corp., 500 w.

**WTAW**

620 kc, 483.6 m, College Station, Tex., Agri. & Mech. College of Texas, 500 w, C.

**WTAX**

1210 kc, 247.8 m, Streator, Ill., Williams Hardware Co., 50 w.

**WTAZ**

1360 kc, 220.4 m, Richmond, Va., W. Reynolds, Jr., and T. J. McGuire, 15 w.

**WTFF**

1480 kc, 202.6 m, Mt. Vernon Hills, Va., Independent Pub. Co., 10 w.

**WTFI**

1430 kc, 209.7 m, Toccoa, Ga., Toccoa Falls Institute, 250 w, E.

**WTHS**

1320 kc, 227.1 m, Atlanta, Ga., Atlanta Technological High School, 200 w, C.

**WTIC**

560 kc, 535.4 m, Hartford, Conn., Travelers Insurance Co., 500 w, E, "The Insurance City."

**WTMJ**

1020 kc, 293.9 m, Milwaukee Journal, Brookfield, Wis., 1000 w, C.

**WTRL**

1450 kc, 206.8 m, Midland Park, N. J., Technical Radio Laboratory, 15 w.

**WWAE**

1320 kc, 227.1 m, Chicago, Ill., Dr. Geo. F. Courier, 500 w.

**WWJ**

850 kc, 352.7 m, Detroit, Mich., The Detroit News, 1000 w, E.

**WWL**

1220 kc, 245.6 m, New Orleans, La., Loyola University, 500 w, C.

**WWNC**

1010 kc, 296.9 m, Asheville, N. C., Chamber of Commerce, 1000 w, E.

**WWRL**

1500 kc, 199.9 m, Woodside, N. Y., Wm. H. Rouman, 100 w.

**WWVA**

580 kc, 516.9 m, Wheeling, W. Va., John C. Stroebel, Jr., 250 w, E.



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**EXCELLO  
CONSOLE**

**for**  
**RADIOLA  
FADA  
CROSLEY  
ATWATER KENT**

**J** *and all other Standard  
A.C. or D.C. Receivers*



Model R 43 has sliding drawer receiver compartment. Ample space for cone speaker and eliminator.

Meets the most exacting demands for beauty and quality in a pleasing variety of models. Cabinet work of character . . . walnut throughout . . . matched butt walnut veneer doors . . . rich piano finish.



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# U. S. Broadcasting Stations Listed by States

**ALABAMA**

Anburn, WAPI  
 Birmingham, WBRC, WKBO  
 Gadsden, WJBY  
 Montgomery, WIBZ

**ALASKA**

Anchorage, KFQD  
 Juneau, KFIC  
 Ketchikan, KGBU

**ARIZONA**

Flagstaff, KFXY  
 Phoenix, KFAD, KFPC  
 Prescott, KPJM  
 Tucson, KGAR

**ARKANSAS**

Blytheville, KLCN  
 Fayetteville, KUOA  
 Hot Springs, KTHS  
 Little Rock, WLBN

**CALIFORNIA**

Avalon, KFOW  
 Berkeley, KKE  
 Burbank, KELW  
 El Centro, KGEN  
 Fresno, KMJ  
 Hollywood, KFQZ, KMTR,  
 KXN  
 Holy City, KFQU  
 Inglewood, KMIC  
 La Crescenta, KGFH  
 Long Beach, KPOM, KGER  
 Los Angeles, KFIK, KFI,  
 KFSO, KGEF, KGEJ, KHI,  
 KFVB, KPLA, KTBI  
 Oakland, KPWM, KGO, KLS,  
 KLX, KTAB, KZM  
 Ontario, KFOW  
 Pasadena, KPCC, KPSS  
 Sacramento, KFHK  
 San Diego, KFBC, KFSD,  
 KGB  
 San Francisco, KFRC, KEWI,  
 KGTI, KJBS, KPO, KYA  
 San Jose, KQW  
 Santa Ana, KWTC  
 Santa Barbara, KFRC  
 Santa Maria, KSMR  
 Santa Monica, KNRC  
 Stockton, KGDM, KWG  
 Venice, KFVD

**COLORADO**

Colorado Springs, KFUM  
 Denver, KFRL, KFUP, KFXP,  
 KOA, KOW, KPOT  
 Dupont, KLS  
 Edgewater, KFXT  
 Fort Morgan, KGEW  
 Greeley, KFKA  
 Gunnison, KFHA  
 Pueblo, KGDP, KGHF  
 Yuma, KGEK

**CONNECTICUT**

Bridgeport, WICC  
 Danbury, WCWS  
 Hartford, WTIC  
 New Haven, WDRC  
 Storrs, WCAC

**DELAWARE**

Wilmington, WDEL

**DISTRICT OF COLUMBIA**

Washington, NAA, WJAL,  
 WRC, WRHF

**FLORIDA**

Clearwater, WFLA  
 Gainesville, WRUF  
 Jacksonville, WJAX  
 Lakeland, WMFL  
 Miami Beach, WIOD, WMBF,  
 WQAM  
 Orlando, WDBO  
 Pensacola, WCOA  
 Sarasota, WJBB  
 St. Petersburg, WSNW  
 Tampa, WDAE, WMDR,  
 WQBA

**GEORGIA**

Atlanta, WGST, WSB, WTHS  
 Macon, WMAZ  
 Toccoa, WTTT

**HAWAII**

Honolulu, KGHB, KGU

**IDAHO**

Bolse, KFAP  
 Jerome, KFED  
 Kellogg, KBET  
 Pocatello, KSEI

**ILLINOIS**

Carthage, WCAZ  
 Chicago, KFEX, KYW, WAAZ,  
 WBBM, WBRZ, WBCN,  
 WCFL, WCWV, WCHI  
 WDCD, WENR, WGES,  
 WGN, WBBM, WHOP,  
 WFT, WIBJ, WIBM,  
 WIBO, WJAZ, WJBT,  
 WKHG, WKBI, WLJB,  
 WLS, WMAQ, WMBI,  
 WPCC, WQJ, WSBG,  
 WVAE, WORD

Decatur, WRAO, WJBL  
 Elgin, WTAS  
 Evanston, WEHS  
 Galesburg, WKBS  
 Forest Park, WNBA,  
 Harrisburg, WERQ  
 Joliet, WOLS, WJBA, WKBB  
 La Salle, WJBC  
 Moline, WJJD  
 Peoria Heights, WMBD  
 Quincy, WTAD  
 Rockford, KFXY  
 Rock Island, WHBF  
 Springfield, WCBS  
 Streator, WTAX,  
 Tuscola, WJGQ  
 Urbana, WIRM  
 Zion, WCBD

**INDIANA**

Anderson, WHBU  
 Brookville, WKBY  
 Crown Point, WLBT  
 Culver, WCMA  
 Evansville, WGBF  
 Fort Wayne, WCWK, WOWO  
 Gary, WJIS  
 Hammond, WFBM, WKBF  
 Kokomo, WJAK  
 La Porte, WRAF  
 Muncie, WLBC  
 South Bend, WSPT  
 Terre Haute, KGFO, WRPI,  
 WBOB  
 Valparaiso, WRBC  
 Lafayette, WBAA

**IOWA**

Ames, WOJ  
 Atlantic, KICK  
 Boone, KFQQ  
 Cedar Rapids, KWCR, WJAM  
 Clarinda, KSO,  
 Council Bluffs, KOIL  
 Davenport, WOC  
 Decatur, KGCA, KWLO  
 Des Moines, WJHO  
 Ft. Dodge, KFII  
 Iowa City, WSUI  
 Le Mars, KWUC  
 Marshalltown, KFJB  
 Muscatine, KINT  
 Ottumwa, WIAS  
 Shenandoah, KPNF, KMA  
 Sioux City, KSCJ

**KANSAS**

Concordia, KGCN  
 Independence, KFVG  
 Lawrence, KFBU, WREN  
 Manhattan, KSAO  
 Milford, KFBB  
 Topeka, WIBW  
 Wichita, KFH

**KENTUCKY**

Hopkinsville, WFTW  
 Louisville, WHAS, WLAP

**LOUISIANA**

Cedar Grove, KGGH  
 New Orleans, WABZ, WCBE,  
 WJBO, WJBW, WKBT,  
 WSMB, WWL  
 Shreveport, KFDD, KRAC,  
 KSBA, KWEA, KWKH

**MAINE**

Baugor, WABI  
 Dover-Foxcroft, WLBB  
 Portland, WCSH

**MARYLAND**

Baltimore, WBAL, WQAO,  
 WCBM, WBPR

**MASSACHUSETTS**

Boston, WATT, WRET,  
 WPIA, WZLZ, WEEI,  
 WNAO, WSSH, WMES  
 Chelsea, WLOE  
 Dartmouth, WMAF  
 East Springfield, WBZ  
 Fall River, WSAU  
 Gloucester, WBSB  
 Lexington, WLEX  
 Medford, WBET  
 New Bedford, WNBH

Webster, WKBE  
 Wellesley Hills, WB50  
 Worcester, WTAG

**MICHIGAN**

Battle Creek, WKBP  
 Bay City, W5BC  
 Berrien Springs, WEMC  
 Detroit, WAFL, WBMH,  
 WCX & WJR, WGHP,  
 WMBG, WWJ  
 Flint, WFDE  
 Grand Rapids, WASH, WOOD  
 Lapeer, WJPC  
 East Lansing, WKAR  
 Ludington, WKBZ  
 Monroe, WKBL  
 Royal Oak, WAGM  
 Ypsilanti, WJBK

**MINNESOTA**

Barrett, KGDE  
 Collegeville, WVEJ  
 Duluth, KGGK  
 Minneapolis, WAMD, WCCO,  
 WGGY, WGMS, WHDI,  
 WLB, WRHM  
 Northfield, KFAX, WCAL  
 Westcott, KSTP

**MISSISSIPPI**

Columbus, WCOO  
 Gulfport, WCCM  
 Utica, WQBO

**MISSOURI**

Cape Girardeau, KFVS  
 Carterville, KFPP  
 Columbia, KFPU  
 Independence, KLDL, KMBC  
 Jefferson City, WOS  
 Joplin, WMBH  
 Kansas City, KWKC, WDAF,  
 WHB, WLBF, WOQ  
 Kirksville, KFJZ  
 St. Joseph, KGBX, KFEQ  
 St. Louis, KFQA, KFUD,  
 KFWF, KSD, KMOX,  
 KWK, WEW, WIL, WMAZ,  
 W5BF

**MONTANA**

Hardin, KGHP  
 Havre, KFBB  
 Kalispell, KGEZ  
 Missoula, KUOM  
 Vida, KGCC

**NEBRASKA**

Central City, KGES  
 Clay Center, KMMJ  
 Columbus, KGRY  
 Grand Island, KGEQ  
 Humboldt, KGDW  
 Lincoln, KFAB, KFOR, WCAJ  
 Norfolk, WJAC  
 Omaha, KOCH, WAAW,  
 WNAL, WOW  
 Ravenna, KGFV  
 Wayne, KGCH  
 York, KGBZ

**NEW HAMPSHIRE**

Laconia, WKAY  
 Tilton, WBRL

**NEW JERSEY**

Asbury Park, WCAP  
 Atlantic City, WHAR, WPG  
 Camden, WCAM  
 Carlstadt, WHAP  
 Cliffside, WPAP, WQAO  
 Cliffside Park, WODA  
 Elizabeth, WBS  
 Jersey City, WAAT, WEBO  
 Kearney, WLWL  
 Midland Park, WTRL  
 Newark, WAAW, WGGP,  
 WNI, WOB  
 North Plainfield, WEAM  
 Paterson, WODA  
 Red Bank, WJBI  
 Secaucus, WGL  
 Union City, WBMS  
 Trenton, WOAX

**NEW MEXICO**

Raton, KGFL  
 State College, KOB

**NEW YORK**

Auburn, WMBO  
 Bay Shore, WRST  
 Bronx, WHPP  
 Brooklyn, WBBG, WSDA,  
 WBR, WRKN, WBSB,  
 WLTH, WMBO  
 Buffalo, WEBR, WGR,  
 WKBW, WKEN, WMAK,  
 W5VS

Canton, WCAD  
 Cazenovia, WMAO  
 Endicott, WNBZ  
 Freeport, WGBB  
 Ithaca, WLCI  
 Jamaica, WMRJ  
 Jamestown, WOCL  
 Long Beach, WCLB  
 Long Island City, WLBN  
 New York, WEAF, WBNY, WCGU,  
 WCAF, WGBS, WGMU,  
 WHA, WJZ, WKBQ,  
 WMCA, WMSG, WNYC,  
 WPCB, WRNY  
 Peekskill, WOKO  
 Richmond Hill, WABC, WBOI  
 Rochester, WRO, WHAM,  
 WREX, WNEQ  
 Saranac Lake, WNBZ  
 Schenectady, WGY  
 Syracuse, WFBL, WSYR  
 Troy, WHAZ  
 Ulster, WJBT  
 Woodhull, WEVD  
 Woodside, WWRL

**NORTH CAROLINA**

Asheville, WWNO  
 Charlotte, WBT  
 Greensboro, WRNO  
 Raleigh, WPTF

**NORTH DAKOTA**

Bismarck, KFYZ  
 Devils Lake, KDLR  
 Fargo, WDAZ  
 Grand Forks, KFJM  
 Mandan, KGCU

**OHIO**

Akron, WADC, WFJO  
 Ashland, WJWB  
 Bellefontaine, WHBD  
 Canton, WHCC  
 Cambridge, WEBE  
 Cincinnati, WAAD, WFBE,  
 WERC, WLW, WSAJ  
 Cleveland, WEAR, WHK,  
 WJAY, WTAM  
 Columbus, WAIL, WCAH,  
 WEAQ, WMAN  
 Dayton, WSMK  
 Harrison, WLW  
 Hamilton, WPK  
 Mansfield, WLBY  
 Middleton, WSRQ  
 Shelby, WOBR  
 Springfield, WCOS  
 Steubenville, WBBE  
 Toledo, WSPD, WTAL  
 Youngstown, WKBN, WLBY

**OKLAHOMA**

Alva, KGEF  
 Tulsa, KVOO  
 Okfuska, KOCW  
 Norman, WNAO  
 Oklahoma City, KFJF, KFJR,  
 KGCB, KGFG, WKY  
 Picher, KGGF

**OREGON**

Astoria, KFJI  
 Corvallis, KOAO  
 Eugene, KGEH, KORE  
 Medford, KMED  
 Portland, KEX, KFEC,  
 KFJF, KFJR, KGW,  
 KLIT, KTBR, KWBS,  
 KWJJ, KXL, KOIN

**PENNSYLVANIA**

Allentown, WGBA, WSNW  
 Altoona, WFBG  
 Carlisle, WNBW  
 East Pittsburgh, KDKA  
 Erie, WEDH, WPAK  
 Grove City, WSAJ  
 Harrisburg, WBAK, WBMS,  
 WPRO  
 Johnstown, WHRP  
 Kingstown, WABF  
 Lancaster, WGAI, WKJC  
 Le Moyne, WBSB  
 Lewisburg, WJBU  
 McKeesport, WMBJ  
 Oil City, WHBA, WLWB  
 Philadelphia, WABY, WCAU,  
 WFL, WRDZ, WPHB,  
 WYAD, WYBG, WYIP,  
 WLIT, WNAI, WOO,  
 WRAX, WPSV, WPAW  
 Pittsburgh, KQV, WCAE,  
 WJAS  
 Reading, WRAP  
 Scranton, WGBI, WQAN,  
 State College, WPSC  
 Wilkes-Barre, WBAX, WBRB  
 Willow Grove, WALK  
 Washington, WNBQ

**PORTO RICO**

San Juan, WKAQ

**RHODE ISLAND**

Cranston, WDWL  
 Newport, WABA  
 Pawtucket, WPCI  
 Providence, WCBB, WCOT,  
 WEAN, WJAR, WLSI

**SOUTH CAROLINA**

Charleston, WBBY

**SOUTH DAKOTA**

Brookings, KFDD, KGOR  
 De Smet, KGDA  
 Pierre, KGFX  
 Rapid City, WCAT  
 Sioux Falls, KSOO  
 Vermillion, KUSD  
 Yankton, WNAK

**TENNESSEE**

Chattanooga, WDDO  
 Knoxville, WFBC, WNBI,  
 WNOX  
 Lawrenceburg, WOAN  
 Memphis, WGBU, WIBO,  
 WMBM, WMC, WNNR  
 Nashville, WBAW, WDDA,  
 WLAC, WSM,  
 Springfield, WSIX  
 Union City, WOBT  
 White Haven, WREC

**TEXAS**

Amarillo, KGRS, WDAQ  
 Austin, KUT  
 Beaumont, KFDM  
 Breckenridge, KFYO  
 Brownsville, KWWG  
 College Station, WTAV  
 Dallas, KRLD, WFAA, WRR  
 Dublin, KPFL  
 El Paso, WDAH  
 Fort Worth, KFJZ, KFQB  
 WBAF  
 Galveston, KPLX, KFUL  
 Greenville, KFPM  
 Harlingen, KHMC  
 Houston, KFVI, KPRC, KTUE  
 San Angelo, KGFT  
 San Antonio, KGCI, KGRD,  
 KGRO, KTAP, KTTA,  
 WOAI  
 Waco, WJAD

**UTAH**

Jerome, KFSD  
 Ogden, KFUR  
 Salt Lake City, KDYL, KSL

**VERMONT**

Burlington, WCAX  
 Springfield, WNBX

**VIRGINIA**

Arlington, NAA  
 Mt. Vernon Hills, WFFF  
 Norfolk, WBBW, WIVA,  
 WFOR, WSEA, WTAR,  
 WVAZ  
 Petersburg, WLJG  
 Richmond, WBRL, WMBG,  
 WRVA, WTAZ  
 Roanoke, WDBT

**WASHINGTON**

Bellingham, KVOS  
 Everett, KFBL  
 Lacey, KGY  
 Pullman, KWSC  
 Seattle, KFOA, KPOW,  
 KQCL, KJR, KKP, KOMO,  
 KPCB, KRSC, KTW, KVL,  
 KUJ, KRKO, KXA  
 Spokane, KFIO, KFPY, KGA,  
 KHQ  
 Tacoma, KMO, KVI

**WEST VIRGINIA**

Clarksburg, WQBJ  
 Charleston, WOBV  
 Huntington, WSAZ  
 Martinsburg, WQZB  
 Wheeling, WVVV

**WISCONSIN**

Appleton, WAIZ  
 Beloit, WEBW  
 Eau Claire, WTAQ  
 La Crosse, WKLB  
 Madison, WHA, WIBA  
 Manitowish, WMTB  
 Milwaukee, WJWB, WHAD,  
 WISN, WTMJ  
 Poyntette, WJBU  
 Racine, WRSS  
 Sheboygan, WHBL  
 Stevens Point, WLBL  
 Superior, WERC  
 West De Pere, WEBY

**WYOMING**

Laramie, KFBU



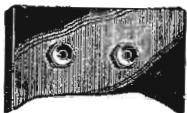
**Air-Cooled Rheostat**  
\$1.35

**Built to the  
Highest Standard**



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**Add Good  
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**Y**AXLEY Approved Radio Products, ever since their inception, have been the first choice of the creators of many of the most prominent and successful circuits.

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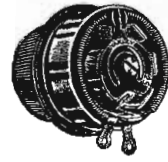
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Dept. C, 9 South Clinton St. Chicago, Ill.

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**Junior Rheostat**  
75c up to 400 ohms

**Correct in  
Design**



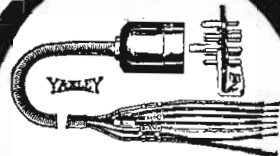
**Midget Battery  
Switch**  
50c

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of the Greatest  
Skill**



**Pilot Light  
Bracket**  
50c

**Material of  
the Highest  
Quality**



**Cable Connector  
Plug**  
\$3.00 and up

# U. S. Broadcasting Stations by Frequencies

**550 Kilocycles, 545.1 Meters:**  
KSD, KFUO, WMAK, WPTF, WFAA, KFDY, WDAY

**560 Kilocycles, 535.4 Meters:**  
WCAC, WTIC, WHO, KXA

**570 Kilocycles, 526.0 Meters:**  
WNYC, KYW, KFKX

**580 Kilocycles, 516.9 Meters—Canadian Shared:**  
WMC, WVVA, WTAG, WFLA-WSUN, KMTR

**590 Kilocycles, 508.2 Meters:**  
WOW, KLX, WEEI

**600 Kilocycles, 499.7 Meters—Canadian Shared:**  
WBAP, KTHS

**610 Kilocycles, 491.5 Meters:**  
KGW, WEAF

**620 Kilocycles, 483.6 Meters:**  
WJAR, WCFL, WEMC, KUSD, WTAW, KFDM, KFBU, KFUM

**630 Kilocycles, 475.9 Meters—Canadian Shared:**  
WSB, WSUI

**640 Kilocycles, 468.5 Meters:**  
WRC, KFI

**650 Kilocycles, 461.3 Meters:**  
WNAC-WBIS, KRLD, WRR, KFNF, WCAE, KUOM

**660 Kilocycles, 454.3 Meters:**  
WJZ, KPRC

**670 Kilocycles, 447.5 Meters:**  
WMAQ, KFOA, WQJ

**680 Kilocycles, 440.9 Meters:**  
WJR-WCX, WIBG, KFSD, WAAW

**690 Kilocycles, 434.5 Meters—Canadian Wave:**

**700 Kilocycles, 428.3 Meters:**  
WLW, WMAF

**710 Kilocycles, 422.3 Meters:**  
WOR, KPO, WOS

**720 Kilocycles, 416.4 Meters:**  
WGN

**730 Kilocycles, 410.7 Meters—Canadian Wave:**

**740 Kilocycles, 405.2 Meters:**  
WLIT, WFI, WCCO

**750 Kilocycles, 399.8 Meters:**  
WEAR, WTAM, WSBT, KHJ, KGBU

**760 Kilocycles, 394.5 Meters:**  
KMA, KWKH, WHN, WQAO-WPAP, KTW, KWSC, KOB

**770 Kilocycles, 389.4 Meters:**  
WBBM, WAAF, WJBT, WABI

**780 Kilocycles, 384.4 Meters—Canadian Shared:**

WQAM, WMBF, KGO, WBSO

**790 Kilocycles, 379.5 Meters:**  
WCAJ, WGY

**800 Kilocycles, 374.8 Meters:**  
KNRC, WOC

**810 Kilocycles, 370.2 Meters:**  
WDAF, KHQ, WLVL, WPCA

**820 Kilocycles, 365.6 Meters:**  
WEBH, WJJD, KMJ, WCSH

**830 Kilocycles, 361.2 Meters:**  
WSAI

**840 Kilocycles, 356.9 Meters—Canadian Wave:**

**850 Kilocycles, 352.7 Meters:**  
KLZ, WWJ, WEW, KFWB, KYA

**860 Kilocycles, 348.6 Meters:**  
WOO, WGBS, WIP, KVOO, KJR

**870 Kilocycles, 344.6 Meters:**  
WLS, WCBD, KWG, KFQD

**880 Kilocycles, 340.7 Meters—Canadian Shared:**

WAPI, WJAX, WHB, WOQ

**890 Kilocycles, 336.9 Meters—Canadian Shared:**

WSM, KNX

**900 Kilocycles, 331.1 Meters:**  
KFQB, WJAD, WHA, WLBI, WBZ, WRZA, KSAC, KFJM, KSEI

**910 Kilocycles, 329.5 Meters—Canadian Wave:**

**920 Kilocycles, 325.9 Meters:**  
KOA, WRNY, WPCB

**930 Kilocycles, 322.4 Meters—Canadian Shared:**

WRHF, WHAS, WKAQ, KFAD, WIAS, KICK

**940 Kilocycles, 319 Meters:**  
KOIL, KFAB, KOIN

**950 Kilocycles, 315.6 Meters:**  
KDKA, KPSN, KPCC

**960 Kilocycles, 312.3 Meters—Canadian Wave:**

**970 Kilocycles, 309.1 Meters:**  
WABC, WBOQ, KOMO

**980 Kilocycles, 305.9 Meters:**  
WHT, WIBO, WHAZ

**990 Kilocycles, 302.8 Meters:**  
WGR, KSL, WNAX, WBRB

**1000 Kilocycles, 299.8 Meters:**  
KFWO, KMOX, WPSC, WBAK

**1010 Kilocycles, 296.9 Meters—Canadian Shared:**

WVNC, WEPS, WSMK, WDEL, WSMB, KUQA, KQW, KGFV

**1020 Kilocycles, 293.9 Meters:**  
WODA, WTMJ, KPRC, WLWB, KGEZ, WSYR, WGL, KGCH, KGDW

**1030 Kilocycles, 291.1 Meters—Canadian Wave:**

**1040 Kilocycles, 288.3 Meters:**  
WDBO, WENR, WNAT, WIAD, WKY, WSSH, WBET, KPLA, WBCN, KGBX

**1050 Kilocycles, 285.5 Meters:**  
WBAL, KFAU, KLCN, WJAG, KMMJ, WCAL, WDCY

**1060 Kilocycles, 282.8 Meters:**  
WAIU, WEAQ, KFXP, WDRB, KVI

**1070 Kilocycles, 280.2 Meters:**  
WHAM, KTAB, WOI

**1080 Kilocycles, 277.6 Meters:**  
WGHP, WKAR, KWWG, KEX, WZD

**1090 Kilocycles, 275.1 Meters:**  
WEAN, WFBM, KFPL, KFBB, KFBK, KTBI, WTAS

**1100 Kilocycles, 272.6 Meters:**  
WPG, WRM, WBAQ, KFBI, WFBJ, KSMR, KWTC, WDFE, WSKC, KFJE, KKP, KRSC

**1110 Kilocycles, 270.1 Meters:**  
KMED, KMBC-KLDS, WJAS, KQV, WGST, WMAZ, WISN, WHAD, KFLX, KGU, KOAC, WGWV

**1120 Kilocycles, 267.7 Meters—Canadian Shared:**

WDAE, KSBA, KFLV, WAAM, WNI, KFVI, WOBV, WFBG, WLAP, WBAO, WGPC

**1130 Kilocycles, 265.3 Meters:**  
WNOX, WOI, WHK, KTSB, WICC, WCWS

**1140 Kilocycles, 263.0 Meters:**  
WSEA, WJAZ, WMBI, WDAQ, KGHP, KGFH, KGEF, WJBO, KFPW, KGEK, WJBI, WEAM, WJBI

**1150 Kilocycles, 260.7 Meters:**  
WOMA, WOOD, WRHM, KGA, WHBA, WCAU, WNBH, WFIW

**1160 Kilocycles, 258.5 Meters:**  
WFBL, KOCH, KFUL, WIL, WSBF, WBT, KDYL, WEBW, WNAL

**1170 Kilocycles, 256.3 Meters:**  
KTNT, WCSO, WASH, WBBR, WEBJ, WLTH

**1180 Kilocycles, 254.1 Meters:**  
KGFV, WRVA, WRFN, KFKU, KMO, WTAQ, WCAV, WHEC-WABO, KGDA

**1190 Kilocycles, 252.0 Meters:**  
KEIK, WORD, WKIC, WQAL, WKBF, WMBR, WKBT, KOCW, KFSG

**1200 Kilocycles, 249.9 Meters:**  
KFKA, KFHA, WBAX, WBRB, KFRU, WCOA, KFJI, KWJL, WJBR, KFJZ, KFJR, WBBY, WSAZ, WREC, WSIX, WQDZ, WCAZ, WHBY

**1210 Kilocycles, 247.8 Meters—Canadian Shared:**

WFKD, WABW, WEBC, WCAT, WIOD, KFBC, KFVC, KFJR, KWLC, WLCI, WRRS, WDWV, WLSI, WABY, WJBA, WTAX, KGCA

**1220 Kilocycles, 245.6 Meters:**  
WGBB, WHDI, WLB-WGMS, WKRC, WWL, KFH, KLS, KFPY, KFIO, KGY, KJBS, WAAT, WEYD, WFBF

**1230 Kilocycles, 243.8 Meters:**  
KSCJ, KGRS, KFCR, KGSX, WMBC, WFBR, WCAO, WDOO, WCAD, KWUC

**1240 Kilocycles, 241.8 Meters:**  
WFCI, WNBX, KFKB, WGES, KFON, WEBC, WMAI, WEDC

**1250 Kilocycles, 239.9 Meters:**  
KFJR, WOAN, WBAW, WJAM, WNAD, KGCC, WRBP, WOAX, WCAP, WSPD, WQBJ, WIBA, KWCR

**1260 Kilocycles, 238.0 Meters:**  
WRAW, WRBC, WIBW, WABZ, KFVI, WIBX, WJBB, WQBA, WADC

**1270 Kilocycles, 236.1 Meters:**  
KHMC, KFDX, WGRF, KFMY, KFWM, WHAP, WMSG, WBNY, WTAR, WBBW, WSRQ, WHBC, WTAD

**1280 Kilocycles, 234.2 Meters:**  
WMAV, KWK, KFOA, WMBS, WMPG, WMAN, WJBY, KGAR, WJAK, WFBC, WDAH, WCAH, WBBL

**1290 Kilocycles, 232.4 Meters:**  
WNBZ, WJKS, WBRL, KUT, KFQZ, WHBJ, WHBQ, KFEY, KFJY, WLBH, WSBQ

**1300 Kilocycles, 230.6 Meters:**  
KFEQ, KGCL, KPCB, WQAN, WGBI, KFPM, WDBJ, WCOO, WIBZ, WAFD, WAAD, KRE, KZM, KDLR

**1310 Kilocycles, 228.9 Meters:**  
WOWO, WMHL, WKBE, KTAQ, WHBP, KELW, WGBB, WNBK, KFIE, KTRR

**1320 Kilocycles, 227.1 Meters:**  
KSO, WIAY, WFIC, WCBQ, KFUP, KEEL, WTHS, KGH, WAIZ, WBBC, WJBC, WSDA, WVAE

**1330 Kilocycles, 225.4 Meters:**  
WMAQ, WLAC-WDAD, KFIU, WAGM, KGEN, KFZK, KFUR, WCBM, WCOT

**1340 Kilocycles, 223.7 Meters:**  
WFAV, KFXR, WCAV, WPCB, KMIC, KFBL, KXRO, WKAV, WSAJ, KGDP, WNRG, KGFK, KFVS, WOCL, WCRW, WBEQ

**1350 Kilocycles, 222.1 Meters:**  
WSAN, WCBQ, WHBD, KGBL, WCGM, WAMD, WHBF, WQMT, KGBY, KWKC

**1360 Kilocycles, 220.4 Meters:**  
KGTI, KGCI, KGRC, KXL, WTAZ, WMBG, WBBW, WJBC, WHBU, KRAC, WMBO, KGFJ, KSTP, KFQU, WKBH

**1370 Kilocycles, 218.8 Meters:**  
KOW, KGEV, WKBC, WRAK, WCGU, WKBO, WKBQ

**1380 Kilocycles, 217.3 Meters:**  
WKBB, KFQW, WKBY, KFOR, WIBU, WKBS, KGDM

**1390 Kilocycles, 215.7 Meters:**  
KGER, KFAD, KGC, KGFQ, WOKO, WLEX, WQBC, WCLS, WEHS, WHFC, WKBB, WKBI

**1400 Kilocycles, 214.2 Meters:**  
KFEC, KVRN, WMBW, WLBG, WJBU, KPJM, WCWK, KFVF

**1410 Kilocycles, 212.6 Meters:**  
KCFJ, WRAX, KGBZ, KTUE, WKBP, KWEA, KGGH, WSAK, WJBL

**1420 Kilocycles, 211.1 Meters:**  
WRRS, WRST, WYRO, WJES, WBMH, KFCR, KFYO, WEDA, WLOE

**1430 Kilocycles, 209.7 Meters:**  
KVOS, WPRC, WIVA, WLBC, WMBM, WLBF, KSOQ, KGHV-WLBY, KFGQ, WTFI, KGHF, KFXJ, WCBQ, WLBQ

**1440 Kilocycles, 208.2 Meters:**  
WGM, WLBZ, WBOW, WEDH, WJWP, WNSA, WRAF, KGCN, KGCR

**1450 Kilocycles, 206.8 Meters:**  
WPSW, WMRJ, WLBV, WNBZ, WNBK, KGGF, KGDR, WHPP, WTRT

**1460 Kilocycles, 205.4 Meters:**  
WNOQ, WKBL, WABF, KFXV, KGDE, KGGF, WRK, WQBT, WMBD, KGOE

**1470 Kilocycles, 204.0 Meters:**  
KFND, WLVN, WMBQ, WBBZ, WHBL, WIBW, WMBH, WKEN, WSVS, KFBI, WBS, WLBX, WMBQ, WOBR, KGES, KGFO

**1480 Kilocycles, 202.6 Meters:**  
KVL, WTFE, WRUF, WTFE, KYL

**1490 Kilocycles, 201.6 Meters:**  
WALK, KPOF, WATT, WCBR, WGMU, WBBM, WIBJ, WIBM, WKBG

**1500 Kilocycles, 199.9 Meters:**  
KWBS, KUJ, KORE, WCLB, WNBW, WBKN, WBS, WKBZ, WWRL, KLIT

# Canadian Stations

Call	Wave	Power	Call	Wave	Power
<b>Nova Scotia</b>			<b>Saskatchewan</b>		
Halifax: (Carlton Hotel station, Northern Electric Co. Ltd.).....CHNS	322.4	100	Moose Jaw.....CJRM	296.9	500
<b>Prince Edward Island</b>			Regina: R. H. Williams & Sons, Ltd.....CHWC	312.3	15
Charlottetown: General during winter.....CFCY	312.3	100	Leader Publishing Co., Ltd.....CKCK	312.3	500
Summerside: R. T. Holman, Ltd.....CHGS	267.7	25	Canadian National Railways. Uses equipment of.....CNRR	312.3	500
<b>New Brunswick</b>			Sask. Co-op. Wheat Prod., Ltd.....CJBR	312.3	500
Fredericton.....CFNB	247.8	25	Saskatoon: The Electric Shop.....CFEQ	329.5	600
Moncton: Canadian National Railways.....CNRA	322.4	500	International Bible Students' Association.....CHTC	329.5	800
<b>Quebec</b>			Wheaton Electric Co.....CJWC	329.5	250
Montreal: Northern Electric Co., Ltd.....CHYG	410.7	750	Canadian National Railways. Uses equipment of other local stations.....CNRS	329.5	500
E. Fontains.....CHRC	347	5	Unity: Horace N. Stovin.....CHSC	267.7	50
La Presse Publishing Co.....CKAC	410.7	1200	Yorkton: Winnipeg Grain Exchange.....CJGX	475.9	500
Canadian Marconi Co.....CFCC	410.7	1650	<b>Alberta</b>		
Canadian National Railways. Uses equipment of other local stations.....CNRM	340.7	5	Calgary: W. W. Grant Radio, Ltd.....CFCN	434.5	1800
Quebec.....CHRC	347	22 1/2	The Alberta Pacific Grain Co., Ltd.....CKLC	356.9	2000
Le Soleil.....CKCI	340.7	50	Calgary Herald.....CFAC	434.5	500
St. Hyacinthe.....CKSH	312.3	50	Canadian National Railways. Uses equipment of other local stations.....CNRC	434.5	500
<b>Ontario</b>			Radio Service & Repair Shop.....CJCI	434.5	250
Rowenville: Gooderham & Woods, Ltd.....CKGW	312.3	5000	Edmonton: International Bible Students' Assn.....CHCY	516.9	250
Hamilton.....CHCS	340.7	10	Alberta Pacific Grain Co., Ltd.....CKLC	356.9	1000
Jack V. Elliott, Ltd.....CFCU	340.7	500	Christian & Miss. Alliance.....CHMA	516.9	250
Wentworth Radio Supply Co.....CKOC	340.7	50	University of Alberta.....CKUA	516.9	500
Burketon Junction.....CKCV	329.5	5000	Radio Supply Co., Ltd.....CFCK	516.9	50
Cobalt.....CKAC	247.8	5	Edmonton Journal.....CJCA	516.9	500
Hantsville: A. Staples.....CHCO	247.8	5	Canadian National Railways. Uses equipment of other local stations.....CNRE	516.9	500
Inquois Falls: Abitibi Power & Paper Co.....CFCH	499.7	250	Lethbridge: J. E. Palmer.....CJOC	267.7	50
King: York Co.....CJQJ	291.1	1000	<b>British Columbia</b>		
Kingston: Monarch Battery Co.....CFMC	267.7	20	Burnaby: International Bible Students' Assn.....CFVC	410.7	500
Queens University.....CFRC	267.7	500	Kamloops: N. S. Dargleish & Sons and Weller & Weller.....CFJC	267.7	15
Kitchener: O. Rumpel.....CJCF	247.8	25	Mission City: E. R. Streeter.....CJCI	247.5	5
London: London Free Press Printing Co., Ltd.....CHGC	329.5	500	New Westminster: Westminster Trust Co.....CFXC	291.1	20
Midland: E. O. Swan.....CKPR	267.7	50	Sea Island.....CJOR	291.1	50
Ottawa: J. R. Booth, Jr.....CHXC	434.5	250	Vancouver: A. Holmstead & William Hanlon.....CFCC	410.7	15
Canadian National Railways.....CNRO	434.5	500	G. W. Deaurille.....CFCT	329.5	500
Dr. G. M. Geldert. (For Ottawa Radio Assn.).....CFCO	434.5	100	A. Halstead & Wm. Hanlon.....CKWX	410.7	10
Prescott: Radio Association of Prescott.....CFLO	290.9	50	Central Presbyterian Church.....CHPC	410.7	1000
Prescott: Wallace Russ.....CFRG	247.8	7 1/2	Radio Corporation of Vancouver.....CFYC	410.7	500
Seabrook Station.....CJYC	291.1	500	Daily Province of Canada.....CKOD	410.7	1000
Toronto: Star Publishing & Printing Co.....CFCA	356.9	500	United Church of Canada.....CKPC	410.7	50
Toronto Radio Research Society.....CHNC	356.9	500	Canadian National Railways.....CNRY	291.1	500
Dominion Battery Co., Ltd.....CKCL	356.9	50	Sprott-Shaw Radio Co.....CFQJ	410.7	10
Canadian Broadcasting Corp. Projected.....CKNG	329.5	5000	Pyramid Temple Society. Uses equipment of other local stations.....CUKC	.....	.....
Canada National Carbon Co.....CKNC	356.9	500	<b>Manitoba</b>		
Northern Electric Co. Uses equipment of other local stations.....CHIC	.....	.....	Winnipeg: Manitoba Telephone System.....CKY	334.4	500
Jarvis Street Baptist Church. Uses equipment of other stations.....CHBC	.....	.....	Canadian National Railways. Uses equipment of other local stations.....CNRW	.....	.....
Evening Telegram. Uses equipment of local stations.....CHSC	.....	.....	<b>Manitoba</b>		
Canadian National Railways. Uses equipment of other local stations.....CNRT	.....	.....	Winnipeg: Manitoba Telephone System.....CKY	334.4	500
St. Michael's Cathedral.....CKSM	291.1	1000	Canadian National Railways. Uses equipment of other local stations.....CNRW	.....	.....
Thorold: D. J. Fendell. Suspended.....CKSM	247.8	75	<b>Manitoba</b>		

## Short Wave Phone and Telegraph Stations

109.0 2XK, Schenectady, N. Y.	42.95 KDKA, East Pittsburgh, Pa.	26.0 KDKA, East Pittsburgh, Pa.
107.1 KIU, Guadalupe, Calif.	49.0 6XBR-KFWB, Los Angeles, Calif.	22.8 WQWO, Ft. Wayne, Ind. (phone).
106.0 2XF, Richmond Hill, N. Y.	37.24 WCFE, Chicago, Ill.	22.1 2XE-WABC, Richmond Hill, N. Y.
105.0 6XBR-KFWB, Los Angeles, Calif.	35.0 WGY, Schenectady, N. Y.	22.02 2XAD-WGY, Schenectady, N. Y.
100.0 2XI, Schenectady, N. Y.	35.0 2XI, Schenectady, N. Y.	21.96 2XAD, Schenectady, N. Y.
65.4 2XAO-WOR, Newark, N. J.	32.77 2XAP-WGY, Schenectady, N. Y.	20.0 2XAW, Schenectady, N. Y.
63.66 KDKA, East Pittsburgh, Pa.	30.91 2XAL-WRNY, Coytesville, N. J.	18.3 WBQ, Schenectady, N. Y.
58.75 KDKA, East Pittsburgh, Pa.	30.0 2XI, Schenectady, N. Y.	15.0 2XAW, Schenectady, N. Y.
52.02 2XAL-WLW, Harrison, Ohio.	26.78 KDKA, East Pittsburgh, Penn.	

## Short Wave Television Stations

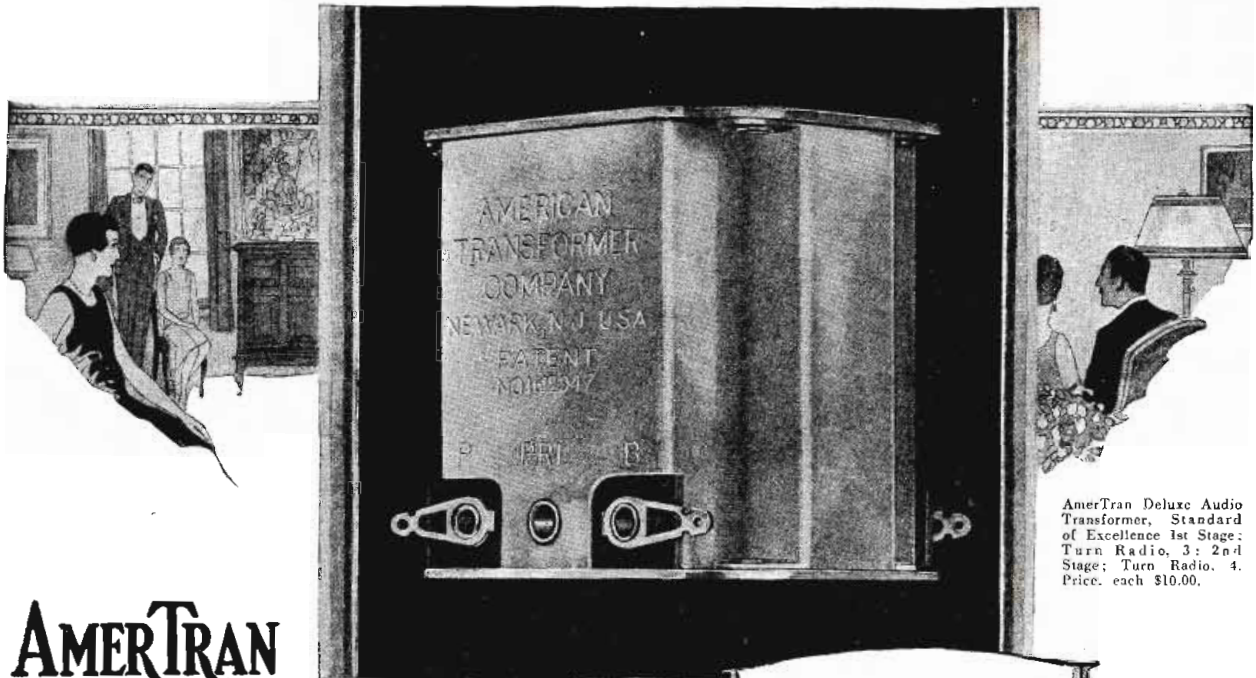
Call	K. C.	Meters	Owner	Apertures	Call	K. C.	Meters	Owner	Apertures
4XA	2400-2500	125-200	WREC, Inc., Memphis, Tenn.	.....	WCFE	4847-4959	61.9-80.50	Chicago Federation of Labor, Chicago.	48
2XIV	4500-4600	66.67-65.22	R. C. A., New York City, N. Y.	.....	3XFE	4900-5000	61.22-60.00	C. Francis Jenkins, Washington, D. C.	48
6XC	4500-4600	66.67-65.22	Robert B. Parrish, Los Angeles, Calif.	.....	8XK	6424	46.72	C. Francis Jenkins, Washington, D. C.	48
2XPS	4600-4700	65.22-63.83	R. C. A., New York City, N. Y.	.....	2NAL	9710	30.91	Radio News, New York City, N. Y.	36
8XAV	4700-4800	63.83-62.50	Westinghouse Elec. Co., Pittsburgh, Pa.	.....	2XAD	13,660	21.96	General Electric Co., Schenectady, N. Y.	24
2XRU	4800-4900	62.50-61.22	H. F. Smith, Bencon, N. Y.	.....	2XRV	15100-15200	19.87-19.74	R. C. A., New York City, N. Y.	.....
1XAY	4800-4900	62.50-61.22	J. S. Dodge, Lexington, Mass.	48	8XAV	15100-15200	19.87-19.74	Westinghouse Elec. Co., Pittsburgh, Pa.	.....

## Foreign Broadcast Stations

Foreign broadcast station lists are kept up to date through frequent checkings. Lack of space prevents running the list in this issue.

However, those interested in such lists may secure a copy gratis by writing a note requesting such a list, addressed to the Editor.

KC	Meters	STATIONS	DIALS		KC	Meters	STATIONS	DIALS	
			1	2				1	2
1500	199.9				1020	293.9			
1490	201.2				1010	296.9			
1480	202.6				1000	299.8			
1470	204.0				990	302.8			
1460	205.4				980	305.9			
1450	206.8				970	309.1			
1440	208.2				960	312.3			
1430	209.7				950	315.6			
1420	211.1				940	319.0			
1410	212.6				930	322.4			
1400	214.2				920	325.9			
1390	215.7				910	329.5			
1380	217.3				900	333.1			
1370	218.8				890	336.9			
1360	220.4				880	340.7			
1350	222.1				870	344.6			
1340	223.7				860	348.6			
1330	225.4				850	352.7			
1320	227.1				840	356.9			
1310	228.9				830	361.2			
1300	230.6				820	365.6			
1290	232.4				810	370.2			
1280	234.2				800	374.8			
1270	236.1				790	379.5			
1260	238.0				780	384.4			
1250	239.9				770	389.4			
1240	241.8				760	394.5			
1230	243.8				750	399.8			
1220	245.8				740	405.2			
1210	247.8				730	410.7			
1200	249.9				720	416.4			
1190	252.0				710	422.3			
1180	254.1				700	428.3			
1170	256.3				690	434.5			
1160	258.5				680	440.9			
1150	260.7				670	447.5			
1140	263.0				660	454.3			
1130	265.3				650	461.3			
1120	267.7				640	468.5			
1110	270.1				630	475.9			
1100	272.6				620	483.6			
1090	275.1				610	491.5			
1080	277.6				600	499.7			
1070	280.2				590	508.2			
1060	282.8				580	516.9			
1050	285.5				570	526.0			
1040	288.3				560	535.4			
1030	291.1				550	545.1			



AmerTran Deluxe Audio Transformer, Standard of Excellence 1st Stage: Turn Radio, 3: 2nd Stage: Turn Radio, 4. Price, each \$10.00.

**AMERTRAN**  
TRADE MARK REG. U.S. PAT. OFF.

## Quality Radio Products

Standards of Excellence for Radio Reproduction

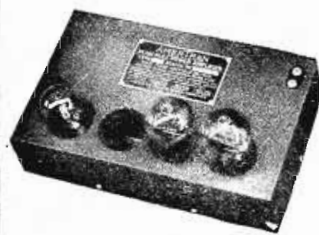
THE real worth of any radio set depends upon "tone quality"—the ability to reproduce music as it is broadcast from the studio. The problem has never been one of refining the radio frequency amplifier—it has always been the manufacturers of audio systems who have had to develop their products to reach the pinnacle of natural reproduction.

Long before broadcasting was thought of, The American Transformer Company had gained a reputation of manufacturing quality products. Since the era of broadcasting, this company has occupied a unique position in the development of quality products for Radio Reproduction. AmerTran products have been considered too expensive for set manufacturers to use in their commercial receivers, so it has developed a clientele of set builders who want, first of all, *natural reproduction*.

AmerTran products are never built down to a price—the procedure has always been reversed—"How good can it be made—then reduce the cost by applying economies in manufacture."

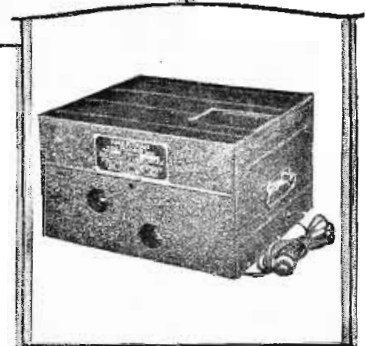
The products shown on this page are but a few of the thirty odd AmerTran devices in the field of radio reproduction, each of which has attained the degree of perfection necessary to be introduced as an AmerTran product. The facilities of our engineering department are at the service of every one interested in better radio reproduction. We will answer to the best of our ability any question in the audio or power fields.

**AMERICAN TRANSFORMER COMPANY**  
Transformer Builders for more than 28 years  
200 EMMET ST. NEWARK, N. J.

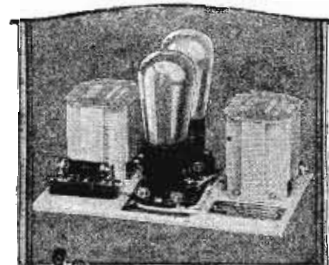


AmerTran Push-Pull Amplifier—complete 2 stage audio amplifier. First stage AmerTran DeLux and second stage AmerTran Push-Pull for two Power Tubes. Choice of standard amplifier or UX 227 AC for 1st stage and two 171 or two 110 power tubes for second stage. Price, east of Rockies—less tubes—\$60.00.

AmerTran ABC Hi-Power Box—500 volts DC plate voltage, current up to 110 ma; AC filament current for rectifier, power tubes and sufficient 216 and 217 AC Tubes for any set. Adjustable bias voltages for all tubes. Price, east of Rockies—less tubes—\$75.00.

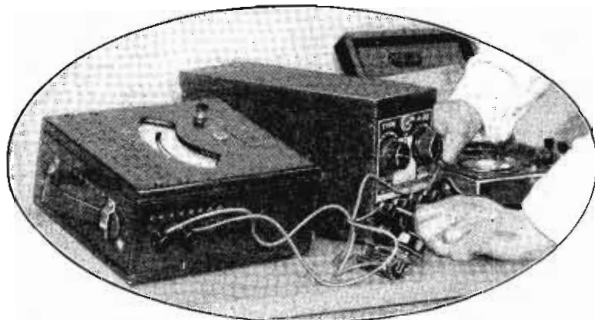
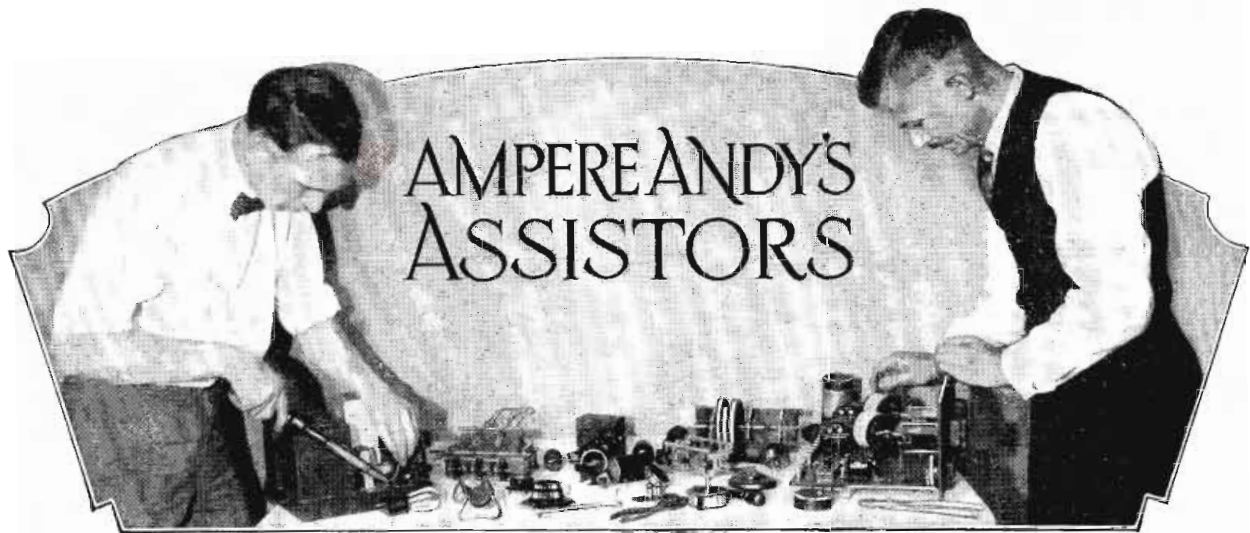


AmerTran Push-Pull Power Stage (illustrated below)—completely wired with input transformer and a choice of 4 output transformers depending on speaker and power tubes. Adaptable to 171 or 210 tubes, cones or dynamic type speakers. Price, east of Rockies—less tubes—\$16.00.

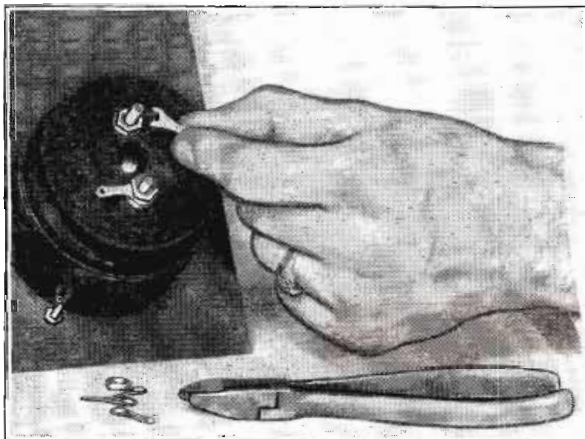


Push-Pull Amplifier, ABC Hi-Power Box and Push-Pull Power Stage licensed under patents owned or controlled by RCA and may be bought complete with tubes.

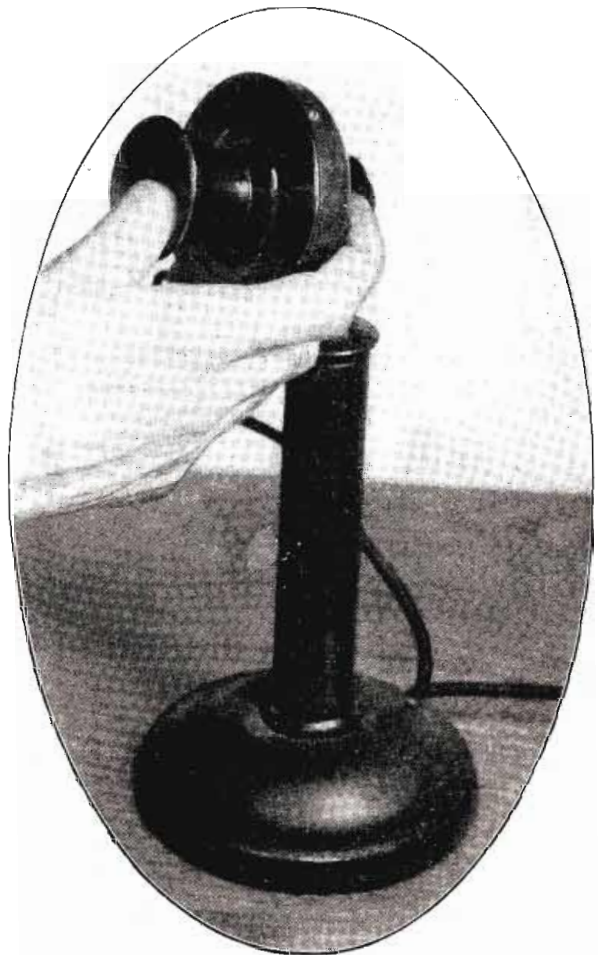




Before tearing down the audio end of your receiver and putting in push-pull amplification, make sure the B power supply which you are using will furnish sufficient current for the set when push-pull is used. A simple way of determining whether the power supply will effectively operate the push-pull combination, is to place a resistance load across the negative B and high voltage terminals of the eliminator and a milliammeter in series. By adjusting the variable resistance the load may be changed so that you can tell the maximum output of the eliminator in milliamperes. However, this is not a complete test because you still do not know the voltage at which this current is available. Therefore, a voltmeter should be used to check the voltages available under the different loads imposed on the power supply. If ample current and voltage are available, as shown by the test, then it is advisable for you to install push-pull amplification. If the voltage or current is not sufficient, it will be necessary to either secure a larger power supply or else remain content with the present audio amplifying system.

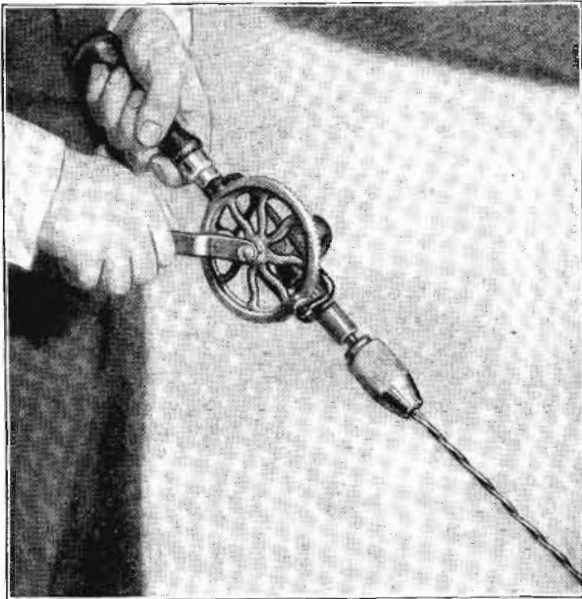


In cases where a builder wishes to use a soldering lug on a binding post or terminal that is too large to go through the opening in the soldering lug, he may find it expedient to clip off a portion of the lug's rim, as shown in the illustration, and then merely place the lug under the terminal. In the photograph above, the lug being held in the hand has been clipped and is ready for placement under the terminal as shown at the lower portion of the meter.

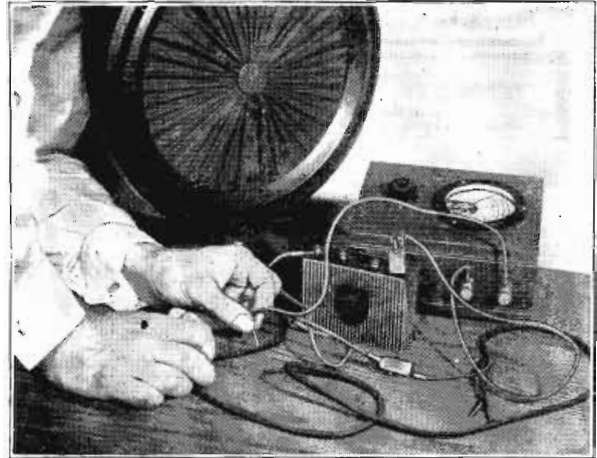


It's a far cry from radio to a house telephone, but many times the operator of a set is forced to turn off his radio in order to talk on the telephone. A simple way of killing the interference which a receiver produces in a telephone set is shown in the photograph above. Placing the thumb in the mouth of the transmitter and pressing against the grating will prevent noises within the room being picked up by the microphone competing against the voice of the party at the other end of the line. When the user desires to talk he merely releases his thumb from the mouthpiece and converses. When he desires to listen he places his thumb in the mouthpiece and all local noise is eliminated.

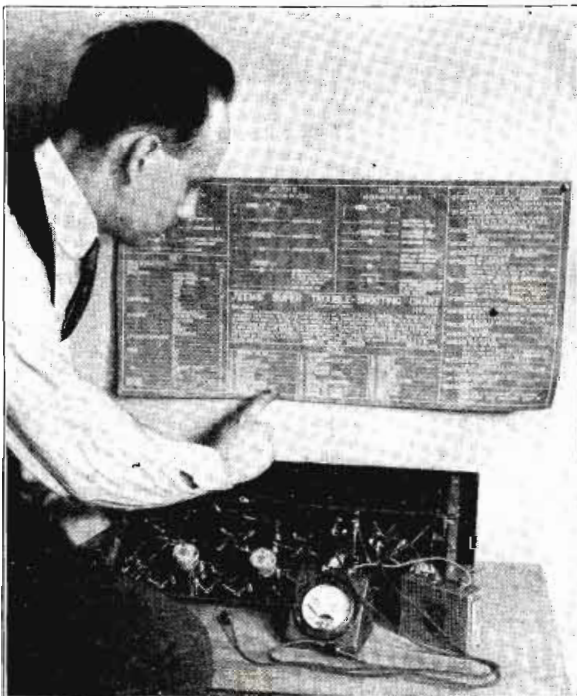




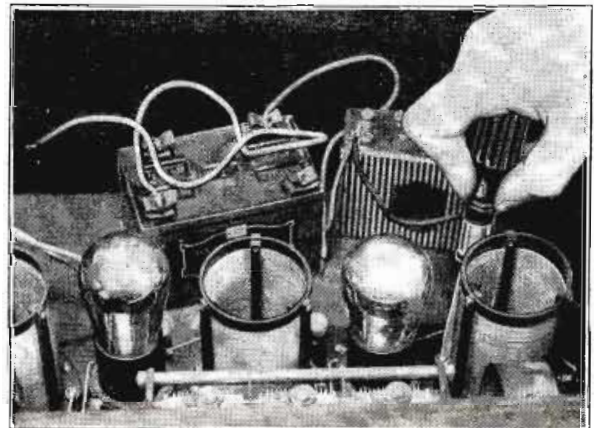
No, the gentleman is not reeling in a tarpon. Instead he is merely twisting rubber covered wire so as to use it for filament leads in receiving sets. Twisting of wire by hand is a very tedious job and the finished job is never a success. However, when it is done with a twist drill, the turns are efficiently spaced and the finished job appears workmanlike. The chuck on the hand drill will easily accommodate the two wires which are fastened at the other end, so that when the drill is turned a slight pull is exerted on the wire.



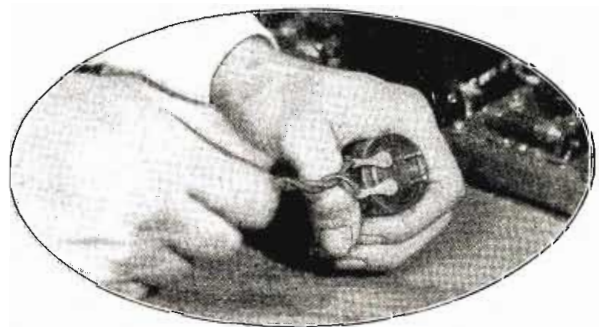
Frequently the owner of a set having a speaker or head phone cord that has seen much usage will discover that the cord has become open. One of the simplest ways of finding an open circuit inside of the insulated cord is by putting a meter in series with a C battery, connecting one end of the cord to the battery and the end of the meter connected to a pin or needle, by means of which the operator may probe through the insulation in an endeavor to locate the point at which the wire inside has broken or frayed.



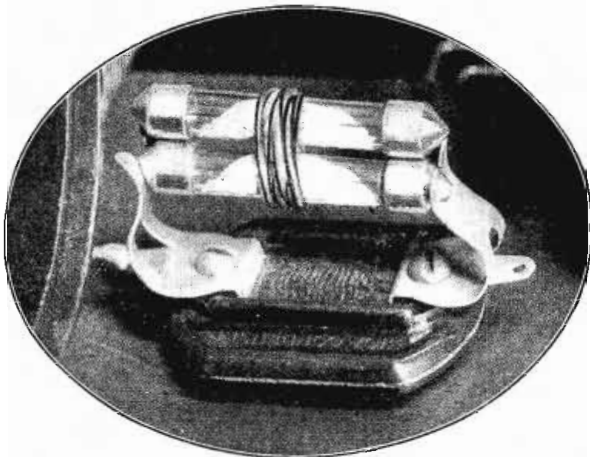
Many fans lack a systematic method of testing for trouble in a superheterodyne. The above photograph shows a trouble shooting chart attached to the wall which the repair man is consulting to determine the cause of trouble. Of course, an expert might not need such a guide, but those who are not thoroughly acquainted with superheterodynes might be helped by the use of such a chart as is illustrated in this photograph.



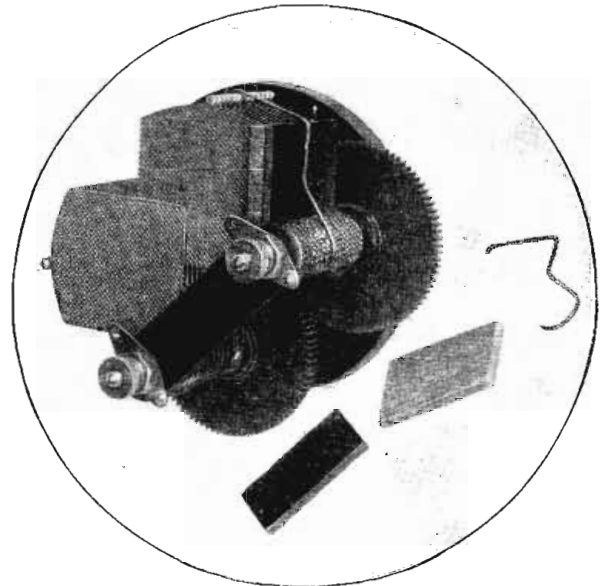
Although you may not think of it at first, it is generally a good idea to disconnect your C battery when tinkering with the set. This is especially applicable where using a C battery of from 16 to 22 volts on the power tube in the last stage. If by accident in your tinkering you should short grid to filament terminals, you are quite likely to burn out the filament of your tube due to the excessive voltage. The safest way is to disconnect your C battery when working on the inside of the set.



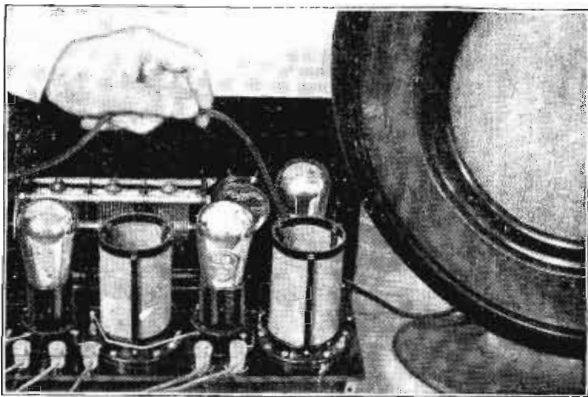
Having a battery operated receiver, many fans may not wish to rewire their particular receiver for alternating current tubes. A simple way of using four prong A. C. tubes in a D. C. set without the necessity of rewiring is illustrated above, where the two filament prongs are clipped off close to the base and a soldering lug placed over and soldered onto each of these lugs. A short length of twisted flexible wire is then attached to the soldering lugs and goes to the filament transformer. The old filament wiring of the receiver is left unchanged the tube being inserted in the socket in the conventional way.



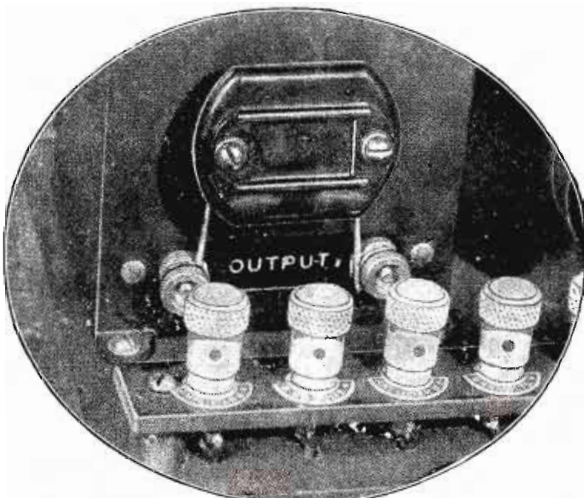
A simple and inexpensive method of paralleling grid leaks to secure a definite value is shown photographically above, where two resistances are held firmly together with a rubber band. On many occasions this may be done to secure a lower value of resistance than is represented in a single cartridge. For example: If you have two 1 megohm leaks, paralleling them will give you 500,000 ohms. By the same token if you have no 2½ megohm leak and you happen to have two 5 megohm leaks, these two in parallel will give you 2½ megohms.



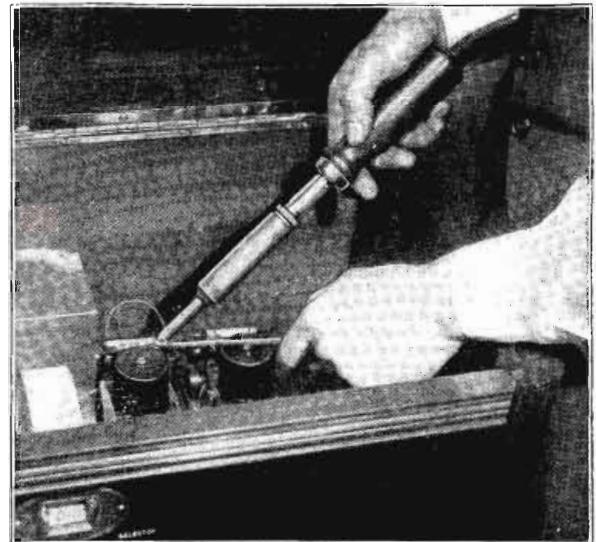
Quite often in superheterodynes or other multi-tube sets, the condenser plates might be set into vibration by the sound waves emitted by the speaker. To prevent the jarring of the plates on the condenser shown in this illustration, a wire hook, a piece of felt and a small strip of bakelite have been provided by the manufacturer, which are attached to the condenser rotors and which serve to damp out any tendency towards vibration. Such an expedient has cured more than one case of sympathetic vibration trouble.



It is not good policy to allow the speaker cord to lay along the panel or close by the radio set, because of the possibility of a feed back. With the speaker in the position as shown in this photograph, trouble is certain to result. Moral: Keep your speaker and its cord away from your set.



The human ear is quite finicky in its choice of tones that are agreeable. In some cases an individual will find that the sound from his speaker is a little annoying, possibly through the presence of some of the high frequencies. This may be bothersome to one individual and yet not to another. In case you wish to shift the pitch of your speaker a trifle, it may be accomplished by placing a fixed condenser across the output terminals of the output transformer, as shown in the photograph above. It may require two or three tests with different size condensers to secure exactly the tone you desire, but within certain limits the pitch may be shifted around at will.

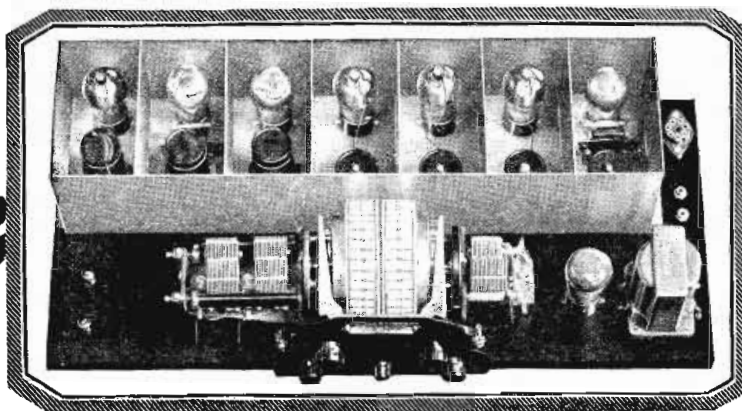


When soldering portions of a receiver inside of the cabinet and with the set hooked up, it is always advisable to take off the ground connection on the receiver so that if by any chance the soldering iron is grounded to one side of the line, a short circuit cannot take place when the iron happens to touch a connection in the receiver which is normally grounded. While it is not customary for irons to be common with either side of the line, nevertheless an iron which has seen considerable service might be touching the heating element inside and if the ground were left on the set when soldering is being done this would establish a short circuit which would likely blow out the fuses in the house.

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# "29"



## SHIELD-GRID RECEIVER

*Unit Construction Gives . . . all the advantages of the Superhet . . . plus ease and speed of assembly . . . plus prices that compare favorably with factory-built sets.*

**R**EMLER never has failed—and never will fail—to deliver honest dollar-for-dollar value to its customers. Now Remler brings out the new "29," a new 8-tube Shield-Grid Receiver, including a Selector-Amplifier Unit, built, wired, and tested at the factory.

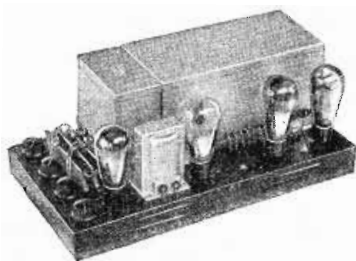
Eight tubes line up this way: one stage of shield-grid radio frequency amplification functioning at the frequency of transmission, a regenerative first detector, an oscillator, 3 stages of shield-grid intermediate amplification functioning at a frequency of 115 kc., a second detector and a first audio stage.

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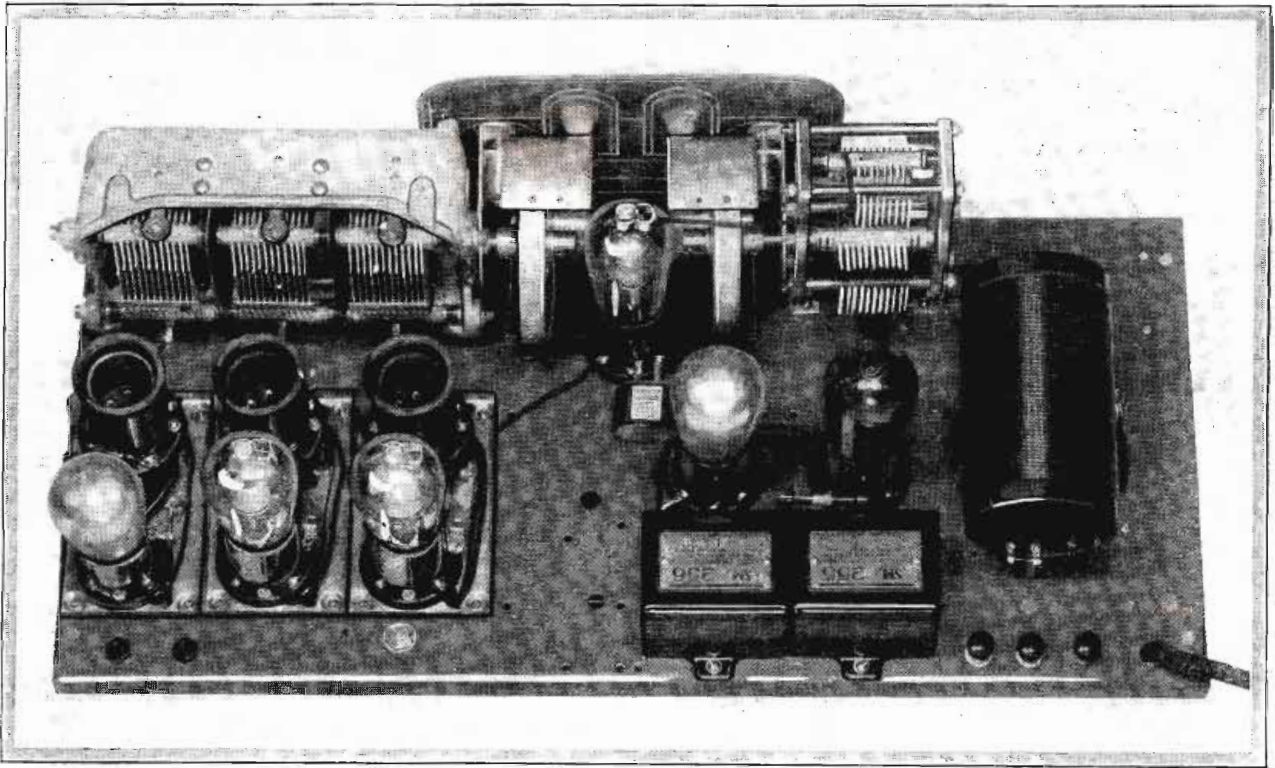
CRCB-9

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**SEND THIS**

# Screen Grid Six Has Low Cost, Performance and Appearance

S-M 720 Designed for Greater Selectivity, Better Quality and  
Simpler Operation



*Fig. 1. This photograph shows the rear view of the 720 Screen Grid Six described in the accompanying article*

PROFESSIONAL set builders and broadcast listeners in general are finding this season major improvements in the application of the screen grid tubes to custom built or home assembled receivers. Even last year, when the screen grid tube was first announced, it showed a marked superiority over the conventional 201-A, if on no other score at least in its ability to be used without an oscillation tendency. However, in the ten or twelve months that the screen grid tube has been on the market, much engineering energy has been expended in producing circuit designs whereby a maximum amplification could be secured from this tube consistent with selectivity, stability and ease of control.

As yet this tube has not appeared in any of the factory built receivers and for that reason the professional set builder or the home assembler is enjoying considerable prestige and satisfaction through his ability to have a receiver giving maximum performance with these tubes.

One of the first popular tuned radio frequency circuits employing the screen grid tubes was the Silver Shielded Grid Six described in the January, 1928, issue of the CITIZENS RADIO CALL BOOK MAGAZINE. With the experience gained during the past ten or twelve months and the performance of the present season receivers, one must realize that the screen grid tube has marked a definite turning point in radio reception and has served to increase the dependable reception range of popular designed

radio sets tremendously, bringing within range stations and programs not previously heard.

### Is Fully Shielded

The new set described in this article has been named the 720 Screen Grid Six and is a dual control, fully shielded six tube tuned radio frequency circuit, combining performance and low cost. It also possesses such features as a metal chassis, antique brass escutcheon and an all metal shielding cabinet, providing a dignity and distinction of appearance equalling that of more expensive factory made receivers.

To the enthusiastic fan performance counts, so performance, low cost and appearance are points upon which a radio receiver is judged. In average residential districts in and about Chicago. Screen Grid Sixes have brought in from forty to one hundred stations in a single evening during the month of June. Selectivity is such that 10 kilocycle separation from locals may be secured. The use of the new Clough audio system provides excellent tone quality and the elimination of hysteretic distortion gives a new depth and brilliancy to the tone.

The receiver has three stages of tuned radio frequency amplification with a tuned antenna input, a detector, two high gain audio stages in which a 171, 210 or 250 power output tube may be used. Phonograph record amplification may be had. Radio

(This receiver tested and all illustrations made in our laboratory)



Fig. 2. The power supply system recommended for use with this receiver is shown above

frequency stages are individually shielded and are tuned by a three-gang die cast condenser of great rigidity and accuracy. The whole receiver is mounted upon a pierced and formed steel chassis 21 1/8 inches long, 9 1/8 inches wide and 5/8 inches high, to which all parts are attached. At the front is an antique brass escutcheon control panel carrying the two knobs for the two vernier drum dials, an antenna selective adjustment and a smooth volume control which in its "off" position turns off the entire set

Modern Antenna Circuit

The receiver is intended to be housed in the new Silver-Mar-

shall type 700 metal shielding cabinet, or it may be mounted in any console or other table cabinet. Great care and attention has been given to each individual circuit, and almost every step throughout the design shows some unusual innovation. To the antenna circuit, for instance, especial care has been given. In ordinary receivers, an untuned antenna input circuit having no inherent amplification is used. For the 720 the best practical input circuit that could be devised is used. The result is an actual r.f. voltage step-up of from 65 to 100 times throughout the broadcast band, coupled with considerable gain in selectivity. This antenna input gain developed before the first r.f. tube is in itself equal to two average stages of r.f. amplification. The high gain is achieved through the use of an antenna coupling coil having only about half the r.f. resistance of the best previously available coils and placed in the circuit with a small antenna selectivity condenser allowing maximum voltage step-up at all waves. This coil is tuned by the left-hand, SELECTOR I, drum, and exhibits as much apparent selectivity as does the oscillator dial of the average super.

The antenna coil feeds into the first screen grid r.f. tube, which, in turn, feeds one of three small r.f. transformers housed in the left-hand copper stage shield. The three screen grid r.f. amplifier tubes each feed an identical transformer in the next stage shield to the right, and one 222 tube and plug-in transformer is considered as a stage of amplification. The manufacturer's actual measured amplification of each stage varies from 14 at 550 meters to 25 at 200 meters. These low values have been taken in order to get a high degree of selectivity, something impractical in the broadcast frequency band with greater amplification. This sacrifice means little practical loss, for the overall r.f. amplification is well above 250,000 times over the broadcast band, from antenna to detector tube grid circuit. This is just about 250 times what is had from three r.f. tubes in average commercial receivers. The wisdom of this policy shows up in selectivity curves, which show a good, sharp 10 k.c. cutoff, which means that the great amplification of the set can actually be used and does not fall in the range blanketed by local stations, as has frequently been the case

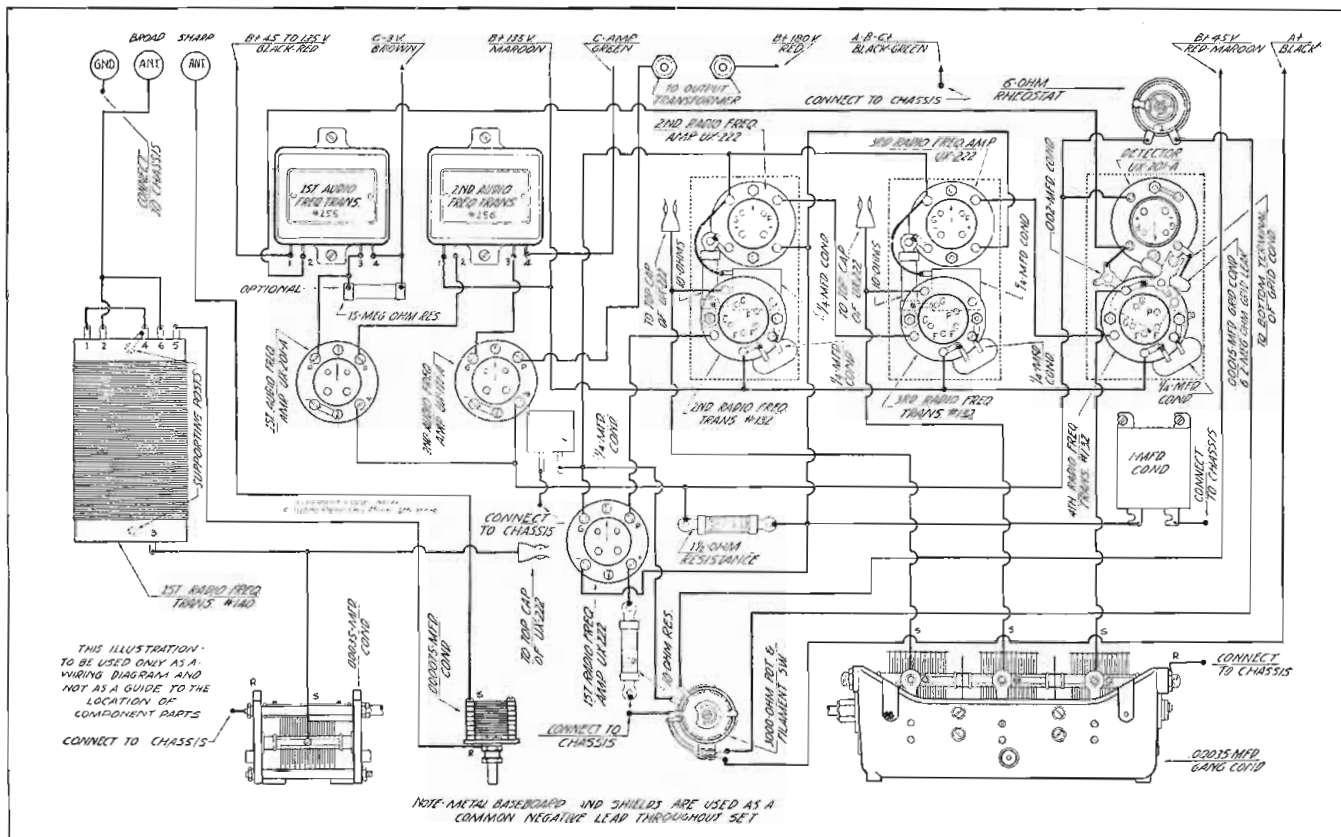


Fig. 3. The above graphic diagram gives the exact manner in which all connections should be made in this receiver

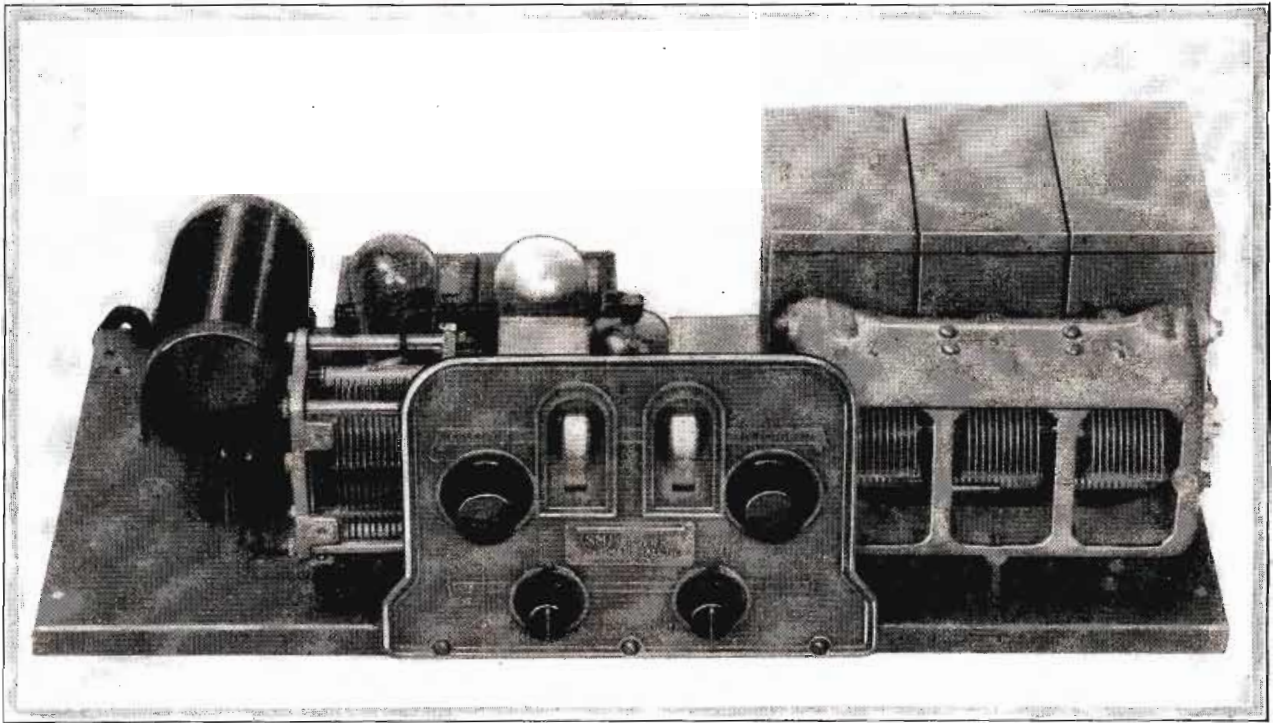


Fig. 4. This photograph shows a front view of the 720 Screen Grid Six with the metal cabinet removed

with sensitive sets in the past.

Each r.f. stage is individually shielded and bypassed, and then doubly shielded by the metal cabinet of the set. The gang condenser for second, third, and detector stages is very rugged, and actually has a 50% safety factor in capacity accuracy. It is equipped with small trimmers to equalize tube and circuit capacities. In operation local stations seldom cover more than three dial degrees—distant stations often group two to a dial degree, and when 10 k.c. apart, always separate positively and cleanly.

**New Audio Design**

The audio amplifier utilizes the new Clough transformer system, and shows some interesting amplification figures. The two transformers used with one UX201A or UX112A first stage tube and a UX171A output tube show an overall gain of about 500 times from 100 to 5,000 or more cycles. A measured frequency curve for both stages in operation together shows the same amplification at 65 cycles as at 1,000 cycles, with a rise around 100 cycles to compensate for average speaker deficiencies, and a flat curve on up to 8,000 cycles. This is a good characteristic for a two stage amplifier, but the 720 a.f. amplifier has still another advantage. This is the elimination of hysteretic distortion due to the elimination of all d.c. from the transformer windings. Through the use of a high voltage B power supply (such as S-M 675 ABC) a UX210 or preferably UX250 power tube can be used right in the set. The result is excellent reproduction. The receiver may

be operated from the light socket with a standard six volt A power unit, and any good B power unit, with a dry C battery. The ideal installation would be completely light socket operated, with a UX250 power output tube, and would employ a 6 volt A power unit and an S-M 675 ABC unit, supplying B power to the entire set, and A, B, and C power to the UX250 tube through an adapter plug accompanying the power unit.

