

23 March - 1929

Seventh Anniversary Number!

LIST OF STATIONS BY FREQUENCIES!

RADIO

REG. U.S. PAT. OFF.

WORLD

The First and Only National Radio Weekly
365th Consecutive Issue—Eighth Year

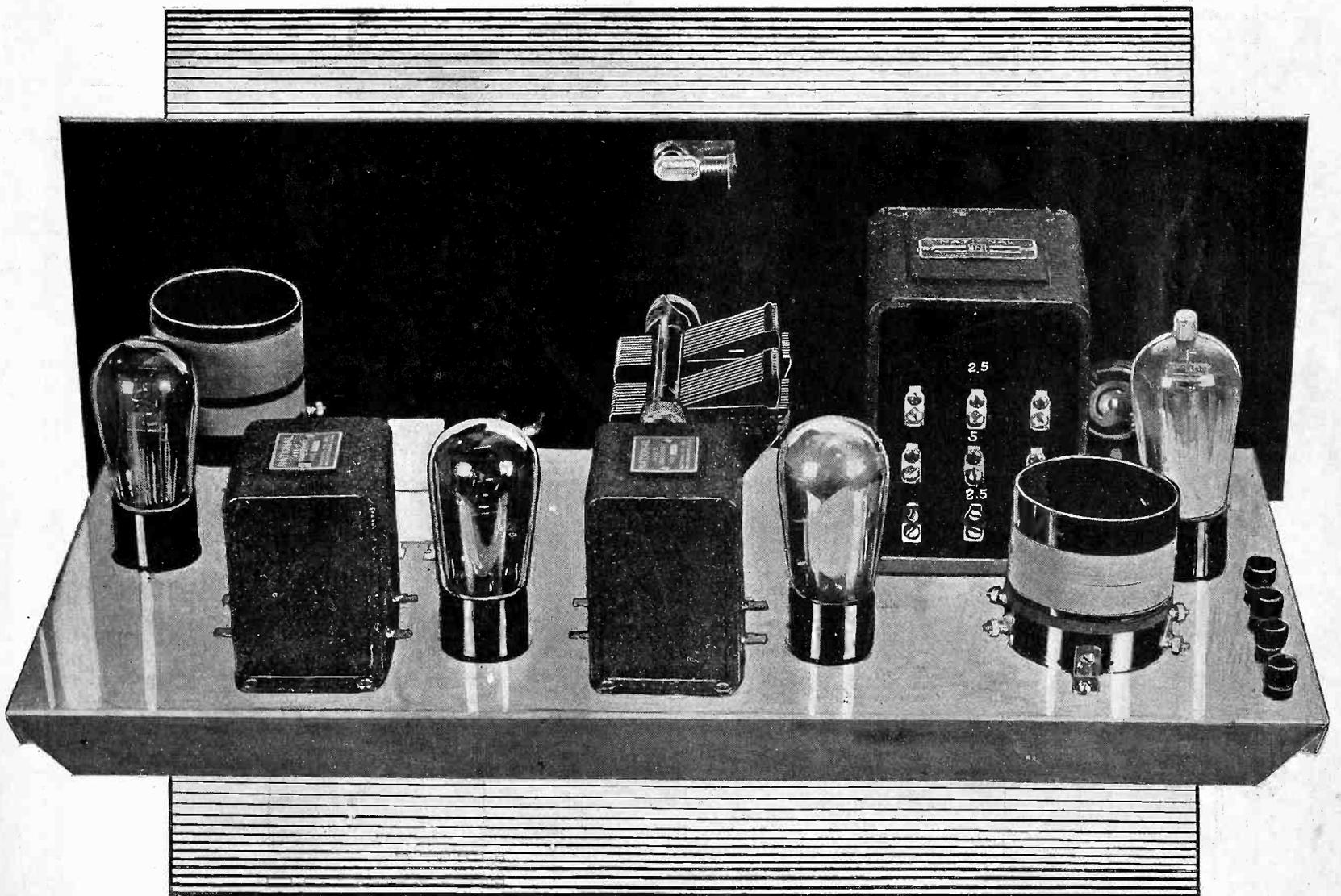
Which Tube Should
Follow Which?

Band Pass Filters

Clear Images 10" Square
in German Television

List of Licensed Manufacturers

AC SCREEN GRID DIAMOND



Rear View of the 4-Tube AC Screen Grid Diamond. See Pages 16 and 17

GREATER FREQUENCY RANGE FROM SHORT WAVE COILS

Moore-Daniels, 5 Tubes, Great for D X!

Crosley Tip-Top Musicone

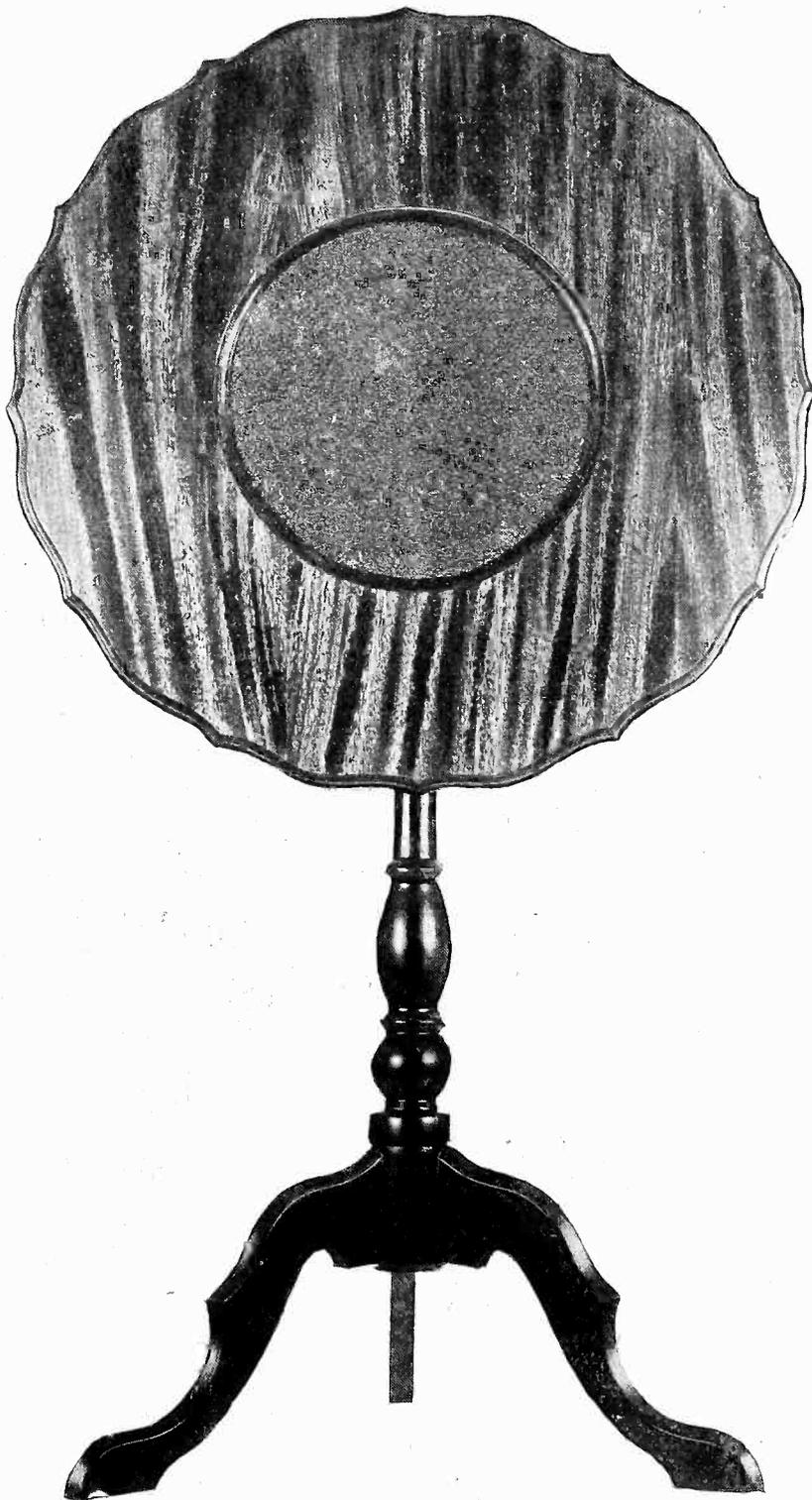
Solid Mahogany Baffle!
9½-inch (large size) Musicone!
Tri-Foot Stand!
9½-Foot Cord!
Factory-Sealed Carton!

LIST PRICE, \$37.50

YOUR PRICE

ONLY

\$10



IF anybody were to tell you that you could buy a Crosley Tip-Top Musicone—list price, \$37.50—for only \$10 you'd naturally doubt his word. But we hasten to assure you we are actually selling this genuine Crosley de luxe Musicone, solid mahogany model, at \$10, on only one condition. You must act right away, and we reserve the right to refund your money in case you're too late with your order.

You can order one of these complete Musicones—with Tip-Top solid mahogany baffle, tri-foot stand and 9½-ft. cord, with perfect safety, because:

(1) We guarantee to refund your money if you are not delighted with the appearance and performance of this speaker after a five-day trial.

(2) Besides our own guarantee you will receive with your speaker the following guarantee signed by the Crosley Radio Corporation: "Purchase this Crosley Musicone. Try it in your home for five days. Test it in comparison with any loudspeaker made. If you are not satisfied, return it to the dealer from whom you purchased it. He will promptly refund your money without argument, delay or question. There will be no annoying red tape to go through."

(3) Each speaker is marked: "M'd. by the Crosley Radio Corp., Cincinnati, Ohio, U. S. A." and bears the following notice: "Pat'd. U. S. A., April 22, 1924—Feb. 10, 1925—May 4, 1926. Canada, Jan. 26, 1926—July 13, 1926. Great Britain, July 1, 1926. France, Aug. 21, 1926. Other U. S. A. and foreign patents pending."

Therefore you're getting the genuine article—the speaker so popular this season and thoroughly up to the minute in design and workmanship—plus a 5-day money-back guarantee!

THERE is nothing the matter with this speaker. We assure you of that. The Crosley Radio Corp. assures you of that. You assure yourself of that, because you don't have to keep the speaker if you don't think it's all we say of it and more!

This speaker—including stand and baffle—stands 40" high. A thumb-nut easily locks the baffle in place on the stand. Without loosening the nut you may turn the baffle to another angle. You can not tilt the baffle forward and backward.

The front is a beautiful sight, the bold grain of the sturdy mahogany catching the eye with almost hypnotic appeal. The finish is extra de luxe, a high polish rubbed in by expert hands. The gold-and-black weave of the grille (at center) blends exquisitely with the master workmanship of the baffle. The edge of the baffle is scalloped.

At rear is the cone proper, with its apex. This Musicone should need no adjusting, as it was carefully adjusted before it left the Crosley factory. A small opening in the rear of the cone renders access to the armature by insertion of a screwdriver. Full directions for adjustment are furnished with each speaker, for those rare instances when adjustment is deemed advisable.

The 9½-ft. cord emerges gracefully at rear, from the golden fold of the turned-back flap of the grille.

Crosley Tip-Top Musicone, in a 20" solid mahogany, de luxe, grained finish baffle, with 9½-ft. tipped cord and tri-foot stand, total height 40 inches; shipping weight 9 lbs. List price, \$37.50. Special price, while they last, at more than 73 per cent. discount.

\$10.00

GUARANTY RADIO GOODS COMPANY
145 WEST 45TH STREET

Just E. of Broadway N. Y. CITY

GUARANTY RADIO GOODS CO.
 145 West 45th Street, N. Y. City

Enclosed please find \$10 for which ship AT ONCE one Crosley Tip-Top Musicone, in solid mahogany baffle, with 9½ ft. cord, tri-foot stand, 5-day money-back guarantee and instruction slip. You are to pay cartage.

Please ship above C. O. D. and I will pay cartage.

Name

Address

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

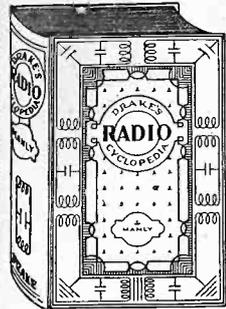
5-DAY money-back guarantee on ALL Musicones

THIS magnetic type speaker—the famous Tip-Top Musicone, manufactured by the Crosley Radio Corporation of Cincinnati, Powell Crosley, Jr., president—is superb in both tone and appearance. It graces any room. Well worth every cent of the list price of \$37.50 you had to pay if you bought this in a music store, it is offered now at more than 73% off list price—at only \$10. Imagine that! Perfect condition! Brand new! Every speaker in an unmolested carton, just as it left the Crosley factory!

THIS OFFER REVOCABLE WITHOUT NOTICE!

YOU MUST GET THIS BOOK!

DRAKE'S RADIO CYCLOPEDIA (New Edition)



has been developed to answer the questions of service men, custom set builders and home constructors, of experimenters, students, salesmen and operators of receiving equipment and to allow all these to have instant access to the information they want. The author, Harold P. Manly, has collected and translated into plain English the material formerly obtainable only from dozens of scattered sources.

BOOK IS 2 1/2" THICK, WEIGHS 3 3/4 LBS., 1,025 ILLUSTRATIONS.

Each rule, fact, method, plan, layout and diagram is instantly picked out and separated from everything else by placing all subjects in alphabetical order with cross references for every imaginable name under which the information might be classed.

This alphabetical arrangement lets the experienced worker refer directly to the one thing in which he is interested at the moment without hunting through non-essentials. The needs of the beginner are cared for.

The important articles deal primarily with receivers and reception. They do not stop with the electrical end, but go also into the mechanics of construction. Every new thing in radio is covered in detail.

1,680 Alphabetical Headings from A-battery to Zero Beat
1,025 Illustrations, Diagrams, Layouts and Graphs
920 Pages, Each 6 by 9 inches
240 Combinations for Receiver Layout
OF THE PRINCIPAL ARTICLES
159 Concern service men, 129 help the set builder, 162 help the experimenter, 155 interest the student, 75 assist in sales work, 73 interest set owners.

GUARANTY RADIO GOODS CO.,
145 W. 45th St., New York, N. Y. (Just E. of B'way)
Gentlemen: Please mail me at once the new (second) edition of "Drake's Radio Encyclopedia," by Harold P. Manly, just published, with all the latest technical information in it. I will pay the postman \$6.00 plus a few cents extra for postage. If I am not delighted, I may return the book in five days and you will promptly refund my purchase money.

Name

Address

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

5-DAY MONEY-BACK GUARANTY!



Audios— Positively Guaranteed Superior



The same unchangeable purity and fidelity of tone, which has established S-M supremacy even more firmly this year than ever before can be built into any receiver or amplifier by using the new S-M Clough-system audio transformers. Guaranteed absolutely and unconditionally to surpass, in their uniform amplification of all notes from 5,000 down to 40 cycles, any other transformers obtainable on the American market at any price, these unique instruments make use of a principle totally different from anything used in standard transformer construction—built-in resonance to even out the amplification curve in the critical range which ordinary transformers weaken—and a circuit which keeps D.C. plate current entirely out of the transformer winding and thereby avoids the common injurious effect of hysteric distortion. Amplification obtainable—running as high as 4 1/2 to 1—is far higher than with any standard transformers of comparable tone quality.

255 and 256, for standard use in first and second stage respectively. Each \$6
Also a full line of push-pull transformers and chokes.

SILVER-MARSHALL, Inc.
846 West Jackson Blvd., Chicago, U. S. A.

[N. Y. Representatives: F. Edwin Schmitt, Inc., 136 Liberty St., New York, N. Y.]

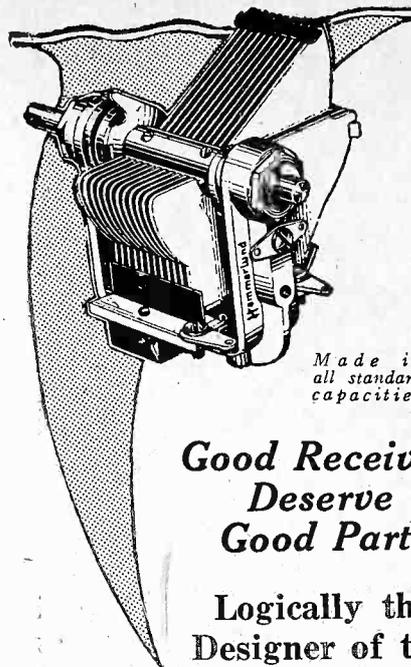
SPEAKERELAY

Cat. No. 121.

\$2

For connecting two speakers by turn of knob so that at No. 1, left, you operate one speaker alone; at No. 2 you operate both speakers together; at No. 1, right, you operate the other speaker alone.

GUARANTY RADIO GOODS CO.
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NEW YORK CITY Just East of Broadway



Made in all standard capacities

**Good Receivers
Deserve
Good Parts**

Logically the
Designer of the

MOORE-DANIELS RECEIVER

Uses the

HAMMARLUND Midline Condenser and Drum Dial

Hammarlund Condensers, Drum Dials, Space-Wound Coils, R. F. Chokes and Equalizers make any receiver better.

Your dealer sells Hammarlund Parts

HAMMARLUND MFG. CO.
424-438 W. 33rd St., New York

For Better Radio
Hammarlund
PRECISION
PRODUCTS

Cash in on This Offer Now!

ONE full year's subscription for any TWO of the following magazines given to you—**RADIO NEWS** or **SCIENCE AND INVENTION** or **RADIO** (San Francisco) or **BOYS' LIFE**.

Select any TWO of these four publications, each of which will be sent to you (at only one address, however) each month for twelve months—in other words, 24 issues—if you will send in now your subscription for **RADIO WORLD** for two years (104 numbers) at \$10.00. **RADIO WORLD'S** subscription price for one year is \$6.00, so you gain the extra 2 dollars by taking advantage of the liberal offer for two-year subscriptions; and, besides, you get a subscription for each of the TWO other magazines selected from the enumerated list, making a total of 128 numbers for \$10.00.

If you want to select only one from among the four other magazines, you may obtain this one for TWO years, so that you will be subscribing for **RADIO WORLD** for two years and for the other magazine for TWO years, all for only \$10.00 (both mailed to one address only).

These offers are rightly regarded as among the most liberal ever made, but as they are limited as to expiration date (see notice below) you must act now.

