

Spring Edition

Radio Listeners' Guide and Call Book

A Quarterly Magazine

Edited by
S. Gernsback

*The Broadcast Station
Directory*

Fifty Cents



HILLIKEY IN THIS ISSUE.

Technical Training for the Custom Set Builder and Service Man... Multiplying Meter Ranges for Economy... The Custom Built Set Market... A "Midget" B Power Unit...



5 Easy Ways to Make \$3.00 an hour in Your Spare Time in RADIO

Each of these plans, developed by the Radio Association of America, is a big money-maker. Set owners everywhere want to get rid of static, to have their sets operate from the electric light socket, the tone improved, and the volume increased, and transformed into single-dial controls. Phonograph owners want their machines electrified and radiofied. If you learn to render these services, you can easily make \$3.00 an hour for your spare time, to say nothing of the money you can make installing, servicing, repairing, building radio sets, and selling supplies.

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 by joining the Association.

Join the Radio Association of America

A membership in the Association offers you the easiest way into Radio. It will enable you to earn \$3.00 an hour upwards in your spare time—train you to install, repair and build all kinds of sets—start you in business without capital or finance an invention—train you for the \$3,000 to \$10,000 big-pay radio positions—help secure a better position at bigger pay for you.

A membership need not cost you a cent!
The Association will give you a comprehensive, practical, and theoretical training and the benefit of its Employment Service. You earn while you learn. Our cooperative plan will make it possible for you to establish a radio store. You have the privilege of buying radio supplies at wholesale from the very first.

Earned \$500.00 Spare Time
Frank J. Deutsch, Penn.: "I have made over \$500 out of Radio in my spare time."

Radio Engineer In One Year
Claude De Grave, Canada: "I knew nothing about Radio when I joined a year ago. I am now a member of a very exclusive organization of Radio Engineers, and my income is 225% greater than it was."

Doubles Income In 6 Months
W. E. Thon, Chicago: "Six months after I enrolled I secured the managership of large Radio Store and doubled my income."

ACT NOW — If You Wish the No-Cost 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 Radio Handbook filled with dollars-and-cents radio ideas. It will open your eyes to the money-making possibilities of Radio.

Radio Association of America, Inc.
4513 Ravenswood Ave., Dept. RR-3 Chicago, Ill.

Radio Association of America, Inc.
Dept. RR-3 4513 Ravenswood Ave., Chicago, Ill.

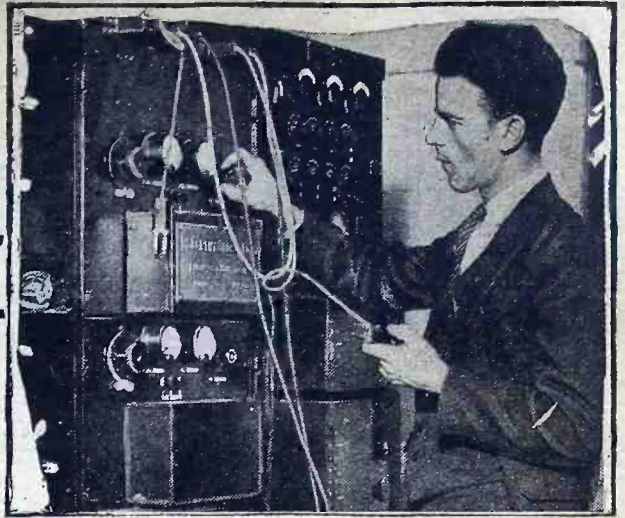
Gentlemen: Please send me by return mail full details of your Special Membership Plan, and also copy of your Radio Handbook.

Name.....

Address.....

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

I Will Train You at Home to Fill a Big-Pay Radio Job



Here's the PROOF



Has Made \$10,000 More in Radio

"I can safely say that I have made \$10,000 more in Radio than I would have made if I had continued at the old job. When I enrolled with you I didn't know a volt from an ampere. I advise all ambitious young men to get into Radio. There is no greater opportunity."

Victor L. Osgood, 931 Cranford Ave., Bronx, New York City.



\$375 One Month in Spare Time

"Recently I made \$375 in one month in my spare time installing, servicing, selling Radio Sets."

Earle Cummings, 18 Webster St., Haverhill, Mass.



\$450 a Month

"I work in what I believe to be the largest and best equipped Radio shop in the Southwest and also operate KGFI. I am averaging \$450 a month."

Frank M. Jones, 922 Guadalupe St., San Angelo, Tex.

If you are earning a penny less than \$50 a week, send for my book of information on the opportunities in Radio. It's FREE. Clip the coupon NOW. A flood of gold is pouring into this new business, creating hundreds of big pay jobs. Why go along at \$25, \$30 or \$45 a week when the good jobs in Radio pay \$50, \$75 and up to \$250 a week. My book "Rich Rewards in Radio" gives full information on these big jobs and explains how you can quickly become a Radio Expert through my easy, practical home-study training.

Salaries of \$50 to \$250 a week not unusual

Get into this live-wire profession of quick success. Radio needs trained men. The amazing growth of the Radio business has astounded the world. In a few short years three hundred thousand jobs have been created. And the biggest growth of Radio is still to come. That's why salaries of \$50 to \$250 a week are not unusual. Radio simply hasn't got nearly the number of thoroughly trained men it needs. Study Radio and after only a short time land yourself a REAL job with a REAL future.

You Can Learn Quickly and Easily in Spare Time

Hundreds of N.R.I. trained men are today making big money—holding down big jobs—in the Radio field. Men just like you—their only advantage is training. You, too, can become a Radio Expert just as they did by our new practical methods. Our tested, clear training makes it easy for you to learn. You can stay home, hold your job, and learn quickly in your spare time. Lack of education or experience is no drawback. You can read and write. That's enough.

Many Earn \$15, \$20, \$30 Weekly on the Side While Learning

My Radio course is the famous course "that pays for itself." I teach you to begin making money almost the day you enroll. My new practical method makes this possible. I give you SIX BIG OUTFITS of Radio parts with my course. You are taught to build practically every type of receiving set known. M. E. Sullivan, 412 73rd Street, Brooklyn, N. Y., writes: "I made \$720 while studying." Earle Cummings, 18 Webster Street, Haverhill, Mass., "I made \$375 in one month." G. W. Page, 1807 21st Ave., Nashville, Tenn., "I picked up \$935 in my spare time while studying."

Your Money Back if Not Satisfied

I'll give you just the training you need to get into the Radio business. My course fits you for all lines—manufacturing, selling, servicing sets, in business for yourself, operating on board ship or in a broadcasting station—and many others. I back up my training with a signed agreement to refund every penny of your money if, after completion, you are not satisfied with the course I give you.

ACT NOW—64-page Book is FREE

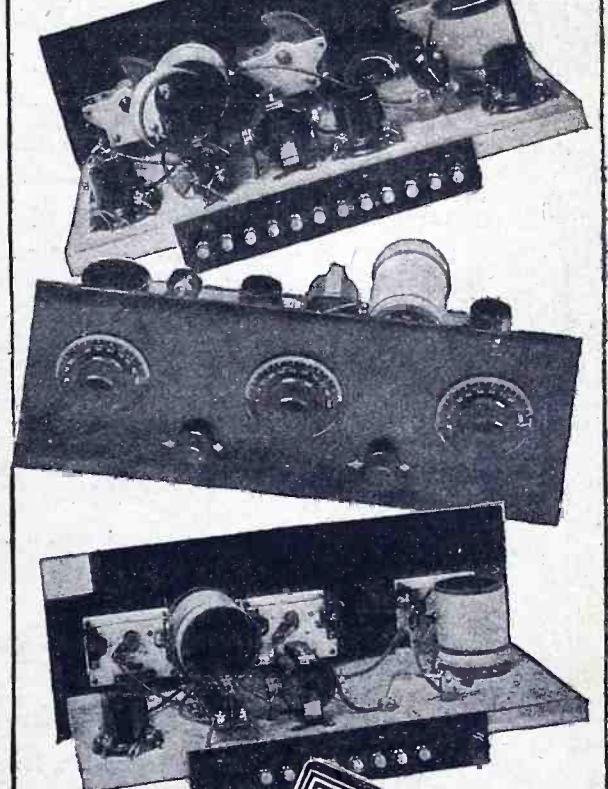
Send for this big book of Radio information. It won't cost you a penny. It has put hundreds of fellows on the road to bigger pay and success. Get it. Investigate. See what Radio has to offer you, and how my Employment Department helps you get into Radio after you graduate. Clip or tear out the coupon and mail it. **RIGHT NOW.**

J. E. SMITH, President, Dept. 9PS National Radio Institute Washington, D. C.



You can build 100 circuits with the six big outfits of Radio parts I give you

3 of the 100 you can build



Find out quick about this practical way to big pay



Mail This FREE COUPON Today

J. E. SMITH, President, Dept. 9PS, National Radio Institute, Washington, D. C.

Dear Mr. Smith: Kindly send me your big book "Rich Rewards in Radio," giving information on the big-money opportunities in Radio and your practical method of teaching with six big outfits. I understand this book is free, and that this places me under no obligation whatever.

Name Age.....
Address
City State

Employment Service to all Graduates
Originators of Radio Home Study Training

Radio Listeners' Guide and Call Book

A Quarterly Magazine

Volume III

Number 4

APRIL, 1929

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RADIO LISTENERS' GUIDE AND CALL BOOK *A Quarterly Magazine*

VOL. III, No. 4

APRIL, 1929

Published quarterly by The Consrad Co., Inc., 230 Fifth Ave., New York, N. Y., telephone number Ashland 9344; Price 50c a copy; subscriptions \$1.75 a year in the United States of America, Canada and all countries within the domestic postal zone; elsewhere \$2.00 a year, payable in advance. Subscriptions only acceptable in U. S. currency or stamps. No foreign currency or stamps. Checks and money orders should be drawn to the order of THE CONSRAD CO., Inc.

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Printed in U. S. A.

RADIO NEWS

Published by the Same Management:
SCIENCE AND INVENTION

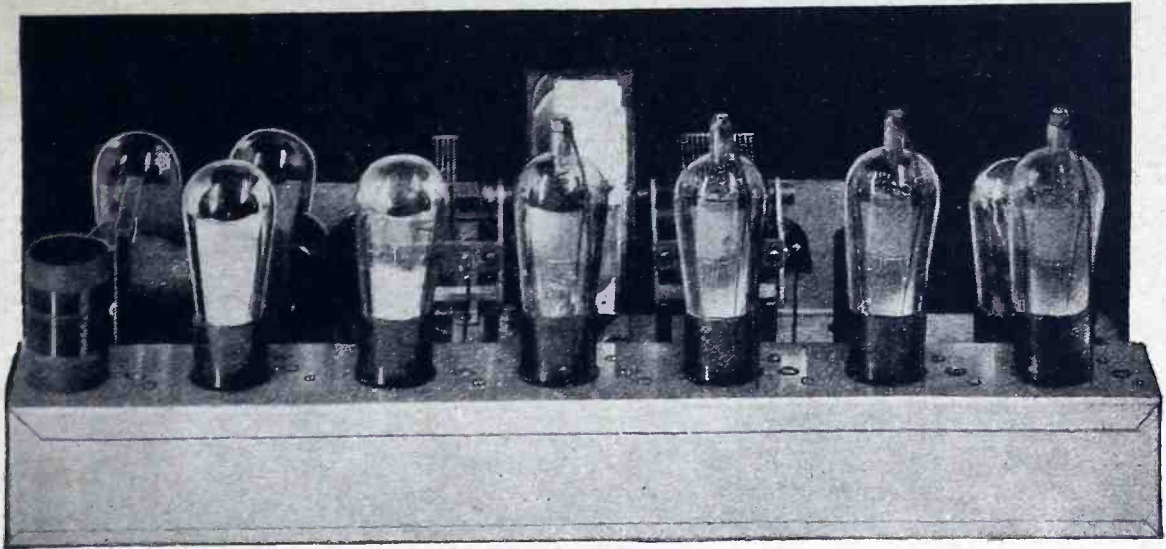
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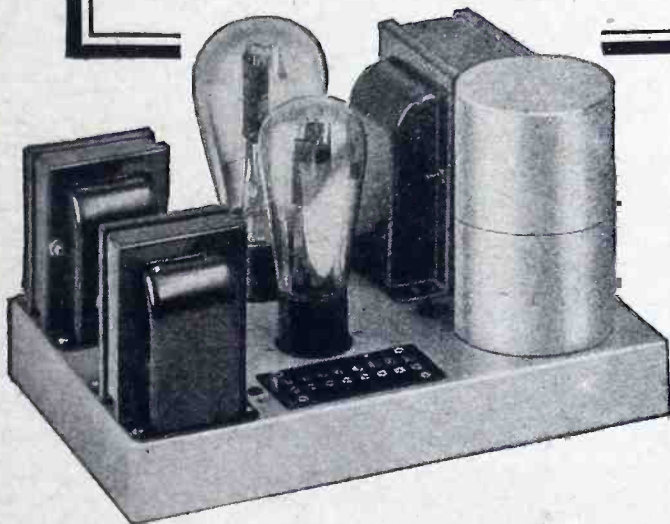
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S. B. Darmstadter, 326 W. Madison St., Chicago, Ill.

A. J. Norris Hill Co., 5 Third St., San Francisco, Calif.
412 West 6th St., Los Angeles, Calif.
Leary Bldg., Seattle, Wash.



Blast your way through . . . with the super powered HFL SPECIAL NINE*



GUARANTEED to out perform any radio set on earth. Priced at \$55.86. A set builder's money making plan that's a knockout. There's the story of the HFL Special Nine.

Radio's latest and greatest super is the chance of a life time for custom set builders. Four screen grid tubes. One dial and one spot. 250 tube power amplifier. A C heater or D C tube operation. No wonder they're selling them like wild fire.

You've never heard anything like the HFL Special Nine. Full loud speaker volume on 3,000 mile signals. Perfect selectivity that let's you get right alongside of the big boys. Tone quality that's a revelation. Absolutely no oscillation.

This HFL job is built like a Mack truck. Nothing

to go wrong. When you sell one, it will stay sold. It's a five year set, allowing short wave operation and excellent reproduction of television signals. The Special Nine is years ahead of everything else in the radio field. And it's priced right, too—

	List Price	Net, less 40 & 2%
D C Chassis—9 tube	\$ 95.00	\$55.86
A C Chassis—8 tube (250 external)	105.00	61.74
Set builder's wiring charge for either set	30.00	17.64
250 Power Amplifier and B supply, factory wired	77.00	45.28

Prices are without tubes. The A C set requires the 250 power amplifier and B supply for operation. The power amplifier will also operate with and furnish plate voltages to the D C Special Nine.

Wide awake set builders! Attach coupon to your business stationery and send for our new plan showing how to sell at low prices and make large profits. Mail the coupon *today*. Grasp this golden opportunity *now!*

If you have mailed a previous coupon to the High Frequency Laboratories, please do not mail this one, as you will automatically receive complete information.

HIGH FREQUENCY LABORATORIES

Office: 9-28 N. Sheldon St., Chicago, Illinois

HIGH FREQUENCY LABORATORIES
Office 9-28 N. Sheldon St., Chicago, Ill.

Gentlemen:
Without obligation please send literature describing the HFL Special Nine, also the new 250 Power Amplifier and B Supply. I have never mailed a coupon to you before.

Name.....
Address.....
City.....State.....
(Please print plainly)

★ Not a kit of loose parts, but a factory assembled chassis ready for wiring. Screen grid amplifier wired and tested.

HFL

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*Aerial
and
Ground
Loud Speaker
Power Pack
Battery
110-Volt A.C.
Connections*



*Single Plates
and in
Gang in Many
Combinations
—
Brushed Brass
and
Bakelite*

Yaxley Radio Convenience Outlets bring a new convenience and comfort to the enjoyment of radio. They provide a neat, workmanlike method of completing radio connections and remove all the unsightly features that mar the radio installation and detract from the good appearance of the modern radio set. With Yaxley Radio Convenience Outlets you plug in the receiver, loud speaker, 110-volt A.C., power pack or batteries just the same as a stand lamp or any other electrical convenience.

Yaxley Radio Convenience Outlets are easy to install. They fit any standard electrical outlet box, or where

outlet box is not available the mounting strap is fastened directly to the plaster, lath or studding. Everything required for a complete radio convenience outlet installation may be bought at your local radio store or electrical shop. The wall plates are finished in brushed brass to harmonize with standard electrical plates, or where desired they may be had in rich brown Bakelite.

Ask your local radio or electrical store to show you Yaxley Radio Convenience Outlets. In the meantime, write to us direct for illustrated bulletin.

YAXLEY GUARDIAN HOME BURGLAR ALARM

Install a Yaxley Guardian Home Burglar Alarm and protect the family, and the contents of the home from the burglar, sneak thief and porch climber. Self-contained, complete, with instructions for installation.

We believe there is a great opportunity for set builders and service men to build up a nice business installing burglar

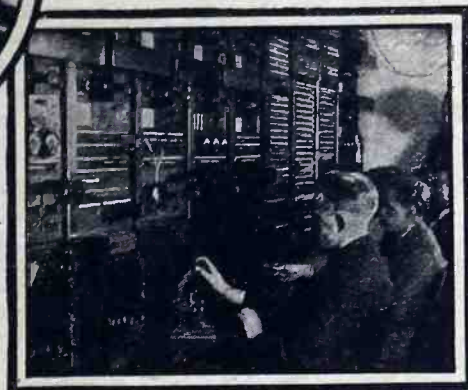
alarms in the home and in fur shops, jewelry, dry goods and drug stores, garages, service stations and similar places in every community. In suburban and rural sections many handy men are making good money installing electrical protection in homes, barns, stables and chicken houses. Write us, giving the name of your jobber, for our special introductory offer and our plan for starting you in this business.

YAXLEY MFG. CO., Dept. I., 9 So. Clinton St., Chicago, Ill.

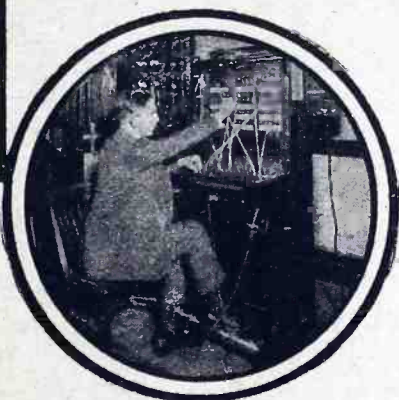
Pick the RADIO JOB you want and fill it in only 9 months!



Radio Operator
\$90 to \$200 per month
with all expenses paid



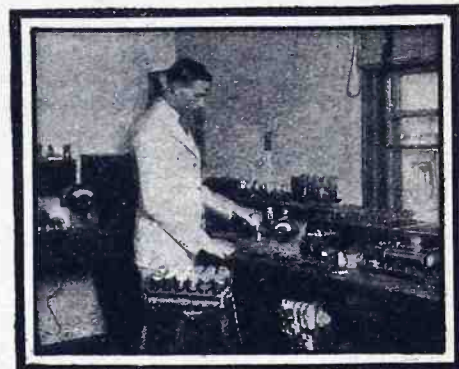
Broadcast Operator
\$1,800 to \$4,800 a year



Radio Inspector
\$2,000 to \$4,500 a year

By means of this "Big-League" home-training sponsored
by Radio Corporation of America

Send for FREE
BOOK about Radio.



WHY struggle along on less than \$45 a week? Why wait years for success that can be yours in only 9 months?

As a result of a marvelous new kind of home-study training in Radio hundreds of men are today leading straight for financial independence! Radio pays from \$2,000 to \$25,000 a year. The work is thrilling. . . the hours are short. Vacations with pay. . . opportunities for seeing the world. . . adventure galore!

Prepare at Home with this Big Laboratory Outfit
Get the "How" as well as the "Why" of Radio—with this expert training! Only an hour or so a day—in spare time—is all you need! As part of your course, you receive absolutely free of extra charge—a magnificent outlay of apparatus. With this outfit you learn to build fine sets and solve the problems that bring big pay.

Training Sponsored by The Radio Corporation of America

Our graduates are in big demand everywhere. They enjoy greater success because they're posted right up-to-the-minute in *everything* in Radio. Radio's progress each year is measured by the accomplishment of the great engineers at work in the research laboratories of the Radio Corporation of America; this radio organization sets the standard for the industry, and stands back of every lesson in the course.

Money Back if Not Satisfied

The lessons prepare you for success in all

phases of Radio—manufacturing, servicing, selling, ship and shore broadcasting, Television, Photoradiograms and Radio equipment. A signed agreement backed by RCA assures you of complete satisfaction upon completion of the training—or your money will be promptly refunded.

Read This Thrilling Free Book

It gives you the real "dope" about Radio and describes in detail the famous training that has enabled us to place thousands of our students in fine positions, usually from 3 to 10 days after graduation. It may mean the turning point in your life. It tells in 50 fascinating pages and photos all about Radio's brilliant opportunities for adventure and success. Mail the coupon now—the book is absolutely free! Radio Institute of America, Dept. LG-3, 326 Broadway, New York.



Radio Institute of America,
Dept. LG-3,
326 Broadway, New York, N. Y.

Gentlemen: Please send me your big FREE 50-page book which tells about the brilliant opportunities in Radio and about your famous laboratory-method of guaranteed radio instruction at home.

Name

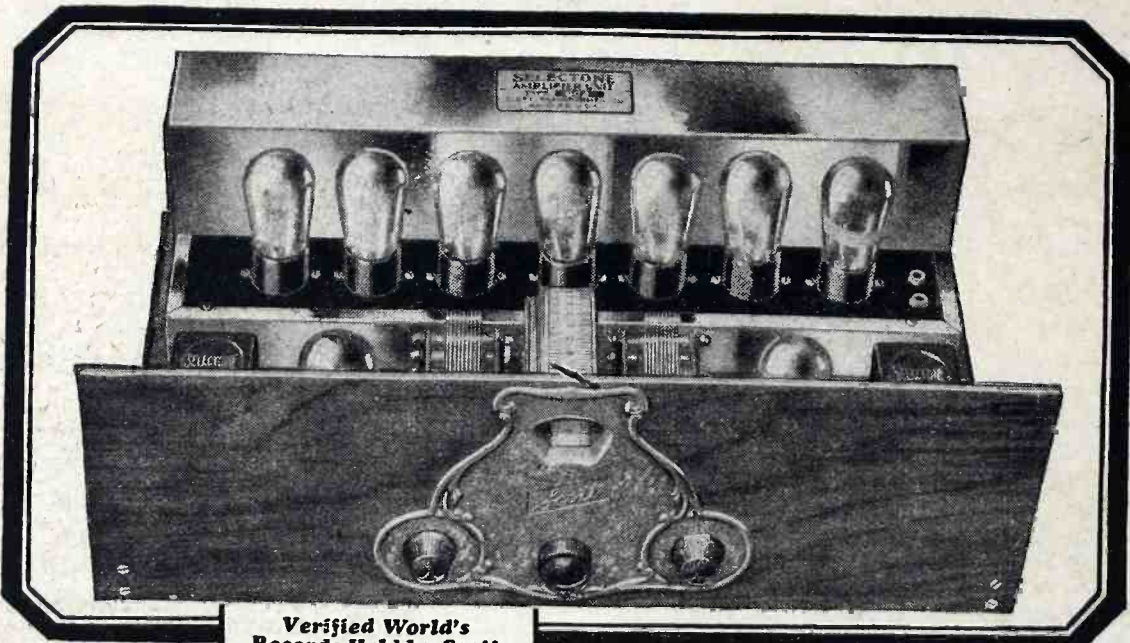
Address

A Scott World's Announcement



E. H. SCOTT
Designer of receivers holding practically all the world's records.

▲ and a policy of distribution which insures the purchaser's complete sat-



ONE DIAL Control on the New Scott A.C. Nine

The New Scott World's Record A.C. Nine which again repeats its unanswered challenge to the whole world of radio to equal its performance in any kind of competitive test, is now improved by the embodiment of *Single Dial Control*. Now, by merely plugging into your light socket and turning one small knob, practically any station within 10 kilocycles of any other station is brought in with thunderous volume and with vigorous, life-like, full-rounded tone. Anyone can tune the Scott World's Record A.C. Nine now. Anyone can fully enjoy its oft-demonstrated limitless range and revel in the endless parade of distant stations its brightly illuminated drum dial records. Thoroughly shielded—perfectly stable—no hum—using A.C. tubes—stations come in at only one point on the dial and always at the same point. Truly, in all its history, radio has never offered so much as is available to you in this latest model of the one proven World's Greatest Receiver.

Verified World's Records Held by Scott Receivers

- (1) A world's record for number of stations heard, distance 6,000 to 8,000 miles.
 - 6 stations distance 6,000 miles.
 - 7 stations distance 7,000 miles.
 - 6 stations distance 8,000 miles.
- (2) A world's record for greatest number of programs heard from stations distant 6,000 or more miles.
 - 19 programs 8,000 or more mls.
 - 19 programs 7,000 or more mls.
 - 79 programs 6,000 or more mls.

THIS is the New Scott World's Record A.C. Nine with the Single Dial Control. The intermediate amplifier is completely shielded. The appearance of the receiver is that of the fine precision instrument which it is.

MAIL COUPON

Scott Receivers are designed for those who have tried other receivers and are now looking for something BETTER. They are custom built to your order and are sold only thru Radio Technicians carefully selected by the Scott Transformer Company. This policy of distribution puts you in contact with a man with years of radio experience and who has a thorough, practical knowledge of radio—who can supply you with a precision instrument that is guaranteed to outperform any other receiver available today—and who will take care of that instrument for you from the time of purchase. This policy eliminates all possibility of dissatisfaction on your part. Send coupon TODAY for full particulars and for name of your local franchised SCOTT Representative.



The New Scott Symphony MODEL A.C. or D.C.

To meet the demand for a better performing custom built small receiver which is low in price but high in performance,

The NEW 4-TUBE MODEL

the new Scott Symphony was created. One stage of Shield-Grid Amplification is used, making it the equal to many nine tube sets and is surpassed in general performance to the same quality standard as the nine tube model and backed with the same unqualified guarantee of superior performance and complete satisfaction.

ance only by the new Scott World's Record A.C. Nine. One dial control—easily tunes out the locals and brings in distant stations. Engineered to the same quality standard as the nine tube model and backed with the same unqualified guarantee of superior performance and complete satisfaction.

Self-contained power supply in A.C. Model

The A.C. Model of the Scott Symphony is equipped with built in A.C. power supply which supplies filament, plate and grid current to all A.C. tubes used and the 171 A power tube. The D.C. Model is so designed electrically, that its current consumption is extremely low, thereby making it the ideal receiver for sections where A.C. current is NOT available or where it is desired to use batteries.

SCOTT

Send Today

Scott Transformer Co. 4450
 Send me full particulars of:
 Scott World's Record A.C. Nine
 Scott Symphony A.C. Model
 Scott Symphony D.C. Model
 Scott Power Supply-Power Amplifier
 Also send me name of nearest franchised Scott Representative. RLCB3

Name.....
 Street.....
 City.....
 State.....

Ravenwood Ave., Chicago

RECORD RADIOS

of New 1929 Models

isfaction and protects all the professional set builder's profits ▲▲▲▲

Professional Set Builders! Scott Apparatus Now Sold Only thru CUSTOM SET BUILDERS

The custom building of fine radio receivers is *still* a profitable profession with our plan for those who are technically qualified, because there are thousands of people who want the best there is in radio and who know that the best cannot be produced by mass production methods but only thru the custom method of hand building.

This season Scott Products will not be sold direct to consumers nor thru jobbers, but exclusively thru professional custom set builders. We have adopted this policy because we believe in you and recognize the fact that your ability to deliver a far better receiver than any mass-production factory can make, and our protection of your market, will result in the growth of your business, and in turn, the growth of ours. Our line this season is complete and will enable you to supply a Scott receiver in a good console from as low as \$90.00 to as high as \$1,500. It embraces the Scott World's Record Shield Grid Nine, the Scott World's Record A. C. Nine, the Scott Symphony in both A. C. and D. C. models, and a line of cabinets which enable you to out-class, at the right price, anything else in the field.

We Help You Promote Sales

We have, ready to imprint your name thereon, illustrated advertising mailing pieces for you to use in spreading the news of your appointment as the franchised Scott Builder in your locality. Our 48 page book "How to Sell Good Custom Built Radio" tells you all about the Scott Plan and our proposition. It is the first and only complete, practical treatise ever prepared which clearly points the way to financial success for the Custom Set Builder. It is, however, sent only to those who can qualify and meet our standards as a Custom Set Builder.

MAIL COUPON

For Qualification Blank

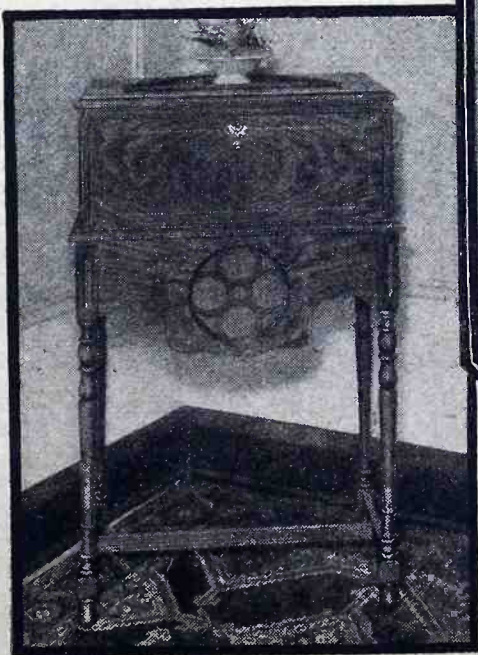
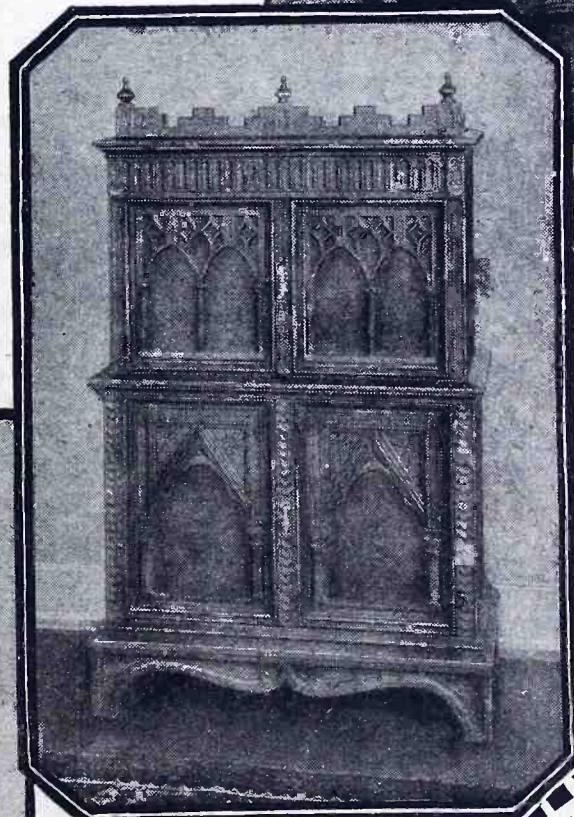
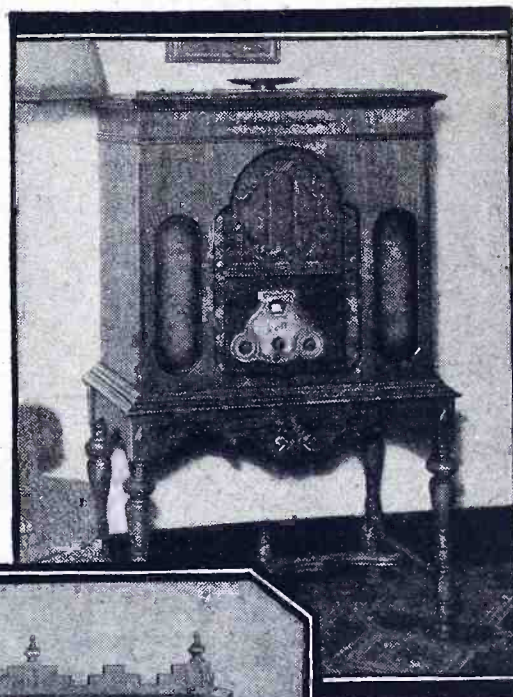
The Scott Franchise is, most naturally, a valuable one. Not only because of the obvious superiority of Scott Receivers, but because after you are appointed a Scott Franchised Builder, you will have taken a step towards establishing for yourself a REAL PROFIT-ABLE business that will, with our co-operation and assistance, enable you to make more money than you ever dreamed was possible in the Custom Set building business.

TRANSFORMER COMPANY

4450 Ravenswood Avenue ▲ CHICAGO, ILLINOIS

Complete Line of CABINETS

Never before have we had a more beautiful or complete line of cabinets. They are the last word in "modernness" with sliding doors, rich selected walnut burls, hand rubbed finish. We show on these pages three of our ten different models and all are fine examples of the modern furniture craftsman's art. They will enable you to meet every cabinet demand from the most modest to the massive, rich, dignified hand carved console that will add distinction to the finest home. You can secure four of these consoles either with or without phono combinations. All are of the very highest quality and workmanship but are priced unbelievably low.



ABOVE:
The Taranaki
TO THE LEFT:
The Canterbury
BELOW:
The Milford

Set Builders! MAIL THIS COUPON

Send me details of your new models and Professional Set Builder's Qualification Blank and your proposition. I understand that your 48 page book "How to Sell Good Custom Built Radio" will be mailed me after 1 qualification.

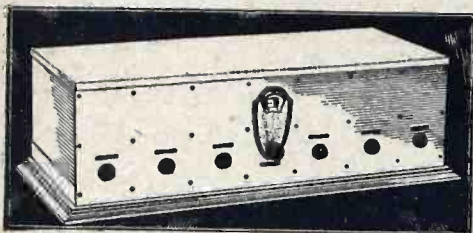
Name..... Street..... City..... State.....

Scott Transformer Co., 4450 Ravenswood Ave., Chicago

SM

Australia to New York— Verified Reception

done—of course—with an S-M Receiver!



The great Sargent-Rayment 710—aptly termed "The Boss of the Air." Everything the most fastidious listener might want—an ultra-sensitive and knife-edge tuning set, which can, nevertheless, be operated when desired as a real one-dial set—with tone quality unsurpassed even in sets not designed for unusual selectivity. All this at \$130.00 for the KIT, or \$175.00 WIRED—both prices including cabinet!

AUSTRALIA to New York City on 353 meters! Direct verification from Station 2BL in Sydney, New South Wales, to a listener by the Hudson—one of the many thousands who have successfully employed the S-M Sargent-Rayment Seven to break through congested local interference.

We congratulate Mr. Parzelt on this feat of reception, and are happy to be able to supply, to all who desire it, a receiver of such caliber.

Correspondence CARD

2B. L. Service

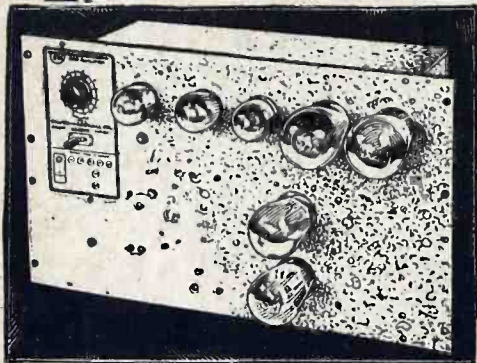
6 AM

1929

We are in receipt of your letter, undated, and have pleasure in confirming the items mentioned by you as having been broadcast by this station. We are always glad to hear from over the seas, and hope to hear from you again with regard to our transmission.

Mr. William Parzelt,
128 Post Avenue,
New York City,
U.S.A.

Giant Voiced—Yet Pure Toned



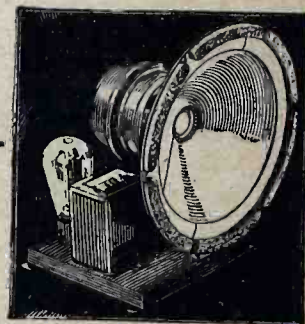
S-M 690 Amplifier: built on black crackle-finished heavy aluminum panel 12x21 inches. Uses seven tubes: 1st stage, one '27; 2nd stage, two '26's in push-pull; 3rd stage, two '50's in push-pull; two '81 rectifiers. Clough audio system used throughout.

List price, assembled complete less tubes, \$245.

NEVER before has such an amplifier as the 690 been available to the set-builder and service man! It brings within his control installation jobs in theatres, auditoriums, and for all public occasions. The public, thoroughly awakened by the talking-movie, is demanding life-like, high-power speech and music—no more "straining the ears."

Find out today about the remarkable things that can be done with an amplifier delivering such tremendous power output as 15,000 milliwatts — from phonograph, microphone, or radio-detector input—with three-point switch on the panel, as well as a knob giving smooth fading control, whatever input is being taken.

Get the new S-M catalog—and begin today to look about you for the opportunities that exist everywhere to make good money by installing S-M amplifiers.



Now a Speaker Made as Good as S-M Amplifiers

The S-M Dynamic Speaker, now announced for the first time, establishes still more firmly the superiority of S-M sound amplifying equipment—a speaker supreme in its ability to handle without distortion an amazingly large amount of power. Has the new S-M 229 output transformer built in, with output taps providing proper impedance matching for use with 171, 250, or the new intermediate power tubes, singly or in push-pull. Two types: S-M 850, for 110 volts A. C. (using '80 rectifier tube) \$58.50. S-M 851, for 110 volts D. C. \$48.50.

Silver-Marshall, Inc.

866 W. Jackson Blvd., Chicago, U. S. A.

... Please send me, free, the complete S-M Catalog; also sample copy of The Radiobuilder.

For enclosed.....in stamps, send me the following:

.... 50c Next 12 issues of The Radiobuilder

.... \$1.00 Next 25 issues of The Radiobuilder

S-M DATA SHEETS as follows, at 2c each:

.... No. 1. 670B, 670ABC Reservoir Power Units

.... No. 2. 685 Public Address Unipac

.... No. 3. 730, 731, 732 "Round-the-World" Short Wave Sets

.... No. 4. 223, 225, 226, 256, 251 Audio Transformers

.... No. 5. 720 Screen Grid Six Receiver

.... No. 6. 740 "Coast-to-Coast" Screen Grid Four

.... No. 7. 675ABC High-Voltage Power Supply and

676 Dynamic Speaker Amplifier

.... No. 8. Sargent-Rayment Seven

.... No. 9. 678PD Phonograph Amplifier

.... No. 10. 720AC All-Electric Screen-Grid Six.

.....Name

.....Address

The Radiobuilder, a monthly publication telling the very latest developments of the S-M laboratories, is too valuable for any set-builder to be without. No. 9 (Jan. 1929) gave full particulars about the new apparatus described above, long before it was available in any other form. Send the coupon for free sample copy, or to enter your subscription if you want it regularly.

If you build professionally, but do not have as yet the S-M Authorized Service Station appointment, be sure to ask about it.

SILVER-MARSHALL, Inc.

866 West Jackson Blvd., Chicago, U. S. A.

SM

Be the **FIRST**
to build the **FIRST**

set designed
around **1930 tubes**

the
long-
awaited

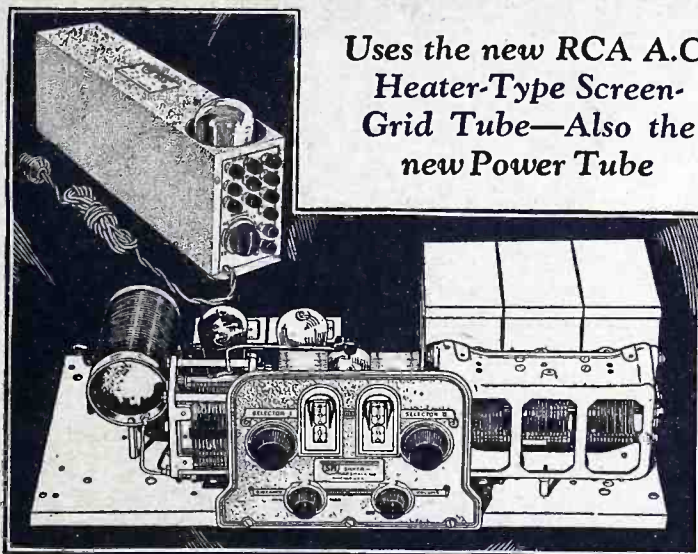
S-M All-Electric Screen-Grid Six

→ Get It **FIRST** from **W. C. Braun Co.** ←

HERE is your chance—build the S-M 720AC All-Electric Screen-Grid Six, and be the first in your neighborhood to own a real 1930 receiver—a set actually designed around tubes of a type utterly new—not found at all in 1929 sets! Just as the 222 screen-grid tube set a new standard of reception in 1928—so the new RCA-Cunningham A.C. screen-grid tube—an even better r.f. amplifier than the '22—will be the central feature of fine receivers for 1930.

And in the audio end as well—the new medium-voltage, super-power output tube will give for the first time all the undistorted volume which could be desired for home use without high voltage wiring.

The receiver in which these revolutionary features are first offered is—naturally enough—a Silver-Marshall design—one in which every feature of the record-breaking 720 (D. C.) Screen-Grid has been embodied and still further improved.

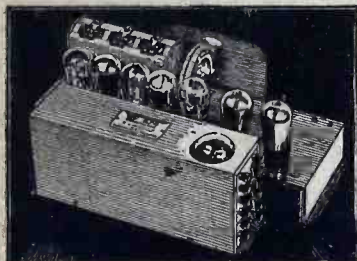


Uses the new RCA A.C. Heater-Type Screen-Grid Tube—Also the new Power Tube

Build the 720AC and See How Next Year's Best Receivers Will Tune and Sound!

THE S-M 720AC Screen-Grid Six, used with the new S-M 669 power supply, is a complete all-electric receiver designed especially to bring out the extreme possibilities of the new RCA screen-grid tube. Three of these tubes are used in the r. f. stages, one 227 tube as detector, another as first stage audio amplifier, and one output tube of the new super-power intermediate-voltage type. Price (less tubes) complete KIT without cabinet \$78.00; S-M 700 cabinet, extra \$9.25. Receiver WIRED complete in the beautiful 700 two-tone shielding cabinet, less tubes and power unit, \$107.50.

Promptness on These, Too—from W. C. Braun Co.



The New
S-M 750
All-Electric
7-Tube
Receiver

Employs four '26 and one '27 tubes, and two '71's in push-pull with the famous S-M Clough-system transformers. Special power unit within cabinet, using '80 tube. Control by single illuminated dial—full light-socket-operation (for 105-120 volts 50-60 cycles only). A set whose performance rivals any ever designed for the popular-priced A.C. tubes. Built complete in S-M 700 cabinet, \$99. Wired chassis, without cabinet, \$89.

S-M Screen-Grid Kits—Breaking All Records for Performance and Sales

S-M receiver kits are available from W. C. Braun Company in all types to suit all requirements—each one an absolute leader in its class.

The Sargent Rayment Seven—world-circling record-breaker—a single control set (with five individual verniers for DX peaking) using four screen-grid tubes, comes complete with handsome aluminum shielding cabinet: KIT \$130, or custom-built complete \$175.

The original 720 Screen-Grid Six—the famous set with which Japanese, Cuban, and Mexican stations are being heard all over the U. S.—has set up an entirely new standard of moderate-price radio value. Six of these 720's are used aboard the U. S. battleship California, flagship of the Pacific fleet, to cut through the ship's powerful transmitters. Tone quality unbeatable, due to the S-M Clough audio system. KIT complete with chassis and antique brass escutcheon, \$72.50; 700 cabinet extra \$9.25. Custom-built complete in cabinet, \$102.

Yes—we have in stock, and strongly recommend as a real "buy"

The New S-M Dynamic Speaker

(See illustration on opposite page)

850 (A.C.) ... \$58.50
851 (D.C.) ... 48.50

OFFICIAL WHOLESALE DISTRIBUTORS FOR S-M PRODUCTS

As official wholesale distributors for the products of the Silver-Marshall laboratories, W. C. Braun Co., Wholesale Radio Headquarters, offers you this big line of radio merchandise with the assurance that your orders will be filled on the very day they are received. Our plant is located very close to the Silver-Marshall factories and we can give you service on your orders impossible to secure anywhere else. Order your favorite S-M parts, kits and supplies here. You'll save time and money.

In addition to the complete Silver-Marshall line, we offer you a complete line of everything in the radio field—sets, radio furniture, tubes, power units, portable receivers, dynamic and other speakers, parts and kits for all popular circuits advertised in the leading radio publications, short wave and television

supplies, short wave transmitters, radiophones, public address systems, novelties, etc.

Special departments include auto tires and tubes, auto accessories, electrical goods, lighting fixtures, wiring material, household appliances, stoves, vacuum cleaners, washing machines, camping equipment, sporting goods, golf and baseball supplies, outing clothing and thousands of everyday necessities.

Our centralized location insures fast service to customers in all parts of the country.

Thousands of choice bargains are shown in the big 1929 Braun Catalog. If you haven't a copy, send for it at once. It is free—mail the handy coupon now.

W. C. BRAUN COMPANY

Pioneers in Radio

528 W. Randolph St.

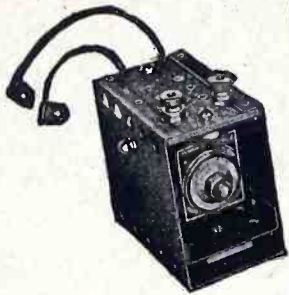
CHICAGO
ILLINOIS

W. C. BRAUN CO.,
528 W. Randolph St., Chicago

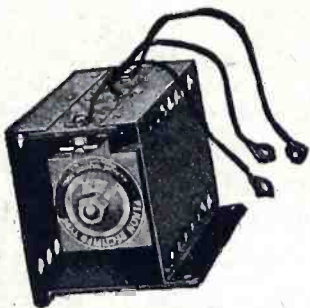
Dear Sirs: I am not receiving the W. C. Braun Co. Catalog regularly. Please put my name on your mailing list of set-builders and dealers, giving me the prices and information on S-M parts and other merchandise including the new 720AC. My letterhead is attached.

Name.....
St. & No.....
City.....State.....

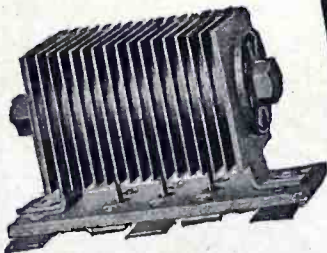
NOW! AN ELKON Dry Rectifier for PHILCO POWER UNITS



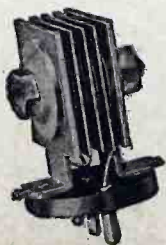
Type BNK for replacing the acid jars in Balkite Types N and K Trickle Chargers.



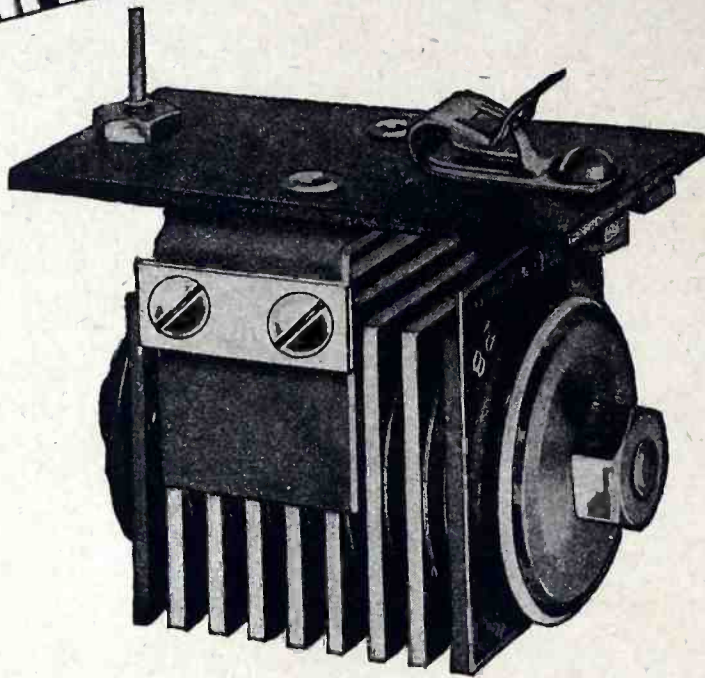
Type BJ for replacing the acid jars in Balkite Type J chargers



Type M-16 for replacing the rectifiers in 11 makes of "A" Eliminators and 3 Ampere chargers



Type V-4 for replacing the rectifiers in 6 makes of trickle chargers.



THIS new Elkon all-dry metallic rectifier Type U-P-8 is so designed that it replaces the wet jar rectifiers designated as Philcatron A and Philcatron AA used in Philco Trickle Chargers, Philco "A" Powers and Philco A and B combinations.

Very simple to attach, two wires to connect. May be done in a minute by anyone. No liquids to bother with—no attention—just satisfaction.

Do not be surprised at its small size—for in its sturdy couples are packed thousands of hours of perfect service. Its compactness is one of the reasons for its efficiency.

The U-P-8 is a fitting member of the Elkon family of dry-metallic rectifiers.

Visit your dealer today.

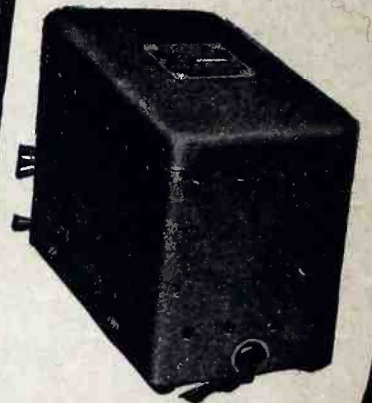
ELKON, Inc.
Division of P. R. Mallory & Co.
350 Madison Ave., N. Y. C.



Not a music lesson but one of the many accurate processes of testing Elkon rectifiers.



5000 hour type EBH rectifier for replacing BH type tubes in "B" eliminators. Replaces fragile 1000 hour tubes.



3 Ampere Charger. Dry, noiseless, no moving parts. Has tapering feature—long life. For radio or auto batteries.



Type E Tapering Charger. Maximum charging rate 1 amp. Dry. No moving parts. Long Life. Ideal for dynamic speakers.



Dry, high-capacity condensers. Capacities from 750 to 2000 microfarads. Used in many leading "A" eliminators.

ELKON, Inc., Dept. 2, 350 Madison Ave., N.Y.C.
Please send me full information on the Elkon Radio Products.
Name.....
Address.....

A HOUSE DIVIDED

A house divided within itself must fall. . . . These seven simple words express most vividly the status of the custom set builders associated with the radio industry. . . . Divided they will fail—unified they will prosper.

The structure of the custom set business has been built under odds—despite wide-spread, powerful competition. . . . The house is completed but what about its members? Will they co-operate, unify to strengthen the structure—to elevate its standing in the community—to lead it to prosperity—or will internal strife, selfish motives, unfair competition ruin a profitable business?

Banding of the myriad custom setbuilders in this nation is imperative if the business is to live—if its participants are to prosper. . . . The professional radio set builder is alone in his field—but fighting alone he cannot survive. . . . The professional radio receiver constructor of today is fighting the admirably organized commercial radio receiver manufacturer. . . . Individual Lilliputians will be driven from the fertile soil by the mighty Gulliver,—but an organized group will secure happy existence.

Individually the professional set builder is a nonentity—his guarantee is without backing. . . . Can he fight commercial set advertising on that basis? Can he secure recognition—among the public—among his own kind? The answer is beyond discussion. . . . Organized, he is powerful—recognized—reliable—with a background. . . . Organized, he represents a firm basis for his dealings with the public. . . . He can secure public recognition—gain public confidence.

The public must realize that a custom built receiver is superior to the commercially manufactured products. . . . Will the puny efforts of the individual professional achieve this result? Are the haphazard efforts of separated thousands equal to the concerted effort of thousands. . . . History repeats itself. . . . United we stand—divided we fall.

We have a plan—a program of vital importance to you, but before we can carry it through we must secure special data. Will you answer this questionnaire? You will find it advantageous. —*Editor.*

Fill out this Questionnaire and mail to Editor, Radio Listeners' Guide and Call Book, 230 Fifth Avenue, New York City.

Name Address

City State

What is your business?

Is set building a side line?

How many receivers do you build each year?.....

Do you have any trouble securing the parts specified?

Do your friends, neighbors, relatives ask you for advice about custom built receiversmanufactured receivers.....

How do you sell your sets?

Custom Setbuilders!

The Radio Set Market Tells Our Readers of Your Services FREE

ARE YOU REPRESENTED?

In this magazine there appears, each month, a number of pages entitled the RADIO SET MARKET. In it we list, as a FREE Service the name and address of all custom setbuilders desiring to take advantage of this generous offer. The purpose of this section is to inform our readers of the whereabouts of these professional builders so that they may benefit by the superior quality of a custom-built set as compared to the manufactured radio receiver.

Turn to page 75 and glance over this section. If you are a custom setbuilder who works industriously and wholeheartedly to produce high quality radio receivers we will list your advertisement in the RADIO SET MARKET section of this magazine at no cost to you. Names of towns are arranged geographically for the convenience of our readers. In this way, all that a reader, interested in procuring a custom-built radio set, need do, is choose the town in which the setbuilder is located and get in touch with him through our magazine.

CONDITIONS

Each advertisement will be keyed and listed geographically in the "RADIO SET MARKET" section as seen on page 75.

No advertisement more than fifty words. Each must be clearly written on a piece of white paper and attached to the coupon herewith. No request will be considered without the coupon.

No ad will be accepted from persons merely desiring to sell a set and who are not bonafide custom setbuilders.

We invite you to take advantage of this service. Fill in the coupon and mail it to us with your ad.

RADIO LISTENERS' GUIDE and CALL BOOK
230 Fifth Avenue, New York City, N. Y.

Radio Listeners' Guide and Call Book,
230 Fifth Avenue, New York, N. Y.

4-29

Gentlemen:—Without cost or obligation to me, kindly insert the attached "custom made set offer" in your next issue.

Name

Address

City State

RADIO LISTENERS' GUIDE and CALL BOOK

A Quarterly Magazine

J. F. RIDER, Managing Editor

RADIO BROADCAST STATIONS OF THE UNITED STATES

Indexed Alphabetically by Call Letters

Turn to page 24 for our FREE SERVICE on Broadcast Station allocations

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
KDB	Santa Barbara, Cal.—Santa Barbara Brcast. Co., 1200 Anacapa St.	100	199.9	1500	Pac.	KFDM	Beaumont, Tex.—Magnolia Petroleum Co.	500	535.4	560	Cent.	KFIZ	Fond du Lac, Wis.—Fond du Lac Commonwealth Reporter, 22 Forest Ave.	100	211.1	1420	Cent.
KDKA	E. Pittsburgh, Pa.—Westinghouse Elec. & Mfg. Co.	50000	305.9	980	East.	KFDY	Brookings, S. Dak.—South Dakota State College (Divides time with KFJR-KFJM)	500	545.1	550	Cent.	KFJB	Marshalltown, Iowa—Marshalltown Electric Co., 1603 W. Main St. (Divides time with WMT)	100	249.9	1200	Cent.
KDLR	Devils Lake, N. Dak.—Radio Elec. Co.	100	247.8	1210	Cent.	KFEC	Portland, Ore.—Meier & Frank Co. (Divides time with KFJI)	100	218.8	1370	Pac.	KFJF	Oklahoma City, Okla.—Nat. Radio Mfg. Co., Security Bldg.	5000	204	1470	Cent.
KDYL	Salt Lake City, Utah—Intermountain Brcast. Corp., 1009 Ezra Thompson Bldg.	1000	232.4	1290	Mt.	KFEL	Denver, Colo.—Eugene P. O'Fallon Argonaut Hotel (Divides time with KFXF)	250	319	940	Mt.	KFJI	Astoria, Ore.—Liberty Theatre, Geo. Kincaid (Divides time with KFEC)	50	218.8	1370	Pac.
KEJK	Los Angeles, Cal.—Macmillan Petroleum Co., 218 N. Larchmont Blvd. (Divides time with KFOX)	500	239.9	1250	Pac.	KFEQ	St. Joseph, Mo.—Scroggin & Co. Bank, Hotel Robidoux (Divides time with WOI)	2500	535.4	560	Cent.	KFJM	Grand Forks, N. D.—Univ. of N. D. (Divides time with KFDY-KFYR)	500	218.8	1370	Cent.
KELW	Burbank, Cal.—Earl L. White, 3702 Magnolia Ave. (Divides time with KNRC)	500	384.4	780	Pac.	KFEY	Kellogg, Ida.—Union High School	10	247.8	1210	Pac.	KFJR	Portland, Ore.—Ashley C. Dixon & Son, Fifth & Stark, Lumbermen's Bldg. (Divides time with KTBR)	500	230.6	1300	Pac.
KEX	Portland, Ore.—Western Brcast. Co. (Divides time with KOB)	5000	254.1	1180	Pac.	KFGQ	Boone, Iowa—Boone Biblical College, 924 W. Second St.	10	228.9	1310	Cent.	KFJY	Fort Dodge, Iowa—Tunwall Radio Co., 1004 Central (Divides time with KWCR)	100	228.9	1310	Cent.
KFAB	Lincoln, Nebr.—Nebraska Buick Auto Co. (Divides time with WBBM)	5000	389.4	770	Cent.	KFH	Wichita, Kans.—Rigby-Gray Hotel Co., Hotel Lassen, First & Market Sts. (Divides time with WIBW)	500	230.6	1300	Cent.	KFJZ	Fort Worth, Tex.—Henry C. Allison, 2121 Refugio St.	100	218.8	1370	Cent.
KFAD	Phoenix, Ariz.—Elec. Equipment Co.	500	483.6	620	Mt.	KFHA	Gunnison, Colo.—Western State College of Colorado	50	249.9	1200	Mt.	KFKA	Greeley, Colo.—Colorado State Teachers College (Divides time with KPOF) (1000 watts daytime)	500	340.7	880	Mt.
KFBB	Havre, Mont.—F. A. Buttrey Co. (Uses 500 Watts Daytime) (Divides time with KGIR)	250	220.4	1360	Mt.	KFI	Los Angeles, Cal.—Earle C. Anthony, Inc., 1000 So. Hope St.	5000	468.5	640	Pac.	KFKB	Millford, Kans.—KFKB Brcast. Assoc.	5000	265.3	1130	Cent.
KFBK	Sacramento, Cal.—Jas. McClatchy Co., 610 California St.	100	228.9	1310	Pac.	KFIF	Portland, Ore.—Benson Polytechnic School	100	211.1	1420	Pac.	KFKU	Lawrence, Kans.—Univ. of Kans. (Divides time with WREN)	1000	245.8	1220	Cent.
KFBL	Everett, Wash.—Leese Bros., 2814 Rucker Ave. (Divides time with KVL)	50	218.8	1370	Pac.	KFIO	Spokane, Wash.—North Central High School (Daytime only)	100	243.8	1230	Pac.	KFKX	Chicago, Ill.—Westinghouse Elec. & Mfg. Co., 508 Michigan Ave. (Consolidated with KYW-KYWA) (10000 watts experimentally.)	5000	293.9	1020	Cent.

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
KGDY	—Oldham, S. Dak.—J. Albert Loesch	15	249.9	1200	Cent.	KGHI	—Little Rock, Ark.—Berean Bible Class, 1201 Louisiana St.	500	199.9	1500	Cent.	KIDO	—Boise, Idaho—Boise Brdcast. Station (Divides time with KDKL)	1000	239.9	1250	Mt.
KGEF	—Los Angeles, Cal.—Trinity Methodist Church, 1201 So. Flower St. (Divides time with KTBI)	1000	230.6	1300	Pac.	KGHL	—Billings, Mont.—Northwestern Auto Supply Co., Fifth Ave. & North Broadway	500	315.6	950	Mt.	KJBS	—San Francisco, Cal.—Julius Brunton & Sons Co., 1380 Bush St. (Daytime)	100	272.6	1100	Pac.
KGEK	—Yuma, Colo.—Beehler Elec. Equip. Co., 109 W. Second Ave. (Divides time with KGEW)	50	249.9	1200	Mt.	KGHX	—Richmond, Tex.—Fort Bend Co. School Board	50	199.9	1500	Cent.	KJR	—Seattle, Wash.—Northwest Radio Serv. Co., 604 Home Sav. Bldg.	5000	309.1	970	Pac.
KGEO	—Grand Island, Nebr.—Hotel Yancey, 116 N. Locust St. (Cons. with KGBZ)	500	322.4	930	Cent.	KGIO	—Idaho Falls, Ida.—Jack W. Duckworth, Jr., 423 Tamarack Ave., Inglewood, Cal. (Divides time with KGIQ)	250	227.1	1320	Mt.	KKP	—Seattle, Wash.—City of Seattle, Harbor Dept. (Divides time with KFQW)	15	211.1	1420	Pac.
KGER	—Long Beach, Cal.—C. Merwin Dobyns, 435 Pine Ave.	100	218.8	1370	Pac.	KGIO	—Twin Falls, Ida.—Stanley M. Soule, Walker Bank Bldg., Salt Lake City, Utah (Divides time with KGIO)	250	227.1	1320	Mt.	KLCN	—Blytheville, Ark.—Daily Courier News	50	232.4	1290	Cent.
KGES	—Central City, Nebr.—Central Radio Elec. Co. (Cons. with KGBZ)	500	322.4	930	Cent.	KGIR	—Butte, Mont.—Symons Brdcast. Co., -200 E. Broadway (Divides time with KFBB)	250	220.4	1360	Mt.	KLDS	—Independence, Mo.—Midland Brdcast. Co. and Reor. Church of Jesus Christ of Latter Day Saints (Limited) (Divides time with WHB) (2500 watts daytime)	500	315.6	950	Cent.
KGEW	—Fort Morgan, Colo.—City of Fort Morgan, City Hall Bldg. (Divides time with KGEK)	100	249.9	1200	Mt.	KGIW	—Trinidad, Colo.—Trinidad Creamery Co., Inc.	100	211.1	1420	Mt.	KLRA	—Little Rock, Ark.—Arkansas Brdcast. Co., 210 Center St. (Divides time with KUOA)	500	215.7	1390	Cent.
KGEZ	—Kalispell, Mont.—Flathead Brdcast. Assn.	100	228.9	1310	Mt.	KGJF	—Little Rock, Ark.—First Church of the Nazarene	250	336.9	890	Cent.	KLS	—Oakland, Cal.—Warner Bros. Radio Supplies Co., 2201 Telegraph Ave. (Divides time with KWG) (250 watts daytime)	100	208.2	1440	Pac.
KGFF	—Alva, Okla.—Earl E. Hampshire, 718 5th St.	100	211.1	1420	Cent.	KGKB	—Brownwood, Tex.—Eagle Pub. Co.	100	199.9	1500	Cent.	KLX	—Oakland, Cal.—The Oakland Tribune	500	340.7	880	Pac.
KGFG	—Oklahoma City, Okla.—Full Gospel Church (Divides time with KGCB)	100	218.8	1370	Cent.	KGKL	—San Angelo, Tex.—KGKL, Inc.	100	218.8	1370	Cent.	KLZ	—Denver, Colo.—(Trans. in Dupont)—Reynolds Radio Co., Shirley Savoy Hotel	1000	535.4	560	Mt.
KGFH	—La Crescenta, Cal. (Trans. in Glendale)—Frederick Robinson, Box 163 (Limited)	250	299.8	1000	Pac.	KGKO	—Wichita Falls, Tex.—The Wichita Falls Brdcast. Co., Perkins-Snyder Bldg.	250	526	570	Cent.	KMA	—Shenandoah, Iowa—May Seed & Nursery Co. (Divides time with KGBZ) (1000 watts daytime)	500	322.4	930	Cent.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGKX	—Sandpoint, Idaho—C. E. Twiss	15	211.1	1420	Mt.	KMEC	—Independence, Mo.—Midland Brdcast. Co. and Reor. Church of Jesus Christ of Latter Day Saints (Limited) (Divides time with WHB) (2500 watts daytime)	500	315.6	950	Cent.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGO	—Oakland, Cal.—General Electric Co.	10000	379.5	790	Pac.	KMED	—Medford, Ore.—W. J. Virgin	50	228.9	1310	Pac.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGRC	—San Antonio, Tex.—Paramount Radio Co., 103 San Pedro Ave.	100	218.8	1370	Cent.	KMIC	—Inglewood, Cal.—J. R. Fouch, 219 N. Market St. (Divides time with KFSG)	500	267.7	1120	Pac.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGRS	—Amarillo, Tex.—Gish Radio Service, 108 E. 8th St. (Divides time with WDAG)	1000	212.6	1410	Cent.	KMJ	—Fresno, Cal.—Fresno Bee	100	249.9	1200	Pac.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGTT	—San Francisco, Cal.—Golden Gate Brdcast. Co. (Divides time with KFQU)	50	211.1	1420	Pac.	KMMJ	—Clay Center, Nebr.—M. M. Johnson Co. (Limited time)	1000	405.2	740	Cent.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGW	—Portland, Ore.—The Oregonian Pub. Co., 806 Oregonian Bldg.	1000	483.6	620	Pac.	KMO	—Tacoma, Wash.—KMO, Inc., Hotel Winthrop (Divides time with KVI)	500	223.7	1340	Pac.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KGX	—Lacey, Wash.—St. Martins College (Divides time with KKP-KFQV) (10 watts at night)	50	249.9	1200	Pac.	KMOX	—St. Louis, Mo.—(Trans. in Kirkwood)—The Voice of St. Louis, Inc., Mayfair Hotel	5000	275.1	1090	Cent.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KHJ	—Los Angeles, Cal.—Don Lee, Inc.	1000	333.1	900	Pac.	KMTR	—Hollywood, Cal.—KMTR Radio Corp., 1025 N. Highland Ave. (Divides time with KPLA)	1000	526	570	Pac.
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KHQ	—Spokane, Wash.—Louis Wasmer, Davenport Hotel	1000	508.2	590	Pac.						
KGFI	—San Angelo, Tex.—San Angelo Brdcast. Co.	100	228.9	1310	Cent.	KICK	—Red Oak, Iowa—Red Oak Radio Corp. (Divides time with WIAS)	100	211.1	1420	Cent.						

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
WEBW	Beloit, Wis. — Beloit College (Daytime only)	250	499.7	600	Cent.	WFDF	Flint, Mich. — Frank D. Fallain, 513 So. Saginaw St.	100	228.9	1310	East.	WGN	Chicago, Ill. — The Chicago Tribune, Drake Hotel	25000	416.4	720	Cent.
WEDC	Chicago, Ill. — —Emil Denmark Brcdcast. Sta., 3860 Ogden Ave. (Divides time with WCRW-WSBC)	100	247.8	1210	Cent.	WFI	Philadelphia, Pa. — —Strawbridge & Clothier (Divides time with WLIT)	500	535.4	560	East.	WGR	Buffalo, N. Y. — Radio St. WGR, Inc., Hotel Statler (Divides time with WSYR)	750	545.1	550	East.
WEDH	Erie, Pa. —Erie Dispatch-Herald	30	211.1	1420	East.	WFIW	Hopkinsville, Ky. —Acme Mills, Inc.	1000	319	940	Cent.	WGST	Atlanta, Ga. — Georgia Sch. of Tech. (Divides time with WMAZ)	500	336.9	890	Cent.
WEEL	Boston, Mass. — The Edison Elec. Illuminating Co.	500	508.2	590	East.	WFJC	Akron, Ohio — W. F. Jones Brcdcast, Inc. (Divides time with WJAY)	500	206.8	1450	East.	WGY	Schenectady, N. Y. — Gen. Elec. Co. (Limited)	50000	379.5	790	East.
WEHS	Evanston, Ill. — —A. T. Becker, 1318 Elmwood Ave. (Divides time with WHFC-WCLS-WKBB-WKBI)	100	228.9	1310	Cent.	WFKD	Philadelphia, Pa. — Foulkrod Radio Engin. Co. (Divides with WNAT-WABY)	50	228.9	1310	East.	WHA	Madison, Wis. — Univ. of Wis. (Divides timewithWPCC-WRM)	750	570	526	Cent.
WEMC	Berrien Springs, Mich. — Emmanuel Missionary (Daytime only)	1000	508.2	590	Cent.	WFLA	Clearwater, Fla. (Trans. in City Park at Causeway)— Clearwater and St. Petersburg Chamber of Commerce (2500 watts daytime)	1000	333.1	900	East.	WHAD	Milwaukee, Wis. — Marquette Univ. (Divides time with WISN)	250	267.7	1120	Cent.
WENR	Chicago, Ill. — Great Lakes Radio Brcdcast. Co., 310 S. Michigan Ave. (Cons. with WBCN) (Divides time with WLS) (50,000 watts experimentally)	25000	344.6	870	Cent.	WGAL	Lancaster, Pa. — Lancaster Elec. Supply & Cons. Co., 23 E. Orange St. (Divides time with WRAW)	15	228.9	1310	East.	WHAM	Rochester, N. Y. (Trans. in Victor Tnshp.)— Stromberg-Carlson Tel. Mfg. Co.	5000	260.7	1150	East.
WEPS	Gloucester, Mass. — Matheson Radio Co., 209 Main St. (Divides time with WKBE)	100	249.9	1200	East.	WGBB	Freeport, N. Y. — Harry H. Carman, 217 Bedell St. (Divides time with WJBI - WINR - WCOH)	100	247.8	1210	East.	WHAP	New York, N. Y. (Trans. in Carlstadt, N. J.)— Defenders of Truth Soc., Inc., 9 W. 96th St. (Divides time with WBBR - WEVD - WHAZ)	1000	230.6	1300	East.
WEVD	New York, N. Y. (Trans. in Woodhaven)— Union Course Labs. Debs Memorial Radio Fund (Divides time with WBBR-WHAP-WHAZ)	500	230.6	1300	East.	WGBC	Memphis, Tenn. — First Baptist Church, Linden & Lauderdale Sts. (Divides time with WNBR)	500	209.7	1430	Cent.	WHAS	Louisville, Ky. — Cour.-Jl. and Louisville Times, 3rd & Liberty Sts.	5000	365.6	820	Cent.
WEW	St. Louis, Mo. — St. Louis Univ. (Daytime only)	1000	394.5	760	Cent.	WGBF	Evansville, Ind. — —Evansville on the Air, Inc. (Divides time with WOS-KFRU)	500	475.9	630	Cent.	WHAZ	Troy, N. Y. — Rensselaer Poly. Inst. (Divides time with WBBR-WHAP-WEVD)	500	230.6	1300	East.
WFAA	Dallas, Tex. — Dallas News and Sears, Roebuck & Co., Baker Hotel (Divides time with KRLD)	5000	288.3	1040	Cent.	WGBI	Scranton, Pa. — Scranton Broadcasters, Inc., 318 Adams Ave. (Divides time with WQAN)	250	340.7	880	East.	WHB	Kansas City, Mo. — Sweeney Auto School Co., Sweeney Bldg. (Divides time with KLDS-KMBC) (2500 watts daytime)	500	315.6	950	Cent.
WFAN	Philadelphia, Pa. — Keystone Brcdcast. Co., Hotel Lorraine (Divides time with WIP)	500	491.5	610	East.	WGBS	New York, N. Y. — (Trans. in Astoria, L. I.)—Gimbel Bros., 33rd St. & Bway. (Limited)	500	254.1	1180	East.	WHBC	Canton, Ohio — St. John's Parish, 627 McKinley Ave., N. W.	10	249.9	1200	East.
WFBC	Knoxville, Tenn. — First Baptist Church	50	249.9	1200	Cent.	WGCM	Gulfport, Miss. — Gulf Coast Music Co., 1319-26th Ave.	100	247.8	1210	Cent.	WHBD	Bellefontaine, Ohio — First Presbyterian Church	100	218.8	1370	East.
WFBE	Cincinnati, Ohio — Park View Hotel	100	249.9	1200	East.	WGCP	Newark, N. J. — Paramount Brcdcast. & Artists' Serv., 591 Broad St. (Divides time with WODA-WAAM)	500	239.9	1250	East.	WHBF	Rock Island, Ill. — Beardsley Specialty Co., 217-18th St.	100	247.8	1210	Cent.
WFBG	Altoona, Pa. — The Wm. F. Gable Co. (Divides time with WHBP)	100	228.9	1310	East.	WGES	Chicago, Ill. — (Trans. in Oak Park)—Oakleaves Broadcasting Corp., 128 N. Crawford Ave. (Divides time with WJKS)	500	220.4	1360	Cent.	WHBL	Sheboygan, Wis. — Press Pub. Co., C. L. Carrell, 1506 No. Amer. Bldg. (Divides time with KFLV - WDGW-WHDI)	500	212.6	1410	Cent.
WFBJ	Collegeville, Minn. — St. John's University	100	218.8	1370	Cent.	WGH	Newport News, Va. — Virginia Brcdcast. Co., Inc.	100	228.9	1310	East.	WHBP	Johnstown, Pa. — Johnstown Automobile Co., 101 Main St. (Divides time with WFBG)	100	228.9	1310	East.
WFBL	Syracuse, N. Y. — The Onondaga Co. (Divides time with WMAK)	750	333.1	900	East.	WGHP	Mt. Clemens, Mich. (Trans. in Fraser)— Geo. H. Phelps, Studio 1408 Maccabee Bldg., Detroit.	750	241.8	1240	East.	WHBQ	Memphis, Tenn. — WHBQ, Inc., Dermon Bldg.	100	218.8	1370	Cent.
WFBM	Indianapolis, Ind. (Trans. in Perry Tnshp.)— Indianapolis Power & Lt. Co. (Divides time with WSBT-WGL) (Limited)	1000	243.8	1230	Cent.	WGL	Ft. Wayne, Ind. — Fred C. Zreg (Allen Wayne Co.), 1729 Lafayette St. (Divides time with WFBM-WSBT)	100	218.8	1370	Cent.	WHBU	Anderson, Ind. — Citizens Bank, 1101 Meridian St.	100	247.8	1210	Cent.
WFBR	Baltimore, Md. — Balt. Radio Show, Inc., Hoffman & Bolton Sts.	250	236.1	1270	East.	WGMS	St. Paul-Minneapolis, Minn. — Washburn-Crosby Co. (Divides time with WCAL - KF MX - WRHM)	1000	239.9	1250	Cent.	WHBW	Philadelphia, Pa. — D. R. Kienzle, 4916 Chestnut St. (Divides time with WPSW-WALK-WOO)	100	199.9	1500	East.
												WHBY	West De Pere, Wis. — St. Norbert's College	50	249.9	1200	Cent.

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
WHDF	—Calumet, Mich.—Chas. C. MacLeod	100	218.8	1370	Cent.	WIBU	—Poynette, Wis.—Wisconsin State Jour.	100	228.9	1310	Cent.	WJBI	—Red Bank, N. J.—Robt. S. Johnson, 63 Broad St. (Divides time with WINR - WCOH - WGBB)	100	247.8	1210	East.
WHDI	—Minneapolis, Minn.—Wm. Hood Dunwoody Indust. Inst., 818 Superior Blvd. (Divides time with WDGY-WHBL)	500	215.7	1390	Cent.	WIBW	—Topeka, Kans.—C. L. Carrell, 901 Natl. Reserve Life Ins. Co. Bldg. (Divides time with KFH) (2500 watts daytime)	1000	230.6	1300	Cent.	WJBK	—Ypsilanti, Mich. Ernest F. Goodwin estate, 803 Congress St. (Divides time with WIBM)	50	218.8	1370	Cent.
WHDL	—Tupper Lake, N. Y.—Geo. F. Bissell	10	211.1	1420	East.	WIBX	—Utica, N. Y.—WIBX, Inc., Hotel Utica	100	249.9	1200	East.	WJBL	—Decatur, Ill.—Wm. Gushard Dry Gds. Co., 301 N. Water St. (Divides time with WJBC)	100	249.9	1200	Cent.
WHEC	—Rochester, N. Y.—Hickson Elec. Co., 36 South Ave. (Cons. with WABO, (Divides time with WMAC-WOKO)	500	208.2	1440	East.	WIBZ	—Montgomery, Ala.—A. D. Trum, 217 Catoma St.	15	199.9	1500	Cent.	WJBO	—New Orleans, La.—Valdemar Jensen, 119 S. St. Patrick St.	100	218.8	1370	Cent.
WHFC	—Chicago, Ill.—Goodson & Wilson, Inc., Hotel Flanders, 4145 Bway. (Divides time with WKBI - WKBB - WCLS-WEHS)	100	228.9	1310	Cent.	WICC	—Bridgeport, Conn. (Trans. in Easton)—Bridgeport Brdcast. Co., Inc. (Divides time with WBRL) (Daytime only)	500	252	1190	East.	WJBT	—Chicago, Ill.—John S. Boyd, Kimball Bldg.	25000	389.4	770	Cent.
WHK	—Cleveland, Ohio Radio Air Serv. Corp., 1116 Carnegie Hall	1000	215.7	1390	East.	WIL	—St. Louis, Mo.—Missouri Brdcast. Corp., (250 watts daytime)	100	211.1	1420	Cent.	WJBU	—Lewisburg, Pa.—Bucknell Univ. Engrg. Bldg. (Divides time with WBAX)	100	247.8	1210	East.
WHN	—New York, N. Y.—Marcus Loew Bkg. Agcy., Inc. (Divides time with WQAO - WPAP-WRNY)	250	296.9	1010	East.	WILL	—Urbana, Ill.—Univ. of Ill. (Divides time with KUSD) (250 watts at night)	500	336.9	890	Cent.	WJBW	—New Orleans, La.—C. Carlson, Jr., 2743 Dumaine St. (Divides time with WABZ)	30	249.9	1200	Cent.
WHO	—Des Moines, Iowa—Bnkrs. Life Co., 1110 Liberty Bldg. (Divides time with WOC)	5000	299.8	1000	Cent.	WILM	—Wilmington, Del.—Delaware Broadcasting Co., Inc., 2303 Franklin St.	100	199.9	1500	East.	WJBY	—Gadsden, Ala.—Elec. Const. Co., 517 Broad St.	50	247.8	1210	Cent.
WHOH	—Gloucester, Mass.—Matheson Radio Co., 209 Main St.	1000	361.2	830	East.	WINR	—Bay Shore, N. Y.—Radiotel Mfg. Co., Carleton Hall (Divides time with WJBI-WGBB-WCOH)	100	247.8	1210	East.	WJJD	—Mooseheart, Ill.—Supreme Lodge, Loyal Order of Moose (Limited)	20000	254.1	1180	Cent.
WHPP	—New York, N. Y. (Trans. in Englewood Cliffs, N. J.)—Bronx Brdcast. Co. (Divides time with WLBH-WMRJ)	10	211.1	1420	East.	WIOD	—Miami Beach, Fla.—Isle of Dreams Brdcast. Co. (Divides time with WQAM)	1000	241.8	1240	East.	WJKS	—Gary, Ind.—Johnson Kennedy Radio Corp., 540 Lake St. (Divides time with WGES)	500	220.4	1360	Cent.
WHT	—Chicago, Ill. (Trans. in Deerfield)—Radiophone Broadcasting Corp., 410 N. Mich. Blvd. (Divides time with WJAZ - WORD - WIBO)	5000	202.6	1480	Cent.	WIP	—Philadelphia, Pa.—Gimbel Bros., Market St. Bldg. (Divides time with WFAN)	500	491.5	610	East.	WJR	—Detroit, Mich. (Trans. in Pontiac)—Good Will Sta. WJR, Inc. & Detroit Free Press, Genl. Motors Bldg. & Book Cadillac Hotel	5000	399.8	750	East.
WIAD	—Philadelphia, Pa.—H. R. Miller, Hotel Vendig	100	218.8	1370	East.	WISN	—Milwaukee, Wis.—Wisconsin News 115 Michigan St. (Divides time with WHAD)	250	267.7	1120	Cent.	WJSV	—Mt. Vernon Hills, Va.—Independent Pub. Co., 339 Pennsylvania Ave., N. W., Wash., D. C.	10000	205.4	1460	East.
WIAS	—Ottumwa, Iowa—Poling Elec. Co., 107 E. 2nd St. (Divides time with KICK)	100	211.1	1420	Cent.	WJAD	—Waco, Tex.—Frank P. Jackson, 801 Austin Ave. (Divides time with KTAT)	1000	241.8	1240	Cent.	WJZ	—New York, N. Y. (Trans. in Bound Brook, N. J.)—Natl. Brdcast. Co., 711 Fifth Ave.	30000	394.5	760	East.
WIBA	—Madison, Wis.—Capital Times Studio & Strand Theatre Corp., 14 E. Mifflin St.	100	247.8	1210	Cent.	WJAG	—Norfolk, Nebr.—Norfolk Daily News, Hotel Norfolk (Limited)	500	282.8	1060	Cent.	WKAR	—East Lansing, Mich.—Michigan State College (Daytime only)	500	288.3	1040	Cent.
WIBG	—Elkins Park, Pa.—St. Paul's P. E. Ch. (Daytime)	50	322.4	930	East.	WJAK	—Kokomo, Ind.—J. A. Kautz, Y.M.C.A. Bldg. (Divides time with WLBC)	50	228.9	1310	Cent.	WKAV	—Laconia, N. H.—Laconia Radio Club, Auditorium, Pub. Serv. Co. of N. H.	50	228.9	1310	East.
WIBM	—Jackson, Mich.—C. L. Carrell (Divides time with WJBK)	100	218.8	1370	Cent.	WJAR	—Providence, R. I.—The Outlet Co.	250	336.9	890	East.	WKBB	—Joliet, Ill.—Sanders Bros., 607 Jefferson St. (Divides time with WCLS - WEHS - WKBI-WHFC)	100	228.9	1310	Cent.
WIBO	—Chicago, Ill. (Trans. in Desplaines)—Nelson Bros., Bond & Mtg. Co. (Divides half time with WNAX - WHA-WPCC)	5000	526	570	Cent.	WJAS	—Pittsburgh, Pa.—M. H. Pickering Furn. Co.	1000	232.4	1290	East.	WKBC	—Birmingham, Ala.—R. H. Broyles Furniture Co., 1428 N. Twelfth Ave.	10	228.9	1310	Cent.
WIBR	—Steubenville, Ohio—Thurman A. Owings (Divides time with WQBZ)	50	211.1	1420	East.	WJAX	—Jacksonville, Fla.—City of Jacksonville, Waterworks Park, 1st and Main Sts.	1000	238	1260	East.	WKBE	—Webster, Mass.—K. & B. Elec. Co., 59 Emerald Ave. (Divides time with WEPS)	100	249.9	1200	East.
WIBS	—Elizabeth, N. J.—New Jersey Brdcast. Corp., 80 Broad St. (Divides time with WBMS-WNJ-WKBO)	250	206.8	1450	East.	WJAY	—Cleveland, Ohio—Cleveland Radio Brdcast. Corp., Hotel Hollenden (Divides time with WFJC)	500	206.8	1450	East.	WKBF	—Indianapolis, Ind.—Noble B. Watson, Hoosier Ath. Club. (Divides time with WBAA-WCMA)	500	214.2	1400	Cent.