**Assembly Is Simple**

The assembly of the Screen Grid Six is very simple, easy, and, above all, positive. The parts mount on the steel chassis as seen in the photos and drawings, the wiring is put in place, and, the set is ready for test. In preliminary testing the three trimmers on the gang condenser are adjusted on a 300 to 350 meter station for loudest signal, and the set is finished. The chassis wiring is laced into a cable with waxed twine. The chassis is set on the cabinet base moulding, the cabinet dropped down over it, and the builder can survey with pride his finished set—a receiver that could not be duplicated at any price in a factory made set on the open market.

In Figure 5 the actual voltage amplification of the three r.f. stages is shown without the antenna coupler. This is represented in curve D. The fall-off in amplification at the high wave end of

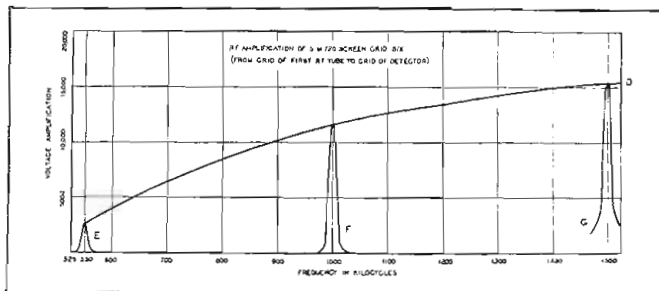


Fig. 5. Curve D in the above graph shows the voltage amplification of the three r. f. stages, less antenna coupler

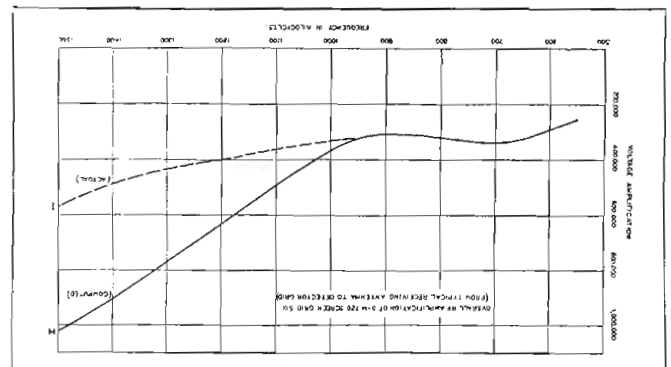


Fig. 6. Curve H in this graph shows the over-all voltage amplification of the three r. f. stages plus the tuned antenna input circuit

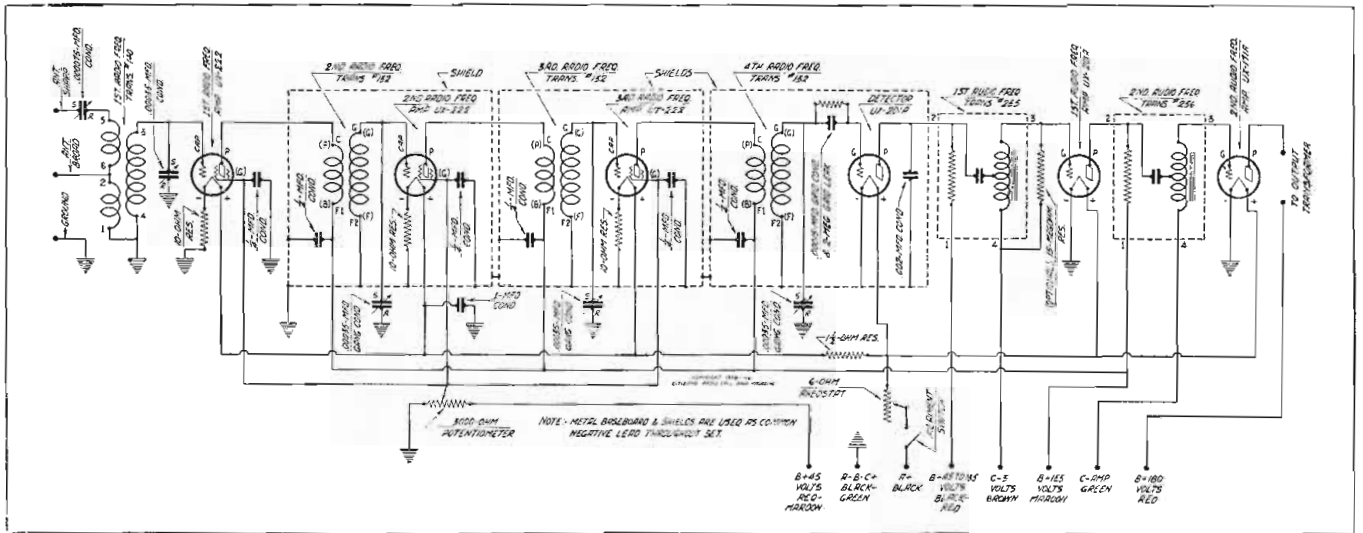


Fig. 7. All electrical connections involved in the receiver are illustrated in the schematic diagram given herewith

the curve is that found in all r.f. amplifiers having a fixed primary coupling. Curves E, F and G show the actual selectivity obtained at three different wavelengths with the three stage r.f. amplifier of the 720 receiver. Curve H of Figure 6 shows the over-all voltage amplification of the three r.f. stages plus the tuned antenna input circuit. Here it will be seen that the antenna input circuit characteristics have flattened out the high wave end of the curve.

Figure 8 represents the measured over-all amplification curve for the two stage audio amplifier when using a 171-A power tube.

Official Parts List

Parts used in the construction of this receiver follow:

- 1 Silver-Marshall 701 Universal chassis
- 1 Silver-Marshall 809 dual control escutcheon
- 1 Silver-Marshall 806-L vernier drum dial
- 1 Silver-Marshall 806-R vernier drum dial
- 1 Silver-Marshall 320-R .00035 mfd Universal condenser

- 1 Silver-Marshall 323 .00035 mfd 3-gang condenser
- 1 Silver-Marshall 342-B .000075 mfd midget condenser
- 3 Silver-Marshall 638 copper stage shields
- 1 Silver-Marshall 140 antenna coil
- 3 Silver-Marshall 132-A plug-in r. f. transformers

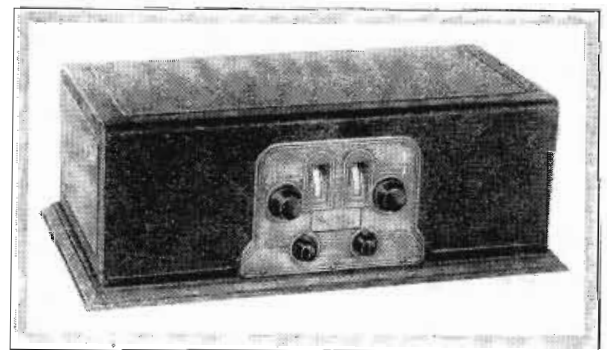


Fig. 9. This photograph shows the receiver in its metal cabinet

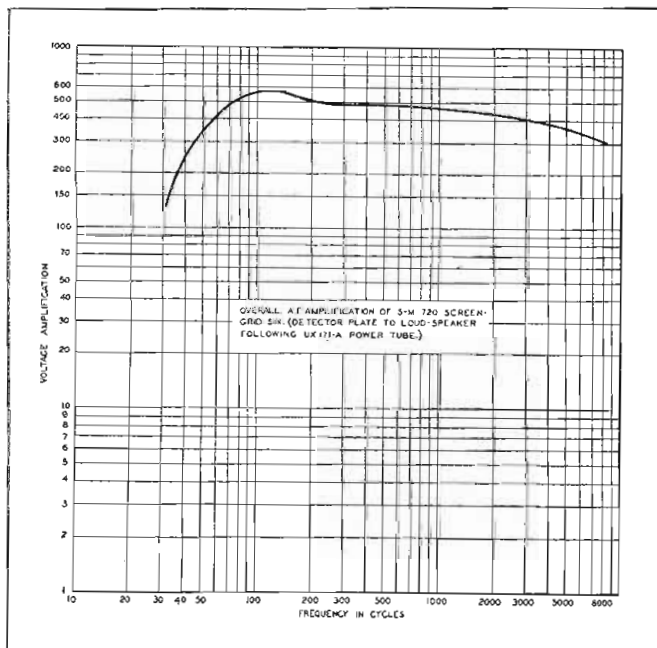


Fig. 8. This graph represents the measured over-all amplification curve for the two stage audio amplifier of the receiver when using a 171-A power tube

- 3 Silver-Marshall 512 5-prong sockets
- 5 Silver-Marshall 511 tube sockets
- 1 Silver-Marshall 255 first stage audio transformer
- 1 Silver-Marshall 256 second stage audio transformer
- 1 Silver-Marshall 708, 10 lead, 5-foot connection cable
- 1 Pkg. Silver-Marshall 818 hook-up wire
- 1 Yaxley 3000 ohm junior potentiometer, No. 53000-P
- 1 Yaxley 500 switch attachment
- 2 Yaxley 420 insulated tip jacks
- 3 Carter RU-10 resistances
- 1 Carter AP-6 sub-base rheostat
- 1 Carter H-1 1/2 resistor
- 1 Potter No. 4, 1 mfd bypass condenser
- 6 Sprague or Polymet 1/4 mfd midget bypass condensers
- 1 Polymet .00015 grid condenser with clips
- 1 Polymet .002 mfd bypass condenser
- 1 Polymet 2 megohm grid leak
- 1 Durham .15 megohm resistor with leads
- 1 Naald 481XS cushion tube socket
- 3 Moulded binding posts
- 1 Set hardware consisting of studs, screws, nuts, washers
- 3 222 type, r.f. amplifier tubes
- 1 201A type, or preferably 112A type, detector tube
- 1 112A type first stage a. f. amplifier tube
- 1 171A type power output tube

# Thordarson 250 Power Amplifier

Latest Design Takes Advantage of New Power Tube's Large Undistorted Output

**D**URING the past two years we have seen a great deal of attention being paid to the development of quality audio amplification. With this development came the education of the radio public to the fundamentals underlying this improvement. We have come to know that distortion is intolerable, that plate impedance is essential for amplifying the lower frequencies, that distributed capacity in the secondary of the audio frequency transformer will produce unnatural amplification of some frequencies to the detriment of the ensemble, that power is demanded when physical displacement of air, which we know as loud speaker performance, is to be accomplished.

## A Big Improvement

This season has seen another big step forward toward the goal of perfect reproduction; that is, the new 250 tube with an undistorted output of 4600 milliwatts. In the construction of such an amplifier, the best insurance with which the home builder may provide himself is the purchase of quality parts and close adherence to constructional data and advice.

The Thordarson 250 power amplifier is adapted for use either with a radio set or as a phonograph amplifier. It has been found a good phonograph "pickup" functions excellently with this amplifier and with such a combination, a quality almost unbelievable is produced from the phonograph. And, this quality does not suffer when volume sufficient to cause objects in the room to vibrate is employed; volume so great that it may be physically felt by the listener.

The filament supply for the 250, for the rectifier tubes, and the plate supply for these same tubes is a 2900 Thordarson power supply transformer. This transformer supplies a rectified filtered output of 450 volts and 110 milliamperes in addition to supplying the filaments of the 250 and the two 281 rectifiers.

The Thordarson 3099 double choke unit consists of two 30 Henry chokes of 130 milliamperes capacity. This, used in conjunction with the Aerovox TH 862 condenser block, forms a filter circuit which renders available an unusually pure direct current. The voltage divider system is composed of Electrad Truvolt resistors.

The new Thordarson R-300 audio transformer used in this amplifier incorporates all the well known qualities of the R-200 model which it supplants with several marked improvements. Wound on a new type of core material, "DX Metal," greater bass note reproduction is secured, and a high frequency cut-off is effected at 8,000 cycles to eliminate any "surface noise" which may be delivered to the transformer. The turn ratio is 3 to 1 instead of 2 to 1, permitting full realization of the rated power output of the 250 power tube. When it is considered that the 250 should have impressed upon its grid 58 volts R.M.S. in order that its output may reach its rating of 4600 milliwatts, it is at once seen that it is essential to have sufficient amplification ahead of

this tube that will give voltage step-up without introducing distortion.

This circuit employs as an output transformer a 2901 Thordarson, which is a high impedance output transformer for use with high impedance speakers. If dynamic speakers are used, this unit should be interchanged for a Thordarson T-2902, which is an output transformer for low impedance speakers.

## Either Type Speakers

When this transformer is used, the speaker coupling transformer mounted in the base of the dynamic speaker should be disconnected from the movable coil at the apex of the cone. The secondary of the transformer T-2902 should then be connected directly to the movable coil terminals. Both of these output transformers have sufficient iron to prevent saturation at the maximum current drain of the power tube.

It is also possible to incorporate the power field for dynamic speakers into the voltage divider circuit by making substitutions in the resistance values and connecting into the divider the power field of the speaker so that it is energized by the current which flows through the voltage divider. The resistance of the field of the dynamic speakers on the market at the present time is about 2200 ohms, and this may be economically used to form a portion of the divider by removing an equivalent resistance.

This can easily be accomplished in the following manner: (1) Open the high voltage circuit at the points marked "X" and insert the dynamic field across these points. (2) Short circuit a portion of the 8000 ohm resistance unit by sliding the voltage regulating tap toward the center of the resistor about two inches from the high voltage end. This will give approximately 100 volts across the field winding of the speaker.

The filament supply for the 227 tube is secured from a 2445 Thordarson filament transformer. This transformer is capable of supplying six 226 tubes from No. 1 secondary; two 227 tubes from No. 2 secondary; and two 5 volt tubes from No. 3 secondary. This renders available power for operation of a receiver using alternating current tubes of these types in addition to the operation of the 227 in the amplifier itself. While no binding posts were mounted for these voltages, sufficient room was provided upon the speaker binding post strip to do this if necessary.

The "C" post of the T-2445, 2½ volt winding is connected to the 45 volt binding post in order to prevent space charge originating from the heater.

The Electrad Truvolts are mounted on a Formica strip and must be arranged to give accessibility and to prevent short circuits between the units. The 8000 ohm unit is placed on one side of the strip and the mounting arms bent up so that the axis of the unit is about an inch above the Formica strip. This unit carries two taps. The voltage regulating tap (to provide for increasing the amount of current available to the set in case it demands

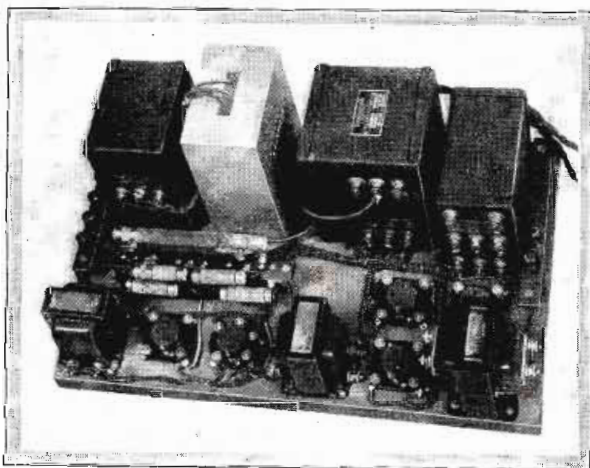


Figure 1. This photograph shows the layout of the power supplies, choke, filter, resistors and other constituent parts

(This amplifier tested and all illustrations made in our laboratory)



more than about 30 milliamperes) is placed about three-quarters of an inch from the high voltage end. The other tap on this unit is placed about one inch from the low voltage end of the unit. This tap supplies 135 volts to the plate of the 227 and is also brought out to a binding post for use externally. These positions are not critical, and while they should be set with a voltmeter to answer the specific set requirements, the above dimensions are sufficiently accurate so that if a voltmeter is not available, the voltages will be close enough for practical purposes. The voltage regulating tap should be set toward the center of the unit in small changes if the glow tube is seen to go out under operation.

Immediately across the Formica strip from the 8000 ohm unit and in a horizontal line with it are placed the two 10,000 ohm units. The low potential side of the 8000 ohm unit is connected to the high potential side of one of the 10,000 units. This in turn is connected to the other 10,000 ohm unit, the other side of which is connected to the negative line of the rectifier circuit. The voltage drop across the upper 10,000 unit is about 45 volts, although under load this is somewhat less, depending on the amount of demand. A sliding contact is provided on this unit and is connected to the binding post marked 67 volts.

For current drains not exceeding 10 milliamperes, the 45 volt binding post is used. For current drains exceeding 10 milliamperes, the 67 volt post should be used and the voltage adjusted by means of the sliding contact to suit the particular requirements. For 25 milliamperes at 45 volts this tap should be set about 1/2-inch from the high voltage end of this unit.

On the same side of the strip and directly beneath the two 10,000 ohm units are mounted the C bias resistances. These are not particularly critical, and need not be adjusted so long as the tube specifications are adhered to.

**Below Average Hum**

The hum from this amplifier measured in the output circuit is of the order of two microamperes, which is considerably below the average in power supply devices. This amount will never interfere with speaker reproduction. Correct location of parts makes this possible. The input transformers, the T-2900 and the T-2445, should be placed exactly as shown.

The two rectifier tubes are closely bunched on the right hand end of the baseboard away from the input transformer. This is important because rectifier tubes have an external field.

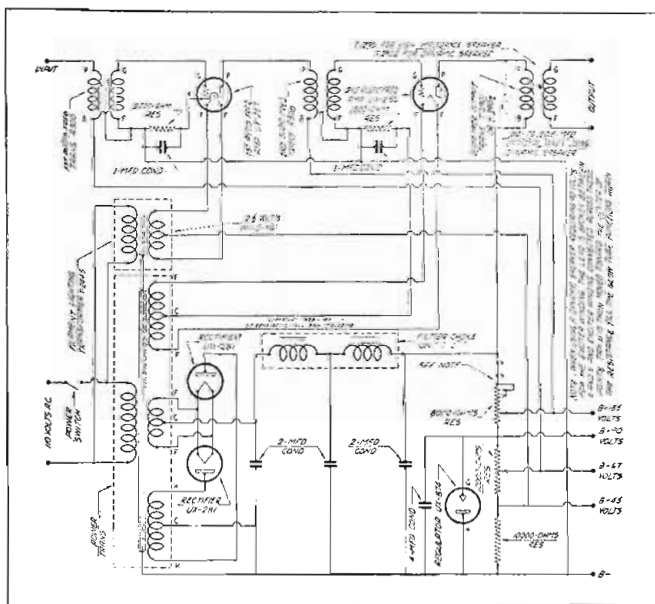


Figure 2. The schematic circuit of the Thordarson 250 amplifier is disclosed in the above drawing. This schematic can be used in checking the completed job

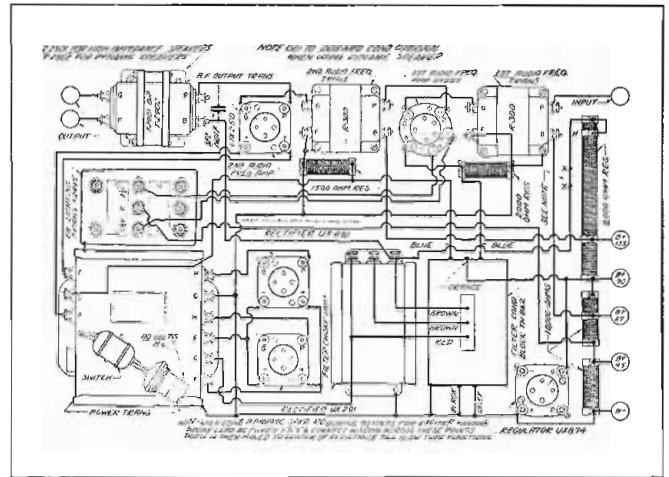


Figure 3. This drawing is only a graphic one insofar as the placement of parts is concerned and is intended as a guide for the individual who is not skilled in radio assembly. The job should be laid out in accordance with the photograph in Figure 1 and then wired in accordance with the above graphic

All transformer and condenser cases should be connected to the negative B and all filament leads should be twisted.

A power switch, preferably of the pendant type, should be used to disconnect the amplifier from the lighting line. If direct current tubes are used in the set with an "A" eliminator, the eliminator may also be plugged into the T-2445 (by using a double outlet) and will be disconnected at the same time the amplifier is disconnected. If the set is operating from batteries and a trickle charger, probably the most convenient method of control is the use of an automatic relay.

In using a phonograph pick-up, it is only necessary to connect the two leads from the pick-up to the binding post marked "input" and "67." The volume control should also be connected to these two binding posts since the amount of output will be too great for ordinary purposes.

This magazine or the manufacturers of any of the parts used in this amplifier will be pleased to give our readers any additional information that may be desired.

**Official Parts List**

The parts listed below were used in constructing the official model described herein:

- |   |  |
|---|--|
| 1 Thordarson T-2900 power supply transformer            | 1 Electrad 1500 ohm, 25 watt, 2-in. fixed resistance             |
| 1 Thordarson 2445 filament transformer                  | 3 Electrad clips   |
| 1 Thordarson T-3099 double choke unit                   | 4 Benjamin UX sockets  |
| 2 Thordarson R-300 audio transformers                   | 1 Benjamin UY socket   |
| 1 Thordarson output transformer T-2901 or T-2902        | 1 Baseboard 12x18x1-in.  |
| 1 Aerovox TH-862 condenser block                        | 25 Ft. Corwico Braidite hook-up wire                             |
| 2 Formica strips 3/4x7-in. for binding posts            | 2 Legs for mounting resistance strip 1 1/2-in. long              |
| 1 Formica strip 3/4x7 1/2-in. for resistances           | 4 Legs for mounting binding post strips 1-in. long               |
| 8 Eby binding posts                                     | 4 No. 5 flat head nickel-plated brass wood screws 1 1/2-in. long |
| 1 Electrad 8000 ohm, 75 watt, 6-in. fixed resistance    | 2 No. 5 flat head nickel-plated brass wood screws 2-in. long     |
| 2 Electrad 10,000 ohm, 25 watt, 2-in. fixed resistances | 10 6/32 R. H. nickel-plated brass machine screws, 3/4-in. long   |
| 1 Electrad 2000 ohm, 25 watt, 2-in. fixed resistance    | 10 6/32x5/16-in. nuts  |
|   | 28 No. 5 R. H. nickel-plated brass wood screws 1/2-in. long      |
|   | 10 No. 5 R. H. nickel-plated brass wood screws 3/4-in. long      |
|   | 1 Pkg. Kester radio solder                                       |

Providing electrical and physical characteristics are identical, the following parts made by the respectively named manufacturers may be utilized in the construction of an amplifier similar to the one described above: Transformers, power filter: Dongan, Jefferson, Karas (filament only), Samson; Filter chokes: AmerTran, Jefferson, Samson; Transformers, audio, output: AmerTran, Dongan, Jefferson, Samson, Sangamo; Filter condensers: Acme, Dubilier, Potter, Sangam, Tobe; Binding posts: XL; Resistances, power: Carter, Frost, Ohmite, Ward-Lennard; Sockets, Eby, Frost; Tubes, Ceco, Sonatron; Voltage regulator tubes, Raytheon.

# The New Scott World's Record Shield Grid Nine Super

This Receiver Designed So That It Is More Powerful Than Ever

THE latest model Scott World's Record Super incorporates the use of the extremely popular shield grid tube. This tube, as is well known, when used in a properly designed circuit, has a tremendously high amplification factor, and still maintains the utmost in stability. That is what this receiver was built to do, give tremendous amplification of all signals no matter how weak they may be when picked up by the antenna, but yet have this power under perfect control at all times. When used with the Scott power pack and amplifier this arrangement gives almost the ultimate in radio reception. The receiver is also so arranged that a phonograph attachment can be easily installed, giving all electric reproduction of your favorite musical numbers. These features are all part of the original design of the receiver, and are not merely extra attachments which do not fit properly and are difficult to install. The power pack and receiver are designed for use together, making all further voltage adjustments unnecessary. This means much to the average home constructor who has no laboratory instruments to aid him in this important work. Because of the simplicity of construction practically no trouble has been experienced by the builders of this receiver in getting the assembly to operate properly. Once built, it works and keeps on working.

## Completely Shielded

The radio of the future is, and must be, a completely shielded job. With modern broadcasting conditions, any receiver having exposed coils and parts, subject to all stray signals, cannot maintain the selectivity of a completely shielded one. In this Scott super all transformers and inductances of any kind are in sealed copper cans, eliminating any stray pickup which may result in stations overlapping each other and causing interference. The only station you can hear is the one you have the dials tuned in resonance with, regardless of how near or how high powered your local stations may be.

To secure maximum signal strength an outdoor antenna is used, although the receiver works satisfactorily on a small indoor aerial. In fact, many of these sets are in operation today with nothing more of an aerial than a string of wire laying under the carpet in the room in which the radio is located.

To further increase power of weak distant stations, one stage of tuned radio frequency is used ahead of the first detector and is controlled together with the antenna circuit by a special Selectone two-gang condenser. To obtain perfect resonance at all

times between these two circuits the antenna coil is tuned by a .0005 m.f.d. condenser, while the radio frequency transformer is tuned by a .0004 m.f.d. condenser having a .0001 vernier condenser located at the center of the panel as a balancing condenser. With this arrangement it is possible to secure perfect resonance from the lowest to the highest wave length, insuring 100 per cent signal strength at all times. The r.f. amplifier tube oscillation is controlled by a filament rheostat, and located at the left of the panel, giving vernier control of both volume and oscillation at the same time.

## Shield Grid I. F. Amplifier

The intermediate amplifier has three stages using a 240 high mu type of tube for the first detector, three 222 shield grid tubes for the amplifier stages, and the customary 201A for the second detector.

The transformers used are all air core type, the two filter transformers being located first and fourth, respectively, and each transformer is shielded from the one next to it by a copper partition through the shield. This arrangement of transformers, together with the precision with which they are matched and the shielding, gives maximum selectivity, while the electrical characteristics of the coils give the greatest amount of coupling efficiency that is possible with the shield grid tube. Rectification in the first detector is obtained by the use of a grid leak and condenser with a negative bias, while the second detector uses a  $4\frac{1}{2}$  volt C bias for rectification with 90 volts of B supply.

The oscillator coil, completely shielded in a copper can, is mounted on the right hand end of the sub-panel, next to the oscillator tuning condenser and oscillator tube. This compact arrangement of the oscillator circuit makes both grid and plate leads short and promotes the already high effi-

ciency of the receiver.

## New Power Amplifier Design

Only one stage of audio is incorporated in the receiver proper, the second stage being built into the power pack. For ordinary home reception one stage is all that is necessary, but two stages are advised for those who want exceptional volume. The Selectone audio transformers used are built especially for this receiver by Scott and are of the large core, low ratio type, giving unbelievably natural tone. A 112A type power tube is used in this first audio stage, eliminating all possibility of overloading the



Fig. 1. This photograph shows the Scott Shield Grid Nine Super placed in a Tasman model console

(This receiver tested and all illustrations made in our laboratory)

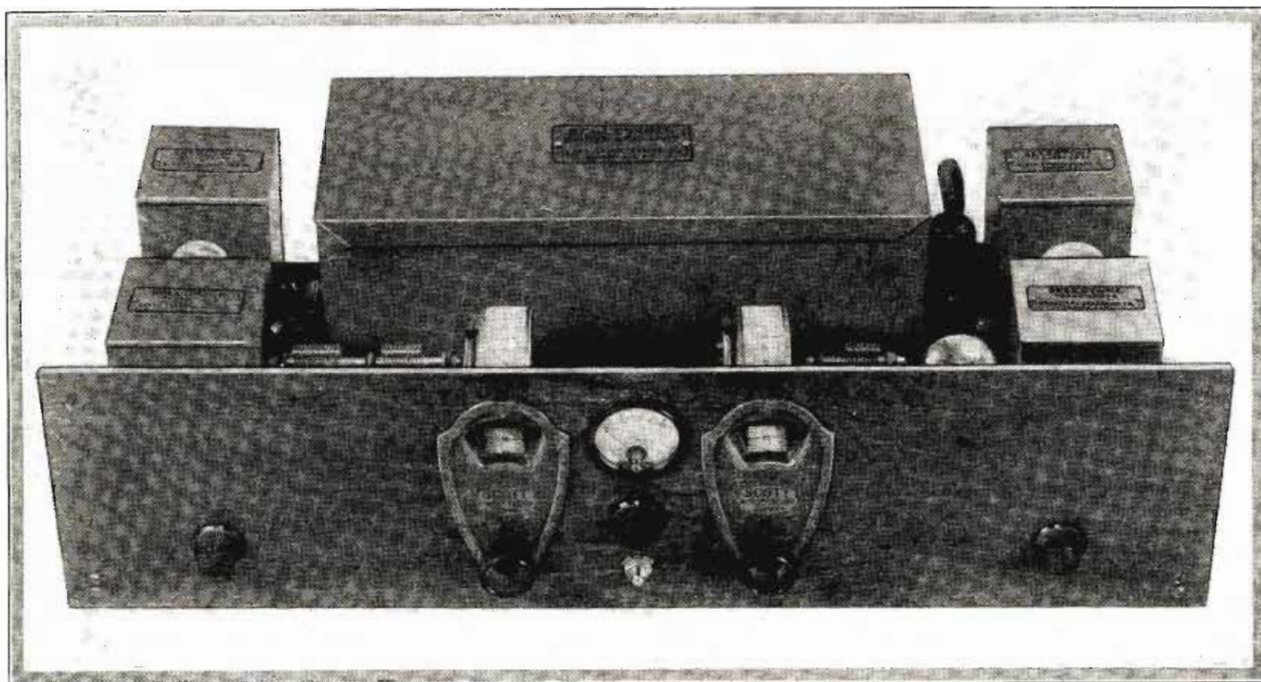


Fig. 2. Simplicity of the receiver is depicted in the above photograph, where all of the necessary units may be seen

tube and causing distortion.

The ninth tube is located in the power amplifier, there being only eight tubes in the receiver proper. This is the new 250 type power tube, using 425 volts on the plate, and gives tremendous volume with excellent tone. All transformers in the amplifier are built especially for this job, and are so constructed that there is ample power, making the performance less subject to line voltage fluctuations than when a small overloaded B eliminator is used to supply B current. A special tapped resistor is supplied which gives the exact voltages required for all tubes in set. The rectification of the 110 volt a.c. current is accomplished by means of two 281 half wave rectifier tubes, making a full wave rectifier unit with more than sufficient power for the work it has to do. The transformers, chokes, condensers, etc., in the pack are all finished in crackle finish and are symmetrical in shape, making a neat, well arranged power unit. All connections between the receiver and power pack are enclosed in a special cable plug, making connecting or disconnecting the pack a simple process. Special provision is made so that either a dynamic speaker with 90 volt field or an ordinary speaker can be used. An inspection of the circuit diagram will show also an improved arrangement which not only reduces the liability of condenser blow out, but also increases the life of the rectifier tubes considerably.

An inspection of the graphic illustrations will show that the wiring is very simple. Both panel and sub-panel come completely drilled, and sub-panel also has the sockets mounted on it. To make it easier still, the i.f. amplifier is completely wired for you by the makers, with colored flexible leads, coming from it, cut the correct length to make connections. The average constructor will not find it a difficult matter to build the whole receiver in about four hours.

One reason for the efficiency of this set is the fact that there is no balancing to be done by the set builder. Both antenna and r.f. transformers and the transformers in the i.f. amplifier are matched carefully at the laboratory. This feature now makes it possible for even the most inexperienced builder to get maximum results from the set.

#### Economical to Operate

The current consumption of the receiver with one stage of audio is only 29 mils of B and less than two amperes of A current. This feature will appeal strongly to those who do not have a.c. current available, for dry batteries can be used and will give long

service. When a.c. current is available any good B eliminator can be used, although the one specially designed for the set will probably give better results, as it gives the exact voltage required for all tubes.

#### Ease of Tuning

Ease of tuning is another feature of this set that will appeal. Volume is controlled by the filament rheostat on the shield grid tubes in the intermediate amplifier, and the voltage of these tube filaments can be instantly read by the voltmeter on the front panel. In operation this should read from approximately  $2\frac{1}{2}$  to 3.1 volts. At this voltage the tubes will give long service. On test, some of these tubes lasted several thousand hours burning at 3 volts. With this rheostat turned down, the tone can be brought down to the faintest whisper, or by slowly raising the voltage it can be made gradually louder until it reaches such a roar that the windows rattle; but always the program comes through undistorted and with a natural quality of tone that is almost uncanny in its lifelike reality. To further increase the sensitivity of the receiver the radio frequency amplifier is so designed that by tuning the filament rheostat controlling the radio frequency amplifier tube, the set can be made to oscillate, but always this oscillation is under perfect control of the operator. On lower wave length stations it is necessary to turn this rheostat down to just below the point of oscillation, where maximum efficiency is obtained. Then, on going to a higher wave station this rheostat is gradually advanced, bringing up the amplification of the radio frequency amplifier to the desired point. At the lower wave lengths, the compensating vernier condenser on the

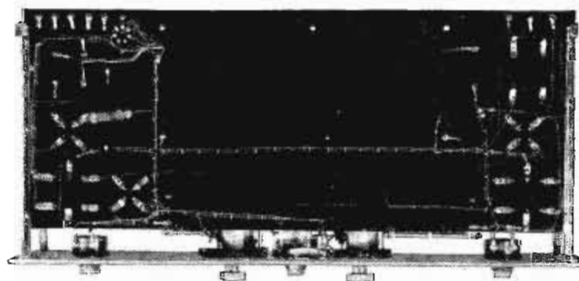
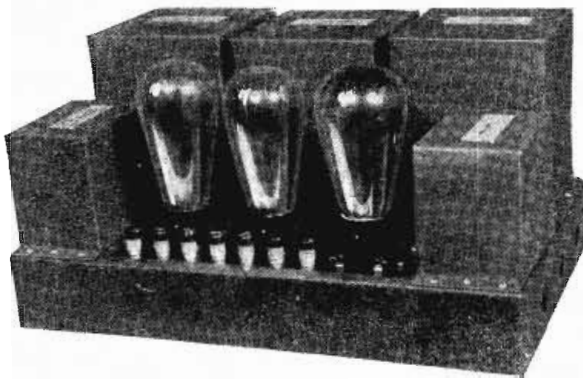


Fig. 3. This photograph shows the small amount of wiring necessary on the bottom of the receiver to put it in commission



**Fig. 4. The power supply recommended for use with the super is shown photographically above**

front panel is opened and then closed gradually as you tune in stations on higher wave lengths. This enables the operator to keep both radio frequency coils in perfect resonance at all wave lengths without any further adjustments.

Regeneration is controlled by a midget variable condenser mounted on the sub-panel, and can be set at nearly maximum and then left the same for all stations.

**Easy to Log**

Both tuning dials track practically together over the entire broadcast wave length, making it simple to find and log stations. Then, too, this is a one-spot superheterodyne, and each station comes in at only one position on the dial. The second dial setting on the oscillator dial is forty or fifty degrees from the first and will never be encountered when tuning in stations when both dials are rotated together. This simplifies tuning considerably and with the inherent stability of the receiver makes it remarkably easy to handle.

When using the Scott Power Pack a phonograph attachment can be used to great advantage. A small switch can be located either on the phonograph or front panel and, by breaking the plate circuit of the detector and cutting in the pickup unit, makes the change over from set to phonograph merely the closing of a switch. No plug-in attachments or other changes are necessary to secure the entrancing music of an electric phonograph.

**Reaches Low Waves**

Both r.f. and oscillator coils are of the plug-in type. Short wave reception is now becoming very popular, as many of the most powerful stations, not only in the U. S. A. but all over the world, are transmitting over them. Special coils can be supplied with this set which will enable one to listen in to either code or broadcast stations transmitting on the low waves.

Reference to the graphic diagram shown in Fig. 5 will give the builder an idea of the relatively small amount of wiring that is required to complete the receiver and put it into operation. The photograph shown in Fig. 3 will also help out in giving the builder an idea of how the wires should run, since some of the wiring may be laced together with twine into a cable, as shown on the bottom of the receiver.

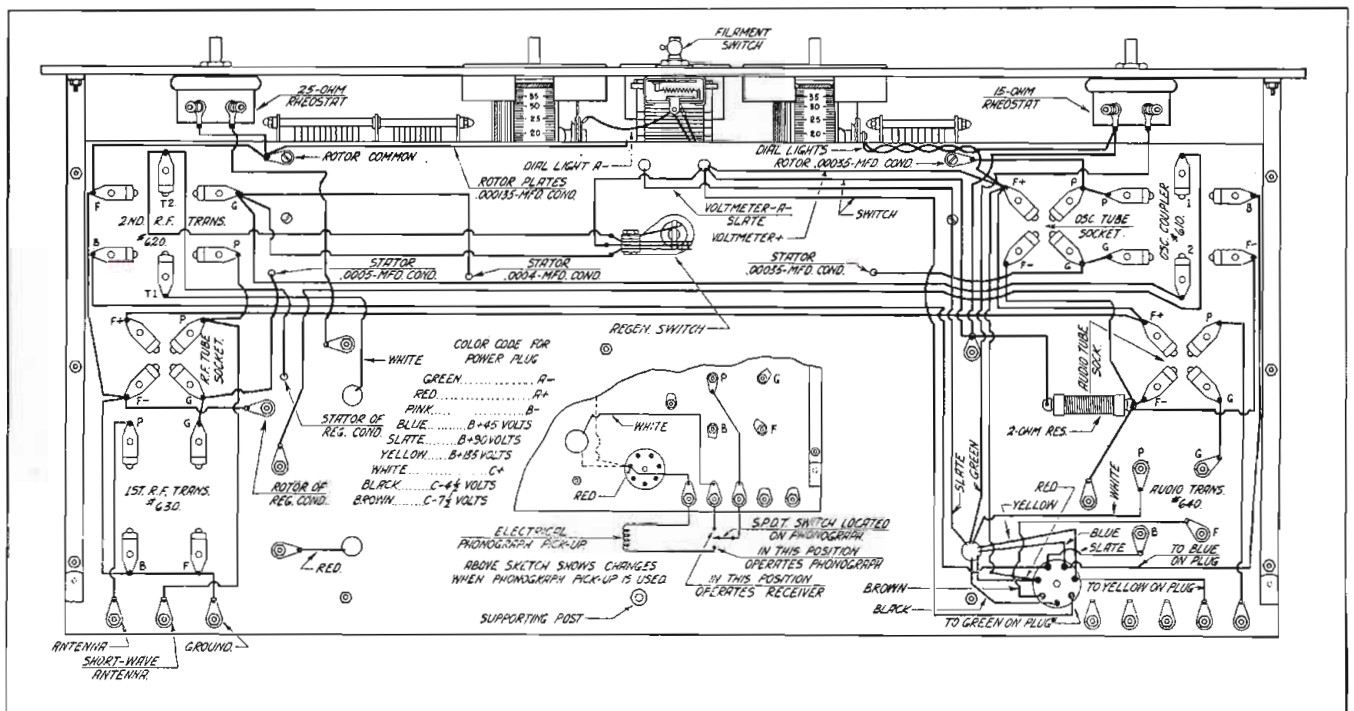
The regeneration switch may be seen by consulting the schematic diagram, Fig. 6. When this switch is in one position, the .000135 mfd condenser is across the .0004 mfd section of the gang condenser, while in the opposite position it is placed in parallel with the .000055 mfd condenser for regeneration purposes. In the position first mentioned the secondary tuning is by means of the .0004 and the .000135 in parallel for wavelength tuning, while regeneration is by means of the .000055 mfd condenser.

**Low Wave Oscillator**

In order to allow the oscillator to tune down low enough for the short wave broadcast, the special oscillator coil supplied for the short waves has a capacity inside of the can so that the .000135 mfd tuning condenser is in series with the special fixed condenser. This departure is only on the short wave coil, the first condenser serving to reduce the capacity of the variable to such a point where the small wavelength range of that coil may be covered in the full travel of the condenser.

For those who desire it a single pole throw switch may be located on the phonograph or on the sub-panel by means of which the electric phonograph pick-up may be cut in to the circuit by the turn of a switch rather than by having to plug in such a unit. This is illustrated in the central portion of the graphic diagram shown in Fig. 5.

An inspection of the schematic circuit in Fig. 7, which shows the manner in which the power supply should be wired, it will be evident that ample provision has been made for bypassing of all voltages required in the receiver. On account of the construc-



**Fig. 5. This illustration is a graphic diagram for the simple wiring of the super described in this article**

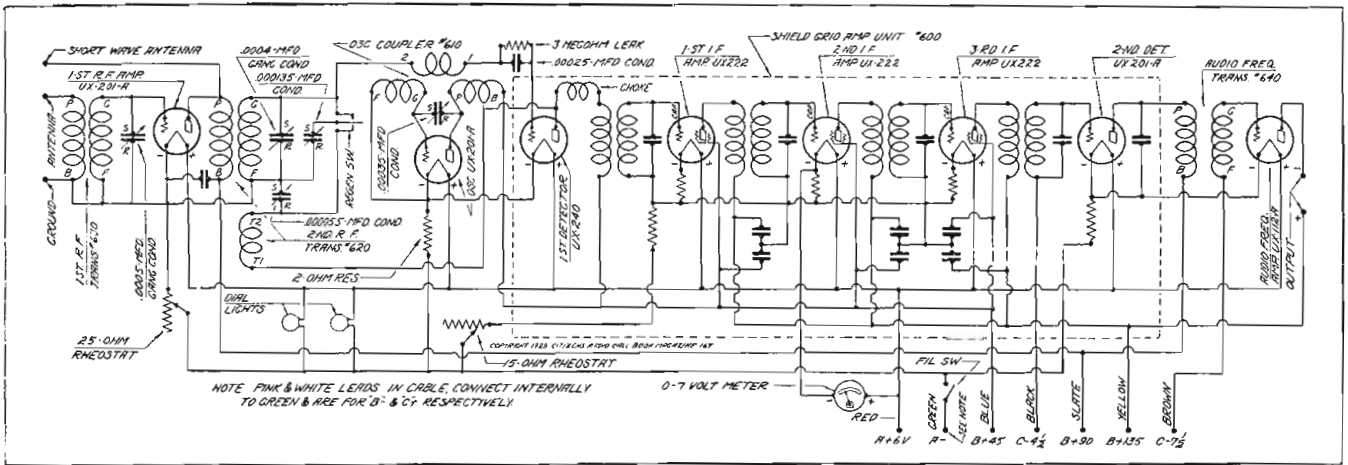


Fig. 6. All electrical connections involved in the set are shown in detail above

sion of the filter choke and the method of placement in the circuit, the voltage stress on the filter condensers is materially reduced and also the life of the 281 rectifier tube should be considerably increased over the conventional method of connection. While the particular form of rectifier circuit involves a higher voltage from the high voltage transformer, nevertheless the drop through the first section of the filter choke with its retarding influence suffices to reduce the stress on the filter condensers and stabilizes the overall operation of the unit.

**Sales Possibilities**

Professional set builders should find in this receiver possibilities of increased sale over the type of receivers to which the industry has been accustomed for the past two years or more. The photograph in Fig. 1 gives an idea of the appearance of the completed job installed in the home. With the excellent tonal qualities secured from the receiver, its distance getting propensities and the fact that its appearance would be in keeping with any living room ensemble, should convince the professional set builder that manufacturers are more than ever producing material which he may readily dispose of at a profit.

On account of the large number of stations that are now transmitting programs on the shorter wavelengths, many of the operators will be able to get stations over surprising distances, which might not be possible with the programs transmitted on the broadcast band. Reference to page 35 of this issue will show a table of some of the better known stations broadcasting on the shorter wavelengths whose programs may be intercepted without any difficulty.

**Official Parts List**

Parts required for this receiver are:

- 1 Front panel, drilled, 26x7
- 1 Sub-panel, drilled, complete with sockets, 25x10
- 1 Selectone 2 gang condenser, .0005-.0004 No. 650, and bracket
- 1 Selectone variable condenser, .00035, No. 660, with bracket
- 1 Selectone variable condenser, .000055, and bracket
- 1 Selectone variable condenser, .000135, No. 671
- 2 Illuminated drum dials
- 1 Selectone audio transformer No. 640
- 1 Selectone screen grid amplifier unit No. 600
- 4 Selectone tube shields No. 680
- 1 Selectone transformer No. 630 (Ant. 200-550)
- 1 Selectone transformer No. 620 (R.F. 200-550)
- 1 Selectone transformer No. 610 (Oscillator 200-550)
- 2 Pair brackets
- 1 Selectone rheostat, 15 ohms
- 1 Selectone rheostat, 25 ohms
- 1 Fixed resistor, 2 ohm
- 1 Bronze filament switch
- 1 Fixed condenser, .00025, with grid clips
- 1 Durham grid leak, 3 megohm
- 1 Special voltmeter
- 1 Special ten-wire connecting cable and plug
- 8 Binding posts

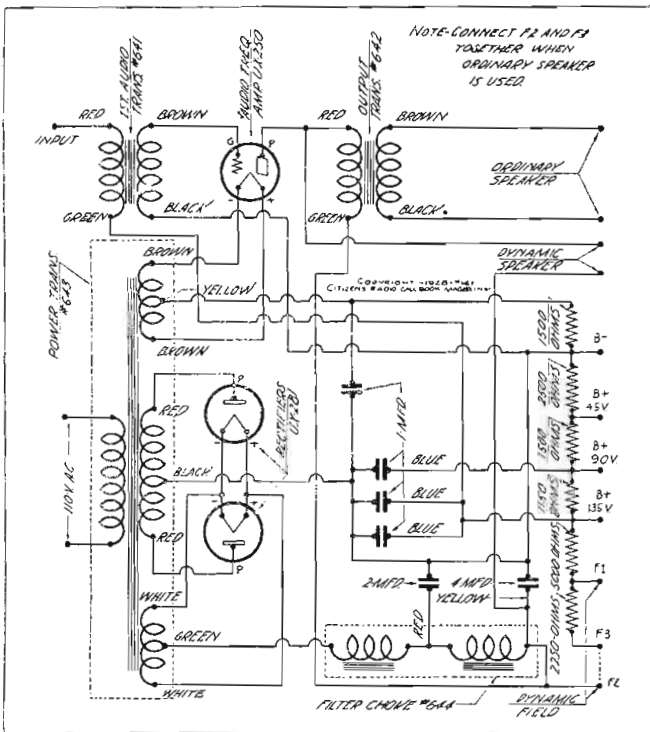


Fig. 7. For wiring up the power supply the schematic circuit shown should be followed

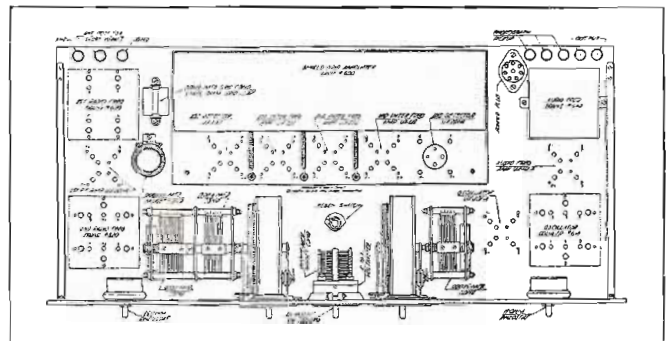
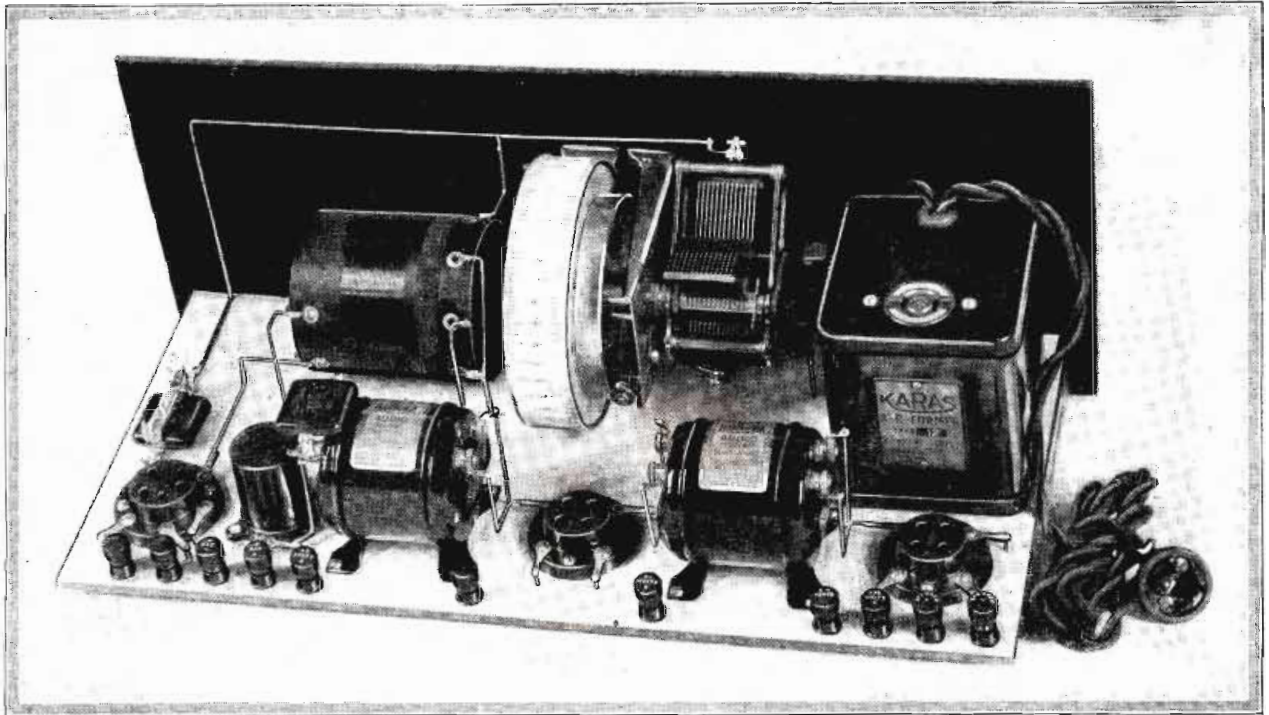


Fig. 8. The drawing above shows the schematic layout of all parts in the Scott Shield Grid Nine receiver. It will be observed that the assembly is very simple on account of the radio frequency, intermediate frequency, audio frequency and the oscillator stages all being individually shielded

# Regenotriac Is Simple Receiver for the Modest Purse

Operates Directly from the Alternating Current Mains and Is  
Economical on Plate Current



*Fig. 1. In this photograph may be seen the rear view of the economical receiver described in this article, which may be operated directly from the light lines. One of the features of the set is its economy of plate current, making it possible to operate it from dry batteries or small eliminators*

WE have had many requests from interested fans for a simple and economical receiver, principally for local work, but which on occasion and with fairly good conditions can be expected to do good distance work provided it is not operated in a locality that is too highly congested with broadcast stations.

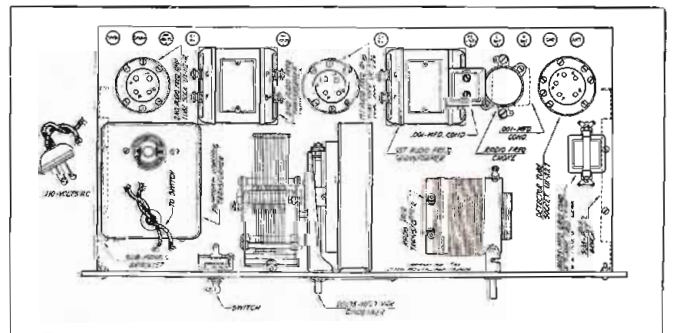
One of the recent requests has been for a set that is simple enough for a child to operate and that is foolproof enough so that no special knack is required to tune the set. The desire of the inquirer was to have a small receiver which he could place in his daughter's room, so that the child could amuse herself with her own radio while the remainder of the family made use of the main set in the living room. Accordingly the receiver described in these columns has been designed with extreme simplicity in view and an inspection of the photographs and schematic circuit in this article will readily attest to this fact.

### Uses A. C. Tubes

Chief simplicity is gained by the use of alternating current tubes energized from an alternating current transformer located on the sub-panel of the set. This does away with the necessity for a storage battery with its attendant charging and watering. Plate current for the set may be derived either from dry cells of the heavy duty type or else from a small B eliminator, several makes of which may be found on the market at the present time. If operated with a B eliminator, then the receiver is completely electric, although the

builder may not wish to go to that expense since a set of heavy B batteries will last a long time on irregular operation.

Essentially the circuit consists of a regenerative detector and two stages of audio amplification, the regeneration being accomplished by a variable plate coil while the tuning is performed by a .0005 mfd variable condenser across the secondary of the three-circuit coupler. Thus, the receiver has only two controls, one for tuning and one for volume. The switch on the front panel of the Regenotriac is in



*Fig. 2. The baseboard layout on the Regenotriac is shown in the above illustration, which should be followed for the location of all parts*

(This receiver designed, tested and all illustrations made in our laboratory)

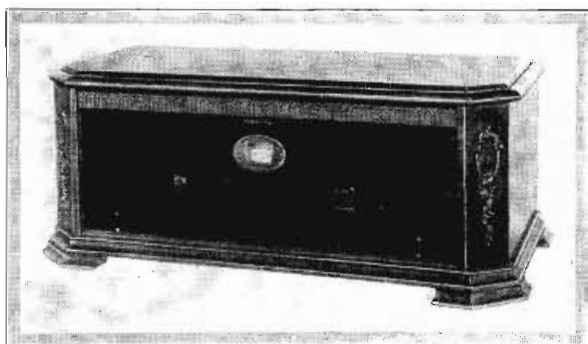


Fig. 3. The receiver is illustrated in the above photograph placed in an attractive Corbett cabinet for table use

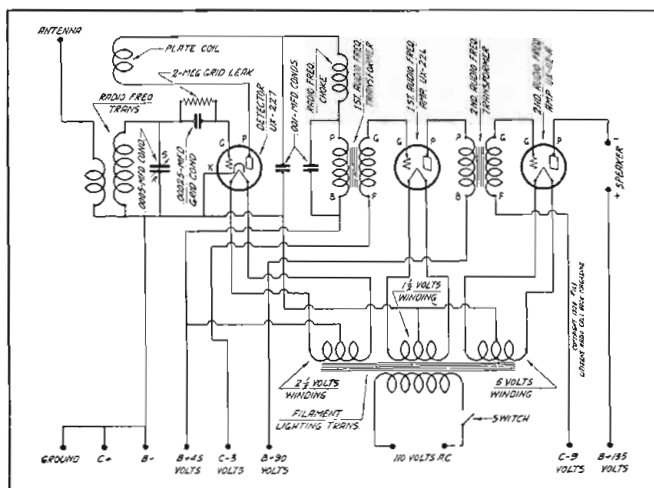


Fig. 5. Professional set builders and others who have done considerable work in radio will be enabled to wire up the receiver by means of the schematic circuit shown above

series with the 110 volt a. c. line and serves to start and stop the transformer, which energizes the tube filaments. When the switch is in the "off" position, of course, no battery current is consumed and the transformer does not draw any current from the line.

On account of the type of filament transformer being utilized in this particular design, all of the filament connections are carried through the bottom of the sub-panel to their respective destinations. The receptacle at the top of the filament transformer may be used by those desiring to employ a B eliminator, which is plugged into this particular position. Then when the "on" and "off" switch is used it cuts out the A supply as well as the B supply. This filament transformer comprises a 110 volt primary and three secondaries, the first being 2½ volt winding for the filaments of the 227 heater type tubes, the second winding being 1½ volts for the 226 type tubes and the third winding a 5 volt one for the filaments of either a 112-A or 171-A tube. While in this particular design the 112-A tube is recommended on account of its economy of plate current consistent with voltage amplification, nevertheless if the builder desires he may use a 171-A in the last stage, although arrangements must be made for providing a higher C bias and a higher plate voltage than the ones specified in this article.

Three Circuit Coupler

The three-circuit coupler has a fixed primary winding located at the extreme left of the winding tube shown in Figure 4, with the secondary winding coming next and a variable plate coil on a rotor inside the right end of the tube. The primary coil has 12 turns of No. 26 D.S.C. wire the secondary uses 48 turns of No. 26 D.S.C. wire on a bakelite form 2 inches diameter by 2½ inches long, while the plate coil is wound with 24 turns of No. 24 D. S. C. wire on a 1 inch diameter, 1¼ inch long rotor, the windings being laid 12 turns each side of the shaft. The coupler itself is affixed to the front panel by means of a single hole mounting through which the shaft of the plate coil passes. With the .0005 mfd variable condenser shown, the receiver will tune from approximately 200 to 550 meters. The strength

of regeneration possible with the set depends largely upon the plate voltage applied to the detector tube and the value of grid leak resistance used across the .00025 mfd grid condenser. In general practice with 45 volts on the plate of the tube and with a 2 megohm grid leak, the set will oscillate over its full range.

In contrast to other designs, the detector tube has been placed in the right end in back of the three-circuit coupler so as to allow the use of a drum dial at the center of the panel. The first audio stage is thus located at the rear center and the power stage at the left in the rear. This also insures that the filament transformer will be located at a point where it will cause least disturbance in the circuit, since the power stage itself is not likely to pick up any 60 cycle hum.

Along the rear line of the sub-panel are located the necessary binding posts for the speaker, B and C voltages, antenna and ground. In the case of the B and C voltages the seven binding posts are arranged so that when a seven wire cable is used the ends may be placed under these binding posts and the other end of the cable attached to the respective batteries required. This is in the event that the builder wishes to have the B and C supplies removed from the set. However, in the event that it is desired to place the B and C supplies inside of the cabinet, which is possible, short lengths of wire may be used between the binding posts and the batteries, or short connectors now available on the market may be utilized instead.

The grid condenser of this model is located on the top of the sub-panel, so different values of grid leaks may be utilized by the operator until the best value is found. However, if it is so desired, the builder might place the grid condenser and leak underneath the sub-panel, this making no difference in the operating conditions of the condenser and leak, but merely being for convenience in getting it out of the way.

Official Parts List

Parts used in the construction of the Regenotriac illustrated in this article are as follows:

- |  |  |
|--|--|
| 1 DeJur .0005 mfd variable condenser   | 11 Eby binding posts                     |
| 2 Polymet .001 fixed condensers        | 2 Silver-Marshall 4-prong sockets        |
| 1 Polymet .00025 grid condenser        | 1 Silver-Marshall 5-prong socket         |
| 1 Birnbach .0005 three-circuit coupler | 1 Remler drum dial                       |
| 1 Karas Harmonik a. f. transformers    | 1 Carter 110 volt line switch            |
| 1 Karas A. C. Former                   | 1 Pr. Silver-Marshall sub-panel brackets |
| 1 Hammarlund 85 mh. r. f. choke        | 1 Pkg. Kester radio solder               |
| 1 Durham 2 megohm grid leak            | 5 Lengths Acme Celatsite hook-up wire    |
| 1 Formica 7x18x3/16 in. front panel    | 1 Ekkko ground clamp                     |
| 1 Formica 8x17x3/16 Ivory sub-panel    | 1 Tobe light socket aerial               |

Granting that electrical and physical characteristics are the same, the following units made by the respectively named manufacturers may be utilized in the construction of a receiver similar to the one described above:

Condensers, variable: AmSCO, Hammarlund, Remler; Transformers, filament: Dongan, Jefferson, Samson, Thordarson; Condensers, fixed, bypass: Acme, Aerovox, Carter, Dubilier, Muter, Potter, Sangamo, Tobe; Inductances, three-circuit: Aero, Hammarlund; Transformers, audio: AmerTran, Dongan, Jefferson, Samson, Sangamo, Thordarson; Chokes, r. f.: Hammarlund, Remler, Samson; Resistances, grid leak: Electrad; Panels, front, sub-panel: Celeron, Lignole; Binding Posts: X-L; Sockets: Benjamin, Eby, Frost; Dials: Hammarlund, National; Switches: Carter, Frost, Yaxley; Tubes, Ceco, Sonatron; Furniture, Corbett, Excello, Fritts, Pierson.

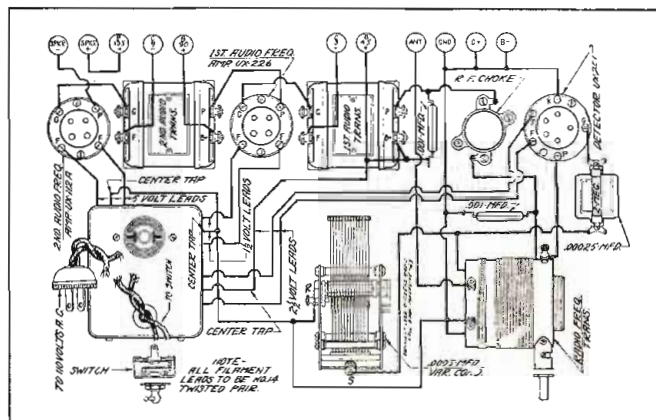


Fig. 4. All necessary connections for hooking up the receiver are shown in the above graphic diagram, which may be followed with ease by those who have not had a great deal of experience in set construction

# H. F. L. Model 10 Isotone Screen Grid Radio-Phonograph Receiver

Highly Efficient Instrument May Be Built from Factory Wired and Tested Units

THE laboratory staff of the CITIZENS RADIO CALL BOOK has long looked forward to the day when some manufacturer would bring out a set of units which could be assembled into an efficient receiver in a comparatively short time. Therefore it was not surprising to us when the H. F. L. Isotone was announced as a custom built kit of just this type, and one which could be completely assembled and wired in less than one hour. The surprise lies in the many totally new features which are incorporated in the design and construction of the instrument.

Inasmuch as the three main units which make up the H. F. L. Isotone are subjected to a rigid factory inspection, there is no occasion to go into the details pertaining to the wiring and assembly work which is done at the factory. The reader may gain a comprehensive idea of these operations by referring to the accurate schematic diagram and photographs which accompany this article.

Fundamentally the H. F. L. Isotone is a standard screen grid super-heterodyne receiver utilizing nine tubes (the tenth tube is for phonograph operation) which is capable of allowing the extremely high radio frequency gain of 65 per stage.

This unusual sensitivity is a product of the specially designed screen grid amplifier which operates at the highly desirable frequency of 450 kilocycles. This allows the receiver to be operated in an absolute one spot fashion.

The ten kilocycle selectivity so much required by the set constructor is a consideration that is easily met by virtue of the high frequency intermediate transformers. These transformers have small variable condensers shunted across the secondary windings which allows the owner of the receiver to hand tune his instrument for maximum selectivity.

The three stage push-pull audio amplifier which is automatically controlled for either phonograph or radio reproduction places the Isotone up in line with the finest musical instruments. Although the designers of the receiver have apparently done everything possible in order to make it a highly efficient device (from an engineering standpoint), it is suspected there must have been a feminine personality involved in the external design work.

The front panel has been stripped of all of the pretentious frills that are ordinarily found on receivers of this type, and one simply sees two well designed gold tuning dials which are illuminated through pyralin strips. The small amount of lettering is embossed with gold leaf into the panel itself, which has a grained walnut finish.

All of the shielding is polished to a jewelry finish and given a good coat of lacquer. Even the steel bases are satin silver finished and it can be truthfully said that the appearance of the H. F. L.

Isotone equals that of the finest factory built receiver in the country.

The dimensions of the receiver chassis are standard. The length of the front panel is 26 inches and the height 7 inches. The receiver measures  $10\frac{3}{8}$  inches from the front of the panel to the back edge of the base plate. The Isotone was designed as a battery operated receiver, although the special ballasting system will allow very satisfactory operation from an A supply and a B unit.

In the first place a set builder desiring to construct an H. F. L. Isotone is not required to go out and pick up the various pieces required to make the assembly. Everything necessary comes in a sealed carton.

The material found in the kit can be set up and wired in less than an hour by most anyone. On an actual test an Isotone was put together in 34 minutes after the material was removed from the carton. Most of the building consists of mechanical assembly operations inasmuch as the wiring itself consists of running in but ten battery connections. The wiring which is done by the set builder can be seen in the bottom view which accompanies this article. Assembling and testing instructions are not given in this article for the simple reason that they are packed in with the complete kit of parts, and inasmuch as every subject is taken up in extensive detail these instructions would be considerably too long for publication.

Probably the most desirable feature of the H. F. L. Isotone is the switching and ballasting arrangement of the audio amplifier. When the Isotone is being used as a radio receiver, three of the audio tubes and transformers are switched into the circuit forming a two stage push-pull amplifier using a 112A tube in the first stage and two 171A tubes in the second stage.

When the control switch is thrown to the phonograph position an additional stage of audio amplification is switched in ahead of the two stage amplifier. This stage consists of another 112A tube, a microphone input transformer, resistances, socket, etc.

When the control switch is thrown to the phonograph position the other six tubes in the receiver are not used and the special filament ballasting resistor compensates for the current load of these tubes. This is a highly desirable consideration in cases of operation with an A supply where the voltage being applied to the tubes is proportional to the current load.

When the control switch is thrown to the radio position nine of the tubes light up and the entire first stage of the audio amplifier is disconnected. Since all of the tubes are on individual filament resistors, applied voltages must remain steady and a considerable saving in tubes is affected by thus operating them slightly below their rated voltages.



**Fig. 1. The Isotone receiver is shown mounted in a beautiful console, together with its power supply, electric phonograph turntable, electric pick-up and a Magnavox dynamic speaker**

(This receiver tested and all illustrations made in our laboratory)



**Undistorted Audio Output**

Due to the carefully engineered balancing and winding of the audio frequency coils the amplifier will furnish an unusually large undistorted power output. The Isotone easily handles cones of the dynamic type and while it has heretofore been considered impossible to handle low notes with a pair of 171A tubes in push-pull, this theory has been exploded very nicely, for the Isotone reproduces low notes with a natural intensity and does not over accentuate them or slight them.

For phonograph operation the flexible leads from the magnetic pickup can be plugged right into the tip jacks of the audio amplifier and left in this position permanently, the control switch taking care of all of the necessary switching operations.

Before describing the other two units, it might be well to take up the method of unit construction. Each of the three main units of the Isotone has an individual steel sub pan and practically all of the wiring is done underneath this base. When any single unit is mounted on the main steel assembly plate the wiring becomes automatically shielded by virtue of the half inch of space between the bottom of the unit pan and the top of the main base plate. The only wires that are not completely shielded are the ten battery connectors on the bottom of the Isotone and inasmuch as 14 large by-pass condensers are built into the instrument it is probably the most perfectly isolated receiver that has as yet been introduced to the set building public.

These by-pass condensers are, in a large part, responsible for the exceptionally fine distance range of the H. F. L. Isotone. Twelve of them are placed where they are used as tank condensers in the screened grid amplifier. These 12 condensers have a capacity of one microfarad each and the extremely low radio frequency resistance of 1/10 of an ohm.

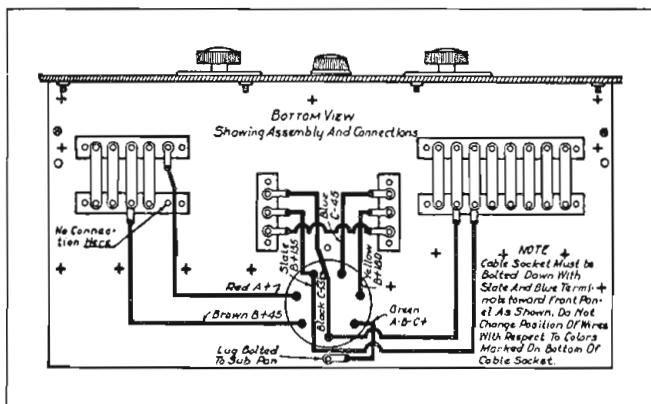
While this is an expensive practice, the results seem to justify the expenditure, for the receiver is perfectly stable in operation and cannot be made to oscillate under any normal condition. The only way in which the Isotone can be operated as an oscillating receiver is by the removal of the shield cans which cover the screened grid amplifier stages.

**Transformer Coupling**

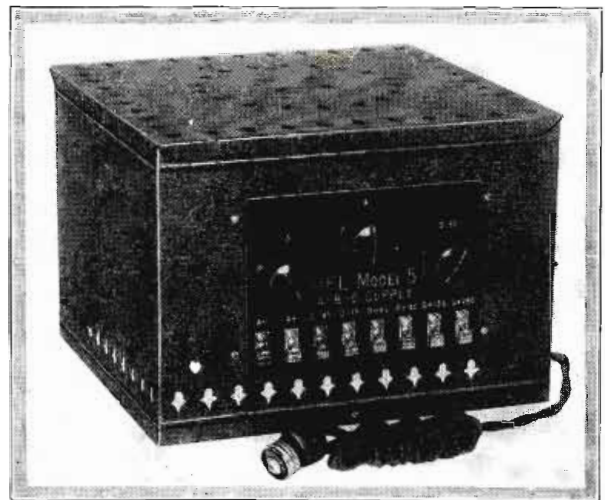
By reviewing the circuit diagram of the screened grid amplifier it will be seen that the conventional form of impedance coupling is not used. A very careful balance of transformer windings allows the use of transformers and their importance may be readily appreciated when it is realized that this allows a system of secondary tuning. These circuits can be hand tuned by the operator of an Isotone by virtue of the small 25 micro-microfarad condensers which are shunted across the larger .0001 m.f.d. condensers.

Inasmuch as this automatically compensates for variations in the tube capacities, it will be seen that the four transformers are really filter transformers and that the amplifier is maintained at all times in its most selective form. The sensitivity of the screened grid amplifier is controlled by an ingenious method of varying the voltage being applied to the screen grids.

The front tuning unit has some new features which are well worthy



**Fig. 2.** This simple illustration shows the few connections that are required to be made on the bottom of the Isotone receiver



**Fig. 3.** The power supply used for the Isotone super is illustrated above

of mention. The antenna tuning circuit has a detachable coil which is a desirable feature inasmuch as it allows the Isotone to be operated with both loop and outside antennas. Thus, when the two dial readings are matched up for consecutive alignment the dials will read in approximately the same position with either kind of an antenna.

This dial balancing operation is made possible by the small trimmer condenser which is shunted across the oscillator circuit. A fraction of a turn one way or the other brings the oscillator reading right up to the reading of the antenna tuning dial for any given station.

One nice feature about the antenna tuning unit is the gold plated hand hammered National dials. These dials are driven by a heavy cord held tight by a spring. The cord works in a vernier arrangement which gives very smooth control and eliminates any tendency toward back lashing of the dials.

The manufacturers of the H. F. L. Isotone have also designed a special power pack which furnishes all of the required voltages to the receiver. This power pack is sold completely assembled and wired and provides the following currents and voltages: "A" current 2½ amperes at 6 volts. "C" voltages variable 0 to 15, and fixed 45 volts. "B" voltages 45 (variable 0-90), 135 and 180.

There is a variable resistor in the A supply circuit which allows the filament voltage being applied to the tubes to be increased or decreased.

Careful attention has been paid to the design of the Isotonic Model 5 ABC power supply. Oversize condenser sections and heavy chokes totally eliminate all tendency toward motor boating and voltage fluctuation. The instrument uses dry rectifiers and condensers throughout and the plate current is furnished by means of a 280 rectifier tube.

The accompanying illustration of the Model 5 ABC power supply will show these three variable controls and give the reader a general idea as to the appearance of the instrument.

The battery equivalent of the special ABC supply would be four heavy duty 45 volt B batteries, two small 22½ volt C batteries having 16½ volt taps, and one 6 volt 120 ampere hour A battery. The plate current drain of an Isotone is approximately 30 milliamperes for the entire instrument and the filament current drain of the receiver is 1.9 amperes.

Assuming that many of our readers will construct the H. F. L. Isotone, we will present a few hints in operating the receiver. To place the Isotone in operation you will require 3 type 222; 3 112A, 2 171A and 2 201A tubes. Instructions for the proper positioning of those tubes come with the Isotone kit, and a glance at the accompanying schematic diagram will show where they fit into the circuit.

**Balancing for Best Results**

After the Isotone has been connected up to its operating accessories

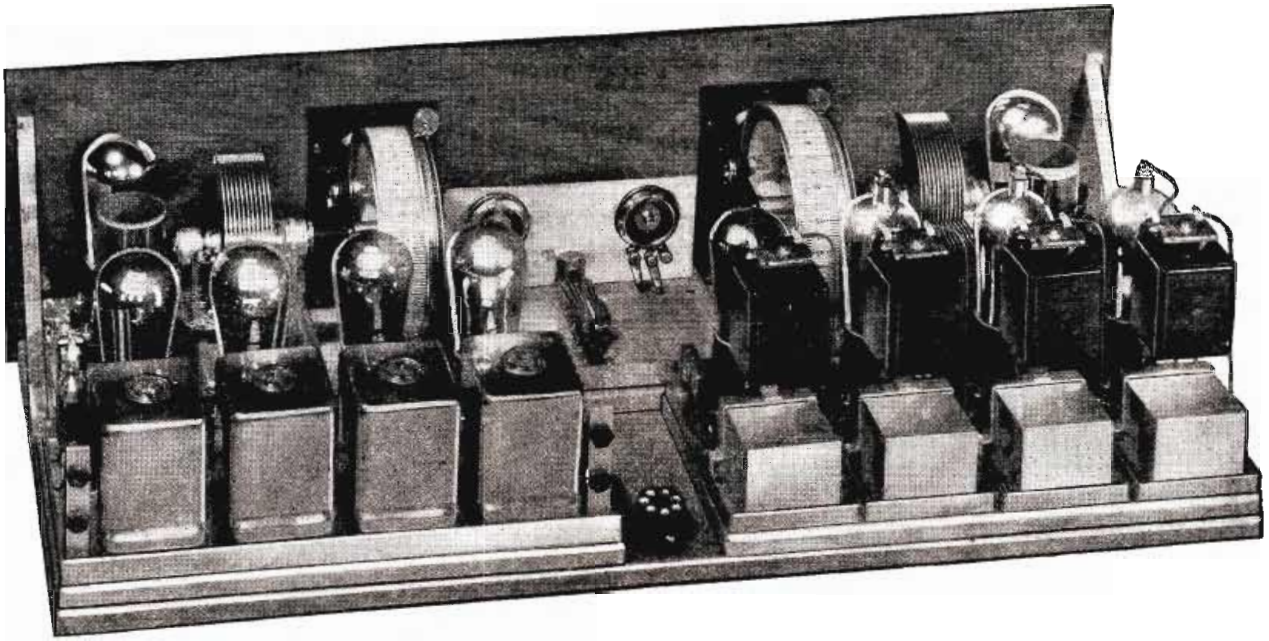


Fig. 4. In this photograph may be seen the rear of the new H.F.L. design

there is a definite way in which to go about balancing the instrument for best results. It is highly desirable to have an additional screened grid tube available to use as a substitute and thus eliminate the chance that one of these important items might not be operating efficiently.

Throw the control switch to the radio position and advance the two large control knobs around to the right as far as they will go. The left hand knob controls the screened grid voltage and at this point it is in an excellent position to act as a sensitivity control for the receiver. The right hand control is the voltage dividing resistance across the secondary of the first audio transformer.

As the individual units are balanced at the factory, the operator will undoubtedly locate a local station within a very short time by the simple process of rotating the two drum dials with their numbers reading numerically alike. The Isotone will not squeal. The stations will simply come in and go out as the dials are turned over and the set tunes so easily that one's first sensation is a lack of power. This impression will be immediately dispelled when the first distant station is encountered coming in with full loud speaker volume.

#### Balance Both Dials

The first balancing operation is to line up the two dials so that they tune as nearly alike as possible all over the wave band. This dial balancing should be done on a station coming in at about No. 45 on the left hand dial. To make the right hand dial match this setting the small trimmer condenser in the right hand front compartment (oscillator can) should be tightened or loosened until the two dials read numerically alike. There will be a slight variation in the settings at the upper and lower ends of the dials, but in general they will run fairly close together.

To balance the intermediate amplifier the operator will be required to tune in a weak signal. If a far distant station can be located before the amplifier is balanced so much the better. At the start of this operation all of the shield cans and tops should be in place. Assuming that a station has been tuned in, leave all controls set just as they are and remove the shield top from the left hand screened grid stage. The trimmer condenser may be adjusted with a screwdriver or socket wrench and it will be found that a variation of this capacity will have a large effect upon the intensity of the received signal. Tune the circuit for maximum volume and replace the shield cover. Repeat this operation right across the amplifier, taking care that the other three covers are always in place when any one individual stage is being tuned. The right hand or audio volume control may be reduced from time to time during this operation if it is found that tuning the transformers brings the signals in so loud that it is

difficult to tell whether any improvement is being made by further tuning.

Once the intermediate amplifier is balanced it should be left that way permanently until such time as any of the screened grid tubes are changed. There is absolutely nothing to be gained by continually readjusting this amplifier inasmuch as all of these tubes are on individual filament resistors and they maintain fairly constant capacities.

The one remaining variable control is the small trimmer condenser in the antenna tuning stage. This is the regeneration control for that circuit and since it is non-critical in adjustment it will generally be found to be set in the correct position at the factory. This can be determined by adjusting the trimmer on a station broadcasting at about 300 meters. Do not make the mistake of tightening this trimmer condenser down too far, as this will throw the antenna circuit into oscillation and throw the set out of operation. This is the only control on the Isotone that will throw the receiver into oscillation and if any persistent squealing is heard (on all stations) this condenser should be loosened up immediately.

The H. F. L. Isotone should be connected to a ground at all times, whether a loop or outside antenna is used, and this grounding connection can be made to any part of the metal chassis inasmuch as the entire set is totally grounded.

#### Try Different Lengths

It will repay the operator to experiment with various lengths of antenna (assuming that loop operation is undesirable). An antenna about 50 feet in length will be found very satisfactory. Selectivity can naturally be increased by using a short antenna and inasmuch

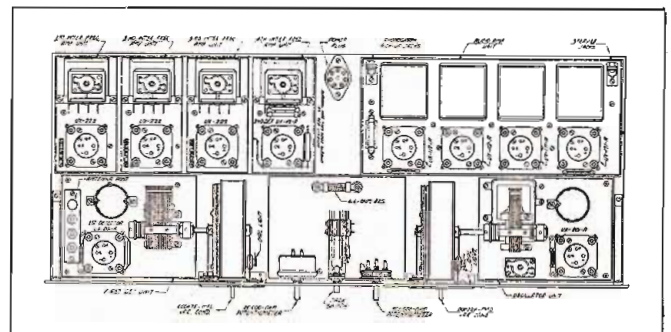


Fig. 5. In this illustration is shown the layout of the receiver, which may be wired up within an hour

as the sensitivity of the instrument is much more than will ever be required, there is no reason why the antenna cannot be shortened until the operator realizes the degree of selectivity which he desires.

Extremely satisfactory operation has been realized by utilizing a small antenna of about 10 feet in length connected right into the tip jack which connects to the first detector grid. This places the incoming signal voltage right onto the grid of the tube and is naturally a very sensitive method of handling incoming signals.

Although the instrument will produce nice quality of tone with any good loud speaker, it has been specially designed to operate with cones of the dynamic type and one of these is very strongly recommended.

The High Frequency Laboratories have done quite a bit of experimenting with dynamic cones and their suggestion for a suitable baffle for one of the new dynamic units is a box having a front dimension of 16 inches square and a depth of 7 inches from the front edge to the back edge. The baffle should be constructed of heavy wood not less than 5/8 inch thickness, preferably of 3/4 inch stock. This coincides approximately with the dimensions given by the manufacturers of dynamic cones and considerable trouble can be saved by the experimenter if he will take these dimensions just as they stand when he constructs his baffle.

The Isotonic screen grid amplifier is available separately for set builders, which will enable such constructors to include this amplifier in an existing set or else make use of parts already on hand which can be built up around the amplifier, resulting in a first class superheterodyne as far as intermediate stages are concerned.

Arrangements are also made in the receiver for plugging in a short wave receiver (such as a one tube regenerative) into the pick-up jacks of the audio amplifier. This would give three stages and push-pull when the control switch is on the phonograph side.

**Official Parts List**

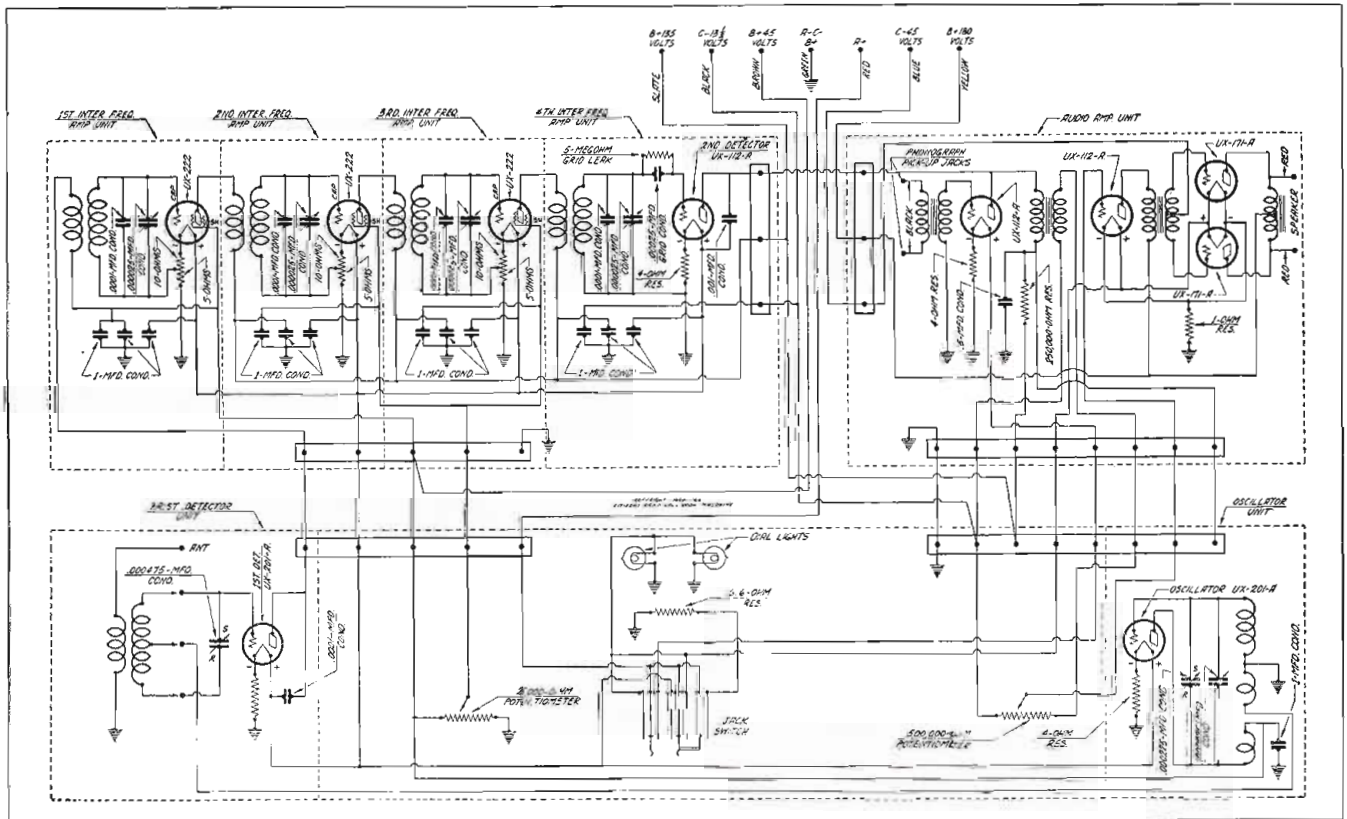
Parts required for the construction of the Isotone Super, Model 10, are:

- 1 H. F. L. Isotone assembled and wired tuning unit
- 1 H. F. L. Isotone assembled and wired screened grid amplifier
- 1 H. F. L. Isotone assembled and wired audio amplifier
- 8 H. F. L. Isotone shield cans with tops
- 1 Base assembly plate
- 1 Drilled and engraved front panel
- 1 Seven wire cable and plug
- 2 Gold escutcheons with knobs (attached)
- 2 Dial lights (inside of drums)
- 2 Large walnut control knobs
- 1 Small walnut switch knob
- 2 Steel panel supporting brackets
- 12 Plated connecting strips
- 55 6/32 hexagon brass nuts
- 14 3/8 inch hexagon spacer studs
- 14 3/4 inch by 6/32 R.H. machine screws
- 6 1/2 inch by 6/32 F.H. black machine screws
- 4 3/8 inch by 6/32 R.H. machine screws
- 11 Tinned copper lugs
- 6 Feet push-back wire

**Suggested Accessories**

Suggested accessories for the receiver are:

- 1 H. F. L. model 5 ABC supply
- 1 Magnavox dynamic cone speaker
- 3 UX 222 tubes
- 3 UX 112-A tubes
- 2 UX 171-A tubes
- 1 UX 201-A tubes
- 1 UX 380 tube
- 1 Magnetic pick-up unit
- 1 Bodine De Luxe loop



**Fig. 6.** Electrical connections for the super described in this article are detailed in the above schematic

# Thordarson Public Address Unit for Dealer Demonstrations

Powerful Amplifier May Also Be Used by the Professional Set  
Builder for Giving Prospects Quality Reproduction

It has been the policy of the average consumer radio publication to cater exclusively to the home constructor and professional set builder. This policy has been justified in the past because of the fact that few of the professional set builders could be considered in the category of a dealer. However, as the industry has improved, many professional set builders are becoming smaller dealers. Therefore, in accordance with the previous policy but few constructional articles have appeared for the exclusive benefit of dealers of radio merchandise.

## Designed for Dealers

The amplifier described in this article, however, was designed exclusively for use by dealers in entertaining their prospective customers both inside and outside of their establishments. It was also produced with a view of permitting a professional set builder to make up such a unit as a demonstrator, so that when prospects drop in or are brought in they can be shown the benefits of high quality reproduction. In addition, this instrument is capable of producing considerably more undistorted volume than would be desired for consumer use and, therefore, ideal for

outdoor broadcasting purposes. This opens up another avenue of profit for the dealer or professional set builder who wishes to engage in local pick-up work for broadcasting events transpiring in his locality.

The amplifier to be described in this article is a complete audio system designed for use either with phonograph, radio or microphone. This enables the dealer to make sales talk or personal comments between his program. The amplifier may also be used to convince a prospect of the desirability of using an electric pick-up on his phonograph instead of the old style reproducing mechanism. One demonstration of this type should be sufficient to convince even the most hard-headed customer that he is missing a great deal of pleasure in quality reproduction by not having an electric pick-up device on his present phonograph. Naturally to take full advantage of the quality, it is necessary for him to have an up-to-date, high quality radio amplifier. This again brings up the possibility of the dealer or professional set builder making an additional sale for an amplifier.