Please use the attached coupon.

SPECIAL TWO-FOR-PRICE-OF-ONE COUPON

RADIO WORLD, 145 West 45th Street, New York City (Just East of Broadway):
Enclosed please find \$10.00, for which send me **RADIO WORLD** each week for two years (104 numbers), and also send me, without extra cost, each month for one year each of the following TWO magazines—total, 24 issues—grand total, 128 numbers:

- | | |
|--|--|
| <input type="checkbox"/> <input type="checkbox"/> RADIO NEWS | <input type="checkbox"/> <input type="checkbox"/> RADIO (San Francisco) |
| <input type="checkbox"/> <input type="checkbox"/> SCIENCE AND INVENTION | <input type="checkbox"/> <input type="checkbox"/> BOYS' LIFE |

If you want one of each, put a cross in a square next to the name of each of the two other magazines. If you want a two-year subscription for ONE of the above magazines, with the two-year subscription for **RADIO WORLD** (same grand total of 128 numbers), put two crosses before the name of one magazine.

If you prefer to pay \$6.00 for only one year's subscription for **RADIO WORLD** (52 numbers) and get one of the other magazines for one year, without extra cost, put one cross in one square in front of the name of one magazine.

Present **RADIO WORLD** subscribers may renew under this offer. If renewing, put a cross here

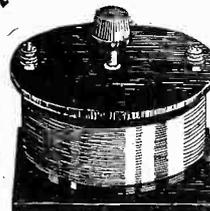
Name.....

Street Address.....

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

THIS OFFER EXPIRES AT NOON ON APRIL 30TH, 1929

NOW ELIMINATE INTERFERENCE



Trans-continental Wave Control

Gets distance by cutting out powerful locals. Will work on any set. Reduces static. Simplicity itself to operate. Ruggedly built.

PRICE \$2.50

Transcontinental coils are used in the Moore-Daniels Receiver.

If your dealer does not stock wave controls or coils, order direct.

Write for data.

Transcontinental Coil, Inc.
GOTHAM ENG. & SALES CO.
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Room 370, 50 Church St., New York City

Moore-Daniels
Coils-Kits-Parts-Sets
Blue Prints \$1.00
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Suite 302

QUIET. HAVE PERFECT RADIO RECEPTION WITH SI-LEN-SER

TRADE MARK PAT. APPLIED FOR

SI-LEN-SER
A TRUTONE PRODUCT

LINE NOISE ELIMINATOR

The SI-LEN-SER makes any electric or any electrified radio play as quietly as any battery operated receiver. It silences all stray line noises which enter the receiver through the power packs of electric sets and eliminators. It eliminates A.C. hum and all knocks and noises that emanate from electric refrigerators, oil burners and other electric household apparatus. When not due to aerial pick-up, it

KILLS LINE NOISES

The SI-LEN-SER is absolutely universal. It may be used on A.C. or D.C., 110 volt, 120 volt or 32 volt farm lighting \$12.50 systems

AT ALL GOOD DEALERS

Jobbers and Dealers write for Territory and Discounts

Manufactured and Guaranteed by **TRUTONE RADIO SALES CO.**

Makers of Laboratory Perfected Radio and Electric Devices
114-16 Worth Street St., N. Y. C.

VOLUME CONTROL FOR A-C SET

It makes no difference what make of A-C set you have. The chances are you need a real volume control. That's easy. Just install a **VOLUME CONTROL CLAROSTAT** across antenna and ground binding posts. Now you're all set! There's a Clarostat for every purpose. Ask your dealer about it.

CLAROSTAT MFG. CO., Inc.
291 North 6th Street, Brooklyn, N. Y.

CLAROSTAT

LYNCH

Tubadapta provides for the use of two power tubes in parallel.

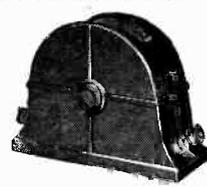
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Send for free Lynch radio manual

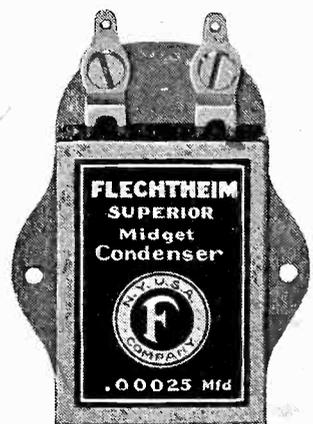
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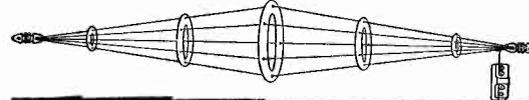
Gives counts and prices on over 8,000 different lines of business. No matter what your business, in this book you will find the number of your prospective customers listed. Valuable information showing how to use the mails to secure orders and inquiries for your products or services is given.

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Largest City Directory Publishers in the World. Branches in Principal Cities
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LIFE-TIME DX AERIAL

No. 30 Length 30 feet



Non-corrosive—30 ft. length—volume of 150 feet aerial with selectivity, of 30 foot antenna. Assembled—ready to string up—all connections soldered or riveted. Rings are heavy gauge solid zinc. Permits using a powerful aerial in 30 ft. space. Duplicates in design because of short length, but has enormous pick up because 150 ft. of enameled 12 ga. wire is used. Insures more uniform reception. Non-corrosive feature insures long life and 100% efficiency at all times. "Truly a Life Time DX Aerial." List..... \$10.00

No. 60—Length 60 ft. Price \$12.50

"Big Boy" size. Best for European tests. (Same description as above, except that 300 ft. of wire is used making this the most efficient and powerful aerial ever made.)

Manufactured by **THOROLA RADIO PRODUCTS** 110 EAST 21ST STREET CHICAGO, ILLINOIS

SET Builders

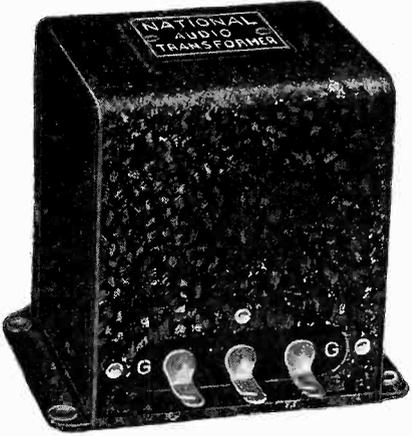
Elections have brought back Custom Set building. Business is booming. Thousands of old-timers are cleaning up. Let Barawik show you the way to bigger profits, more sales. Send today for Barawik's Big Bargain Book—the radio man's bible.

BARAWIK CO. 1330 Canal Sta., CHICAGO, U. S. A.

FREE LATEST RADIO GUIDE

Velvet Smooth Tone

A New and Finer Audio Unit by NATIONAL CO.



Type A100 Turn-Ratio of 4 to 1. For use in 1st and 2nd Stages of Audio. List Price, Each **\$9.50**

Types P-50 and P-10. Input and Output pair for push-pull amplifiers. List Price, Each **\$9.50**

The new high-permeability core and special split secondary winding give transformers reasonable size with unusually fine frequency characteristics.

These transformers used with the new UX245 Power Tubes set a new standard in Audio Amplification. Write us for Audio Bulletin No. 150-W.

NATIONAL

Velvetone Audio Transformers

NATIONAL COMPANY, INC., MALDEN, MASS.

SALESMEN special new line of brushes for every store, garage, office, school. Big sales easy. Big profit. The Brush Works, 990 4th St., Fairfield, Iowa.

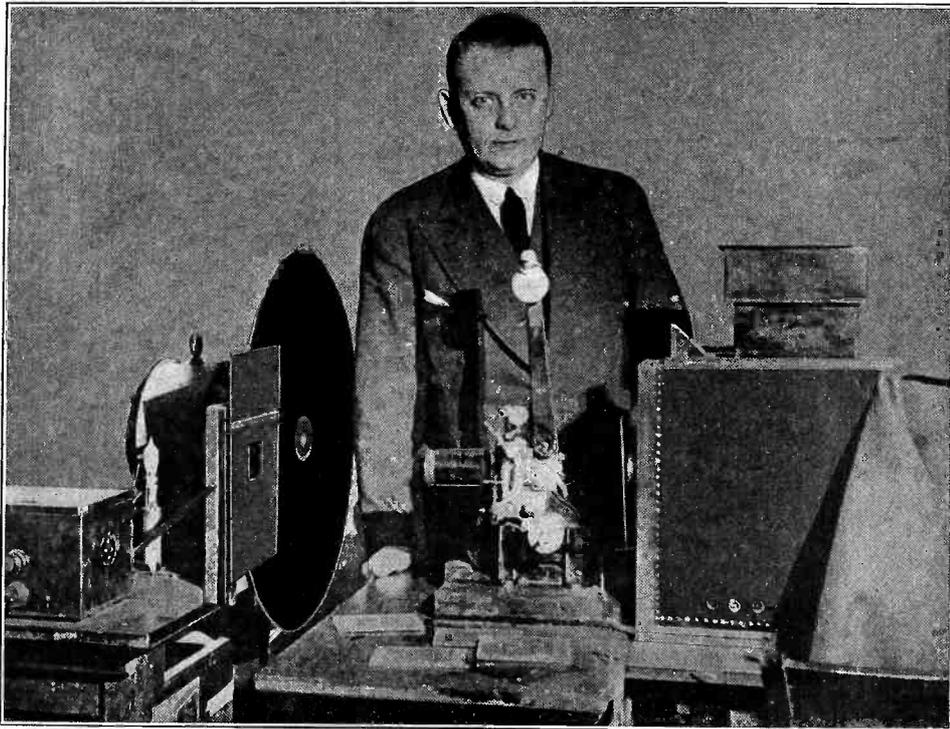


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 15c per Copy, \$6.00 per Year
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Technical Accuracy Second to None
 Latest News and Circuits

A Weekly Paper published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.
 (Just East of Broadway)
 Phone: BRyant 0558 and 0559

Has Own System for Home Television



(Acme)
DENES VON MIHALY, HUNGARIAN ENGINEER, HAS DEVELOPED A NEW SYSTEM OF TELEVISION WITH WHICH HE EXPECTS TO TRANSMIT MOVING PICTURES BY RADIO TO THE HOME.

**CLEAR IMAGES
 10" SQUARE IN
 NEW TELEVISOR**

Another step toward the perfection of television and the transmission of movies by radio and wire has been announced by Denes von Mihaly, a Hungarian engineer doing research work in Berlin. Scientists who are familiar with von Mihaly's method believe that the new apparatus virtually solves the problem of television.

Von Mihaly first demonstrated his apparatus last fall at the annual radio exposition in Berlin, but since has improved it so that it is capable of sharper definition of pictures.

New Transmission System

The inventor employs a new system of transmission, using a Wolfram point light. The image of the scene to be transmitted is projected on a ground-glass. Before this window a shutter containing hundreds of pin holes revolves at the rate of 12 revolutions per second, which throws 150,000 points of light on the screen every second.

All points of light are reflected into a sensitive photo-electric cell and are converted into equivalent pulses of electric current. These electric pulses are amplified and transmitted.

The receiving apparatus is similar to the transmitter. A Wolfram point light is used as the light source, a disc is used for scanning and a light valve to modulate the intensity of the ray of light from the lamp in accordance with the received signal.

Clarity in 6" to 10" Square

The inventor says that clear pictures as large as six to ten inches square may be received with the new system.

Von Mihaly, who calls his new apparatus the telehor, is already planning on marketing small receiving sets for as low as \$25 each. These receivers may be used in conjunction with any simple radio receiver. Larger receiver to cost about \$100 each are also to be marketed, according to present plans.

The inventor has been experimenting with television for ten years and he has great confidence in the latest apparatus.

FLECHTHEIM SAILS FOR EUROPE

A. M. Flechtheim, head of the A. M. Flechtheim Co., 136 Liberty Street, New York City, manufacturers of condensers for every purpose and accurate voltmeters, sailed for Germany and continental Europe on the SS. Berlin.

**HOTEL INSTALS MOVIES TO GO
 CENTRAL RADIO ON AIR APRIL 1**

The first major hotel installation of its new centralized radio system was announced by the Radio Corporation of America. The Allerton House, Chicago, provides individual radio reception through a wall-type loudspeaker to guests in 887 of its 990 rooms.

Other hotels have experimented with radio service in guest rooms. Headphones, plugged into a baseboard switch and movable loudspeakers connected in the same manner have been installed in several hotels. The Allerton House, however, is the first important hotel to adopt the standard centralized equipment developed only a few months ago by the Radio Corporation's engineers.

Briefly, the present centralized radio installation comprises a central receiving unit with one, two, three or four "channels," each tuned to a different program; a powerful and highly efficient amplifying unit; and a number of automatic controls.

The Jenkins Television Corporation announced motion picture films will be broadcast by radio in the form of television images from the New York area, beginning about April 1st. The station for this purpose is now being erected on top of the Jenkins manufacturing plant at 346 Claremont Ave., Jersey City, N. J.

This station has been assigned the call letters 2-XCR and it will operate on a wave of 140 meters and a power of 5,000 watts.

A similar station to be erected in Washington, D. C., has been authorized by the Federal Radio Commission. This station will also use 5,000 watts, but a wavelength of 100 meters.

At first the transmission will be of an experimental nature and of the silhouette type.

Scanning discs having 48 holes and operated at a speed of 900 revolutions per minute can be used to intercept the images. The audio amplifier should be a good one, so that the pictures will not be blurred.

RETAIL SALES TAKE DROP OF \$20,000,000

Retail sales of radio equipment during 1928 totalled \$70,877,517 compared with sales totalling \$90,785,050 reported for 1927, according to a survey of dealers' stock in hand made by the Department of Commerce for the quarter ending January 1st, 1929.

Information for this 1928 survey was obtained from 6,569 of the 32,159 dealers and from 7,737 dealers for the 1927 report. These figures are compiled quarterly with the cooperation of the Radio Division of the National Electrical Manufacturers Association.

53½% in Last Quarter

The dollar volume of business during the last three months of 1928 amounted to \$37,975,015 or 53½% of the total volume of business for the year. The volume of business for this fourth quarter included sales by 1,023 dealers who reported that they engaged in sales of radio equipment only during the three-month period, the volume of this business, however, being only \$2,695,597.

The survey revealed that the average value per set sold in 1928 was \$158.50 compared with \$231.00 in 1927, while the volume of business per dealer averaged \$10,800 in 1928 compared with \$11,750 the previous year. The average number of sets sold per dealer was 60 for 1928 and 51 for 1927.

94 Exceeded \$100,000

Sales for the year of \$500 or less were reported by 495 dealers while 94 dealers reported doing a business of \$100,000 or more. Approximately 30% of the dealers reported doing a volume of business between \$1,000 and \$3,000.

Diamond Four Gives Utmost in Selectivity

EDITOR RADIO WORLD:

Thanks for the new Screen Grid Diamond. It is a wow. I never heard a more selective set, even up to seven tubes. There is a 7-tube set opposing me in the house but the owner can't come near me with my new Diamond. I can get every local in New York and New Jersey and plenty of DX with volume to spare. As for separation, take notice:

WODA, Paterson, N. J.....	30½	30½
WIODA, Miami, Fla.....	31½	31½
WFBM, Indianapolis, Ind.....	32½	32½
WCAU, Philadelphia, Pa.....	37½	37
WAPI, Bangor, Me.....	40	39

LOUIS ROTH, JR.

58-41 Fresh Pond Road,
Maspeth, L. I.

Control of Volume Easy at the Input

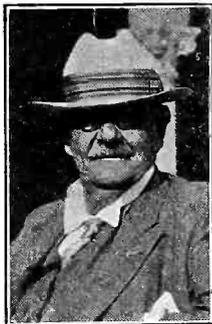
With the perfection of the line voltage lighted tube, the AC set has leaped into popular favor. Sets most in favor include power tubes singly or in push-pull. These sets deliver great volume, necessitating some good type of precise volume control. One popular way is to connect a Volume Control Clarostat between the antenna and ground binding posts of the receiver.

They Say

MORGAN L. EASTMAN, manager of WENR, Chicago: "The cost of broadcasting is increasing. Modern receiving sets are increasing in efficiency, and radio listeners are becoming increasingly discriminate in their selection of programs. Today there is little competition as keen as that among radio broadcasting stations. The result is that the standard of programs is being raised higher and higher every week, and the cost has gone up by leaps and bounds. Scientific developments have also brought costlier apparatus and many stations today are finding that their financial investment runs into six and sometimes seven figures."

* * *

COL. EDWARD H. R. GREEN, sponsor of WMAF, Round Hills, Mass., and son of Hetty Green: "Television will be the greatest instrument to make future navigation of the air nearly 100 per cent perfect. More knowledge is had through the eye than through the ear. If a pilot can see what is ahead of him, even under adverse weather conditions, he will have a quicker and more complete understanding than by receiving the same message through the air. Fog is one of the hardest things to fight. Radio and television will eventually overcome it."



Col. E. H. R. Green

* * *

IRA ROBINSON, chairman of Federal Radio Commission: "Financial reports should be required of all stations, and license fees should be charged to all stations. For a study of the propriety of licensing, it would be well to require such reports. There is another element—it would also give us the financial strength of that station and whether or not it was rendering good service. It would be enlightening in the consideration of the renewal of the license."

McDonald is Elected Investment President

At a directors' meeting of the Seneca Securities Corporation, in Chicago, Commander E. F. McDonald, Jr., was elected president and U. J. Herrmann, first vice-president.

The Seneca Securities Corporation is an investment company dealing in securities of various industries and the introduction of these two men so closely identified with radio is expected to mean that a goodly share of the capital of this company will be invested in the radio industry.

A THOUGHT FOR THE WEEK

SEVEN years ago the first issue of RADIO WORLD was offered to the public with high hope and at least with some conviction. The intervening years have been interesting, —at times even a little tempestuous—but here we are, safe and sound. Other radio papers have come and gone—peace to their ashes! The same publisher who asked for your patronage seven years ago presents this issue to you and asks you to take another seven-year journey with him and his able and splendidly loyal co-workers.

All aboard! Let's go for 1936!

KENT WINNERS TO GET BIGGER VOCAL PRIZES

In the Atwater Kent Foundation's nation-wide vocal audition for this year the amount of the aggregate awards to finalists is \$25,000 in place of the \$17,500 total of 1927 and 1928. All ten finalists, in whose selection the radio listener plays a more important part than do the musical experts, are to be given further musical training.