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
WKBH	— La Crosse, Wis.—Callaway Music Co., 221 Main St. (Divides time with KSO)	1000	217.3	1380	Cent.	WLBH	— Farmingdale, N. Y.—Nassau Broadcasting Co. (Divides time with WHPP-WMRJ)	30	211.1	1420	East.	WMAF	— South Dartmouth, Mass.—Round Hills Radio Corp. (Divides time with WBET)	500	220.4	1360	East.
WKBI	— Chicago, Ill.—Fred L. Schoenwolf, Lincoln Tr. & Sav. Bank Bldg. (Divides time with WHFC - WKBB - WCLS-WEHS)	50	228.9	1310	Cent.	WLBG	— Petersburg, Va.—R. A. Gamble	100	249.9	1200	East.	WMAK	— Buffalo, N. Y. (Trans. in Martinsville) —WMAK Brdcast. Sta. (Divides time with WFBL)	750	333.1	900	East.
WKBN	— Youngstown, Ohio—Radio Elec. Serv. Y. M. C. A. (Divides time with WSMK)	500	526	570	East.	WLBL	— Stevens Point, Wis.—Wis. Dept. of Markets (Daytime only)	5000	333.1	900	Cent.	WMAL	— Washington, D. C.—M. A. Leese Radio Co., 720 Eleventh St. N. W.	250	475.9	630	East.
WKBO	— Jersey City, N. J.—Camith Corp., 2866 Blvd. (Divides time with WBMS-WNJ-WIBS)	250	206.8	1450	East.	WLBO	— Galesburg, Ill.—Frederick Trebbe, Jr. (Divides time with WKBS)	100	228.9	1310	Cent.	WMAN	— Columbus, Ohio—W. E. Heskett Radio Station, 507 N. High St.	50	247.8	1210	East.
WKBP	— Battle Creek, Mich.—Battle Creek Enquirer & News	50	211.1	1420	East.	WLBV	— Mansfield, Ohio — Mansfield Brdcast. Assn., Cham. of Comm. Bldg.	100	247.8	1210	East.	WMAQ	— Chicago, Ill.—Chicago Daily News, 15 North Wells St.	5000	447.5	670	Cent.
WKBQ	— New York, N. Y.—Standard Cahill Co., Inc., 1100 E. 177th St. (Divides time with WBNY-WMSG-WCDA)	250	222.1	1350	East.	WLBW	— Oil City, Pa.—Petroleum Telephone Co.	500	238	1260	East.	WMAY	— St. Louis, Mo.—Kings Highway Presbyterian Church (Divides time with KFWF)	100	249.9	1200	Cent.
WKBS	— Galesburg, Ill.—P. N. Nelson, 227 Duffield Ave. (Divides time with WLBO)	100	228.9	1310	Cent.	WLBX	— Long Island City, N. Y.—John N. Brahy, 283 Crescent St. (Divides time with WCLB-WWRL-WMBQ)	100	199.9	1500	East.	WMAZ	— Macon, Ga.—Mercer Univ. (Divides time with WGST) (Uses 250 Watts at Night)	500	336.9	890	East.
WKBV	— Brookville, Ind.—Knox Battery & Elec. Co., 1058 Main St.	100	199.9	1500	Cent.	WLBZ	— Bangor, Me.—Maine Brdcast. Co. (500 watts daytime)	250	483.6	620	East.	WMBA	— Newport, R. I.—LeRoy Joseph Beebe, 19 Broadway	100	199.9	1500	East.
WKBW	— Buffalo, N. Y. (Trans. in Amherst)—Churchill Evan. Assn., 1420-1428 Main St.	5000	204	1470	East.	WLCI	— Ithaca, N. Y.—Lutheran Assn. of Ithaca	50	247.8	1210	East.	WMBC	— Detroit, Mich.—Mich. Brdcast. Co., Savoy Hotel	100	211.1	1420	East.
WKBZ	— Ludington, Mich.—Karl L. Ashbacher, First Natl. Bank Bldg.	50	199.9	1500	East.	WLEX	— Boston, Mass. (Trans. at Medford)—Boston Transcript (Divides time with WMAF)	500	220.4	1360	East.	WMBD	— Peoria Heights, Ill.—Peoria Hts. Radio Lab., 107 E. Glen Ave. (Divides time with WTAD) (1000 watts daytime)	500	208.2	1440	Cent.
WKEN	— Buffalo, N. Y. (Trans. in Grand Island)—WKEN, Inc., 2 E. Hazeltine Ave. (Limited)	1000	288.3	1040	East.	WLEY	— Lexington, Mass.—The Lexington Air Sta., 131 Willow Ave. (Divides time with WSSH) (250 Watts Daytime)	100	211.1	1420	East.	WMBF	— Miami Beach, Fla.—Fleetwood Hotel Corp.	500	535.4	560	East.
WKJC	— Lancaster, Pa.—Kirk Johnson & Co., 16 W. King St. (Divides time with WPRC)	100	249.9	1200	East.	WLIB	— Chicago, Ill. (Trans. in Elgin)—Liberty Weekly	25000	416.4	720	Cent.	WMBG	— Richmond, Va.—Havens & Martin, 914 W. Broad St. (Divides time with WTAZ)	100	247.8	1210	East.
WKRC	— Cincinnati, Ohio — Kodel Radio Corp., 507 E. Pearl St. (Divides time with WEAO)	500	545.1	550	Cent.	WLIT	— Philadelphia, Pa.—Lit Bros., 8th & Market Sts. (Divides time with WFI)	500	535.4	560	East.	WMBH	— Joplin, Mo.—Edwin Dudley Aber, 1526 E. Fifty-third St.	100	211.1	1420	Cent.
WKY	— Oklahoma City, Okla.—WKY Radio-telephone Co., Huckins Hotel	1000	333.1	900	Cent.	WLOE	— Chelsea, Mass.—Boston Brdcast. Co., 56 Wash. Ave. (Divides time with WMES)	100	199.9	1500	East.	WMBI	— Addison, Ill.—Moody Bible Inst. Radio Station (Divides time with WCBD)	5000	277.6	1080	Cent.
WLAC	— Nashville, Tenn.—Dad's Auto Acces. & Radio Store & The Life & Cas. Ins. Co. (Divides time with WBAW)	5000	201.2	1490	Cent.	WLS	— Chicago, Ill. (Trans. in Crete)—Prairie Farmer (Divides time with WENR-WBCN)	5000	344.6	870	Cent.	WMBJ	— Wilkesburg, Pa.—Rev. John W. Sproul	100	199.9	1500	East.
WLAP	— Louisville, Ky.—American Broadcasting Corp. of Kentucky, 2600 Virginia Ave.	30	249.9	1200	Cent.	WLSI	— Cranston, R. I.—Dutee W. Flint and Lincoln Studios, Inc., 335 Westminster St., Providence (Divides time with WPAW-WDWF)	100	247.8	1210	East.	WMBL	— Lakeland, Fla.—Benford Radio Studios, 121 N. Kentucky Ave.	100	228.9	1310	East.
WLB	— Minneapolis, Minn.—Univ. of Minn. (Divides time with W C A L - K F M X - WRHM)	1000	239.9	1250	Cent.	WLTH	— Brooklyn, N. Y.—Flatbush Radio Labs., 1421 E. 10th St. (Divides time with WCGU-WBBC-WSGH-WSDA)	500	214.2	1400	East.	WMBM	— Memphis, Tenn.—Seventh Day Adventist Church	10	199.9	1500	Cent.
WLBC	— Muncie, Ind.—D. A. Burton, 2224 So. Jefferson St. (Divides time with WJAK)	50	228.9	1310	Cent.	WLW	— Cincinnati, Ohio (Trans. in Harrison)—Crosley Radio Corp.	5000	428.3	700	Cent.	WMBO	— Auburn, N. Y.—Radio Serv. Lab., 17 South St.	100	218.8	1370	East.
						WLWL	— New York, N. Y. (Trans. in Kearney, N. J.)—Paulist Fathers, 415 W. 59th St. (Divides time with WPG)	5000	272.6	1100	East.	WMBQ	— Brooklyn, N. Y.—Paul J. Gollhofer, 95 Leonard St. (Divides time with WCLB-WLBX-WWRL)	100	199.9	1500	East.
						WMAC	— Cazenovia, N. Y.—Clive B. Meredith (Divides time with WSYR)	500	526	570	East.	WMBR	— Tampa, Fla.—F. J. Reynolds	100	247.8	1210	East.
												WMBS	— Harrisburg, Pa. (Trans. in Lemoyne)—Mack's Battery Co. (Divides time with WCAH)	500	209.7	1430	East.

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	
WMC	Memphis, Tenn.—Memphis Coml. Appeal, Inc., Coml. Appeal Bldg.	500	384.4	780	Cent.	WNBW	Carbondale, Pa.—Home Cut Glass & China Co., 21 Salem Ave.	5	249.9	1200	East.	WOO	Philadelphia, Pa.—John Wanamaker (Divides time with WHBW-WALK-WPSW)	100	199.9	1500	East.	
WMCA	New York, N. Y. (Trans. in Hoboken, N. J.)—Asso. Broadcasters, Inc., Hotel McAlpin. (Divides time with WNYC)	500	526	570	East.	WNBX	Springfield, Vt.—First Cong. Church (Divides time with WCAX)	10	249.9	1200	East.	WOOD	Grand Rapids, Mich. (Trans. in Farnwood) Walter B. Stiles, Inc., Hotel Rowe (Divides time with WASH)	500	236.1	1270	Cent.	
WMES	Boston, Mass.—Educational Society, Barristers Hall (Divides time with WLOE)	50	199.9	1500	East.	WNBZ	Saranac Lake, N. Y.—Smith & Mace (Daytime only)	10	232.4	1290	East.	WOQ	Kansas City, Mo.—Unity School of Christianity (Divides time with WDAF)	1000	491.5	610	Cent.	
WMMN	Fairmont, W. Va.—Holt-Howe Nov. Co., Hotel Fairmont (Uses 500 Watts at Night)	250	336.9	890	East.	WNJ	Newark, N. J.—Radio Inv. Co., 89 Lehigh Ave. (Divides time with WBMS - WKBO - WIBS)	250	206.8	1450	East.	WOR	Newark, N. J.—(Trans. in Kearney)—L. Bamberger & Co.	5000	422.3	710	East.	
WMPC	Lapeer, Mich.—First Meth. Protestant Church	30	199.9	1500	East.	WNOX	Knoxville, Tenn.—People's Tel. & Tel. Co., 313 Commerce Ave.	1000	535.4	560	Cent.	WORD	Chicago, Ill. (Trans. in Batavia)—People's Pulpit Assn., 124 Columbia Heights, Bklyn., N. Y. (Divides quarter time with WHT-WIBO-WJAZ)	5000	202.6	1480	Cent.	
WMRJ	Jamaica, N. Y.—Peter J. Prinz, 10 New York Blvd. (Divides time with WLBH-WHPP)	10	211.1	1420	East.	WNRC	Greensboro, N. C.—Wayne M. Nelson	500	208.2	1440	East.	WOS	Jefferson City, Mo.—Missouri State Marketing Bureau (Divides time with KFRU-WGBF) (1000 watts daytime)	500	475.9	630	Cent.	
WMSG	New York, N. Y.—Mad. Sq. Garden Brdcast. Corp., 319 W. 49th St. (Divides time with WBNY - WCDA-WKBQ)	250	222.1	1350	East.	WNYC	New York, N. Y.—Dept. of Plant & Structures, Municipal Bldg. (Divides time with WMCA)	500	526	570	East.	WOV	New York, N. Y. (Trans. in Secaucus, N. J.)—Interl. Brdcast. Corp., 485 Fifth Ave. (Daytime)	1000	265.3	1130	East.	
WMT	Cedar Rapids, Iowa (Trans. in Waterloo)—Waterloo Brdcast. Co., 322 Third Ave. W. (Divides time with KFJB)	100	249.9	1200	Cent.	WOAI	San Antonio, Tex.—So. Equip. Co., 1031 Navarro St. (Divides time with WRR)	5000	252	1190	Cent.	WOW	Omaha, Nebr.—Woodmen of the World Life Ins. Assn. (Divides time with WCAJ)	1000	508.2	590	Cent.	
WNAC	Boston, Mass.—Shepard Norwell Co.	500	243.8	1230	East.	WOAN	Lawrenceburg, Tenn.—Church of the Nazarene & Vaughan School of Music (Divides time with WREC)	500	499.7	600	Cent.	WOWO	Fort Wayne, Ind.—The Main Auto Supply Co., 213 W. Main St. (Divides time with WWVA)	5000	258.5	1160	Cent.	
WNAD	Norman, Okla.—Univ. of Okla. (Divides time with KGGF)	500	296.9	1010	Cent.	WOAX	Trenton, N. J.—Franklyn J. Wolff, The Monument Pottery Co. (Divides time with WCAM-WCAP)	500	234.2	1280	East.	WPAP	Palisade, N. J. (Trans. in Cliffside, N. J.)—Palisades Amusement Park, Studio at 1540 Bway., N. Y. C. (Divides time with WHN-WRNY)	250	296.9	1010	East.	
WNAT	Philadelphia, Pa.—Lennig Bros. Co., Spring Garden & 9th Sts. (Divides time with WFKD-WABY)	100	228.9	1310	East.	WOBT	Union City, Tenn.—Tittsworth's Radio & Music Shop, 114 South First St.	15	228.9	1310	Cent.	WPAW	Pawtucket, R. I.—Shartenberg & Robinson (Divides time with WDFW-WLSI)	100	247.8	1210	East.	
WNAX	Yankton, S. Dak.—Gurney Seed and Nursery Co. and Dakota Radio App. Co. (Divides half time with WIBO-WHA-WPCC)	1000	526	570	Cent.	WOBU	Charleston, W. Va.—Charleston Radio Brdcast. Co., 1026 Quarier St. (Divides time with WSAZ)	250	516.9	580	East.	WPCC	Chicago, Ill.—North Shore Congregational Church (Divides time with WRM-WHA)	500	526	570	Cent.	
WNBF	Binghamton, N. Y.—Howitt-Wood Radio Co., Inc.	50	199.9	1500	East.	WOC	Davenport, Iowa—The Palmer School of Chiropractic, 1002 Brady St. (Divides time with WHO)	5000	299.8	1000	Cent.	WPCH	New York, N. Y. (Trans. in Hoboken, N. J.)—Concourse Radio Corp., Hotel McAlpin, Bway. & 34th St. (Daytime only)	500	370.2	810	East.	
WNBH	New Bedford, Mass.—New Bedford Brdcast. Co., New Bedford Hotel	100	228.9	1310	East.	WOCL	James town, N. Y.—A. E. Newton	25	247.8	1210	East.	WPG	Atlantic City, N. J.—Municipality of Atlantic City (Divides time with WLWL)	5000	272.6	1100	East.	
WNBK	Knoxville, Tenn.—Lonsdale Bapt. Church, 122 W. Conn. Ave.	50	228.9	1310	Cent.	WODA	Paterson, N. J.—James K. O'Dea, Inc., 115 Ellison St. (Divides time with WAAM - WGCP)	1000	239.9	1250	East.	WPOR	Norfolk, Va.—Reliance Elec. Co., 519 W. 21st St. (Divides time with WSEA)	500	384.4	780	East.	
WNBO	Washington, Pa.—John B. Spriggs, So. Main St.	15	249.9	1200	East.	WOI	Ames, Iowa—Iowa State Coll. (Divides time with KFEQ) (Daytime)	3500	535.4	560	Cent.	WPRC	Harrisburg, Pa.—Wilson Printing & Radio Co., Fifth & Kelker Sts. (Divides time with WKJC)	100	249.9	1200	East.	
WNBQ	Rochester, N. Y.—Gordon P. Brown, 192 S. Goodman St.	15	199.9	1500	East.	WOKO	Poughkeepsie, N. Y. (Trans. at Mt. Beacon Summit)—Harold E. Smith, Hotel Windsor (Divides time with WHEC - WABO - WMAC)	500	208.2	1440	East.	WPSC	State College, Pa.—Penna. State Coll. (Daytime only)	500	243.8	1230	East.	
WNBR	Memphis, Tenn.—Popular Radio Shop, 883 Poplar Ave. (Divides time with WGBC)	500	209.7	1430	Cent.	WOL	Washington, D. C.—Amer. Brdcast. Co., Hotel Annapolis (Daytime only)	150	236.1	1270	East.	WPSW	Philadelphia, Pa.—Phila. School of Wireless Tel., 1533 Pine St. (Divides time with WALK-WOO-WPSW)	50	199.9	1500	East.	
						WOMT	Manitowoc, Wis.—Mikadow Thea.	100	247.8	1210	Cent.							

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
WPTF	Raleigh, N. C.—Durham Life Ins. Co., 226½ Fayetteville St.	5000	440.9	680	East.	WRBW	Columbia, S. C.—Paul S. Pearce, 2011 Green St.	100	228.9	1310	East.	WSDA	Brooklyn, N. Y.—Amateur Radio Spec. Co., 77 Cortlandt St., N. Y. (Divides time with WCGU-WLTH)	500	214.2	1400	East.
WQAM	Miami, Fla.—Miami Brdcast. Co., 42 Norwest Fourth St. (Divides time with WIOD)	1000	241.8	1240	East	WRC	Washington, D. C.—Radio Corp. of America,	500	315.6	950	East.	WSEA	Virginia Beach, Va. (Trans. at Portsmouth) — Va. Beach Brdcast. Co., Cavalier Hotel, Main Studio at Norfolk (Divides time with WTAR-WPOR)	500	384.4	780	East.
WQAN	Scranton, Pa.—Scranton Times, Penn Ave. & Spruce St. (Divides time with WGBI)	250	340.7	880	East.	WREC	Memphis, Tenn.—WREC, Inc. (Divides time with WOAN)	500	499.7	600	Cent.	WSGH	Brooklyn, N. Y.—Amateur Radio Spec. Co., 77 Cortlandt St., N. Y. (Divides time with WBBC-WCGU-WLTH)	500	214.2	1400	East.
WQAO	Cliffside, N. J.—Calvary Bapt. Ch., 123 W. 57th St., New York City (Divides time with WHN - WRNY)	250	296.9	1010	East.	WREN	Lawrence, Kan.—Jenny Wren, Inc. (Divides time with KFKU)	1000	245.8	1220	Cent.	WSIS	Sarasota, Fla.—Sarasota Co. Chamber of Commerce	250	296.9	1010	East.
WQBC	Utica, Miss.—Utica Chamber of Com.	300	220.4	1360	Cent.	WRHM	Minneapolis, Minn.—Rosedale Hospital Co., Inc., Andrews Hotel (Divides time with WCAL-KFMX-WLB)	1000	239.9	1250	Cent.	WSIX	Springfield, Tenn.—Six Thirty Eight Tire & Vulc. Co.	100	247.8	1210	Cent.
WQBJ	Clarksburg, W. Va.—John Raikes, Willow Beach Club	65	249.9	1200	East.	WRJN	Racine, Wis.—Racine Brdcast. Corp., Hotel Racine (Divides time with WCLO)	100	249.9	1200	Cent.	WSM	Nashville, Tenn.—The Natl. Life & Acc. Ins. Co., National Bldg.	5000	461.3	650	Cent.
WQBZ	Weirton, W. Va.—J. H. Thompson, 3337 Elm St. (Divides time with WIBR)	60	211.1	1420	East.	WRK	Hamilton, Ohio—S. W. Doron and J. C. Slade, 325-329 North "B"	100	228.9	1310	East.	WSMB	New Orleans, La.—Saenger Amusement Co. and Maison Blanche Co.	500	227.1	1320	Cent.
WRAF	Laport, Ind.—The Radio Club, Inc., 719 Michigan Ave. (Divides time with WWAE)	100	249.9	1200	Cent.	WRNY	New York, N. Y. (Trans. in Coytesville, N. J.)—Experimenter Pub. Co., 230 Fifth Ave. (Divides time with WQAO-WPAP-WHN)	250	296.9	1010	East.	WSMD	Takoma Park, Md. (Trans. in Salisbury)—Tom F. Little	100	228.9	1310	East.
WRAK	Erie, Pa.—C. R. Cummins, 1931 State St.	50	218.8	1370	East.	WRR	Dallas, Tex.—City of Dallas, Police and Fire Signal Dept. (Divides time with WOAI)	5000	252	1190	Cent.	WSMK	Dayton, Ohio—S. M. K. Radio Corp., 39 E. Third St. (Divides time with WKBN)	200	526	570	Ease.
WRAW	Reading, Pa.—Avenue Radio & Elec. Shop, 460 Schuylkill Ave. (Divides time with WGAL)	100	228.9	1310	East.	WRUF	Gainesville, Fla.—Univ. of Florida	5000	204	1470	East	WSPD	Toledo, Ohio—Toledo Brdcast. Co.	500	223.7	1340	East.
WRAX	Philadelphia, Pa.—Berachah Church, Inc., 1608 Allegheny Ave. (Divides time with WABF) (Daytime only)	250	293.9	1020	East	WRVA	Richmond, Va.—Larus & Bro. Co., Inc. 22nd & Cary Sts.	5000	270.1	1110	East.	WSRO	Middletown, Ohio — Middletown Brdcast. Co., Central & Canal Sts. (Divides time with WAAD)	100	211.1	1420	Cent.
WRBC	Valparaiso, Ind.—Immanuel Luth. Church (Daytime)	500	241.8	1240	Cent.	WSAI	Cincinnati, Ohio (Trans. in Mason)—U. S. Playing Card Co., Crosley Radio Corp., Lessee (Limited time)	5000	374.8	800	Cent.	WSSH	Boston, Mass.—Tremont Temple Baptist Church (Divides time with WLEY)	100	211.1	1420	East.
WRBH	Manchester, N. H.—New Hampshire Brdcast. Co., 33 Kimball St.	500			East.	WSAJ	Grove City, Pa.—Grove City College	100	228.9	1310	East.	WSUI	Iowa City, Iowa—State Univ. of Iowa (Divides time with KSAC)	500	516.9	580	Cent.
WRBI	Tifton, Ga.—Kent's Furn. & Music Store (Divides time with WTHS)	20	228.9	1310	Cent.	WSAN	Allentown, Pa.—Allentown Call Pub. Co. (Divides time with WCBA)	250	208.2	1440	East.	WSUN	Clearwater, Fla.—(Trans. in City Hall Park at Causeway)—Clearwater and St. Petersburg Chamber of Commerce (2500 watts daytime)	1000	333.1	900	East.
WRBJ	Hattiesburg, Miss.—Woodruff Furn. Co., 119 W. Pine St.	10	199.9	1500	Cent.	WSAR	Portsmouth, R. I. (Trans. in Fall River, Mass.)—Doughty & Welch Elec. Co., 46 N. Main St.	250	206.8	1450	East.	WSVS	Buffalo, N. Y.—Seneca Voc. School, 666 E. Delavan Ave.	50	218.8	1370	East.
WRBL	Columbus, Ga.—R. E. Martin	50	249.9	1200	Cent.	WSAZ	Huntington, W. Va.—McKellar Elec. Co., 1143 Fourth Ave. (Divides time with WOBU)	250	516.9	580	East.	WSYR	Syracuse, N. Y.—Clive B. Meredith, Hotel Syracuse	250	526	570	East.
WRBQ	Greenville, Miss.—J. Pat Scully	100	247.8	1210	Cent.	WSB	Atlanta, Ga.—The Atlanta Journal	10000	405.2	740	Cent.	WTAD	Quincy, Ill.—Illinois Stock Medicine Brdcast. Corp. (Divides time with WMBD)	500	208.2	1440	Cent.
WRBT	Wilmington, N. C.—Wilmington Radio Assn., 720 North Fourth St.	50	218.8	1370	East.	WSBC	Chicago, Ill.—World Battery Co., 1219 S. Wabash Ave. (Divides time with WEDC-WCRW)	100	247.8	1210	Cent.	WTAG	Worcester, Mass.—Worcester Telegram Pub. Co., 18 Franklin St.	250	516.9	580	East.
WRBU	Gastonia, N. C.—A. J. Kirby Music Co., 221 E. Main St.	100	247.8	1210	East.	WSBT	South Bend, Ind.—South Bend Tribune, 225 W. Colfax Ave. (Divides time with WFBM-WGL)	500	243.8	1230	Cent.						

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WTAM	— Cleveland Ohio—Willard Storage Batt. Co., 1100 Chester Ave. (Divides time with WEAR)	3500	280.2	1070	East.	WTAZ	—Richmond, Va.—Thos. J. McGuire (Divides time with WMBG)	150	247.8	1210	East.	WWAE	—Chicago, Ill. (Trans. in Hammond)—Dr. Geo. F. Courier, 2024 So. Wabash Ave. (Divides time with WRAF)	100	249.9	1200	Cent.
WTAQ	— Township of Washington, Wis.—Gillette Rubber Co. (Divides time with KSCJ)	1000	225.4	1330	Cent.	WTBO	—Cumberland, Md.—Cumberland Elec. Co., 138 Va. Ave.	50	211.1	1420	East.	WWJ	—Detroit, Mich.—Evening News Assoc.	1000	325.9	920	East.
WTAR	—Norfolk, Va.—Reliance Elec. Co., 519 W. 21st St. (Divides time with WSEA)	500	384.4	780	East.	WTFI	—Toccoa Falls, Ga.—Toccoa Falls Inst.	500	206.8	1450	East.	WWL	—New Orleans, La.—Loyola Univ. (Divides time with KWKH)	5000	352.7	850	Cent.
WTAS	—Batavia, Ill.—Illinois Brdcast. Corp.	15000	461.4	720	Cent.	WTHS	—Atlanta, Ga.—Atlanta Technological High School. (Divides time with WRBI)	100	228.9	1310	Cent.	WWNC	—Asheville, N. C.—Asheville Cham. of Com., 101 Patton Ave.	1000	526	570	Cent.
WTAW	— College Station, Tex.—Agricul. & Mech. Coll. of Texas (Divides time with KUT)	500	267.7	1120	Cent.	WTIC	—Hartford, Conn.—Travelers Ins. Co. (Temp. assigned to 600Kc., 250Watts, pending completion of trans.) (Divides time with WCAC)	50000	282.8	1060	East.	WWRL	—Woodside, N. Y.—W. H. Rauman (Divides time with WMBQ-WLBX-WCLB)	100	199.9	1500	East.
WTAX	—Streator, Ill.—Williams Hdwe. Co., 115 So. Vermillion St. (Divides time with WCBS)	50	247.8	1210	Cent.	WTMJ	—Milwaukee, Wis. (Trans. in Brookfield)—Milwaukee Jrnl. (Divides time with WHA)	1000	483.6	620	Cent.	WWVA	—Wheeling, W. Va.—W. Va. Brdcast. Corp., 1229 Main St. (Divides time with WOWO)	5000	258.5	1160	East.

This list has been corrected up to and including February 15th, 1929

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RADIO BROADCAST STATIONS OF THE UNITED STATES

By Wavelengths and Frequencies

Figures in brackets () stand for power of Stations in Watts

199.9 Meters. 1500 Kilocycles

KDB Santa Barbara, Cal. (100)
KGDR San Antonio, Tex. (100)
KGHI Little Rock, Ark. (500)
KGHX Richmond, Tex. (50)
KGKB Brownwood, Tex. (100)
KPJM Prescott, Ariz. (100)
KUJ Longview, Wash. (10)
KWBS Portland, Ore. (15)
KWTC Santa Ana, Cal. (100)
WAFD Detroit, Mich. (100)
WALK Willow Grove, Pa. (50)
WCLB Brooklyn, N. Y. (100)
WHBW Philadelphia, Pa. (100)
WIBZ Montgomery, Ala. (15)
WILM Wilmington, Del. (100)
WKBV Brookville, Ind. (100)
WKBZ Ludington, Mich. (50)
WLBX Long Island City, N. Y. (100)
WLOE Chelsea, Mass. (100)
WMBA Newport, R. I. (100)
WMBJ Wilkinsburg, Pa. (100)
WMBM Memphis, Tenn. (10)
WMBQ Brooklyn, N. Y. (100)
WMES Boston, Mass. (50)
WMPC Lapeer, Mich. (30)
WNBF Binghamton, N. Y. (50)
WNBO Rochester, N. Y. (15)
WOO Philadelphia, Pa. (100)
WPSW Philadelphia, Pa. (50)
WRBJ Hattiesburg, Miss. (10)
WWRL Woodside, N. Y. (100)

201.2 Meters. 1490 Kilocycles

WBAW Nashville, Tenn. (5000)
WLAC Nashville, Tenn. (5000)

202.6 Meters. 1480 Kilocycles

WJAZ Chicago, Ill. (5000)
WHT Chicago, Ill. (5000)
WORD Chicago, Ill. (5000)

204 Meters. 1470 Kilocycles

KFJF Oklahoma City, Okla. (5000)
KGA Spokane, Wash. (5000)
WKBW Buffalo, N. Y. (5000)
WRUF Gainesville, Fla. (5000)

205.4 Meters. 1460 Kilocycles

KSTP St. Paul, Minn. (10000)
WJSV Mt. Vernon Hills, Va. (10000)

206.8 Meters. 1450 Kilocycles

KSBA Shreveport, La. (1000)
WBMS Fort Lee, N. J. (250)
WFJC Akron, Ohio (500)
WIBS Elizabeth, N. J. (250)
WJAY Cleveland, Ohio (500)
WKBO Jersey City, N. J. (250)
WNJ Newark, N. J. (250)
WSAR Portsmouth, R. I. (250)
WTFI Toccoa Falls, Ga. (500)

208.2 Meters. 1440 Kilocycles

KLS Oakland, Cal. (100)
WABF Kingston, Pa. (250)
WABO Rochester, N. Y. (500)
WCBA Allentown, Pa. (250)
WHBC Rochester, N. Y. (500)
WMBD Peoria Heights, Ill. (500)
WNRC Greensboro, N. C. (500)
WOKO Poughkeepsie, N. Y. (500)
WSAN Allentown, Pa. (250)
WTAD Quincy, Ill. (500)

209.7 Meters. 1430 Kilocycles

WBAK Harrisburg, Pa. (500)
WBRL Tilton, N. H. (500)
WCAH Columbus, Ohio (250)
WGBC Memphis, Tenn. (500)
WMBS Harrisburg, Pa. (500)
WNBR Memphis, Tenn. (500)

211.1 Meters. 1420 Kilocycles

KFIF Portland, Ore. (100)
KFIZ Fond du Lac, Wis. (100)
KFOU Holy City, Cal. (100)

KFQW Seattle, Wash. (100)
KFXD Jerome, Ida. (15)
KFXY Flagstaff, Ariz. (100)
KFYO Abilene, Tex. (100)
KGCN Concordia, Kans. (50)
KGCX Vida, Mont. (10)
KGFJ Los Angeles, Cal. (100)
KGFV Ravenna, Nebr. (50)
KGGF Picher, Okla. (100)
KGHD Missoula, Mont. (50)
KGIW Trinidad, Colo. (100)
KGKX Sandpoint, Idaho (15)
KGTT San Francisco, Cal. (50)
KICK Red Oak, Iowa (100)
KKP Seattle, Wash. (15)
KOCW Chickasha, Okla. (100)
KORE Eugene, Ore. (100)
KTAP San Antonio, Tex. (100)
KTUE Houston, Tex. (5)
KXRO Seattle, Wash. (75)
WAAD Cincinnati, Ohio (25)
WEDH Erie, Pa. (30)
WHDL Tupper Lake, N. Y. (10)
WHPP New York, N. Y. (10)
WIAS Ottumwa, Iowa (100)
WIBR Steubenville, Ohio (50)
WIL St. Louis, Mo. (100)
WKBP Battle Creek, Mich. (50)
WLBF Kansas City, Mo. (100)
WLBH Farmingdale, N. Y. (30)
WLEY Lexington, Mass. (100)
WABC Detroit, Mich. (100)
WMBH Joplin, Mo. (100)
WMRJ Jamaica, N. Y. (10)
WQBZ Weirton, W. Va. (60)
WSRO Middletown, Ohio (100)
WSSH Boston, Mass. (100)
WTBO Cumberland, Md. (50)

212.6 Meters. 1410 Kilocycles

KFLV Rockford, Ill. (500)
KGRS Amarillo, Tex. (1000)
WBCM Hampton Tnshp., Mich. (500)
WDAG Amarillo, Tex. (1000)
WHBL Sheboygan, Wis. (500)

214.2 Meters. 1400 Kilocycles

KPWF Westminster, Cal. (50,000)
WBAA West Lafayette, Ind. (500)
WBBC Brooklyn, N. Y. (500)
WCGU Brooklyn, N. Y. (500)
WCMA Culver, Ind. (500)
WKBF Indianapolis, Ind. (500)
WLTH Brooklyn, N. Y. (500)
WSDA Brooklyn, N. Y. (500)
WSGH Brooklyn, N. Y. (500)

215.7 Meters. 1390 Kilocycles

KFPY Spokane, Wash. (500)
KLRA Little Rock, Ark. (500)
KOW Denver, Colo. (500)
KUOA Fayetteville, Ark. (1000)
KWSC Pullman, Wash. (500)
WDGY Minneapolis, Minn. (500)
WHDI Minneapolis, Minn. (500)
WHK Cleveland, Ohio (1000)

217.3 Meters. 1380 Kilocycles

KQV Pittsburgh, Pa. (500)
KSO Clarinda, Iowa (1000)
WCSO Springfield, Ohio (500)
WKBH LaCrosse, Wis. (1000)

218.8 Meters. 1370 Kilocycles

KFBL Everett, Wash. (50)
KFEC Portland, Ore. (100)
KFJI Astoria, Ore. (50)
KFJM Grand Forks, N. Dak. (500)
KFJZ Fort Worth, Tex. (100)
KFLX Galveston, Tex. (100)
KFUR Ogden, Utah (50)
KGAR Tucson, Ariz. (100)
KGBX St. Joseph, Mo. (100)
KGCB Enid, Okla. (100)
KGCI San Antonio, Tex. (100)
KGDA Dell Rapids, S. Dak. (50)

KGER Long Beach, Cal. (100)
KGFG Oklahoma City, Okla. (100)
KGFL Raton, N. Mex. (50)
KGGM Albuquerque, N. Mex. (100)
KGKL San Angelo, Tex. (100)
KGRC San Antonio, Tex. (100)
KOH Reno, Nev. (100)
KOOS Marshfield, Ore. (50)
KRE Berkeley, Cal. (100)
KVL Seattle, Wash. (100)
KWKC Kansas City, Mo. (100)
KZM Oakland, Cal. (100)
WBBL Richmond, Va. (100)
WCBM Baltimore, Md. (100)
WFBJ Collegeville, Minn. (100)
WGL Ft. Wayne, Ind. (100)
WHBD Bellefontaine, Ohio (100)
WHBQ Memphis, Tenn. (100)
WHDF Calumet, Mich. (100)
WIAD Philadelphia, Pa. (100)
WIBM Jackson, Mich. (100)
WJBK Ypsilanti, Mich. (50)
WJBO New Orleans, La. (100)
WMBO Auburn, N. Y. (100)
WRAK Erie, Pa. (50)
WRBT Wilmington, N. C. (50)
WSVS Buffalo, N. Y. (50)

220.4 Meters. 1360 Kilocycles

KFBB Havre, Mont. (250)
KGB San Diego, Cal. (250)
KGIR Butte, Mont. (250)
WGES Chicago, Ill. (500)
WJKS Gary, Ind. (500)
WLEX Boston, Mass. (500)
WMAF South Dartmouth, Mass. (500)
WQBC Utica, Miss. (300)

222.1 Meters. 1350 Kilocycles

KGFL Trinidad, Colo. (50)
KWK St. Louis, Mo. (1000)
WBNY New York, N. Y. (250)
WCDA New York, N. Y. (250)
WKBQ New York, N. Y. (250)
WMSG New York, N. Y. (250)

223.7 Meters. 1340 Kilocycles

KFPW Sulphur Springs, Ark. (50)
KMO Tacoma, Wash. (500)
KVI Des Moines, Wash. (1000)
WSPD Toledo, Ohio (500)

225.4 Meters. 1330 Kilocycles

KSCJ Sioux City, Iowa (1000)
WDRG New Haven, Conn. (500)
WTAQ Tnshp. of Wash. Wis. (1000)

227.1 Meters. 1320 Kilocycles

KGHF Pueblo, Colo. (250)
KGIO Idaho Falls, Ida. (250)
KGIO Twin Falls, Ida. (250)
WADC Akron, Ohio (1000)
WSMB New Orleans, La. (500)

228.9 Meters. 1310 Kilocycles

KFBK Sacramento, Cal. (100)
KFGQ Boone, Iowa (10)
KFJY Fort Dodge, Iowa (100)
KFPL Dublin, Tex. (15)
KFPM Greenville, Tex. (15)
KFUP Denver, Colo. (100)
KFXJ Edgewater, Colo. (50)
KFXR Oklahoma City, Okla. (100)
KGEZ Kalispell, Mont. (100)
KGFI San Angelo, Tex. (100)
KGHG McGehee, Ark. (50)
KMED Medford, Ore. (50)
KOY Phoenix, Ariz. (100)
KRMD Shreveport, La. (50)
KTSL Cedar Grove, La. (50)
KWCR Cedar Rapids, Iowa (100)
WABY Philadelphia, Pa. (50)
WAGM Royal Oak, Mich. (50)
WBMH Detroit, Mich. (100)
WBOW Terre Haute, Ind. (100)
WBRE Wilkes-Barre, Pa. (100)
WCLS Joliet, Ill. (100)
WDAH El Paso, Tex. (100)

WEBR Buffalo, N. Y. (100)
WEHS Evanston, Ill. (100)
WFBG Altoona, Pa. (100)
WFDF Flint, Mich. (100)
WFKD Philadelphia, Pa. (50)
WGAL Lancaster, Pa. (15)
WGH Newport News, Va. (100)
WHBP Johnstown, Pa. (100)
WHFC Chicago, Ill. (100)
WIBU Poyntette, Wis. (100)
WJAK Kokomo, Ind. (50)
WKAV Laconia, N. H. (50)
WKBB Joliet, Ill. (100)
WKBC Birmingham, Ala. (10)
WKBI Chicago, Ill. (50)
WKBS Galesburg, Ill. (100)
WLBC Muncie, Ind. (50)
WLBO Galesburg, Ill. (100)
WMBL Lakeland, Fla. (100)
WNAT Philadelphia, Pa. (100)
WNBH New Bedford, Mass. (100)
WNBK Knoxville, Tenn. (50)
WOBT Union City, Tenn. (15)
WRAW Reading, Pa. (100)
WRBI Tifton, Ga. (20)
WRBW Columbia, S. C. (100)
WRK Hamilton, Ohio (100)
WSAJ Grove City, Pa. (100)
WSMD Takoma Park, Md. (100)
WTHS Atlanta, Ga. (100)

230.6 Meters. 1300 Kilocycles

KFH Wichita, Kans. (500)
KFJR Portland, Ore. (500)
KGEF Los Angeles, Cal. (1000)
KTBI Los Angeles, Cal. (750)
KTBR Portland, Ore. (500)
WBBR Rossville, N. Y. (1000)
WEVD New York, N. Y. (500)
WHAP New York, N. Y. (1000)
WHAZ Troy, N. Y. (500)
WIBW Topeka, Kans. (1000)

232.4 Meters. 1290 Kilocycles

KDYL Salt Lake City, Utah (1000)
KFUL Galveston, Tex. (500)
KLCN Blytheville, Ark. (50)
KTSA San Antonio, Tex. (1000)
WJAS Pittsburgh, Pa. (1000)
WNBZ Saranac Lake, N. Y. (10)

234.2 Meters. 1280 Kilocycles

WCAM Camden, N. J. (500)
WCAP Asbury Park, N. J. (500)
WDAY West Fargo, N. Dak. (1000)
WDOD Chattanooga, Tenn. (1000)
WEBC Superior, Wis. (1000)
WOAX Trenton, N. J. (500)

236.1 Meters. 1270 Kilocycles

KFUM Colorado Springs, Colo. (1000)
KGCA Decorah, Iowa (50)
KOL Seattle, Wash. (1000)
KTW Seattle, Wash. (1000)
KWLC Decorah, Iowa (100)
WASH Grand Rapids, Mich. (250)
WDSU New Orleans, La. (1000)
WEAI Ithaca, N. Y. (500)
WFBR Baltimore, Md. (250)
WOL Washington, D. C. (150)
WOOD Grand Rapids, Mich. (500)

238 Meters. 1260 Kilocycles

KOIL Council Bluffs, Iowa (1000)
KRGV Harlingen, Tex. (500)
KWWG Brownsville, Tex. (500)
WJAX Jacksonville, Fla. (1000)
WLBW Oil City, Pa. (500)

239.9 Meters. 1250 Kilocycles

KEJK Los Angeles, Cal. (500)
KFMX Northfield, Minn. (1000)
KFOX Long Beach, Cal. (1000)
KIDO Boise, Idaho (1000)
KXAL Portland, Ore. (500)
WAAM Newark, N. J. (500)
WCAL Northfield, Minn. (1000)

483.6 Meters. 620 Kilocycles
KFAD Phoenix, Ariz. (500)
KGW Portland, Ore. (1000)
WDAE Tampa, Fla. (1000)
WDBO Orlando, Fla. (1000)
WLBZ Bangor, Me. (250)
WTMJ Milwaukee, Wis. (1000)

491.5 Meters. 610 Kilocycles
KFRC San Francisco, Cal. (1000)
WDAF Kansas City, Mo. (1000)
WFAN Philadelphia, Pa. (500)
WIP Philadelphia, Pa. (500)
WOO Kansas City, Mo. (1000)

499.7 Meters. 600 Kilocycles
KFSD San Diego, Cal. (500)
KWYO Laramie, Wyo. (500)
WCAC Storrs, Conn. (250)

WCAO Baltimore, Md. (250)
WEBW Beloit, Wis. (250)
WOAN Lawrenceburg, Tenn. (500)
WREC Memphis, Tenn. (500)

508.2 Meters. 590 Kilocycles
KHQ Spokane, Wash. (1000)
WCAJ Lincoln, Nebr. (500)
WEEI Boston, Mass. (500)
WEMC Berrien Springs, Mich. (1000)
WOW Omaha, Nebr. (1000)

516.9 Meters. 580 Kilocycles
KGFF Alva, Okla. (500)
KGFX Pierre, S. Dak. (200)
KSAC Manhattan, Kans. (500)
WOBV Charleston, W. Va. (250)
WSAZ Huntington, W. Va. (250)
WSUI Iowa City, Iowa (500)
WTAG Worcester, Mass. (250)

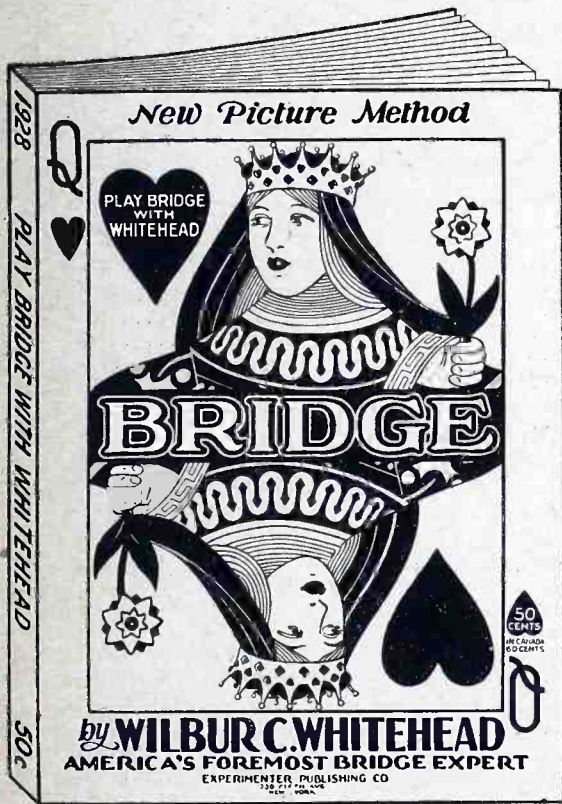
526 Meters. 570 Kilocycles
KGKO Wichita Falls, Tex. (250)
KMTR Hollywood, Cal. (1000)
KPLA Los Angeles, Cal. (1000)
KUOM Missoula, Mont. (500)
KXA Seattle, Wash. (500)
WHA Madison, Wis. (750)
WIBO Chicago, Ill. (5000)
WKBN Youngstown, Ohio (500)
WMAC Cazenovia, N. Y. (500)
WMCA New York, N. Y. (500)
WNAX Yankton, S. Dak. (1000)
WNYC New York, N. Y. (500)
WPCC Chicago, Ill. (500)
WSMK Dayton, Ohio (200)
WSYR Syracuse, N. Y. (250)
WWNC Asheville, N. C. (1000)

535.4 Meters. 560 Kilocycles
KFDM Beaumont, Tex. (500)

KFEQ St. Joseph, Mo. (2500)
KLZ Denver, Colo. (1000)
KOAC Corvallis, Ore. (1000)
WFI Philadelphia, Pa. (500)
WLIT Philadelphia, Pa. (500)
WMBF Miami Beach, Fla. (500)
WNOX Knoxville, Tenn. (1000)
WOI Ames, Iowa (3500)

545.1 Meters. 550 Kilocycles
KFDY Brookings, S. Dak. (500)
KFUO St. Louis, Mo. (500)
KFYR Bismarck, N. Dak. (500)
KSD St. Louis, Mo. (500)
KTAB Oakland, Cal. (500)
WEAN Providence, R. I. (500)
WEAO Columbus, Ohio (750)
WGR Buffalo, N. Y. (750)
WKRC Cincinnati, Ohio (500)

This list has been corrected up to and including February 15, 1929



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Canadian Radio Broadcast Stations

Indexed Alphabetically by Call Letters

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
CFAC	—Calgary, Alberta—The Calgary Herald, Herald Bldg.	500	434.5	690	Mt.	CHGS	—Summerside, P. E. Island—R. T. Holman, Ltd., Holman Bldg.	25	267.7	1120	Atl.	CJRM	—Moose Jaw, Sask.—Jas. Richardson & Sons, Ltd., 337 Co-teau St., W.	500	499.7	600	Mt.
CFBO	—St. John, N. B.—C. A. Munro, Ltd., Imperial Theatre, King Square	50	336.9	890	Atl.	CHLS	—Vancouver, B. C.—W. G. Hassell (Uses Station CKCD)	50	410.7	730	Pac.	CJRW	—Fleming, Sask.—Jas. Richardson & Sons, Ltd.	500	499.7	600	Cent.
CFCA	—Toronto, Ont.—Star Pub. & Prtg. Co., S. W. Cor. Yonge St. and St. Clair Ave.	500	356.9	840	East.	CHMA	—Edmonton, Alberta—Christian and Missionary Alliance, 9618—106A Ave.	250	516.9	580	Mt.	CJRX	—Winnipeg, Man.—Jas. Richardson & Sons, Ltd., Grain Exchange Bldg.	2000	25.6	11720	Cent.
CFCF	—Montreal, Que.—Canadian Marconi Co., Mt. Royal Hotel	1650	291.1	1030	East.	CHML	—Mt. Hamilton, Ont.—Maple Leaf Radio Co., Ltd., Yale Ave.	50	340.7	880	East.	CJSC	—Toronto, Ont.—The Evening Telegram. (Uses Station CKCL.)	500	516.9	580	East.
CFCH	—Iroquois Falls, Ont.—Abitibi Power & Paper Co., Ltd.	250	499.7	600	East.	CHNC	—Toronto, Ont.—Toronto Radio Research Society, Hillcrest Park (Uses Station CKNC)	500	516.9	580	East.	CKAC	—Montreal, Que.—La Presse Pub. Co., Ltd., Cor. St. James St. and St. Lawrence Blvd.	1200	410.7	730	East.
CFCN	—Calgary, Alberta—W. W. Grant (Ltd.), 708 Crescent Rd., N. W.	1800	434.5	690	Mt.	CHNS	—Halifax, Nova Scotia—Halifax Herald, Ltd., Lord Nelson Hotel	500	322.4	930	Atl.	CKCD	—Vancouver, B. C.—Vancouver Daily Province, 142 Hastings St., W.	50	410.7	730	Pac.
CFCO	—Chatham, Ont.—Western Ontario "Better Radio" Club, 49 Park Ave. E.	25	247.8	1210	East.	CHRC	—Quebec, Que.—E. Fontaine, 46 Palace Hill	25	499.7	600	East.	CKCI	—Quebec, Que.—Le "Soleil", Ltd., 46 Palace Hill.	22½	499.7	600	East.
CFCT	—Victoria, B. C.—Victoria Broadcasting Assoc., 1405 Douglas St.	500	475.9	630	Pac.	CHWC	—Pilot Butte, Sask.—R. H. Williams & Sons, Ltd., Section 2, Township 18, Range 18	500	312.3	960	Mt.	CKCK	—Regina, Sask.—Leader Pub. Co., Ltd.	500	312.3	960	Mt.
CFCY	—Charlottetown, P. E. Island—Island Radio Company, 143 St. George St.	100	312.3	960	Atl.	CHWK	—Chilliwack, B. C.—Chilliwack Broadcasting Co., Ltd., Wellington Ave.	5	247.8	1210	Pac.	CKCL	—Toronto, Ont.—Dominion Battery Co., Ltd., 20 Trinity St. (Call signal CFCL used during Sunday broadcasts only.)	500	516.9	580	East.
CFJC	—Kamloops, B. C.—N. S. Dalgleish & Sons and Weller & Weller, 186 Victoria St.	15	267.7	1120	Pac.	CJBC	—Toronto, Ont.—Jarvis Street Baptist Church. (Uses one of the stations in Toronto City or District)	500 1000 5000	516.9 356.9 312.3	580 840 960	East.	CKCO	—Ottawa, Ont.—Dr. G. M. Geldert (for Ottawa Radio Assoc.), 282 Somerset St., W.	100	434.5	690	East.
CFLC	—Prescott, Ont.—Radio Association of Prescott, Victoria Hall	50	296.9	1010	East.	CJBR	—Regina, Sask.—Saskatchewan Co-Operative Wheat Producers, Ltd. (Uses Station CKCK.)	500	312.3	960	Mt.	CKCR	—Brantford, Ont.—John Patterson, Arcade Bldg.	50	296.9	1010	East.
CFNB	—Fredericton, N. B.—James S. Neill & Sons, Ltd., 212 Waterloo Row	50	247.8	1210	Atl.	CJCA	—Edmonton, Alberta—The Edmonton Journal, Ltd., N. W. Cor. of Section 5, Township 54, Range 23.	500	516.9	580	Mt.	CKCV	—Quebec, Que.—G. A. Vandry, 66 St. Joseph St.	50	499.7	600	East.
CFOC	—Saskatoon, Sask.—The Electric Shop, Ltd., 1322 Osler St.	500	329.5	910	Mt.	CJCB	—Sydney, Nova Scotia—N. Nathanson.	50	384.4	780	Atl.	CKFC	—Vancouver, B. C.—United Church of Canada, Cor. Thurlow and Pendrell Sts.	50	410.7	730	Pac.
CFRB	—York Co., Ont.—Standard Radio Mfg. Corp., Ltd., Township of King	1000	312.3	960	East.	CJCJ	—Calgary, Alberta—The Albertan Pub. Co., Ltd., 18th Ave. and 7th St., E.	250	434.5	690	Mt.	CKGW	—Bowmanville, Ont.—Gooderham & Worts, Ltd.	5000	312.3	960	East.
CFRC	—Kingston, Ont.—Queen's Univ., Dept. of Electrical Engineering, Fleming Hall	500	267.7	1120	East.	CJGC	—London, Ont.—London Free Press Ptg. Co., Ltd., Hotel London.	500	329.5	910	East.	CKLC	—Red Deer, Alberta—Alberta Pacific Grain Co., Ltd.	1000	356.9	840	Mt.
CHCA	—Calgary, Alberta—The Western Farmer (Uses Station CJCJ)	250	434.5	690	Mt.	CJGX	—Yorkton, Sask.—The Winnipeg Grain Exchange.	500	475.9	630	Mt.	CKMC	—Cobalt (East Side), Ont.—R. L. MacAdam.	15	247.8	1210	East.
CHCK	—Charlottetown, P. E. Island—W. E. Burke, 36 Upper Hillsboro St.	30	312.3	960	Atl.	CJHS	—Saskatoon, Sask.—Radio Service, Ltd., 238—1st Ave. S.	250	329.5	910	Mt.	CKMO	—Vancouver, B. C.—Sprott-Shaw Radio Co., Bekins Bldg.	50	410.7	730	Pac.
CHCS	—Hamilton, Ont.—The Hamilton Spectator, Spectator Bldg.	10	340.7	880	East.	CJOC	—Lethbridge, Alberta—J. E. Palmer, 1235—5th Ave. A, South.	50	267.7	1120	Mt.	CKNC	—Toronto, Ont.—Canadian National Carbon Co., Ltd., Hillcrest Park.	500	516.9	580	East.
CHCT	—Red Deer, Alberta—G. F. Tull & Ardern, Ltd. (Uses Station CKLC)	1000	356.9	840	Mt.	CJOR	—Sea Island, B. C.—Geo. C. Chandler, Block 20.	50	291.1	1030	Pac.	CKOC	—Hamilton, Ont.—Wentworth Radio and Auto Supply Co., Ltd., Royal Connaught Hotel.	100	340.7	880	East.

Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station	Radio Call Stations	Broadcast Stations, Location and Owner	Power	Wave length	Kilocycles	Time at Station
CKOW	Toronto, Ont.—Nestle's Food Co. of Canada. (Uses Station CFCA.)	500	356.9	840	East.	CKY	Winnipeg, Man.—Manitoba Telephone System, Provincial Agricultural College Grds.	5000	384.4	780	Cent.	CNRQ	Quebec, Que.—Canadian National Railways. (Uses Station CKCV.)	50	499.7	600	East.
CKPC	Preston, Ont.—Wallace Russ, 40 Russ Ave.	25	247.8	1210	East	CNRA	Moncton, B. B.—Canadian National Railways.	500	475.9	630	Atl.	CNRR	Regina, Sask.—Canadian National Railways. (Uses Station CKCK.)	500	312.3	960	Mt.
CKPR	Midland, Ont.—E. O. Swan.	50	267.7	1120	East.	CNRC	Calgary, Alberta—Canadian National Railways. (Uses Station CFAC.)	500	434.5	690	Mt.	CNRS	Saskatoon, Sask.—Canadian National Railways. (Uses Station CFQC.)	500	329.5	910	Mt.
CKSH	St. Hyacinthe, Que.—City of St. Hyacinthe, Que., Mondor and Cascades St.	50	296.9	1010	East.	CNRE	Edmonton, Alberta—Canadian National Railways. (Uses Station CJCA.)	500	516.9	580	Mt.	CNRT	Toronto, Ont.—Canadian National Railways. (Uses Station CFCA.)	500	356.9	840	East.
CKUA	Edmonton, Alberta—University of Alberta.	500	516.9	580	Mt.	CNRM	Montreal, Que.—Canadian National Railways. (Uses Stations CHYC, CKAC or CFCF.)	1000-1650	410.7	730	East.	CNRV	Vancouver, B. C.—Transmitter is on Lulu Island—Canadian National Railways.	500	291.1	1030	Pac.
CKWX	Vancouver, B. C.—A. Holstead & W. Hanlon, 1220 Seymour St.	100	410.7	730	Pac.	CNRO	Ottawa, Ont.—Canadian National Railways, Jackson Bldg.	500	434.5	690	East.	CNRW	Winnipeg, Man.—Canadian National Railways. (Uses Station CKY.)	500	384.4	780	Cent.
CKX	Brandon, Man.—Manitoba Telephone System, 8th St.	500	555.6	540	Cent.												

Canadian Radio Broadcast Stations

By Provinces and Cities

Province and City	Call Letters	Wave Length	Province and City	Call Letters	Wave Length	Province and City	Call Letters	Wave Length	Province and City	Call Letters	Wave Length
ALBERTA			Vancouver.....	CNRV	291.1	Hamilton.....	CKOC	340.7	Summerside.....	CHGS	267.7
Calgary.....	CFAC	434.5	Victoria.....	CFCT	475.9	Iroquois Falls.....	CFCH	499.7			
Calgary.....	CFCN	434.5				Kingston.....	CFRC	267.7	QUEBEC		
Calgary.....	CHCA	434.5	MANITOBA			London.....	CJGC	329.5	Montreal.....	CFCF	291.1
Calgary.....	CJCJ	434.5	Brandon.....	CKX	555.6	Midland.....	CKPR	267.7	Montreal.....	CKAC	410.7
Calgary.....	CNRC	434.5	Winnipeg.....	CJRX	25.6	Mt. Hamilton.....	CHML	340.7	Montreal.....	CNRM	410.7
Edmonton.....	CHMA	516.9	Winnipeg.....	CKY	384.4	Ottawa.....	CKCO	434.5	Quebec.....	CHRC	499.7
Edmonton.....	CJCA	516.9	Winnipeg.....	CNRW	384.4	Ottawa.....	CNRO	434.5	Quebec.....	CKCI	499.7
Edmonton.....	CKUA	516.9				Prescott.....	CFLC	296.9	Quebec.....	CKCV	499.7
Edmonton.....	CNRE	516.9	NEW BRUNSWICK			Preston.....	CKPC	247.8	Quebec.....	CNRQ	499.7
Lethbridge.....	CJOC	267.7	Fredericton.....	CFNB	247.8	Toronto.....	CFCA	356.9	St. Hyacinthe.....	CKSH	296.9
Red Deer.....	CHCT	356.9	Moncton.....	CNRA	475.9	Toronto.....	CHNC	516.9			
Red Deer.....	CKLC	356.9	St. John.....	CFBO	336.9	Toronto.....	CJBC	516.9	SASKATCHEWAN		
						Toronto.....	CJSC	516.9	Fleming.....	CJRW	499.7
BRITISH COLUMBIA			NOVA SCOTIA			Toronto.....	CKCL	516.9	Moose Jaw.....	CJRM	499.7
Chilliwack.....	CHWK	247.8	Halifax.....	CHNS	322.4	Toronto.....	CKNC	516.9	Pilot Butte.....	CHWC	312.3
Kamloops.....	CFJC	267.7	Sydney.....	CJCB	384.4	Toronto.....	CKOW	356.9	Regina.....	CJBR	312.3
Sea Island.....	CJOR	291.1				Toronto.....	CNRT	356.9	Regina.....	CKCK	312.3
Vancouver.....	CHLS	410.7	ONTARIO			Toronto.....	CFRB	312.3	Regina.....	CNRR	312.3
Vancouver.....	CKCD	410.7	Bowmanville.....	CKGW	312.3	York Co.....			Saskatoon.....	CFQC	329.5
Vancouver.....	CKFC	410.7	Brantford.....	CKCR	296.9				Saskatoon.....	CJHS	329.5
Vancouver.....	CKMO	410.7	Chatham.....	CFCO	247.8	P. E. ISLAND			Saskatoon.....	CNRS	329.5
Vancouver.....	CKWX	410.7	Cobalt.....	CKMC	247.8	Charlottetown.....	CFGY	312.3	Yorkton.....	CJGX	475.9
			Hamilton.....	CHCS	340.7	Charlottetown.....	CHCK	312.3			

Licenses Required for Both Transmitters and Receivers in Canada

All radio stations, whether used for transmitting or receiving purposes are required to be licensed in Canada. The penalty on summary conviction for operating an unlicensed radio station is a fine not exceeding \$50.00, and on conviction or indictment a fine not exceeding \$500.00 with imprisonment for a term not exceeding 12 months, in addition to forfeiture of all unlicensed apparatus. The different classes of stations for which licenses are issued and their license fees vary from \$1.00 for a private receiving set to \$50.00 for a public commercial station.

The issue of licenses for transmitting stations is limited to British subjects or to companies incorporated under the laws of the Dominion of Canada or its provinces. Licenses for private receiving sets are issued to any person irrespective of nationality. Licenses for receiving sets are obtained from the Postmaster of the larger towns and cities in the Dominion, radio dealers, Royal Canadian Mounted Police, Department of Radio Inspectors, Departmental Agencies or from the Department of Marine and Fisheries. Licenses for all other classes of stations are obtained from the Department of Marine and Fisheries at Ottawa.

Foreign Radio Broadcast Stations

Including U. S. Possessions

(On January 13th, 1929, all wavelengths in Europe were changed.)

Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)	Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)
ALASKA				Sydney—Trades Hall Broadcasting Station			
Anchorage—Anchorage Radio Club	KFQD	243.8	100	.....	2KY	280	1500
Juneau—Alaska Elec. Light & Power Co.	KFIU	228.9	10	Sydney—Farmer & Co., Ltd.	2FC	442	5000
Ketchikan—Alaska Radio & Service Co.	KGBU	333.1	500	Sydney	2WA	462	100
ALGERIA				Sydney—Broadcasters Sydney Ltd.	2BL	358	5000
Algiers—Colin & Fils	8DB	310	2000	Sydney—Otto Sandel	2UW	267	500
ARGENTINE				Toowomba—Gold Radio Elec. Service	4GR	294	100
Buenos Aires	LOJ	270	1000	Wagga—Otto Sandel	2UX	300	500
Buenos Aires—Radio America	LOL	236	2000	AUSTRIA			
Buenos Aires—Radio Fenix	LON	210	5000	Graz—Oesterreichische Radio-verkehrs Gesellschaft		354.2	500
Buenos Aires—Radio Prieto	LOO	252	1000	Innsbruck		283	500
Buenos Aires—Radio Buenos Aires	LOQ	261	500	Klagenfurt		219	1500
Buenos Aires—Sociedad Radio Argentina	LOR	344.8	1000	Linz			250
Buenos Aires—Municipality of Buenos Aires	LOS	291.2	5000	Vienna—Oesterreichische Radio-verkehrs Gesellschaft	ORV	577	750
Buenos Aires—Radio Broadcasting	LOT	400	1000	Vienna		519.9	20000
Buenos Aires—Francisco J. Brusa	LOV	361.5	1000	BELGIUM			
Buenos Aires—Grand Splendid	LOW	303	1000	Brussels—Radio Belgique Co.	BAV	511.9	1500
Buenos Aires—Radio Cultura	LOX	380	1000	Brussels—Radio Belgique Co.	SBR	329.7	1500
Buenos Aires—Sociedad Radio Nacional	LOY	315.8	1000	BOLIVIA			
Buenos Aires—"La Nacion"	LOZ	330	1000	La Paz		175-300	50
Buenos Aires—Gino Bocci y Hno.	B2	275	100	La Paz		300	50
Buenos Aires	D3	253.3	100	BRAZIL			
Cordoba—Antonio Vanelli	H5	275	100	Bahia—Radio Sociedade de Bahia	SQAD	350	50
Cordoba—Diario "Los Principios"	H6	250	20	Bello Horizonte—Radio Sociedade de Mina Geraes		400	500
La Plata, FCS.—Universidad Nacional	LOP	425	1000	Ceare—Radio Club Cearense			50
Mendoza—Ministerio de Obras Publicas	LOU	380	500	Curytiba—Livio Moreira			
Rosario—Manuel Fugardo	F2	270	100	Fortazela—Radio Club			300
Santa Fe—Jose Roca Soler	F1	279	20	Goyanna—Benedicto Ravello			
AUSTRALIA				Juiz de Fora	SQAY	380	200
Adelaide—Central Broadcasters Ltd.	5CL	395	5000	Matto Grosso—Radio Club de Campo Grande			
Adelaide—5 DN Pty. Ltd.	5DN	313	500	Minas Geraes—Luiz de Fora			100
Adelaide—Sports Radio Broadcasting Station	5KA	250	1000	Para—Radio Club de Para			100
Adelaide—Millswood Auto & Radio Co.	5MA			Parana		370	300
Adelaide—Marshall & Co.	5MC	273	500	Parahyba—Radio Sociedade de Parahyba			
Bathurst—Mockler Bros.	2MK	275	250	Pelotas—Radio Sociedade Pelotense			
Brighton	3PB			Penedo—A. G. Oliveira			
Brisbane—Dr. V. McDowell	4CM	278	250	Pernambuco—Radio Club de Pernambuco		310	1000
Brisbane—Radio Manufacturers Ltd.	4MB	337	250	Pernambuco—Cia Radiotelegrafica Brasileira		250-380	500
Brisbane—Queensland Radio Service	4QG	385	5000	Pernambuco—Radio Sociedade de Jader de Andrada			
Hobart—Tasmanian Broadcasting Pty.	7ZL	516	3000	Pernambuco—Radio Sociedade de Garanhuns			
Melbourne—Associated Radio Co.	3AR	481	3000	Petropolis—Radio Club de Petropolis			
Melbourne—Druleigh Business & Technical College	3DB	225	500	Porto Alegre—Radio Sociedade Riograndense	RSR	381	80
Melbourne—Broadcasting Co. Australia	3LO	371	5000	Praia Vermelha—Radio Club do Brasil	SQIB	320	500
Melbourne—O. J. Nilson & Co.	3UZ	319	100	Rio de Janeiro—Radio Sociedade de Rio de Janeiro	SQAA	400	2000
Melbourne—L. J. Hellier	3WR	303	100	Rio de Janeiro	SQAB	320	500
Mildura—R. J. Egge	3EO	286	100	Rio de Janeiro	SQAJ	260	250
Newcastle—H. A. Douglas	2HD	288	100	Sao Paulo	SQAG	365	1000
Northbridge—Otto Sandel	2UW	263	500	Sao Paulo	SQBO	225.4	1000
Perth—Westralian Farmers, Ltd.	6WF	1250	3000	Sorocaba		425	....
Rockhampton—Queensland Gov't.	4RN	323	500				
Sydney—The Electrical Utilities Supply Co.	2UE	293	250				
Sydney—Burgin Electric Co.	2BE	316	100				
Sydney—Theosophical Broadcasting Service	2GB	316	3000				

Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)	Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)
CANARY ISLANDS				Havana—Julio Power			
La Laguna —Servando Ortoll Delmotte	EAJ5	280	50	Havana —Frederick W. Borton	2CX	320	10
Las Palmas —Canary Islands Radio Club		300	6	Havana —Alberto S. Bustamante	2AB	250	10
Teneriffe —Servando Ortoll Delmotte	EAR5	350	200	Havana —Cuban Telephone Co.	PWX	400	500
CEYLON				Havana —Jose Leiro	2JL	275	5
Colombo		800	1500	Havana —Alvara Daza	2K	200	20
CHILE				Havana —E. Sanchez de Fuentes	2KD	350	50
Antofagasta —Sr. J. Pedreny	CHAO			Havana —"El Pais"	2EP	355	400
Concepcion	CMAI	345	1500	Havana —Bernardo Barrie	2BB	250	15
Santiago —"El Mercurio"	CMAC	360	1200	Havana —Frederick W. Borton	2BY	260	100
Santiago —Castagneto Felli	CMAD	320	1000	Havana —Jose Lara	2LR	215	15
Santiago —Radio Comercial	CMAE	280	100	Havana —Manuel y Guillermo Salas	2MG	284	15
Santiago —Sociedad Broadcasting de Chile	CRC	385	350	Havana —R. B. Waters	2MK	32	100
Tacna —Ministerio de Relaciones Exteriores	CMAT	550	200	Havana —Mario Garcia Velez	2OK	360	100
Tacna —Chilean Government	CRCT	550	200	Havana —Oscar Collado	2OL	257	100
Temuco	CMAK	245	100	Havana —Roberto E. Ramirez	2TW	270	30
Valparaiso		400	50	Havana —Benito Veita Ferro	2UF	265	20
CHINA				Havana —Raul Karman	2RK	315	100
Hong Kong —Government	GOW	300	1500	Havana —Homero Sanchez	2SZ	180	10
Kharbin —Chinese Government	COHB	340	50	Havana —Miguel Troncoso	2WX	340	150
Mukden	COMK	425	2000	Havana —Lecuona Music Co.	2XA	230	200
Peking —Chinese Government	COPK			Havana —Raul Perez Falcon	2JD	105	20
Shanghai —Kellogg Switchboard & Supply Co.	KRC	335	150	Havana —Heraldo de Cuba	2HC	275	500
Shanghai —Shinsho Co.	NKS	318	50	Hershey —Alberto Alvarez	2FG	200	20
Tientsin —Gisho Electric Co.	GEC	288	50	Marianao —Jose L. Ferriol	2JF	245	5
Tientsin —Chinese Government	COTN	480	500	Marianao —Jose Leiro	2JL	294	5
Victoria (Hongkong) —Hongkong Radio Society	5HK	475	150	Marianao —Modesto Alvarez	2MA	215	50
CHOSEN				Marianao —Samuel I. Wheelon	2WD	274	7½
Seoul	JODK	345	1000	Mariano —Antonio A. Genard	2XX	225	5
COSTA RICA				Nueva Gerona —Isle of Pines Telephone Co.	8JQ	130	20
San Jose —Government				Sagua la Grande —Santiago Ventura	6HS	200	10
CUBA				Sancti Spiritus —Antonio Galguera	6KP	250	20
Caibarien —Maria J. Alvarez	6EV	250	50	Santiago —Alfredo Vinnet	8FU	225	15
Caibarien —Manuel A. Alvarez	6LO	325	250	Santiago —Pedro C. Anduz	8DW	275	50
Camaguey —Pedro Noguera	7AZ	225	10	Santiago —Alfredo Broock Galo	8AZ	240	50
Camaguey —Armanda Vaquer	7GT	195	5	Santiago —Ceferino Ramos	8IR	190	20
Camaguey —Melchor Aguero	7KP	300	15	Santiago —Alberto Ravelo	8BY	250	20
Camajuani —Diego Iborra	6YR	200	20	Santiago —Guillermo Polanco	8HS	200	30
Caney —Juan Fdez. de Castro	8KP	30	100	CZECHOSLOVAKIA			
Caney	8LO	300	100	Bratislava	OKR	254.2	500
Central Elia —Salvador Rionda	7SR	350	500	Brunn —Radio Journal	OKB	432.3	3000
Central Tuinucu —Frank H. Jones	6KW	368	100	Kbely		1100	1000
Central Tuinucu —Frank H. Jones	6JK	272	100	Koszice (Kaschau)		277.8	5000
Ciego de Avila —Eduardo V. Figueroa	7BY	235	20	Prague —Radio Journal	OKP	343.2	5000
Ciego de Avila —Feliciano Isaac	7FU	200	15	DANZIG			
Ciego de Avila —Porfirio de la Cruz	7HS	192	15	Danzig		272.7	750
Florida —Leonard B. Fox	7JQ	42	5	DENMARK			
Cienfuegos —Jose Ganduxe	6BY	260	200	Copenhagen —Copenhagen Radio Broadcasting Station		339.8	1000
Cienfuegos —Eduardo Terry	6DW	225	10	Kalundborg		1153.8	7500
Cienfuegos —Gustavo Rodriguez	6GR	150	10	Ryvang		1150	1000
Cienfuegos —Juan Pablo Ros	6GT	190	50	Soro —Ministry of War		1153.8	1500
Colon —Leopoldo V. Figueroa	5EV	360	100	EGYPT			
Guanajay —Antonio Zarazola	1AZ	275	30	Cairo	SRE	255	
Havana —Ulpiano Muniz	2MU	265	10	ESTONIA			
Havana —Casimiro Pujadas	2CP	280	10	Tallinn		408	2200
Havana —Cristina W. Vda. de Crucet	2HP	205	200	Tallinn		1200	100
				FINLAND			
				Bjorneborg —Nuoren Voiman Liiton Radiohydists		311	200
				Hango —Nuoren Voiman Liiton Radiohydists		260	250

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FINLAND				Danzig 272.7			
Helsingfors—Civil Guards of Finland		375	1200	Dortmund—Westdeutsche Funkstunde		283	750
Jacobstad		275.2	200	Dresden—Mitteldeutscher Rundfunk		387.1	700
Jyväskylä—Nuoren Voiman Liiton Radiohydists		297	250	Elberfeld—Westdeutsche Funkstunde		468.8	750
Lahti		1522	20000	Flensburg		219	
Mikkeli—Nuoren Voiman Liiton Radiohydists		566	250	Frankfort-on-the-Main — Sudwestdeutscher Rundfunkdienst	LP	421.3	4000
Pori—Nuoren Voiman Liiton Radiohydists		255.3	100	Freiburg im Breisgau—Suddeutscher Rundfunk		577	750
Skatudden—Military Station Radio-Div.		318	750	Gleiwitz—Schlesische Funkstunde		326.4	750
St. Michel—Nuoren Voiman Liiton Radiohydists		566	250	Hamburg—Nordischer Rundfunk	HA	391.6	4000
Tammerfors—Nuoren Voiman Liiton Radiohydists	3NB	400	250	Hanover—Nordischer Rundfunk		566	750
Tampere		373	250	Kassel—Sudwestdeutscher Rundfunk		250	750
Uleaborg		250	250	Kiel—Nordischer Rundfunk		250	750
Viborg		285.7	750	Koenigsberg—Ostmarken Rundfunk		280.4	4000
FRANCE				Langenberg	LA	462.2	25000
Agen—Dept. of Lot et Garonne	2BD	305.5	250	Leipzig—Mitteldeutscher Rundfunk	MR	361.9	4000
Angers—Radio Anjou		275.2	500	Munich—Deutsche Stunde in Bayern		536.7	4000
Beziers		211.3	500	Muenster—Westdeutsche Funkstunde	MS	265.5	1500
Biarritz—Cote d'Argent		200	250	Norddeich	KAV	1829	
Bordeaux		275	1000	Nuremberg—Deutsche Stunde in Bayern		240	4000
Bordeaux		238.1	1500	Stettin—Funkstunde A. G.		236.2	500
Dijon		207.5	1000	Stuttgart—Suddeutscher Rundfunk	OKP	374.1	4000
Grenoble—Ministry of P. T. T.		588.2	1500	HAITI			
Issy-les-Moulineaux—Ministry of War	QGA	1800	500	Port-au-Prince—Haitien Government	HHK	361.2	1000
Juan-les-Pins		252.1	500	HAWAII			
Lille		252.1	500	Honolulu—Radio Sales Co.	KGHB	227.1	250
Limoges		273	500	Honolulu—Honolulu Advertiser	KGU	319	500
Lyon—Ministry of P. T. T.	YN	468.8	1000	HUNGARY			
Lyon—Radio Lyon		291.3	1500	Budapest—Hungarian States' Post and Telegraph	MTI	554.5	20000
Marseilles—Ministry of P. T. T.		309	500	Budapest—Magyar Tavorati Iroda		1050	2000
Mont-de-Marsan—Radio Club Landrais		230.8	4000	ICELAND			
Montpellier—Societe Languedocienne de T. S. F.		236.2	250	Reykjavik		333.3	1000
Paris—Ecole Superieure de P. T. T.	FPTT	449.8	500	INDIA			
Paris—Eiffel Tower, Army	FL	1480	5000	Bangalore—Indian Broadcasting Co.			
Paris—Societe Francaise Radioelectrique	8AJ	1780	100	Bombay—Walter Rogers & Co.	2AX	226	
Paris—Lucien Levy		350	250	Bombay	7BY	357.1	3000
Paris—Petit Parisien	5NG	336.3	500	Bombay—Bombay Residency Radio Club	2FV	375	220
Paris—Cie. Francaise de Radiophone		1750	6000	Calcutta—Radio Club of Bengal	2BZ	800	500
Paris—Radio Paris	CFR	1744	12000	Calcutta—Indian States & Eastern Agency	5AF	425	1500
Paris—Radio Vitus		308	1000	Calcutta	7CA	370.4	3000
Pic du Midi		350		Karachi—Karachi Radio Club		425	40
Reims		204.1	500	Madras—Crampton Elec. Co.		220	120
Reziars		178	500	Madras—Madras Presidency Club	2GR	400	200
St. Etienne—Radio Club Forezien		220	50	Rangoon—Radio Club of Burmah	2HZ	350	350
Strasbourg—Military Station Radio Club	8GF	222.2	250	IRISH FREE STATE			
Toulouse—Aerodrome	MRD	260	1000	Cork	6CK	222.2	1500
Toulouse—La Radio		382.7	3000	Dublin—Government	2RN	411	1500
GERMANY				ITALY			
Aix-la-Chapelle		455.9	750	Milan		504.2	7000
Augsburg		566	1500	Milan—Unione Radiofonica Italiana	IMI	387.1	1500
Berlin—Koenigswusterhausen Deutsche Welle A. G.	AFP	1648	8000	Naples—Unione Radiofonica Italiana	INA	333	1500
Berlin—Koenigswusterhausen Station	AFT	1250	35000	Rome—Unione Radiofonica Italiana	IRO	443.8	3000
Berlin—Vox Haus Funkstunde	AB	566	2000	Trieste		256.4	
Berlin—Witzleben Funkstunde A. G.		475.4	4000	Turin		275.2	
Berlin—Wolf's Bureau		2525	5000	JAPAN			
Bremen—Nordischer Rundfunk	BMN	387.1	1500	Hiroshima—Broadcasting Corp. of Japan	JOFK	353	10000
Breslau—Schlessische Funkstunde		321.2	5000	Keijo—Keijo Broadcasting Association	JODK	366	1000
Cologne	SMXQ	263.2	4000				

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JAPAN				NEW ZEALAND			
Kumamoto—Broadcasting Corp. of Japan.....	JOGK	380	10000	Auckland—Newcomb (Ltd.).....	1YL	260	500
Nagoya—Broadcasting Corp. of Japan..	JOCK	370	1000	Auckland—The Radio Broadcasting Co. of New Zealand.....	1YA	333	500
Osaka—Broadcasting Corp. of Japan...	JOBK	385-400	10000	Auckland—La Gloria Gramophone Co..	1YB	275	50
Sapporo—Broadcasting Corp. of Japan	JOIK	361	10000	Auckland—L. R. Keith.....	1ZO	330	50
Sendai—Broadcasting Corp. of Japan..	JOHK	396	10000	Christchurch—Radio Broadcasting Co. of New Zealand.....	3AC	240	10
Tokyo—Broadcasting Corp. of Japan...	JOAK	345-375	10000	Christchurch—Radio Broadcasting Co. of New Zealand.....	3YA	306	500
JAVA				Dunedin—Otago University.....	4XO	140	
Batavia—Bataviasche Radio Vereeninging.....	JFC	220	40	Dunedin—Radio Broadcasting Co. of New Zealand.....	4YA	463	750
KWANTUNG				Dunedin—Radio Supply Co.....	4YO	370	500
Dairen—Government Bureau of Communications.....	JOAK	395	5000	Dunedin—Radio Broadcasting Co.....	VLDN	380	750
LATVIA				Gisborne—Gisborne Radio Co.....	2YM	260	500
Riga.....	KCX	528.2	2000	Napier—B. C. Spackman.....	2YL	190	100
LITHUANIA				Wellington—Broadcastings Ltd.....	2YB	275	15
Kovno.....		2000	15000	Wellington—Radio Broadcasting Co. of New Zealand.....	2YA	420	5000
LUXEMBURG				Whangerei—N. C. Shepherd.....	1YC	250	15
Luxemburg.....	LOAA	220.6	250	NORWAY			
MEXICO				Bergen—Bergen Broadcasters.....		365.9	1500
Chihuahua—Federal Government.....	CZF	310	250	Fredrikstad—Broadcasting Co. A. S.....		387.1	750
Guadalajara—Federal Military Command.....	FAM	490	1000	Hamar—Broadcasting Co. A. S.....		566	750
Mazatlan—Castulo Llamas.....	CYR	475	250	Natodden—Broadcasting Co. A. S.....		297	700
Merida—Partido Socialista del Surestan	CYY	549	100	Oslo—Broadcasting Co. A. S.....	OSLO	496.7	1500
Mexico City—Efran R. Gomez.....	CYA	300	500	Porsgrund—Broadcasting Co. A. S.....		455.9	1000
Mexico City—Jose J. Reynosa (El Buen Tono).....	CYB	275	500	Rjuken—Broadcasting Co. A. S.....		241.9	250
Mexico City—Miguel S. Castro (La High Life).....	CYH	375	100	Stavanger.....		277.8	250
Mexico City—General Electric Co.....	CYJ	400	2000	Tromso—Tromso Broadcasters.....		500	
Mexico City—"El Universal".....	CYL	400	500	Trondhjem.....		243.9	
Mexico City—Martinez y Zetina.....	CYO	425	100	PARAGUAY			
Mexico City—Excelsior Compania Editorial.....	CYX	325	500	Asuncion.....			12
Mexico City—Departamento de Educacion	CZE	350	500	PERU			
Monterey—D. Constantino de Tarnava, Jr.....	CYH			Lima—Peruvian Broadcasting Co.....	OAX	360	1500
Monterey—Constantino de Tarnava....	CYS	311	250	PHILIPPINE ISLANDS			
Oaxaca—Federico Zonilla.....	CYF	265	100	Baguio.....	KZUY	359.9	500
Puebla—Augustin del P. Saenz.....	CYU	312	100	Iloilo.....	KPM	400	500
Tampico.....	CYQ	322	100	Manila—Radio Corp. of the Philippines	KZIB	260	500
Torreon.....	CYM	225	1500	Manila—Radio Corp. of the Philippines	KZKZ	270	500
Vera Cruz—Ministerio de Comunicaciones.....	CYC	337	50	Manila—Radio Corp. of the Philippines	KZRM	413	1000
Vera Cruz.....	CYD			Manila—Radio Corp. of the Philippines	KZRQ	400	1000
MOROCCO				POLAND			
Casablanca—Radio Club de Moroc....	CNO	305	2500	Cracow.....		566	1500
NETHERLANDS				Kattowitz.....		416.1	10000
Amsterdam.....		760		Posen.....		247.9	1500
Bloemendaal.....		566		Vilna.....		314.1	500
De Bilt.....	PCFF	1100	1250	Warsaw—Government.....	PTR	380	700
Eindhoven—Phillips Lamp Works.....	PCJJ	30.2		Warsaw.....	AXO	1416.1	8000
Huizen (daytime 300 meters).....		1852	1950	PORTO RICO			
Hilversum—Nederlandische Seintoellen Fabriek.....	HDO	1071	5000	San Juan—Radio Corp. of Porto Rico..	WKAQ	337	500
Scheveningen.....		1950	2500	PORTUGAL			
NETHERLANDS EAST INDIES				Lisbon—Grandes Armazens do Chiado..	PIAA	267.8	500
Soeabaya—Radiotelegraph Club.....		90		Montesanto—Government Wireless Station.....	CTV	2450	1500
				SAN SALVADOR			
				San Salvador—Government of el Salvador.....	AQM	482	500
				SENEGAL			
				St. Louis—Senegal Radio Club.....		300	100