The 250 tubes are used in push-pull in the output stage, which, when working at full capacity, will deliver considerably more

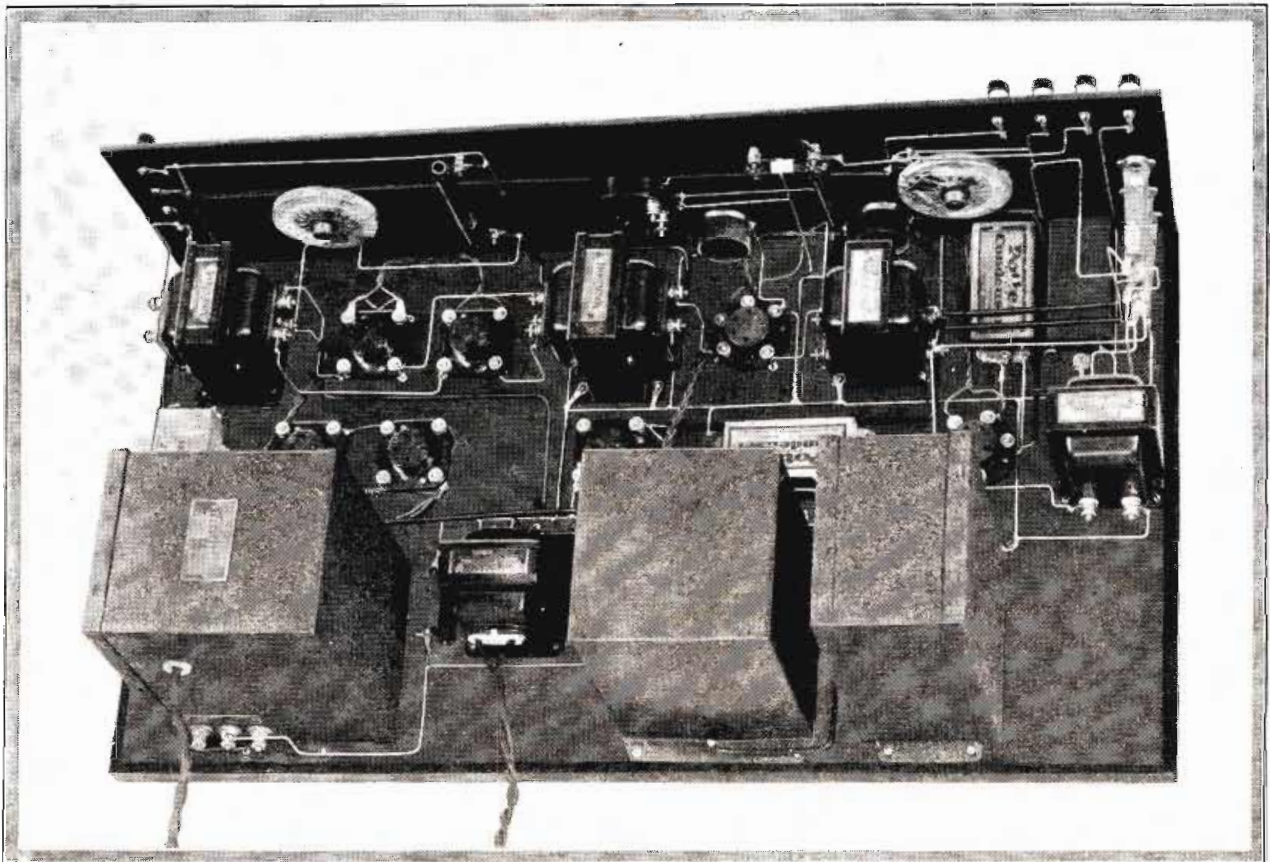


Figure 1. This photograph shows the rear view of the Thordarson dealer amplifier described in the accompanying article, construction of which will be easy for set builders or dealers

(This amplifier tested and all illustrations made in our laboratory)

power than any present speaker will handle without distortion. Two stages of straight audio frequency precede this push-pull stage. For phonograph and radio broadcasting only two stages are used, while for use with a microphone, which requires additional amplification, the complete three stages are brought into action.

Jacks are provided for the three different types of input. When a plug is inserted into the radio receiver jack, a plate lead from the first stage is disconnected, so that the detector of the radio set is fed directly into the second audio transformer. When the phonograph pick-up is used, the phonograph plug likewise opens the plate circuit of the preceding tube and also opens the high potential of the second audio transformer so that the pick-up may be grounded if desired. Connecting the radio receiver plug to the power amplifier, one wire should be run from the plate of the detector tube in the receiver to the tip of the plug. The other plug terminal should be connected to the minus B lead of the radio receiver, thus making all necessary connections for receivers which use another source of B supply than this amplifier. If the B supply is taken from this amplifier, it will be unnecessary to run the ground connection to the plug.

**Volume Control**

A volume control for the amplifier is provided by means of a 200,000-ohm potentiometer and is inserted across a second audio transformer. Care should be exercised in inserting this variable resistance into the circuit in the proper manner. Potentiometer connection No. 1 should be connected to the filament terminal, and No. 3 to the grid terminal of the audio transformer. Terminal No. 2 is the movable tap and should be connected to the grid of the second 2Y-227. For microphone coupling purposes either a Thordarson R-300 or type T-3020 transformer may be used, depending upon the type microphone employed. A conc speaker such as the Western Electric 540-AW makes an excellent microphone in case a two-button microphone is not on hand. The microphone should be isolated from the speaker in order to prevent mechanical feedbacks and howls.

The plate voltage for the second audio stage is stepped up to 180 in order to secure the increased amplification. When using the three stages with the microphone it will probably be necessary to reduce the volume to some extent through the volume control mentioned above.

**Uses Dynamic Speakers**

This amplifier is designed for use only with dynamic speakers as they are capable of handling considerably more power than other types. All dynamic speakers on the market today are designed to couple directly into a single 210 power tube and in order to obtain proper quality from 250 push-pull tubes a special output transformer must be employed such as the Thordarson T-2903 shown in the diagrams. The coupling transformer in the base of the speaker should be disconnected from the movable

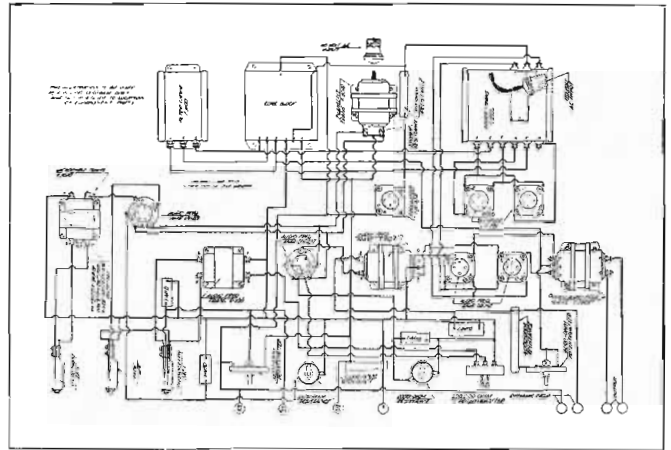


Figure 3. Even a novice may wire up the amplifier if the connections outlined in the above graphic diagram are carefully followed

coil of the speaker and the secondary of transformer T-2903 should be connected directly to the movable coil.

If a high frequency tone filter is desired to replace the filter across the original transformer in the speaker, an equivalent effect may be secured by connecting two .0015 condensers across each half of the primary of transformer T-2903. These condensers are shown in dotted lines in the schematic diagram. The dynamic field of 100 volts at 45 to 50 m.a. for the speaker unit is also secured from this amplifier. This is done by breaking the voltage divider system between the 10,000-ohm variable unit and the 4000-ohm fixed unit. The field for additional dynamic speakers may be easily secured by reducing the 4000-ohm fixed unit by 2000 ohms for each additional field used. The use of additional speakers is recommended if extreme volume is required, for it will be found that a single speaker unit will blast long before the amplifier works at full volume.

The power supply unit for this amplifier is secured through the Thordarson T-2950 power transformer which is designed to handle the push-pull 250 arrangement. The rectifier system consists of two 281 tubes used in full wave. The filter system consists of the Thordarson T-3100 double choke unit and the Potter 250 B-block.

Filament supply for the 250 tubes is secured from the power transformer T-2950, while the filament supply for the two 227 tubes is secured from the small filament transformer T-3081. Only the 2½ volt winding of transformer 3081 is used. The other winding does not apply in this amplifier. The voltage divider system is so arranged as to supply the conventional B voltages at sufficient capacity to handle any receiver.

**Official Parts List**

Parts used in the construction of the official model are:

- 1 Thordarson 2950 power supply transformer
- 1 Thordarson 3100 double choke unit
- 1 Thordarson R-300 audio transformer
- 1 T-3020 double button microphone transformer or R-300 audio transformer
- 1 Thordarson 3081 filament transformer
- 1 Thordarson 2922 push-pull input transformer
- 1 Thordarson R-2098 resistor kit
- 1 Thordarson 2903 speaker coupling transformer
- 1 Potter type 250 condenser block
- 3 Potter 1 mfd bypass condensers
- 1 Potter 2 mfd bypass condenser
- 2 Carter 2000 ohm variable resistors
- 1 Carter 25 ohm center tapped resistor
- 1 Centralab 200,000 ohm modulator
- 1 Yaxley single circuit jack
- 1 Yaxley open circuit jack

(Continued on page 110)

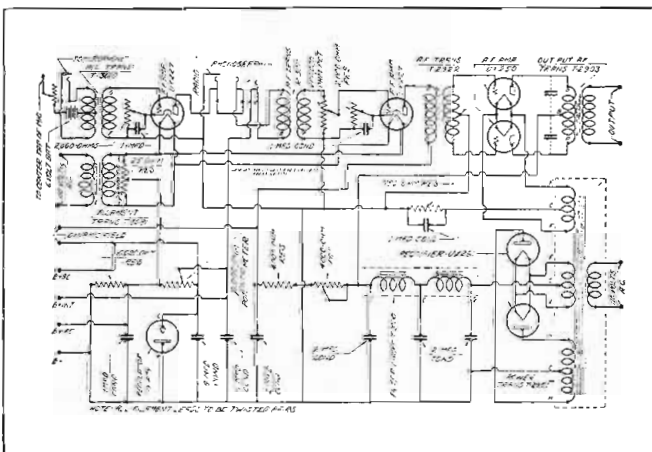


Figure 2. The schematic circuit employed in the amplifier is disclosed in the above drawing

# The 1929 Laboratory Model Nine-Tube Superheterodyne

Super of Two or Three Years Ago Inadequate for Present Day  
Conditions Because of Lack of Selectivity

**S**UPERHETERODYNES for many years have been regarded as the most sensitive and selective type of radio receiver. Whether or not this regard is justified at the present time is open to some question, but one thing is quite certain—that a superheterodyne receiver which was thoroughly satisfactory for broadcast conditions of two, three and four years ago is totally inadequate for present-day conditions. This is due not so much to lack of sensitivity, for any superheterodyne can be built with a high enough value of sensitivity for practical requirements, but rather to lack of selectivity. In the average super, lack of apparent selectivity is due to the fact that two powerful stations, separated by the intermediate amplifier frequency, can heterodyne themselves through the receiver without the use of the oscillator at all, and further because the normal repeat point appearing upon the oscillator dial for each station actually halves the effective selectivity of the receiver, disregarding entirely the problem of stations heterodyning each other, which today is of major concern. One system—the use of a high intermediate frequency, helps, but in no way eliminates the difficulty; and a second, that of using very selective r.f. amplification ahead of a good low i.f. super, is much more satisfactory. This is because of the perfectly obvious desirability of a low i.f. to get great amplification and selectivity, while the selectivity possible in the short wave t.r.f. amplifier effectively eliminates the heterodyne squeals had even on one-spot supers, no matter how “one-spot” they are.

The receiver described herewith is essentially a seven tube superheterodyne receiver preceded by three stages of broadcast band r.f. amplification, one stage untuned and two stages sharply tuned. Not only does this r.f. amplification increase the sensitivity tremendously, but it increases the effective selectivity of the receiver more than four times as fast as it increases sensitivity. The net result is that this set provides for the dyed-in-the-wool superheterodyne fan an opportunity for greater selectivity and greater distance reception than any other superheterodyne not employing preceding short wave t.r.f. amplification. Three stages of screen grid r.f. amplification are of themselves sufficient to provide a remarkably sensitive and satisfactory receiver, and when such an r.f. amplifier is coupled with a screen grid first detector and two unusually high gain intermediate frequency amplifier stages, some truly remarkable results may be anticipated, and are obtained with the receiver described herewith.

Operated in the heart of Chicago broadcasting, this set has given positive 10 k.c. selectivity against all local stations. Its reception range has been limited only by the atmospheric noise level. In the summer months the set has consistently “gone down” and brought in many stations with good selectivity. On top of this, the receiver is simplicity itself to build and the simplification of control to only two tuning controls and two amplification controls makes the operation a pleasure even for the totally inexperienced operator. The construction is very simple, but a point to be borne

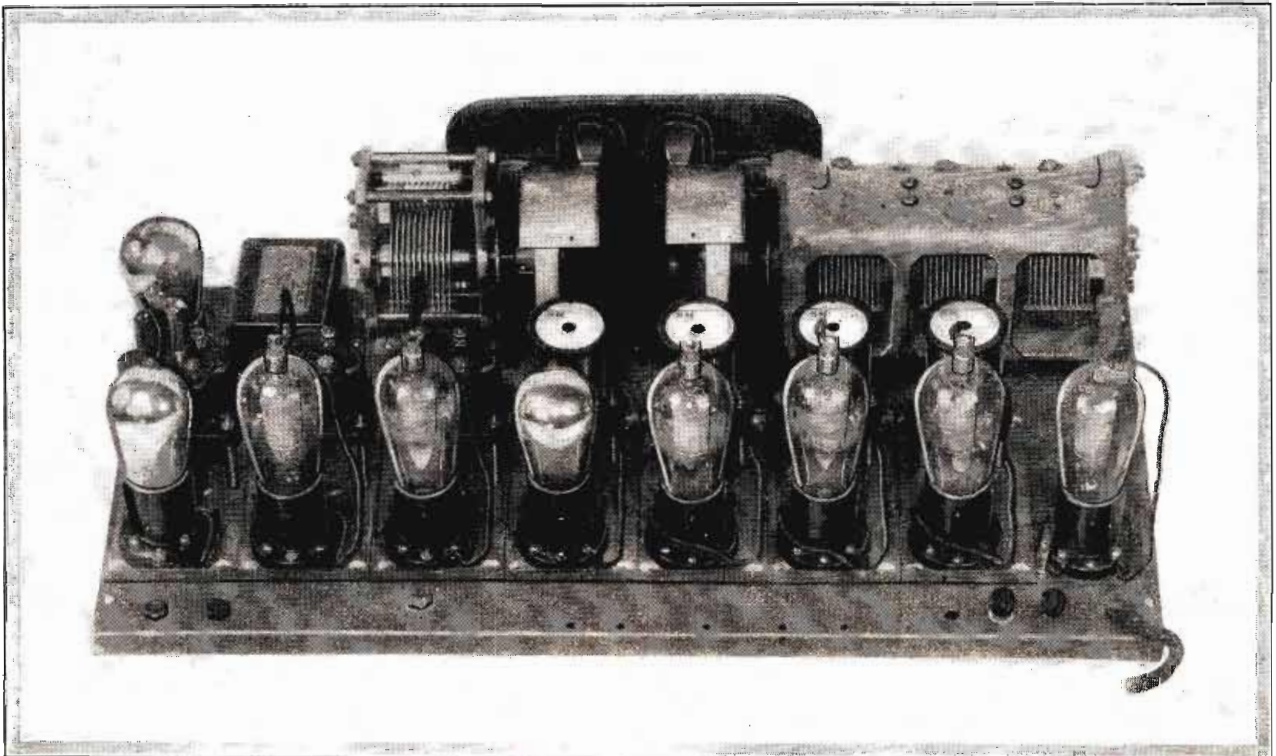


Fig. 1. This photograph shows the latest nine tube screen grid super using Silver-Marshall parts, copper stage shields lifted off

(This receiver tested and all illustrations made in our laboratory)

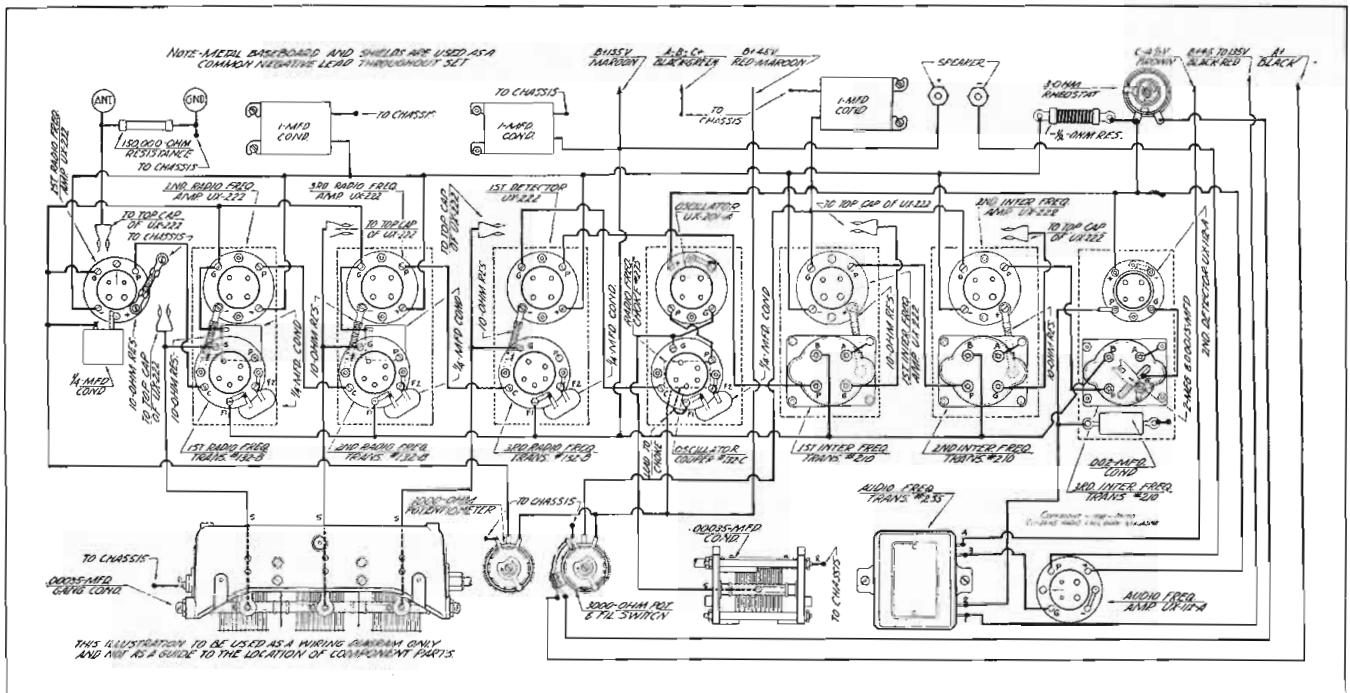


Fig. 2 The receiver may be wired in accordance with this graphic diagram shown above

in mind is that despite the simplicity of the mechanical assembly and wiring the construction of a receiver employing as much r.f. amplification as does this set should not be undertaken except by an experienced set-builder with a successful record of having constructed at least three to five ordinary superheterodynes.

What Photographs Show

Examining the photographs and circuit diagram, the receiver will be seen to consist of a pierced and formed steel chassis 21 1/8 inches long 9 1/8 inches wide and 5/8 inch deep. Attached to the front of this chassis is an antique brass escutcheon control panel carrying the two station selector vernier drum dials, the sensitivity adjustment for the short wave r.f. amplifier, and the amplification adjustment for the intermediate amplifier (an on-off switch attachment is also carried upon this latter control). The left-hand Selector I dial controls a three-gang die-cast condenser of unusual accuracy which tunes the second and third r.f. amplifier, and the detector circuits which are housed in the three left-hand copper stage shields at the rear of the chassis. Just to the left of these cans is seen a single tube socket for the untuned r.f. stage connected between the antenna and the first tuned r.f. stage to allow positive ganging of the three tuned circuits immediately following. In the untuned r.f. stage, the two tuned r.f. stages, and the first detector stage are employed screen grid r.f. amplifier tubes with their various supply circuits individually bypassed in each stage shield. Small plug-in r.f. transformers are used with

them of a very high degree of uniformity and efficiency; which accounts for the fact that the short wave r.f. amplifier of this superheterodyne, when operated alone, is adequately sensitive to give practical 10 to 15 k.c. selectivity without the super portion of the receiver at all. The central stage shield houses the oscillator, using a UX201A tube, and a small plug-in oscillator coil which is tuned by the right-hand or Station Selector II single condenser. In the oscillator stage shield, beneath the coil, is located an r.f. choke; while the 1/4 mfd bypass condensers in this and the preceding stage compartments are clearly visible in the photos.

An Interesting Feature

A very interesting feature of this receiver and one allowing the accurate ganging of the r.f. stages is the introduction of the oscillator voltage into the screen grid lead of the first detector rather than into the grid circuit as has been customary practice. The great advantage of this system can only be appreciated after operating this receiver. To the right of the oscillator are seen the three stage shields housing the two stage 65 k.c. screen-grid long wave amplifier and the second detector. In the development of this receiver a great deal of work was done upon the intermediate amplifier and in the course of experiments it was found that for this particular type of receiver (where the selectivity of the circuits preceding the first detector was unusually great) it was not necessary to resort to a high intermediate frequency to get the cue-spot effect so necessary to a superheterodyne not equipped with preceding r.f. amplification. This was particularly advantageous since it is a well known fact that greater amplification can be obtained at a low intermediate frequency than at a high intermediate frequency. With the intermediate frequency to be used left to a free choice of that value which would give greatest amplification, it was noted that frequencies below 100 k.c. were definitely preferable, and in the standard S-M 210 long wave transformer a practically ideal interstage coupler for screen grid tubes was found. With ordinary tubes this transformer functions as a broad-band semi-tuned i.f. transformer, but measurements of it in connection with screen grid tubes showed that it functioned with them as a very sharply tuned transformer in the range between 60 and 70 k.c., and that it provided adequate amplification on the order of 80 to 100 times per stage. This definitely eliminated the necessity of designing new intermediate transformers. The second detector stage compartment is at the extreme right of the chassis and in front of it are located the first

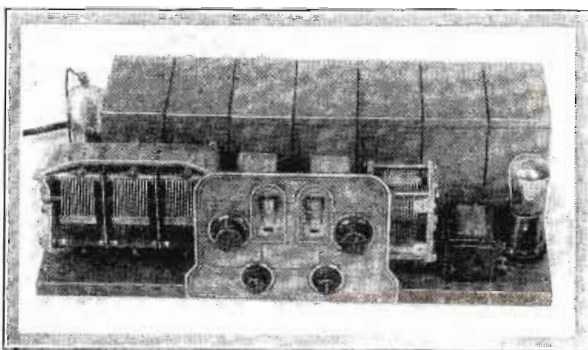


Fig. 3. Here is shown the front view of the set with shields in place

audio tube and the first audio transformer, which is of the new Clough system type. Only one stage of a.f. amplification is used in the receiver because it is vitally essential, if maximum tone quality is to be obtained, that nothing less than a 210, 250, or preferably a 210 or 250 push-pull, power amplifier be used as a last audio stage. For the sake of simplicity this audio stage has been omitted from the receiver assembly. Any good standard power pack, or the S-M 681-210 or 681-250 type will furnish not only the last stage of power amplification but complete receiver B power as well. Incidentally, it is not feasible to operate this super-heterodyne receiver upon B batteries and it is absolutely essential that a light-socket power supply be used for it.

The simplicity of the whole assembly is well illustrated in the photographs, for it is seen to consist essentially of seven individual stage shields, in the cans of which are mounted and wired all parts for each stage, the individual stage cans then being bolted down to the chassis to which are also attached the gang condensers, control panel, audio stage, and input tube. On the bottom of the chassis are fastened the three 1 mfd bypass condensers, the 150,000 ohm antenna resistor, the 3 ohm filament rheostat (seen behind the first i.f. amplifier stage), and the 1/2 ohm filament resistor for the six screen grid tubes. Practically all wiring follows the common path provided by the battery lead hole at the rear of each stage shield, so that once the receiver has been wired using flexible hook-up wire and the battery cable ends soldered to the proper points, all wiring may be laced into a common cable to provide the simplicity so strikingly evident in the illustration of the bottom view of the chassis, which shows all wiring in place just before it is laced with waxed shoemaker's thread into a cable.

**Check All Circuits**

Once the receiver has been assembled and wired, all circuits should be very carefully checked out by connecting the set to the proper power supplies and measuring the various voltages with a good voltmeter directly at tube socket terminals. Of course, filament voltages will not come out correctly until tubes are inserted, but preliminary A, B and C measurements should be made with tubes omitted in order to locate any possible error.

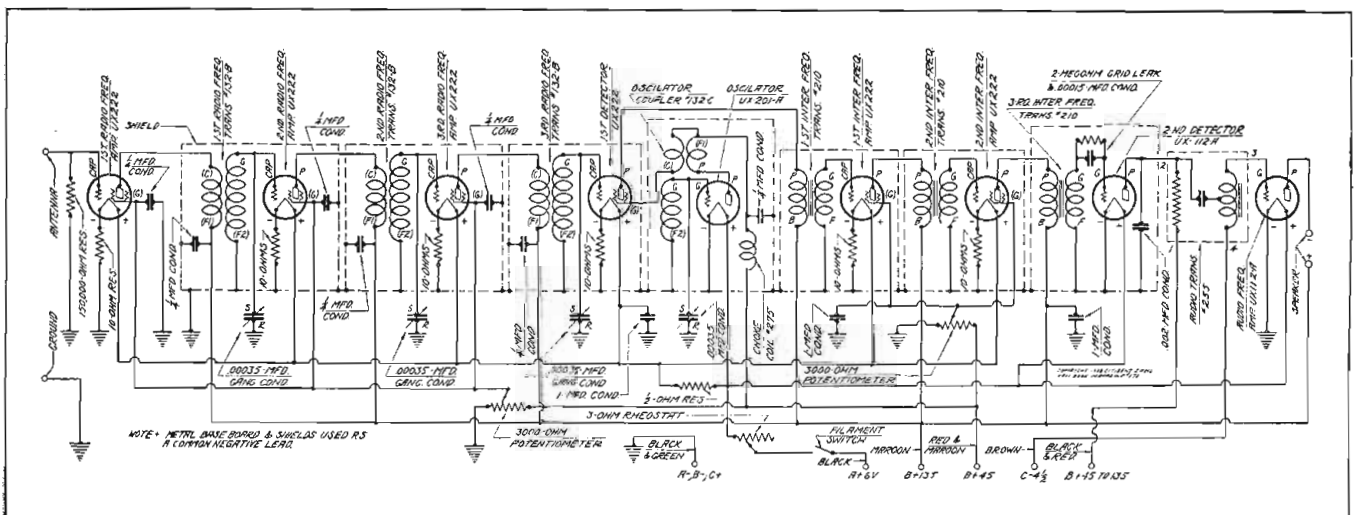
Any 6 volt A battery or suitable light-socket A power unit may be used to operate the receiver, which will also require one 4 1/2 volt dry C battery of practically indefinite life, since no current is drawn from it. The B power supply for the receiver must be of a high capacity unit with adjustable voltages such as the S-M 675 or S-M 670B, if a loud speaker is to be operated directly from the single audio stage of the set. While it is perfectly feasible to operate a loud speaker directly from the receiver, maximum volume and most satisfactory tone will not result and such a course is not recommended except in preliminary testing. A power amplifier stage such as is found in the S-M 681-210 or 681-250 Unipac should be used, with the Unipac connected be-

tween the tipjacks of the receiver and the loud speaker. Such a Unipac will supply all B power to the receiver with a slight adjustment. This adjustment is made necessary by the fact that the 45 volt circuit of the nine tube receiver draws 30 milliamperes, whereas the Unipac and all ordinary power supplies will only furnish 5 to 10 milliamperes from their 45 volt taps. It is therefore necessary to obtain an Ohmite or Ward-Leonard 1500 ohm resistor of 3 or more watts capacity and to connect this resistor from the +45 to +90 binding posts of the Unipac in order to hold the voltage of the 45 volt tap constant at a 30 milliampere drain. This done, the glow tube in the Unipac may go out, but this is not a serious drawback, if it should occur.

In testing the receiver, a small antenna 20 to 50 feet long should be used, together with a good ground connection. A signal should be tuned in using the two dials and with the two volume controls set so far to the right that no squeals will be heard. This done, the antenna length should be cut down gradually to a point where the signal is just audible and the three small trimmer adjustments on the top of the gang condenser adjusted using a bakelite or wood screwdriver to obtain maximum sharpness of tuning on the Selector I dial and likewise to obtain greatest volume. The proper adjustment for these trimmers will probably be found with their screws practically entirely out; that is, with very little trimmer capacity in use. The Station Selector I and Station Selector II dials will track to within four to five degrees of each other throughout the broadcast band so that stations may be found without any great difficulty. Each station will be heard at two points upon the Station Selector II dial separated by 10 or 15 degrees, but because of the great effective selectivity of the Selector I dial, this is not a drawback in any way and, unusual as it may seem, it is an actual advantage in this receiver, since in the very few places in which interference might be experienced (as in a crowded broadcasting center) such interference can always be eliminated by using one or the other of the Station Selector II dial points. It should be borne in mind, however, that when the receiver is working properly, interference between stations is practically totally absent unless the stations have strayed from their assigned frequencies and are beating upon each other, thus causing a heterodyne squeal.

A little care must be exercised in getting on to the operation of the receiver, this care having to do with the adjustment of the small volume control knob. Either one may be used to control receiver volume, the left-hand knob controlling the amplification of the short wave amplifier and the right-hand knob controlling the gain of the i.f. amplifier and turning the entire set off when it is turned to the Off position. If either of these knobs is turned too far up, either one or both of the r.f. amplifiers will oscillate and, as a result, stations will be blurred, mushy, and received with an accompaniment of squeals. This condition simply indicates improper adjustment of the volume control knobs, which should

*(Continued on page 108)*



**Fig. 4.** In the above illustration is shown the schematic circuit covering the 1929 laboratory model



# Aero International Short Wave Receiver for Broadcast Programs

Low Wave Set and Converter Unit Permit Public Appreciation of High Frequency Telephony

**K**NOWN in the past as manufacturers of high class, efficient inductances, this season Aero Products, Inc., have designed a line of short and long wave receivers for the home builder and the broadcast fan. On account of the interest in short wave broadcasting, the article covering the International Four is presented in this issue.

Owners of short wave receivers may be assured of reception from key stations, such as Pittsburgh and Schenectady, whenever these stations are on the air, either in the daytime or at night, and always regardless of weather conditions, because of the fact that seasonal decrease in signal strength and static disturbances are greatly reduced on the short waves. In some parts of the country where local broadcast stations are few and far between, the use of short waves has been practical and pleasurable, where reception on the longer waves has been unsatisfactory.

Most of the short wave receivers which have been made available to the public up to the present time have been designed primarily for the reception of continuous wave code signals, and have been more or less unsatisfactory for the reception of musical programs. It appears that the receiver presented in the following paragraphs is the first placed before the general public which has been designed primarily for the reception of broadcast programs on short waves.

## Several Design Features

In the design of such a receiver, several factors must be considered. First, the receiver must be essentially non-radiating. Due to the surprising distances which may be covered by short wave transmitters with a limited amount of power, it is essential that little or none of the high frequency current generated locally by the receiver shall reach the antenna, for otherwise, should short wave broadcasting reach the proportions which it bids fair to do, the ether would be filled with a congestion of squeals and howls exceeding that which reigned in the present broadcast band in the days of single circuit tuners.

Secondly, it must be adaptable to either phone or code reception. This requirement applies principally to the type of audio amplification employed in the receiver. It has been customary in receivers for c.w. operation to employ transformers having little amplification of the bass notes and which were inadequate for phone reception, due to the fact that c.w. signals are usually heterodyned to a high pitched whistle and very low grade transformers are adequate for the amplification of the signals.

Thirdly, the oscillation control must be smooth and without extraneous noises. This requirement will be discussed more fully and is very important, due to the fact that many "noise producing" features of a design which are completely negligible in the broadcast band, assume astounding proportions in the vicinity

of twenty to thirty meters.

Fourthly, it must be simple of operation. It is quite important that a receiver designed for short wave reception should be as easily controlled as the average broadcast receiver in order that the operator may not be forced to learn new procedure and new methods in order to contribute to his enjoyment.

Fifth, it must cover an adequate range of wave lengths. Due to the fact that the short wave broadcasting stations have not assumed a permanent status, it is important that the receiver should be capable of being adapted to the many changes which will undoubtedly ensue as time goes on.

## Limited Radiation

In order to limit the radiation of the receiver, the shield grid tube is the most plausible prospect. The insertion of this tube between the antenna circuit and the oscillating tuned circuit of the short wave receiver will limit the transfer of energy from the tuned circuit to the antenna, due to its extremely low grid-to-plate capacity.

It was the original intention that this tube should be used as a radio frequency amplifier with a tuned grid circuit coupled to the antenna, but the idea was abandoned for two reasons; the first being that the tube is not strictly a non-oscillating one, and when connected with tuned circuits in the grid and plate, they must be adequately and carefully shielded; also, plug-in coils must be used in

order to cover the necessary band of wave lengths and to have shielded these circuits would have entailed considerable difficulty in the removal of two shield tops and the replacement of two coils for each change of wave band. In addition to these, there is the fact that the tube possesses not zero, but an appreciable, though small, grid-to-plate capacity, which causes a disagreeable interlocking of the two tuner controls which is an additional complication in an attempt to secure high ease of operation.

It has been found experimentally that while, due to its low distributed capacity, the Aero choke serves very well as an aperiodic input circuit between the aerial and ground, across which the grid circuit of the shield grid tube is connected, as shown in the schematic circuit, Fig. 2, somewhat better results could be obtained by an especially designed input impedance which has been given the type number "65." Excellent results will be obtained with the No. 60 choke, but due to the fact that this choke was originally designed for use as an isolator in circuits where either a low external capacity or one easily controlled obtained, when it was subjected to a varying capacity such as is obtained when antennas of universally different characteristics are used, a pronounced improvement is noticeable when the especially designed No. 65 impedance is utilized. It was also found

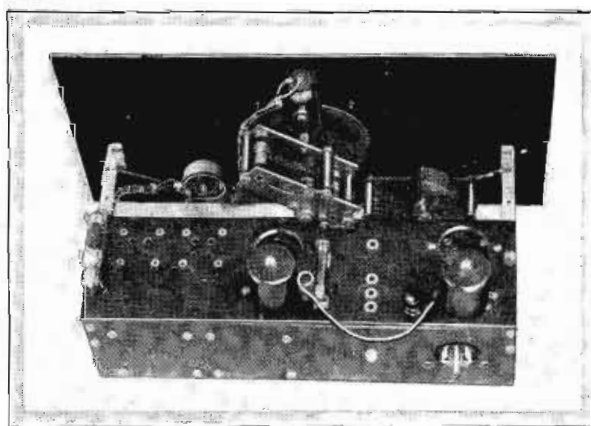


Fig. 1. Four tube non-radiating receiver using a screen grid tube as shown in the above photograph

(This receiver tested and all illustrations made in our laboratory)

that by the use of this connection a considerable degree of amplification was produced by the shield grid tube.

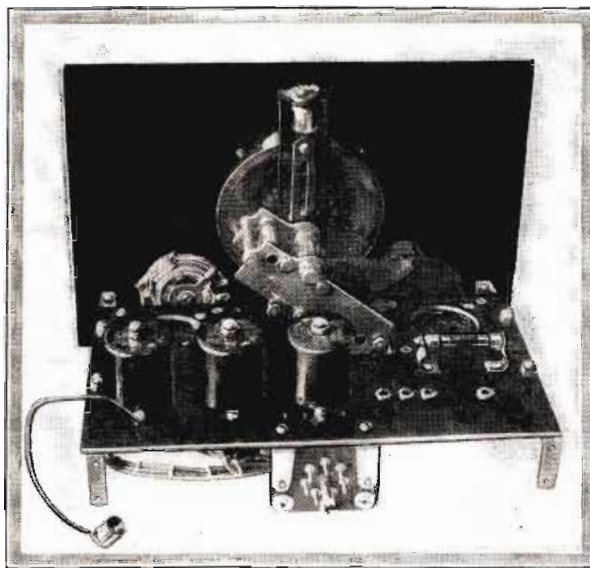
As connected in Fig. 2, the shield grid tube also contributes to the ease of operation by elimination of the so-called "holes" in the tuning range of the conventional short wave receiver. These "holes" are due to the antenna at the natural period, or multiples thereof, subtracting enough energy from the tuned circuit to cause the detector tube to cease oscillating in narrow bands, whereupon the antenna coupling must be reduced and again increased as the "hole" is passed on the tuning dial. As was stated, the shield grid tube, due to its low internal capacity, eliminates this objectionable feature and permits a band of waves to be swept by the tuning condenser, without other adjustments saving a minor manipulation of the regeneration condenser.

**Quality Audios**

This receiver has also been improved for broadcast reception by the employment of audio frequency transformers of a type heretofore only used in line amplifiers of broadcasting stations, and, due to the expense of manufacture, have never been available to the general public. These transformers give unusually good results and when used with a 112 or 171 tube, for which the receiver is wired, surprising tone quality will be encountered.

In order to give this unit the greatest possible versatility, it has been designed in two and four tube units, both built up on handsome panel sets with all wiring concealed, so that a very handsome appearance and compact construction are obtained with no loss of efficiency.

Smooth operational control has been attained by no small amount of effort. A portion of the success of this feature is due to the splendid characteristic of the r.f. choke at all frequencies, which serves to isolate the regeneration circuit, consisting of the secondary inductance and the regeneration condenser, at all frequencies to which the tuner is capable of responding. Stability of control is also obtained by isolating the various circuits as completely as possible by the following functions: the bypassing condenser assures that the shield grid will be maintained at ground potential and is of .003 mfd capacity. In the same way the plate circuit of the shield plate tube is isolated by means of



**Fig. 3. This photograph shows the converter unit, by means of which low wave stations may be received through a standard broadcast receiver**

a condenser of .003 mfd capacity, and in view of the fact that other portions of the receiver are also operating from the 135 volt tap of the battery, another r.f. choke is inserted. In order to prevent small radio frequency currents from being carried through the stray wiring capacities of the audio amplifier, which is objectionable when wearing the headphones, the cores of the audio transformers are grounded, and in addition a capacity is employed across the secondary of the second audio transformer, as well as another capacity across the output terminals of the receiver. These last capacities may be left out if desired, in most instances being purely precautionary devices.

In the diagram of the four tube receiver, a 4 mfd condenser will also be noticed, connected from the 135 volt side of the battery to the ground. This condenser need

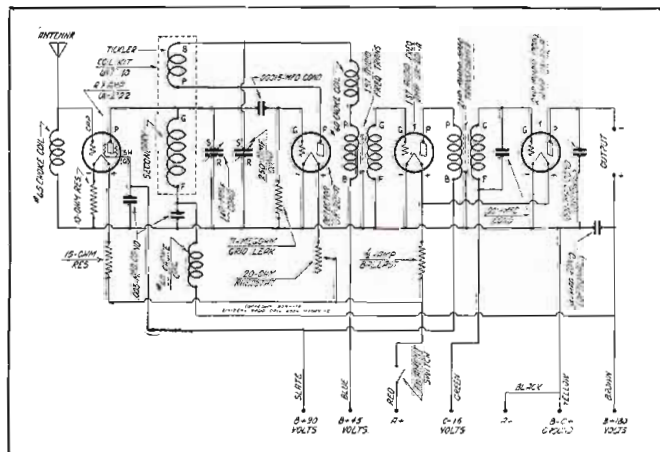
not always be used, but may possibly be found necessary with some B eliminators and with either somewhat depleted dry B batteries or with storage B batteries. Its need will be indicated by the presence of a rather high pitched audio howl, which will be eliminated when the condenser is used. This howl is caused by common coupling through the resistance of the supplying batteries or eliminator between the plate of the shield grid tube and the plate of the last audio tube, and the condenser should, under no circumstances, be required if a separate power amplifier is used in place of the second stage of audio frequency amplification. It is an apparent fact that these improvements for eliminating audio noises in the output of the receiver, regulating the oscillation of it, also contribute materially to the ease of operation.

By the unique construction of the 140 mmf. condenser, which was for use in all the new Aero short wave receivers, much of the trouble which has previously been experienced with noisy operation has been done away with.

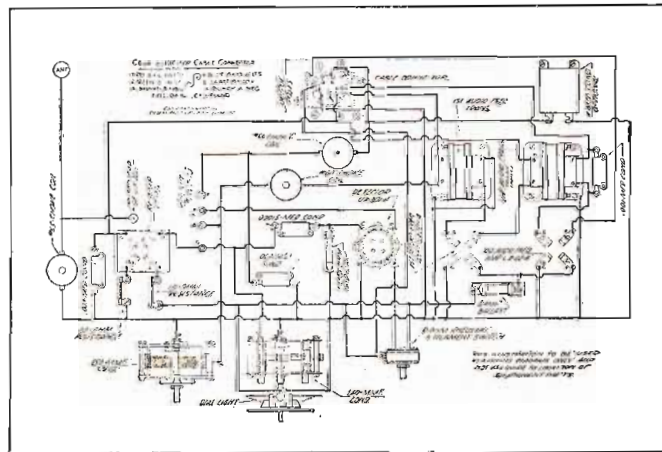
The wave length range of the receiver with the three plug-in coils included in the LWT-11 kit, is from 17 to 89 meters, and with the No. INT-104, sold separately, 205 meters, arranged to include all short wave stations broadcasting at present or contemplated, as well as the principal amateur phone and telegraphic bands.

**Short or Long Waves**

The physical dimensions of the receiver have been so arranged that if the user desires to employ the "International" receiver for



**Fig. 2. Schematic diagram of the International Four is illustrated above**



**Fig. 4. Wiring of the receiver is simplicity itself, if the above diagram is followed**

the broadcast band, the standard Aero coils INT-4 and INT-5 may be inserted, but due to the fact that the constants of the circuit have been arranged primarily for the most satisfactory operation on short waves, where even a very sharp radiation must cover up to fifty or sixty kilocycles to retain good quality of reproduction, the receiver will be found to be quite broad on the regular broadcast bands. In sections fifty miles or more from high powered broadcasting stations, and particularly in foreign countries, the INT-4 and INT-5 coils may be used in the "International" receiver with a considerable gain in sensitivity as compared with the three tube set for which the INT-4 and INT-5 coils were designed. In sections where the ether is highly congested, as for example in the cities of New York and Chicago, the "International" will give highly satisfactory results as a broadcast receiver with about ten feet of wire as an antenna, and it may even be found desirable to reduce the antenna length to five feet.

It should be noticed that the construction of the popular Aero short wave plug-in coils has been altered in the "International" kits from a three inch diameter to a two inch size, except on the broadcast band coils. This change has improved the structure and rigidity of the coil; it constricts the field of the coil materially by increasing the ratio of length to diameter for a given inductance; it minimizes the pickup from powerful nearby stations, and also provides a more favorable coefficient of coupling between the tickler and secondary for operation at extremely low waves.

In the converter a resistance control of regeneration has been used instead of the customary variable condenser control. It will be noted that where the resistance control is used it is in series with a fixed condenser, and inasmuch as the variable condenser in this lead operates only as a variable radio frequency resistance, either method may be used with equal smoothness of operation and efficiency. The resistance is used in a converter to secure small size and compact construction. In the receiver there is plenty of room and so the condenser is employed. It will be noticed from the photographs that the circuits are identical with the exception of the fact that the four tube job includes a two stage audio frequency amplifier, using the special transformers already described.

### Operation Is Simple

The operation of the receiver is very simple. With suitable tubes inserted in the socket and the directed battery voltages in the circuit diagram applied, one of the coils may be placed in the socket. With the regeneration condenser all the way out, the filament rheostat is turned up about half way. As soon as the rheostat is removed from the off position, the shield grid tube should light to its proper brilliancy and remain that way, unaffected by other variation of the rheostat which affects the detector tube alone. Then when the regeneration condenser is advanced part way, the detector tube should go into oscillation with a soft "thud" accompanied by a considerable increase in tube noises, and so on. Should the detector fail to oscillate with the regeneration condenser fully advanced, the filament rheostat should be turned up further. In the event that it should go into operation sharply or with disagreeable noises, it should be retarded to the point where oscillation is accomplished smoothly. After oscillation is obtained, the wave band covered by the coil may be swept with the tuning condenser, always simultaneously manipulating the regeneration control in such a way to keep the tube just oscillating. Code signals will be received with the set in this condition and their pitch may be carried by slight adjustments of the tuning condenser. The signal of a broadcasting station will be indicated by a distinct heterodyne whistle, which instead of being broken up, as in code signals, will be perhaps varied in pitch by the modulation; but after locating the heterodyne point of the broadcaster, retard the setting of the regeneration condenser until the tube is just out of oscillation. The setting of the tuning condenser should then be corrected for maximum signal strength and it will then be found that the regeneration control can be advanced slightly with some increase in signal

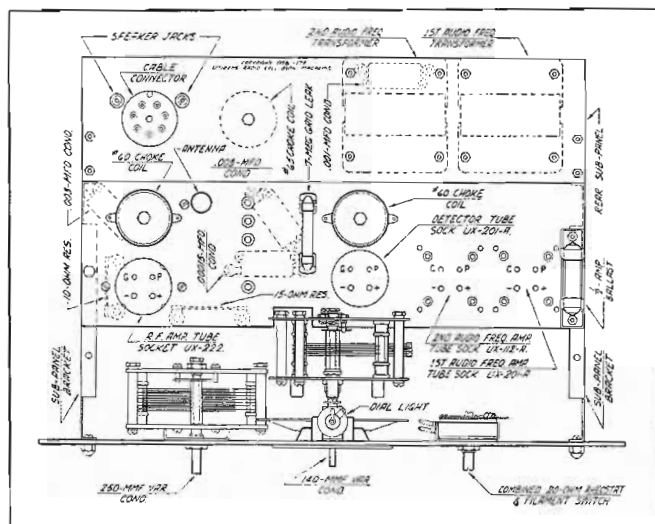


Fig. 6. Parts for the Aero International Four should be laid out in accordance with the baseboard layout printed above

strength up to the oscillating point of the tube.

Models of this receiver have been in operation for about six months and very excellent results have been secured. Only one "bug" has developed in the receiver during this time. If the B batteries are not in good condition, or if an eliminator is used in which the filter capacities are deficient, a persistent audio whistle may develop. This development, however, has been found to be non-existent when the outfit is used with an external power amplifier, using separate power supply, and in all cases it can be easily remedied in ordinary operation by the addition of the 4 mfd condenser already mentioned and the insertion of a .0001 to .001 condenser across the secondary of the first or second audio transformer. This will not affect the quality in any way, but will completely remove the whistle, which is caused by the tremendous amplification factor of the shield grid tube, causing any slight variations in the voltage of the B batteries to be amplified sufficiently to cause audio frequency amplification.

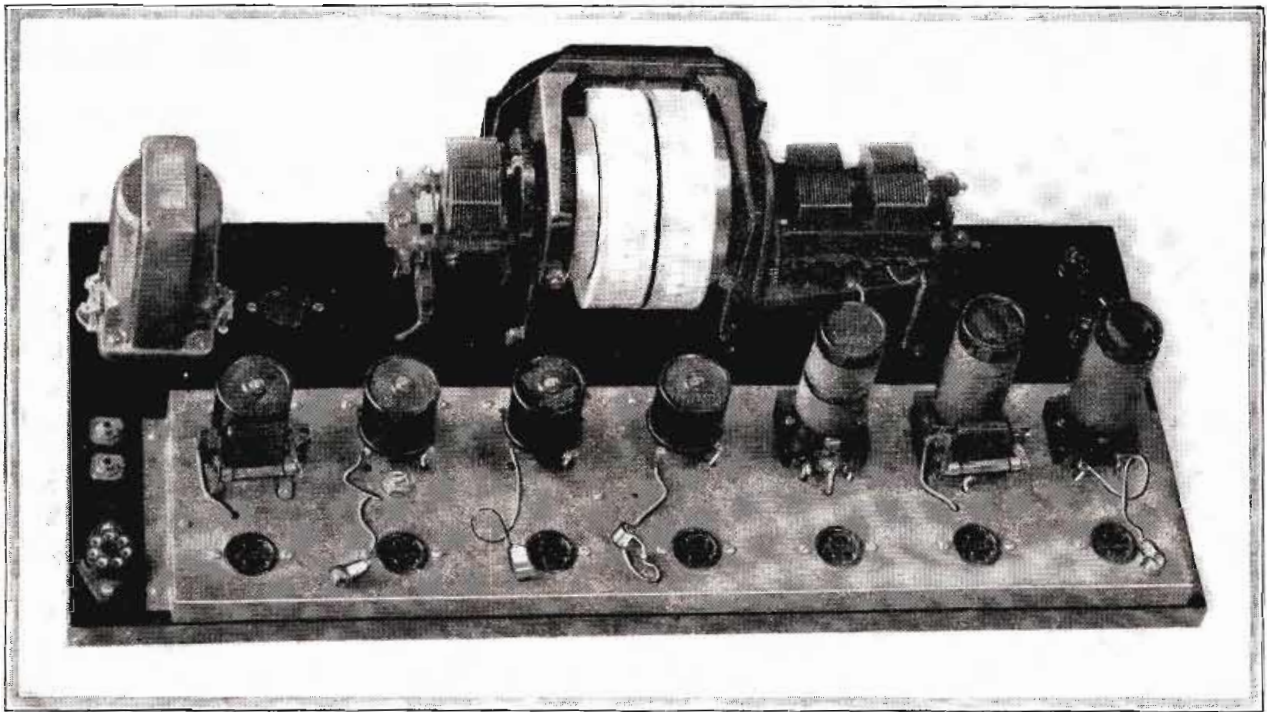
### Official Parts List

Parts used in the construction of the Aero International Four and the International Converter are:

- 1 Aero International base unit (No. 8 for receiver, No. 9 for converter), including drilled panel, subpanel and back panel, with tube sockets and ballast clips and coil sockets already mounted, and including all machine screws, nuts, bushings, solder, wire, lugs, escutcheon plate, etc.
- 1 Aero special Amsco .00014 condenser
- 1 Amsco .00025 condenser (used in receiver)
- 1 Aero special Centralab resistance, Type AE-8 (used in converter only)
- 1 Aerovox .001 fixed condenser (used in converter only)
- 1 Aerovox .00015 condenser
- 2 Aerovox .003 condensers
- 1 No. 520 Yaxley rheostat
- 1 No. 500 Yaxley switch
- 1 No. 669 cable connector
- 1 10 ohm Yaxley resistance
- 1 15 ohm Yaxley resistance
- 1 LWT-10 Aero coil kit
- 2 C-60 Aero Noskip chokes
- 1 C-65 Aero Noskip choke
- 1 Type "E" National dial
- 3 Kurz-Kasch knobs
- 1 Carter shield grid connector
- 2 Aero transformers, Type AE-770 (used in set only)
- 1 Eby binding post (used in set only)
- 1 Allen Bradley 10 megohm grid leak

# Remler 29 Shield Grid Super Now Made in Unit Construction

Radio Frequency and Intermediate Amplifiers Completely Shielded and Enclosed in Copper Case Fully Tested and Wired at Factory



*Fig. 1. This photograph shows the rear view of the Remler 29 described in this article. The simplicity of the design may be readily seen by inspecting this photograph*

**T**HE Remler 29 shield-grid superheterodyne combines the great selectivity and sensitiveness of the superheterodyne with low cost and ease of assembly. It is compact, rigid in construction and attractive in appearance and is the ideal set for the man who wants performance superior to that of any factory-built receiver, regardless of price, for a minimum outlay of time and money. Economies made possible through the use of unit construction are passed on to the consumer in the form of prices far below those heretofore necessary for products providing an equivalent in performance.

All of the component parts of the Remler 29 receiver are mounted on a pressed steel base which is supplied with the No. 752 foundation kit. The radio frequency and intermediate amplifiers are completely shielded and are enclosed in a single copper case which is fully wired at the factory. All wiring with the exception of connections to the audio components, the instruments mounted on the front panel, and the battery terminal block is completed. Such wiring as is necessary is installed from an easily followed full-size blueprint. Colored wire is used and this wire is supplied with the Remler No. 712 shield-grid selector and amplifier. The wire is No. 18 tinned copper, double cotton insulated. The insulation can be slipped back from the ends of the wires and does not need to be scraped, with the result that wiring is greatly facilitated. The builder need not be particularly familiar with radio in order to build and obtain the maximum in

results from the receiver. All that is necessary is the ability to correctly handle a soldering iron. The set can very easily be assembled and put into operation by the novice in an evening's time.

#### Assembly Is Compact

The 29 shield-grid superheterodyne is compact and does not require the large amount of space ordinarily necessary for a multi-tube set. The pressed steel base is 25 inches long by 11 inches wide. All controls are mounted on an attractive bronze escutcheon plate which is  $6\frac{3}{4}$  inches high. Any cabinet intended for a panel 7 inches high and 25 inches or more in length can be used.

The super incorporates one stage of shield-grid radio frequency amplification functioning at the frequency of transmission, a regenerative first detector, an oscillator, three stages of shield-grid intermediate amplification functioning at a frequency of 115 kc., a second detector and a first audio stage. The second audio stage can be included in the set proper or it can be built into an external power amplifier and power supply unit. It is recommended that an external power amplifier be employed.

The first radio frequency stage is purely a selective stage and no attempt has been made to obtain radio frequency amplification over that which might be had with a non-regenerative tube of the 201A type. A shield-grid tube is used in the radio frequency stage because of its inherent stability of operation. An "A"

(This receiver tested and all illustrations made in our laboratory)

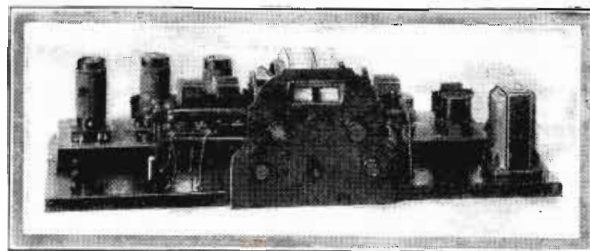
tube, with regeneration present, might have been used in the radio frequency stage with somewhat greater gain but such regeneration causes a loss of the higher audio frequencies with the result that quality of reproduction suffers and it also introduces whistles which are particularly annoying to the inexperienced operator. The shield-grid tube is entirely free from inherent regeneration and is therefore felt to offer decided advantages as a radio frequency amplifier. More than sufficient amplification is provided in the intermediate stages of the receiver and no advantage would be gained through the use of additional amplification in the radio frequency stage.

**Regenerative First Detector**

Regeneration is employed in the first detector circuit. The detector plate circuit is inductively coupled to the detector grid circuit through a third winding in the radio frequency transformer. The degree of regeneration is controlled by means of a 2000 ohm variable resistor which is shunted across the feed-back coil. The method of regeneration control used is of particular interest as it provides more uniform regeneration over the broadcast band than could be had with capacity control and as the detuning effect due to regeneration is very small and is much less than that for other methods of control. The regeneration control can be adjusted for maximum gain at the longer wavelengths and the set will not break into oscillation as the lower wavelengths are approached. With other methods of regeneration control, constant adjustment is necessary during tuning. Maximum regeneration will be used only for distant reception, when a slight sacrifice in quality of reproduction is permissible. For high quality, local and semi-distant reception regeneration will not be used and the regeneration control will be retarded.

Three stages of transformer intermediate shield-grid amplification are used and the intermediate amplifier functions at a frequency of 115 kc. Although the shield-grid tube is theoretically capable of giving very high gain per stage, say 40 to 50, in no case investigated has such gain been obtained together with the necessary degree of selectivity. In the Remler 29 the gain per stage in the intermediate amplifier has purposely been reduced in order to maintain the degree of selectivity considered necessary for modern broadcast conditions. By keeping the gain per stage relatively low, a decided improvement is also made from the standpoint of quietness of operation. The gain in the three stage intermediate amplifier as designed is the maximum obtainable with the pre-determined necessary degree of selectivity and both the gain and selectivity are considerably greater than could be obtained from an intermediate amplifier employing tubes of the 201A type even were excessive regeneration employed. The shield-grid intermediate amplifier is operated well below the point of oscillation. Regeneration in an intermediate amplifier will cause a loss of the higher audio frequencies, as it will in an ordinary radio frequency amplifier and absence of regeneration in the shield-grid intermediate amplifier therefore means better quality of reproduction.

The radio frequency and intermediate amplifiers are enclosed in a single copper case and constitute the Remler No. 712 shield-grid selector and amplifier. The intermediate amplifier transform-



**Fig. 2. In this photograph is shown a front view of the Remler 29 with the shielding cover removed**

ers are tuned at the factory. Vernier adjustments are provided so that compensation may easily be made for differences in tubes and for any misalignment due to rough handling in shipping.

Type 201A tubes are used in the first detector, oscillator, second detector and first audio positions. A 112A tube can be used in the first audio position if desired. Both detectors are of the grid-leak-grid condenser type.

Automatic filament control is used for the 201A tubes. The shield-grid tubes are controlled by the panel rheostat. A limiting resistance is connected in series with the panel rheostat so that excessive voltage cannot be applied to the shield-grid tubes from a fully charged 6 volt battery. This protective resistance makes a voltmeter unnecessary. In practice the shield-grid tubes can be operated at voltages lower than the maximum of 3.3.

**Use Small Antenna**

The Remler 29 is intended for use with small antenna coupling. A short antenna should preferably be used. If a long antenna is used a series antenna fixed condenser of from .00001 to .0002 mfd should be employed. The antenna compensator variometer is built directly into the first radio frequency transformer or antenna coupler. Once adjusted on the installation of the receiver it need not be further used. This construction is possible because of the small degree of antenna coupling. The antenna deflection will never be more than can be taken care of through a single adjustment of the compensator variometer.

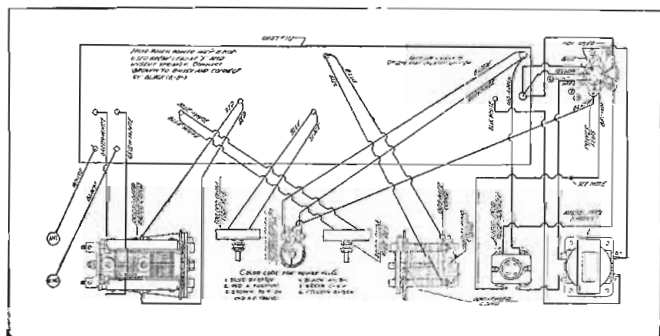
The receiver is theoretically not a "one-spot" receiver. In practice, however, repeat settings will not be found unless operation is in the immediate vicinity of broadcasting stations transmitting on the lower end of the broadcast band.

In the set as photographed in this article, one stage of audio frequency amplification is employed. An external Remler power amplifier making use of a tube of the 250 type will be used. The external power amplifier will be incorporated in a combined power amplifier and power supply device constructed with the parts listed hereafter for the purpose. An external power amplifier is earnestly recommended where the utmost quality of reproduction is desired.

All wiring in the Remler 29 is concealed by the pressed steel base so that the receiver presents an appearance equal to that of the most expensive factory-built product. The leads are in no case so crowded that they are difficult to install and the blueprint can be followed with the greatest ease.

**Resonated Primary**

The Remler audio transformers specified for use in this receiver will provide quality of reproduction surpassing that obtainable with an audio amplifier of the conventional type. Remler audio transformers are designed for use in pairs and their characteristics are such that the over-all frequency characteristics for the amplifier will be essentially flat over the band of transmitted frequencies. The first-stage transformer is in each case of the resonant primary type and is made to give particular emphasis to the lower part of the frequency band. The frequency characteristic of the second-stage transformer is allowed to fall at the lower end and the degree of compensation introduced into the first transformer is such that the over-all characteristic is flat. In addition to per-



**Fig. 3. Only a few wires need be run by the set constructor, as disclosed in the above graphic diagram**

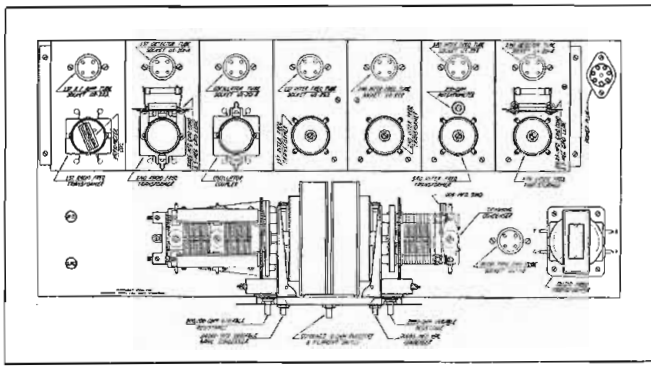


Fig. 4. The layout of the parts is disclosed in the above drawing

mitting proper emphasis to the lower frequencies, which give fullness and body to the reproduction, the resonant primary circuit confines the audio frequency currents in the detector plate circuit of the transformer system and keeps them out of the power supply device. The resulting lack of impedance coupling in the plate supply device between the detector circuit and the remaining circuit makes for stability of operation.

The over-all frequency characteristic for the amplifier is, of course, what one is most interested in. The individual frequency characteristics of the first and second stages is of minor importance. The primary circuit of the first-stage transformer only is resonated first because adequate compensation can be made there for any drop in the second transformer characteristic and second because the comparatively heavy direct-current flow to the plate of the first audio tube would cause an excessive voltage drop in the resistor and excessive EI loss were the second transformer primary resonated. If the value of the resistor were lowered to get away from the large voltage drop and EI loss a comparatively large amount of the audio voltage available at the plate of the first audio tube would be lost in the resistor and amplification would be lowered. Excessive voltage drop and EI loss in a resistor for a resonant-primary second-stage transformer would be particularly troublesome where it desired to use a tube such as the 112A in the first audio position to obtain the somewhat more favorable relation between the tube plate impedance and the transformer primary impedance.

### High Ratio Transformer

Since compensation is made in the first-stage transformer for the falling frequency characteristic of the second-stage transformer the second-stage transformer can be a high-ratio transformer and the smaller primary necessary with increased ratio

can be used without any detrimental effect upon the final quality of reproduction. Since one may use high-ratio transformers without adversely affecting quality of reproduction one can obtain without overload of the detector, the large voltage swing on the grid of the power tube necessary for maximum undistorted output from that tube. This is most important as with the usual low-ratio transformers the detector is badly overloaded before maximum output is obtained from a large power tube, such as the 250, and because of such detector overload second harmonic frequencies resulting in serious distortion are introduced.

### Energy Required

A considerably larger amount of energy is necessary to produce a low note than is required to produce a high note in the same apparent volume. Suppose that the frequency characteristic of the broadcasting station were flat, that is, that it amplified by equal amounts the energy received at all frequencies. This is not strictly the case but modern stations have been perfected to a degree such that one can make the assumption for the purpose of illustration. The energy transmitted at the lower frequencies would then be considerably greater at the lower frequencies. There is very little frequency distortion in a radio frequency amplifier as used without regeneration for local reception and we will therefore assume that we have at the detector an input frequency-amplification relation that we have at the broadcast station. If the detector is not overloaded very little distortion will be introduced at that point. Now if our audio amplifier has a flat over-all frequency characteristic, that is, if it amplifies equally all of the musical frequencies, the power tube will be called upon to deliver to the speaker very much larger amounts of energy for the lower notes than it will for the higher notes at the same apparent volume. If a power tube of limited output, such as the 112A or 171A is used it is better that the audio system does not reproduce the very low frequencies in their true relation to the higher frequencies since the low notes would cause overload of the power tube for relatively low volume. If the very low frequencies are attenuated greater volume can be had from a power tube of limited output without overload and excellent quality of reproduction will be obtained. It will, moreover, be no use to amplify in the audio system the very low frequencies if the speaker used will not respond to them. Most magnetic cone speakers offer very little response to frequencies much below 200 cycles per second. They may offer apparent response but analysis of the output shows a very small percentage of fundamental frequencies below about 200 cycles and a large percentage of second harmonic frequencies generated in the speaker itself. These second harmonic frequencies introduce distortion.

Because of the desirability of attenuating the very low frequencies when power tubes of limited output or speakers not respond-

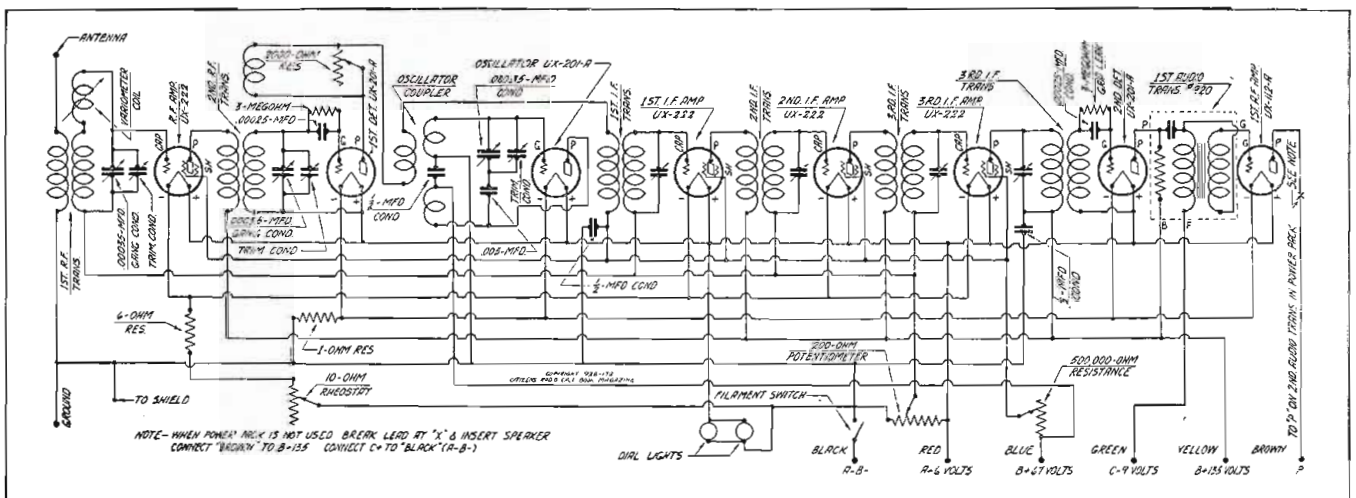


Fig. 5. Schematically the receiver is presented in the above diagram, which gives all necessary constants

ing to the very low frequencies are used Remler transformers Nos. 900 and 901 have been given a sharp cut-off just above 60 cycles. They are recommended for use in the Remler 29 receiver if a power tube of the 112A or 171A type is to be employed.

**External Power Amplifier**

When the utmost in quality of reproduction is desired it is recommended that an external power amplifier incorporating a 250 power tube be used. The 250 tube will handle without distortion at more than normal room volume the very lowest frequencies transmitted. It should be used in conjunction with a dynamic cone speaker properly mounted in a baffle-board. The dynamic speaker, mounted in a baffle-board of sufficiently large diameter will respond to the very lowest frequencies it will be necessary to reproduce. The baffle-board should have a diameter equal to one-quarter of the wavelength corresponding to the lowest frequency desired. Remler transformer Nos. 920 and 921 are particularly suited to use in an amplifier employing a 250 power tube. These transformers provide an amplifier whose over-all frequency characteristic is essentially flat over the entire band of transmitted frequencies and they provide a voltage gain between the plate of the detector and the grid of the power tube such that full undistorted power output can be obtained from the power tube without overload of the detector.

An output transformer is desirable in any amplifier since it permits the correct relation between the power tube plate impedance and the external plate circuit impedance and the correct relation between the impedance of the speaker winding and the input circuit to the speaker. It also protects the speaker winding from damage by excessive direct-current. For power tubes 112A and 171A the Remler No. 922 output transformer is recommended. For power tubes 210 or 250 the No. 923 output impedance-compensating transformer should be employed. The No. 923 output impedance-compensating transformer has a flat frequency characteristic over the entire band of transmitted frequencies. The large plate current for the power tube does not flow through the transformer primary and so cannot cause distortion due to core saturation. The plate current is fed to the power tube through a large choke. The audio currents in the power tube plate circuit are confined to the primary of the output transformer and do not flow through the plate supply device. Impedance coupling can therefore not occur in the plate supply device between the last audio circuit and the remaining circuits in the receiver and stability of operation results.

**Labor Saving Assembly**

Professional set builders will recognize the facility with which the power amplifier designed by Remler for use with the Remler 29 receiver may be wired. All preliminary work has been

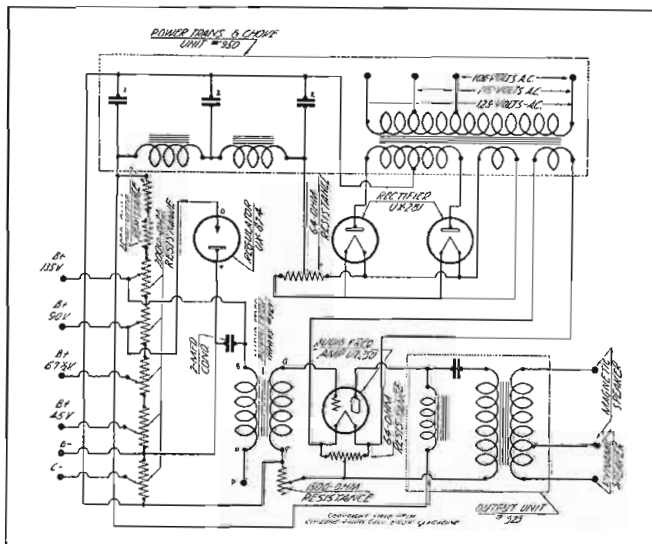


Fig. 7. The schematic circuit by means of which the amplifier should be wired is disclosed in the above drawing

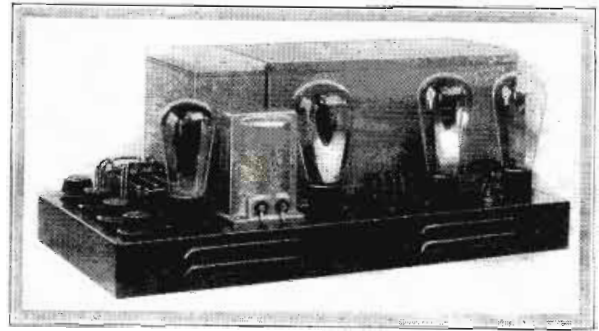


Fig. 6. The Remler 29 was designed for the use of an external power amplifier No. 950 which is shown in the above photograph

smoothed out by the production of the 952 foundation kit, which includes a pressed steel base onto which are mounted the four sockets, the center-tapped resistor unit and where holes are provided for the placing of the second stage audio transformer, the output impedance compensating transformer, the power transformer and choke together with heavy duty filter condensers and other by-passes. The voltage divider resistance is known as the Frost No. 300 resistance kit, which has the necessary resistance values to give 135, 90, 67½, and 45 volts and a C negative voltage for the 250 power tube.

The power supply may be easily mounted at the bottom of the console if the receiver is to go in that type of housing. If it is to be on the top of a table, provision can be made for the power amplifier to be placed at one end, or if the table is wide enough, to be placed at the rear of the receiver.

**Official Parts List**

Parts used in the construction of the Remler 29 receiver and power amplifier are:

**Receiver**

- 1 Remler 712 shield grid selector and amplifier
- 1 Remler 752 foundation kit, including one pressed steel base, one pressed steel instrument panel, one bronze escutcheon plate, all necessary fixed and compensating condensers, cord tip jacks, binding posts, bakelite knobs, insulating washers, bolts, nuts and screws
- 2 Remler No. 110 Universal drum dials
- 1 Remler No. 632 twin rotor condenser
- 1 Remler No. 638 twin rotor condenser
- 1 Frost 1895 500,000 ohm variable resistor
- 1 Frost 1896 2000 ohm variable resistor
- 1 Frost S-1910 10 ohm rheostat and switch
- 1 Frost 782 battery cable plug socket.
- 1 Frost 780 battery cable and connector
- 1 Remler 900 or 920 first stage audio transformer
- 4 Type 222 shield grid tubes
- 3 Type 201-A tubes
- 1 Type 112-A tube
- 1 Pkg. Kester radio solder
- 1 Ekko ground clamp

**Power Amplifier**

- 1 Remler 921 second stage audio transformer
- 1 Remler 923 output impedance compensating transformer
- 1 Remler 950 power transformer and choke
- 1 Remler 952 power amplifier foundation kit, including one pressed steel base, 4 Remler 50 sockets, one Frost FT-20 center tapped resistor, necessary bolts, lugs, screws, nuts, terminals and wire
- 1 Frost 300 Universal resistance kit
- 3 Frost 1405 2 mfd heavy duty filter condensers
- 2 Frost 1105 2 mfd bypass condensers
- 2 Type 281 rectifier tubes
- 1 Type 250 power amplifier tube
- 1 874 voltage regulator tube
- 1 Pkg. Kester radio solder

# National Screen Grid Five Receiver Shown in Simplified Form

Well Known Circuit Considerably Improved in Selectivity and Distance by Use of Screen Grid Tube

FOR a good many years now, the Browning-Drake receiver has been recognized as one in which simplicity of construction and excellence of performance have been combined in a most satisfactory manner. By the use of the 222 as the radio frequency amplifier tube in even this receiver, however, not only is its general performance improved to a most marked extent, but also its construction and operation materially simplified.

Without resorting to the use of either shielding or neutralization, the operation of the receiver is made exceedingly stable. Even the operation of the detector circuit is improved, because advantage can be taken of the regeneration control without throwing the r. f. tube into undesired oscillation. As a result of the r. f. tube not being right on the point of oscillating most of the time, the tone quality obtainable from the receiver as a whole is also improved.

But real pleasure to be derived from the operation of such a receiver comes from the way in which it will break through the locals in even such congested areas as New York and Boston and

bring in distant stations with volume and quality worth listening to.

## The Amplifier

The secret of the good selectivity seems to be in the use of a very short antenna, the use of a regenerative detector and the use of a slot wound high impedance primary transformer rather than the more generally advocated "tuned plate" system. Certainly the transformer coupling along with the proper location of coils and condensers is responsible for the extremely stable operation. The grounded metal drum tuning control placed as it is between the two tuning units offers all the shielding necessary. This drum, which is of the vernier type, is also of considerable aid to easy tuning.

In general appearance, the National tuning unit employed is the same as the regular National Browning-Drake unit, except for the greatly increased impedance of the slot wound primary of the r. f. transformer, the omission of the neutralizing winding and the use of an inductive or variometer type of antenna com-

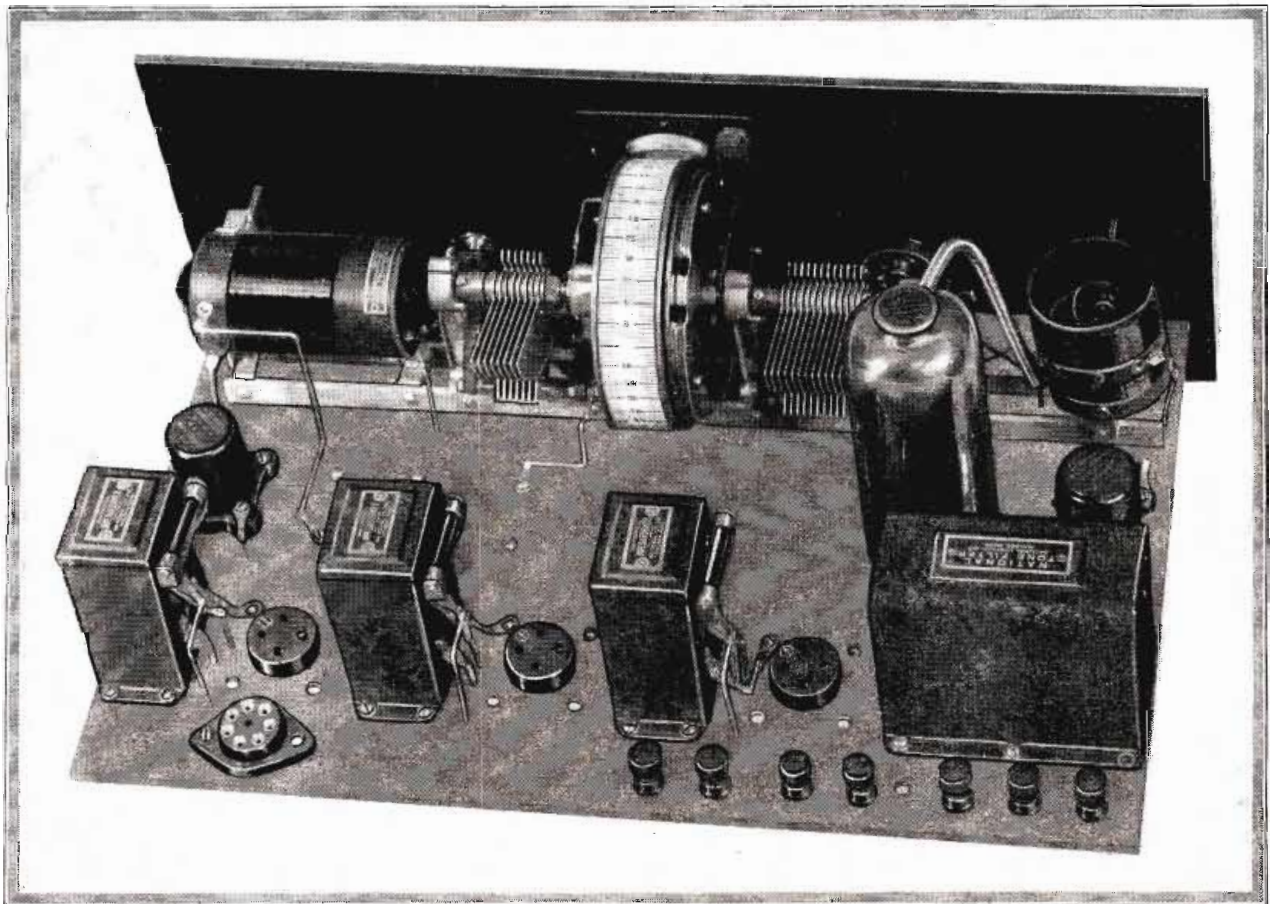


Fig. 1. In this photograph is shown the rear view of the National Screen Grid Five recently constructed in our laboratory

(This Receiver Built, Tested and All Illustrations Made in Our Laboratory)



pensator or trimmer in place of the midget "trimmer" condenser formerly used.

Because of the low internal electrostatic capacity of the 222 tube, a small .0001 mfd mica condenser, indicated by the dotted lines in the circuit diagram, must generally be connected across the antenna circuit tuning condenser in order to keep the two tuned circuits in quite close "step" throughout the tuning range of the receiver. Any slight variations are then easily compensated for by adjustments of the "inductive trimmer."

The 15 ohm cartridge in the negative lead of the UX222 filament circuit serves the double purpose of dropping the voltage down to the proper value and also for supplying the grid biasing potential for this tube. In the other lead is a 20 ohm rheostat that serves as a volume control.

It will be noticed that a radio frequency filter circuit comprising an r.f. choke and a 1 mfd condenser are used in the screen grid leak. As a result of such an arrangement, no trouble will be had in operating the receiver from a B eliminator. With some eliminators the condenser alone is sufficient, but in most instances the addition of the choke is well worth while.

The r.f. choke for the detector plate circuit is incorporated as part of the first stage National Impedformer. An additional choke, however, as shown in the diagrams and photos, will in many instances still further improve the operation.

**The Audio Amplifier**

The combination impedance-resistance coupled amplification employed is one capable of excellent tone quality at a reasonable cost for the various parts needed.

The first stage Impedformer consists of an r.f. choke coil, plate impedance, coupling condenser and grid resistor. The second stage unit differs from the first only in that it does not include an r.f. choke, while the third stage unit comprises a plate resistor coupling condenser and grid impedance. There are several advantages to the use of this "reversed" Impedformer as the last coupling unit. First it improves the operation of the amplifier when used with B-power units by overcoming any tendency toward "motorboating" which is encountered at times with straight impedance coupled amplification, and, second, it makes possible the use of a high mu tube in the second a.f. stage, where additional volume is required without any sacrifice in tone quality. In the plate circuit of the power tube is incorporated a Tone Filter to protect the loud speaker when using full voltage on the plate of a UX171.

The grid bias for the first two tubes is obtained from the

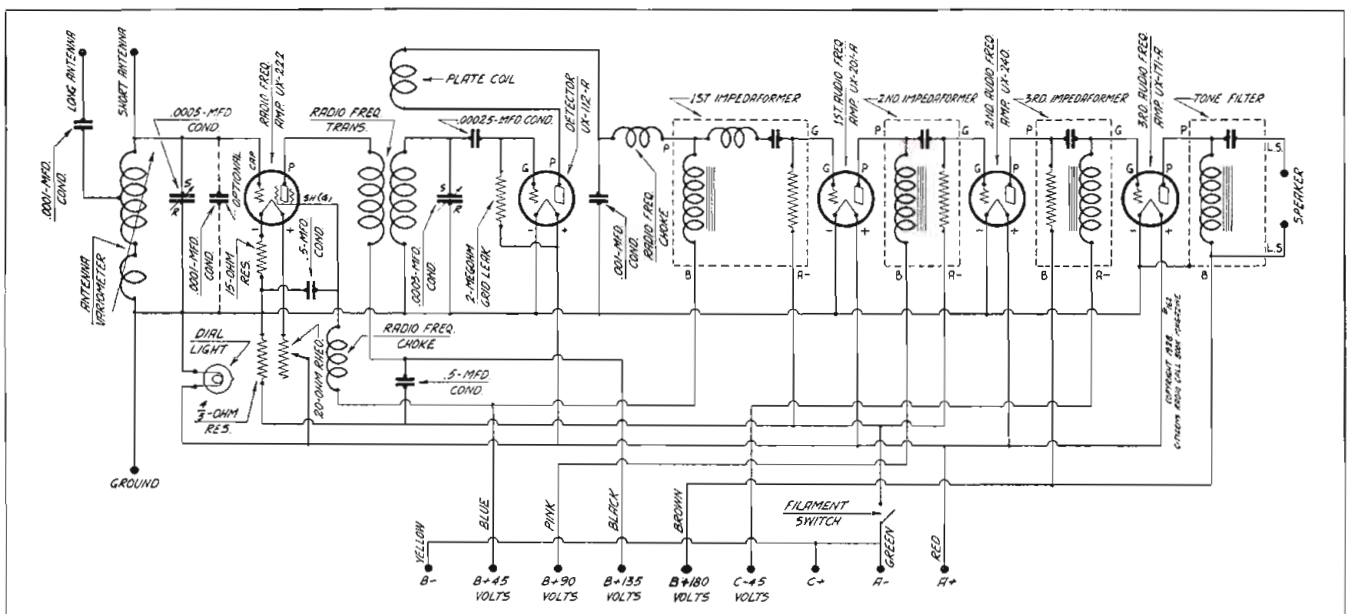


*Fig. 2. In this photograph the receiver is placed in a Fritts cabinet. The antenna used is the Effarsee tapstry model shown on the wall at the left*

voltage drop across the filament equalizer, while that for the power tube is obtained from a dry C battery.

It will be noticed that a 4/5 ohm filament resistor is employed to drop the 6 volt battery potential down to the 5 volts required for all the tubes save the 222. The 15 ohm resistor then drops the 5 volts down 3.3 volts for the filament supply of the 222. A 4/5 ohm resistor, however, provides a 1 volt drop when used with five 1/4 ampere tubes. In this receiver there are four such tubes and the 222, which only requires a trifle more than an eighth of an ampere for filament current.

The filament current required for dial light, however, when added to that of the 222, makes a total of a quarter ampere, so that the standard 4/5 resistor is operated under proper condi-



*Fig. 3. The schematic circuit of the National Screen Grid Five may be observed by referring to the above diagram*

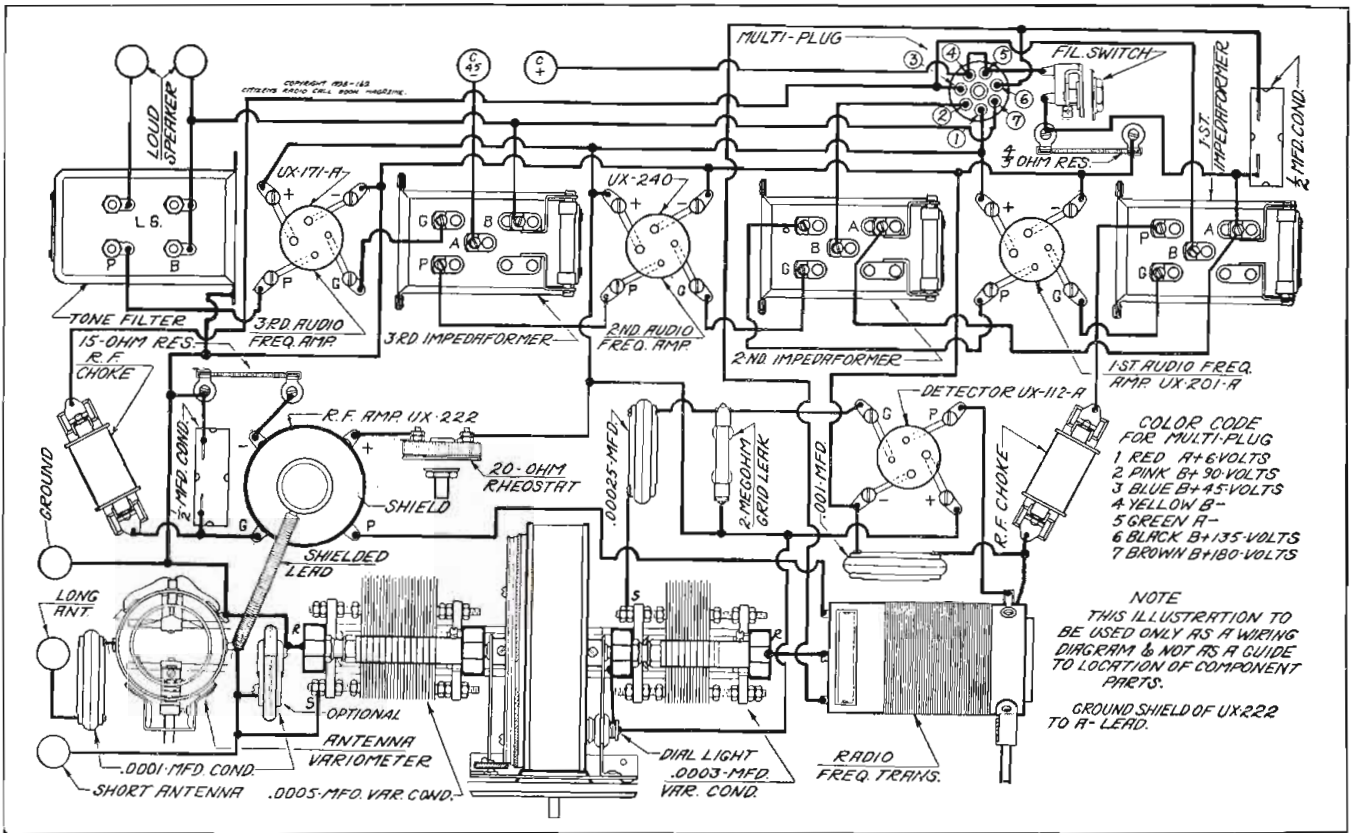


Fig. 4. All wiring of the receiver may be accomplished by following carefully the graphic printed above

tions. The use of 5 volts instead of 6 volts across the dial light filament makes no appreciable difference in the brilliancy of the scale illumination, while it does materially increase the life of the small bulb.

**Assembly and Wiring Notes**

The actual assembly and wiring of the receiver is quite simple and straightforward. The first step is to prepare the front and sub-panels.

The tuning unit, sockets, audio components and all other parts are then mounted in place on the sub-panel and the set completely wired before mounting the front panel in place.

There is only one long lead carrying any r. f. current—the one from the plate of the 222 to the primary of the r. f. transformer. This lead should be run underneath the sub-panel in as direct a line as possible. Although best results are generally obtained when the plate lead is connected to the primary terminal nearest

the front panel and the B135 volt lead to the remaining primary terminal, it is well to try interchanging these two leads. With some sets the reversed connection gives considerably better performance. The location of the other parts is such as to eliminate the need for any long high frequency leads. By making connection to the condenser frame at several convenient points, as shown in the illustrations, the wiring is considerably simplified. As an aid in making connections to this frame, soldering lugs should be placed under the heads of the several mounting screws that hold the tuning unit to the sub-panel.

**May Need Shield**

Although not absolutely necessary, nevertheless in laboratory tests conducted by this magazine in a very congested district, a Carter shield for the 222 tube is recommended, which shield has an armored lead for the cap of the 222 tube. Be sure to ground the tube shield, as the set might howl when it is ungrounded.

The antenna coil in this receiver consists of a nine turn primary of No. 27 d. s. c. wire and a 60 turn secondary of No. 28 enamel on a 2 inch tubing. The regenerative coupler consists of 108 turns on the secondary of No. 28 enamel, 22 turns of stranded enamel No. 27 d. s. c. wire on a small rotor at the high potential end of the transformer. The primary is a slot wound, high impedance one, having 22 turns of No. 34 d. s. c., this being located at the low potential end of the coil. The antenna variometer comprises a 12 turn rotor located inside the 2 inch tube of the antenna coil, on which there is a stator winding of No. 28 enamel wire spaced one-half the diameter.