There have been more than 100,000 young voices heard in the two years the Foundation has been conducting these nation-wide tests.

Of the ten finalists selected by the radio audience in conjunction with a jury of musicians to compete before experts in New York for national classification and award, the first three prize winners have heretofore been given musical training in addition to the cash prizes.

Must Obtain Courses

This year, however, the increase of monetary award is reinforced by an award of at least a year's training in a recognized school of music for each of the finalists.

"It seems to me," said A. Atwater Kent, president of the Foundation, "that after devoting nearly a year to preliminary contest, in which 50,000 or 60,000 voices are tried out, we should make certain that all ten of the finalists be assured of further vocal instruction and the means with which to pursue it."

Awards Listed

The awards this year will be as follows: Winners of first place (one boy and one girl), \$5,000 each and two years' tuition in and American conservatory.

Winners of second place, \$3,000 each and one year's tuition.

Winners of third place, \$2,000 each and one year's tuition.

Winners of fourth place, \$1,500 each and one year's tuition.

Winners of fifth place, \$1,000 each and one year's tuition.

During the Summer and early Fall local contests will be held in the cities and towns of every State, open to amateur singers from 18 to 25. State auditions will follow and will be broadcast from a central point in each State. Two winners, one boy and one girl, will be selected to represent each State in district contests, of which there will be five, held at central points in the East, Middle West, Southeast, Southwest and Far West.

The ten finalists (one boy and one girl from each district) will be put on the air over a coast-to-coast network in December, for final rating by a board of musicians of national standing.

WCFL, Labor Station, Joins the NBC System

WCFL, Chicago, has been added to the National Broadcasting Company's System.

WCFL is owned and operated by The Chicago Federation of Labor and is supported by The American Federation of Labor. It is supported by subscriptions from the thousands of members of organized labor.

It has a power of 15,000 watts and operates on a frequency of 970 kilocycles (309.1 meters). It recently received a permit from the Federal Radio Commission for a 50,000 watt transmitter.

BOARD TO TAKE WGY APPEAL TO HIGHEST COURT

Washington.

The last judicial word will not have been uttered in the controversy between WGY, of Schenectady, N. Y., and the Federal Radio Commission, over WGY's lot in the reallocation, until the United States Supreme Court has spoken, said Bethuel M. Webster, general counsel of the Commission. He made this remark following the recent refusal of the Court of Appeals of the District of Columbia to grant a rehearing in the case which the Court of Appeals had decided in favor of WGY.

Under the reallocation, as effective November 11th last, WGY was given part time on 870 kc. in the main being ruled off the air at night, as KGO, Oakland, Calif., also owned and operated by the General Electric Company, was granted 870 kc. as a cleared channel. Thus the channel was granted primarily to the Fifth Zone, and incidentally to WGY (First Zone) during daytime only, when the signals of the two stations on the same wave would not cause interference.

WGY Wins Appeal

WGY appealed to the Court of Appeals of the District of Columbia, which, under the radio law, is the appellate court. The decision was cast in favor of WGY, which was granted the right to use 870 kc. full time, and at 50,000 watts.

The court's decision was rendered while a supplementary brief on behalf of the Commission's case was being printed, as the Commission's legal staff maintained that under the court rules it still had several days, beyond the time the decision was actually rendered, to file this brief.

Refusal a Surprise to Him

Mr. Webster said on this point: "As the court did not receive our brief of facts in the case before making its decision, a refusal to grant us an opportunity for reargument is unexpected.

"In any event, the decision will have to be reviewed by the United States Supreme Court, as we will ask immediately for a writ of certiorari."

New Company Features AC Audio Amplifiers

The General Amplifier Company, Cambridge, Mass., has entered the market with a series of high quality, AC operated audio amplifiers. These are all designed for standard voltages of 105 to 120 volts and 50 to 60 cycles, and they are equipped with filters in all the plate and grid circuits to eliminate frequency distortion which would result from the feedback through the common plate supply. Due to these filters the characteristics of the amplifiers are those determined by the audio transformers employed. The by-pass condensers used in the various filters are of the self-healing type.

Model GA 10 comprises one 227, one 250 and one 281 tube, and it will deliver approximately 4 watts of undistorted power to the reproducer, which may be either of the magnetic or the dynamic type.

Model GA 20 comprises two 250, two 226, two 281 and one 227. It will deliver about 14 watts of undistorted power to the reproducer. It is of the dual push-pull type and it requires no output device between itself and the loudspeaker.

Model GA 30 is a three-stage ampli-

Equality Upset, Says Commission

Washington.

B. M. Webster, general counsel of the Federal Radio Commission, asserted that the action of the Court of Appeals in favor of WGY in effect takes a cleared channel away from the Fifth Zone and awards it to the first Zone, since WGY's 50,000 watts is 65/7 times as great as KGO's power.

"To that extent," he continued, "the court's action invalidates the Commission's general order, which was directed by the Davis amendment passed by Congress, and calling for an equal division of radio facilities among the five radio zones."

RMA COMPILES EXPORT GUIDE

American radio products will be sold more widely throughout the world under plans announced by the Radio Manufacturers Association, 11 West Forty-second Street, N. Y. City, to aid its members in developing their foreign sales, especially in Latin America.

A complete radio export guide has just been compiled by the Radio Manufacturers Association comprising virtually all prominent makers of all radio products.

The export campaign is expected to increase radio foreign sales, which last year were \$12,061,410., as compared with \$2,000,000. five years ago.

The radio export guide, prepared under the direction of George H. Kiley, of New York, Chairman of the Foreign Trade Committee, includes complete radio information in all Latin America, and most other countries of the world. The population, number and character of radio stations, control of radio, number of type of receiving sets in use, license fees, trade marks, patents, and other valuable export information are detailed in the guide. Lists of radio exporters, Latin American importers, foreign broadcast stations, foreign tariffs and import regulations are also given. The data will be supplemented, in loose leaf form, in future additions to the radio export information.

fier using two 250, two 281 and two 227 tubes. Its undistorted output power is about 12 watts. It requires no output device.

Model GA 40 has an undistorted power output of approximately 25 watts, and it comprises four 250 power tubes and four 281 rectifier tubes. It is a single stage amplifier suitable for use where a very great output is required.

Model GA 50 is a two-stage amplifier which incorporates a switching arrangement whereby either a microphone or a magnetic pick-up may be employed. This amplifier is primarily designed to feed the other amplifiers described.

In addition to the stock amplifiers the company is prepared to design and build special equipment to meet specific requirements. The Engineering Department of the company is well equipped to handle any design problems in this field that may arise.

The General Amplifier Company was established by A. R. Wilson, formerly of the engineering department of General Radio Company. Address Mr. Wilson at 27 Commercial Avenue, Cambridge, Mass., and mention RADIO WORLD.

LYNCH IS CHIEF EXECUTIVE OF 6 PERIODICALS

Announcement was made by the Experimenter Publishing Company, 230 Fifth Avenue, New York City, publishers of "Radio News," "Science & Invention," "Radio Listeners' Guide and Call Book" and other magazines, that it has appointed



Arthur H. Lynch

Arthur H. Lynch to conduct the editorial and advertising departments of all the publications. The company recently was petitioned in bankruptcy and the Irving Trust Company was appointed receiver. The schedules subsequently showed liabilities approximating \$500,000. Assets

were not stated in the schedules, but are estimated at \$182,000.

Mr. Lynch was formerly editor of "Radio Broadcast," now published by Doubleday, Doran & Co., Inc., although then published by Doubleday, Page. He sponsored the international radio transmission and reception tests several years ago, and won distinction for his services, receiving official thanks from President Harding, who took pleasure in being photographed with Mr. Lynch. Previously he was publicity director and assistant advertising manager of RCA.

How Lynch Was Chosen

His work was so successful with "Radio Broadcast" that when the creditors of the Experimenter Publishing Company looked about for some one highly competent to conduct the editorial and advertising departments, since Hugo Gernsback and S. Gernsback had severed their relations with the company, Mr. Lynch was chosen. He was president and guiding genius of Arthur H. Lynch, Inc., manufacturer of metallized resistors, etc., but finally consented to accept the proffered post.

The principal creditors listed in the Experimenter Company's schedules in bankruptcy are: Bukley Dunton Company (printers), \$154,406; Art Color Printing Co., Dunellen, N. J., \$152,998; Edward Langer Printing Co., Hollis, N. Y., \$14,614; Walter Braunstein, \$10,258; Wynne Paper Products, Newburgh, N. Y., \$9,249; Steidinger Press, \$8,719; S. Gernsback, \$8,450; Service Photo Co., \$6,277.

Besides the three magazines previously mentioned, the company publishes "Amazing Stories," "Your Body," "Aero Mechanics," and books merchandised by Consrad.

To Continue All Publications

"It has been decided to continue the publication of all these magazines," an official of the Irving Trust Company was quoted as saying.

The Experimenter Publishing Company also owns WRNY, New York City, and An improvement in programs is promised. The station likewise is to be continued. Mr. Lynch is executive of the station, too.

B. A. Mackinnon is in charge of circulation under the new Experimenter regime. He was for twenty years circulation manager of "Pictorial Review," and now is himself a publisher of four magazines. Both he and Mr. Lynch took rein in time to complete getting out the May issues of the company's magazines.

S-M LICENSED TO MAKE SETS; NEW RCA LIST

Silver-Marshall Inc., 846 West Jackson Boulevard, Chicago, famous as the biggest parts manufacturers in the radio field, has been licensed as a receiver and electric phonograph manufacturer by the Radio Corporation of America. The RCA made this announcement on issuing an up-to-the-minute list of licensees.

From other sources it was learned Silver-Marshall will have a set of its own and will manufacture private brand receivers. The company's entrance into the set field does not mean it will be any less alert in the parts field, said a representative of S-M, but plans for even greater activities in parts than heretofore are under way.

Adequately Financed

The entrance into the set field required refinancing, and adequate additional capital has been raised, it was said. A gigantic plant is being constructed, meanwhile the present factory is being used. Due to McMurdo Silver's great sales and engineering talents it is expected S-M will do a tremendous set business.

The RCA list gives E. M. Combs as president of S-M.

Colin B. Kennedy Corp., 231 South La Salle Street, Chicago, has been licensed by RCA for receiver and power device construction.

The RCA license terms are 7½% of sales income, with \$100,000 as the guaranteed minimum. All the manufacturers of any consequence use up the minimum in about three months. Following is the revised list of licensees as announced by RCA, consisting of 32 receiving set licensees, 33 power supply and amplifier licensees, and 14 electric phonograph licensees:

RECEIVING SET LICENSEES

All American Mohawk Corp., 4201 Belmont Ave., Chicago, Ill. Eugene Farny, President.
American Bosch Magneto Corp., 3664 Main St., Springfield, Mass. A. T. Murray, President.
F. A. D. Andrea, Inc., 24 Orchard St., Long Island City, N. Y. F. A. D. Andrea, President.
Atwater-Kent Mfg. Co., 4700 Wissahickon Ave., Philadelphia, Pa. A. Atwater Kent, President.
Bremer-Tully Mfg. Co., 656-662 Washington Blvd., Chicago, Ill. J. C. Tully, President.
Colonial Radio Corp., 25 Wilbur Ave., Long Island City, N. Y. Fulton Cutting, President.
Consolidated Radio Corp. (two Divisions) Wells-Gardner & Co., Div. 1720 N. Robey St., Chicago, Ill. G. M. Gardner, Manager; Arborphone Division, Ann Arbor, Michigan, C. A. Verschoor, President.
Crosley Radio Corporation, Cincinnati, Ohio. Powel Crosley, Jr., President; Amrad Corp., Medford Hillside, Mass. (manufacturers under Crosley's License). J. F. Hahn, President.
Day Fan Electric Co., Dayton, Ohio. L. W. James, President.
Electric Research Laboratories, Inc., 2500 Cottage Grove Ave., Chicago, Ill. Burton Greene, President.
Federal Telephone Mfg. Co., Buffalo, N. Y. L. E. Noble, President.
Freed-Eisemann Radio Corp., Junius St. & Liberty Ave., Brooklyn, N. Y. J. D. R. Freed, President.
Chas. Freshman, Inc., 240 W. 40th St., New York, N. Y. C. A. Earl, President.
(The above two companies have merged)
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, California; Branch at Waukegan, Illinois. S. W. Gilfillan, President.
A. H. Grebe & Co., Inc., 70-72 Van Wyck Blvd., Richmond Hill, N. Y. Douglas Rigney, Gen. Mgr.
Grigsby-Grunow Co., 5801 Dickens Ave., Chicago, Illinois. B. J. Grigsby, President.
Howard Radio Co., 4949 N. Crawford Ave., Chicago, Illinois. A. A. Howard, President.
Kellogg Switchboard & Supply Co., 1066 W. Adams St., Chicago, Illinois. W. L. Jacoby, President.
Colin B. Kennedy Corp., 231 S. La Salle St., Chicago, Illinois. Colin B. Kennedy, President.
King Manufacturing Corp., Buffalo, N. Y. E. E. Eckler, President.
Kolster Radio Corp., 200 Mt. Pleasant Ave., Newark, N. J. Ellery Stone, President.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa. J. M. Skinner, Vice-President.

Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago, Ill. E. M. Combs, President.
Splittorf Bethlehem Electrical Co., 392 High St., Newark, N. J. Chas. Edison, President.
Steinite Manufacturing Co., Atchison, Kansas. F. W. Stein, President.
Stewart Warner Speedometer Corp., 1826 Diversey Pkwy., Chicago, Ill. C. B. Smith, President.
Stromberg Carlson Telephone Mfg. Co., 1060 University Ave., Rochester, N. Y. W. Roy McCanne, President.
Temple, Inc., 1925 S. Western Ave., Chicago, Illinois. A. Marchev, President.
United States Radio & Television Corp., 1338 S. Michigan Ave., Chicago, Ill. W. C. Perkins, President (3 Div.).
Apex Electric Mfg. Co., 1410 W. 59th St., Chicago, Ill. O. G. Nilson, President.
Case Electric Company, Marion, Indiana. A. E. Case, President.
Continental Radio Corp., Ft. Wayne, Indiana. C. D. Boyd, President.
Zenith Radio Corporation, 3620 Iron St., Chicago, Illinois. E. F. McDonald, President.

POWER SUPPLY AND AMPLIFIER LICENSEES

All American Mohawk Corp., 4201 Belmont Ave., Chicago, Illinois. Eugene Farny, President.
American Transformer Co., 174 Emmett St., Newark, N. J. G. H. Courter, Mgr.
Autorad Electric Corp., Griswold First State Bank Bldg., Detroit, Mich. H. S. Finkenstaedt, President.
Bremer Tully Mfg. Co., 656-662 Washington Blvd., Chicago, Illinois. J. C. Tully, President.
Consolidated Radio Corp., Wells-Gardner Div., 1720 N. Robey St., Chicago, Ill. G. M. Gardner, Mgr.
Crosley Radio Corporation, Cincinnati, Ohio. Powel Crosley, President.
H. H. Eby Mfg. Co., 4710 Stenton Ave., Philadelphia, Pa. H. H. Eby, President.
Electrical Research Laboratories, Inc., 2500 Cottage Grove Ave., Chicago, Ill. Burton Greene, President.
Enterprise Mfg. Co. of Pa., 3rd & Dauphin Sts., Philadelphia, Pa. H. E. Asbury, President.
Farrand Mfg. Co., Inc., Thompson Ave. at Court St., Long Island City, N. Y. C. L. Farrand, President.
Federal Telephone Mfg. Company, Buffalo, New York. L. E. Noble, President.
Ferranti, Inc., 130 W. 42nd St., New York, N. Y. G. F. Chellis, Mgr.
General Radio Co., 30 State Street, Cambridge, 39, Mass. H. B. Richmond, Treas.
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, California. S. W. Gilfillan, President.
A. H. Grebe & Co., Inc., 70-72 Van Wyck Blvd., Richmond Hill, N. Y. A. H. Grebe, President.
Grigsby-Grunow Co., 5801 Dickens Ave., Chicago, Illinois. B. J. Grigsby, President.
Howard Radio Co., 4949 N. Crawford Ave., Chicago, Illinois. A. A. Howard, President.
King Manufacturing Corporation, Buffalo, New York. E. E. Eckler, General Mgr.
Kingston Products Corporation, Kokomo, Indiana. J. Johnson, President.
Kolster Radio Corp., 200 Mt. Pleasant Ave., Newark, N. J. Ellery Stone, President.
Martin Copeland Company, Providence, R. I. Edgar W. Martin, President.
National Company, Inc., Malden, Middlesex County, Mass. Wm. A. Ready, President.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa. J. M. Skinner, Vice-President.
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. Ludwig Arnsen, Sales Mgr.
Splittorf Bethlehem Electrical Co., 392 High St., Newark, N. J. Chas. Edison, President.
Steinite Manufacturing Co., Atchison, Kansas. F. W. Stein, President.
Sterling Manufacturing Co., Cleveland, Ohio. Treasise, President.
Stewart-Warner Speedometer Corp., 1826 Diversey Pkwy., Chicago, Ill. C. B. Smith, President.
Stromberg Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y. W. Roy McCanne, President.
Temple, Inc., 1925 S. Western Ave., Chicago, Illinois. A. Marchev, President.
J. S. Timmons Co., Inc., 79 E. Wister St., Philadelphia, Pa. J. S. Timmons, President.
United States Radio & Television Corp., 1338 S. Michigan Ave., Chicago, Ill. W. C. Perkins, President.
Zenith Radio Corp., 3620 Iron Street, Chicago, Illinois. E. F. McDonald, President.