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SIBERIA				Stockholm—The Swedish Broadcasting Co.			
Tomsk.....	RA21	300	250	Sundsvall—Radiotjanst.....	SASA	438	1500
SPAIN				Trolhattan — Trolhattans Rundradio-station.....	SASD	545.5	800
Almeria.....	EAJ18	323.8	1000	Uddevalla.....	SMXQ	277.8	1000
Barcelona—Radio Barcelona (Hotel Colon).....	EAJ1	350.5	1500	Umea.....	SMZP	294.1	250
Barcelona—Radio Catalana.....	EAJ13	277.6	1000	Uppsala.....	SMSN	229	250
Bilbao—Radio Club Vizcaina.....	EAJ9	436	1000	Varborg.....	SMSO	500	250
Bilbao—Radio Vizcaya.....	EAJ11	418	2000	SWITZERLAND			
Bilbao—Armando de Otera.....		383	200	Basle.....	HB3	1010	250
Cadiz—Radio Cadiz.....	EAJ3	400	500	Berne—Radio—Genossenschaft.....	HBA	406	1500
Cadiz—Radio Lahera.....	EAJ10	297	1000	Geneva—Radio Broadcasting Soc. of Geneva.....	HBI	760	500
Cartagena—Enrique de Orbe.....	EAJ16	335	1000	Lausanne—Lausanne Radio Society.....	HB2	680	600
Cartagena.....	EBX	1200	1000	Zurich—Zurich University.....	RGZ	515-650	500
Madrid—Radio Espana.....	EAJ2	393	3000	Zurich—Zurich Radio Genossenschaft..	HBZ	489.4	1000
Madrid—Escuela Superior.....	PTT	426.7	1000	TUNISIA			
Madrid—Antonio Castilla.....	EAJ4	375	6000	Carthage.....	TNV	1850	5000
Madrid—Radio Iberica.....	EAJ6	392	1000	Carthage.....		1840	4000
Madrid—Union Radio.....	EAJ7	373	1500	Tunis—French Army.....	OCTU-TUA	1450-45	500
Madrid.....	EAJ12	306	2000	TURKEY			
Madrid—Radio Espanola.....	EAJ15	490	1000	Angora.....		1800	6000
Madrid.....	EGC	1650-2200	2000	Osmanieh—Broadcasting Co.....		1200	6000
Malaga—Spanish Telecommunication Co.	EAJ25	325	1000	Stamboul.....		1200	15000
Malaga—Alfonso Villota.....		325	200	UNION OF SO. AFRICA			
Oviedo (Cima)—Arturo Cima Fernandez	EAJ19	340	100	Cape Town—African Broadcasting Assn.	WAMG	375	1500
Salamanca.....	EAJ22	405	1000	Durban—Town Council.....		400	1500
San Sebastian—Sabino Ucelayeta.....	EAJ8	335	500	Johannesburg — African Broadcasting Co.....	JB	450	500
Sevilla—Manuel Garcia Ballesta.....	EAJ17	400	1000	UNION OF SOVIET SOCIALIST REPUBLICS (formerly Russia)			
Sevilla—Jorge la Riva.....	EAJ21	300	1000	Astrakhan.....	RA26	700	1000
Sevilla—Radio Club Sevillano.....	EAJ5	369.9	1000	Baku.....	RA45	760	1250
Valencia.....	EAJ24	360	1000	Bogorodsk.....	RA8	750	
Valencia—Jose Lopez Aznar.....	EAJ14	500	500	Charkow-Narkompotschel.....		1680	
Zaragoza.....	EAJ23	325	1500	Ekaterinburg.....	RA15	750	250
STRAITS SETTLEMENTS				Homel.....	RA39	925	1250
Singapore—Malaya Amateur Wireless Society.....		330	150	Irkutsk.....		1300	
SWEDEN				Ivanovo Voznesensk.....	RA7	800	1000
Boden—Radiotjanst.....	SASE	1200	1000	Kharkov.....	RA43	640	4000
Boras.....	SMBY	230.8	1000	Kharkov.....	RA24	475	4000
Eskilstuna—Radio Club.....	SMUC	250	250	Kiev.....	RA5	775	1000
Falun—Radiotjanst.....	SMZK	357	2000	Kniepropetrovsk.....		560	1000
Gaeve—Radio Club.....	SMXF	204.1	250	Krasnodar.....	RA38	513	1000
Goteborg—Radiotjanst.....	SASB	346.8	1000	Leningrad.....	RA6	940	2000
Halmstad.....	SMSB	215.8	250	Leningrad.....	RA42	1000	10000
Helsingborg.....	SMYE	229	250	Minsk.....	RA18	950	1250
Hudiksvall.....	SMSL	272.7	250	Moscow—Sokolniki.....		1010	2000
Jonkopings—Jonkopings Rundradiostation.....	SMZD	201.3	500	Moscow—Trade Union.....	KAZ	450	2000
Kalmar.....	SMSD	254.2	250	Moscow—Lubovitch.....		365	
Kalmar.....	SMSW	252.1	250	Moscow.....	MSK	650	2000
Karlsborg—Radiotjanst.....	SASF	1350	50	Moscow—Union of Soviet Workers.....	RA4	675	500
Karlsborg.....	SAJ	1365	5000	Moscow—Kominern.....	RDW	1450	40000
Karlskrona.....	SMSM	196	250	Moscow—Radio-Peredatcha.....	RAI	420	2000
Karlstadt—Radio Club of Karlstad.....	SMXG	221	250	Niji-Novgorod.....	RA13	1400	1500
Karlstadt.....	SMXZ	221	250	Novosibirsk.....	RA33	700	4000
Kiruna.....		238.1	250	Odessa.....	RA40	1000	1250
Kristinehamn.....	SMTY	202.7	250	Rostov-on-Don.....	RA14	820	1250
Linkoeping—Radio Club.....	SMUV	588.2	250	Saratoff.....		700	1000
Linkoeping.....	SMUW	497.5	250	Sevastopol.....	RA9	800	1000
Malmo—Radiotjanst.....	SASC	229	1000	Stavropol.....	RA20	655	1250
Motala.....		1365	20000	Tashkent.....	RA27	800	4000
Norrkoeping—Radio Club.....	SMVV	275.2	250	Tiflis.....		870	4000
Orebro.....	SMTI	236.2	250				
Ostersund.....		720	2000				
Saffle.....	SMTS	252.1	500				

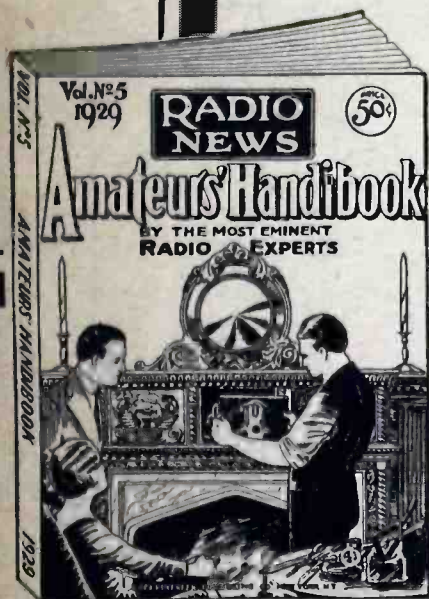
Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)	Countries, Cities and Owners	Call Letters	Wave Length (Meters)	Power (Watts)
UNION OF SOVIET SOCIALIST REPUBLICS (formerly Russia)				Liverpool—British Broadcasting Corp....			
Tver.....	RA44	965	1250	London—British Broadcasting Corp.	2LO	358	2000
Ust-Sysoolsk.....	REG	1000	1250	Manchester—British Broadcasting Corp.	2ZY	378.3	1000
Veliky-Ustjuk.....	RA16	1010	1250	Newcastle—British Broadcasting Corp...	5NO	243.9	1000
Vladivostok.....	RA17	456	1250	Nottingham—British Broadcasting Corp.....	5NG	288.5	200
Vladivostok—Union of Soviet Worker's Radio Club.....	RL20	480	1500	Plymouth—British Broadcasting Corp...	5PY	288.5	200
Voronesh.....	RA12	950	1250	Sheffield—British Broadcasting Corp....	6FL	272.7	200
UNITED KINGDOM				Stroke-on-Trent—British Broadcasting Corp.....	6ST	294.1	200
Aberdeen—British Broadcasting Corp. . .	2BD	311.2	1000	Swansea—British Broadcasting Corp.....	5SX	288.5	200
Belfast—British Broadcasting Corp.	2BE	302.7	1000	URUGUAY			
Bournemouth—British Broadcasting Corp.....	6BM	288.5	1000	Montevideo—Diario "El Dia".....	CWOR	350	500
Bradford.....	2LS	260.9	200	Montevideo—Danree & Cia.....	CWOF	300	100
Cardiff—British Broadcasting Corp.....	5WA	323.2	1000	Montevideo—Templo Metodista.....	CWOG	280	10
Chelmsford—British Broadcasting Corp.	5SW			Montevideo—General Electric Co. of Uruguay.....	CWOS	380	500
Daventry (Experimental).....	5GB	482.3	25000	VENEZUELA			
Daventry—British Broadcasting Corp....	5XX	1562.5	25000	Caracas—Empresa Venezolana de Radio-telefonía.....	AYRE	375	1000
Dundee—British Broadcasting Corp.	2DE	288.5	200	YUGOSLAVIA			
Edinburgh—British Broadcasting Corp. . .	2EH	288.5	200	Agram (Zagreb).....		308.3	350
Glasgow—British Broadcasting Corp.	5SC	401.1	1000	Belgrade—Cie. Generalle De T.S.F.....	HFF	260.9	1000
Hull—British Broadcasting Corp.	6KH	294.1	200				
Leeds—British Broadcasting Corp.	2LS	277.8	200				

VOL. NO.5



1929

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Operating on Wavelengths Below 100 Meters

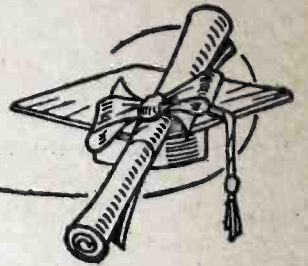
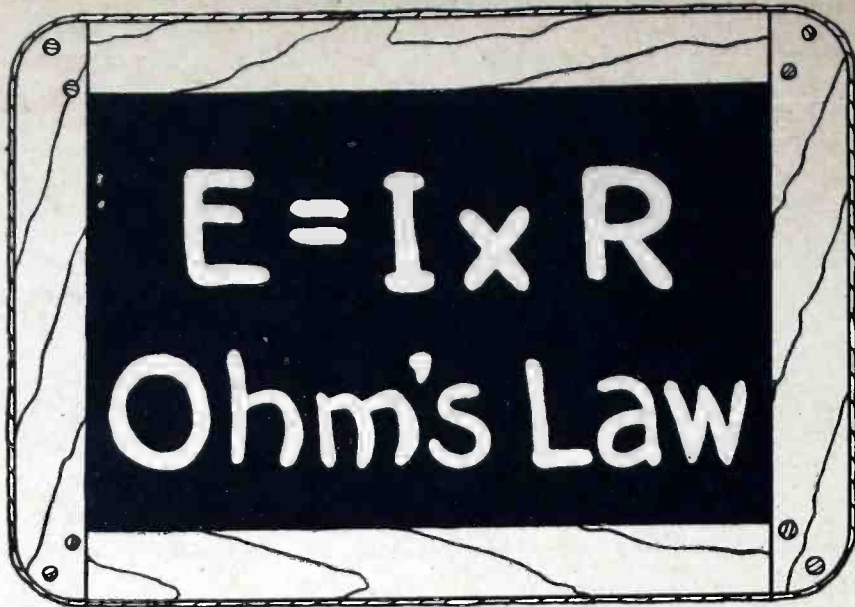
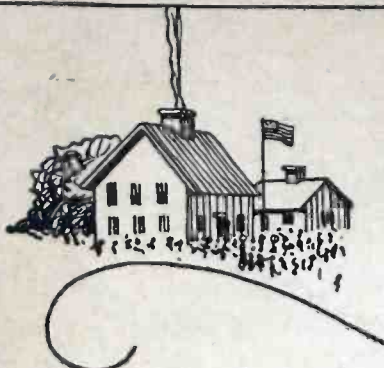
Stations by Call Letters

Call Letters	Stations and Location	Wave Length (Meters)	Remarks	Call Letters	Stations and Location	Wave Length (Meters)	Remarks
AFI	Konigswusterhausen	26.3		FAMJ	French SS. Jeane d'Arc (French Navy).....	26-60	
AFJ	Konigswusterhausen	53.5		FL	Eiffel Tower.....	54.02, 32.0, 75.0	
AFK	Doberi, †2 (Berlin).....	45.3, 42.12, 41.5		FTJ	SS. Jacques Cartier (France)	75.0	
AFL	Hamburg.....	52.0, 70.0		FW	St. Assize, Cie. Radio, France	14.28, 23.25, 25.0, 41.95, 43.0	Traffic with Buenos Aires
AFU	Konigswusterhausen	39.7		FUA	Bizerta-Sidi-Abdallah, Tunis	42.5, 56.0, 73.0	
AGA	Nauen.....	14.9, 12.25, 13.5, 14.25, 16.0, 26.0		FUE	Mengam, France.....	38.5	
AGB	Nauen.....	25.5, 26.6, 27.0	Phone occasionally.	FUL	Beyrouth-Djedeide, Lebanon	28.0, 80.0	
AGC	Nauen.....	17.2, 26.0, 39.8, 40.2	Phone after 1800 G.M.T.	FUM	Montebourg (Air Station)	37.0	
AGJ	Nauen.....	56.7		FUT	Toulon-Mourillon, France	36.5	
AGK	Nauen.....	11.0, 20.0 (2 kw.)		F 8AV	Nogent, France.....	80.0	
AJN	Casablanca, Ain Bordja ..	51.0	Weather reports, 0830 & 1930 G.M.T.	F 8GA	Clichy.....	30.0	
AKA	German Naval Vessel, M.81	54.0		F 8GB	St. Assize, Paris (S.F.R.)...	75.0	S.F.R. Bulletins Phone
AKB	German Naval Vessel, M.82	54.0		F 8GC	Radio LL, Paris.....	60.0	
ANC	Tjililin, Java.....	26.2, 40.2	Code	F 8KR	Constantine, Algeria.....	42.8	
AND	Tjililin, Java.....	18.8, 28.8, 37.5	Code	GBH	Grimsby (Beam Station) ...	25.906	
ANDIR	Malabar, Java (Military Aerodrome).....	38.5		GBI	Grimsby (Beam, Indian Circuit).....	16.216, 34.168	
ANE	Bandoeng, Java.....	19.93	Code and Phone	GBJ	Bodmin (Beam, S. Africa Circuit).....	16.146, 34.013	
ANF	Tjililin, Java.....	20.3, 36.5	Code	GBK	Bodmin (Beam Station)...	16.574, 32.397	
ANH	Malabar, Java.....	17.4, 27.0, 32.0	Code. Phone Sat. 1200-1700 G.M.T. Exp. Tests	GBL	Leafield (P. O. Station) ...	17.5, 21.5, 24.0, 30.0, 56.0	
ANK	Malabar, Java.....	19.4, 30.20		GBM	Leafield (P. O. Station) ...	17.5, 21.5, 24.0, 30.0, 56.0	
AQE	SS. Sir James Clark Ross...	33.5		GBO	Leafield (P. O. Station) ...	17.5, 21.5, 24.0, 30.0, 56.0	
ARCX	Norwegian Whaler Nielsen Alonso.....	30.5	After 0700 G.M.T.	GDKB	SS. Dorsetshire.....	24.0, 41.7	
ARDI	SS. C. A. Larsen.....	32.0		GFA	Air Ministry, London.....	44.0	
AYG	Guayra, Venezuela.....	31.8		GFR	Winchester (R.A.F. School)	20.0	
A 2FC	Sydney, N. S. W.....	32.0	Phone	GFY	Royal Air Force, Henlow...	76.0	
A 2ME	Sydney, Australia.....	28.50	Phone Sun., 1830-2000 G.M.T.	GLG	Royal Air Force, Henlow...	15.740, 15.707	
A 3LO	Melbourne.....	29.8, 32 or 36	Phone Sun., 1830-2030 G.M.T.	GLH	Dorchester (Beam Station)	22.091	U.S. Circuit
BAM	Tahiti.....	40.0		GLQ	Ongar (for communication with New York, Buenos Aires, and Rio de Janeiro)	24.5	
BJV	R. N. College, Dartmouth..	46.0		GLS	Ongar.....	15.0	
BWW	Gibraltar, North Front (Naval Station).....	35.0		GLSQ	SS. Olympic.....	20.0	
BXW	Seletar, Singapore (Naval)	35.0		GLW	Dorchester (Beam Station, South American Circuit)...	15.707	
BXY	Stonecutters Island, Hong-Kong.....	35.0		GLYX	SS. Derbyshire.....	37.0	
BYB	Whitehall R. C. (Naval) ...	35.0		G 2BR	Chelmsford.....	15.0, 17.0	
BYC	Horsea (Naval).....	35.0		G 2NM	G. Marcuse, Caterham.....	32.5	Phone Tues., Thurs., Sat., Sun., 0600-0700, and Sun., 1600-1800 G.M.T.
BYZ	Rinella, Malta (Naval)....	35.0		G 2YT	Poldhu.....	25.0, 32.0, 60.0, 92.0, 94.0	
BZC	Portsmouth Signal School ..	35.5		G 5DH	Dollis Hill (P. O. Station) ..	21.7, 27.6, 35.3, 47.0	
BZE	Matara, Ceylon (Naval)....	35.0		G 5SW	Chelmsford (B.B.C. Exp.)...	24.0	Phone 1330, 1430, and 1930 onwards
BZF	Aden (Naval).....	35.0		HBC	Berne, Switzerland.....	34.2	
B82	Uccle, Belgium.....	40.0		HJG	Bogota, Colombia.....	22.0	
CF	Drummondville, Montreal (Beam Station).....	32.0	Temporary	HVA	Hanoi, Tonkin.....	32.0	
CG	Drummondville, Montreal..	16.501, 32.128		HZA	Saigon.....	25.0	
CH	Quilicura, Chile.....	15-20		H 90C	Telegraphic and Radio Service, Case No. 63, Poste Transit, Berne.....	32.0	Relays, Berne, Mon., Thurs. and Sat., 2000-2100
CJRX	Winnipeg, Man.....	25.60		H 9XD	Radio Club of Zurich.....	32.0, 85.0	
CRHA	Lourenco Marques, Portuguese East Africa.....	18.360		IAA	Iwatsuki.....	40.0	
CRHB	Praia, Cape Verde Islands ..	18.094		ICC	Coltano.....	18.0	
CRHC	Loanda, Angola.....	18.182		ICD	Rome (Cento Celle)	63.0	
DCP	SS. Cap Polonio (German).	25.0, 34.0		ICF	Messina, Sicily.....	49.0	
DNSC	Royal Danish Dockyard Copenhagen.....	47.0		ICJ	Bengasi, Cyrenaica.....	26.0, 53.0	
DS	H.M.S. Renown.....	36.0		ICK	Tripoli.....	45.0	
EAM	Madrid.....	30.7		ICO	Derna, Cyrenaica.....	54.0	
EAR 55	Barcelona.....	22.30					
EATH	Vienna.....	37.00					
EB 4A2	Brussels.....	42.00					
EH 90C	Berne.....	32.00					
EH 9XD	Zurich.....	85.00					
EK 4ZZZ	Dantzig.....	40.00					

Call Letters	Stations and Location	Wave Length (Meters)	Remarks	Call Letters	Stations and Location	Wave Length (Meters)	Remarks
ICU	Tobruk, Cyrenaica.....	54.0		KQS	Lone Pine, Calif. (City of Los Angeles).....	45.77	
ICX	Massawa.....	47.0		KQT	Los Angeles, Calif. (City of Los Angeles).....	45.77	
IDO	Rome, San Paulo.....	33.0-37.5		KRP	Salt Lake City, Utah (Western Air Express, Inc.).....	49.5	
IDX	Amara, Erythrea.....	32.5, 64.0		KSS	Bolinas, Calif. (R.C.A.).....	14.40, 28.80	
IHF	Catania, Italy.....	53.5		KSZ	McCamey, Texas.....	48.05	
IST	Chisimaio, It. Somaliland..	38.0		KTA	Guam (Mackay R. & T. Co.)	18.0, 21.8, 22.0, 23.5, 36.0, 43.6, 44.0, 47.0	
IAX	Rome, Via Savoia 80.....	45.0	Phone occasionally	KTF	Midway Island (Mackay R. & T. Co.).....	21.6, 33.2, 43.2, 66.4	
IAY	Rome.....	45.00		KUN	Bolinas, Calif. (R.C.A.).....	16.93, 33.88	
IEA	Rome.....	40.20		KUY	Bear Creek, Alaska.....	82.0	
IFC	Royal Frederico Cesi School, Rome.....	33.0, 34.0		KVR	Las Vegas, Nev. (Western Air Express, Inc.).....	49.5	
IMA	Rome, Via Bramante 3.....	43	Sun., 1700-1930 G.M.T.	KWE	Bolinas, Calif. (R.C.A.).....	14.08, 28.15	
IRG	"Radiogiornale," Lake Como	10.0, 18.0, 35.0, 65.0		KWJ	Portland, Ore.....	53.54	¼ kw.
IB	Johannesburg.....	32.0	Phone	KWT	Palo Alto, Calif. (Fed. Telegraphic Co.).....	34.86, 48.05, 49.97, 58.10	
IBK	Kagoshima, Japan.....	30.0, 40.5, 70.0		KWV	Bakersfield (Pacific Air Transport).....	66.48	
IES	Osaka, Japan.....	24-71		—	Lyons, Radio Lyon.....	39.5	Phone 1700-1800 G.M.T. except Sun.
IEW	Osaka, Japan.....	24-71		LA1E	Meteorological Hut, Bergen	43.0	
IFAV	Taipeh, Formosa.....	39.5	0900 G.M.T.	LA1M	Meteorological Inst., Oslo	45.0	
IHBB	Ibarakiken.....	37.50		LCHO	Telegraph Administration, Oslo.....	33.0	
IHL	Hiroshima, Japan.....	32.0, 58.0, 74.0		LPI	Buenos Aires.....	34.0	
IKV	Kanasawa, Japan.....	37.5	Temporary	LPZ	Buenos Aires.....	36.0, 75.0	
IKZB	Tokyo Electric Co.....	20.5		LY	Bordeaux, Lafayette.....	32.0	
IOC	Otchishi, Japan.....	43.0		—	Matagora (Spain), Cie. Transatlantic Espagnola.....	70.0	
IPP	Tokyo, Japan.....	16-73		NAA	Washington.....	24.9, 37.4, 74.7	
IPS	Sapporo, Japan.....	29.0, 38.0, 60.0		NAJ	Great Lakes, Illinois.....	40.0, 76.0, 34.0	
YB	Tokyo, Japan.....	16-73		NAL	Navy Yard, Washington, D. C.....	20.0, 30.6	
YZ	Tokyo, Japan.....	16-73		NAS	Pensacola, Florida.....	40.0	
IAA	Iwatsuki, Japan.....	40.5		NBA	Balboa, Canal Zone.....	54.0	
IPP	Tokyo.....	20.0, 21.5, 35.0		NEL	Lakehurst, N. J.....	80.0	
KAV	Norddeich.....	39.0, 68.0		NEPQ	U. S. SS. Relief.....	20.0	
KDKA	East Pittsburgh, Pa. (Westinghouse E. & M. Co.)...	26.3, 42.95, 62.5	Phone from 2300 G.M.T.	NERM	U. S. SS. Los Angeles.....	70.0-84.5	
KDO	SS. Esparta (United Fruit Co. U. S. A.).....	33.0		NFV	U. S. Marine Corps, Quantico, Va.....	77.4, 77.5	
KDZ	Point Barrow, Alaska.....	21.4, 42.08, 74.77		NIRX	U. S. SS. Canopus.....	75.0	
KEB	Oakland, Calif. (G. E. Co.)...	18.62, 21.8		NKF	Naval Lab., Bellevue, Anacostia.....	16.0, 17.0, 20.8, 21.0, 25.5, 41.3, 54.4, 61.0, 71.3, 81.5	
KEG	Vancouver, Washington (Pacific Air Transport).....	45.0		NKL	Arlington.....	29.0, 37.4, 74.7	
KEL	Bolinas, Calif. (R.C.A.).....	14.1, 29.3, 95.0		NOSN	U. S. Submarine Base, Cocos Solo, Panama.....	40.0	
KEMM	Bolinas, Calif. (R.C.A.).....	14.29, 28.58		NPC	Puget Sound, Washington..	37.0	
KESS	Bolinas, Calif. (R.C.A.).....	14.40, 28.80		NPG	San Francisco, Calif.....	16.49, 32.98	
KET	Bolinas, Calif. (R.C.A.).....	99.0		NPL	U. S. Training Ship, San Diego, Calif.....	71.7	
KEU	Los Angeles, Calif. (Pacific Air Transport).....	45.02		NPM	Honolulu, Hawaii.....	35.0 and 36.8	
KEUN	Bolinas, Calif. (R.C.A.).....	14.08, 38.38		NPO	Cavite, Philippine Islands..	68.0, 70.0	
KEWE	Bolinas, Calif. (R.C.A.).....	14.08, 28.15		NPU	Tutuila, Samoa.....	37.0-40.0, 53.0	
KFD	Denver, Colo. (G. E. Co.)...	17.7, 24.3		NQC	San Diego, Calif.....	75.0, 86.0	
KFW	SY. Poinsettia.....	40.0		NQW	U. S. SS. Mexico.....	40.0	
KFQU	Holy City, Calif.....	31.0, 53.0, 63.0		NRRG	Winter Park, Florida.....	39.5, 82.0	
KFVM	SS. Idalia.....	17.0, 37.0, 74.0		NRRL	U. S. SS. Seattle.....	40.0	
KFWB	Los Angeles, Calif.....	40.0		NUQB	U. S. SS. Pope.....	75.0	
KFY	Poinciana, Florida.....	68.4		OCBA	Bamako (Soudan).....	41.50	
KFZG	Port Barrow.....	45.32, 69.25		OCBV	French Military Station at Beyreuth.....	58.0	
KFZH	Fairbanks, Alaska.....	44.71, 68.32		OCCO	Conakry (French W. Africa)	33.0	
KFZO	SS. Robador.....	37.5		OCDA	Dakar (French W. Africa)..	35.0	
KGBB	U. S. SS. Ungava (R. B. Metcalf).....	22.0, 37.0		OCDB	Djibouti.....	72.0	
KGDU	SS. Four Winds.....	35.03		OCDJ	Issy-les-Moulins.....	33.0	
KGE	Medford, Oregon (Pacific Air Transport).....	46.06				65.0	1008-1028 G.M.T., Corresponding with OCDB
KGFT	Portable Station, Texas....	50.0				32.0	Time Signal 0756 and 0955
KGH	Hillsbro', Oregon (Fed. Telegraphic Co.).....	36.52, 46.99					
KGJ	Fresno, Calif. (Pacific Air Transport).....	46.06					
KIO	Kahuku, Hawaii (R.C.A.)...	90.04					
KKC	Palo Alto, Calif. (Fed. Telegraphic Co.).....	17.0, 27.5					
KLL	Bolinas, Calif. (R.C.A.).....	21.85					
KMM	Bolinas, Calif. (R.C.A.).....	14.29, 28.58					
KMV	Bandini, Calif. (Western Air Express, Inc., Morse)....	49.5					
KNN	Honolulu (Mackay, R. & T. Co.).....	17.2, 23.0, 23.7, 28.0, 34.4, 46.0, 47.4, 56.0					
KNR	Clearwater, Calif. (Fed. Telegraphic Co.).....	29.5, 49.15					
KNW	Palo Alto, Calif. (Mackay, R. & T. Co.).....	16.7, 17.0, 24.0, 33.4, 34.0, 48.0, 51.0					

	Stations and Location	Wave Length (Meters)	Remarks	Call Letters	Stations and Location	Wave Length (Meters)	Remarks
OCMV	French Military Station, Mont Valerien, Suresnes (Seine).....	39.0, 44.0, 46.0	At 1000, 1100 1230, 1330, 1600, 1900, 2000, 2100 and 2200 G.M.T. on either 600 cycles or D.C.	PT PVC	Quartel-General, Brazil..... Curacao.....	30.5 15.0-20.0	
OCNG	Nogent-le-Rotrou.....	29.0, 32.0, 45.0, 48.0, 72.0		RABL RAU RA 19 RCRL RCT RDI RDRL RDW RFM RFN	Habarousk..... Tashkent..... Tomsk..... Central Lab., Leningrad.... Sebastopol..... Petrozavadosk..... Leningrad..... Moscow..... Khabarousk..... Moscow.....	22.0 23.0, 34.0 37.0 27.0 64.0 34.2 28.5 83.0 70.2 29.0	800-1000 G.M.T.
OCRB	Rinck, Meteo Aviation, Rabat, Morocco.....	36.0		RKV RLT RRP RTRL	Moscow..... Tommot..... Nijni Novgorod..... Tiflis.....	21.0, 34.0 23.0 20.0-42.0 22.0-42.0	
OCRF	Reggu, Morocco.....	74.0	2130-2145 G.M.T.	SAA SAB SAD SAJ SDK SFR SGT SIC SKB SMHA SOJ SOK SPM	Karlskrona..... Goteborg..... Flottads Stations, Stockholm Karlesborg, Sweden..... SS. Kiruna..... Paris..... Motorship Suecia..... SS. Masilia..... Motorship Gripsholm..... Stockholm..... Brazilian SS. Jaquarao..... Moskwa Sokoleniki Radio..... Radio Laboratory, Ministry of Posts, Helsingfors..... Sepetiva, Rio de Janeiro, Brazil.....	44.0 36.5 31.0-51.0 50.0 54.0 75.0, 85.0 42.0, 50.0 42.0, 51.5 37.5 41.0 100.0 37.0 47.0 22.180	
OCRU	Rufisque (French W. Africa)	39.0	Series of "a" from 1530-1540 G.M.T.	SPU SPW SPX SP 1 SUC 2	Santa Cruz (Beam)..... Rio de Janeiro..... Rio de Janeiro..... Rio de Janeiro..... Abuzabal (Cairo).....	15.576 29.3 40.5 17.0, 44.5, 47.0 47.0	
OCTN	Mourillon, Toulon.....	20.0	Series of "b" from 1545-1555 G.M.T.	TFA TSB TUK TVE	Reykjavik, Iceland..... Norwegian SS. Helder..... Tomsk, Siberia..... SS. Solderijk.....	42.5, 49.5 46.5, 51.0 20.0 31.1	
OCTP	The Military Station of Nogent-le-Rotrou.		Series of "c" from 1600-1610 G.M.T. daily, except Sun.	VAS VGJL VIS	Louisburg, Nova Scotia.... SS. Canadian Commander.. Sydney.....	52.0 43.0 22.0, 26.0, 32.0, 42.0, 51.5	Press report
OCTU	Tunis la Casbah.....	48.0, 50.0		VIT VIZ VJZ	Townsville, Queensland.... Ballan, Melbourne (Beam Station)..... Rabaul, New Britain.....	22.0, 42.0 25.728 22.0, 26.0, 32.0, 42.0	
OHK	Vienna.....	39.5, 40.6		VKO VNB	Garden Island, Sydney..... Klipheuval, South Africa (Beam).....	35.0 16.077, 33.708	
OLQ	SS. Slamet.....	19.0, 22.5, 37.0		VQF VWZ VZDK	Kuching, Sarawak..... Kirkee, Bombay (Beam).... SS. Jervis Bay.....	32-38 16.286, 34.483 33.0	
OP	Paris, Radio LL..... Paris, Radio Vitus..... Alfragidi, Lisbon (Beam)...	61.0 37.0 15.641	Phone Phone Wed., Fri., Sun., 2100 - 2245 G.M.T.	W1XAQ W 1XAB W 1XR W 2XAA W 2XAC W 2XAD W 2XAF W 2XAI W 2XAL	Belfast, Maine..... Portland, Maine (Congress Square Hotel Co.)..... Manila, Philippine Islands.. Houlton, Maine..... G. E. Co., Schenectady, N. Y. G. E. Co., Schenectady, N. Y. G. E. Co., Schenectady, N. Y. transmitting program from WGY..... Newark, N. J. (Westinghouse Electric Co.)..... New York, short-wave transmitter of WRNY (Experimenter Publ. Co.).....	40.0, 56.0, 60.0, 70.0 63.79 30.0 22.99 50.0 21.96 32.7 43.0 30.91	Meteorological reports, 1530 local time
OU 7MK	Copenhagen, Denmark.....	32.90					
OU 7RL	Copenhagen.....	42.12, 84.25					
PCA	Amsterdam.....	33.33					
PCG	Malabar, Java.....	17.0					
PCH	Scheveningen Port.....	20.0, 20.6, 20.69, 21.127, 28.800, 29.226, 29.283					
PCJJ	Hilversum, Holland (Philips Lamp Works).....	30.2	Phone Wed., 1400-1600 G.M.T. and occasionally on Mon. and Fri., and other wavelengths below 60 meters (40 kw.)				
PCLL	Kootwijk, Holland.....	46.0, 32.0, 18.0	and other wavelengths below 60 meters (10 kw.)				
PCMM	Ministry of Posts and Telegraphs, Kootwijk.....	25.0, 27.5, 36.0					
PCPP	Kootwijk, Holland.....	27.0					
PCRR	Kootwijk, Holland.....	20.0, 25.0, 37.0					
PCTT	Kootwijk, Holland.....	21.0, 29.5					
PCUU	Dutch Colonial Ministry, The Hague.....	34.0					
PKD	Koebang.....	24.0					
PKE	Amboina.....	20.0					
PKH	Soerabaja, Java (D. E. Indies)	23.0					
PHP	Medan.....	15.5					
PKX	Java.....	27.0, 32.0					
POF	Nauen.....	13.5, 18.0					
POX	Nauen.....	20.0					
POY	Nauen.....	25.0					
POZ	Nauen.....	47.0					
POS	Alfragidi, Lisbon (Beam)...	18.270					Phone Tues., Thurs., and Sat., 2300 G.M.T. Phone and Television

Call Letters	Stations and Location	Wave Length (Meters)	Remarks	Call Letters	Stations and Location	Wave Length (Meters)	Remarks
W2XAO	Belfast, Maine.....	40.0, 56.0, 60.0, 70.0		WEQB	Rocky Point, N. Y. (R.C.A.)	16.71, 33.42	
W 2XAP	New York (Bull Insular Line)	18.3, 18.7, 36.6, 37.5		WEQC	Rocky Point, N. Y. (R.C.A.)	16.78, 33.37	
W 2XAW	G. E. Co., Schenectady, N. Y.	3.0-20.0, 15.0		WEQX	Rocky Point, N. Y. (R.C.A.)	14.85, 29.71	
W 2XBA	Newark, N. J. (Short-wave Station of WAAM).....	65.18	Phone Mon., Wed., Fri., 2355 - 0500 G.M.T.	WEQY	Rocky Point, N. Y. (R.C.A.)	14.91, 29.83	
W 2XBB	New York (R.C.A.)	1-5	1 kw.	WFV	Poinciana, Florida (Florida RT Co.).....	70.54	
W 2XBC	Rocky Point, N. J. (R.C.A.)	14.09 and 5.35-18.74		WFX	Rocky Point, N. Y. (R.C.A.)	15.70, 31.59	
W 2XBI	Rocky Point, N. Y. (R.C.A.)	1-15	10 kw.	WGI	Alpena, Mich. (Alpena Marine Radio Service).....	98.3	
W 2XAO	Richmond Hill, N. Y. (Short-wave of WABC).....	22.1	Phone after 2300 G.M.T.	WGT	S. Juan, Porto Rica (R.C.A.)	21.75, 65.3	
W 2XG	Rocky Point, N. J. (Western Electric Co.).....	16.02	Phone Mon. and Fri. after 1700 G.M.T.	WGW	Vieques, Porto Rico (Bureau of Insular Telegraphs).....	52.0	
W 2XH	Schenectady, N. Y.....	50.0		WGY	Schenectady, N. Y. (G. E. Co.).....	35.0	
W 2XI	Schenectady, N. Y.....	30.0, 35.0, 38.0		WHD	Sharon, Pa. (Westinghouse Co.).....	49.0	
W 2XK	South Schenectady, N. Y. (General Electric Co.).....	65.5		WHK	Cleveland, Ohio.....	66.04	1/2 kw.
W 2XN	Rocky Point (R.C.A.).....	5-80	150 watts	WHR	Rocky Point, N. Y. (R.C.A.)	15.93, 31.96	
W 2XS	Rocky Point (R.C.A.).....	14.93	80 kw.	WHW	Highland Park, Ill. (Wireless Telegraph & Communication Co.).....	45.02	
W 2XT	Rocky Point, N. Y. (R.C.A.)	16.17	Radio Movies)	WIK	New Brunswick, N. J.....	21.48, 21.5	
W 3XK	Washington, D. C.....	46.72	30 kw.	WIR	New Brunswick, N. J. (R.C.A.).....	74.0	20 kw.
W 3XL	Bound Brook, N. J.....	60.0		WIZ	New Brunswick, N. J. (R.C.A.).....	43.35	Phone occasionally from 2300 G.M.T
W 3XQ	Mountain Lakes, N. J.....	37.95, 75.9		WJD	New York International News Service.....	37.01	
W 4XK	San Juan, Porto Rico (Bull Insular Line).....	18.3, 18.7, 36.6, 37.5		WJZ	Boundbrook, N. J. (R.C.A.)	18.17	
W 5XH	New Orleans (Tropical Radio Telegraphic Co.).....	42.0		WKC	Newark, N. J.....	17.5, 27.9	
W 6XAI	Inglewood, Calif.....	66.04	Phone 2400 G.M.T. onwards	WKI	Newark, N. J. (Fed. Telegr. Co.).....	17.3, 27.9	
W 6XAR	San Francisco, Calif.....	33.00	Phone 2400 G.M.T. onwards	WKK	Cuba, Porto Rico (Bureau of Insular Telegraphs).....	52.0	
W 6XI	Bolinas, Calif.....	29.3		WLL	Rocky Point, N. Y. (R.C.A.)	16.57	
W 8XAO	Detroit, Mich.....	32.0		WLW	Cincinnati, Ohio (Crosley Radio Corporation).....	52.02	2200 - 0400 G.M.T. except Fri. Special Time Signals
W 8AXV	East Pittsburg, Pa.....	62.50	(Radio Movies)	WNBT	Elgin, Ill.....	33.5	
W 6XO	Kahuhu, Hawaii.....	90.0		WND	Ocean Township, N. J. (American Telephone & Telegraph Co.).....	13.88, 16.35, 22.38, 32.69, 46.48	
W 8XJ	Columbus, Ohio.....	54.02		WNU	New Orleans, La.....	26.0, 40.0	Press reports
W 8XK	East Pittsburgh (Westinghouse Co.).....	26.8	Mon. and Fri. 1900-2100 G.M.T.	WOBD	SS. Radio.....	37.0, 43.74, 77.0	
W 8XS	East Pittsburgh, Pa.....	67.0, 96.0		WOBV	U. S. SS. Nippekontu.....	36.2, 72.4	
W 9XU	Council Bluffs, Iowa.....	61.06	Phone	WOP	Rocky Point, N. Y. (R.C.A.)	21.57, 43.14	
WABC	Richmond Hill, N. Y. (Atlantic Broadcasting Cpn.)	64.0		WOWO	Fort Wayne, Ind. (Main Auto Supply Co.).....	22.80	1 kw. Phone after 2300 G.M.T.
WAJ	Rocky Point, N. Y. (R.C.A.)	22.24, 44.48		WPE	Rocky Point, N. Y. (R.C.A.)	21.63, 43.14	
WAQ	Newark, N. J. (Westinghouse Elec. & Mfg. Co.)	44.03		WQA	Rocky Point, N. Y. (R.C.A.)	14.13, 28.26	
WBO	Dearborn, Mich. (Ford Motor Co.).....	44.62		WQB	Rocky Point, N. Y. (R.C.A.)	16.71, 33.42	
WBU	Rocky Point, N. Y. (R.C.A.)	14.09		WQC	Rocky Point, N. Y. (R.C.A.)	16.78, 33.57	
WBZ	Springfield, Mass. (Westinghouse E. & M. Co.).....	50.0, 70.0	20 kw.	WQN	Rocky Point, N. Y. (R.C.A.)	51.5, 54.5, 57.0	
WCFL	Chicago, Ill. (Fed. of Labor)	37.24	1/2 kw.	WOO	Rocky Point, N. Y. (R.C.A.)	35.03, 44.0	
WCGB	Brooklyn, N. Y.....	54.0	1/2 kw.	WOQ	Rocky Point, N. Y. (R.C.A.)	14.8	
WCSH	Portland, Maine.....	63.79		WOX	Rocky Point, N. Y. (R.C.A.)	14.85, 29.71	
WDJ	Harrison, Ohio (Crosley Radio Corporation).....	21.4, 26.3		WOY	Rocky Point, N. Y. (R.C.A.)	14.91, 29.83	
WDS	Rocky Point, N. Y. (R.C.A.)	15.86, 31.73		WRB	Miami, Florida (Florida Radio Telegraph Co.).....	70.74	
WEAJ	Rocky Point, N. Y. (R.C.A.)	22.24, 44.48		WRNY	Coytesville, N. J. ("Radio News").....	30.91	Phone Mon., Wed., Fri., 1930 - 2215 G.M.T.; other days, 2355-0500
WEAO	Columbus, Ohio (Ohio State University).....	54.02		WSS	Rocky Point, N. Y. (R.C.A.)	16.0, 20.0	
WEDS	Rocky Point, N. Y. (R.C.A.)	15.86, 31.73		WTT	Rocky Point, N. Y. (R.C.A.)	16.02	
WEEM	Rocky Point, N. Y. (R.C.A.)	16.41, 32.84		XC 51	Mexico City.....	44.00	From 0400
WEFX	Rocky Point, N. Y. (R.C.A.)	15.79, 31.39		XDA	Mexico City, Mex.....	34.0	Press reports 0500 G.M.T.
WEGT	S. Juan, Porto Rico (R.C.A.)	21.75, 65.3		XEK 4AP	German Aeroplane.....	42.5	
WEHR	Rocky Point, N. Y. (R.C.A.)	15.93, 31.96		YN	Lyons, France.....	58.0, 16.30, 17.30	
WEM	Rocky Point, N. Y. (R.C.A.)	16.41, 32.84		YR	Lyons.....	40.20	
WEOP	Rocky Point, N. Y. (R.C.A.)	21.57, 43.14		YZ	Fort d'Issy, France.....	45-47	
WEP	Cape Charles, Virginia (Norfolk Cape Charles Radio Telegraph Co.).....	99.9		ZWT	Bremerhaven.....	53.0	
WEPE	Rocky Point, N. Y. (R.C.A.)	21.63, 43.33		ZZ	Fort d'Issy (Portable).....	45-47	
WEQA	Rocky Point, N. Y. (R.C.A.)	14.13, 28.26					



Technical Training

Knowledge is the firmest foundation for every man who ranks as a professional and this is particularly applicable to the custom set builder.

By J. E. SMITH*

THE custom set builder is oftentimes known as a professional set builder. According to Webster, a "profession" is "an occupation that involves a liberal education and mental rather than manual labor." A professional in turn according to the same lexicographer is "one skilled in a profession and one who obtains monetary remuneration for the sale of his knowledge."

It is evident that a professional set builder bears a definite relation towards the public and is classified in a special category. Consideration of the definition cannot help but show that every custom set builder is not a professional set builder, despite the fact that he should be within that classification if he desires to achieve success. Let us be truthful with ourselves—What is there to substantiate the claim of every custom set builder that he is a professional? . . . Is it experience? . . . Is it knowledge? . . .

Despite the great number of clothing stores selling ready made clothes to the populace, custom tailors are to be found in every city and innumerable are successful. . . . The basis of their success is the basis for the success of the professional radio set builder. The fact that a receiver is built according to specifications set forth by a kit manufacturer or an author, does not signify that the receiver in question when finished, is a custom built receiver. Nothing can be more distant from the truth. . . . Consider for a moment the reason for a "tailored" suit of clothes. Why would you as an individual enter the shop of a tailor and have a suit made to your own specifications and to your own liking? . . . Because it would be exactly what you want—because it would satisfy your personal fancy—because it is made specifically for you

and would fit perfectly. . . . The status of the custom built receiver is identical. . . . The person who orders a "tailored" radio receiver expects it to fulfill his requirements just as the "tailored" suit fits the customer. If the custom set builder can produce such a receiver his success is assured and he justifies the classification of a professional set builder.

Unfortunately this is more easily said than done. The knowledge involved in the scientific construction of a radio receiver involves many phases of radio. This, however, does not mean that it is complex or intricate. We assume that the man who enters this field is acquainted with radio matters. We have found numerous instances where this was untrue and this condition should not exist. This field is still virgin. With the keen competition between the manufactured receiver and the custom built receiver it is imperative that every custom set builder be capable of producing a fine radio receiver. Unqualified professional set builders injure the entire custom built set market. We have faith in the custom set builder because it is our honest opinion that *every custom built receiver, properly designed and constructed for any one locality, should prove superior to a manufactured receiver.* This contention is based upon actual experience.

COMMERCIAL RECEIVER IS COMPROMISE

A commercial manufactured receiver is a compromise. It must be a compromise because its design must afford operating utility in every locality. It is true that the most scientific methods are applied to commercial receiver design, but it is unfortunate that finest refinements are not incorporated. They cannot be incorpora-

ted because of phenomena ever present in radio transmission and reception. A compromise can never be equivalent to a specific unit specially designed to fulfill a need. Radio transmission is not uniform. . . . the apportionment of radio broadcasting stations operating in this country is not uniform. Some localities contain more stations, more powerful stations. Other localities in turn, have few stations; sometimes weak, sometimes powerful. Some territories are poor locations with respect to the field intensity distribution of broadcast stations. Under such conditions radio reception must needs be an unknown factor—and the fact of the matter is, that it is an unknown factor. No one can guarantee reception beyond certain limits and these limits are not 1000 miles or more.

THE TAILORED RECEIVER

The strongest argument in favor of the custom built radio receiver is the fact that it is constructed to fulfill requirements at the point of reception. This is a very important item. The reason for the existence of the custom set builder or the professional set builder is not one of economy. . . . It is quality of product. . . . He is in a position to satisfy every demand of the prospective customer. He can fill every fancy or whim. It is his duty to produce and he can if he possesses the required amount of knowledge. In this respect he has a tremendous advantage over the radio receiver manufacturer because every receiver is individual.

Knowledge is required to produce such custom built or "tailored" radio receivers. The incorporation of the fine details during the construction of a radio receiver designed to perform with maximum effi-

*President National Radio Institute.

ciency in a certain territory is beyond the commercial manufacturer. Not that the latter cannot do the same. He is controlled by the economical factor and by the fact that he is not a specialist; that his equipment must find universal application. The operating finesse is possible in a custom built receiver but impossible in a commercial manufactured receiver. The radio manufacturer must design his receiver to fulfill a public want, to satisfy all; whereas the professional set builder designs each receiver to satisfy the individual purchaser, a task much simpler and much more profitable.

Again we repeat that knowledge is essential to the attainment of the above and the purpose of this story is to set forth the educational requirements—what a custom set builder should know—what he should do to justify his ranking as a professional. The successful professional set builder must be well versed in various fields. His work is not mere wiring. He must be a specialist. He must specialize in the design and construction of certain receivers. The types of receivers are governed by the ground he covers, by the receiving conditions in the territory covered by his organizations. A radio survey of his territory is of inestimable value. Certain localities do not permit the use of a receiver equipped with a single stage of tuned radio frequency amplification. The broadcasting stations operating in that zone are too numerous—perhaps the field intensity of one station is too great and this station necessitates a finer degree of selectivity. If this is the case, why specialize in the construction of a receiver which does not perform to complete satisfaction. The fact station field intensity is excessive is of no consequence. Many other sufficiently selective receivers are available and should be used. The number of receivers available for use is sufficiently great to afford a wide choice and the number of localities is sufficient to permit the sale of all types of radio receivers.

The successful custom set builder determines personal requirements—Does the prospective purchaser require distance reception or is he interested in locals. This decision decides the choice of the receiver. A receiver with a single stage of tuned radio frequency amplification is satisfactory for a certain territory and fulfills certain receiving conditions. Other territories and individuals require receivers equipped with three stages of tuned radio frequency amplification, perhaps four stages. *Specialize in the receivers suitable for use in your territory.*

The "tailored" receiver is one built to fit—the place of reception—the room—the

conditions in the house—the knowledge possessed by the prospective owner and operator. Economy and performance go hand in hand. Why sell a receiver which is too powerful for a certain location and is continually operated at 15% of its full capacity. A safety factor is necessary but it need not be 85%.

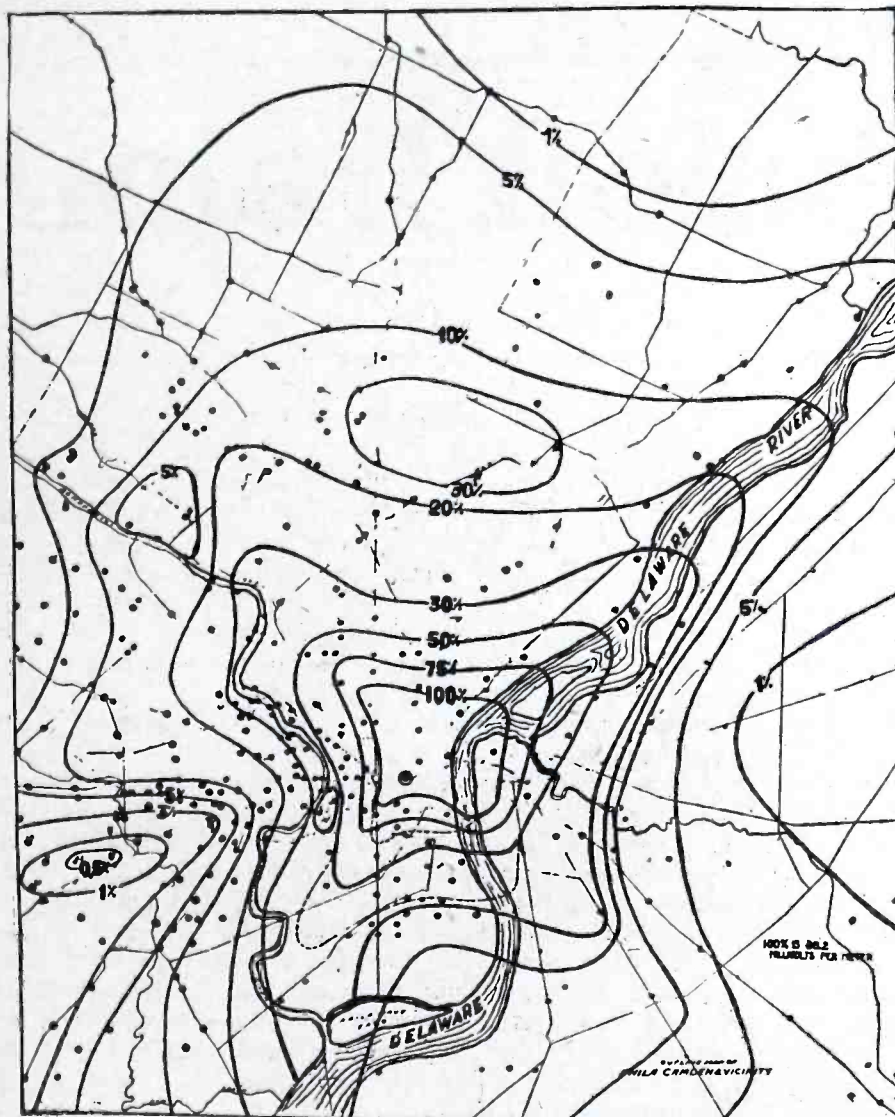
The "tailored" receiver must be built with an eye for appearance. It should fit well with the appointments of a room. It should be as beautiful as the commercial receiver since it must compete with the manufactured product. It is clearly evident that the professional set builder has many interests. He must be sufficiently versed in radio lore to be able to change the electrical characteristics of units utilized as components within a

The receiver is satisfactory but the audio system is not and they desire the incorporation of their pet arrangement. The professional set builder must be technically equipped to be able to make such changes. This radio knowledge should be sufficient to permit interchanging systems; the radio frequency amplifier of one receiver with the audio frequency amplifier of the other. This he can do if he is fully aware of the function of the radio frequency amplifier, the detector and the audio frequency amplifier. He must know that the grid bias detector is less sensitive than the grid-leak and condenser system, but that the former will carry a greater signal input without distortion.

The interpretation of radio symbols must be flawless. He should be familiar with every radio symbol used in the public press. He must understand the progression of amplification throughout the receiver installation. This information is essential since it guides his choice of the total amplification required. He must know the advantages of amplification in the radio frequency amplifier and in the audio frequency amplifier. He must be able to calculate the "gain" per stage in a radio frequency amplifier. He must associate without difficulty the impedance of a tuned circuit and the mutual conductance of the associated vacuum tube. He must understand the importance of the relation between tube output impedance and load impedance in a voltage amplifier because it influences the tone quality available with the amplifier. He must comprehend the relation between the tube output impedance and the load impedance in a power amplifier such as the output tube, because it governs power output consistent with the elimination of distortion.

The professional set builder who can display to his customer that he is possessed of knowledge and can produce a good receiver will succeed. The modern professional set builder does not build for the immediate future. This is particularly true with respect to power equipment. He makes provision for future receivers. His power device is an integral part of the radio installation yet it is so designed that it can be removed at short notice and applied to another receiver. The electrical characteristics of the device are such that the power output is not only fully capable of supplying the present or immediate needs, but it will also supply the possible need one year distant.

The professional set builder of today, is a radiotrician, who can redesign a system so as to comply with existing conditions or with personal requirements. He



Courtesy Institute of Radio Engineers.
This map of Philadelphia and its environs shows how the field intensity distribution of a local transmitter varies and reception is not uniform in all localities as determined by a survey made by the American Telephone and Telegraph Co.

radio receiver. He must know the effect of a resistance or a condenser shunted across a loud speaker or a transformer primary. In order to satisfactorily comply with the customer's wishes it is essential that the set builder know the operating characteristics of whatever receiver he produces. Does it amplify uniformly over the entire audio frequency spectrum or does it attenuate one frequency? He should be in a position to overcome or rather balance attenuation or to decrease accentuation. He must coordinate the performance of the radio frequency system with the audio frequency amplifier.

TECHNICAL KNOWLEDGE

Radio enthusiasts are usually adherents of a certain system or a certain receiver.

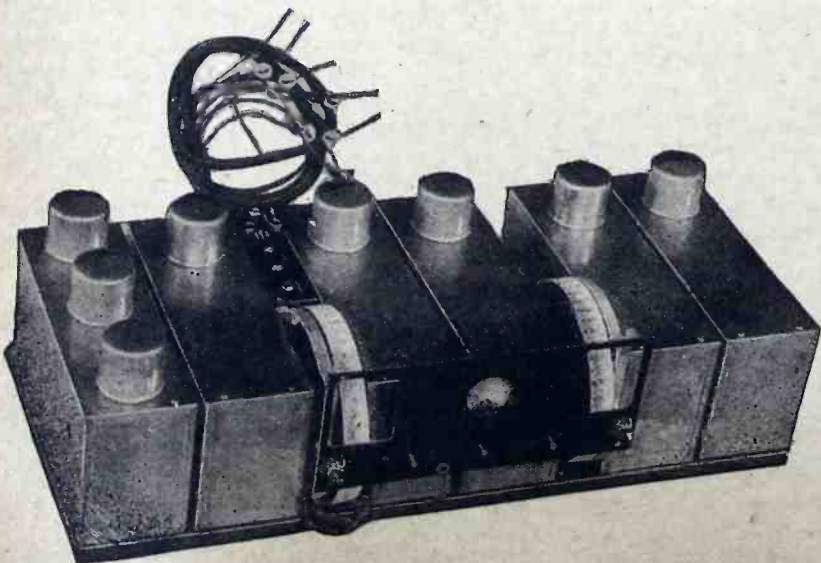
understands radio technique without being a full fledged engineer. He has an eye for beauty since he designs the panel layout and often picks the cabinet. He must be a mechanic, handy with tools because much of his special work calls for special part arrangement and consequently mounting. His purpose upon this earth is fruitless unless he can satisfactorily accomplish the special assignment represented by every order.

SECURE ALL DATA

To secure every bit of vital information the professional set builder should carry out a test at the future location of the receiver. He should have a standard receiver with known characteristics, loop operated and calibrated. The performance of this receiver should be his guide as to the requirements of the receiver he is to construct. The advantage of a radio survey of this type cannot be appreciated. The most perfect receiver designed in Chicago cannot perform to perfection in New York unless small changes are made to adapt it to receiving conditions in New York City. It is true that these changes are simple and small, differing in each case, but fine "tailoring" is necessary because it constitutes that "nth" degree of finesse.

The successful custom set builder must be a close follower of all radio publications. His knowledge must be equivalent to that of his many customers. They in a group peruse all radio periodicals, and it is his duty to be able to answer all questions pertaining to new products. He should communicate with all radio manufacturers who produce equipment of interest to the custom built set field. No item is too small. The whims and fancies of the public are varied and many, and the professional set builder should be able to incorporate whatever device his public may demand.

A thorough comprehension of vacuum tube performance and the electrical characteristics and constants of all available tubes should be at his finger tips, because these data are vital when selecting parts for a receiver. The perfect radio receiver is far distant, perhaps an outcome of the millenium, but the highly efficient receiver of today is the product of sound engineering and design, of utmost coordination between the respective parts.



The custom built receiver chassis should be as perfect as the manufactured product shown above. The same high degree of scientific design should prevail.

Reference to text books and manufacturers' literature will result in a thorough comprehension of what is at hand. After all is said and done, custom set building is a business—not a hobby. It is necessary to expend money for equipment and advertising, small as it may be. Why not protect even this small investment. The man who knows what he is doing can produce receivers of superior calibre. Vital information is available from many sources. Knowledge is available to the man who seeks it, and knowledge is essential to the successful professional set builder. Make every effort to secure it.



The professional set builder who can display to his customer that he is possessed of knowledge and can produce a good receiver, will succeed.

Receiver specialists should study every kink, every trick and every possible improvement. Do not consider the kit receiver as the ultimate. Attempt improvements, but whatever you do, note the effect of every change. Every kit receiver available on the market at the present time, when placed into the hand of an experienced professional set constructor can be made to produce more than the same receiver without the fine detail changes, when in the hands of one who is ever ready to "leave well enough alone."

The kit receiver is only the basis. While it is a product of sound and scientific engineering, it nevertheless is open to improvements when it is to be used in any one special location. Every home is a special location because receiving conditions differ.

SET BUILDERS IN DEMAND

The radio industry needs the capable professional set builder.

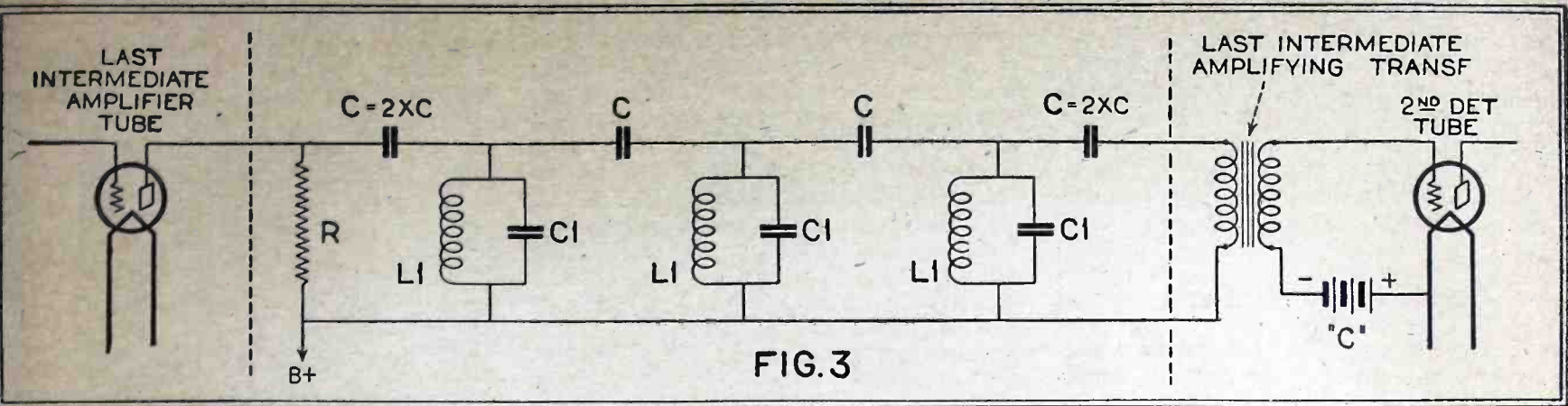
He is greeted with open arms and every possible cooperation offered. One manufacturer, has prepared a radio course for the service man and the professional set builder. The capable professional set builder is studying all the old types of receivers, obsolete at this time, but millions are still in use. Every one of these receivers may be converted into a modern installation. Tuning circuits have undergone few changes but bet-

ter audio systems have been developed. Many of these old receivers afford satisfactory selectivity and the only necessary change is a new audio system. Revamping the filament circuits is a simple procedure to the man who knows. The capable custom set builder is making a thorough study of A.C. tubes and how to apply them to old receivers—to modern receivers. A.C. tubes are as good as their D.C. brothers when correctly used. The correct use of these tubes is a matter of study. A few valuable hints about A.C. tubes are contained on another page in this issue.

Custom set building is a profitable enterprise—if the man interested knows his business. One can never know too much.

Practical and theoretical information is always useful. School courses, text books, manufacturer's literature, newspaper sections and radio magazines are sources of vital information. It is true that the data in many text books is now obsolete, but modern books are available. One is reluctant to expend money for books, particularly when the reading material is dry—but the information is vital to the welfare of the business. Very often one significant point of information produces remuneration sufficient to reimburse for a few books. . . . The item of knowledge is not only for the present—it is the foundation for expansion, for the ability to meet all requirements.

Go where you will—the successful man is the one with knowledge.



Schematic diagram of band pass filter described in this article and its position in the receiver circuit.

SUPERHETERODYNE BAND PASS FILTERS

By

Frederick Reed

A GREAT deal of interest has been evinced in band pass filters suitable for use in superheterodyne receivers. Such devices were exploited some time ago but interest waned because the units were cloaked in a veil of mystery. The appellation "band pass filter" sounds highly technical, but it is really simple to the one actually interested in its construction.

The band pass filter is nothing more than an electric wave filter and identical to the myriad tuned radio frequency stages used in receivers today. By identical we do not mean electrical characteristics or physical appearance; we refer to function. The filter family as we know it today has many members and the difference between the various types is found in the frequency response and the position in the circuit. In some instances, as in the case of the ordinary wave trap, its function is to reject one band of frequencies and to pass all others; in other instances its function is to pass one band of frequencies and to reject or greatly attenuate all others.

Many owners of superheterodyne receivers have requested custom set builders to add a band pass filter. The information contained in the accompanying tables affords the electrical constants of band pass filters for practically all popular models of superheterodyne receivers, manufactured within the last five years. This filter is intended, as is evident in figure 3 for application between the last intermediate amplifier tube and the second detector, functioning as the coupling medium between the plate of the last intermediate amplifier tube and the pri-

The accompanying tables should be of vital interest to the many individuals who have aspired to band pass filters for their superheterodynes, but were unable to solve the supposed intricate formulae. . . . The construction of the filter is a simple matter and the author hopes that many custom set builders will have the occasion to install such equipment.

—EDITOR.

mary winding of the last intermediate frequency transformer.

FILTER DESIGN

The filter is designed to consist of three sections, affording excellent attenuating characteristics. Due to the transmission of a 5,000 cycle side band, the electrical constants are such that each filter has a 10,000 cycle band pass, affording a side band of 5,000 cycles each side of the peak frequency.

The basic circuit for a band pass filter is shown in figure 1, and consists of a number of identical series impedance L and C and a number of identical shunt impedance L1 and C1, each combination of LC and L1C1 constituting a section. The combination of inductance L and capacity C constitutes the series impedance of one section and the combination of L1 and C1 constitutes the shunt impedance of the same section. The combination of the series and shunt impedance as shown provides a means of passing two bands

of frequencies, the limit being governed by the electrical constants of L, C, L1 and C1. We, however, are interested in the passage of but one band of frequencies lying between two prescribed limits, hence we remove one element in the series impedance, the inductance L, in each section. The effect of the change is shown in figure 2, where the four element filter has been reduced to three elements. The filter network shown in figure 2, is identical to that shown in figure 1, with the exception of the absence of inductance L in figure 1.

The design of a band pass filter for use in a superheterodyne receiver, in the intermediate frequency amplifier, while not complicated necessitates the consideration of certain factors, very simple to comprehend. First, is the peak frequency of the intermediate frequency amplifier. This is known to every owner of a superheterodyne, since the peak frequency of the intermediate frequency transformers is definitely specified by the transformer manufacturer. As a matter of fact many superheterodynes are known by the peak frequency of the intermediates. As examples we have "The 45 K.C. Super", "The 115 K.C. Best Super", etc. In both cases the peak frequency is specified. Where it is unknown it may be ascertained by communication with the transformer manufacturer.

The second important factor is the width of the band to be passed, or the extent of the sidebands, the total width being equal to twice the width of either side band, since they are identical. In this

respect it is customary to provide for a band pass of 10,000 cycles or 10 K.C. allowing a 5000 cycle or 5 K.C. sideband, since everyday broadcast transmission is of this nature—the transmission of a 5000 cycle sideband each side of the carrier frequency.

Third, is the impedance of the filter network. The significance of this term need not be studied, if one realizes its application. In technical parlance it is essential that a certain relation exist between the intermediate frequency amplifying tube and the associated coupling transformer, in order that satisfactory amplification be obtained. The addition of the band pass filter should not change this relation, consequently one is obliged to consider the output impedance of the amplifying tube associated with the filter system, i.e., the tube feeding the filter network. The output impedance of standard A.C. and D.C. tubes at various voltages is usually quoted in the tube manufacturers' sales literature and is therefore easily obtainable. We will, however, for the sake of simplicity, mention the tube output impedance of some of the tubes now being employed as intermediate frequency amplifiers. Note that the tube output impedance varies with the plate voltage applied. When considering the design of a filter for any one superheterodyne one is at liberty to employ the closest approximation of required electrical values. It should not be difficult to ascertain the plate voltage being applied to the intermediate frequency amplifiers, and every owner of such a receiver knows the type of tube being employed.

Type of Tube	Plate Voltage	Output Impedance
WD11 C11 WD12 or C12	45	18,000 ohms
	67.5	17,000 ohms
	90	16,000 ohms
199	45	19,500 ohms
	67	16,500 ohms
	90	15,000 ohms
201A	45	18,000 ohms
	67.5	14,000 ohms
	90	12,000 ohms

FILTERS

Study of figure 2 shows that the first condenser C would normally connect to the plate of the associated intermediate frequency amplifying tube. Under such conditions it would be impossible to apply plate voltage since the condenser does not pass D.C. It is therefore necessary to add some means of feeding the plate voltage to the amplifying tube. Two methods are available, a plate coupling choke or a resistance. The former is un-

satisfactory for one major reason, namely, that numerous precautions must be exercised to eliminate coupling between the plate choke and the inductances in the filter. Hence the use of a resistance R as shown in figure 3. The value of R is equal to the output impedance of the tube. Since this resistance is in parallel to the tube output impedance, the resultant impedance of the combination consisting of the tube and the resistance, is one-half of the tube impedance, since the resultant resistance of two equal resistances in parallel is one-half of either one. The impedance of the filter network is then made equal to the resultant impedance of the tube and the external resistance in parallel. In other words if the tube in question is a 199 with 45 volts applied to the plate and with an output impedance (according to the table) of 19,500 ohms, the external resistance R is likewise of 19,500 ohms and the resultant impedance is $19,500/2$ or 9750 ohms. For the sake of simplicity and because a difference of 250 ohms is of little consequence, we can consider the required filter impedance to be 10,000 ohms.

The following tables give the required values of C, L1 and C1 as shown in fig. 3.

The explanation: $C=2 \times C$.

accompanying the input and output capacity C signifies that these condensers are equal to twice the value of C utilized for the other condensers designated as C. The electrical constants quoted for C are applicable to all condensers specified as C, with the exception mentioned. Likewise the electrical constants for C1 and L1 are applicable to all the capacities and inductances bearing these designations. The tables are arranged to cover all values of filter impedance between 5000 and 20,000 ohms and all well known peak frequencies from 30 to 115 K.C.

These filters are designed for a band pass of 10 K.C. or 10,000 cycles equal to 5000 cycles each side of the peak frequency.

Peak Frequency 30 K.C.

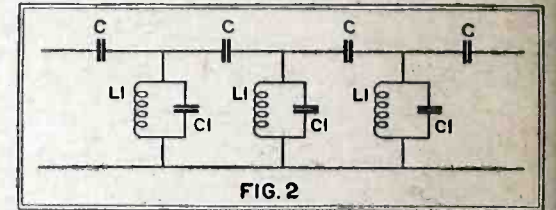
Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.00109 mfd.	.00454 mfd.	4.55 mil. hen.
6000	.00091	.00378	5.46
7000	.00078	.00324	6.37
8000	.00068	.00283	7.28
9000	.000606	.00252	8.19
10000	.000546	.00227	9.1
11000	.000496	.00206	10.01
12000	.000455	.0019	10.92
13000	.00042	.00174	11.83
14000	.00039	.00162	12.74
15000	.000364	.00151	13.65
16000	.000341	.00141	14.56
17000	.000321	.00133	15.47
18000	.0003	.00126	16.38
19000	.000287	.0012	17.29
20000	.000273	.00113	18.20

Peak Frequency 35 K. C.

Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.00093 mfd.	.00476 mfd.	3.34 mil. hen.
6000	.000775	.00396	4.008
7000	.000664	.0034	4.676
8000	.00058	.00297	5.344
9000	.000516	.00264	6.012
10000	.000465	.00238	6.68
11000	.000422	.00216	7.348
12000	.000387	.00198	8.016
13000	.000357	.00183	8.684
14000	.000332	.0017	9.352
15000	.00031	.001586	10.020
16000	.00029	.001487	10.688
17000	.000273	.0014	11.356
18000	.000258	.00132	12.024
19000	.000244	.00126	12.692
20000	.000232	.00119	13.36

Peak Frequency 45 K.C.

Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.000715 mfd.	.00507 mfd.	1.99 mil. hen.
6000	.000596	.00424	2.48
7000	.000511	.00363	2.78
8000	.000447	.00317	3.18
9000	.000393	.00282	3.58
10000	.000358	.00254	3.98
11000	.000325	.00230	4.38
12000	.000298	.00211	4.77
13000	.000275	.00195	5.17
14000	.000256	.001813	5.57
15000	.000238	.001695	5.97
16000	.000224	.00159	6.37
17000	.000210	.001495	6.77
18000	.000199	.00141	7.17
19000	.000188	.001337	7.57
20000	.000179	.00127	7.97



Modified circuit designed to pass one band of frequencies.

Peak Frequency 52 K.C.

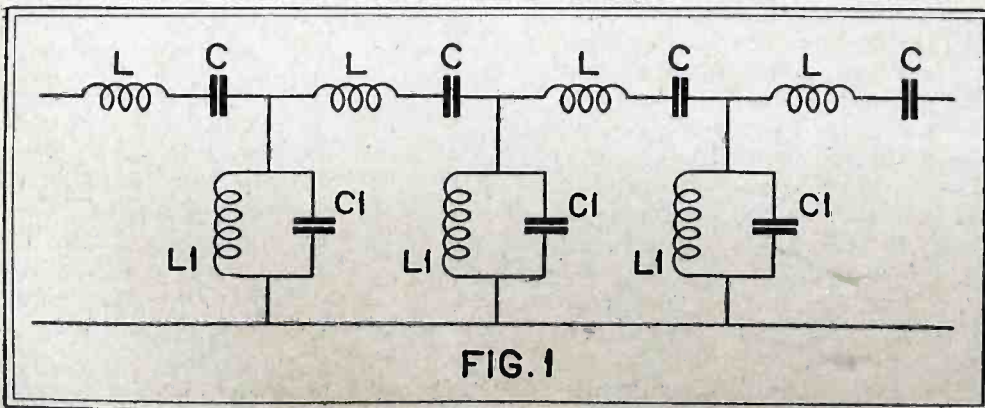
Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.00062 mfd.	.00524 mfd.	1.48 mil. hen.
6000	.00051	.00436	1.776
7000	.00044	.00374	2.072
8000	.00038	.00327	2.368
9000	.00034	.0029	2.664
10000	.00031	.00262	2.96
11000	.00028	.00238	3.256
12000	.000258	.00218	3.552
13000	.000238	.00201	3.848
14000	.00022	.00187	4.144
15000	.0002	.00174	4.24
16000	.00019	.00163	4.736
17000	.00018	.00154	5.032
18000	.00017	.00145	5.328
19000	.00016	.00138	5.624
20000	.00015	.00131	5.92

Peak Frequency 60 K.C.

Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.000532 mfd.	.00538 mfd.	1.11 mil. hen.
6000	.000443	.00448	1.33
7000	.00038	.00384	1.55
8000	.000332	.00336	1.77
9000	.000296	.00299	1.99
10000	.000266	.00269	2.22
11000	.000242	.00244	2.44
12000	.000222	.00224	2.66
13000	.0002042	.00207	2.88
14000	.00019	.00192	3.11
15000	.0001775	.00179	3.33
16000	.000166	.00168	3.55
17000	.0001565	.00158	3.77
18000	.0001488	.00149	3.99
19000	.00014	.001415	4.22
20000	.000133	.001345	4.44

Peak Frequency 70 K. C.

Filter Impedance Z	Condenser C	Condenser C1	Inductance L1
5000 ohms	.000456 mfd.	.0055 mfd.	.82 mil. hen.
6000	.00038	.00458	.984
7000	.000325	.003928	1.148
8000	.000285	.003437	1.312
9000	.000253	.003055	1.476
10000	.000228	.00275	1.64
11000	.000207	.0025	1.804
12000	.00019	.00229	1.968
13000	.000175	.00211	2.132
14000	.000162	.00196	2.296
15000	.000152	.00183	2.460
16000	.000142	.001718	2.624
17000	.000134	.001617	2.788
18000	.000126	.0015	2.952
19000	.00012	.00144	3.116
20000	.000114	.00137	3.280



Basic circuit arrangement for the design of band pass filters of the Campbell type.

Peak Frequency 80 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 5000 ohms.

The various impedance values mentioned in this table are beyond the values usually employed. They are however quoted for the purpose of supplying data to the man who is confronted with a problem differing from the conventional.

Peak Frequency 88 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 5000 ohms.

Peak Frequency 90 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 5000 ohms.

Peak Frequency 100 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 5000 ohms.

Peak Frequency 110 K. C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 5000 ohms.

Peak Frequency 112 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 20000 ohms.

Peak Frequency 115 K.C.

Table with 4 columns: Filter Impedance Z, Condenser C, Condenser C1, Inductance L1. Values range from 5000 ohms to 20000 ohms.

With respect to application, let us assume that we have a superheterodyne utilizing three stages of intermediate frequency amplification, peaked at 88 kilocycles.

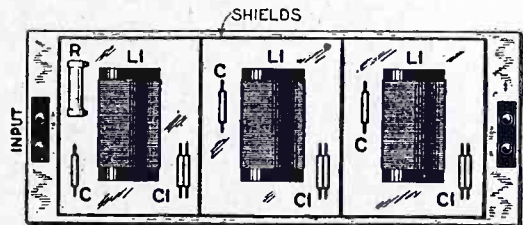


FIG. 4 Completed band pass filter for 115 K. C. super-heterodyne. Note that each section is individually shielded.

Impedance is 19,500 ohms and according to our explanation the filter impedance is 10,000 ohms. The width of the band to be passed is 10,000 cycles.

Unfortunately, it is impossible to obtain standard capacities of this value, and it is necessary to construct capacity banks. Fortunately the effect of a small variation is not appreciable, and exact condenser specification or inductance specifications need not be fulfilled.

The formula for C is F1 + F2

C = 12.56 x F1 x F2 x Z

for C1 is F1

C1 = 3.14 x F2 x D x Z

for L1 is D x Z

L1 = 12.56 x F2 x F1

Where F1 is lower cut off frequency F2 is upper cut off frequency. D is difference between them in cycles. Z is filter impedance.

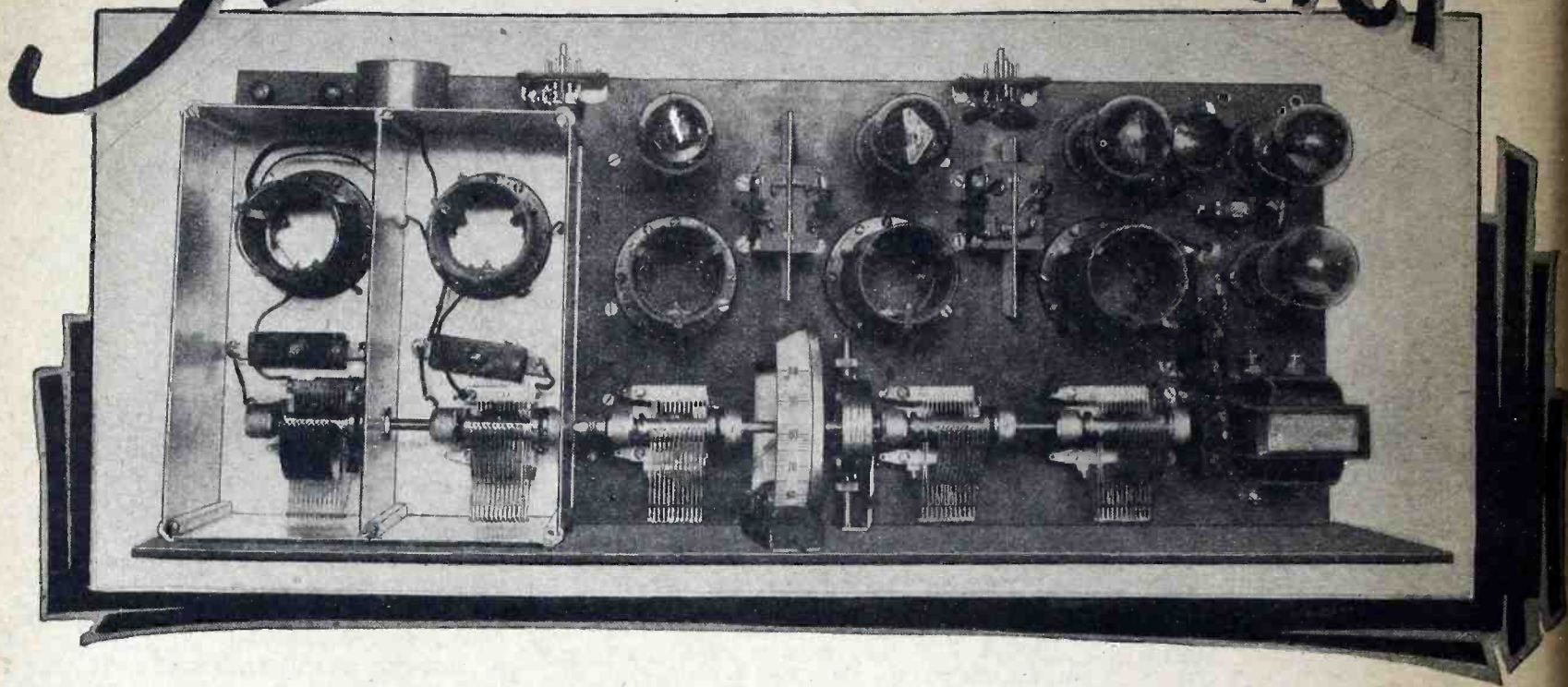
A complete band pass filter for a 115 K.C. peak frequency superheterodyne is shown in figure 4. The three sections are contained in individual shielded compartments.

LIST OF PARTS

- 1 Aerovox 19,500 ohm Lavite resistance (R). 4 Aerovox .00014 mfd. mica condensers (C). 2 Aerovox .003 mfd. mica condensers (C1). 4 X-L binding posts. 3 3-in. lengths of Bakelite tubing 1.5-in. in diameter. 1 Roll of Corwico Braidite hook-up wire. 2 Bakelite strips 1x3x1/2 in. Aluminum for shields.

Mention must be made of several pertinent facts associated with band pass filters. Their incorporation into the receiver is made with a definite purpose in mind, namely greater selectivity, but this gain in the ability to choose between stations is secured with a slight loss in signal intensity.

A 10 K.C. Receiver



Top view of receiver with shield covers removed.

By H. G. CISIN

THE phenomenon of radio broadcast transmission involves the generation of a certain signal designated as the "carrier" and interpreted in wavelength or frequency. The wavelength allocation is mentioned as being a certain number of meters and the frequency allocation as being a number of kilocycles or cycles. The abridged term for kilocycles is K.C. The terms wavelength and frequency are closely allied since each is a function of the other when considering the speed of the electric wave through air and determining either one of the two mentioned. When a station is said to transmit on a 500 meter wave, it is equivalent to a wavelength allocation of 500 meters and a frequency allocation of 600 kilocycles, or 300,000,000 (the speed of the electric wave) divided by the wavelength in meters.

In order to transmit speech or music, the carrier wave must be "modulated," that is to say the electrical equivalents of the sounds spoken or passed into the studio microphone are impressed upon the carrier wave, and the shape of this wave is altered. These modulating frequencies are those which the ear distinguishes as sound, and according to the accepted audio frequency limitations, to be found in radio practice range from about 25 to 6000 cycles. Assuming transmission on 600 K.C. or 600,000 cycles, the original carrier wave of 600,000 cycles will be increased to 606,000 cycles and decreased to 594,000 cycles, during the process of modulation. These frequencies above and below the carrier wave are referred to "as upper and lower side

This receiver should be of particular interest to the broadcast listener who is interested in high calibre local reception and to the professional setbuilder whose customers are classified in this category. The combination of a band pass filter and the slightly detuned R.F. stages produces a state of sideband responsivity ideal for the attainment of excellent reproduction at a small sacrifice of sensitivity.

Editor.

band" frequencies. It can readily be seen that a receiver tuning with so-called "knife-like" selectivity, would be unable to give true reproduction of speech or music, as a portion of the side band frequencies would be tuned out. In such a case, the sharper the tuning, the poorer would be the reproduction. The absence of "partials" or "harmonics" are especially noticeable when the side bands are cut off and in consequence, music and speech sound unnatural and not true to life. The necessity of tuning in the side bands, is therefore quite obvious.

The difficulty which now arises, lies in the fact that the various broadcasting stations, in accordance with the rulings of the Federal Radio Commission, are separated just 10,000 cycles (10 kilocycles). If the ordinary receiver is designed to fully cover the side bands, it would in many cases tune broadly and bring in two or even three stations at once. The result is a compromise—satis-

factory selectivity with a small amount of sideband suppression.

THE BAND PASS SELECTOR

The use of a band pass filter in conjunction with the average tuned stages overcomes this difficulty, because it limits the passage of a selected band of frequencies through the filter system, and the other stages are arranged to satisfactorily cover the full modulated carrier. For example is this receiver the band pass selector when designed to pass a band 10 K.C. wide and tuned to 600 kilocycles, will pass all frequencies between 595 and 605 kilocycles. Below 595 and above 605 kilocycles the cutoff is sharp and attenuation great, resulting in the effective suppression of all frequencies below and above the cutoff frequencies. Between these two points, practically uniform amplification is available for passage to the remaining amplifying tubes. In non-technical language, the upper and lower sidebands are amplified to practically the same degree as the carrier wave.

The band pass selector consists of a system of reactances (inductance coils and variable condensers) arranged so that they are mutually balanced, for a group or band of frequencies. When the reactances are balanced for any one particular band, they are unbalanced outside this band, thus being non-responsive to all frequencies outside the band in question.

FILTER DESIGN

Figure 1 shows an elementary circuit of a band pass selector in which a mutual

inductance, M_1 , provides the direct coupling between the two resonant circuits $C_1 L_1$ and $C_2 L_2$. The mutual inductance, M_1 , is a coil having but a very few turns (a five turn coil is used in the Ten 10 k.c. Receiver). The input voltage is induced in coil L_1 by means of magnetic coupling through a primary winding L_p connected between the antenna and the ground. The output voltage is taken off through the primary coil L , which is inductively coupled to coil L_2 .

peaks and the depression between them are due to the operating characteristics of the system. As is evident in figure 1, the two circuits are series circuits and consequently utilize the series resonance phenomenon. Under the circumstances, the reactance at resonance for each circuit is zero, and infinite for the frequency between these two resonant frequencies.

The natural resistance of the circuit helps to produce approximately equal amplification within the selected band, by

issue of *Radio Engineering Magazine*. A 50 watt oscillator was used as a local driver and small variations in its frequency about an arbitrary value were determined by measuring the beat note between it and a crystal oscillator. For each setting of the local oscillator, the radio frequency voltage across C_2 (see Fig. 1) was measured with a vacuum tube voltmeter. The mutual inductance M_1 consisted of a separately shielded coil of 5 turns, wound on a 1-in. dia. form.