**Operating Notes**

As already intimated, very excellent performance may readily be obtained with a 3 or 4 foot wire connected directly to the control grid of the UX222 (the cap on top of tube) as an antenna. In fact, such an antenna is to be recommended for use wherever extreme selectivity is desired. Where the set is not located very close to any broadcasting stations, however, a 20 or 25 foot indoor

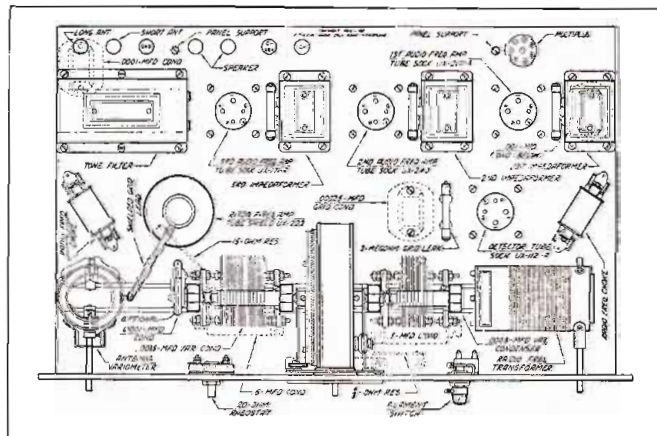


Fig. 5. This diagram shows the layout of all parts in the receiver

(Continued on page 112)

# Hints on the Profitable Use of Power Amplifier Units

Enterprising Professional Set Builders or Dealers May Cash In on "Pick-Up" Work in Their Own Locality

**T**HERE are countless opportunities in every professional set builder's locality for cashing in on the public demand for radio, phonograph pick-up or microphone broadcasting of all types of public events occurring frequently throughout the year. The measure of profit to be derived by the professional set builder depends to a large extent upon his ingenuity, aggressiveness and willingness to work. Apparatus is available both in kit form and complete assembled manner with which to take care of any demand for the pick-up or broadcasting of public entertainments, so that the builder or dealer need not hesitate further on that score. The next thing to do is to find the jobs and work up the transaction.

Just as an indication of the widespread field before a local set builder or dealer using public address and other types of amplifiers, the following are some of the prospects readily accessible: phonograph owners, churches, restaurants, display rooms, tea rooms, apartment houses, poolrooms, clubs, Y.M.C.A., Y.W.C.A., filling stations, radio set owners, schools, broadcast stations, theaters, dance halls, hospitals, hotels, fraternal lodges, confectioners, drug stores, amusement parks, funeral parlors, roadside stands, railroad stations, beauty shops, dancing schools, charitable institutions and many others.

Let us say, for example, the local Kiwanis Club is going to stage an entertainment for the town, which involves speeches and music. Possibly it is to be an outdoor affair, or if indoor, an event that will require dissemination of the voice and music to all parts of the auditorium. The professional set builder, knowing of the event, immediately communicates with the chairman of the entertainment committee and proposes that a microphone pick-up be installed at the auditorium or the meeting place and suitable amplifiers be provided in different sections of the hall to insure every attendant being able to easily hear the proceedings. For this service a nominal charge can be made. Perhaps the entertainment committee does not wish to pay this charge. There is still a possibility that the owner of the auditorium would be a prospect for the actual sale of the apparatus as a means of broad-

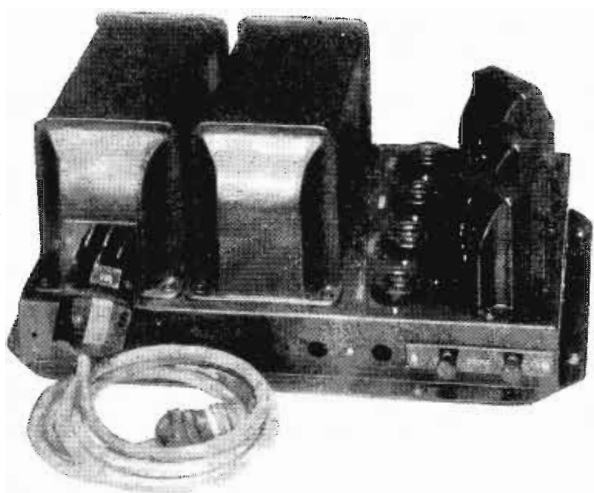


Fig. 1. This photograph represents the Samson PAM 16-17, which operates from a. c.

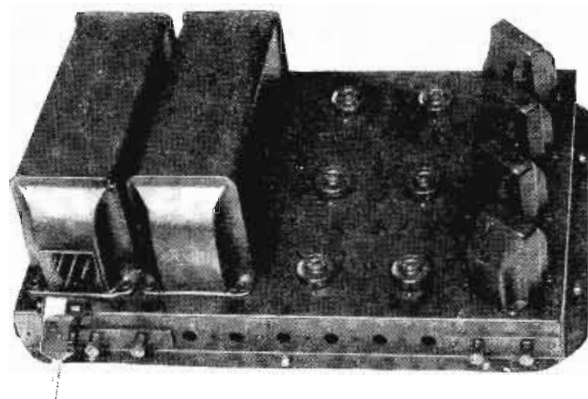


Fig. 2. In this photograph is seen the PAM 19-20, which is a full wave rectifier job

casting all local events occurring in that particular auditorium. Quite frequently when a rental proposition does not work out, it has been possible to sell outright the apparatus to the owner of a hall or auditorium.

Assuming that the local movie house makes use of only a piano during the run of a film, a phonograph amplifier and electromagnetic pick-up may be arranged for the amplification of the phonograph records through dynamic or other type speakers in the movie house, giving the patrons a wider diversity and better quality of music than would be normally obtainable locally.

The Samson PAM 16-17 shown in Fig. 1 is an alternating current operated amplifier using a 227, two 210's and one 281 rectifier tube. Thus, this amplifier is a two-stage amplifier with push-pull. The model 16 handles the standard type of speakers, while the model 17 has a provision for energizing the field of a dynamic speaker. This particular amplifier will furnish sufficient volume for fifteen speakers of either type, or 700 head sets.

The PAM 19-20, which is a three-stage affair, uses two 227's, two 250's in push-pull and two 281 rectifier tubes. The model 19 takes care of the standard speakers, while the 20 is used on the dynamic type. The capacity of this unit is 45 speakers of either type or 2000 head sets. In both of these models the well known Symphonic audio transformers are employed.

In addition to the two amplifiers previously mentioned, the Samson line includes the MIK-1, which has two 227's and a 280. It also comprises a microphone gain control and a rheostat for the microphone button current, together with a meter and switch to read microphone button current. It is a. c. operated and is adapted for use with the PAM amplifiers, where microphone pick-up is desired.

Another of the models in the Samson line is the PAC-2, which is the same as the PAM-16, except the fact that it supplies A, B and C current for alternating current sets, or B and C current for direct current sets. It consists of a 227, two 210's in push-pull, a 281 rectifier tube and a glow tube. This particular unit when used in conjunction with a small a. c. tuner suffices to make an exceptionally good radio set for quality reception.

# Tyrman Imperial 80 Shows Custom Built Design Progress

New Model Is Socket Powered Using Alternating Current Screen Grid Tubes; Has Built-in Power Supply

**T**HE progressive tendency in custom built receiver design is aptly expressed in the latest model bearing the Tyrman name and combines a number of features previously sought.

The Tyrman Imperial 80 to be described in this article is a completely a. c. socket powered receiver using alternating current shield grid tubes for radio frequency amplification and the alternating current heater type tubes for detection, oscillator and audio purposes.

### All Together

In order to simplify the design as much as possible and to put in the hands of the custom set builder a receiver which is compact and efficient, the Tyrman engineers decided to build the power supply on a common platform with all of the other radio apparatus. The power supply, which is completely factory assembled, matches the design of all other parts on the chassis and being an integral part of the whole system also contains the audio output transformer. The latest power tube, the 250, is part of the power compact and with the two 281 tubes for full wave rectification assures ample current for the receiver and sufficient undistorted output for the dynamic speaker recommended for use with the receiver.

An inspection of the schematic circuit in Figure 2 will show that the radio frequency circuit is a happy combination of transformer and impedance coupling, the former rendering the desired selectivity, while the impedance coupled stages assure the maximum amplification that may be expected from screen grid tubes.

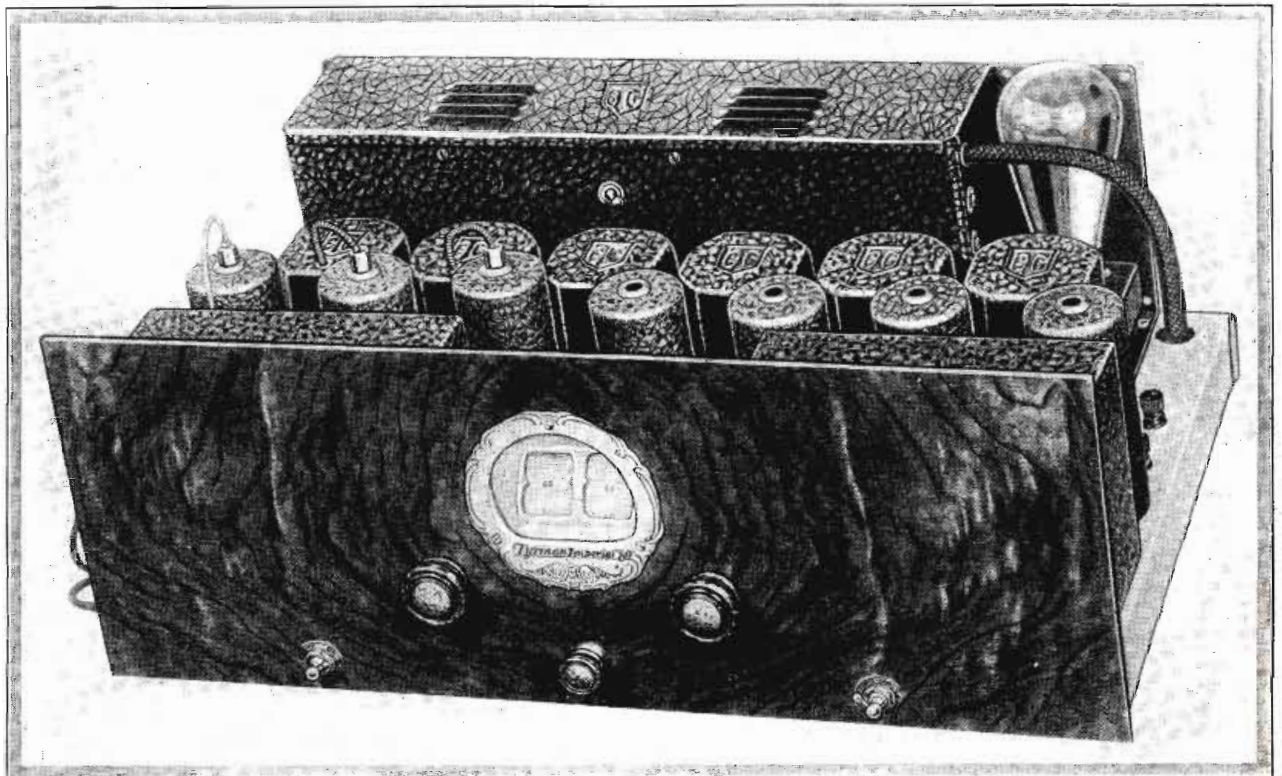
Although the designers have experimented with screen grid tubes since the early introduction of this type of tube, they find that actual

amplification per stage of 150 is not obtainable regardless of the circuit employed. These engineers find that after careful analysis of all screen grid tube receivers, it may be safely said that an amplification of 50 per stage is about the highest obtainable gain. The actual stage amplification in this receiver was measured by the designers as being 45 to 50 per stage. From that rate the total radio frequency amplification of the receiver, including the 227 applied to the last stage, would amount to nearly one million. However, it is stated that due to the interstage losses, this number was fortunately not reached, as it is obvious that no detector stage could be designed to take care of this voltage amplification.

Custom set builders, acquainted with the amplification possibilities of last season's Tyrman 70, however, will notice that the Tyrman 80 is a considerably more powerful receiver, with added selectivity and tone quality only obtainable with high voltage power amplification as applied in this system. The tonal performance is excellent, while the sensitivity on long distance signals seems to be equal to, if not in excess of the purest direct current operated set.

### Short Wave Coils

Another feature which bears important relation and which seems to be a question answered by some of the manufacturers this season is the importance of short wave reception. This question has been fully appreciated by the designers of the Tyrman 80 and a complete set of plug-in coils is furnished to cover the wave bands that are required by amateurs and those who wish to experiment with television systems. It has been stated that the shield grid tube has no special



*Fig. 1. Combining the receiver and power supply into a single unit, the Tyrman 80 should be well received by the custom set builders and fans in general*

(This receiver tested and all illustrations made in our laboratory)

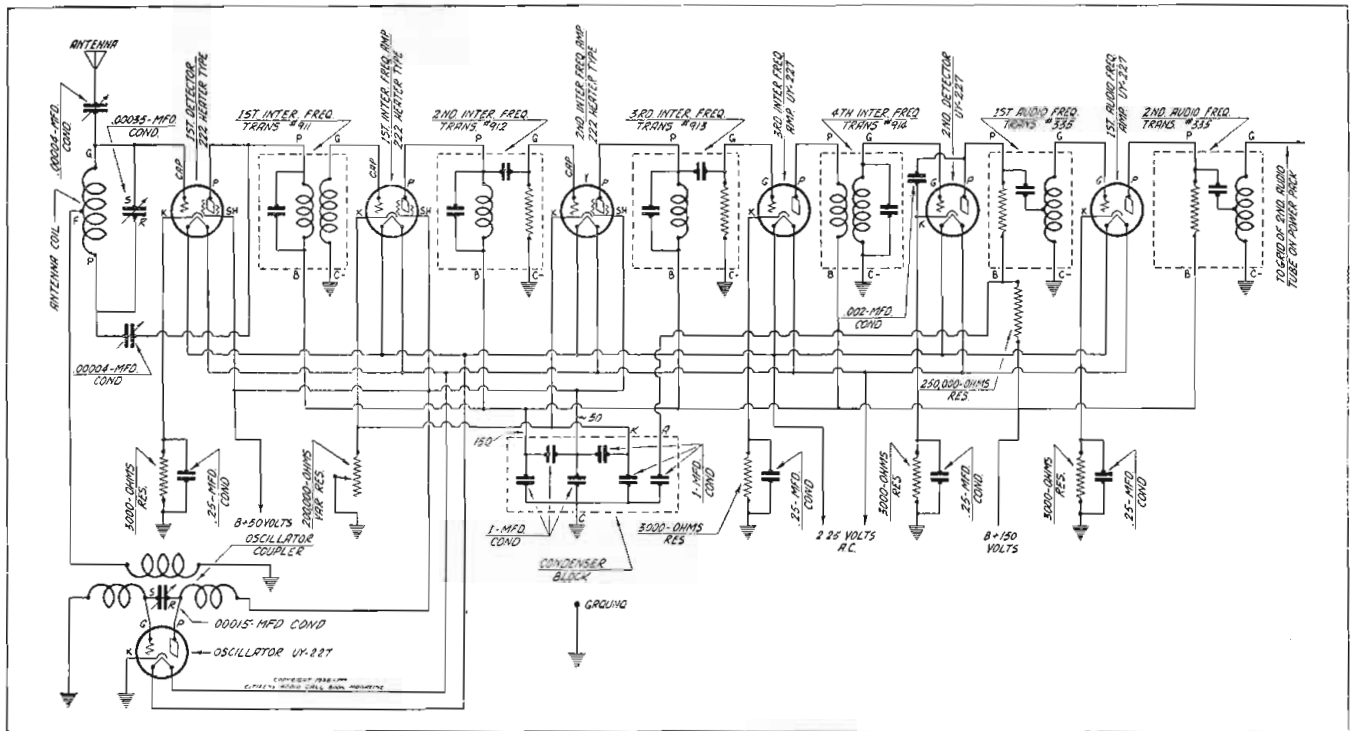


Fig. 2. The schematic circuit involved in the latest Tyrman model is shown above

advantages if used in ordinary short wave receivers and only in superheterodyne circuits will it be possible to make use of the great amplification possibility of that particular tube.

The appearance of the receiver is an elegant one and the form of construction meets the requirements of modern set building, containing as it does all safety factors as to the alternating current and high voltage operation. Symmetrical arrangement of all apparatus is predominant and in spite of the number of tubes employed and the incorporation of a complete power supply and 250 power amplifier, the Tyrman engineers succeeded in arranging all of the apparatus into a chassis which is only 21 inches long.

Craftsmanship is obvious in the parts used and especially predominant in the front panel layout, which contains a novel tuning arrangement known as the Tyrman vernier drum, which may be seen in the photograph in Figure 1. This instrument is of such high grade appearance that the designers feel that it will successfully compete with manufactured sets. The tuning condensers are driven by a worm drive gear and a positive motion without backlash is obtained.

Individual Biases

The schematic wiring diagram in Figure 2 will show many of the

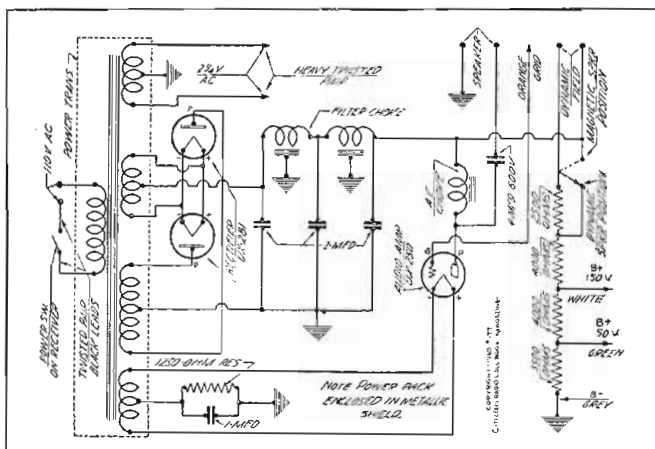


Fig. 3. The power supply schematic is drawn above

details and novel ideas employed in the receiver. An individual bias arrangement is provided for the first detector, third intermediate amplifier tube, the second detector and the first audio stage through the use of individual 3000 ohm resistances bypassed by 1/4 mfd condensers. In the case of the bias from the first and second intermediates, the bias is made variable by means of a 200,000 ohm variable resistance located between two cathodes and the ground and properly biased by a 1 mfd bypass condenser. In the case of the oscillator, the cathode is common with the ground, since no bias is required in this position. The screen grid terminals all receive 50 volts potential, which is supplied by the power supply included.

It will be noted by referring to the schematic that the pick-up coil of the oscillator is connected to the center tap of the antenna inductance. The first detector is regenerative, such regeneration being afforded by the .00004 mfd midget condenser between the plate of the first detector and the bottom of the antenna coil. A .00004 mfd midget condenser is also provided in series with the antenna binding post, so that the receiver may be balanced for different types and sizes of antenna.

In the schematic of the power supply shown in Figure 3, the design has been greatly simplified because of the fact that a metal chassis is used as a common ground, which enables each circuit to be grounded at the closest point. The power transformer has a 2 1/2 volt a. c. winding for the alternating current screen grid tube and the 227 heater type tube. A 7 1/2 volt winding supplies current for the filament of the 250 power amplifier tube, while another 7 1/2 volt filament winding energizes the filaments of the 281 rectifiers. The high voltage winding is across the plates of the two 281 rectifier tubes, while a heavy duty filter choke is placed in the positive line with ample bypass capacities to afford perfect filtration. An audio frequency choke is used in the plate circuit of the 250 tube, across which is placed a 4 mfd 600 volt coupling condenser for use with the speaker. A novel switch on the power amplifier enables the operator to use either a dynamic field in the resistance network by shorting out a 2500 ohm fixed resistor or use a regular magnetic speaker but leaving in the circuit the 2500 ohm resistor. The biasing arrangement for the 250 tube consists of a 1250 ohm resistance with a 1 mfd condenser in parallel located between the center tap of the filament transformer for the 250 and the ground.

A phonograph-radio switch, as well as binding post for attaching the phonograph pick-up, are also a part of the receiver.

# Citizens Shield Grid Booster for Use Ahead of Any Receiver

Simple Unit May Be Easily Assembled to Add Radio Frequency Pep to an Old Set

**T**AKING advantage of the anti-oscillation tendencies of the screen grid tube, to say nothing of its extreme amplification properties, the Citizens Shield Grid Booster Stage described in this article forms a sequel to the radio frequency amplifier using a Rice bridge circuit, which was described on page 91 of the March issue of this magazine. Since the publication of that article there have been many requests from professional set builders and experimenters in general for such a booster stage, using the well known screen grid tube. While this design of a booster was built some time ago, nevertheless it has not been prepared for publication until such a time as more experimentation could be performed on it with particular reference to the type of semi-tuned plate coil used. With this experimental work completed, the unit is now ready for publication and will be described in the ensuing article.

## Fixed Tune Plate

Essentially the circuit consists of an untuned primary winding on a 1½-inch form, the primary being located at the bottom end of the tube and consisting of 15 turns of No. 26 single silk wire. The secondary of this radio frequency transformer has 100 turns of No. 26 single silk wire on the 1½-inch tube, the overall length of which is ¾ inches. The inductance shown in the schematic circuit, figure 3, as being located in the plate circuit of the shield grid tube consists of 400 turns of No. 30 enamel wire on a 1-inch diameter form having a length of 5 inches. These particular coils have been made to our specifications by one of the coil manufacturers.

Reference to the schematic in Figure 3 will disclose the fact that the input circuit of the shield grid tube is tuned by the .00035 mfd variable condenser, while the output of the tube is of the fixed-tuned type, the peaking of the coil being accomplished by means of the 28.8 mmf Variodens located on the bottom of the stage. More data on the peaking of this plate coil will be given later in this article.

## Non-Inductive Condensers

Two radio frequency chokes are used, both being 85 millhenries, the first one being placed in series with the screen grid and the positive 67 or 90 volt terminal. This choke is bypassed with a ½ mfd condenser. It is essential that the non-inductive type of condenser be used. The second radio frequency choke is located between the lower extremity of the plate coil and the positive 135 volt terminal. It is likewise bypassed with a ½ mfd condenser and this too is of the non-inductive type. The shield in the booster stage is used as a common negative line, onto which

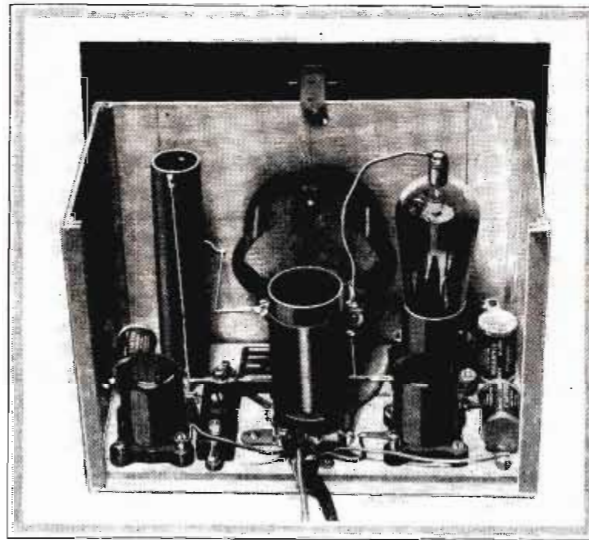
terminate the ground binding post, the ground terminal of the antenna coil, the filament terminal of the secondary coil, the rotor of the .00035 mfd tuning condenser, one side of the ½ mfd fixed condenser in the negative filament, one side of a 10 ohm fixed resistance in series with the negative filament, one side of a 5 ohm resistance, one side of the ½ mfd condenser bypassing the screen grid, one side of the ½ mfd condenser bypassing the radio frequency choke in the 135 volt line the rotor or movable plate in the variodens, and one side of the ½ mfd coupling condenser leading to the set ground. The filament switch and the 20 ohm rheostat used as a volume control are both located on the Formica front panel and are thus kept away from the shield.

Two output terminals of the Booster Stage will be seen. One goes from the plate end of the .0005 mfd fixed condenser, this terminal leading to the antenna binding post on any set. The second output terminal passes through a ½ mfd condenser common with the shield and then leads to the ground binding post on any set. This insures that regardless of the form of connection inside a receiver, that the addition of the booster stage will not cause a short circuit or otherwise disturb the circuit arrangement.

## Wires in Cable

Six wires of the Birnbach 7-wire cable terminate inside of the can with the following destinations: The black tracer goes to one side of the filament switch, the blue tracer goes to one end of the radio frequency choke in series with the screen grid of the tube, the red tracer goes to the positive filament terminal on the Benjamin socket, the brown tracer goes to the free side of the ½ mfd condenser between the socket and the variable condenser, the yellow tracer is grounded directly to the can, while the green tracer goes to one side of the radio frequency choke in series with the plate coil of the tube. The 7th wire in the cable is not used.

Two separate wires outside of the cable should be used, one for the antenna connection on terminal P of the radio frequency transformer and the other on the free end of the .0005 mfd fixed condenser, this latter wiring going to the antenna binding post on the receiver, whose signals are being boosted. It is not advisable to include either the outside antenna or the set antenna wires within the cable on account of the possibility of feed back or capacitive conditions. The free ends of the Birnbach cable are for use in attaching to the terminals of the A and B supplies used with the receiver. The C bias for the grid of the 222 tube is automatic and is obtained by the drop across the 10 ohm



*Fig. 1. This photograph represents the rear view of the Shield Grid Booster Stage described in the accompanying article*

(This unit designed, tested and all illustrations made in our laboratory)

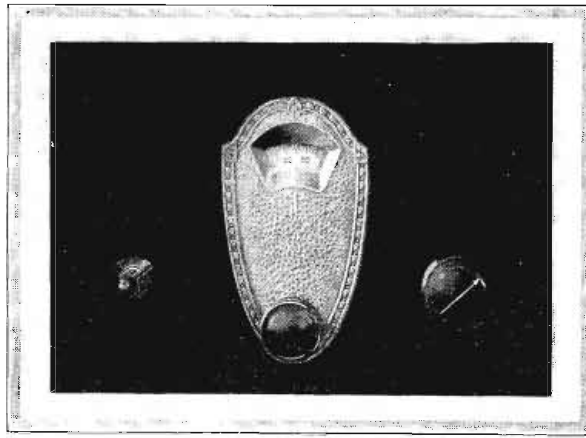
resistance between the negative filament of the tube and the common ground line. It will be observed that no provision has been made for a negative B terminal, inasmuch as that has already been supplied in the receiver ahead of which the booster stage is being placed. And the unit will work equally well regardless of whether the negative B connection in the receiver is made to the positive A battery or the negative.

**Peaking Plate Coil**

While the tuned input circuit of the 222 tube is continuously variable from approximately 200 to 550 meters, or a sufficient range to cover the entire broadcasting band, nevertheless the tuning of the plate circuit is semi-fixed in that it is set for a predetermined frequency and then left in that position. With the 400 turns of wire on the 1-inch diameter tube and the 28.8 mmf. Variodenser, it is possible to peak this plate circuit at the highest wavelength desired or at a fairly low one, although best results were secured when the set was peaked at a wavelength somewhere between 450 and 475 meters. Under certain conditions it might be desired to keep it even as high as 500.

In tuning the condenser select a distant signal at about 450 or 460 meters and then with a wooden stick sharpened like a screw-driver turn the screw on the Variodenser in a clockwise direction to increase the capacity until a point is reached where the distant signal is loudest. After the capacity has once been set in that position, it may be left alone and the receiver used as a booster stage. There will be no tendency on the part of the booster to go into oscillation as long as the screen grid potential is kept at a value of 45 volts or more, and as long as the receiver itself is not oscillating violently.

The experimenter may find it interesting to alter the amount of voltage required for the shield grid. Although the laboratory model worked best at values ranging between 67 and 90 volts on the shield grid, nevertheless there are occasions when 45 might



**Fig. 2.** There are only two controls on the front panel of the Booster Stage shown in the above photograph. The center control is that of the tuning condenser, while the right hand control is a 20 ohm rheostat for control of volume

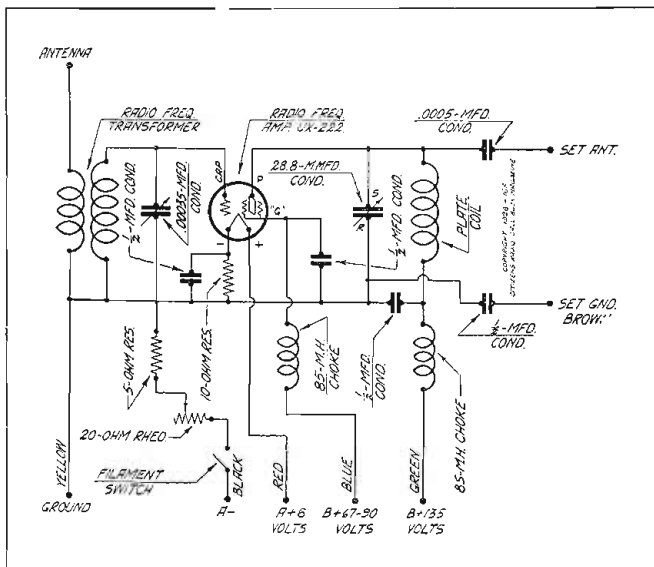
by trial whether a light socket antenna or a short wire inside the house will give the greatest volume.

**Official Parts List**

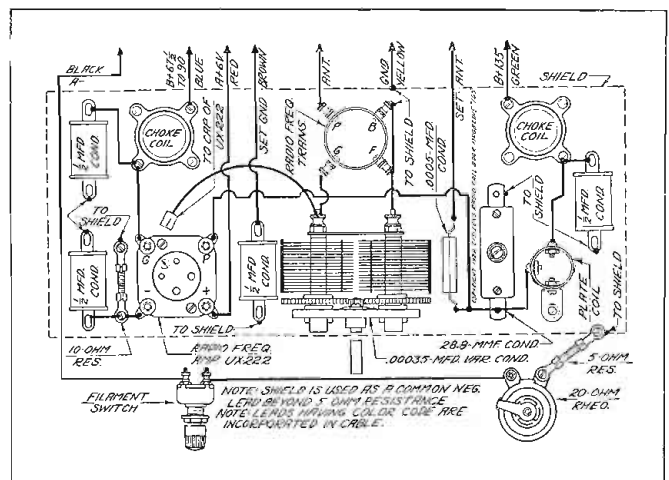
The following parts were used in the official model:

- |  |   |
|--|---|
| 1 Remler .00035 mfd variable condenser     | 1 Formica black front panel 7x10x $\frac{1}{8}$ inches                            |
| 1 Carter .0005 mfd fixed condenser         | 1 Formica ivory sub-panel 8 $\frac{1}{2}$ x4 $\frac{1}{2}$ x $\frac{1}{8}$ inches |
| 1 X-L type G-1 variodenser                 | 1 Birnbach 7-wire cable   |
| 1 Birnbach special .00035 r.f. transformer | 1 Benjamin UX socket  |
| 1 Birnbach special plate coil              | 1 National dial   |
| 2 Hammarlund 85 m.h. r.f. chokes           | 1 Carter filament switch  |
| 1 Carter 10 ohm fixed resistance           | 1 Aluminum Co. of America box shield  |
| 1 Carter 5 ohm fixed resistance            | 5 lengths Acme Celatsite hook-up wire   |
| 1 Carter Imp 20 ohm rheostat               | 1 pkg. Kester radio solder  |
|  | 1 Tobe light socket aerial  |
|  | 1 Ekko ground clamp   |
|  | Misc. lugs, nuts, screws, etc.  |

Assuming that electrical and physical characteristics are the same, the following items made by the respectively named manufacturers may be employed in the construction of a receiver similar to the one previously described:  
 Condensers, fixed: Acme, Aerovox, Dubilier, Muter, Porter, Sangamo, Tobe;  
 Inductances, r.f. and regenerative: Aerovox, Hammarlund;  
 R.F. chokes: Remler, Sanson;  
 Resistances, fixed, variable: Electrad, Frost, Yaxley;  
 Cable: Belden;  
 Sockets: Eby, Frost;  
 Dials: Hammarlund;  
 Switches: Frost, Yaxley.  
 Tubes: Ceco, Sonatrou.



**Fig. 3.** Examination of the schematic circuit shown in this illustration will give the builder an idea of the simplicity of the unit. On account of the coupling condensers placed inside of the can, the output of the unit may be attached to the input of any type of receiver regardless of how connected



**Fig. 4.** In this particular graphic diagram the parts have been placed exactly as shown in the photograph in Fig. 1, so that this illustration serves both as a layout and a graphic wiring diagram

# Sargent-Rayment Seven Receiver Using Screen Grid Tubes

Designers of the Infradyne Circuit Provide a New Set for Home Constructor to Build

WITH the present trend in receiver kits in which the builder only has a few wires to run, and in which the r. f., i. f. and audio systems are usually embodied within their respective shielding units, there remains but little after all for the home experimenter or professional set builder to do in making up a receiver. There are still a great many experimenters and seasoned fans who delight in completely assembling a receiver from standard parts and then securing the utmost efficiency possible by means of perfect balances in all stages. The Sargent-Rayment Seven receiver described in this article presents a rather striking design in that it has deviated from the conventional home built receiver design and in its completed form approximates the higher priced factory built receivers, but with the added feature of extreme flexibility which would be a pleasure to any radio veteran.

The receiver is named for Sargent and Rayment, who will doubtless be remembered as the designers of the Infradyne circuit, and is a seven tube radio frequency receiver having four individually shielded tuned r. f. amplifier stages, a detector and two high gain Clough audio amplifier stages. An inspection of the photograph in Figure 1 will show that the receiver consists of an aluminum shielding assembly, which acts as the cabinet for the entire receiver and at the same time an individual stage shielding for the various sections of the set. The cabinet is made up of a pierced aluminum chassis with edges turned down, to which are fastened a number of smaller formed pans, which serve as partitions between the respective stages. The front and back panels which are attached to the chassis and to all eight partitions complete the assembly. For the cover an aluminum sheet, the edges of which are turned over, is provided.

## Novel Rejector Stage

Examining the schematic circuit in Figure 2, a novel tuning method

will be found in the first radio frequency stage which comprises the antenna coupling coil and its associated screen grid tube. In contrast to general practice the antenna coil of this first stage is tuned by a different method than usually found. The antenna lead goes to one end of the coil and at the same time the cap of the 222 tube. The other end of the antenna coil is common with the lower end of the secondary, across which is placed a .00035 mfd variable condenser spanned by a .000025 mfd trimmer, the rotors of both condensers being common with the shield and the ground. It will thus be seen that instead of the antenna tuning taking place between the eap of the tube and the filament, that tuning is accomplished across the secondary so that this stage forms a tuned rejector stage. The coil having a winding of 20 turns of No. 28 d.c.c. wire spaced over a  $2\frac{1}{4}$  inch tube. This winding goes to the antenna circuit and the grid circuit of the first r.f. tube. Surrounding this coil and coupled closely to it is the secondary, which is similar to the secondary windings in the succeeding r. f. stages. This particular coil is tuned by the left-hand tuning condenser and although not in either the antenna or grid circuit, it serves to tune both of them on account of the close coupling. It, therefore, effectively rejects undesired signals without having its tuning effected by various lengths of antenna.

Examination of the photograph in Figure 1 will show that the energy from the antenna progresses from the antenna tuning circuit in the extreme left compartment of the aluminum shielding cabinet through the four stages of tuned r. f. to the detector in the sixth compartment. Four screen grid tubes are used in the r. f. stages and a 112-A for the detector. In the extreme right compartment is located the two stage audio amplifier and output transformer with a volume control. While the photograph seems to actually show only two audio transformers, nevertheless this is not the case, for the 251 output transformer is placed on top of the 256 second stage audio trans-

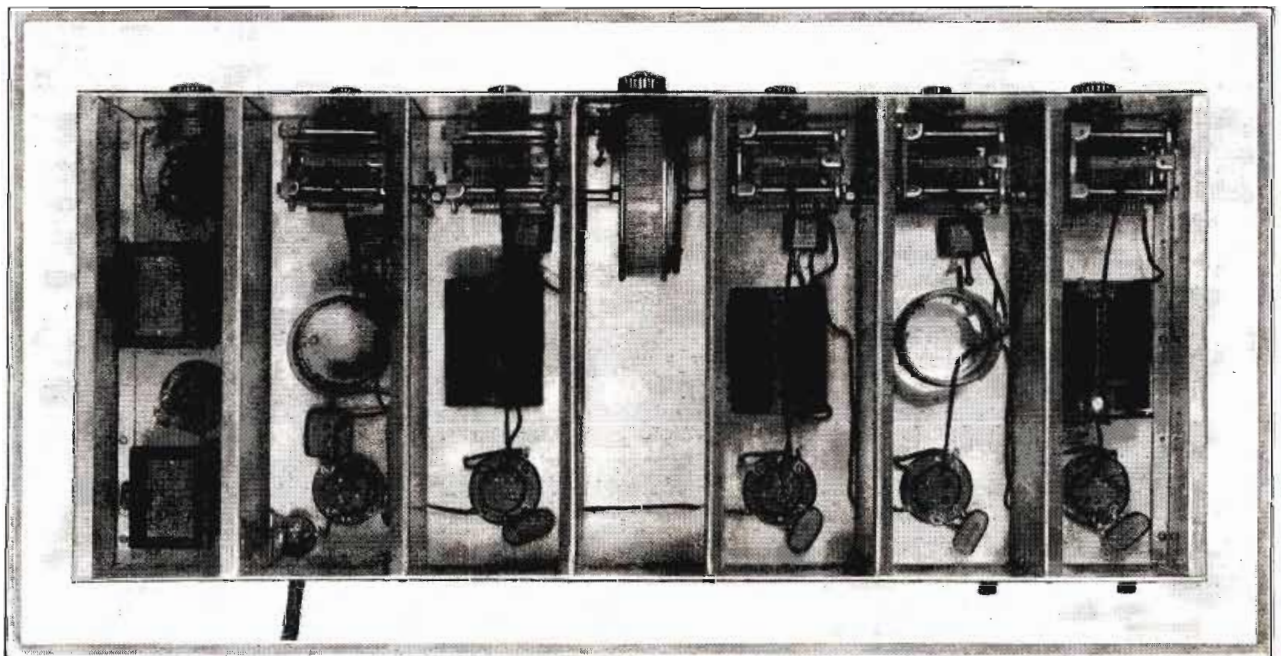


Fig. 1. This photograph shows the top view of the receiver with the shield removed

(This receiver tested and all illustrations made in our laboratory)



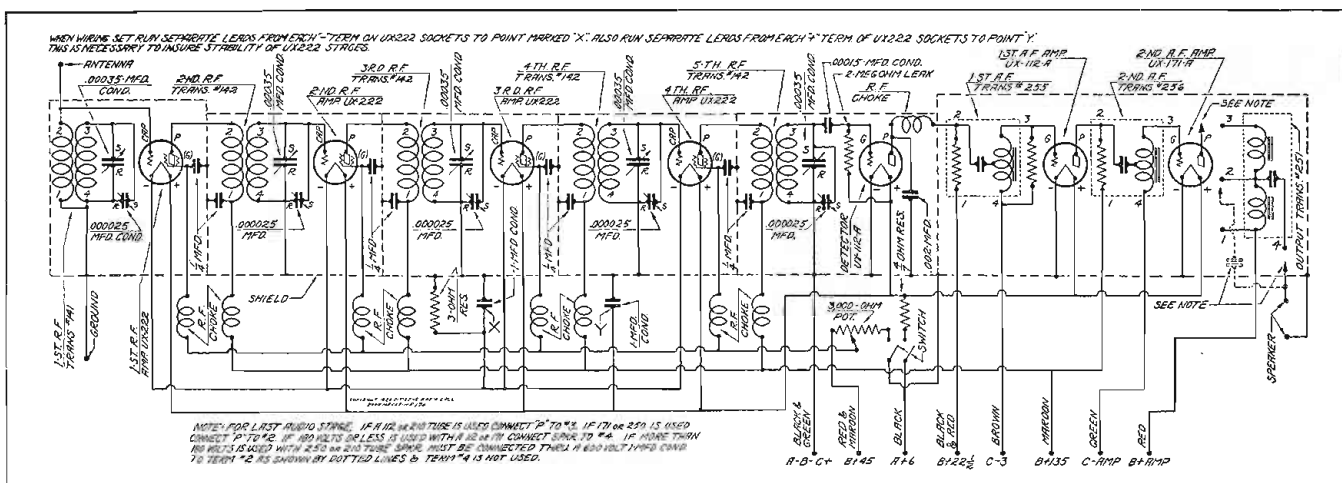


Fig. 2. The schematic circuit shown above gives all electrical connections required for hooking up the receiver after it is assembled

former. This is done on account of a desire to have everything included in the last compartment and saves considerable space. The drum dial, which turns all five of the tuning condensers, is located in the center compartment of the receiver. The depth of the large compartments is 12 inches, the height 6 inches and the width 4 1/16 inches. All of the metal work is of 17/64 inch aluminum, which provides satisfactory electrical shielding. The size of the complete shielding assembly is 27 7/8 inches long 12 1/2 inches wide and 8 1/2 inches high.

Plenty of Flexibility

While the receiver may be tuned by a single drum control, nevertheless for the experienced fan the utmost flexibility has been provided, allowing a very high degree of r. f. amplification, extreme selectivity and in general all of the attributes that the seasoned veteran interested primarily in radio receiver performance rather than furniture value would appreciate.

All of the four radio frequency stages consist of essentially similar tuning coils and tuning condensers, associated with 222 screen grid amplifier tubes, the necessary bypass condensers and choke coils to isolate the radio frequency component in each amplifier circuit. Each stage consists of a radio frequency transformer with a secondary winding of 72 turns of No. 25 plain enameled wire on a threaded bakelite tube 2 1/2 inches in diameter, the winding occupying a space 2 1/4 inches and the turns being spaced 32 turns per inch. To each of the interstage radio frequency transformer secondaries is coupled a primary consisting of 25 turns of No. 28 double d. c. wire wound upon a 2 1/4 inches threaded bakelite tube, which fits inside of the secondary at the filament end. The r. f. resistance characteristics of these coils are quite good and when tuned by the condensers used in the receiver excellent selectivity and amplification factors are obtained.

Examination of the schematic circuit in Figure 2 will show that the typical r. f. stage consists of the r. f. transformer, the .00035 mfd tuning condenser with its .000025 mfd midget vernier condenser, a tube socket for the screen grid amplifier tube, two 1/4 mfd bypass condensers and two radio frequency choke coils. Each amplifier circuit is complete in its own shielded compartment and the only leads carrying r. f. current running from stage to stage are the plate leads, which may be seen by consulting Figure 5, which shows a photographic view of the bottom of the receiver. One of the 1/4 mfd condensers is connected from the screen grid to the grounded shield and one from the positive B side of the r. f. transformer primary to the grounded shield. Electrical isolation is further insured by 2 r. f. choke coils, one connected in the screen grid lead and one in the plate lead of each r. f. amplifier stage. These r. f. chokes may also be seen in the photograph in Figure 5. An additional r. f. choke is used in the detector plate circuit to prevent any r. f. current from straying through the audio amplifier.

With all of these precautions the receiver is quite stable. However, when it is desired it may be made to oscillate. Analysis of the functioning of the screen grid tubes as r. f. amplifiers indicates that even though the plate to grid capacity of the tube has been reduced

to an almost negligible value, this value is still high enough to allow oscillation if sufficiently good circuits are used with the tube. Since efficient circuits have been employed in the receiver to provide as high amplification and selectivity as possible, the volume control has been combined with a stability control so that the r. f. amplifier stages may be operated at peak efficiency at every wavelength regardless of the tendency towards oscillation.

Measurements made by the designers show that repeater voltage gains varying from 17 at 550 meters to 30 at 200 meters are secured, these comparatively low values having been selected by the designers in order that the tuning circuit might have the advantage of the selectivity required by modern broadcasting conditions. The rising characteristic of the r. f. amplifier is compensated for by the tuned antenna input circuit, which has an opposite characteristic in that it shows greatest voltage step-up at 550 meters with a decreasing step-up at higher frequencies. The result is comparatively flat over all amplification curves for the receiver, which is due in part to the effect of the stabilizing control which decreases the screen grid potential of the amplifier at higher frequencies, thus decreasing their plate resistance and tending to hold the defective selectivity of the amplifier constant at all wavelengths.

The five tuning condensers are all connected together, and are operated by a single drum control dial, this connection being effected by means of the floating removable shafts, and flexible couplings arranged to link the condensers. The receiver can be tuned over the entire broadcast band with the single tuning drum, no difficulty being experienced in ganging, due to the high accuracy of the double spaced condensers employed. It was felt desirable to equip each stage with individual tuning verniers, however, so that there would be absolutely no question in the mind of the operator that his receiver could always be tuned to peak efficiency on any and all wavelengths in the broadcast band.

The construction of the receiver is quite simple, for there is available for it the complete shielding assembly, fully pierced, and requiring

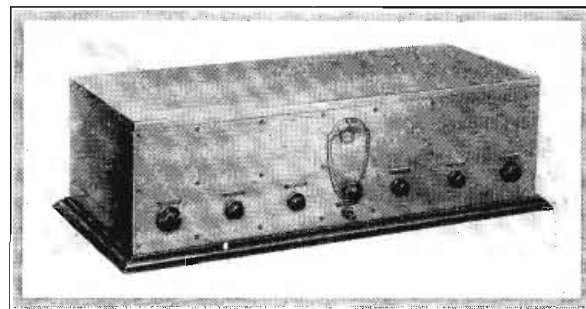


Fig. 3. This photograph represents the front panel of the receiver with its single tuning, driving and individual trimmer controls

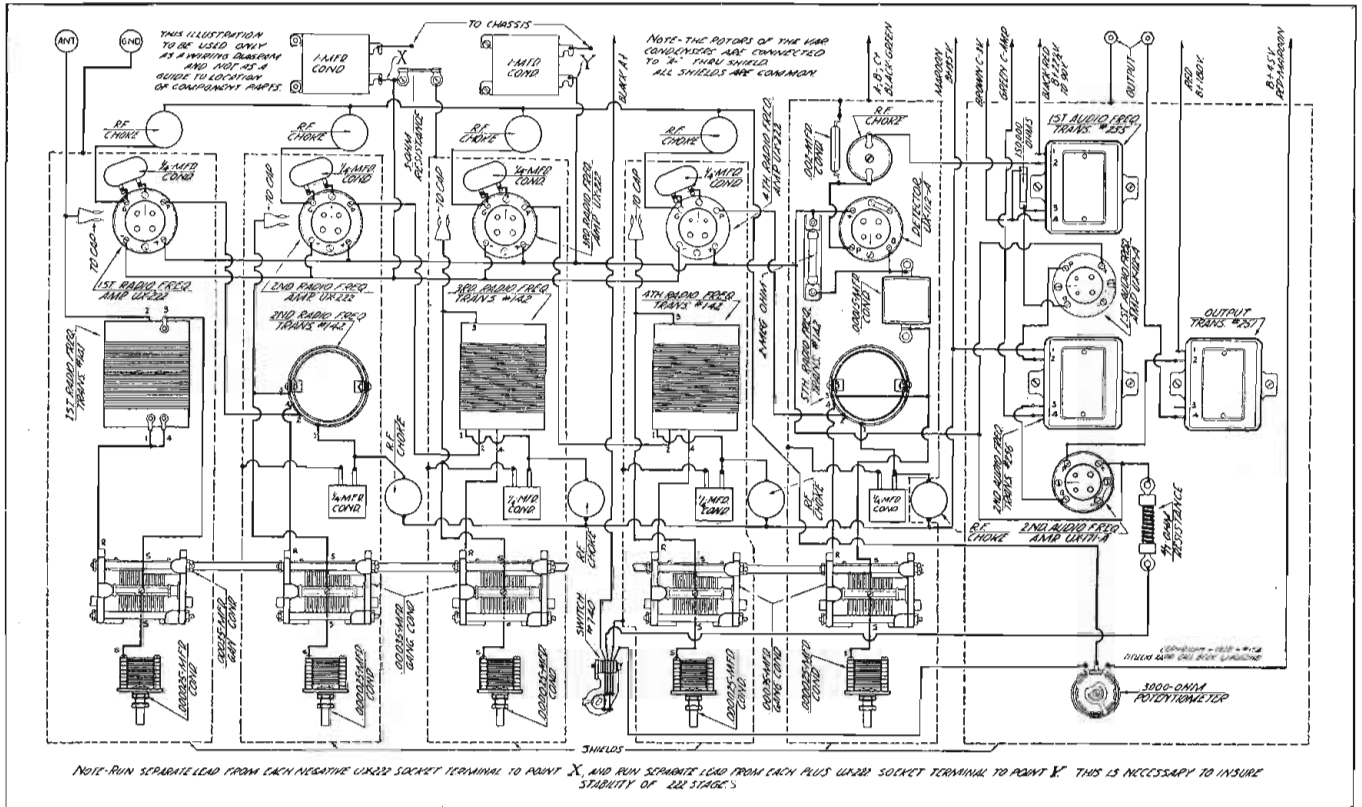


Fig. 4. The layman may wire up the Sargent-Raymont Seven by means of the graphic illustration shown above

only the insertion of some 88 6/32 screws with their nuts, to put it together. The use of this large number of screws to hold the shielding together is the result of an interesting observation made during the development of the set. At first an endeavor was made to use the simple and attractive corner-post assembly provided by a well-known manufacturer, attaching these posts to the chassis and slipping the partitions, ends, front and back panels into the slots of these corner posts. The result was a very attractive mechanical job, but of very poor electrical characteristics, for the electrical joints provided between the partitions and the chassis (and for that matter between the partitions and the corner posts) were of such a variable nature as to change the entire performance of the receiver. It was only necessary to strike the shielding with the palm of one hand to change the electrical contact between the different portions of the shielding.

The parts used in the Sargent-Raymont Seven are listed at the end of this article, and being of standard manufacture, may all be procured upon the open market, including the specially prepared aluminum cabinet assembly. The assembly of the receiver is quite simple, involving only the mounting of the parts upon the pierced chassis with machine screws, wiring them up and, finally, the attachment of partitions and front and back panels with the 88 machine screws previously mentioned. The wiring of the set is surprisingly simple for a receiver of this type.

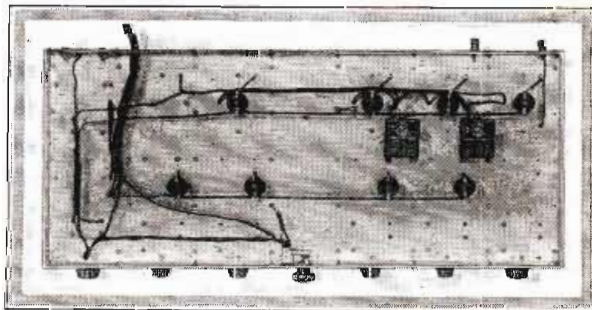


Fig. 5. This photograph shows the simplicity of construction on the bottom of the sub-panel and the relatively few wires required for connecting up the different sections

A point to be observed is that the plus and minus filament leads from the r. f. tube sockets must be run individually to the two 1 mfd bypass condensers. These leads may not be common or undesirable coupling will result.

Official Parts List

The following parts are needed to build the receiver described in this article:

- 1 Silver-Marshall 705 aluminum shielding cabinet with control legends
- 1 Silver-Marshall 706 walnut finish base moulding
- 1 Silver-Marshall 141 antenna coil
- 4 Silver-Marshall 142 r. f. transformers
- 5 Silver-Marshall 320-R variable condensers .00035 mfd
- 5 Silver-Marshall 340 .000025 mfd midget condensers
- 9 Silver-Marshall 275 r. f. chokes
- 7 Silver-Marshall 511 tube sockets
- 1 Silver-Marshall 255 first stage audio transformer
- 1 Silver-Marshall 256 second stage audio transformer
- 1 Silver-Marshall 251 output transformer
- 1 Silver-Marshall 708 ten-lead battery cable
- 2 Silver-Marshall 818 cartons hook-up wire
- 1 National type F Velvet vernier dial with illuminator
- 8 Sprague or Polymet 1/4 mfd condensers
- 1 Polymet .00015 mfd grid condenser
- 1 Polymet .002 mfd bypass condenser
- 1 Polymet grid leak mounting
- 1 Polymet 2 megohm grid leak
- 2 Potter 1 mfd bypass condensers
- 2 Yaxley 420 insulated tip jacks
- 1 Yaxley 53000-P Junior potentiometer, 3000 ohms
- 1 Yaxley 740 Junior switch double circuit
- 1 Durham 150,000 ohm resistor with leads
- 3 Hammarlund flexible shaft couplings
- 1 Carter H-4/7 resistor, .57 ohm
- 1 Carter H-3 resistor, 3 ohms
- 2 Eby binding posts
- 1 Set hardware, etc.

# Halldorson Shield Grid 56 Receiver

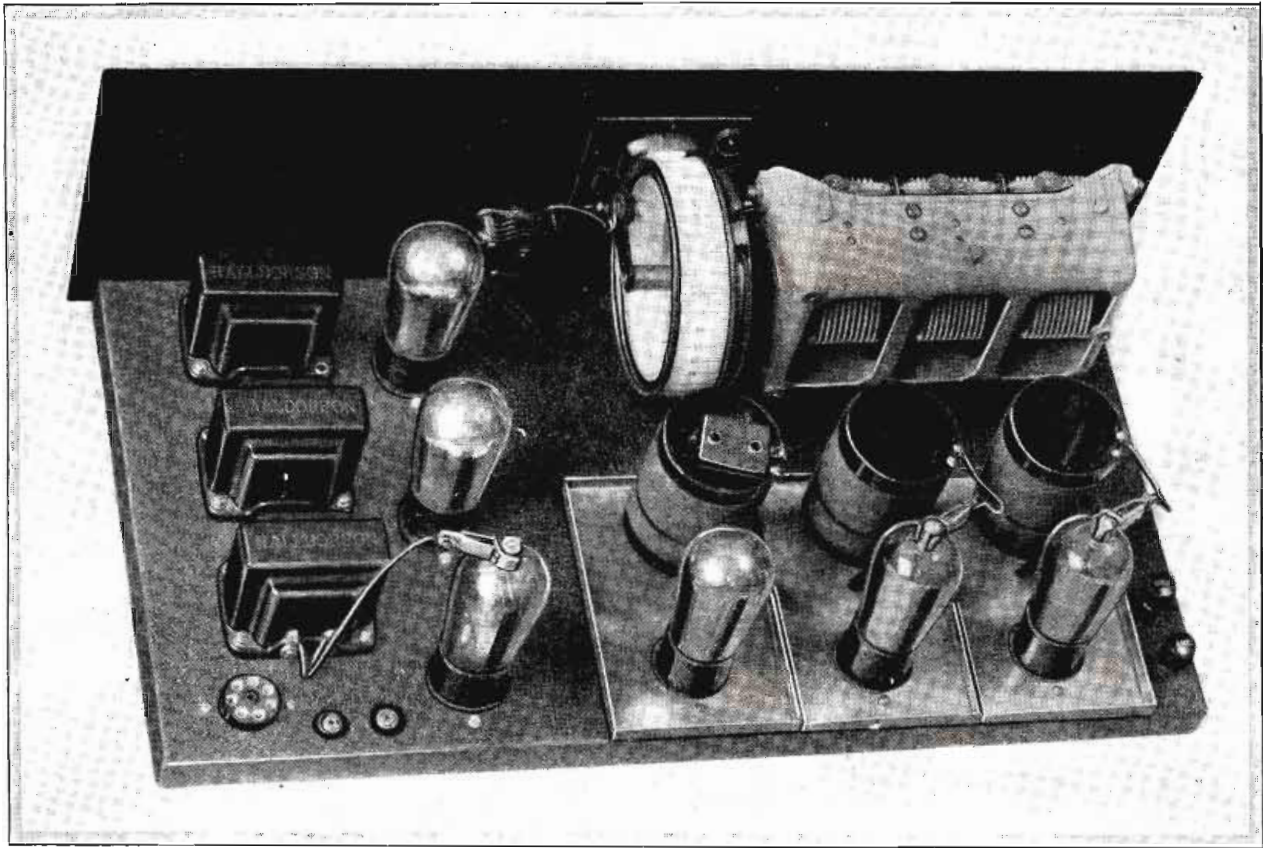


Fig. 1. This photograph shows a clear view of the rear of the Halldorson Shield Grid 56 receiver, with the three individual shielding cans removed from the r. f. stages

ONE of the most interesting receiver kits to appear on the market this season is the Halldorson shield grid 56 receiver, which is briefly described on this page.

Chief among the latest ideas involved in the receiver is the use of shield grid tube in both the radio frequency and first audio stages. The first two r. f. tubes are shield grid tubes operating in conjunction with special r. f. transformers, both r. f. and detector stages being totally shielded with polished copper shields.

### Shield Grid in Audio

Probably the most unusual departure from custom in the Halldorson kit is the use of shield grid tubes in the first audio stage. This is accomplished by means of a special audio coupling unit. This shield grid audio stage has a very interesting effect in bringing out weak

distant signals that are ordinarily of not sufficient strength to actuate the amplifiers. The second audio stage consists of two 171 tubes in a push-pull circuit, the output of which is sufficient for any of the present speakers to be operated with excellent tonal quality.

By an ingenious jack arrangement the set may be disconnected and the amplifiers used for phonograph purposes with volume and quality equal to the finest electrical phonographs. While the first model is announced for battery operation, the manufacturers state the kit will also be available for alternating current operation using standard a. c. tubes. The Halldorson interests are also manufacturing a complete line of power equipment, among which will be an ABC eliminator to supply all power for the a. c. receiver.

A study of the kit would lead one to infer that it would be an ideal one for professional set builders from a constructional standpoint as well as the operational. It further develops that the list price is to be low, which should place it within the reach of the average radio set buyer and in a good competitive position with respect to the factory made receivers.

### Official Parts List

Parts required for the construction of the Halldorson Shield Grid 56 receiver are:

- |  |  |
|--|--|
| 1 Halldorson escutcheon plate, single window                         | 1 7-wire multiplug and cable                   |
| 1 Front panel, mahogany finish, 7x21 inch                            | 2 Halldorson drum dials                        |
| 3 Halldorson copper stage shields                                    | 1 Halldorson trimmer condenser                 |
| 1 Halldorson three-gang condenser                                    | 1 Halldorson volume control and switch         |
| 2 Halldorson Overtone audio transformers, push-pull input and output | 1 Potter .002 mfd fixed condenser              |
| 1 Halldorson Overtone screen grid audio coupler                      | 1 Potter .5 mfd bypass condenser               |
| 3 Halldorson shield grid r.f. coils                                  | 1 Double circuit phonograph jack               |
| 1 Halldorson steel crystallyne sub-base with sockets attached        | 1 6 ohm rheostat with switch                   |
|  | 1 4 ohm resistance strip                       |
|  | 1 Assortment hardware, wire, screws nuts, etc. |

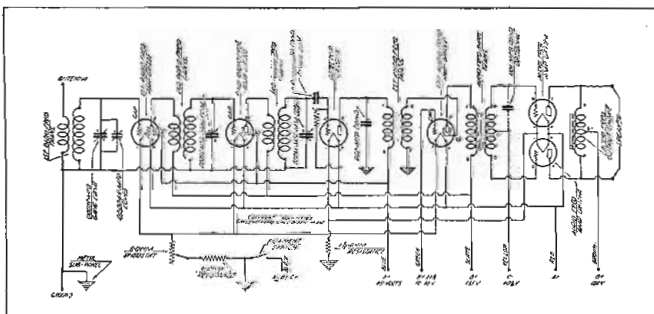


Fig. 2. Schematic circuit of the receiver is illustrated in the above schematic

(This receiver tested and all illustrations made in our laboratory)

# Lincoln 8-80 One Spot Super Kit

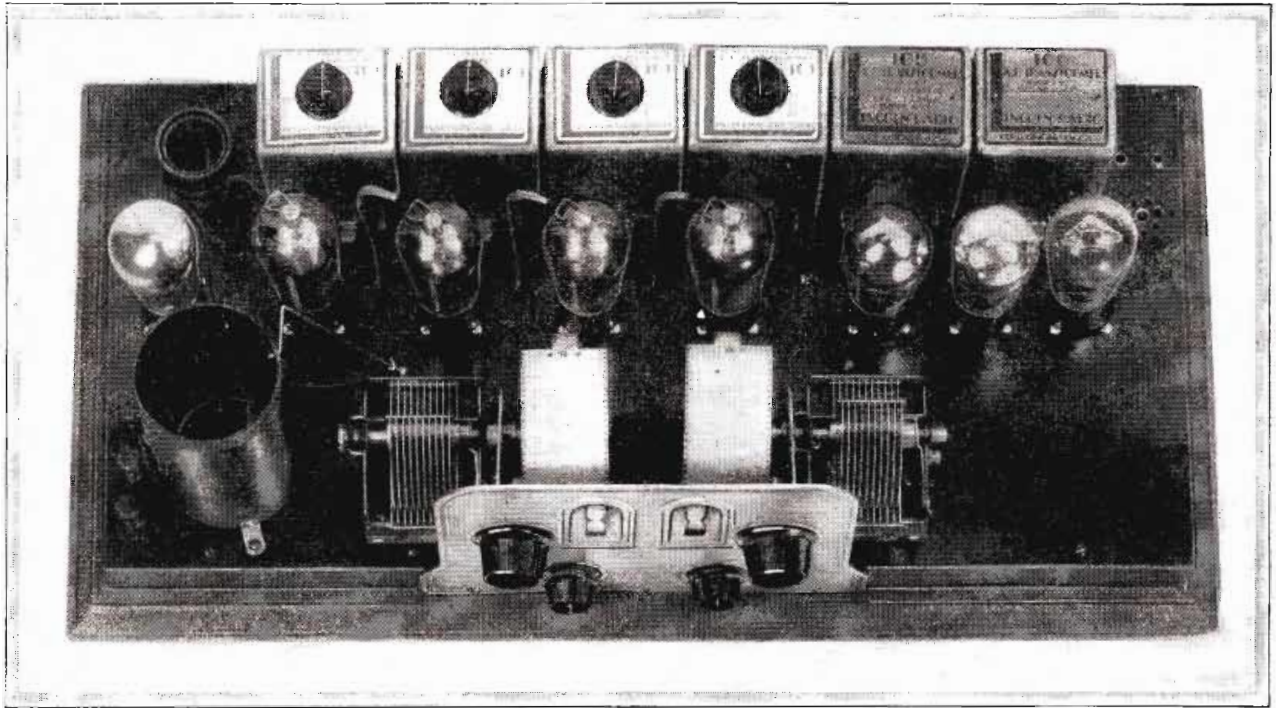


Fig. 1. The completely assembled and wired Lincoln 8-80 is shown in the above photograph

DESIGNED for economy and high efficiency through the use of screen grid tubes, the Lincoln 8-80 super is illustrated on this page. The set is provided with a tap on the antenna stage for short or long aerial. It utilizes four screen grid tubes, three 201-A's and one 171-A. The audio system is one that permits wide frequency range, absence of hysteretic distortion and a fullness of tone that is quite pleasurable. In contrast to usual super designs, the first detector uses a 222 tube. The receiver is obtainable in kit form and very little labor is involved in assembling all parts and wiring the set.

In the photograph on this page the left-hand drum dial controls the tuned input stage, while the drum on the right controls the oscillator. There are two refining controls, one being a 3000 ohm potentiometer for varying the potential applied to the screen grids, while the other is a 10 ohm rheostat that controls the filament brilliancy of the four 222 tubes.

Parts used in the construction of this receiver are:

- 1 Lincoln 102 oscillator coupler
- 1 Lincoln 103 antenna coupler
- 4 Lincoln 101 tuned IF transformers

- 1 Lincoln 105 first a.f. transformer
- 1 Lincoln 106 second a.f. transformer
- 2 Lincoln 104L and 104R .00035 condensers
- 1 Lincoln escutcheon control panel
- 1 Sub-base  $2\frac{1}{8} \times 9\frac{7}{8} \times \frac{1}{8}$  inches
- 8 Tube socket assemblies
- 2 Wood sub-base supports  $2\frac{1}{8} \times 1\frac{1}{8} \times 5\frac{1}{8}$  inches
- 1 8 lead battery plug and cable
- 1 Silver-Marshall 806L (left) drum dial
- 1 Silver-Marshall 806R (right) drum dial
- 6 Potter 104 1 mfd condensers
- 1 Aerovox .002 mfd condenser
- 1 Aerovox .00015 mfd condenser with clips
- 1 Aerovox 2 megohm grid leak
- 1 Yaxley 53000-3000 ohm potentiometer
- 1 Yaxley 10 ohm midget rheostat
- 2 Yaxley 420 tip jacks
- 3 Binding posts
- 1 Carter H-4/7 .57 ohm resistor
- 4 Carter RU10 10 ohm resistors
- 1 Silver-Marshall 275 r.f. choke
- 1 Yaxley 500 switch attachment
- 4 Ceco or Sonatron 222 tubes
- 3 Ceco or Sonatron 201A tubes
- 1 Ceco or Sonatron 171A tube

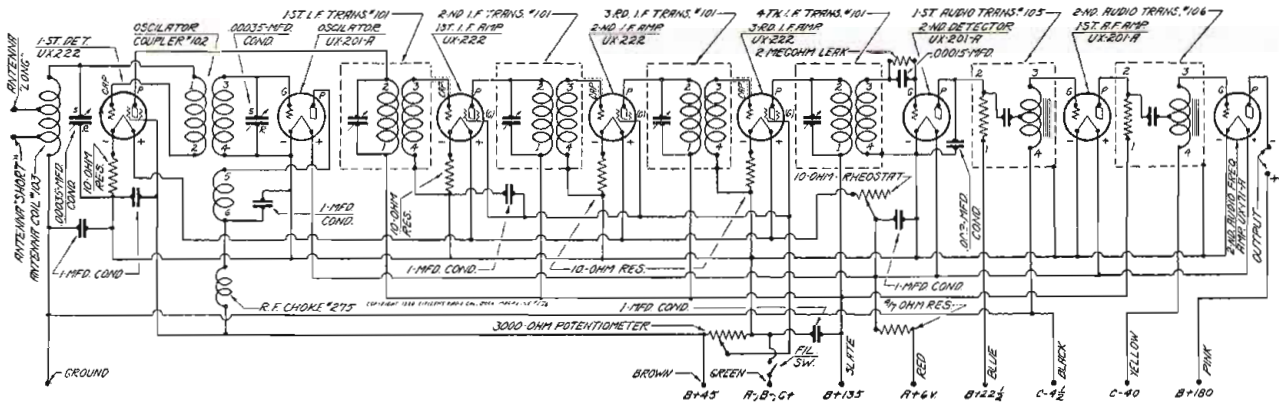


Fig. 2. This drawing gives the electrical constants of the circuit involved in the receiver described briefly herein (This receiver tested and all illustrations made in our laboratory)

# How to Make an Ohmmeter

FEELING that many professional set builders would be very glad to have a simple, inexpensive means of testing the resistance of various circuits, the technical staff of the CITIZENS RADIO CALL BOOK MAGAZINE has recently designed for such purposes the ohmmeter to be described in the following article.

The unit is simple and compact and although shown in the photograph in a small carrying case, if desired it may be built up for standing upright on the work bench.

The instrument has three measurement ranges. Referring to the schematic shown in Fig. 1, if the switch is thrown to the 1 and 2 position and the 0 terminal and the 1 terminal placed across a circuit to be measured for resistance, the range on that particular setting will be from 20 to 240 ohms. If the switch is left in the 1 and 2 position and the circuit to be measured placed across terminals 0 and 2, the range of the instrument will be from 80 to 1040 ohms. When desiring to make higher resistance measurements than the two foregoing ones, the switch is turned to position 3 and the circuit to be measured placed across terminals 0 and 3. Under these conditions the resistance range is from 4000 to 52,000 ohms. The exact values of resistances may be learned by referring to the graph shown in Fig. 3. All three curves are placed on the one graph.

When measuring a resistance, the 0-1 millimeter is set at the maximum reading of the meter by means of the rheostat pertaining to that particular job. For example, for measuring a resistance from 20 to 240 ohms, the switch is thrown in the 1 and 2 position, terminals 0 and 1 are shorted, the left-hand rheostat is then turned until the milliammeter reading is exactly full scale. The terminals 0 and 1 are unshorted and placed across the resistance to be measured. The needle of the milliammeter will then show a corresponding decrease from the maximum reading on account of the resistance placed in the circuit. The exact value of resistance is determined by referring to the chart. The same principle applies for the reading from 80 to 1040 ohms, while the zero adjuster rheostat for the high resistance readings is the one at the right in the photograph, Fig. 2.

The Citizens Radio Engineering Laboratories will be glad to calibrate these instruments for professional set builders at a nominal cost and furnish a chart with such calibration.

### Official Parts List

Parts used in the construction of the ohmmeter are: —

- 1 H24 Carter 24 ohm fixed resistor.
- 1 H200 Carter 200 ohm fixed resistor.

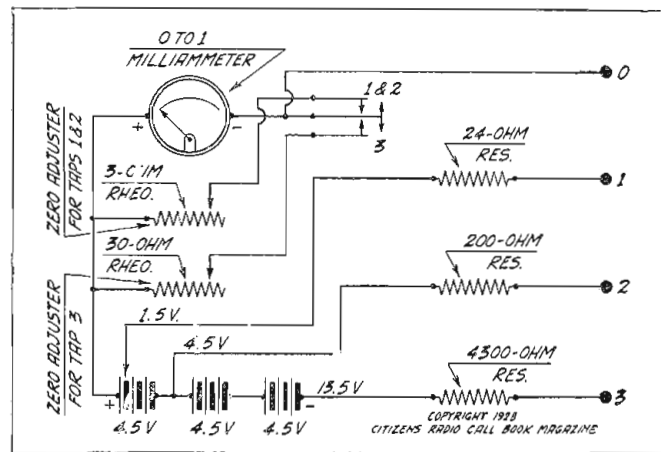


Fig. 1. The schematic circuit used in the ohmmeter is shown above

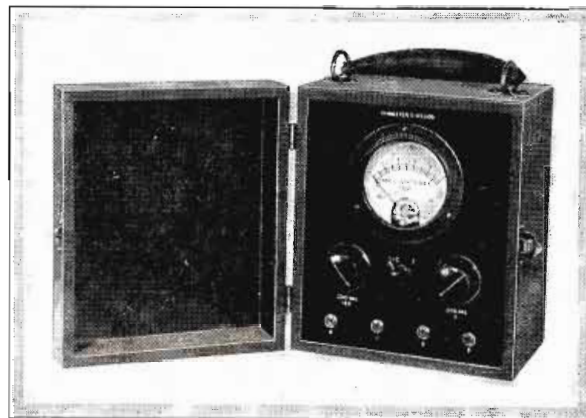


Fig. 2. This picture represents the finished product in an attractive carrying case

- 1 P-5-4300 Carter 4300 ohm fixed resistor.
- 1 IR-3 Carter 3 ohm rheostat.
- 1 IR-30 Carter 30 ohm rheostat.
- 1 Celeron 6 1/2 x 7 3/4 x 3 1/4 inch black front panel.
- 1 V-22 Carter jack switch.
- 4 10 Carter pin jacks.
- 2 Carter Imp plugs.
- 1 64 Jewell 0-1 milliammeter.
- 1 Package Kester radio solder.
- 3 Lengths Acme Celatsite hook-up wire.

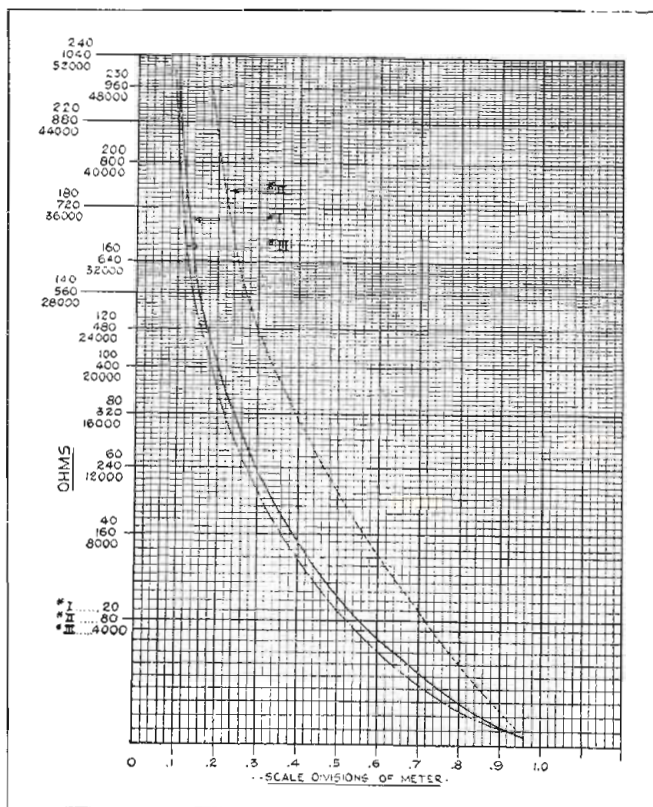


Fig. 3. This graph shows the three ranges of the ohmmeter, as explained in the text

(This ohmmeter designed, tested and all illustrations made in our laboratory)

# Notes on Practical Television

Seasoned Radio Man Now Has New Field for Experimentation Which Harks Back to Days of the Crystal Detector and the Loose Coupler

**T**ELEVISION for public entertainment is not here today. However, in its stead we have television in its embryonic stages, comparable in results to our experiences with radio eight and ten years ago. What is more, we have today a hardy band of experienced radio men and technicians already busily engaged in applying to television all of the lessons that have been learned by the industry during the course of the last ten years, with the hope of accelerating the rate of progress on this art to such a degree that less time will be required to place television in the home than was the case with the reception of music by radio.

## How to Get Pictures

Realizing intense interest on the part of our readers in this new art, which is even possibly more absorbing than that of radio as far as the experimenter is concerned, we have been doing preliminary work on the various types of television transmission during the past summer, and now after this work has been completed we are prepared to place before our readers definite instructions on practical television, the following of which will enable them to see movies or stationary images the same as our technicians have done in the laboratory.

One of the first steps necessary before deciding upon the method of reception was to determine which of the several transmitters we desired to intercept. Considerable study was devoted to this particular phase of the subject, because of the fact that since this article was to appeal to the greatest number of our readers, it would be imperative that we do our preliminary work on a station whose signal would cover the greatest territory. It was felt that even though a transmitter might have a terrific signal strength over practically the entire area of the country, nevertheless if such transmission were carried on in the daytime, it would be of practically no value to our readers, because of the fact that most of them are otherwise occupied during the day hours. It was, therefore, vital that we decide upon a station whose transmission was carried on at a reasonable hour during the evening and also whose signal could be picked up over a wide area.

This led to the reception of signals during early July from station 3XK, at Washington, D. C., maintained for experimental purposes by C. Francis Jenkins, a pioneer in the movie and television art. Signals from his station were received for several evenings and their average intensity noted before it was finally decided to adopt the Jenkins transmission as standard for our tests and for recommending these signals to our readers.

This policy having been adopted, we proceeded with the construction of a short wave receiver to pick up the signals on 46.72 meters, a resistance coupled amplifier with which to amplify the signals, and a scanning disc with its associated motor and neon

tube. It developed quite fortunately during the course of our investigation that although the Jenkins transmitter could be best followed with the drum scanner invented by Mr. Jenkins, that nevertheless any flat disc with a parabolic set of 48 holes could be utilized by the experimenter in picking up moving images from 3XK.

## We Get a Thrill!

We frankly believe that the thrill of hearing music out of the air ten years ago does not compare to the feeling of exhilaration when gazing for the first time, in a darkened room, at a revolving disc and seeing thereon moving silhouettes. While the marvel of radio reception has become accepted as a commonplace event, we now have the enthralling mystery of transmitting through the air a scene occurring 600 or 700 miles away. Where in the past our ears have been delighted with music, we are now to be entertained by our eyes.

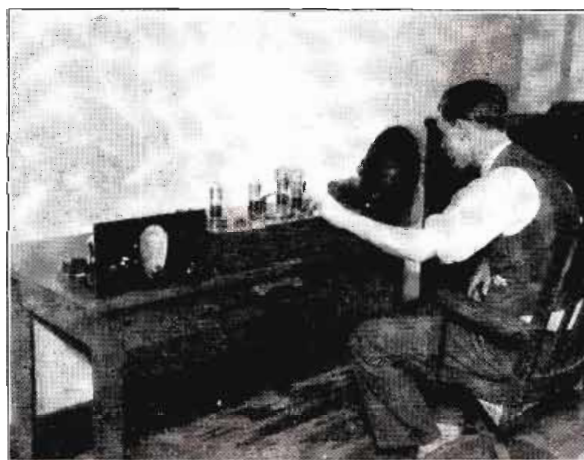
Although with the extreme amplification required for a heavy signal to be impressed on the neon tube, considerable static may be encountered during the summer-time even on the short waves, nevertheless the experimental results achieved by the staff of this magazine have been highly satisfactory, considering the state of the art. In the case of the Jenkins transmission, we have repeatedly seen a moving silhouette of a girl bouncing a ball in the childish game "O'Leary." We have also seen a moving silhouette of a shadow boxer and have witnessed the sub-title "The End" at the termination of the film. While it is true that these silhouettes are of two dimensions only, width and height, nevertheless it is anticipated the remaining dimension will soon be forthcoming and we will then have ample detail on

the pictures to satisfy even the most discriminating.

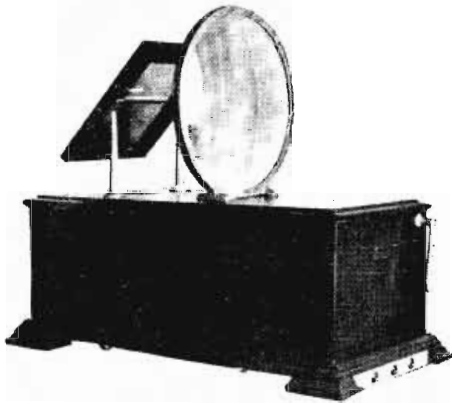
While some of the other stations have been experimenting with the transmission of still pictures or of faces, we have felt that the transmission of radio movies had more romance than any of the previous systems and for that reason we have in this article decided to describe that method of reception. The technique of transmission we will leave to those engineering journals interested in that subject; our main interest from the standpoint of our readers is in the reception, and the following notes will serve to acquaint the experimenter with the steps necessary to witness radio movies.

## The Jenkins Schedule

Station 3XK at present has a schedule every Monday, Wednesday and Friday nights at 8 p. m. Eastern Standard Time and lasting for an hour, on a wave length of 46.72 meters. Any of the good short wave hook-ups will permit picking up the signal from this station. Announcements by 3XK are made both in code and voice, for the benefit of all who are listening in, and a statement

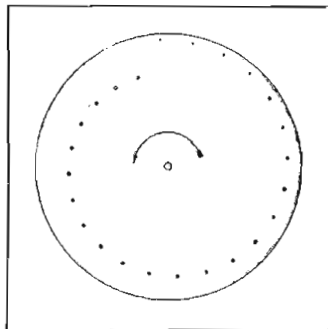


*Fig. 1. Experimental television set-up is shown in the photograph above, with the short wave receiver at the left, the amplifier in the center and the Daven disc and motor at the right. The technician is looking through the top of the scanning disc, in the rear of which is located the neon tube*



**Fig. 2.** This photograph shows the drum scanner recently invented by Jenkins, which may shortly be on the market. It consists of a motor, the drum scanner, a mirror and a magnifying glass. With this Jenkins scanner images 6 x 6 inches may be secured

is made as to what picture will be transmitted. In the early July tests the program consisted exclusively of the film depicting the girl bouncing the ball. In later tests this same film was used only a portion of the time and the remainder of the hour was taken up with one or two short films showing a shadow boxer and then one of a young lady dancing and enjoying herself on the beach. Later it is anticipated that more complex subjects will be transmitted. The type of signal received when 3XK is transmitting pictures is one that has a fluttery note, which changes somewhat in intensity in accordance with the frequency of the subject being scanned. Reception is only possible when the signal is tuned exactly to resonance and in a slightly regenerative state. If the receiver goes into oscillation, the picture goes out. By the same token, if the receiver is not absolutely in resonance with the transmitter as far as wavelength is concerned, the picture is dim and even non-existent.



**Fig. 8.** A twenty-four hole scanning disc is shown in the above drawing. The 48 hole disc is the same except it has twice as many apertures. The arrow shows direction of rotation for 3XK reception

Short wave reception methods being already well known, we are skipping that portion of the circuit shown in Fig. 5, only stopping long enough to make a suggestion that the experimenter use grid battery rectification instead of grid condenser and leak. This is suggested for two reasons, the first on account of the greater stability of the detector and consequently less tube noise, and the second because an even number of resistance coupled stages may be utilized. A third advantage should be noted in the use of the 50,000 ohm variable resistance across the tickler coil as a regeneration con-

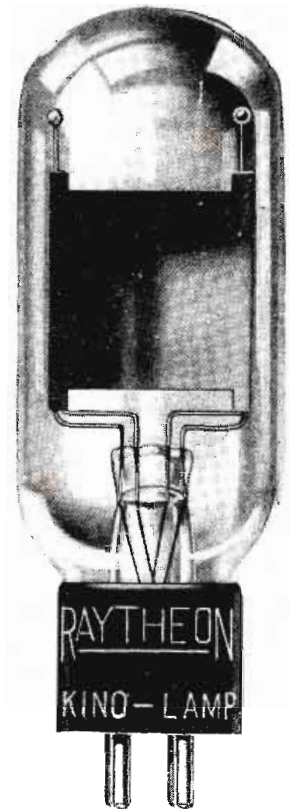


**Fig. 3.** This photograph shows the motor, drum scanner and the neon tube, the latter going in the center of the drum. This Jenkins scanner is now being used by several experimenters in picking up signals from 3XK at Washington, D. C.

rol instead of the series resistance, because of the fact the output of the detector tube is coupled across a resistance into the input of the resistance coupled amplifier and in this position it is not desired that the resistance of the input circuit be constantly varied.

The middle section of the schematic shown in Fig. 5 represents the four stage resistance coupled amplifier, with an arrangement whereby a pair of head phones may be carried across the coupling resistor of the third tube, which will allow the operator to listen in at the same time that the picture is being received. The last tube is a 171-A in whose plate circuit is located the neon tube and the milliammeter. The grid circuit of the 171-A has its necessary bias, about which more will be related here. The method of coupling the neon tube to the plate circuit of the last audio tube is merely one of the several means which may be utilized. This particular scheme was used on account of its extreme simplicity. However, attention should be called to the

fact it is quite likely that more than 180 volts will be required to ignite the neon tube, because its striking potential is somewhere around 220 volts. The neon tube is shown in the photograph in Fig. 4 and comprises two flat metal plates, placed parallel and very close together. Rigidity of the plates is obtained as a result of the novel system of bracing. The plates are approximately  $1\frac{1}{2} \times 1\frac{1}{2}$  inches, and the glow over the cathode plate is exceedingly uniform. Either plate may be used as the cathode by interchanging the base connections. The tube has been so designed as to have a dynamic impedance of about 1500 ohms in order to permit its operation directly in the plate circuit of a 171 without resorting to the use of impedance adjusting transformers. The Raytheon lamp shown in Fig. 4 draws 15 milliamperes at 220 volts. This tube when ignited has a pinkish light, which is observed through the holes in the scanning disc. In connecting the tube into the circuit, the plate of the neon tube (the plate terminal of the socket), should go to the plate of the 171-A. The milliammeter is not absolutely essential, although it serves to warn the operator when excessive current is being used. The neon tube lights and extinguishes itself in exact accordance



**Fig. 4.** A neon tube is required for television work and the one shown here is made by Raytheon, a description of which will be found in the text of this article

with the voltage fluctuations applied to it by the incoming signal. This rapid extinguishing and lighting cannot be seen by the unaided eye. Hence it is necessary to have an interpreting device which will permit the eye to perceive or translate these rapid lighting changes into a definite light frequency perceptible to the eye. This is where the scanning disc comes into play. The disc rotates at approximately 900 r.p.m. and the 48 holes placed on a parabola on the disc traverse the  $1\frac{1}{2} \times 1\frac{1}{2}$  inch plate of the neon tube at such a rate that 15 pictures per second are visible. This is the minimum number of pictures per second allowed without flicker. While the disc rotation at the transmitter may be clockwise and scanning from the top left towards the right, nevertheless at the receiver the disc should be rotated counter-clockwise so as to scan from the top right to the left. (See Fig. 8.) Of course, if the transmitter is scanning from the top right to the left, then the receiver will have to scan from the top left to the right. If the operator finds that his image is upside down,

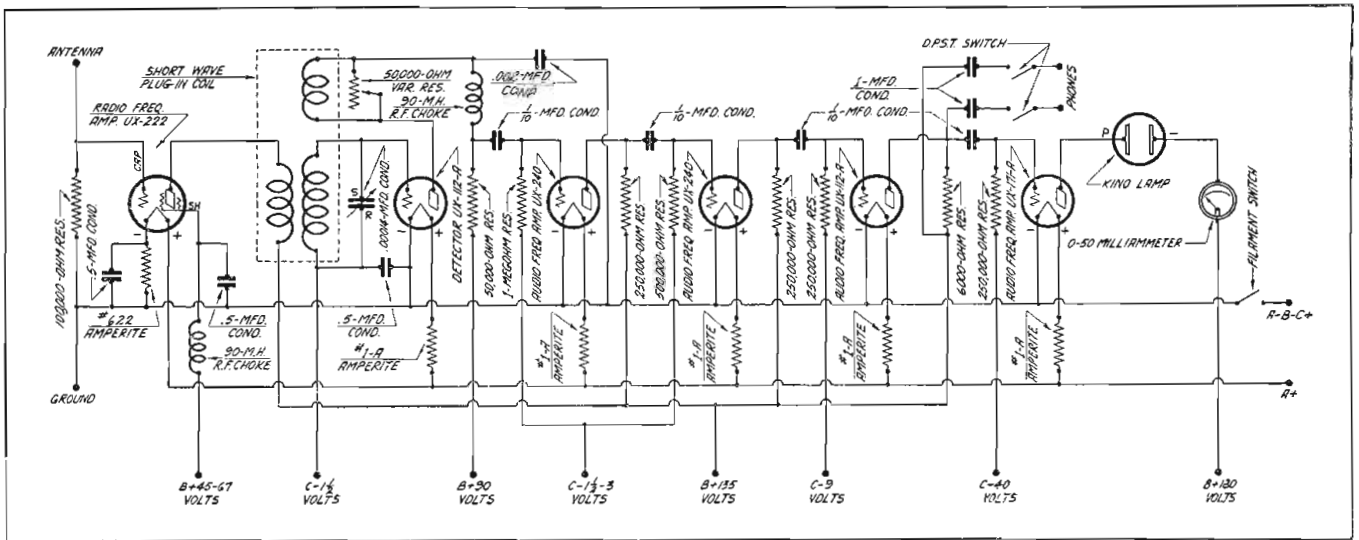


Fig. 5. The schematic circuit shown above illustrates the basic connections involved in a television amplifier suitable for picking up signals from 3XK

he will have to turn around the disc or else reverse the direction of the motor rotation. However, for the Jenkins reception, if the operator will arrange his motor so that when he is facing the shaft of the motor it turns in a counter-clockwise direction, and so that the top hole of the parabolic series will turn towards the left, then he is assured of getting pictures right side up.

It should be noted in connection with the schematic, Fig. 5, that if the grid leak and condenser rectification is used in the detector, it would then be necessary to have a five stage amplifier instead of a four, because of the fact that the detector acts as an amplifier stage and reverses the image to be secured. With a circuit like the one shown in Fig. 5, the image received is black and the background is pink. If one more stage were added to the amplifier or one less were used, then the image would be pink and the background would be black. For general purposes it may be stated that for grid leak and condenser reception, the stages should be odd, whereas for the grid bias rectification the stages should be even. When the image is pink, it is said to be a negative, and when the image is black it is said to be a positive. As a rule the transmitter is sending positive images which the receiver may convert into negatives or positives by the number of stages used.