ELECTRIC PHONOGRAPH LICENSEES

All-American Mohawk Corp., 4201 Belmont Ave., Chicago, Ill. Eugene Farny, President.
Bremer Tully Mfg. Co., 656-662 Washington Blvd., Chicago, Ill. J. C. Tully, President.
Colonial Radio Corp., 25 Wilbur Avenue, Long Island City, N. Y. Fulton Cutting, President.
Consolidated Radio Corp., Wells Gardner Div., 1720 N. Robey St., Chicago, Ill. G. M. Gardner, Mgr.
Electrical Research Laboratories, Inc., 2500 Cottage Grove Ave., Chicago, Ill. Burton Greene, President.
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, California. S. W. Gilfillan, President.
Grigsby-Grunow Co., 5801 Dickens Ave., Chicago, Illinois. B. J. Grigsby, President.
Howard Radio Co., 4949 N. Crawford Ave., Chicago, Illinois. A. A. Howard, President.
Colin B. Kennedy Corp., 231 S. La Salle St., Chicago, Ill. Colin B. Kennedy, President.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa. S. M. Skinner, Vice-President.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago, Ill. E. M. Combs, President.
Splittorf Bethlehem Electrical Co., 392 High St., Newark, N. J. Chas. Edison, President.
Stromberg Carlson Telephone Mfg. Co., 1060 University Ave., Rochester, N. Y. W. Roy McCanne, President.
Temple, Inc., 1925 S. Western Ave., Chicago, Illinois. A. Marchev, President.

A LASTING WRIT IS CLAMPED ON DEFIANT WMBB

Chicago. The use of injunctive relief by the United States government to stop a station from unlicensed broadcasting was upheld on the merits by Judge Wilkerson in the Federal Court for the Northern District of Illinois. The case was that of the United States vs. American Bond & Mortgage Co., operators of WMBB-WOK, Homewood, Ill.

The Federal Radio Commission, acting in conjunction with the Federal Attorney, obtained a temporary injunction. Whether this should be made final was the question decided by Judge Wilkerson.

Grounds of Attack

Defendants attacked the constitutionality of the Radio Act on the following grounds:

1.—The Act is an unreasonable exercise of the power to regulate commerce and attempts to reach matters of private business which are not interstate commerce and which are not so related thereto that they may be regulated by Congress.

2.—The Act is unreasonable and arbitrary as to the business of defendants, even if interstate and foreign commerce is involved, because (a) the standard prescribed will not effectually prevent and, in fact, requires, the exercise of arbitrary power by the administrative body; (b) the Act places no limit upon the destruction of an established business in the exercise of the regulatory power and provides a confiscatory and destructive method of regulating a lawful occupation in violation of the Fifth Amendment.

3.—The Act attempts an unlawful delegation of legislative power, because the standard set up in the Act for the guidance of the administrative body is not sufficient.

Congress Sustained

Judge Wilkerson overruled all these contentions by the stations. In sustaining the power of Congress the court said:

"The contention that the Act, in bringing the broadcasting stations themselves under national control, transcends the power of Congress, overlooks the fundamental nature of this species of commerce.

"The transmission is brought about by concert of action on the part of broadcaster and receiver. The regulation is for the purpose not only of protecting the broadcaster in his operations, but also for the purpose of promoting the interests of the public who are obliged to submit to whatever is sent out for their reception.

"The authority of Congress extends to every instrumentality or agency by which commerce is carried on; and the full control of Congress of the subjects committed to its regulation is not to be denied or thwarted by the commingling of interstate and intrastate operations.

Injunction Approved

"The execution by Congress of its constitutional power to regulate interstate commerce is not limited by the fact that intrastate transactions may have become so interwoven therewith that the effective government of the former incidentally controls the latter."

The temporary injunction was therefore made permanent.

The case is regarded in legal circles as an important one because involving fundamental rights of stations and Federal government.

Which Tube Should Follow Which?

Purpose and Power Handling Capacity Are Main Considerations

By Herbert E. Hayden

“WHICH tube should follow which in a radio receiver?”

Many fans have asked that question. “That’s easy,” says the office boy. “Everybody knows that the detector follows the radio tubes and the audio tubes follow the detector.”

But that is no answer to the fans who knew that order before they asked the question. What they have in mind are the special purpose tubes which should be used in a modern radio receiver to get the most out of it.

General purpose tubes are no longer used throughout the receiver if it is up-to-date. There is a tube for every special purpose and only if the proper tube is used in each stage can the best results be obtained.

Best RF Amplifier

The peer of all radio frequency amplifier tubes is the screen grid tube. This gives a vastly greater amplification than any other tube and it does not require neutralization. But it is a critical tube and does not always give good results when used by inexperienced fans. When it fails, it is usually because the tube is not operated with the proper voltages. Sometimes a particular tube fails to give results because it is defective, but that does not happen very often unless it has received rough handling.

The screen grid tubes (if more than one stage is used) require shielding in place of neutralization. This is because the tube amplifies tremendously and for no other reason. The tube itself need not necessarily be shielded, but the tube with its associated coils, condensers and leads should be shielded from similar parts in other stages. This precaution is also advisable when other tubes are used.

There is a screen grid tube for both AC and DC filament supply.

The next best RF amplifier is the 112A for DC circuits and the -27 for AC circuits. Close thirds are the 201A and -26 for DC and AC, respectively. The dry cell tubes should be regarded as useful for portable sets only. Even for this type of receiver the DC screen grid tube will gain rapidly in favor, for it is unquestionably superior for this service.

Screen Grid Disadvantages

Much complaint has been expressed against the screen grid tube on the ground that it makes the receiver broad. It is true that a receiver seems less selective when a screen grid tube is used than when a general purpose tube is employed, but this is largely due to the greater sensitivity of the screen grid tube. It amplifies so much that the set will bring in stations much farther away, thus requiring a greater selectivity to suppress interference from local stations.

Even so, the actual selectivity with a screen grid tube is generally slightly lower than when a general purpose tube is used, but by proper coil and circuit design the required selectivity can be obtained.

Best Detector

The question of best detector for a receiver depends on what type of audio amplifier follows the detector, and also on what type of filament supply employed. The best detector of all is the -27 heater tube. But it is only available for circuits using AC on the filaments. It is best because it is sensitive as a detector, good as

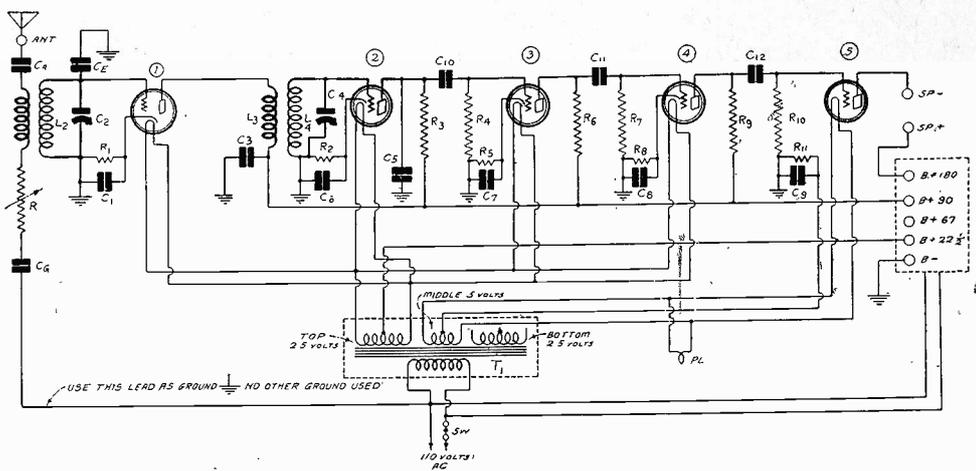


FIG. 1

THIS CIRCUIT ILLUSTRATES THE BEST COMBINATION OF TUBES IN AN AC SET OF THE RESISTANCE COUPLED TYPE. THE HEATER TYPE OF TUBE IS USED IN THE FIRST STAGE BECAUSE THE SCREEN GRID AC TUBE IS NOT YET AVAILABLE. THE LAST TUBE MAY BE A -71A OR A 245.

an amplifier and hum-free. The detector must be a good amplifier because it not only serves as a rectifier of radio signals but also as an amplifier of audio signals.

If the receiver is a battery set and resistance coupled, the best detector is the 240 high mu tube. This tube cannot be used when the filaments are heated with AC because it would hum. Hence for an AC resistance coupled amplifier the 227 type tube should be used as detector.

For battery sets with transformer coupling following the detector, the 112A type 2 tube is the best detector. A 201A is a close second for this service. If a little hiss is not objectionable a gaseous rectifier tube might be substituted for either of these tubes with little gain except the hiss. There is no need of using any but the 112A or the 201A types for detection in this kind of circuit.

Audio Amplifier Tubes

In battery sets of the resistance or impedance coupled types the greatest amplification is obtained with high mu tubes of the -40 type. If high enough coupling resistors and plate voltages are used these tubes will handle any signal required to load up any of the power tubes used in home receivers. The only trouble with high mu tubes in direct coupled circuits is that they may give rise to motorboating, especially when the plate supply unit is a battery eliminator.

Motorboating can always be stopped in such cases although it is not always easy. More bypass condensers across the plate supply leads, individual filters in these leads, lower values of grid leak and stopping condensers, and suitable connection of the loudspeaker are some of the effective means in curing this trouble.

In severe cases of motorboating it may be necessary to use one or two tubes having a lower amplification constant, such as 201A or 112A type tubes.

In an AC set of the resistance coupled type the best tube for audio amplification is the 227 type tube. This type of tube is also the best for impedance and transformer coupling in AC circuits. Some day a high mu tube of the heater type may be developed for direct coupled circuits of the AC type.

The kind of output tube to use depends on the power that is desired, as well as on the type of filament supply that is used.

For moderate power the 227 is a good output tube in AC sets. It is on a par with the 112A tube as far as output goes, and is better in that it does not hum. A greater undistorted power output will be handled by the -71A type tube provided that the required plate and grid voltages are available. A still better tube is the new 245 type. It hums less than the -71A and gives more power for the same signal input voltage. It gives about as much output as the obsolescent -10 type tube and requires less plate voltage. The 245 promises to become the most popular output tube.

Where very large undistorted volume with dynamic speakers is desired the 250 tube should be used. But this tube handles so much power that it cannot be operated at maximum in a home without disturbing the neighbors. If it is turned down to tolerable volume it is made to handle no more than some of the smaller tubes like the -71A and the 245, but what it does deliver contains less tube distortion. From the quality point of view alone it is well worth while to use the 250, if the expense of operating it is of no importance.

For battery sets the available output type tubes are the 112A and 171A. As to the amount of output power than any tube will deliver, of course, does not depend on the kind of current used to heat the filaments.

There is only one 3-volt battery tube which will deliver enough power well to operate a loudspeaker, and that is the 120 type tube.

Any two equal tubes may be used in a push-pull stage. The power output of such a stage is variously estimated at from 3 to 5 times the output of a single tube of the same type, without increasing the wave-form distortion. To get this output it is necessary to impress a greater signal voltage on the grids. The comparison of power output is for the same input on each tube.

Very good push-pull power stages may be made of two of each of the following tubes: 112A, 171A, 227, 245, 210 and 250.

(Continued on page 14)

Why Every Receiver Band Pass

By J. E. Technic

INTEREST in electrical filters is gaining rapidly. This is largely due to their increased use in radio receivers and accessories. In every battery eliminator a low pass filter is used. In many circuits high pass filters are used to stop the low frequencies from being transmitted.

Band pass filters with square top characteristics are being used more and more to prevent the attenuation of the higher audio frequencies in highly selective circuits. It will not be long before every radio receiver will have one of these filters in the tuner, because of retention of sharp selectivity without cutting side bands.

Even suppression filters are used to eliminate certain bands of frequencies.

Another form of filter is the equalizer, which is used to reduce the response of

values. The attenuation characteristics, cut-off frequencies and terminal impedances depend on the values. Z1 may be an inductance or a capacity, or a combination of inductances and capacities. The same applies to Z2.

Note that both the T and the pi sections are symmetrical as they look the same from either side.

Low Pass Filter

In the simplest low pass filter Z1 is an inductive reactance and Z2 is a condensive reactance. A T type section of the simplest low pass filter is shown at the right. The shunt element is a single condenser C2 but the series element consists of two equal inductance coils the total inductance of which is L1. The two coils are not coupled mutually.

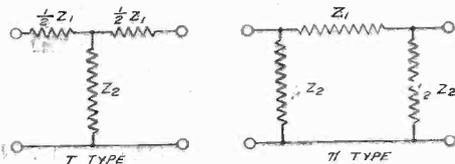


FIG. 1 SECTIONS OF FILTERS WITH GENERAL SERIES AND SHUNT IMPEDANCES. AT LEFT IS A T SECTION AND AT RIGHT A PI SECTION.

a complete radio installation at frequencies where the response is exaggerated.

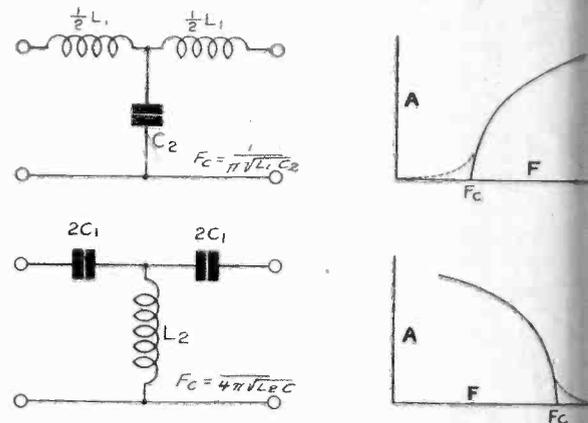
General Structures

Filters consist of impedances in series with the line and other impedances in shunt with the line. A section of a filter consists of one series and one shunt element or impedance, as illustrated in Fig. 1. This figure shows two types of section, the T type and the pi type. Z1 is the series element and Z2 the shunt element.

The T type illustrates the mid-series termination and the pi type illustrates the mid-shunt termination. These two types of sections have the same attenuation but they have different impedances so that they must be placed between different impedances if their attenuations are to be the same.

The Zs in these sections may have any

FIG. 2 (UPPER PAIR). A T SECTION OF A SIMPLE LOW PASS FILTER WITH ITS ATTENUATION CHARACTERISTIC AT RIGHT. FIG. 3 (LOWER PAIR). A T SECTION OF A HIGH PASS FILTER. NUMERAL "1" SHOULD BE ABOVE FORMULA'S DIVIDING LINE



When another similar section is added to this filter the two coils in the middle are combined into one having an inductance L1, so that two equal sections require three coils and two condensers. The attenuation of two sections is just twice as great as that of one at any given frequency.

The attenuation curve shows that there is no attenuation up to a frequency Fc, the cut-off frequency. Beyond that frequency the attenuation rises rapidly and becomes infinite at infinite frequency. The cut-off frequency is determined by the formula given on the figure.

Loss in Filter

The full line in the attenuation curve gives the attenuation only, that is, it assumes there is no resistance loss in the coil. An actual filter will have some resistance which will cause a certain loss, which is indicated by the dotted line. The

loss is appreciable only in the transmission band, that is, below the cut-off frequency. The lower the resistance in the coil, the more nearly will the dotted line coincide with the full and the axis.

The high pass filter corresponding to the low pass filter in Fig. 2 is shown at left in Fig. 3 and the attenuation characteristic at the right. The formula for the cut-off frequency is also given. At zero frequency the attenuation is infinite because no direct current can pass through the series condensers. Above the cut-off frequency there is no attenuation but a slight resistance loss as shown by the dotted curve.

Filters With Sharp Peaks

In Fig. 4 is shown a low pass filter of two sections with its attenuation curve. The termination is mid-series. This filter has two critical frequencies, the cut-off frequency and the frequency at which the attenuation is infinite. The full line, as before, gives the attenuation alone and the dotted curve shows the alteration due to resistance losses.

The cut-off frequency now depends on the series inductance and on both the series and shunt condensers, as shown by the formula for Fc. The frequency of infinite attenuation is determined by the series element alone. The reason the attenuation is infinite at the frequency for which the series elements form a tuned circuit is that a tuned circuit offers an infinite impedance at resonant frequency.

Due to resistance in the series elements the impedance is not infinite, but has a finite value, and therefore the height of the peak is finite. The lower the resistance, the higher the peak and also the more nearly does the dotted line below Fc coincide with the curve and the axis.

The two critical points can be placed almost as close as is desired. The closer they are, the steeper will be the curve. This is a desirable feature. But the closer the points are, the lower is the curve in the region R, which is not always desirable. But when more sections than one are used it is possible to make all the sections have the same cut-off and yet to place their peaks at different points. This will

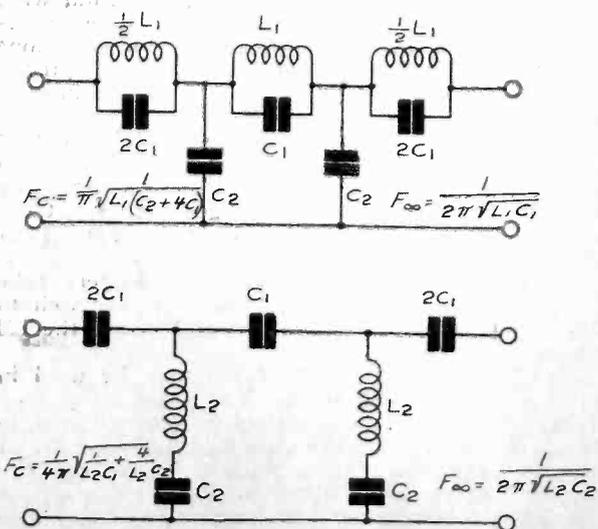


FIG. 4 (UPPER PAIR). TWO T SECTIONS OF A LOW PASS FILTER WITH A PEAK IN THE ATTENUATION CURVE SHOWN AT RIGHT. FIG. 5 (LOWER PAIR). TWO T SECTIONS OF A HIGH PASS FILTER WITH A PEAK IN THE ATTENUATION CURVE SHOWN AT RIGHT.

Soon Will Have a

s Filter

Anderson

Editor

lift the attenuation in the region R.

Two sections are shown in Fig. 4 in order to indicate how the line elements are combined in the middle, or rather how they are broken up at the ends.

High Pass Counterpart

Fig. 5 shows the high pass filter corresponding to the low pass in Fig. 4. It will be seen that the two attenuation curves are similar except that they are reversed. The various designations have the same significance in the two curves.

The reason there is a sharp peak in the high pass filter is that the tuned shunt circuit L2C2 forms a short circuit at the resonant frequency. At this frequency there is only the resistance in L2 which prevents the short from being absolute.

In these filters it should be remembered that a condenser 2C has only half the impedance of C. For that reason 2C1 and 1/2C2 have been used when the general structure in Fig. 1 calls for 1/2Z and 2Z.