Figure 2 shows the type of curve obtained at 540 meters. The band width was measured arbitrarily between the points where the response falls to half its maximum, giving a width of 9 kilocycles. At 340 meters, figure 3, there was a band width of 12 kilocycles, with a slightly greater center dip. At 200 meters, figure 4, the band width spread to somewhat over 20 kilocycles and the curve shape was of the less desirable form of a rounded top and sloping cut-off.

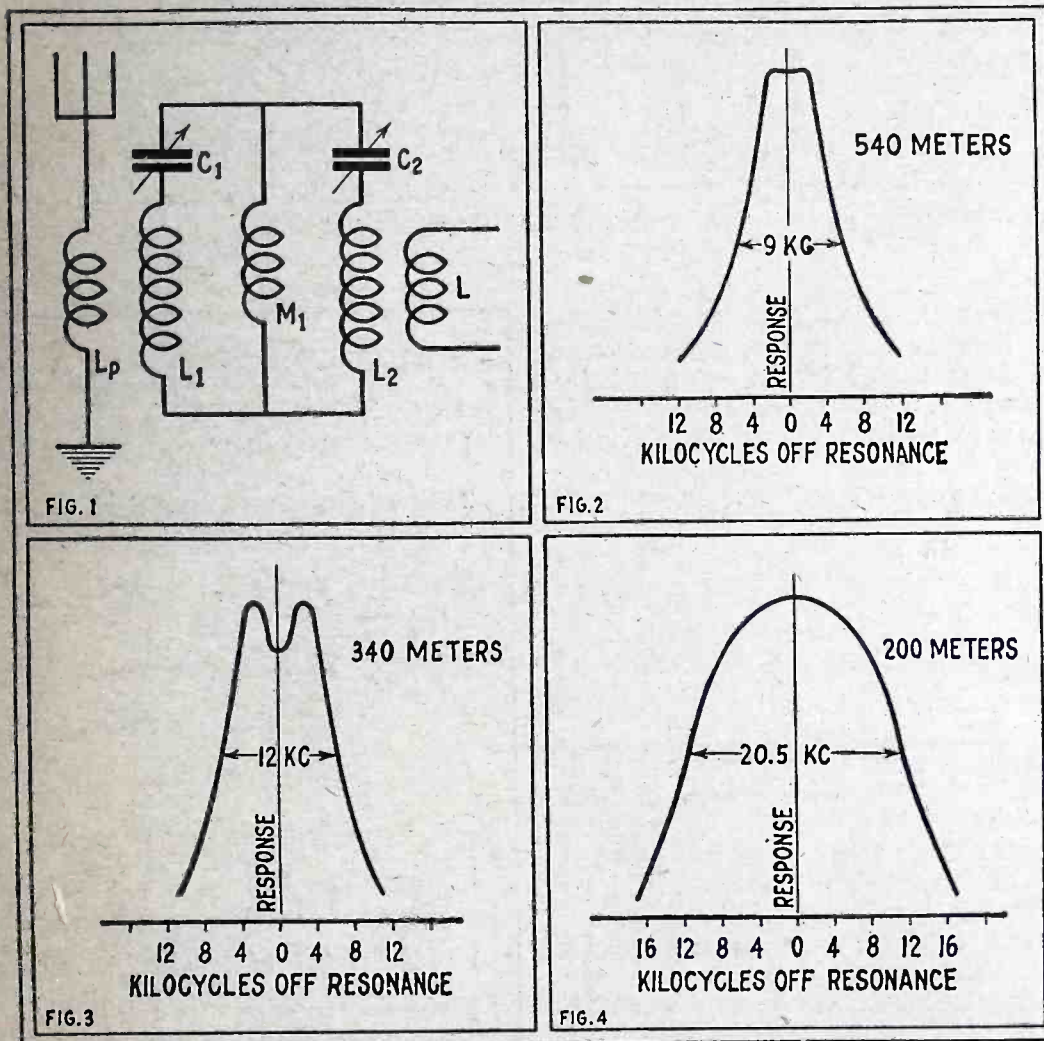
A study of these curves reveals the fact that a band pass selector designed for 10 kilocycle selectivity at 500 meters will tune twice as broadly at 200 meters. Nevertheless, this does not alter the fact that this type of selector provides an enormous improvement over previous resonating methods.

The actual circuit of the A.C. Band Pass Receiver is shown in one diagram. It is recommended that the set be built in two separate parts, with the band pass selector, the three r.f. stages,—the detector and the first audio stage in one section and a push-pull power amplifier, "A", "B" and "C" power supply in another section.

The receiver is constructed of standard parts obtainable everywhere. The only special part is the coil (7) which can be wound readily in accordance with the directions given below.

Single dial control is attained through the use of a drum dial. A curve is shown in Figure 6 which gives the relation between dial setting and station frequency. Volume is controlled in the radio frequency portion by means of a 75 ohm rheostat shunted across the primary of the antenna coupler. An additional volume control is furnished in the audio system in the form of a tonatrol shunted across the secondary of the first stage audio transformer. The grid leak is of metallized resistor type.

In order to prevent inductive coupling between the inductances of the band pass selector, an aluminum shield having two



The basic band pass filter circuit is shown in Figure 1. The remaining figures illustrate three band pass filter characteristics.

The band-pass selector in this receiver consists of the parts shown within the shields in the top view illustration.

Two resonant circuits are clearly evident, one of which consists of the secondary of radio frequency transformer designated as number 4 and a .0005 mfd. variable condenser. The other resonant circuit consists of the secondary of radio frequency transformer number 9 and another .0005 mfd. variable condenser. These circuits are carefully matched and arranged to resonate at identical frequencies when applied to the filter. They are coupled to each other by a small mutual inductance coil designated as 7 in figure 7. When the two resonant circuits are balanced at one frequency, by tuning the individual circuits to the same frequency, the total reactance of the entire circuit is zero at that particular frequency. The function of the band-pass filter however, requires that a certain band be covered, hence the use of the special coupling coil whereby a double peak resonance curve is secured.

A double resonance arrangement of this type produces a double resonant peak such as that shown in figure 3. The two

preventing zero reactance and infinite impedance between the two points of minimum reactance. The proximity of the two "zero reactance" points may be increased by decreasing the number of turns of the special coil; or if it were desired to permit the selection of a broader band of frequencies by increasing the distance between the two "zero reactance" points, it would simply be necessary to increase the number of turns of the special coil (7). It should be noted that with a system designed to pass a band of frequencies of a certain width, the band will be wider at higher frequencies (lower wavelengths) narrower at lower frequencies (higher wavelengths). This is because the reactance of the special coil varies in direct proportion with the frequency.

RESPONSE CURVES

In order to illustrate the response of the band pass filter circuit used in the A.C. Band Pass Receiver, curves are given in figures 2, 3 and 4, showing the results obtained from an experimental set-up, using a similar selector in tests made by G. F. Lampkin and set forth in a recent

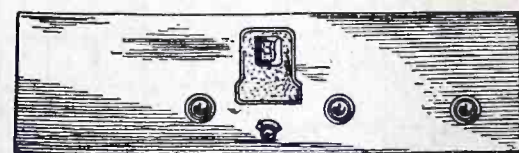


Fig. 5. Front panel view.

compartments is used. A special shield made of brass tubing, is provided for the special inductance coil and individual shields are used between R.F. stages.

In addition to having remarkable selectivity, the A.C. Band Pass Receiver is extremely stable and there is no tendency towards inter-circuit reaction or regeneration. Hence no balancing devices or neutralizers are required.

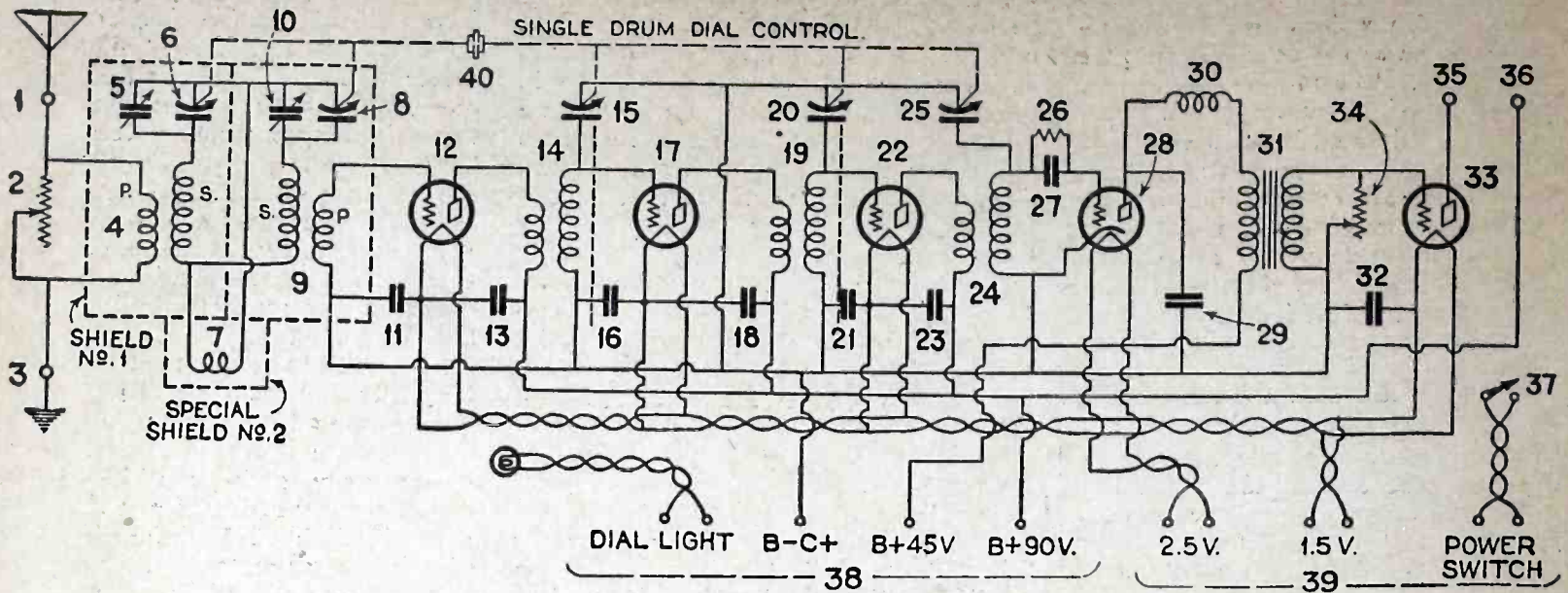


Fig. 7. Wiring diagram of 10 K.C. band pass receiver. Parts Specifications correspond with numerals in list of parts.

In view of the inherent ability of the R.F. portion of the circuit to give almost perfect tone quality, it goes without saying that the audio portion should be of the highest quality, as used in this receiver.

PREPARING THE SPECIAL COIL

Procure a piece of 1-in. diameter bakelite tubing 1 1/8 in. long. On this form, wind 5 turns of No. 26 double cotton covered magnet wire. The winding should be in the center of the tubing. The special shield, No. 2 for this coil can be made out of a piece of thin brass tubing, 2 in. in diameter and 1 1/8 in. long. One end of the brass tubing rests against the shield, as shown in the illustrations. The other end is closed by a flat brass disc. A 6-32 machine screw, about 1 1/2 in. long, is used to fasten special shield No. 2 to the large aluminum shield No. 1. The accompanying diagram gives all location details. The tubing on which the coil is wound is filed so that it is held rigidly in position between the aluminum shield and the brass disc, when the nut on the 6-32 machine screw is tightened. Leads for the coil are passed through holes drilled in the aluminum shield.

WIRING THE BAND PASS TUNER

Practically all wiring is done beneath

the sub-panel. The wire is brought up to the terminals of the various parts through small holes drilled in the sub-panel for this purpose. Stranded core "braidite" is used for all wiring. The use of this hook-up wire will be found to be of great convenience to the set builder. In order to make a soldered connection, it is unnecessary to strip back the insulation. The braid is simply pushed back while the soldering is done.

Shielding of the radio frequency transformers employed in the band pass filter is imperative. All inductive coupling between these two stages must be eliminated, the special coil alone, being the coupling medium. A correct resonance in these tuned circuits is likewise of importance. The constructor must remember that the width of the band pass is controlled by the special coupling coil. Furthermore, inductive coupling between the special coil and the two major radio frequency transformers must likewise be eliminated. It is normally customary to utilize band pass filters with transformer coupled stages. To accomplish a similar effect it is necessary to detune the radio frequency stages 14, 19 and 24 about 4 K.C. off resonance or to insert a small value of resistance of approximately 6 to 8 ohms into each of these tuned circuits in order to broaden the tuning of each stage.

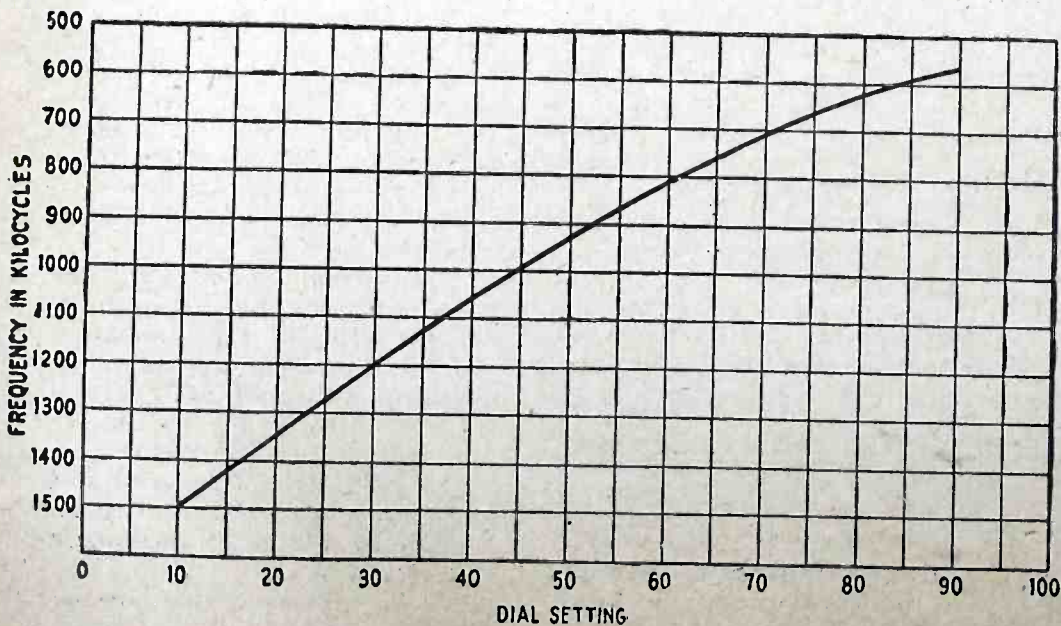
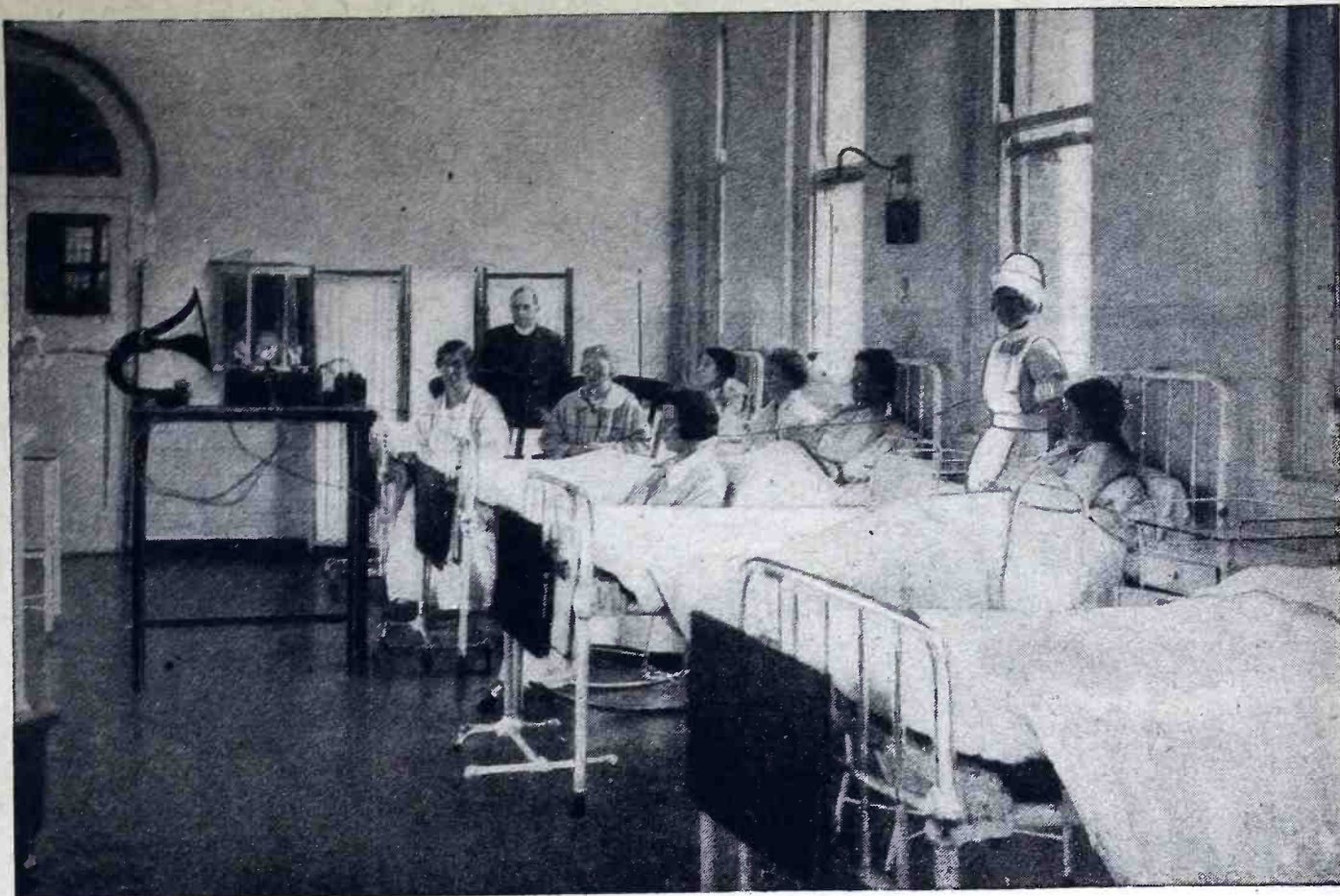


Fig. 6. Tuning curve of 10 K.C. band pass receiver showing dial setting when tuning according to frequency of the broadcasting station.

LIST OF PARTS FOR A 10 K.C. RECEIVER

- 1 Aero Universal Tuned R.F. Kit, Type U-12, (4, 9, 14)
- 2 Additional Aero matched R.F. transformers, same as in U-12 kit (19, 24)
- 5 Hammarlund .0005 mfd. Midline variable condensers (6, 8, 15, 20, 25)
- 1 Yaxley 75 ohm junior rheostat (2)
- 2 Yaxley insulated tip jacks, No. 422 (35, 36)
- 4 Eby Ux type sockets, (12, 17, 22, 33)
- 1 Eby UY type socket (28)
- 1 Electrad Tonatrol, type S (34)
- 1 Polymet .00025 mfd. molded bakelite fixed mica grid condenser (27)
- 1 Polymet .001 mfd. molded bakelite fixed mica condenser (29)
- 7 Polymet 1/2 mfd. "Hi Volt" filter condensers, type C-903 (11, 13, 16, 18, 21, 23, 32)
- 1 Durham 2 meg. metallized resistor grid leak, with Durham vertical single mounting (26)
- 1 Silver-Marshall vernier drum dial, type 806-R, with drum dial window, type 807
- 1 Thordarson transformer, type R-300 (31)
- 1 Hammarlund R.F. choke, type RFC-85 (30)
- 1 Carter "Imp" power switch (37)
- 1 Hammarlund flexible coupling, type FC (40)
- 1 Hammarlund aluminum shield, type HQS
- 1 Special inductance coil
- 1 Shield for special coil
- 2 Muter variable balancing condensers, type 1900 (5, 10)
- 2 Yaxley cable connectors, No. 660, complete with plugs and mountings, (38, 39)
- 2 X-L engraved binding posts (1, 3)
- 1 Bakelite 7 x 26 x 3-16 in. panel
- 1 Bakelite 10 x 25 x 3-16 in. sub-panel
- 4 Brackets, 1 in. high
- 4 Gold Seal tubes, type GSX 226 (12, 17, 22, 33)
- 1 Gold Seal tube, type GSX 227 (28)
- 1 Can Kester radio solder
- 1 Roll Corwico Braidite, stranded core, hook-up wire.



Enjoying the news of the day.

Outlets

for the

Custom Set Builder

By ARMSTRONG PERRY

DID you ever see a school, church, club, hotel, Y.M.C.A., orphanage or home for the aged that was adequately equipped with radio?—If you have, it was an unusual institution.

Some such institutions are found in every community. Few of them have anything better than a makeshift radio installation, although they spend thousands of dollars for first-class equipment of other kinds. A few community set builders have seen the opportunity offered by such institutions, and have grasped it, and these few point the way to profits for the rest. The radio dealer is constantly seeking the set that will draw customers to his store and sell in large quantities. He may see the opportunity offered by the half dozen or more institutions in his territory, but he seldom takes time to study them because they are exceptional cases; present complex problems.

The folks who pass his windows are shopping for homes. There are enough of them to keep him busy. Why go after a proposition that means cultivating a whole board of directors and, if the sale

is made, developing a lot of special apparatus?—That seems to be the average dealer's attitude. Sometimes a dealer does sell to an organization. When he does, he usually sells the same kind of an outfit that he sells to homes. That means that he sells a flivver to a concern that needs a 50-passenger bus.

The set is installed. The loud speaker reaches only one or two rooms. When the set is needed in other rooms it is moved. The work is done by volunteers, or by janitors who are not longing for extra work. Connections are loosened. The set is as likely to be hooked up wrong, as right.—The results are poor. — Then someone steals the tubes. Before long there is a dust-covered set in some corner, a tangle of wires leading hither and yon, and a group of overworked officials who are tired of trying to do anything with radio.—Radio is condemned.

A MAN WHO RENTS RADIO SERVICE TO HOTELS

To jump to the other extreme which happens to be successful, there is a man in Washington who refuses to touch anything but a big proposition. He has no

salesroom. He approaches only hotels and other institutions where perfect results are demanded and appreciated.

His business methods should be failures, yet they succeed. He refuses to sell an outfit. His equipment is installed only on a rental basis.

One of the first hotels that he approached had an orchestra, as in most of the better hotels of today. The orchestra could play in only one place at a time, of course. When the musicians were in the main dining room there was no music in the grill. The manager laughed at a dealer who tried to sell him an ordinary receiver, although the dealer offered a reliable high-priced one. The hotel man and all his patrons had had plenty of experience with radio sets. He might as well use an ordinary phonograph. Either one would classify his house as a commonplace hostelry. He could not afford to have anything in the place that was not distinctive.

The set builder followed the foot-steps of the radio dealer, but sold the hotel man on the idea of having a pick-up where the orchestra played, and a loud speaker in the grill. The outfit was installed for a

week's demonstration. The "mike" was dolled up so that it was ornamental as well as useful and the loud speaker in the grill was a work of art and scientifically correct.

Within a short period of time the manager found that some guests preferred to eat where the loud speaker was. In the room with the orchestra they might be too near the piano or the drums or the bass viol. The music did not blend perfectly, as it did when it came from the loud speaker. Then, of course, it was easy for the radio man to put in a receiver and pick up programs from other places. That gave the hotel all-day musical service.

His policy of not selling his outfits is a sound one—in his case. He owns them and takes care of them. They are never allowed to run down. He keeps the results so far above those that other sets deliver that there is no comparison. His installation adds a tone of distinction to

in Every Room" stamps the hotel as ultra-modern. A contract to equip a house of twenty to one hundred rooms is large enough to permit a good margin for the set builder, who can do his own work and make sufficient profit to justify his work and recompense him for his labors.

SELLING RADIO TO SCHOOLS

Strangely enough, very few schools are satisfactorily equipped, with radio installations. School teachers will work for years to pound geography into the heads of unwilling pupils, when a single radio program by Byrd, MacMillan or some other great explorer would give the children such an interest in geography and related subjects that they would eat up the information in the text books and spend hours at the public library looking for more. Lack of radio installations may be the result of ultra-conservatism on the part of school officials, or the difficulty that they have in securing sufficient

service. They said that the schedule was crowded in the school and that they could not afford to waste the time of their classes by trying to tune in radio programs.

Nothing but a demonstration could upset that notion. The set builder installed a set in one classroom. He discussed the radio programs with the principal and the teacher and they selected the subjects of interest to the class. He tested the set and logged stations on a card for the use of the teacher. He showed her how to set the dial for each station. All she had to do was to set the dial and pull the switch—the program was there.

At first the teacher and the officials merely tolerated the demonstration. It stimulated the interest of the pupils in their studies to such an extent that in a week the teachers were actually absorbed in the work. The classes without radio, set up a howl and forced action. The officials saw that the whole school should have radio if any part of it did. That gave them "cold feet." They did not like to spend money for anything except what they always had spent money for. The average dealer would have lost patience at the delays and obstacles in the way, but this community set builder, having a big stake in sight, kept hammering away.

The school board seemed hopeless. The expenditures would run into hundreds of dollars. But one of the schools had a peppy Parent-Teachers' Association. The set builder invited the president, a well-to-do and socially prominent lady, to attend one of the demonstration lessons. This lady had none of the inhibitions of the school board. She promptly got her organization back of a movement to install radio in their school. She also said things to the wives of some members of the school board that resulted in a quick shift of attitude by those members. The movement was under way.

The ultimate result was that the community set builder equipped six schools with radio in every classroom. He lifted himself out of the "electrician" class to which the public assigns radio men, and rose to the dignity of a radio contractor.

RADIO FOR ROTARIANS

A community set builder went over a list of organizations in his town with a view to finding prospects.

The Rotary Club was the liveliest bunch in town, but for some time he could think of no proposition to put up to them. Rotary had no club room. It met for luncheon once a week at some hotel or restaurant. It needed no loud speaker—there were plenty of those in the membership!

But Rotary was something like a Boy Scout organization for men. The club was always looking for some good turn to do for the town. That gave the set builder an idea. He talked with the doctors and town officials and made a list of all the cripples, invalids and blind persons in town. He took this list to the president of Rotary. It was easy to make this kind hearted gentleman see that such persons need radio more than anyone else. At the next meeting of Rotary it was proposed that the organization give a radio outfit to every disabled person in town who was not able to buy one. The president gave the members some suggestions, which the radio man had given him, about



A local radio installation in a factory provided to furnish dance music during luncheon hour.

any hotel, and he cannot be prevailed upon to install one of them in a second-class hotel no matter what the price.

The income from a limited number of such installations pays all the expenses of a laboratory and a trained staff, in addition to a good margin for himself. The standardized outfits offered by dealers cannot compete with his. He is alone in his field and he makes a good thing out of it.

RADIO IN EVERY HOTEL ROOM

A chain of big hotels announced recently that they were installing radio in every room. The value of the free publicity secured by being the first to offer this service to guests probably was greater than the expense of the installations. As a matter of fact the installation is comparatively simple. There are master receivers and the output is distributed to head phones in the rooms of the guests.

Any community set builder could work out a similar installation for a local hotel. All hotels have competition and "Radio

appropriation for equipment. More likely, it is the fault of radio men who do not make a real effort to sell to the schools.

The State of Ohio added a Director of Radio Broadcasting to the personnel of its Department of Education in the fall of 1928. When this Director, B. H. Darrow, sent out a questionnaire to find out how many schools would equip classrooms with radio when the educational programs started, hundreds of enthusiastic affirmative replies were received. Many schools have installed radio receivers in order to bring in the Damrosch lessons in music appreciation, but this big field is hardly touched as yet.

The community set builder is in a better position to equip schools than the average dealer. His knowledge is greater. A study of the local situation usually reveals some way to get radio into the local schools. One set builder had to develop the situation from the ground up. The teachers had radio in their homes and had found it unreliable, as it often is where there is no regular and competent

how a number of obsolete sets that were still good could be secured from their owners, repaired and installed at small expense.

Rotary was for it, to a man. The members gathered up all the usable radio junk in town and paid the set builder for the needed repairs. Two or three weeks of work on the installations. From then on—service and battery replacements. The radio man was reasonable in his charges. He could afford to be, considering the volume of business the club gave him. His idea worked out so well that he was invited to join Rotary. After that it was natural, of course, that the members should go to him with their individual radio problems.

CULTIVATING THE CHURCH

Church business often is hard to handle. Ministers are continually asking for discounts. On the other hand, dealing with a church is likely to bring a community set builder into contact with some very fine people who will be helpful to him. One dealer did so much business with members of one church recently that, as a means of showing his appreciation, he donated a good radio outfit to be raffled off at a church fair.

There are few churches, presenting an opportunity to install a radio outfit for regular church services. There are plenty of such services on the air, but any church that is open on Sunday is likely to have its own services. The best chance with a church, one set builder found, was to propose some radio activity for one of its auxiliary organizations. There are anywhere from two to a dozen of these in the average church and they are always raising money for one purpose or another.

He sold an outfit to a church choir by demonstrating how it could improve its work by listening, between numbers on choir practice night, to prominent singers and musical organizations. Another outfit went to a serious minded group of middle-aged people who organized a club for following important talks that were broadcast over the air. The members could have heard the same talks at home, of course, but it was much more interesting to get together, discuss the talks after they heard them, and have something to eat.

The set builder found another church was up against a common problem. Its young people had gone fairly crazy over dancing and were getting out of control. Even their parents did not always know where they were or whom they were dancing with.

A suggestion to the pastor led to the preparation of a basement room for a weekly party. The set builder sold a set to the church with sufficient volume to be audible above the animated conversation of a very lively crowd. The natural desire of the younger set for sociability was satisfied, and the church rose in their estimation.

IN THE Y'S

Another community set builder had never tried to sell an outfit to the Y.M.C.A., because it already had one. One day he awoke to the fact that the "Y" was without real radio service. The receiver was in the secretary's office. The loud speaker was fifty feet away at the

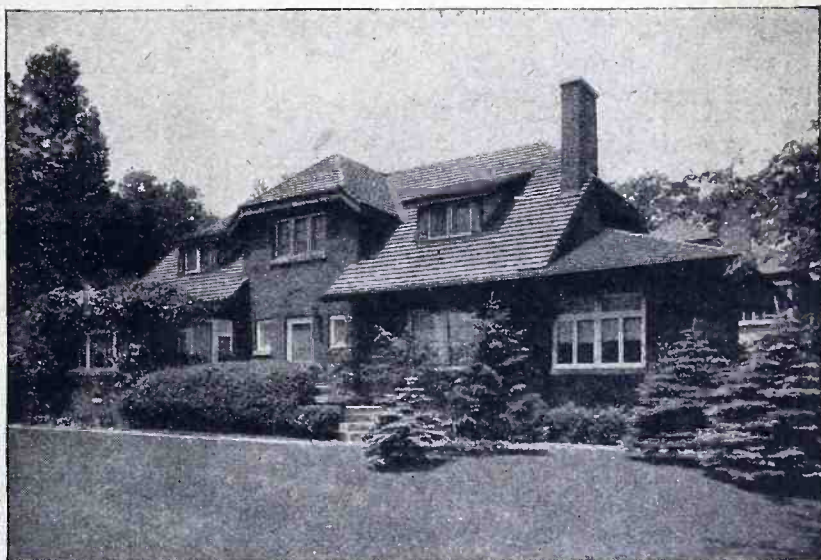
end of a pair of wires, sloppily draped over hooks and nails. Sometimes it was possible to tell whether it was a speech or a concert that was coming in, but whose speech or what concert it was usually a mystery. There was another loud speaker down in the boys' department, but it never worked.

"If you're going to have radio at all, why don't you get something out of it?" the set builder asked the secretary, whom he knew very well.

"Well, I'm willing to be shown," was the "Y" man's comeback.

The set builder sat down with him and painted a word picture of a "real" radio installation. A master receiver—a good one—in the secretary's office. A good loud speaker in the social room, and a committee to get the fellows together every time there was a baseball game or other sporting event of importance on the air. Another loud speaker in the gymnasium to add pep to the class work. Another in the boys' department, whose members were as much interested in the sports broadcasts as the men.

The modern private residence is equipped with convenience outlets in each room—a speaker in each room.



By Courtesy of Yarley Mfg. Co.

The auditorium was idle more than nine-tenths of the time, the usual status of "Y" auditoriums. He suggested a high power radio outfit for this big hall, and a committee to interest the public in hearing and discussing some of the outstanding radio programs. He added a new feature, inevitable where there are wide-awake radio men, and reading rooms. A separate receiver in the corner of the reading room, with a daily bulletin, posted every day to call attention to radio programs of interest to readers. This set was to be equipped with head phones, so that those who did not care to listen would not be disturbed.

The set builder worked himself into a position of prominence. The secretary agreed to find the money for the installation if the radio man would head a committee to organize and supervise the radio service. He shifted the detail work soon after the service started, by training the young men on his committee to take care of them.

Incidentally, as always is the case in work with organizations, the set builder made contacts and developed friendships that brought more business and were more valuable than cash.

ORPHANAGES AND HOMES FOR THE AGED

The situation of children in orphan-

ages, and of old folks in homes for the aged, appeals to everyone. Yet, for one reason or another, these folks at the extremes of life often are denied the privilege of radio, which can do so much for anyone who is out of the main currents of the world.

One community set builder, stirred by a desire to do something for these unfortunates but being unable to do so at his own expense, presented the problem to a well-to-do customer. The response came so quickly and decisively that it took his breath away:

"Fix 'em up and I'll pay the bill!"

It is needless to say that the radio man did a thorough and conscientious job, and that his charges were reasonable.

After it was done, he asked the man who was paying the bill to visit the two institutions that had been equipped. The appreciation that was shown by the inmates and officials was touching. The two men cut their visits short and they did not look at each other for some time after they started away in their car.

When they did, both had tears in their eyes.

This rich man, in his business dealings, had the reputation of being hard as nails. But the suggestion of succoring the needy, appealed to him. Such a suggestion invariably appeals to a man who possesses the wherewithal.

BEHIND THE BARS

Many a jail has a radio receiver, and many have not. Some community set builders have found that the keepers welcome it and that the inmates will chip in for it if they have anything to chip. Jail life is not a picnic, but it helps all concerned if they can be kept in as good humor as the circumstances will permit. Radio is a big help.

MANY OTHER PLACES FOR CUSTOM BUILT SETS

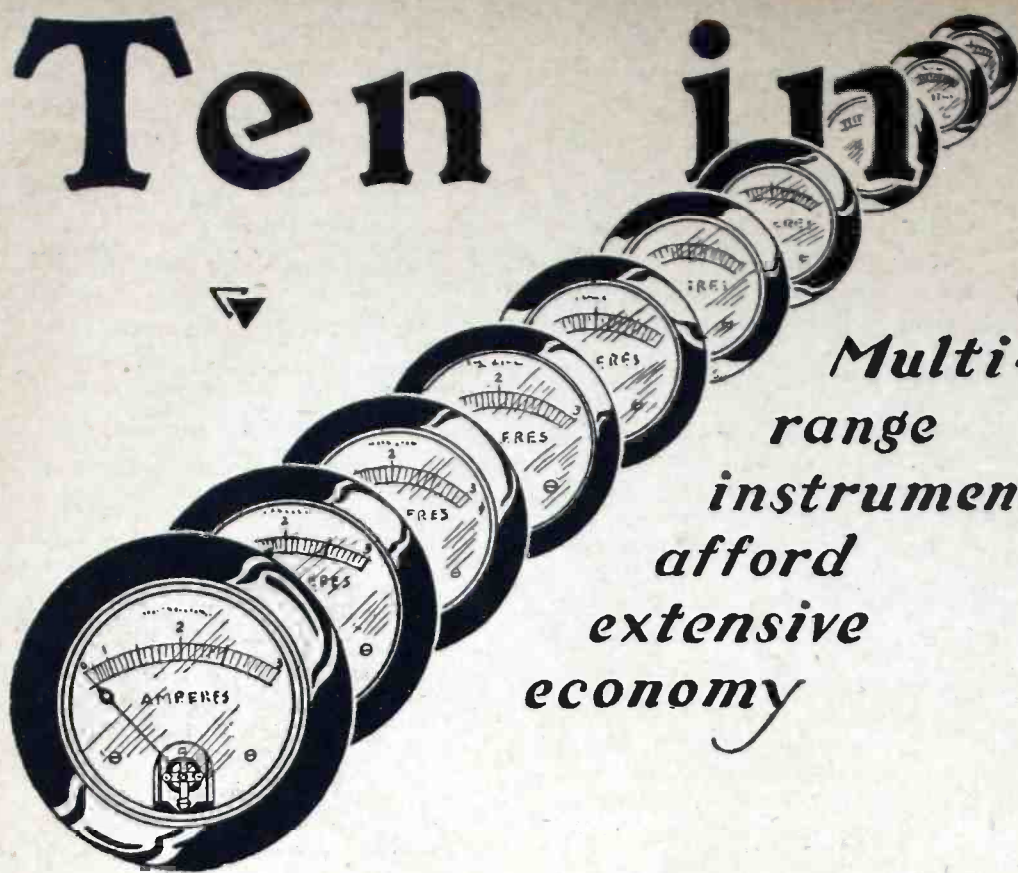
In many other institutions community set builders have installed their outfits. They are found in police barracks, where the boys play cards while waiting to go on duty; in fire houses where there is little to do between alarms; and in barber shops where the *Police Gazette* now divides the honors with the voice from the ether.

Railway waiting rooms ought to have radio and some of them have it. The

(Continued on page 106)

Ten in One

by M.J. Stone -



Multi-range instruments afford extensive economy

THE material in this story should have particular appeal to the service man, custom setbuilder and experimenter.

METERS or indicating instruments are vital to the service man. They constitute by virtue of their function the heart of radio receiver servicing. Unfortunately, meters are expensive, and consequently with limited funds a full assortment of meters is seldom possible. But the use of instruments is a necessity in the business, and if individual meters cannot be purchased, some means must be devised whereby one meter or indicating instrument may be utilized to perform several functions or to indicate voltage and current in several circuits. This means the use of multi-range indicating instruments.

Improvising a multi-range meter, whether voltmeter or ammeter is a simple task, providing that the internal resistance of the device is known. The selection of a series multiplier resistance or a shunt resistance is based upon two factors; first, the internal resistance of the instrument at hand and second, the required operating range. Much has been said and written about the methods employed to increase the operating scale of a voltmeter, and we will not dwell at great length upon this subject. It is generally understood that the operating range of any voltmeter is increased by the use of an external series resistance in conjunction with the meter. The value of this external resistor is governed, as we mentioned previously by the internal resistance of the voltmeter at hand and the required operating scale. The use of an external resistance equal in ohmic value to the internal resistance of the instrument doubles its operating scale or range. In other words, if a voltmeter rated at 200 volts maximum and a total internal resistance of 22,000 ohms, is utilized in conjunction with an external resistance of 22,000 ohms, the operating range of the voltmeter is increased twofold. If the resistance of the external resistor is equal to twice the internal resist-

ance of the meter, the operating range is increased threefold. In every case the multiplying factor is equal to the ratio between the external resistor R_x and the internal resistance of the meter R_m , plus 1. An idea of how such multiplier resistances are employed is shown below in figure 1.

"B" UNIT VOLTMETER

A high resistance voltmeter may be improved by employing a low reading D.C. milliammeter in conjunction with an external series resistance, as shown here-with in figure 2. The principle covering the design of this combination is that the voltage across two points in a circuit may be interpreted by the current flow in the circuit, when the circuit resistance is known. A current indication on a current meter connected in series with a known resistance may be interpreted in voltage, by applying Ohm's law for voltage. The current meter indicates the current, the resistance is known, and the product of current (I) x resistance (R) is equal to voltage (E). This is the basis for the frequently suggested 1000 ohms per volt voltmeter for the measurement

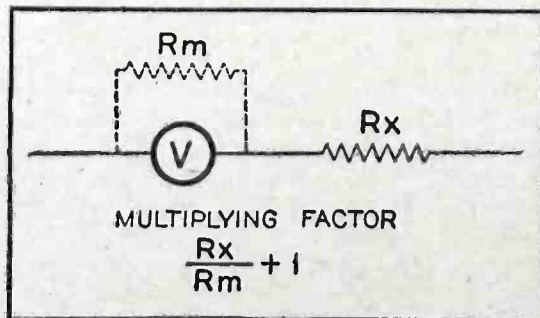


Fig. 1

The operating range of a voltmeter is increased by using a series multiplier resistance.

of power B unit output voltages, consisting of a 1 milliamper D.C. milliammeter connected in series with a 500,000 ohm resistance to produce a voltmeter with a maximum range of 500 volts. The value of external resistance R in figure 2 for

any known D.C. milliammeter and known maximum voltage, is determined by applying Ohm's law for resistance, viz:

$$R = \frac{E}{I}$$

where E is the maximum voltage to be applied and I is the current range of the meter at hand.

The internal resistance of the milliammeter is entirely negligible since the ratio between the external series resistance and the meter resistance is often as high as 300,000 to 1. Such meters when designed for the measurement of B power unit output voltage should be of the 1 to 2 milliamper type.

CURRENT METERS

In contrast to voltage indicating devices and the use of series multiplier resistances the operating range of a current meter is increased by means of a shunt rather than a series resistance. The principle covering the design of this combination is that the total resistance of a path consisting of two or more resistances in parallel is always less than the resistance of either one of the individual resistors. The current flow through the circuit divides between the two branches; the sum of all the branches being the total circuit current. The current flow in the various branches is proportional to the ohmic resistance of the various branches. We made mention that every current indicating device possessed a certain value of internal resistance. If we add in shunt to this resistance another resistor of equal ohmic value, the total resistance of the meter circuit consisting of the meter A and the external resistance R_s as shown in figure 3, is reduced to half the original value.

If the value of R_s is equal to R_a , the meter scale is doubled. The determination of the shunt for any known range is comparatively simple. Let us assume R_s to be the required shunt resistance. R_a is the internal resistance of the current indicating meter. I_a is the meter current scale. I is the total current flow in the

circuit and I_s is the current which is to flow through the shunt. The unknown shunt resistance is determined by

$$R_s = \frac{I_a}{I_s} \times R_a$$

With any known value of shunt resistance the multiplying factor is

$$\frac{R_s + R_a}{R_s}$$

As an example of the foregoing, let us assume a D.C. milliammeter rated at 20 milliamperes and 1.5 ohms resistance. We wish to increase the operating scale three-fold, to 60 milliamperes. Under these conditions the meter must indicate 60 milliamperes current flow for full scale deflection. Since the meter is capable of passing only 20 milliamperes, 40 milliamperes must flow through the external

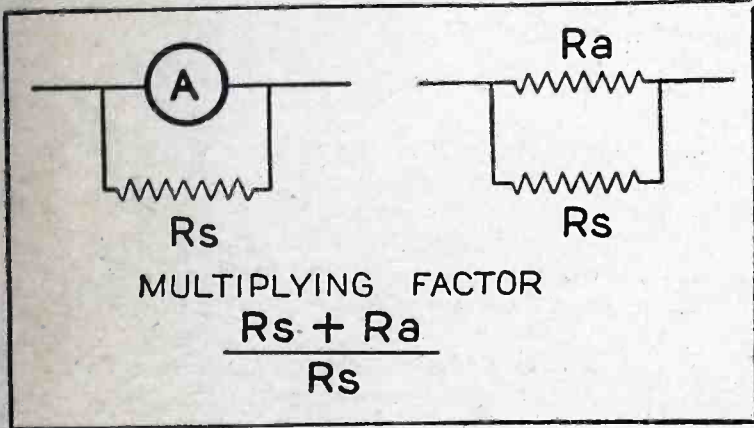


Fig. 3

Ammeter range is increased by employing shunt resistance.

shunt resistance. Applying the first formula and substituting we have

$$R_s = \frac{.02}{.04} \times 1.5 \text{ or } R_s = .75 \text{ ohms}$$

Assuming a known resistance of .75 ohms for use with this meter, the multiplying factor for the meter scale indication is obtained by applying the second formula. Substituting our values we have

$$\frac{.75 + 1.5}{.75} \text{ or } 3$$

In other words the meter scale indication must be multiplied by three when the above mentioned shunt is utilized in conjunction with the meter in question.

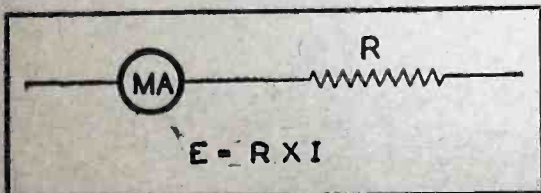


Fig. 2

A milliammeter can be converted into a voltmeter by adding a series resistance.

All of the above is an introduction to what is to follow. Realizing the need for information pertaining to the internal re-

sistance of the popular types of electrical meters, we have compiled a list of such instruments, with special emphasis upon the internal resistance of every device, thus affording to the interested service man the possibility of selecting correct series or shunt resistances to increase the operating scales to fulfill all requirements.

METER DESIGN

The versatility of the current indicating meter is not limited to one range. Any number of external shunt resistances may be utilized to increase the operating scale. The increase is governed solely by the external shunt resistance, that is, its ohmic value. A 1 milliamperes resistance may be utilized to indicate 1 ampere if the proper shunt is employed. The arrangement shown in figure 3 illustrates the use of one additional external shunt. Any number of such shunts may be employed, and when arranged with a switch and a number of contacts, the operating range of the instrument may be changed at will. If desired a current indicating instrument may be employed to indicate voltage with one arrangement of series resistances and current with another arrangement of shunt resistances.

A few words pertaining to the type of meters usually employed cannot help but be of aid. The average electrical meter is usually classified in two groups, the "switchboard" type of meter and the "portable" type of instrument. The former has no sub classifications and is illustrated herewith. This is usually a round meter with a flange and is designed to fit into a hole bored in a panel. The other classification, however, has two types, although only one type is favored by the average service man or custom set builder. This type is the meter arranged to be placed upon a table and operates in a horizontal position.

The type of instrument selected is of importance, because the mounting employed in the meter, governs the operation with respect to position. The "switchboard" type of meter is designed for operation at 45 or 90 degrees with respect to the horizontal. The portable on the other hand is designed for operation in a horizontal position. The instruments will function in any position, but the position displays an effect upon the zero calibration.

JEWELL ELECTRICAL INSTRUMENT COMPANY

Model 53 D.C. Milliammeter

Meter Range	Approx. Aver. Resist.
0-1	28 ohms
0-5	12 ohms
0-10	5 ohms
0-20	3.7 ohms
0-50	1.5 ohms
0-100	.75 ohms
0-200	.37 ohms
0-500	.15 ohms

WESTON ELECTRICAL INSTRUMENT COMPANY

Model 375 Portable D.C. Galvanometer

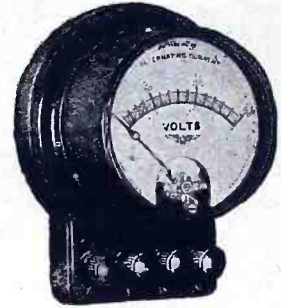
Current per scale division: Approximately 22 micro amperes. Resistance of Galvanometer about 30 ohms. Scale: 30 divisions each side of zero.

Model 301 D.C. Voltmeters

Approximate resistance:—62 ohms per volt. Available with 1,000 ohm per volt rating.

Model 301 D.C. Ammeters

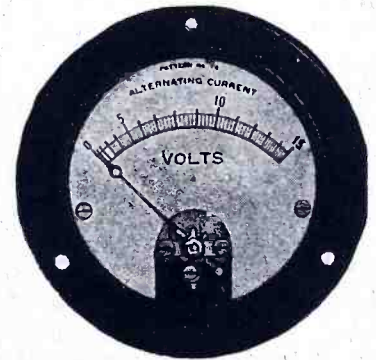
Ammeters up to 50 amperes inclusive have a drop of 50 M. V. + 5%



Courtesy Jewell Electrical Instrument Corp. Portable type of meter.

Model 301 D.C. Milliammeters

Milliamperes	Total Resistance in Ohms
1	27
1.5	18
2	18
5	12
10	8.5
15	3.2
20	1.5
25	1.2
30	1.2
50	2.0
100	1.0
150	.66
200	.50
300	.33
500	.20
800	.12



Courtesy Jewell Electrical Instrument Corp. Switchboard type of meter.

Model 476 A.C. Voltmeters

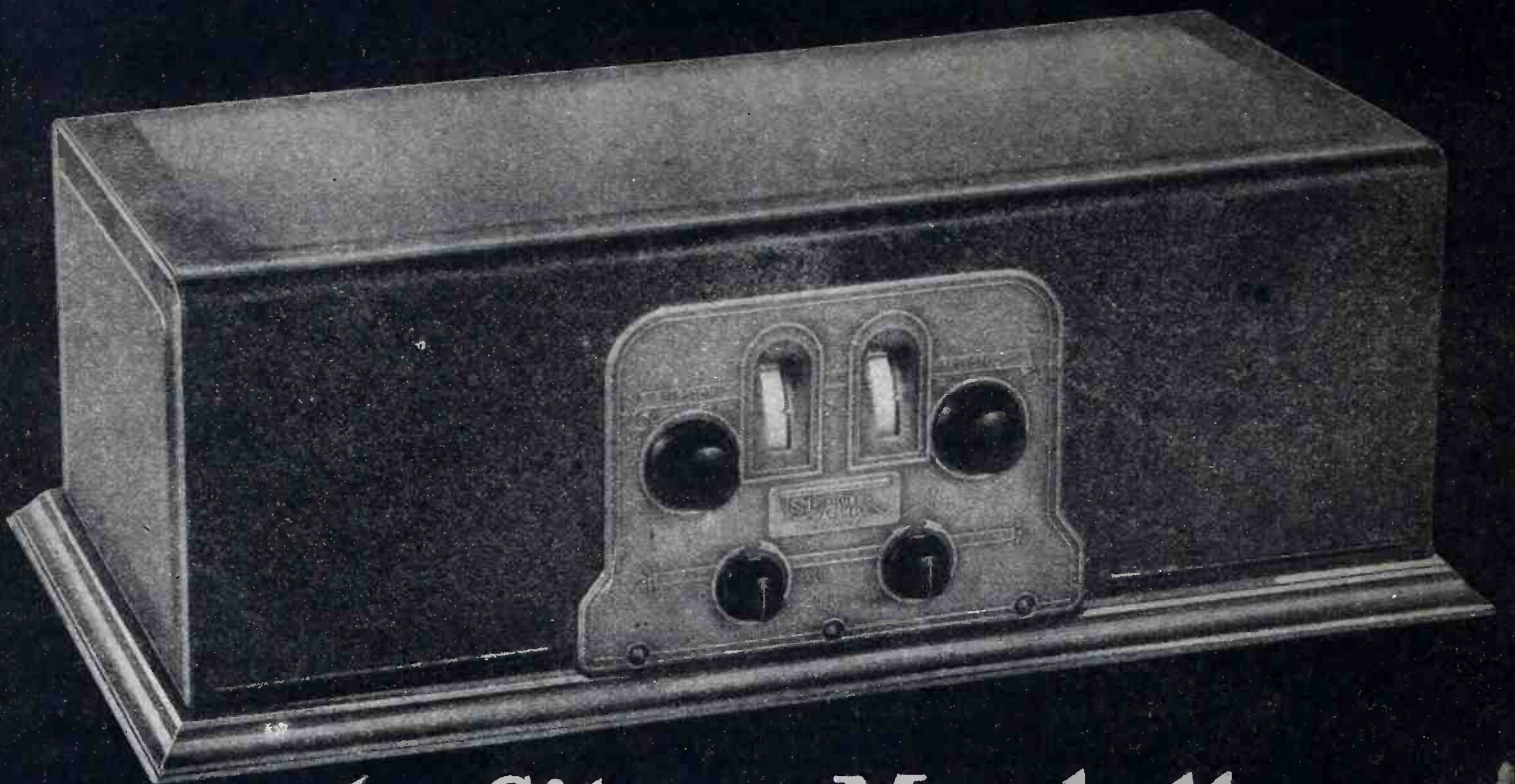
Range Volts	Approximate Ohms per Volt
1.5	3
2	4
3	6
5	10
10	14
15	14
25	26
50	52
150	105
250	166
300	166
150/8/4	67/10/10

Model 476 A.C. Ammeters

Range Amperes	Total resistance in ohms
1	.2030
2	.05
3	.024
5	.010
10	.0058
20	.00162
30	.00070
50	.00057

(Continued on page 105)

The 720-AC-Screen Grid Six



by Silver-Marshall

THOSE who know the vast superiority of the D.C. screen-grid tube over other battery-type tubes, and have experienced the tremendous margin of performance provided by the Screen-Grid Six as described in the Fall Issue of RADIO LISTENERS' GUIDE, can form an adequate idea of the change which is undoubtedly impending in all-electric receiver design in consequence of the recently announced RCA and Cunningham A.C. screen-grid tubes.

Hence, it is difficult to over-estimate the importance to the setbuilder of the new version of this receiver, to be described in these pages. Not only is it the first design presented to the setbuilder to be founded directly on the possibilities of the new UY type A.C. screen-grid tube, but as the lineal descendant of the original D.C. Screen-Grid Six, it may logically be expected to become the standard of the utmost possible performance of the new type of tube.

NEW TUBES USED

In the audio end as well, the new set is equally improved and refined. Rather than to make the choice, as has been heretofore necessary, between the 171 type of power tube, with its scarcely adequate output according to present-day standards, and the 210 or 250 types, requiring a plate voltage so high as to necessitate a more expensive power supply—to say nothing of the objection from the safety standpoint which many find in the presence of such high voltages in a home radio set—the new receiver utilizes the new UX-245 power tube, which requires a B voltage but little in excess of the 171 type, and

yet which provides an undistorted power output greater than that of a 210 tube, and fully ample for dancing or other special uses in the home. In fact, the available undistorted power is all that the average dynamic speaker can be expected to handle without overloading.

Two new tube developments are incorporated into this radio receiver, the new A. C. screen grid tube and the new type 245 intermediate power tube.

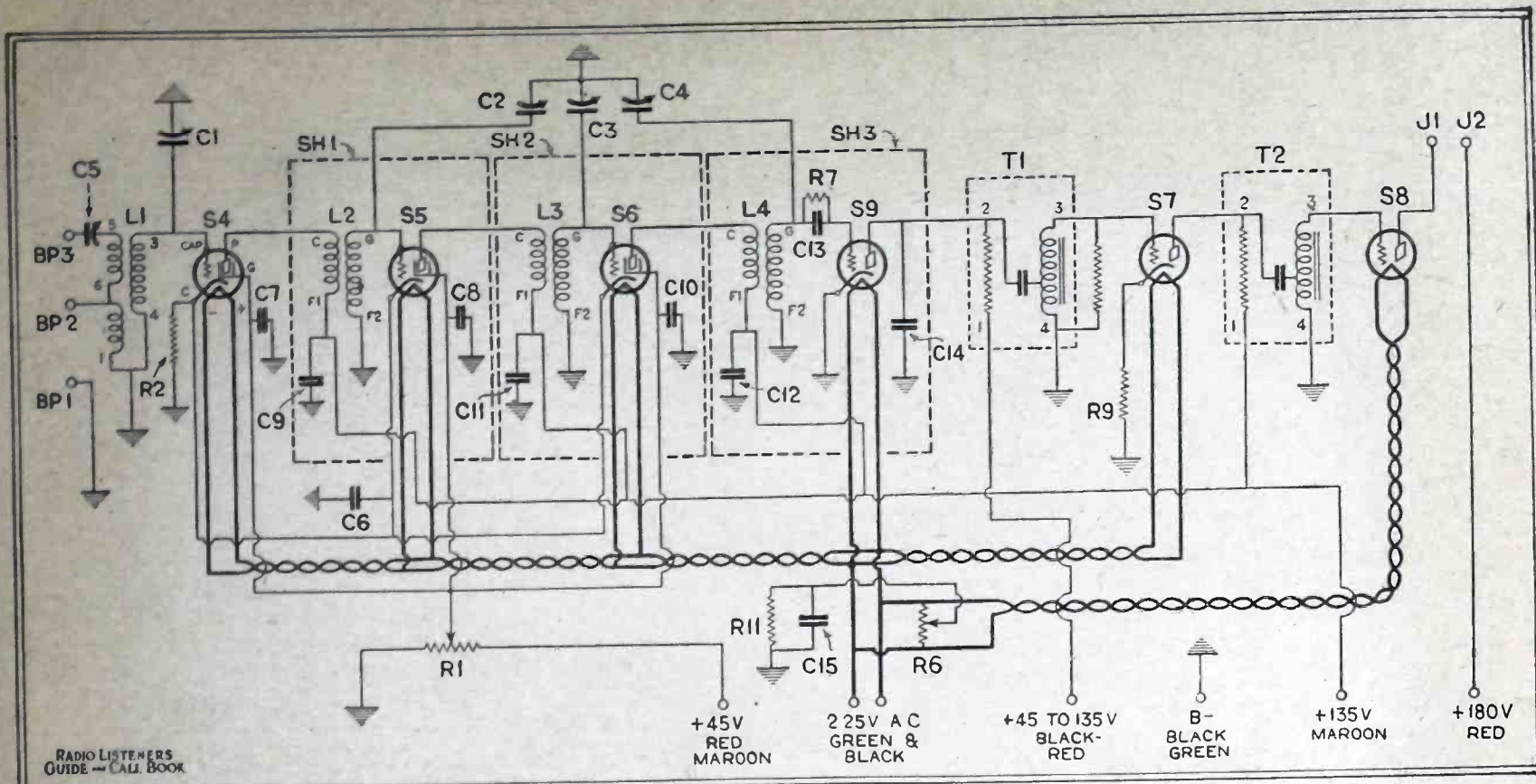
Editor.

The demand for an adequate-power output tube operating with a moderate B voltage has been great, as evidenced by the number of sets where the expedient of using two 171's in push-pull has been adopted. That the same effect may now be obtained without the expense and complication incident with the push-pull system is a notable advantage in the new "All-Electric Screen-Grid Six," second only to its outstanding power as a distance getter. It would not, of course, be proper to make such a comparison between the new power tube and the older use of two 171's in push-pull, if the audio transformers used with the single power tube were of ordinary type, where direct plate current introduces distortion of a kind largely avoidable by push-pull connection. But where Clough-system transformers are used in both stages, as in the Screen-Grid Six, their almost total elimination of all hysterical distortion

gives tone quality of unsurpassed fidelity no matter what the cost of the receiver or its elaborateness, in which this vital improvement in audio amplification has not been incorporated.

COMPLIMENTARY LETTERS

Reference to the D.C. operated receiver, first described in the Fall 1928) edition of RADIO LISTENERS' GUIDE AND CALL BOOK, as the pioneer set of this series, recalls to the writer some extremely interesting instances of how the rather ambitious-sounding predictions made for it, on the basis of its mathematically calculated properties and the performance of sample sets in the laboratory, have been more than realized by the experience of actual users. In his most enthusiastic moments the writer did not conceive of the D.C. Screen-Grid Six as a medium affording regular reception of Asiatic broadcasting in the United States. Performances of this character are reported occasionally, but this receiver seems to have brought for the first time, spanning of the Pacific within the operating range of a six-tube set of moderate cost. A letter, for example, from Mr. Alonzo Henderson in Mossy Rock, Washington, describes receiving JOIK of Sapporo, Japan, as well as two other Japanese and some other foreign stations. Similar reception of Japanese broadcasting is reported by Mr. F. A. Forbes of Oakland, California as well as by various other rather astonished listeners. A Wisconsin owner numbers WKAQ of Porto Rico among the 28 stations over 1000 miles



Wiring diagram of S-M 720 A.C. Screen Grid Six.

away, in 24 states and provinces, whose entertainment he enjoyed during one evening.

In many respects the new A.C. Electric Screen-Grid Six follows closely the layout and circuit features of the D.C. operated set, as built by the listeners just quoted. The modern type of all metal construction is followed, just as in the highest-priced factory-built receivers. Important originalities are evident in coil design, since this is the basis of the secret of bringing out the vast amplifying possibilities of the screen-grid tube. More and more, with the development of receivers built to the modern requirements of 10 kc. separation, it becomes apparent

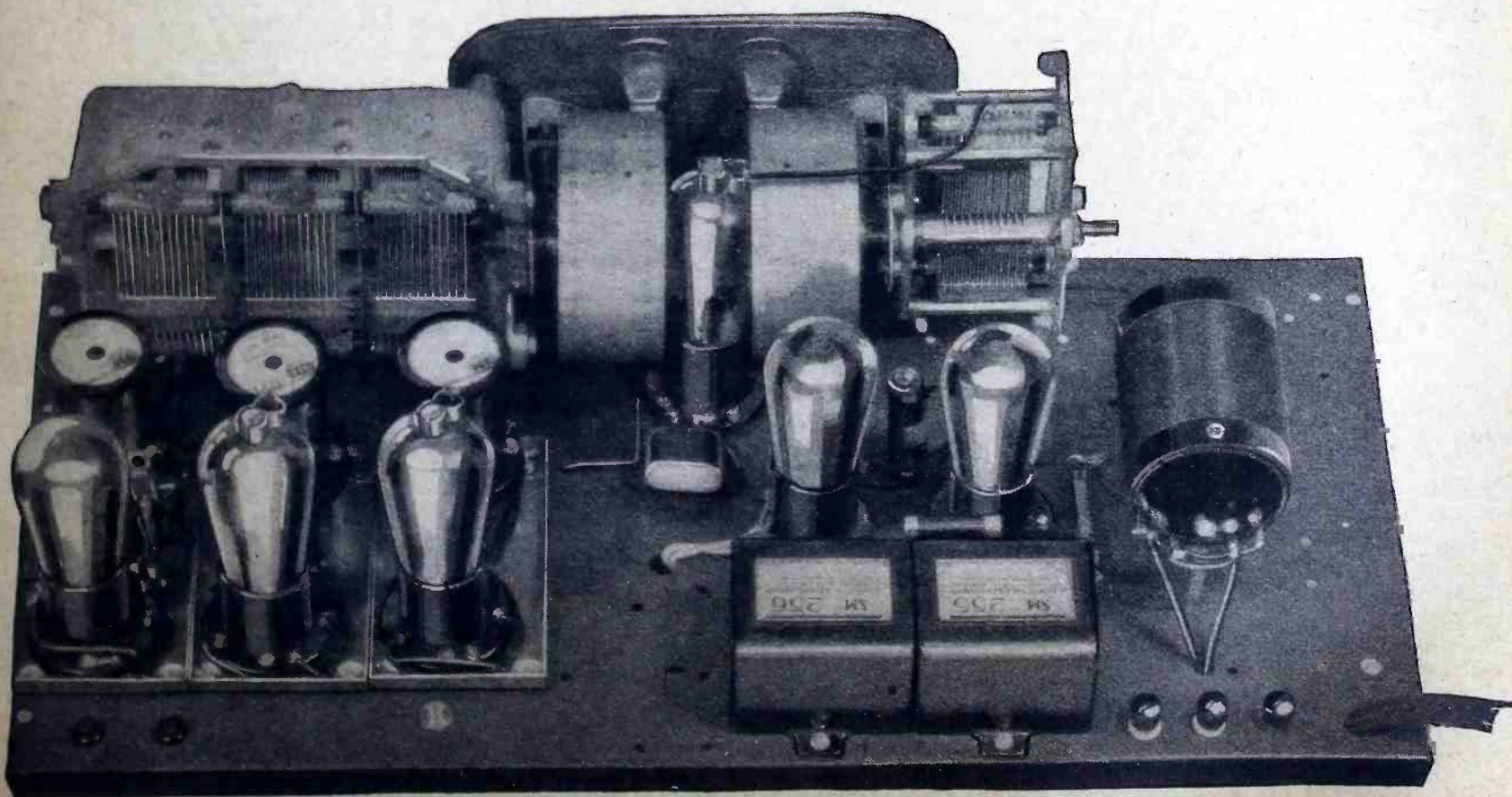
that extreme precision in manufacture, rather than "freak" shape or style, is the secret of superior coil performance. The S-M "Universal Coil" seen at the right in the rear view photograph, exemplifies this modern idea of coil construction.

DESIGN DATA

As in the D.C. set, three screen-grid tubes are employed, but they are of the A.C. type in this receiver. Due to operating characteristics these tubes are of the cathode type, employing a heater filament and a cathode as the source of electrons. In this respect they are identical to the 227 type. The first tube is located between the tuning dials, and the next two

placed in copper shielding cans, directly behind the S-M plug-in coils of the 5-prong tube-base type, which with coils inserted serve as interstage transformers. The third copper shield contains the detector stage, in which is used a heater tube of the ordinary 227 type. At the rear left, just forward of the audio transformers, are the two audio tubes; the first a 227 type heater tube, and the second, the new 245 type power tube referred to above.

The audio transformers, as will be noticed in the photograph, are of the Clough-system type, rather conspicuous by their small size as compared with standard circuit transformers approxi-
(Continued on page 86)



Internal view of parts layout with screen grid tube shields removed.

Man Made Static- Radio's Greatest Enemy

CRACKLE

BUZZ

SPUTTER!

A Symposium—

THE general public having experienced the thrills of radio is now awakened to the fact that many queer, undesired noises are interfering with their radio reception and impairing radio receiver performance upon numerous broadcast channels. Considering the progress made in receiver design and the high standard of reproduction obtained, the radio industry as a whole cannot brook this form of interference.

Realization of its source necessitates immediate action, since the problem is one which is mounting daily, and unless combated at once will assume proportions sufficiently great to limit the scope of radio receivers and the expansion of the radio industry. This form of annoyance is man-made static, with man's brain children, supplying the needs of every day existence and convenience, as the source.

Extensive research has been carried on in the laboratories of many reputable radio manufacturing organizations and the opinions and findings of some of the engineers coping with this problem should prove of vital importance to the radio service man who considers the elimination of electrical interference, erstwhile man-made static, an exceptionally profitable field.

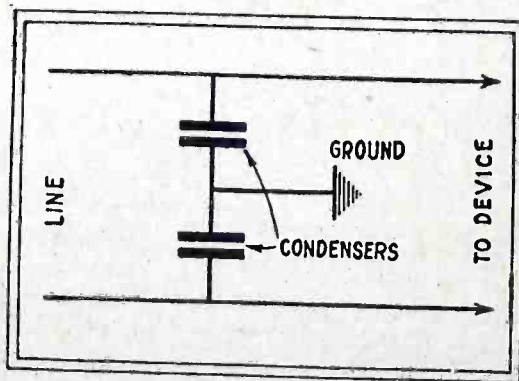
The following are expressions and opinions voiced by the engineering staffs of the Tobe Deutschmann Company, the Aerovox Wireless Corporation and the Dubelier Radio Corporation who are coping with this enigmatical problem.

INTERFERING NOISES IDENTIFIED

The multiplicity of undesired sounds heard in the average sensitive radio set are so great and so varied that it is difficult to determine what is causing the disturbance. In a great many cases the disturbance may be set up several thousand feet away, and yet create as much interference as if it were next door. It is

plain to be seen that if one is to locate and suppress these disturbances, one must first determine the cause, then its location.

About the easiest type of interference to detect is that caused by Universal type motors used on appliances mentioned elsewhere in this paper. This interference is generally heard as a high-pitched whine or singing tone, running steadily or varying in intensity. In other cases it is heard as a buzzing sound, which is rapidly built up in intensity as the motor starts, and then remains constant in pitch. The disturbance set up by a generator or D.C. motor is very similar to that of the Universal motors. However, it is considerably rougher in tone and steady in character, with a slight crackling sound mixed up with the steady buzzing.



The simplicity and the efficacy of the capacity type of filter, illustrated above is really surprising. The voltage rating of the condensers must be chosen with care.

The disturbance set up by the ignition system of oil burners is heard as a steady rough buzzing with wavering intensity and crackling sounds at frequent intervals. The disturbance set up by an electric refrigerator is heard as in intermittent crackle, sometimes steady and coarse in tone for a period of several seconds.

The disturbance set up by battery chargers of the bulb type is a low-pitched buzz, generally very steady, without any fluctuations. The disturbance set up by heating pads is heard as a rough crackling noise occurring at intervals from one to five minutes. Sometimes the sound suggests indistinct code transmission.

It is true that the above descriptions are rather vague, but it does not take long to become familiar with the noise set up by various apparatus, and search for the offender is facilitated.

SOURCES OF INTERFERENCE

The following is a list of man-made devices capable of creating electrical interference and to which a simple capacity type of interference elimination device is applicable. The various types of filters or interference eliminators will be discussed later in this text.

Household Appliances

- Vacuum Cleaners
- Floor Polishers
- Sewing Machines
- Hair Dryers
- Massage Machines
- Drink Mixers
- Egg Beaters
- Kitchen Help Machines
- Small Fans
- Some types of Oil Burner Furnaces
- Small Blowers

Office and Store Appliances

- Cash Registers (electric)
- Adding Machines
- Billing Machines
- Drink Mixers
- Small Fans

Machine Shop and Garage Appliances

- Portable Electric Drills
- Small Electric Drills
- Valve Grinders

Shoe Shine Parlor Appliances

- Small Fans
- Shoe Dryers

Barber Shop and Beauty Parlor Appliances

- Hair Clippers
- Massage Machines
- Hair Dryers
- Small Fans
- Generators and motors are used in the following places:
- Power Companies
- Factories
- Machine Shops
- Garages
- Battery Charging Shops
- Moving Picture Theatres
- D.C. Elevators
- Plating Works
- Dental Offices

While upon the subject of electrical interference it is necessary to differentiate between inductive interference induced into the power system and interference induced into the antenna system. The possible sources of general electrical interference are expansive, covering all electrical devices and electrically operated mobile equipment such as generators, trolley cars, elevated systems, exposed subway systems and feeder wires. The power house so often considered to be a prolific source of interference has been liberated from the stigma and accusations have proved unjust. (Editor's Note.—Investigation carried out in New York City showed very little interference from power houses, inclusive of D.C. generating stations. Receivers of the superheterodyne type were located within the confines of power houses without interference from the generating equipment.) If the interference emanating from some external local source is induced into the aerial system, nothing can be done at the receiver end. If on the other hand the interference is induced into the power supply wiring and carried to the speaker via the eliminators and tubes, two possible means of elimination are available. One is at the source and the other is at the receiver.

INTERFERENCE PREVENTION DEVICES

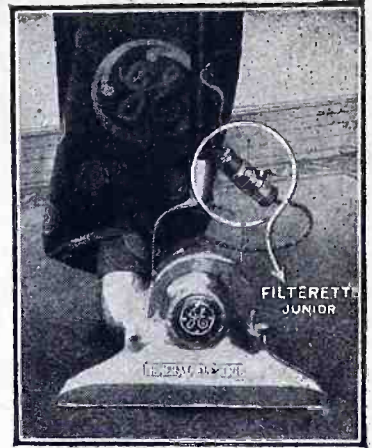
With respect to the interference prevention devices, engineers of the companies mentioned in a preceding paragraph seem to agree. While there are many forms of electrical disturbance, the inductive type of interference, that is, the form of disturbance induced into the wiring associated with the receiver power supply is in their opinion the one of interest to the service man since it is the one within his power to eliminate.

While there are many forms of inductive interference, a thorough engineering analysis and survey carried out by these three companies discloses the fact that the great majority may be cleared up by means of capacity filters. This opinion is also shared by other organizations interested in this work. Only the most serious form of inductive interference calls for the use of elaborate filter systems consisting of combination inductance-capacity networks.

The application of the interference filter at the source and even the selection of the type of filter is governed by the unit causing the disturbance or rather the form of disturbance. Whatever the form of local interference, every effort should be made to suppress the disturbance at the source because elimination at the source has its economical advantages. A small electrical device may be creating interference in a hundred homes. Needless to say, it is more economical to utilize one filter at the source to overcome the trouble than to apply a filtering system to every receiver.

CAPACITY FILTER

The capacity filter, consisting of a series combination of two condensers with the midtap connection to ground, constitutes the simplest form of interference filter and strange to say finds extensive



The Filterette "Jr." is sufficiently small to be applicable to mobile equipment such as a vacuum cleaner.

application. The efficacy of the device is governed to a certain extent by the capacity value of the condensers, and the values selected are chosen according to the service required. The capacity filter finds application to practically every form of motor and transformer circuit, and experiments conducted by the three organizations mentioned have shown this type of filter to be extremely satisfactory. The application of the capacity type of filter unit to various circuits is shown in figures 1 to 4 inclusive.

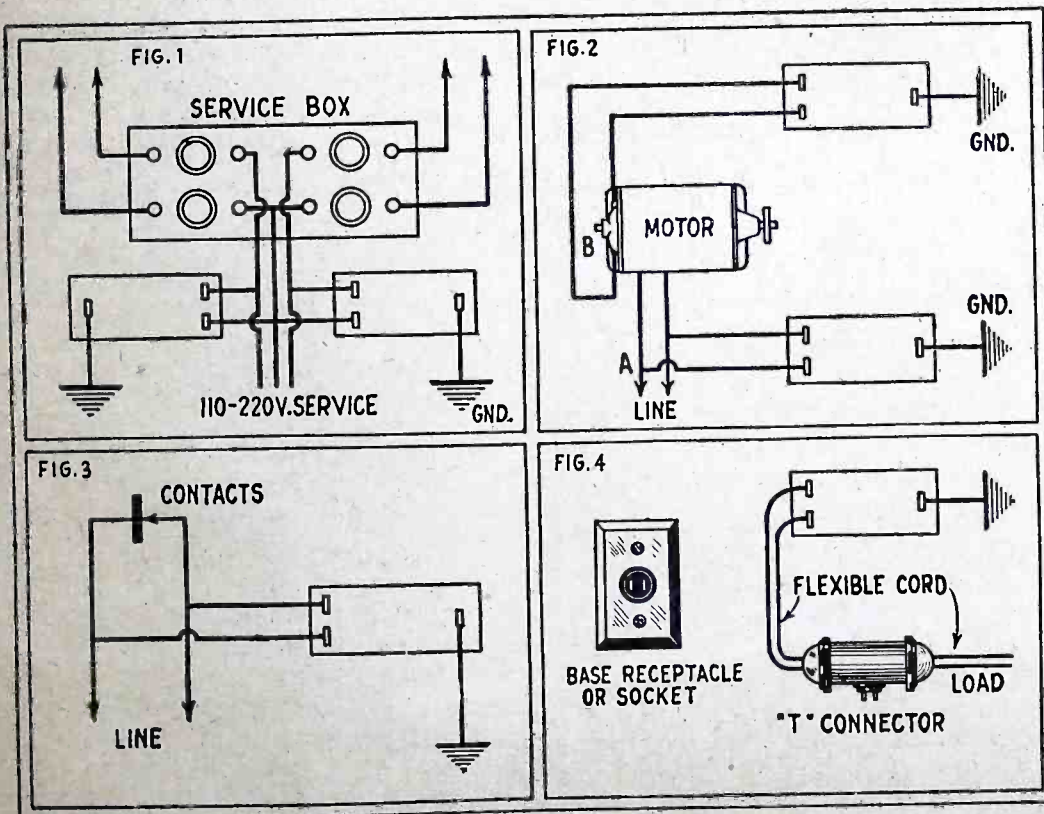
It might be well to add at this time that these classifications are associated with the possible interference creating devices mentioned in the list. In other words if a capacity filter finds application across the brushes of any one motor, it will find application across the brushes of any similar motor employed in a household device. By the same token if a capacity filter is employed across the line circuit of any one device, it finds application across the line circuit of any household appliance.

This filter finds wide application in conjunction with the input circuits of receiver power devices, such as "A" and "B" power units. This form of utility permits elimination of inductive interference in the power supply system and is conducive to more quiet operation of the complete receiver installation. In the opinion of the Aerovox engineers, condenser filters are the only type suitable for application in numerous instances.

The selection of filters of this nature necessitates consideration of the voltage applied across the condensers when they are placed into operation, hence, voltage rating is according to the existing operating voltages involved. Due to the midtap grounded terminal, it is imperative that the condensers remain intact, since a ruptured condenser will short across the circuits being bypassed.

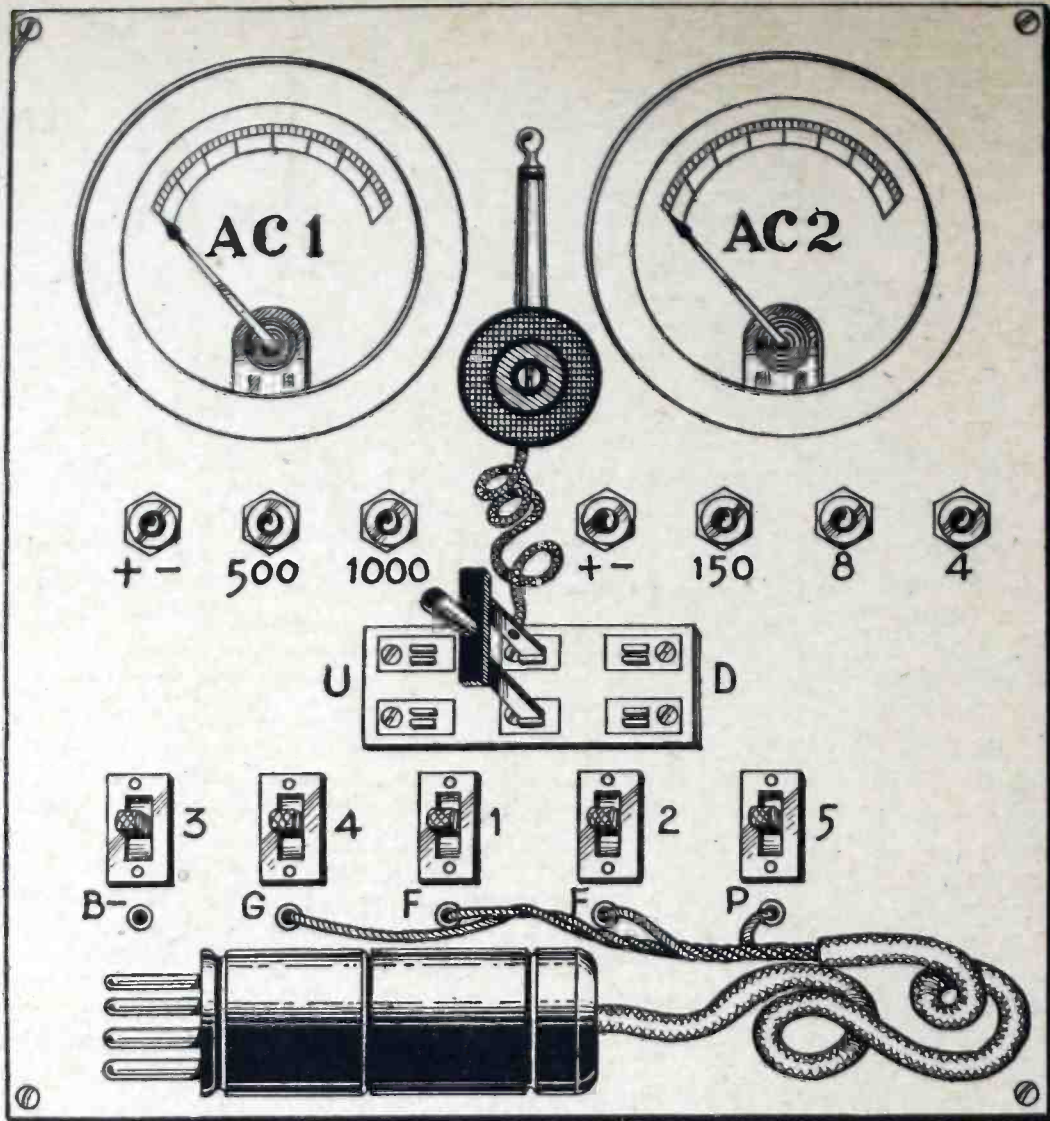
CAPACITY-INDUCTANCE FILTER

A more elaborate filter is the capacity-inductance filter shown in figure 5 and is (Continued on page 111)



The above four wiring diagrams illustrate the installation of the capacity type of filter. Figure 1 shows the adaptation of two such filters to a three wire 220 volt line. Figure 2 shows the application of two capacity filters to a motor circuit, one condenser across the line and another across the brushes. Figure 3 illustrates the application of the filter to sputtering or breaking contacts and Figure 4 shows the application of the filter across the ordinary line circuit.

This tester is a necessary adjunct in every service station



Front panel view of tester.

A TEST-SET for "B" Power Units

By J. R. FRANCIS

THE occasion frequently arises when it is necessary to determine the A.C. voltages available from the transformer supplying the anode and cathode (plate and filament) voltages from "B" eliminator rectifiers. If the complete rectifier is assembled upon a bread board, measurement is a simple matter, but in many cases the power unit on test, is a commercially manufactured product sealed within a housing, the only accessible part being the rectifier tube socket. While complaints of power transformer burn-out are infrequent, variations in output voltage with consequent effect upon the operation of the associated rectifier tube is frequently mentioned. Herewith is shown a "B" battery eliminator tester unit which should be part of the equipment possessed by every service man and custom setbuilder.

This test set is designed for the sole

LIST OF PARTS

- 1 Jewell model 74 0 to 100 A.C. voltmeter AC-1.
- 1 Jewell model 74 0 to 3-15-150 A. C. voltmeter AC-2.
- 1 double-pole double-throw switch.
- 5 Carter pinjacks and 1 plug.
- 5 Cutler-Hammer toggle switches.
- 5 X-L binding posts with insulated levers.
- 1 Bakelite panel 12" x 12" x 1/4" Rub-Rubber covered cable.
- 1 4 prong insert plug and cord.
- 1 20,000 ohm resistance.
- 1 45,000 ohm resistance.

purpose of measuring the anode and cathode A.C. voltages supplied to rectifier tubes without disturbing any of the con-

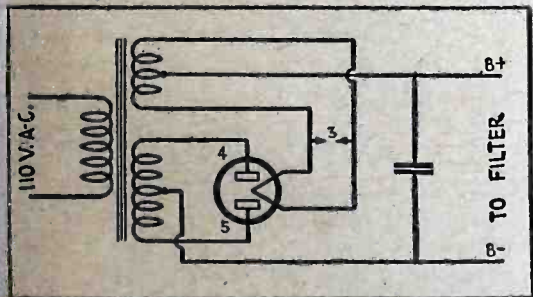
nections within the "B" unit. Unfortunately, the adaptability of this unit is not universal, one special arrangement being beyond its scope of operation. However, the number of circuits to which it is applicable is sufficiently great to make its construction worthwhile. The "B" power pack we mention as being unsuited for test with this device is the half wave filament type rectifier, wherein one end of the plate winding connects to the center tap of the filament winding and the other end of the plate winding is positive. With the sole exception of the above, this tester is applicable to all other half-wave and full-wave rectifiers of the filament type and also the full-wave gaseous type of rectifying tube.