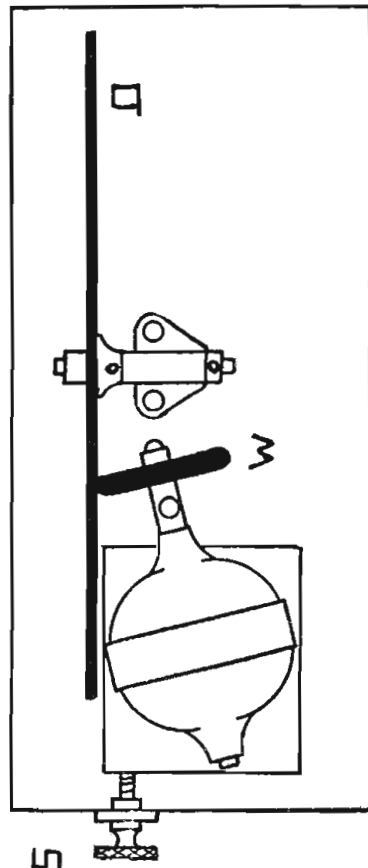


Fig. 6. A novel method of securing good synchronism between transmitter and receiver discs is suggested by Mr. Jenkins, who is a pioneer in television work

Our laboratory staff has two experimental set-ups, one located in the residential district where a Baldor motor, type Y-2V, is being utilized for driving the National scanning disc. In this receiver the speed of the motor is varied by means of a variable rheostat of approximately 50 ohms, which passes two amperes

at 110 volts. The speed is set at 900 r.p.m., or a few revolutions under, and then a shorting button which short circuits about 15 per cent of the resistance is used to kick the motor ahead to maintain it in exact synchronism with the transmitter. This is not very difficult to do as soon as the operator has learned how much "kicking" is necessary to maintain the speed. In case it is desired to further stabilize the speed of the motor, we have been informed by the makers of the Baldor that four small metal fins placed on about the center of the face plate, which holds the disc, will serve to load the motor to such an extent that its speed control is even better than when the disc is running free. This method has been tried out in the residential test station and performs very satisfactorily.

Another method of synchronization suggested by Mr. Jenkins is shown in the diagram in Fig. 6, where the disc is located on a shaft, and where a motor carries a disc of about 2 1/2 to 3 inches in diameter, W in the drawing, made from the rubber inner tube of an automobile tire and placed between 2 inch diameter flanges on a hub to go on the shaft of the driving motor. This motor should be mounted on a board which can slide between guide strips on the platform or table, so that the rubber disc turns against the back of the scanning disc about 3 inches from the scanning disc center. Naturally to do this the disc should be fairly rigid. The speed of the disc is altered as the motor is pushed closer or pulled further away from the center of the scanning disc. An r.p.m. counter, several types of which are on the

(Continued on page 108)

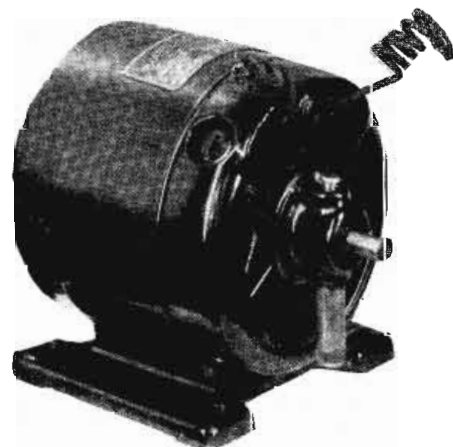


Fig. 7. One of the Chicago manufacturers, the Bodine Electric Co., is making a small motor suitable for television purposes, this motor being used in our laboratory set-up



# With THE PROFESSIONAL SET BUILDER



OUR department for the professional set builder, having been started in the March issue of this magazine, revealed at that time some of the possibilities for profit to be derived by the enterprising professional set builder. In this issue there are a few other examples of the manner in which money may be made by the builder in doing pick-up work with a power amplifier or dealer's amplifier. On page 58 is a story covering the Thordarson Dealer's Amplifier using 250 push-pull, while on page 73 is a story covering the Samson PAM amplifier for local pick-up and demonstration work. In the former article the builder makes up his own amplifier, whereas in the latter article the amplifier is already built. Both types seem to meet with fairly equal favor on the part of the builder. Each has its own set of advantages and both perform with extreme satisfaction to the extent for which they are designed.

Having laid the ground work for a set builder to visualize money-making possibilities in local pick-up work, as well as demonstration work, the problem now becomes one of acquainting the builder with the methods he should pursue in selling merchandise he produces. One set builder in Indiana has worked out his business to such a fine point that during a season he will probably build as many as 2000 sets. Naturally he does not build them all himself, but hires young high school boys in manual training classes to turn out the work on a piecework schedule. Naturally, to dispose of as large a number of sets as this during the course of a season, it is essential that he have an intensive sales method. For example, one of the first requisites in a sale, in the case of this professional set builder, is a deposit of \$100 on the job. The job sells for somewhere around \$300 and \$350, and this deposit of \$100 is required before the work even starts. Thus, you can see that some of the financing is being taken care of by the customer himself. This set builder has two or three demonstrator jobs at prospects' homes all of the time. He does not sell the demonstrator set, but takes an order for an identical set on which the previously mentioned deposit must be made. These demonstrator sets are put in the prospects' homes for a two or three nights' run. In the case of the a. c. set, these are the easiest to install, since all that need be done is to plug into the lighting circuit. In the d. c. sets a little more difficulty is involved in that the storage battery and the power supply must be carted around. The prospect is given a preliminary lesson in the tuning of the receiver and then is left to his own devices to familiarize himself and sell himself on the receiver. It may be said to the credit of this particular set builder that in 98 cases of every 100 there has been a sale after such a demonstration.

To maintain such a high ratio of sales to demonstrations involves an inquiry into the financial rating of the prospects. Bankers, lawyers, dentists, executives and others of a class more fortunate financially are the ones that this set builder canvasses first. Knowing the financial worth of a prospect, the builder is in a better position to determine whether or not a complete set

would be a burden on the prospect or not. If there is any likelihood of a set being a burden, the name of the prospect is discarded and another one looked up.

However, there are many occasions when an individual who could afford a quality receiver might not wish to pay cash for it. A transaction of this sort might be handled through the local bank, the prospect signing a note for the difference between the \$100 deposit and the total cost of the set, the builder discounting the note at the bank. Thus, the enterprising set builder has two methods of disposing of his wares. The first is by the sale to individuals who are perfectly capable of paying cash for the job and the second by selling to individuals whose note may be discounted at the bank. If the bank is willing to discount a local citizen's note, it is a fair indication, although not an absolute guarantee, that the customer will be able to take care of the note when it falls due. In the transaction involving payment for a receiver over a period of months, the set builder should arrange that interest charges should be included so that the customer pays for the accommodation of time.

Many individuals from all walks of life have found profit in building radio sets for resale. There is no royal road to success in this line of endeavor any more than in any other business in the world. The richest rewards come to those who are aggressive in cashing in on opportunities which present themselves in their own field. Not all set builders confine themselves to a single receiver, although some of them have found that a particular type of super will yield them the greatest sales. Others will play two lines, one the high priced super and the other a medium priced tuned r. f., on the assumption that if the most expensive set cannot be sold, there is always an opportunity for the moderately priced one.

With the change in the conditions existing in the radio industry, as reflected this season, possibilities of making money are better than ever. The merchandise offered, both in the unassembled kits and in the totally assembled kits, is better than ever seen before. The manufacturer is designing his products so that the professional set builder has the least amount of resistance to overcome in their sale. The universal adoption of the 222 tube has made possible a much better receiver at a lower price than has been feasible heretofore. All in all, the prospects for the professional set builder are very bright. If he applies himself assiduously to the cultivation of the sales field in his locality, he is certain to reap a harvest. This department will offer from time to time such suggestions as we feel may be of some assistance to the professional set builder, not only from the construction standpoint but the servicing and sales.

## Radio-Phonograph Switch

THERE are thousands and thousands of radio sets of all types and descriptions which, by a simple means, may be arranged so that phonograph records may be played by the owner. In many cases the owner does not know how to arrange

a simple switching device to accomplish this transition of radio to phonograph. The professional set builder may be able to perform this work for the owner, selling a piece of merchandise and collecting a service charge for the job.

While it is not anticipated that the mere inclusion of a switch in any type of receiver will necessarily guarantee great volume or quality, nevertheless it will allow the owner to play the electrically cut phonograph records to the best of the possibilities of the amplifier in his present set. If it should so happen that the

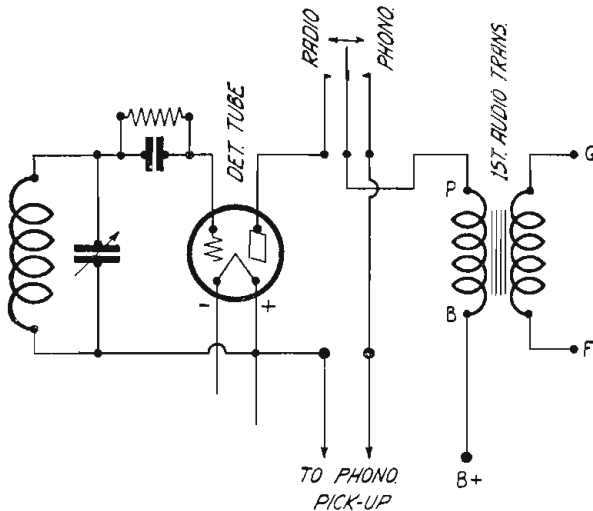


Figure 1

amplifier he possesses is not a particularly good one, the very absence of quality might contribute towards his desire for either a new receiver or a new amplifier in which quality predominates. In either event this desire should be of interest to the professional set builder.

The connection referred to is simplicity itself and is disclosed in the schematic circuit, Fig. 1, herewith. A single pole, double throw jack switch, similar to the type made by Carter, Frost or Yaxley, may be placed on the front panel, if desired, with the center arm going to the P terminal of the first audio transformer. One of the contacts of the switch leads directly to the plate of the detector tube, while the other contact leads to one side of the phonograph pick-up. The other side of the phonograph pick-up goes around to the negative filament or the positive filament, depending upon the grid return of the detector stage. Thus, when the switch is thrown in one direction, the set is a radio receiver, while when thrown in the opposite direction the phonograph pick-up is placed in series with the primary of the first audio transformer and supplies energy to the grid of the first audio tube through the transformer. This also involves the use of a first class electric pick-up unit, which the professional set builder may sell to the set owner. It would be well for the professional set builder to try out three or four of the electric pick-ups now on the market to familiarize himself with their good points and determine which of these he desires to recommend to the set owner.

## Making an "A" Eliminator

WITH the rapid strides made by the radio art during the past few years, the experimenter is often confronted with what at the time he deems to be a piece of obsolete equipment. Many useful pieces of apparatus have found their way into the discard, when by the use of suitable additional equipment they could have been put to useful and permanent application. So many different radio items are today considered obsolete that it would be out of place to mention them all here.

One piece of equipment possessed by nearly every old time radio fan which is being being discarded as useless is the "A" battery charger. The electrical and physical forms of "A" battery chargers are many and varied; some of them employ electrolytic

rectifiers, some tubes, while others employ methods of mechanical interruption whereby half of the alternating current wave form is clipped off, producing an interrupted direct current, which, however, is suitable for charging batteries. The most widely used type of battery charger is undoubtedly that employing a tube containing a gas under low pressure, commonly known as the "tungar bulb." These bulbs are manufactured in various sizes to conform to different requirements of charging rate.

With the advent of the a. c. tube many chargers are now standing idle, and while some time ago a charger was useful for only one purpose, namely, charging the "A" battery, it can today, with the addition of various attachments, be applied to a variety of uses in the radio field.

The most widely used form of charger delivers a current of approximately 2 amperes at 6 volts. The rectifier element is employed in a half wave rectifier circuit, the output of which without being filtered is not suitable for heating the filaments of tubes in a radio set. However, by suitably filtering the output the d. c. obtainable at the terminals of a good filter can be used for heating the filaments of the radio tubes and also energizing the field winding of an electrodynamic loud speaker. Electrodynamic speakers employing low voltage field windings are usually somewhat lower in price than the type employing a high resistance field, the difference in price nearly paying for a suitable "A" filter to be attached to the output of the charger. "A" filters and "A" condensers have been put up in many different forms. Some are instruments of purely chemical functioning, while others are of the dry type. A good example of a dry condenser is found in the Tobe "A" condenser. This type of condenser is also incorporated in the Tobe "A" filter. The Tobe "A" filter has an outstanding advantage, inasmuch as there are no solutions contained therein which are liable to spill and burn the rug or any other furnishings of the home. It can therefore be used with safety anywhere.

A condenser for use in "A" eliminator circuits must of necessity possess a considerable amount of capacity encompassed in a small space. This high amount of capacity is necessary since the physical dimensions of the chokes to be used in such a filter system must not be unduly large. As the chokes are to carry currents of the order of 2 amperes, the amount of inductance available is exceedingly small, usually of the order of .1 henry. The Tobe "A" condenser can be secured in sizes up to 8000 micro-farads for operation at low voltages.

Thus it may be seen that a charger may be used in conjunction with an "A" condenser to energize the field of an electrodynamic speaker.

While a choke is not absolutely essential when the charger is used to energize the speaker alone, it becomes necessary to provide for some additional filtering if the output of the charger is

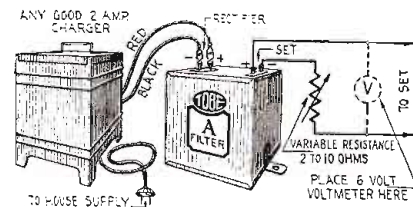


Figure 2

to be used to heat the tubes in the radio set as in Fig. 2. Here it might be mentioned that when a charger is to perform this double duty it should be at least of the 2 ampere variety.

Before proceeding further it would perhaps be better to offer a word of caution as regards the use of the charger itself.

Many of the chargers now in use employ what is known as an auto-transformer as a means of stepping-down the line voltage to the voltage required to operate the rectifier bulb. The auto-transformer is essentially one winding across a portion of which a tap is taken to secure the necessary voltage to operate the bulb. Under these circumstances one side of the output of the charger will be grounded to one of the power lines, and since one side of the power lines is grounded and the set itself is also grounded,

disastrous results are likely to occur to the filaments of the tubes. It is therefore necessary to connect a condenser of approximately 1 mfd in series with the ground lead of the radio set itself. This condenser allows the radio frequencies to pass unhindered to the ground circuit and isolates the set from the low frequency current component encountered in the lighting circuit. As a device to protect the set against static under such conditions, a grid leak of approximately .5 megohm can be connected across the condenser itself. This allows any charges acquired by the antenna to leak away to earth.

The filter that is shown at Fig. 2 may be used to energize both the speaker and supply the filament current to the radio set. The "A" filter as shown in the accompanying sketch is a combination of choke and condenser in one unit. Both the input and output terminals of the filter are clearly marked and must be connected up in the proper manner to the remainder of the equipment.

The use of a voltmeter across the filaments of the tubes will insure their operation at the correct filament potential. A power rheostat of approximately 10 ohms should be connected in series with one side of the filter output. This rheostat must be capable of carrying two amperes for long periods of time without undue heating. The application of rectifiers other than the bulb type must not be overlooked. The metal contact rectifier, a comparatively new development to the radio field, is perhaps becoming more popular than any other type of rectifier in use today. It is perhaps more suited to "A" eliminator duty than the bulb type, due to its quietness of operation and the comparatively small amount of heat generated.

Many set builders will find, after reading the above, another means of making a sale to some set owner who wishes his set socket powered.

### Push-Pull Substitute

**O**FTEN it is desirable to apply the push-pull form of amplification, using the usual type of audio transformer. This may be done by securing an electrical mid-point across the secondary of the transformer, which serves for the C— connection. Now this electrical mid-point should be obtained by means of a total resistance of the value found best by actual test for the conditions obtaining in the circuit, as well as the electrical mid-point. By having the necessary values on each side of that connection. While fixed resistance may be employed for this purpose, provided the exact resistance values are known in advance, it is generally preferable to use a potentiometer device with variable total resistance as well as variable mid-point.

In the diagram, Fig. 3, is shown a simple means for obtaining the necessary electrical mid-point and total resistance across the transformer secondary for push-pull amplification. It will be noted that the two terminals of the transformer, shunted by the duplex Clarostat, go to the grids of the two tubes, while the center terminal of the dual resistance goes to the C— connection. The tubes are arranged in the usual push-pull style, the two plates being connected to the ends of a center-tapped choke coil or transformer, the center-tap of which is connected with the B plus power source.

Because of the precise total resistance and mid-point obtained with this arrangement some degree of efficiency is realized even with the ordinary transformer, at a considerable saving to the radio experimenter.

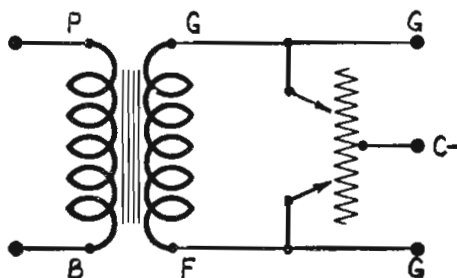


Figure 3

### Makeshift Voltage Multiplier

**T**HERE is hardly a day that passes in the experience of an average set builder that he is not called upon to read some voltage in excess of the usual meter he possesses. In this day and generation, when power supply devices running as high as 425 volts are as common as automobiles, there is a demand for a high resistance voltmeter that will read up to 500 or 600 volts. Not every set builder has such a high resistance voltmeter, although he may have one using a limited range of, say, 250 volts. In the event that he has a high resistance meter, the scale reading as high as 150 volts, he may construct a makeshift voltage multiplier by using in series with a voltmeter a 0-500,000 ohm variable resistance, such as those made by Carter, Electrad or Frost. The meter should first be placed across a source of definite voltage, such as a 45 volt B battery or 90 volt B battery, and then the resistance inserted in the circuit so that the reading, when the resistance is in, will be one-fifth of the 90 volt reading. Thus, if the meter reads 90 volts without the resistance and the resistance is put in and the voltage is cut down to 18 volts, then when the meter and resistance are placed across a high voltage circuit, whatever voltage reading is secured is multiplied by five. In case the meter is tested across a 45 volt portion, the resistance is inserted in the circuit until the reading drops to 9 volts, and then any value of voltage read on the meter should be likewise multiplied by five. In case the maximum scale of the high resistance voltmeter is 250 volts and it is desired to test voltages up to 500 volts, the meter should be placed across a known voltage and resistance inserted until the voltage reads one-half of the known voltage. In the case of the 250 voltmeter, this half reading would be 125 volts. Then, whenever it and the resistance are placed across a circuit, the voltage reading obtained should be multiplied by two.

This method of multiplying only applies to the type of meters having a resistance of 1000 ohms per volt, such as the high resistance meters made by Jewell or Weston. On voltmeters having a lower resistance per volt than the values mentioned above, the accuracy of the readings will not be very great.

**P**ROFESSIONAL set builders may be interested in a recent radio receiver nomenclature adopted by the Radio Manufacturers Association. A clearer understanding of the types of receivers on the part of the professional set builder enables him to give his public a much better conception of how the different receivers operate.

A radio receiver designed to operate from primary and/or storage batteries shall be known as a "Battery-Operated Set."

A radio receiver of the "Battery-Operated" type, when connected to a power unit operating from the electric light line, supplying both filament and plate potentials to the tubes of the receiver, shall be known as a "Socket-Powered Set."

A radio receiver operating from the electric light line, without using batteries, shall be known as an "Electric Set."

A radio receiver employing tubes which obtain their filament or heater currents from an alternating current electric light line without the use of rectifying devices, and with a built-in tube rectifier for the plate and grid biasing potentials, shall be known as an "A. C. Tube Electric Set."

A radio receiver employing tubes which obtain their filament or heater currents from a direct current electric light line without the use of rectifying devices, and with a built-in power plant for the plate and grid biasing potentials, shall be known as a "D. C. Tube Electric Set."

### Hum in Power Supply

**H.** V. LANDERS, 6 Cress Street, Binghamton, New York, writes on behalf of seven custom set builders in his neighborhood concerning the elimination of hum from push-pull and other amplifiers of the 500 volt class. He states

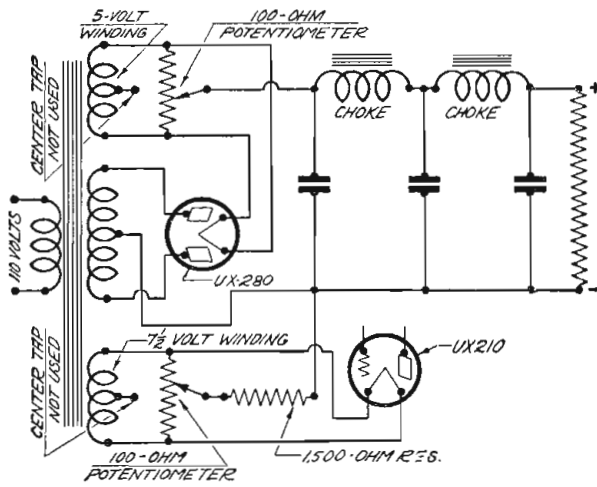


Figure 4

that when he demonstrates to a customer, the buyer is satisfied with volume, selectivity and quality, but objects to the presence of hum in the speaker. While it is true that a certain amount of hum may be expected from many of the power supplies, nevertheless this hum should not reach a point where it is objectionable to the customer. If any hum is heard during the course of a program, it can be safely said that something is wrong. Of course, if the microphone at the broadcast station is cut off, some hum is going to be heard, but it is a question as to whether the hum is produced in the power amplifier alone or whether part of it is manufactured by the imperfectly filtered carrier of the broadcast station. With a less sensitive set, doubtless even a poorly filtered carrier of the broadcast station might not be audible, although it would be present but not amplified to a sufficient extent to disturb the listener. For extreme or obstinate cases of hum encountered in a power supply, the schematic shown in Fig. 4 might be consulted and possibly it will give some suggestion that might be followed in remedying an annoying hum.

For example, instead of taking the center of the 5 volt winding shown in the schematic, the center tap on the transformer may be ignored and instead a 100 ohm potentiometer capable of carrying sufficient current for the total output, which in this particular case would be approximately 125 milliamperes, may be placed across the extremities of the winding with the arm leading to the choke. This arm may be shifted backwards and forwards until the point of least hum is encountered. This is an extreme case and should ordinarily not be necessary. The problem represented in the 7 1/2 volt filament winding is more likely to be one in which a solution will be readily reached. Here, as in the other filament winding, the center tap is ignored and a 100 ohm potentiometer of the same type and current carrying capacity as the one previously mentioned is placed across the 7 1/2 volt filament winding, with the 1500 ohm fixed resistance for the grid bias of the 210 located in series with the arm and thence to the B negative of the circuit. Here again the center arm should be shifted until the hum is at a minimum. While this particular schematic does not represent any one given power supply, it is only given as a basic diagram for the professional set builder. In the case of the 171 compacts, where the choke and the transformer are located inside of a single case, it will not be possible to make such a change. However, the scheme outlined above will work on any assembled job regardless of whether the transformer secondary is 5 volts or 7 1/2 volts.

It should also be borne in mind that annoying cases of hum may be greatly reduced by the physical placement of the apparatus. In one case of which we have knowledge, it was necessary to change the position of the transformers in order to get away from hum. While the above suggestions are offered for whatever value they may be to the professional set builder, nevertheless there is no guarantee that these particular ideas will prove a sure remedy. At best they should be accepted as a possibility.

## Voltage Divider System

FOR the home laboratory, or for the professional set builder who wishes to simplify and speed up assembly and wiring of power amplifiers, Electrad, Inc., has recently begun the marketing of a voltage divider known as the Truvolt divider, which consists of three variable Truvolt resistances for plate voltages and two variable Truvolts for bias voltages. A pictorial view of the divider is shown in Fig. 5, where it is included in a typical full wave rectifier circuit. Suitable binding posts are provided on the unit for the various B and C voltages.

In Fig. 6 is shown a schematic of the divider, which consists primarily of five variable resistances in series, the arms of the various dividers giving 135, 90 and 45 volts for plate potential and minus 9 and minus 40 for C bias.

Reference to the schematic circuit in Fig. 5 will show that the binding posts on the unit may be used for the termination of the condenser sections and also as binding posts for the various plate voltages desired. One of the features of this unit, which should appeal to the professional set builders, is the fact that the individual dividers may be set at predetermined values for definite voltages, provided the proper fixed resistance is placed in the circuit between the maximum voltage tap and the 180 volt tap.

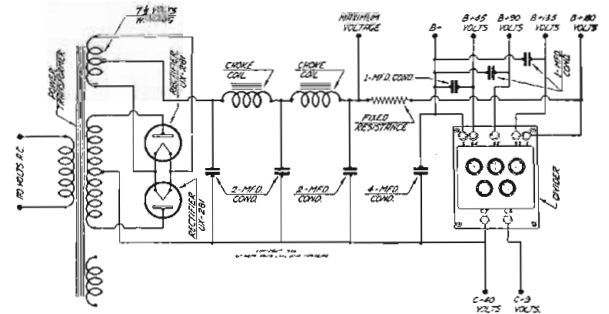


Figure 5

This particular resistor is the one that is called upon to pass the heaviest amount of current and to drop the voltage from 425 or more to 180. It will, therefore, be seen that the Truvolt divider should not be placed in a circuit where it is called upon to handle in excess of 200 volts. Naturally the divider cannot take the place of the fixed resistance, which drops the voltage from 425 to 180, although it does serve perfectly in the handling of voltages from 180 down to 45.

Another feature of the device is the fact that it may be mounted upright, flat on the sub-panel, or on the side, the method of mounting being determined by the manner in which the mounting bracket is placed. Such a device in the laboratory, when used with a power supply, enables one to secure, with a good degree of accuracy, definite voltages from the divider. It will also be quite useful to a set builder who wishes to have a method of securing odd voltages not available through fixed resistances, as is customary in most power supply devices.

Interesting literature covering the operation of the Truvolt divider may be secured by writing Electrad, Inc., whose address will be found elsewhere in this magazine.

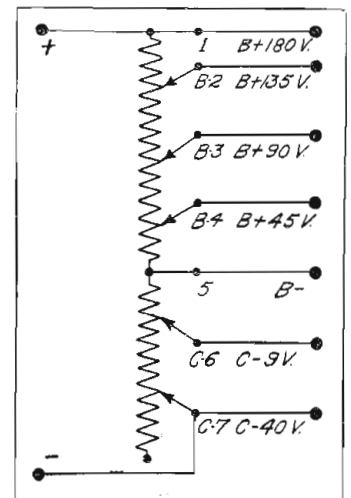


Figure 6

## Finding Bias Resistance Value

**W**HEN using an assembled power supply on more than one type of a receiver it quite frequently happens that the builder may switch from a 171 to a 210 tube, or from a 112 to a 171 tube whose filament is energized by raw alternating current from the low voltage winding of the power supply transformer. In these cases the bias placed on the grid of the power tube, regardless of whether it is a 112, 171, 210 or 250, is not the same for all tubes. It is, therefore, essential that the builder make sure he is using the proper resistance between the B negative and the center tap of the low voltage filament winding to get the desired bias potential for the grid. For example, a value of resistance which would be suitable for a 112 would not give the proper bias for a 171, and by the same token that of the 171 would not be satisfactory for the grid circuit of a 210.

In solving such a problem, two factors of the equation  $\frac{E}{I} = R$  are always known. E as shown in the schematic diagram, Fig. 7, herewith represents the negative bias between the grid and the center tap of the filament winding. For a 171 tube, it will be seen by consulting the tube chart accompanying the tube, that for a given plate potential of 180 volts the bias voltage should be 40½ volts negative on the grid. Therefore, E in the equation just referred to is 40½. The second factor, which is known as I, is the current the tube plate draws. Referring again to the tube chart accompanying this particular tube, it is found that when 180 volts are placed on the plate and 40½ volts negative on the grid, the tube draws 20 milliamperes plate current. Therefore, if E, which is 40½ volts, should be divided by I, which is 20 mils, the unknown value of resistance to secure this voltage will be found to be a 2025 ohm resistance between the B minus and the center tap of the filament winding which gives a negative bias of 40½ volts on the grid (20 mils is written .020 ampere).

Assuming that the set builder knows the value of resistance he has in this circuit and knows the plate current which the tube draws, but does not know the bias voltage which that resistance will place on the grid, he may easily find it by the equation  $E = R \times I$ , where R is known as a resistance between the negative B and the center tap of the filament winding, and where I is known as the current which the tube actually draws. If he has measured the plate current of the tube and measured the resistance of the biasing resistor and knows that value, multiplying the resistance by the plate current will give him the value of the grid bias being applied to the tube.

Having found that 2025 ohms are required for the grid of the 171 (2000 ohms will be close enough), he decides to take out the 171 tube and insert instead a 210. Consulting his tube chart, he will find that for a plate voltage of 425 volts, the C bias voltage should be 35 volts and the plate current should be 18 milliamperes. Here again he may solve the problem by the

equation, where E is known as 35 and I is known as 18. Dividing E by I, he finds that the resistance value should be 1944 ohms. It just so happens in this particular case that this value of resistance is close enough to a 2000 value to not materially affect the results. If he knows the resistance of the grid resistor and the plate current of the tube, he may secure the grid bias value by multiplying the resistance by the plate current.

In the event a 112-A tube is being used and he wishes to determine the value of grid bias resistance necessary, he consults the tube chart and finds that with a plate potential of 135 volts the bias should be 9 volts negative, under which conditions the tube will draw 7 milliamperes. Dividing E, which is shown as 9 volts, by I, which is shown as 7 milliamperes, the result is R, which is a resistance of 1285 ohms.

When the change is made from a single 210 to a single 250, it can generally be said that the same biasing resistor may be used, because of the fact that the plate current of the 250 is double that of the 210. The same thing would apply if two 210's were used in push-pull and were then supplanted by two 250's used in push-pull. Here again the plate current of the 250's would be double that of the 210's, and while for temporary purposes the same resistor used in the push-pull 210's might be used, nevertheless, for getting accurate results, it would be best to determine the value

of the resistance by the formula previously quoted of  $\frac{E}{I} = R$ .

## Sub-panel Assembly Popular

**B**OOSTING the use of sub-panel construction for professional set builders, Mr. M. W. Shepherd, 3620 Main Street, Kansas City, Missouri, writes as follows:

"Is not any set worth building worth building neat? Can a set be made neat without sub-panel mounting? In the past four years the writer has built 47 supers and some 50 or more tuned radio frequency and neutrodyne jobs. The most of these were made with sub-panel mounting and in nearly every case the set with sub-panel mounting sold quicker and for about 20 per cent more. As we look to the CALL BOOK to bring out the latest in best circuits, we were pleased to note a good many sets shown in the last issue made with sub-panel mounting. The writer believes the majority of professionals would prefer this type of building."

It is not difficult to see the reason for the popularity of the sub-panel assembly for sets destined to be sold. Two, three and four years ago there were practically no professional set builders, the constructional work being confined to the type of individual who built a set for his own use. It is quite likely that the set did not remain intact more than 30 days before the builder would have it torn up and a new circuit involved. Naturally a wood baseboard was the most economical method of construction, because it could be used over and over again for the building of a set. Then, too, the manufacturer at that time had been educated to produce units which were more susceptible to baseboard mounting on a wood baseboard than any other method.

However, the industry changed and in the last year or more we have seen a tremendous number of receivers built for resale. When this condition exists, the builder no longer has himself to please, but must primarily please the buyer or prospect. There is no question as to the advantage of the sub-panel over the wood baseboard as far as presenting a workmanlike and neat appearance to the prospect. This point of view was not very difficult for a manufacturer to appreciate and as a result a great deal of the material that is now produced in the radio industry is designed for sub-panel mounting. This is more evident than ever in this present season when the shield grid tube and complete shielding have become so universally employed. Here again the professional set builder saves a great deal of labor in the assembly of the material and the running of connections, and at the same time produces a job which is, from standpoint of appearance, a close competitor to the factory made receiver. Even in the short wave field, where previously so much of the work was done on a bread board, we may find the sub-panel form of assembly.

We are glad to have Mr. Shepherd's comments on this subject

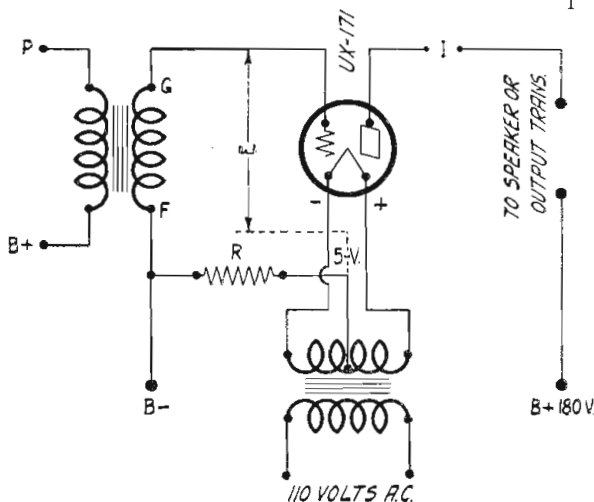


Figure 7

and trust that he will be pleased by the type of receivers which are being produced and described in this magazine during the course of the present season.

### Transformer Versus Impedance

COMPARATIVE TESTS between the use of a 201-A tube and a typical audio transformer on one hand against a 222 tube and an impedance is possible if the set builder is curious as to the difference in volume to be secured.

The simple schematic circuit shown in Fig. 8 accompanying this article reveals how the comparative test may be made for the benefit of either the professional set builder or some customer who is desirous of converting an old style audio layout into an impedance layout using the screen grid tube. All that is necessary besides the tubes, transformer and impedance is a double pole double throw switch. The detector stage remains unchanged during these tests with the second audio. When the switch is thrown to the A position shown in the diagram, the energy is

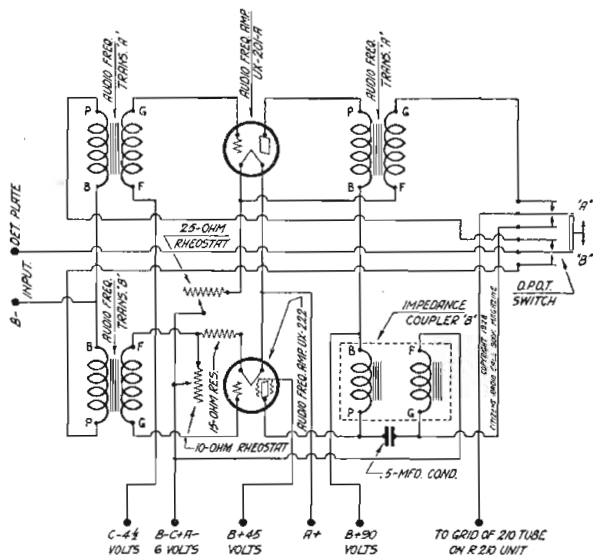


Figure 8

amplified through a 201-A and its associated conventional audio transformer into the grid circuit of a 210 tube. When the switch is thrown to the B position, amplification from the detector stage passes through the transformer B, thence through the 222 screen grid tube and after passing through the impedance coupler B goes to the grid of the 210 tube. The necessary resistance for the filament of the 201-A and that of the 222 are shown in the diagram and do not require any particular description.

This method of change-over permits a rapid comparison between a screen grid audio using an impedance coupler, such as the Thordarson Z coupler, and the standard transformer coupled audio using a 201-A tube. The receiver in use during the test is tuned into a specified station and then maximum undistorted volume secured on the A position of the switch. The switch is then turned over to the B position and the increase may be noted.

### Hints on Wiring

WITH the gain in the popularity of the sub-panel form of assembly and wiring, some of our practice has to be revised from the days of wooden baseboards. Paul H. Estabrook, 1500 South Union Avenue, Grand Rapids, Michigan, has requested on behalf of himself and other set builders hints regarding the wiring of a receiver. He writes as follows:

"There is one subject on which I would very much appreciate an article. It is not my own personal belief by any means, but I have many times heard the same expression from other fans. I am not so cocksure of the fine points of it, either, so in any event I believe an article covering the fine points of wiring a receiver would be acceptable to many builders both experienced and other-

wise. Along these lines I have particularly in mind such things as not paralleling plate and grid wires; if necessary to parallel, how far apart must they be to avoid pick-up; what in a complicated wiring job is the best way to arrange the wiring, such as all B battery wires close together or cabled, A wires twisted together or at the most how close to grid wires should battery wires come; making grid and plate wires as short as possible, and if not possible, the best means of overcoming. There are a thousand and one things that the unprofessional builder knows nothing about regarding the wiring, such as the why and wherefore of additional bypass condensers in a receiver built according to drawings."

He is further interested in points covering capacity in wiring, causes and what to do to avoid it, resistance in wiring, inductance in wiring, purposes of fixed condensers. He gives one example of a receiver he had which howled and whistled continuously. After several attempts the trouble was located in the parallel leads of the potentiometer across the primary of an iron core intermediate transformer in a superheterodyne. These wires were fully 1/2 inch apart, but upon separating them and bringing them 1 1/2 inches the howls and whistles disappeared.

In general practice it would seem that when grid and plate wires are to be paralleled they should be kept apart at least the distance represented by the separation of the grid and plate on the tube socket. This subject was of much more importance in the days when wood baseboards were used than it is at present. In the modern receiver and the sub-panel method of assembly and wiring it usually is found that grid and plate connections are very short. In some cases where the intermediates, r.f.'s and audios are mounted on a sub-panel, these same connections are less than 1 inch in length. However, when long leads of either plate or grid are to be run, they should at least be kept as far apart as the distance between the two terminals on the socket.

Grid returns on any type of circuit may be run immediately adjacent to any filament circuit, because there is practically no difference of potential between the grid return and either the plus or minus filament. Plate leads or grid leads themselves should not be run parallel to a filament circuit. They should go by the shortest path to their respective terminations without running parallel with the filament leads and if possible at right angles to them. However, in the case of the present day receiver where a cable plug is used on one end of the baseboard, it is seldom that the plate supply leads are very long. As a matter of fact in many of the late receivers all of the filament wiring is being done with wires similar to the "push-bak" type and after having been completely wired, these leads are laced together with twine into a cable. When wiring a receiver whose filament supply is alternating current from a 1 1/2 volt, 2 1/2 volt, 5 volt or 7 1/2 volt transformer, these leads should be in twisted pair and kept as far away from the grid and plate connections as possible.

The use of bypass condensers is more or less dependent upon the type of B power supply which the operator is using. In some of the smaller B power supplies sufficient capacity has not been allowed for complete filtering and in cases like this some trouble might be expected unless additional bypasses were placed across existing ones. The purpose of a bypass condenser is to return radio frequency currents by the shortest route to ground, which in 99 cases out of 100 is the negative filament of the receiver. If it is desired to bypass the B terminal of the first radio frequency transformer to filament, it is much better to bypass it right at the tube socket than to place the bypass from 12 to 18 inches away from the socket by placing it across the 45 or 90 volt binding post on the receiver. This is becoming more apparent than ever by an inspection of the receivers being marketed this season, because in these cases where stage shields are used all of the bypassing is done for that particular stage within its own shield. Observance of the type of receiver described in this present issue of the magazine will give professional set builders an idea as to the desired location of bypass condensers.

Capacity in any wiring is produced by the proximity of one wire to another. The remedy for such capacity is to increase the space between the two wires. After all capacity in wiring is very

much like capacity between two plates of a condenser. Its capacity is maximum when the two plates are closest together and minimum when further apart. The area of the wiring itself is relatively small over a distance of only 1 inch, but over distances of 6, 10, 14 and 18 inches capacity effects may be encountered. Therefore, the best thing to do is to keep the wires as far apart as possible.

Resistance in wiring is almost universally caused by poor soldering, either in one of the inductances or transformers, in the cable plug contacts, or at any position where two wires are joined by solder. In this connection it might be of interest to professional set builders to read carefully on "How to Build an Ohmmeter," which is contained in this issue. The use of such an instrument will readily permit a set builder to determine the location of resistance in wiring.

Inductance in wiring is seldom encountered, except in short wave receiver work where the leads from the inductance to the tuning condenser are so long as to throw the fundamental wavelength of the coil higher than it should be. It is possible for this same condition to occur on the broadcast bands, but a small increase in inductance in these wavelengths is usually not very bothersome. Unlike the case of capacity in wiring, the remedy is shortening the length of the wire itself.

Quite a number of professional set builders have found that in servicing superheterodynes a trouble shooting chart may be helpful. Recently we have had an opportunity of looking over the Jeems Trouble Shooter, which is applicable to superheterodynes and which, for the general run of set builder, would probably be quite helpful since it gives a series of symptoms and the numerous causes of trouble that might be encountered in building or servicing a super.

### Condenser Plate Vibration

ATTENTION of the professional set builder might be called to a photograph on page 40 of this issue, where a vibration damper is used on the plates of the Remler variable condenser to stop any sympathetic vibration set up between the speaker and the condenser itself. One or two cases have occurred where the volume from a speaker has been sufficient to start the oscillator condenser plates into motion, thus creating a continuous howl. Moving the speaker around or enclosing the set did not have a marked effect. The only solution that was found was to place these felt dampers on the plates of the condenser and when this was done the sympathetic vibration ceased. This condition does not exist on the condenser used for tuning a loop, but apparently is confined to the oscillator condenser. It is quite likely that this condition would not be manifest with condensers having thicker plates.

### Radio Convenience Outlets

MODERN hotels, apartments, hospitals and other types of buildings are rapidly being equipped with radio convenience outlets, such as baseboard or wall plugs for antenna, ground, speaker and in some cases a socket plug for the radio set itself.

In this connection, it is observed that the Yaxley Mfg. Co. is making a line of these convenience outlets for specification by architects in contemplated or pending jobs. This might prove a tip to the professional set builder to get in touch with the leading architects in his own vicinity and consult with them concerning the possibility of equipping new dwellings with convenience outlets for radio. In addition to this possibility there is also the chance that in some of the larger apartment houses it might be desired to have a central receiving station and radiating from that station a line of circuits going to each dwelling within the building for the entertainment of the residents. Two articles in this present issue, one covering the Samson amplifier and the other covering the Thordarson dealer's amplifier, might be of interest in keeping with this particular subject on the creation of new business for professional set builders. If desired, we will be glad

to have literature forwarded to those who are interested enough to write us for it.

### Converting Transformer to Impedance

DOUBTLESS many professional set builders know of quite a number of the Thordarson autoformer jobs that could be converted for the use of the Z coupler and the 222 tube. In such a conversion there is practically no rewiring to do other

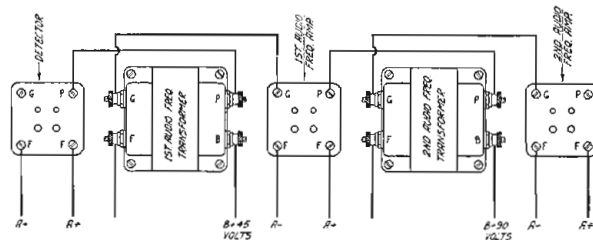


Fig. 9

than taking out the old audio transformers or the old Autoformers and putting in instead the Z coupler for securing maximum volume and quality.

The schematic circuit shown in Fig. 9 shows the conventional transformer in the circuit. In Fig. 10 may be observed a schematic covering the use of the Z coupler in place of the second audio transformer, or in place of the third Autoformer. The dia-

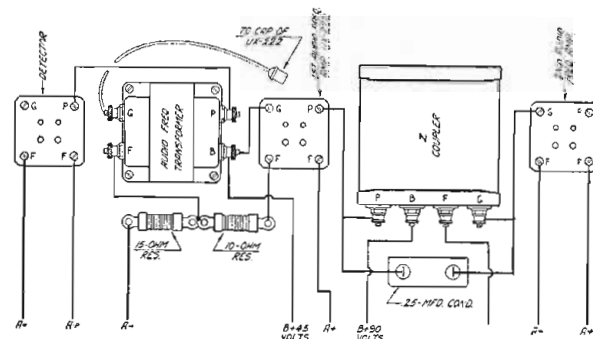


Fig. 10

grams are sufficiently clear so that no trouble need be experienced in the transportation of an old set into a new one. Literature covering this subject is available and if interested set builders will write us, we will see to it that they are furnished with a copy.

### Choosing a Set

PERHAPS the most often asked question from experimenters, as well as professional set builders, is, "What set should I build?" or, "What set should I buy?" In answering such a question, there are many factors that have to be fully understood before any definite decision can be made. We have found from experience that the decision remains entirely with the individual, just as it does in each purchase of an automobile, washing machine or percolator. The cost enters into consideration as one of the major items with a certain type of buyer, whereas quality determines the sale when another class of buyer is considered. Another class still would look for flexibility in the operation of the receiver, while still another class will have no desires other than reception of local programs. Then there is the class that wishes loop reception as contrasted to those who will use either an indoor or an outdoor antenna. There is still another class that will just wish for room volume, while others will desire extreme volume for entertainment of a large audience.

The location of the set, the use to which it is to be put, the type of current available, local reception conditions and a multitude of other problems must all be taken into consideration, if the buyer is making a wise selection of a receiver either for himself or for resale. Local reception conditions are not difficult to

understand, because of the fact that the professional set builder is fairly well acquainted in his own neighborhood and knows what may be expected. He can also find out from the prospect whether maximum volume is desired or whether only moderate room volume is wanted. Likewise, we can tell whether the prospect can afford an expensive receiver or a cheap one. As a matter of fact, the professional set builder can easily decide for himself and for his customer which receiver should be built.

However, there is another angle in the selection of a receiver to build for resale which has some interesting phases, about which the professional set builder might wish to know. Assuming that two receivers are of identical capabilities, cost, appearance and performance, there is still a question in the set builder's mind as to which of the two he should choose for the greatest turnover of sales. In part he may solve this problem by remembering the sales policy of the manufacturer, promptness of deliveries, facility with which the set may be assembled and constructed, and, most important of all, to what extent the manufacturer is advertising his products so as to insure that the prospects will be acquainted with the name of the manufacturer, or his set. It has always been found true that the greatest sales are made from the most widely advertised lines. This does not necessarily mean that during one month the advertiser emblazons his name across the public's visual horizon and then lets it drop, assuming that a single announcement will serve to sell the public. If such type of advertising were indulged in by the Standard Oil Co., General Motors and other national advertisers, the concerns would not remain in existence very long. It is the constant repetition in varying forms of a manufacturer's message which causes the public to remember that name and express a desire for such products when in the market. Therefore, it would be well to investigate carefully the manufacturer's merchandising as well as advertising policy. Some manufacturers go to the extent of supplying professional set builders with sales literature for prospects on which the builder's name and address may be imprinted and this literature mailed out by the manufacturer at the request of the professional set builder.

### Edison Base Resistors

**S**IMPLICITY of construction and the rapidity with which changes may be made in the resistance network across a power supply are two items of interest to every professional set builder who has already built a power supply or contemplates constructing one. By the expedient shown in the diagram, Fig. 11, it is possible to change from one value of resistor to another on a moment's notice, in the event that the power supply is to be used with a receiver having a current drain heavier than that which would be provided for with the first set of resistances.

The schematic circuit, Fig. 11, is a conventional one of any full wave rectifier circuit. The only departure that is made is in the manner in which the resistors are placed in the circuit across the two output terminals of the rectifier. R-1 in the diagram is an Edison base resistor, which is screwed into an ordinary electric light socket. The other three resistors, R-2, R-3 and R-4, are of the same type. R-5 is a cartridge resistance used for biasing of the grid of a 210 or 250 power tube or 210 or 250 in push-pull. It may be changed in value by merely substituting another cartridge of the desired resistance. However, this latter resistance R-5 does not require much change, whereas the other four resistances may be changed whenever a new type of set is being used on the power amplifier.

These Edison base resistors are obtainable on the market, being made by either Ohmite Mfg. Co. or Ward-Leonard, and their use in such a circuit adds a great deal of flexibility to the power supply. For the benefit of those who might be interested in learning the method by which the resistance value of each of these resistors is determined, the following is written:

The maximum voltage output of the power supply we will say is 450 volts. The receiver has a tap for 180 volts, one for 90 and one for 45 volts. Starting with 450 volts, it is desired to find a resistor which will drop the voltage to 180 volts suitable for use on a receiver at that particular voltage. We know what the voltage is, but we do not know what the current is. So by test it is

determined that the 180 volt terminal on the receiver will use 15 milliamperes. We also determine that the 90 volt tap on the receiver will use approximately 12 milliamperes and that the top on the 45 volt line will use 6 milliamperes. This makes a total of 33 milliamperes which must pass through R-1. Knowing our prime voltage, which is 450 volts, we subtract 180 volts from it to determine the amount of voltage drop we are going to have across resistor R-1. This gives a result of 270 volts. Now we know the voltage drop and we know the current that must pass through that resistor, but we don't know the resistance value. Referring

to Ohm's law, we find that  $\frac{E}{I} = R$ . We have E, which is 270 volts, and we have I, which is 33 mils. All we have to do now is to divide 270 by 33 mils, which gives us 8181 ohms. This is an odd value and an 8000 ohm resistor would serve just as well.

The next step we wish to take is to drop our voltage from 180 to 90 volts in order to use it on the r. f. or a. f. portion of the receiver. We subtract 90 from 180, which gives us a 90 volt drop across resistor R-2. The current which resistor R-2 is called upon to carry will be 12 mils for the 90 volt tap plus 6 mils for 45 volt tap. The total of these two is 18 mils. Again referring to our

equation  $\frac{E}{I} = R$ , we know that the voltage drop E is 90 volts and that the current I is 18 mils. Therefore, divide 90 by 18 mils (.018 amp.) and we find the answer to be 5000 ohms resistance.

Now we wish to determine the value of R-3. We have to drop the voltage from 90 to 45, which is equivalent to a 45 volt drop. The 45 volt terminal consumes 6 mils. Therefore, by the same process as previously mentioned, we divide E, 45 volts, by I, 6 mils (.006 amp.), and the answer is 7500 ohms. The value of the R-4 resistor should be approximately a little more than R-3, and since R-3 was 7500 ohms, R-4 may be 10,000 ohms. The last named resistor merely serves to complete the resistance network across the high voltage terminals. It is purposely kept high in order that the resistance value of R-3 and R-4 across the glow tube shown in the schematic will be high enough to force current through the tube rather than through the resistances.

In cases where a voltage regulator or glow tube is used across R-2 and R-3, the current drain of the tube is merely added to the calculations, considering the 90 volt terminal as the point of current drain. Glow tube current can generally be calculated at about 25 to 30 mils. Thus, in the case of the 90 volt terminal having a drain of 18 mils, there is added to this value the current drain of the glow tube, which is about 25 mils.

The method of finding the value of R-5 is shown elsewhere in this section, where a description is given of the means by which the bias resistor value may be determined. This other article involving the use of Ohm's law should be considered in connection with the above so as to give the builder a complete example of the means for determining resistance values.

Any set builder having a milliammeter, such as made by Jewell or Weston, may readily determine the current which his receiver is taking, or if he wishes he may consult the tube characteristic chart and learn from it what each type of tube draws. Knowing the current drain and the voltage required, it is easy to see how the resistance may be found.

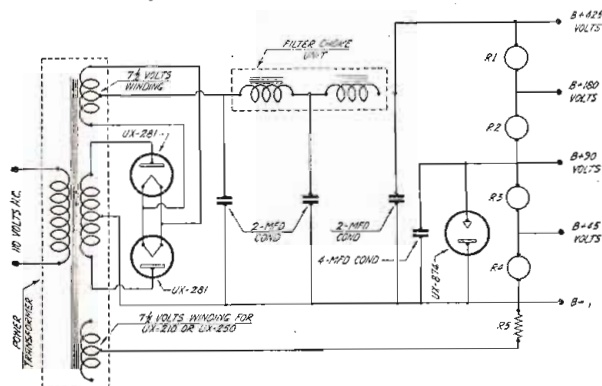
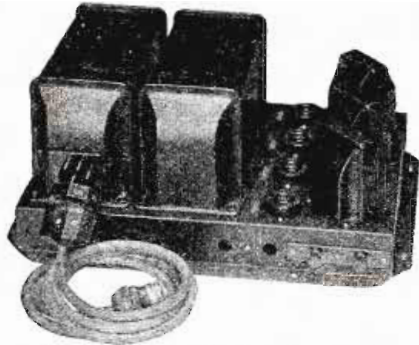


Fig. 11

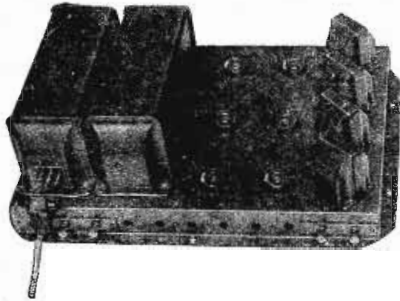


# A "Pam" Amplifier is a Sound Investment

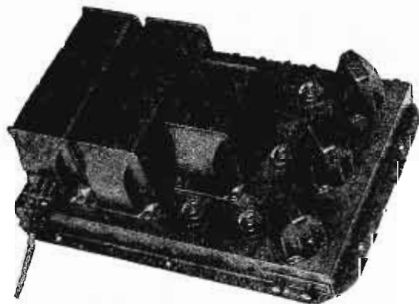
## 1000 uses---all seasons



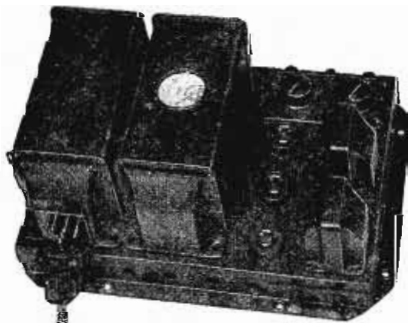
Pam 16 or 17 requires a 227 tube in first stage and two 210 tubes in last or output stage. A UX 281 half wave rectifier tube is also required. Price, without tubes, \$125.00.



Pam 19 or 20 requires 227 tube in each of first two stages and two 250 tubes in last or output stage. Two UX 281 tubes are also required. Price, without tubes, \$175.00.



PAC2 requires one 227 for first stage, two 210 tubes for last stage, one UX 281 and one UX 874 tube. Price, without tubes, \$175.00.



MIK1 requires one 227 tube in each of two stages, and one UX 280 full wave rectifier tube. Price, without tubes, \$135.00.

SAMSON Amplifiers are *soundly* designed to meet AIEE Standards and requirements of the National Board of Fire Underwriters; *soundly* built of best materials, *soundly* tested and have shown *sound* performance. Nothing has been left to chance. Compensation is provided by our exclusive attachment plug for 105 to 120 volt 50-60 cycle line current.

Pam 16 for ordinary and Pam 17 for dynamic type speakers—for which the latter also supplies field current—deliver an approximate undistorted power output of 7 watts—usually ample for operating 1 to 16 loud speakers or 500 to 700 pairs of headsets.

Pam 19 for the usual and Pam 20 for dynamic type speakers—for which it also supplies field current—deliver from 2½ to 3 times the undistorted power output of Pams 16 and 17.

The PAC2 is a combined power amplifier and A, B, and C battery eliminator which supplies externally 45, 90 and 135 volts plate current,—4½ volts C current, and raw AC for two 227 and five 226 tubes. Neither Pam nor PAC2 requires an output device between it and loud speakers due to the use of push pull output transformers.

The MIK 1 is the only completely AC operated amplifier of its kind. It is designed for use with a standard two button carbon microphone and supplies current for it. The output terminals connect directly to the input terminals of any PAM amplifier. It has volume control and microphone rheostat—which with switch and milliammeter permits quick adjusting of button currents. The MIK 1 uses the same high quality microphone input transformer that we supply to many of this country's better class broadcast stations.

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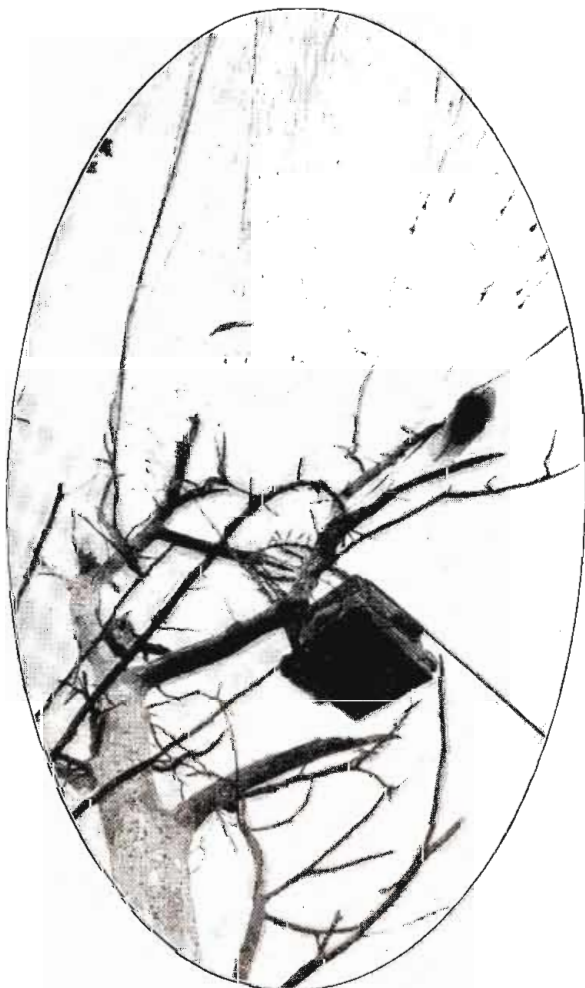


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# Digest of Science



## Balloonists' Luck



Wide World Photo

The wreck of the *Munster*, the German "Bag" entered in the James Gordon Bennett race from Detroit, caught in the top of a tree down which the crew climbed and spent the night on the ground among the rattlesnakes. The disaster occurred just outside of Lynchburg, Va.

## Labrador Current Width Measured by Expedition

The Labrador current has an average width of 110 miles, the United States Coast Guard Oceanographic Expedition on board the government vessel *Marion* has discovered as a result of observations made on the first leg of its explorations of the birthplace of the icebergs.

Through one of the amateur radio stations of the American Radio Relay League located at Bridgewater, Mass., communication was established with NITB, the radio station of this vessel, and information of the scientific work of the expedition transmitted to Science Service.

Lieut. Commander Edward H. Smith, in command, told how oceanographic observations were made beginning when the vessel left Belle Isle on the north tip of Newfoundland. The expedition sailed from Sydney, Cape Breton, N. S., on July 16 to cruise 3,000 miles through the foggy and stormy waters between Greenland and Labrador.

"Seven hundred icebergs were observed strewn along the Labrador coast from Cape Chidley to Belle Isle," the expedition reported. Oceanic conditions and a counterset current were found outside the continental edge. In spite of the many icebergs seen, there was no field ice.

The *Marion* is now approaching the west coast of Greenland. She has encountered overcast weather and easterly winds for the past week.

The ship will now proceed northward up the west coast on Greenland.

## Diamond Mystery Remains Unsolved

How does Nature make her diamonds? The fascination of the glittering jewel is heightened by the mystery of its origin. It remains a mystery, in spite of many attempts to solve it.

Diamonds are known to be a form of carbon. Graphite, another form of carbon, may be produced from diamonds, but the reverse has never been accomplished.

The most famous attempt to make diamonds artificially was that of Professor Henri Moissan. He melted pure iron with sugar charcoal in an arc furnace, then plunged the molten mass into cold water. The pressure produced by the quick chilling of the outer crust was supposed to convert the carbon so that it would crystallize from the iron solution as diamond and not graphite. After treatment with various acids so as to remove all other minerals, Moissan obtained tiny crystals which had the optical properties of diamonds. Sir Charles Parsons, the English scientist, has since repeated the experiments, but he concluded that Moissan's theories were erroneous and that the crystals were due to impurities in the iron.

Many other methods have been tried from time to time. Rifle bullets have been fired into cavities which they fitted closely. Rapid compression and heating of acetylene has been tried. In every case the results have been negative, and the diamond mystery today remains unsolved.

## To the Rescue



Wide World Photo

Queer oxygen helmets prove equally adaptable for fire or water, as the Los Angeles Fire Department tests out their oxygen breathing apparatus in a unique exhibition, during which the firemen performed submarine rescues and remained submerged for long periods.

### Radio Movies Demonstrated



*Wide World Photo*

A picture receiving machine which can be readily attached to the ordinary home radio receiving set has been invented by C. Francis Jenkins, Washington, D. C., inventor. The picture when received over the radio is reflected through a mirror instead of being shown on a screen and the size of the cartoon or moving scene is 6 by 6 in. In the photograph, left to right: C. Francis Jenkins; Gen. George O. Squires, former chief signal officer of the Army; Carl Butman, secretary of the Radio Commission; Capt. Guy Hill, U. S. Signal Corps; Harold LaFount, member Radio Commission

### Babies May Remember Experiences, Believed

An adult who relates strange things that happened to him in the first years, or even the first days, of his life may be remembering the actual facts, in the opinion of J. A. Hadfield, psychologist at London University.

People who apparently recall events out of a supposedly blank babyhood are noted from time to time by psychoanalysts as they probe into the early years of life in search of the root causes of maladjustments. Such stories have often been taken with a grain of salt by the individual's family, who believe that these must be merely imaginative memories that have come to seem real to the individual. It is also possible that the individual's "memory" of an event was gained in perhaps his third or fourth year of age, from hearing some one else recount an incident of his babyhood.

Describing a number of cases in the British medical journal, *Lancet*, Mr. Hadfield tells of a doctor who remembered a fire that occurred when he was eight months old. The fire completely destroyed the house and no pictures of the home were preserved. The doctor described the circular staircase and a colored glass window at the landing, and the flames licking at the glass panels. When he was about seven years old, he had told his parents about his memory, and gave so many details that they accepted the story, incredible as it seemed to them.

A more remarkable instance cited by Mr. Hadfield is that of a woman under hypnosis who vividly described the terrifying infantile experience of being slapped, held upside down and shaken harshly. The psychologist inquired if she did not know how they revived infants when they do not breathe after birth. She answered that she had no idea, and was surprised to hear that she had described the usual procedure.

Undoubtedly young children are too young to understand the whole significance of their experiences, Mr. Hadfield comments. But they "are not too young to feel, and experiences that are not in the least understood by a child may produce violent commotion in its soul."

Studies of anatomy, he states, show that in the year-old child the brain center for emotion is active, though the center for more discriminative thought is probably not in full function.

The young child, he suggests, can hold in its memory the feeling

of a scene, and later when he can use language, he puts the feeling into words more or less accurately as the case may be.

### Quartz and Earthquakes Reveal Earth's Interior

Crossing earthquakes with quartz pebbles to raise a flock of speculations about the inside of the earth is the feat performed by Prof. R. A. Daly of Harvard. Linking the fact that the common substance, quartz, changes its physical properties when heated with other seemingly totally foreign facts about earthquake waves, Professor Daly has discovered relationships that may lead to our finding out the real nature of the foundations of our continent.

Quartz is a material found nearly everywhere on the surface of the earth. As white pebbles on beaches, crystals in cavities, or sand grains in sandstone, it is known to many. No one knows, however, if quartz is as abundant inside the earth as it is on the surface. Indeed, it may not exist there at all, at depths of many miles.

Neither mines nor oil-wells can tell us much about the deep insides of the earth. Professor Daly's information is based on the study of earthquakes. Earthquake shocks send out earth-waves which are received on seismographs all over the globe. It is known that the deeper these waves penetrate the faster they travel. But the increase of speed is not uniform. On the contrary, there are two sharp jumps, at depths estimated by European computers to be about twenty and forty miles below the surface.

Returning to the subject of quartz, Professor Daly points out that its physical properties change when it is heated. Again, this change is not uniform. There is a sharp jump at a certain temperature. Vibrations would spread more rapidly in quartz above this temperature than in quartz below this temperature. The earth gets hotter as we burrow down into it. At a depth of twenty miles it may well be hot enough to change low-quartz into high-quartz, and this change would readily explain the change in speed of the earthquake waves. As for the second jump in speed, the discontinuity at forty miles, Professor Daly suggests that below this depth there may be no quartz in the rocks at all. In a recent number of the *American Journal of*

### Fitting Army Shoes



*Wide World Photo*

Capt. C. R. Miller, 26th infantry supply officer, fitting army shoes for F. Boyce Bryan, of Malone, N. Y. Two pails filled with sand are balanced in either hand by the candidate, thus forcing his feet to spread to proper width and length, which is recorded on a machine that decides the size and width of the shoes to be worn

Science, Professor Daly has elaborated his views and has brought many lines of scientific thought to a focus on that unknown territory, the inside of the earth.

## Borax Discovered To Be Deadly to Mosquito Larvae

Borax has had another use added to the long list of things it is good for, by Prof. Robert Matheson and E. H. Hinman of Cornell University, according to Science Service. They have discovered that a concentration of one and one-half parts in a thousand of water is very quickly fatal to the larvae, or "wigglers," of mosquitoes that breed in rainwater barrels, cisterns and other exposed reservoirs. The borax seems to hold its larva-killing properties for a long time: one experiment ran from July 25 to September 7 of last year without any signs of weakening at the end.

The two entomologists add, however, that borax should be used only where its possible effects on other animals and on plant life will be of no consequence. They are of the opinion that a cheap form of the chemical can be successfully marketed for mosquito-fighting purposes.

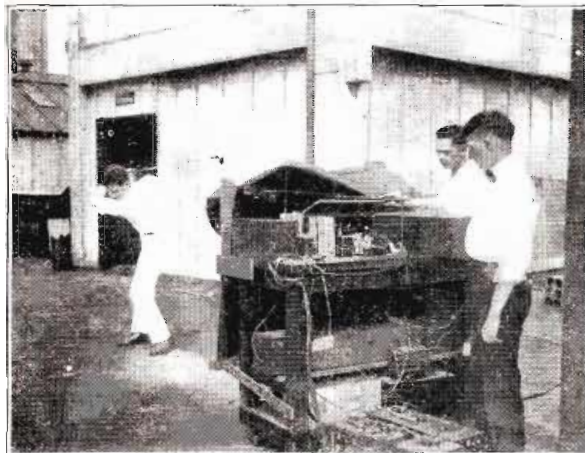
In the course of their experiments they raised large numbers of mosquito larvae, which had to be fed artificially. They state that they found common compressed yeast, such as goes into the collegiate "double malted," a very good wiggler food.

## Beri-Beri Results from Prohibition

In the United States people are getting wood alcohol poisoning and shotgun wounds from prohibition. In the Pacific Island of Nauru they are getting beri-beri, reports Dr. G. W. Bray to the Royal Society of Tropical Medicine.

This severe nutritional disease, resulting from a lack of vitamins in the diet, appeared in Nauru shortly after that country became a mandate of Australia and, curiously enough, is most prevalent during the dry season. Supply of alcohol to native peoples of mandated territory is not allowed. The natives of Nauru make their fermented beverage from the toddy palm which contains large amounts of yeast. Apparently the absence of this drink from their diet, with the accom-

## Daylight Television



Wide World Photo

The latest development in the process by which we will be able to view events as they actually happen in various parts of the world from the privacy of our own homes is daylight television, which was tested with remarkable success by Bell Telephone Laboratories. Hitherto, powerful arc lights were necessary to the transmission of pictures over the wire. Now by the addition of a powerful lens outdoor scenes may be transmitted. In the test A. L. Johnsrud was snapped by the television apparatus and his actions registered on the receiving set, sent by wire and then shown on a screen several stories below in the Bell Laboratories. Photo shows Dr. Frank Gray and John Hefele at the controls of the television transmitting set registering the actions of A. L. Johnsrud.

panying absence of the yeast that supplied vitamins, resulted in the appearance of beri-beri.

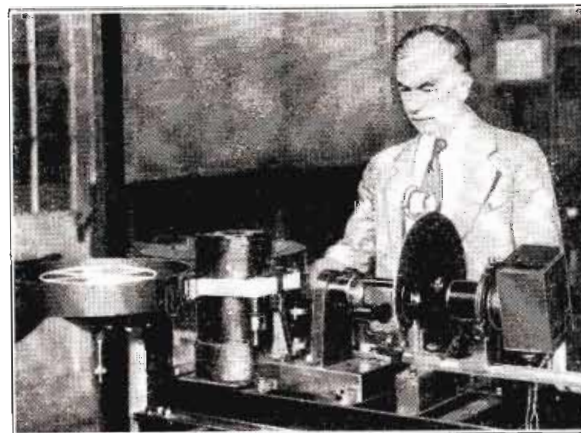
The people of the island never touch rice, which has usually been the main food of populations suffering from beri-beri. The disease occurs only among breast-fed infants, thereby upsetting another dietary theory. Feeding these infants concentrated toddy cured them of the disease.

Consumption of toddy has not entirely stopped since the mandate, although it is much reduced. During the wet season, the toddy palm yields much more of its fermentable sap, which accounts for the higher number of cases during the dry season.

## Chemical Magic Made Possible Through Catalysts

Chemical go-betweens, that make marriages between separate elements without themselves being party to the union, are responsible for much of the convenience and prosperity of modern life, declared

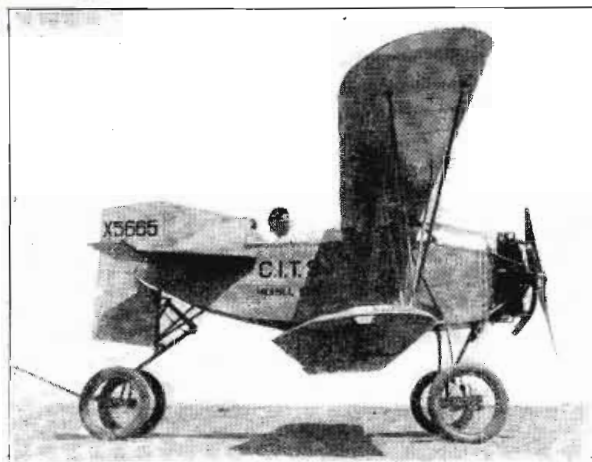
## KDKA to Have Radio Movies



Wide World Photo

Frank Conrad, assistant chief engineer of the Westinghouse Electric and Manufacturing Co. at East Pittsburgh, Pa., and the television motion picture projector which recently transmitted movies by radio. The scanning disc of the apparatus is shown in the foreground. Recent press dispatches state that KDKA will shortly be on the air with radio movies on their short wave channel.

## New Plane Almost Flies Itself



Wide World Photo

New type of airplanes that will practically fly themselves and will stop in a short distance when landing have been perfected by aeronautical experts of the California Institute of Technology at Pasadena, Calif. The new plane is constructed on the stagger-decalage principle with all of its stability in the wings. The pilot sets the wings for a certain speed and the plane automatically is synchronized to it, eliminating the danger of stalling. The wings have a stagger range of 50 per cent and are controlled by a wheel in the cockpit, the tail serving only to steer the machine. Although experts assert that the stagger, or lateral movement of the wings, is almost as important in aeronautical circles as the flapping movement invented by the Wright Bros. to enable the wings to be adjusted so as to rise from the ground. With the new principle perfected, it is expected that aircraft may be able to stop within 30 or 40 feet after hitting the ground. An unusual view of the new biplane showing the lower wing drawn back laterally by the pilot, who is Dr. A. L. Klein, one of the designers. The tail and upper wing have no ailerons, all of the wing controls of the novel ship being in the lower wing, which has an aileron. The adjustable struts which allow the lower wing to slip forward and backward are plainly shown. The rear wheels do not belong to the plane, but are part of a light truck

Dr. Robert E. Burk of Western Reserve University, speaking at Chicago before the Institute of Chemistry of the American Chemical Society.

These matchmakers are known as catalysts, and their activities are used in almost all chemical industries. In some processes they make possible combinations that could not take place without them, in others they reduce the amount of time or heat or electrical energy needed to bring about desired results. In still other industries a given batch of chemicals might turn out in any one of three or four different ways, only one of which is desirable, and in these cases the catalyst acts as a program steerer and sees the ingredients through to the wished-for end.

### Lightning Stroke Electrocutes Tree

A freak stroke of lightning apparently electrocuted a large white oak tree in the New York Botanical Garden recently. The tree was struck during a thunderstorm, but was not shattered as trees frequently are by lightning. Almost immediately, however, the leaves began to wither, and within a month the tree presented an autumnal appearance against the bright green of the rest of the grove. Continued observation convinced the garden authorities that the tree was dead, and that it had apparently died instantaneously. After it was cut down a ring count gave its age at approximately 200 years.

### 300 Year Old Blood Mystery Solved

Using a specially devised instrument, Drs. W. F. Hamilton, J. W. Moore, J. M. Kinsman and R. G. Spurling, of the University of Louisville School of Medicine at Louisville, Ky., have solved a 300-year-old puzzle of medicine and physiology when they determined by experiments just completed that the heart pumps blood at the rate of 5.2 liters, or about 5½ quarts, per minute.

The amount of the heart's output has been an unsolved problem since Harvey discovered and announced in 1628 how the blood circulates from the heart through veins and arteries. That was just 300 years ago.

The method used by the investigators here is an improvement on one developed over 100 years ago. A harmless dye is injected into a vein and samples of blood are taken from an artery every second, using a special apparatus designed for the purpose. From the concentration of the dye in these samples the workers were able to determine the heart's output and also the strength of time it takes for the blood to flow from the vein into and through the heart and back out the artery. This figure was found to be 23 seconds.

### Go Cart, Row Cart



Wide World Photo

A clever French inventor has developed a little cart which can be transformed in a moment's notice from a little go-cart, in which a child can be pushed about crowded streets, into a car which the youngster can propel by means of hand levers on the sides. Thus, mother can go calling on her friends with her restless infant, and turn the child loose to play while she visits tranquilly over a cup of tea. Photo shows the practical toy as a row-cart

### Society Misses Explore Deep Sea



Wide World Photo

The sub-debs at Ocean Park, Calif., near Los Angeles, do not intend to take up deep sea work as a profession, but it provides a thrill for them and consequently Ted Linthicum's School of Diving is a paying proposition. Linthicum is a well known coast undersea expert. Miss Shirley Parkiu "goes below." Linthicum is putting on her helmet

This harmless method will be used to help solve some of the problems of heart disease and will be of assistance in treating this condition, it is hoped.

### Synthetic Vinegar Lacks Vitamins

Vinegar made by the old-fashioned fermentation process is far superior to synthetic acetic acid, German scientists have found, according to Science Service. While all vinegars vary greatly in their vitamin content, the synthetic variety is lacking in vitamin D, the important food factor that prevents rickets in children, report Dr. A. Janke and H. Lacroix.

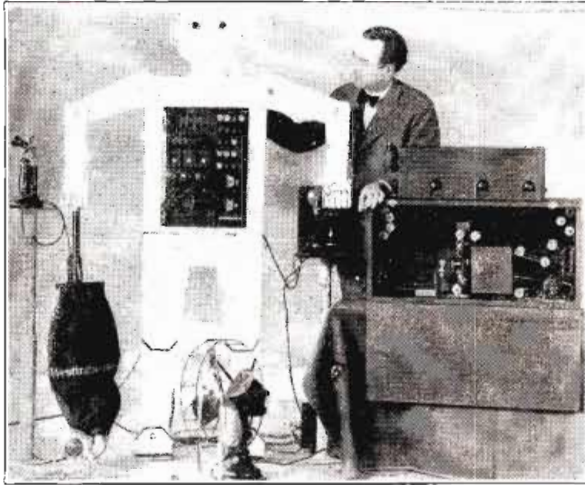
### Tattoos Small Fish Instead of Tagging

Tattooing spots under the scales of fish instead of fastening tags on them, is new method of keeping track of aquarium specimens described by Ansel B. Keys of the Scripps Institution of Oceanography in the forthcoming issue of Science. Mr. Keys marks fish too small for the ordinary tagging method by just barely puncturing the outer skin with a hyperdermic needle loaded with India ink. He reports that his scaly pets suffer no ill effects from the spotting operation, and that the marks last for several weeks.

### Serum Test Distinguishes Infection from Immunity

The increasing use of antitoxins and inoculations against specific diseases is presenting a new problem to scientists. To diagnose a number of diseases, agglutination tests are now made on the patient's blood serum. However, agglutination may occur as a result of previous immunization against certain diseases, for example, typhoid fever. A new serum that distinguishes between agglutination due to an infection and that due to immunity has been perfected in the case of undulant fever (abortion disease in cattle), by I. Forest Huddleston of the department of bacteriology at the Michigan State College at East Lansing, Mich.

## Robot Now Talks



Wide World Photo

"Televox," the Westinghouse mechanical man, who has won world fame for his amazing ability to execute commands given him over the telephone, has now learned to talk. Now, when his master, Roy J. Wensley, calls him on the 'phone, "Televox" answers in a deep bass voice telling who he is and that he is ready to go to work. By incorporating into it parts of the talking movies, this man of copper veins, porcelain bones and vital organs of vacuum tubes, has acquired the power of speech. When "Televox" hears the telephone ring, a roll of film carrying pictures of appropriate sound waves is set into motion, producing a suitable sentence and sending it back over the telephone wires to the operator. Photo shows Roy J. Wensley, the inventor, with his mechanical man.

## Swedish Warriors Took Horses on Death "Voyage"

Graves fifteen centuries old recently unearthed at Tuna in central Sweden have shed a new light on the elaborate and loving care which ancient Swedes lavished upon their dead. The burial mounds, according to Dr. T. J. Arne, a government archaeologist, are the richest and most remarkable found in Sweden for many years.

In one of the graves the skeleton of a man lay in the remains of a boat which was to carry him on his last long journey. Like the other graves, it was placed in true east to west direction, and the traveler had been well provided for. His horse, fully harnessed, and his dog had been placed in the stern of the ship and he had been given plenty of food for his journey.

A round bronze buckle, evidently serving to fasten his mantle around his shoulders, was also found as well as several iron arrow heads, which showed he had been well armed. To keep his weapons sharp, he had a small whetstone, fastened in a ring. A number of well preserved earthenware pots were also discovered in the grave.

The next burial place contained a similar boat, in which a man and his wife had started their last journey together, each of them having a horse and a dog.

The man had his sword and shield, and the woman had iron cooking implements and knives to enable her to prepare their food, and also a number of little female trinkets, including two combs of bone.

Under another mound the remains of a man were discovered, but he had been buried without a boat. By the side of the deceased lay a mighty iron sword, a dagger, a knife, a flint and tinder for making fire, a beautiful sword belt of bronze and gold, richly ornamented, and a large silver buckle, inlaid with garnets set in gold. All these articles were in a decorative design of striking character and probably were of southern Germanic origin.

## Using Science to Brown Cookies

Just how brown is the "golden brown" cookie of the recipe books and how does it get that way? Three scientists, Prof. C. H. Bailey, Eva L. Stephens and Alice M. Child of the Minnesota Experiment Station at St. Paul, Minn., found a way to tell and have reported it to the American Association of Cereal Chemists.

An instrument called a spectrophotometer is used to measure the color quantitatively. The reflection of light from the cookies is com-

pared with that from a standard of a certain degree of brownness, and the color of the cookies is determined by mathematics.

The color of the cookies depends somewhat on the color of the molasses, as every cook knows. Also, increasing the amount of the baking soda makes the cookies darker as does increased temperature of baking.

By the use of this instrument it is possible to determine the difference in color of baked products which results from changing the recipe or the time or temperature of baking.

## Salt Water Bath to Cure Seasickness

When the ship begins to pitch and roll and you feel waves of seasickness overwhelming you, try a salt water bath. The water should be from 90 to 95 degrees Fahrenheit, its specific gravity 1.020.

Lie in the bath with your eyes blindfolded, your body supported lightly at shoulders, buttocks and back of head, with the toes just touching the end of the tub to keep the legs from floating. Stay in the bath for a half hour, an hour, or longer if necessary. This procedure gives great and unusually permanent relief within a short time.

This method of treatment was worked out by Dr. R. A. Bennett of London, who used it in extreme cases where exhaustion from seasickness was becoming dangerous. The bath moves as the ship does, but the water has not time to respond to the motion, so it and the patient immersed in it remain fairly motionless. It is this relative immobility and not the sedative effect of the bath that is responsible for the relief it gives.

## Need Red and Yellow Rays as Well as Violet and Ultra-Violet

The red and yellow light rays of long wavelengths are just as important as the shorter violet or ultra-violet rays for normal growth

## World's Greatest X-Ray Tube Perfected



Wide World Photo

The world's greatest X-ray tube, 15 ft. tall, is perfected by scientists of the California Institute of Technology at Pasadena, Calif. The giant million-volt tube which produces rays that will penetrate 2 in. of lead and are visible 300 ft. away has been completed by Professors C. C. Lauritsen and R. D. Bennett, of the famous Pasadena institution. The basic plan of the scientific invention is to seek information concerning the structure of the nucleus of the atom which may lead to the unfolding of new wonders in the field of chemistry, biology and medicine. General view of the gigantic X-ray tube surrounded by its wooden support that protects its 15 ft. of high voltage.

### Electric Sealing Outfit



Wide World Photo

In the course of a day's shipment of small packages of some value, the task of sealing with the old wax and flame method became so tedious that a French inventor developed a method of doing this electrically. The wax is held in the little crucible, through which a heating rheostat is passed. The melted wax is allowed to run in a small stream onto the paper and the seal, which is on the bottom of the support shaft, is moistened by a small sponge and pressed on the hot wax.

and developments, reports Dr. Charles Sheard of the Mayo Clinic at Rochester, Minn.

Dr. Sheard and associates experimented with chickens, exposing different groups of them to sunlight, from which the ultra-violet, red-yellow and green-blue rays respectively had been removed by special glass filters. At the same time, all the chickens were fed a diet rich in everything except vitamin D.

When either the red-yellow or the green-blue light was filtered out, the parathyroid glands, which play an important part in the process by which food is transposed into tissue and energy, increased greatly in size in order to maintain normal growth and development.

During the first two months the rate of growth of the chicks was greater under all filters when a small amount of cod-liver oil was added to the diet. At the end of six months' time it was found that the weights of chicks under both the amber and blue filters was much less than under the whole of sunlight except in the cases where cod-liver oil was fed. This small amount of cod-liver oil is apparently able to induce normal growth and development irrespective of the presence or absence of any portion of either ultra-violet or visible solar energy.

Without cod-liver oil and on a standard ration, experiments showed that normal growth did not take place unless both the ultra-violet and visible rays of sunlight were admitted.

### Chemists Seek Way to Unmix Oil and Water

The old adage that oil and water can't be mixed makes the oil producer smile wryly when he hears it. For like many another proverb, it is very far from the truth, and in this instance it is a most ex-

pensive joke on the oil man, according to Dr. Gustav Egloff of Chicago, who spoke at Chicago before the Institute of Chemistry of the American Chemical Society.

Oil and water do not mix as a chemical compound, it is true, but they often come out of oil wells together in that very intimate physical mixture known as an emulsion, wherein very fine droplets of one are suspended in the other and won't come out without the most troublesome and expensive of treatment. Thus it has resulted that nature every year burdens the oil industry with 200,000,000 barrels of intimately mixed oil and water as emulsified crude oil. Such oil does not separate its water even after years of storage. To refine emulsified crude oil into dry oil and water is both difficult and expensive.

"There are present over 100,000,000 barrels of emulsified crude oil in storage tanks and in sump-holes in the ground, and the refiner is at his wits' end as to how to separate the oil from the water," Dr. Egloff stated. "Thus over \$100,000,000 is tied up in stored emulsified oil for whose utilization no really economical method has been evolved, which is applicable to all situations.

"Not alone do we have nature producing highly stable emulsified oils, but they are also produced in the refining process, particularly in the manufacturing of lubricating oils. As a matter of fact extremely thorough refining is necessary to produce lubricating oils which will not emulsify under service conditions in motors and turbines."

### Cigarette Smoke Alike, Psychological Tests Show

The evidence in widely published cigarette advertisements that tell how blindfolded celebrities selected the particular brand whose money bought the advertising space is called in question by exhaustive psychological tests carried out in Reed College, Portland, Ore., by Louis Goodman, a graduate student, according to a story by Science Service.

Instead of the 100 per cent recognition claimed in the advertisements, the seasoned smoker-subjects were able to pick their favorite brands only once in every nine times that it was presented to them. Stuart Chase, who is campaigning against purchasing based on trade-names, fancy labels and other present-day advertising methods rather than upon quality, will summarize these tests in the next issue of a national magazine.

By pure chance, the smoker should be able to recognize his favorite brand 17.6 per cent of the attempts, but in the tests the rating made

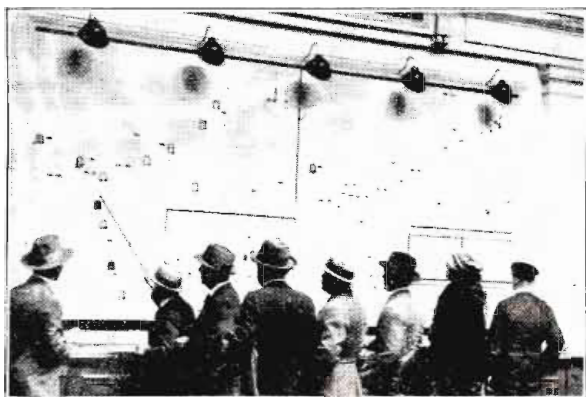
### Something New in Vehicles



Wide World Photo

Robsy Ceccarine, of Milan, Italy, gives a demonstration of a monocycle, a wheel 5 ft. in diameter, inside of which is the seat and motor moves on a groove, before the delegates to the International Advertising Association in Detroit. The monocycle is said to have attained a speed of 80 miles an hour in tests.

## New \$1,000,000 English Airport



Wide World Photo

The world's greatest airport, constructed at Croydon, England, at a cost of \$1,000,000, was recently dedicated by Sir Samuel Hoare, British air secretary. The airdrome has its own weather bureau and can at a moment's notice get in touch with any plane by means of wireless telephone. Photo shows the weather reports of the world. Upon this large map, on which every aerodrome is marked accurately relatively to the others, are hung cards bearing the latest climatic news from all districts

was only 11.6 per cent. Even when not blindfolded the testers could not tell what cigarettes they were smoking if they were not allowed to see the label.

The conclusions of the tests claim that smokers cannot recognize brands on the basis of odor or taste, name brands correctly when deprived of visual clues, differentiate between two cigarettes, differentiate between strong and mild cigarettes or tell the difference between straight Turkish and domestic tobaccos.

## Ice Cakes Become Standardized

Now the ice cake that meltingly does its part in combatting summer heat is to be standardized. The United States Bureau of Standards has issued standard weights and maximum sizes for the chunks of frozen water that the ice man puts into the refrigerator daily. Cakes of 25, 50, 75, 100 and 150 pounds are declared standard and for these weights maximum dimensions are specified. The smallest weight, 25 pounds, must measure less than 12 by 12 by 8 inches, while the 150 pound cake must not exceed 12 by 24 by 24 inches. Manufacturers will shape the ice compartments of refrigerators so that the standard cakes will slide into them easily.

## Red Line Opens New Aurora Mystery

Photographs made in Flagstaff, Ariz., at the Lowell Observatory of the spectrum of the Northern Lights at the time of the brilliant display on July 7 has opened up a new scientific mystery. For the first time, there appears, in addition to the various lines due to known elements, a very prominent line in the red region of the spectrum. As it has never before been photographed, Dr. V. M. Slipher, director of the observatory, who recorded it, is unable to state definitely what elements cause the reddish color. However, he suspects that it is due to some known gas in the atmosphere of the earth, possibly nitrogen.

On the photographs taken by Dr. Slipher there also appeared very prominently the so-called green auroral line, which was long a mystery. First photographed during visible displays of the northern lights, or aurora borealis, it was found at the Lowell Observatory in 1915 that it could be recorded by pointing a spectrographic camera at any part of the sky on any night even if cloudy. Dr. Slipher has also made such photographs of it on numerous occasions and under all sorts of sky conditions, always with success. He finds an unaccountable variation of its intensity shown even in a few minutes. This may occur during a night that remains constantly clear, so is not due to the weather conditions.

However, the origin of the green line was shown a few years ago by Prof. J. C. McClennan, of the University of Toronto, and Prof. G. M. Shrum, of the University of British Columbia. Studies made in his laboratory with the aid of low temperatures obtained with liquid air and liquid hydrogen finally demonstrated that it was due to familiar oxygen.