Band Pass Filters

It is clear that a low pass and a high pass filter may be combined so that the combination will be a band pass filter provided that the cut-off frequencies be chosen properly. One method of doing this in a radio receiver is shown in Fig. 6. A two-section low pass filter of the type in Fig. 4 is placed between the first and the second tubes. A coupling transformer is used to match the impedance of the tube with that of the filter. A grid resistance R is connected on the other side of the filter to provide the proper load on the filter.

Suppose the low pass filter is designed so that its impedance is 6,000 ohms. Then the impedance of the secondary of the transformer must have the same impedance. It would be possible to design the filter so that it would match the plate resistance of the tube directly, but nothing would be gained, for a choke coil would have to be used to supply the plate with power and a condenser would have to be used to prevent the plate voltage from reaching the succeeding grid.

Since the impedance of the filter was assumed to be 6,000 ohms, the load resistance R would have to be 6,000 ohms also.

Between the second and the third tubes a high pass filter is used. This also is of the T type and it may have a different impedance from the low pass filter. For example, it may be designed to match the tube. This can be done to advantage in this instance because only a choke coil is needed to supply the plate of the tube. This choke should have such a high impedance that it does not affect the characteristic of the filter. Since the filter has been designed to match the tube, the resistance R in the grid circuit of the third tube should be equal to the plate resistance of the second tube.

How It Works

The first tube amplifies all the frequencies that reach its grid. The low pass filter following passes all the frequencies below the upper cut-off Fc2, Fig. 7. All higher frequencies are attenuated so much

that practically no voltage at these frequencies is impressed on the second grid.

The second tube amplifies all frequencies that reach its grid, that is, all below Fc2. The high pass filter passes only those frequencies which are above the lower cut-off Fc1 and it attenuates all frequencies below. Thus only those frequencies which lie between Fc1 and Fc2 are transmitted to the third grid, and they alone will appear in the plate circuit of the third tube with any appreciable magnitude.

Of course, a filter of a few sections will not absolutely suppress everything in the attenuation region. Some voltage will get

coils and condensers, and the entire curve can be raised by using several sections. The peaks can be distributed so that the low regions R will have more attenuation. The width of the transmission band can be chosen at will. The formulas for placing the cut-off frequencies are given in Figs. 4 and 5. Also the formulas for placing the peaks.

Note that the cut-off for the low pass filter is higher than the cut-off for the high pass filter. This is necessary if there is to be any transmission band. Of course, the peak must be higher than the cut-off for the low pass and lower than the

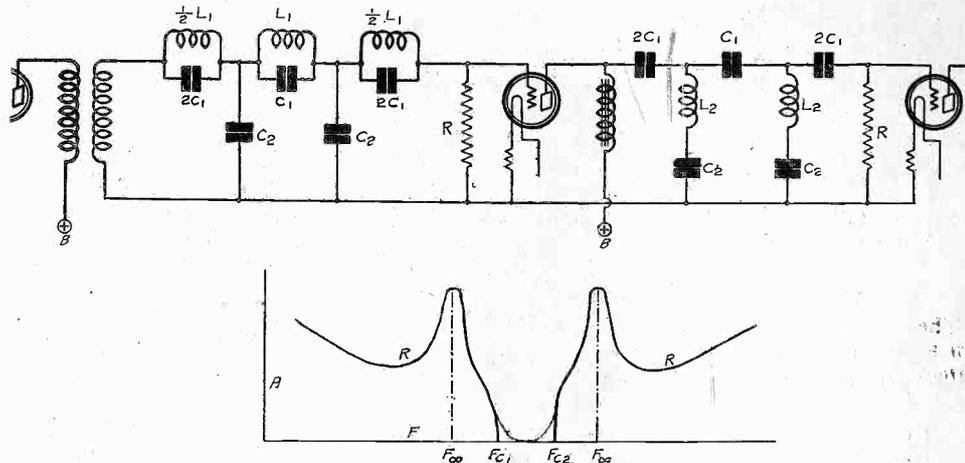


FIG. 6, UPPER. A BAND PASS FILTER MAY BE CONSTRUCTED BY USING ONE LOW PASS FILTER AND ONE HIGH PASS FILTER AS SHOWN IN THIS CIRCUIT.

FIG. 7, LOWER. THE ATTENUATION CURVE RESULTING FROM A BAND PASS FILTER CONSTRUCTED AS IN FIG. 6.

through at all frequencies. Also, due to resistance in the coils, the transmission between Fc1 and Fc2 will not be perfect. But the filtering will be very good.

The Band Pass Curve

Fig. 7 shows the type of attenuation curve that will be obtained with this type of band pass filter. The steepness of the sides of the curve between the peaks and the cut-off frequencies can be made much greater by suitably choosing the values of

cut-off for the high pass.

An arrangement like that in Fig. 6 is suitable for an intermediate frequency amplifier where many tubes are needed to boost the amplification. If it is used for that purpose the intermediate frequency should lie half way between Fc1 and Fc2 as determined by the formula $F_m = (F_{c1}F_{c2})^{1/2}$. The cut-off frequencies are determined by the width of band desired. The theoreti-

(Continued on page 28)

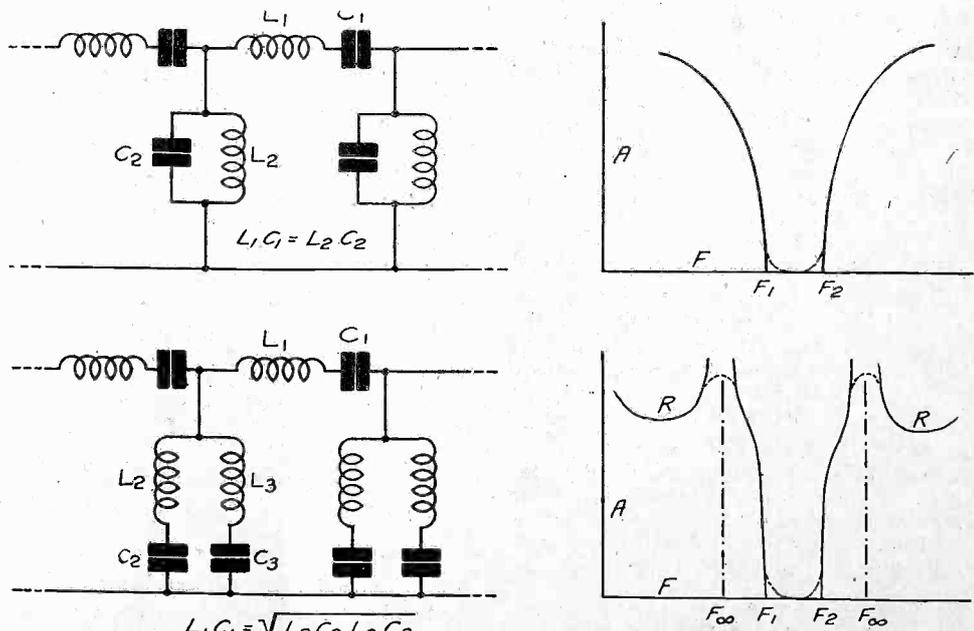
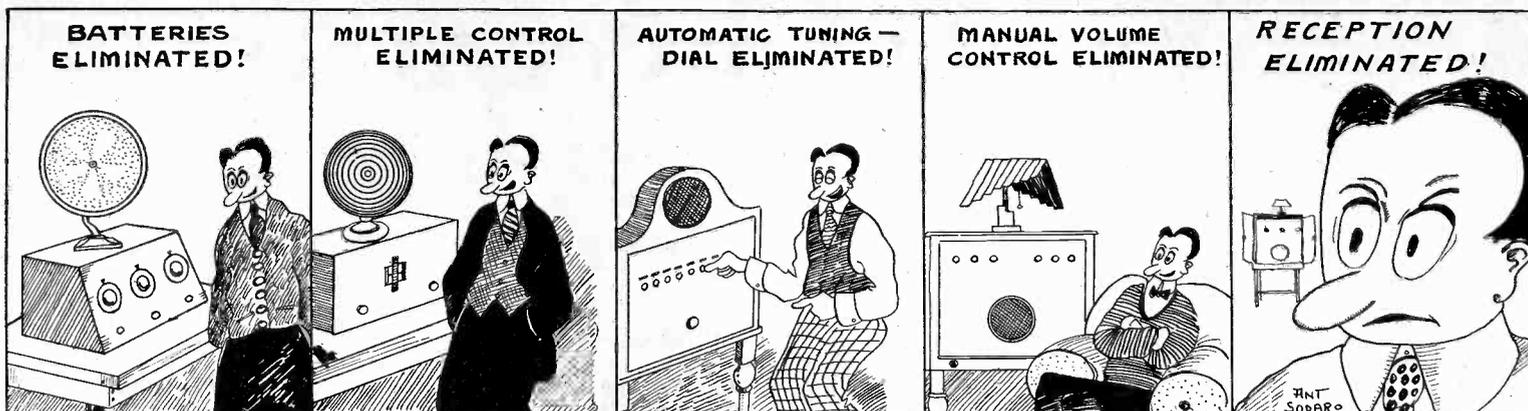


FIG. 8 (UPPER PAIR). A BAND PASS FILTER OF TWO SECTIONS HAVING AN ATTENUATION CURVE AS SHOWN AT RIGHT.

FIG. 9 (LOWER PAIR). A MORE COMPLEX BAND PASS FILTER HAVING STEEP SLOPES ON THE SIDES OF THE TRANSMISSION BAND AND HIGH ATTENUATION PEAKS AS SHOWN IN THE CURVE AT THE RIGHT.

THE EVOLUTION OF ELIMINATION

By Anthony Sodaro



Comic Relief

Feeding Problem

Meters tell you whether a set is being given the correct diet.

* * *

Unequal Distribution

There are 20,000,000 sets in the world. On a warm night, with all windows open, 19,000,000 are in your neighborhood.

* * *

Prayer for Relief

College men get first preference as station announcers. Preserve us then from those who never went to college!

* * *

Seventh Anniversary Note

When RADIO WORLD printed its first issue, in March, 1922, the editor accidentally broke a mirror on the stenographer's desk, but now the spell is broken.

* * *

Old Versus New

An old set is obsolete, a new set is consolette.

* * *

The Middle Man's Question

What with high boys and low boys, what is the middle class to do?

* * *

Limited Jurisdiction

An insensitive set is prudish, because it permits you to go only so far but no farther.

* * *

Companionate Exactitude

Sleepy Neighbor (through wall)—How often do you turn off your set?

DX Owl—As often as I turn it on.

* * *

Musical Appreciation

Bill—My wife is a music expert.

Tom—Well, what did she think of the new dynamic speaker you brought home?

Bill—She said the cabinet was beautiful but the cord wasn't long enough.

* * *

A Rule For DX

A good rule for tuning in a distant station is, first, be sure the station is on the air, and second, to be sure your set is turned on. Many persons are unnecessarily disappointed because they disregard this rule.

* * *

More Speed Wanted

With all the advance in science since broadcasting began, nobody has yet dug up a formula that will make a radio wave travel faster than 186,000 miles a second. This oversight wears on the nerves of fight-fan listeners who want to know at once what the referee's decision is.

The Inventive Faculty

A leaden medal, suitably engraved, should be awarded to the engineer who lately invented the traditional four-tube circuit.

* * *

The K Mystery

Everyone who ever hears mention of "the four corners of the earth" wonders what becomes of the fifth corner or cathode K.

* * *

Temperance Note

The juice from the A battery should be prohibited under the Eighteenth Amendment because it causes the tubes to become lit up.

* * *

A Difficulty Circumvented

Student—What does an impatient audience do when a complete program hour is rendered in a foreign language they do not understand?

Milkman—Tune in a language lesson on another station, learn the language in half an hour, and tune back the other station to enjoy the second half of the program.

Student—All right. One quart of Grade A. Say, you don't happen to have a piece of toast in your pocket?

* * *

Racial Question

Izzy asks what is this gefilter band pass circuit, anyway?

* * *

Week's Solace

If the Berlin televisor is on the square, 10' more or less, all will be well for a week.

* * *

Prosperity for Ninety-four

Ninety-four dealers in the United States each did more than \$100,000 business last year, which accounts for the many new automobiles parked in Cortlandt Street these days.

* * *

Rule of Success

If business is great, laugh. If it is just good, merge!

* * *

Watchful Wakefulness

Sleeping potion manufacturers will make no money out of Arthur H. Lynch. With six publications to take care of, there's no time left for sleep.

* * *

Must Obey

Rebel stations can't make whoopee without Federal sanction.

All-Electric 6 Has Quality AF

There should be no motorboating or audio frequency oscillation of any kind in the amplifier of the All-Electric 6-tube AC circuit described last week, due to the very large filter condensers used in the battery eliminator. But oscillations may occur nevertheless, because any high quality amplifier is subject to this condition. Hence it is best to be prepared to combat it in case it should occur, and to combat it in such a way that amplification is not unnecessarily cut down or that quality is not impaired.

The very best way to reduce the tendency to motorboating in any circuit is to augment the bypass condensers in the B battery eliminator, particularly the last condenser across the line, that is, C15 in the circuit diagram. As it is this condenser is 9 mfd. Another section of the same size, or of twice the size, is an almost certain cure for motorboating.

Add Condensers

While no bypass condensers are shown across the two lower voltage taps, it will help greatly to stabilize the circuit by using them. Of course, the larger these condensers are the more effective they will be. A suitable value for each of these condensers is 4 mfd. They need not be rated at more than 200 volts, since the voltage across them will never exceed this. It is best to place them in amplifier rather than in the B supply.

The grid bias resistors are adequately bypassed.

Tubes of the -27 type have a low amplification constant compared with tubes of the -40 type, and therefore the tendency to motorboating is slight. But still it may be necessary to alter the coupling devices. In this connection it is well to know that as a rule increasing the plate coupling resistors reduces the feedback and at the same time increases the amplification.

Change of Grid Leaks

Motorboating will occur at the low frequencies, if it occurs at all. The reason for this is that the bypass condensers are not as effective at these frequencies as at the higher. But with the large condensers suggested the oscillation, if any, will be at a subaudible frequency.

This suggests the remedy. If either the grid leak resistors or the stopping condensers be reduced the amplification will be reduced greatly at the low frequencies while at the audible it will not be reduced nearly so much. Hence the quickest and simplest way of stopping motorboating is to use lower grid leak resistors. Exactly the same effect will be obtained by reducing the stopping condensers, but this is not so easily done.

(Concluding installment next week, issue of March 30th)

Design of an Adapter

16 to 225 Meters Covered Without Any Blind Spots

By Hollis S. Baird

Shortwave & Television Laboratory, Inc.

THERE is a big demand at present for a satisfactory shortwave adapter, particularly for use with AC receivers.

With this idea in mind I designed a shortwave adapter which is very versatile and works on any radio receiver except in certain cases where a crystal detector is used.

I have tried to incorporate in the Baird Shortwave Adapter all the features that are desirable in shortwave reception and I will describe these different features in succession, starting from the antenna.

Fixed antenna coupling for each band is at once prohibited if we wish the set to oscillate over the complete scale on each coil. The antenna coupling may be varied in three ways: by a different antenna coil for each secondary, by varying the antenna coil coupling with the secondary, and by capacitive coupling with a midget variable condenser. This last method was chosen for an adapter as being the most practical and efficient. For a condenser I use a small 5-plate .00005 capacity.

Secondary Tuning

Next came the choice of the secondary tuning condenser. Most adapters use a small midget for the tuning condenser to save cost but at the expense of crowding the stations on the dial. To avoid this last bad feature I use a standard straight frequency line variable condenser, .00015 capacity, as short wave stations bunch together a certain amount at best.

The coils now come in for consideration. The idea of winding them on a tube base, as some adapter manufacturers have done, was discarded due to poor appearance and the fact that fine wire must be used. After spending considerable time experimenting with different forms and sizes of wire the Octocoil was the result. See Fig. 1. The description follows:

The form is 1 7/8" in diameter and has eight ribs from which it gets its name. The wire used is No. 12, 14, 16 and 25 for the four coils which cover a band from 16-225 meters. This is a much wider band than most other adapters cover and takes in the lower part of the broadcast band which many broadcast receivers will not tune down to.

There is some demand for broadcast coils in the adapter but I do not advise them as of course the adapter is a single circuit set and the receiver it is being used with in the majority of cases will be more selective than this. The different sizes of wire used and the ranges of each are as follows:

Green coil No. 12 bare wire, 16-32 meters.

Brown coil No. 14 bare wire, 30-60 meters.

Blue coil No. 16 bare wire, 55-110 meters.

Red coil No. 25 enameled wire, 105-225 meters.

These secondaries are all space wound. The ticklers are wound with No. 25 wire and are not spaced, as it is unnecessary.

These features just described all combine to make a very efficient and attractive coil plus strength.

Next I will mention the method of regeneration used. The "throttle" method was chosen as being very smooth and having the least effect on tuning. A .0001

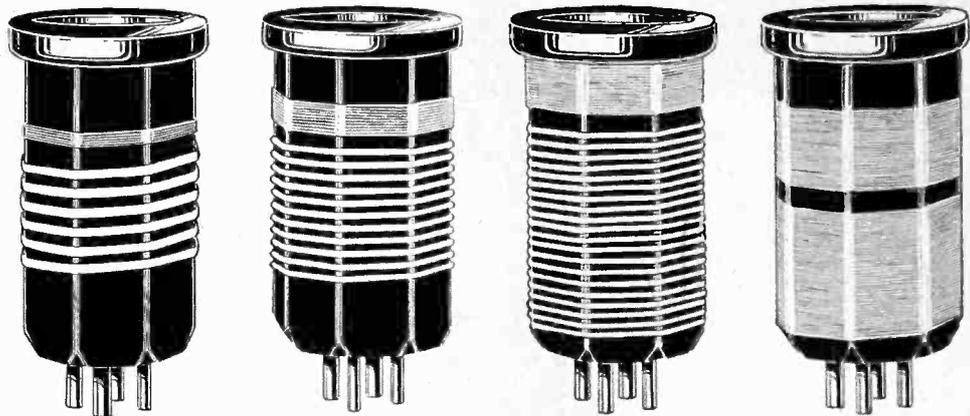


FIG. 1
THE FOUR COILS DISCUSSED BY THE AUTHOR IN THE ACCOMPANYING ARTICLE.

midget condenser is used to control the regeneration, as using a smaller condenser with a larger tickler would increase the effect on detuning of the secondary. On the battery model the series feed is used, that is, the plate current goes through the tickler coil while in the AC model we use shunt feed which gives smoother control regeneration from the power pack.