The basis of the device is the connection of either one of the voltmeters, by means of the plug insert, across the cor-

rect transformer windings, by connecting across the correct socket terminals. Connection to the socket terminals is equivalent to connection to the transformer terminals, that is, if the connections between the transformer and the tube socket are intact. The voltmeters are equipped with tip jack terminals and choice of voltage scales is available by insertion of the tip plug into the proper jack. Five single contact toggle switches and a double pole double throw switch are provided for the purpose of controlling the various circuits. As is evident from the voltage designations accompanying the voltmeters one meter is employed for the measurement of A.C. voltages applied to the anodes or plates of the rectifier tubes and the other meter is employed for the measurement of the filament voltages applied to filament type rectifiers. This voltmeter is also used for the measurement of the line voltage input to the power unit.

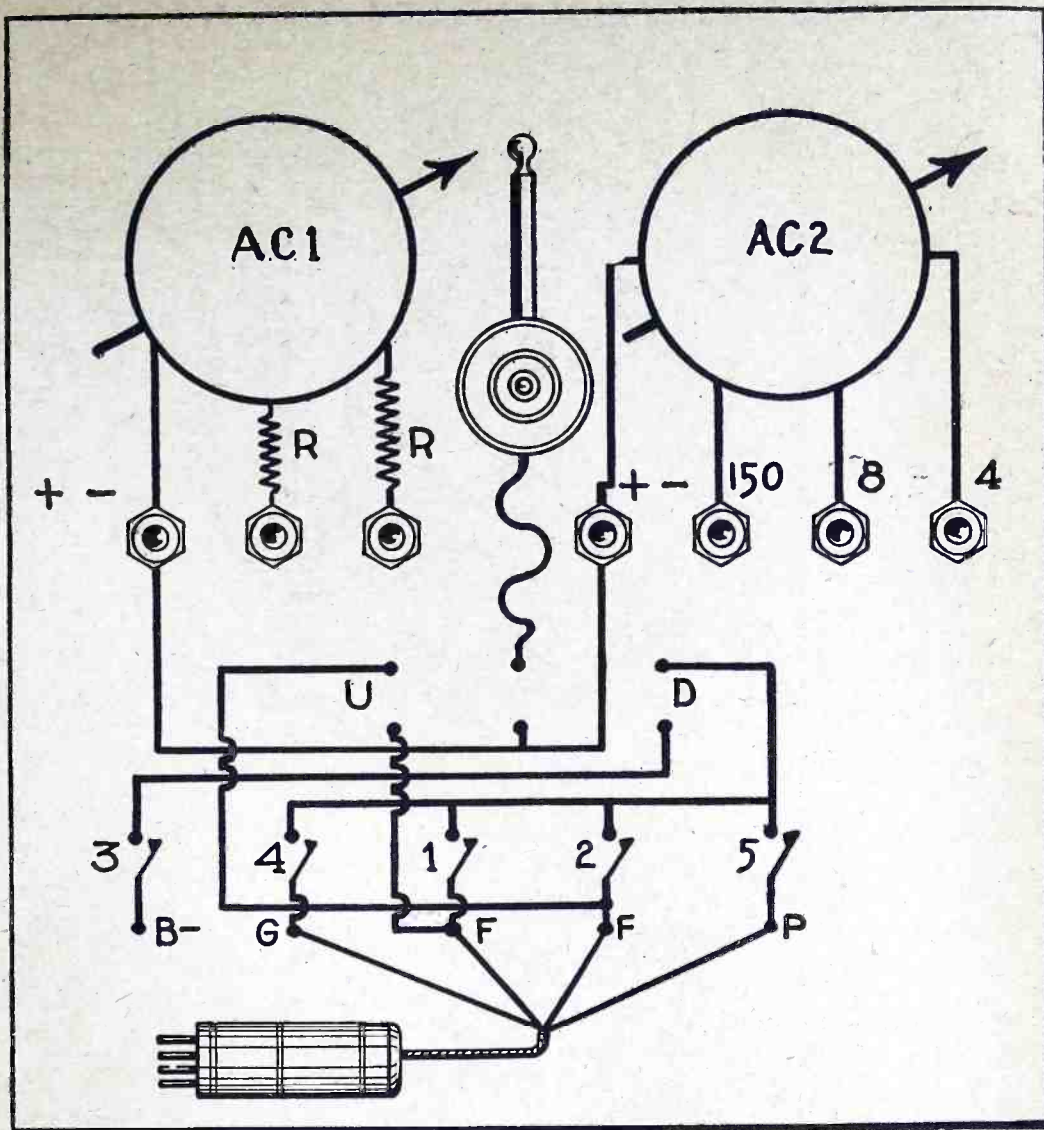
In view of the fact that the connections to the filament type of rectifier and the gaseous type of rectifier differ to a marked degree, it is necessary to provide connection to every terminal on the socket. Whereas the anode voltages for filament type rectifiers are applied to the plate terminal in half wave rectifiers and to the plate and grid terminals in full wave rectifiers unless two half wave rectifiers are employed, the anode voltages, applied to the gaseous type of rectifier are applied to the filament terminals of the socket. In turn the filament voltage for filament type rectifiers is applied to these same filament terminals. Hence we must provide a means of connecting these voltage indicating devices to the correct terminals. This is accomplished by means of the double-pole double-throw switch and the contact switches.

The following operating directions will explain the function of the device. Let us assume that we wish to determine the voltages applied to the anodes of a gaseous rectifier. The B minus tester terminal is connected to the B minus terminal of the eliminator. If the power unit supplies a C bias voltage, this B minus connection is removed from the B minus terminal and shifted to the most negative C voltage terminal. The major "U"- "D" switch is set to the position "D". It should be understood that all switches are "open" when the tester is first applied.



Wiring diagram of filament type rectifier. Numbers show circuits controlled by toggle switches.

The voltmeter plug is inserted into the 500 volt range jack, since the anode voltages applied to such rectifiers are within this voltage range. The plug insert is placed within the rectifier tube socket after the tube has been withdrawn. Switch 3 controls the continuity of the B minus



Wiring diagram of complete tester showing connection of various switches and system of controlling circuits. Numbers correspond with front view.

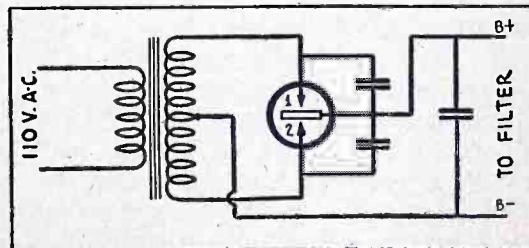
circuit and is closed. According to the wiring diagram switches 1 and 2 are connected into the filament circuit, each switch controlling one line. The anode voltages to the gaseous type of rectifier are applied through the filament terminals. If we close switch 1, the voltmeter AC-1 will be connected across one-half of the plate winding, across the points B minus and 1, and the voltmeter will indicate the available anode voltage. Then switch 1 is opened and switch 2 is closed. The other connections are not disturbed. The voltmeter will now indicate the A.C. voltage available from the other half of the plate winding, or across points B minus and 2.

A study of the wiring diagram of the filament type of rectifier shows that switches 4 and 5 control connection to the plate and grid terminals of the socket employed in a full wave rectifier. Hence if the plug insert originally placed into the gaseous rectifier is now transposed to another eliminator employing a filament type of rectifier, and switch 2 is opened, to be followed by the closing of switch 4, the voltmeter will show the A.C. voltage available from one-half of the plate winding. If switch 4 is opened and 5 closed instead, the A.C. voltage available from the other half of the winding will be indicated on the meter. To measure the filament voltage, we shift the position of the major switch to "U" and shift the position of the voltmeter plug to the correct AC-2 voltage scale, say 8 volts.

The operation of the device is really simple, but several precautions are neces-

sary. The B minus terminal must be connected, otherwise voltage readings are impossible. The levers of the toggle switches should be of Bakelite or some other insulating material and the voltmeter plug should be insulated. Simultaneous personal contact with the B minus circuit and a high voltage circuit should be avoided.

The 1000 volt scale is provided for measurement of the anode voltage employed in half wave rectifiers such as the 216-B and the 281. The variable voltage scales for AC-2 are part of the voltmeter. The voltmeter designated as AC-1 is in reality a 0 to 100 voltmeter with external resistances. Its internal resistance is 5000



Wiring diagram of gaseous rectifier. Numbers show circuits controlled by toggle switches.

ohms total, which in turn is the equivalent of 50 ohms per volt. To multiply its scale 5 times, we use an external resistance of 20,000 ohms of four times the internal resistance of the meter. To increase its range to 1000 volts we use an external resistance of 45,000 ohms, or nine times the internal resistance of the instrument. These resistances should be
(Continued on page 82)



ONE of the prevalent drawbacks of custom built receivers is the fact that the physical appearance, both inside and out, is inferior to that of a commercially manufactured radio receiver. The new H.F.L. line introduces innovations in manufacture which remove the above mentioned objection and both A.C. and D.C. models are worthy of comparison. This superiority should be, and fortunately is, the basis for success of the "tailored" radio receiver.—Editor.

THE advent of a new year is invariably accompanied by the announcement of new models of radio receivers. The extent of newness or rather the value of the new model is governed by the improvements developed during the past year and incorporated into the new model.

The H.F.L. organization are responsible for two new radio receivers of the superheterodyne type, one of which is designed for A.C. operation and is an A.C. electric receiver, and the other, for D.C. operation in the form of an electrified receiver utilizing "A" and "B" eliminators. In due justice for the work expended, we should enumerate the new features of the A.C. receiver. Unfortunately, space does not permit full description of both. Hence the choice of the A.C. model as the one of greatest interest to the professional setbuilder and home constructor, who are the individuals interested in A.C. installations.

The A.C. model H.F.L. Special Nine utilizes four A.C. screen grid tubes, single

dial tuning, a 250 power amplifier, 227 type (cathode) A.C. tubes, plug-in coils and a new physical arrangement in the form of catacomb assembly of the intermediate frequency amplifiers, four in number and contained in one housing. The use of the catacomb expedites wiring, because the units are already assembled and partially wired. As a matter of fact, the wiring of the entire receiver should not consume more than an hour or two.

The A.C. and D.C. receivers are identical in appearance and over-all dimensions. In each case the chassis is the same and the only difference is the method of obtaining biasing voltages through resistors and the choice of different inductances to realize the maximum gain from the A.C. and D.C. types of tubes.

SPECIAL RADIO FREQUENCY ASSEMBLY

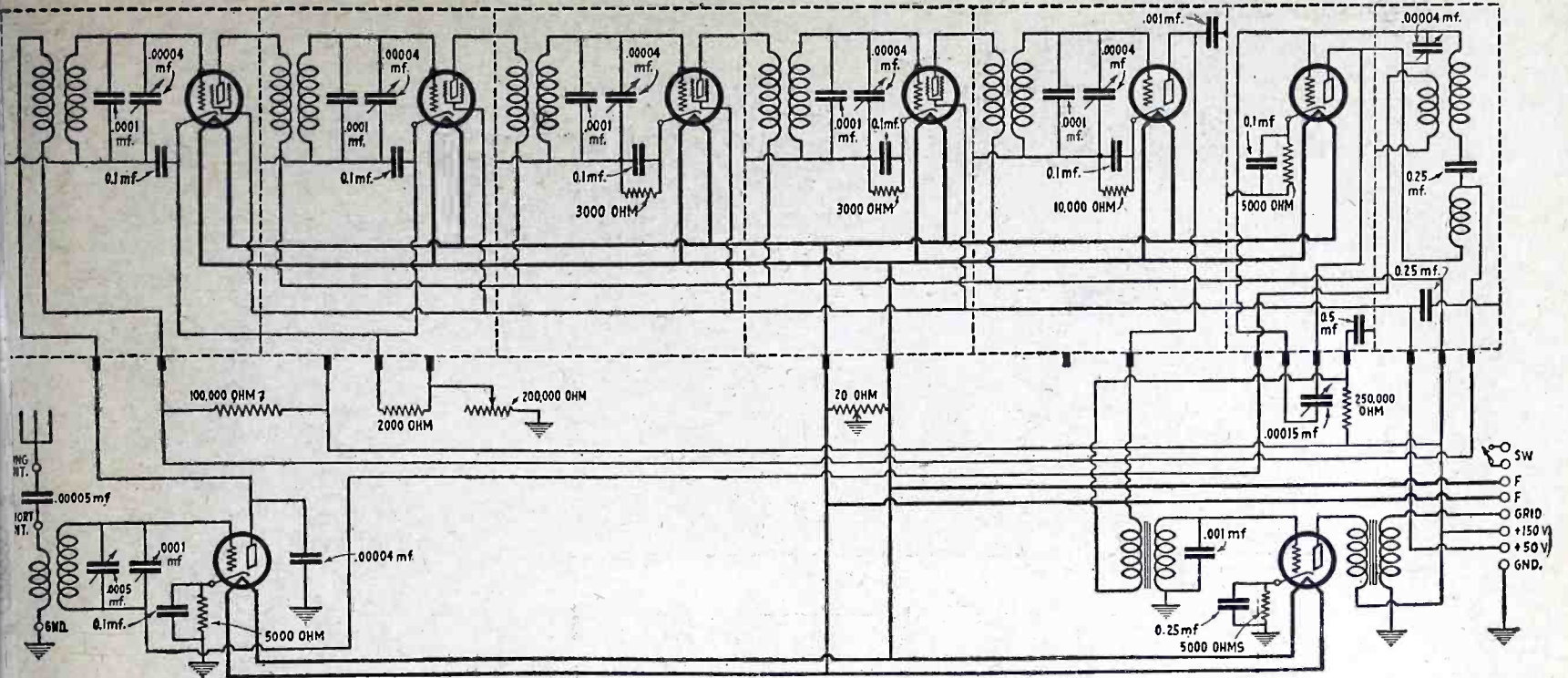
The development of the new A.C. screen-grid tube described in the Listeners' Accessory Guide section of this issue makes necessary special design of the intermediate frequency transformers since the characteristics of these tubes differ from the old type of D.C. screen-grid tubes. As a matter of fact, the mutual conductance of the new tube is approximately three times that of the old tube. As is evident in the wiring diagram, the intermediate frequency-transformers utilize an untuned plate circuit and a tuned grid circuit.

The intermediate amplifier catacomb fits along the back end of the receiver chassis. The chassis itself measures 20 inches long x 4¾ in. deep. When the amplifier catacomb is bolted onto the rear of the chassis, the depth of the entire receiver becomes 7½ in. The front panel protrudes ½ in. beyond the chassis face at each end and measures 21 in. long by 7 in. high.

The catacomb is divided into seven compartments, one for each radio frequency circuit and its associate equipment. This method of construction allows extremely high radio frequency gain and permits operation of the screen-grid tubes without individual shielding. The intermediate frequency amplifier operates at a frequency which allows one-spot tuning and each transformer in the amplifier can be peaked to exact resonance by adjusting the small trimmer condensers provided for that purpose. These small adjusting nuts are located between the tubes, as shown in the illustration.

The set is designed for indoor or outdoor aerial. Provision for exact tuning of the aerial stage and for compensation of aerial length is made by a variable compensating condenser, shunted across the regular input stage tuning condenser and a small fixed condenser in series with the antenna circuit. Binding posts are provided for "long" and "short" antenna connections. Experiments have shown that satisfactory operation of the A.C. model is secured when the house radiator is employed as the regular aerial.

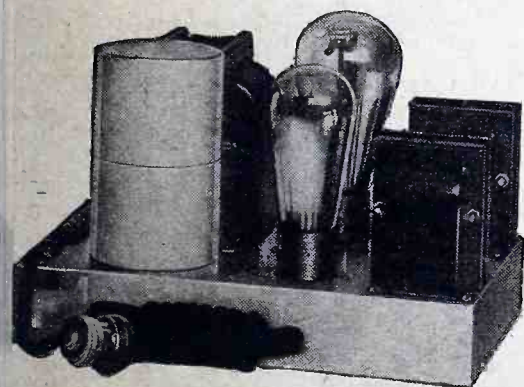
An examination of the panel assembly



Wiring diagram of the H.F.L.—A.C. Special. The electrical constants of the various parts are shown. The second audio stage is in the power supply unit.

shows the extreme simplicity of the entire unit. Two controls are evident in addition to the major tuning knob. The left hand knob is attached to the antenna vernier condenser and the right hand knob manipulates the volume control. The last named unit is a combination volume adjuster and control switch whereby the power circuit may be turned "on" and "off".

The statement that this A.C. model Special Nine is a one dial super is made despite the presence of the three knobs upon the panel. In actual operation, it is possible to hear 20 consecutive stations without adjusting the antenna compensator and for local reception the entire broadcast band can be covered by manipulating the main tuning condenser control without vernier adjustment of any kind. Thus, the set is a one dial receiver.



Combination power amplifier and power supply unit. The power tube is a 280 and the amplifier tube is a 250.

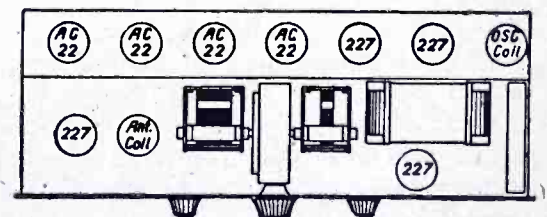
The design of the circuits is such that the minimum wavelength is 200 meters and the maximum 550 meters with stability over the complete range. A small padder condenser across the oscillator tuned circuit is provided for the purpose of adjusting the reading of the main tuning dial so that the various tuning circuits are at exact resonance. The wave band mentioned extends between the 3rd and 97th divisions of the tuning dial.

LIST OF PARTS FOR H.F.L. SPECIAL A.C. NINE

- 1 H.F.L. copper amplifier housing.
- 1 H.F.L. copper amplifier top.
- 1 H.F.L. copper amplifier bottom.
- 9 H.F.L. U.Y. type sockets.
- 1 H.F.L. U.X. type socket.
- 5 H.F.L. R.F. transformers.
- 7 Hammarlund .00004 mfd. trimmer condensers.
- 5 Aerovox .0001 mfd. fixed condensers.
- 7 Aerovox .1 mfd. by-pass condensers.
- 3 Aerovox .25 mfd. by-pass condensers.
- 10 Plastic resistors—various values. (Love)
- 1 H.F.L. No. 3 terminal strip.
- 1 H.F.L. No. 4 terminal strip.
- 2 Muter .001 mfd. fixed condensers.
- 4 Carter screen grid clips.
- 1 H.F.L. .5 mfd. by-pass condenser.
- 1 H.F.L. 2 stage audio transformer unit.
- 1 Frost 200,000 ohm volume control and switch.
- 1 Hammarlund .0001 mfd. variable condenser.
- 1 Hammarlund .00015 mfd. variable condenser.
- 1 Hammarlund .0005 mfd. variable condenser.
- 1 H.F.L. cord driven drum dial.
- 1 H.F.L. steel chassis, cadmium plated.
- 1 H.F.L. 7 x 21 in. steel front panel.
- 1 1 3/4 in. bakelite knob.
- 2 1 1/4 in. bakelite knobs.
- 1 Yaxley 20 ohm hum balancer.
- 2 H.F.L. steel control supports, cadmium plated.
- 1 H.F.L. 110 volt supply cable.
- 1 H.F.L. plate supply cable.
- 8 H.F.L. condenser mounting studs.
- 3 X-L binding posts.
- 1 2 1/2 volt dial light.
- 2 H.F.L. steel chassis supports, cadmium plated.
- 1 H.F.L. No. 5 terminal strip.
- 1 H.F.L. plug-in antenna coil.
- 1 H.F.L. plug-in oscillator coil.
- 1 H.F.L. bakelite condenser drive shaft.
- 1 Muter .0005 mfd. fixed condenser.
- 2 rolls Corwico Braidite Hook-up Wire.
- Miscellaneous equipment consisting of lugs, nuts, bolts, instructions, etc.

As was mentioned, the receiver is equipped with "plug-in" inductances permitting operation over wave bands other than that used for regular broadcasting, namely between 200 and 550 meters. Empirical determinations have shown that excellent performance is secured when operating on wavelengths as low as 120 meters. With respect to ultra high frequency reception between 5 and 80 meters, we recommend the use of a converter system such as that described on page 84 of the Winter edition of Radio Listeners' Guide and Call Book.

Satisfactory A.C. operation with the cathode type of A.C. tube has been conclusively demonstrated and an examination of the wiring diagram will show that this type of tube is employed throughout. Furthermore, a potentiometer is employed to secure electrical balance in the heater circuit. These two features in addition to careful wiring constitute the basis for the low value of total ripple voltage or hum. Further examination of the wiring diagram discloses the fact that individual grid bias resistances are employed for the screen grid intermediates, thus minimizing the tendency towards oscillation because the effect of a common impedance in the form of a common C bias resistance, is eliminated. This ar-



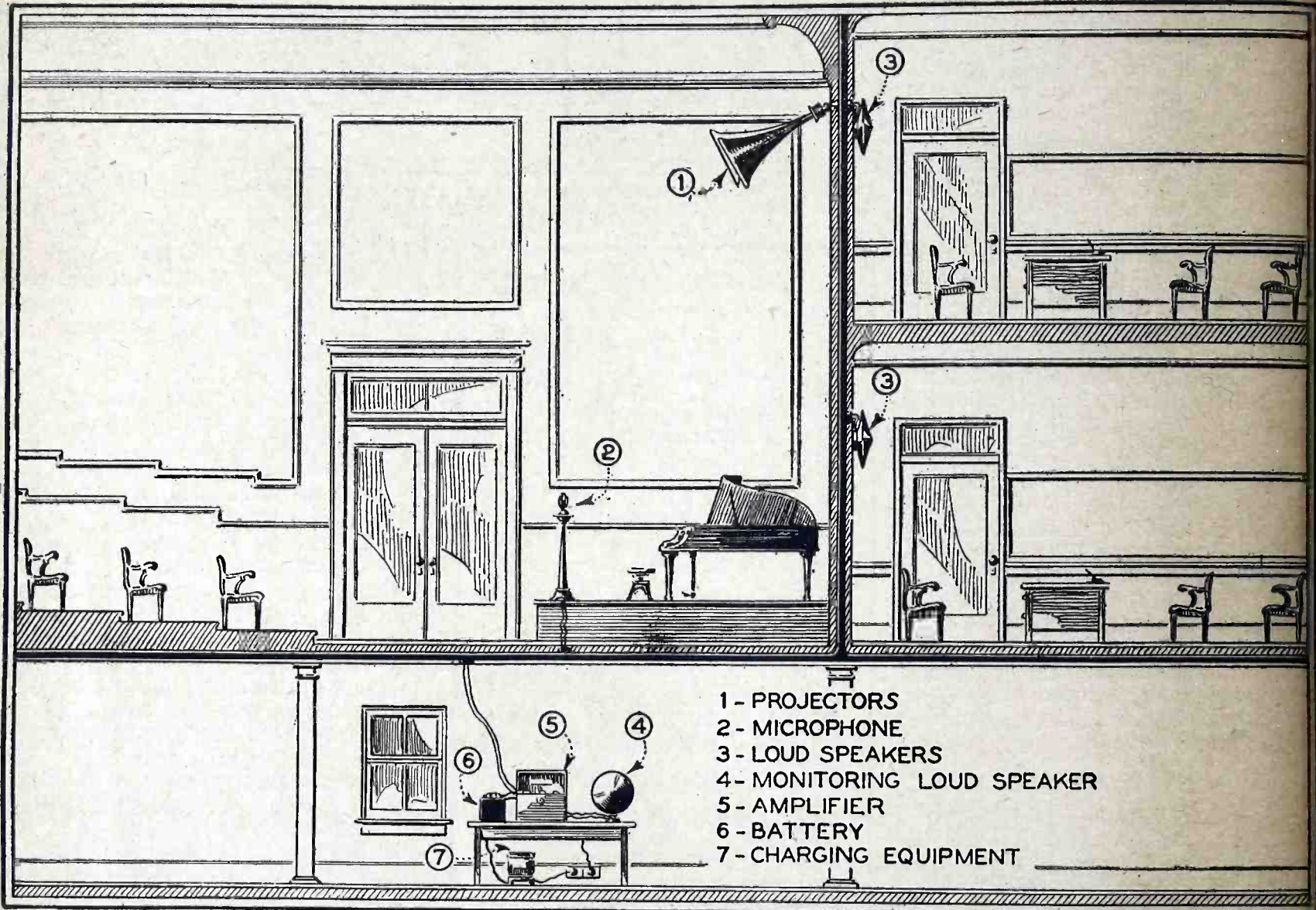
Tube layout showing position of respective tubes.

angement of securing grid bias is conducive to better performance and increases the safety factor of the B power unit. Furthermore, individual C bias resistances of this type provide better regulation of the grid bias voltage because the value of this potential is governed

(Continued on page 98)

The Problems of Speech Amplifier Installation

By ROBERT DAVIE, E. E.



STRANGE as it may seem and despite the extensive popularity of the speech amplifier for the magnification of sound and voice transmission at public functions, in theatres, amusement parks, county fairs, restaurants, etc., very little is actually known about the work at hand. This is attributable to a very large extent to the fact that the problems involved are somewhat removed from the natural run. In contrast to other phases of the radio industry, speech amplifier design and installation is not a subject based upon pure theory. True, that theory is involved, but empirical determinations are of greater consequence. The practical man is worth much more than the theorist, although theory pertaining to radio and sound is essential.

Since the purpose of this story is to convey to the reader the problems encountered in speech amplifier design and installation, we will omit all mention of

the potentialities of the business and dwell more upon the problems presented. Contrary to general opinion acoustics of a completed structure cannot be determined by mere observation. While it is true that the acoustical requirements are considered when a large room or chamber is constructed, these same characteristics are unknown to the strange individual who views the room for the first time, and they remain unknown even after observation. An acoustical test is imperative. This test need not be elaborate—hand-clapping or simple speech being sufficient to show reverberation or excessive damping, corners which causes echos and reflection of the sound. The purpose of such a test is twofold. First, to determine the acoustic properties and second the amount of power required. It is logical that if the sound of the hand-clapping or the voice carries well within

the room, large amount of amplification or sound power or volume is unnecessary. If however the expanses of the structure or the room are such that sound travels poorly, greater amplification and sound volume is required. Definite statements relative to the amount of power required for a certain room according to its size, are impractical and will lead to poor results. Acoustic properties of rooms are not standard and should not be considered as such.

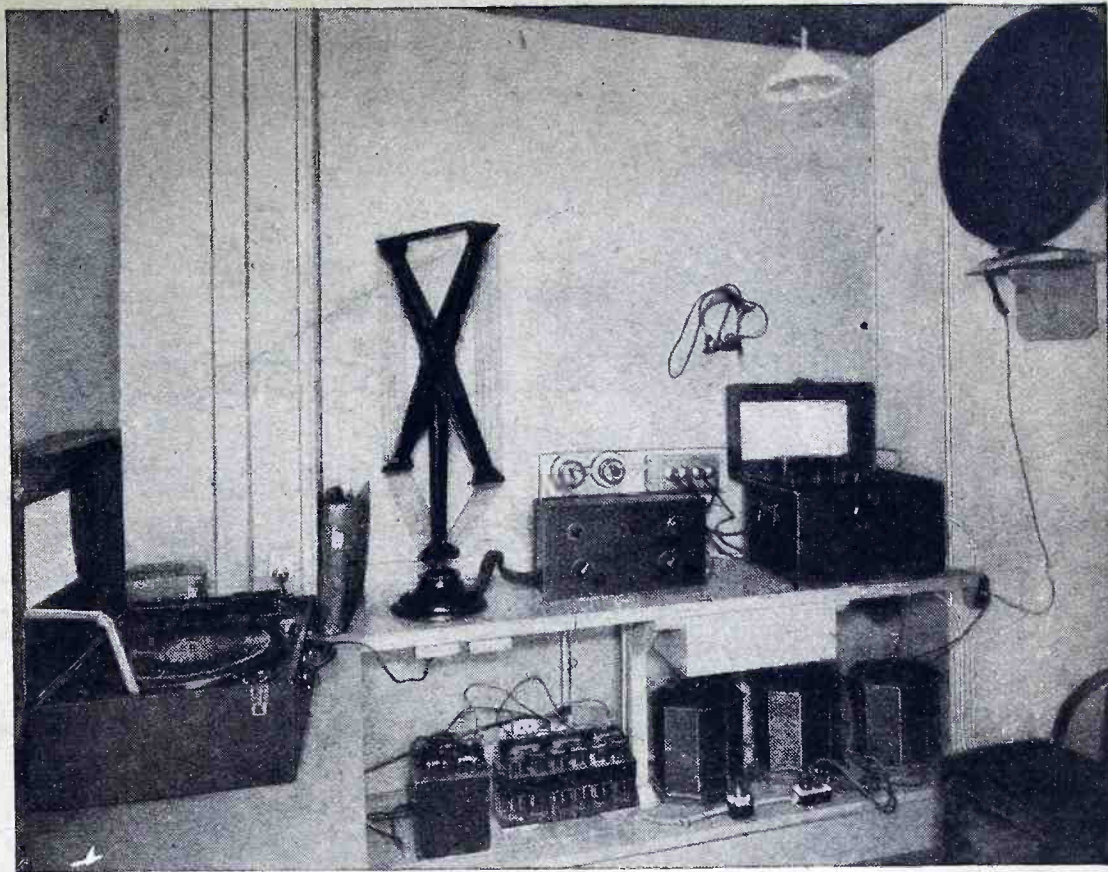
SPEAKERS

The types of speakers employed in an installation are governed by existing conditions and sound illusion requirements. In a chamber wherein reverberation is very pronounced, better results are obtained when horn type speakers are employed in place of cone type speakers, because the sound may be directed away

from the microphone, thus reducing coupling back to the microphone. The type of installation governs the type of horn required. Bearing in mind the fact that sound illusion is imperative, that is to say, if a person is addressing a gathering, it is imperative that all the sound appear to be coming from the talker and not from various parts of the room. Hence the location of the horn speaker directly above the talker.

The use of the cone type of loud speaker scatters the sound and is only used where a general effect is required, or where the source of sound is not restricted to a certain prescribed area. No matter what the source of the original sound, the speakers within a chamber should not be scattered. All the sound should issue from in front of the listener and not from the rear. Scattered speakers increase the echo effect. This does not mean that all the speakers must be located in a cluster—but they should not be scattered in the four corners of the room. Whatever their position, they should always face the listener. The individual concerned should always remember that the horn and the cone type of speaker possess different characteristics with respect to sound illusion. The horn projects the sound in a certain direction, whereas the cone spreads the sound in all directions.

The prime interest of the installation is to make audible the required sounds, but in numerous installations the audible sound is less than normal, and audibility is low. If the chamber involved is a square room and the listeners in the farthest corners, in line with the speakers do not receive sufficient sound volume, greater amplification is required. But if the sound is not uniformly distributed, the requirement is not additional amplifier power but more loud speakers, in other words, greater speaker capacity rather than greater amplification.



By Courtesy of Graybar Electric Corp.
Equipment employed as source of sound in the Welfare Island installation described in this article.

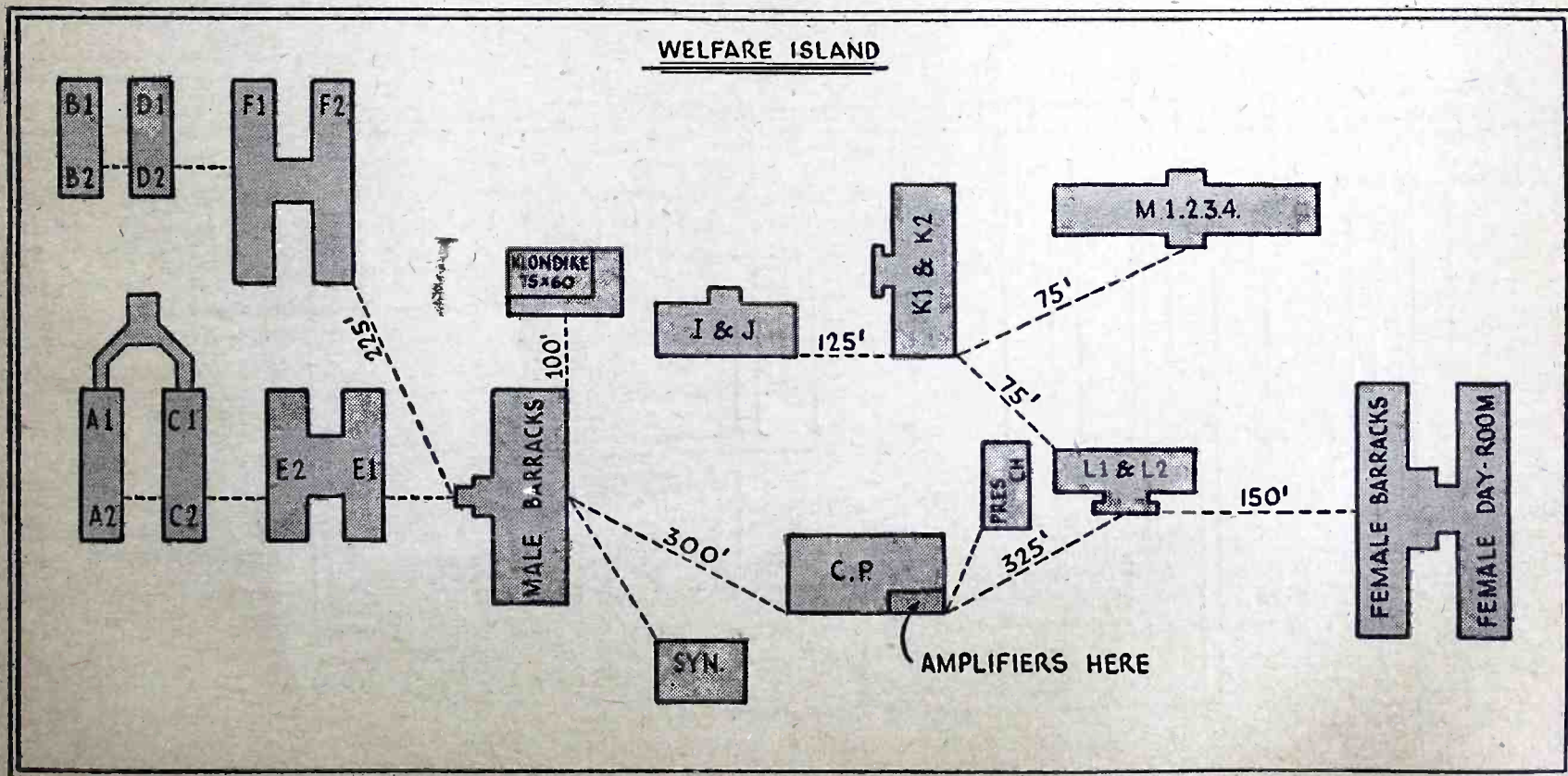
The number of speakers employed for an installation is controlled to a very large extent by the structural conditions of the room or locality involved. Observation and experience are the best guides because requirements change with each installation. One cannot predetermine results. One believes that a certain arrangement of speakers will prove best, but only after they have been placed into operation can one decide upon the results. This does not mean that speech amplifier installation involves haphazard arrangements and "cut and try" methods.

What we wish to stress, is that the practical has greater significance than the theoretical.

CALCULATION OF POWER

The calculation of the amount of power required for a room of certain dimensions presents an interesting subject. We are certain that very few individuals are aware of the fact that an enclosed chamber can be classed as an open air auditorium. This classification is governed by the physical dimensions of the room, particularly the height of the ceiling.

(Continued on page 90)



Building layout on Welfare Island showing position of various structures and length of connecting feeder cables.

Analyzing

a

Successful Speech Amplifier

By F. E. SCHMIDT

Features—Complete A. C. operation—Microphone—Phonograph or Radio Pickup—Two push-pull stages—Three stages in all.

In line with what has been said about speech amplifier installations we believe that the following analysis of a successful power amplifier for work of this nature will be interesting.

Editor.

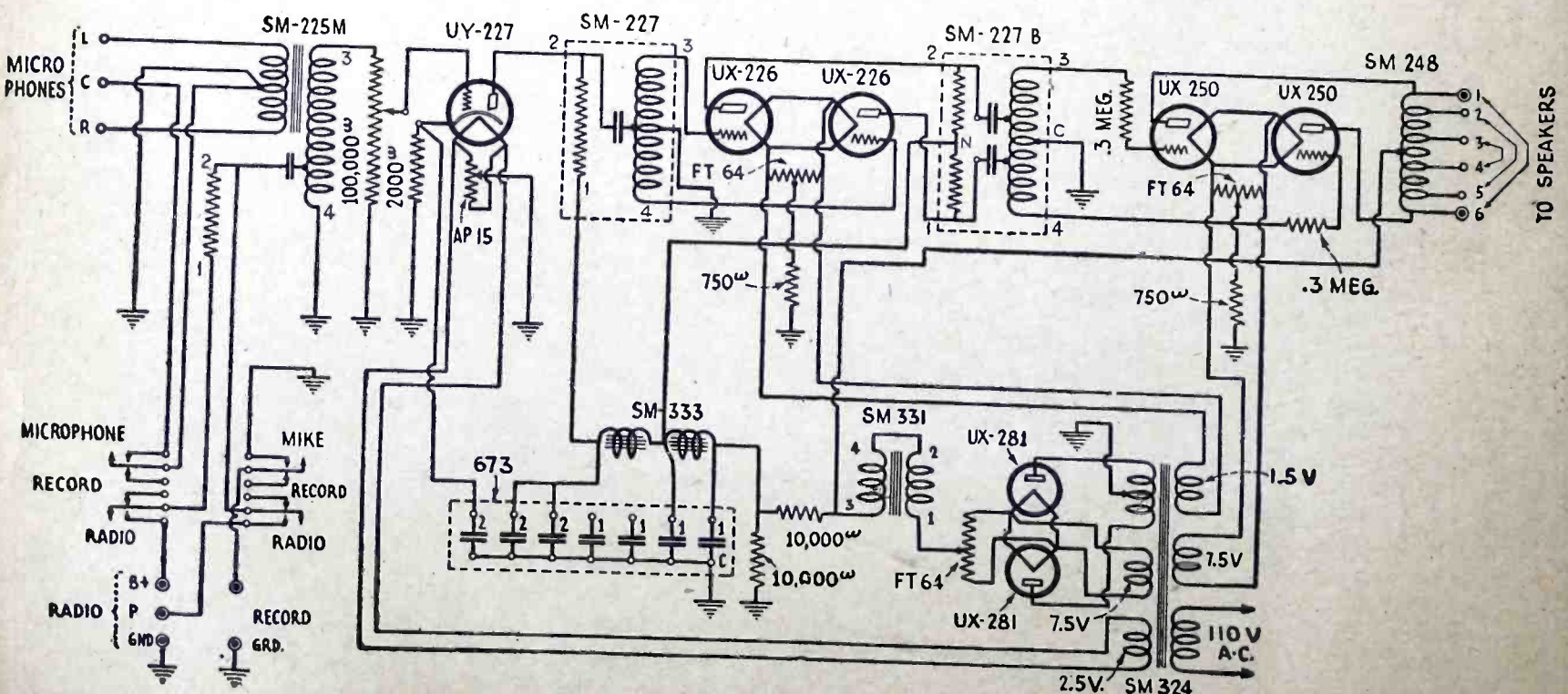
THE requirements of audio amplifiers satisfactory for use in large quarters, and where it is necessary to supply power to hundreds of head-sets and numerous loud speakers are somewhat more complex than the average individual imagines them to be. Albeit the fact that undistorted amplification is essential, the subject of amplifier design involves problems pertaining to power and versatility. An amplifier suitable for a theatre with a seating capacity as great as 3,000 requires an appreciable amount of undistorted output. The design of an instal-

lation of this nature involves not only the amplifier but a number of loud speakers of such design that when operated at maximum capacity, undistorted sound is available. The requisites of such amplifiers are numerous with versatility the most important. Receiver, microphone and phonograph pick-up should be applicable with equal facility, and the gain of the amplifier should be within control when operated at the lowest or the highest level.

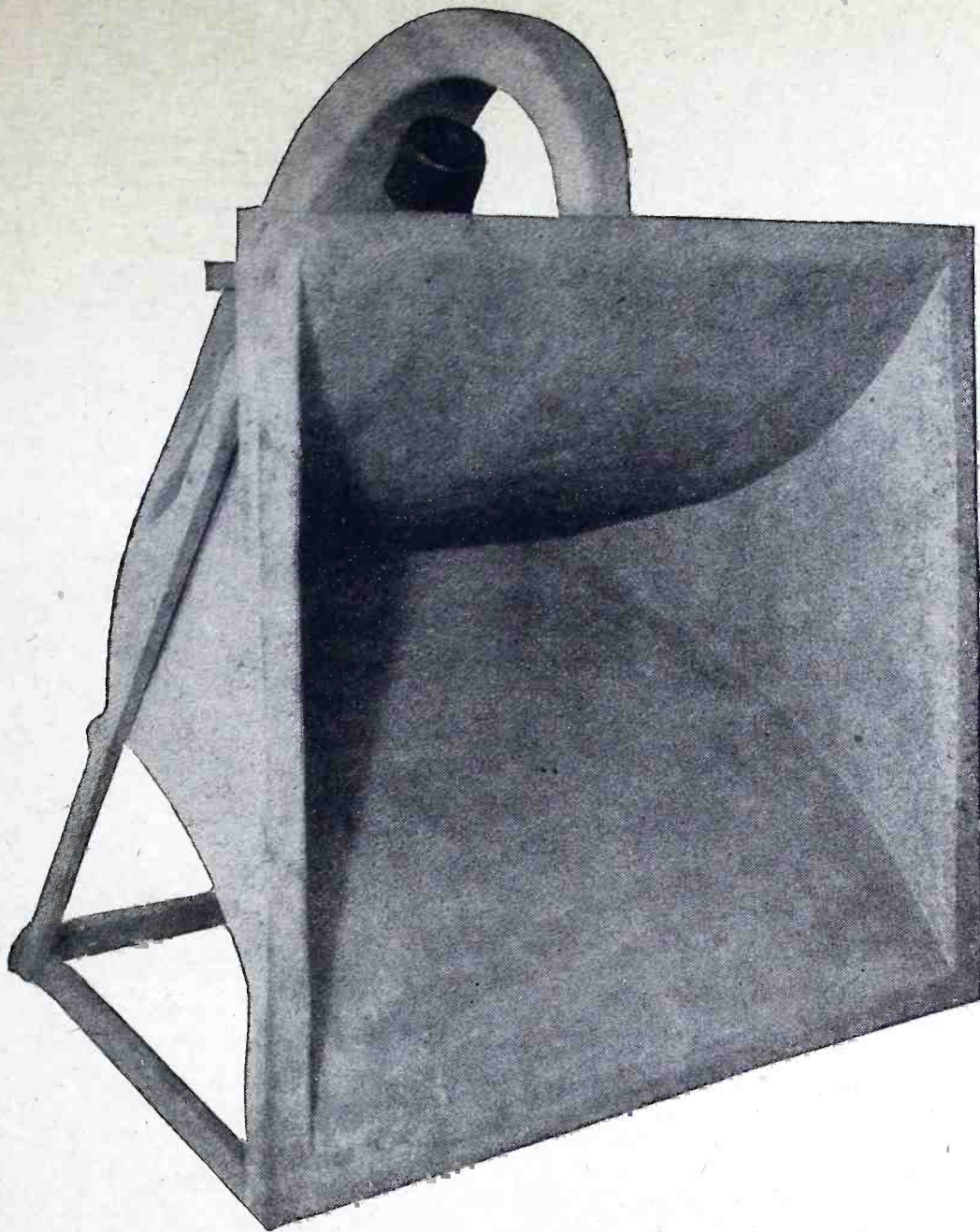
The amplifying stages preceding the power stage must possess sufficient gain to produce the required power tube input without overloading preceding stages. The change from minimum to maximum power must be instantaneous with an excellent volume control, one which is smooth and gradual without abrupt changes of intensity. As a concrete ex-

ample of such an amplifier, we see the S-M 690 consisting of seven tubes inclusive of the two half-wave rectifiers. This public address amplifier arranged for microphone, phonograph or receiver input utilizes three stages, two of which are of the push-pull type. Rated at 15 watts of undistorted output, this rating is secured by the use of two 250 type tubes connected in push-pull fashion. The advantages underlying the use of push-pull connection are secured in both the second and output stages, the first stage alone being wired in conventional fashion. As is evident, the entire unit is A.C. operated. Raw A.C. is applied to the filaments of the various amplifying tubes. The plate potential is secured from the two UX 281 tubes operating in a full wave rectifier circuit.

(Continued on page 96)



Wiring diagram of S. M. 690 speech amplifier.



Dynamic exponential horn employed in talking movie installations.

Behind The Screen and Curtain

By E. N. CORNWELL*

It is difficult to estimate the number of rolls of thunder, the number of aeroplane propellers in motion, or the number of wind storms that have been simulated by means of electrical devices. Now comes a play wherein a generator displays human emotions and reactions. The play is set in a generator-station and sound of the whirl of the rotating armature varies in response to human association and comment.

With such a setting it is logical that the play is electrical, that electrical equipment is necessary each instant to produce the psychological effects. Where the success of the play is based upon the generated sounds and the accompanying amplification one need not wonder long about the importance of the sound amplifying devices. A definite line of demarcation exists between sound devices and the spoken stage and sound devices and the movies. Location is impossible in the former, in direct contrast to the ease of attainment in the latter.

The requirements of sound amplifying devices for theatre use are somewhat numerous, but two factors stand out above all others, namely fidelity of reproduction and versatility of operation. The sound conveyed to the audience must be a faithful reproduction of the original. An illusion is created—and must be maintained to the “nth” degree throughout. Falling water should not sound like rustled leaves—the roar of a propeller should not sound like an electric fan. It is true that special devices are in use for the reproduction of the original sounds, but science has been able to reproduce whatever sound is required with excellent accuracy and fidelity. It is up to the amplifying equipment to maintain this accuracy. . . . Without it the play will fail.

Proper volume level is important—much more than one is wont to imagine Another important factor is the mixing of sounds. Nature in its daily production of various sounds makes them simultaneously—mixes them simultan-

ously, each sound of proper proportion. We in our daily grinds, must produce these proper proportions electrically. Every circuit must be under proper control. Every circuit must be arranged for mixing or separate operation. Every possible facility for the reproduction of nature-sounds must be available at instant notice for the control man. An idea of what is being accomplished is shown in Eugene O’Neill’s newest play, *Dynamo*.

The setting is in a power house, with the dynamo as the leading force, displaying human reactions. The actors speak to the machine, which replies by varying its speed of rotation, consequently the volume of sound of the whirl. One can readily comprehend that the installation of a dynamo sufficiently large to create a volume of sound great enough to provide satisfactory audibility throughout the theatre would be impossible. Hence a small dynamo, an exact duplicate of its larger brothers is used as the source for

*Amplion Corporation of America.

this sound. Its whir is picked up by a microphone and amplified. The resulting sound is the exact of that to be found when one is adjacent to a large dynamo in a generating station. This whir is the background for the actors. Its realism is a vital influence in the entire play.

However, a dynamo alone does not constitute a generating station. Large turbines actuated by water drive the generators. Hence sound of water passing through the turbine must be produced. If the station is near a waterfall, the sound of a waterfall must be produced. Each of these requires a separate microphone, mobile in design so that it may be shifted from one sound producing device to the other. Complete microphone mixer and control panels are imperative in order to provide a means of separating the sounds and blending them in correct proportion. It would not do to have the roar of an adjacent waterfall, drowned out by the water passing over the blades in the turbine.

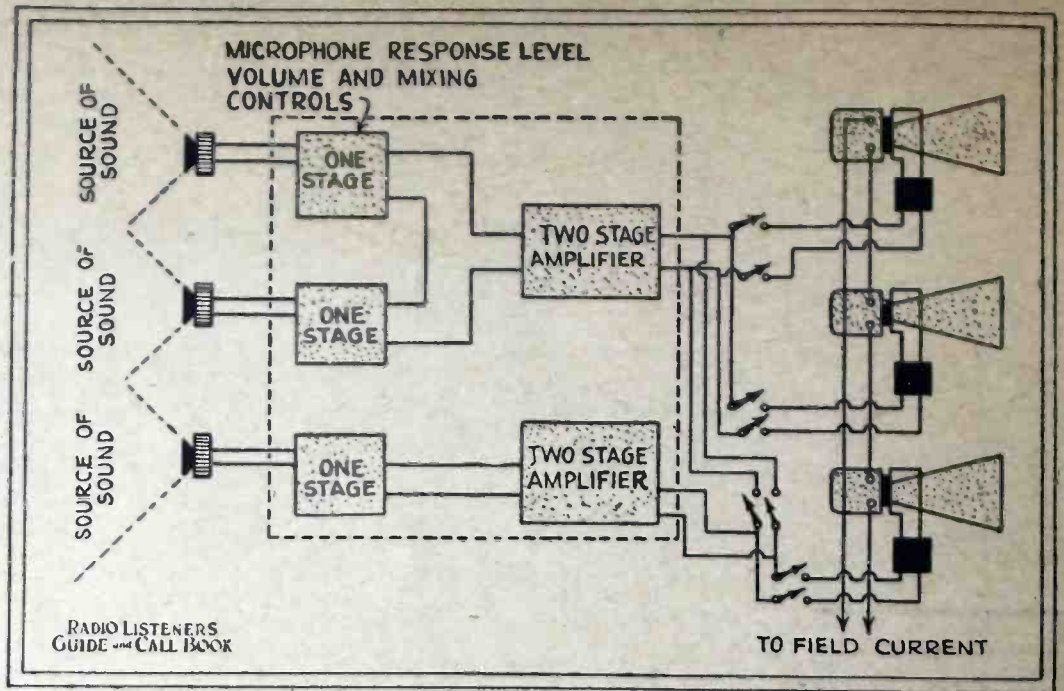
Having described the problems involved in such theatre installations, we believe that the equipment used in the Martin Beck Theatre for the purpose of amplifying the sounds produced back stage. The layout of the equipment employed is shown in an accompanying wiring diagram. Three speakers are located around and in back of the stage setting. The exact position of these horns is such that the correct sound illusion is produced. These horns are of the exponential type.

Three microphones of a new type are used. (Editor's Note. This new microphone is shown on page 65. It does not utilize the regular "button" arrangement.

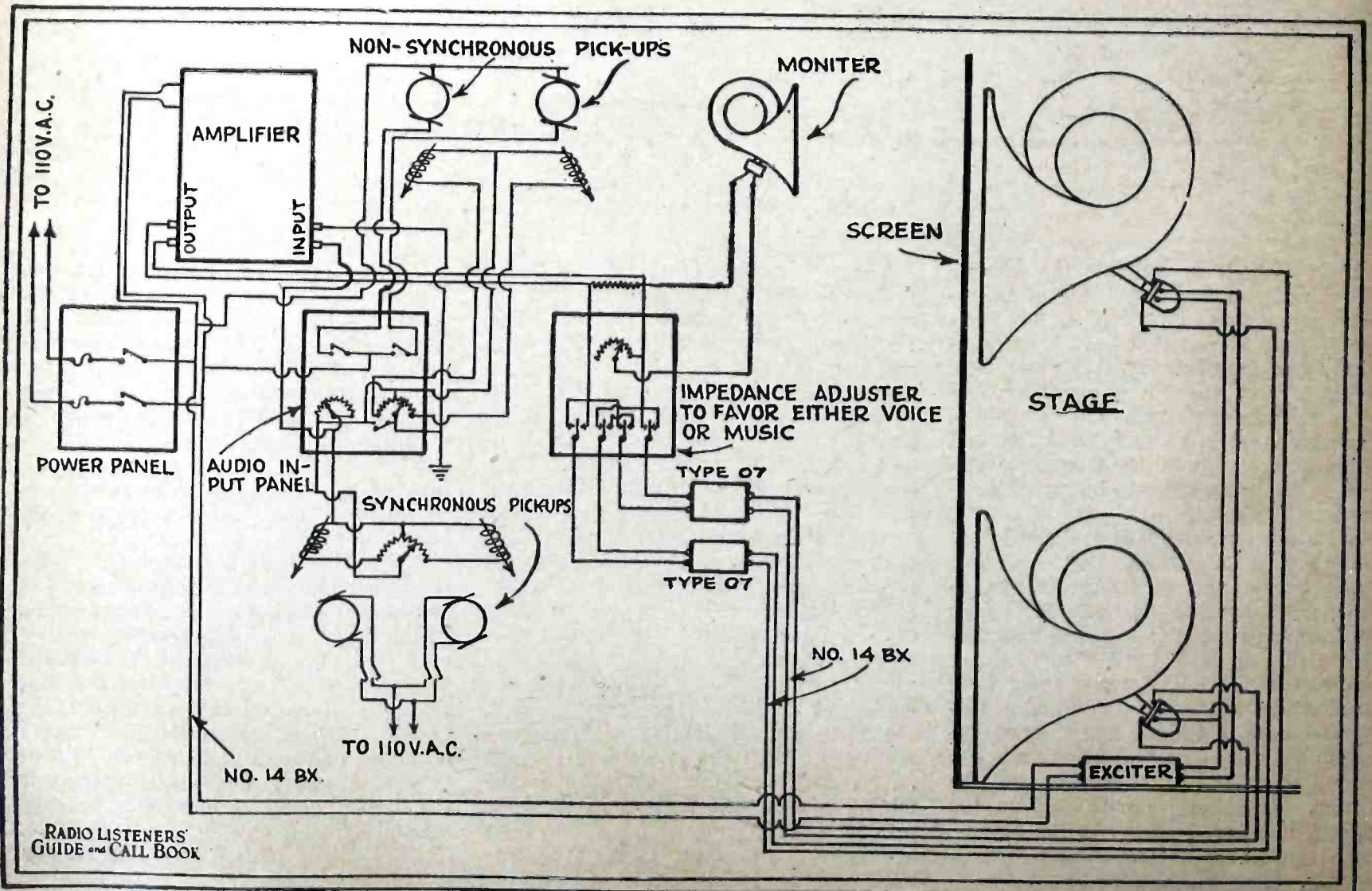
Instead a pulverized carbon is placed between two brass surfaces and is acted upon by a thin gutta-percha membrane. The design of the pick-up device permits a microphone current range between 6 and 60 milliamperes with a corresponding variation in sensitivity. The characteristic carbon "hiss" has been eliminated.) Each of these microphones has a special single stage booster amplifier of D.C. design operated from the available power supply. Two of these microphones are connected to one special two-stage amplifier which feeds two dynamic speakers. One of the booster amplifiers is also arranged for controlling microphone

sensitivity and mixing of the sounds picked up by the two microphones. The use of individual microphones permits placement at the most advantageous position and also in the event of emergency, substitution of a good layout for a poor one.

The third pick-up system consists of another mobile microphone and a single stage booster audio amplifier, arranged with sensitivity and volume control. This single stage amplifier feeds into another two-stage system, which is connected to the other amplifier by means of switches, so that the output may be added. This amplifier feeds another speaker.



Complete sound amplifier employed in the play "Dynamo."

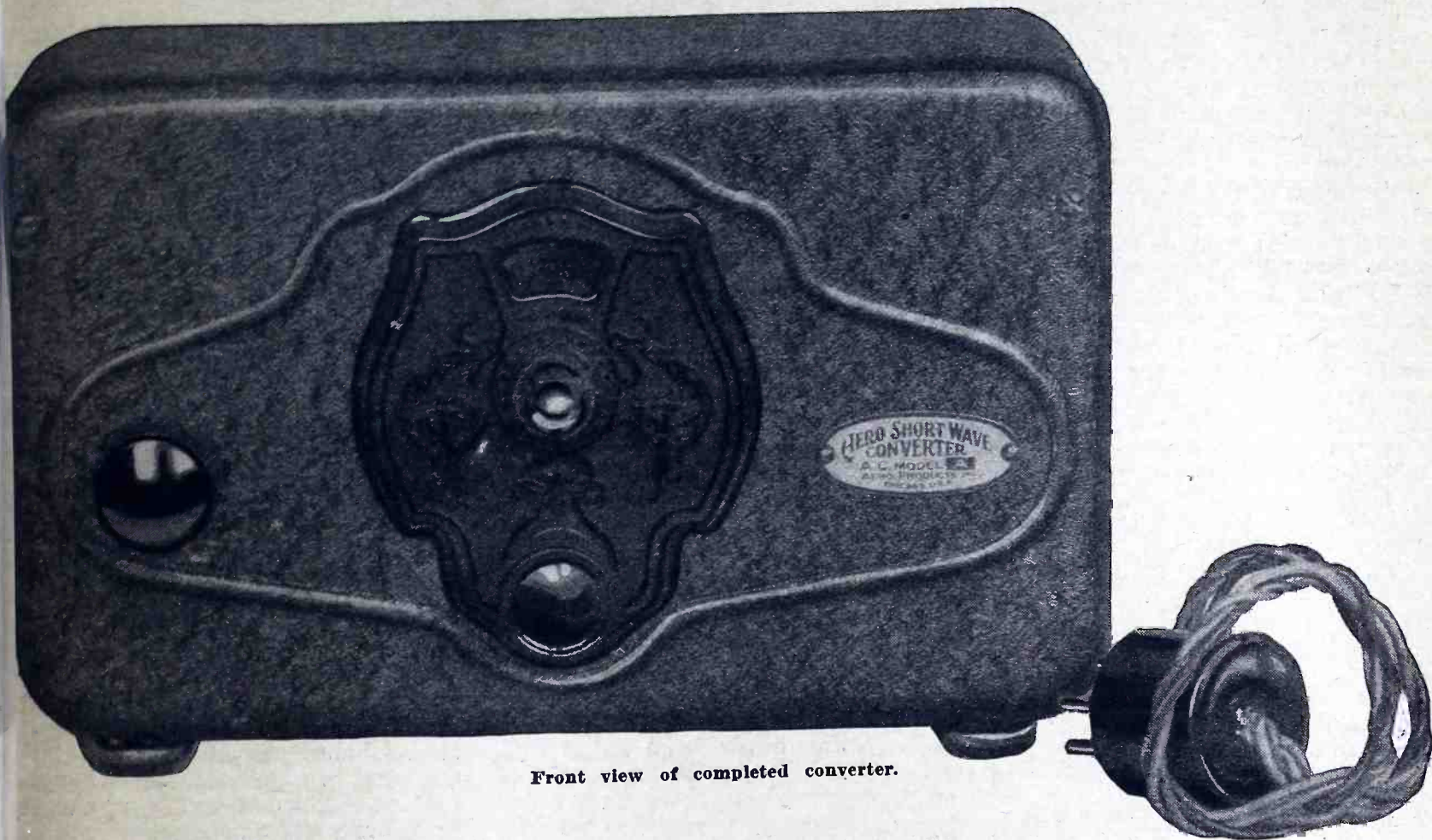


Complete sound amplifier system for use in sound and talking moving picture installations.

New AERO Converter

Aero Introduces New Finished A.C. Short Wave Converter.

Not Available in Kit Form.



Front view of completed converter.

SHORT wave converters whereby a regular broadcast receiver may be adapted for use on short waves, have been widely exploited. For some time past, experiences with A.C. converters, that is adaptor units suitable for A.C. receivers, have been very unsatisfactory. With this in mind, we introduce a complete A.C. short wave converter, designed for use with any A.C. electric receiver utilizing a 227 type detector tube. Because of the many intricacies involved, the unit is not offered for sale in kit form. Instead, it is available as a finished product, with physical appearance as shown in the accompanying photographs.

The unit consists of a detector input stage particularly designed for A.C. operation, bearing in mind that the "hum" present in the average A.C. receiver becomes excessive when the tuned stages are operated close to the point of regeneration. The difficulty of "motorboating" is also removed by the use of a specially designed filter system.

The converter is arranged for connection with the receiver proper, by means of a cable lead and plug attachment, that is inserted into the receiver detector socket. The tube employed as the detector in the receiver, is removed from its socket and inserted into the converter-box

socket provided for that purpose. The entire unit with the exception of the inductances is housed within a metal container. The coils are located to the rear of the housing unit and are of the plug-in type, affording utility over the entire short wave band.

The detector tube required in the converter box is inserted after the rear cover is removed. This is accomplished by removing three screws, which are again replaced when the rear cover is in position. The front panel carries the tuning control, a single knob, and also the volume control. The rear panel carries the mounting for the tuning inductances. The cable supplied with the unit carries all the leads required for connection. This cable as was mentioned terminates in a five prong insert.

COILS

The coils supplied are classified as smallest, medium and largest. The wavelength band covered by the smallest is from 16.5 to 32 meters. The operating range of the medium coil is from 26.2 to 47.8 meters. The tuning range of the largest coil is from 46.7 to 90 meters. With respect to these classifications reference is made to the number of turns

and not the physical dimension, although the length of the coil increases with the number of turns.

The diameter of the winding in each case is 2 inches. The number of turns used for the smallest coil is four; for the medium coil, nine and for the largest coil, eighteen. Referring to the rear view of the converter the primary coil is moveable with respect to the secondary and tickler windings. By movable we mean that it swings on a hinge. The grid and plate windings are contained in one unit, the tickler being wound within the grid inductance. The inside view includes the primary coil, but it should be understood that this coil is outside of the rear plate.

FILTER

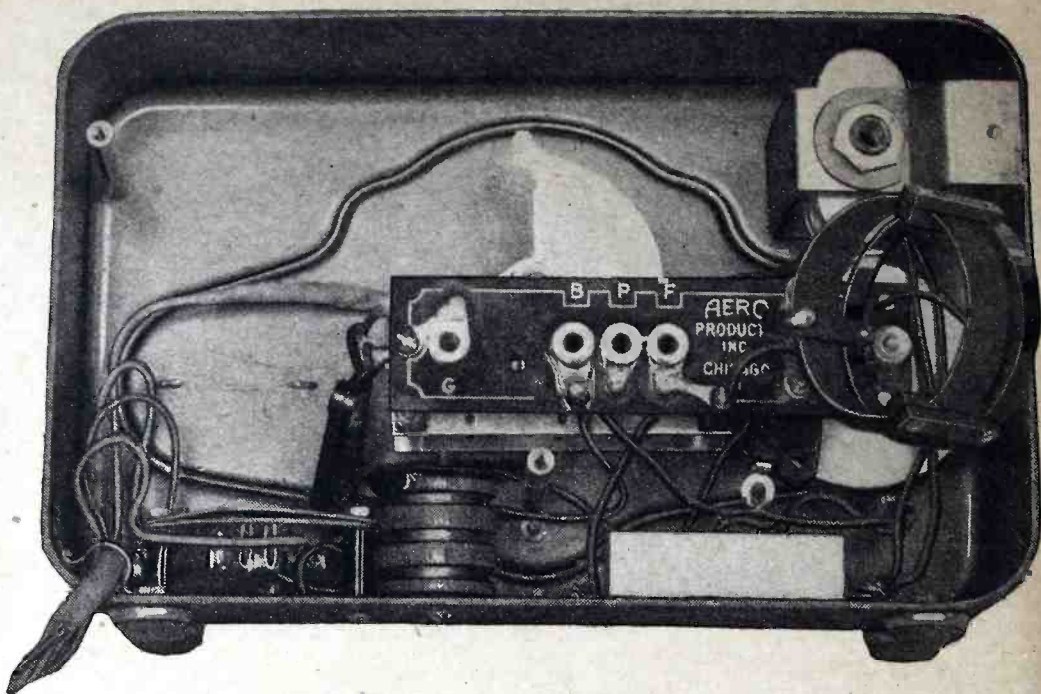
A "B" filter consisting of a resistance and a fixed capacity is provided to minimize the effects of motorboating. While a wiring diagram of the unit is not available, examination of the system shows the use of the conventional tickler feed back arrangement as mentioned and with regeneration control in the form of a series resistance-capacity arrangement connected across the plate-filament circuit, between the battery end of the tickler coil

and the cathode of the tube. The detector tube is a 227 with a cathode as the source of electrons and the filament functioning as a heater. The input system consists of the conventional primary-secondary arrangement where a separate primary is employed. The ground side of the primary is connected to the ground side of the secondary circuit. The detector system consists of the conventional grid condenser with the grid leak connected between the grid and the cathode terminals of the tube. A radio frequency choke is provided in the plate return circuit between the plate return of the radio frequency choke and the inserted plug.

This plug is of the five prong type but only four prongs are used, since the grid terminal remains open, or rather disconnected. The "B" filter is connected into the "B" plus circuit of the insert plug, where the resistance controls the value of plate potential applied to the detector tube in the converter. The capacity in this filter is the required bypass condenser. Generally speaking the unit performs well and considering the usual trouble in A.C. installations its performance is very creditable.

Experiments with the converter show the necessity of coordinating manipulation of the filter control knob and the tuning system. Changing wavebands invariably requires readjustment of this knob. Motorboating control is very effective in the form of plate voltage reduction. As it happens, very satisfactory performance is possible with the filter resistance adjusted to the point where motorboating ceases.

A new innovation in socket design is introduced with this converter unit and the contacts employed in the socket are excellent in every respect. This data is a matter of pure information rather than material of intrinsic value to the reader. The coil mounting is an integral part of the entire assembly, and under such conditions is very rigid and maintains its position. Since the primary, secondary and tickler coils are on one mounting, these coils retain their position once inserted. This overcomes a great difficulty present where individual mountings are



Inside cover of Aero's new A.C. short wave converter—"B" filter resistance in upper right hand corner.

employed and the possibility of shifting is present. With the system shown, calibration is possible without fear of any change in the setting of the condenser dial. The value of the tuning capacity is approximately .00014 mfd. The entire unit is contained within a crockle finished metal cabinet 9 inches long, 5½ inches high and 2½ inches deep.

A unit of this nature fills a long felt want, particularly so because the modern radio receiver owner is an ardent A.C. enthusiast. Contrary to the usual run of popular subjects, short wave reception and broadcast transmission are daily increasing in popularity. The number of distant stations recorded as received at remote points are likewise growing daily and we believe that this gradual increase is due to the period of time required to understand and study the peculiarities of short wave broadcast receivers. Results are usually poor at the start, but improve rapidly as the operator learns each little trick and peculiarity.

The converter unit requires very little attention or any particular position with respect to the radio receiver. It is logic-

al of course, that its tuning dial control should be easily accessible. In all other respects the limit is the length of cable between the adaptor unit and the receiver.

DETECTOR TUBE

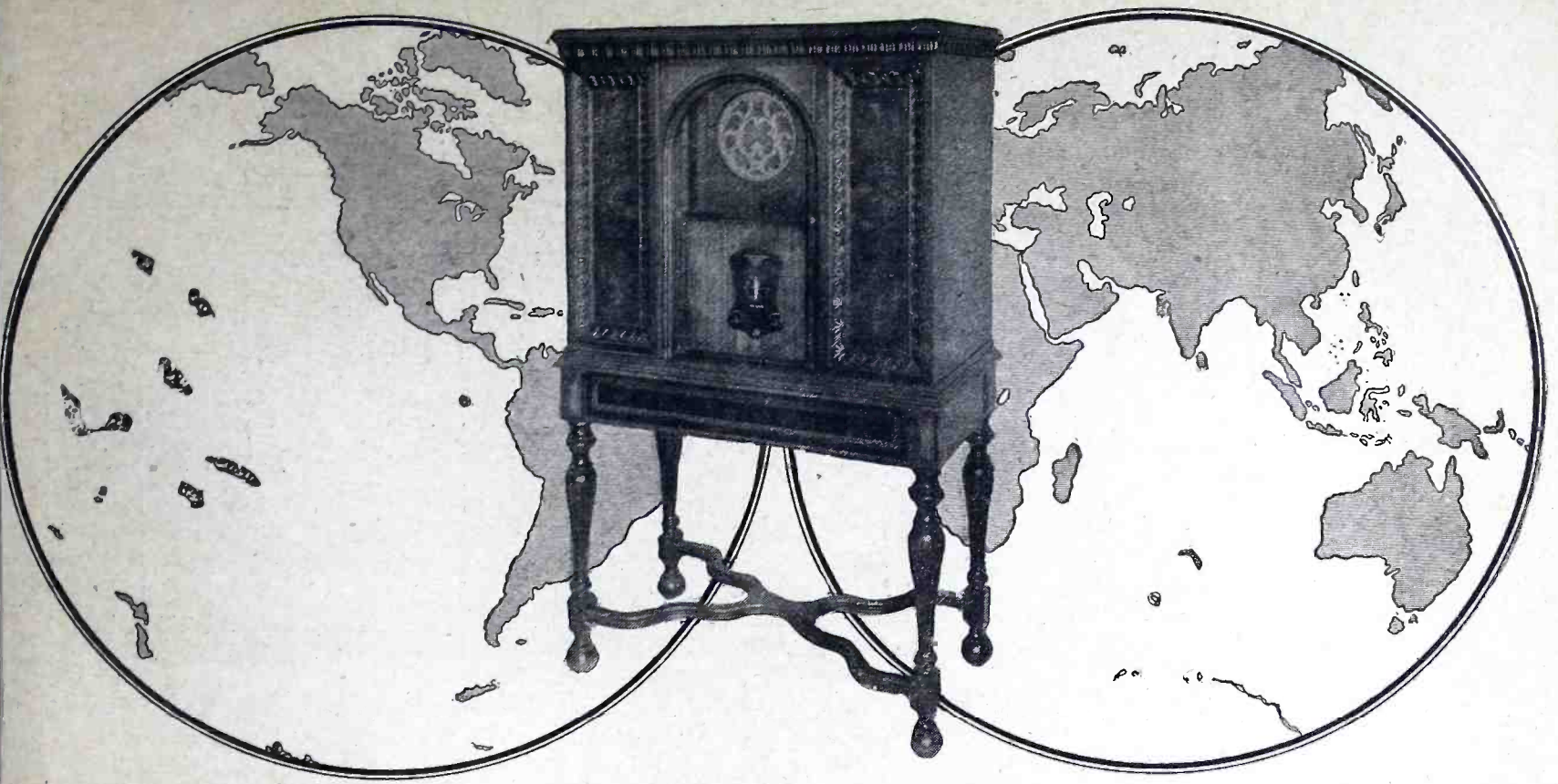
With respect to the use of the 227 type tube as the detector, this is imperative. The 226 can not be employed because its design does not permit operation under the conditions present when the tube is employed as a detector. The plate current consumption of the 226 type of A.C. tube is very critical, and satisfactory performance is not available with the low values present when the tube is employed as a detector. The 227 on the other hand is free from this effect.

Supplementing this is the normal voltage ripple present in the 226. In actual comparison it is several times that of the 227. When we consider that operation close to the oscillation point or within the oscillation range, is difficult because of the "hum" present in the system, it becomes evident that every step must be taken to minimize the "hum" in every possible way. A great stride is the cathode type of A.C. tube.

While upon the subject of short wave receivers, we believe that a few instructions pertaining to such tuners will not be amiss. One can readily understand that short wave stations operating on high frequencies require very sharp tuning—accurate tuning. The portion of the tuning dial covered by one of these stations is very small—a fraction of that found in normal broadcast reception, hence tuning must be carried out with care. One does not realize how easy it is to pass over a number of stations. Rapid twirling of the tuning control in unsatisfactory. It will not permit a conclusive demonstration of the ability of any short wave receiver or converter regardless of type. . . . If you would enjoy short wave reception—tune slowly and accurately. Every control manifests an effect upon the tuning. The coupling between the aerial and the grid coil is an important item and should be accurately adjusted.



Rear view of A.C. short wave converter—Coils are in the rear—Note variable primary coil.



The finished receiver.

The

“Seven Seas”

CONSOLE

By C. R. LEUTZ

THE “SEVEN SEAS” Console receiver is a complete installation of the tuned radio frequency amplifier type, employing nine tubes, three of which are the screen grid radio frequency amplifiers, one tube is a detector, three are employed in the audio system and two tubes are employed as full wave-rectifiers. The entire installation is A.C. operated employing A.C. tubes. The radio frequency amplifiers are A.C. 222. The detector is a 227 and the first audio stage is likewise a 227 tube. The second audio stage consists of a pair of 210s in push-pull arrangement. The two rectifiers employed in the power supply unit are 281s.

The console is 55 inches high, 33 inches wide and 18 inches deep. Two sliding doors are provided to cover the control panel and Dynamic Speaker Grille.

MAIN CHASSIS

The main chassis contains the three tuned radio frequency stages, detector stage and first audio stage only. The chassis is 28½ inches long, 7½ inches wide and 7½ inches high, constructed of heavy aluminum sheet and divided into five separate compartments, each shielded

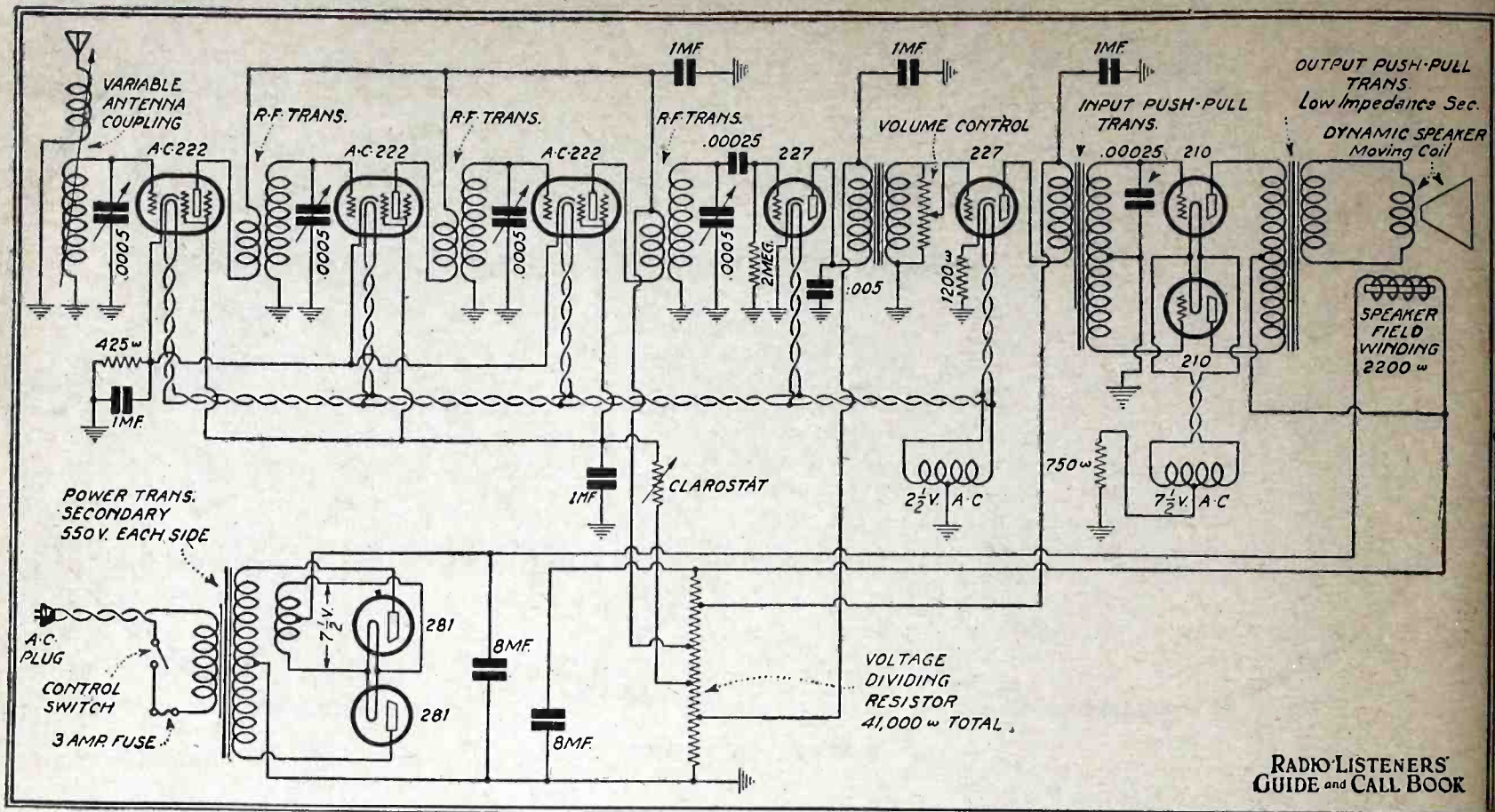
from the other. The tuning condensers are mounted outside the chassis, but these condensers are also totally shielded externally and each condenser section is shielded from the other. A total of four variable condensers are used, two attached to one tuning drum and two on the second tuning drum. These two tuning drums are connected together with a sliding friction clutch. While these tuning drums are ordinarily adjusted for the same dial reading, there are cases where it is very desirable to have them independent for extreme selectivity. The friction clutch permits individual control.

The coupling device through which the antenna is coupled to the radio frequency amplifier is adjustable. It is not necessary to vary this frequently. The main purpose is to allow the coupling value to be determined and fixed for each individual antenna encountered and for the section where the receiver is located. When several local stations are nearby, the coupling can be set for maximum selectivity. At a remote section of the country, the coupling can be set to suit particular requirements. Measurements made upon the receiver prove the

high gain calculated in the design. A night range of from 500 to 1,000 miles is obtainable with a very short aerial. The average outdoor aerial is satisfactory for distant work.

Supplementing the five compartments housing the tubes, individual tube shields are also employed, thereby isolating the tubes from the coupling units. In the effort to minimize losses due to the proximity of the shields to the coils, these components are widely spaced. The major portion of the wiring is beneath the chassis. The same is true of the various resistors, fixed condensers, and the other equipment employed in the radio frequency system.

The design of the radio frequency transformers is of special character—incorporating details required to secure the best performance from the screen grid tubes. The tuner ratio of these transformers is 1:2, a satisfactory compromise for gain and selectivity. The high gain in the radio frequency system, permits comparatively low gain in the audio frequency amplifier, and the turn ratio of the first stage audio frequency transformer is 1:3.



Wiring diagram of the "Seven Seas" console receiver.

POWER PACK

The main transformer is designed to supply the necessary direct current when used with two 281 rectifier tubes with a full wave rectifier circuit. The A.C. voltage before rectification is 1100, with a center tap at 550 volts. After rectification and filtering, the D.C. voltage measured at the plates of the power tubes is 425 under full load. The power pack is built in a separate unit so that it can be readily removed for service, if this is necessary. The parts are all mounted on a steel sub-base, readily accessible and well ventilated. The power transformer also supplies 7.5 volts at 2.5 amperes to the two 281 rectifier tube filaments, 7.5 volts at 2.5 amperes to the two 210 power tube filaments and 2.5 volts, 8.75 amperes to the radio tubes, 3-222 and 2-227s. A large voltage dividing resistor having a total of 41,000 ohms is used to divide the output voltage, feeding required voltages to the detector and radio frequency and audio frequency tube plates as well. The screen grid voltage is variable. The field winding of the dynamic speaker is

used as a filter choke for the power pack. Two large S. M. F. condensers are used in the filter circuit. These are designed for a high operating voltage and are also self-healing, that is if they are punctured by an abnormally heavy voltage surge, after turning the set off, the condenser is again ready for operation. These condensers are not of the electrolytic type.

POWER AUDIO AMPLIFIER

The power audio amplifier is assembled on a steel sub-base, all the parts readily accessible and well ventilated. The input and output transformers are of the best design and have an excellent response curve between 40 cycles and 8,000 cycles. The transformers supplied as standard are designed for use with two 210 power tubes. When 2-250 power tubes are specified, other transformers are installed in the power audio amplifier, and the power transformer in the power pack is also of heavier construction to handle the increased load taken by these tubes. For all ordinary purposes, the arrangement using 2-210 power tubes will give all the

volume desired, even on distant stations.

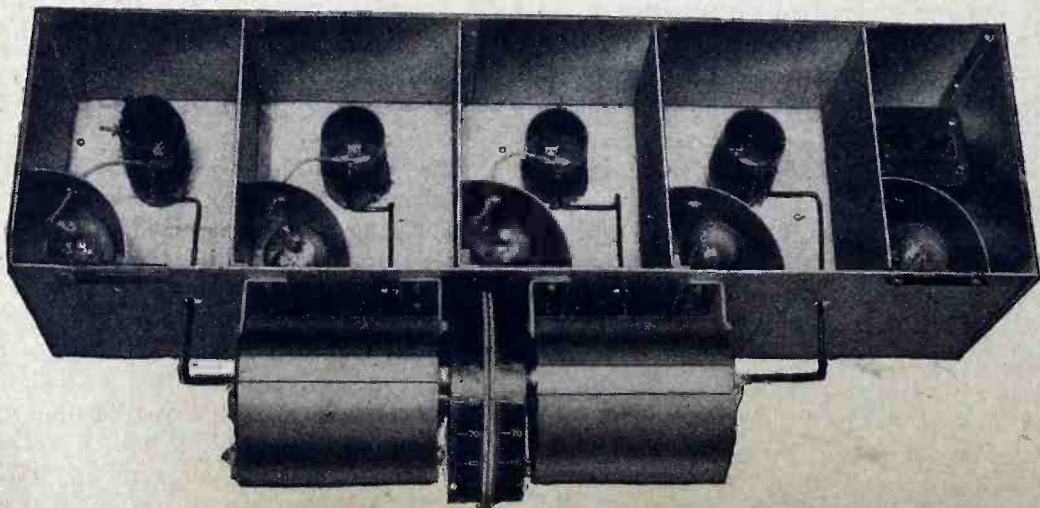
DYNAMIC SPEAKER

The dynamic speaker used in this console has the desirable feature of being able to handle maximum volume without any distortion. The rear of the console cabinet is not enclosed with wood, a frame covered with wire mesh being used. This allows free air movements and eliminates the "hollow" or "barrelled" effect given by some console installations. Incidentally this also provides good ventilation for the receiver and power pack. The field winding of the dynamic speaker is used as a filter inductance or choke for the power pack.

CONTROL PANEL

The control panel consists of the double drum for tuning and two volume controls. One volume control regulates the sensitivity of the radio frequency amplifier, by varying the shield grid control voltage. The other volume control is at the first audio amplifier tube and prevents overloading of the power amplifier tubes on extremely strong signals. A switch which connects or disconnects all circuits in one operation is also available. A safety switch is installed in the rear cabinet frame so that when the back of the console is opened, the house current is automatically disconnected.

A thorough study of the wiring diagram shown above will bring several interesting facts to light, facts which may be applied to good advantage when constructing similar equipment. Note the use of comparatively high values of filter capacity and the use of a single section filter. Excellent economy consistent with satisfactory performance is secured by utilizing the dynamic speaker field winding as the single filter choke.



Inside view of new Leutz receiving system—Note individual shields and separate tube compartments.



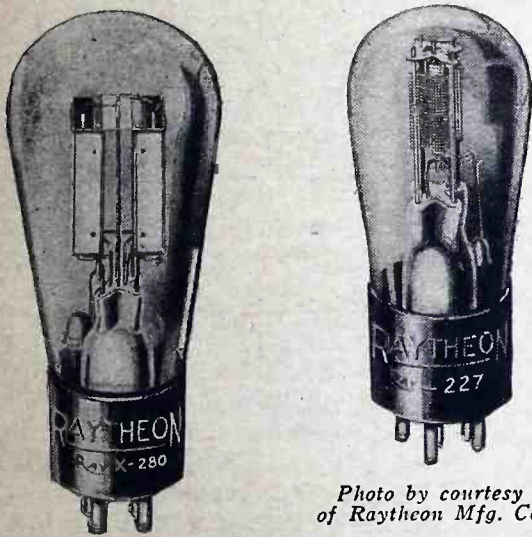
The LISTENERS' ACCESSORY GUIDE

A New Line of Vacuum Tubes

FIVE new tubes for radio receivers have been introduced by a Cambridge manufacturer consisting of a number of A.C. receiving tubes and a rectifying tube.

The rectifier is the RX280 designed for full wave rectification and for applied A.C. potentials of 300 volts per plate. The filament is operated at 5 volts and the maximum current output is 125 milliamperes.