## High Pressure Boiler Works at 3375 Pounds

Steam at a pressure of 225 atmospheres, or 3,375 pounds per square inch, is generated in a new battery of boilers recently installed at the Siemens-Schuchert Works at Charlottenburg. The installation has attracted considerable attention among German power engineers because of a number of unique features it involves. The design was developed by an Englishman, Benson, but the German plant is its first construction on a large industrial scale.

Each boiler consists of a high, relatively slender octagonal tower. There is an open interior space, surrounded by the water tubes. Coal dust is used as the fuel. This is blown in at the top of the tower, together with a blast of pre-heated air, and combustion takes place in the central open space, generating an unprecedentedly high firebox temperature, and producing steam at a pressure of over 3,000 pounds per square inch and a temperature of 450 degrees Centigrade.

At the bottom the small amount of ash falls out, and the combustion gases are turned back to warm up the pre-heater for the air blast, which is raised to a temperature of 400 degrees Centigrade before it enters the combustion chamber. So completely is the heat used up that the outside of the towers are said to be but little warmer than the surrounding air.

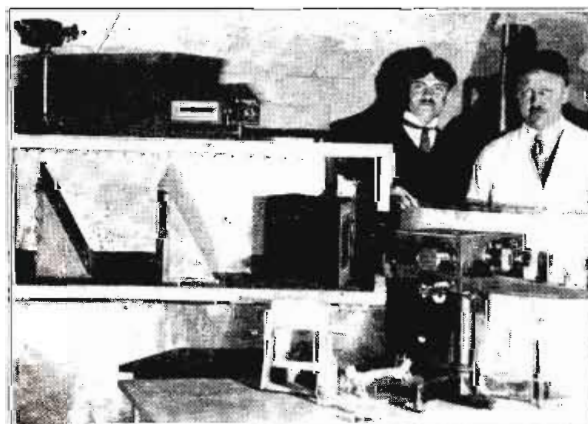
No firemen or boiler tenders are required, for the coal dust, air and water supplies are all regulated electrically. There is not even any boiler house; the towers stand out in the open. The elimination of a shelter for the boilers of course effects an additional saving in installation costs.

## Warns Chemists on Food Fads

The charlatan who used to make the medical man's life a burden by flooding the market with nostrums has now changed his trade to that of food faddist, and it is the chemist's turn to look out. This warning was sounded by Dr. C. Robert Moulton of Chicago, speaking before the Institute of Chemistry of the American Chemical Society.

"Knowledge of things scientific plus a vigorous campaign have almost driven the old patent medicine man out of business," Dr. Moulton said. "At the same time the marvelous new knowledge of foods and nutrition has offered him a new field for conquests. As a result we have some strange and wonderful things told us about the harmfulness of certain food combinations, about the superiority of all foods as furnished by nature, about the danger from cooked foods, about the harmfulness of animal foods, about the bogey of acidosis, about the esthetic virtues of the nut and fruit diet and about many other food fads too numerous to mention.

## The World's Largest Spectroscope



Wide World Photo

The spectroscope in this photo is considered by its builders as the largest in the world. They worked nearly two years to develop it for the purpose of giving treatments of pure ultra-violet rays of the shorter wavelength. Ultra-violet can only pass through the best quartz lens, any other type of lens either filtering out the short wave rays or allowing other light radiations to penetrate. The lens in this monster spectroscope weighs about four and a half pounds and the prism weighs nearly twenty pounds. The normal sized spectroscope is the instrument on the pedestal on top of its giant brother. Dr. Jean Saidman (left) and Mrs. Louis Dupestel are the ones responsible for its development and installation at the Institut D'Actinologie, Paris



## World's Most Powerful Steam Turbine



Wide World Photo

A colossus of power, the largest single shafted steam generating turbine ever built is put into operation at the Long Beach steam plant of the Southern California Edison Company with appropriate ceremonies. It generates 125,000 electric horsepower, the greatest amount of power ever developed by one piece of apparatus. Its shaft is over 100 ft. in length and 16 in. in diameter. It is one of eight which will be installed in the Long Beach plant by the Edison Company.

"There is some truth behind some of the food fads, but there is more fiction. The chemist has an obligation to perform in seeing that the public, or those who educate the public, are correctly informed. But he should not make the mistake of being too technical or of giving the layman too many details. He should avoid setting himself up as an authority in nutrition simply because he knows the language. He should be cautious and humble, and not let the few experiments of his laboratory set at naught the long experience of mankind with diet. He should get the truth, carefully interpret it, and then pass it on to the public. He should fight the food fad."

## Egyptian Swimmers Knew Modern Strokes

The "modern" crawl stroke recently adopted by European and American swimmers was nothing new to the Egyptians 3,000 years ago, according to Prof. James E. Dunlap, of the University of Michigan, writing in *Art and Archaeology*.

Study of ancient mosaics and vases has convinced Professor Dunlap that overhand strokes were practiced by swimmers of Egypt, Rome and Greece. The Assyrians appear to have been less at home in the water. In one scene of Assyrian soldiers crossing a river, two of the three soldiers stopped to blow up inflated skins, so that they would have support. Clinging to the long balloon-like skin, the soldier pushed back and down with his free hand and so propelled himself across.

That the Greeks used the overhand stroke is shown by a vase depicting a scene in a women's bathing establishment. One of the women is swimming with her right arm extended forward to begin the downward and backward stroke, and her left arm is near her side at the end of a stroke. Two of the other Greek women in the picture wear bathing caps, but bathing suits were thought unnecessary.

Swimming instructors were known upon the banks of the River Nile at a very early date, Professor Dunlap points out. A nobleman of Egypt, who lived before 1800 B. C., recorded proudly that his children and the children of the king took their swimming lessons together.

## Molds Cheating Lemons Out of Their Jobs

How a common black mold, known as a spoiler of food, has been drafted for the manufacture of citric acid, long a monopoly of lemons and other sour citrus fruits, was told recently by H. T. Herrick of

the United States Department of Agriculture, speaking before the American Chemical Society Institute.

At least as far back as Noah's famous spree, Mr. Herrick reminded his audience, man has used fungi for the production of desired chemicals; for the yeasts that ferment sugar to alcohol are fungi. The molds, belonging to a different fungus family, have also served mankind in the making of such things as cheese, for the green streaks in prime Parmesan are really moldy spots. But it is only lately that molds have been deliberately set to work on sugar, and their possibilities as chemical servants are only beginning to be realized.

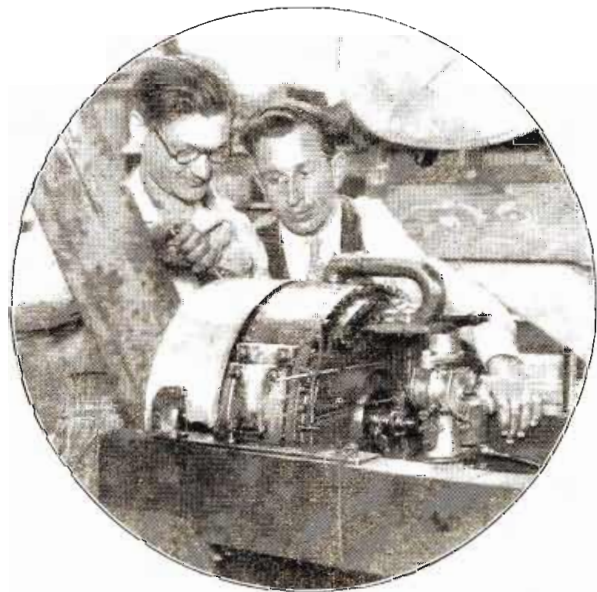
The principal industrial exploitation of the appetite of a mold for sugar at present is the manufacture of citric acid. This has received a special stimulus from the imposition of an export tax by Italy on its citrate product, derived at present wholly from lemon culls. Since the whole soft-drink industry depends on citric acid, and a great deal is used in flavoring extracts as well, the Italian export duty may have almost the same effect on the infant American acid-from-mold industry as a protective tariff.

At present the sugar from which the mold makes citric acid is the familiar cane sugar or sucrose. This is relatively expensive, and Mr. Herrick and his assistant, O. E. May, are now hard at work in the hope of producing citric acid from the action of mold on the cheaper corn sugar or glucose. Hitherto this has not been possible because of the impurities present in commercial glucose, but a product of high purity is now available.

Citric is not the only acid that can be produced by the action of molds on sugar. There are many different kinds of mold, and many varieties of sugar, and the combinations possible are almost infinite, according to Mr. Herrick. Such acids as oxalic, malic, lactic and succinic are now known to be produced by molds, and the investigation has not proceeded very far.

One acid, which has hitherto been so rare that it is listed at over \$100 a pound, has been produced by Mr. Herrick and Mr. May in the government laboratories at about 35 cents a pound. This is gluconic acid, which is the result of the action of one species of mold on glucose. Very little is known of what gluconic acid may be good for, because its high price has hitherto practically prohibited experiments, but an investigation of its industrial possibilities may now be expected.

## New Airplane Motor Perfected



Wide World Photo

A new airplane motor, a semi-turbine rotary with no reciprocating parts, is perfected by Los Angeles mechanics. The motor, which is pistonless, valveless, sleeveless, camless and has no springs, was invented by Kenneth W. Barkman and N. E. Cherdavoine, who claim it will develop 450 horse power. The new engine has but 15 parts and consists of two housings. The combustion housing is stationary and the timing housing from which the drive is taken also acts as a hub for the propeller blades attached to it. The entire motor weighs 220 lbs. and its dimensions over all are approximately 18 by 18 by 12 in. Photo shows Kenneth W. Barkman (left) and his assistant, N. E. Cherdavoine, with their new motor.

## WITH THE ACCESSORY & PARTS MANUFACTURERS



# Dynamic Speaker Is Latest Aid to High Quality Reproduction

**A**RRIVING on the scene at the time when the radio public was intensely interested in high quality reproduction, the dynamic speaker has been immediately seized upon as an ideal reproducer from the standpoint of tone, power and compactness. The widespread use of the dynamic speaker is further shown by the preponderance of speakers of this type in the manufactured sets this season. In addition to this fact, it develops that the professional set builder has been casting about for a strong and rugged speaker to install in high powered sets which he constructs and this season the professional set builder's attention is being centered on the dynamic. Added to this fact that the general public has tired of the old style reproducers, it will not be difficult to understand the popularity of the dynamic speakers.

### An Old Principle

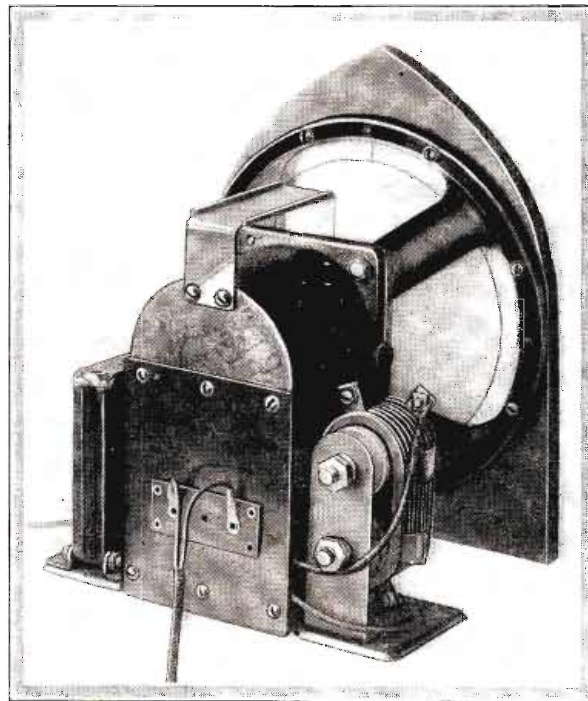
Dating back to the days prior to the war, the dynamic principle has always been accepted as the logical one provided it could be applied in the proper manner. In the past it was found that its application did not lie in the use of horn type speakers, although many of the fans can remember the day when the first horn using the dynamic principle was quite popular.

As an outgrowth of the cone type speaker which held sway for a couple of seasons, it is only natural that the dynamic should appropriate to itself the outstanding advantages of the cone and merge these advantages with its own inherent reproducing features, such a combination giving the radio world what it considers to be the best form of reproducer, even though it may be more expensive than preceding types.

The chief virtue of the dynamic really reposes in its strong magnetic field, a type of field heretofore not possible with the use of permanent magnets alone. In addition to this the dynamic type of speaker is capable of a degree of air displacement which no previous type could approximate, and this without any attendant distortion or rattling.

### Energizing the Fields

Still another advantage of the dynamic is observed in the use of a baffleboard, which serves the purpose of preventing sound emanating at the front of the cone from reaching the back when the cone is operated outside of a cabinet. When the cone is operated in its own cabinet, the sides and top serve to amplify the lowest bass notes and give a lifelike reproduction, which has so pleased the radio public at recent demonstrations of the dynamic speakers. There are two methods of energizing the field windings of a dynamic speaker. The first use was a storage battery of 6 volts and a current of approximately  $\frac{1}{2}$  ampere, the field winding generally being attached to the same storage battery that serves for the filaments of the receiver. An outgrowth of this first method is the use of a step-down transformer and contact rectifier together with a filter to give 6 volts of direct current from the alternating current line. This later development of the 6 volt field seems the most logical, because it is not a drain on a battery operated receiver or in the case of an electric receiver it is in keeping with it. The second method of energizing the field winding is by means of the field winding with a resistance of ap-



*Fig. 1. This photograph reveals the details of the Peerless unit, which is an exceedingly simple and compact one. Its field is energized by 6 volts direct current secured through a rectifier shown at the right of the unit in the above picture*



**Fig. 2.** This illustration shows the Magnavox dynamic operated from a.c. and available either in the 25 cycle or 60 cycle models. The rectifier is shown at the right of the unit

pecially treated, moves back and forth freely within the magnetic field set-up by the field winding. The light weight movable coil, which is in series with the step-down output circuit or the step-down transformer supplied in the base of the unit, traverses a powerful electro-magnetic gap. The cone is supported in two positions, one being flexible supports at the perimeter of the cone, these usually being of lamb skin or some other suitable material, while the support for the small end of the cone is usually by means of two springs which maintain the vertical rigidity of the cone but do not effect its horizontal reciprocal motion.

**Peerless Dynamic**

The Peerless dynamic speaker illustrated in Figure 1 is made by the United Radio Corp. As shown in the illustration, it is of the a. c. type, having its own transformer and contact rectifier for energizing the 6 volt field winding of the speaker. In this speaker the movable coil consists of a single turn copper ring, the extension of which becomes the spring that holds the cone in place and permits forward and backward travel. This is a departure from other types of speakers in that it simplifies production work and assembly. The finished job is placed in a cabinet of Gothic design, which presents a very attractive appearance to those seeking beauty as well as utility.

**Four Magnavox Models**

The Magnavox dynamic speaker differs from other speakers both in principle and construction, the movable coil in this speaker consisting of a number of turns of small insulated wire wound around the tubular extension of the small end of the cone. The photograph of the Magnavox unit is shown in Figure 2, where the rectifier for the field winding will be seen at the right, suitable

proximately 2250 ohms, so that this winding may be inserted in a power amplifier instead of a 2250 volt resistor in the resistance network across the high voltage rectifier. Where manufacturers are putting in their own power supply, this latter form of field winding excitation seems the most popular.

**Floats in Magnetic Field**

Perhaps the greatest virtue of the dynamic is the fact that a light weight movable coil attached directly to the cone, which is usually a circular paper one, especially

step-down transformer for the rectifier, and an input transformer for the speaker also being made a part of the unit. In addition to the unit type available for many manufacturers, the Magnavox is obtainable in four models, the Cordova, with the dynamic 500 unit, 110 volt 60 cycle a.c. combining rectifier and power amplifier, which takes the place of the last audio stage in a receiver. It operates with one 281 rectifier tube and one 210 power tube; the Belvidere model is a beautiful screen type of rich two-tone walnut, this

model being obtainable in 6 volt d.c., 110 volt d.c., 110 volt a.c. 60 cycle, or 110 volt a.c. 25 cycle. The a.c. speakers plug directly into the light socket. Another model known as the Beverly, which is a two-tone brush walnut cabinet of graceful contour for table use and also available at the voltages and current specified previously. The Aristocrat, a graceful butt-burl walnut cabinet finished in brush two-tone effect completes the line announced by Magnavox for this season.

**Jensen Models**

The Jensen dynamic speaker shown in Figure 3 is available in two unit forms, and in cabinet and console. The illustration shown in Figure 3 shows the rear view of the Jensen Model D4 a.c. unit containing its own rectifier and necessary input and step-down transformers. In the Jensen design the full sensitivity of reproducing mechanism is retained and at the same time the current consumption is exceedingly small. The units are available in three forms, 6 volt operation, 90 to 180 volts d.c. operation, and 110 volts a.c. operation. The Jensen Model 6 cabinet in size and appearance is suited for use in the most artistically furnished living room or music room, while the Jensen Model 7 console is for the prospective purchaser who desires a Jensen dynamic housed in a console design of artistic proportion and beauty.

In both the models 6 and 7 a built-in toggle switch conveniently located at the rear of the cabinet have been provided for turning on and off the speaker field. The sound reproducing mechanism in all of the models is identical, the difference being in the means used to energize the magnetic field. The same source of current supply used for the radio receiver will operate with one of the three Jensen units. The sensitivity of the instruments is the same regardless of the method of field excitation.

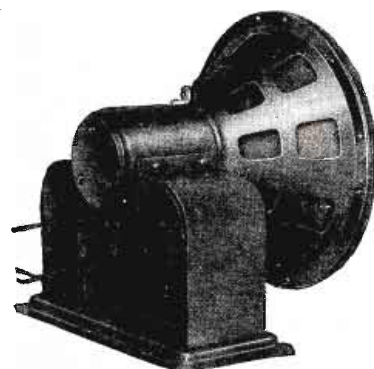
**Muter's Dynamic Speaker**

The Muter Dependable dynamic speaker is exceptionally well built and possesses a number of very unusual features. It is well designed throughout and its mechanical and theoretical construction makes it worthy of the name Dependable.

Three types are furnished for operation from 6 volts d.c., 90 volts d.c. and 110 volts a.c, the rectifying unit in the latter being the Rectox. All models are made up in three types, the manufacturers' type for console installation, the table model and the spinet console model for external attachment to any set.

If to be used with push-pull amplification, a special push-pull type speaker can be had in either model for a slight additional charge. This is an exclusive feature of the Muter dynamic and will effect a saving for those having this type of amplification.

Every part of the Muter dynamic is completely shielded and enclosed, protecting the working parts from dust, corrosive effect of the air and accidental injury. The appearance is also greatly enhanced by this design. The entire unit is manufactured under one roof, making close supervision and extreme care in manufacture possible.



**Fig. 3.** In this illustration is found the Jensen model D4 a.c. unit, the transformer and rectifier being housed in the compartments at the left and right of the main unit

Readers desiring descriptive literature on the dynamic speakers will be supplied with same upon written request addressed to the Editor of this magazine.



**Fig. 4.** This photograph gives an idea of the appearance of the Muter, which has just been announced. Transformer and rectifier are located to the left and right of the central unit, while below the speaker rear is placed the coupling transformer. All connections in this unit are by terminals or binding posts and the assembly is quite simple

## Robertson Davis Automatic Super-Six Receiver

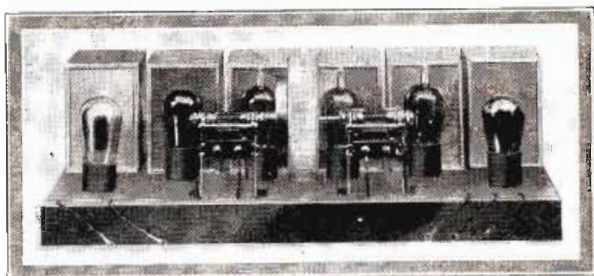


Fig. 1

THE radio fan gets a new thrill this season, with the advent of automatic radio. The receiver that makes this possible is the new Automatic Super-Six (a. c. shield grid operated), a product of the Robertson-Davis Company, Inc., of Chicago, well-known as the designers of the long-distance superheterodyne receivers, the Melo-Heald Eleven and the Hot Spot Fourteen. Though this new receiver uses but six tubes, the ability for selectivity and distance reception is actually improved, and the automatic tuning device makes it possible to bring in a desired station and cut out any other station being played by the simple automatic expedient of pressing a button.

The name is a virtual description, for the Automatic Super-Six is a six-tube set using the superheterodyne circuit. It is entirely a. c. operated, using only the a. c. type of tube. The intermediate amplifier, which gives a high gain per stage, is made up of three a. c. shield grid tubes. The other three tubes are of the conventional a. c. variety.

Fig. 1 shows the simple and practical construction of the set, which contrary to accepted practice employs transformer coupling throughout. Sub-panel construction is used for the chassis, and the sub-panel is completely wired and sealed into an aluminum case. All of the instruments used in the receiver are fitted and housed in this sub-panel except the trimmer and volume control which are mounted directly on the panel. The tubes and transformers all plug right into the sub-panel for which a double row of sockets is provided, one row for the six tubes and the other for the six transformers.

### Plug-In Coils

The type of transformers used are Robertson-Davis Melo-couplers of the new shielded plug-in type. They are completely shielded by aluminum and contain all the necessary inductances and capacities for coupling between stages. The intermediate transformers are peaked at a frequency of 465 kilocycles, which is the most favorable for one spot reception; and like the Hot Spot Fourteen, this is a one spot receiver.

Nine flexible marked leads with soldering lugs attached are provided for connecting the condensers, trimmer and volume control. No soldering whatever is necessary to assemble this receiver—only a screw driver is required to connect the nine leads to their respective instruments. All of these unique features mean that only 18 minutes are required to assemble the receiver complete ready to use.

Tuning has been greatly simplified. No oscillation control is used. The only tuning controls are the single illuminated drum dial, the trimmer condenser used when searching for extreme distance, and the volume control. By limiting the amplification of the intermediate transformers, the volume control automatically governs the output of the receiver. Because of this rare feature, any desired amount of volume can be used without interfering with performance in the least. Only 18 milliamperes of "B" current are consumed by this set.

Ten kilocycle separation between a high-powered local and extreme distance is assured. As it is impossible to force the receiver into a state of oscillation, it is entirely free from all squeals and howls. Any length of antenna desired may be used

for the pick-up system.

The mere interchange of antenna and oscillator coils makes it possible to cover a wave-band of from 20 to 555 meters, thereby adapting the set for television or short-wave use.

Dimensions of the panel are 7x21 inches, and the dimensions of the chassis enable a cabinet of 7x21x12 inches to accommodate this receiver.

Automatic tuning is permitted by an automatic electric tuner which plugs directly into the receiver. Any six stations can be selected, and these can be changed at will. The desired station is tuned in on the drum dial, and is then quickly transferred to the automatic tuner by two simple adjustments. When the six desired stations are adjusted to the automatic tuner, they are marked on the index holder. One button controls each of the six stations, and another button is provided for set operation from the drum dial. Depressing any one of the seven buttons automatically cuts out all the rest, and brings in only the station desired from the six selected on the automatic electric tuner or any other tuned in with the drum dial on the receiver.

Another unique development in this receiver is that either 171 or 250 tubes may be used in the audio system, which is a completely wired sub-panel provided with flexible marked leads with soldering lugs ready to attach to the Thordarson transformers as recommended. This leaves the selection of the power tube to the user. This audio unit is in two stages, the second stage using either the 171 or 250 power tube, and carries the filament supply transformer. Those who wish to use 171 tubes employ "B" supply similar to that furnished for the ordinary audio system. While those who want intense power and exceptional tone as delivered by 250 tubes require the super-speech amplifier which supplies the high "B" voltage necessary for the No. 250 Tubes. Electric phonograph pick-up facilities are a part of this audio unit.

Due to the absence of a. c. power in certain locations, this receiver can be supplied when desired for battery operation.

With these many new features, ease of assembly, simplicity of operation, quality of reception, ability to bring in distance, one spot tuning, and a high over-all amplification, the new Robertson-Davis A. C. Shield Grid Automatic Super-Six seems well entitled to the considerable interest and enthusiastic reception that have been accorded it by radio fans and set-builders throughout the United States and Canada. At last, automatic radio has really and truly arrived, with all of the refinements indigenous to the finest dial-tuned set.

## Electrad Eliminator Booklet

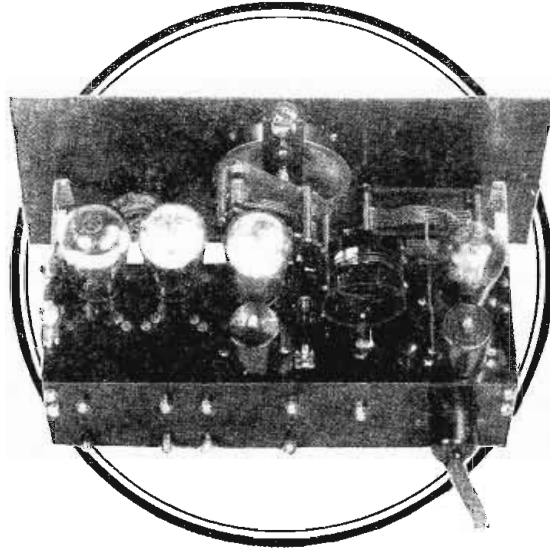
UNDER the title "What B eliminator should I build?" there has been recently published an interesting booklet consisting of thirty-two pages and giving instructions and illustrations on the use of variable wire wound resistances in such nationally known power supply units as Thordarson, Sangamo, AmerTran and Silver-Marshall.

Of the many advantages gained by the use of good variable wire wound resistances, the most important is the fact that definite detector, radio frequency and audio B voltages can be obtained for various sets, making the power supply devices more uniform and flexible in their use. This is very important in superheterodyne sets because their 45 and 90-volt taps should be variable. We understand that Electrad, Inc., 175 Varick Street, New York City, N. Y., will be glad to send a copy of this booklet to anyone interested who will make application for same.

In addition to its electrical line of Truvolts, Tonatrols, Royalties and Phasatrols, Electrad's line this season is featuring a new product known as the Truvolt Divider, which is a complete resistance unit for simplifying the construction of B battery eliminators. It is arranged with the variable taps so that the proper grid and plate voltages are easily obtained with any set and eliminator combination. By dividing the filter voltage into useable values, it eliminates a great deal of the mathematical calculations and much wiring.

(Continued on page 126)

# Now Receive Broadcast on Low Wave



## The AERO INTERNATIONAL

Broadcast reception on short waves is remarkably clear and free from static. Programs are brought in from greater distances with the utmost simplicity of control.

You can easily assemble the Aero International. This remarkable set is built around the new Aero L.W.T. Coils—the acknowledged leaders in the short wave field. Newly designed parts are used throughout. The tuning condenser has no metal-to-metal bearing, so that noises caused by the variation in contact have been eliminated. The isolation of the antenna from the tuned stage means that swinging of the antenna will have no effect on tuning and variations in antenna length have little effect on the operation of the set. The foundation unit comes with holes already drilled, assuring ease of construction and proper placement of all parts. As an aid to home builders, Aero Kits include complete schematics and actual size pictorial wiring diagrams. Ask your dealer for a complete Kit of all parts for the Aero International. If he cannot supply you, write us, giving his name.

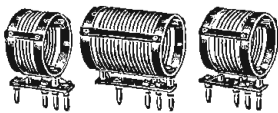
### Your Present Set

Wave Converters and receive short set. The complete Kits include No extra tubes are needed when Simply remove detector tube to the Converter. Order No. 14 for A. C. Sets. tube converter for grid R. F. stage

Build one wave prop drilled M you use from your Aero Kit If you want your D. C. and regen

### AERO COIL KITS

#### The L. W. T. 10 Kit

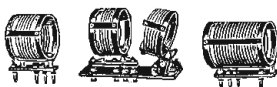


If you wish to purchase only the Aero Coils for the Aero International, order the L. W. T. 10 Kit. The price is \$10.50. These coils are designed to be used with our foundation unit.

#### The L. W. T. 11 Kit

If you prefer to furnish your own foundation unit for the Aero International, order the L. W. T. 11 Kit. The coils are the same as in the L. W. T. 10 Kit, but a mounting strip is provided. The price is \$11.50.

#### The L. W. T. 12 Kit



Here are the newest Aero Coils. They are small in diameter, providing a much smaller external field, a better shape factor and improved efficiency. The Kit consists of three Aero Interchangeable coils and base mounting with Primary Coil. Price, \$12.50.



Department 113R

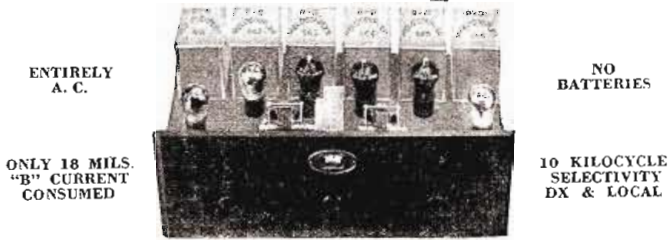


Illinois

**1929 Radio's Newest Automatic Reception**  
**Six Tube A. C. Superheterodyne**  
**3 Stages A. C. Shield Grid**  
**Completely Assembled in 18 Minutes**  
**One Spot Reception**

The New **ROBERTSON-DAVIS**

# Automatic Super-Six



ENTIRELY A. C.

NO BATTERIES

ONLY 18 MILS. "B" CURRENT CONSUMED

10 KILOCYCLE SELECTIVITY DX & LOCAL

## Over 2,000,000,000 Over-All Amplification

An entirely A. C. and Shield Grid Superheterodyne. Six tubes. No batteries. No aerial required. The intermediate amplifier, which gives a gain of 105 per stage, is made up of 3 A. C. Shield Grid Tubes. Only 3 controls—single illuminated drum-dial, trimmer for use when bringing in the extreme distance obtainable with this receiver, and the volume control. Any desired volume can be used without interfering with the performance of the set. Sub-panel contains all instruments except controls, and is completely wired and sealed in an aluminum case. Six tubes and six transformers plug into the sub-panel. Everything completely shielded. Only 9 flexible marked leads to connect. Takes but 18 minutes to assemble—all you need is a screw driver. The Robertson-Davis Automatic Super-Six fits together like a set of building blocks—anyone can assemble and operate.

Has all of these features in addition to the Distance-Getting, Tonal Quality, Volume, Selectivity, Sensitivity and One Spot Reception characteristics for which last year's HOT SPOT Fourteen Receiver was famous. And, also gives you AUTOMATIC RECEPTION with the R-D Automatic Electric Tuner.

### Phonograph Pick-Up

The Automatic Super-Six is an all-around receiver—it does everything you wish. An electric phonograph pick-up can be used perfectly with it.

### Television

Covers a wave-band of from 20 to 555 meters by mere change of antenna and oscillator coils—adapting it for Television and Short Wave use.



## ROBERTSON-DAVIS Automatic Electric Tuner

Converts the R-D Automatic Super-Six from a Dial-controlled into a Push Button-controlled receiver. Any six stations can be selected for automatic playing, and these can be changed at will. One button controls each of your six favorite stations, and another button is provided for set operation from the drum-dial.

### Press Button and Your Station Plays

Depressing any one of the seven buttons automatically cuts out all the rest, and brings in only the station desired from the six selected on the Tuner, or any other you wish to tune in with the drum-dial on the receiver.

## ROBERTSON-DAVIS COMPANY, INC.

412 ORLEANS ST.  
 CHICAGO,  
 U. S. A.

**SET BUILDERS: HERE'S A RECEIVER EVERYONE IS LOOKING FOR. YOUR RADIO FANS: HERE'S A SET THAT GOES TOGETHER LIKE BUILDING BLOCKS. TAKES 18 MIN. TO ASSEMBLE. MAIL COUPON FOR FREE CIRCULAR.**

**HERE'S A RECEIVER EVERYONE IS LOOKING FOR. YOUR RADIO FANS: HERE'S A SET THAT GOES TOGETHER LIKE BUILDING BLOCKS. TAKES 18 MIN. TO ASSEMBLE. MAIL COUPON FOR FREE CIRCULAR.**

## 1929 Laboratory Model Super

(Continued from page 62)

then be moved far enough to the left to eliminate all squeals. (The two small knobs operate exactly as do ticklers on a regenerative receiver, except that they are not particularly critical.)

### Official Parts List

Parts used in the construction of the laboratory model are:

- 1 Silver-Marshall 700 Universal shielding cabinet and walnut base moulding
- 1 Silver-Marshall 701 Universal pierced chassis
- 1 Silver-Marshall 809 dual control escutcheon
- 1 Silver-Marshall 806-L vernier drum dial
- 1 Silver-Marshall 806-R vernier drum dial
- 1 Silver-Marshall 320-R .00035 mfd Universal condenser
- 1 Silver-Marshall 323 .00035 mfd three-gang condenser
- 7 Silver-Marshall 638 copper stage shields
- 3 Silver-Marshall 132-B plug-in r.f. transformers
- 1 Silver-Marshall 132-C plug-in oscillator
- 1 Silver-Marshall 255 first stage audio transformer
- 3 Silver-Marshall 210 long wave transformers
- 4 Silver-Marshall 512 five prong sockets
- 8 Silver-Marshall 511 tube sockets
- 1 Silver-Marshall 275 choke
- 1 Silver-Marshall 708, 10 lead, 5 foot connection cable
- 2 Packages Silver-Marshall 818 hook-up wire
- 2 Yaxley 3000 ohm junior potentiometers, No. 53,000-P
- 1 Yaxley 500 switch attachment
- 2 Yaxley 420 insulated tip jacks
- 6 Carter RU-10 ohm resistors, No. RU-10
- 1 AP-3 ohm sub-base rheostat
- 1 Carter H-1/2 ohm resistor, No. H-1/2
- 1 Durham 150,000 ohm resistor, with leads
- 3 Potter No. 4, 1 mfd bypass condensers
- 7 Sprague or Polymet 1/4 mfd midjet bypass condensers
- 1 Polymet .00015 grid condenser with clips
- 1 Polymet .002 mfd bypass condenser
- 1 Polymet 2 megohm grid leak
- 1 Naald 481XS cushion tube socket
- 2 Moulded binding posts
- 1 Set hardware consisting of studs, screws, nuts, washers, etc.
- 1 Package Kester radio solder
- 1 Ekko group clamp
- 6 Type 222 tubes
- 2 Type 112A tubes
- 1 Type 201A tube

## Notes on Practical Television

(Continued from page 86)

market, may be used for setting the speed at 900 r.p.m., which is the rate of rotation used for station 3XK.

In the experimental outfit used in the downtown laboratory of this publication, a Bodine motor turns a Daven disc of the 48 hole type, behind which is placed a Daven or Raytheon neon tube. Speed control is by a rheostat and a shorting button as previously described. We are informed that Daven is now making a 48 hole disc which also has on it a 24 and a 36 series of holes so that the disc may be used for three different types of transmission. The Daven Co. as early as the June radio show had on the market a television kit which included a 24 hole disc, a neon tube, small motor for driving the disc, and necessary resistances and condensers for an amplifier.

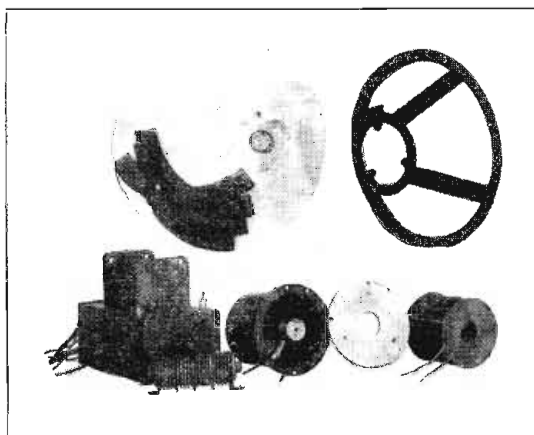
Port wave receivers in parts form are available from Aero Products, National Co. and Silver-Marshall. Resistances for the distance amplifier are made by Allen-Brady, Amsco, Electrad, Durham, Muter and Daven.

Coupling condensers for connection between plate of one tube and the grid of the succeeding tubes are to be made by Acme, Vox, Carter, Dubilier, Muter, Potter, Sangamo and Tobe. Tuning discs are made by Daven and National.

Neon tubes may be secured from Daven and Raytheon. Other parts shown in the schematic circuit, Fig. 5, are standard radio parts and may be easily secured from any of the manufacturers. In summing up all of the foregoing (which after all is a trifle compared to what could be written on the subject if space per-

(Continued on page 110)

No  
Hum



No  
Tubes

No Adjustments

# Build Your Own Dynamic!

*The speaker the radio world is wild about*

**W**ITH this remarkable Bryden Dynamic Speaker Kit you can build the finest electric speaker you ever listened to. You've never had real radio reception unless you own a Dynamic!

***The Kit Is Complete—Nothing Else to Buy***

The Bryden Dynamic Speaker Kit contains a 16-plate Elkon rectifier, transformers, chokes, filters, a cone that is cut so that it cannot be improperly assembled, coils already wound and all parts drilled and tapped so they must assemble perfectly.

***Set It Up in a Jiffy!***

An hour after you have received your Bryden kit your speaker can be in full operation and you will enjoy the finest reception you ever enjoyed. Remember, you don't have to be a mechanic or a radio engineer to assemble the Bryden Dynamic. It is easy to build and this really great 110 volt AC, 60 cycle speaker will faithfully reproduce the full tone range of every instrument without hum or distortion.

***Really Enjoy Your Radio***

No radio is better than the speaker. Order your Bryden Speaker Kit today and enjoy the splendid, country-wide broadcasting. If your dealer cannot supply you use the coupon, it is for your convenience.

*Other models for 6 volt storage battery; 115 volt DC and 110 volt AC 25, 30, 40 and 50 cycle.*

**LIST PRICES**  
 110 Volt AC ..... \$40.00  
 110 Volt DC ..... 30.00  
 6 Volt DC ..... 25.00

**Bryden Products, Inc.**  
 2559 Bellevue Avenue  
 Detroit, Michigan

*If Your Distributor Cannot Supply You Send to*  
**BRYDEN PRODUCTS, Inc.**  
 2559 Bellevue Ave., Detroit, Mich.

Enclosed please find .....check or .....money order for  
 .....complete speaker kit as checked below:

\$24.00 ..... 110 Volt AC  
 18.00 ..... 110 Volt DC  
 15.00 ..... 6 Volt DC

Name.....  
 Address.....  
 City.....

OLDEST EXCLUSIVE RADIO JOBBERS IN THE WEST

# CHI- RAD

## Headquarters for Set Builders

A NEW, complete stock of parts and accessories made by leading manufacturers. Set builders and dealers are urged to write for our special bulletins and discounts.

### The Latest Kits

New Tyrman 50-60-72-80  
H. F. L. ISOTONE  
MADISON-MOORE A. C.  
And Others

### Power Amplifiers

New Thordarson  
210—210 pp.—250—250 pp.  
Phonograph Amplifiers

### Transmitting Apparatus

In addition to our regular broadcast apparatus, we carry a very good stock of transformers, chokes, grid leaks, high test condensers, etc., for transmitting purposes. All latest 1928-9 equipment.

### New Catalog Ready

All the latest kits, accessories and parts. Dealers and set builders write for your free copy. Also for discounts.

## CHICAGO RADIO APPARATUS CO.

415 South Dearborn Street  
Chicago, Ill.

## Thordarson Public Address Unit

(Continued from page 59)

- 1 Yaxley two circuit jack
- 5 Benjamin UX sockets
- 2 Benjamin UY sockets
- 8 X-L binding posts
- 1 110 volt switch
- 1 Formica panel 26x7x3/16 inches
- 1 Wood baseboard 25x15x1 inches
- 10 Lengths Acme Celatsite hook-up wire
- 1 Pkg. Kester radio solder
- 1 UX-874 voltage regulator tube
- 2 Ceco or Sonatron type 250 tubes
- 2 Ceco or Sonatron type 281 tubes
- 2 Ceco or Sonatron type 227 tubes
- Misc. lugs, nuts, screws, etc.

Granting that electrical and physical characteristics are identically the same, the following units made by the respectively named manufacturers may be employed in the construction of a power amplifier similar to the one described above.

Transformers, power: AmerTran, Dongan, Samson;  
Transformers, filament: AmerTran, Dongan, Karas, Samson;  
Chokes, filter: AmerTran, Samson;  
Condensers, filter, bypass: Acme, Aerovox, Carter, Dubilier, Muter, Sangamo,  
Tobe;  
Resistances, power: Carter, Electrad, Frost, Ohmite, Ward-Leonard;  
Sockets: Eby, Frost;  
Jacks: Carter, Frost;  
Switches: Carter, Frost, Yaxley;  
Panels: Celeron.

## Notes on Practical Television

(Continued from page 108)

mitted), we will briefly give some points which may be of help to the experimenter in getting started.

The disc must be absolutely true as far as the holes are concerned. The motor should be smooth running and capable of good speed control. Spring sockets should be used in the receiver and amplifier stages to cut down microphonic tendencies. The motor and the amplifier should not be mounted on the same frame, because of vibration which the motor will transfer to the amplifier. The receiver must not be in an oscillating condition or no images will result. If the images slant towards the left, the disc speed is too great. If the images slant to the right, the disc speed is too slow. If the images are upside down, the disc should be turned around or else the motor direction reversed. If the images are climbing, the disc is out of synchronism. If white images are secured, add one more audio stage or take out the grid leak and condenser and use C batteries for detection. If the images are fuzzy, it may be due to static, vibration of amplifier or the detector being critically regenerative. If the images are first dark and then dim, the trouble most likely is fading of the signal from the transmitter.

A list of the short wave television stations recently authorized by the Federal Radio Commission may be found by consulting page 35 of this issue.

As we go to press and about forty days subsequent to the inauguration of the Jenkins movie broadcast, press releases show that KDKA is going to work on the air with movies by radio on short wavelengths. At this time there is no definite information to hand as to the method used at their transmitter.

In the next issue of this magazine we will have a section on practical television, which may be of further interest to the serious experimenter trying to get images by radio. It has been observed that Mr. Jenkins is genuinely interested in having as many experimenters take up this work as possible and has repeatedly offered to do anything to get these experimenters on the right track in the event they run into any difficulty. The Jenkins laboratory in Washington, D. C., is at 1519 Connecticut Avenue. Experimenters may either write direct to Mr. Jenkins or to this magazine for any further data which they might require.

While the preceding article has dealt chiefly with the results secured by the receiver in the residential test station, in the November issue of our publication we expect to chronicle the results of our downtown laboratory work and also show photographs of all of the apparatus involved with clear instructions as to how it should be made.

(Continued on page 114)



# Advanced construction ideas feature new Halldorson Shield-Grid Kit

## PLAIN FACTS

**Selectivity**—Guaranteed 5 to 8 K.C. separation of locals.

**Sensitivity**—On a 40-ft. antenna it will bring in distance stations with greater volume than most 9 or 10 tube receivers.

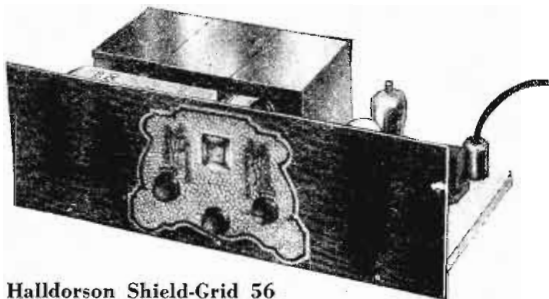
**Volume**—Shield-Grid first and Push-Pull second audio deliver tremendous power on weak input signals. Total gain over 6,400,000 times, several times that of any receiver not using a space charge Shield-Grid first audio tube.

**Price**—Compare the price with that of any other kit on the market. Never before has such value been offered.

**Appearance**—The keenest job you've ever seen.

## All Steel Chassis

A beautiful bronze escutcheon plate



**Halldorson Shield-Grid 56**

carrying all controls may either be mounted upon the mahogany finished steel panel supplied or directly upon a wood panel such as is supplied with console cabinets. All parts are mounted upon a black crystal finished steel sub-base and sockets are riveted in place at the factory. The remaining parts may easily be mounted in 15 minutes ready for the wiring.

Two stages of shield-grid R. F. amplification produce tremendous step up in signal strength. These two R. F. stages, as well as the detector stage, are totally shielded with highly buffed copper shields. This provides a finished receiver that is almost weird in its quiet and smooth operation. Distance and locals slip in one after another without any trace of background noises.

Your jobber will show you these new Halldorson products—new catalog folder sent upon request describes entire line, including marvelous new Halldorson Shield-Grid Super—write today.

# Halldorson Radio Products

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

## Shield-Grid First Audio Stage

The first stage of audio amplification is also a shield-grid tube. This type of tube was selected for this stage after many laboratory tests, because of its superior ability to amplify very weak detector signals, while at the same time handling the large power demands made upon it, with ease and smoothness. This is one of the important improvements in the Halldorson 56 receiver, because it permits loud speaker operation of signals that are ordinarily too weak to satisfactorily swing the grids of the amplifier tubes.

## Push-Pull Audio System Smooth and Powerful

The last amplifier stage consists of two 112 or 171 tubes in a push-pull circuit. To realize fully the advantages of push-pull amplification, one has only to remove one tube from the amplifier, allowing it to operate as a straight audio. The soft, smooth power of the push-pull amplifier is at once apparent.

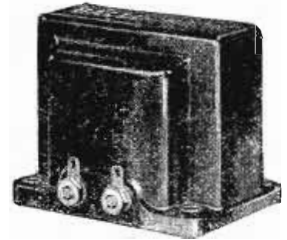
The power handling capacity of this stage is such that any of the present power dynamic speakers may be operated to its fullest extent direct from the receiver.

## Phonograph or Radio Music

By an ingenious jack arrangement the amplifier stages may be used for either radio or phonograph music. Switching over takes but a few seconds. With the amplifiers on the phonograph the quality will compare with the finest electric Victrolas.

D. C. Kit complete.....Price **\$59.85**  
For A. C. operation.....Price **63.85**  
Power Supply Unit for A. C. Kit.....Price **32.50**

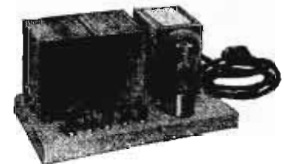
NOTE—A. C. Kit uses 226 and 227 A. C. tubes



**Halldorson Push-Pull Transformers**

Halldorson Overtone Audio Transformers have been the standard among large set manufacturers for years. By a special design of laminations from a very high grade of steel, the core is made more efficient than that of transformers with twice the amount of iron. Whether in the regular audio or the push-pull, the amplification of overtones thus made possible adds depth and brilliancy to music or speech such as seldom is heard in radio or phonograph instruments.

Shield-Grid Audio Coupler.....**\$4.75**  
Overtone Audio.....**4.75**  
Overtone Output.....**4.75**  
Push Pull Input.....**5.75**  
Push Pull Output Choke.....**5.75**



**Halldorson Power Pack and A.B.C. Supply Units**

Halldorson Power Packs and A. B. C. supply units are designed with a liberal margin of power capacity to insure smooth and quiet operation with receivers of as high as ten tubes. All have filament windings to supply any standard A. C. tube and are designed to prevent premature burnouts of tubes. Write today for prices on all Halldorson power items.

**THE HALLDORSON COMPANY**  
4745 N. Western Ave., Chicago

I would like my name placed on your mailing list to receive all future literature.

I am interested in Halldorson Products. Please send catalog.

NAME.....

ADDRESS.....



## Whatever Your Connection with Radio

Whatever you need for instruments—whether as set builder, amateur transmitter or service and repair man—the name “WESTON” on any meter you select is the highest guarantee of long life and dependable service with the lowest possible cost of instrument upkeep. Listed herewith are but a few timely models. The complete radio line is fully described in Circular J, mailed upon request.

### A. C. and D. C. Portable Models



The compact little instrument held in the hand above is a new 3-range A. C. voltmeter—for testing the supply and tube voltages of A. C. receivers. 150—8 and 4 volt ranges. Mottled red and black bakelite case. Made also in double voltage ranges. Prices, \$13.50 to \$18.00. Also D. C. voltmeter with black bakelite case—1000 ohms per volt—\$28.00.

### A. C. and D. C. Set Tester

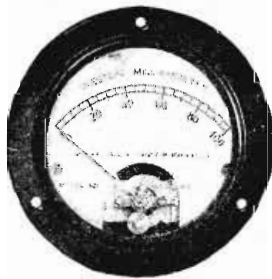
Model  
537

A dealer's or radio serviceman's complete testing outfit. Weight, only 6½ lbs. No additional tools, instruments or equipment necessary. Simple, automatic method of making connections. Meter equipment:—Two 3¼" diam. high grade Weston models. (1) 3-range A. C. voltmeter—150/8/4 volts. (2) D. C. volt-milliammeter with four voltage ranges—600/300/60/8 volts (1000 ohms per volt resistance) and two current ranges—150/30 milliamperes. Price, \$100.00.

### A. C., D. C. and Thermo-Couple Types

For panel  
mounting

Two complete lines—2" and 3¼" diam. sizes, uniform in appearance. Remarkably precise as to electrical characteristics and of highest quality in workmanship and construction. From \$7.00 up.



## WESTON ELECTRICAL INSTRUMENT CORPORATION

574 Frelinghuysen Ave.  
Newark New Jersey

# WESTON RADIO INSTRUMENTS

## National Screen Grid Five

(Continued from page 72)

antenna may be used if preferred. Such an antenna should be connected directly to the tap on the antenna coil. Where the conventional 50-60 foot outdoor antenna is to be used, an antenna series condenser of about .0001 mfd must be employed. Such an antenna will be found of considerable aid in increasing the range and volume of the receiver on distant stations in any locations where local interference, power leaks and other sources of noise are not bothersome.

When the receiver is first put into operation, the inductive trimmer should be set in mid position, the set screws on the tuning condensers loosened, and then some local station carefully tuned in by moving the two tuning condensers separately. This process is necessary in order to get the two circuits in "step." The set screws are then tightened, and any slight variations on other stations compensated for by means of the trimmer.

If the two circuits are not properly lined up, broad tuning and lack of sensitivity are certain to result.

Whenever a station seems to come in at two slightly different dial settings, a slight simultaneous readjustment of the trimmer and the tuning dial will correct matters.

In tuning for distant stations, the use of regeneration in the detector circuit will be found of great assistance. As a result of the use of the screen grid tube in the r. f. stage, the detector may, if desired, be permitted to oscillate and stations picked up by their carried wave, without annoying the neighbors.

In order to obtain smooth regeneration, it is advisable to try several different values of grid leaks and also different values of detector plate voltage. While almost any type of tube may be employed as a detector, the 112A will generally be found to be more preferable than either the 200A or the 201A. While a good 200A is more sensitive than the 112A, there seems to be quite a number of these tubes that are "not so good." Then, again, they have the very serious drawback of being noisy and of causing many receivers to motorboat. The 112A is very much less microphonic and in almost every other way a better tube for general use than the less expensive 201A.

Some of the 222's are inclined to be rather microphonic and thus cause trouble when the loud speaker is placed quite close to the set. This difficulty is generally only encountered when the volume control rheostat is in approximately the mid position.

A slight readjustment of the rheostat in most instances will correct the trouble, unless the tube is a poor one.

Generally about 45 volts on the screen grid and 135 on the plate of the 222 give very satisfactory results.

The screen grid voltage should be approximately 45 when using 135 volts on the plate of the r. f. tube. This voltage is not critical, however, and variations of a few volts in either direction do not make an appreciable difference in performance.

In the first audio stage a UX-201A should be used, while in the second stage either a UX-201A or a high mu tube may be employed, depending upon the volume desired. A UX-171A is recommended for the last stage unless there are no "local" stations, in which event the use of the 112A, with proper C bias, will result in increased volume.

### Official Parts List

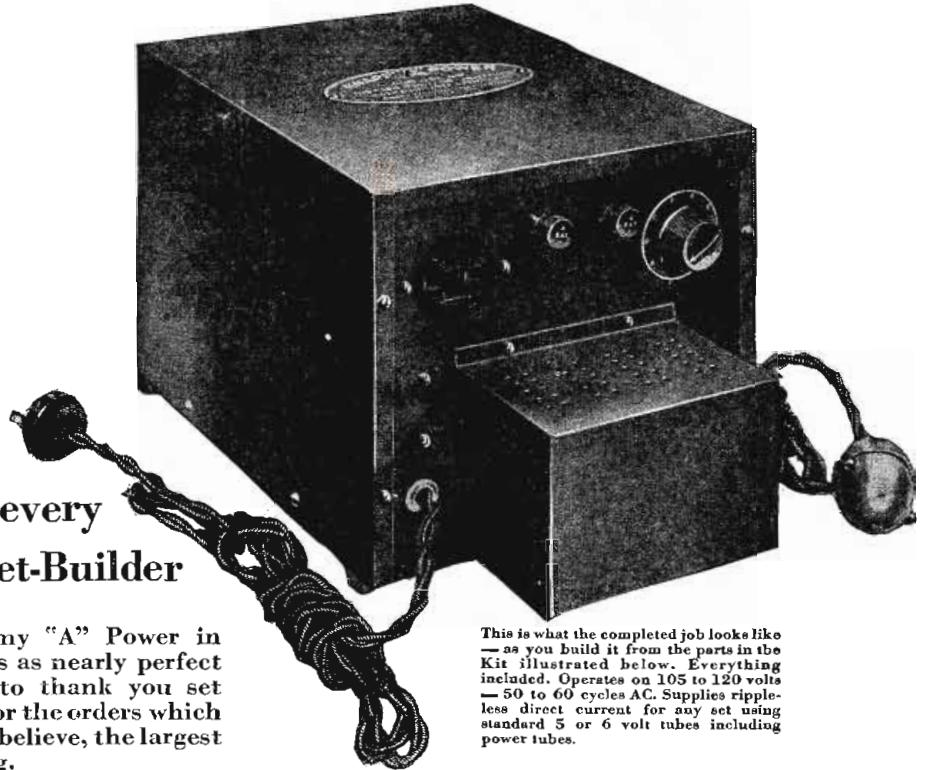
Parts used in the construction of our laboratory model are:

- 1 National BD222 complete unit.
- 2 Sangamo .0001 mfd condensers.
- 1 Sangamo .00025 mfd condenser.
- 1 Sangamo .001 mfd condenser.
- 2 Acme Parvovolt .5 mfd bypass condensers.
- 3 National Impedaformers.
- 1 National tone filter.
- 2 National r. f. choke coils.

(Continued on page 114)

# The **NEW** KNAPP "A" POWER KIT

**Improved  
Design  
Efficiency  
Appearance  
AND a New  
Money-making  
Plan for every  
Set-Builder**



This is what the completed job looks like — as you build it from the parts in the Kit illustrated below. Everything included. Operates on 105 to 120 volts — 50 to 60 cycles AC. Supplies rippleless direct current for any set using standard 5 or 6 volt tubes including power tubes.

WHEN I first announced my "A" Power in January, I thought it was as nearly perfect as it could be made. I want to thank you set builders for your interest and for the orders which enabled the Knapp "A" to be, I believe, the largest selling "A" power in the Spring.

Your confidence has made it possible for me to improve my "A" Power to such an extent that from the standpoint of appearance, and design it is second to none, regardless of price. The efficiency, however, was harder to improve. You fans who bought last spring would know that — but with an additional condenser and newly designed choke coils it is even better than before. *And the price is reduced!*

### Truly Magic Silence Ideal for Superhets and Short Wave Sets

The improved filter system, using 3 Elkon Bone Dry Condensers, each with a capacity of 1500 mf. plus improved choke coils makes the Knapp "A" the outstanding "A" Power in the country. The silent Knapp "A" will power any super-het using 5 or 6 volt tubes, without the trace of a hum.

Short wave sets with the use of headphones

require an "A" Power which will give them unflinching filament current with absolute quiet — The Knapp "A" is the only answer. The "head phone test" will prove it to you. Of course the Knapp can and should be used with any set using standard 5 or 6 volt tubes including Power Tubes.

### Complete Kit

Everything is included in this remarkable Kit — every screw, wire, even a die cast base plate and the specially baked metal cover. You can't buy another thing — because you do not need anything — and the instructions are so simple that anyone can put it together.

### New Money-Making Plan

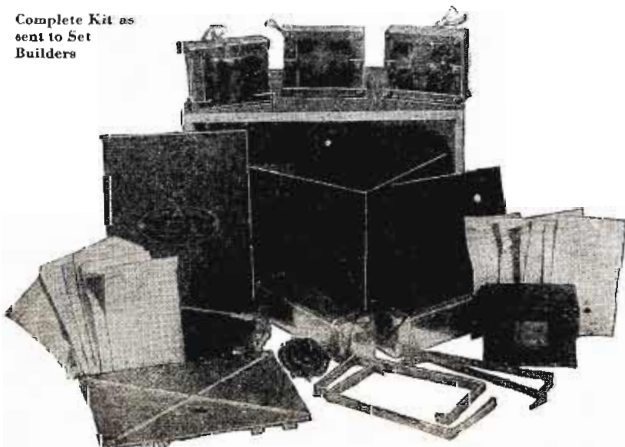
That's what you are interested in — and I have it for you. I am working with the Set-Builders and I don't care who knows it. You can buy my Kit at a price which will enable you to make some real money. Send the coupon today for my special money-making proposition for Set-Builders.



DAVID W. KNAPP, President

Knapp Electric, Inc., Division of P. R. Mallory & Co., Inc., Port Chester, N. Y.

Complete Kit as sent to Set Builders



Just Clip

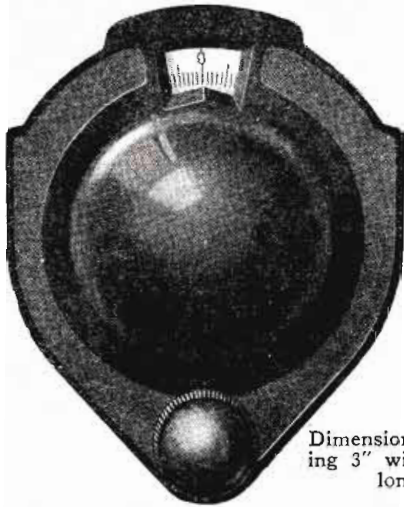
and

Mail 

-----  
 David W. Knapp, President  
 Knapp Electric, Inc.,  
 365 Fox Island Road,  
 Port Chester, N. Y.  
 Kindly send me complete information on your Knapp "A" Power and your special profit-making proposition for Set-builders.  
 Name.....  
 Address.....  
 Please print name and address

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

# Now The New Junior Vernier Port Dial ILLUMINATED



Dimension Hous-  
ing 3" wide, 3 $\frac{3}{4}$ "  
long

Bring your set up-to-date  
with this Dial



No. 92  
1 $\frac{1}{4}$ " Fleur de lis  
Top  $\frac{1}{4}$ " with set  
screw



No. 97  
1 $\frac{3}{8}$ " Two-Tone  
Top  $\frac{1}{4}$ " with set  
screw

**T**HIS new translucent Vernier Port Dial with genuine bakelite housing affords you a real opportunity to bring your present set up-to-date and also improve its beauty and efficiency. You must install these dials to appreciate what wonderful improvements they will make.

You may have this dial to match the panel of your radio. Furnished in black, mahogany or walnut finish. The graining of the colored dials is exquisite, obtained by an exclusive Kurz-Kasch process!

If your dealer cannot supply you, tell us about it.

THE KURZ-KASCH COMPANY  
Dayton, Ohio

**KURZ**  **KASCH**  
*Aristocrat Dials and Knobs*

- 1 Yaxley .8 ohm fixed resistance.
- 1 Yaxley 15 ohm resistance.
- 1 Frost 20 ohm Gem rheostat.
- 1 Durham 2 megohm grid leak.
- 1 Formica front panel, 7x18x $\frac{1}{8}$  inches.
- 1 Formica sub-panel, 10 $\frac{1}{2}$ x17x $\frac{1}{8}$  inches.
- 1 Frost 7 contact cable plug.
- 7 Eby Ensign binding posts.
- 5 Benjamin UX sockets.
- 1 Yaxley filament switch.
- 1 Carter tube shield.
- 2 Brass  $\frac{1}{4}$ x1 $\frac{1}{8}$  inch drilled and tapped 632 one end brackets.
- 20 Feet Belden No. 14 tinned copper hook-up wire.
- 1 Muter grid leak mounting.
- 1 Ceco or Sonatron 222 tube.
- 2 Ceco or Sonatron 201-A tubes.
- 1 Ceco or Sonatron 240 tube.
- 1 Ceco or Sonatron 112-A tube.
- 1 Package Kester radio solder.
- 1 Ekko ground clamp.
- Miscellaneous lugs, nuts, screws, etc.

## Practical Television

(Continued from page 110)

After the main article on television reception had gone to press, we are informed by the Raytheon Mfg. Co. that the plate impedance of the neon tube has now been changed to 500 ohms. It has been found that this value of resistance is quite satisfactory when used in the output of a 171 tube and serves to reduce the voltage drop across the lamp.

The voltage drop at 20 mils across the neon tube is approximately 140 volts. This voltage drop should be added to whatever voltage is desired on the plate of the last power tube. If it is desired to place 180 volts on the power tube plate, the total voltage applied to the 171 in series with the kilnolamp should be the total of 140 and 180, or 320. Accordingly, if the method outlined in figure 5 is used where 180 volts is placed on the last power tube, the value shown in the schematic should be changed to read 320 volts in order to make allowances for the 140 volt drop through the tube. Again in this case it is advisable to make use of a variable resistance that will carry 20 milliamperes, this resistance value being from zero to 12,000 ohms, which should be inserted in order to control the current through the lamp.

In booking up the power tube end of the receiver, the output circuit is so arranged that the kilnolamp is always illuminated and when a signal is received the brilliancy of the illumination merely varies in accordance with the signal. A good background will be obtained if the current is limited to 10 or 20 milliamperes. More current will cause the lamp to grow brighter and brighter, but there is no advantage in this so far as the picture is concerned and it only serves to shorten the life of the lamp. In fact, quite satisfactory results may be obtained by adjusting the d. c. voltage to just below the starting voltage for the lamp. In that case a black background is obtained and the image stands out in sharp contrast. (This particular method may be satisfactory on signals from WGY, WLEX or other stations but it did not work so satisfactorily when tried by our laboratory on the signals from Jenkins transmission at 3XK.)

There are two ways of adjusting the current through the neon tube once it has started. The first is by varying either the d. c. voltage and the second by altering the series resistance. The latter method is more practical. A fixed resistance of 10,000 ohms in series with the lamp may be used, however, with satisfactory results.

Variable resistors suitable for use in series with the neon tube are made by Centralab, Clarostat, Carter, Electrad and Frost.

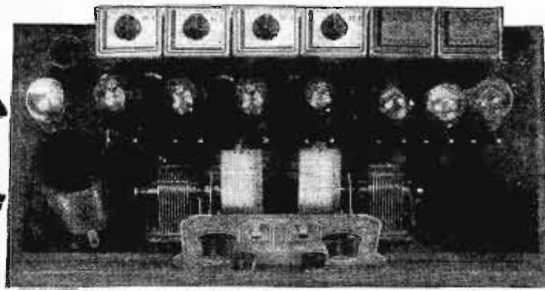
In the construction of the amplifier spring sockets should be used in order to eliminate as much as possible any tendency

(Continued on page 126)

# THE NEW LINCOLN 8-80 DOES IT

**4 SCREEN GRID TUBES**

**ONE SPOT**



**TUNABLE I.F. STAGES**

**NEW AUDIO**

**400 MILES IN DAYLIGHT  
2000 MILES AT NIGHT**

**ON A 15-FOOT ANTENNA!  
INSIDE A STEEL BANK BUILDING**

**T**HE Lincoln 8-80 gets its remarkable results from a new principle as simple as it is radical—just merely that you tune the “one-spot” intermediate amplifier stages after your set is built, instead of our doing this at the factory when we don’t know how you’re going to build your particular set! If you’ve ever built a super, you know what it is to use “laboratory matched” transformers that turn out to be away off when your set is done—you get squeals, broad tuning, station repeats—but try as you will, you are at the mercy of “factory matching.”

In the 8-80 four screen grid tubes are used, three in the tunable “one-spot” intermediate amplifier. And that’s the heart of the set. In it are four new Lincoln 101 Transformers, each with its own little tuning knob on top. And when you finish building your set you don’t pray that your i.f. amplifier is matched—you just turn the knobs and match it for your own particular tubes and circuit conditions.

And at the same time you are correcting for all variations in peak frequency due to built-in transformer capacity, varying constants in different tubes, and various capacity and feed-back reactions due to slight differences in wiring layout—all these things which have helped to ruin the team-work of so many sets of “laboratory-matched” transformers. Every such influence is immediately overcome, once you have tuned the four stages to peak with each other. To do that is just as simple as tuning once the several dials on a t.r.f. set—and when it’s done once, your i.f. stages are permanently matched. Then if you want to change your intermediate frequency, you can do so by another turn of the same four knobs—selecting anything from 300 to 500 kc.—all “one-spot” frequencies. Yet this obviously sensible amplifier is entirely different from anything that has been offered in the past.

Not alone in selectivity, though, is the 8-80 supreme. Its new Clough audio system gives it better tone, more volume and less

distortion than any old-style transformers possibly can—an effective transformer ratio averaging 4.4 to 1—50% greater in each stage than many more expensive transformers. And with all this—a true tone fidelity, giving positively uncanny realism.

Even for “eye value”—hardly to be hoped for in the average super—the 8-80, when neatly housed in the beautiful Lincoln 112 two-tone metal shielding cabinet (\$9.25 extra) compares favorably in appearance with the most beautiful factory jobs.

It is these features that make the 8-80 the sweetest eight-tube super you’ve ever tuned. And that it positively is. In the Lincoln offices in a steel-reinforced-concrete building—the most difficult type for radio reception—the 8-80 plays stations 1000 to 2000 miles away on a hot summer night, and several hundred miles away during the day! All this is with all Chicago stations operating, and with only a 15-foot inside antennal Pittsburgh, Davenport, Nashville, New Orleans—generally these and more come in without any antenna at all!

The price of the complete kit for the 8-80 is \$92.65. And the set you build from it will give these same results, for every set built innes easily and positively to peak efficiency, thanks to the new principle of William H. Hollister—an old-timer in the game who demonstrated “wireless” to college professors before Marconi first bridged the Atlantic. And all his experience, ranging over a quarter of a century, has gone into the 8-80. It ought to be some set—and it is!

Lincoln guarantees that the 8-80 will give better results than any other eight-tube super you can build!

If you want an evening full of straight-from-the-shoulder super-heterodyne dope written by an engineer who has played with every super going in the last few years, send 25 cents for William H. Hollister’s “Secret of the Super,” using the coupon below.

Have you seen the new Lincoln power supplies? There are two: one for B voltage only and one for A, B and C voltage for AC tubes. Each one comes in a beautiful brown crystalline steel shielding case. B current of 50 to 60 m.a.—plenty for any ten tube set—at 130 to 200 volts, with 22½, 90 and 135 available—also 22-90 variable. Type 110B lists at \$36.00. type 110ABC at \$39.00. They’re fully guaranteed, and are described in detail in the big catalog which the coupon below will bring you.

## LINCOLN ENGINEERING SERVICE ON STANDARD KITS

DO YOU KNOW THAT

you can buy the really finer standard kits—those that have come up to the rigid standards of performance set by the Lincoln Laboratories—at standard prices, and at standard discounts if you are a professional setbuilder or dealer? The Lincoln Engineering Service means a lot—you are assured not only of same-day shipment, but you have the double assurance of factory inspection, plus Lincoln inspection—and Lincoln offers you only complete kits that exhaustive tests have proven to be right—and then fully guarantees each to you.

Order today for immediate shipment any of the following Lincoln-Guaranteed complete kits:

Sargent-Rayment Sever (S-M 710) kit.....	\$120.00	Tyrman 80—super—less power pack.....	\$134.50
S-M 720 Screen Grid Six.....	72.50	Tyrman 72 receiver kit.....	98.50
S-M 720 Screen Grid Six—factory wired.....	102.00	Tyrman 72AC, with power pack.....	153.50
1929 Laboratory Superheterodyne.....	95.70	Scott World’s Record 9-tube S.C. super.....	138.10
		H.F.L. Isotone 10-tube super.....	195.00

# LINCOLN RADIO CORPORATION

**329 SOUTH WOOD ST. - CHICAGO - ILLINOIS.**

Setbuilder agents are wanted in every community. We have a most interesting plan which you will find highly profitable. Write for complete details, or use the coupon.

LINCOLN RADIO CORP.  
329 South Wood St., Chicago, Ill.  
.....Send me your big free catalog, listing a complete line of 1929 kits for custom building.  
.....Let me have details of your agency plan.  
.....Enclosed find 25c. for which send me William H. Hollister’s new book “The Secret of the Super.”

Name.....  
Address.....

Authorized Distributors for Lincoln 8-80

WESTERN RADIO MFG. CO.  
128 W. Lake St. Chicago, Illinois

W. C. BRAUN COMPANY  
564 W. Monroe St. Chicago, Illinois

WALTER ROWAN COMPANY  
833 W. Washington St. Chicago, Illinois

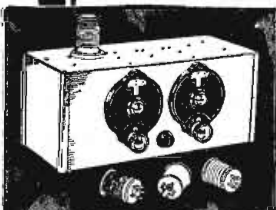
# SM

## WHAT *Makes* LEADERSHIP?



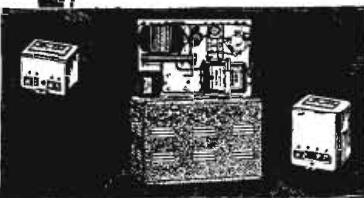
**Selectivity—  
demonstrably sharper**

When you build a set from an S-M kit or from S-M parts, you know it's going to have the selectivity that makes all the difference between satisfying reception and a scramble of interference. And new coils, condensers, and shields insure even more selectivity than ever before in the new kits announced on the following pages. In these you'll find the positive 10 to 15 K.C. selectivity necessary to give leadership today—and they're all sure-enough leaders!



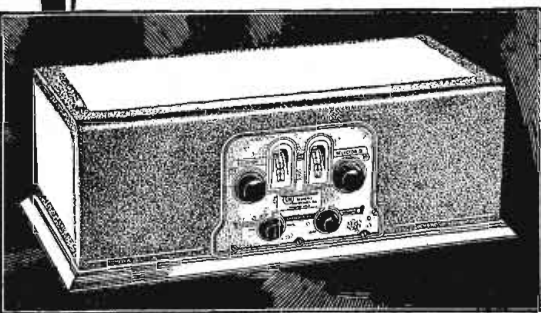
**Distance—  
utterly  
unbeatable**

Distance, too, you've gotten with S-M—but the new S-M designs are even more powerful distance-getters. Take the short-wave "Round-the-World" Four—bringing in five continents in an evening, or the Sargent-Rayment with its 100-station record made on a hot evening. Or take the leader of them all, the Screen Grid Six, which, on test, has left supers, regenerative hook-ups, multi-tube t.r.f. sets—all far behind. On distance alone—forgetting all other factors—S-M kits lead the field.



**Quality—  
overwhelmingly  
finer**

Tone quality—that's where S-M stands supreme. At the Trade Show in June, Silver-Marshall, already famous as the manufacturer of the never-excelled 220 audio transformers, surprised the radio world by demonstrating entirely new audios, built on a totally different principle, and placing S-M at least two years ahead of all competition. Just as you would not think of buying today an audio amplifier two years old—so you can today buy tone quality just two years ahead when you use S-M audios. S-M leadership in quality accounts for S-M's actual leadership in sales—and big sales mean low prices.



**Cost—  
amazingly  
lower**

Four short years have brought the S-M trade-mark to dominance—first place—in the radio parts and kit field—the best possible proof that better radio for less money is to be had from S-M. Today, as the economies of S-M production methods are increasingly passed on to you, it becomes still more overwhelmingly true that, with S-M parts, you can build it better and cheaper.

*If you don't wish to build, yet want your radio to be custom-made, with all the advantages that this implies, S-M will gladly refer your inquiry to an Authorized Silver-Marshall Service Station near you. If, on the other hand, you build sets professionally, and are interested in learning whether there are valuable Service Station franchises yet open in your territory, please write us.*

*Are you receiving "The Radiobuilder" regularly? Published every month, this little magazine provides you with the earliest information on forthcoming S-M developments, and with operating hints and kinks that will help you to get the most out of radio. To S-M Authorized Service Stations, "The Radiobuilder" is mailed each month, free of charge, together with all new Data Sheets and Service Bulletins as they come from press. To all others a nominal charge is made; see coupon.*

SILVER-MARSHALL, INC.  
836 W. Jackson Blvd., Chicago, Ill.

- ....Send Complete Catalog—FREE, with sample copy of "The Radiobuilder."
- ....Send information about the S-M Authorized Service Station franchise.
- ....Enclosed is 10c for five selected S-M constructional Data Sheets on new products.
- ....Enclosed is 50c for the next twelve issues of "The Radiobuilder" (or \$1.00 for the next twenty-five issues).

.....Name  
.....Address

### SILVER-MARSHALL, INC.

836 W. JACKSON BOULEVARD, CHICAGO, U. S. A.

# SM

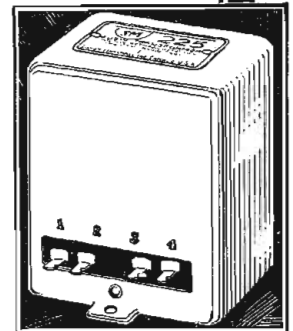
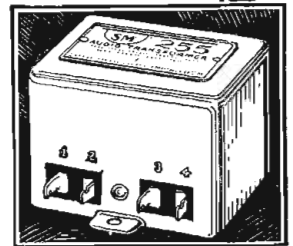
## AUDIO TRANSFORMERS *just Two Years in Advance!*

**W**HEN the bewildering story of the radically new S-M Clough system audio transformers burst upon the 1928 Radio Trade Show at Chicago, it caused incredulous wisecracs to crowd around the test bench where these new transformers were being comparatively tested against the highest priced instruments ever placed on the market. One man after another turned away, convinced beyond question that here was the greatest actual advance in quality of reproduction that American inventive genius has brought forth in years.

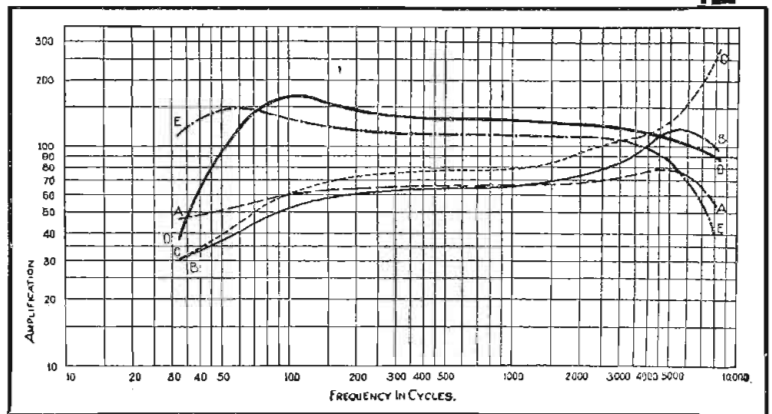
No matter what kind of a set you have, or what you're going to build, these new audio transformers will give you greater amplification, tonal quality you've never heard the equal of before, and greater "punch" and volume. They are the first audio transformers to give freedom from the hysteretic distortion found in all other types. They are the first to give the realism of recreation that will make you gasp and wonder how you could ever have been content with the tone you've had in the past.

S-M transformers have been acknowledged leaders for two years—now these new types place S-M performance just two years ahead of the best—yet you can have this finer performance in every set you build, or install it in your present set, at less than average transformer costs!

For the finest possible tone, the new S-M 225 first stage and 226 second stage types at \$9.00 each are utterly unequalled. Their two stage curve is shown at E, with its rising bass characteristics and 5,000 cycle anti-hiss cut-off. The two smaller types, S-M 255 first stage and 256 second stage, are unconditionally guaranteed finer than all other types on the market, and give the curve D—see how much better they are than three sets of standard eight and ten dollar types, shown at A, B, and C under the same operating conditions.



**Q** SEVERAL of our co-operating distributors, whose announcements directly follow, join us in presenting a complete descriptive summary of the outstanding values to be found in the new S-M line.

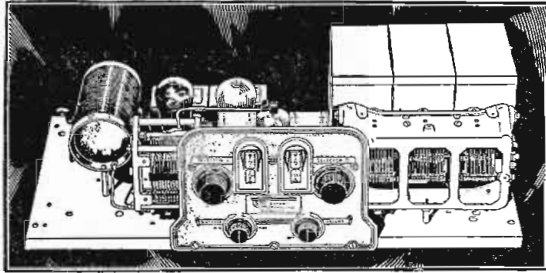


**SILVER-MARSHALL, INCORPORATED**  
836 WEST JACKSON BOULEVARD . . . CHICAGO, U. S. A.



# 720 SCREEN GRID SIX

## The Year's Biggest Value!



OF ALL the radio sets the S-M Laboratories have ever tested, of all the sets that have borne the S-M endorsement in the last four years—yes, of all these and more—we believe the new 720 Screen Grid Six to be the finest all-around set of them all.

That's a man-sized recommendation. And you can bet it's some set when S-M gets squarely behind it and tells you that you'll find the biggest radio value today in this new Screen Grid Six. This is as it should be, for the new receiver is a simplified and improved design of the Shielded Grid Six that took the country by storm this past winter and spring—the only receiver that anyone ever dared to offer with an unqualified guarantee of absolute satisfaction or your money back! And now S-M tells you that the new Screen-Grid Six is an even better set!

It's the kind of a set you can build in an evening, with its pierced metal chassis and positive fitting assembly. And the thrills begin when you put on the air. Station after station will come in with local volume, you'll really find positive 10 kc. selectivity; and tone—well, like those who have tested it already, you just won't be able to help sitting back and telling the world "Baby, that's a radio set." Three stages of tuned, shielded screen-grid r.f. amplification, a detector, and two stages of the new S-M audio transformers that were the marvel of the RMA Trade Show—two vernier drum dials in a beautiful antique brass control escutcheon, individually copper-shielded r.f. circuits, a rigid die-cast gang condenser—look these features over and you'll realize why the 720 cuts through Chicago regularly to New York, California, Canada and Texas stations, why it gives 10 kc. selectivity and almost unbeatable DX.

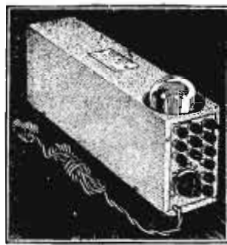
Remember that S-M backs the 720 to the limit—assures you that you can't get more actual radio at twice the cost. And—S-M passes on to you right now the production savings of a big season, and prices the 720 kit at only \$72.50 complete, or \$102.00 custom-built with cabinet. For the kit, the new metal shielding cabinet is \$9.25 additional.

Better get your order in now—720's will be scarce as hen's teeth pretty soon, judging from present demand.

### MEDIUM AND HIGH VOLTAGE POWER SUPPLIES

#### B and ABC Power Units for Radio Sets

S-M 670B Reservoir Power Unit has five different B voltages, of 22, 90, 135 and 180 volts fixed, and one variable voltage ranging from 22 to 90 volts. It will deliver up to 60 M.A. to operate any standard receiver, and is specifically recommended for S-M receivers. Type 670ABC is the same unit with 1½, 2¼ and 5 volt A.C. filament supply added, and is a complete ABC power plant for any A.C. tube equipped receiver. Both use one UX280 rectifier. Price, 670B, WIRED, \$43.50 or in kit form \$40.50. Price 670ABC power supply WIRED, \$46.00, or, in kit form, \$43.00.



#### 675ABC High Voltage Power Unit

Type 675 power unit is a high voltage power supply delivering 450 volts maximum. It is provided with an adapter which allows a UX210 or UX250 super-power tube to be used in the last stage of any receiver at all, to which the 675ABC supplies 22 fixed, 22 to 90 variable, and 90, 135 and 450 volts B power, as well as A and C power for the power tube, and 1½ and 2¼ volts DC field, to which it supplies necessary power. A.C. for A.C. tube filaments if used. It is the biggest power unit value ever offered, and costs but \$58.00 WIRED, or \$54.00 in kit form, less one UX281 rectifier tube.



#### The New 676 Dynamic Speaker Amplifier

This is a single stage power amplifier especially for use as a third stage, after any radio set, to boost volume and tone to give extra fine results with standard dynamic loud speakers. It uses one UX281 rectifier and one UX250 super-power amplifier,

and has binding posts for receiver output connections, loud-speaker cord tips, and also for the dynamic speaker field. The 676 Amplifier operates any dynamic speakers having a 90 to 120 volt DC field, to which it supplies necessary power. Added to any set equipped with a dynamic speaker, it will provide a marvelous improvement in tone and volume. Price, 676 WIRED, \$55.00; or 676 in KIT form, \$49.00.

#### A Full Line of S-M Products

We carry every kit or part mentioned in this section. Prompt service is assured. Maximum discounts to dealers. Send the coupon now.

WESTERN RADIO MFG. CO.  
128 W. Lake St., Dept. C1  
Chicago, Ill.

Please send at once your new FREE catalog listing S-M parts and kits as well as many other highest-quality radio products.

.....Name  
.....Address  
.....Town and State

## Western Radio Manufacturing Co.

"The Big Friendly Radio House"

128 West Lake Street

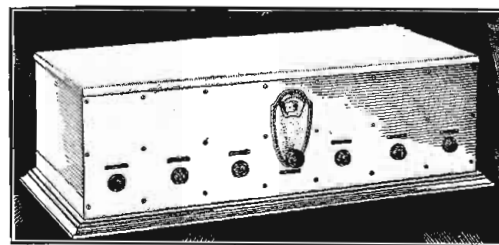
Chicago, Illinois



**SM**

**OUTSELLING ALL OTHER KITS**  
 the **SARGENT-RAYMENT SEVEN**

BECAUSE OF ITS  
**Selectivity . . . . Tone**  
**Distance-Getting Ability**



**STONE**

The tone quality of the Sargent-Rayment Seven is one of its features. The new Clough system of audio amplification is used thus assuring the total elimination of hysteretic losses due to core saturation and giving a higher degree of amplification with less transformer material. The Clough system favors neither the high nor the low notes, both being amplified equally. The tone therefore accentuates neither the "boom, boom" of the bass drum nor the shrill note of the violin. It is natural, clear, and lifelike.

An output transformer is included in the kit.

**CABINET**

The "cabinet" problem is completely solved in the Sargent-Rayment Seven. The kit when assembled forms its own cabinet. The entire outside is finished in grained aluminum, with name plate and panel indicators in black—a distinctive appearance and totally different from the usual run of radio receivers.

For the benefit of those who prefer darker finish, Radio Constructors Corporation will supply either the kit or the built-up set in a "crackle crystalline" lacquered finish,—the same dark surfacing generally used on metal cabinet radio receivers. An extra retail charge of \$10.00 is made for this, and all orders involving it will be delayed in shipment three days to have the special finish put on.

**SELECTIVITY**

Selectivity is today the most important requisite of a radio receiver. The present congestion of the ether and the clamor of many prospective broadcasters to get on the air make it imperative that a radio set receive one wave channel,—and only one,—at a time. This means ten kilocycle selectivity or less. The designers of the Sargent-Rayment Seven spared nothing to achieve this aim. In order to make absolutely sure that the circuit would cut ten kilocycles under all conditions, the set after being thoroughly tested in Chicago was sent to the West Coast and there tested again under the most trying conditions. In the opinion of the designers, the Sargent-Rayment Seven is the most selective receiver ever offered for sale, regardless of number of tubes or type of circuit.

**DISTANCE**

The Sargent-Rayment Seven uses the full power of four screen grid tubes. Oscillation has been practically eliminated from the circuit,—not by grid suppressors or "lossers," but fundamentally in the circuit design. Thus the full power of the set can be used and the gain is tremendous. Competitive tests against sets using nine and ten of the older type tubes show the Sargent-Rayment Seven to have from two to three times the amplification on a weak signal. During the winter months and in a favorable location reception of stations 2000 to 5000 miles away should be possible. Summer tests at Chicago and San Francisco resulted in some 2000 mile reception and it is reasonable to assume that this winter existing distance records will be smashed and new ones set up.

**Buy It in Kit Form or Built-Up!**  
 FOR THE COMPLETE KIT

The SM-710 Sargent-Rayment Seven Kit is complete in every respect. All parts are inspected at the Silver-Marshall factory for both electrical and mechanical defects and are fully guaranteed by both Silver-Marshall and by Radio Constructors Corporation to be in first-class condition. Everything is carefully packed to withstand shipment. Complete instructions for assembling and wiring the kit are included. These instructions are so explicit and so well illustrated that the novice will have no difficulty in following them.

All hardware, screws, nuts, washers, brackets—everything necessary to build the set—is included. There is nothing additional to be bought. The kit includes even the "cabinet."

Standard Model, Grained Aluminum Finish. Code Word, "MERCURY" . . . \$130.00  
 De Luxe Model, Brown, Crackle Crystalline Finish. Code Word, "VENUS" . . . 140.00

**FOR THE BUILT-UP SET**

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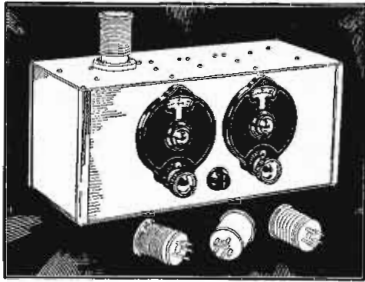
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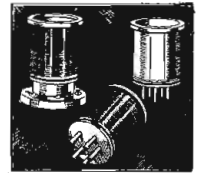
Here are the trimmest short wave sets ever—the new “Round-the-World” kits.

## Tune Over the “Thrill Band” with an S-M Short Wave Set

**H**AVE you had your taste of the “thrill band”—the wavelength band from 17 to 200 meters? Down on these low waves are the foreign broadcasters—English 5SW with Colonial programs—Dutch, French, German and other re-broadcast programs. Down there you can hear KDKA, WGY, and WLW programs when static blankets out their regular waves. And television—the low wave band is its busy nursery. You can hear amateurs in almost every country, all in an evening—if you have an S-M “Round-the-World” short wave set. S-M “Round-the-World” kits build up into such neat, trim, snappy receivers—with screen grid R.F. amplification, and one dial tuning—that you just can’t help getting the thrill of your life as you tune one.

The “Round-the-World Four” is a complete four-tube regenerative (non-radiating) short wave receiver kit with aluminum shielding cabinet. It has one screen grid R.F. stage, a regenerative, non-radiating detector, and two high-gain Clough audio stages. It tunes from 17.4 to 204 meters with four plug-in coils, and has brought in five continents in an evening. The kit is \$51.00, complete with cabinet and coils—ready for immediate shipment. Full instructions are included in every kit.

The 731 “Round-the-World” Adapter is the two-tube, R.F. amplifier and detector, less the two stage A.F. amplifier of the above set. With an adapter plug, it converts any set to long-distance short wave reception. Price, complete with cabinet and four coils (17.4 to 204 meters) \$36.00. The 732 “Round-the-World” Essential Kit contains the two tuning and tickler condensers, the four plug-in coils, coil socket, and three R.F. chokes, with full instructions for building a one, two, three or four tube short wave set. It costs but \$16.50 complete.

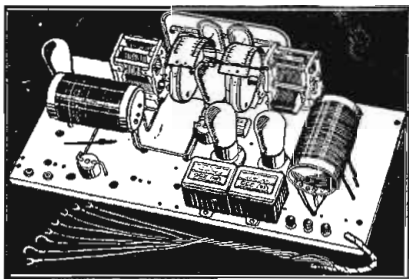


New 5-prong plug-in coils, for short and broadcast waves. Wound on forms of threaded, moulded bakelite.

Choose any one of the three kits you prefer, and step out into the “thrill band”!

The “Round-the-World Four” is a complete four-tube regenerative (non-radiating) short wave receiver kit with aluminum shielding cabinet. It has one screen grid R.F. amplification, and one dial tuning—that you just can’t help getting the thrill of your life as you tune one.

## Get Quality Reception at Minimum Cost with the Coast-to-Coast Four



Biggest Value Ever Offered in the Fifty-Dollar Class—for either DC or AC Tubes.

**T**O the thousands of fans for whom the four tube, R.F. amplifier, regenerative detector and two stage audio amplifier is the time-tested standard of receiver comparison, the new Silver-Marshall Coast-to-Coast Four offers the finest performance yet attained with this remarkable circuit. A screen grid R.F. amplifier stage, immeasurably finer coils than ever before, the new Clough high-gain audio system, and an all-metal assembly like those of the finest of ready-made sets, make the “740” the biggest \$51.00 worth of radio set you’ve ever listened to.