Hum Subdued

It is quite well known that AC operation on short waves is usually unsuccessful due to a bad hum. This comes from using a 227 detector tube in the adapter. We have overcome this by using a 199 detector in the AC model which is lighted by a small C battery in the lower compartment. Our only source of hum is now the B supply, which is usually well enough filtered so as not to bother reception.

When the coil is pulled out of most adapters a loud howl is heard which is due to the grid circuit being open and the plate circuit still being closed. This noise is rather objectionable in changing coils frequently. This is eliminated in our battery model, as the plate current passes through the tickler, and in the AC model by using a grid leak from grid to filament.

A vernier dial is a necessity and we have provided a large vernier knob with an etched scale on a bronze panel. This bronze panel also effectively shields the interior of the adapter from body capacity. The grid condenser and leak are .00015 mfd. and 10 meg. respectively, which combination is found to work very satisfactorily for short waves.

The lower compartment of the adapter accommodates the coils when not being used and prevents them from being mislaid or damaged.

From the foregoing description it will be seen that the Baird Shortwave Adapter fulfills all of our demands for a good adapter.

1. An antenna may be used with the adjustable control.
2. Very efficient coils which cover a wide band: 16-225 meters.
3. SFL tuning condenser with vernier dial.
4. Successful AC operation.
5. Compartment in base for coils.

6. Metal panel for shielding interior of adapter.

DX Results

In six months we have received reports on reception of the following shortwave stations from all parts of the world:

- JB, Johannesburg, South Africa.
- SSW, Chelmsford, England.
- PCJJ, Eindhoven, Holland.
- CJRX, Winnipeg, Manitoba.
- XC51, Mexico City.
- W6XN, Oakland, California.

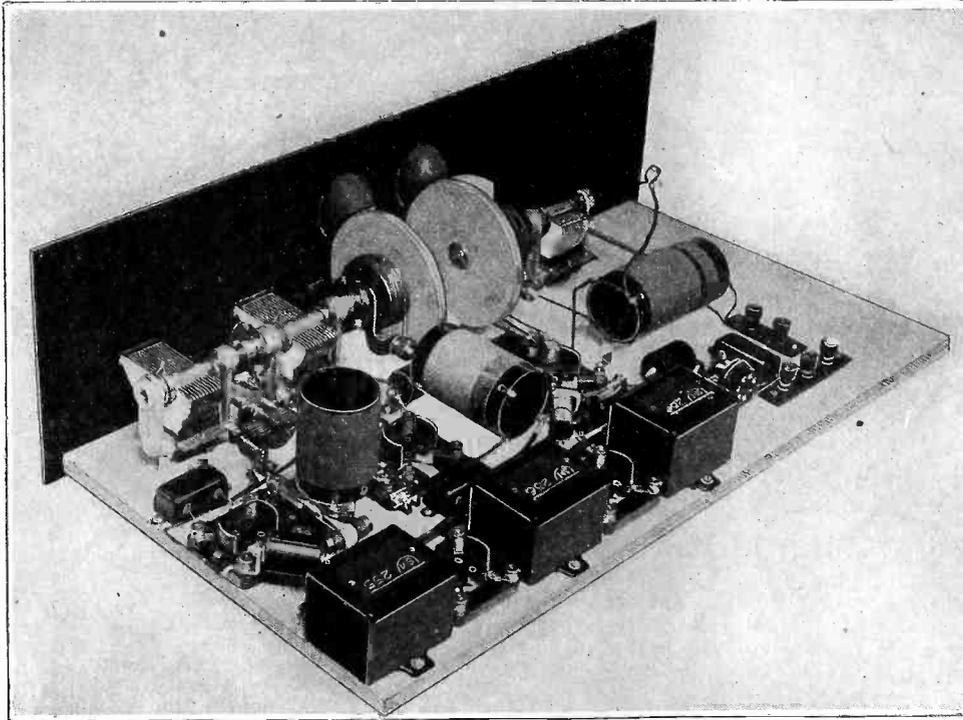
All these were heard regularly in the Eastern part of the country. W6XN is picked up regularly in the afternoon. SSW and PCJJ were both heard in Denver, which is a real record, besides some other South American and Alaskan stations, received at the same location.

New Corporations

- Allenjay Electric Co., radios—Atty. J. E. Stearns, 38 Park Row, New York.
- American Photoelectric Corp.—Atty. Ogren & Severy, 149 Broadway, New York.
- Apex Radio and Electrical Contracting Co., Inc., Jersey City, radio supplies—Atty. Donald M. Waesche, Jersey City, N. J.
- Auto Radio Corp., New York, radio supplies, radios—Atty. Corp. Trust Company of America, Dover, Del.
- National Voice Amplifying System, Inc., Washington, D. C.—Capital Trust Company of Delaware, Dover.
- M. R. Radio Corp.—Atty. I. Reingold, 3,429 3rd Ave., New York, N. Y.
- Service Radio Co., Inc., Asbury Park—Atty. Edwin P. Longstreet, Asbury Park, N. J.
- Acme Radio & Electric, Inc., Wilmington—Corp. Service Co.
- Radiotone Pictures Corp., Moving talking pictures—Atty. Hughes, Schurman & Dwight, 100 Broadway, New York.
- Tip Top Radio Co.—Atty. A. M. Dreyer, 44 Court St., Brooklyn, N. Y.
- Ger-Alt Radio Laboratories, wireless instruments—Atty. Kaufman & Kaufman, 66 Court St., Brooklyn, N. Y.
- Balkeite Radio Co., Wilmington, Del.—Corp. Trust Co. of America, Wilmington, Del. May Distributing Co., radios—Atty. Falk & Orleans, 165 Broadway, New York, N. Y. Superior Automatic Radio Co., Inc., Newark, N. J.—Atty. Peter A. Sena, Newark, N. J. Automatic Radio Sales Corp.—Atty. H. E. Frankenberg, 52 Broadway, New York, N. Y. A & M. Sales Co., radios—Atty. A. A. Allen, 60 Wall St., New York, N. Y. Arlington Radio & Battery Service Co.—Inc., Philadelphia, Pa.—Corp. Guarantee and Atty. H. M. Mandel, 27 Pennsylvania Ave., Brooklyn, N. Y. Excellent Radio Co. of America, Trust Co.

WMAQ with full loudspeaker volume volume through WEAFF! WGN while WOR is broadcasting! WLS while WABC is on the air! Salt Lake City, Denver, Texas and Winnipeg before 10:00 P. M. The Pacific Coast as soon as they are on the air! All this from the heart of New York City!

Several years of close contact with all the "new" and "wonderful" and otherwise much-praised circuits have rendered the writer thoroughly hard-boiled about new circuits, so when he began hearing a lot of enthusiasm about a new receiver he couldn't help being cautious.



However, one evening last week a friend called up asking for aid in locating trouble in his new receiver and I dug up the pliers and Jiffy Tester and set forth. It proved to be one of these "Moore-Daniels" sets, and the only apparent trouble was the reversing of a couple of B leads. They were speedily corrected, a twirl of the dials brought in a station, and we reached for the hat to depart.

A Surprising Announcement

Now that station was about in the place on the dial where WABC ought to be, and it sounded plenty like a local. But just as I got my hat back, the announcer said: "KTHS, come to Hot Springs!"

Now, that much hop in that location is little short of astounding, so the hat was forgotten for a while, and WTMJ, KOA, Shreveport, Winnipeg, Dallas, all came roaring in without any particular effort. "Get Chicago! That set ought to do it!" coaxed the owner.

"Bologna!" was the answer, as I had tried such before. Nevertheless, I moved the dial down a trifle from WEAFF, and lo, WEAFF was gone, and the familiar voice of Bill Hay was heard announcing the "Chicago Daily News" Orchestra from WMAQ.

Now, I have a yen for Coon-Sanders Nighthawks and Guy Lombardo's Orchestra, so I promptly went after WGN and WBBM. WGN, only 10 kc. away from WOR, was easy, but Coon-Sanders weren't playing just then. WBBM was a little harder, but two or three minutes playing with the dials, and WJZ disappeared to give room to the dreamy rhythmic strains that could emanate from no other orchestra than the Royal Canadians.

The Two Designers

That settled that evening, but the next day found me dashing down to Cortlandt street to find out whether the Moore-Daniels circuits all performed like that. It appeared that two or three hundred scattered all over the city were giving

just that kind of result. Whether in Astoria, Coney Island, Greenwich Village or the Bronx, they all got lots of distance, and they got it regardless of powerful locals.

Investigation showed the set to have been designed by two men who already have reputations for receiver design. E. Bunting Moore, well known for his work on the "Everyman 4" set, had been associated with the H. & F. Radio Laboratories, Colonial Radio Corporation, and the Laboratory of David Grimes, Inc. His work on the "Everyman" has made him particularly well-known to New York fans.

Alfred J. Daniels, his co-designer, has recently been in charge of the laboratory

DX with a

Plenty of It Assured in

By James
Contributor

LIST OF PARTS

- One Set Transcontinental Moore-Daniels coils.
- Five Transcontinental RF choke coils.
- Five air gap sockets.
- Two Hammarlund illuminated drum dials.
- Three Hammarlund midline condensers, .0005 mfd.
- One Hammarlund neutralizing condenser.
- Three Hammarlund universal couplers.
- One Precise microdenser, 32 mmfd.
- One Potter Aristocrat fixed condenser, .00025.
- One Potter Aristocrat fixed condenser, .001.
- Four Potter by-pass condensers, 5 mfd.
- One Silver Marshall audio unit No. 255.
- One Silver Marshall audio unit No. 256.
- One Silver Marshall output unit No. 251.
- One De Jur 3 meg grid leak with mount.
- One De Jur 5-tube thermatrol with mount.
- One Hagel plug and cable.
- One filament switch.
- Five Eby Junior binding posts.
- One 500-ohm flexible resistor.
- One 15-ohm resistor, tapped.
- Two Binding post strips.
- One 7x24 Bakelite panel, drilled.
- One 11x23 Subpanel.
- One Roll Corwico hook-up wire.

of Aero Products, in Chicago, where he did much of the experimental work on the Chronophase circuit. Prior to that he was connected with the Rauland Manufacturing Company, manufacturers of All-American radio equipment, and Pfantstiehl Radio Corporation, of Waukegan, Ill., in charge of coil design.

Premeditated DX-Getter

Anticipating that the action of the Radio Commission in clearing many chan-

Which Tube Should Follow

(Continued from page 9)

All of these are suitable for AC on the filament and the first two can also be used for battery sets.

In some receivers not only is the power stage push-pull but also the preceding stage. The tubes to be used in the first push-pull stage are determined by the same considerations as in a single sided circuit. The tube on each side must be able to handle enough signal voltage without wave form distortion to load up the tube that follows it.

Voltage Limitations

The allowable input voltage on any amplifier tube is determined by the grid bias on that tube. When the filament is heated by direct current or when 227 tubes are used the peak input voltage may be equal to, but not greater than, the grid bias. When the filament is heated by AC the peak of the signal voltage should be less than the bias by one half of the filament

voltage of the tube. This assumes that the bias is measured from the midpoint of the filament.

For example, consider the 245 type tube. It requires a bias of 50 volts when the plate voltage is 250 volts. The filament voltage is 2.5 volts. Hence the peak of the signal voltage may be 50 volts less 1.25 volts.

Now what tube should precede the 245 when a coupling transformer of 1-to-3 ratio is used? The maximum peak voltage across the secondary of this transformer should be 48.75 volts. Since the ratio is 1-to-3 the primary voltage will be 16.25 volts. This will be approximately $\frac{2}{3}$ of the total voltage in the plate circuit of the tube ahead of the transformer, or the total voltage will be 24.4 volts. If we select a tube having an amplification constant of 8, the input voltage to that tube should be a little over 3 volts. Almost any tube with a plate voltage of 90 or more can be operated with a bias of 3

Vengeance!

Moore-Daniels Receiver

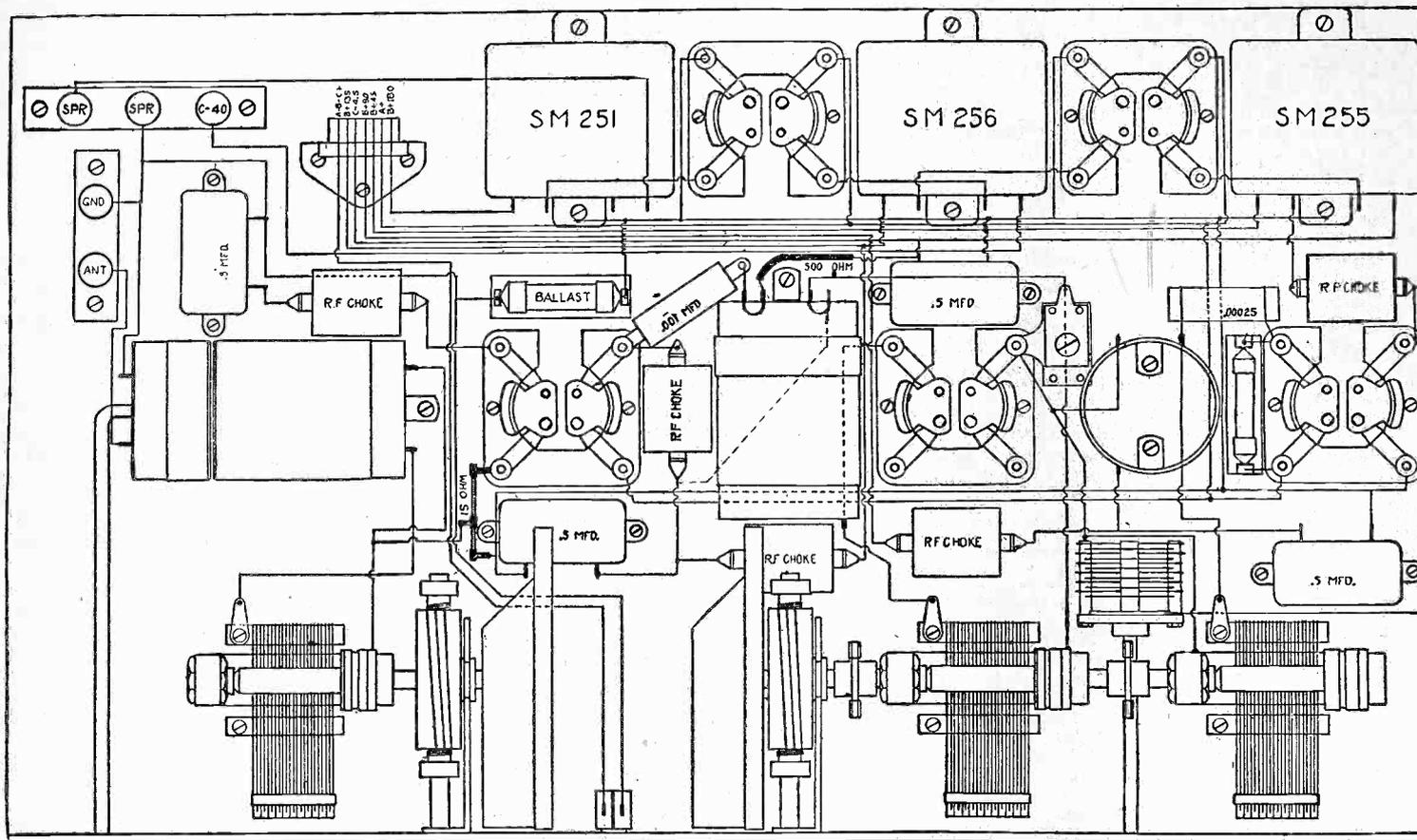
I. Carroll

Editor

tube in this circuit is operated at full efficiency by the use of a further development of the Chronophase output circuit, which in a different form was employed by Daniels in Aero circuits last Summer. In its improved form greater selectivity and gain are acquired without the use of a separate oscillation control for each stage.

Improvements Worked Out

The output of the improved Chronophase stage works into a second stage of standard neutralized RF amplification.



nels would bring back the old urge for "DX", these two designers had set out to develop a receiver which contained all the elements necessary for long-distance reception, combined with simple tuning, simple construction and perfect reproduction.

Absolutely standard circuits were used throughout, "trick" circuits being barred as likely to prove troublesome.

The tuning controls are two in number,

with a volume control and sensitivity adjustment, and there is no interlinking between them whatever. Selectivity is obtained by adapting the old-time variocoupler, well known to fans of five years ago. It is in this circuit, plus the tremendous amplification of the RF amplifier, that provides the astounding selectivity which permits the reception of Chicago and New York stations, only 10 kc. apart, in both cities. The screen grid

Adapted from the Betts circuit, long a favorite with Western Electric engineers, and combined with the "Rice" balancing system and the latest grid stabilizing developments, this stage is electrically entirely self-contained, and can be brought up to the peak of oscillation without affecting other circuits.

The detector input circuit is unusually sensitive, due to very tight coupling to the plate of the RF tube, and a carefully designed capacity controlled feedback system, which employs a single winding RF transformer, or autoformer, in the grid circuit, having an RF resistance of less than half that of the conventional three- or four-winding cell.

Altogether, Moore and Daniels have taken the best features from popular receivers and combined them into a homogeneous unit which is an outstanding application of the work of DeForest, Armstrong, Hazeltine, Betts, Millen and others.

The audio system adopted is that recently developed by Kendall Clough, Chicago research engineer. Silver-Marshall makes these transformers.

Moore to "Tell All"

The receiver, as designed by Moore and Daniels, is particularly well adapted to construction by the average radio fan, and Mr. Moore has been persuaded to lay aside the slide-rule and soldering iron long enough to write an article on how to build this receiver. This article, well illustrated, will appear in ensuing issues of RADIO WORLD. Mr. Moore will discuss a battery operated Moore-Daniels receiver, and an all-electric model.

How Which in a Receiver?

to 4.5 volts. So if the tube is a 227 with 135 volts on its plate and a bias of about 7.5 volts there will be plenty of room for the required signal swing. In transformer coupling there is little chance of overloading the tube ahead of the power tube of the 245 type. This also applies to the 250 tube.