The receiver tube line consists of the RX227, the RX226, the RX250 and the RX171-A. The 227 type tube utilizes an indirectly heated cathode with a heater potential of 2.5 volts A.C. consuming 1.75 amperes. Its electrical characteristics with 135 volts applied to the plate are as follows: Amplification Constant 8.1, Mutual Conductance 810 micromhos and Plate Impedance 9800 ohms. The maximum plate voltage is 180 volts.



Two new A.C. receiver tubes described here-with.

The RX226 is of the A.C. filament type operated at a filament potential of 1.5 volts consuming 1.05 amperes. The electrical characteristics with 136 volts applied to the plate are: Amplification Constant 8.3, Plate Impedance 7500 ohms and Mutual Conductance 1050 micromhos.

The RX171-A is designed for operation at a plate potential of 180 volts and a filament potential of 5 volts and consumes .25 of an ampere filament current. The electrical characteristics at the above mentioned value of plate potential are Amplification Constant 3, Plate Impedance 2000 ohms and Mutual Conductance 1450 micromhos. The undistorted power output under correct operating conditions is approximately 710 milliwatts.

These tubes employ standard bases and are interchangeable with all tubes of similar type. The physical dimensions are likewise standard.

Calibration of Resistance Units

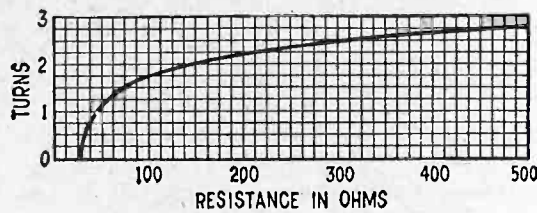


Fig. 1

THE operating characteristics of a device which is continuously variable and is not calibrated cannot help but be of interest to the individual who has occa-

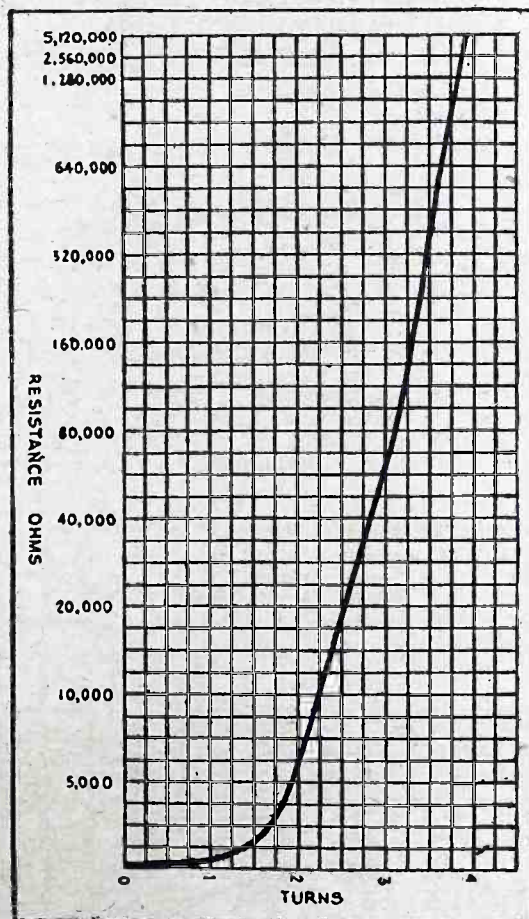


Fig. 3

sion to utilize this device. The accompanying three graphs illustrate the variation in resistance of three Clarostat variable resistances. Figure 1 is the low range power unit with a maximum resistance of 500 ohms and a minimum of 20 ohms with a power rating of 80 watts. Figure 2 illustrates the volume control unit rated at 7 watts and a resistance variation from 0 to 2,000,000 ohms. Figure 3 illustrates

the type known as "Standard", with a resistance variation between 0 and slightly more than 5,000,000 ohms and a power rating of 20 watts.

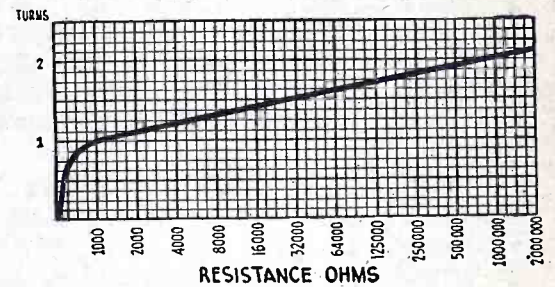
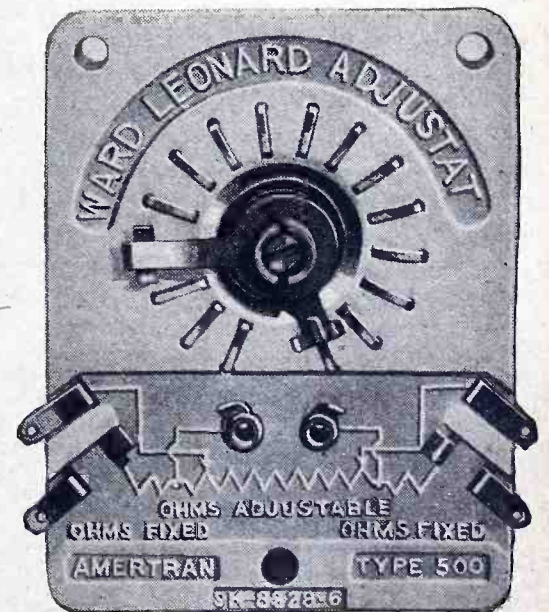


Fig. 2

These graphs illustrate the variation in resistance with turns of the control knob. Comprehension of the graphs is simple and makes possible the approximate calibration of these resistances when employed for experimental work.

New Calibrated Voltage Divider

A NEW voltage divider suitable for use in B power units for the attainment of variable voltages is shown below.



The device known as the Dual Adjustat is a combination of fixed and variable resistances, designed to replace fixed resistances wherever variable output B voltages are required. As is evident in the wiring diagram, the device unit consists of two fixed resistances and one variable resistance one of which is arranged with

(Continued on page 100)

Knapp "A" Voltage Regulation Curve

THE function of a battery eliminator is to supply a required value of voltage at a required value of current drain or current load. The variation of output voltage with output current is usually known as the voltage regulation curve, and is of great importance during the utility of the device. Inasmuch as the average eliminator of today, be it an "A" or a "B" unit, is not a constant voltage device but affords a varying voltage output depending on the load, it is important that the voltage regulation curve be at hand when the device is being utilized. As a matter of fact, the data usually contained in a voltage regulation curve is of utility when the unit is being purchased, because it indicates the operating characteristic and the performance under known conditions.

The graph illustrated below shows the voltage regulation curve of the Knapp "A" Power Unit, indicating the available D.C. voltage output with an A.C. line voltage of 116 volts and various settings of the switch tap. An analysis of these curves will result in information necessary for the satisfactory utility of the device. The data contained therein shows the available supply voltage when the switch tap is set at certain points and the load is varied between .1 and 2.5 amperes. The D.C. load in amperes is also interpreted in the number of .25 ampere tubes such as 201A, 112A and 171A which are the equivalents of known values of load.

An illustration of the usefulness of these curves is the following: Let us imagine that we wish to operate five tubes of the .25 ampere type equipped with automatic filament control devices which require a 6 volt source of filament potential. The load current of five .25 ampere tubes is approximately 1.25 amperes. Reference to the curve shows that with 116 volts A.C. input, and the switch tap set at D, the eliminator will function as a 6 volt source of D.C. supply at a load of 1.3 amperes.

This regulation curve is applicable to the "A" power unit illustrated and described on page 96 of the Winter edition of RADIO LISTENERS' GUIDE AND CALL BOOK.

Two New RCA Amplifying Tubes

TWO new tubes have been announced by the Radio Corporation of America; one a new A.C. screen grid tube and the other a new power tube. The latter tube is of particular interest because it provides a very satisfactory power output at a relatively low value of plate potential. It will find ready application as a replacement tube to be used in place of the 210. Unfortunately however, its amplification constant value is less than the 210. The accompanying figures speak for themselves.

The other tube is an A.C. screen grid tube, with a surprisingly low value of plate impedance, considering the high amplification constant factor. This tube is of the cathode type, utilizing a heater filament and a cathode as the source of electrons.

	A.C. Screen Grid Tube	Intermediate Power Tube
Filament Voltage A.C.	2.25-2.5	2.5 2.5
Control grid voltage	1.5	.....
Screen grid voltage	75.	.....
Plate voltage	180.	180 250
Bias voltage	.....	33 50
Amplification factor	420	3.5 3.5
Plate resistance in ohms	400,000	6,000 6,000
Mutual conductance	1,050	1,800 1,850
Plate current in milamps	4.	26. 32.
Output impedance in ohms	.....	1,950 1,900
Max. Undis. pow. output	750 milwatts	1,600 milwatts

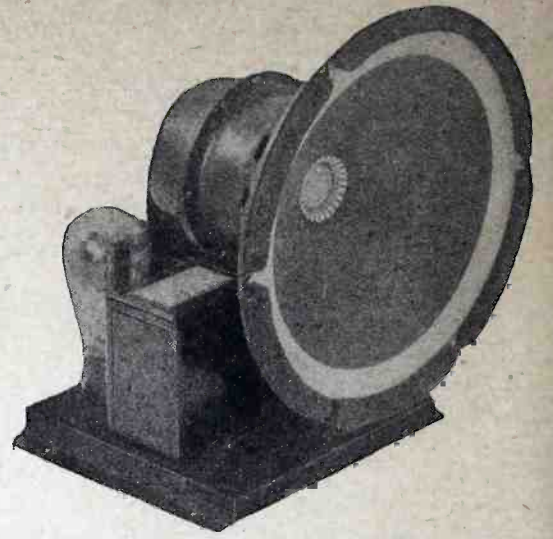


Photo by Courtesy Silver-Marshall, Inc. New Dynamic for Home or Theatre.

and are being manufactured by a mid-western organization well known in the radio field. The photograph shown below is that of the A.C. speaker.

As is evident in the photograph, the speaker utilizes a filament rectifying tube of the 280 type as the source of excitation current. The design of the field winding is such that it operates at a relatively high D.C. potential. This voltage is supplied by a regular power supply unit, consisting of the rectifying tube, and a filter section consisting of the speaker field winding functioning as the filter choke, and a separate filter condenser. The voltage supplied to the speaker field winding is 120 volts D.C. The rectifying system employed in the speaker power supply consists of a full wave arrangement with 150 volts A.C. supplied to each anode of the rectifying tube.

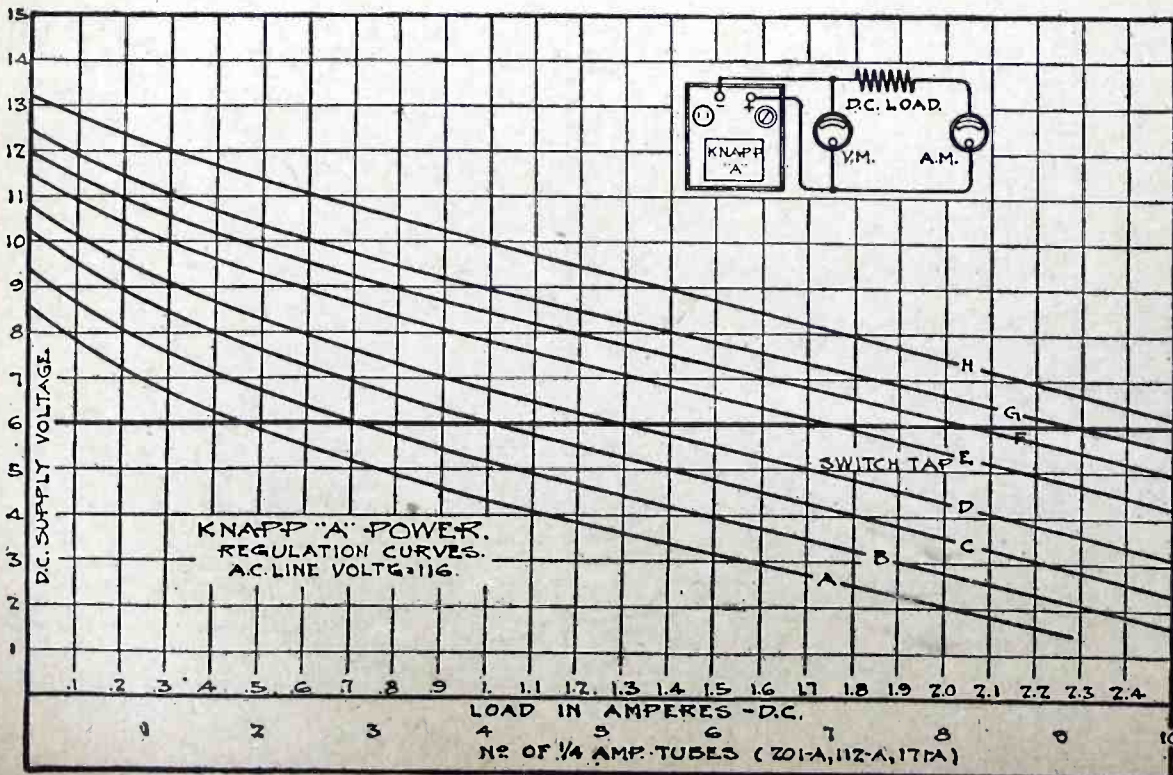
The D.C. model is identical to the A.C. type with the power system for field coil excitation removed. The field magnet coil in the D.C. model has a resistance of 1900 ohms and is designed for connection to the 90-120 volts D.C. supply system.

The use of a complete filter system in the A.C. model is a large factor contributing to the elimination of the 60 and 120 cycle "hum" voltages and thus makes possible a greater frequency range without recourse to systems necessary to eliminate the "hum" voltage when the filter is omitted.

For the guidance of custom set builders who have occasion to install speakers in theatres or other such structures, the manufacturer makes the following statements. Each unit is recommended to dissipate two or three watts of signal energy. Each dynamic model is equipped with an input transformer which makes the unit suitable for use with a pair of 171s arranged in push-pull fashion, a pair of 250s arranged in similar fashion or a pair of the new intermediate amplifier tubes, mentioned elsewhere in this section. A tap is available for connection to the output of other systems.

New Dynamic for Home or Theatre

TWO new dynamic speakers, one A.C. and another of D.C. type suitable for home or theatre use are now available,



Voltage regulation curve showing the available voltage and current.

The RADIO SET MARKET

This department is conducted in the interest of our readers who either build sets for sale or desire to have sets built to order. Anyone desiring to communicate with setbuilders whose notices appear in these advertisements can do so by addressing correspondence to the key number of each setbuilder in care of RADIO LISTENERS' GUIDE AND CALL BOOK, 230 Fifth Avenue, New York City.

All advertisements of custom set-builders appearing in the radio set market are published without cost or obligation. How-

ever, the publishers reserve the right to reject any advertisement which in their opinion appears illegitimate or cases where concerns merchandising parts would take advantage of this offer to custom set-builders. No more than fifty words to each advertisement and only one advertisement is allowed to each party or concern. Each request must be written on a separate sheet of paper to which must be attached the special coupon given in the notice appearing on another page preceding the feature articles in this issue.

MIDDLE ATLANTIC STATES New York, New Jersey, Pennsylvania

No. 530—Custom setbuilder in Albany, N. Y., will build any circuit. Tyrman Imperial 80 on demonstration. Radio specialist since 1917. Service plus guaranteed workmanship.

No. 630—Custom setbuilder in Auburn, N. Y., will build to order any make of set. Will also rebuild, repair or rewire your old set. Harkness and Silver-Marshall sets a specialty. All work guaranteed.

No. 520—Custom setbuilder in Bayville, N. Y., will build any type of custom-made set to order. Short wave receivers and Silver-Marshall parts and sets a specialty. Old sets electrified. Authorized Silver-Marshall Service Station.

No. 440—Custom setbuilder in Binghamton, N. Y., will build all the latest kits to order. Specializes in Silver-Marshall, Hammarlund-Roberts and Thordarson 250 radio and phonograph amplifiers with Magnavox dynamic speakers. Models on display. All sets electrified.

No. 119—Buy a custom built radio set from a setbuilder in Brewerton, N. Y. All circuits built of national advertised parts. All work guaranteed whether rebuilt or new.

No. 148—Custom setbuilder in Brooklyn, N. Y., will build latest circuits to order. Specializes in A.C. shield grid sets. Sets from 1 to 14 tubes built.

No. 175—Professional custom setbuilder in Brooklyn, N. Y., has facilities for construction of all high grade sets, irrespective of type. Specified equipment only considered in assembly. Specializes in Hammarlund-Roberts, Browning-Drake, Super-Hilodyne and Super-Heterodyne receivers.

No. 268—Setbuilder in Brooklyn, N. Y., has for sale the following, One Freshman Masterpiece, one three tube portable also an R.E.L. short wave receiver and some Ham parts and will build any short wave set or any type of set to order. All work guaranteed.

No. 253—Setbuilder in Brooklyn, N. Y., will build any make of set to order with standard parts and circuits used. Will rematch condensers which improve reception and selectivity on one-dial sets. Seven years experience.

No. 277—Setbuilder in Brooklyn, N. Y., will build to order any type of radio set for A.C. or battery operation.

No. 427—Radio-trician in Brooklyn, N. Y., specializes in all standard kit sets, circuits appearing in Radio Listeners' Guide and Call Book and Radio News, such as the Strobodone D.C., Scott Shield Grid Nine, Hammarlund-Roberts and Silver-Marshall sets.

No. 436—Setbuilder in Brooklyn, N. Y., student of National Radio Institute, will build all sets to order. All sets repaired. All work guaranteed.

No. 444—Setbuilder in Brooklyn, N. Y., will build any sort of set to order. Specializes in D.C. All-Electric sets.

No. 508—Custom setbuilder in Brooklyn, N. Y., will build any radio set or power pack featured in this magazine. Repairing of all kinds. Authorized Silver-Marshall Service Station.

No. 125—Setbuilder in Buffalo, N. Y., can build any set you wish at right prices. Fully equipped with accurate test instruments. Also maker of famous power antenna for more stations and distance.

No. 151—Setbuilder in Buffalo, N. Y., can build any make of set to order. Victoreen Super-Heterodyne specialist.

No. 179—Custom setbuilder and radio consultant in Buffalo, N. Y., will build or design any circuit to order. Modernizing sets a specialty. 12 years' practical experience. Associate of Institute of Radio Engineers. Will build anything from a 1-tube receiver to broadcast station. All work guaranteed.

No. 194—Certified radio-trician in Buffalo, N. Y., with six years experience, specializes in Shielded Grid circuits and Super-Heterodynes. Will build to order any circuit, eliminator or power pack. Complete kits and accessories for sale. Associate Member of Institute of Radio Engineers. Authorized Silver-Marshall Service Station.

No. 110—Custom setbuilder in Cohoes, N. Y., will construct any nationally known circuit at very reasonable prices. Authorized Silver-Marshall Service Station.

No. 118—Setbuilder in Elmira, N. Y., has one 8-tube Super-Heterodyne for sale—walnut case, Goldsmith circuit, A-1 condition. Will rewire, repair or build any type set or amplifier. Also repair "A" and "B" eliminators of any make. All work guaranteed.

No. 445—Custom setbuilder in Far Rockaway, N. Y., will repair or build any type of radio set, power pack and push-pull amplifiers. All work guaranteed. Specializes in Silver-Marshall sets. Authorized Silver-Marshall Service Station. Service to all parts of Nassau and Suffolk County, N. Y.

No. 250—Custom setbuilder in Frankfort, N. Y., will build or repair any standard circuit of the day, also A & B eliminators and television apparatus. Factory specifications followed whenever available. Silver-Marshall products a specialty. Authorized Silver-Marshall Service Station.

No. 523—Authorized Silver-Marshall Service Station in Gardenville, N. Y., has facilities for building or repairing Silver-Marshall sets, power units, amplifiers or other apparatus.

No. 180—Radio consultant and professional custom setbuilder in Hastings-on-Hudson, N. Y., will build any set to order. All types of sets remodeled and repaired. Complete laboratory testing equipment used and all work guaranteed. All kits and accessories in stock. Authorized Hammarlund-Roberts and Silver-Marshall Service Station.

No. 582—Custom setbuilder in Hoosick Falls, N. Y., will construct practically any set which is considered practical. Will also repair and test all kinds of sets.

No. 460—Custom setbuilder in Ithaca, N. Y., specializes in Silver-Marshall Screen Grid sets and power amplifiers. Service and repairs on all sets and amplifiers. Authorized Silver-Marshall Service Station. A deposit of 25% must accompany all C. O. D. orders. Satisfaction guaranteed.

No. 240—Radio expert and professional setbuilder in Jamestown, N. Y., will convert all sets for A.C. operation. Kits wired and sets tested. Antennas erected and sets installed.

No. 601—Professional radio-trician in Kenmore, N. Y., will build any set or power pack to order. Twelve years experience. Prices reasonable. Old sets taken in trade. Rewiring and repairing on A.C. and D.C. sets. Specialist on Victoreen, Magnaformer and Scott receivers. All work guaranteed.

No. 262—Authorized Silver-Marshall setbuilder in Corona, L. I., N. Y., builds and repairs radio receivers at a reasonable price. All popular A.C. receivers made to order such as the Tyrman 72, Imperial 80, Victoreen and all Silver-Marshall receivers, "B" eliminators and power packs.

No. 476—Custom setbuilder in Long Island City, N. Y., having complete laboratory equipment to render quick and efficient service, will build to your requirements sets, power packs, amplifiers, short wave sets and converters. Authorized Silver-Marshall Service Station.

No. 138—Custom setbuilder in Richmond Hill, L. I., N. Y., will build sets, "B" eliminators and power packs to fit your requirements. Will also electrify your old sets.

No. 424—Setbuilder in Syosset, L. I., N. Y., builds any type of modern radio receiver and short wave sets to order at reasonable prices. Expert work with guaranteed satisfaction. Also quick antenna service and repairs anywhere within twenty miles.

No. 132—Four or five-tube sets with cabinet made by setbuilder in New Rochelle, N. Y. Wonderful DX "go-getters."

No. 109—Setbuilder in New York, N. Y., specializes in Hi-Q receivers. Can also build any set to individual specifications. Associate of Institute of Radio Engineers.

No. 124—Radio Rex of New York, N. Y., will build any set to order. Specializes in Magnaformer 9-8. All inquiries answered promptly.

No. 133—Latest sets built and installed by a custom setbuilder in New York, N. Y. Sets repaired and rewired. Expert on S-M Shielded Grid Six, Tyrman Seven, Hammarlund-Roberts Hi-Q Six and all makes of power packs.

No. 134—Sets built to order by custom setbuilder in New York, N. Y. Old sets remodeled and brought up-to-date. Electrifying sets our specialty. Authorized service station for Atwater-Kent, Fada, Freshman, Sonora, Stewart-Warner and Grebe receivers.

No. 154—Setbuilder in New York, N. Y., specializes in custom-built A.C. and D.C. receivers and power packs. No order too large or too small. At your service.

No. 219—Setbuilder in New York, N. Y., specializes in Acme, Victoreen and Silver-Marshall. Sets made to order. Repairing a specialty. Can also build a short-wave tuner—just plug it into your present set—the results are wonderful.

No. 221—Setbuilder in New York, N. Y., has custom built 3-tube radio set for sale. Only one dial and very compact. Uses small loop aerial which is contained in the set. Has excellent volume and tone quality with a hundred mile range.

No. 237—Custom setbuilder in New York, N. Y., catering to musical instructors has a seven-tube receiver of his own design for sale. This radio set has a guaranteed range of 2,000 miles; remarkable tone fidelity and tremendous volume. Will duplicate to order and to external specifications only. Four weeks delivery on orders.

No. 272—Have a set built into your old favorite cabinet by a super-heterodyne expert in New York, N. Y., or change your old receiver to use the new A.C. screened grid tubes with guaranteed results. Sets converted to A.C. operation. Will build any make of receiver or power pack, and will service same free for one year.

No. 312—Custom setbuilder in New York, N. Y., specializes in Silver-Marshall sets. Any set built to order. Finest materials and workmanship. Authorized Silver-Marshall Service Station. Power packs and eliminators non-motorboating to order.

No. 321—Radio expert in New York, N. Y., will build, rewire or repair any type of set, speaker, eliminator or power amplifier. Remote control and radio-teleautomatic devices a specialty. Inventor of the Copeman radioplane. No order too large or small. Certified consultant.

No. 326—Custom setbuilder in New York, N. Y., specializes in Hammarlund-Roberts Hi-Q, Browning-Drake, Screen-Grid, and Quadraformer. Will make any set A.C. operated. All types of power packs including 250 with dynamic output. Will repair any make radio set. All work guaranteed. Quick service. Deposit on all orders.

No. 332—Direct current specialist in New York, N. Y., builds all-electric sets of his own design. Musicians express fine comment. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 372—Professional set designer and builder in New York, N. Y., has facilities for construction of all standard kits and sets for prompt delivery. Member Associate Institute Radio Engineers. No construction considered unless specified apparatus is used. Specializes in Erla reflex and Ultradyne Super-Heterodynes of all types.

No. 432—Custom setbuilder in New York, N. Y., has 7-tube A.C. electric long distance set, own design, complete with dynamic speaker, console table model cabinet, walnut finish, for sale. Economical to operate. Delivery 10 days after order is placed.

No. 458—Custom setbuilder in New York, N. Y., specializes in Silver-Marshall sets, B eliminators and power packs. Can also build and electrify any set to individual specifications. Repairing done on all makes of sets. Authorized Silver-Marshall Service Station.

No. 487—Radio sets of all makes built and repaired by setbuilder in New York, N. Y. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 488—Authorized Silver-Marshall expert in New York, N. Y., will build any of the S-M sets free of charge. Special price on the Round-the-World Four or Coast-to-Coast Four. All kits and parts in stock at lowest prices. For sale at very low prices, used sets, speakers and eliminators.

No. 516—Sets built to order by custom setbuilder in New York, N. Y. Authorized Silver-Marshall Service Station. Specializes in A.C. and D.C. receivers and power packs, also battery sets. Parts and Air-Chrome Speakers in stock.

No. 528—Professional setbuilder in New York, N. Y., is prepared to build, install, service and repair all types of Silver-Marshall receivers and power supply units. Authorized Silver-Marshall Service Station.

No. 562—Setbuilder in New York, N. Y., builds all kinds of radio receivers. Specializes in four-tube Diamond of the Air with or without screen-grid tube. Satisfaction guaranteed with every set. Member of R.A. of A., and A.R.R.L.

No. 594—Authorized Silver-Marshall expert in New York, N. Y., will supply the kits and build the following receivers: S-M Sargent Rayment Seven, S-M Round-the-World-Four, S-M Screen Grid Six, Browning-Drake and Scott's World Record Nine.

No. 304—Custom setbuilder in North Lawrence, N. Y., will build Super-Heterodynes to order. Expert repair work on all types of receivers. Browning-Drake sets a specialty, latest models for sale. Power amplifiers and reproducing equipment for home and auditorium use.

No. 113—Authorized Silver-Marshall service man in Patchogue, N. Y., will build, remodel or repair any type of set. Sets carried in stock. Experience since 1910.

No. 164—Setbuilder in Pittsford, N. Y., will build any kind of set you wish.

No. 249—Custom setbuilder in Plattsburgh, N. Y., specializes in Remler Best 115 Kilocycle 9-tube Super-Heterodyne. Any make set built to fit your pet piece of furniture, or in standard form.

No. 314—Certified radio-trician in Rochester, N. Y., will build all types of receivers to order. Expert repairs on any set. Only best parts used. Workmanship and satisfaction guaranteed. Have Hammarlund-Roberts and Browning-Drake A.C. sets for sale. Member A. R. R. L.

No. 367—Setbuilder in Rochester, N. Y., will build your custom radios at from 10 to 15% discount from list prices. All work guaranteed. Three years' experience. Work endorsed by National Radio Institute at Washington, D. C.

No. 207—Setbuilder in Rockaway Beach, N. Y., will build to order all latest types of radio circuits to meet your own ideas as to style and performance. Special consideration given to all orders for the Tyrman "70" using the new shielded-grid tubes. Above service to all points on Long Island only.

No. 456—Sets built to order by custom setbuilder in Port Richmond, S. I., N. Y. Old sets remodeled up-to-date, also electrified. Authorized agent for Harkness battery and electric sets.

No. 115—Setbuilder in West New Brighton, S. I., N. Y., is specialist in custom built sets and Super-Heterodynes. Will repair or build any type of radio set or power pack. All work guaranteed.

No. 376—Setbuilder in Tuckahoe, N. Y., will build or repair any set. Complete laboratory equipment.

No. 479—Setbuilder in Watertown, N. Y., will build any set desired. Sets modernized and rebuilt. Satisfaction guaranteed. Best parts used. Authorized Silver-Marshall Service Station.

No. 446—Custom setbuilder and radio-trician in West Albany, N. Y., will repair and build all types of A.C. and D.C. sets.

No. 350—Setbuilder in White Plains, N. Y., has designed sensational new 3-tube Ambassador circuit. Gives phenomenal distance, code and local reception. Will build same for you. Particulars upon request.

No. 620—Custom setbuilder and repairman in Woodside, L. I., N. Y., will build any type of set to order, several on hand. Specializes in Scott's World Record Super 10. Graduate of Radio Corporation of America's School of Wireless.

No. 597—Custom setbuilder in Yonkers, N. Y., will build all makes of receivers to order. Sets serviced and rebuilt. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 603—Setbuilder in Absecon, N. J., will build any make of set to order. Radio sets installed, adjusted and repaired, and aerials erected. Expert service at a reasonable price. Endorsed by National Radio Institute, Washington, D. C.

No. 551—Setbuilder in Atlantic City, N. J., will build, install and service all Silver-Marshall kits and power packs. Silver-Marshall Service Station.

No. 636—Custom setbuilder in Audubon, N. J., will build any make of set to order. Specializes in Hammarlund-Roberts Hi-Q and Silver-Marshall receivers. All types of speakers and A-B-C power units repaired anywhere in South Jersey.

No. 197—Setbuilder in Barrington, N. J., will build any type of set to order. Battery sets converted to operate direct from house current. Expert service anywhere in southern New Jersey and Philadelphia. Tubes tested and rejuvenated free of charge.

No. 187—Custom setbuilder in Bayonne, N. J., specializes in special power packs and power amplifiers. Also on Silver-Marshall super-heterodynes.

No. 265—Setbuilder in Belleville, N. J., has special amplifier for sale. Four stages of impedance coupling. Sixteen units. Uses 201-A, 112-A, 210, 4-250 tubes. Two eliminators using 4-281-280 tubes. May be attached to your old set. Two year unconditional guarantee.

No. 417—Graduate radio-trician in Belleville, N. J., will build and repair all makes of sets, amplifiers and power packs. All work guaranteed. Unlimited service. Authorized Hammarlund-Roberts and Silver-Marshall Service Station.

No. 399—Setbuilder in Bloomsbury, N. J., will build any type of set desired. Specializes in Silver-Marshall sets. Sets delivered and installed within one hundred miles.

No. 103—Expert radio-trician in Camden, N. J., specializes in Hammarlund-Roberts Hi-Q 29 receivers. Television apparatus, power packs and short wave receivers custom built to your order. Amplifier systems built for churches, schools, etc. My laboratory is at your service. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 163—Setbuilder in Cliffside Park, N. J., specializes in Hammarlund-Roberts and Silver-Marshall receivers. Also short wave receivers and transmitters. Sets for special purposes designed and built. "B" eliminators repaired. Old sets rebuilt and repaired.

No. 478—Authorized Silver-Marshall Service Station in Clifton, N. J., builds and repairs all Silver-Marshall sets and power units.

No. 203—Custom setbuilder in Dumont, N. J., has five and six tube radio frequency sets for sale. Specializes in this kind of set. Will build any kind of receiver to order. Prices reasonable.

No. 251—Setbuilder in Jersey City, N. J., has 4 and 5-tube Diamond of the Air and 2-3-4 tube reflex sets for sale. Can build or rebuild any make set to order.

No. 536—Expert setbuilder in Jersey City, N. J., has the Melo-Heald Eleven and Fourteen tube standard receivers for sale, A.C. or battery operation. Literature gladly sent upon request. Can build any set to order. Graduate electrical engineer.

No. 178—Setbuilder in Keyport, N. J., will build and repair all makes of radio sets. Specializes in Silver-Marshall Screen-Grid receivers.

No. 147—Setbuilder in Lakehurst, N. J., will build sets the way you want them. Push-pull amplifiers and shielded grid sets a specialty.

No. 116—Setbuilder in Newark, N. J., specializes in Hammarlund-Roberts Hi-Q 6 and Everyman 4 sets. Built to your specifications. Expert service on all sets. References and particulars on request.

No. 352—Custom setbuilder in Newark, N. J., has Hammarlund-Roberts Hi-Q 6 battery and electric sets for sale. Will build any set, eliminator or amplifier to order with specified parts at lowest prices.

No. 396—Setbuilder in Newark, N. J., has 3-tube Popular Mechanics Loop sets, one dial control, for sale. Also one Atwater Kent No. 20.

No. 532—Custom setbuilder in Newark, N. J., will build, service and repair any make of circuit. Your old set remodeled. Sets electrified. Consultation free.

No. 375—Setbuilder in North Bergen, N. J., will build any circuit to order. Specializes in LC. 28 sets and short wave converters.

No. 172—Setbuilder in Passaic, N. J., specializes in A.C. sets, "B" eliminators, and special step-up or step-down transformers. All work guaranteed.

No. 156—Setbuilder and service man in Phillipsburg, N. J., will build to order sets of the highest quality. Specializes in Scott's World Record Shielded Grid Nine, the new Magnaformer A.C. 29, Hammarlund-Roberts Hi-Q 29 and Silver-Marshall sets. Workmanship unsurpassed. 72 hour service. Authorized Silver-Marshall Service Station.

No. 610—Setbuilders in Trenton, N. J., will build anything from a crystal set to a 5-tube set. Specialists in crystal sets and remodeling of old sets.

No. 517—Custom setbuilder in Westfield, N. J., specializes in sets of quality, Scott, Lincoln or Silver-Marshall Supers in special cabinets with electric pick-up for records. Authorized Silver-Marshall Service Station and Associate Member of Institute of Radio Engineers. No job too small or too large. Will build any set on order.

No. 281—Setbuilder in Allentown, Pa., specializes in the building of reflex, Browning-Drake and Hammarlund-Roberts circuits. Best quality parts used at the lowest consistent price, guaranteeing the greatest satisfaction.

No. 344—Authorized Hammarlund-Roberts and Silver-Marshall Service Station conducted by graduate radio-trician in Altoona, Pa., specializes in modernizing your old receivers. Satisfaction guaranteed.

No. 297—Setbuilder in Bethlehem, Pa., builds the Magnaformer 9-8 Super-Heterodyne. Good selectivity and great volume.

No. 407—Setbuilder in Bethlehem, Pa., specializes in 5 and 6-tube sets, Aero short wave sets and converters, 3- and 4-tube Browning-Drake receivers. Three-tube sets for sale. Will also build A-B-C eliminators and amplifiers. Repairing done on all kinds of sets.

No. 472—Custom setbuilder in Bethlehem, Pa., will service any type of set. Repairing and installations neatly done. Authorized Silver-Marshall Service Station.

No. 313—Setbuilder in Chester, Pa., can build any make of set to order. Specializes in kit sets.

No. 328—Custom setbuilder in Chester, Pa., specializes in Scott SG9, Lincoln 8-80, H. F. L. Isotone, Silver-Marshall sets, Robertson-Davis Automatic Super Six, and all lowwavers. All types of apparatus constructed and repaired. All sets laboratory tested. Have custom built Aero-Dyne Improved Six for sale.

No. 480—Radio-trician in Chester, Pa., will build or repair any make of D.C. or A.C. receiver, public address system or power pack. Authorized Silver-Marshall and Hammarlund-Roberts Service Station. Satisfied customers, quick service and moderate rates are my watch words. Graduate of National Radio Institute.

No. 217—Setbuilder in Crafton, Pa., has custom built Browning-Drake 4-tube sets for sale. Will also build any make of set to order.

No. 624—Radio-trician in Darby, Pa., will build A.C. or D.C. sets from kits or according to your own design. No work too complicated.

No. 324—Custom setbuilder in Easton, Pa., has one Silver-Marshall Shielded Six (type 630) and one Aero Short Wave Converter (verification from England and France) for sale at a reasonable price. Specializes in Silver-Marshall and Aero sets, but can build all types. Authorized Silver-Marshall Service Station.

No. 560—Custom setbuilder in Erie, Pa., will build any make of radio set, phonograph amplifier or public address system. Laboratory test made on all radio sets to analyze troubles. Scientific repairing. Workmanship guaranteed.

No. 543—Custom setbuilder in Franklin, Pa., will build or repair any radio set to order. Specializes in S-M kits and parts. Satisfaction guaranteed and prices right. Authorized Silver-Marshall Service Station.

No. 430—Setbuilder in Greenville, Pa., will build any set or circuit you wish. Specializes in modern amplifiers. Ten years' experience in radio and six years of it as professional service man.

No. 144—Setbuilder in Irwin, Pa., specializes in Browning-Drake and Silver-Marshall 4-tube Shielded Grid sets. All types of sets custom built.

No. 290—Custom setbuilder and service man in Kittanning, Pa., will build the set you would like to have with guaranteed tone quality, volume, selectivity and sensitivity. Individual requirements and preferences satisfied. Old sets remodeled, repaired, or taken in exchange. Authorized Silver-Marshall Service Station.

No. 434—Custom setbuilder in Lancaster, Pa., will build any set or circuit—broadcast, short wave, eliminator or amplifier—at list. Also repairing, rewiring or rebuilding. Guaranteed work. Prices quoted on request.

No. 330—Setbuilder in Mill Hall, Pa., will design and construct radio equipment to meet the requirements of your locality. Constructor of super-fine custom built radio broadcast receivers. Repair department is at your service.

No. 365—Custom setbuilder in New Kensington, Pa., with eight years' experience, will make old sets up-to-date, A.C. or D.C. Let me rewire that old set for better results. All work guaranteed. Authorized Silver-Marshall Service Station. Have 6-tube Aero-Dyne for sale.

No. 527—Professional custom setbuilder in Oil City, Pa., will build to order any set or apparatus described in Radio Listeners' Guide and Call Book. Will also build any Silver-Marshall or Hammarlund-Roberts receiver, amplifiers or power packs. All work guaranteed. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 101—Setbuilder in Philadelphia, Pa., has on demonstration the latest Browning-Drake receiver. Will also build any set to order. Best material, workmanship and results at lowest prices.

No. 106—Modern up-to-date sets constructed and serviced by a setbuilder in Philadelphia, Pa. Tuned Radio Frequency, Browning-Drake and Neutrodyne a specialty. Power Amplifiers.

No. 123—Setbuilder in Philadelphia, Pa., specializes in Hammarlund-Roberts Hi-Q sets.

No. 141—Setbuilder in Philadelphia, Pa., has 6-tube Hammarlund-Roberts and Aerodyne sets for sale. Can build any make of set to order.

No. 149—Setbuilder in Philadelphia, Pa., builds high-grade receivers and power packs. Specializes in Super-Hilodyne, Tyrman 70, Hammarlund Hi-Q, Continental, H.F.L. Model 28, World's Record Super, and sets using screen grid tubes.

No. 155—Setbuilder in Philadelphia, Pa., specializes in building the Harkness Screen Grid DeLuxe A.C. and D.C. sets and the Aero receivers. Can build any make set or power supply to order.

No. 191—Setbuilder in Philadelphia, Pa., specializes in A.C. sets. Will build to order any type of set.

No. 264—Custom setbuilder in Philadelphia, Pa., has 5-tube, one-dial DX Shielded T.R.F. sets for sale with walnut cabinet. Specializes in this type of set. Can build any make of set to order, also socket power amplifiers and eliminators.

No. 360—Expert setbuilder in Philadelphia, Pa., specializing on modern custom built receivers, invites inspection of latest A.C. and D.C. sets now in display at reduced rates.

No. 394—Authorized radio-trician in Philadelphia, Pa., specializes in the Hammarlund-Roberts Hi-Q set. Any make set built to order. Also short wave sets built.

No. 461—All leading circuits built to your requirements with an expert with 20 years' experience in Philadelphia, Pa. Authorized Silver-Marshall Service Station. Complete laboratory testing equipment. Prompt repair service on all sets and power units.

No. 595—Custom setbuilder in Philadelphia, Pa., will build any make of set to order. Repairing done on all sets. Will install my type of antenna in your locality with a two-year guarantee. Specializes in the Magnaformer 9-8, Harkness electric and battery sets, and Atwater Kent receivers. Endorsed by National Radio Institute, Washington, D. C.

No. 598—Custom setbuilder in Philadelphia, Pa., has for sale apparatus designed and built by himself. Engineering results that will amaze you. Dealters to exclusive trade for home installations. Graduate Radio Engineer, Associate member in Institute of Radio Engineers.

No. 626—Custom setbuilder in Philadelphia, Pa., has the famous S-M 720 Screen Grid Six on demonstration at all times. Be an adventurer. Explore the world with a Silver-Marshall "Round-the-World Four," a screen grid short wave set. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 152—Authorized radio-trician in Pittsburgh, Pa., has Hammarlund-Roberts Hi-Q 6 and Tyrman '70' radios for sale. Demonstration at your request. Sets built to your order.

No. 358—Authorized Hammarlund-Roberts radio-trician in Pittsburgh, Pa., has the New Master and Junior models of the Hi-Q 29 for sale. Four years' experience on building and servicing Hammarlund-Roberts sets. All work guaranteed. Any set custom-built to order at small cost.

No. 364—All types of sets made to order and designed to meet your requirements by setbuilder in Pittsburgh, Pa. Will electrify, repair or redesign your present set. Authorized Silver-Marshall Service Station.

No. 370—Custom radio setbuilder in Pittsburgh, Pa., will build any set or apparatus described in Radio Listeners' Guide and Call Book on satisfaction or money back basis. Specializes in modernizing obsolete model receivers. All kinds of indicating instruments repaired and recalibrated.

No. 395—Setbuilder in Pittsburgh, Pa., will repair all makes of radio sets. Old sets rebuilt and improved and new sets built to order. Prices reasonable. Ten years' experience.

No. 515—Custom setbuilder in Pittsburgh, Pa., will build Silver-Marshall and Hammarlund-Roberts sets to order Silver-Marshall Service Station. No charge made for building, except for the list cost of parts. Endorsed by National Radio Institute, Washington, D. C.

No. 534—Authorized Silver-Marshall Radio Service Station in Punxsutawney, Pa., has facilities to take care of any of your radio troubles. Silver-Marshall apparatus a specialty. Old sets rebuilt to latest type, A.C. or D.C. All work guaranteed to give satisfaction.

No. 241—Setbuilder in Reading, Pa., has guaranteed custom-built radio receivers and short wave sets for sale.

No. 294—Setbuilder in Reading, Pa., has 9-tube Ultradyne and Silver-Marshall short wave sets for sale.

No. 608—Custom setbuilder in Rendham, Old Forge, Pa., has custom built sets and short wave converters for sale. Will also remodel old battery sets into all-electric sets.

No. 604—Custom setbuilder and service man in Cicota, Pa., will build to order any receiver or power pack using standard parts. Endorsed by National Radio Institute, Washington, D. C. Authorized Silver-Marshall Service Station.

No. 205—Setbuilder in Scranton, Pa., has Tyrman "70" for sale. Write for our low prices on custom built sets. Repairing, designing and building any set on market.

No. 146—Setbuilder in Sharon Hill, Pa., is authorized Cardwell builder. My responsibility extends beyond ordinary guarantees and all designs are far in advance of commercial types.

No. 627—Setbuilder in Wilkes-Barre, Pa., will build any make of set to order. Will repair, rebuild or electrify any make of set. Prompt service. Authorized Browning-Drake Service Station.

NEW ENGLAND STATES Connecticut, Maine, Massachusetts New Hampshire, Rhode Island, Vermont.

No. 129—National Radio Institute expert radio-trician in East Norwalk, Conn., is completely equipped for building, servicing and repairing any circuit, receiver or power pack. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 493—Custom setbuilder in Guilford, Conn., will build or service A.C. or D.C. sets and Knapp A power units. Authorized Silver-Marshall Service Station.

No. 544—Custom setbuilder in Hartford, Conn., specializes in building and repairing all types of Silver-Marshall receivers and any other make of set, power packs and eliminators; also power amplifier and public address installations using microphone, phonograph or radio-pick-up. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 331—Professional radio set constructor in New Britain, Conn., specializes in Geo. H. Cooper's 9-tube All Wave Super-Heterodyne set, 7 x 18 in. front panel and 7 x 17 in. sub-panel. Straight line sequence. Studies radio technology through I. C. S. schools. Member Supreme Instrument Service League—A.C. and D.C. Service.

No. 232—Setbuilder and experimenter in New Haven, Conn., has for sale the Lacault short wave set, International short wave receiver using one screen-grid tube, (this set is housed in Monel-metal cabinet), Ultradyne L2 and AmerTran A-B-C 2-stage power unit. Sets built to order. Prompt service.

No. 122—Setbuilder in New London, Conn., with years of experience in radio business, has custom made sets for sale. Can build any make of set to order. Prompt service.

No. 439—Experienced setbuilder in Putnam, Conn., will build the latest sets to order. Sets repaired, adjusted or electrified. Prompt service, good work. Authorized Hammarlund-Roberts and Silver-Marshall Service Station. National Radio Institute graduate.

No. 378—Setbuilder in Southington, Conn., will construct any set or power unit desired regardless of size. Old radios rewired, repaired and brought up-to-date.

No. 435—Custom radio setbuilder in Stafford Springs, Conn., with six years experience, will build any radio set in kit form. Specializes in Tyrman's latest shield grid super-heterodyne receivers. Demonstration for the asking. Sets remodeled, repaired and rewired for A.C. operation. All work guaranteed.

No. 588—Custom setbuilder in Stafford Springs, Conn., with five years of radio experience, will build any set in kit form. Specializes in Tyrman Shielded Grid Super-Heterodyne receivers. Sets remodeled and repaired. All work guaranteed.

No. 242—Authorized Hammarlund-Roberts radio-trician in Staffordville, Conn., will build and repair all makes of sets and convert any type battery set to A.C. electric sets. Also have for sale 5-tube sets, 5-tube kits and power units. All work guaranteed.

No. 482—Radio-trician in Waterbury, Conn., will build, repair and service any kind of radio receivers. Power packs, eliminators, power amplifiers and television apparatus built to order. Authorized Silver-Marshall Service Station. Complete laboratory equipment. All work guaranteed.

No. 559—Setbuilder in Waterbury, Conn., will build or repair any make of set or power pack.

No. 127—Custom made sets built to order by a setbuilder in West Haven, Conn. No set too small, none too large. Also repairing and remodeling of all kinds. Have your old set made up-to-date. Tyrman "70", all electric, for sale.

No. 495—Custom setbuilder and radio-trician in Bangor, Maine, will build any make of radio receiver or power supply to order. Expert on super-heterodyne circuits. Endorsed by National Radio Institute. Authorized Silver-Marshall Service Station.

No. 377—Radio expert and custom setbuilder in Portland, Maine, will build any of the latest sets to order. Sets repaired and adjusted for the best results at reasonable prices. Old sets rewired for the new A.C. tubes. A trial is all I ask.

No. 452—Radio-trician in Portland, Me., offers expert service at a reasonable price. Specializes in Silver-Marshall receivers, power packs and eliminators. Will remodel your present receiver for A.C. operation.

No. 613—Setbuilder in South Portland, Me., will build any set described in Radio Listeners' Guide and Call Book. Will also service any set and erect aerials. Scott's World's Record Shield Grid Nine a specialty.

No. 473—Setbuilder in Auburndale, Mass., specializes in the complete Silver-Marshall line, but will build any type of receiver, power pack or amplifier for the list price of parts. Expert servicing and repairs. Authorized Silver-Marshall Service Station. Deposit required on all orders.

No. 303—Setbuilder in Boston, Mass., builds excellent, low priced short wave receivers. This circuit was used by Commodore Dyott for his Roosevelt Memorial Expedition to the River of Doubt, Brazil, for constant communication with the outside world. Will repair any type of set.

No. 554—Professional setbuilder in Boston, Mass., will build A.C. and D.C. electric sets. Custom built television and short wave sets and converters. Reconditioned sets that have been taken in trade. Any make set repaired or installed. Ten years' experience. Authorized Silver-Marshall Service Station.

No. 320—Setbuilder in Cambridge, Mass., will build to order or service any radio set or power pack described in Radio Listeners' Guide and Call Book, for residents of Boston or vicinity. My laboratory is at your service.

No. 500—Master radio-trician in Chatham, Mass., specializes in Silver-Marshall and Hammarlund-Roberts sets. All types of sets built, remodeled and repaired. Complete kits and accessories for sale. Member Associate Institute of Radio Engineers. All work guaranteed. Six-years' experience. Authorized dealer for Federal, Fada and Philco.

No. 441—Radio-trician in Harwich, Mass., with nine years' experience, will build or repair any type of long or short wave receivers, power amplifiers, dynamic speakers or what-have-you. Headquarters for R.C.A., Bosch, Eveready, Philco, Fada and Crosley sets.

No. 521—Authorized Silver-Marshall Service Station in Lowell, Mass., will build to your order any Silver-Marshall kit or power pack and will service any set. Will also build any advertised set.

No. 550—Setbuilder in Ludlow, Mass., will build custom built sets from three to fourteen tubes or power supplies to order. Any set repaired. No job too large, none too small. All work guaranteed. Former U. S. Navy operator and repair man.

No. 139—Setbuilder in Medford, Mass., has 5-tube Browning-Drake for sale. Sets built to order. Repairing and service work done at very reasonable prices.

No. 258—Authorized Hammarlund-Roberts radio-trician in Medford, Mass., will build any of the popular circuits to order. Sets electrified, rebuilt, repaired and installed. All work guaranteed.

No. 114—Hammarlund-Roberts radiotrician in Natick, Mass., will inspect any set in trouble without cost. Will assemble any circuit. Hammarlund-Roberts a specialty. Tubes, batteries and all other accessories for any radio for sale on order.

No. 107—Professional setbuilder and radio expert in Quincy, Mass., will build any make of set to order. Workmanship and results guaranteed, using materials as specified in Radio Listeners' Guide and Call Book.

No. 468—Custom setbuilder in Roslindale, Mass., will build or service any type of receiver. Specializes in the complete Silver-Marshall line, and Scott's World's Record Shield Grid Nine. All work guaranteed and reasonably priced. Authorized Silver-Marshall Service Station.

No. 484—Custom setbuilder in Roslindale, Mass., specializes in Victoreen Super-Heterodyne and Silver-Marshall receivers, power amplifiers and eliminators. Repairing and rebuilding old sets to A.C. No. 740 A.C. 4-tube Silver-Marshall shielded grid for sale. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 343—Professional setbuilder in Springfield, Mass., will build any set or circuit to order. Authorized Hammarlund-Roberts service station. Sets rewired for A.C. One year guarantee on any set. Graduate of N. R. I.

No. 195—Setbuilder in Worcester, Mass., has facilities to build on order any type set in sizes for homes or large halls. Factory built sets and accessories supplied where preferred. Builder and engineering graduate with seven years' experience. Personal service.

No. 514—Up-to-date sets built and repaired at reasonable prices by setbuilder in Worcester, Mass. Authorized Silver-Marshall Service Station. Will change old Browning-Drake sets with 222 R.F. tube. Satisfactory work guaranteed.

No. 243—Custom setbuilder in Chesham, N. H., has short wave adapters for sale cheap. Authorized Silver-Marshall Service Station. Silver-Marshall and Karas sets a specialty. Quality work at moderate prices. Sets repaired.

No. 619—Custom setbuilder in Dover, N. H., will build Silver-Marshall, Hammarlund-Roberts or Browning-Drake sets to order. Graduate of National Radio Institute. Authorized Silver-Marshall, Hammarlund-Roberts and Browning-Drake Service Station.

No. 263—Setbuilder in Pawtucket, R. I., has Everyman 4 sets for sale. Specializes in this kind of set. Can build any make of set to order.

No. 270—Radio technician in Woonsocket, R. I., will build sets to order. Super-Heterodyne expert.

No. 309—Setbuilder in Bethel, Vt., will build any set to order, either A.C. or battery operated, with or without cabinet, tubes, accessories, eliminators or power packs.

No. 563—Certified radio-trician in Rutland, Vt., will build, repair and service radio receivers at reasonable prices. Authorized Silver-Marshall Service Station. Television apparatus, power packs, eliminators and power amplifiers custom-built to order. Specializes in Supers and Screen Grid circuits. Complete laboratory testing equipment. All work guaranteed.

SOUTHERN ATLANTIC STATES

District of Columbia, Florida, Maryland, North Carolina, Tennessee, Virginia.

No. 108—Custom setbuilders in Washington, D. C., specialize in Robertson-Davis super-heterodyne kit, Silver-Marshall and Pilot short wave kits. We build all kinds of sets and guarantee satisfactory results. Shipment made to all points of the United States. Literature sent on request. All sets pass a thorough DX test when completed.

No. 496—Graduate certified radio-trician in Washington, D.C., will build and repair all types of sets at rock bottom prices. Satisfaction guaranteed or money cheerfully refunded. Have for sale 1928 Silver-Marshall Screen-Grid Super-Heterodyne fully guaranteed. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 126—Setbuilder in Bradentown, Fla., can save you money on a custom built radio set and build it to suit you and your furniture. Will guarantee good reception and great distance.

No. 112—Setbuilder in Daytona, Beach, Fla., will build any type of the latest custom-made sets to order. Specializes in short wave receivers and transmitters. Service on all types of sets. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 283—Authorized Hammarlund-Roberts radio-trician in Ft. Pierce, Fla., can build to order any make of set, electric phonograph, or combination. Have you a fine old piece of furniture in which you would like to install a modern set?

No. 285—Setbuilder in Jacksonville, Fla., will build any type of set to suit your taste. Aero short wave sets and converters a specialty. Only the best parts on the market used.

No. 291—Certified radio-trician and authorized Silver-Marshall Service Station in Jacksonville, Fla., will build any set or power pack, power amplifier or public address system to order.

No. 305—Setbuilder in Manatee, Fla., has Hammarlund-Roberts Hi-Q 6 receiver ready to go in a cabinet for sale. Perfect reproduction and distance getter, fully tested and tuned.

No. 366—Setbuilder in Miami, Fla., will repair A.C. or battery operated sets. Will build any set you desire from reputable manufactured parts with a guarantee of satisfaction at reasonable prices.

No. 300—Setbuilder in Oneco, Fla., will wire to your specifications all standard kits or special hook-ups.

No. 581—Setbuilder in Baltimore, Md., will build any of the latest A.C. or D.C. sets to order. Sets rewired and repaired for best results. Nine years experience with all kinds of radios. Have Victoreen and Karas sets for sale at present.

No. 410—Setbuilder in Charlotte, N. C., specializes in Neutrodynes and other complicated circuits. All work guaranteed for one year. We do this work cheaply to help promote the idea of custom made sets.

No. 393—Professional setbuilder in Ellenboro, N. C., makes a specialty on Silver-Marshall Shield Grid, Hammarlund-Roberts Hi-Q and World's Record Supers. Will assemble and wire any set for price of the parts and cabinet.

No. 168—Setbuilder in Chattanooga, Tenn., builds any kind of set or eliminator. Old sets rebuilt or brought up-to-date; adaptation from battery to light socket operation.

No. 275—Setbuilder in Chattanooga, Tenn., specializes in Hammarlund-Roberts receivers or will build to order any other make of set. All make of sets serviced.

No. 587—Expert radio-trician in Bristol, Va., will build, repair, design, overhaul or remodel any and all makes of custom built radio sets, power packs, amplifiers, short wave sets and adapters. Official representative for H. F. L. Isotone and Tyrman 80.

No. 361—Custom setbuilder in Norfolk, Va., with five years' experience, will construct any type set at a reasonable price and give written guarantee for satisfactory performance. Estimates gladly furnished.

No. 218—Setbuilder in Richmond, Va., offers exceptional service in designing and building special sets to suit individual needs. All types of sets serviced and repaired. Specialist on Super-Hets. Let's get together and build that DX set you've always wanted.

No. 286—Setbuilder in Richmond, Va., will build any set from three tubes to a World's Record Super 9 and 10 tubes. Estimates cheerfully given.

No. 572—Custom setbuilder in Roanoke, Va., will build radio receivers from any of the kits now on the market, such as Hammarlund-Roberts Hi-Q, Silver-Marshall, Pilot, Tyrman, Scott World Record Shield Grid Nine Super and others. Repairing of all kinds of sets, battery or A.C. operated.

No. 157—Setbuilder in St. Charles, Va., has 6-tube Bremer-Tully Power Six receivers for sale. Will build any set from one to fourteen tubes on order. All work first-class and guaranteed. Six years' experience in building radio receivers.

CENTRAL STATES

Alabama, Arkansas, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, New Mexico, North Dakota, Ohio, Oklahoma, South Dakota, Texas, West Virginia, Wisconsin.

No. 388—Radio setbuilder in Powerly, Ala., will build to order any radio receiver. Specializes in 3-tube Ambassador sets.

No. 545—Custom setbuilder in Pratt City, Ala., will build to order any type of set. Will also repair any set regardless of whether factory or custom built. All work guaranteed. Complete test equipment used. Authorized Silver-Marshall and Hammarlund-Roberts Service Station. Endorsed by National Radio Institute, Washington, D. C.

No. 566—Custom setbuilder in Russellville, Ala., can build any type of set to order and guarantees all sets for one year. Sets sold with or without accessories. Specializes in Silver-Marshall, Tyrman and Browning-Drake receivers. All inquiries answered promptly.

No. 229—Setbuilder in Eureka Springs, Ark., can build any make of set to order. Five years experience. Workmanship guaranteed.

No. 593—Custom setbuilder in Hot Springs, Ark., will construct any A.C. or D.C. circuit. Only specified parts considered for standard kits. Screen Grid sets a specialty. Eight years experience as a designer and builder.

No. 540—Authorized Hammarlund-Roberts radio-trician in Idaho Falls, Idaho, will build short wave receivers. Hammarlund-Roberts Hi-Q receivers a specialty. We repair, install and service sets.

No. 579—Setbuilder in Big Rock, Ill., will build any advertised kit and furnish any accessory on order. All work guaranteed.

No. 140—Custom made radio receiving sets employing such circuits as Remler, Browning-Drake and other high grade receivers built by setbuilder in Champaign, Ill. Lowest prices for quality merchandise. For sale, 5-tube radio frequency receiver, coast to coast reception, complete with accessories.

No. 142—Custom setbuilder in Chicago, Ill., will build any type of receiver to order free. You pay for the parts at list. Four years of radio experience. Six tube A.C. and D.C. sets ready for delivery.

No. 162—Setbuilder in Chicago, Ill., specializes in Bremer-Tully Counterphase, Hammarlund-Roberts Hi-Q, short wave sets, and can build any other make of set to order. "A" and "B" eliminators also built. Guaranteed radio service on repairing, remodeling and designing.

No. 167—Setbuilders in Chicago, Ill., take second-hand sets in trade on their wonder set, the "King Kustombuilt 10," cheap. We are pioneers in the radio business, having started as wireless operators in 1907.

No. 204—Setbuilder in Chicago, Ill., will build the Tyrman 70, Hammarlund-Roberts, Nine-in-Line, Silver-Marshall, Aero, or any high grade receiver to fit any style console or cabinet. All sets equipped with power amplification for battery or socket operation. Very selective—remarkable tone quality.

No. 248—Setbuilder in Chicago, Ill., will build Super Heterodynes of all makes and styles, also Hammarlund-Roberts, Silver-Marshall, Karas, Scott and Browning-Drake sets. Any others made to order, including power packs. Workmanship guaranteed. Installations on work free.

No. 259—Setbuilders in Chicago, Ill., have for sale the following sets and amplifiers: Hammarlund-Roberts Hi-Q, Silver-Marshall, Madison-Moore, Remler, Victoreen, Camfield, and Karas A.C. Prices on application.

No. 288—Setbuilder in Chicago, Ill., will build any make of set to order. Specializes in Hammarlund-Roberts Hi-Q Six and Thorola-Do-Nut 5. Meets actual local conditions. Distortionless, perfect reproduction of broadcastings. DX. Safe delivery of set. Guaranteed master workmanship.

No. 308—Highest class of custom sets built to your order and specifications by setbuilder in Chicago, Ill. Power amplifiers built to order. Your favorite circuit can be built to suit any size and kind of cabinet. Specializes in Super-Heterodynes.

No. 334—Custom setbuilder in Chicago, Ill., will build sets to your order. Specializes in 5-tube set embodying a tuned band pass filter. 50% deposit on all orders. Experimental sets made.

No. 338—Professional setbuilder in Chicago, Ill., with six years' experience, will build any circuit best parts only. Specializes in H.F.L. Isotone Ten and Scott's Shield Grid Super. One year guarantee and service anywhere in Cook County.

No. 341—Setbuilder in Chicago, Ill., will build to order any sets or power-packs. Assembling and wiring free of charge. Also servicing and repairing old sets.

No. 380—Setbuilder in Chicago, Ill., will build custom built sets of any design for A.C., battery or eliminator operation.

No. 383—Super-Heterodyne specialist in Chicago, Ill., invites anyone in or near Chicago interested in distance reception to call and take an air tour with him from coast to coast and Canada to Mexico, using a standard receiver which he builds to order. Any set built or repaired. Authorized Silver-Marshall Service Station.

No. 387—Setbuilder in Chicago, Ill., will build to order and repair any Silver-Marshall set and power pack. All workmanship guaranteed. Specializes in the Nakken Ultra Five using Silver-Marshall parts. Authorized Silver-Marshall Service Station.

No. 400—Custom setbuilder in Chicago, Ill., will build receivers from any kit using only specified parts. Specializes in Hammarlund-Roberts Hi-Q Scott's World's Record Super, Aero Seven, Kara, and short-wave sets. Workmanship and performance guaranteed. Prices reasonable.

No. 422—Professional set designer in Chicago, Ill., will rebuild old receivers in the modern way. Any make receiver built to suit any choice of cabinet. Special discounts to readers of this magazine. Power amplifiers, Scott's Shield Grid 9, and the Isotone a specialty. Demonstrations. Hear and be convinced.

No. 459—Efficient radio engineers in Chicago, Ill., will build, rebuild or remodel any set on the market today. Specialize in Transoceanic Phantom, Tyrman, H. F. L. Isotone, television and short wave sets. Established since 1923. Complete testing laboratory.

No. 462—Professional setbuilder in Chicago, Ill., specializes in Super-Heterodyne circuits. Authorized Silver-Marshall and H. F. L. Service Station. All sets constructed in an up-to-date equipped laboratory. Will service all makes of sets.

No. 474—Custom setbuilder in Chicago, Ill., has the facilities for building, repairing and testing Silver-Marshall sets, power units, amplifiers and other apparatus. Any set, eliminator or power pack built or repaired. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 481—Custom radio setbuilders in Chicago, Ill., specialize in Isotone 10, Scott Shielded Grid 9, Tyrman 80-72, Lincoln 8-80, Silver-Marshall line, and Robertson-Davis Automatic Super, a guaranteed to cut through locals and get DX in original laboratory models. Guaranteed and serviced for one year.

No. 486—Custom setbuilder in Chicago, Ill., specializes in Silver-Marshall, Hammarlund-Roberts and H. F. L. Isotone sets. All types of sets built, rebuilt, remodeled and repaired. All complete kits and accessories for sale. Authorized Silver-Marshall Service Station.

No. 497—Authorized Silver-Marshall radio-trician in Chicago, Ill., has the facilities for building, repairing and testing Silver-Marshall sets, power units, amplifiers and other apparatus. Specializes in bringing your old set up-to-date such as rewiring for A.C. operation and using A.C. tube. All work guaranteed. Endorsed by Radio Association of America.

No. 498—Custom setbuilder in Chicago, Ill., will build any Silver-Marshall set and power unit to order. Work guaranteed. Will ship anywhere C. O. D. Will demonstrate anywhere in Chicago or vicinity. Authorized Silver-Marshall Service Station.

No. 509—Setbuilder in Chicago, Ill., specializes in bringing your old set up-to-date such as rewiring for A.C. operation using A.C. tubes. Will install all types of power amplifiers and build A-B-C power packs for all sets.

No. 578—Setbuilder in Chicago, Ill., will build receivers to your order, rebuild old sets and rebuild wire sets for the new A.C. tubes. Television receivers built. Can repair all makes of speakers including the new dynamic. Complete laboratory test used. All work guaranteed. Only the best of parts used.

No. 586—Custom made sets built to order by a setbuilder in Chicago, Ill. Sets built at low prices; wiring free. Latest in short wave, television and super-heterodynes. Specializes in Tyrman shielded grid receivers. Also have late eliminators and power packs.

No. 596—Custom setbuilder in Chicago, Ill., will repair or build any set, power amplifier or eliminator. Will also service all kinds of radio. Authorized Silver-Marshall Service Station.

No. 629—Custom setbuilder in Chicago, Ill., will build to order Silver-Marshall receivers and power packs; also National Browning-Drake sets. Will service receivers free for one year.

No. 580—Custom setbuilder in Cicero, Ill., is fully equipped and experienced to build or service circuits and sets. Authorized Silver-Marshall Service Station.

No. 570—Setbuilders in Danville, Ill., will build or order Silver-Marshall sets and unipacks, Rembrandt Isotone receivers.

No. 311—Setbuilder in Decatur, Ill., is in a position to build any kind of set desired. The famous Strobodine in beautiful burl walnut cabinet filled with all specified parts for sale. Guaranteed mechanically perfect and built by an expert who knows Super-Heterodynes.

No. 169—Custom setbuilder in East Moline, Ill., specializes in S-M products. All orders received from this ad for S-M products will be assembled and wired free of charge and sent to you post paid. So have an A.C. 8-tube set in table model or cabinet console fully shielded for sale. Official Silver-Marshall Service Station.

No. 406—Setbuilder in Fiatt, Ill., has one 4-tube set with three UX201-A tubes and one UX171 tube for sale. Silver-Marshall Screen Grid Fours a specialty. Other types of sets also made to order.

No. 448—Professional setbuilder in Fulton, Ill., will build any set to order. Workmanship and performance absolutely guaranteed perfect. No construction charge. Prompt delivery. Shielded sets a specialty.

No. 295—Setbuilder in Glenview, Ill., has for sale a B.T. 5-tube set, wonderful tone, fair distance, 3 jacks, ear phones, speaker and extra loud speaker. Plain hardwood cabinet. Also All-American 3-tube reflex. Will build any set to order.

No. 573—Radio-trician in Herrin, Ill., specializes in "Masterbuilt" receivers either from standard kits or will design to meet your individual requirements; also television, short wave and public address systems for theatres, parks and halls. Will service, repair or rewire any set. All work guaranteed.

No. 315—Setbuilder in Lena, Ill., can build any type of set to order. Has 5-tube tuned radio frequency sets with very good tone and excellent sensitivity for sale.

No. 485—Custom setbuilder in Malta, Ill., will build any Silver-Marshall set ordered, for the full price of the parts used. Business done on a cash in advance basis. References furnished on request. Any radio serviced or rebuilt. Five years' experience. Authorized Silver-Marshall Service Station.

No. 421—Custom setbuilder in Midlothian, Ill., will build, repair, remodel, and install any radio or power amplifier. Authorized Silver-Marshall Service Station. Everything in radio fully guaranteed. Best quality. Lowest prices.

No. 412—Setbuilder in Ontarioville, Ill., will build any type of set to order and guarantee to use you. Can also build experimental television apparatus. Can repair any type of set. Also test and rejuvenate tubes.

No. 507—Radio-trician in Peoria, Ill., builds sets in any standard kits. Also short wave sets, television, power packs, and amplifiers. Silver-Marshall and Hammarlund-Roberts Service Station. All work guaranteed.

No. 464—Custom setbuilder in Polo, Ill., will build any receiver described in Radio Listeners' Guide and Call Book at list price of parts. Specializes in Silver-Marshall Shielded Grid Six, Downing-Drake sets and Silver-Marshall A-B-C power packs. Repairing a specialty. All work thoroughly tested and guaranteed. Authorized Silver-Marshall Service Station.

No. 567—Setbuilder in Rockford, Ill., will build sets to harmonize with surroundings. Let me convert your battery set to an all electric model. An efficiently service any set. Will also build "B"—"C" eliminators.

No. 209—Setbuilder in Springfield, Ill., will build to order from practically all standard kits, sets and power packs.

No. 505—Custom setbuilder in Springfield, Ill., will build any type of set or circuit to suit. Will service and repair any make or type of radio receiver units, or speakers. Parts matched to laboratory instruments. Satisfaction guaranteed. Authorized Silver-Marshall Service Station.

No. 137—Setbuilder in Stockton, Ill., has five, and seven-tube sets that have the promised ten cycle sharpness with the new shielded grid sets. Silver-Marshall Shielded Grid Six special. Can build any make of set to order. Last in up-to-minute reproducers.

No. 633—Custom setbuilder in Villa Grove, Ill., will wire and test free of charge any kit purchased from him. Will repair or take in trade old set.

No. 546—Setbuilder in Waukegan, Ill., will build any set, battery or A.C., with any number of tubes. All work guaranteed.

No. 335—Setbuilder in Wheaton, Ill., specializes in the Air Scout Four receiver as described in the August 1928 edition of Radio Listeners' Guide and Call Book. Will build any one, two, three, four or five tube set; also crystal sets and short-wave receivers.

No. 615—Custom setbuilder in Zeigler, Ill., will build any Silver-Marshall set, amplifier or public address system to order; also radio phonograph combination.

No. 362—Setbuilder in Albany, Ind., will build all makes of sets to order. Will also repair any make of set. All work and repairs guaranteed.

No. 145—Setbuilder in Elkhart, Ind., wants to build your next set for you. Madison-Moore and Diamond of the Air are specialties. Will guarantee you more for your money. Also expert repairing and rebuilding. Prices are very reasonable.

No. 143—Custom setbuilder and radio doctor in Emison, Ind., specializes in Scott Shield Grid Nine, H. F. L. Isotone, Karas Equamatic and all high grade receivers. Will build or service any type of set desired. Absolute satisfaction guaranteed.

No. 628—Custom setbuilder in Fort Wayne, Ind., will build any S-M set or power pack for list price of parts. Will also build and service any other set at very reasonable cost. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 425—Setbuilder in Gary, Ind., will build to order any make of set you choose. Five years' experience enables me to fully guarantee all work. Specialist in Sargent-Rayment Seven and new Robertson-Davis Automatic Super-Six with push button control. Servicing and repairing also a specialty.

No. 433—Setbuilder in Harrodsburg, Ind., can build any type of radio from one to five tubes. 50% deposit on all orders.

No. 181—Setbuilder in Indianapolis, Ind., is specialist on A.C. and shielded grid tube sets. Will build to your order a set from any nationally advertised kits with parts specified by designer of circuit. Guaranteed workmanship at reasonable prices.

No. 327—Eventually you will own a custom-built Super-Heterodyne. Buy this set from a Super-Heterodyne specialist in Indianapolis, Ind. Nine years' experience and personal service. Authorized Silver-Marshall Service Station.

No. 371—Setbuilders in Indianapolis, Ind., will service all makes of radios, eliminators and speakers. Will also install our style of antenna in our locality with a two-year guarantee. Authorized Silver-Marshall Service Station.

No. 423—Setbuilder in Indianapolis, Ind., specializes in building to order all Hammarlund-Roberts Hi-Q A.C. or D.C. models, short wave converters, Silver-Marshall Shield Grid 720, Aero Metropolitan A.C. Four, Aero Chronophone A.C. and Harkness Screen Grid DeLuxe. Authorized Hammarlund-Roberts Service Station.

No. 463—Custom setbuilder in Indianapolis, Ind., will build, install, service and repair radio receiving sets. Power units and power amplifiers custom built. Authorized Silver-Marshall Service Station. Silver-Marshall sets a specialty. Will build and repair any type of set. Estimates gladly furnished.

No. 402—Custom setbuilder in Lapel, Ind., will build or rebuild any type of receiver. All A.C., battery or power pack installations. Any circuit and any number of tubes built from best grade parts. Neat factory-built appearance. Any type cabinet or console. Workmanship and performance guaranteed.

No. 413—Custom setbuilder in Linton, Ind., can build any type set or power pack to order. Specializes in Hammarlund-Roberts Hi-Q Six A.C. or D.C. Can change D.C. sets to A.C. operation.

No. 602—Setbuilder in Logansport, Ind., will build and repair any make of receiver. Authorized Silver-Marshall Service Station.

No. 186—Setbuilder in Muncie, Ind., specializes in Silver-Marshall Six with the new shield-grid tubes and 210 power tube. Highest quality workmanship only.

No. 166—Setbuilder in Richmond, Ind., specializes in the complete Silver-Marshall line. Sets completely built, and sold for standard nationally advertised prices of kits alone. No construction charge. Each set tested and results sent with set. 24-page S-M catalog sent free.

No. 625—Setbuilder in Scotland, Ind., will build any receiver described in Radio Listeners' Guide and Call Book. Will also repair and remodel any type of set. Full instructions sent with each set built or repaired. All work guaranteed.

No. 261—Setbuilder in Burlington, Iowa, will rebuild or make any set to order. Specializes in four and five tube sets employing regeneration. Expert repair service on all makes of sets. Satisfaction guaranteed.

No. 369—Custom setbuilder in Cedar Rapids, Iowa, with three years of actual experience will make to order or rebuild any kind of set. Specializes in Victoreen Super-Heterodyne—A.C. or D.C.

No. 455—Setbuilder in Clear Lake, Iowa, will build to order any make or type of radio receiver, A-B-C eliminator or power pack. Hammarlund-Roberts receivers a specialty. All makes of receivers repaired. All work guaranteed. Endorsed by the National Radio Institute, Washington, D. C.

No. 499—Setbuilder in Conrad, Iowa, builds sets to order. Is graduate of Radio Association of America. All work guaranteed. Will repair any type of radio. Authorized Silver-Marshall Service Station.

No. 208—Setbuilder in Council Bluffs, Iowa, has Bremer-Tully Power Six and World's Record Super 10 sets for sale with or without accessories. One to fourteen tube sets, any make, built to your order.

No. 269—Setbuilder in Des Moines, Iowa, will build any set described by the Radio Listeners' Guide and Call Book. Prompt and reliable service on any make of radio or eliminator.

No. 437—Setbuilder in Des Moines, Iowa, will construct anything you desire. Years of experience. Satisfaction guaranteed.

No. 526—Custom setbuilder and authorized Silver-Marshall service representative in Des Moines, Iowa, specializes in custom built superheterodynes, shield grid sets and power amplifiers, also rebuilding present sets to improve tone quality. All work is thoroughly guaranteed and reasonably priced.

No. 257—Authorized Silver-Marshall and Hammarlund-Roberts Service Station in Dubuque, Iowa, builds all Silver-Marshall receiving sets, power amplifiers and unipacs. Will also build 1929 model Hammarlund-Roberts Hi-Q receivers, or any circuit described in Radio Listeners' Guide and Call Book.

No. 317—Custom setbuilder in Greene, Iowa, will build any set to order. Power units and power amplifiers custom-built. Authorized Silver-Marshall Service Station. Will also service any radio set or eliminator. All work absolutely guaranteed.

No. 273—Setbuilder in Iowa City, Iowa, will build to order the Diamond of the Air, four and five tubes, and the Air Scout 4-tube receiver.

No. 404—Setbuilder in Knoxville, Iowa, will build sets from any nationally advertised kit. Specializes in Silver-Marshall sets and phonograph-radio combinations. Beautiful consoles with built-in electric phonograph, electric pick-up and any make of radio receiver desired. All work guaranteed. Can furnish cabinets, consoles, tubes, batteries, eliminators, speakers, etc.

No. 233—Professional setbuilder in McGregor, Iowa, will build sets to your specifications, using any circuit, and to fit any console or cabinet. Hammarlund-Roberts Hi-Q Six a specialty.

No. 183—Setbuilder in Newton, Iowa, offers some 5-tube T.R.F. radio sets without cabinets, wired for power tube and "C" battery. These are real volume and distance getting sets and are priced at about one-half parts price alone. Also offer complete 5-tube kits comparatively low priced.

No. 117—Setbuilder in Red Oak, Iowa, builds all high grade receivers using standard parts throughout. Will repair any make set, factory or custom built. Specializes in Bremer-Tully Power Six and R. C. A. III 2-tube portable weighing 28 lbs. complete.

No. 298—Setbuilder in Tama, Iowa, has Silver-Marshall Shield Grid Sixes and all S-M products for sale. One year guarantee. Endorsed by National Radio Inst., Washington, D. C.

No. 374—Setbuilder in Coffeyville, Kans., builds any type of receiver to order. Specializes in six tube and short-wave sets. Two on hand.

No. 538—Custom radio engineer in Hutchinson, Kans., builds all apparatus from one tube sets to largest super-heterodynes and all power amplifiers. Specializes in Silver-Marshall receivers. All orders filled within ten days. Authorized Silver-Marshall Service Station.

No. 252—Seven years' radio experience enables custom setbuilder in Kansas City, Kans., to offer custom built sets that will surprise you in their marvelous operation regardless of their low prices. Specializes in Shielded Grid receivers. Will quote prices on any set.

No. 431—Setbuilder in Kansas City, Kans., builds any set you desire in the most expert manner. Specializes in Silver-Marshall sets. Am authorized Silver-Marshall Service Station for this territory. One coast-to-coast Shield Grid 4 for sale.

No. 591—Setbuilder in Leavenworth, Kans., will build any set, power supply or amplifier equipment, using only standard high grade parts. Cost to you is list price of parts specified plus 10 per cent and you pay the transportation. Six years actual experience. Authorized Silver-Marshall Service Station.

No. 506—Setbuilder in Randolph, Kans., will build any of the popular circuits to order. Will also repair any make of receiver. All work guaranteed. Eight years' radio experience.

No. 631—Setbuilder in Topeka, Kans., has Silver-Marshall sets for sale. I am equipped to balance and service any make of set. Will build to order any and all makes of custom made sets.

No. 282—Custom setbuilder in Wellington, Kansas, will build any size set or power supply to your specifications. First class workmanship guaranteed. Victoreen Supers and power supplies our specialty. Can furnish parts if desired. Prices and references on request.

No. 381—Custom setbuilder in Middlesboro, Ky., will guarantee every part of complete set (except tubes) for one year on any circuit. Short-wave receivers and transmitters built and only the best parts used. Guarantee volume and tone. All sets tested. Experience since 1908 continually. All shipments C. O. D. Satisfaction or your money back.

No. 612—Setbuilder in Lafayette, La., will build to order a set from any model, design, or kit, for the price of parts. Results and workmanship guaranteed.

No. 301—Custom setbuilder in New Orleans, La., will build any type radio set to order.

No. 491—Authorized Silver-Marshall Service Station in New Orleans, La., will build any Silver-Marshall set and guarantee satisfaction. Specializes in 720 Screen Grid Six. Will service and repair all makes of receivers. Endorsed by the National Radio Institute of Washington, D. C.

No. 503—Setbuilder in New Orleans, La., will build any type of receiver with really fine quality together with the very latest advances in radio to order. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 128—Setbuilder in Shreveport, La., will build any set to order. Specializes in Browning-Drake Screen Grid circuits. Estimates given. Results guaranteed.

No. 111—Custom setbuilder in Battle Creek, Mich., specializes in Silver-Marshall kits. Silver-Marshall Service Station. Can build anything you want. Work reasonably guaranteed.

No. 415—Setbuilder in Bridgeport, Mich., has Tyrman 70 sets for sale, and builds all makes of sets. You name it, we build it.

No. 184—Setbuilder in Detroit, Mich., has for sale a 9-tube Lincoln Super complete. Specializes in any Super. Guarantee satisfaction or money refunded. \$200 in bank your protection.

No. 190—Setbuilder in Detroit, Mich., will build any set described in Radio Listeners' Guide and Call Book. Six years' experience. Specialist on Scott's World's Record Supers 8-9-10, Nine-in-Line, Shielded Grid Six and Hi-Q Six. All work guaranteed. Any set tailored to your order.

No. 279—Setbuilder in Detroit, Mich., will make sets to order and install them in your Victrola or any antique furniture as writing desks, bookcases or cabinets.

No. 307—Designer and setbuilder in Detroit, Mich., specializes in short wave receivers. Will design or build to order any make of sets for any waveband.

No. 465—Authorized Hammarlund-Roberts radio-trician in Detroit, Mich., will build any make of A.C. or D.C. sets to order.

No. 553—Professional setbuilder and technician in Detroit, Mich., will build any receiver, amplifier or public address systems to order. Authorized Silver-Marshall and Hammarlund-Roberts Service Station.

No. 348—Community setbuilder in Flint, Mich., builds any set to order. Utmost satisfaction assured. Day or night radio service. Many years experience.

No. 420—Setbuilder in Gladwin, Mich., will build any battery operated set to order. Can also furnish any manufactured A.C. or light socket operated set. Repairing done on all kinds of sets.

No. 466—Professional designer and custom setbuilder in Grand Rapids, Mich., will build all high grade receivers, power-packs and amplifiers. Master craftsmanship. Graduate radio-trician. All sets guaranteed. Authorized Silver-Marshall Service Station.

No. 634—Custom setbuilders in Hamtramck, Mich., will build all types of A.C. or D.C. sets to order. Will also repair all makes and types of radios with a guarantee for your satisfaction.

No. 296—Setbuilder in Jackson, Mich., specializes in such sets as Magnaformer, Harkness, Scott's World's Record Super and S-M Shielded Grid Six. Satisfaction guaranteed. Supplies and aerial installed.

No. 561—Custom setbuilder in Lansing, Mich., will build any type of special set upon order. Specializes in Tyrman and Silver-Marshall sets. Authorized Silver-Marshall Service Station. No order too large or too small.

No. 605—Custom setbuilder in Lansing, Mich., is endorsed by the National Radio Institute to do your set building or special radio jobs. Screen grid tube circuits a specialty. All work guaranteed.

No. 223—Setbuilder in Manton, Mich., specializes in Silver-Marshall shielded grid sets. Can make any other kind of set to order.

No. 379—Authorized Silver-Marshall Service Station in Port Huron, Mich., will build any type of set desired. Specializes in Silver-Marshall, Remler and Browning-Drake. Technical laboratory service in remodeling or repairing any set. Fifteen years' technical experience. Will build any type of eliminator, power amplifier or power pack.

No. 535—Custom sets built to suit your needs and desires by setbuilder in Saginaw, Mich. Shielded Grid sets and Super-Heterodynes a specialty. Can furnish any type of cabinet or console wanted. Five years' experience.

No. 319—Setbuilder in Sault Ste. Marie, Mich., has Hammarlund-Roberts sets for sale. Also building and repairing of all other makes of sets. Seven years' experience. All work guaranteed.

No. 429—Setbuilder in Sturgis, Mich., builds radio sets to order. Old radios rebuilt. Specializes in five and six-tube sets.

No. 158—Setbuilder in Cloquet, Minn., specializes in Silver-Marshall sets, Tyrman 70 Shielded Grid Amplimax and other Super-Heterodynes. Reasonable prices. Can build any circuit desired. Also convert and service radios.

No. 592—Custom setbuilder in Duluth, Minn., specializes in Silver-Marshall sets. Short wave and converter sets built to order. All makes of radios repaired and serviced. Batteries recharged. Service calls and sets installed anywhere within 25 miles of Duluth.