Through summer static, the Coast-to-Coast Four plays on the speaker New York, Florida, Texas, and California stations, cutting through local Chicago interference only 10 or 20 K.C. away. Its tone quality is such as only S-M transformers can provide. Housed, like the 720 six, in the new S-M 700 table-model metal shielding cabinet, it harmonizes beautifully with any home furnishings.

Despite this demonstrated superiority, in every respect, over all other sets in its price class against which we have tested the 740, the complete kit of all approved parts costs but \$51.00; or the 740AC kit, \$53.00 complete. The 700 cabinet is \$9.25 additional.

We go emphatically on record that no matter what set you build or buy, the 740 Coast-to-Coast Four is the best dollar for dollar value you can find around fifty dollars. It goes together easily and simply, performs with a vengeance, and for the professional setbuilder provides a low-priced set that will out-demonstrate ready-made sets at twice its price.

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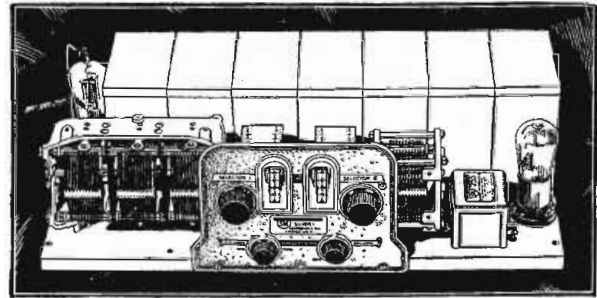
# THE NINE TUBE SCREEN GRID *Laboratory Receiver!*

## The 1929 Laboratory "Super"

**T**HREE stages of screen grid radio-frequency amplification, a screen grid first detector, two stages of 65 kc. intermediate screen grid I.F. amplification, and a super-powered second detector—all copper shielded—working into an audio stage using the new Clough system—no wonder the 1929 Laboratory receiver spins rings around the best of superheterodynes!

And all of this tremendous amplification, with selectivity that makes stations literally snap in and snap out, is controlled by two vernier drum dials, and a "volume" and a "sensitivity" knob. No wonder it's easy to bring in stations from Maine to Florida, Texas, California, and Canada all in one evening. No wonder a log of a hundred stations can be piled up with this ultra-selective, extraordinarily-sensitive screen-grid super that has out-performed every other superheterodyne tested against it!

For the fan who wants real "super" results without squeals and station repeats clogging up his dials, the Laboratory Super is the set. Just imagine a super that can be tuned from one end of the dials to the other right in Chicago without a single local station repeating, and yet be able to use a 65 kc. intermediate frequency with all the tremendous amplification this frequency, plus screen-grid tubes, gives. No wonder the new Laboratory Receiver is the set you've been looking for—a set so sensitive that you can out-demonstrate any other super with it at any

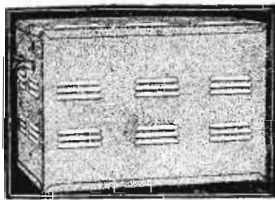


time at all. And it has the ultra-fine tone that can be gotten only from the new S-M audio transformers and a stage of external light socket, push-pull 210 or 250 Unipac amplification, the highest powered, finest toned amplification that money can buy!

If you've built lots of supers, and know what real results are, this set will give you a new thrill for distance, selectivity, tone.

Despite its absolutely startling performance, the parts, mostly of S-M manufacture with all that this implies, cost but \$95.20 complete, less Unipac amplifier which is not absolutely essential. And the overwhelmingly superior results the Laboratory Super will give, no matter what you compare it with, make it outstandingly the finest superheterodyne money can buy.

## UNIPAC POWER AMPLIFIERS



### Single Stage Unipac Amplifier

Either of two S-M single stage power amplifiers replaces B batteries on any receiver and adds a stage of super-power amplification. Type 681-210, the most powerful amplifier made, uses 2-UX210 or UX250 power tubes in push-pull, two UX281 rectifiers, and a UX874 regulator tube. It supplies 45, 90 and 135 volts B to the radio receiver. A lower-powered unit

is the 681-250, using only one UX210 or UX250 amplifier tube, but identical with the 681-210 in other respects. Price, 681-210 WIRED push-pull Unipac \$102.00; or 681-210 KIT, \$87.00. Both are ideal for the Laboratory super. Price 681-250 WIRED Unipac, \$96.50; or 681-250 KIT, \$81.50.

### Public Address Unipac

For coverage of crowds of 1,000 to 10,000 people, indoors or outdoors, with one to twelve loud-speakers, the 685 Public Address Unipac is the only light-socket amplifier now available. It uses one UY227, one UX226, one UX250, and two UX281 rectifiers in three stages for microphone, radio, or record pick-up amplification. It is the ideal self-contained, portable or permanent amplifier for conventions, theatres, churches, etc. Priced 685 WIRED Unipac, \$160.00; or 685 KIT, ready to assemble, \$125.00.



### Two Stage Unipac Amplifier

Two complete two stage super-power Unipac Amplifiers, for amplification of radio set detector output or phonograph record pickup are the finest and most powerful of their types. Type 682-210 uses one UX226 first stage tube, two UX210 or UX250 super-power tubes in a push-pull second stage, two UX281 rectifiers, and a UX874 regulator tube. It supplies two stages of power amplification and 45, 90 and 135 volts B power for a receiver, and A.C. filament power too. Type 681-250 is the same Unipac except that it uses only one UX210 or UX250 tube in the last stage. 682-210 WIRED push-pull Unipac lists at \$117.00; or 682-210 KIT at \$102.00. The 682-250 WIRED Unipac lists at \$111.50; or 682-250 KIT at \$96.50 ready to assemble.

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1929 Nine Tube Laboratory Super

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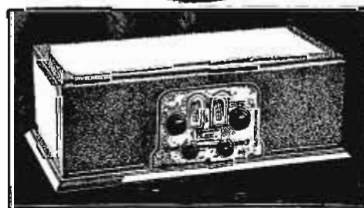
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CORWICO Braidite Hook-Up Wire is the first choice of amateurs, professional set builders, and engineers of the leading set manufacturers.

### READ WHAT THEY SAY:

*"Corwico Braidite is the only stranded insulated hook-up wire that I have ever used that holds its shape permanently after bending. All others twist and get out of place."*

*A Professional Set Builder.*

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*"After exhaustive laboratory tests, we have found your Braidite hook-up wire the most practical on the market. It's the one hook-up wire that you cannot scorch or burn with a soldering iron."*

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For converting battery operated sets of six or less tubes to A-C house current operation without rewiring, the Corwico A-C Adapter Harness is the most simple outfit on the market. These harnesses are made in two types, Type "R" for R. C. A. type tubes, price \$8.00, and Type "A" for Arcturus Cable Type Tubes, price \$5.00. At your dealer's or order direct.

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## Chi-tran 250 Power Amplifier Announced

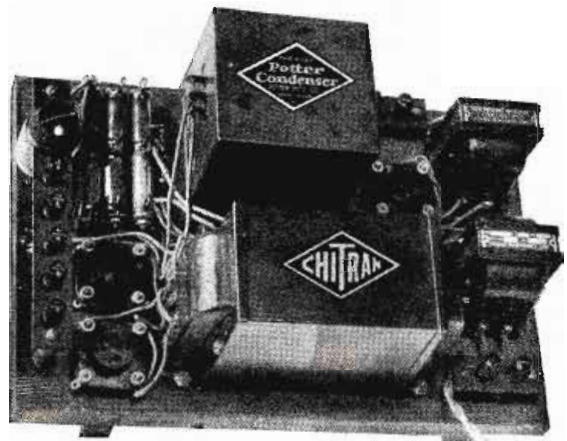


Fig. 1. This photograph shows the completed power amplifier built out of ChiTran parts described briefly in the accompanying article

WITH public interest running high on the subject of power amplifiers suitable for maximum undistorted output and especially for use in conjunction with dynamic speakers, the Chicago Transformer Co. has recently announced the production of parts suitable for the construction of a 250 power amplifier compact, such as the one illustrated in this article.

Briefly the features of the ChiTran amplifier are: Compactness in that all windings and the filter chokes are contained in a single unit; a modified filter system giving a more uniform regulation; voltage terminals for operation of any receiver and less possibility of condenser break-down due to a reduced a. c. component in the first filter condenser section.

### Official Parts List

Parts required for the construction of the ChiTran 250 power amplifier are:

- 1 ChiTran 250 transformer compact.
- 1 ChiTran Type CT770 input transformer.
- 1 ChiTran output transformer.
- 1 Potter 250 B block.
- 1 Electrad .5,000 ohm resistance.

(Continued on page 126)

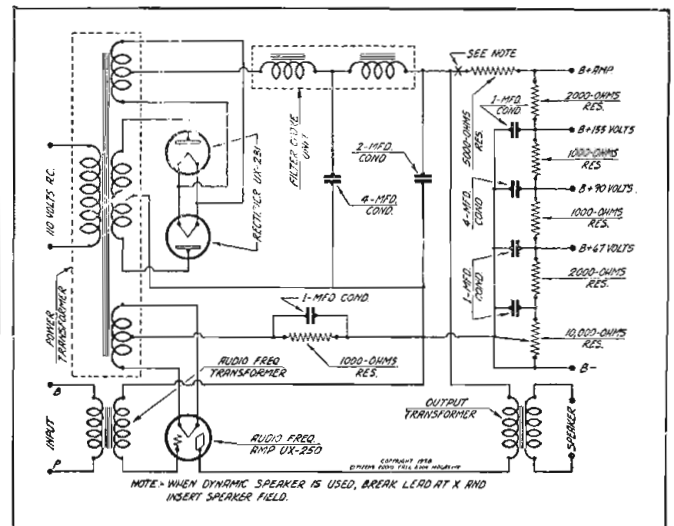


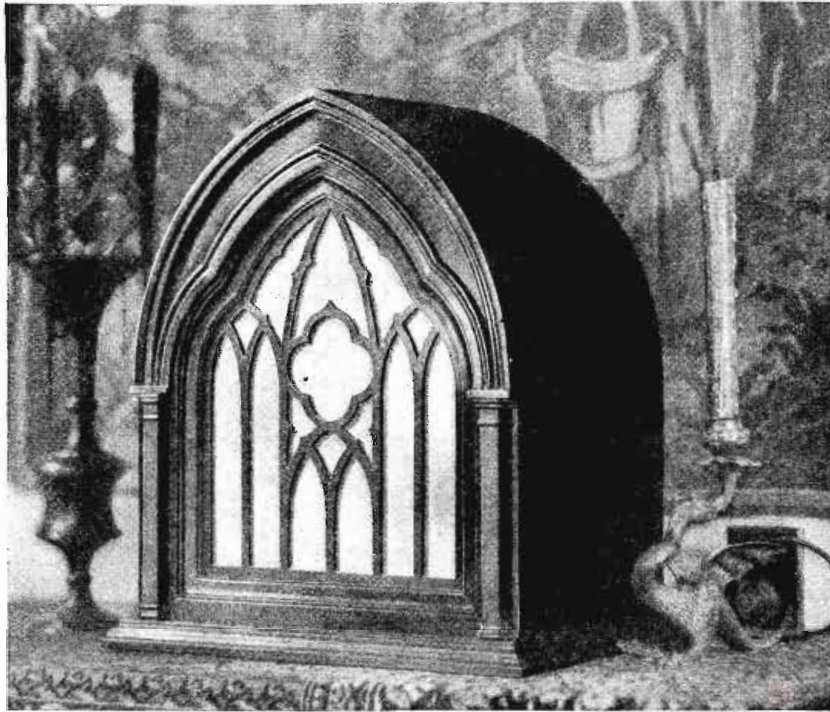
Fig. 2. The schematic circuit by which the ChiTran 250 power amplifier should be wired is shown in the above drawing

**... most beautiful . . .** An air of serenity hovers about the classic Gothic lines of this new Peerless Dynamic Power Speaker . . . In its contour there is a fluid gracefulness that gives unceasing pleasure to the eye of the connoisseur . . . In the majestic perpendiculars of its Gothic grill there is poise and dignity and a challenge to perfection

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which even its most avid imitators will never be able to duplicate . . . In performance it is worthy of its label . . . List \$75 . . . made by United Radio Corporation, Rochester, New York.

**Peerless**  
DYNAMIC REPRODUCERS  
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*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

# RADIO AT NEW YORK'S LOWER PRICES

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- 2 Electrad 2,000 ohm resistance.
- 1 Electrad 1,000 ohm resistance.
- 1 Electrad 10,000 ohm resistance.
- 1 Electrad 1,500 ohm resistance.
- 9 X-L binding posts.
- 3 Benjamin 9040 sockets.
- 1 Potter No. 3 1 mfd bypass condenser.

### Practical Television

(Continued from page 114)

towards vibration of the tube elements. The Benjamin cushion sockets have performed satisfactorily in this capacity.

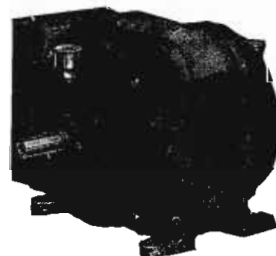
The experimenter may find that it will be more advisable to replace the 1/4 megohm resistance in the grid circuit of the 171 tube by an audio choke and a radio frequency choke, the former being a Samson type G and the latter a Samson type 500. This will probably give much better results than the grid leak in that circuit, if the audio choke is placed at the grid end, the radio frequency choke next and then the negative 40-volt bias applied to the lower end of the radio frequency choke.

In the next issue of this magazine we will show the various methods of connecting a neon tube to the output circuit of a power amplifier. For the time being and for the experiments conducted on station 3XK the method outlined in Fig. 5 has been sufficiently practical for all purposes.

### Baldor Television Motor

(Continued from page 106)

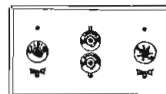
THE motor shown in the accompanying illustration is one recently announced by Interstate Electric Co., manufacturers of electric motors, 4351 Duncan Street, St. Louis, Missouri. Three types of motors are recommended by the makers for television work in driving the scanning disc, these three being the Y-1V, 1/8-h.p. 110-volt 60-cycle single phase 1800 r.p.m., type Y-2V 1/8-h.p. 110-volt 60-cycle 1200 r.p.m. and the type M-2V 1/15-h.p. 110-volt 60-cycle 1800 r.p.m.



In addition to the three types of motors the Baldor interests are in position to supply a machined flange for holding the scanning disc and a rubber cushion base for the motor.

### Radio Convenience Outlets

TWO items in the Yaxley line, which are quite interesting this season from the standpoint of apartment, hotel and other building radio wiring, are the Yaxley 350 convenience outlet containing a cable plug for all of the A and B wires of the set, an antenna and ground outlet and a jack for the speaker; the second convenience outlet being 353, which provides two outlets for alternating current, an aerial and ground connection and the speaker connection. Both of these are illustrated in this column.

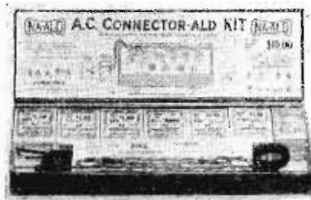


Those interested in securing information covering wiring suggestions for Yaxley radio convenience outlets may secure literature by writing the Editor of this publication or the manufacturer, Yaxley Mfg. Co., 9 S. Clinton St., Chicago, Ill.



# How to Get the Most Out of Your Radio Set

NA-ALD accessories and parts will help get the best results from a radio set. With them you can get better quality—use power tubes—attach an electric pickup or convert your battery set to an electric set. Read the story below:—



No. 906 A.C. Kit—\$10.00

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For anyone with an old battery set they want to bring up to date or that has worn out batteries or tubes, use a NA-ALD A.C. CONNECTORALD Kit with any good filament transformer. Discard your storage battery and give your set new life with A.C. tubes. They will improve its quality and help get greater distance. Send for the A.C. CONNECTORALD booklet.



No. 426—Price 50c

NA-ALD Sockets are made in several types for the set builder. They can be used above or below sub-panels and with A.C. or D.C. tubes. Special contacts on the outside of the tube prongs carry the heavy current to A.C. tubes without voltage drop. Colored locator rings guide the prongs of the tubes into the holes for them and also add to the beauty of the set.



No. 913 Price \$1

The NA-ALD Silencer Socket 481-XS is a cushion socket for detector and screen grid tubes. Note its action, absorbing all shocks sidewise, up and down or pivotally.

The NA-ALD tube shield, universal for both A.C. and D.C. type 222 shield grid tubes, is adjustable to fit the varying length of these tubes. A rubber cushion in the top also clamps onto the glass preventing microphonic noises. It can be used with any UX socket, but when used with the NA-ALD Silencer Socket provides a perfect installation for these delicate tubes.

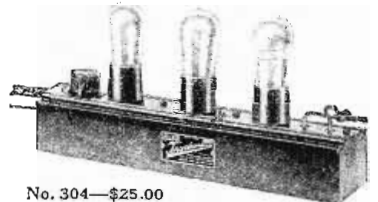


No. 303—Price \$15.00. Output Unit \$5.00

In the NA-ALD line there are over thirty different Adapters and CONNECTORALDS, for making every conceivable tube change and for converting battery sets to A.C. sets—over twelve different Sockets—an Electric Phonograph



desired to improve the quality of a set now in operation the complete TRUPHONIC Amplifier No. 304 can be used. This amplifier can be attached to any standard set and is completely wired ready for use. It will also be found ideal for connecting to Electric Pickups and for a television amplifier.



No. 304—\$25.00

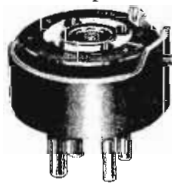


No. 502—Price \$5.00

If you are not satisfied your money will be refunded.

The No. 945 Adapter permits readings to be taken from five prong detector sockets in A.C. sets with the regular D.C. testers.

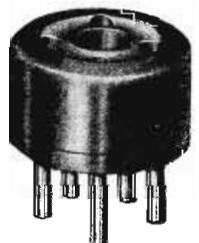
Set builders, service men and experimenters will find the No. 934 Oscillation Control Adapter a great time saver. This Adapter has a little jack clip built in the grid circuit into which NA-ALD oscillation suppressor resistors can be slipped. The Adapter can be made a permanent



No. 934—\$1.25

installation or can be used for test to determine correct value of resistors needed. Resistors are made in 500-600-700-800-900 and 1000 ohms. 25c each.

Fill in the coupon and get the new complete NA-ALD catalog, which is now ready. You will find many accessories listed in it to help you improve your radio set and get better results from it.



No. 945—Price \$1.00

**ALDEN MANUFACTURING CO.** Dept. CCB2  
Brockton, Mass.

Please send me the Booklets marked below:

How to Convert Battery Sets to A. C. Sets.

How to Get the Most Out of Your Radio.

What to Build.

Complete Naald Catalog.

Name.....

Street.....

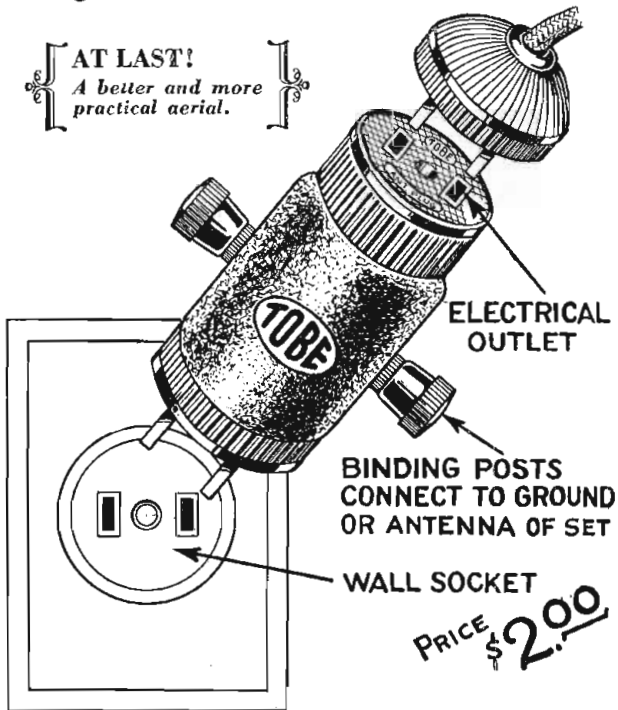
City..... State.....

**ALDEN MFG. COMPANY** ~ ~ ~ ~ **Brockton, Mass.**



*Now Offers*  
**THE 4 PURPOSE  
LIGHT SOCKET AERIAL**

**AT LAST!**  
*A better and more  
practical aerial.*



**A Better Aerial or Tobe Would  
Never Build It**

This Tobe product is GOOD and does the work for which it was designed. The device combines—a perfect antenna or ground, a through way power outlet and eliminates the necessity for lightning arrester. Uses no current.

**Reduces Static Pick-up to a Minimum**

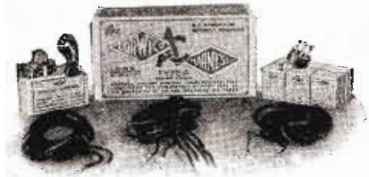
Compare this light socket aerial with others—if you have never used one you are in for a pleasant surprise. The quiet receptive qualities of this new TOBE product will amaze you.

This light socket aerial is TRUTHFULLY better and is sold by all good dealers with a trial money-back offer, because we have faith in its performance.

**Tobe Deutschmann Co.**  
Canton, Mass.

**Corwico A. C. Adaptor Harness**

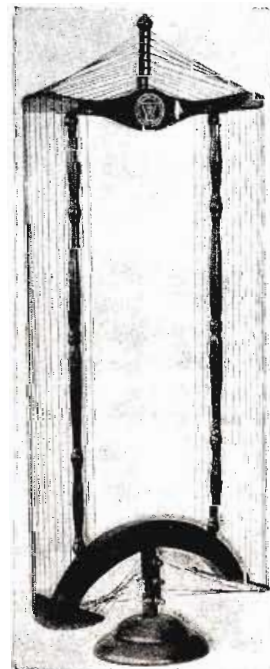
THERE is still some demand for conversion of battery operated sets for use with alternating current, and with this in view the Cornish Wire Co., Inc., 30 Church Street, New York City, N. Y., has announced an a. c. adaptor harness for converting battery operated sets of six or less tubes to alter-



nating house current without rewiring. The illustration herewith shows the harness kit, which may be used with practically all receivers and will fit such sets mechanically and electrically. Due to the difference in design and characteristics of the RCA and the Arcturus type tubes, it is necessary to produce a harness for each type. Adapters are supplied with the RCA type harness, while the Arcturus cable type tubes require no adapters and can be used in any set without raising the height of the tubes. Ample provision is made for the C bias and the volume control is supplied with all harness.

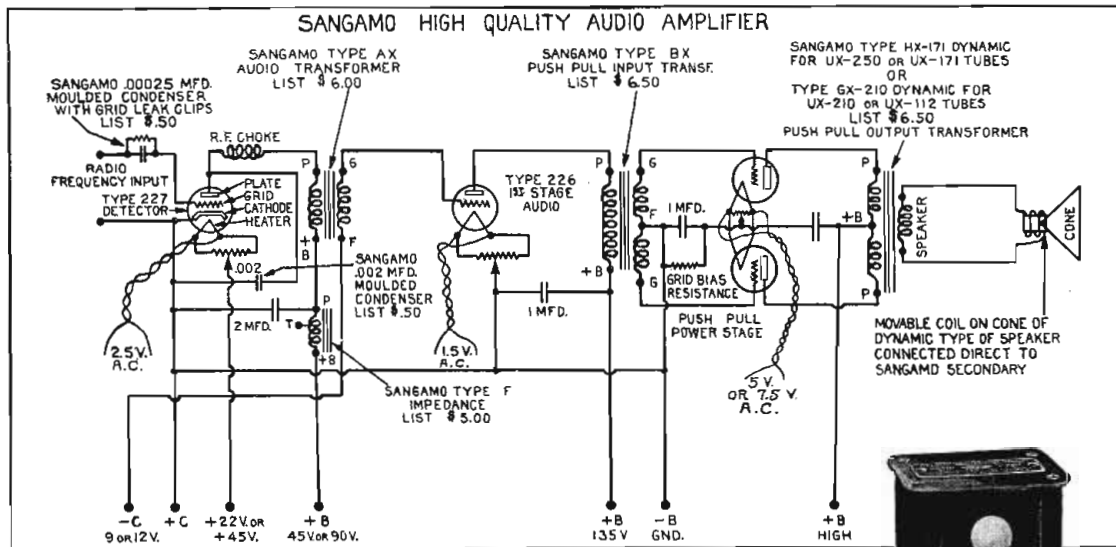
**New Vee Coil Antenna**

DESIGNED by Chas. J. Victoreen, Cleveland, Ohio, the new Vee coil antenna recommended for superheterodyne and other loop sets has recently been announced and is shown in the illustration below.

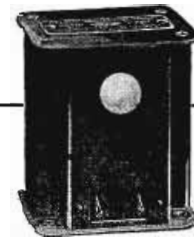


The new and improved design gives greater pick-up, sensitivity and directional ability with low distributed capacity and low resistance. The highest operating efficiency and convenience is combined with the fine appearance and a beautiful finish. One of the features which particularly appeals to the users is the provision for keeping the wires taut, thus compensating for stretch. Each Vee coil antenna is packed in a separate carton and is accompanied with full directions and diagrams for use with tuned radio frequency sets or any other set of five or more tubes. Instructions are also included for its use with condensers of any capacity.

# Build this modern amplifier!



## gets the low notes



The up-to-date radio is using "push-pull" for the last audio stage with two power tubes—the output going directly to the moving coil of a dynamic speaker. Thus ample capacity and energy for those low notes are available. Such an amplifier using good transformers gives a quality of reception never attained before.

### Little Expense Necessary

Sangamo, manufacturers of precision electrical apparatus since 1899, have recently completed a line of audio transformers and impedances which match the various types of power tubes now available—and which sell at a price considerably lower than usual for apparatus of high quality. Included in this new "X" line is the "AX" audio

transformer which has an extremely flat amplification curve over the entire audio frequency band. Two of these transformers and a Sangamo Output Impedance to match the power tube used form the basis for a remarkably efficient amplifier of the conventional type.

### Push-Pull Amplifiers

The circuit diagram shown above is the latest and perhaps most satisfactory amplifier developed to date. It will be noted that the Sangamo Output Transformer is especially designed for the particular power tube used and for a dynamic speaker. That is, the primary has an impedance to match the tube and secure maximum energy transfer and the secondary impedance matches that of the moving coil of

the dynamic speaker. The Sangamo Input Transformer has an accurately divided secondary to secure practically identical frequency curve characteristics for both tubes in the stage.

Similarly in the "X" line are found Push-Pull Transformers to match power tubes but designed for use with speakers not of the dynamic type.

The cost for the apparatus is shown in the diagram. The approximate cost of building the amplifier is only about \$25.00.

### Latest Audio Hook-Ups

A free circular describing Sangamo apparatus and circuit diagrams of best types of audio amplifiers will be sent on request.

# SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS, U. S. A.

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

# America's Leading Kit House

## Official Service Station for the Leading Kit Manufacturers

The confidence of the leading kit manufacturers is evidenced by our being appointed "Official Service Station." You will obtain here the same conscientious and courteous service the manufacturer would give you himself. Our corps of trained and experienced radio men will serve you efficiently.

### All Parts Are Carefully Matched and Tested, Before Shipping, for the Following Popular Circuits

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Scott World's Record Shield Grid Nine.....	129.00
Thordarson 250 Power Supply and Amplifier.....	101.45
Thordarson Radio Phonograph 250 Push-Pull Am- plifier for Dealer, Public Address or Demonstra- tion.....	136.55
Citizens Shield Grid Booster Stage.....	29.50
Citizens Regentriac-Regenerative Three Tube A. C. Receiver.....	48.24
1929 Silver-Marshall Model Nine Tube Super.....	95.20
New Silver-Marshall Screen Grid Six Tube T. R. F. Receiver.....	72.50
Hallidorsen Shield Grid 5-6 Receiver.....	58.60
National Screen Grid Five.....	72.36
H. F. L. "Isotone" 10 Tube Screen Grid Receiver.....	195.00
Power Amplifier for Above.....	95.00
Sargent Rayment 7 Tube Receiver.....	120.00

### Set Builders and Dealers

Write or call on us for prices on any circuit ap-  
pearing in any of the radio magazines. Our prices  
are lowest to professional set builders and dealers.

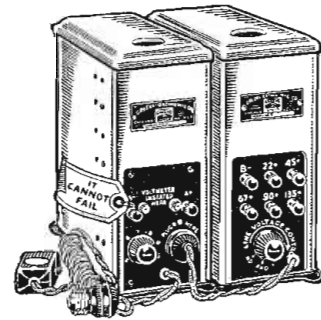
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We have complete line amateur transmitting and  
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PHILADELPHIA, PA.

## Great Greene AB Power Pair

RECENT announcement is made by the Greene-Brown Co., 1500 Ravenswood Ave., Chicago, Ill., of the Great Greene AB power pair shown in the accompanying illustration, this being a combination of the dry electric A and B units. This unit, or power pair as it is called, is suggested for any battery receivers of seven tubes or less, which may be easily and quickly converted to a.c. reception at comparatively low cost. Rewiring of the set is not required. Any house light socket supply 90 to 135 volts 60 cycle a.c. current will provide the power. These units contain no battery in any form. Therefore, they do not require water or acid replenishments.

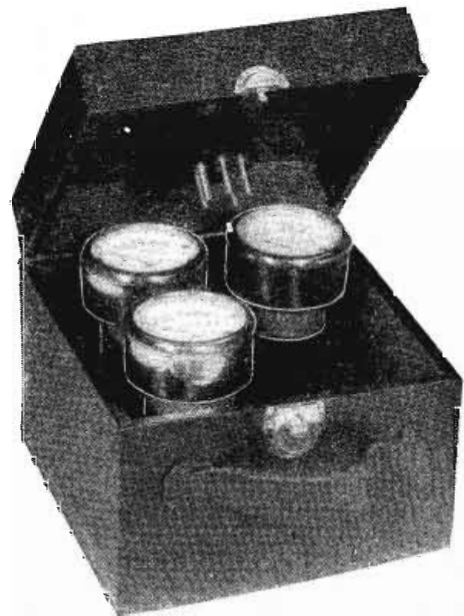


The A and B power is turned on or off by one control switch provided at the twisted cord of the A unit shown at the left.

In addition to the unit previously mentioned, the Greene line includes the Great Greene dry electric A unit, the Great Greene high power B unit and the Great Greene A. C. Synchrofilters.

## Beede Test Kit

A HANDY test set for the professional set builder or service man is announced this season by the Beede Electrical Instrument Co., 136 Liberty St., New York City, N. Y. The kit No. 80 is illustrated below.



One of the features of the Beede line is the fact that these test meters are of the socket type for making tests directly at the socket of the tube. All that the service man has to do is to remove the tube and insert the meter, thus knowing the true conditions at the heart of the set.

Four types of meters are supplied in the plug-in assembly, No. 50, 0-300 volts for testing plate voltages in any set; No. 55, grid bias meter 0-50 volts for checking up the proper C voltage; No. 60, a.c. filament meter 0-7½ volts for testing the filament

# Over 900,000 Balkite Chargers Need This Authorized Replacement Rectifier



Type BNK  
for Models N  
and K Balkite  
Trickle Chargers.



Type BJ  
for Model J  
Balkite Charger.

## ELKON *the only authorized* Replacement Unit for Balkite Chargers

The Elkon Replacement Units and those made by the Fansteel Products Co. containing the Elkon Dry Rectifier are the only ones authorized for replacing the acid jars in Balkite Power Units.

No trouble in making the change—anyone can do it. And the difference! No fussing and messing with water and dangerous acids, with the Elkon Rectifier in place all trouble, attention and adjustment is eliminated for 5000 hours!

Increased efficiency, too. With the Elkon Replacement Units, the charging rate of Model K is increased from 4/10 of an ampere to 8/10; The Model N is increased from 8/10 to 1 ampere; and all of the charging rates of the Model J are increased 20%!

Solid, dry, self-healing, not affected by line surges, noiseless—truly the trouble-free rectifier.

**ELKON, INC.**  
PORT CHESTER, N. Y.

Division of  
P. R. MALLORY & CO., INC.

**ASK  
ABOUT  
THE  
OTHER  
ELKON  
RECTIFIERS.  
TOO**

M-16 for "A" Eliminators and 3 ampere chargers. V-4 for trickle chargers—and this new EBH for replacing BH tubes in "B" Eliminators.



Not a telephone switchboard—operators testing Elkon rectifiers and the seasoning boards in the background.

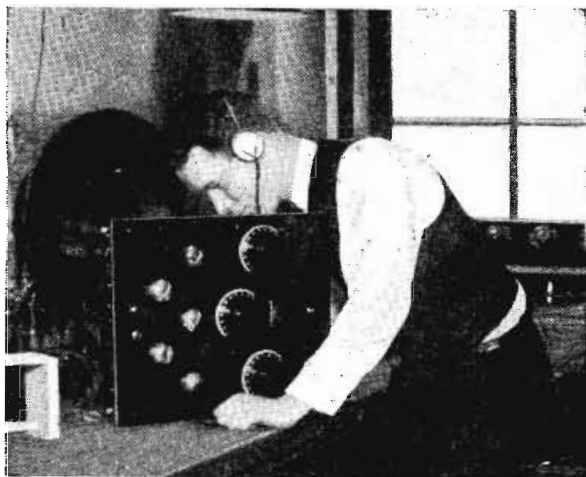
Radio Department, ELKON, Inc.  
240 Fox Island Road, Port Chester, N. Y.

Send me full information on Elkon Radio Products

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# There's money for you in RADIO



*Wonderful opportunity for ambitious men to win success in this fast-growing profession*

The Radio industry is expanding so rapidly that trained men are at a premium. There is a constant, urgent demand for operators—factory superintendents—engineers—service men—designers—salesmen.

There is no better way for you to succeed in this fascinating business than to study the Radio Course of the International Correspondence Schools. This course is new and complete. It was written by practical authorities in this field. It is endorsed by leading radio experts and radio manufacturers.

Quincy J. Workman, of Scranton, Penna., writes that he has "nearly doubled his salary" since he took up the I. C. S. Radio Course. He is now manager of the Radio Department of a large store.

J. B. McCune, of Donora, Penna., writes that the I. C. S. Radio Course enabled him to start a radio business of his own. This same course enabled John M. Paynter, of the U. S. Lighthouse Service, Charleston, S. C., to get a position as Radio Operator and Ship's Electrician. Scores of other men in radio factories, laboratories and stores report similar progress.

You, too, can get in on the ground floor if you act quickly. But don't delay too long. Mark and mail the coupon today and let us tell you all about the I. C. S. Radio Course and what it can do for you.

**Mail the Coupon for Free Booklet**

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| <input type="checkbox"/> Machine Shop Practice  | <input type="checkbox"/> Concrete Builder        |
| <input type="checkbox"/> Railroad Positions     | <input type="checkbox"/> Structural Engineer     |
| <input type="checkbox"/> Gas Engine Operating   | <input type="checkbox"/> Chemistry               |
| <input type="checkbox"/> Civil Engineering      | <input type="checkbox"/> Automobile Work         |
| <input type="checkbox"/> Surveying and Mapping  | <input type="checkbox"/> Airplane Engines        |
| <input type="checkbox"/> Metallurgy             | <input type="checkbox"/> Navigation              |
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| <input type="checkbox"/> Banking and Banking Law                 | <input type="checkbox"/> Business English                                 |
| <input type="checkbox"/> Accountancy (including C.P.A.)          | <input type="checkbox"/> Civil Service                                    |
| <input type="checkbox"/> Nicholson Cost Accounting               | <input type="checkbox"/> Railway Mail Clerk                               |
| <input type="checkbox"/> Bookkeeping                             | <input type="checkbox"/> Common School Subjects                           |
| <input type="checkbox"/> Private Secretary                       | <input type="checkbox"/> High School Subjects                             |
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Name.....  
Address.....

voltage at the tube, and No. 75, a. c. line tester 0-150 volts, which plugs into any receptacle or light socket and gives correct line voltage.

The company is also marketing an a. c. voltage control unit, which permits control of the a. c. line, this particular unit being used with the alternating current receivers.

## New Jewell Catalog

**I**NDICATING its establishment in every branch of the electrical industry and that the contributions which it has made in the way of instruments for better radio are only the natural sequence of electrical experimentation and manufacturing of electrical measuring instruments, the new Jewell catalog, which is just off the press and is being distributed, is a revelation for anyone who may have felt that this company was only interested in radio.

In addition to making the well known line of meters with which the radio fan is acquainted, the Jewell organization also manufactures ohmmeters, galvanometers, wattmeters, a full line of portable test meters, railroad tube checkers, head light voltmeters, student's voltmeters, universal laboratory instruments, X-ray milliammeters, Coolidge filament meters, kilovoltmeters, polarity indicators, relays, automotive testing instruments, tachometers and a number of other items for the general electric industry. The range of the Jewell line is so wide that it is a surprise to those seeing the new Jewell catalog, which may be secured by interested parties upon application to the Jewell Electrical Instrument Co., 1640 Walnut St., Chicago, Ill.

## Tobe Light Socket Aerial

**A**NSWERING a demand for a safe and efficient antenna for those who live in crowded city apartments, the Tobe four-purpose light socket aerial plugs have recently been marketed by Tobe-Deutschmann Co. of Cambridge, Mass. The socket is illustrated in the picture herewith.

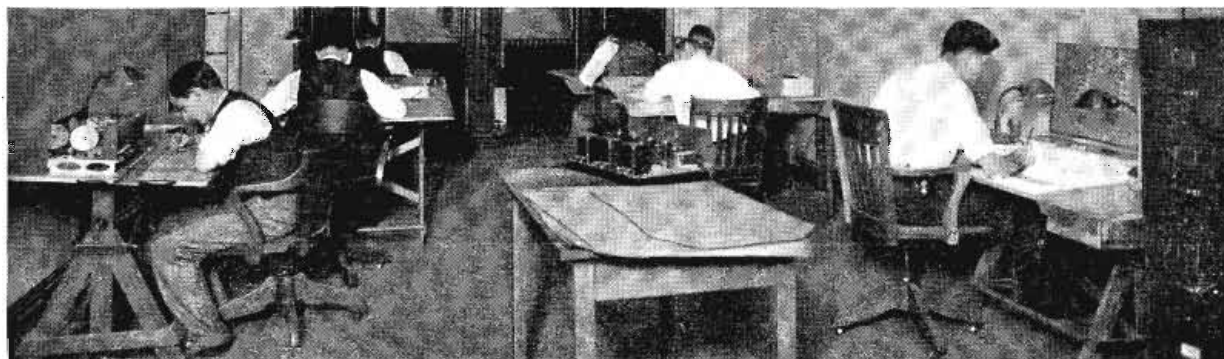


The Tobe socket aerial plugs into any electric lamp socket or convenience outlet as an antenna, doing away with the troublesome and sometimes expensive outdoor antenna. It does away with lightning arrestors, ground switches and similar units. One of its chief features is the fact that it allows the use of a light socket for electrical purposes as floor lamps or other electrical attachments, while at the same time providing an efficient and safe antenna for the radio receiving set. The device uses no current, is neat and attractive and no danger may be anticipated from shock.

## New Sonatron 171 A. C. Tube

**P**IONEERING important tubes is a tradition of the Sonatron Tube Company, and the latest news from the Sonatron plant along these lines is the development of the X171 A. C.

# OUR DRAFTING ROOM



This staff of highly trained draftsmen is continually preparing the most accurate and complete full size blueprints of radio receivers and power packs obtainable.

Blue prints are available on all circuits described in the CALL BOOK. Each set of prints is composed of all the necessary drawings prepared in such complete detail and accuracy as to enable an inexperienced builder to duplicate in every respect the receivers built in our laboratory, thus assuring positive success and the greatest satisfaction.

## PLEASE ORDER BLUE PRINTS BY NUMBER AND NAME

No. 4	Browning-Drake 5 Tube Receiver using National Impedance Transformer.....	1.40	No. 98	Madison Moore International One Spot and Power Pack Baseboard Job (6 drawings).....	1.50
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No. 14	Browning-Drake 4 Tube Receiver Using Audio Frequency Amplification.....	1.40	No. 107	Bremer-Tully A. C. Power Six.....	1.40
No. 32	Scott "World's Record" Super Eight.....	1.40	No. 109	Harkness Counterionic 6-Tube Receiver.....	1.40
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## GRAPHIC WIRING DIAGRAMS

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No. 26	4 Tube Non-Radiating Receiver using Audio Frequency Amplification.....	.60	No. 139	Silver-Marshall Shield Grid Super.....	.60
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No. 77	St. James Semi-Portable Receiver.....	.60	No. 146	Citizens 115 K.C. Shield Grid Super.....	.60
No. 88	Two-Tube Browning Drake with Power Supply.....	.60	No. 150	Samson Push-Pull Amplifier & Power Supply.....	.60
No. 101	World's Record Economy Super 8.....	.60	No. 154	Silver-Marshall 4-Tube Shield Grid Receiver.....	.60
No. 108	Aero A. C. Seven T.R.F. Receiver.....	.60	No. 155	Thordarson Shield Grid Power Amplifier.....	.60
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			*No. 174	Sargent-Rayment Seven Receiver.....	.60

## SCHEMATIC WIRING DIAGRAMS

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*No. 165a	Citizens SG Booster Stage.....	.50	*No. 171a	Thordarson Dealer's Amplifier.....	.50
*No. 166a	Silver-Marshall SG Six.....	.50	*No. 174a	Sargent-Rayment Seven Receiver.....	.50
*No. 168a	HFL Isotone.....	.50	*No. 176a	Lincoln "B-80" One Spot Super.....	.50
*No. 169a	Halldorson SC 5-6.....	.50	*No. 177a	Tyrman Imperial Eighty.....	.50

\*Circuits described in present issue.

Any of the above blue prints will be sent postpaid by return mail upon receipt of the proper amount or they can be obtained from any of the Radio jobbers advertising in this publication. C. O. D. orders not accepted.

# CITIZENS RADIO SERVICE BUREAU

508 So. Dearborn Street

7th Floor

Chicago, Illinois

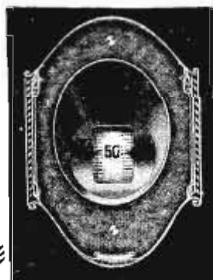
# HAMMARLUND'S New Contributions to Modern Set-Building

## Knob-Control Drum Dial

Unmatched beauty and a control mechanism that would delight a watchmaker.

The control knob is uniquely planned to be placed in any position on the panel desirable for attractive balance.

Numbers and degrees illuminated from the back.

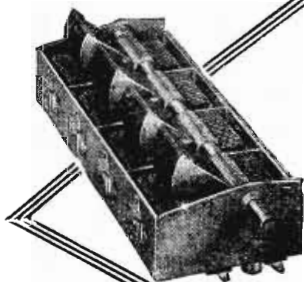


## "Battleship" Multiple Condenser

Leader of the gangs. Built for strength as well as performance. Die-cast frame, free-moving rotor. Sections accurately matched to within 1/4 of 1% (plus or minus).

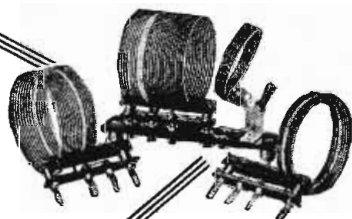
Recesses in the frame permit direct attachment of new type Hammarlund Equalizing Condensers for utmost precision.

Made in 350 mmfd. and 500 mmfd. sizes, with two, three and four gangs.



## For the Short-Wave Fan

Plug-in coils covering the short-wave bands from 8 to 215 meters. Extremely low resistance; widely-spaced plug-in terminals. Adjustable primary, held in any position by friction.



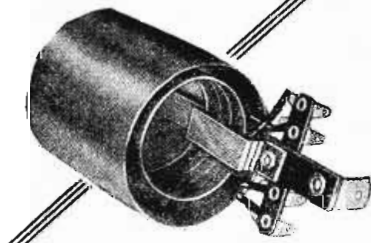
## Shield-Grid Coils

Exceptionally efficient, low-resistance, space-wound, self-supporting inductance. 2 in. in diameter.

A high-impedance primary with three taps for desired pick-up and selectivity.

Antenna coupler and R. F. Transformers for use with either .0005 mfd. or .00075 mfd. condensers.

Vertical mounting lug. Convenient soldering terminals.



Write for literature on these and other new Hammarlund developments

**HAMMARLUND MANUFACTURING CO.**  
424-438 W. 33rd St. New York, N. Y.

For Better Radio  
**Hammarlund**  
PRECISION  
PRODUCTS



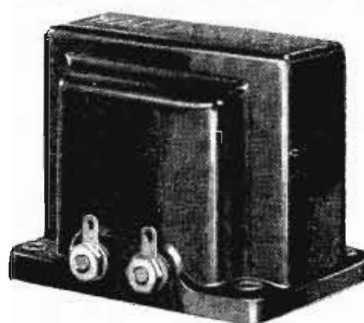
Recognizing that the 171 and 171A did not give perfect results in a. c. sets, Sonatron engineers set themselves to perfect a tube which would be based on the requirements of a. c. circuits. The X171 A. C. is the result of constant experiment and research in this direction. It is created especially for the 171 sockets in a. c. sets.

It offers far longer life than has come to be expected of the 171. At the same time, volume is appreciably increased—and the tone quality is correspondingly better.

This newest Sonatron achievement has opened up a big field of sales to dealers, who can replace the hundreds of thousands of 171s now used in a. c. sets, and also sell this tube with their new a. c. set sales. Thus again has Sonatron's progressiveness given its dealers a greater opportunity for profits.

## Halldorson Push-Pull Audios

RECENTLY designed for quality reproduction, the Halldorson push-pull audio transformer illustrated below is utilized in the Halldorson kit described elsewhere in this issue.

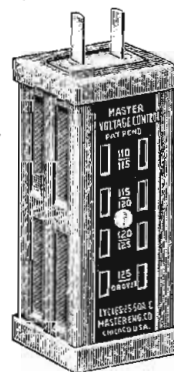


It is also made available to the set builder through the conventional jobber channels, together with a line of other merchandise which the Halldorson Co., 4745 N. Western Ave., Chicago, Ill., is presenting this season.

By a special design of laminations from a high grade of steel, the core is made exceptionally efficient. The same type of core is used in all of the Overtone models, whether push-pull or straight audio. The Halldorson line is rounded out this season by the production of power packs and ABC supply units.

## Master Voltage Control

ANNOUNCED by the Master Engineering Co., 122 S. Michigan Ave., Chicago, Ill., the Master voltage control is illustrated below and is described as a recently invented device which is necessary on all alternating current sets. The device consists, as shown in the illustration, of a unit which is plugged into the light socket, having on its side outlets for four different line voltages. These line voltages are clearly indicated so that the proper setting may be had to correspond with the line voltage of the set user in his particular district. All that is necessary



to do is to ascertain from the power company the maximum line voltage and plug the a. c. set into the outlet of the Master voltage control to correspond to that line voltage. The unit has no moving parts and once installed it requires no further attention.

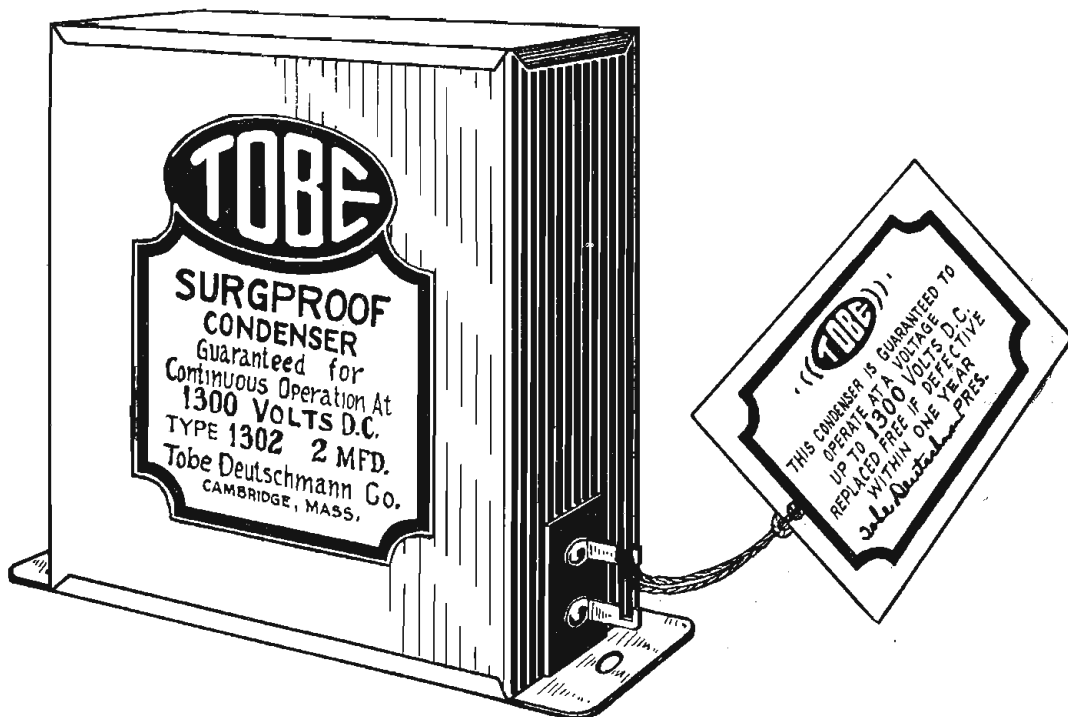




# ANNOUNCES

*With Pride and Pleasure*

## A New Condenser—Trade Marked—Surgproof



The test of a manufacturer's faith in his products is how long will he guarantee them?

Surgproof Condenser carries an immediate replacement guarantee if defective within a year.

SURGPROOF Condenser has a safe working voltage of 1300 volts D. C. and is recommended for any high-voltage amplifier using two 210 Power Tubes in Push Pull or the new 250 Tubes. Encased in a familiar Tobe Silvered Case 4½" x 5" x 1½".

Type 1302—2 Mfd. . . . \$5.00    Type 1304—4 Mfd. . . . \$9.00

*For Sale at your Dealer*

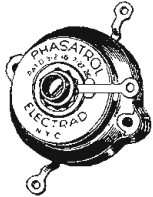
### TOBE DEUTSCHMANN CO., CANTON, MASS.

## For Better Radio Results! Phasatrol

Reg. U. S. Patent Off.

### A True Balancing Device for Radio Frequency Amplifier

Licensed by Rider Radio Corp. Pat. 5-2-16; 7-27-'26. Pats. Pending.



IN constructing a receiver using R.F. amplification, it is important to insert a Phasatrol for each stage of R.F. amplification to suppress and control A.F. oscillations.

After installation of Phasatrol, it is possible to adjust its variable resistance to a permanent value for an amplifying tube so that no further change of oscillations breaking out is experienced.

This device is excellent for use in purchased sets to cure them of the R.F. oscillation habit. Very easy to install even by a novice. Price \$2.75 each.

## Truvolt

U. S. Patent 1,676,869 and Patents Pending

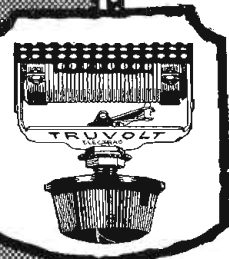
### All-Wire RESISTANCES

The ideal variable, fixed and tapped voltage controls and resistances for use in construction of eliminators or receivers.

Truvolt Variables simplify B-Eliminator construction by eliminating difficult calculation and making all adjustments easy. 22 stock sizes, \$3.50 each.

Truvolt Fixed Resistances are adjustable to different set values by the use of sliding clip taps—an exclusive Truvolt feature! Made in all desirable resistance values and current ratings.

Electrad specializes in a full line of Controls for all Radio Purposes.



U. S. Patent 1,676,869 and Patents Pending

Tear out and mail coupon for full information

----- CUT HERE -----  
ELECTRAD, Inc.  
Dept. E-9, 175 Varick Street, New York  
Please send me descriptive circulars on the following products and put me on your mailing list for similar literature.

- ..... General Circular.
- ..... Tonatrol Volume Controls.
- ..... Phasatrols.
- ..... Royally Variable Resistors.
- ..... "Electrad Control Manual" (Enclose 10c for mailing).
- ..... "What B Eliminator Shall I Build?" (Enclose 10c for mailing).

I am particularly interested in.....

Name.....

Address.....

# ELECTRAD Inc.

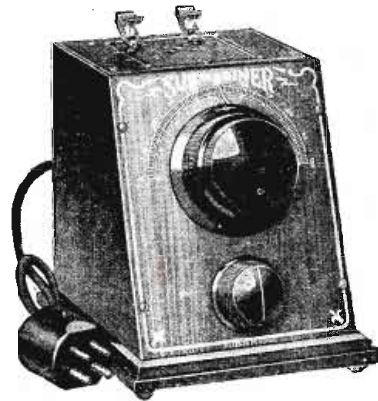
## Amperite Blue Book

RADIO fans and experimenters will be interested in the recent announcement of the publication of the Amperite Blue Book, recently revised by the Radiall Co., manufacturers of Amperite automatic current controls. In the past this booklet has been quite interesting to radio fans because of the amount of data which it contains covering filament control in many circuits. Now the edition has been further brought to date to cover new progress in the industry up to the present moment. Copies of the booklet may be secured by writing the Radiall Co., 50 Franklin St., New York City, N. Y.

Two new types of Amperites have also been recently announced, these being for alternating current tubes and being known as Amperite No. 226 for the UX-226 and all similar type tubes; Amperite No. 227 for the UY-227 and all similar type heater tubes.

## J-M-P Submariner

WITH all of the excitement on the part of the listener concerning short wave broadcasting, to say nothing of television, the Submariner manufactured by the J-M-P Mig. Co., Milwaukee, Wisconsin, is of interest. It is illustrated below.

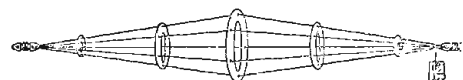


The Submariner is a neat, sturdy, compact device that is used to plug in on any receiver in place of the detector tube. It has a sensitive low loss circuit and permits reception on wavelengths below 200 meters. No wiring changes are required for the receiver with which it is to be used.

The device consists of a tuning dial, tuning condenser, a tube socket, a plug, a cable and a cabinet. It is made in three models, the first for the battery operated receivers and covers a wavelength of 26 to 68 meters; the second is the a. c. model for use with alternating current receivers and covering the wave band from 26 to 68 meters. Another model is known as the inter-

## LIFE-TIME DX AERIAL

No. 30



Length 30 ft.  
Non-corrosive—30 ft. length—volume of 150 feet aerial with selectivity of 30 foot antenna. Assembled—ready to string up—all connections soldered or riveted.

### Guaranteed Double Volume and Sharper Tuning

Rings are heavy gauge solid zinc. Permits using a powerful aerial in 30 ft. space. Duplicates in design and material. The aerials used by largest Broadcasting Stations. Sharpens tuning of any set, because of short length, but has enormous pick up because 150 ft. of enameled 12 ga. wire is used. Insures more uniform reception. Non-corrosive feature insures long life and 100% efficiency at all times. "Truly a Life Time DX Aerial." List.....

\$10.00

No. 60—Length 60 ft. Price \$12.50

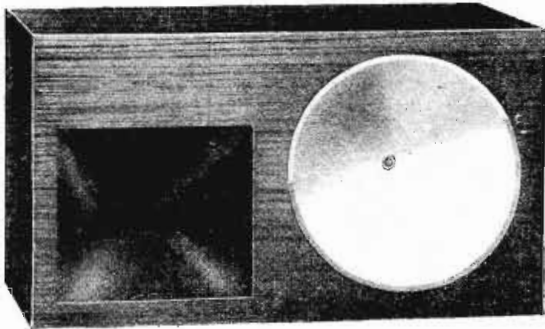
"Big Boy" size. Best for European tests. (Same description as above, except that 300 ft. of wire is used making this the most efficient and powerful aerial ever made.)

Manufactured by

THOROLA RADIO PRODUCTS 110 E. 21st St. Chicago, Illinois

# Now! Tripl-Tone

*the most amazing speaker ever built!*

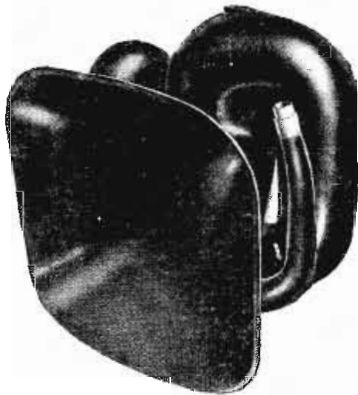


HERE is an ingenious arrangement that brings a new delight to every radio enthusiast. One turn of the dial and you have perfect cone reproduction—another turn and the wonderful tonal qualities of the air column chamber are at your command—and another turn of the dial blends these two together in a manner that will instantly surprise you. Being compact it will fit into consoles or cabinets or with table models it can be arranged as desired. Overall Dimensions— $9\frac{3}{8}'' \times 16\frac{3}{4}'' \times 8\frac{5}{8}''$ . Clip and send the coupon below for complete information.

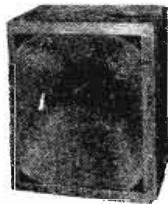
**Price \$30.00**

## Molded Wood Tone Chambers

*Assure You the Finest Reproduction Possible!*



The sweet, mellow tones of this graceful, compact, molded wood tone chamber makes any radio set a beautiful musical instrument. Natural reproduction of all notes—high or low—without distortion or overtones is the result of this scientific construction that so closely follows the basic principles of the violin. The lover of music will here find the effect he has long searched for—one trial will convince you. Send the coupon today for detailed information.



Molded Wood Tone Chambers for Consoles and Cabinets are available with either 6 ft. or 8 ft. air column. There is no mounting problem. They are shipped already mounted in light weight box that fits neatly into cabinet, or can be placed in any other convenient location when console space is not available. Over-all dimensions of the 8 ft. size are  $21 \times 18 \times 15$  in. and the 6 ft. measures  $15 \times 12 \times 12$  in.

**Price—With 6 ft. Chamber, \$13.00; 8 ft. size, \$18.00**

**This Beautiful, Compact Table Speaker is built to withstand powerful A. C. Operation!**



All the advantages of the Molded Wood Tone Chamber have been built into this wonderfully finished table model. The new Fairfax "Green Cap" unit combined with the non-vibrating, non-metallic tone chamber provides reproduction that will meet

## THE "GREEN CAP" UNIT

**Eliminates Distortion!**

This sturdy unit was designed particularly to withstand the power of A.C. operation. It eliminates distortion and will retain the full range of tonal frequency even under the output of large power amplifiers. Send today for complete description of this efficient reproducing unit—clip the coupon below!



**Price \$6.00**

# Jensen

## DYNAMIC SPEAKER

*Dynamic in Principle  
-but Supreme of all  
Speakers because of  
Peter L. Jensen's Application  
of this Famous Principle*

Laboratories, scientists and engineers everywhere vouch for the superiority of the Jensen Dynamic Speaker because they can readily see and hear the difference between Jensen design and the ordinary application of the dynamic principle.

The public, too, realize Jensen superiority because Jensen Dynamic Speakers *sound better to the ear.*

All models of Jensen Dynamic Speakers are suitable for operation with any type of amplifier. The field current consumed is extremely slight and long rectifier life is assured in A.C. models.

Two big factories are now necessary to meet the demand for Jensen Dynamic Speakers further attesting to their preference by radio set manufacturers and owners.

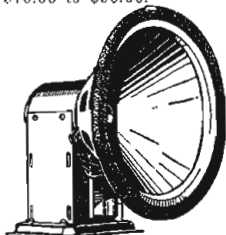
Jensen Dynamic Speakers are available in types to operate with conventional sources of current supply, 6 to 12 volt D.C., 100 to 120 volt A.C. and 90 to 180 volt D.C., including regular 110 volt D.C. house lighting current.

Their construction and



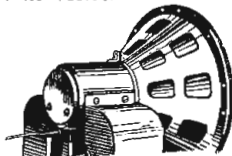
Jensen Model 6

Jensen Model 6 Cabinet may be had with any type Jensen Dynamic Speaker Unit. Prices: \$55.00 with D4 Unit, \$55.00 with D5 Unit and \$70.00 with D4 A.C. Unit. Model 7 in a Console type. Prices: \$70.00 to \$90.00.



Jensen D4 or D5 Unit

D4 Unit operates with from 6 to 12 volts requiring .4 of an ampere at 6 volts. Price \$40.00. Model D5 operates with 90 to 180 volts D.C. including 110 volt D.C. house lighting current. Requires 40 milliamperes at 90 volts. Price \$43.00.



changeable coil model, which is the same size and same appearance as the other models but having sockets in the rear into which the different wave band coils are plugged.

## Yankee Tube Tester

THIS tester, known as the Yankee S-550 made by the Lundquist Tool & Mfg. Co., Worcester, Mass., and illustrated in this column, has been designed to meet all the requirements of testing practically all of the different type tubes now in general use, including a. c. and d. c. types, as well as a number of the two element rectifier tubes. It is also an efficient and easily operated tube reactivator and may be used for this purpose on all tubes having a thoriated tungsten filament.



This feature in combination with tube testing is unique and idea inasmuch as when a tube is tested and found unserviceable, it may be either reactivated or proved worthless without further delay. No batteries of any kind are necessary. Current used for testing is taken directly from the 110-volt 60-cycle a. c. line. The filament, plate and grid voltages are supplied by a special transformer. Its construction is extremely simple and all parts are mounted on a genuine bakelite panel, all connections being permanently wired and soldered.

## Dubilier Spark Suppressor

A NEW type of interference prevention device intended for use directly across sparking or arcing contact points, is now announced by the Dubilier Condenser Corporation of New York City. Aside from reducing the sparking or arcing, thereby preventing "freezing" of points and also adding materially to the life of the points, the Dubilier spark suppressor, Type PL 1083, effectively prevents interference with radio receivers in the vicinity. Also, this device serves to eliminate errors in operation caused by sticking contacts. In the increased life of costly platinum contacts alone, the use of this spark suppressor soon pays for itself, quite aside from the prevention of interference with radio reception.

*Thorola*

**Newest and Best Dynamic!**

**No. 6 D.C. Chassis, \$25.00**  
For mounting in console or phonograph.  
Works from your 6 volt A Bat.

**No. 110 A.C. Chassis, \$32.00**  
For mounting in console or phonograph.

*For Perfect Reproduction!*

... with your instant  
... Be sure to hear it be-  
... you consider any other  
speaker—send today for litera-  
ture—use the coupon!



**Price \$25.00**

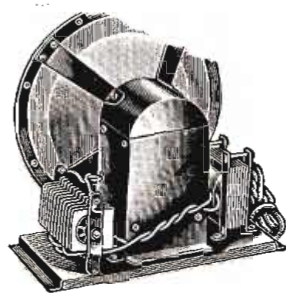
## OLDEN WOOD PRODUCTS

*Incorporated*

219 West Chicago Avenue

Chicago, Illin

*Tell 'Em You Saw It in the C*



In U.S.  
operate.

**No. 111c  
Cabinet**

In beautiful Walnut Cab.  
operate direct from 110 A.C. line  
Plug In."

*Sales Division*

**THOROLA RADIO  
PRODUCTS**

110 East 21st St. Chicago, Ill.

*s Radio Call Book Magazine*

# Now-Make Your Radio Clear as a Bell~ with Marvelous New **GROUND AERIAL!**



**Sub-Aerial Endorsed  
by Experts**

May 8, 1928.  
I am very glad to state that after testing many Aerials in my Laboratory I find your Sub-Aerial is the best for clarity of tone and elimination of static, also for greater volume and selectivity. It will fill a long felt want among the Radio Fans.  
Yours truly,  
A. B. Johnson, Radio Engineer.

Chicago, May 9, 1928.  
Received my Sub-Aerial and it has been installed as per directions. We are more than satisfied with the results. The tone is marvelously clear without static interruptions. We would not consider changing back to an outdoor aerial under any circumstances. Very truly,  
M. H. Grey,  
1416 Juneway Terrace.

**Get Amazing Distance, Greater  
Volume and Finer Selectivity  
without Distortion**

**W**HY go on listening to terrible static and other maddening outside noises? Now you can get the real music your present Radio is capable of giving, by hooking your set on to the clear, practically static free ground waves with Sub-Aerial. The air is always full of static and your overhead-aerial picks it up and brings it to your speaker. So why stay in the air—when you can use the whole earth as a static and noise filter with Sub-Aerial?

SUB-AERIAL is a scientific, proven system of taking the radio waves from the ground, where they are filtered practically free of static. It brings these filtered waves to your radio set clear of static and interference common with overhead aerials. The result is positively clear reception, remarkable selectivity and greatly increased volume. The overhead aerial is a thing of the past because it is the weak link in radio. SUB-AERIAL has replaced overhead aerials because SUB-AERIAL is 100% efficient. How can you get good reception without one?

**Low Original Cost—No Upkeep Cost**

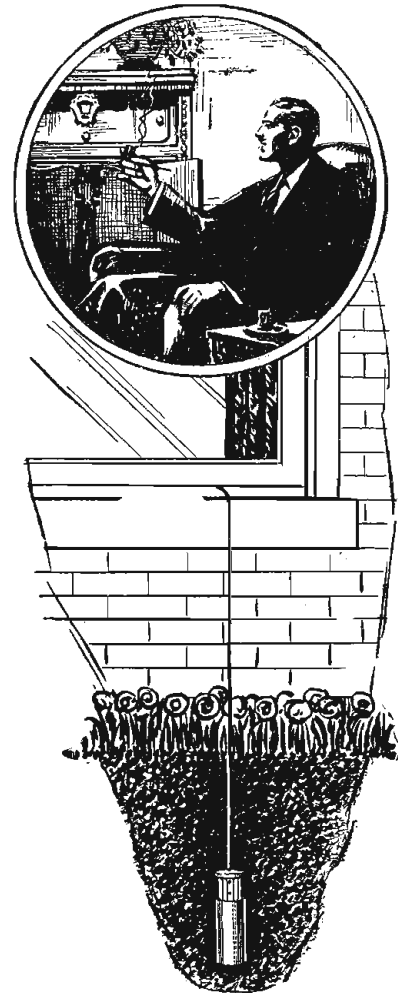
SUB-AERIAL costs no more than an overhead or loop aerial and less than many. Its first cost is the only one. SUB-AERIAL is permanent. No trouble—no hard work, or risking your neck on roofs.

**25-Year Guarantee**

SUB-AERIAL is guaranteed against any defects in workmanship or material and against deterioration for 25 years. Any SUB-AERIAL which has been installed according to directions and proves defective or deteriorates within 25 years, will be replaced free of charge; and also we will pay \$1.00 for installing any such new replacement.

**TRY IT FREE!**

We know so well the surprising results you'll get that we'll let you put in a Sub-Aerial entirely at our Risk. You be the judge. Don't take down your overhead Aerial. Pick a summer night when static and noise interference on your old Aerial are "Just Terrible." If Sub-Aerial doesn't Sell Itself to You Right Then on Performance—you needn't pay us a cent. Send for "all the Dope on Sub-Aerial." You'll be surprised. Do it NOW.



*Can Be Installed  
in a Few Minutes*

**UNDERGROUND AERIAL SYSTEMS**

St. Clair Bldg., Dept. 502-M.S.  
Cor. St. Clair & Erie Sts. Chicago, Ill.

# Ground Out Static with SUB-AERIAL

Underground Aerial Systems,  
Dept. 502-M.S. St. Clair Bldg.,  
Cor. St. Clair & Erie Sts., Chicago, Ill.  
Send me complete information on Sub-Aerial, Proof and Free Trial Offer. No obligation.

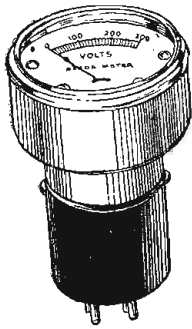
Name.....  
Address.....  
City..... State.....

Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

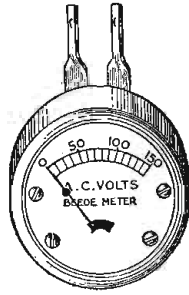
# Beede Radio Necessities

## For Set Users and Repair Men

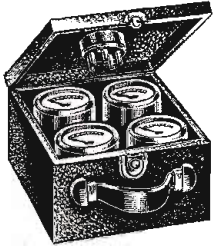
Beede Socket Test Meters for making tests directly at the socket. Note how easily they are applied. Simply remove the tube and insert the meter and know the true conditions at the heart of your set. With a Beede Socket Test Meter any set user can quickly and easily determine minor troubles and save expenses and inconvenience. Beede Socket Test Meters are just as necessary for a set user as a tire gauge is for a motorist. The four Beede Socket Test meters are as follows:



No. 50—0-300 volts, for testing the plate voltage of tubes in any set .....\$3.00  
 No. 55—Grid Bias Meter, 0-50 volts. For checking up the proper "C" voltage.....\$3.00  
 No. 60—A-C Filament Meter, 0-7½ volts. For testing the filament voltage at the tube.....\$3.00



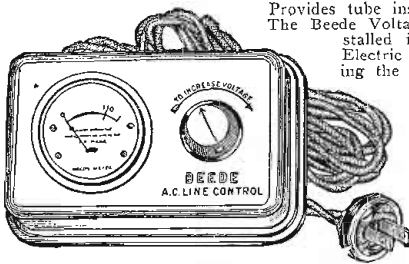
No. 75—A-C Line Tester, 0-150 volts. Plugs into any receptacle or light socket and gives correct line voltage.....\$3.00  
 (We also furnish an adapter for converting from 4 to 5 prongs) Price .....\$1.00



### Kit No. 80

The above meters furnished in Leatherette carrying case, complete with adapter, \$15.00.

### BEEDE AC VOLTAGE CONTROL



Provides tube insurance at a low cost. The Beede Voltage Control can be installed in one minute on any Electric set. By simply turning the knob until the pointer rests on the black line, the user is assured that he is getting the greatest efficiency from his set and eliminating the danger of burning out tubes. Made of Bakelite and guaranteed.  
**\$8.00**

If your dealer cannot supply you fill out the coupon and we will ship you direct prepaid at the list prices. Trade Discounts allowed to Professional Set Builders, Dealers and Jobbers. Write for our printed matter and prices.

**BEEDE ELECTRICAL INST. CO.**  
 136 Liberty St. Dept. A New York

### COUPON BEEDE ELECTRICAL INST. CO.

136 LIBERTY ST., NEW YORK CITY  
 Inclosed find check or M. O. for the following meters, for which I enclose \$.....  
 Ship to.....  
 City.....  
 State.....

# Dubilier

## SOCKET POWER

# Condensers



Type PL-575 especially designed for use in the R-210 Thordarson Power Pack, the AmerTran 210 and 216 B or 281 Filament Rectifiers. Full instructions in every carton. Price \$17.50.

"Blowing" condensers is one of the indoor sports of every radio fan who tries to save a few cents in buying socket power condensers. Dubilier condensers are built with one idea in mind—quality plus a higher factor of safety than seems necessary.

You can forget the condensers—if they are Dubiliers.

### A Light Socket Aerial that works —or Money Back



No need to wonder if the Dubilier Light Socket Aerial will give you smoother reception with a minimum of interference or static. No current consumed. Sold by good dealers on a 5 day, money-back basis. If your dealer can't supply you, write direct to us. Price \$1.50.



4377 Bronx Blvd.

Free catalog to interested radio fans.  
**DUBILIER CONDENSER CORPORATION**

New York

# The ALVON ~ ~ ~

## Custom-Built Radio



Just the thing for your vacation! With a weight slightly under 30 lbs., fully equipped, dimensions of 13¼" high, 14¼" wide and 8¾" deep, the ALVON CUSTOM BUILT PORTABLE offers you the features of TONE, SELECTIVITY, SENSITIVITY and CRAFTSMANSHIP, unsurpassed by any commercial receiver on the market.

Agents desired at once. Write today for special proposition and descriptive literature

**ALVON RADIO LABORATORIES**  
 716 West Madison St. Chicago, Illinois



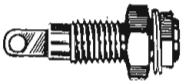
### 3 Constructional Aids by DeJUR



Radio frequency chokes properly used aid appreciably in the quest for receiver stability; minimize regeneration and improve tone quality. The DeJur RF choke coil is admirably suitable wherever retardation of radio frequency currents is required. Available in 85 and 125 milhenrys inductance values.



Because of filament wiring, perfect electrical balance in AC filament circuits is obtainable only with center tapped filament resistances. The DeJur adjustable strip resistance available in all values between 1 and 2000 ohms makes possible accurate electrical balance in all filament circuits.



Pin jacks are much more convenient than binding posts, especially in cramped quarters. The DeJur pin jack is suitable for subpanel or panel mounting and is an excellent means of connection between the set and the loud speaker.

Write for descriptive literature

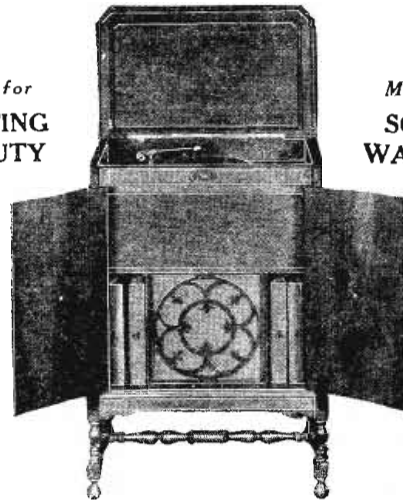
## DeJUR PRODUCTS

199 LAFAYETTE STREET, NEW YORK CITY

### A Console or Cabinet by "FRITTS" Is the Final Touch of Excellence FOR THAT CUSTOM BUILT RECEIVER

Built for  
**LASTING  
BEAUTY**

Made in  
**SOLID  
WALNUT**



Opened view of the GLENCOE NO. 731

THIS is just one of our several new Super-Models in Consoles, equipped with electrical phonograph turn tables. Our new designs in speaker furniture are also an innovation in Radio.

If interested, just drop us a card. We will be pleased to send you our descriptive booklet with illustrations and complete specifications.

## D. H. FRITTS & COMPANY

R-604 Hearst Building

CHICAGO, ILLINOIS

### STOPS AC TUBES from BLOWING!



Installed in an instant

Checks all house current voltage in excess of 110 volts, a protection against overloading current and line surges (a daily occurrence everywhere). Acts as fuse in case of short circuit in set, tubes and set wiring remaining unharmed. Is lightning arrester. Also checks line noises caused by electric appliances in home. For any AC Tube of Eliminator operated set. If dealer cannot supply, order from us, pay postman only.

**\$ 1.50**

Manufactured by:

**INSULINE CORP. OF AMERICA**

Standard Products Since 1921

Insuline Bldg., 78-80 Cortland St., N. Y.

Write for details on ICA complete Television Kit

Dealer's and Jobber's inquiries solicited

### Beautiful, Durable CELORON PANELS for These Popular Kits

Citizens 115 K.C. Super:

The Tyrman Ten: Front Panel.....each \$6.70. Sub-Panel.....each \$5.40

The Tyrman Seventy: Front Panel.....each \$6.00. Sub-Panel.....each \$5.40

Melo-Heald Super-heterodyne: Front Panel.....each \$6.00. Sub-Panel.....each \$3.36

The "Hot-Spot" Melo-Heald Fourteen: Front Panel.....each \$7.20. Sub-Panel.....each \$6.02

Aoro Seven Tube T.R.F.: Front Panel.....each \$6.10. Sub-Panel.....each \$5.20

B.-T. Power Six: Front Panel.....each \$5.72

St. James Upright Eight Super-heterodyne: Sub-Panels (2).....per set of 2.....\$6.00

Karas Equamatic—2 Dial: Front Panel.....each \$5.50. Sub-Panel.....each \$6.00

"World's Record" Super Ten: Front Panel.....each \$6.30. Sub-Panel.....each \$6.80

Magnaformer Super-heterodyne: Front Panel.....each \$6.40. Sub-Panel.....each \$6.50

Victoreen Super-heterodyne: Front Panel.....each \$5.64.

Victoreen Universal Super-heterodyne, Single Dial: Front Panel.....each \$5.80.

H.F.L. Nine-in-Line, Model 28: Front Panel.....each \$6.20. Sub-Panel.....each \$5.70

Knickerbocker 4: Front Panel.....each \$3.00. Sub-Panel.....each \$3.90

Thompson Super 7: Front Panel.....each \$5.24. Sub-Panel.....each \$4.58

Thordarson Power Amplifier: Front Panel.....each \$0.00. Sub-Panel.....each \$0.00

Camfield Super Selective 10: Front Panel.....each \$6.90. Sub-Panel.....each \$8.00

Camfield Seven: Front Panel.....each \$7.32. Sub-Panel.....each \$6.58

Citizens Super 4: Front Panel.....each \$5.80. Sub-Panel.....each \$6.28

Popular Mechanics: Front Panel.....each \$4.46. Sub-Panel.....each \$4.92

Hardware Sockets Mounted.....each \$5.50

Hardware Sockets Mounted.....each \$5.50

If Your Dealer Can't Supply You Order from  
**THE CELORON CO., Bridgeport, Pa.**

### Latest GREATEST RADIO CATALOG and GUIDE

Barawik offers set builders bigger bargains—bigger opportunities to make money this season. New sets, new kit ideas, all the leading parts, dynamic speakers, supplies, etc. Lowest rock-bottom prices, bigger stocks, quicker service. Send for Big Bargain Book today—free.

Barawik Co., 39C Canal Sta., Chicago, U.S.A.

LATEST  
RADIO  
GUIDE

# Hand-Fitted RESISTANCE

NO matter what the circuit, you *must* have proper resistance values. Don't take any chances with the variables and unknown factors in any radio circuit! If you would avoid mere guesswork, use Clarostats with their positive, micrometric, hand-fitted resistance. Available in a type and resistance range for every radio purpose. Just for example—



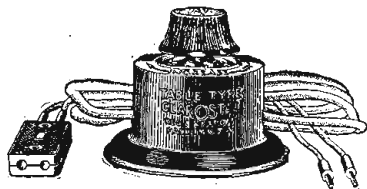
Grid Leak, Volume Control and Standard Clarostats, intended for panel, sub-panel or baseboard mounting in short-wave, broadcast or long-wave receivers, in power units, in power packs, and other assemblies.

Duplex Clarostat, combining two variable resistances in a single unit. Screwdriver adjustment. Ideal for circuits where proper resistances must be provided—and then left alone.



Big, husky, Power Clarostat, to take the place of guesswork wire-wound resistors. Adjusted to best operating conditions.

And for those who wish to use micrometric resistance in convenient accessory form, there is the Table Type Clarostat. With handy connecting cords and block, it may be instantly applied to any receiver or loud-speaker for volume, tone, sensitivity, regeneration and other control. No tools. No bother. No engineering skill.



## WRITE—

for literature on Clarostats and how to use them in bettering your radio, whether old or new, home-made or factory built. Better still, send 25 cents in stamps or coin for "THE GATEWAY TO BETTER RADIO"—the best investment you ever made in radio.

**CLAROSTAT MFG. CO.**  
Specialists in Variable Resistors  
285-7 NORTH SIXTH STREET  
BROOKLYN, N. Y.

**CLAROSTAT**  
Reg. U. S. Pat. Off.

# When



L. M. CLEMENT  
CHIEF ENGINEER  
F. A. D. ANDREA, INC.



PAUL A. CHAMBERLAIN  
CHIEF ENGINEER  
MORAVK CORP. OF ILL.



FRED STEIN  
PRESIDENT  
STEINITE RADIO CO.



JOHN W. MILLISON, JR.  
CHIEF ENGINEER  
KING MFG. CORP.

# Specify



THESE engineers know that POLYMET Condensers will "stand the gaff" of the varied operating conditions existing throughout the country, thus assuring the perfect performance of their receivers wherever sold.

That's why they specify "POLYMET" whenever it's a matter of electric set essentials. Why not do likewise? You'll find it pays to follow such leaders.

Send for our latest catalogue, showing the complete Polymet line, including many new items, and circuits in which Polymet is specified.

**THERE is no Guesswork about their Decision**

**Polymet Manufacturing Corp.**

609 Broadway, New York City

**POLYMET PRODUCTS**

## 50,000 FEET OF RADIO

50,000 square feet of floor space in a large, modern building devoted exclusively to radio. Tremendous stock of latest kits, parts, accessories and sets in improved designs and styles. Write for Catalog "C". Wholesale Prices.

**Allied Radio CORPORATION**

711 W. LAKE STREET, CHICAGO

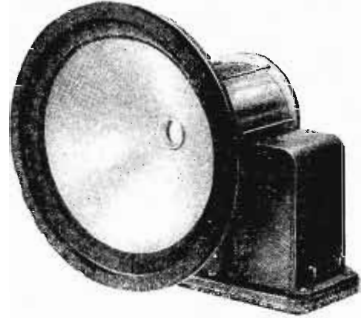
# MUTER

## Dependable Dynamic Type Speaker



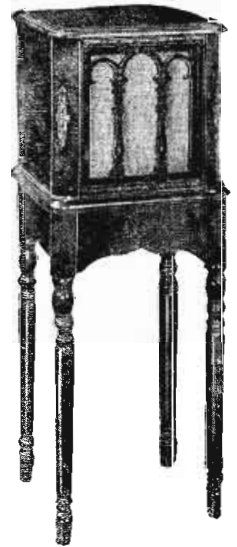
Table Model in Solid Mahogany Case

6 volts D.C. 4406—\$49.50  
 90 volts D.C. 4490—\$53.00  
 110 volts A.C. 4410—\$59.50



Dependable Dynamic Speaker

6 volts D.C. 4306—\$29.50  
 90 volts D.C. 4390—\$33.00  
 110 volts A.C. 4310—\$39.50



Console Model of Solid Mahogany

Power	Type	Price
6 volts D.C.	4506	\$64.50
90 volts D.C.	4590	68.00
110 volts A.C.	4510	74.50

Note: For push-pull amplification add \$3.00 and specify Type P.

The definite superiority of the Dynamic Speaker is an accepted fact. The determining factors in the decision as to which type to buy should be dependability—quality of workmanship and materials—reliability of the manufacturer—and price. The Muter Dynamic type Speaker embodies every feature of desirability. It was designed by nationally known engineers, with the sole thought in mind of making the best possible reproducer, regardless of price. Every part used in its construction is the finest that money can buy. For example, the rectifying unit in the A.C. model is the Westinghouse Rectox. The unlimited facilities of the new Muter factory, the finest accessory plant in the world, has produced a Dynamic Speaker that is an engineering masterpiece—priced so low as to be within easy reach of every purse.

The Muter Dynamic is the logical buy in a speaker. It is furnished in a power type to suit every need, and is also made in special models for use with push-pull amplification for an additional charge of but three dollars. Send for complete information on this new speaker and the entire line of Muter Dependable Products.

**LESLIE F. MUTER CO., 8440 South Chicago Avenue, Chicago, Illinois**

# SAFE~SANE~SATISFACTORY

*Beautifies the Home—Easy to Install—No Outside Wires*



The above is a reproduction of the new Woodland horizontal panel also made in Japanese Garden design both at \$7.50 each. The vertical Art Panels Nymph and Faun so successful last year are continued at \$9.50 each. Plain EFFARSEE antennae for installation in attics, closets, or under a rug are available in two sizes, small at \$2.50, large at \$4.00.

THE Art Panel Effarsec Antennae not only improves radio reception but is a beautiful addition to the most handsomely furnished home. Thousands of satisfied users attest the remarkable performance of EFFARSEE, in improving Radio reception—less static—greater selectivity—splendid volume—no lightning hazard. No outside wires or masts to disfigure your home and be ruined by storms. EFFARSEE Antennae can be installed in a minute and lasts forever.

## UNEQUALED FOR SHORT WAVES

If you like to experiment with TELEVISION or short wave broadcast reception, the EFFARSEE will give you unequaled results—no other short aerial gives you the capacity effect and strong signals. A commercial wireless station reports loud speaker reception from Buenos Aires, London, Berlin and other European stations, day or night, on three tube set, using a small EFFARSEE.

**Fishwick Radio Co.**  
 133-135 West Central Parkway  
 Cincinnati, Ohio

**FISHWICK RADIO COMPANY (Dept. 11)**  
 133-135 West Central Parkway, Cincinnati, Ohio

Send me information about ART PANEL EFFARSEE ANTENNAE   
 PLAIN EFFARSEE ANTENNAE.....

Send me LARGE \$4.00  SMALL \$2.50  PLAIN EFFARSEE.

With privilege of returning in ten days for refund or credit on purchase of an ART PANEL EFFARSEE. (Complete instructions furnished with each EFFARSEE.)

Name.....

Address.....

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



# .5 of 1 micromicrofarad



All gang condensers are equipped with compensators to balance effect of receiver wiring, and a shield between sections.

at minimum capacity and 1% at maximum capacity are the tolerance values for the **AMSCO** "Bathtub" gang condenser.

"Low Loss" design is no longer a goal—it is available in every good variable condenser. . . . Perfect uniformity of capacity in a two, three and four section tuning condenser is the new pinnacle of scientific design.

Precision design, construction and calibration make the **AMSCO** "Bathtub" two, three and four section tuning condensers the ideal tuning capacities for multi-stage radio frequency receivers. . . . Ideal because of the precision "matching" where it is needed most—at the low end of the scale . . . where faulty matching means the loss of stations—a band of stations, . . .

Write for latest descriptive literature

## AMSCO PRODUCTS

Broome and Lafayette Street

New York City

## EBY SOCKETS

Models UX and UY



Bottom view, with base removed, of UY socket showing contacts.

The spring action of the phosphor bronze contact prongs of EBY sockets cannot be injured no matter how many times the tubes are inserted or withdrawn. Specially designed for AC tubes.



The new EBY tip jack is built to deliver a perfect contact. The tops are recessed so that phone tip can't move after insertion. Equipped with red and black washers for insulation.

Also makers of the famous line of EBY Binding Posts—"The Tops Don't Come Off."



The H. H. Eby Manufacturing Co., Inc.  
4710 Stenton Ave., Philadelphia, Pa.

**Amazing Discovery For Any Radio**

**SATISFACTION GUARANTEED**

Your money instantly refunded if you are not satisfied. The attachment furnished free with the "Distance Getter" alone is worth the price. "Results beyond all expectations. Cuts thru local stations like a knife." writes Galloway of Chicago, Ill. "Send three more for my friends. I get Denver and Calif. easily," says Homes, Palos, Ill.

# Get Distance

Why confine your radio program to a few local stations when the expansive concert, dance music and lectures of hundreds of big cities are made for you? With every order for our treasure, "The Distance Getter," we include FREE our wonderful new Distance Transformer. Tune your set according to our special instructions and presto—note the distant stations roll in!

**MAIL COUPON TODAY**

**HAZLETON LABORATORIES**  
4554 Malden St., Dept. X, Chicago, Ill.  
Send me Distance Getter, postpaid. Enclosed find \$2.00 (M.O., stamps or check.)  
Send C.O.D., plus small postage added.  
Also send 100-page Radio Catalogue Free.

Name.....  
Address.....  
City.....State.....

## Send for WESTERN RADIO

# new 1929 Catalog

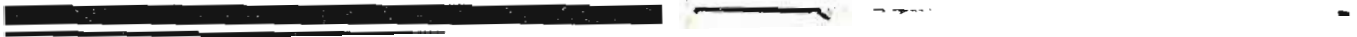
**DEALERS AND SET BUILDERS**  
The NEW 1929 Catalog is crammed full of the FINEST, NEWEST, Nationally known A.C. sets, consoles, cabinets, dynamic speakers, kits, eliminators and accessories at **LOWEST PRICES**. Largest stock of radio parts. Prompt delivery. Write for our **FREE** catalog.