Case of Resistance Coupling

If the 245 tube is coupled to the preceding tube with resistance the situation is somewhat different. The drop across the plate resistor should be approximately 50 volts. If the tube is of the -40 type and the coupling resistor is 100,000 ohms, the output voltage will be about 5/7 of the total voltage in the plate circuit. Or the total voltage will be 70 volts. The amplification factor of the tube is 30 or more. Hence the input voltage to the high mu tube should be 2.3 volts. The bias may be 3 volts. There is ample latitude. The plate voltage of the high mu tube should

be 135 or 180 volts. Let's take another example. If the power tube is a 250 requiring an input of 84 volts the bias on the high mu tube should be at least 4.5 volts and the plate voltage 180.

Suppose the power tube is preceded by a 227 tube in a resistance coupled circuit. If the power tube is a 250 the bias on the 227 should be at least 15 volts. This is too high for the maximum plate voltage allowable on this tube. Hence this tube cannot be used in a resistance coupled circuit to load up a 250 without some wave form distortion. But it is not necessary to load up this tube. The plate coupling resistor may be increased to .25 megohm to improve the wave form on loud signals.

If the power tube is a 245 the bias required on the 227 is nearly 9 volts. This is entirely practical with 180 volts on the plate of the -27. And in this case also the plate coupling resistance may be increased for some improvement in the wave form.

WHY build a set having only four tubes?

Because a set should be measured in terms of performance, not by the number of tubes, as the two considerations are not synonymous.

When a 4-tube receiver can separate low-wavelength local stations that are only one degree apart on the tuning dial, it is abundantly selective.

The sensitivity of this receiver, now shown for the first time as an AC circuit, is so great that steady reception of distant stations, even though powerful locals separated from the distant stations only by 10 or 20 kc., is common practice.

When the volume is more than you need the amplification is high. By use of fine audio transformers the tone quality is excellent. Single dial tuning is easily successful.

With these assets at your command, why not build a 4-tube set?

The tuning is easier than ever, because the two tuning controls have been consolidated. This is made possible only by putting a small equalizing condenser (C1) across the input tuning condenser C2, setting this equalizer once, then letting it alone.

Two Circuits Made Identical

It adds just enough extra capacity to equalize the first tuned stage with the tuned detector stage, across which appears a rather larger capacity than ordinarily

The AC Screen

External B Eliminator Used with Screen

By Her...

denser with a common shaft, since the common rotor goes to the ground lead.

Three Heater Tubes

Heater type tubes are used in three sockets, since the AC 222 tube is of the heater type, as is the 227 tube. The final tube is a 112A or 171A. The choice of power tube will depend largely on the type of external B eliminator you use. If the maximum obtainable voltage is 180 you may use a 171A tube, but if the maximum is 135 you should use 112A. Of course, if you want to use the higher voltage on a 112A tube you may do so, although the tube life thereby would be somewhat shortened.

If your maximum voltage is 250 you may use the new 245 power tube, simply by moving the three connections from the 5-volt winding as shown in the diagram

LIST OF PARTS

CA, CG, C7—Three Aerovox .0005 mfd. mica fixed condensers, moulded type.

C3, C4, C8—Three Aerovox .006 mfd. mica fixed condensers, moulded type.

C6, C9—Two Aerovox .02 mfd. mica fixed condensers, moulded type.

C10—One Aerovox 4 mfd. condenser.

C1—One Hammarlund Equalizer, 70 mfd.

C2, C5—One Hammarlund Midline double condenser, each section .0005 mfd. (MLD23).

L1L2—One AC5 coil, manufactured by Screen Grid Coil Co.

L3L4L5—One SGT5 coil, manufactured by Screen Grid Coil Co.

R1, SW—One Electrad Royalty volume control (0-5,000 ohms) with 110-volt Hart & Hegeman AC switch built in.

R2, R4—Two Electrad 900-ohm resistance strips (grid suppressor type).

R3—One Lynch 50,000 ohm resistor, with clips.

R5—One Electrad 2,000-ohm type B resistor (B20).

T1, T2—Two National A100 audio frequency transformers.

T3—One filament transformer; one winding 2.5 volts at 9 amperes or more, one winding 2.5 volts at 3.5 amperes or more, one winding 5 volts at 2 amperes or more (merchandised by Guaranty Radio Goods Co.).

PL—One Yaxley pilot light bracket with green jewel and lamp.

Sp. -, Sp. + — Two binding posts, Speaker minus and Speaker plus.

Antenna, Ground—Two binding posts, Antenna and Ground.

One 7x21 inch front panel.

One 10x20 inch aluminum subpanel, self-bracketing, with three five-prong sockets and one four-prong socket built in.

One dial.

Two knobs (one for tickler, the other for volume control).

Note: The optional condenser, CX, is .006 mfd.

Accessories

One National Velvet-B, type 3580.

One 222 AC tube, two Kelly 227 tubes, and one Kelly 112A or 171A tube.

One 7x21x12 inch cabinet.

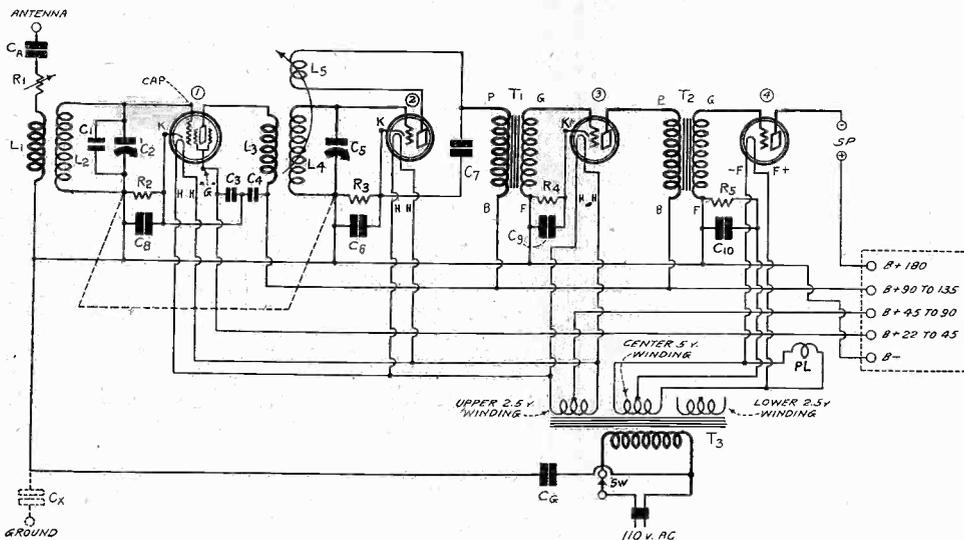


FIG. 1

THIS IS THE FIRST PUBLICATION OF THE CIRCUIT DIAGRAM OF THE AC SCREEN GRID DIAMOND. THIS CIRCUIT IS AMAZINGLY SELECTIVE, YET AT A HIGH VOLUME LEVEL. THE B SUPPLY IS EXTERNAL, SO YOU MAY USE WHATEVER B ELIMINATOR YOU HAVE.

met, due to the large primary on the three-circuit tuner and the plate-to-filament capacity of the screen grid tube. This primary, L3, has 24 turns of No. 24 silk covered wire on a 2½-inch diameter tubing. The ordinary three-circuit tuner, with 10 to 14 turns or so, will not provide any more amplification from the screen grid tube than from a general purpose tube, so be sure to use a generous primary.

The fundamental circuit of the AC Screen Grid Diamond is the same as that of the battery-operated design that has proven so successful. The changes were only such as were required by the use of AC tubes. For instance, the negative bias on the amplifier tubes is obtained through the voltage drop in individual resistors through which the plate current of each of these tubes passes independently. Also, the same system is used in the detector circuit, but with a higher bias, due to use of a larger resistor, thus providing grid bias detection, a simpler form of detection for AC sets, and one which facilitates the use of a two-section tuning con-

to the otherwise unused 2.5 volt winding of the filament transformer. Even if you want to use a 7½-volt-filament output tube you may do so by joining the lower 2.5-volt winding with the 5-volt winding. Connect the two lugs of these windings that are at right. Then put the filament and a center-tapped 10 or 15-ohm resistor of 2 ampere capacity across the remaining posts. Connect the grid return to the center tap.

The biasing resistor R5 is 2,000 ohms, but it has a slider so that less may be used, depending on the power tube type and plate voltage. About 1,500 ohms is average.

Grounded to 110-Volt Line

Reference has been made to the ground lead. The receiver does not require that any external connection be made to the ground post, in fact, the post itself may be omitted, for ground is established through the condenser CG that connects to one side of the line. The power company has one side of the line grounded,

and you pick up this ground through the condenser CG. To avoid connecting to the "high" side of the line, reverse the plug in the convenience outlet or wall socket that provides the access to the 110-volt line, and determine which way gives louder signals. The louder results show ground side properly picked up. No consequences other than a little less volume can result from reverse insertion.

Switch and Ground Opposed

In some instances an external ground may be desired, so a fixed condenser, CX, shown in dotted lines in Fig. 1 because optional, may be connected, one side to the external ground, the other side to the set side of CG. If you use CX be sure you connect to the proper side of

Grid Diamond

Active, Highly Selective 4-Tube Circuit

by Bernard

CG, and not to the line side. CX is .006 mfd., if used.

It will be seen that the switch is in the opposite side of the line to the ground connection. This puts the switch in the "high" side, so that even accidental connection can not complete the 110-volt circuit when the switch is open. When it is shut of course this circuit is completed, but the load is on it.

The volume control is an Electrad Royalty variable resistor of 0-5,000 ohms, and it has the 110-volt AC switch built in, thus combining the two adjustables to one knob, and, besides simplifying the operation, improves the symmetry of the front panel. This knob is placed at left on the front panel, while the tickler knob is at right.

14½" Between Centers

The distance between the centers of the two coils, L1L2 and L3L4L5, is so generous that no objectionable back-coupling due to inductive fields will arise. The usual recommendation is a minimum distance of 6 inches, but in this instance the distance is actually 14½ inches!

The B voltages are exceedingly important. The general rule is to apply about 135 volts on the plate of the screen grid tube, and 45 volts on the screen grid (G post), but voltages above and below these should be tried. The 45 volts is nearly always right, but the plate voltage may be increased.

The circuit diagram shows a B supply in dotted lines, this being the Velvet-B, Cat. 3580, manufactured by the National Company. It is recommended as a highly suitable B supply, if you are to purchase one of the factory-made type, since not only does it provide all the necessary voltages, but all voltages except the maximum are adjustable, and besides the eliminator has 18 mfd. of Mershon electrolytic condensers in it, which, with a generous choke coil system, assures quiet, tone-pure operation.

Detector Biasing Resistor

The detector B voltage is shown as being the same as the B voltage on the screen grid plate and the first audio plate, and this practice is a good one to follow. By choosing the right value of biasing resistor for R3 you will obtain fine detection. This value depends on the actual voltage applied and on the DC resistance of the primary winding of the first audio transformer. Since these will vary with different B supplies and audio transformers, the value of 50,000 ohms is merely suggested for R3. If you use the National Velvet-B, and the National audio transformer in the first stage, you can rely on 50,000 ohms being correct, but if you use other parts you should experiment for yourself to determine which value of resistance is best for R3. In making the test depend on two things: (1), maximum volume consistent with perfect clarity, and (2) ease of regeneration. Under some circumstances as low a resistance as 10,000 ohms will give good detection.

Do not omit C7, as the detecting efficiency depends considerably on that condenser. The capacity is .0005 mfd.

The circuit is built preferably on a self-bracketing aluminum subpanel, with built-in sockets. This subpanel is drilled to take the coils manufactured by the Screen Grid Coil Company and the National audio transformers, although this since you will find it easy indeed to drill does not restrict your choice of parts, the few holes necessary for any substituted parts. If you make any substitutions be sure that you choose parts of excellent quality, as this receiver is bound to perform extraordinarily well, if good parts are used. Under no circumstances use a cheap multiple condenser, for instance, because you may run into ungovernable squeals on the low wavelengths, and fair operation on the high waves, or much squealing on the high waves with stability but no sensitivity on the low ones. This vice is due to failure of the two sections to provide the same capacity in each at given settings of the dial. The Hammarlund multiple condenser is accurate to a small fraction of a per

cent. of that tube's socket). The G post, you will remember, goes to a positive B voltage, about 45 volts.

The tuner is connected with beginning of primary to plate of the screen grid tube, end of primary to B plus, usually 135 volts. The terminal of the secondary that adjoins the B plus end of the primary goes to ground, while the other end of the secondary goes to grid.

The tickler is connected so that when its windings are in the same direction as those of the secondary, the lower terminal of the tickler goes to B plus and the other end to plate of the detector tube. When properly connected, the tickler will regenerate, but when reversely connected it will stifle self-regeneration on the lower wavelengths but provide no deliberate regeneration on the higher wavelengths, that is, it will serve only as a damper, not as a booster. In such an instance, of course, reverse the tickler connections and regeneration will be yours.

Here are some precautions:

Do not use a metal dial. If you do there may be a slight electric discharge when you touch the metal dial, due to body capacity storing electricity which is released by such touching. There is no danger whatever connected with this, only a slight annoyance, and the object of the warning is to dispense with the annoyance.

Do not use "any ordinary filament transformer," since the three heater type tubes draw 5.25 ampere, and the power tube (depending on its type) at least a quarter ampere. The prescribed power

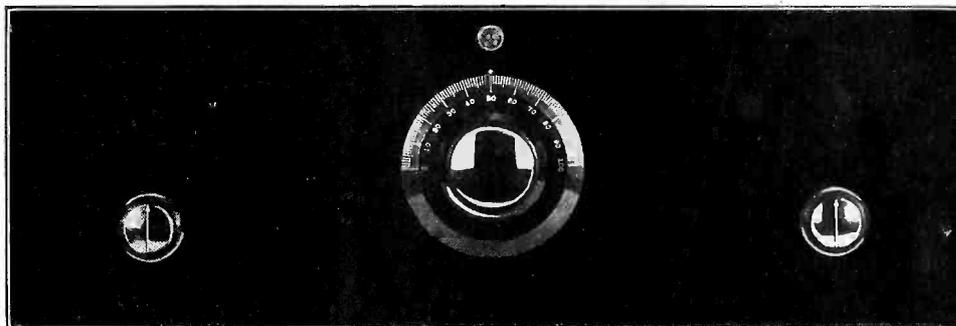


FIG. 2
THE VOLUME CONTROL AT LEFT DETERMINES THE RELATIVE POSITION OF THE TICKLER AT RIGHT. MOUNT TICKLER COIL UPSIDE DOWN

cent., and that accuracy is necessary if you want real sensitivity.

Coil Data

In building the receiver use an antenna coil with a small primary, and tuner with a large primary. For .0005 mfd. tuning the winding data are: Diameters, 2½ inches for primaries and secondaries, 1¼ inches for tickler. Wire is No. 24 single silk covered. L1 has 6 turns. Leave ¼ inch space and wind 48 turns for L2. For L3 wind 24 turns on the other large form, leave ¼-inch space and wind 48 turns for L4. Put 20 turns on the tickler form.

These winding data take into account the extra capacity present automatically in the detector circuit, and that arbitrarily added, by including C1, in the input circuit. The entire wavelength is covered, in fact, from 198 to 575 meters, which is two meters lower than the lowest broadcast wavelength and 20 meters higher than the highest.

When connecting the coils in circuit, join the volume control R1 to the beginning of the primary winding L1, the end of this winding going to the grounded side, while the terminal of the secondary that adjoins the grounded side of the primary also goes to the same point—ground. Thus the remaining terminal of the secondary goes to grid, which is the cap of the screen grid tube (not G

transformer, merchandised by Guaranty Radio Goods Company, has two 2.5 volt winds, the upper one standing even 10 amperes without any heating and capable of 12.5 amperes with slight heat. The 5-volt winding is good for 2 amperes and the lower 2.5 winding for 3.5 amperes.

Do not use leaky condenser rectification, as the grid return can be only zero or negative, and not positive, and you get better quality by the bias method.

Do not be afraid to connect the center-tap of the 2.5 upper winding, which serves the three heater tubes, to B plus 45, since this positive voltage does not reach the cathode K, but it does serve to make all hum virtually disappear.

Do not substitute parts, unless you are fully qualified to determine whether the substitution is a fitting one.

Do not wire up the set until you have tested each coil and resistor, to be sure its circuit is continuous. A small battery or dry cell and meter are all you need for this test.

If you do not get the expected results do not assume that the circuit diagram is faulty. Fig. 1 is absolutely correct. It is well to make wiring as easy as possible by following the official blueprint.

(Other Illustration on Front Cover.)

Details of the operation of this receiver, as well as some other interesting facts, will be published next week, issue of March 30th.

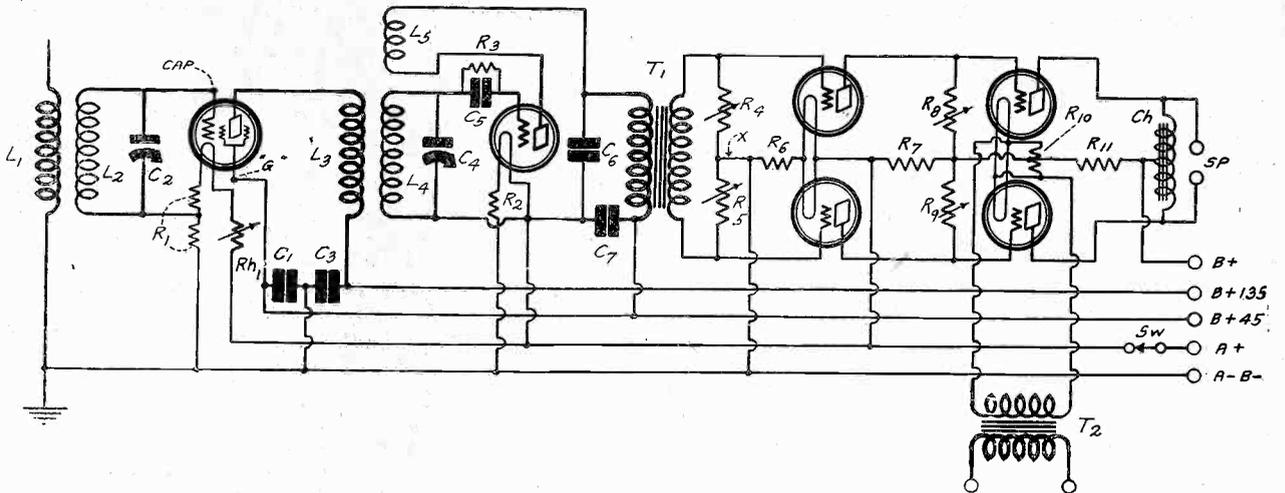
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of this and other similar circuits see the issue of September 15th, 1928.