No. 189—Setbuilder in Minneapolis, Minn., specializes in Norden-Hauck Shielded Super 10 custom built receiver. Five type UX-222 screen grid tubes are used in this ultra-powerful broadcast receiver increasing the radio frequency amplification and sensitivity over 500 times. Installation on this receiver in any part of the country.

No. 600—Custom setbuilder in Minneapolis, Minn., will build any type of power pack to order. Several new and rebuilt sets always on hand. All work guaranteed.

No. 121—Setbuilder in Stanchfield, Minn., has seven years' experience in custom setbuilding and will build your favorite set for you. Fast, modern assembly equipment used and price will please you.

No. 555—Radio setbuilder in West Duluth, Minn., will build to order any radio receiver. Sets repaired and adjusted. Endorsed by National Radio Institute, Washington, D. C.

No. 524—Custom setbuilder in Winona, Minn., will build all Silver-Marshall sets and power packs or any other set you wish to have built. All workmanship guaranteed. Authorized Silver-Marshall Service Station.

No. 392—Practical certified radio-trician in Vicksburg, Miss., specializes in any standard circuit and especially those described in Radio Listeners' Guide and Call Book. Any type of receiver or eliminator built or repaired at a reasonable price.

No. 577—Professional setbuilder in Barnard, Mo., will construct any type of custom built receiver desired. Thoroughly trained by the Radio Association in all lines of radio service and construction work.

No. 224—Setbuilder in Denton, Mo., will build Victoreen Super and any other sets to order.

No. 513—Authorized Silver-Marshall Service Station and expert custom setbuilder in Kansas City, Mo., will build any of the sets described in this and other radio publications. Satisfaction guaranteed. Will take in your old set as part payment.

No. 136—Setbuilder in Memphis, Mo., has three-tube coast-to-coast receivers for sale, and specializes in this type of set. Full loud speaker volume. Can build any type of set. My best reference is satisfied customers.

No. 339—Setbuilder in Pine Lawn, Mo., will build your favorite radio set to order. Also has Tyrman 70 for sale.

No. 230—Custom setbuilder in St. Louis, Mo., will gladly furnish estimate of cost of constructing any type radio of recognized merit, four to fourteen tubes; also power packs and short wave receivers. Workmanship unsurpassed. Have Victoreen 8-tube super for sale.

No. 267—Radio expert and custom setbuilder in St. Louis, Mo., will build any type set you desire. Get my price to make a Panathrope combination from your radio set and your phonograph. Can also change your D.C. battery type set to use the new A.C. type tubes. All work guaranteed.

No. 373—Custom setbuilder in St. Louis, Mo., specializes in A.C. sets of any size or make, and amplifiers from three tubes upwards. Can deliver 682-210 or similar amplifiers complete within 24 hours. All work guaranteed for one year.

No. 475—Setbuilder and authorized Silver-Marshall Service Station in St. Louis, Mo., will build sets from any advertised kit. Specializes in Silver-Marshall Screen Grid sets. Service and repairing on any make of sets. All work guaranteed.

No. 539—Custom setbuilder in St. Louis, Mo., specializes in screen grids, super-heterodynes, public address systems and high voltage power packs. Silver-Marshall and Remler parts a specialty. Authorized Silver-Marshall Service Station.

No. 583—Custom setbuilder in Springfield, Mo., will build any radio set to order. Authorized Silver-Marshall Service Station.

No. 589—Custom setbuilder in Springfield, Mo., will build any radio receiving or transmitting set to order. Television sets built to order. Any make of radio repaired, rebuilt or installed. Battery operated sets converted to A.C. operation. Authorized Hammarlund-Roberts Service Station.

No. 271—Setbuilder in Thayer, Mo., has a five-tube tuned radio frequency set for sale. Will also make and repair any kind of set at lowest prices. All work guaranteed.

No. 492—Certified radio-trician in Bozeman, Mont., will build, remodel and repair all kinds of radio apparatus. Graduate of National Radio Institute. Authorized Silver-Marshall Service Station.

No. 483—Union radio-trician in Butte, Mont., will build any circuit tailored strictly to order.

No. 341—Setbuilder in Geraldine, Mont., will build any kit or receiver to order. Workmanship guaranteed. Specializes in Tyrman receivers.

No. 428—Setbuilder in Hagerman, N. Mex., will construct any of the popular radio sets to order. Specializes in custom-built A.C. and D.C. receivers. Send your specifications. All work guaranteed.

No. 405—Setbuilder in Melrose, N. Mex., will build any make of broadcast receiver or short-wave receiver and transmitter to order. Will also build eliminators and cone speakers. Specializes in power amplifiers.

No. 182—Setbuilder in Minot, N. Dak., will build any popular circuit to fit your requirements. Variety as to appearance offered. Buy a custom set adapted to the locality.

No. 584—Custom setbuilder in Akron, Ohio, with eleven years experience, specializes in Scott's Shield Grid Supers, Tyrman 80, Victoreen A.C. and D.C. receivers. Will also repair and remodel old sets. All types of sets with or without short wave adapter and phonograph pick-up built to order.

No. 201—Setbuilder in Alliance, Ohio, with three years experience, will build any make of set to order. Specializes on Magnaformer 9-8 receivers.

No. 206—Custom setbuilder in Canton, Ohio, specializes in Aero-Dyne Six and Seven. Will construct any standard custom set. All work guaranteed.

No. 337—Setbuilder in Canton, Ohio, specializes on 5-tube Lynch-Hammarlund and Precision receivers. Also assemble 6-7-8 tube kits of single or dual control. Receivers only or all necessary equipment supplied at moderate price.

No. 289—Setbuilder in Charndon, Ohio, specializes in Silver-Marshall sets. Can also build or install any make of set desired and service sets too. All work guaranteed satisfactory or money back. Get estimate before buying. Courtesy and service of the kind that builds up good will.

No. 280—Setbuilder in Cincinnati, Ohio, will build to order all sets using the new shield grid tubes.

No. 363—Hammarlund-Roberts radio-trician in Cincinnati, Ohio, has complete Silver-Marshall and Hammarlund-Roberts sets and parts for sale. Will also build Aero, Bremer-Tully, Browning-Drake and Tyrman sets and power packs. Short wave sets a specialty. Authorized Silver-Marshall Service Station.

No. 368—Custom setbuilder in Cincinnati, Ohio, will build to order any A.C., D.C. or shield grid sets. Specializes in Magnaformer A.C. Shield Grid receiver, Silver-Marshall, Tyrman and many others. Will repair any set, power pack, power amplifier, etc. Authorized Silver-Marshall Service Station.

No. 457—Expert radio-trician and custom setbuilder in Cincinnati, Ohio, will build to your specifications any type set or power pack. Set installed in any cabinet or console you prefer. Work is guaranteed to satisfy. Endorsed by the National Radio Institute.

No. 153—Setbuilder in Cleveland, Ohio, will build to order and repair any Silver-Marshall Shielded Grid Super-Heterodyne and Shielded Grid Sixes.

No. 160—Setbuilder in Cleveland, Ohio, will build to order the new Browning-Drake sets. Specializes in completing the factory made kits. Satisfaction guaranteed. Moderate prices.

No. 211—Setbuilder in Cleveland, Ohio, has for sale 4, 5 and 6-tube sets for 1, 2 or 3-dial control. Can also build any set to order.

No. 318—Expert radio-trician in Cleveland, Ohio, will remodel and electrify any set. Radio sets built and repaired. Five-tube sets a specialty. Work is guaranteed and you get expert workmanship at a reasonable price.

No. 494—Dependable radio doctor in Cleveland, Ohio, will build to order or repair any set, large or small, in the right way with parts specified by designer of circuit. Authorized Silver-Marshall Service Station.

No. 511—Custom setbuilder in Cleveland, Ohio, has all Silver-Marshall sets and power packs for sale. Authorized Silver-Marshall Service Station.

No. 512—Custom setbuilder in Cleveland, Ohio, has a Silver-Marshall 5-tube set for sale. Will build, assemble or wire any set to order. Old sets rebuilt to bring them up-to-date. Authorized Silver-Marshall Service Station.

No. 531—Setbuilder in Cleveland, Ohio, will build to order any popular receiving set. Scott's Shield Grid Nine a specialty. Let me build you a real DX set. Only best materials used. Also many good used sets for sale.

No. 614—Custom setbuilder in Cleveland, Ohio, will build any set to order. Specializes in Hammarlund-Roberts Hi-Q sets. Only highest quality material and workmanship used throughout. Will also build quality power amplifiers for any purpose. All work absolutely guaranteed.

No. 247—Custom setbuilder in Columbiana, Ohio, specializes in Super-Heterodynes, Browning-Drake, Hammarlund-Roberts, etc. Am capable of building any other set when ordered. I build custom built sets which give custom built results.

No. 170—Setbuilder in Columbus, Ohio, will build all latest circuits, Hi-Q Six, Hot-Spot, 14, Nine-in-Line, etc. Sets made A.C. or D.C.

No. 501—Custom setbuilder in Columbus, Ohio, specializes in custom setbuilding from Silver-Marshall products. Will also build, service or repair any circuit desired. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 385—Custom setbuilder in Dayton, Ohio, will build any kind of radio set with a guarantee that counts.

No. 177—Custom setbuilder in Fostoria, Ohio, is authorized Hammarlund-Roberts radio-trician. The best in radio made by custom built. Write for literature or demonstration. Any receiver, any furniture, built to your order.

No. 565—Setbuilder in Greenville, Ohio, with twelve years' radio experience, will build any set from one to twelve tubes, A.C. or D.C. to order. Will remodel or repair your present set. Also builds short-wave and television outfits. All work neatly done and only the best parts used.

No. 606—Setbuilder in Lakemore, Ohio, will build to order and repair all Silver-Marshall receivers. Sets built for cost of parts only. Reasonable charge with your own parts. Short wave specialist. Nine years experience. Authorized Silver-Marshall Service Station.

No. 469—Custom setbuilder in Lakewood, Ohio, will solve your radio troubles. Will build a custom-built receiver of great distance and tone quality. Full information mailed on request. Complete testing equipment for expert repair work on any make receiver or accessories at reasonable cost. Work guaranteed. Authorized Silver-Marshall Service Station.

No. 502—Custom setbuilder in Lakewood, Ohio, specializes in S-M 720 and short wave sets. Other makes built to order. Custom finishing and refinishing of cabinets. Your set will be different if finished in "lace lacquer." Authorized Silver-Marshall Service Station.

No. 322—Setbuilder in Lancaster, Ohio, has Hammarlund-Roberts and Aero sets for sale. Any type of set built to order. All work guaranteed. Amplifier systems built for schools, churches, auditoriums. Also buildings wired for radio. Satisfaction guaranteed.

No. 599—Setbuilder in Lancaster, Ohio, specializes in Silver-Marshall receivers, but will build or repair any set at lowest prices.

No. 105—Setbuilder in Malvern, Ohio, assembles, wires and constructs any make of set to order. Specializes in Silver-Marshall line. Thoroughly experienced.

No. 216—Custom setbuilder in Mansfield, Ohio, can build any set to order. Specializes in Silver-Marshall and Tyrman receivers. Have experimented with practically every type of circuit and speaker. Will also build any type power supply for radio sets. All work guaranteed.

No. 302—Setbuilder in Massillon, Ohio, makes a specialty of receivers for hotels, restaurants, schools, boats, etc. In your choice of custom built sets, please expect from me choice parts and a complete set backed by experience and workmanship which has come from extensive training.

No. 504—Custom setbuilder in Massillon, Ohio, specializes in Silver-Marshall and Hammarlund-Roberts receivers installed in any type of cabinet and with electric phonograph if so desired. Demonstrations and explanations cheerfully given. Why not try a custom-built radio and be convinced as to its superiority.

No. 556—Custom setbuilder in Risingsun, Ohio, will make any set to order, repair or remodel your old battery set to operate from current. Will build or rebuild your set to fit any cabinet. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 533—Radio-technician and custom setbuilder in Sandusky, Ohio, specializes in quality receivers. All work guaranteed. Recommended by the National Radio Institute. Authorized Silver-Marshall Service Station.

No. 622—Custom setbuilder in Springfield, Ohio, will build or service radio receivers of any kind. All work guaranteed. Fifteen years experience.

No. 255—Custom setbuilder in Steubenville, Ohio, builds any make of set to order, either battery or electric operated.

No. 569—Setbuilder in Urbana, Ohio, will build any type of set to order. Specializes in Scott's Shield Grid Nine.

No. 529—Expert radio-technician in Warren, Ohio, will build any radio circuit, power unit or eliminator. Old sets taken in trade. Will repair any radio or eliminator, etc., at lowest prices. Kits and accessories at lowest prices. Authorized Silver-Marshall Service Station.

No. 549—Custom setbuilder in Picher, Okla., will build, rebuild or service any type of set. Specializes in Silver-Marshall sets. All work guaranteed. Estimates gladly furnished.

No. 403—Setbuilder in Shawnee, Okla., will build, rebuild or repair any type set desired. Special sets made to order. Ten years' practical experience. Charges reasonable.

No. 325—Radio expert and custom setbuilder in Stilwell, Okla., will build any set to order regardless of size. Electrifying and rebuilding old sets a specialty.

No. 346—Setbuilder in Sanator, S. Dak., has Silver-Marshall sets for sale. As authorized S-M Service Station, will build to your specifications.

No. 369—Setbuilder in Winner, S. Dak., will build to order any set from any nationally advertised kit. Specializes in Silver-Marshall, Victoreen and Diamond 4 and 5 tube sets, A.C. or D.C. Will also electrify and repair any make of receiver.

No. 202—Custom setbuilder and radio trouble shooter in Yankton, S. Dak., will build S-M Shield-Grid Sixes or any type of set to order.

No. 351—Setbuilder in Alice, Tex., has Counterphase Power Six in scroll work cabinet hand made compartment for batteries, tubes, meter, etc. Will sell special horn for cash. Will build any kind of set with or without cabinet from 3 to 10 tubes.

No. 618—Setbuilder in Austin, Tex., will build all makes of sets to order. Excellent broadcast receivers, short wave sets and converters a specialty. Quality and satisfaction assured.

No. 130—Any set described in popular radio magazines built to order by custom setbuilder in Beaumont, Texas. Also power amplifiers. Local installations free.

No. 623—Setbuilder in Coleman, Tex., will build any receiver, power supply or power amplifier to order. Only highest quality material used. Workmanship and material guaranteed. Specializes in amateur short wave transmitting and television equipment. Records are being made with our custom-built broadcast receivers. Authorized Silver-Marshall Service Station.

No. 161—Setbuilder in Fort Worth, Texas, has 5-tube resistance coupled Radio Broadcast Universal receiving set for sale. Can build any make of set to order. Specializes in Browning-Drake receivers.

No. 489—Custom setbuilder in Fort Worth, Tex., specializes in S-M sets but will be glad to furnish estimate on other types of sets. Real scientific repair service on any radio receiver—no guess work. All work guaranteed. References given. Authorized Silver-Marshall Service Station.

No. 292—Professional setbuilder in Harper, Tex., can build any make receiver from a one-tube set to a thirteen-tube Super-Heterodyne; the Rolls Royce of reception. Six years' experience.

No. 150—Short wave tuners and receivers built to order by a setbuilder in Houston, Texas. Specializes in Silver-Marshall Shielded Grid Six and Laboratory Super. Satisfaction guaranteed or no pay. Lowest possible prices consistent with good work.

No. 397—Setbuilder in McGregor, Tex., specializes in Aero, Hammarlund and Silver-Marshall receivers; also Screen-Grid All-Electric receiver and the new Pilot electric sets. Bargains in battery sets.

No. 616—Government licensed radio operator in Marshall, Tex., will construct all types of radios, electric phonographs and combinations to order. Short wave transmitters and receivers a specialty. All work guaranteed.

No. 632—Custom setbuilder in Marshall, Tex., will build any type of custom made set from standard kits. Power packs and amplifiers made to order. Will also modernize your old set by employing A.C. tubes and changing to one dial control. All work guaranteed.

No. 449—Custom setbuilder in Terrell, Tex., will build and install any type of set according to your specifications. Only the best parts are used. Prices are very reasonable.

No. 215—Authorized Hammarlund-Roberts radio-technician in Hollidays Cove, W. Va., will build and repair all makes of receivers and will convert any type battery set to A.C. electric sets. Also have 6, 7 and 8 tube receivers for sale, A.C. or D.C. operated.

No. 414—Setbuilder in Huntington, W. Va., builds all kinds of sets, eliminators and audio amplifiers, etc., at reasonable prices. Authorized Silver-Marshall Service Station. Have Melo-Heald Eleven equipped with Temple Senior drum speaker, Silver-Beauty "A" eliminator and Burns "B" eliminator on hand for sale.

No. 419—Setbuilder in Kingmont, W. Va., builds and repairs all kinds of sets. Also sets and speakers tested free for my customers. Short wave receivers a specialty. Old sets rebuilt or repaired at the lowest possible prices. All work guaranteed to give perfect satisfaction. Graduate of several radio courses.

No. 451—Setbuilder in Philippi, W. Va., will build any set for list price of parts. Authorized Silver-Marshall Service Station. Short wave sets and transmitters built to order. Will repair any make of set.

No. 519—Authorized Silver-Marshall Service Station in South Charleston, W. Va., will build any nationally advertised receiver, power amplifier or power pack. Specializes in screen grid super-heterodyne construction. I am equipped to accurately analyze and service any type of receiver.

No. 541—Authorized Silver-Marshall service man in Fond du Lac, Wis., specializes in Silver-Marshall radio equipment for all purposes. Will build any other set the way you want it. Expert radio service anywhere. Work endorsed by National Radio Institute, Washington, D. C.

No. 234—Setbuilder in Hustisford, Wis., specializes and has for sale A.C. or D.C. operated 6-tube one-dial radio frequency sets. Will build and repair any make of set.

No. 171—Setbuilders in Milwaukee, Wis., will build any set to suit individual taste. Specializing in Hammarlund-Roberts Hi-Q Six, Browning-Drake, Tyrman Amplimax 70, Nine-in-Line and radio cabinets and consoles. Satisfaction guaranteed.

No. 188—Setbuilder in Milwaukee, Wis., has 5-tube Karas Equamatic for sale. Will build any make of set (preferably of the neutrodyne type).

No. 222—Setbuilder in Milwaukee, Wis., will construct any set desired from one to fourteen tubes and build it into any cabinet, console or desk you wish. Speakers and amplifiers built. Satisfaction guaranteed or your money refunded.

No. 238—Custombuilt is invariably the reply when you ask what set have you that enables you to get such phenomenal results? Setbuilder in Milwaukee, Wis., will bring the world to your fire-side with a custom built receiver placed in the type of cabinet or console you like best. Installation and service in and near Milwaukee.

No. 266—Setbuilder in Milwaukee, Wis., specializes in building Silver-Marshall sets and has same for sale. Any make of set built to order. Expert work in building, repairing and servicing custom-built sets. Authorized Silver-Marshall Service Station.

No. 349—Setbuilder in Milwaukee, Wis., will build any radio set to order. Graybar-Western Electric Headquarters.

No. 353—Custom built radio receivers of unexcelled quality, built by setbuilder in Milwaukee, Wis. Specializes in Hammarlund-Roberts Hi-Q, Tyrman 70 and Lynch-Hammarlund; shield grid tubes employed. Special amplifiers and power packs built and installed. What are your needs?

No. 450—Custom setbuilder in Milwaukee, Wis., will build or service any make of set. Specializes in Silver-Marshall sets and power packs. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 135—Setbuilder in Monomonic, Wis., will build any set with 10% cash discount. Each set carries a guarantee for one year free service, express prepaid. Laboratory tested Super-Heterodynes our specialty.

No. 558—Authorized Silver-Marshall Service Station in Racine, Wis., has facilities for building or repairing Silver-Marshall sets, power units, amplifiers and other apparatus. Will build, rebuild or repair any type set desired. All work guaranteed.

No. 342—Authorized Silver-Marshall Service Station in Wauwatosa, Wis., builds any set to order, but specializes in Silver-Marshall 720 kits. These sets built for list price of parts. 50% deposit to accompany each order.

PACIFIC STATES Arizona, California, Colorado, Nebraska, Oregon, Utah, Washington

No. 212—Setbuilder in Ajo, Ariz., specializes in the new Silver-Marshall 720 Screen Grid Six. All sets rebuilt for A.C. References furnished. Express prepaid on all new sets. All work guaranteed.

No. 382—Setbuilder in Flagstaff, Ariz., will build and service any make of set from the biggest to the smallest. No charge made for building except the list cost of parts. Four years' real experience. Free consultation.

No. 260—Setbuilder in Phoenix, Ariz., has the following sets for sale or trade; three tuned radio frequency sets, one Browning-Drake set, one Marco-Dine set and one Aero short-wave set. These sets are built of first class material and in first class condition.

No. 537—Setbuilder in Phoenix, Ariz., will build any kind of radio set. Short wave and screen grid tube sets a specialty. No extra charge for building. You are charged only the standard national advertised prices. All work guaranteed.

No. 490—Expert professional setbuilder in Berkeley, Calif., specializes in Silver-Marshall products. All makes of sets repaired and serviced. Authorized Silver-Marshall Service Station.

No. 635—Any nationally advertised kit built to order by an electrical engineer in Berkeley, Calif. Specializes in H. F. L. and Scott's World's Record Supers, Sargent-Rayment Seven and Silver-Marshall sets. Twenty years experience.

No. 256—Custom setbuilder in Glendale, Calif., specializes in Bremer-Tully, Silver-Marshall and Browning-Drake receivers. Official Arcturus service station. Inquiries gladly answered without cost or obligation. Let us help you with your problems.

No. 611—Certified radio-technician and custom setbuilder in Hanford, Calif., will build any set regardless of size or kind. Specializes in Silver-Marshall line. Endorsed by National Radio Institute, Washington, D. C.

No. 228—Setbuilder in Hollywood, Calif., has Silver-Marshall Shielded Grid Six sets for sale. I am equipped to balance and service any make of sets. Will also build to order any and all makes of sets.

No. 220—Setbuilder in Huntington Park, Calif., will build to order Hammarlund-Roberts Hi-Q Six, H. F. L. 9, Scott's New Super 9, Silver-Marshall New 720, Television and short-wave sets. Sets built for quality and distance.

No. 522—Setbuilder in Huntington Park, Calif., will build and repair all types of receivers. All work guaranteed.

No. 185—Professional setbuilder in Los Angeles, Calif., has 6-tube Silver-Marshall Shielded Six. Specializing in this kind of set. Can build any kind of set to order. Can design cabinets or consoles to match.

No. 316—Setbuilders in Los Angeles, Calif., are specializing in Browning-Drakes, and in special sets for those who want individuality in design and appearance, together with the ultimate in performance. Such sets are engineered not "just built."

No. 418—All electric advanced type powerful Torgerson 7 tube distance receivers in walnut console cabinet for sale by setbuilder in Los Angeles, Calif. Positively unexcelled tone. Cuts through powerful locals. Fifteen hundred miles with volume. Stands voltage variations.

No. 525—Custom setbuilder in Los Angeles, Calif., specializes in short wave equipment. All types of radio sets repaired, serviced, rebuilt or built to order. Operating short wave station W6DEG and W6DPW. All Silver-Marshall parts carried in stock. Authorized Silver-Marshall Service Station.

No. 210—Setbuilder in Oakland, Calif., will build any make of radio set, power pack and power equipment, all laboratory tested. Phonographs converted into electric Orthophones. Television and short-wave receivers built. Specializes in the new S. M. Sargent-Rayment Seven with four stages of shield grid R.F.

No. 609—Setbuilder in Oakland, Calif., will build to order only the best A.C. sets. Each set guaranteed.

No. 227—Setbuilder in Oildale, Calif., has Aerodyne Sixes for sale. Also make Magnaformer 9-8, and any other radio set you may wish. Mounted in any type cabinet you prefer.

No. 411—Factory trained expert designer and builder in Pomona, Calif., will design especially to suit your requirements any circuit you desire for A.C. or D.C. operation. All makes of sets rebuilt or repaired. Laboratory matching and calibrating service.

No. 564—Setbuilder in Pomona, Calif., builds Hammarlund-Roberts sets and specializes in Silver-Marshall power amplifiers. Seven years of radio experience in custom setbuilding.

No. 198—Custom setbuilder in Roseville, Calif., will build to order any make of receiver described in Radio Listeners' Guide and Call Book at list price of parts used. Workmanship guaranteed. All work Jewell tested. Specializes in Scott's World Record Supers, and Browning-Drake receivers. One year service free on sets constructed.

No. 329—Custom setbuilder in San Diego, Calif., can construct any set up to eight tubes. Aerodyne, Karas Equamatic and Knickerbocker Four a specialty. Sets complete if desired. All sets guaranteed.

No. 284—Authorized Hammarlund-Roberts radio-trician in San Francisco, Calif. is capable of building custom-built radio receivers of real merit. Specializes in the Quadruphase, Magnaformer 9-8, and Browning-Drake receivers. One year written guarantee issued with any custom built receiver. Endorsed by National Radio Institute, Washington, D. C.

No. 477—Custom setbuilder in San Francisco, Calif., will build any type of radio receiving set. Specializes in Remler No. 29 Super Infradyne and Best 115 K.C. Super. All work guaranteed for one year.

No. 542—Setbuilder in San Francisco, Calif., is fully equipped to build and service any Silver-Marshall sets, power packs, and amplifiers. Will electrify your present phonograph at a moderate price, and make your present D.C. set to A.C. Any make of sets built and repaired. Authorized Silver-Marshall Service Station.

No. 359—Custom setbuilder in Santa Ana, Calif., is authorized Hammarlund-Roberts radio-trician. Will build the Hammarlund-Roberts Hi-Q or other good makes of sets. Will repair any make of radio receiver.

No. 571—Authorized Hammarlund-Roberts radio-trician in Santa Ana, Calif., will build to order the new Hammarlund-Roberts Hi-Q 29 or other popular makes. Will service any make of set.

No. 568—Setbuilder in Santa Monica, Calif., will build all kinds of radio receivers, television and short wave receivers. All kinds of radios repaired.

No. 389—Professional custom setbuilder in Tuolumne, Calif., has laboratory for building radio sets, eliminators and amplifiers. Sets converted to A.C. Hammarlund-Roberts Service Station. Short-wave sets, inductors and transmitters built.

No. 231—Custom setbuilder in Whittier, Calif., will build any kind of broadcast receiver or short wave receiver. Will also rebuild or repair sets or remodel old battery set to A.C. operation. Specializes in 4 and 6-tube broadcast receiver of own design and the Junk Box short wave receiver. All work guaranteed.

No. 384—Setbuilder in Denver, Colo., will build you a set to suit your own ideas using any circuit. Will make any size or shape to fit in desk, phonograph, wall space, etc. Power units to match any set. Will take your old set in on a trade or bring it up-to-date for a small fee. Victoreens a specialty.

No. 174—Setbuilder in Durango, Colo., specializes in short wave sets. Will build any type short wave set and any other type of sets.

No. 621—Custom setbuilder in Grand Junction, Colo., will repair and remodel all makes of sets. Trained by National Radio Institute. Authorized Silver-Marshall Service Station.

No. 590—Experienced radio-trician in Hereford, Colo., will build all types of receivers to meet local conditions. Nine years experience. Graduate of National Radio Institute in 1922. Associate Member I. R. E. Specializes in H. F. L. Isotone, Scott's Shield Grid 9, Silver-Marshall and Hammarlund-Roberts receivers. Results guaranteed.

No. 356—Setbuilder in Longmont, Colo., will build any make of set to order in cabinet or console models. I have Ultradyne and Browning-Drake receivers for sale. Repair service a specialty. All work guaranteed.

No. 409—Authorized Hammarlund-Roberts radio-trician in Pueblo, Colo., will demonstrate and build sets to your order for battery or A.C. operation. Also short-wave sets and adaptors.

No. 336—Setbuilder in Albion, Nebr., has selective 5-tube set with good tonal quality for sale. Specializes in rebuilding and repairing radio sets. Can build any make of set to order.

No. 557—Expert professional setbuilder and service man in Boelus, Nebr., will build any set to order from high grade parts. Converting D.C. sets to A.C. operation a specialty. Prompt and efficient service on all sets, and good stock of standard sets, tubes, batteries and accessories on hand at all times.

No. 278—Expert professional setbuilder in Exeter, Nebr., will build any radio receiver to order. Silver-Marshall sets a specialty. Prompt efficient service. Stocks, parts and accessories. Set repairing and tube testing, service equipment and installation.

No. 345—Setbuilder in Mt. Clare, Nebr., will build any make of set for list price of parts. All types of sets serviced and repaired at small cost. All work guaranteed. Five years' experience. Have five-tube home-built Neutrodyne and 18 inch cone speaker for sale.

No. 357—The set you have always wanted—the custom built Quadraformer, made by a setbuilder in Omaha, Nebr. Also kits and parts. Must be seen to be appreciated. Will also build any set to order, and "A" and "B" power units.

No. 585—Setbuilders in Omaha, Nebr., will build short and long wave radios from one to ten tubes. Static or interference eliminators built, and underground, overhead or loop aerials installed. Satisfaction absolutely guaranteed unconditionally.

No. 575—Custom setbuilder in Sargent, Nebr., will build or repair any set or power pack. Silver-Marshall sets a specialty. All work guaranteed.

No. 173—Setbuilder in Upland, Nebr., will build any set and also repair sets of all kinds.

No. 274—Setbuilder in Medford, Ore., will repair and build all types of radio receivers and amplifiers. All work guaranteed. Endorsed by National Radio Institute, Washington, D. C.

No. 416—Experienced custom setbuilder in Ontario, Ore., will build any type of set to order. Repairing and service. Sets adapted for light socket operation.

No. 340—Custom setbuilder in Portland, Ore., builds any radio from simplest crystal set to largest super. Now specializing on the Silver-Marshall Shielded Grid Six and Silver-Marshall All Wave Tuner.

No. 355—Setbuilder in Portland, Ore., will build any radio set to order. Satisfaction guaranteed. Specializes in Super-Heterodynes.

No. 398—Setbuilder in Portland, Ore., will build any make of radio set from one to ten tubes. Five years' experience.

No. 408—Setbuilder in Portland, Ore., specializes in Bremer-Tully and all kinds of Super-Heterodynes. Only high grade parts are used in sets and power amplifiers. Will build your set to fit your phonograph, bookcase, etc., and guarantee it to work. Eight years' experience.

No. 131—Setbuilder in Price, Utah, specializes on Infradyne and S-M Shielded Grid Six. Can build any make of set to order. Prices reasonable and all work fully guaranteed.

No. 159—Setbuilder in Oak Harbor, Wash., will build custom radio sets free. My only charge is list price for parts. Any type of set built to your order. I also design and rebuild them for any need. No set too small or too large. Free consultation.

No. 200—Setbuilder in Seattle, Wash., has radio sets that bring in the stations you want. Up-to-date sets installed in your old cabinet or console.

No. 467—Setbuilder in Seattle, Wash., has for sale 5-tube All-Electric Browning-Drake. Will rewire, repair or build any type of set or amplifier at reasonable prices. Workmanship guaranteed.

No. 213—Setbuilder in South Tacoma, Wash., has for sale all Silver-Marshall sets and power units. Any set built to order. All work guaranteed. Authorized Silver-Marshall Service Station.

No. 287—Custom built sets, laboratory built and tested on the air by setbuilders in Tacoma, Wash. Any set preferred built and guaranteed. Delivery anywhere in western Washington.

No. 518—Custom setbuilder in Thornton, Wash., will build any type of set and install it in any type of console or cabinet. Will service any make of receiver. Workmanship guaranteed. Specializes in Hammarlund-Roberts Hi-Q, Scott's World Record Super, and Magnaformer 9-8.

CANADA

Alberta, British Columbia, Manitoba,
New Brunswick, Ontario, Quebec,
Saskatchewan

No. 442—Radio setbuilder in Coleman, Alberta, Canada, can save you money by building one of the modern A.C. or D.C. circuits into your old console. Shield-Grid circuits especially. Specializes in Sargent-Rayment Seven. Silver-Marshall "Round the World" set for sale; also "Coast-to-Coast Four."

No. 235—Setbuilder in New Dayton, Alta., Canada, has long distance, one, two, three, four, five, six and ten-tube sets for sale. Any make built to order. Dry or wet cell equipped. Sets installed and repaired. Work guaranteed.

No. 225—Setbuilder in Nanaimo, B. C., Canada, will build any type of receiver from complete kits. Expert work. Five years' experience. Satisfaction assured. Distance no obstacle. If you propose buying, write for information and unbiased advice on how you can have a better receiver for less money.

No. 607—Custom setbuilder in Prince Rupert, B. C., Canada, will build any set to order. Will also repair any make of radio set.

No. 165—Custom setbuilders in Hamilton, Canada, will build any of the popular kit sets at a very low cost. Best results guaranteed.

No. 199—Setbuilder in Winnipeg, Man., Canada, will build and repair all makes of sets. Special terms to the trade. Eight-tube Super for sale, electrified, built-in Silver-Marshall Unipac, UX-210 push-pull amplifier, complete with 3-ft. cone, built-in loop in beautiful walnut cabinet.

No. 454—Certified radio-trician in Winnipeg, Manitoba, Canada, specializes in Hammarlund-Roberts, Scott's World Record, and all makes of A.C. operated high class "A" and "B" batteries, eliminators, power packs, amplifiers, dynamic speakers, phonographs, etc. Will also test and repair all makes of sets. Complete laboratory equipment. Deposits on all orders.

No. 470—Setbuilder in Renner, Manitoba, Canada, will build any type of radio receiving sets, speakers or eliminators to order. Estimates gladly furnished.

No. 347—Setbuilder in Montreal, Canada, features single control radio sets of five and six tubes of the most advanced designs. Also Ferranti push-pull phonograph amplifiers. Any set built to order.

No. 471—Custom setbuilder in Moncton, N. B., Canada, has complete equipment for building and repairing Silver-Marshall radio sets and power packs and other makes of sets. Authorized Silver-Marshall Service Station.

No. 401—Custom setbuilder in Fort Frances, Ont., Canada, builds any type of set in cabinet or phonograph. Specializes in Browning-Drake, Aero and reflexes. Will supply tubes, kits and accessories at lowest prices. Prompt service.

No. 323—Setbuilder in Port Arthur, Ont., Canada, builds sets that produce results. Specializes in Quadraformer and Mercury Super-Ten. Can build any make of set to order or rebuild the old one. Workmanship guaranteed.

No. 340—Community setbuilder in Ontario, Canada, will make any set to order. Satisfaction guaranteed.

No. 193—Setbuilder in Toronto, Ont., Canada, builds all popular circuits, more sensitive, selective, powerful and cheaper than equivalent circuit in manufactured set. Specializes in 5-tube receiver which has received verifications from Cuba, Mexico and Pacific Coast.

No. 333—Setbuilder in Toronto, Ont., Canada, is specialist in all Harkness circuits, including new Shield Grid Five and counterflex circuits. Will be glad to furnish any prices and information free on request.

No. 548—Setbuilder in Toronto, Ont., Canada, will build or repair all types of receivers at reasonable rates. Can design cabinets or consoles to match.

No. 617—Custom setbuilder in Toronto, Ont., Canada, will build any make of set to order.

No. 576—Expert professional setbuilder in Acton Vale, Que., Canada, will build any radio receiver to order. Specializes in completely assembling and testing kits of all kinds. Prompt, efficient service.

No. 426—Setbuilder in Montreal, Que., Canada, specializes in Bremer-Tully, Kenneth Harkness, Aero, Pilot and Silver-Marshall receivers. All high grade sets built to order and serviced. Workmanship guaranteed. Graduate of Ozarka, Inc., and Radio Association of America. Authorized Silver-Marshall Service Station.

No. 552—Setbuilder in Glaslyn, Sask., Canada, will build any battery operated set to order. Three years' experience. All work guaranteed. Old sets repaired. Silver-Marshall Service Station.

No. 443—Setbuilder in Hanley, Sask., Canada, specializes in 4, 5 and 6 tube sets. Any make of set built to order or will rebuild old sets up-to-date.

No. 386—Certified radio-trician in Hirsch, Sask., Canada, specializes in Hi-Q Six and Silver-Marshall custom built sets, using either regular or screen grid tubes. Short-wave adaptors built to plug in your present set. Tubes rejuvenated. Any set made to your order. Estimates given and work guaranteed.

No. 176—Setbuilder in Regina, Sask., Canada, has for sale a 4-Tube Bremer-Tully receiver and 2-tube Bremer-Tully short wave receiver (12½-200). Specializes in Bremer-Tully and Silver-Marshall sets. Any make of set built to order.

No. 226—Setbuilder in Regina, Sask., Canada, specializes in 5 and 6 tube receivers, Super-Heterodynes, power suppliers and amplifiers. Estimates gladly given on the above to suit purse, taste and location.



Reap Big Dividends from this Investment in Tone Quality

A Thordarson Power Amplifier (Home Constructed) Will Transform Your Radio Into a Real Musical Instrument

WITH the insistent demand for quality reproduction, power amplification has become a vital radio necessity. Today, it is hard to find a radio set manufacturer who does not employ one or more power tubes in the output stage of his receiver.

There is no need, however, for you to discard your present radio instrument in spite of the fact that it is out-classed by newer models with power amplification. You can build a Thordarson Power Amplifier which, attached to your receiver, will provide a fullness and richness of reproduction that will equal or surpass the finest offerings of the present season.

Thordarson Power Amplifiers are exceedingly easy to assemble, even for the man with no previous radio experience. Only the simplest tools are used. Specific instructions with clear-cut photographs, layouts and diagrams insure success in home construction.

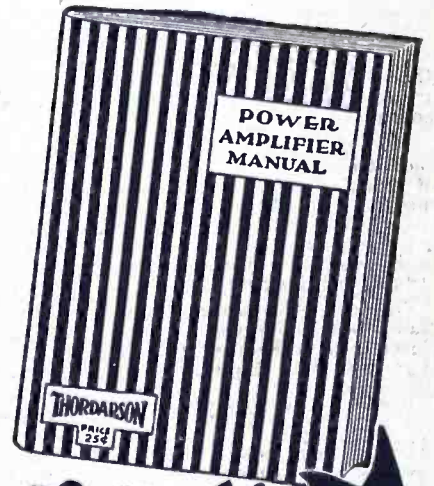
Whether your present receiver is factory made or custom built one of these amplifiers may be attached with equal ease. In fact, most Thordarson Amplifiers require absolutely no changes in

the wiring of the receiver itself, attachment being made by means of a special plug which fits the last audio socket of the receiver.

Thordarson Power Amplifiers for the home constructor and professional set builder range from the simple plate supply unit up to the heavy-duty three stage units employing the 250 type power tube in push-pull arrangement. These power amplifiers cover the requirements for every purpose and every pocket-book. They may be used with any type of horn, cone or dynamic speaker.

With a background of over thirty-three years manufacturing quality transformers, it is only natural that so many manufacturers of receiving sets of undisputed superiority have turned to Thordarson as the logical source of their audio and power supply transformers. The discriminating home constructor will do well to follow the lead of these manufacturers when buying his power amplifier.

Write to the factory today, enclosing 25c for the new "Power Amplifier Manual"—just off the press.



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No Amateur or Professional Set Builder Should Be Without This Book—

"POWER AMPLIFIER MANUAL"

A simple, yet complete, treatise on the subject of audio and power amplification, including full information on building, servicing, and testing power amplifiers in general. Also contains detailed specific construction data on twelve individual power units, with clear-cut layouts and diagrams of each.

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Gentlemen: Please send me your new "Power Amplifier Manual" for which I am enclosing 25c.

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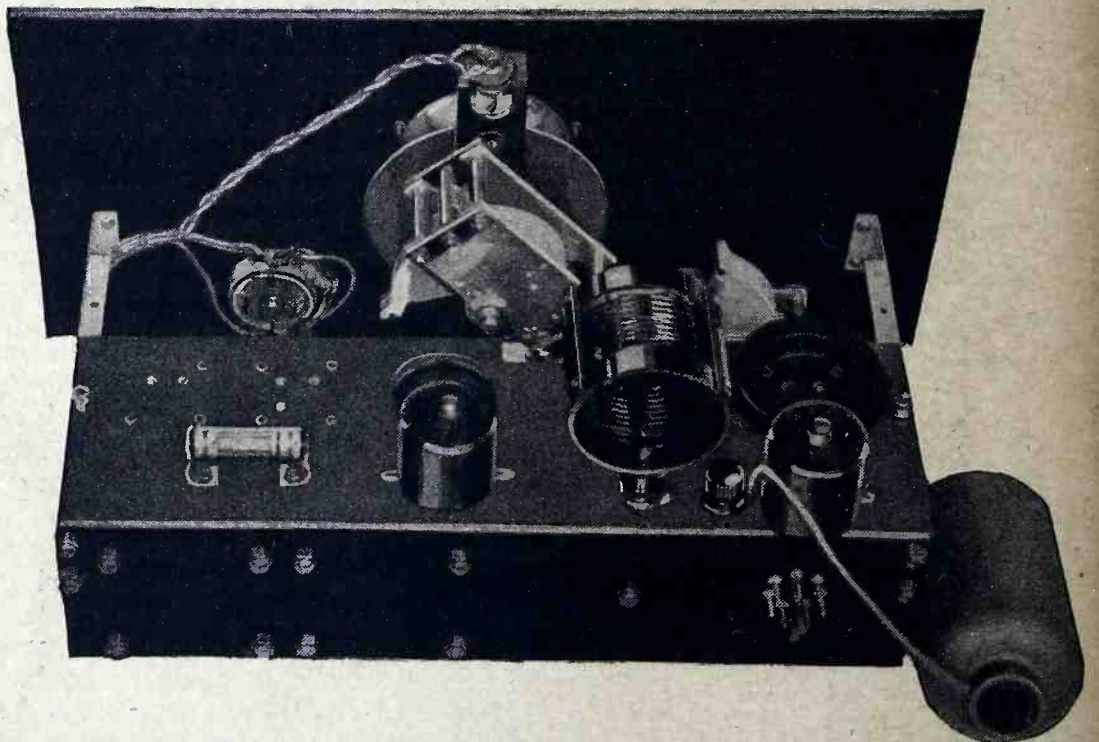
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A FEW changes which have been found exceptionally beneficial with respect to the overall amplification and receiver sensitivity, have been made in the Aero "International."

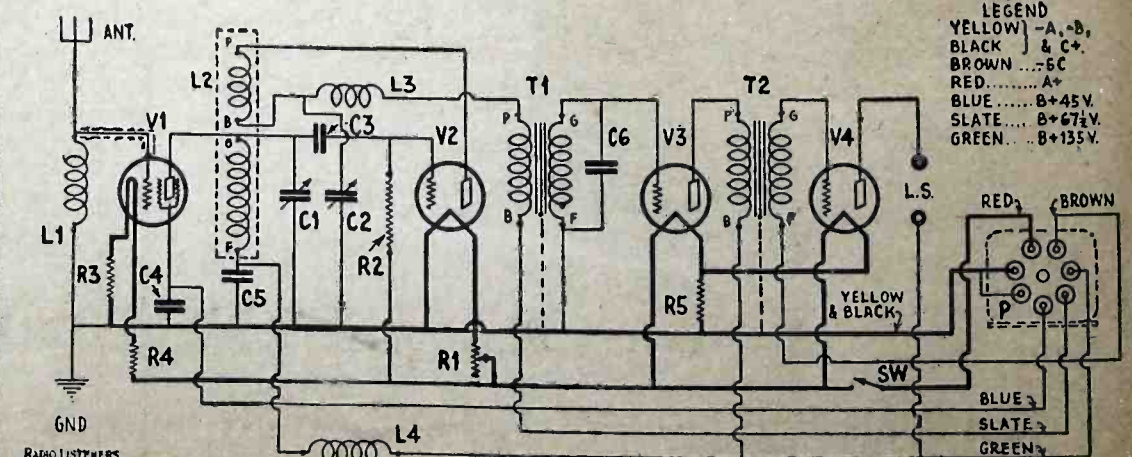
Quantitative measurements made upon the 1928 model (Fall issue of RADIO LISTENERS' GUIDE) when compared with the 1929 arrangement shown in the accompanying photograph, illustrate very forcibly the beneficial effects of shielding the screen grid connection and the screen grid tube. This gain is obtained by means of a very simple alteration. Whereas the old (1928) model utilized an unshielded screen grid tube, the new arrangement employs a tube shield and a shielded cable. Reference to the accompanying photograph will bring to light the shift of the radio frequency choke adjacent to the screen grid tube. This has been moved

towards the rear end of the sub-panel to make room for a combination screen grid tube socket and screen grid tube shield base. The lead between the control grid and the grid end of the aerial choke is shielded. The screen grid tube shield is of Carter manufacture and the flexible shield cable is made by Belden. Both are maintained at ground potential.

The effect of a shielded screen grid cable is indeed surprising. This part of the entire tube is the most vulnerable and requires greatest care when the tube is applied to a radio receiver. Correctly employed the tube affords excellent advantages, but when incorrectly applied, its results are very disappointing. Whatever the circuit arrangement, whatever the position of the screen grid tube, the control grid lead should always be shielded.



The improvements carried out upon the Aero International are evident in this photograph—Note the shield socket, the shield and the shield cable.

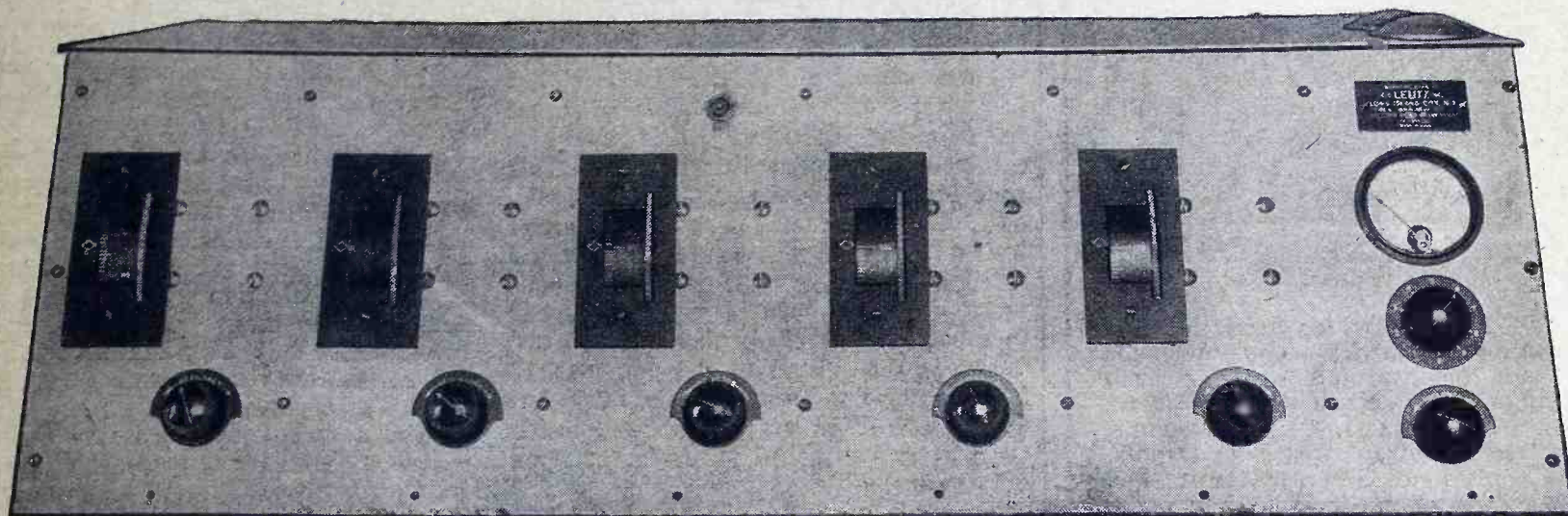


This wiring diagram differs very little from the original. The only change is the addition of the shielded screen grid cable.

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"PHANTOM SPECIAL"

9 TUBES



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WITH FOUR UX222's

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Reports coming in from Phantom Special owners located all over the world, indicate that the performance obtained is far superior to all competitive receivers used in the same vicinities.

This is not only true in regard to distance, but also in respect to volume on distant stations, extreme selectivity and wonderful quality of reproduction.

The new Screened Grid "PHANTOM SPECIAL" is now available in Kits at a net price of \$92.00 to Custom Set Builders. This price includes all the component parts ready for assembly and wiring. The power packs, tubes, speakers, etc., are of course extra.

Complete literature and further details will be forwarded upon request. This is the ideal broadcast receiver for the Custom Set Builder with customers that require the best in radio today.

Literature on request.



PRICES

Phantom Special, completely constructed and laboratory tested....	\$250.00
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15 ft. Air Column (57x57x35).....	250.00
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AMPLIFIERS	
2-stage (210 tubes in P.P. in last stage) (17x14x9).....	125.00
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MICROPHONE INPUT AMPLIFIER A. C. (14x15x9).....	
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Amplion Cabinets for Moving Pictures

Cabinets contain 2 turntable electric motors. Amplion electric pick-up and control board for fading one piece of music into another, or making instantaneous switches.

P.M.S. 2 std. (30x40x46).....	\$300.00
P.M.S. portable (12x32x22).....	225.00
Phono Record Library	
200 Record (14x14x30).....	\$200.00
250 Record (14x14x30).....	250.00

Especially designed for Non-Synchronous Moving Pictures.

We furnish the complete installation or any part of the equipment as desired.

WRITE FOR PROFITABLE AMPLION PROPOSITION TO COMPETENT ENGINEERS.

Amplion Corp. of America
133 W. 21st St. New York

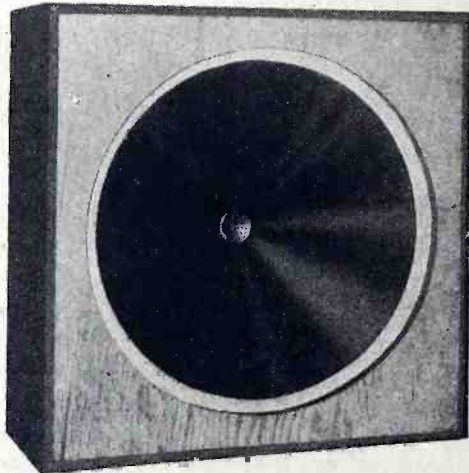
Semi-Dynamic in Kit Forum

By E. W. WEBB

An attempt has been made in a new speaker, recently introduced, to combine in one, the several advantages of the three principal loud speakers, that is, the horn, the cone and the dynamic. It has been fairly demonstrated that each has meritorious features, hence a combination should prove interesting.

In the semi-dynamic speaker shown herewith, a cone approximately 13 inches in diameter (a purely arbitrary size chosen as a happy medium) is used. This cone is made of a material that is aperiodic. In other words it has fundamental tone of its own. The cone is shallow and fitted at its outer edge with a chamois baffle, which in turn is rigidly attached to a baffle board of ply wood. The baffle board is then fitted to a box about 17 inches square and approximately 7 inches deep. The drive unit is mounted inside the box and attached to the outer apex of the cone.

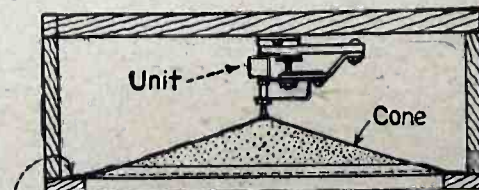
The unit used for the speaker operates on the direct drive principle. A secondary armature of aluminum is used to dampen the action of the main vibrating armature or pole piece. The second armature (aluminum) is non-resonant and acts to bring the main armature to



Assembled speaker with front curtain removed.

a normal position after each impulse. In operation the impulse is transmitted to the cone apex and the cone moves with a piston action. The angle at the apex, the size of the diaphragm, its thickness, the size of the baffle, the depth of the chamber and its size have been worked out for maximum efficiency.

A section view of the speaker showing the various components is illustrated below. Note the position of the speaker unit, with respect to the diaphragm and cabinet. Note how a sound chamber is secured by means of the complete wood housing, entirely sealed.



Chamois glued to baffle board
~ SECTIONAL TOP VIEW ~

S M 720

(Continued from page 57)

mating equal amplification at the low frequencies. This result is secured in an individual manner, not by use of the unusually heavy core construction which has been found necessary in standard audio transformers if frequencies below 80 to 100 cycles are not to be very seriously weakened, but by a fixed condenser within the transformer case, of correct proportion to introduce a factor of resonance at predetermined frequencies which the heavy cores formerly were designed to preserve. Added to the fact that with the circuit used in these peculiar transformers, no direct current from the plate of the preceding tube is allowed to flow through the transformer winding—thus practically eliminating the well-known hysteretic distortion due to such D.C. components—these transformers also have an unusually high amplification factor, so that the performance of the audio system in a set of this type has usually proved a complete surprise to technical men who observe the somewhat diminutive transformer cases without a knowledge of the entirely distinctive construction employed within.

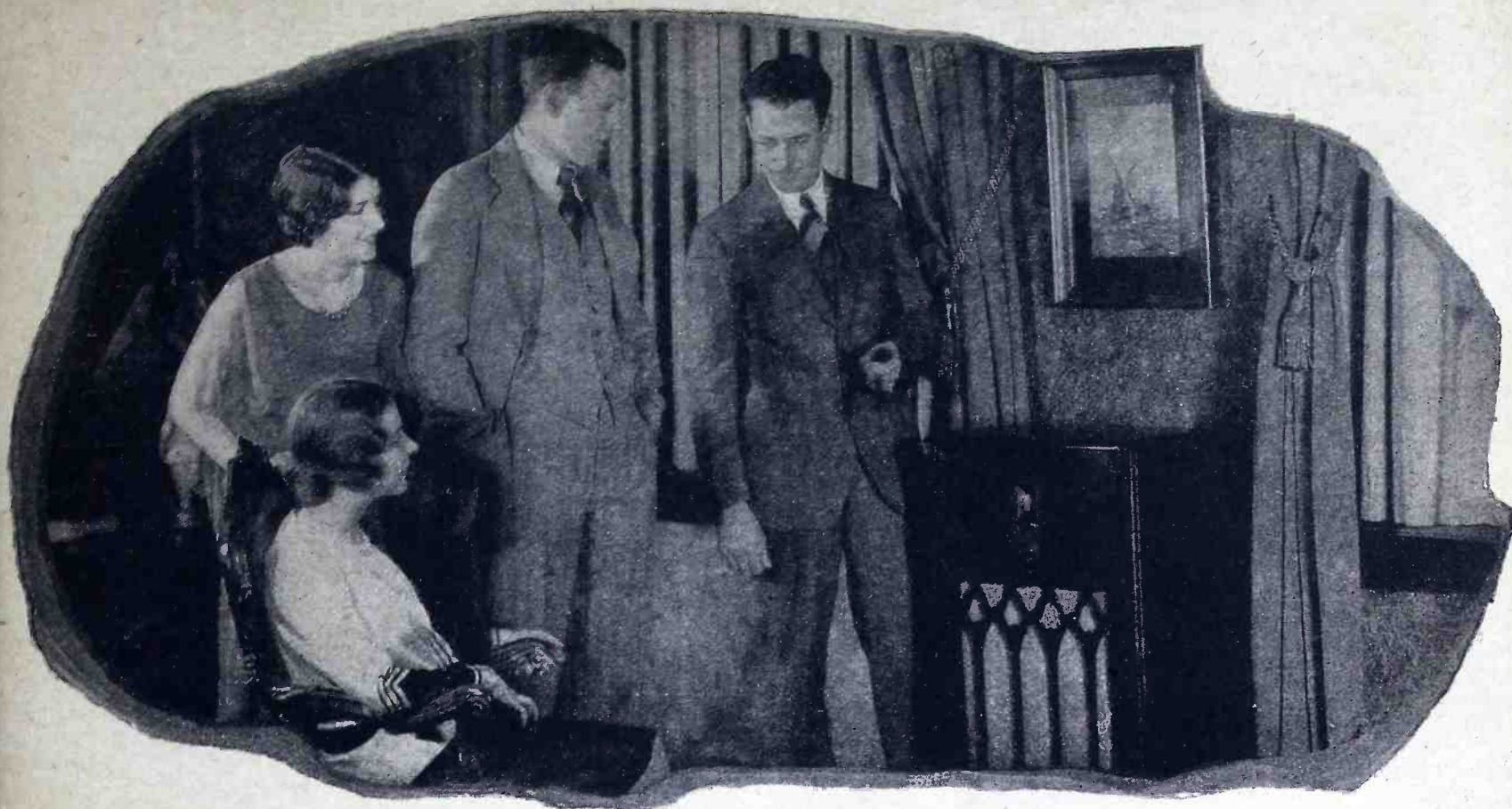
Sifting out unfounded claims, and adhering strictly to well authenticated statements, it appears that some almost unheard of feats of sensitivity and selectivity have been actually accomplished. There is, for example, the fact of the Screen-Grid Six which was built and installed in Union, New Jersey, described as being only a "couple of miles" from the transmitters of WOR and WJZ—the latter one of the most powerful in the world—with which loud speaker reception of KFI in Los Angeles was accomplished the first night after it was installed. 53 other stations, extending from coast to coast, in about four hours the second time the set was operated! All this without interference from the two powerful neighbors who were on the air during most of that time. Then there is the case of a battery dealer in West Palm Beach, Florida, who receives New York in broad daylight, as well as various other northern stations—all with loud speaker volume described as "terrific."

(Editor's Note:—This locality must be the Utopia of Radio.)

The Screen-Grid Six is likewise popular among naval men. One of its most interesting adventures, has been the installation of a group of six of these receivers aboard the U.S.S. California, as reported by the assistant Chief Radio Officer of that vessel, who described in the most glowing terms, the satisfaction the receivers have given to Uncle Sam's sailors by effectively cutting through the ship's many high-powered transmitters.

The photograph of the set shown in this article did not include the power supply which forms an integral part, electrically speaking, of every A.C. operated or so-called "all-electric" set. The power supply designed for use with the All-Electric A.C. Screen-Grid Six is of a new type, known as the S-M 669. It is designed, of course, to supply the exact plate voltage necessary to bring out the full rated power of the 245 output tube, and to supply the full amount of 2.25-2.5 volt filament potential required by the six tubes.

(Continued on page 101)



They Could Hardly Believe Their Own Ears - when I Switched to *Ground Wave Reception!*

"IT'S no use trying to listen in to-night," said Bill as I took his hat. "Jane and I tried to get reception during dinner but all we got was static. It's usually this way—just the night they broadcast Paul Whiteman's band or some other good program it's spoiled by howls and fading. Why own a radio at all?" he ended disgustedly.

"Perhaps my set will do a little better," I suggested. I had a surprise in store for him!

He looked doubtful as I turned on the set switch. I had left my old aerial antenna attached on purpose and soon the room was filled with an ear-splitting excuse for music. Manipulation of the dials only served to make it worse or to choke down reception until it was hardly audible. Occasionally it faded out altogether and I could picture the roof aerial swaying helplessly in the strong wind. Then the jumble and howls would start up again until my wife finally shouted above the din "Turn that thing off—it's terrible!"

Satisfied, I laughed and disconnecting the old aerial and ground wire, I then attached the lead-in wires of my new underground antenna, which I had installed just before dinner, "Now listen!" I commanded.

The Thrilling Test

As though by magic, the sweet high notes of

violins, the stirring sobbing of saxophones, the clear pure notes of a clarinet brought Bill to his feet! Jane looked dumbfounded. Even my wife, who had not paid much attention to my preliminary tests, was amazed. "What did you do to it?" she demanded. "I think he bewitched it," Jane accused. The music went on, clear and strong, with only a long moan or slight jumble now and then to remind us of the storm raging outside. The static was so greatly reduced that we hardly noticed it. The important thing was—we were getting one of the year's best programs with scarcely any trouble on a wild, stormy night.

"You see," I explained later to Bill,

"I buried my new underground aerial about two feet below the ground, where wind and storms can't affect it so easily. It has certainly been proved tonight that radio waves are just as strong in the ground as they are in the air. They call this thing 'Subwave-Aerial' and it's insulated some way to keep out interference and noise. It's combined with a scientific ground so I'm sure now that I have the correct ground connection. And all this isn't costing me any more than my old aerial antenna that I've nearly broken my neck repairing after wind storms like this. And last, but not least," I finished triumphantly, "I'll never need to touch it again. It's guaranteed for 25 years."

SUBWAVE-AERIAL GETS DX INSTALLED 50 FEET FROM 60,000 VOLT POWER LINE

Underground Aerial Products, Suite 618, St. Clair Bldg., St. Clair and Erie St., Chicago, Ill.

Gentlemen: Regarding a test with your underground aerial, "Subwave-Aerial." On January 27, 1929, Mr. Frank Smith and I drove out near the Sanitary District power plant in a Ford Sedan. We stopped about 50 feet distant from the plant's 60,000 volt transmission line and dug a small hole, into which we dropped the Subwave-Aerial. We left the two sets we brought with us in the sedan, attaching the lead-in wires of the Subwave-Aerial first to one, then the other. One set was a 5-tube Freshman—the other a single dial Atwater-Kent, Model 35. We used the Ford battery.

At 15 minutes to six we got WCCO, St. Paul, Minnesota. It came in loud and clear at 27 on the dial. There was not the slightest interference from the 60,000 volt power transmission line only 50 feet away. At 20 minutes after six, we got Toronto, first on one set and then the other. We plainly heard the program which was being sponsored by a Spartan Radio dealer. It was impossible to get reception at all with an overhead aerial under the same conditions.

Yours truly,
F. Bennett Smith,
Harry F. Jackson.

Hardly necessary to say that Bill went home with the name and address of the Subwave-Aerial manufacturers in his pocket.

Test It Yourself—Free!

The above story illustrates the results for which the designers of the Subwave-Aerial struggled for months. At last, enthusiastic reports such as this from Radio Experts reproduced here, proved that they had succeeded. Now you have a chance to prove the merits of this great new radio development for yourself. Try, if possible, to pick a night when static is bad and make the thrilling test. It's fun! And if you are not more than pleased with Subwave-Aerial, the test won't cost you a cent. We feel safe in saying, however, that once you've heard the amazing difference in reception and realize the wonderful convenience of this modern combined antenna and ground, you'll wonder how you ever put up with the old-fashioned, dangerous, inefficient methods. Be sure to send at once for all the interesting details on the development of Subwave-Aerial. It's the newest, most thrilling thing in the romantic world of radio! Use the coupon below. Fill it in and mail it NOW!



UNDERGROUND AERIAL PRODUCTS

Suite 618, St. Clair Bldg.
Dept. 585-C.W.,
St. Clair & Erie St.

Underground Aerial Products
Suite 618, St. Clair Bldg.
Dept. 585-C.W.
St. Clair & Erie Sts.,
Chicago, Ill.

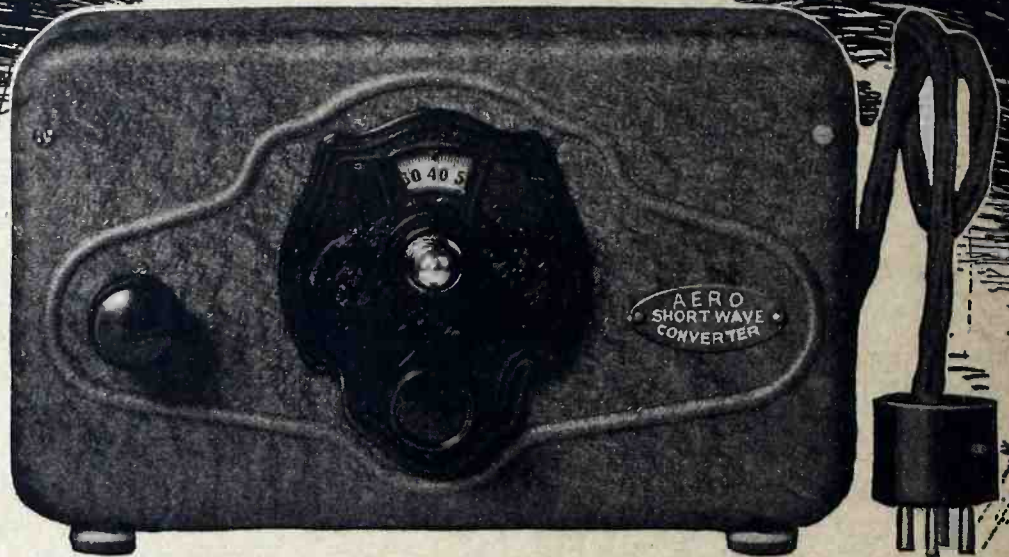
Rush illustrated literature on the new Subwave-Aerial and details of your Free Test Offer.

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City State

AERO SHORT-WAVE RECEIVER

GERMANY
FRANCE
HOLLAND
ENGLAND
AUSTRALIA
COSTA RICA
JAVA
NEW-ZEALAND

REACHES AROUND THE WORLD



NEW 1929 "AERO-CALL" Short Wave Converter

Factory-Built, Ready to Plug Into Your Present Radio Set

Illustration shows the new Aero 1929 Converter—a compact factory-built short-wave adapter equipped with special short-wave coils. It is designed for both A.C. and D.C. Sets. Operates perfectly on all sets without motorboating, by an auxiliary filter system control an exclusive feature (patent applied for). It can be plugged into any regular radio set. This amazing radio instrument now makes it possible for you to reach 'round the world—England, France, Germany, Holland, Australia, Panama, Spain, Java and many foreign stations are some that are tuned in regularly on short wave. Permits you to enjoy international programs and many others from coast-to-coast that your regular receiver cannot get. What a thrill it is to plug this into a tube socket on your regular set and instantly be in another world! No change or wiring required. All complete, ready to operate, tubes and coils hidden, no apparatus in sight, except the neat, golden-brown, compact metal cabinet in crackle finish. Size 9x5½x2½ in.

The only converter we know of that really works on all sets. Two models—A.C. and D.C. Order from your dealer now, or remit \$25.00 direct, giving dealer's name. Free booklet on request. Dealers and Jobbers write for literature and prices.

Model A, for A.C. Sets.....\$25.00
Model D, for D.C. sets.....

AERO SHORT WAVE KITS

The world is at your instant call with Aero Short-Wave Receivers and Transmitters. The thrill of getting the far-off places of the earth, expeditions, ships at sea, transcontinental airplane messages and hearing musical programs and code messages from foreign countries is something you will enjoy tremendously. It's something new, something different. You can get this with an Aero Short-Wave Receiver. Astound yourself and your friends. These amazing hidden sides of radio reception are unknown to many, but thousands of fans are getting a bigger "kick" out of radio by their use.

You don't know radio until you get a taste of real short-wave reception with an Aero Standard or International Receiver. Try it yourself—you'll be happily surprised. Order an Aero Kit today and you'll have a new interest and a new lease on life.

NEW 1929 AERO COILS

Since January 1st, 1929, many short-wave enthusiasts and "hams" have had difficulty in getting anywhere with their old sets. Aero was first to come out with new receiver and transmitter coils to meet the new conditions. The new 1929 Aero coil kits are now ready. Bring your old sets up to date. Get these new coils now and get everything that's in the air. The new Aero Listening Monitor is another 1929 product that is a necessity with "hams." Send for the new 1929 supplement and the Big Green Book. Don't miss out on these newest developments.

AERO PRODUCTS
INCORPORATED

Dept. 839, 4611 E. Ravenswood Ave., Chicago, Ill.

AERO Users Tune In on the World

List of foreign short-wave stations received by Richard H. Addison, 29 Armandine St., Boston 24, Mass., from October 1st to December 12th, 1928, using Aero Short Wave Coils.

5SW—Chelmsford, England; 5XX—Danvers, England; PCJJ—Eindhoven, Holland; PCLL—Kootwijk, Holland; CJRX—Winnipeg, Manitoba, Canada; 2ME—Sydney, Australia; 3LO—Melbourne, Australia; ANH—Bandoeng, Java; 9RH—Herida, Costa Rica; 1YB—Auckland, New Zealand, etc.

England, France, Germany, Holland and Australia!

List of foreign stations received by G. E. Morcroft, Jr., Bellevue, Pa., on set using Aero Coils:

5SW—England; PCLL and PCJJ—Holland; AFK—Germany; RW—Paris, France; ANH and ANE—Java; GBS—English Trans-Atlantic phone; 2ME—Sydney, Australia; 3LO—Melbourne, and 5CL—Adelaide, Australia, etc.

Gets South America and Honolulu

Under very unfavorable conditions, I have heard phone stations as far away as South America. Buenos Aires comes in great. I have had no trouble at all in getting KGU at Honolulu and PWX, Cuba. ARTHUR W. HOWARD, Boulder, Colo.

Gets Europe and South America

I desire to inform you that I have completed the Aero Short Wave Receiver and I am very well pleased with the results. I have already received European stations and South American stations, and practically every district in the United States, including Canada.

F. W. JACOBY, Cashier.

Hears "Big Ben" Strike in London

Have heard, so far, 5SW at Chelmsford, England, on 24 meters on March 21, 22 and 23, between six and seven o'clock E. S. T. I positively heard "Big Ben" striking twelve o'clock G. M. T. on these three nights.

HARRY MAYS.

6,000 Mile Musical Reception

All of the receivers I have built using your coils have been receiving musical programs from Eindhoven, Holland, on 30.2 meters and several times with loud speaker volume at four o'clock p. m., eastern standard time. I suppose that this reception distance is about 6,000 miles.

CHARLES WIGGINS,
Ancon, Canal Zone, Panama.

Aero Coils Are the "Berries"

Last night I got up at 2 a. m. and before the sun rose I logged 22 sixes, 5 BZ's, 2 F's, 3 A's, 2 Z's and several others whose call I mixed up or lost. All of these signals were on the 40 band and all were at least R4-5.

I really think your coils are the berries and all the boys that have seen the set are crazy about it.

Vy 73a es Cu agn.
2 AYJ (Bob Poucel, Op.)

England Every Afternoon

We have received your International Converter and we are well pleased with it. We get England every afternoon between 5 and 6 with a lot of volume.

MATHIS & BARKER.
Aero Coils on Byrd Expedition

Aero coils and parts are used in the short wave apparatus used by Commander Byrd on his Antarctic expedition.

Aero Products, Inc.,
4611 E. Ravenswood Ave., Dept. 839, Chicago.
Send me one of your new 1929 "Aero-Call" Short Wave Converter Boxes, ready to plug into my set. Enclosed is remittance for \$25.00.

Your Name
Street and Number
City State.....
State whether A.C. or D.C. Model is desired
Name and Address of Dealer or Jobber

Order Your AERO Products From Short-Wave Headquarters...

Barawik Always Has It In Stock!

BARAWIK was first to establish a special short-wave department for its customers, and today Barawik is known the world over as "short-wave headquarters."

If you haven't experimented with short-wave yet, now is a good time to begin. It is a most fascinating pastime—you get a real thrill out of communication with foreign countries and distant points not reached by regular radio receivers.

Ordering your Aero products by mail from Barawik assures you quick service, as we are located only a short distance from the Aero factory—and we keep complete stocks on hand. Our central location gives quicker service to every point—much quicker than you can get elsewhere.

Get your Aero factory-built coils, kits, converters, transmitters and parts here. You will be agreeably surprised at the fast service, extra free blueprints, instructions, etc., and the business-like manner in which your needs will be supplied.

New 1929 Coils, Transmitters, Etc. for the New S. W. Bands

On January 1st, 1929, the federal government put into effect a new policy regarding short-wave transmission and reception. The new 1929 Aero receiving and transmitting coils, for the 10, 20, 40, 60, 80 and 100-meter bands will bring your present equipment up to date. Get them from Barawik and keep your equipment modern.

You Save Money Here on Thousands of New Items

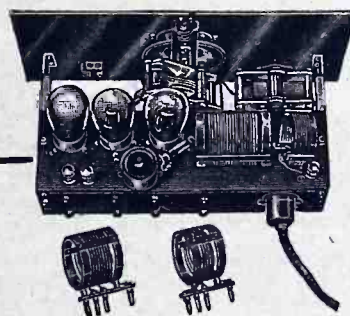
The Spring and Summer 1929 edition of Barawik's Big Radio Guide is crammed full of many new money-saving bargains that you will need constantly. Besides a full line of radio products, parts, accessories, kits, etc., you will find auto tires, tubes and accessories, electrical fixtures, lamps, appliances, wiring material, sporting goods, tennis, golf and baseball supplies, outing, camping and touring equipment, novelty furniture, portable radio sets and phonographs, radio-phonograph combinations, television supplies and household specialties, including vacuum cleaners, washing and sewing machines, electric massager-exercisers, electric stoves, flashlights, electric water supply systems, motors, electric fans, garden hose, spraying outfits and hundreds of items that are in everyday need in most homes.

If you haven't received your copy of this money-saving book yet, write for it today. Use the handy coupon below now! Free to readers of the Radio Listeners' Guide and Call Book.



Aero International Short Wave Receiver

This is the first short wave receiver designed exclusively for the reception of broadcast on low waves. Broadcast reception on short waves is remarkably clear and free from static. Programs come in from greater distances with the utmost simplicity of control. Complete kit includes everything necessary to assemble the set. Aero Kit No. 8—List Price.....\$55.30



Aero Standard Short Wave Receiver

This three-tube short wave receiver utilizes a circuit which has been proven by years of excellent results in the hands of amateur operators. The audio transformers are of the same type as are used in broadcasting stations, assuring excellent tone quality even when receiving programs from a great distance. Aero Kit No. 10 for A. C. Tubes—List Price.....\$49.95
Aero Kit No. 11 for D. C. Tubes—List Price..... 49.95

The Barawik Co.

43-E Canal Station,
Chicago, Ill.

BARAWIK CO., 43-E Canal Station, Chicago, Ill.

Dear Sirs:

Please send me your Big Bargain Book showing the Aero Products line and the many bargains in radio goods, sporting goods and the new lines for 1929 that you advertise.

Name
Address
City State.....

The Radio Business Needs Trained Men

Get into it now and make big money!

Radio today offers an assured future to the young man who turns to it as a career. And because radio development has been put on a firm basis, the demand for trained men is stronger than ever.

There is probably no industry in the world where advancement will come faster than to the man who combines executive ability with a sound technical knowledge of the science of radio. In every branch of the business it is the same—designing, manufacturing, selling, servicing. The call is for men who know.

Get into radio now. Learn to install sets and service them, and build a business of your own. Or enter the industry as designer, engineer, operator, salesman, as you choose. All you need is training and there is no better way to secure it than the Radio Course of the International Correspondence Schools. Endorsed by radio experts and manufacturers, this course is complete and thorough—abreast of the latest radio developments.

I. C. S. radio graduates everywhere report increased salaries and better positions through this splendid training.

Mail the Coupon for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7874, Scranton, Penna.

Without cost or obligation, please tell me how I can qualify for the position or in the subject, before which I have marked an X:

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| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <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"/> Steam Engineering | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Pharmacy | |
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|---|--|
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Management | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Accountancy, incl'g C.P.A. | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> English |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Civil Service |
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FREE RADIO GUIDE

Radio has been changing so fast lately that it's hard to keep up with it. Barawik's Big Radio Guide will keep you posted on the newest wrinkles. Thousands of illustrations of sets, parts, new ideas. Big chance to save big money. Send for free copy now.

BARAWIK CO. 43-B Canal Sta. CHICAGO, U. S. A.

Mail This Coupon Now for Free Radio Guide

Name
Address

Amplifier Problems

(Continued from page 64)

Here we find that all enclosed chambers are not classified as enclosed rooms. Since the volume in cubic feet is the function of the height, width and depth, we have three factors to consider. However, we find that a ceiling height of 35 feet is the limit, employed in calculations. In other words if the height of the ceiling is greater than 35 feet, say 45 or 55 feet, it is considered as being the equivalent of open air, and the maximum height of 35 feet is employed in the formula. If however the ceiling height is less than 35 feet, the actual dimension is employed. As a concrete example, let us consider a reception hall with the following dimensions; 125 ft. x 25 ft. x 35 ft. or 328,125 cubic feet. With full realization that some readers will be able to apply the following mathematical data, we submit the formula employed for the determination of the amount of power required to fill a certain space, designated as volume.

$$\text{Watts} = \frac{\sqrt{.708}}{92.5}$$

where v = volume in cubic feet.

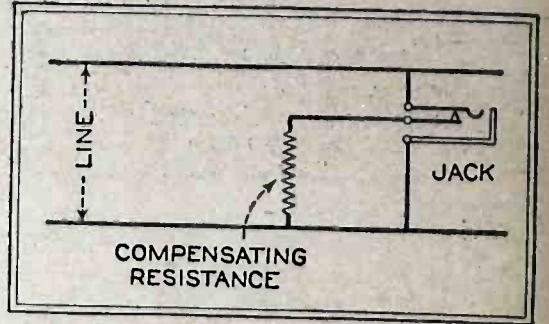
The choice of the amplifiers is made after one knows how much power is required. In this respect many radio installations used at home are ample to fill large auditoriums. A room of 100,000 cu. ft. requires .385 watts and a 300,000 cu. ft. room requires .8 watts. A 50% safety factor is usually allowed.

The coverage by the speakers is governed by the type of speaker and where the morning glory type of horn is employed, 40° is the angle of coverage. These speakers are arranged so that they shoot the sound in a certain direction, but always in the face of the listener.

CHANNELS

The wiring of the speakers presents an interesting problem. In view of the fact that in many instances all speakers are not operated at the same level, some means must be provided whereby each speaker or each group of speakers will be under control. The auto-transformer arrangement is shown herewith. The output stage is coupled to an auto-transformer tapped to supply various values of power output. The impedance of this trans-

former is designed to match the output impedance of the amplifier output transformer and the entire output impedance is designed to match the impedance presented by the speakers used. Where all speakers are operated at the same level, they are connected in parallel and the amplifier output circuit is designed to adapt the combined speaker impedance to the output stage of the audio amplifier. Experience has shown that each installation requires separate design of the output impedance, unless a variable impedance output transformer is available. In view of the fact that the impedance of the load is a varying factor, a specific frequency value is chosen and this is usually 500 cycles.

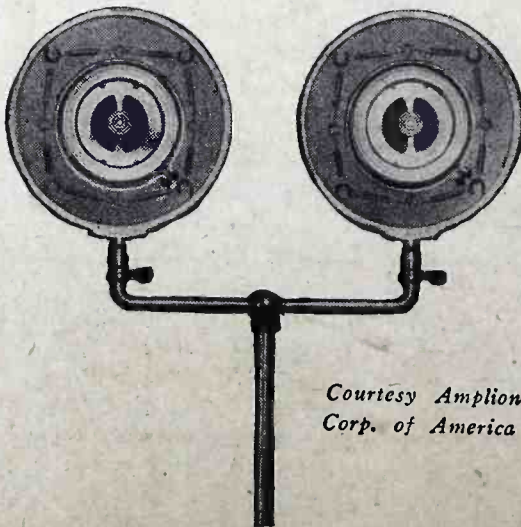


Outlet connection of jack and compensating resistance.

The length of circuit between the amplifier and the speakers is not limited to a short distance, one-half mile lines being satisfactorily executed. In the event that the existing conditions necessitate longer lines, small single stage booster amplifiers are added to the circuit. Parallel connection is invariably employed because it is always possible to design the correct impedances required to meet specific requirements. What has been said about loud speakers is applicable to head-sets, with respect to the parallel connection. If desired 500 head-sets may be connected in parallel and fed from a properly designed output system. A group of head-sets of this number may be arranged into two channels, in which case each channel is either fed from a different output system or joined at the amplifier. In certain cases, separate junction boxes are located on several floors of hotel installations involving several thousand head-sets.

Be it speakers or head-sets, each channel must be housed within its separate lead sheath, so as to eliminate cross talk and reaction. If the system is arranged to provide two programs, each program is carried on a separate channel and through its own lead sheaths. Each speaker or head-set channel should be equipped with a two wire circuit ungrounded, and the wires generally employed are No. 14 and No. 16 B & S.

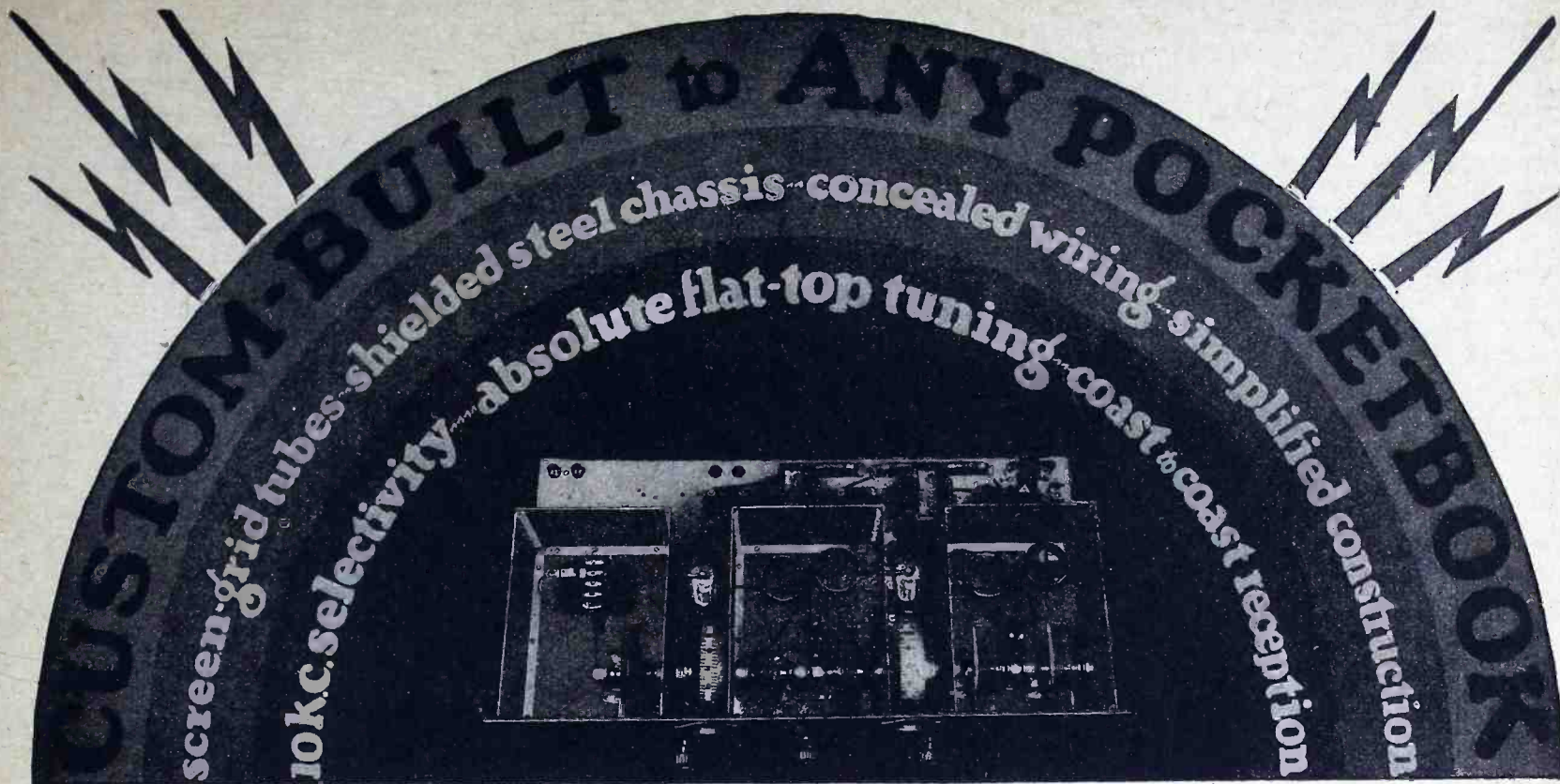
When arranged in parallel and provision is made for removal of any one or a number of speakers or head-sets from the circuit, it is necessary to provide compensating resistances, automatically placed into, and withdrawn from the channel when the speaker or head-set plug is removed from the jack or inserted into the jack. This arrangement is imperative



Courtesy Amplion Corp. of America

Double microphone arrangement.