Western Radio Mfg. Co., Dept. C-1, 128 W. Lake St., Chicago

**"The Big Friendly Radio House"**





**Send for WESTERN RADIO**  
**new**  
**1929 Catalog**

**DEALERS AND SET BUILDERS**  
 The NEW 1929 Catalog is crammed full of the FINEST, NEWEST, Nationally known A.C. sets, consoles, cabinets, dynamic speakers, kits, eliminators and accessories at LOWEST PRICES. Largest stock of radio parts. Prompt delivery. Write for our FREE catalog.  
 Western Radio Mfg. Co., Dept. C-1, 128 W. Lake St., Chicago

**FREE** 

**The Big Friendly Radio House**



**Where Service Is Paramount**

**500 Rooms**

**SPINK ARMS HOTEL**  
 Indianapolis  
 Wm. A. Holt, Proprietor

*Excellent parking and garage facilities*

**Tune In on the Short Waves**

Get distance—escape static on the long wave broadcast band. See Call Book for short wave stations. SUBMARINER wave band includes all powerful stations on short waves—thousands of SUBMARINERS now in use—short waves are the new adventure—a new thrill awaits you.

**Short Waves Popular**  
 The SUBMARINER has taken the country by storm. Nothing made like it. Many users have been getting London, England; many get Holland, even in summer. Short waves are great distance carriers with less static.

**Best of All**  
 Your present radio receiver, whether battery operated or all electric, will bring in short wave broadcasting when used with



**THE SUBMARINER**

It is easy to connect a SUBMARINER. Simply remove a tube from receiving set and place in SUBMARINER socket; then insert SUBMARINER plug in place of tube. Attach regular aerial and ground to clips on SUBMARINER. That's all. No changes in wiring of set necessary. No additional tubes, batteries or cords required. If set operates a loud speaker, it will do so with SUBMARINER. We guarantee that the SUBMARINER will operate within the wave band covered equal to any short wave receiving system known, when attached to your receiver. Get the short wave activities. Never before has so much in radio been offered for so little money! Order a SUBMARINER now!

**FOUR MODELS**

20 to 65 meter range—for battery operated radios, \$15.00. For all electric radios, \$17.50. 12 to 180 meter range—for battery operated radios, \$22.50. For all electric radios, \$22.50. 12 to 180 meter range models have interchangeable coils.

If your dealer does not carry, order direct from factory. Sent anywhere in the U. S. post paid upon receipt of price. Canada and Foreign, 60c additional. Money order only. Also sent C.O.D. plus postage in U. S. if \$1.00 accompanies order to insure carrying charges. In ordering be sure to name set and tubes used, such as UX199, UX199, 201A, UX226 or UY227. See dealer or order direct today.

**J-M-P MANUFACTURING CO., Inc.**  
 3441 Fond du Lac Ave. Milwaukee, Wis., U. S. A.

**A New and Finer Receiver—**  
**THE BRAXTON-KING SHIELD GRID EIGHT**

*Tremendous R.F. Amplification—Real One Spot Reception—Super Selectivity—  
 No Oscillation—Moderately Priced*



**NOTE:** We are prepared to convert any standard superheterodyne into a modern shield-grid receiver, utilizing all of your present parts with the exception of the intermediate transformers and oscillator coil. These are replaced with our Braxton-King Impedance Units, Plug-in oscillator and antenna coils and the set completely rewired and tested. Write for prices on this special work.

**VARIABLE THE BRAXTON-KING SHIELDED PLUG-IN R.F. IMPEDANCE UNIT 450 KC**



These Units are sold only in Accurately Matched Sets of 4. Complete with Circuit Diagram and Instructions. Price per Set..... **\$25.00**

**B-K TUBE SHIELD for Shield Grid Tubes Price 65c**

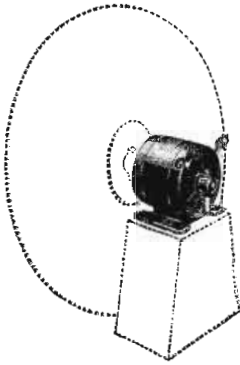


**PROFESSIONAL SET BUILDERS**  
 Write for Literature and Prices on This Remarkable Receiver

**MISSISSIPPI VALLEY RADIO COMPANY**  
 914 Pine Street St. Louis, Missouri

# Bodine Developments that appeal to Set Builders and Radio Fans

## Bodine Type TV Motors For Television Scanning Discs



Especially designed with a compensated winding for universal operation of television scanning discs on A.C. or D.C. circuits. Speed regulation from 25% below to 25% above synchronizing speed of 1080 R.P.M. No special starting switch needed. Very rugged. Made in three ratings for 18, 20 and 24-inch discs. Discs or rheostats are not included with the motor.

## Bodine Type RC-10 Electric Turntable For Phonographs or Radio-Phonograph Combinations



An electrically driven turntable that absolutely will not create crackling noises in the loudspeaker. The motor is of the induction type having no commutator or brushes. There is no sparking of brushes to be reproduced in the loudspeaker or to interfere with reproduction. An easily adjusted governor maintains exact record speed regardless of line voltage fluctuations, and enables the record to be played at any speed desired. Spring support absorbs any vibration. Easily installed—there are no belt or other connections to be made. For 110 volt, 60 cycle, A.C. operation only.

## Bodine DeLuxe Loop An Attractive Loop That Increases Selectivity

The pronounced directional characteristics of this loop greatly increase the selectivity of superheterodyne and T.R.F. receivers. It is especially effective in congested broadcasting districts and for tuning out powerful nearby stations. Also ideal for apartments. The Bodine DeLuxe Loop is very attractive and will harmonize with any interior furnishings. It is constructed of walnut with a beautiful hand-rubbed finish.



Mail This Coupon Today!

**BODINE ELECTRIC COMPANY**  
2256 W. Ohio St., Chicago, Ill.

Please send information and prices on items marked below.

- Bodine Type TV Motors for Scanning Discs.
- Bodine Type RC-10 Electric Turntable.
- Bodine DeLuxe Loop.

Name.....

Address.....City.....

# RADIO SETS

—at—  
**LOWEST PRICES**

RADIO GUIDE

Every farm, every home, every man and woman needs radio this year to follow elections, markets, big national events, football, sports, music, etc. Barawik's Big Radio Guide tells you the best sets, methods and supplies to use and how to use them for best results at lowest cost. Thousands of clear illustrations and latest valuable information, furnished free. Just send for Barawik's Big Radio Guide, the guide to radio and real radio enjoyment. You can get what you want here at biggest savings.

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*Mail this coupon for Free Radio Guide*

FREE

Name .....

Address .....

# MASTER Voltage Control

**Protects AC Tubes from High Voltage**

This voltage regulator (patent pending) is a necessity on all A-C sets. It protects A-C tubes from burning out by reducing excessive line voltage to the proper value.

**Anyone Can Install It!**

MASTER VOLTAGE CONTROL is simple to install. Requires no guesswork in setting for proper voltage. Has NO moving parts, therefore nothing to get out of adjustment or wear out.

**No Tools Necessary**

Simply call up the power company and ascertain the maximum line voltage in your district. Plug your A-C set into the marked outlet of MASTER VOLTAGE CONTROL to correspond with that line voltage. These various line voltages are clearly indicated at each outlet so that the proper setting may be had. Then plug MASTER VOLTAGE CONTROL into any convenient light socket. No volt meters, no tools or a service man's time is required for installation. Once installed it requires no further attention. To get proper life out of A-C tubes and keep them from burning out, use a MASTER VOLTAGE CONTROL.

**Price \$2.50**

*At Your Dealers or Write Us*

**MASTER ENGINEERING COMPANY**  
126 South Michigan Ave. Chicago, U. S. A.



Send for WESTERN RADIO

# New 1929 Catalog

**DEALERS AND SET BUILDERS**

The NEW 1929 Catalog is crammed full of the FINEST, NEWEST, Nationally known A.C. sets, consoles, cabinets, dynamic speakers, kits, eliminators and accessories at **LOWEST PRICES**. Largest stock of radio parts. Prompt delivery. Write for our **FREE** catalog.

Western Radio Mfg. Co., Dept. C-1, 128 W. Lake St., Chicago

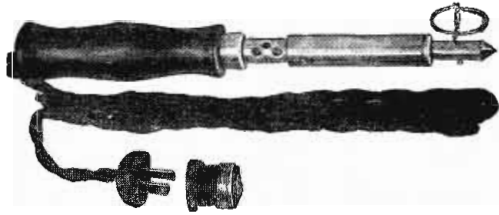
FREE



The Big Friendly Radio House



# WARD Electric Soldering Irons



No. 212—\$1.40

A complete line of soldering irons designed for radio work—or wherever a soldering tool is required.

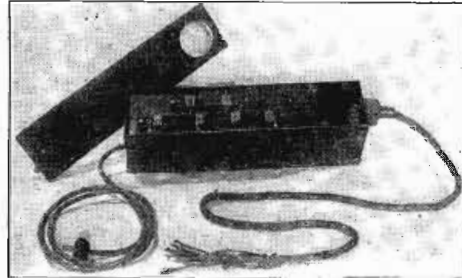
Repeat orders, over a period of years, from the leading jobbers throughout the country prove beyond anything we could ever tell you that the workmanship and quality of these irons is of the best. If your local dealer cannot supply you, write us direct.

**Heavy Irons for Manufacturers**

**Jobbers, Dealers—Write for  
Special Discount**

**WARD MFG. COMPANY**  
941 Wellington Avenue Chicago, Illinois

# EQUIP NOW! with Arcturus A-C Super-Filter (25 or 60 Cycle)



(15"x5"x3½")

**YOUR** experience in radio has shown you that Quality Equipment Pays!

When **QUALITY** is combined with reason in price, your interest is aroused.

The **SUPER-FILTER PACK** incorporates complete Power-Supply and conversion for A-C Sets, including facilities in the pack itself. The price is **\$40.00**, including Jones Cable and Multiple Plug. One 280 Type full wave rectifier tube required. State whether or not you are a Dealer.

**SUPER RADIO  
LABORATORIES**

Inc.  
3109 West  
Montrose Avenue  
Chicago, Ill.

Please send complete information and data, regarding A-C SUPER-FILTER.

Name.....  
Address.....  
City.....State.....

# GENERAL RADIO Type 565A Power Transformer for UX250 POWER TUBES



The type 565-A transformer is rated at 600 volts plate, 7½ volts power tube, and 7½ volts rectifier tube. Power rating 200 watts.

**Price - - - - \$13.50**

*Bulletin No. 930 on request*

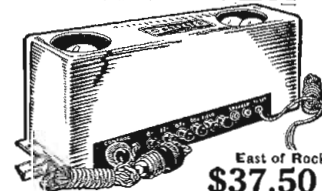
**GENERAL RADIO CO.**  
30 State Street, Cambridge, Mass.  
274 Brannan St., San Francisco, Calif.

Announcing~

## THE GREAT **GREENE** DYNAMIC AMPLIFIER

**Push-Pull  
AMPLI-  
FICATION**

*For every  
Type of  
RADIO  
and  
SPEAKER*



East of Rockies  
**\$37.50** Less  
Tubes

# A Sensational Innovation providing every feature of the Costliest Radio

Requires no change in wiring or tubes. Supplies **PUSH-PULL POWER AMPLIFICATION**. The DC current for energizing Dynamic Speaker field.—Also supplies the necessary B current for the receiver. A Radio luxury, low enough in cost for all.

**SEND for FREE 5-Day Trial Offer**

Fill out and mail the coupon for full details. Attach coupon to a sheet of paper bearing your dealer's name and address. We will arrange a **FREE 5-Day Demonstration**—in your home. We promise you a radio revelation. And the **FREE Trial** entails no obligation on your part. Use coupon—**NOW**.

**GREENE-BROWN MANUFACTURING COMPANY**  
5100 Ravenswood Ave., Chicago, Illinois

Please arrange through local dealer whose name and address is stated on the attached sheet of paper, to permit me to try the Great Greene **DYNAMIC-Amplifier**—in my home—for **FREE 5-Day's Demonstration**.

Name.....  
Address.....

**NOTE: If dealer or wholesaler, please attach letterhead**



**The VEE**  
Coil Antenna

## New Features Bring Double Value!

The Vee Coil Antenna marks a big step forward in loop design, for it shows

**Greater Selectivity    Low Distributed Capacity**  
**Greater Pick-up        Sharper Directional Ability**

These big advantages have been secured without undue size and while retaining a handsome appearance. It will add to the beauty as well as the performance of any set.

Use it on Tuned R. F. Sets, too. We supply diagram, so a few simple changes will enable you to operate your tuned R. F. set on a Vee Coil Antenna. At your dealer's or post paid for \$15.00. Folder on application.

### Send for Pre-Announcement Bulletin on the Vee Screen-Grid Kit

THIS newest Vee Product—complete kits, either A. C. or D. C., for utilizing fully the remarkable amplification of the new screen grid tubes—will be announced shortly. Send now for pre-announcement, special bulletin—it tells of the Vee Shield-coils, and how this new loop-operated set makes 6 tubes do the work of 10, with great selectivity and undistorted volume.

*Be First with This Better Radio!*

**CHARLES J. VICTOREEN**

*Vee Products*

12426 Cedar Road

Cleveland, Ohio

## BARAWIK, THE OLD RELIABLE RADIO SERVICE

Radio fans, from "way back when," will remember the exceptional service that Barawik rendered when getting radio parts was like pulling hens' teeth. Today Barawik has grown to be a mighty institution. Here you can secure the proved, reliable merchandise of the world's leading radio manufacturers—everything from complete sets to the smallest individual parts so necessary to the set builder. You can depend upon Barawik's ability to deliver the kind of service that means time saved in waiting. You can depend upon Barawik's honesty, ability and willingness to serve you.

*Send now for big new Catalog—Free*

BARAWIK CO., 39A Canal Sta., Chicago, U.S.A.



## YANKEE S-550

**Tube Tester and Rejuvenator**

for the  
Radio Dealer  
and  
Set Builder

*Write for details*

**Lundquist Tool & Manufacturing Co.**

144 Green Street Worcester, Mass.



*Comfort for the guest is the first rule of the Brevoort*



## Hotel Brevoort

Madison St., East of La Salle, Chicago

Let your choice be this famous hotel of hospitality in central downtown. Hospitality . . . quality accommodations. . . careful, cheerful service . . . moderate charges. 2½ blocks from shopping center and world's busiest corner. Financial and insurance districts just around the corner. Near theaters, depots and all classes of transportation. Rooms: 1 person, \$2.50 to \$5 a day; 2 persons, \$3.50 to \$8. Garage extends special courtesies. Guests' cars called for and delivered.

R. E. Kelliher, Manager

E. N. Mathews, President

### STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

OF CITIZENS RADIO CALL BOOK MAGAZINE, published four times yearly at Chicago, Illinois, for April 1, 1928. State of Illinois, County of Cook, ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Chas. O. Stimpson, who, having been duly sworn according to law, deposes and says that he is the Editor of the CITIZENS RADIO CALL BOOK MAGAZINE and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Citizens Radio Service Bureau, Chicago, Ill.; Editor, Chas. O. Stimpson, Chicago, Ill.; Managing Editor, Fred A. Hill, Chicago, Ill.; Business Manager, D. H. Bell, Chicago, Ill.
2. That the owner is (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given): Citizens Radio Service Bureau, Chicago, Ill.; Chas. O. Stimpson, Chicago, Ill.; D. H. Bell, Chicago, Ill. H. Anheiser, Chicago, Ill.
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 (if there are none, so state): There 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.
5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (this information is required from daily publications only).

CHAS. O. STIMPSON,  
Editor.

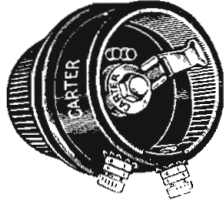
Sworn to and subscribed before me this 21st day of March, 1928.

(SEAL)  
(My commission expires July 26, 1928.)

NELLIE F. RYAN.

*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

# CARTER



**CARTER Tapered Volume Control.** Developed especially for new A. C. Circuits. Unsurpassed for smoothness and quietness in circuits where range of adjustment is crowded into small part of knob rotation. Moulded bakelite frame. A type for every requirement. 400 to 10,000 ohms resistance. Rheostat and potentiometer types.



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**CARTER Vitreous Enamel Steel Tube Resistors.** Unbreakable; unvarying; cooler; terminals do not work loose, a new principle and big advance in radio construction. Made in types and styles to meet every requirement. Send for literature.

The 1928-29 season, with its complete electrically operated radio, finds Carter ready to fill every demand of designers and set builders. A few of the popular items are illustrated. Write to "Parts Headquarters" for your copy of the new catalog of the complete line of old favorites and new friends, fully illustrated and described. Any dealer can fill your order.



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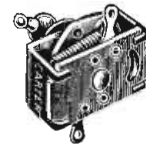
**CARTER RADIO CO., Ltd., Toronto**

Offices in principal cities of the world



**CARTER**

**CARTER New A. C. Set Outlet Plate.** Combines A. C. outlet with aerial and ground lead-in connections. Finished—  
Lacquered Brass.....\$1.00  
Brown Bakelite..... 1.25  
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Complete with Carter "Imp" Plugs. Fits standard outlet box. Complete diagrams for radio wiring of homes on request.



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*new*  
**1929 Catalog**

**DEALERS AND SET BUILDERS**

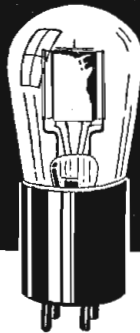
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For clear reception on election news, market news, radio programs, your radio set should have new tubes. Why pay \$2.00? Here's the chance to get guaranteed high quality 201A type radio tubes for only 39c each. Send check, money order or sent C. O. D.

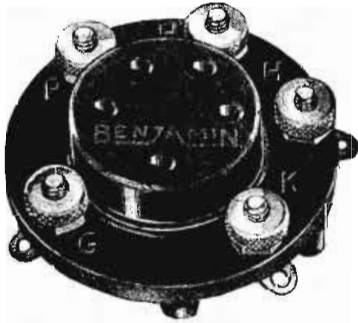
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Tell 'Em You Saw It in the C

# BENJAMIN

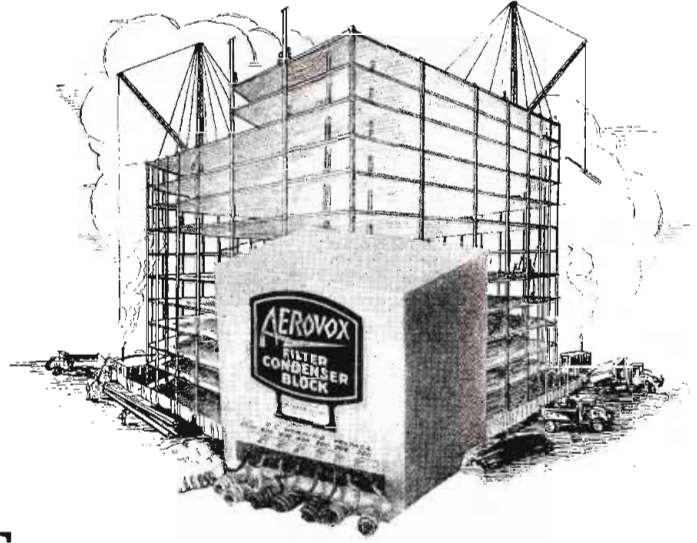
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### Specially Designed for A. C. Detector Tubes

Spring supported, shock absorbing. The tube holding element "floats" on perfectly balanced springs. Reduces microphonic disturbances, tends to lengthen life of tube and lessens the possibility of short-circuiting closely spaced tube ele-

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1929 Catalog is crammed full of  
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sets, consoles, cabinets, dynamic  
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sets. Prompt delivery. Write for  
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- 1 Durham Resistors—500 Ohms to 10 Megohms; standard brass end tip, mould or pigtail type.
- 2 Durham Grid Suppressors—250 Ohms to 3000 Ohms in steps of 100; standard brass end tip.
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- 4 Durham Powerohm—2 1/2 Watts; 500 to 250,000 Ohms; standard brass end tip type.
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- 7 Durham Powerohm—2 1/2 Watts; 500 to 250,000 Ohms; screw-end type.
- 8 Durham Powerohm—5 Watts; 250 to 250,000 Ohms; soldered end tapped or screw-end type.
- 9 Durham Powerohm—10 Watts; 250 to 350,000 Ohms; soldered end tapped or screw-end type.
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As for years past with Durham Resistors, these modern Powerohms are guaranteed for accuracy and absolute dependability.

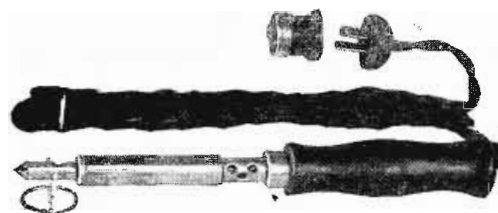
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**"B" Socket Power**

**A.C.-D.C.  
Any Cycle**  
Delivers up to 100  
volts on any set. Full  
tone. Clarity, Volume,  
Distance.

**Logs 380 Stations**  
**From CUBA to CANADA!**

Never in the history of Radio has there been anything that gets such sensational results at this astounding low price. Just read this letter received April 26th, 1928: "Your Townsend does its work, and more besides. I have it working about six or seven hours every day. I have tuned in 380 Stations all over the country, and Canadian, Cuban, Mexican, and Haiti Stations—all on a 5-tube Atwater Kent. And besides, only a 60-foot Antenna. Yes, sir, it is a dandy! Nobody can beat it."

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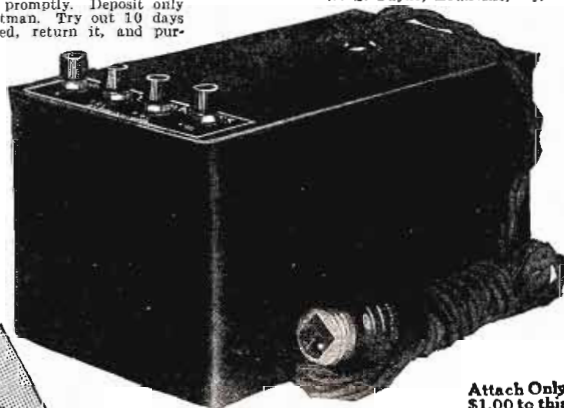
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guaranteed 10-day free trial.

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The Eliminator purchased from you last winter has been in use constantly ever since, and I want to say it has been perfect in every way and cannot be beat by any other.

Peter Ruinell, Irvington, N. J.  
I have had very fine reception with your Eliminator and never experienced any hum.

Russell Lindley, St. Petersburg, Fla.  
The Eliminator purchased from you last fall has given perfect satisfaction; in fact, it has operated far better than some other power units costing four times its price.

A. W. Lee, Hewlett, N. Y.  
Your Eliminator works fine. Reception comes in loud and clear. Could not wish for better.

H. Harishorn, Montreal, Quebec  
Have had good results with your Eliminator; in fact, better than they have had from an all electric I recently heard in town.

V. C. Kessinger, Childress, Tex.  
I have tried four different types (two high-priced ones) and find your Eliminator the best.

W. S. Payne, Louisville, Ky.

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Operates perfectly on any alternating current house wiring. Gives constant voltage and steady power to any set up to six tubes. Completely assembled. Only two connections; plug into light socket and connect to set. Costs no more than a good storage battery—lasts forever. No upkeep cost.

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Full wave DRY rectifier eliminates costly rectifying tubes. Beautifully finished metal case. Send No Money—Mail Name and Address

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New hook-ups. This book shows how to make Short Wave Receivers and Short Wave Adapters. How to use the new screen grid tube in D. C. and A. C. circuits.

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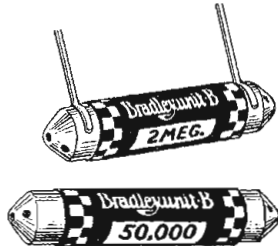
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City..... State..... 4026-J

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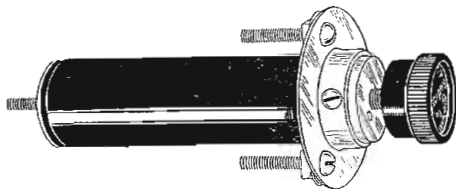
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A solid-molded fixed resistor that will not cause noise or interference in radio amplifier circuits. Its remarkable stability of resistance, regardless of voltage used, assures perfect and quiet operation at all times. Unaffected by weather conditions. Furnished with or without soldering leads in values from 500 ohms to 10 megohms. Especially adapted for amplifiers used in experimental television equipment.

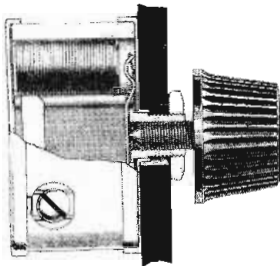


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A reliable filament control rheostat for supply transformers of 500 watts or less. A uniform stepless variation of resistance, caused by pressure exerted on a column of specially treated discs, provides extreme fineness of control. This remarkable Radiostat is unaffected by moisture or weather conditions, and will not deteriorate in service. Used for controlling speed of scanning disc motors in television equipment.

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Use  
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Perfect Radio Devices

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You can enjoy the convenience of this unique and perfect loudspeaker **absolutely free**. This speaker is especially convenient because it can be used in different rooms of the house, at the table during meals—or in apartments late at night without disturbing others. Though small in size—the Midget Cone Speaker is a practical speaker with a surprising number of uses in your home. This speaker is manufactured by one of the largest radio manufacturers in the country.

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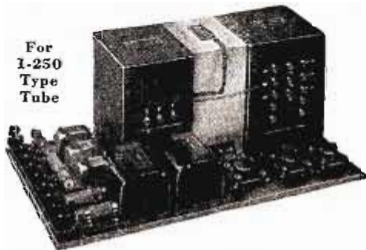


New T. C. A.

# AMPLI-PACK

Makes Your Set an Ultra-Modern  
A. C. Power Receiver

A complete A. C. Power Supply—"A" and "B" and "C"—makes any D. C. set into an Ultra-Modern A. C. Receiver. Uses two 210 type tubes in push-pull; or one of the new 250 type tubes. Power Amplification gives perfect reproduction over the entire musical scale range.



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You can assemble an AmpliPack easily in one evening. A screw driver, a pair of pliers and a soldering iron are all the tools needed. We supply complete layout diagrams. Simple to install. Attached to set in three minutes.

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Every coil in our Transformers is vacuum impregnated with a special compound. This prevents moisture disintegration and short circuiting. Clean cut laminations make them hum proof and banish noise interference.

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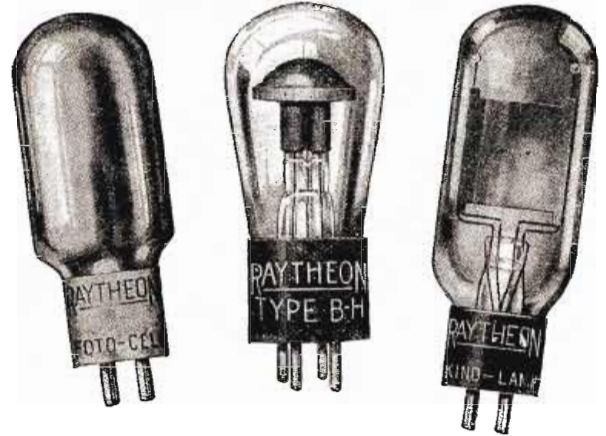
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Lower priced than paper condensers

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The new LAFAYETTE is a perfect All-Electric Set, designed in accordance with latest scientific principles of radio reception. Operates from a light socket, just as your percolator or electric iron does. Has 8 tubes—two 171 power tubes in push-pull assure power and excellent tone quality. Includes the New Dynamic Speaker. So positive are we of the unexcelled quality and value of LAFAYETTE sets that we extend to our dealers the privilege of testing sample sets on a 30 day free test basis.

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A complete aerial kit that contains every item essential to an efficient outdoor antenna system, such as aerial, ground and lead-in wires, lightning arrester, lead-in strip, ground clamp, glass insulators, nail-on knobs, etc. The Beldenamel Aerial Wire cannot corrode in service. The Beldenamel Jr. Aerial Kit, Belden Bare Copper Aerial Kit, and Belden Jr. Bare Copper Aerial Kit are also furnished for your particular needs.



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**T**RAVELERS select the Great Northern for its wonderful location in Chicago's "loop". They return because the large comfortable rooms, homelike environment, attentive service, excellent food and moderate charges make it an ideal hotel.

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# Radio

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The newest radio wrinkles—A-C, grid tube, short wave, television, dynamic speakers, newest tubes and circuits—anything and everything in radio—are now ready for you at Barawik's. With elections, football, National Broadcasting, Roxy and other big doings filling the air, thousands of newcomers will take to radio this year as never before. Business will be good—Set builders will make money. You can clean up big by buying from Barawik—the oldest, biggest, most reliable radio house in the world. Let us prove it. Send now for the Big Book—all ready for you—free. Get the latest radio information and lowest prices. **BARAWIK CO., 39E CANAL STA., CHICAGO, U. S. A.**

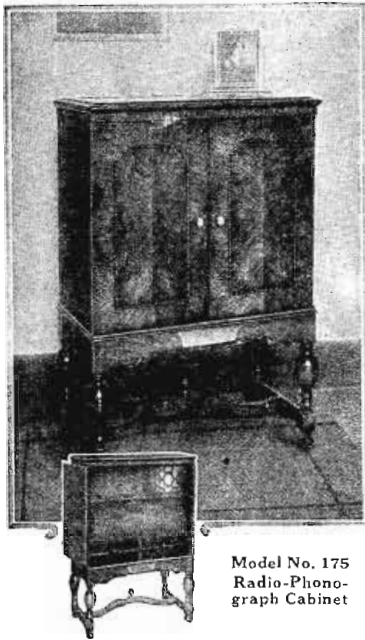


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*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

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Model No. 175  
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Model "C"

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We also carry:—

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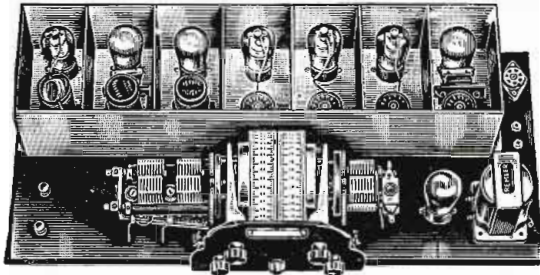
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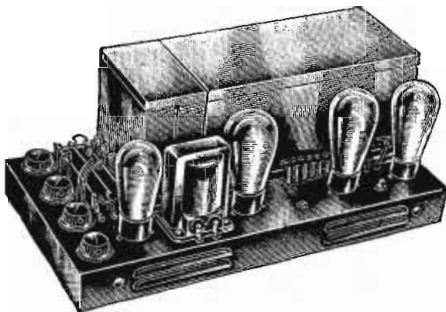


### List of Parts Required

1—Remler No. 712 Amplifier Unit.....	\$ 70.00
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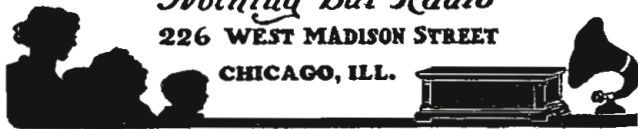
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*"Nothing but Radio"*

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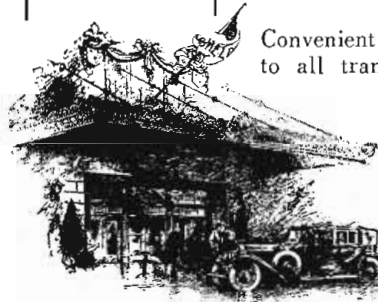
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equipped with every advanced feature of accommodation, including SERVIDORS

WHETHER your choice be one of the very comfortable rooms at \$2.50, \$3 or \$4, or one of the especially large rooms or fireplace suites in the new addition, with an entrancing view of city, river and Canadian shore, you will enjoy a special sense of value in Hotel Fort Shelby.



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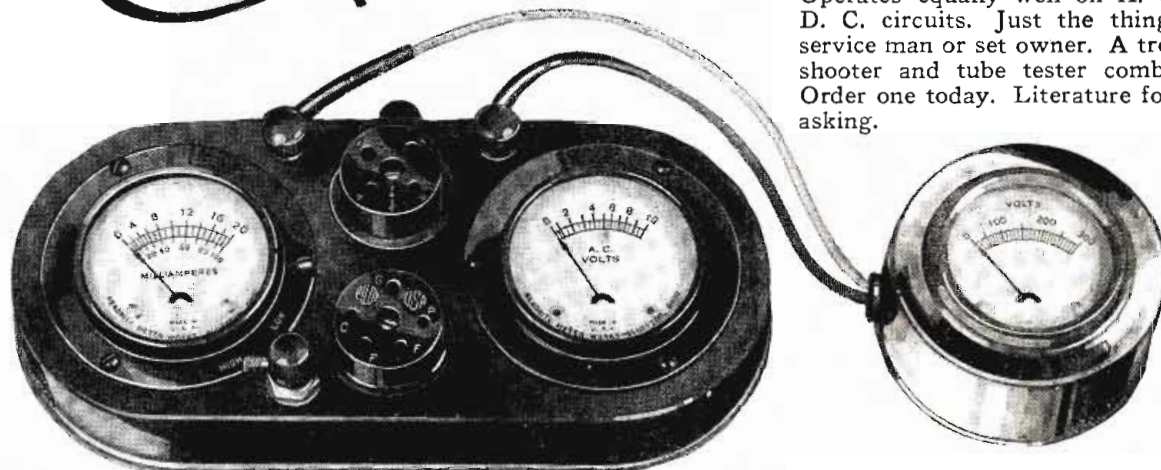
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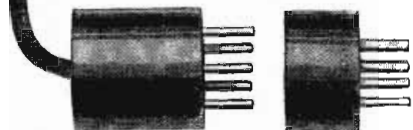
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Complete Outfit, Shown One-Half Scale

Operates equally well on A. C. or D. C. circuits. Just the thing for service man or set owner. A trouble shooter and tube tester combined. Order one today. Literature for the asking.



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Custom-Bilt Shielded Grid

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SHIELDPLATE SP 122 A-C Shielded Grid Amplifier Tubes are the latest development in radio. They are especially designed for use in the Tyrman Imperial "80," and make possible its wonderful performance. Here is a real long-life shielded grid A-C tube that is naturally rugged and dependable due to precision construction.

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Now you can be assured of better radio reception with the use of this new SP 122 A-C tube. SHIELDPLATE tubes are manufactured by the makers of the original and famous SP 122 SHIELDPLATE tube, which created a big sensation among radio engineers last season.

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**Six Superior Features**

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Gentlemen: Kindly send me FREE special information describing the new SHIELDPLATE SP 122 A-C tube.  
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Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

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Lynch Metallized Resistors are dependable, permanently accurate, noiseless, non-inductive, and non-capacitative.

.25 to 10 Meg.....	\$0.50
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All Lynch products are guaranteed against mechanical or electrical defect.

WHEN you need a special resistor designed to carry heavy currents that you can rely on to operate without noise or loss of accuracy, ask your dealer for the Lynch Dynohmic Resistor.

Intensive research in laboratory and field has produced in this resistor a unit that sets a new standard for precision-built resistance products. Various ratings and resistance values obtainable on request.

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Sales Offices in Most Large Cities



### Leak-Proof Mountings

Their rugged construction, single-hole mounting feature, low surface leakage, mechanical strength, and rigid mounting of the springs make them the best single and double mountings available anywhere.

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Your Dealer Has a Lynch Precision-Built Resistor for Every Resistance Need

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## Birnbach Acid-Proof Battery Cables



These battery cables are acid proof and are composed of Stranded Wires insulated with Colored Rubber and enclosed in an attractive Braid over all the wires. Furnished complete with brass soldered terminals for neat and quick attaching. Made in 5, 6, 7, 8, 9 or 10 wires, 54 inches long. For those who wish a longer cable, Birnbach 10 foot cord is recommended. Similar in construction to above, but 10 feet long. Made in 5, 6, 7, 8, 9 or 10 conductors.

who wish a longer cable, Birnbach 10 foot cord is recommended. Similar in construction to above, but 10 feet long. Made in 5, 6, 7, 8, 9 or 10 conductors.

## Birnbach Riga Battery Cable



A heavy duty Battery Cable for use with a storage battery. The wires for the A Battery are made of heavier construction and assembled with Storage Battery Clips. All wires are acid proof. Will not absorb moisture. Made in 5, 6, 7, 8, 9 or 10 conductors, 54 inches long or 10 feet long, as required.

54 inches long or 10 feet long, as required.

## Birnbach Battery Connector



A handy flexible connector for use with DRY Cell Batteries. Also for connecting the B and C batteries.

A handy flexible connector for use with DRY Cell Batteries. Also for connecting the B and C batteries.

## Birnbach Bakelite Tuner



Decidedly new and attractive, wound on genuine Colored Bakelite. Smaller in size, more room in your set, gives you better tone qualities, sharper tuning, more volume and greater distance. Covers the entire Broadcast bands. Comes in two sizes for .00035 and .0005 mfd. Tuning condensers. A Radio Frequency coil is sold to match the Tuner. These coils can be used in any of the popular circuits.

to match the Tuner. These coils can be used in any of the popular circuits.

**B**IRNBACH Colored Extension Cords allow the loudspeaker to be placed in any part of the room where the acoustical reception is the best. While at the same time harmonizing with any color scheme of home decoration. Birnbach Moisture Proof Extension Cord for those who wish to move the speaker to the sun porch or to any other room where dampness may prevail. A damp cord is a short circuit and causes poor reception. Your dealer will be glad to show you a Birnbach Extension Cord.

## Birnbach "360" Tuned R. F. Kit

Kit consists of three matched coils, wound on Colored Bakelite. For use in any of the two and three tuned R. F. circuits. Cover the Broadcast bands when used with .00035 Variable Condensers.



## New Birnbach Moisture Proof Extension Cords

The finest extension cord available. Attaches instantly. Made with strands of copper wires insulated with rubber with an outer brown covering of the finest mercerized braid. These cords are moisture proof, no leakage between conductors, no scratchy noises in the loudspeaker. With a Birnbach 10, 20, 30, 40, 50 or 100 foot Extension Cord you can move your loudspeaker to any part of the house.



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For Sale by Your Neighborhood Dealer



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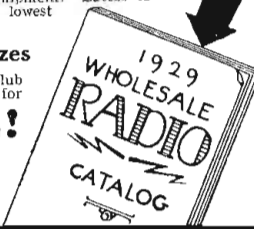
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NEW YORK, N. Y.

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The Choice of Leading Radio Engineers For Power Amplifiers and Power Packs



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No.	Tapped Cap.	Price
T2900	2, 2, 2, 4, 2, 2.....	\$20.00
T2950	2, 2, 2, 4, 2, 2.....	22.50
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SR210	2, 2, 2, 4, 1.....	15.50
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**By-Pass Condensers**

No.	Cap.	DC Test	Working Voltage	Price
1	.1 Mfd.	200v.	160	\$0.60
2	.25 Mfd.	200v.	160	.70
3	.5 Mfd.	200v.	160	.75
4	1. Mfd.	200v.	160	.90
101	.1 Mfd.	400v.	200	.70
102	.25 Mfd.	400v.	200	.75
103	.5 Mfd.	400v.	200	.90
104	1. Mfd.	400v.	200	1.25
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Potter Manufacturing Co.

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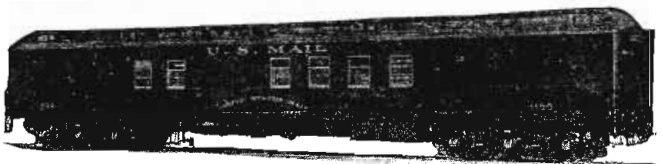
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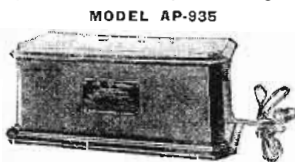
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**Special \$19.75 EA.**

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Automatic Radio "A" Power from Your Light Socket  
LIST PRICE \$39.50 EA.

Model AC-6-K (6 Volt) Kathanode Unipower is the highest quality "A" Power Unit built. Furnishes rich, smooth, unflaring "A" current without any trace of hum for the largest power tube sets, which is automatically replenished from the light socket. Installed in less than three minutes, makes any set as simple and convenient to operate as an expensive A-C outfit at only a fraction of the cost. No wiring necessary in your set.



EXTRA SPECIAL  
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Its Kathanode construction insures longer life and freedom from service expense

and when sold it will take care of itself. It is very economical and will outlast several storage batteries. Its Kathanode construction is an exclusive patented feature, being used by the U. S. Government in their submarine batteries, which are furnished by Gould.

Equipped with a new noiseless Balkins Charging Unit, which has four graduated charging rates and in addition one booster rate (1 1/2 amperes) for emergency charge.

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**Approved Parts for use with UX 250 Tube**

**No. 7568**—Designed for full wave rectification using two UX281 tubes to supply B and C power to receiver and power for two UX250 tubes. Use one No. 6551 double choke in filter circuit. Approximate D. C. output from filter 525V. 130 mls. Secondary voltages 650-650V. 170 mls. 7 1/2 V 2 1/2 amp. C.T. 7 1/2 V 2 1/2 amp. C.T. ....\$13.50

**No. 6551 Double Choke.** May be used where current does not exceed 250 mls. ....\$15.00

**D-600 Power Amplifier Condenser Unit** has been designed for use with the CX281 rectifier tubes, and CX 210 or 250 power tubes. Having a working voltage of 1000 volts, and mounted in crystal lacquered steel cases, they will be found unsurpassed for reliability and stability. Unit contains sections of 2-2-4 Mfd. ....\$16.50

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No. 7568

**No. 1176.** Similar to No. 1177 but of the Push Pull Type. ....\$12.00

Send check or money order for immediate delivery of any of the above items. Complete information on Transformers, Chokes and Condensers for all types of power units sent upon request.

**Dongan Electric Manufacturing Company**

McDougall at Franklin Street

Detroit, Mich.

**TRANSFORMERS of MERIT for FIFTEEN YEARS**



Radio dealers recommend and use the

**ekko Ground Clamp**

because it eliminates the high percentage of radio troubles due to faulty ground

Imperfect ground contacts are responsible for a high percentage of all radio troubles. The ekko Clamp eliminates these troubles by insuring perfect contact. Radio dealers know this. That is why they include an ekko Clamp with radio set installations and instruct their service crews to use it in replacing old faulty grounds.

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25¢



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Custom-Bilt Shielded Grid

ALSO the "72" and "60" IN STOCK

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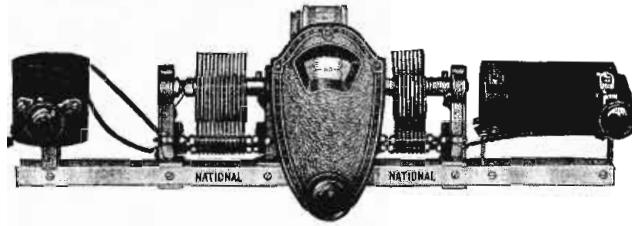
Write today for our large illustrated new Catalog "C," showing how this organization of men with years of experience, can give you personal service.

**Allied Radio CORPORATION**  
711 W. LAKE STREET, CHICAGO

# NATIONAL

## TUNING UNIT TYPE 222

Single  
Control  
—  
Shielding  
Not Required

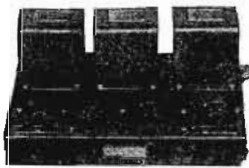


No  
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Troubles  
A Rugged  
Well Built Unit

HERE is a tuning unit for constructing a very sensitive and selective radio set with the greatest simplicity and ease of assembly. The Unit comprises a newly designed National Browning-Drake Transformer, with high impedance primary for working out of a screen grid tube. The antenna coil has a trimmer which adjusts its inductance within very fine limits. Two National Equitune Variable Condensers are mounted on the same girder frame as the coils and operated by a National Velvet-Vernier Drum Dial Type F. Shielding and neutralization of R. F. Tube are done away with.

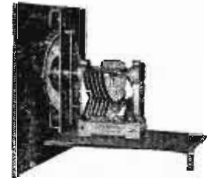
Results in operation are all that could be asked for. Only a short indoor antenna is required in most cases. List price—Type No. 222—\$25.00. Two other types also available.

### NATIONAL PUSH-PULL AMPLIFIER— for 210 or 250 Tubes



A completely wired Audio Amplifier Unit. May be A.C. operated without batteries from National High-Voltage Power Supply. Uses the new-design National Push-Pull Transformers with special alloy steel cores and new type windings. For electrification of phonographs, use with 2-tube tuners or for large rooms or halls. Price, completely wired—less tubes—\$40.00.

### NATIONAL SHORT-WAVE EQUIPMENT for use with 222 Tube



A complete new line of equipment including National Velvet-Vernier Dial Type E, special Equicycle Short-Wave Condenser, four Plug-in Short-Wave Transformers—15 to 115 meters, R.F. Choke, H.F. Impedance, special panels with sockets and clips. For construction of non-radiating short-wave receiving sets for experimental work in broadcast, code and television signals.

Write for New Bulletin No. 130-CB

NATIONAL CO., INC.

W. A. READY, PRES.

MALDEN, MASS.

# Are Your Tubes Just Limping Along?

MANY a good radio tube is abused by too high or too low filament temperature. Either means short life and crippled performance. Designed for a definite operating voltage, tubes deteriorate rapidly if over or under-taxed.

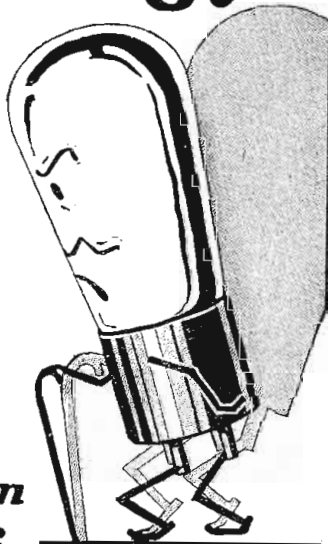
AMPERITE maintains constant, uniform filament temperature—automatically adjusts its resistance to variations of "A" current supply. Its principle is unique and patented. No ordinary fixed resistance, designed to look like AMPERITE, can possibly do AMPERITE'S work. Improves panel layout (no hand-operated rheostats), simplifies wiring (short, direct leads), aids tuning, increases sensitivity, and rounds out tone quality. Ask for AMPERITE by name and see that you get it. A type for every tube—battery or A. C.

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Give them  
New Life  
with



**AMPERITE**  
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The "SELF-ADJUSTING" Rheostat



FREE—"Amperite Blue Book" of latest circuits and construction data.  
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Radiall Company  
50 FRANKLIN ST., NEW YORK



THE Shanco Clip design assures free and uninterrupted flow of electrical current. There are no springs to heat up, burn or drop out. Made of powerful tension, tempered spring steel solidly riveted together. All parts electro-plated before assembly (not galvanized or tinned), acid-resisting. The jaws open wide and are easily applied. The Griptite bulldog teeth "stay put" and bite right through corroded bars and terminals. The teeth are so arranged that the clip cannot fall over and "short" the battery.

There are 4 sizes for every battery need: 5 Ampere, 15 Ampere, 50 Ampere, 300 Ampere.

Write for our literature and prices

Shanklin Manufacturing Co.  
Dept. 61, Springfield, Illinois



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Cincinnati's hospitality is exemplified at the Hotel Gibson, Cincinnati's Most Distinguished Hotel.

Here, in America's logical convention city, is the Hotel Gibson, the most suitable convention headquarters.

Spacious meeting rooms, exceptional sample rooms and the newly remodelled Roof Garden offer 20,000 square feet display space. Restaurant accommodations meet with the approval of the most discriminating. Write for particulars.

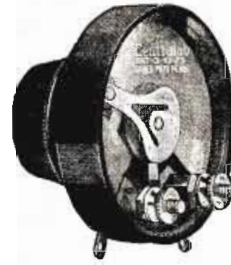
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RALPH HITZ *Manager*

## Consider First—the Volume Control



Care must be taken to choose Volume Controls that give longest trouble-free service—a type that will not introduce noise to interfere with quality of reception after a short period of service.

Centralab Volume Controls have a patented rocking disc contact that eliminates all wear on the resistance material. This feature adds to the smoothness of operation, because a spring pressure

arm rides smoothly on the disc and NOT on the resistance. Bushing and shaft are thoroughly insulated from the current-carrying parts. This simplifies mounting on metal panel or sub-base and eliminates any hand capacity when the volume control is in a critical circuit. Full variation of resistance is obtained in a single turn of the knob.

Centralab has carefully studied every volume control circuit and has built up tapers of resistance that for each application assure a control that smoothly and gradually varies volume from whisper to maximum.

The specific circuit in which each of these units is used, is outlined in a folder. Write for it.

**CENTRAL RADIO LABORATORIES**  
26 Keefe Avenue Milwaukee, Wis.



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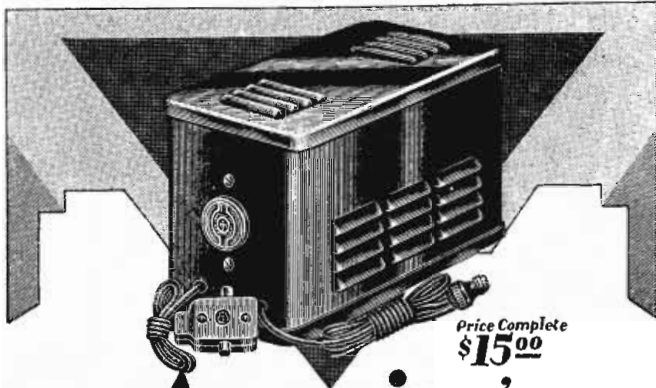
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Address..... City.....

# ACTS in 7 seconds

—against 30 seconds to a minute for other tubes... Arcturus 127 A-C Detector Tube—quickest acting, longest-lasting... Proved by test to have useful life far in excess of 1,000 hours... For quicker action, better tone, longer tube life—put an Arcturus A-C Long Life Tube in every socket... "Get Action With Arcturus Tubes—quicker, better."

ARCTURUS RADIO COMPANY  
255 Sherman Ave. Newark, New Jersey

# ARCTURUS



Price Complete  
**\$15.00**

# Amazing Results in A.C. Voltage Regulation with the WEBSTER Auto-Potentialator

**H**ERE at last is the successful solution of the puzzling problem of A.C. line voltage regulation.

The new Webster Auto-Potentialator provides complete, instant and automatic regulation of A.C. current. It delivers to the A.C. set or A and B Eliminator an absolutely even flow of A.C. current of the exact voltage necessary for the most successful operation of any make of receiver.

The Webster Auto-Potentialator, besides being entirely automatic, contains no tubes or liquids—needs no complicated adjusting—never wears out.

It affords absolute protection from the sudden line fluctuations that occur in every A.C. lighting circuit. It gives marvelously steady, uninterrupted reception of highest possible efficiency, because tubes are operating at their peak point under exactly correct voltage. It greatly lengthens the life of A.C. tubes—saving you considerable money in tube replacements.

When you attach a Webster Auto-Potentialator to any factory built or custom built receiver, you at once and forever do away with the bugaboo of line voltage fluctuations. No more trouble—no more grief—just wonderfully clear, steady, uniform reception.


Sturdily built. Small in size. Slips out of sight in a jiffy. Measures about 8 3/4 x 4 1/2 x 5 1/4 in. Never in the way. Silent. Absolutely dependable.

## Order From Your Dealer Today

Order a Webster Auto-Potentialator from your dealer today. If he is out of stock and you are in a hurry you can order direct from us by filling out and mailing coupon below. If coupon is used, send check or money order for \$15 for each Auto-Potentialator ordered. Test it on your set—any set. If it does not do all that we claim, if it fails to give entire freedom from voltage fluctuation troubles, your money will be promptly refunded. Mail coupon today—NOW.

## THE WEBSTER COMPANY

850 Blackhawk Street, Chicago




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Ship me..... Webster Auto-Potentialators, price \$15 each I enclose \$.....

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St. Address.....

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



# BUILD A DAVEN TELEVISION RECEIVER

Complete Essential Kit, \$60.00

THE first complete Kit. Furnished with either T-24, T-36 or T-48 Scanning Disk, Motor, Bushing, Rheostat, Daven Television Tube, 3 Complete Stages of Daven Television Amplification and Instructions for Building. Daven Television Receiver. Complete, including Television Tube—\$100.00 (Less Amplifier Tubes).



## DAVEN TELEVISION APPARATUS

Each		Each	
Daven Television Scanning Disk	\$ 5.00	Daven Telev. Photo Elect. Cell 1 3/4" Bulb.....	\$20.00
24 T-24.....	7.50	Daven Telev. Photo Elect. Cell 3" Bulb.....	37.50
36 T-36.....	10.00	Daven Television Couplers	
48 T-48.....	15.00	1st Stage No. 421x D-421xx	
Comb. Disc with 24, 36 and 48 Apertures T-46S.....	12.50	2nd Stage No. 422x D-422xx	
Daven Tele. Amp. T-3.....	17.50	3rd Stage No. 423x D-423xx	
Daven Spec. Telev. Amp. T-4 for 2 Hi Mu Tubes and 2 power Tubes 171, 210, 250 Types.....	12.50	x Glastors are used for Grid and Plate Resistors.....	2.15
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Daven Bushing to fit 3/4" 5/16 and 3/8" Motor Shafts.....	3.50	Daven AC 10 (for brighter illumination).....	9.00
Daven for 48 Aperture disc.....	3.50	Daven Mu 20 Hi Mu Tubes for Amp. Stages.....	2.25
Daven Rheostat.....	3.50	Daven Mu 6 Power Tube.....	3.50

Send 2c stamp for new Television Booklet

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Amplification Specialists

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Let the largest Radio Mail Order House in the East serve you!

You'll get better service and better merchandise at the lowest wholesale prices obtainable anywhere.

### NEW 1929 BUYING GUIDE

Your copy is ready for you. It lists all the latest Radio Parts, Accessories, Sets and Kits. Catalog K also lists Electrical Supplies, Household Appliances, Golf and Tennis Equipment, Cameras, Traveling Bags, etc. Send for your copy now. It's free.

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ADJACENT TO EVERY ACTIVITY  
 600 BRIGHT SUNLIT ROOMS,  
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SINGLE ROOM <sup>with</sup> BATH \$3<sup>00</sup>  
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 WIRE AT OUR EXPENSE FOR RESERVATIONS  
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## MANY THANKS! For Your Hearty Response

IN the last issue of the Call Book, we announced our new 104 page catalog which had just come off the press. We were literally swamped with requests for copies of this catalog and the resultant orders were most gratifying. We take this opportunity of thanking our many old and new friends for their kindness and want them to know we greatly appreciate their patronage and the good things they have said about us.

*Don't Forget We Are Distributors For:*

Frost	Carter	Yaxley
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*If you have not received your copy of our FREE catalog, write for one today.*

**JAMES C. GORDON CO., INC.**

1211 Pine Street

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## How to Select a Resistor

Find out the answers to these two questions—"How accurate is it?" and "How long will it maintain that accuracy under the average load I will put upon it?" No resistor can give more satisfactory answers than the Har-field.

1. Har-field Resistors can be supplied to you as accurate as plus or minus 1%, five times more accurate than the average resistor.
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Available in two types of coating—vitreous enamel or a specially processed cement. There are sizes and styles to meet every radio and electrical need, and large quantities can be quickly supplied. Prices are low enough to demand careful consideration from every purchasing agent or individual. MANUFACTURERS AND JOBBERS—Tell us about the resistors you want and we will gladly make up samples with prices. Write to

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# Guaranteed

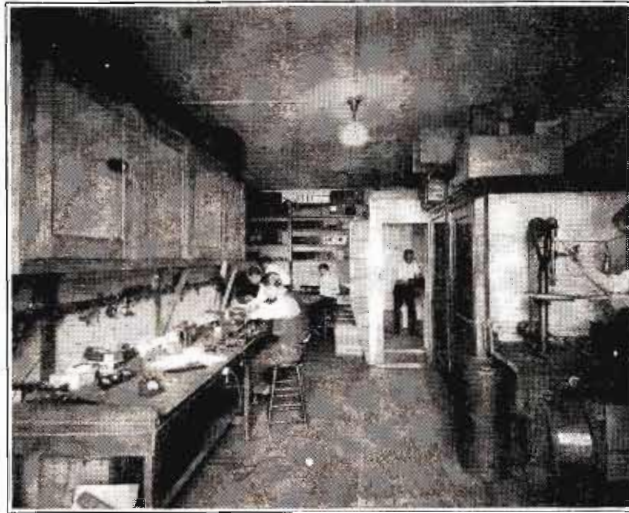
## BY THE LARGEST AND MOST UP-

This highly efficient organization with trained service men, together with a completely equipped laboratory, is at your disposal for repairing, testing and advice on all types radio receivers, battery eliminators and power units. Our experience in this field has helped all our clients to enjoy better and continuous radio reception. All laboratory instruments used in testing and repairing are modern and up to date, insuring rapid and accurate location of trouble involved in your receiver.

### Remember

the confidence of many leading manufacturers has been placed in this laboratory. The Radio Service Laboratories will give to you the same conscientious service that the manufacturer himself would give you.

Any receiver or power device repaired by us is positively guaranteed to perform in the manner claimed by the manufacturer.



*Because the largest staff of trained service repairmen and engineers are at your service, you can be assured at all times of the most careful and competent work. This is proven by the large numbers of sets shipped to us for service from every state in the U. S., Canada, Alaska and Mexico.*

### We Specialize

on all receivers illustrated in the Citizens Radio Call Book. If you have constructed any of these receivers and are not obtaining satisfactory results, let us give an estimate for putting the set in first class condition. Each receiver repaired by us is given a thorough inspection of each individual part.

## Announcing Our Service in Your Home

*Service Includes Chicago and Surrounding Suburbs*

Effective September 15th, we will have a corps of specially trained service men ready to call at your home to service your radio receiver and accessories.

These service men have been carefully trained in this laboratory to be familiar with all types of receivers and power units. Each service man is completely equipped with laboratory instruments so that he may in a scientific way rapidly locate and correct the defects in your radio.

# RADIO SERVICE

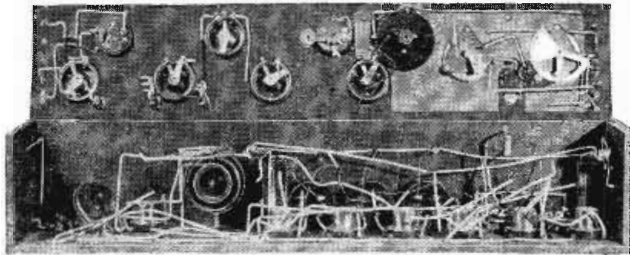
508 South Dearborn Street

Telephone

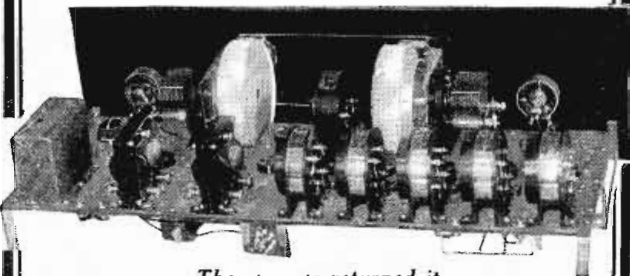
*Tell 'Em You Saw It in the Citizens Radio Call Book Magazine*

# Radio Service

## TO-DATE SERVICE STATION IN AMERICA



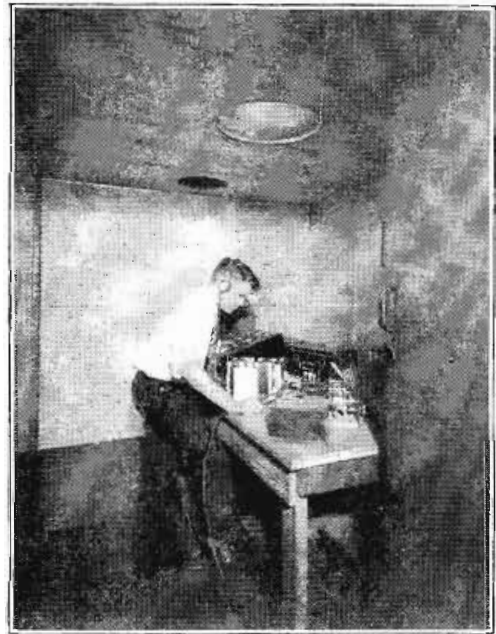
*The way it came in*



*The way we returned it*

**W**E will repair, test or design any type of receiver you may desire. Being specialists in this field we are in an excellent position to rebuild your present receiver and bring it up to date.

It is more practical and wise to bring your problems here than to some irresponsible radio man who is unfamiliar with the merchandise you wish serviced. This is an era of specialized effort and our charges are no more than you would pay for inferior workmanship.



*(All receivers serviced in this laboratory are given a final test in a completely shielded room where the internal noises are absolutely eliminated.) This insures noise-free reception, which is necessary for satisfactory performance. In addition, complete equipment is available for properly testing all types of power units.*

If you are unable to personally deliver the receiver or unit you wish to have repaired, securely pack it in a strong box with plenty of cushioning material such as excelsior, and ship it to us via American Railway Express, prepaid. It is not necessary to ship the cabinet or accessories.

In order that you may safely ship your receiver to us for repairs, we can supply you with a strong fabricated carton, including the required amount of packing, sealing tape, wrapping paper and rope at a cost of \$1.00. This carton conforms to the construction requirements of Consolidated Freight Classification, a resistance of 200 pounds per square inch and a gross weight limit of 65 pounds.

# LABORATORIES, Inc.

Harrison 2870

Chicago, Illinois

# WITHOUT APOLOGIES OR EXAGGERATION *Tyrman* PRESENTS

## TO YOU WHO KNOW RADIO A NEW SERIES OF *Improved* SHIELD GRID RECEIVERS

TYRMAN, the pioneer of Shielded Grid circuits in this country, again leads the advance to better radio performance with the creation of a series of three new Custom Built Shielded Grid Receivers—the *Tyrman Imperial "80"*—the *Tyrman "72"* and the *Tyrman "60"*. Read the descriptions given here and you will readily see why the new Tyrman series determines new standards of comparison for Appearance, Performance and Price.

Tyrman receivers are designed for set builders—not just to satisfy the "whims" of engineers. The design of Tyrman products began months ago, after inquiry among set builders. They told us what they would like. So, we set out deliberately to design receivers to meet their ideas. It looked like an insurmountable task. But we were convinced set builders knew what they wanted. Who would, if they didn't? Thanks to an unsurpassed working knowledge and experience in Shielded Grid circuits, we were able to meet set builders' requirements.

When you examine the diagrams and layouts of the new series of Tyrman receivers you will quickly see how well we have met those requirements.

### *The Tyrman Imperial "80"*

is definitely designed to satisfy those who want only the finest in radio receivers. It is intentionally non-competitive. To use such words as "amazing," "marvelous," "greatest" and so on, to describe it would merely detract from its superiority. We would rather you judge its hair-line selectivity, its tonal qualities, its unequalled power and ability to bring in distance under most trying conditions.

The Shielded Grid principle in radio reception introduced and developed by Tyrman Engineers has now been further advanced in the "80" by the Duo System, a Tyrman development.

### *Especially designed for A-C Shielded Grid Tubes*

The essential parts of the Tyrman "80" are especially designed for the efficient use of the tremendous amplification possibilities of A-C Shielded Grid Tubes. The Duo System of Amplification, an achievement of months of systematic experimenting, when co-ordinated with Tyrman design creates in the final assembly a receiver unequalled for Selectivity—Sensitivity—Stability and Power.

### *Striking in appearance*

With its front panel of solid butt-walnut compressed on steel, equipped with the new illuminated Worm Drive Drum Dial and matched control knobs, the Imperial "80" presents a new standard of beauty in Custom Built Receivers.

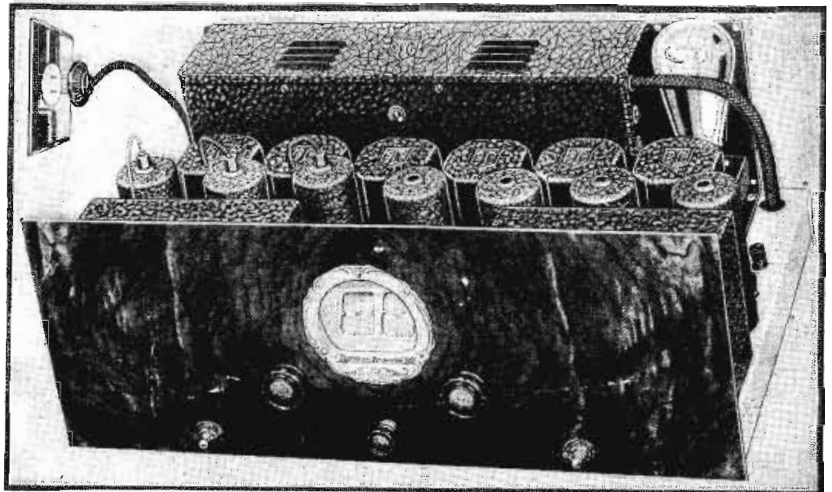
### *UX250 Power amplifier for phonograph reproduction*

Phonograph switch is placed on front panel permitting use of UX250 Power amplifier for power phonograph reproduction. Also, 110 A-C Switch on front panel.

### *Easy to assemble*

Look at the layout in the "80" illustration. Despite the number of tubes employed—despite the incorporation of a complete A-C Power Supply and UX250 Power Amplifier, Tyrman Engineers succeeded in arranging all apparatus into a chassis on a subpanel only 13½" x 20½". The platform itself is cadmium plated, brushed to a silver-like finish. Shielded parts, coated with a beautiful black crystal finish. In order to assure duplication of laboratory model extreme care has been taken in selection of materials and precision manufacture. By a special diagrammatic method right at point of wiring, assembling is made interesting and can be completed in a fraction of an hour, assuring craftsmanship you will be proud of.

Check over the Tyrman features. Where, even at many times the cost, will you find a receiver incorporating so many truly outstanding features?



## *Tyrman Imperial "80"* Custom-Built Shielded Grid

for Complete A-C Socket Operation Using  
A-C Shielded Grid Tubes

### *Tyrman Imperial "80" Features*

—Complete A-C Socket operation using A-C Shielded Grid Tubes and A-C Tubes for detector and audio purposes—Duo Shielded Grid System of Amplification—Plug-in Coils furnish short wave adaptability—Superior tone quality through use of UX 250 Power Amplifier Tube and New Tyrman Audio Coupler System—Distortionless plate detection—Power Supply an integral part of chassis designed especially for Tyrman Imperial "80", factory assembled—automatic grounded Shielded Sockets—Individual in appearance and beauty—Panel only 8" x 21" of genuine butt-walnut on metal (Pat'd)—New Tyrman Worm Drive Illuminated Drum—only three controls with A-C and Phonograph



Tyrman  
Shielded  
Socket  
Automatically  
Grounded

Radio Switch on front panel—10 K.C. Selectivity throughout entire broadcast band without sacrifice of volume—Stability—Sensitivity—One spot—Non-oscillation—No critical adjustments—Adjustable as to length of antenna—Sub-panel 13½" x 20½" making a most compact receiver—100% Shielding—Precision-made parts of finest materials—All intermediate frequency units matched in factory.

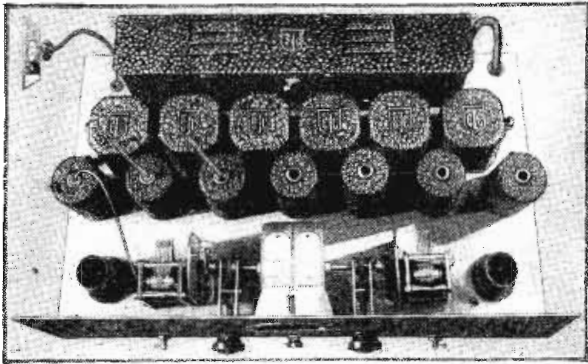
The Tyrman Imperial "80" uses (3) A-C Shielded Tubes, (4) 227 Tubes, (1) 250 Tube and (2) 281 Tubes in Power Supply. Receiver parts, factory packed \$134.50. "80" Power Supply factory assembled \$65.00. Complete with parts and Power \$199<sup>50</sup> Supply factory packed, ready to assemble, only

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# TYRMAN ELECTRIC

Dept. 108 314 West Superior Street





Tyrman "72" Assembled for A-C Socket Operation

# Tyrman "72"

Custom-Bilt Shielded Grid

for Complete A-C or Battery Operation

Following the suggestion of set builders who said, "Give us a receiver for either A-C operation, with the power pack right on the chassis, or for Battery operation," the Tyrman "72" was designed. It can be assembled either for Battery, Eliminator or Complete A-C Socket operation.

The Tyrman "72" provides an advanced Shielded Grid receiver for those who wish to keep their present batteries or eliminators, or for localities where A-C power is not available. Even if assembled as a battery-operated set, it is a simple matter to convert it to complete socket operation by changing the wiring scheme, a few parts and sockets for A-C Tubes.

Many of the advanced features of the Tyrman Imperial "80" are incorporated in the "72." When assembled for A-C Socket Operation it employs A-C Power Supply designed especially for the "72" and is mounted on the chassis as illustrated above. The Tyrman Duo System of Amplification, adapted to the "72" together with the Tyrman Audio Couplers, assures full, rich tonal qualities and efficient use of the enormous amplification values of Shielded Grid Tubes.

*Sensitivity, Stability, Selectivity, Power and Distance comparable only to the Imperial "80." No oscillation, distortion or critical adjustments. Front panel only 8" x 21" of beautiful Burl-Walnut finish on metal, equipped with Tyrman Illuminated Double Worm Drive Drum. 110 A-C Switch and Phonograph jack on panel. Easily and quickly assembled. A-C wiring diagram lithographed on subpanel. Power Pack Factory wired. Parts precision-made of finest materials. All intermediate frequency units matched in factory.*

The Tyrman "72" when assembled for A-C Operation uses (3) A-C Shielded Grid Tubes, (1) 171 Tube, (3) 227 Tubes, (1) 280 Tube in Power Pack.

Complete parts for battery or eliminator operation factory packed, ready to assemble..... **\$98<sup>50</sup>**

"72" A-B-C Power Pack for A-C Socket Operation, factory assembled..... \$55.00

Complete parts including A-B-C Power Pack for A-C Socket operation, factory packed..... \$153.50

Complete Set of 4 short wave coils, \$10

**TYRMAN RECEIVERS—FREE**

**CORPORATION**  
CHICAGO, ILLINOIS

## Tyrman, the first to introduce Shielded Grid Receiver

Just a few short months ago the Shielded Grid Tube was announced. A tube with an amplification of 170 compared to 8 in ordinary tubes. This means almost unlimited power! Sensitivity! Distance-getting qualities! Engineers proclaimed it the most advanced step in radio reception since broadcasting began.

The Shielded Grid principle was not new. Europe had been using it some two years. Laboratories in this country had been experimenting with Shielded Grid Tubes for a year or more. After intensive research and experimenting Tyrman was the first, in this country, to introduce an efficient Shielded Grid Receiver.



While credited as an outstanding achievement, the important thing is that Tyrman Engineers were the first to recognize that to obtain efficient results from the enormous amplification gain of Shielded Grid Tubes, it was necessary to design the circuit and essential parts especially for Shielded Grid Tubes.

Today it isn't too much to say that there is hardly a receiver using Shielded Grid Tubes which does not have the ear-marks of Tyrman influence.

With the actual production of thousands of Shielded Grid Receivers behind them, Tyrman Engineers have an unsurpassed working knowledge and experience in Shielded Grid circuits. Reinforced with this knowledge, strengthened by experience, backed by systematic experimenting and research, together with the helpful suggestions of set builders, Tyrman introduces in this new series of Custom Built receivers advanced features that again sets the measure of comparison for Beauty, Tonal Qualities, Performance and Price.

**FREE**—Send for complete descriptive literature and judge for yourself.



## Tyrman "60"

Custom-Bilt Shielded Grid for Battery or Eliminator Operation

For appearance, tone, quality, distance, selectivity, sensitivity, stability and power, the Tyrman "60" is comparable only to other Tyrman Shielded Grid Receivers. An improved design for battery or eliminator operation. Especially designed for Shielded Grid tubes, every part made of finest materials, carefully tested and matched, the Tyrman "60" creates a new standard of comparison for performance and value in six tube receivers. Panel only 7" x 18" equipped with Tyrman Single Vernier Drum Dial. **\$69<sup>50</sup>** Complete Parts, factory packed, ready to assemble, only.....



**Money Makers for You** *Not only are Tyrman receivers outstanding in performance but they are equal in appearance to highest priced radio equipment, and at a price range within the means of the average buyer. Experience of set builders all over the country proves that Tyrman receivers are money makers. Send coupon for FREE descriptive literature so you can judge for yourself. There is no better time to send the coupon than now while it is before you.*

TYRMAN ELECTRIC CORPORATION, Without obligation send me free literature describing Tyrman Custom Bilt Receivers.  
Dept. 108—314 W. Superior St.  
Chicago, Illinois.

I am particularly interested in..... "80" A-C operation  
..... "72" A-C or Battery operation..... "60" Battery operation.

Name.....  
Address.....  
.....  
My jobber is.....

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Pierson offers a most complete line of Phono-Radio. Cabinets only, or completely equipped. Ranging in price from \$185.00 to \$700.00.

New Catalog Now Ready

## The Pierson Ortho-Type

line of Radio Cabinets are the leading line of Radio Furniture on the market. "Be First with Pierson."

HAVE YOU SEEN THE NEW MIRACLE CABINET?

**THE PIERSON  
COMPANY**  
ROCKFORD, ILL.

## Are You a Custom-Set Builder?

**Y**OU will be interested in our Program and in a Special Announcement for the protection of your Business.

1. *Pierson Cabinets will not be sold through catalog houses who sell promiscuously.*
2. *Every Custom-Builder who builds quality Radio will be issued a Dealer's Pass Card admitting him to any Pierson Display Room where he may bring his customers.*
3. *Pierson has inaugurated a program of establishing over 300 Display Rooms. There will be one in your community.*
4. *Pierson can supply you all types of speakers and amplifiers—rendering a complete service to you.*
5. *Pierson makes the Highest Quality Radio and Combination Radio and Phono-graph Cabinets—ranging in price from \$23.00 to \$500.00. Meeting all your requirements.*

Send now for Questionnaire and Application for Dealer's Pass Card.

**THE PIERSON CO.**  
830-840 Cedar Street  
Rockford Illinois

# W.C. BRAUN COMPANY

## WHOLESALE RADIO HEADQUARTERS

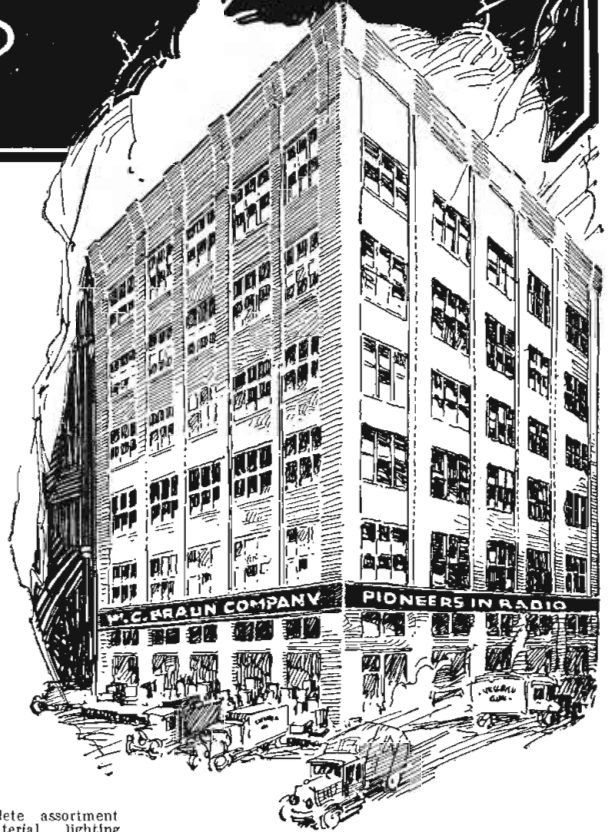
With presidential and other elections holding the stage, the entire radio world is "all set" for the biggest year in history.

Radio Headquarters—W. C. Braun Co.—will be a mighty big help to you when you want the newest in sets, parts and supplies promptly, for here, all under one roof, is the distributing headquarters for almost everything that can be thought of in radio—the dependable products of the leading radio manufacturers.

Keeping up with the times, we have the newest A-C sets, circuits and accessories—the latest dynamic, air column and other popular speakers, television supplies, short-wave and ham equipment, cabinets that fit any set, factory or home-built; in fact, everything from a screw to the most pretentious phonograph-radio combination.

Besides huge radio stocks, we have available other saleable merchandise in auto supplies, electrical and sporting goods, household utilities and a host of popular merchandise that has a ready sale.

Make this your headquarters as thousands of others are now doing. Get what you want when you want it. Dependable goods, fast service, big varieties—it's the kind of service you will appreciate.



### Factory-Built Radio Sets

A complete line of high-grade factory-built radio sets—A-C, all-electric and battery-operated models. Big sellers—remarkable quality at moderate prices. The finest of engineering and construction. Everything from table models to deluxe highboys and super-panels. Also a fine line of portable radio sets for camping, etc. Big discounts, big profits, fast sellers—beat all competition. No values approach ours.

### Service to Professional Set Builders

We carry the largest stock of radio parts in the world—parts for all the leading radio A-C and battery-operated circuits—Tyrman, Silver-Marshall, Hammarlund and Hi-Q, Karas, Aero, Scott's World Record, Magnaformer, Madison-Moore, L.C.29, all the new Grid Tube circuits; in fact, everything published in the way of circuits by the radio magazines and newspapers. Special combination offers that afford big profits to dealers and custom set builders.

### Short Wave and "Ham" Section

Recent developments in short wave equipment have popularized this fascinating study as never before. Thousands of "hams" are talking daily with the continents of the world—Australia, South America, Africa, Europe, etc. Every set builder and experimenter will find our Short Wave Department a big help in keeping pace with the newest ideas in this most interesting and instructive radio art. We carry everything in short wave equipment and are ready to serve you at all times.

### Television Department

Nothing much of consequence in television has developed to date, but we have everything in this line that is to be had and will continue to add to this line as rapidly as it develops. Experimenters who want to delve into the mysteries of television will find here everything required to carry on their work.

### Electrical Goods

Here is a line that is closely affiliated with radio; that will sell in any radio shop at all

seasons. Complete assortment of wiring material, lighting fixtures, electric stores, heaters, grilles, percolators, waffle irons, curling irons, motors, tools, household appliances, vacuum cleaners, etc.

### Also Wholesale Headquarters for Auto Supplies, Electrical Goods, Etc.

Lowest prices in history on guaranteed tires and tubes for all cars and trucks. The most complete line of auto supplies, including everything needed by the garage, auto dealer and auto supply shop. Standard quality seat covers, tools, tire gauges, pumps, jacks, luggage carriers, shock absorbers, springs, gaskets, replacement parts, special accessories and parts for all Ford models—in fact, everything that a motorist needs for city, country or camping.

### Sporting Goods

You will be surprised at our complete line of sporting goods, including golf clubs, bags, golf balls and other golf equipment, tennis, basketball and football goods, outing equipment, etc.

### Distributors of These Nationally Known Radio Lines

All-American	Micamold	Hammarlund-Roberts
Aero	Baldwin	Steinitz
Jewel	Thordarson	Maximite
Amaco	Trimma	De Jur
Pacnet	Excello	Jones
Bremer-Tully	Samson	Magnavox
Silver-Marshall	Thorla	Jensen
Raytheon	Carter	Temple
Browning-Drake	Polymet	Farrand
Kingston	Pilot	R. F. I.
Belden	Cardwell	Potter
Cockaday	Mathleson	Peerless
Lynch	McCullough	Newcomb
Bosch	Chelton	Hawley
Scott	Alco	Superior
Pioneer	Burgess	Lund
Hammarlund	Bodine	Pierson
Karas	Remler	Showers
Daven	Hoyt	Amplion
Valley	Acme	Pathe
Benjamin	Continental	Aerovox
Jefferson	Allen-Bradley	Parvot
Amertran	Victoreen	Amperita
General	Signal	Arcturus
Sangamo	Ultradyn	Cornish
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Kodel	U. S. L.	And Many Others
Balkite	Na-Aid	



# W.C. BRAUN COMPANY

## Pioneers in Radio

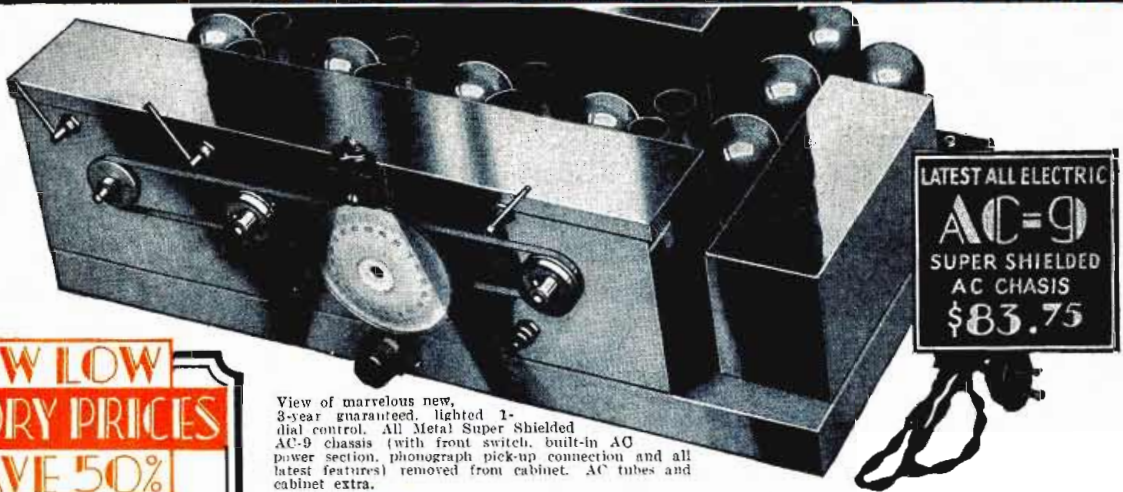
596 W. Randolph St.



Tell 'Em You Saw It in the Citizens Radio Call Book Magazine

Our 9th Anniversary Offer!

**ENJOY ANY MIRACO 30 DAYS - RETURN EVERYTHING, OUR EXPENSE, UNLESS DELIGHTED**



View of marvellous new, 3-year guaranteed, lighted 1-dial control, All Metal Super Shielded AC-9 chassis (with front switch, built-in AO power section, phonograph pick-up connection and all latest features) removed from cabinet. AC tubes and cabinet extra.

**NEW LOW FACTORY PRICES SAVE 50%**

**Wide Selection of Beautiful Cabinets AC or Battery Sets**

**30 DAYS' HOME TRIAL**



A popular walnut Hi-Boy Console, with drop-leaf desk. Beautiful two-tone finish. Rare bargain!



Beautifully graceful Spinet console, genuine two-tone walnut. Choice of speakers. Also comes in Electric Phonograph-Radio Combination.



A new-type arm-chair console. Genuine walnut. Very pretty. Low priced. Electro-dynamic or magnetic Power Speakers.



At right, a Lo-Boy console, walnut finish, that costs little. A gem!



Above, popular inexpensive combination. Set on Table Speaker (sold separately).



Metal or wood compact style cabinets. Wood cabinets in walnut or new shaded silverchrome finishes. Cathedral Electro-Dynamic or Magnetic - Power Speaker to match!

# MIRACO

TRADE MARK REGISTERED

Cathedral Toned, Super Selective, Powerful Distance Getters

Celebrating its 9th successful year, America's big, old, reliable Radio Corporation springs a genuine sensation in high-grade sets. With its latest, Super-powered, 1-dial Miraco's—the All Electric wholly self-contained, hum-free, AC-8 and AC-9, using AC tubes or the new 8-tube models for batteries or Eliminators—you are guaranteed values and savings unsurpassed in the fine set field.

Compare a Miraco with highest-priced radios, for 30 days in your home. Surprise and entertain your friends—get their opinions. Unless 100% delighted, *don't buy it!* Return everything—the complete outfit—at our expense. Your decision is final—absolutely! Only exceptionally fine radios, of the very latest approved type, at rock-bottom prices, could possibly back up so liberally unconditional a guarantee. Send coupon now for *Amazing Special Factory Offer!*

### IMPORTANT NOTICE!

"30 Day Free Trial" offers usually are money-back guarantees frequently only on the "set." Please understand that unless you are thoroughly pleased we pay return charges and refund the FULL purchase price on both the "set" and ALL equipment—tubes, cabinet, speaker, antenna (also on batteries or eliminators with Ultra-8 sets). Could any offer be fairer?

MIDWEST RADIO CORP., 531-AS Miraco Bldg., Cincinnati, Ohio

BEAUTIFULLY ILLUSTRATED CATALOG, AMAZING SPECIAL FACTORY OFFER, TESTIMONY OF NEARBY USERS—All the proof you want—of our honesty, fairness, size, financial integrity, radio experience and the performance of our sets—including Amazing Factory Offer—sent with catalog.



**Free!**

### Don't Confuse with Cheap Radios

With its rich, clear Cathedral tone, hum-free operation, tremendous "kick" on distant stations and razor-edge selectivity—with its costly sturdy construction, latest features, including phonograph pick up connection, ease of tuning, beauty, and economy—a Miraco will make you the envy of many whose radios cost 2 to 3 times as much!

Many thousands of Miraco's — bought after 30 day home comparisons—are cutting through locals and getting coast to coast with the tone and power of costliest sets, their delighted users report. Miraco's are laboratory-built with finest parts, and embody 9 years' actual experience in constructing fine sets. Approved by Radio's highest authorities.

### Deal Direct with Big Factory

Everything reaches you splendidly packed and rigidly tested to insure your instant enthusiasm. Enjoy the outfit 30 days—then decide. Liberal 3-year guarantee on each set. Play safe, save lots of money, and insure satisfaction by dealing direct with Radio's old, reliable builders of fine sets—9th successful year.

LATEST ALL ELECTRIC  
**AC-9**  
SUPER SHIELDED  
AC CHASIS  
**\$83.75**



**AC-8 \$71.50**

Unbeatable value in a 3-year guaranteed Super Shielded Metal Chassis (similar to AC-9 shown above).



**Also New More Powerful Battery Sets**

The newest and latest in battery operated sets, designed with same advanced features used in electric sets! Same wide choice of cabinets. Highest quality, amazingly low priced!

**8 TUBE BATTERY Super Shielded Metal Chassis \$49.88**

Tubes, batteries or eliminators and cabinets are extra. 30 days' home trial on EVERYTHING!

MIDWEST RADIO CORPORATION  
Pioneer Builders of Sets—9th Successful Year  
531-AS Miraco Bldg., Cincinnati, Ohio

**THIS COUPON IS NOT AN ORDER**

WITHOUT OBLIGATION, send free catalog, Amazing Special Factory Offer, testimony of nearby users, etc. ( ) User ( ) Agent ( ) Dealer  
NAME..... ADDRESS.....



44 TYPES OF RADIO TUBES

# SONATRON

## THE WORLD'S LARGEST RADIO TUBE LINE



### Why your SONATRON dealer can serve you BEST!

**S**TACKED high on his shelves, your Sonatron dealer carries evidence of his purpose to render a better tube service. Row upon row, the distinctive Sonatron cartons display the descriptive numbers which constitute the World's Largest Radio Tube Line.

Your Sonatron dealer *can* serve you best . . . first, because no matter what type of tube you seek, *he has it*; and second, because his connection with Sonatron makes him a source of reliable information on all that is new in radio tubes. In addition, he is able to offer you consistently better tube results, and the definite assurance of consistent quality.

The Sonatron dealer has been an important factor in building up a strong public confidence in Sonatron products. Almost without exception he is the leading dealer in his community, *choosing* to sell the Sonatron line because he finds in it a greater opportunity to serve his customers. Finally, he is able to sell Sonatrons with the knowledge that he is selling with them a *finer kind of radio tube performance.*

The final expression of the Sonatron ideal of service is to be found on the shelves of your Sonatron dealer's store. *Go to him for your tube needs*—and for the latest information on radio tube developments.

**FREE!**  
New 1939 Edition of  
this famous book

### SONATRON TUBE COMPANY

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88 Eighth Ave., Newark, N. J.  
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SONATRON TUBE COMPANY, 108 W. Lake St., Chicago  
Gentlemen: Please send me the FREE book: "How To Take Care of Your Radio Tubes"

Name: .....

Street Address or R. F. D.: .....

City and State: .....

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Manufacturers!**  
The SONATRON PROPOSITION this year offers greater sales possibilities than ever. Write for it—or simply check the coupon.