(Continued on page 103)



THE 4 GREATEST RECEIVERS IN HI-Q HISTORY!

TO say that these four new Hi-Q Receivers are the greatest instruments ever produced in Hi-Q History is equivalent to saying that they are the most efficient, most selective, most sensitive and most beautifully toned radios in the world. A powerful, all-inclusive statement. But every professional RADIO-TRICIAN who has built one knows this statement is a fact.

For example, there is no receiver, to our knowledge, which employs the Band Pass Filter—an entirely new system used exclusively in the Master Hi-Q 29 models. This new development effects absolute flat-top *square cut-off* tuning for the first time in radio history. It assures positive 10 K. C. selectivity. Even in crowded areas it is impossible to tune in more than one program at a time. "Cross talk" cannot occur. Oscillation, buzzing, humming and background noises are totally eliminated. Stations don't simply "swish" in—they *snap* in, clear

and positive. Tone is practically identical with the original broadcast at the microphone!

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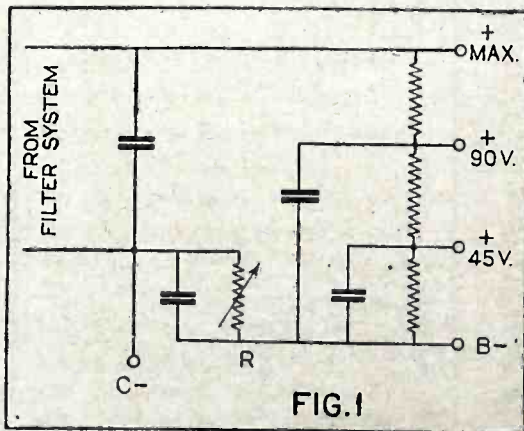
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Individual C Bias Resistances Preferred

THE casual observer seldom considers the possibilities of various electrical systems employed to produce identical results. Take as an example the C bias voltages obtained in electric receivers.

Two methods of obtaining C bias voltages in power circuits are available to the interested individual. One, is the common C bias resistor employed in the negative lead of the power B unit. The voltage drop across this resistance is due to the flow of the total eliminator current through the resistance. The other method consists of the use of a separate resistance in the filament plate circuit of the vacuum tube, so that the tube plate current flows through the resistance. The voltage drop across this resistance is applied to the grid of the tube as the negative grid bias. The former system is illustrated in figure 1 and the latter in figure 2. A comparison of the actions associated with these devices as they are shown illustrates the advantage of one system, the latter, wherein individual C bias resistances are employed in the filament-plate circuits of the tubes.

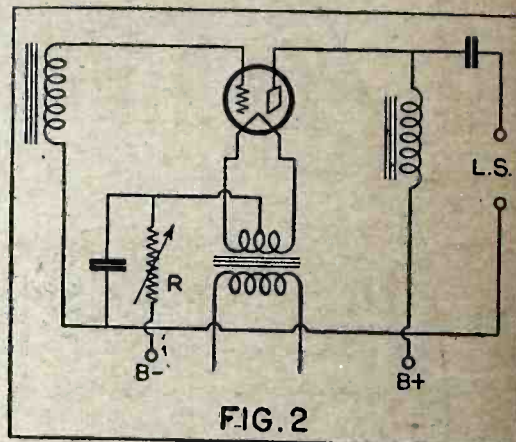
The load upon the power B unit influences the voltage output of the rectifying tube and consequently the voltage applied across the filter condensers. A study of the relative positions of these resistances shows that the C bias resistances in figure 1, are in a vulnerable position. If some unforeseen action takes place and the resistance supplying the C bias burns out and opens the circuit, the entire load upon the eliminator is removed and the voltage output of the rectifying system will increase to an abnormal value. Such conditions lead to but one effect, overload and rupture of the filter condensers. The disastrous effect of an opened load does not cease with the ruptured filter condenser or condensers as the case may be. The shorted filter condensers invariably cause the breakdown of the rectifying tube, rendering it unfit for further use.



Method of connecting C bias resistance in B eliminator.

The common C bias resistance being discussed is disliked for other additional reasons. The total eliminator B supply current is flowing through this resistance and thereby producing a certain grid bias voltage which is applied to one or more of the tubes in the receiver. Since the resistance value of the resistor is fixed, any variation in plate current flow in the plate circuit of the tube will

cause a variation in the value of grid bias. This is to be avoided unless the plate current variation takes place in the plate circuit of the tube or tubes connected to the grid bias resistance. If this resistance supplies other tubes, every variation in plate current will alter the grid bias potential applied to the other tubes in the receiver.



Individual C bias resistance arrangement.

If we now consider the case of the C bias resistance as employed in figure 2, we find that its position is most advantageous. In the first place, possibility of breakdown of this resistance is reduced, since the plate current flow through the resistance is less than in the other case, to be exact, equal to the plate current of the associated tube. If the resistance opens, and the load of the tube is removed from the eliminator the entire load upon the power B unit has not been removed. The plate circuits of the other tubes are still connected, and sudden rise of voltage across the filter condensers is prevented. The individual C bias resistance functions as a stabilizing resistance, since the voltage drop across it increases with each increase in plate voltage or decreases in reverse manner. The variation in plate current for every variation in plate voltage causes a corresponding variation in current flow through this resistance and consequently a corresponding variation in grid bias voltage. The grid return in Fig. 2 should be connected to the B—terminal.

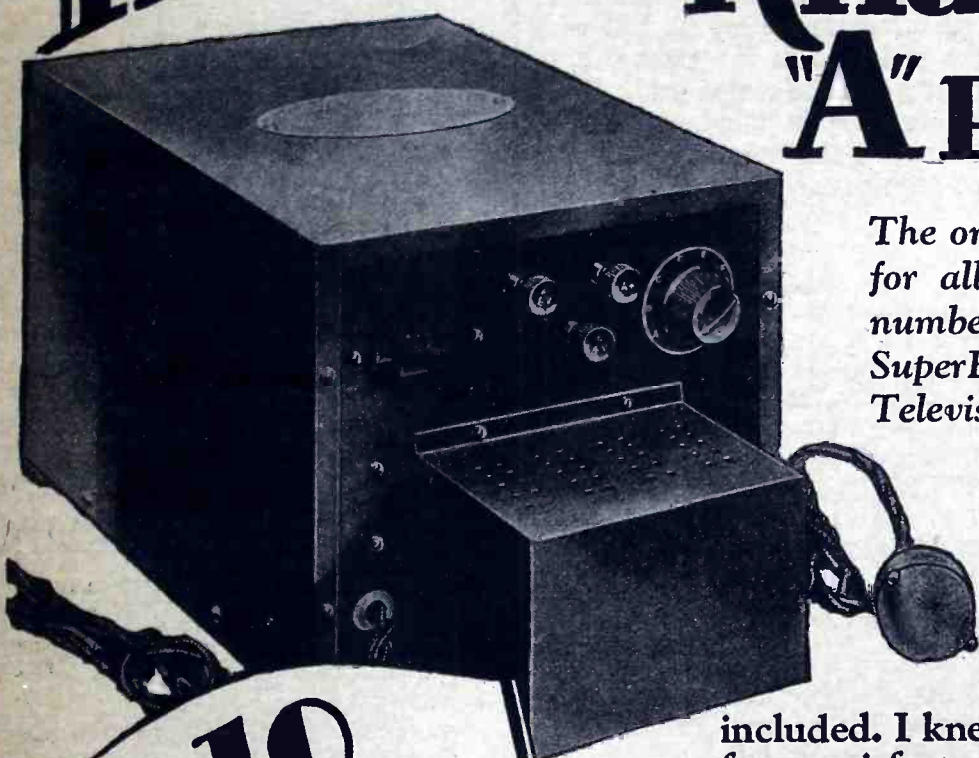
A Tester for "B" Power Units

(Continued from page 61)

capable of passing 20 milliamperes. The voltmeter plug should be insulated to avoid accidental shock during manipulation.

The plug insert is an old four prong tube base forced over an old broom handle furnished with a hole for the connecting wires. The insulation of the wires should be rubber covered in order to withstand the voltages involved. The switches should remain open until measurements are to be made, and personal contact with associated circuits should be avoided when the contact switches are closed.

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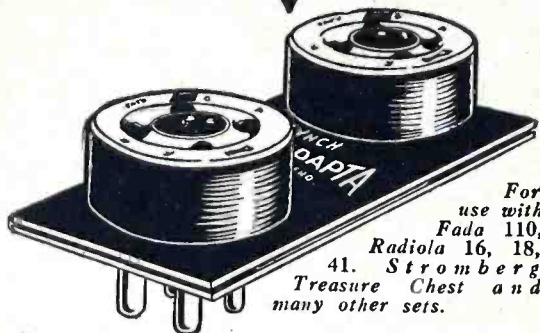
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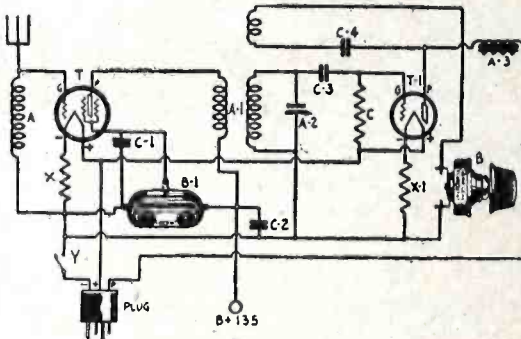
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Wiring diagram of short wave converter.

Our short-wave converter makes use of suitable coils, such as the National short-wave kit for screen-grid and regenerative detector. Tuning is accomplished by a single variable condenser. The point of departure is the stepless or micrometric variable resistance in the plate lead of the detector circuit. This serves to provide the much desired regeneration adjustment so essential for short-wave DX work. Many users of such short-wave kits and similar layouts have found marked improvement in their outfits by using a micrometric variable resistor for regeneration control.

A second point of departure is the adjustable voltage applied to the screen grid of the 222 tube. This is accomplished by means of a duplex clarostat, which also places a small bias on the control grid of the tube, as indicated in the diagram. This duplex resistor has screw adjustments, so that once set with a screwdriver, it may be left alone without the necessity of further tinkering.

A, National short-wave kit including front panel and sub-panel, all plug in coils "A-1", tuning condenser "A-2", choke "A-3". B, gridleak Clarostat. B-1, duplex Clarostat. C, Tobe 8 Meg. Tipon. C-1, Tobe bypass filter condenser 0.5 mfd. C-2, Tobe bypass filter condenser 0.5 mfd. C-3, Tobe .00025 vacuum condenser. C-4, Tobe .001 vacuum condenser. X, 622 Amperite. X-1, 1-A Amperite. Y, Yaxley switch.

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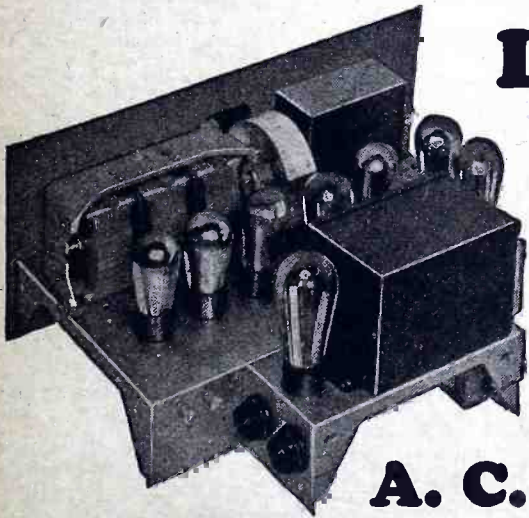


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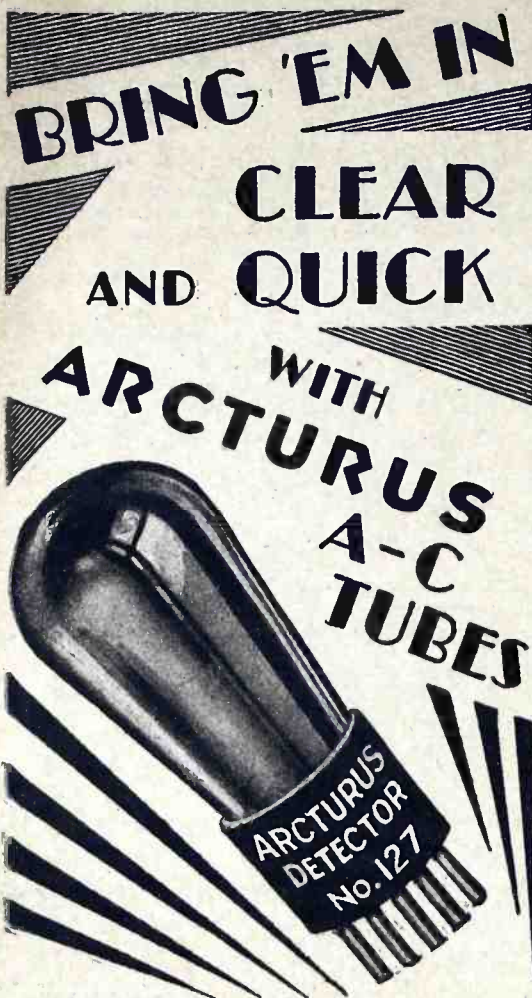
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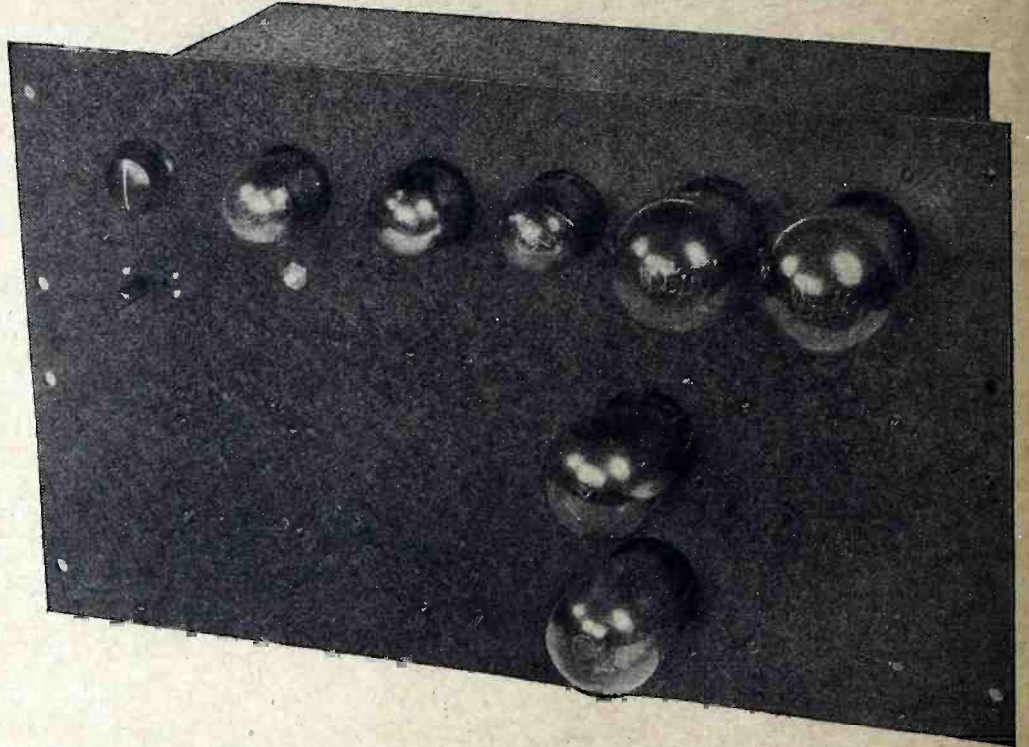
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S. M. 690

(Continued from page 65)

An analysis of the wiring diagram shows the scientific design of the complete amplifier and should be a guide to the individuals who are interested in the design and construction of such installations. A.C. operation of powerful amplifying systems necessitates consideration infinitely greater than that involved in D.C. systems. The elimination of the A.C. ripple or hum voltage is a difficult task. The same can be said with even greater emphasis about the elimination of the effect of mutual im-

of plate potential. The input transformer is designed for microphone, radio or phonograph pick-up, any one of which may be inserted by means of an anti-capacity cam switch. The volume control is a potential divider connected across the input secondary. The output system utilizes a center tap choke equipped with a series of output terminals, arranged in pairs for speaker connection with properly apportioned impedance relations. The volume control located directly above the switch is in reality a potentiometer with a tapered winding, so that pick-up from any one of the three sources used, can be smoothly "faded out" and another



An idea of the appearance of the complete amplifier may be secured from the above. Dust cover surrounds the entire unit.

pedance to be encountered in the rectifying systems supplying voltages to such powerful amplifiers. The minimization of regeneration is of exceptionally great interest because when present it alters the frequency characteristic of the system.

The design of the first stage is usually critical and this problem has been solved by the use of a cathode type A.C. tube with an individual grid bias resistance connected into the cathode circuit, as the means of securing the grid bias voltage. This arrangement provides a balanced state because the voltage developed across this resistance varies with the plate voltage applied. Filament balance is secured by means of a potentiometer connected across the heater circuit. The greater tendency towards voltage ripple in the 226 type of tube is counteracted by the use of a push-pull stage. Two such tubes connected in push-pull manner constitute the second stage of audio frequency amplification. Whatever advantages accrue from push-pull amplification, with respect to tube overloading and the ability to handle greater signal input are to be found in this stage.

What has been said about the intermediate stage is applicable to the first stage. Particular mention is made of the individual resistances employed to secure the grid bias voltages. The function of the "B" eliminator is purely as a source

"faded in." Skillful operation of this control and knob switch eliminates the sputtering sounds to be found in many installations utilizing phonograph pick-up with a double turn table, when pick-up is shifted from one record to another record. The coupling equipment is of the Clough type employed in all S-M amplifier units.

An examination of the filter system cannot help but prove enlightening to the individual interested in such appurtenances. A three section filter system is employed, the output of one section supplying the plate potential for the output tubes, the output of two sections supplying the plate potential for the intermediate stage and a filtering effect of three sections being applied to the plate potential fed to first stage of audio. The "B" eliminator utilized in the amplifier is not designed to supply plate voltage to the detector tube.

The entire unit is encased in a dust housing, which is attached to the front panel by means of screws. Viewed from the front, the only visible items are the various tubes, the gain control knob and the input selector switch. The upper row of tubes are the amplifying tubes, the single stage at the extreme left, the first push-pull stage tubes, the next two tubes in line and the output push-pull stage tubes are the two tubes on the right. The two tubes remaining are the two rectifiers arranged in full wave fashion.

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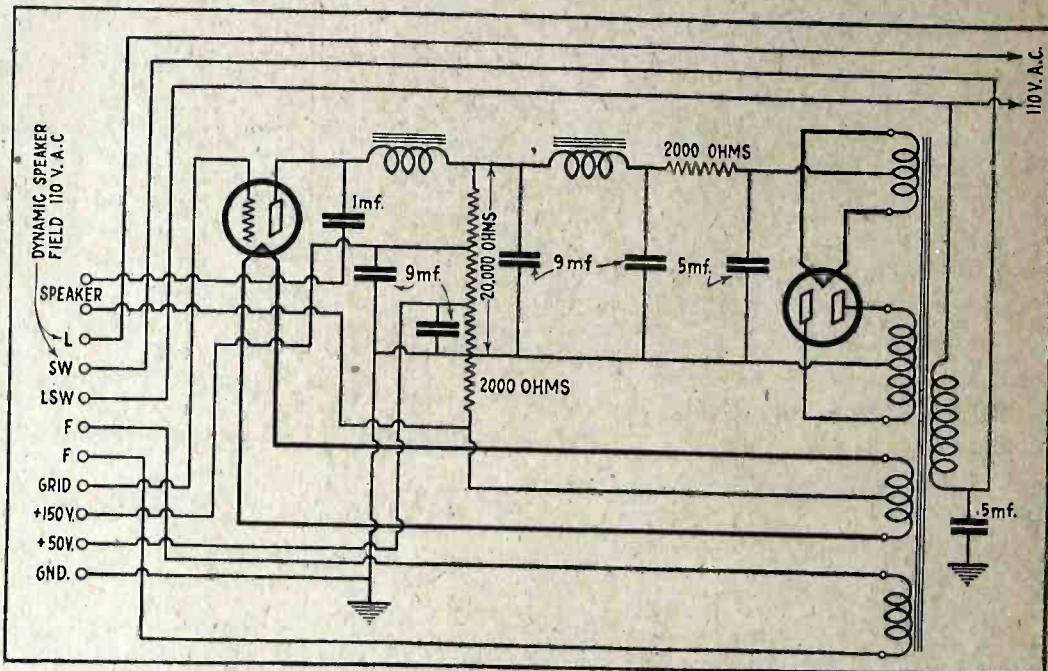
H. F. L. Special

(Continued from page 62)

by the plate voltage applied to the individual tubes. Any change in plate voltage causes a corresponding change in applied grid voltage since the plate current flows through the biasing resistance varies with the applied plate voltage.

The first detector is of the grid bias type and increases the selectivity factor of the antenna circuit. The oscillator is likewise biased in order to do away with, or at least minimize harmonics. The

plying tubes, the oscillator and one stage of audio frequency amplification. The position of these tubes is indicated in a separate illustration. The second stage of audio frequency amplification is the output power stage, a 250, located in the B power pack. The power plant supplies the A.C. voltage required for the various A.C. tubes in the receiver, and also the plate voltage for the 250. The power transformer contains four windings, one supplying the A. C. voltage for the plates of the single 280 full wave rectifier. Another supplies the filament voltage (5 volts) for the rectifier tube filament. A third supplies 7 volts for the filament

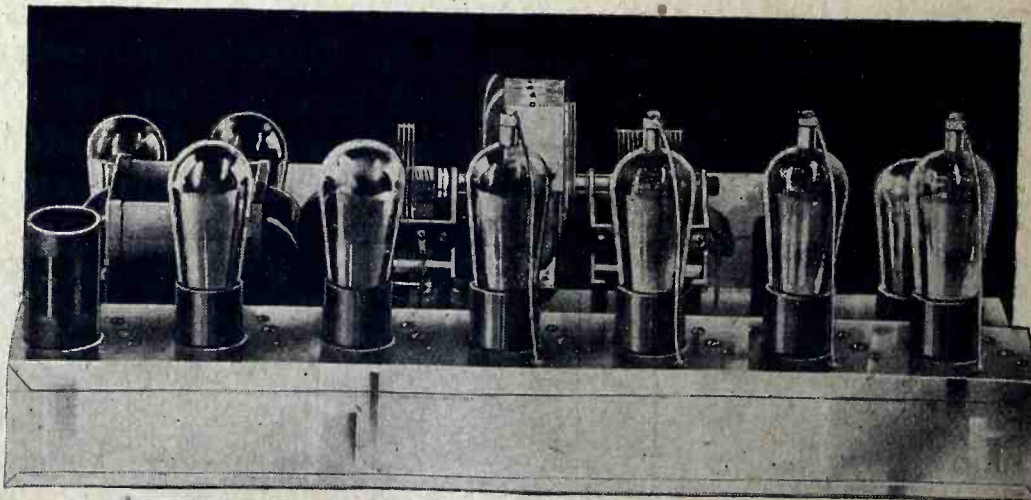


Wiring diagram of combination power amplifier and power supply. The rectifier is a 280 and the output power tube a 245 or a 250.

second detector is also of this type, that is utilizing a grid bias instead of a grid leak and detector. This system is preferred for the second detector because it permits full utility of the gain in the amplifier system preceding the detector and also provides tube characteristics excellently suited to the first audio coupling device. The fact that the sensitivity of a detector is reduced when a

of the 250 and the fourth supplies 2.25 volts for the tubes in the receiver.

A combination resistance-capacity inductance-capacity filter system is employed in the B power pack and the abundant use of capacity, 37 mfd., to be exact provides a humless eliminator. The unit is designed for a dynamic speaker such as the Muter or the Silver-Marshall, which are operated from the 110 volt A.C.



Rear view of complete receiver showing catacomb and mountings of tubes.

grid bias system is employed is counteracted by the high gain in the radio frequency and intermediate amplifier. Another advantage accruing from the use of the grid bias arrangement is that detector tube overloading is greatly minimized.

As is evident in the wiring diagram the receiver proper consists of the two detectors, the intermediate frequency am-

supply and are equipped with rectifiers and filters.

The method of securing grid bias voltage for the 250, by means of the grid bias resistance in the filament circuit rather than a common biasing resistance in the eliminator B minus lead, affords superior operation.

(Continued on page 107)

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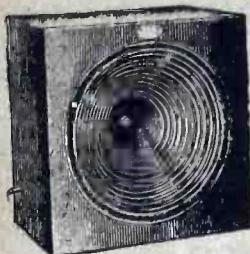
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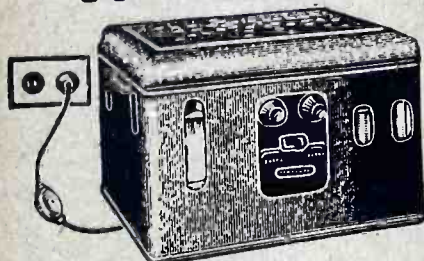
BIG CHIEF Magnetic SPEAKER



The very newest in design and construction. A most faithful reproducer with a full rich tone quality.

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Shipping weight 6 lbs.

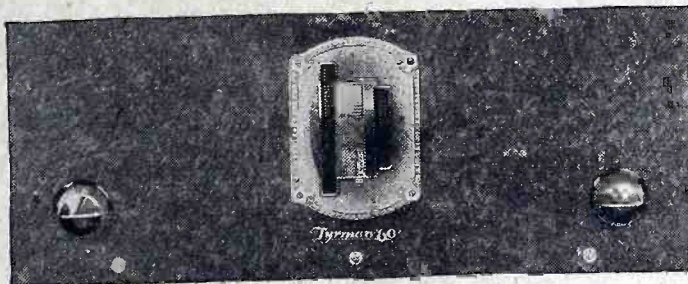
Willard "A" and "B" Combination Power Unit



The premier of all power units. Convenient, simple, and efficient. It is controlled automatically by the switch of your radio set. Just plug in your light socket. Regular list price \$77.50. Shipping weight 82 lbs. **\$29.95**

Tyrman 60

Custom-Bilt Shielded Grid



An Amazing Receiver At An Amazing Price

For battery or eliminator operation. Especially designed for Shield Grid tubes. The Tyrman "60" sets a new standard of comparison in performance and value in six-tube receivers. Panel is only 7x18 inches equipped with the Tyrman Single Vernier Drum Dial. Complete parts, factory packed, ready to assemble. Shipping weight 16 lbs.

Regular List Price \$69.50
Our Special Reduced Price

\$29.95

Now Ready



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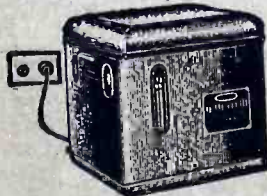
Set Builders and Dealers Save Money on Everything in Radio

HEADQUARTERS

Catalog also lists parts and kits for Tyrman, Carter, Tobe, Utah, Dresner, Hammerlund, Aero, Frost, Amertran, Thordarson and hundreds of others at rock bottom wholesale prices.

SM

WILLARD Standard "A" Power Unit



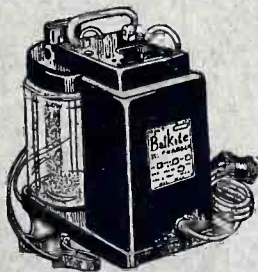
Charging current is supplied through a trickle charge of .7 amp. output. A relay switch is included as part of the unit where this feature is desired. With Relay. **\$10.00**
List Price \$35.00. Shipping weight 45 lbs.

Without Relay. **\$9.50**
List Price \$32.50. Our Net Price

SPECIAL ELECTRIC SOLDERING IRONS
(List Price \$2.50) Net Price **85c**
Shipping weight 2 lbs.

BALKITE "J" CHARGER

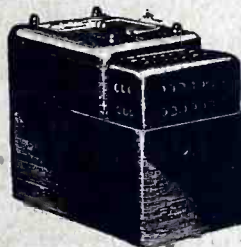
Big Reduction
List Price \$17.50



\$6.95

Trickle or Heavy Duty Use

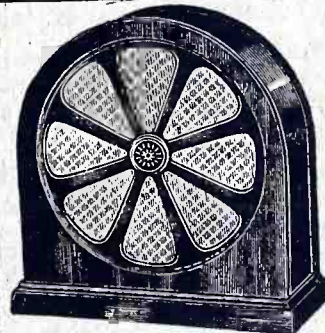
Noiseless charger for 4 or 6 volt "A" batteries. Shipping weight, 19 lbs.



4 Volt A. C. Abox Converter

It provides a steady 4-volt direct current for your set and with a "B" eliminator it transforms the set to A.C. electric operation. Works only when the set is in operation and does not store up current. Regular Price...\$27.50 Shipping weight, 15 lbs. **\$8.95**

6 VOLT ABOX
Regular Price \$35.00. Our Net Price...\$14.95
Shipping weight 25 lbs.



ORCHESTRION CONE

Enclosed in rich two-tone mahogany cabinet. Pure reproduction, marvelous tone, full and resonant. Sensitive to the faintest impulses. Has a full 12-inch diaphragm actuated by the Orchestrion cone unit. Designed to stand the heavy volume of power tubes and power amplifiers. List Price \$15.00. Our Net Price...\$4.65
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BAKELITE 3 Circuit TUNER

Not only makes your set better and different, but perform better. Mention for condenser desired. Shipping weight 1 lb. **98c**

Loud Speaker Tone FILTER
Place it between the loud speaker plug and the speaker itself will produce much better clarity of tone. Protects the speaker from burning out. List \$2.50. Shipping weight 2 lbs. NET... **\$1.50**

MICROPHONE Electric Cigar Lighter



For use with 110 Volt A.C. or D.C.

Here is the very latest in Electric Cigar Lighters; the Microphone Lighter is the most attractively designed and thoroughly dependable Lighter ever offered to the public. Made in miniature to conform to the exact appearance of the Radio Microphone used in all Broadcasting Stations, and equipped with a long life, quick heating coil.

For Home or Office

The radio fan, the man at home or in the office will find it a pleasure to have a Light with the Microphone. To the ultra modern women who smoke, the MICROPHONE LIGHTER will have an instant appeal. It will harmonize with any fittings, and is so convenient and so useful.

Price, \$4.50 Each

Finished in gold or chromium plate which will not tarnish and in Chinese colors of Red, Green and Blue. All parts of the MICROPHONE are of the very best materials, from the Bakelite attachment plug and silk cord, to the little button on the top—it is quality throughout. Six feet of cord with each Lighter provide ample length for nearly all installations. It is only necessary to plug in and Light up! In the event the heating element is damaged, the coil and its porcelain unscrew and are easily replaced.

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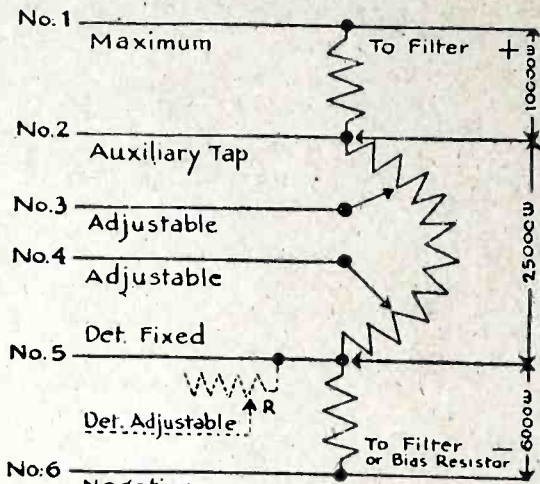
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YOUR OWN CORRESPONDENCE Stationery. Name and address on 125 DeLuxe letter-sheets and 125 envelopes, \$2.20 postpaid. Oberman Company, Box 1042, Chicago.

Voltage Divider

(Continued from page 73)

two adjustable levers. Provision is made for the insertion of a variable resistance which when applied makes possible a variable detector B voltage.



Wiring diagram of voltage divider.

The design of the unit is such that five positive voltages are available, three of which are fixed and two, variable, with provision to change one of the fixed into a variable. A separate terminal provides the B minus connection. Since this device supplies positive voltages, separate resistances must be employed to provide C bias voltages. The input terminals of the unit connects to the output of the eliminator filter or to the positive lead of the filter and the C bias resistance.

A calibration of the device is as follows:

Tap	Approximate Voltage
No. 1	Maximum 135 volts
No. 2	135 volts
No. 3	between 20 and 135 volts
No. 4	between 20 and 135 volts
No. 5	40 volts
*Det. Adj.	between 10 and 40 volts
No. 6	B negative

The resistance shown as "R" on the diagram has a resistance of 100,000 ohms, should be wire wound and capable of carrying 3 milliamperes.

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"THE BRAID SLIDES BACK"

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Type A for ARCTURUS type tube 5.00

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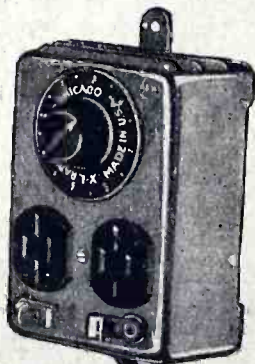
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100% Voltage Control PLUS 5 Exclusive Features

XL



List Price \$5.75

- 1 Double Socket Outlet for A.C. Set and Dynamic Speaker or for A and B Eliminators.
- 2 Antenna and ground connections.
- 3 Line Switch.
- 4 Fuse protection of entire set.
- 5 Perfect Link between your Set and light socket.

X-L Link

Eliminates all irregularity in line voltage—the bane of A.C. reception. With the X-L Link your tubes last full life and give maximum service because they are protected from the destructive effect of high voltage fluctuations which weaken or burn out the filament. Reception is smooth and clear without strain or distortion.

No complicated connections—one wire operates everything including ground and antenna. Perfect, unfailing control of line voltage surges that gives you full reception value. Install an X-L Link and note the difference in tube performance.

At your dealer or postpaid on receipt of price. Write for FREE folder.

XL

X-L RADIO LABORATORIES, Dept. E, 1224 Belmont Ave., Chicago

Also Manufacturers of X-L Variodensers and Push-Posts

S. M. 720 A. C.

(Continued from page 86)

The complete list of parts required for construction of the receiver proper is given herewith. The S-M 669 power supply is required in addition, and it is highly advisable to add an output transformer, unless the speaker to be used is equipped with an output transformer.

LIST OF PARTS

- 1 S-M 701 Universal pierced chassis.
- 1 S-M 809 dual control escutcheon, E.
- 1 S-M 806L (left) vernier drum dial, D.
- 1 S-M 806R (right) vernier drum dial.
- 1 S-M 320R .00035 mfd. Universal condenser, C1.
- 1 S-M 323 .00035 mfd. 3-gang condenser, C2, C3, C4.
- 1 S-M 342B .000075 mfd. midget condenser, C5.
- 3 S-M 638 copper stage shields, SH1, SH2, SH3.
- 1 S-M 140 antenna coil, L1.
- 3 S-M 132A plug-in R.F. transformers, L2, L3, L4.
- 8 S-M 512 5-prong tube sockets for R.F. coils L2, L3, L4 and S4, S5, S6, S7, S9.
- 1 S-M 511 tube socket, S8.
- 1 S-M 255 first stage A.F. transformer, T1.
- 1 S-M 256 second stage A.F. transformer, T2.
- 1 S-M 708 10 lead, 5-foot connection cable.
- 1 S-M 818 hook-up wire (25 ft. to carton).
- 1 Yaxley 53,000, 3,000 ohm midget potentiometer, R1.
- 2 Yaxley 420 insulated tip jacks, J1, J2.
- 1 Yaxley 1000 ohm resistor R2.
- 1 Carter A6, 6 ohm sub-base rheostat, R6.
- 1 Yaxley 1500 ohm resistor, R9.
- 1 Ohmite 1500 ohm resistor, R11.
- 2 Polymet 1 mfd. by-pass condensers, C6, C15.
- 6 Polymet 1/4 mfd. midget condensers, C7, C8, C9, C10, C11, C12.
- 1 Polymet .00015 mfd. grid condenser with clips, C13.
- 1 Polymet .002 mfd. by-pass condenser, C14.
- 1 Durham 2 megohm grid leak, R7.
- 1 Durham .15 megohm resistor with leads, R8.
- 1 S-M cushioned tube socket, S9.
- 3 X-L Binding Posts, BP1, BP2, BP3.
- Miscellaneous hardware.
- 1 Pkg. Acme celatsite hook-up wire.

Any speaker may be used, of construction sufficiently modern so that the low frequencies available in the audio system, will not be lost before being heard.

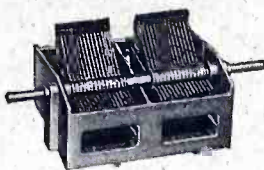
There is not a particle of doubt in the minds of listeners who have studied the two new types of tubes around which this set is built, that they will be a dominant factor if not the outstanding sensation of almost every quality receiver which leading factories will announce for 1930.

The builder of this receiver may feel that in every real sense he is "a year ahead."

Build a "HiQ-29" Receiver

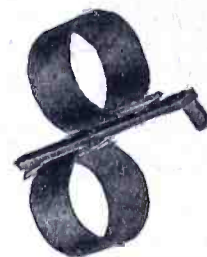
Use the Radio News Arrangement or Follow the Original,

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"Battleship" Multiple Condenser

The Radio News' Arrangement of the Master "HiQ-29" Receiver will appeal to many set builders. It employs the new Hammarlund "Battleship" Multiple Condenser and Push-Pull Audio Amplification.



Master "HiQ-29" Coils

Plan your Master "HiQ-29" either way —using the Radio News' arrangement or following the original specifications. You will be delighted with results beyond all former standards.



R. F. Choke Coil

The new "HiQ-29" receiver, with tuned band-pass filters, was designed for extraordinary performance and that is what it gives. Perfect selectivity, amazing volume and delightful tone.



Illuminated Drum Dial

[The coils, condensers, chokes, shields, drum dials and foundation unit are of Hammarlund design and manufacture — which means **QUALITY UNSURPASSED.**]

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Send 25c for "HiQ-29" Construction Manual. It gives all details.

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—All worth-
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Prepared by Eminent Short Wave Experts

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This is unquestionably the foremost book on short wave receivers and the theory of short wave reception ever written. The data which it contains is a compilation of the knowledge of an eminent board of Short Wave Experts.

As practically every one today knows, some of the finest programs are being broadcast over the short wave bands. There are many reasons for this. Paramount among them all is the fact that that entertainment, broadcast in this band, can be received over distances which with the ordinary broadcast receiver would be impossible! Thousands of letters, which pour in an unremitting stream into our offices tell the same tale—it is a common and everyday matter to receive programs

from all foreign countries, from the most distant climes. England, France, Germany, towns on the African continent, from every conceivable corner of the globe where a station is located—programs come in with surprising volume and clarity. One would think they were hearing a New York, Chicago or San Francisco station until the voice of the announcer, many thousands of miles away discloses the true location of station.

In the Short Wave Manual you will find complete diagrams, full size blueprints pasted into the book. These tell plainly how to construct all the short wave circuits which our tireless laboratory researches have shown to be most efficient.

The SHORT WAVE MANUAL contains complete information on everything concerning Short Wave reception. Large size book (same size as Radio News) with a beautiful colored cover. Replete with illustrations, diagrams and with FULL SIZE BLUE PRINTS. This big valuable book will show you how to receive all the foreign countries clearly and easily. Write today for your copy.

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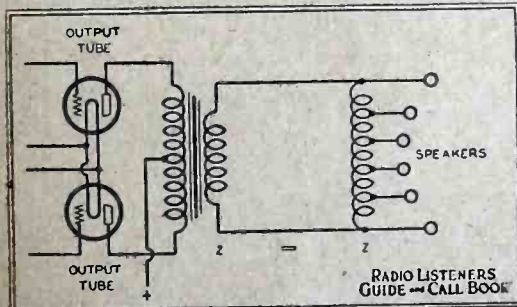
Amplifier Problems

in order to maintain the impedance balance at the correct value, and to secure best power transfer. Individual circuits are provided for the speakers and the head-sets because each channel is operated at a different power level. The size of wire is not the only important consideration associated with the wiring. The use of twisted instead of parallel cord is imperative in order to minimize capacity across the circuit, by virtue of the capacity between the leads. This capacity if present attenuates the upper audio causing a loss in "sibilance" manifest by the loss of the consonants "s", "f", "z". It also results in a hardness of speech and music, particularly the female voice and the music produced by a violin or viola, flutes, piccolos, etc.

Installations in homes for the aged, hospitals and other similar institutions are now prevalent and as an example of a modern installation we show the equipment in use on Welfare Island, New York, a charitable home for the aged. Six amplifiers are installed in the building designated as C.P. and speakers and head-sets are distributed throughout the other buildings. The grand total of reproducing equipment employed is 211 head-sets, distributed between the structures A1-C1 and B1-D1. 38 loud speakers of the cone type are distributed throughout the remainder of the buildings.

The equipment used at the controlling point, is shown in a photograph and provision is made for receiver, phonograph or microphone input. The receiver is a W.E. superheterodyne, loop operated. Potential for the tubes is secured from storage batteries, and the plate potential from rectifiers. Particular attention is focused upon the switches and the conduit cabling to the sources of potential.

The wiring between houses is of the exposed type, similar to the regular exposed telephone system, No. 14 B & S twisted pair. Reference to the layout of the structures upon the island shows the wiring, insofar as the leads to the various buildings are concerned. Switches are provided in each ward so that the service may be turned "on" or "off" without affecting the service elsewhere.



Outlet system employed in all Western Electric speech amplifier installations. Output of auto transformer connects to several switches which govern power passed to speakers.

Whatever the arrangement, that is, the number of outlets on the line, impedance ratio between the load and the output of the amplifier is maintained constant.

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WITH THE SKINDERVIKEN TRANSMITTER UNIT

Simple microphone unit provides a most effective and inexpensive way to satisfactory speaker operation. Easy to build and operate circuit.



Everybody can do this now with a Skinderviken Transmitter Unit.

The unit is fastened to the diaphragm of the speaker unit. It will act as a "microphonic relay." Every time an incoming signal actuates the diaphragm, the electrical resistance of the microphone unit will be varied correspondingly and the current from the battery, in series with it and the loud speaker, will fluctuate accordingly.

Thus the problem of securing sufficient power to actuate the loud speaker is simply and adequately solved.

The results from this very novel and simple unit will astound you.

The expense of this hook-up is trifling compared to the elaborate tube circuits that give no greater actuation of the speaker.

Besides this there are many other valuable uses in Radio Circuits for this marvelous little unit. Every builder of Radio sets should have a few on hand.

LISTENING THROUGH WALLS

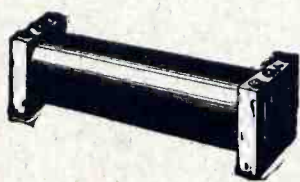
This Unit makes a highly sensitive detectaphone, the real thing—you listen through walls with ease. Plenty of fun and real detective work too.

CONDUCTING SOUND THROUGH WATER

Make yourself a miniature submarine signaling apparatus like those used during the war. Simple circuit with this microphone unit gives splendid results.

12-PAGE INSTRUCTION BOOKLET containing suggestions and diagrams for innumerable uses, furnished with each unit.

P. G. MICROPHONE TRANSFORMER



A Modulation Transformer specially designed for use with the Skinderviken Transmitter Unit. Has many other uses. Primary resistance, 1/2 ohm; secondary, 55 ohms. **\$2**

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...P. G. Microphone Transformers at \$2. When delivered I will pay the postman the cost of the items specified plus postage.

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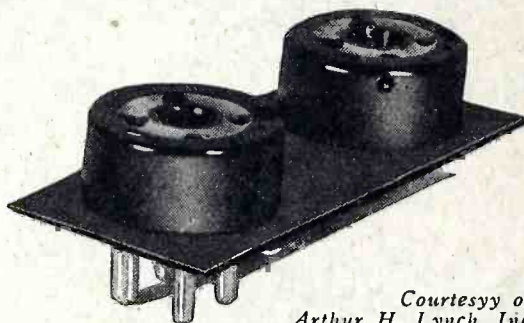
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Adaptor for Paralleling Tubes

OF special interest to the exponent of parallel audio output tubes is a new unit specifically developed for the purpose of expediting the use of audio output tubes in parallel by permitting the conversion of a single tube output stage into a parallel arrangement without recourse to any wiring changes.

This ingenious unit is illustrated here-with and is known as the Tubadapta. One of the essentials of good reproduction is satisfactory power transfer between the output stage and the speaker. This is particularly true with the magnetic or cone type of speaker, wherein the impedance of the entire combination constituting the load upon the output tube is a function of the applied frequency. Recognizing the importance of satisfactory



Courtesy of Arthur H. Lynch, Inc.

New adaptor for parallelling tubes.

energy transfer at low frequencies as essential to good quality, and also the optimum conditions for undistorted power output, a load impedance equal to twice the output impedance of the output tube, this manufacturer takes a step in the solution of this problem by arranging a paralleled stage, whereby the output impedance of the output stage is reduced to half the value found when a single tube is employed.

Ordinarily the changes necessary to convert a single tube output stage into a paralleled output stage would involve troublesome wiring changes in the receiver or power amplifier. The introduction and use of the device shown eliminates all wiring. The output stage is arranged for two tubes in parallel by simply removing the power tube from the last audio socket, inserting the converter unit into the last audio socket and placing the two power tubes into the sockets contained in the adaptor unit.

As is evident, the device consists of two sockets of the four prong type with the filaments connected in parallel, the grids connected in parallel and the plates connected in parallel. The device is adaptable for use with all types of power tubes, and constitutes a satisfactory and rapid method of paralleling output tubes.

ARCTURUS CHANGES NAME

The name of the Arcturus Radio Company of Newark, N. J., has been changed to the Arcturus Radio Tube Company. The change is merely a matter of policy and the same personnel continues to operate its five New Jersey A.C. tube plants.



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Aerovox condensers and resistors are conservatively rated and thoroughly tested. They are not the most expensive, nor the cheapest but they are the best that can be had at any price.

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Has an interesting proposition for custom set builders and service stations. Write now for details.

Browning-Drake Corporation
Cambridge, Mass.

(Continued from page 55)

Model 476 A. C. Milliammeters

Range Milliamperes	Total resistance in ohms
15	2000
25	520
50	120
100	21
250	4
500	1.1

Model 489 Portable D.C. Voltmeters

Resistance 125 ohms per volt
Also available in 1000 ohms per volt

Model 506 Panel A.C. Voltmeters

Resistance of voltmeters 125 ohms per volt.

Model 506 D.C. Milliammeters

Range Milliamperes	Approximate resistance in ohms
1.5	18
5	8.5
10	3.2
15	1.5
25	2
50	1
100	.5
200	.25
300	.16
500	.1

Model 517 A.C. Panel Voltmeters

Range Volts	Approximate ohms per volt
1.5	3
2	4
3	6
5	10
10	14
15	14
25	26
50	52
130	105
150	105
250	166
300	166

Model 517 A.C. Ammeters

Range Amperes	Resistance in ohms
1	.2030
2	.05
3	.024
5	.010
10	.0058
20	.00162
30	.00070
50	.00057

Model 528 A.C. Portable Voltmeters

Range Volts	Approximate total resistance in ohms
150-15	7810-781
300-150	31600-15800
600-300	100000-50000
*150-8-4	10000-80-40

Model 528 A.C. Ammeters

Range Amperes	Approximate total resistance in ohms
1	.2040
3	.0249
5	.0108
10	.0067
15	.0030
20	.0025
30	.0016
50	.0014

Model 528 A.C. Milliammeters

Range Milliamperes	Approximate total resistance in ohms
15	2000
25	520
50	120
100	21
250	4
500	1.1

* Supplied with pin tipped 30" flexible cables for plugging into connection jacks on instrument.

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Resistance 200 ohms per volt

Model B.V.500 D.C. Voltmeter

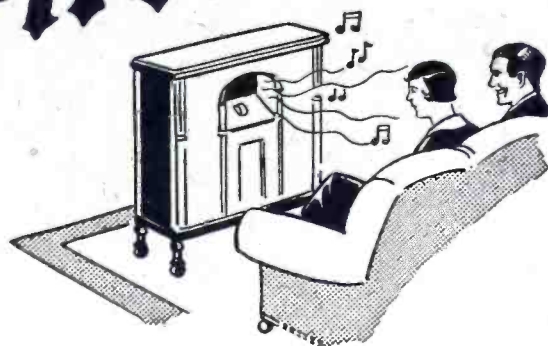
Model C.V.600 A.C. and D.C. Voltmeter

Resistance 100 ohms per volt

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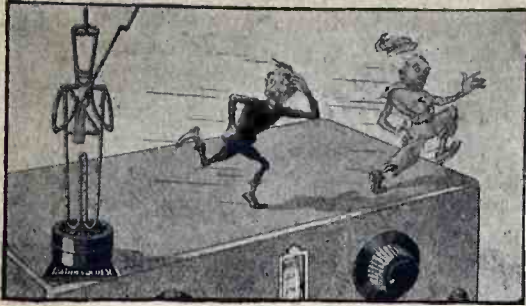
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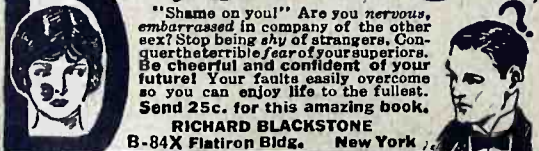


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Outfits

(Continued from page 53)

little red caboose behind the train sometimes affords a set. Trolley stations and bus terminals are more popular when there is something interesting to listen to besides the fat lady inquiring what car goes where. Nickel-in-the-slot-radio is capable of further development.

Power station men like to listen to radio while they watch the gauges, and a radio set built by a good mechanic who can talk with them about its "innards" is always more interesting than one that comes ready-made from a dealer. A community set builder who totes an outfit in to a lumber camp will never bring it out again unless all the men have eaten their wages' worth of candy, at the company store. Set builders have invaded the factory field and have proven that music increases the product of workers performing at a monotonous task.

There is scarcely any type of organization or institution that has not been supplied by some community set builder somewhere. And as long as the dealer in factory sets tends so strongly to standardization, and neglects to study the peculiar needs of individual institutions, there will continue to be good opportunities for set builders to place large installations that will include a number of receivers and many loud speakers.

Your own experiences in equipping institutions would be of interest, and you are invited to send them in.

New General Electric Development

SCIENTISTS in the laboratories of the General Electric Company have solved one of the most serious industrial problems, the choice of a cutting tool which will eliminate the need for diamond tools. Dr. Samuel L. Hoyt in charge of research announces the development of Carboly, a new product composed of tungsten carbide and cobalt, a combination which results in a cutting tool that is twice as hard as the hardest steel which can be made; compares as 2000 to 850 with the common hardened tool steel. It was the addition of cobalt to the tungsten carbide, however, which gave Carboly its needed strength, which was raised to more than half that of highspeed steel. An effective cutting tool for lathe work must possess a high degree of hardness, toughness, and tensile strength.

There are other interesting properties concerning this new tool substance which make it suitable for working almost any combination of materials or under almost any circumstances. It does not pit or tarnish, and such temperatures as are encountered in cutting metal at the speeds generally used have been observed to be harmless.

Some interesting results of tests bear witness to the performance of Carboly. Cobalt-chromium had given the best previous service in cutting the Bakelite fabric gears used in automobiles, but required redressing after every 150 parts machined. Carboly tools, operating under identical conditions, finished 11,000 parts before sharpening was required.

Ten Rules for the DX Fan

THE new wavelength allocations made by the Federal Radio Commission have cleared the air channels to an extent conducive to DX reception. Here are ten commandments for the DX fan as set by the Clarostat engineering staff.

1. Good reception begins with the interception of ample signal strength. Therefore, make sure of a good antenna and ground connection. Joints should be soldered, or at least taped. A suitable socket antenna plug will often prove more efficient than an antenna, particularly in poor radio localities. It may be employed as a "booster," in addition to the usual antenna.

2. Reception can be no better than the tubes employed. Tubes, contrary to general opinion, do not last forever. Even if they light, that is no indication of their goodness. When tubes have been in use more than a year, they should be replaced with fresh tubes. Only tubes of a reliable brand should be used. Cheap tubes are more expensive in the end.

3. Proper A, B and C voltages should be applied. In the case of batteries, this may be done by voltage taps. In the case of radio power units, this may be done by employing efficient variable resistors, in obtaining precise voltages for all purposes.

4. The grid leak in the detector circuit should be adjusted for best results. While the 2 megohm value may be satisfactory for powerful local signals, this resistance value is too low for weak DX signals. Either a collection of grid leaks of various values should be on hand, or a suitable variable grid leak should be employed if you would enjoy DX results.

5. Regeneration is essential to real DX results. It can be secured in various ways, for practically every radio-frequency circuit has some form of stabilizer to prevent regeneration, and this can be altered when in search of DX, so as to permit of regeneration or approach to maximum sensitivity.

6. A sensitive loud speaker should be employed, or, better still, a pair of headphones, plugged into the first audio stage. Many loud speakers today are relatively insensitive, because they are designed to operate on powerful local signals without blasting.

7. It is well to change tubes around, so as to obtain the best tube for each function in the radio set. There is sufficient variation in most tubes to make some better for one purpose than for another.

8. If troubled by excessive background noises or microphonic interference, the cause is generally traced to the detector tube, which should be changed.

9. By-pass condensers of 1 or 2 mfd., connected between minus B and the various plus B terminals of the radio set, will improve sensitivity and tone quality of weak signals.

10. And in the final analysis, DX is largely a matter of patience and skill.

H. F. L. Special

(Continued from page 98)

Laboratory measurements and experiments show a very high gain and a high degree of selectivity, indicating excellent balance of the tuning circuits. The response curves of the intermediate frequency transformers afford excellent 10 kilocycle band pass, thus increasing selectivity without impairing quality and at the same time minimizing external interference. Among other excellent receiving records is the reception of C.Z.E. located in Mexico City, P.W.X. Havana, Cuba., K.W.K.H. Shreveport, Louisiana and K.F.I. All of these stations were received with loud speaker volume during periods of local station operation. The tests were made in the heart of Chicago, employing short indoor aerials.

One significant feature pertaining to the whole installation is that the power amplifier A and B power pack is a separate unit and can be utilized in conjunction with any receiver. The filament output windings supply 14 amperes at 2.25 volts. Another item of interest is that the filament voltages applied to the tubes in the receiver are less than the maximum rating. The 2.25 volt filaments are operated at 2.1 volts, thus adding to the operating life of the filament.

The operation of oxide coating filament below normal temperature is permissible. This is in direct contrast to the requirements for tungsten coated filaments. The plate voltage applied to the 250 is less than 450 volts.


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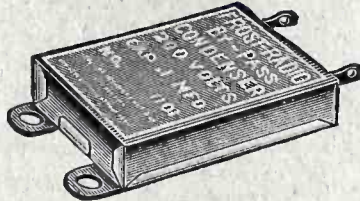
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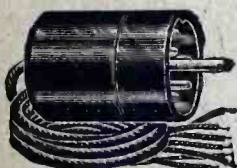
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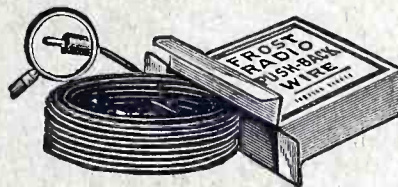
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How To Use A.C. Tubes

THE successful utility of the 226 and the 227 type of A.C. tube is governed by the degree of comprehension of the operating characteristics of these tubes. An understanding of the basic principles is conducive to successful application. The A.C. tube, while differing in few respects from its D.C. brother, possesses peculiar operating characteristics, which manifest a decided influence upon the performance of the tube when

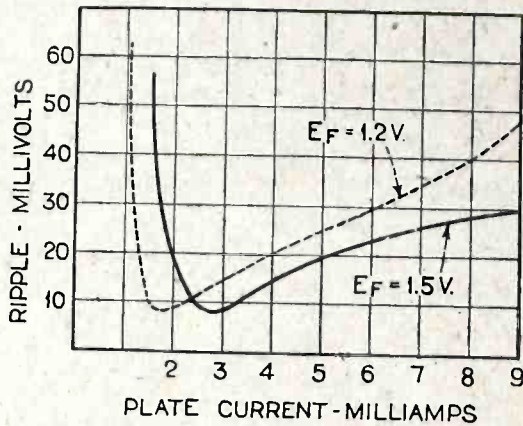


Fig. 1. These curves show how the voltage ripple in the 226 type of tube varies with plate current and filament voltage.

applied to a radio receiver. Comprehension of these characteristics constitutes the difference between success and failure. The 226 in particular, is possessed of queer operating requirements and fulfillment of these requisites is a long stride towards successful application and utility.

Let us consider the operating characteristics of the 226 and the 227.

	Plate Voltage	Grid Bias Volts	Plate Current Milliampères
226	90	6.	3.5
	135	9.	6.
	180	13.5	7.5
227	90	6.	3.
	135	9.	5.
	180	13.5	6.

If we now associate the information in this table with the data shown in figure 1, which curves indicate the voltage ripple, or "hum" present in the output circuit of the 226, during certain values of plate current, we can obtain a fair idea of the plate current limitations required for minimum ripple voltage or hum.

The plate current values are indicative of applied plate voltage and analysis of the data will show the limits of versatility of the 226. Experimental determinations of similar types of tubes, showed practically identical results, hence this information can be considered as applicable to all type 226 tubes. The solid line curve shows the ripple present when the applied filament voltage is of the rated value, 1.5 volts. The broken line curve shows the ripple present at a subnormal filament voltage of 1.2 volts. We observe from the solid line curve, that the

minimum ripple is present when the plate current is approximately 2.75 mils. We further note that as the plate current is decreased from this value, there is a definite and rapid increase in output ripple. We further note an increase in ripple, not as rapid as before, when the plate current of the tube is increased above 2.75 mils. We note a practically level state of output ripple for plate current values between 2.5 to 3 mils. Decreasing the plate current drain from 2.5 to 2 mils results in a ripple increase of approximately 125 percent. Increasing the plate current from 3 to 4 mils shows an increase in ripple of approximately 60 percent. Considering the ripple present in the output as a limiting factor, we observe a definitely limited band of plate current variation. A reduction of the filament voltage to 1.2 volts or to a subnormal value shows inferior operation and even a lower limit of plate current for minimum hum and inferior results for increase in plate current. An analysis of the two curves makes evident the fact, that the 226 tube will not perform satisfactorily as a detector tube because when so used, the plate current is low and the output ripple value very high.

The curve further shows that the applied plate voltage should be of such value as to cause a plate current flow between 2.5 and 3.5 milliampères with the correct grid bias. According to the table, we find that this value is limited in the upper extreme to 90 volts, with a probable minimum of 67 volts. We find in figure 1 and in the tabulation of plate current values that the 226 is not very satisfactory when more than 90 volts is applied to the plate. With 135 volts applied to the plate and the correct bias of 9 volts, the plate current drain is 6 mils, which value according to figure 1 results in the presence of 25 millivolts of ripple in the output. The value present

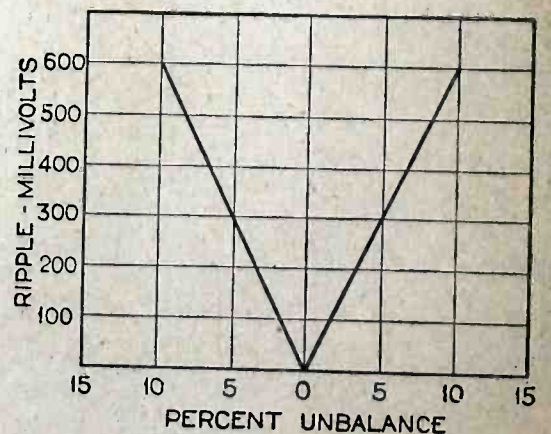


Fig. 2. Variation in output ripple with unbalance in filament circuit.

and amplified in a number of stages results in an annoying hum. With a normal value of filament voltage, the most satisfactory range of applied plate potential for the 226 lies between the limits of 67 and 90 volts. Excessive grid bias

A. C. Tubes

(Continued from page 108)

resulting in low plate current is to be avoided. Judging from the above, it is evident that the scope of operation of the 226 is limited to two positions in the receiver as a radio frequency amplifier and as an audio frequency amplifier. An

Electrical balance in the filament circuit of the 226 is likewise of importance. This balance is obtained by means of the transformer winding centre tap or the tapped filament shunt resistance. The effect of correct or incorrect filament balance is shown in Fig. 2. Mention of percent unbalance alludes to the position of the midtap on the winding or resistance with respect to the electrical balance of the entire tube filament circuit. A physical midtap in either case is not necessarily the electrical centre or 0 percent unbalance in figure 2.

resistance. We observe that the balance in the filament circuit of the 226 is critical, that a variation of approximately 2 percent either way increases the hum or ripple voltage present in the output approximately 400 percent. The harmful effect of a 5 or 10 percent unbalance is clearly evident, as is the vital importance of perfect balance, and the need for a variable centre tap filament shunt resistance.

As in the case of the filament type of A.C. tube the 227, the indirectly heated cathode type of tube makes use of a mid-tapped transformer winding or a mid-tapped shunt filament resistance. In direct contrast to the 226, the electrical balance of the filament circuit of the 227 tube is not very critical. The ripple characteristic for various conditions of electrical balance of the filament circuit of the 227 are shown in figure 3. A 15 percent unbalance produces an increase in output ripple entirely negligible in quantity.

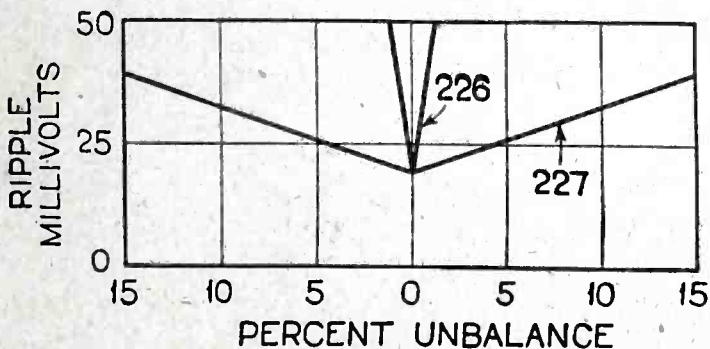


Fig. 3. Effect of filament unbalance with 226 and 227 type of tube.

The percent unbalance in the filament circuit is plotted against ripple voltage or "hum" in the output circuit. If a resistance is used, the percent unbalance designation signifies the setting of the tap on the above mentioned shunt filament

This means that variable centre tap shunt filament resistances are unnecessary for the 227 and that centre tapped filament windings and fixed centre tapped filament shunt resistances are satisfactory.

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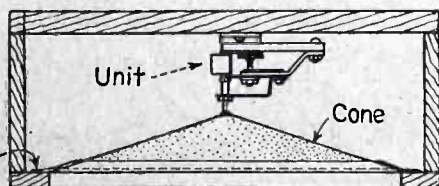
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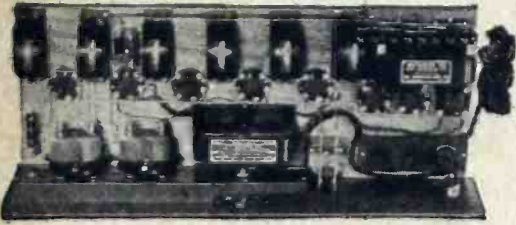
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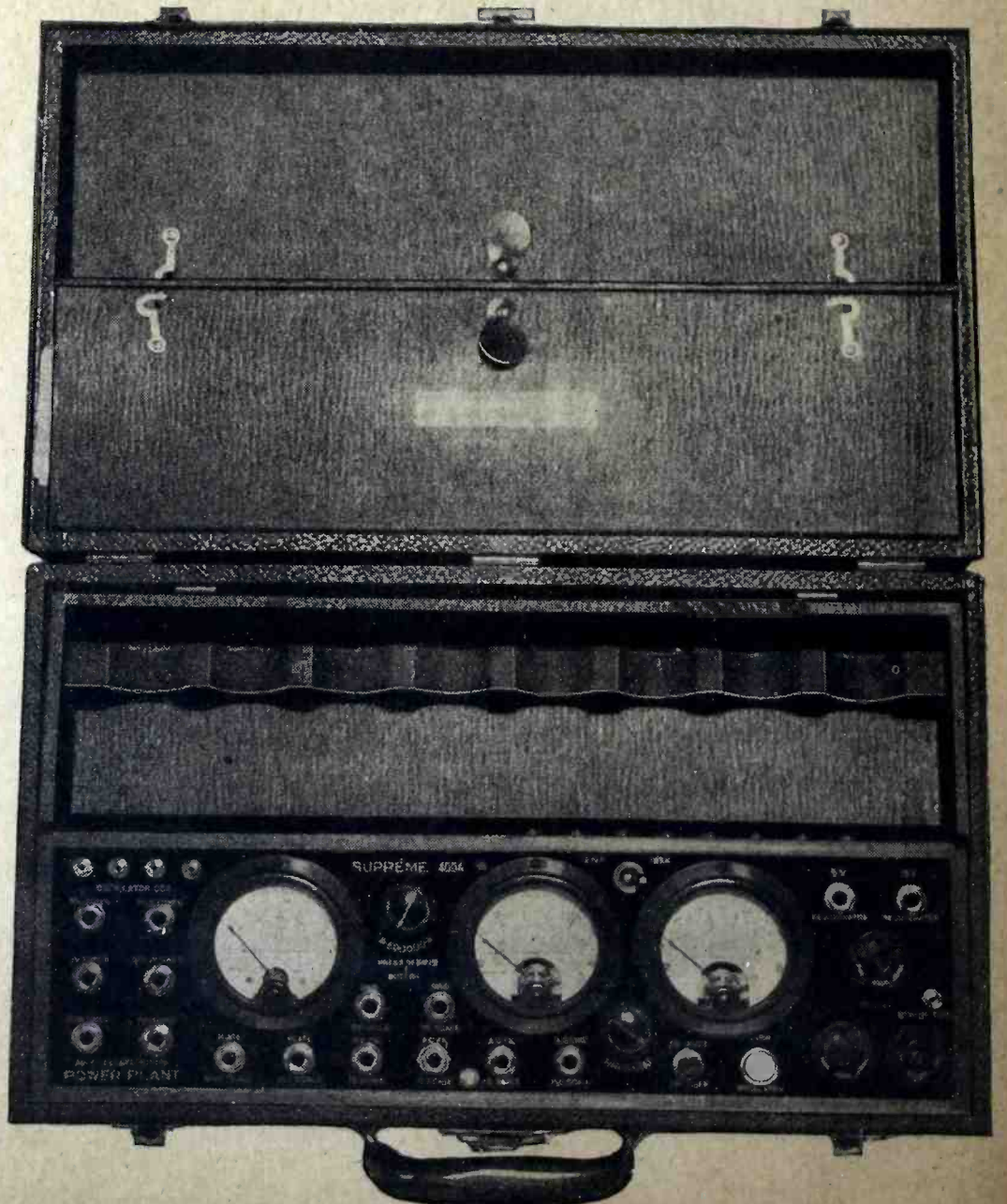
The demands made upon the service man of today are more numerous than of yesteryear. The types and styles of radio receivers have multiplied many-fold and more versatile detailed analysis of receiver troubles is necessary. Gone are the days when the service man called with a pair of pliers, solder and soldering iron. The visiting radio doctor of today is equipped to make every possible type of test to expedite his diagnosis. It is true that repairs in the home of the radio receiver owner are very limited, but analysis may be as extensive and as detailed as is necessary.

With the above in mind we show an extremely versatile testing unit. This piece of apparatus if we may call it that, has been developed specifically for the conscientious service man, visiting and in the shop. The three meters shown, by virtue of the multiple ranges, are the equivalent of eight individual indicating instruments. The meters illustrated below are a multi-range D.C. voltmeter with a 0-10-100-600 volt scale; an A.C. voltmeter with a 0-3-15-150 volt scale and a

D.C. milliammeter with 0-2.5-125 milli-ampere scale.

A series of tip-jacks are provided as a means of securing whatever testing arrangement may be desired. An assortment of cabled plugs, adaptors and inserts are also available. A step-down transformer operated from the 110 volt 60 cycle house supply is inserted for the purpose of supplying filament potential to A.C. tubes when testing with local supply. Another step-down transformer with variable output voltages is provided and is a part of the reactivating system.

A local source of modulated radio frequency energy is available in the form of an oscillator. This system finds application for resonance testing and neutralization of radio receivers being serviced and repaired. The gamut of tubes suitable for testing with the 400-A is extensive, including every commercial type with the exception of the gaseous rectifier. Means are provided whereby combinations of meters may be arranged in any fashion to meet whatever requirement may arise.



Model 400A complete set and tube tester.

Man-Made Static

(Continued from page 59)

a filter of superior design. As is evident the filter network employs a combination of inductance and capacity. The chokes are high inductance reactors with very low values of D.C. resistance. Laboratory experiments show that this type of filter is much more effective than the capacity filter, but its cost is greater.

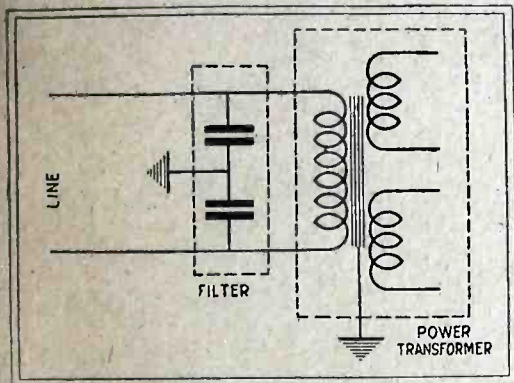
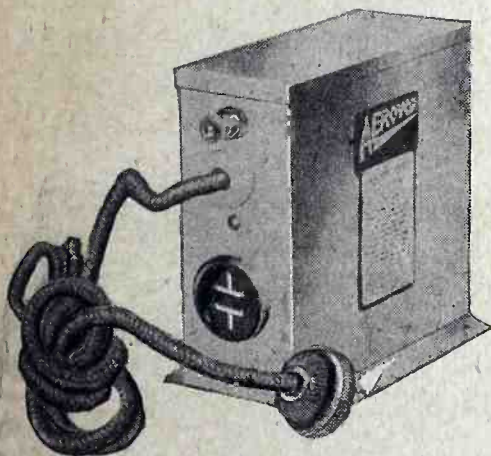


Fig. 5. Application of capacity filter.



Commercial type of capacity filter.

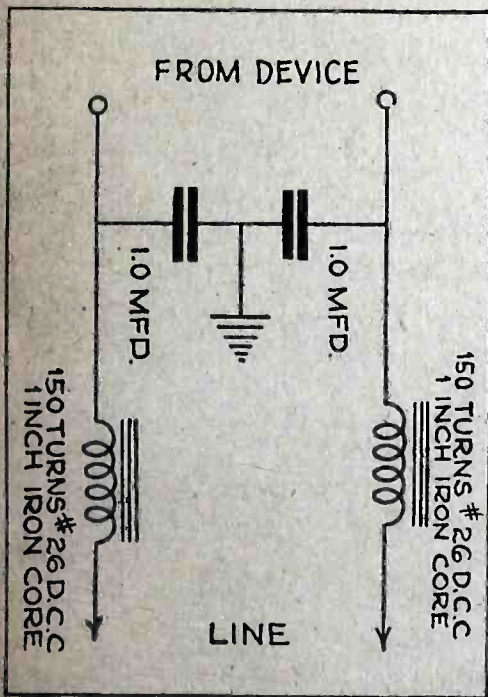


Fig. 6. Capacity-inductance filter network.

It is important to stress, again the point, that radio interference of the types enumerated above can be eliminated only where the interfering trouble is carried to one's radio set by means of the power supply lines themselves. In other words,

one must be careful to note whether such trouble is picked up by these lines or through the medium of the antenna circuit. Where the trouble is found to be radiated into space and then picked up through the antenna circuit it is apparent that such interference is of a nature directly equivalent to a radio signal and will, of course, be amplified, detected and finally sent through the audio amplifier system and the loud speaker. This type of trouble cannot be cured by any form of interference device located at the receiver end, since under these conditions the received radio signal would also become eliminated.



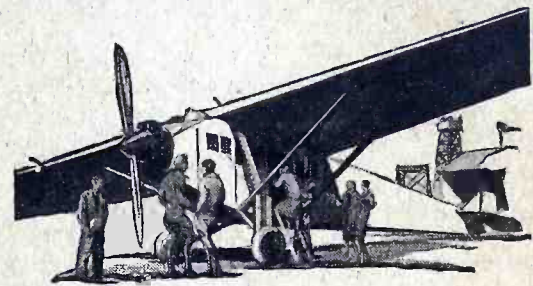
Commercial form of capacity-filter. Fuses are provided for circuit protection.

Interference caused by the following devices:

- X-Ray Machines
- Diathermic Machines
- All Other Electro-Therapeutic Machines
- Electric Flashers

cannot be eliminated at the receiving end, because this form of disturbance is induced into the aerial system. The disturbance created by the electro-medical devices is oft times sufficient to blanket an entire neighborhood, the interfering signal being sufficiently strong to completely mar reception over an area of two square miles. The most complicated filter is necessary for the minimization of this form of disturbance and its installation must be made at the source.

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WHOLESALE RADIO HEADQUARTERS



What's Next?

THOUSANDS of radio dealers, set builders, technicians and service men, who have been working at a steady pace throughout the fall and winter of the busiest radio season ever known, are beginning to wonder what to do this Spring and Summer. Working at top-speed through the busy radio season, our own organization some time ago, was confronted with the same situation.

Several years ago, however, the W. C. Braun Co., hit the bull's-eye when they started an experiment that effectively solved this problem happily by adding some new lines of goods to our stock—and the idea took so well with our customers, that today not only our own big force, but thousands of our customers and their employees are enjoying a steady, dependable, profitable business from January first through to the end of December, a business that keeps going every month of the year.

This idea has proved so successful that thousands of our customers are doing a big business now during spring and summer in portable radios and phonographs, auto tires and accessories, electrical appliances, camping and outing equipment, golf, tennis and baseball goods, bathing suits, household specialties and hundreds of items that are in daily demand and that sell the year 'round.

Don't think that your season is over just because *it used to be that way*. It isn't so any longer. Let Braun service point the way for your success, for constantly increasing sales for you, and for steady, day-by-day profits. Certainly you can do as well as so many others have done.

GIVE THIS NEW IDEA A TRIAL

Put our service to the test. Your trial order can be as small as you please. Our central location and our exceptional 12-hour service will keep you supplied as you need the goods, without stocking up for a season's supply in advance. You'll be surprised to see how little money it takes and how easy it is to do a thriving business.

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By all means send me free that Big Wholesale Buyers' Guide of yours in which you show the new 1929 ideas mentioned in your ad.

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Unquestionably~ the most complete Radio Testing Apparatus Ever Devised

THE SUPREME is sweeping the country by storm. Radiotricians and engineers everywhere are amazed at its performance, and its already long list of users are enthusiastically proclaiming its superiority. Truly an amazing instrument; it makes every test that can be made by all other testing devices combined and many that heretofore have not been available in any service instrument.

Complete Handy Carrying Case

The case containing the instrument was designed after careful study by practical radiotricians of many years' experience in radio service. Its arrangement is most complete and convenient—a proper place for every tool, accessory, part, and material that a service man might need; even a swinging tube shelf that affords absolute protection to tubes. A complete set of tools, from electric soldering iron to screw driver, is furnished, and of course, all necessary adapters and accessories. Everything the service man requires—all in one case. And still, due to ingenious design, this case is only 18x10½x7 in., and weighs complete only 25 pounds.

Send No Money

The SUPREME must sell itself to you on sheer merit and performance. We are willing to place it in your hands for actual use in your service work, and allow you to be the sole judge of its value. Fill out and sign the following request for six-day trial.

6-Day Trial

Date

Supreme Instruments Corporation,
316 Supreme Building,
Greenwood, Miss.

Please ship me one Model 400A SUPREME.

Upon delivery of the instrument, I will deposit with the express agent either the cash price of \$124.65 or \$38.50 cash and 10 trade acceptances (installment notes) for \$10 each, due monthly, at my option, subject to the following conditions:

It is agreed that the deposit made with the express agent shall be retained by him for six days. If within that time, after testing the instrument I am not entirely satisfied, I have the privilege of returning the instrument to the express agent in good condition, with the seal unbroken (see note below) and all tools and parts intact. Upon such return and upon the prepayment of return express charges, the deposit I have made with the express agent will be promptly returned to me.

Signed

Firm Name

Address

City State

Please send three or more trade references, including at least one bank, with this coupon.

NOTE: The seal on the panel of the instrument covers the master screw in the assembly. It is never necessary to disturb this, and it does not in any way prevent or restrict the use of the instrument. Factory guarantee ceases with disturbance of seal.

Three Weston Meters
Mounted in Bakelite cases.

1 Voltmeter, three scales of 0/10/100/600 1,000 ohms per volt.

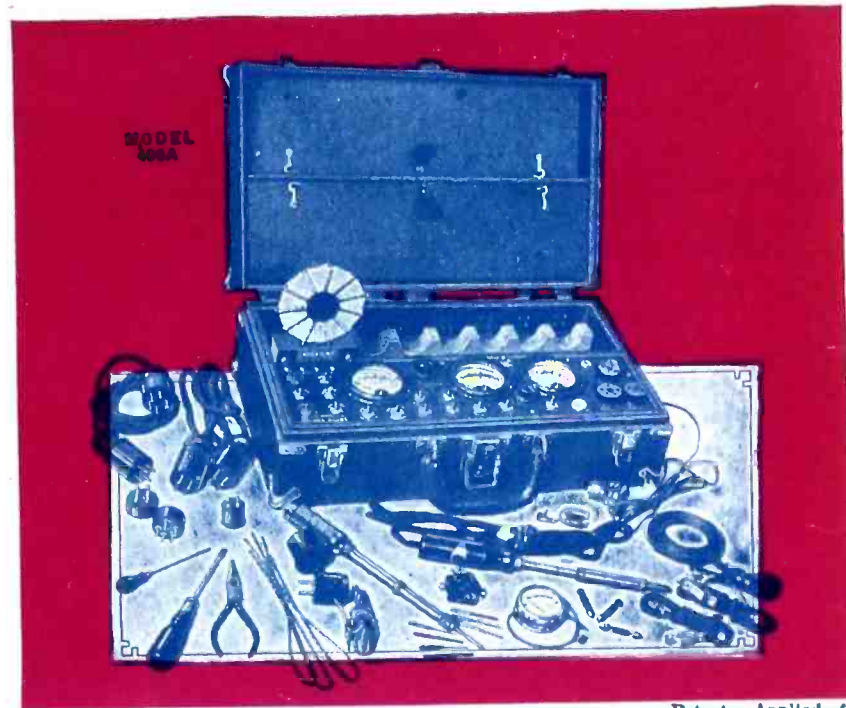
1 Milliammeter, of 125 mills and 2½ amps.

1 A.C. Voltmeter, three large scales of 0/3/15/150.

All instruments are manufactured for 110 volts and 60 cycles. Instruments for other voltages or frequencies can be furnished special at slight increase in price.

Prices and Terms

Under our time payment plan, the Model 400A SUPREME can be bought for \$38.50 cash and 10 trade acceptances (installment notes) for \$10 each, due monthly. Cash price, if preferred, \$124.65. All prices are net and do not carry dealers' discounts.



Patents Applied for

conceivable Makes every test on any Radio Set-

You have waited long and patiently for an instrument such as the SUPREME. It is now here—at your command for greater accuracy and thoroughness, bigger profits and satisfied customers.

Tubes, power units, loads, breakdowns, voltages, all instantly analyzed, peaking condensers, also modulated radiator. Everything you have ever hoped for is there, all contained in one compact instrument.

The only self-rectifying oscillation tester in existence.

The exact working conditions of any tube from 1½ to 15 volts, including screen grid, heater type, and rectifier tubes, are shown by meter readings; the only service instrument that shows output of rectifier tubes on meter.

The oscillation tests from alternating current are made possible by the exclusive self-rectifying SUPREME Power Plant. Every radio engineer and service man will appreciate this feature.

The SUPREME radiator sends out a modulated wave. Simply plug into A.C. line. No more wasting valuable time on broadcast stations; always at your service and finer adjustments assured.

Condensers can be balanced or synchronized—not by the former tedious methods—but with both meter reading and audible click. Easy and much more accurate.

All continuity tests can be made from socket on either A.C. or D.C. sets, with independent cathode readings.

The SUPREME heavy duty rejuvenator provides scientific method of rejuvenation of any thoriated filament tube. Will reactivate up to 12 tubes at one time without removal from set. Push a plug—the SUPREME does the rest.

The SUPREME will give direct reading of amplifying power of tubes and will show actual working condition of all tubes.

The SUPREME will play radios with open transformers and will give condenser, choke coil output, and capacity output on radios not wired for that purpose.

Access is provided to all apparatus through pin-jacks. Will test condensers for breakdown. Contains various fixed condensers from .001 to 2 mfd., a 30-ohm rheostat, a 500,000-ohm variable resistance, and an audio transformer, for instant use and various combinations.

It will give plate and filament voltage readings with or without load; will test voltage and current of all radios, including those using tubes such as 210 and 250. It will give grid circuit readings up to 100 volts; plate voltage readings up to 600 volts; will test output of trickle chargers, or any output up to 2½ amps.

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Radio Owners:
Look for this emblem in your radio shop or on the button or card carried by your service man. It is your guarantee of dependable service.



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Radio Diagonometer

FACTORY TO YOU—SAVE 50%—COMPARE WITH COSTLIEST OUTFITS BEFORE YOU BUY

Enjoy a powerful new Miraco ^{set or complete outfit} 30 DAYS FREE

AC Electric or Battery



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Built like, Looks like, Performs like a \$200 set

Marvelous new 3-year guaranteed, lighted 1-dial control. All metal Super Shielded Miraco set, removed from cabinet. Front switch, phonograph pick-up connection and all latest features. Built in power section on AC models.

The Latest, Finest and Costliest Construction

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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!

Richly designed, genuine walnut console of finest type. Electro-dynamic or magnetic power cone, or long air column speaker. Marvelous value.



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 silver-chrome finishes. Cathedral Electro-Dynamic or Magnetic-Power Speaker to match!

8 tube ^{one dial} Electric Lighted

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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

BIG DISCOUNTS
Exclusive Territory to User-Agents on **BATTERY OR AC ELECTRIC OUTFITS**

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!**

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With its rich, clear Cathedral tone,

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On the Miraco Unitone, to start with, will say: I got to date 61 stations outside of Chicago, from the Pacific Ocean to the Atlantic Ocean, and from Anchorage, Alaska, to the Gulf of Mexico, and I tried the set with 3 different antennas. That is an outside aerial 152 feet, an inside aerial 20 feet, and

cost 2 to 3 times as much!

Many thousands of Miracos—bought after 30 day home comparisons—are cutting through locals and getting coast to coast with the tone and power of costly sets, their delighted users report. Miracos 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.

light socket. I want to say that your set does outperform the other sets I have. I put it up against a World Record Super 9 and beat that one. Then I put it up against a (names expensive make), and beat that one. Next I put it up against a Neutrodyne and beat that one. HARRY KOPP, 6555 South Peoria Street, Chicago, Illinois.

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