(2)—You will need a voltage of about 250 volts for the two push-pull stages, including the grid and plate voltages for both stages.

FIG. 736A
This circuit employs a direct coupled push-pull stage without any stopping condensers. It is capable of high fidelity and great volume. Circuit requested by Clem Mitchell.



PLEASE GIVE the plate current, plate voltage and grid bias for the new UX-245 tube.

(2)—Also give the filament voltage and the filament current.

(3)—What is its amplification factor? Its output power?

ELMER WINTER,
Atlanta, Ga.

(1)—For 250 volts on the plate the negative grid bias should be 50 volts and the plate current will be 32 milliamperes. For 180 volts on the plate the negative grid bias should be 33 volts and the plate current will be 26 milliamperes.

(2)—The filament voltage should be 2.5 volts and the current will then be 1.5 amperes.

(3)—The amplification factor is 3.5 and the output power is 750 milliwatts for 180 volts on the plate and 1,600 milliwatts for 250 volts on the plate, with recommended bias. The plate resistance is 1,950 ohms for 180 volts and 1,900 ohms for 250 volts.

I NOTICE that in the picture diagram of the 2-tube short wave adapter receiver described by Lewis Winner in the March 2 and 9 issues of RADIO WORLD, the plus and minus posts of the filament supply are connected. Isn't this an error?

(2)—Is the grid return brought to the minus as shown or to the plus?

R. ROSENTHAL,
Bronx, New York City.

(1)—No. If you will study the diagram you will note that although the plus and minus leads of the sockets are connected together, they are both connected to one

point on the battery, e.g., A plus. The leads were reversed for wiring simplicity.

(2)—The grid return, as was shown, goes to the plus.

* * *

I WISH TO INSTALL four loudspeakers in four different rooms, all operated from the same receiver. How should I connect them?

(2)—How will the output power be divided among the speakers? Will there be enough output to operate all of them? I have a -71A push-pull stage in the output.

WILSON HANCHETT,
Jersey City, N. J.

(1)—If you want all to play at the same time connect them in series parallel. If you want to arrange the circuit so that any one may be cut off without interfering with the others connect in parallel.

(2)—If the speakers are all equal each will take one fourth of the output.

* * *

PLEASE PUBLISH a circuit incorporating one screen grid tube, a regenerative detector and two stages of push-pull audio. I am particularly interested in the direct type of coupling in which the stopping condensers are omitted.

(2)—Is a higher plate voltage necessary when this type of coupling is used?

(3)—Is it necessary to use a regular push-pull input transformer or can the voltage be divided by means of a split resistance?

CLEM MITCHELL,
Chicago, Ill.

(1)—See Fig. 736A. If you wish details

(3)—As the figure shows you can divide the secondary voltage of an ordinary transformer, but a push-pull input transformer is preferred.

* * *

I AM A SERVICE man and I wish to gain a more thorough knowledge of the theory of tubes and circuits. Will you kindly suggest some books which will be of aid in learning the fundamentals of radio?

HAROLD FORD,
Buffalo, N. Y.

The following are some of the books that are available on the subject:

Radio Instruments and Measurements, Circular No. 74, which may be obtained for 60c from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Thermionic Vacuum Tube, by H. F. Van Der Bijl, McGraw-Hill Book Co., Inc., New York (\$3.00).

Principles of Radio Communication, by J. H. Morecroft, John Wiley and Sons, Inc., New York (\$7.50).

Drake's Radio Encyclopedia, Guaranty Radio Goods Co., 145 W. 45th St., New York (\$6.00).

* * *

IS IT POSSIBLE to build a voltmeter having a sensitivity of more than 1,000 ohms per volt? If so, what is necessary?

WILLIAM AUSTIN,
Brownsville, Tex.

It is possible to build a voltmeter with almost any desired sensitivity. If you use a microammeter with a 0-10 microampere range as the indicating instrument the meter will have a sensitivity of 10,000 ohms per volt. This is about the most sensitive portable instrument. By using a galvanometer of very high sensitivity you can make an instrument having a sensitivity of one megohm per volt, or even greater. If you employ a vacuum tube with a sensitive indicating instrument you can get a still higher sensitivity.

* * *

IS IT TRUE that the quality is better when grid bias method of detection is used than when grid leak and condenser detection is used?

(2)—If it is, why is not this method used more?

(3)—What are the advantages and disadvantages of each method?

EUGENE ACKERMAN,
St. Paul, Minn.

(1)—It is. The high audio frequencies are detected better.

(2)—Because it is less sensitive.

(3)—The grid bias method is less sensitive, more faithful and will stand a greater input and output. The grid condenser and leak method is much more sensitive but is noisier.

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Name

Street

City and State

OFFICIAL LIST OF STATIONS BY FREQUENCIES

Corrected up to March 14th from data obtained direct from Federal Radio Commission

LEGEND

- *—Daytime. See General Order No. 41.
- †—Power until local sunset.
- ‡—Limited Time. See General Order No. 48
- §—Limited Power. See General Order No. 42
- ||—Construction Permit authorized.
- ¶—Where main studio location differs from transmitter, same is shown below transmitter location.

TIME AND POWER LIMITATIONS

Call	Location	Owner	Sharers	Power
550 KILOCYCLES				
WEAN	Providence, R. I.	Shepard Stores Co.		250
WGR	Buffalo, N. Y.	Radio Station WGR, Inc.		1 KW
WEAO	Columbus, Ohio	Ohio State University	WKRC	750
WKRC	Cincinnati, Ohio	Kodei Radio Corp.	WEAO	500
KFUO	Clayton, Missouri	Concordia Theological Seminary	KSD	500
KSD	St. Louis, Missouri	Pulitzer Publishing Co.		1 KW†
KFDY	Brookings, S. D.	S. D. State College	KFUO	500
KFYR	Bismark, N. D.	Hoskins-Meyer	KFYR	500
KFDY	Oakland, Calif.	Associated Broadcasters	KFDY	500
560 KILOCYCLES				
WDGY	Minneapolis, Minn.	Dr. Geo. W. Young	WHDI	500
WHOI	Minneapolis, Minn.	Wm. H. Dunwoody Indust. Inst.	WDGY	500
WLIT	Philadelphia, Pa.	Lit Brothers	WFI	500
WFI	Philadelphia, Pa.	Strawbridge & Clothier	WLIT	500
KFDM	Beaumont, Texas	Magnolia Petroleum Co.		500
WMBF	Miami Beach, Fla.	Fleetwood Hotel Corp.		500
WNOX	Knoxville, Tenn.	Sterchi Brothers		1 KW
WOI	Ames, Iowa	Iowa State College of Agri. & Mech. Arts.	KFEQ	3½ KW*
KFEQ	St. Joseph, Missouri	Scrogin & Co. Bank	WOI	2½ KW*
KOAC	Corvallis, Ore.	Oregon State Agri. College		1 KW
KLZ	Dupont, Colo.	Reynolds Radio Co., Inc.		1 KW
570 KILOCYCLES				
WNYC	New York, N. Y.	Dept. Plant & Structures (City of New York)	WMCA	500
WMCA	Hoboken, N. J.	Greenley Square Hotel Co.		500
WNYC	New York, N. Y.			500
WSYR	Syracuse, N. Y.	Clive B. Meredith	WMAC	250
WMAC	Cazenovia, N. Y.	Clive B. Meredith	WSYR	250
WSMK	Dayton, Ohio	Stanley M. Krohn, Jr.	WKEN	200
WKEN	Youngstown, Ohio	W. P. Williamson, Jr.	WSMK	500
WVNC	Asheville, N. C.	Citizens Bdstg. Co.		1 KW
KGKO	Wichita Falls, Tex.	Wichita Falls Bdstg. Co.		250
WHA	Madison, Wis.	University of Wisconsin	WNAX-WPCC-WIBO	750
WNAX	Yankton, S. D.	Gurney Seed & Nursery Co.	WPCC-WHA-WIBO	1 KW
WPCC	Chicago, Ill.	North Shore Cong. Church	WNAX-WHA-WIBO	500
WIBO	Desplaines, Ill.	Nelson Bros. Bond & Mort. Co.	WPCC-WHA-WNAX	1 KW
KUOM	Missoula, Mont.	State University of Montana	KXA-night	500
KXA	Seattle, Wash.	American Radio Tel. Co.	KUOM-night	500
KMTR	Hollywood, Calif.	KMTR Radio Corp.	KPLA	1 KW
KPLA	Los Angeles, Calif.	Pacific Development Radio Co., Inc.	KMTR	1 KW
580 KILOCYCLES—(Canadian Shared)				
WTAG	Worcester, Mass.	Worcester Telegram Pub. Co., Inc.		250
WOBU	Charlestown, W. Va.	Charleston Radio Bdstg. Co.	WSAZ	250
WSAZ	Huntington, W. Va.	W. C. McKellar	WOBU	250
KGFX	Pierre, S. D.	Danna McNeill		200*
KSAC	Manhattan, Kans.	Kansas State Agri. College	WSUI	500
WSUI	Iowa City, Iowa	Iowa State University of Iowa	KSAC	500
590 KILOCYCLES				
WEEL	Boston, Mass.	Edison Elec. Illum. Co. of Boston		500
WEMC	Berrien Springs, Mich.	Emmanuel Missionary College		1 KW*

Call	Location	Owner	Sharers	Power
590 KILOCYCLES (Continued)				
WCAJ	Lincoln, Nebr.	Nebr. Wesleyan University	WOW	500
WOW	Omaha, Nebr.	Woodman of the World Life Ins. Assn.	WCAJ	1 KW
KHQ	Spokane, Wash.	Louis Wasmer, Inc.		1 KW
600 KILOCYCLES—(Canadian Shared)				
WTIC	Hartford, Conn.	Travelers Bdstg. Service Corp. (Temporary assignment pending completion of new 50,000 watt station)	WCAC	250
WCAC	Storrs, Conn.	Conn. Agri. College	WTIC	250
WCAO	Baltimore, Md.	Monumental Radio, Inc.		250
WREC	Whitehaven, Tenn.	WREC, Incorporated	WOAN	500
WOAN	Lawrenceburg, Tenn.	James D. Vaughan	WREC	500
WEBW	Beloit, Wis.	Beloit College		350*
KFSD	San Diego, Calif.	Airfan Radio Corp.		500
KWYO	Laramie, Wyo.	Bishop N. S. Thomas		1 KW†
610 KILOCYCLES				
WFAN	Philadelphia, Pa.	Keystone Bdstg. Co.	WIP	500
WIP	Philadelphia, Pa.	Gimbel Bros., Inc.	WFAN	500
WDAF	Kansas City, Missouri	Kansas City Star Co.	WOQ	1 KW
WOQ	Kansas City, Missouri	University School of Christianity	WDAF	1 KW
KFRC	San Francisco, Calif.	Don Lee, Inc.		1 KW
620 KILOCYCLES				
WLBZ	Bangor, Maine	Maine Broadcasting Co., Inc.		250
WDBO	Orlando, Fla.	Rollins College, Inc.	WDAE	1 KW
WDAE	Tampa, Fla.	Tampa Pub. Co.	WDBO	1 KW
WTMJ	Brookfield, Wis.	The Journal Co. (Milwaukee Journal)		1 KW
KGW	Portland, Ore.	Oregonian Publishing Co.		2½ KW†
KFAD	Phoenix, Ariz.	Electrical Equipment Co.		1 KW
630 KILOCYCLES—(Canadian Shared)				
WMAL	Washington, D. C.	M. A. Leese		250
WOS	Jefferson City, Missouri	Missouri State Mktg. Bureau	WGBF-KFRU	500
KFRU	Columbia, Missouri	Stephens College	WOS-WGBF	500
WGBF	Evansville, Ind.	Evansville on the Air, Inc.	WOS-KFRU	500
640 KILOCYCLES				
WAIU	Columbus, Ohio	American Insurance Union		500‡
KFI	Los Angeles, Calif.	Earl C. Anthony, Inc.		5 KW
WSM	Nashville, Tenn.	Nat'l. Life & Acc. Ins. Co.		5 KW
650 KILOCYCLES				
WEAF	Bellmore, N. Y.	Nat'l. Bdstg. Co., Inc.		50 KW§
WAAW	Omaha, Nebr.	Omaha Grain Exchange		500*
670 KILOCYCLES				
WMAQ	Addison, Ill.	Chicago Daily News, Inc.		5 KW
680 KILOCYCLES				
WPTF	Raleigh, N. C.	Durham Life Ins. Co.		1 KW
KPO	San Francisco, Calif.	Hale Bros. & The Chronicle		10 KW‡
690 KILOCYCLES (Canadian Exclusive)				
WLW	Mason, Ohio	Crosley Radio Corp.		50 KW§
KFVD	Culver City, Calif.	Auburn Fuller Co.		250‡

Call	Location	Owner	Sharers	Power
710 KILOCYCLES				
WOR	Kearney, N. J.	L. Bamberger & Co.		5 KW
720 KILOCYCLES				
WGN-WLIB	Elgin, Ill.	The Tribune Co.		25 KW
730 KILOCYCLES (Canadian Exclusive)				
740 KILOCYCLES				
WSB	Atlanta, Ga.	Atlanta Journal Co.		1 KW
KMMJ	Clay Center, Nebr.	The M. M. Johnson Co.		1 KW‡
750 KILOCYCLES				
WJR-WCX	Silver Lake Village, Mich.	WJR, Incorporated		5 KW
760 KILOCYCLES				
WJZ	Bound Brook, N. J.	Radio Corp. of America		30 KW§
WEW	St. Louis, Mo.	St. Louis University		1 KW*
770 KILOCYCLES				
KFAB	Lincoln, Nebr.	Nebraska Buick Automobile Co.	WBBM-WJBT	5 KW
WBBM-WJBT	Glenview, Ill.	The Atlas Co., Inc.	KFAB	10 KW
780 KILOCYCLES—(Canadian Shared)				
WBSO	Wellesley Hills, Mass.	Babson's Statistical Orgn., Inc.		250*
WTAR-WPOR	Norfolk, Va.	WTAR Radio Corp.		500
WMC	Memphis, Tenn.	Memphis Comm. Appeal, Inc.		500
KELW	Burbank, Calif.	Earl L. White	KTM	500
KTM	Santa Monica, Calif.	Pickwick Bdstg. Corp.	KELW	500
790 KILOCYCLES				
WGY	Schenectady, N. Y.	General Electric Co.		50 KW
KGO	Oakland, Calif.	General Electric Co.		77½ KW
800 KILOCYCLES				
WSAI	Mason, Ohio	Crosley Radio Corp. (Lessee)		5 KW‡
WBAP	Ft. Worth, Tex.	Carter Publications, Inc.	KTHS	10 KW
KTHS	Hot Springs Nat'l Park, Ark.	Hot Springs Chamber of Commerce	WRAP	10 KW
810 KILOCYCLES				
WPCH	Hoboken, N. J.	Eastern Broadcasters, Inc.		500*
WCCO	Anoka, Minn.	Washburn-Crosby, Inc.		7½ KW
820 KILOCYCLES				
WHAS	Jeffersontown, Ky.	The Courier Journal Co. & The Louisville Times Co.		5 KW
830 KILOCYCLES				
WHDH	Gloucester, Mass.	Matheson Radio Co., Inc. (C. P. only)		1 KW*
KOA	Denver, Colo.	General Electric Co.		12½ KW
840 KILOCYCLES (Canadian Exclusive)				
850 KILOCYCLES				
KWKH	Kennonwood, La.	W. K. Henderson	WLW	5 KW
WVW	New Orleans, La.	Loyola University	KWKH	500
KFOZ	Hollywood, Calif.	Leslie E. Taft		250‡
860 KILOCYCLES				
WABC-WBOQ	West of Cross Bay Blvd., Queens Co., N. Y.	Atlantic Bdstg. Corp.		5 KW
KFOZ	Hollywood, Calif.	Taft Radio & Bdstg. Co.		250‡
870 KILOCYCLES				
WLS	Crete, Ill.	Agricultural Broadcasting Co.	WENR-WBCN	5 KW
WENR-WBCN	Chicago, Ill.	Great Lakes Broadcasting Co.	WLS	50 KW§
880 KILOCYCLES—(Canadian Shared)				
WOAN	Scranton, Pa.	Scranton Times	KGBI	250
WGBI	Scranton, Pa.	Scranton Broadcasters, Inc.	WQAN	250
WCOC	Columbus, Miss.	Crystal Oil Co.		500
KLX	Oakland, Calif.	Tribune Pub. Co.		500
KPOF	Denver, Colo.	Pillar of Fire, Inc.	KFKA	500

(Continued on next page)

Call	Location	Owner	Sharers	Power	Call	Location	Owner	Sharers	Power	Call	Location	Owner	Sharers	Power
880 KILOCYCLES (Continued)					1000 KILOCYCLES (Continued)					1130 KILOCYCLES				
KFKA	Greeley, Colo.	Colorado State Teachers College	KPOF	500 1 KW†	WOC	Davenport, Iowa	Palmer School of Chiropractic	WHO	5 KW	WJJD	Mooseheart, Ill.	(temporary frequency. See 1180 kc.)		See
890 KILOCYCLES—(Canadian Shared)					1010 KILOCYCLES—(Canadian Shared)					1140 KILOCYCLES				
WJAR	Providence, R. I.	The Outlet Co.		250-500†	WQAO-WPAP	Cliffside, N. J.	Calvary Baptist Church	WHN-WRNY	250	WAPI	Birmingham, Ala.	Alabama Polytechnic Inst.		5 KW
WKAQ	San Juan, P. R.	Radio Corp. of Porto Rico		500	WRNY	Coteyville, N. J.	Experiment Pub. Co.	WQAO-WPAP-WRNY	250	KVOO	Tulsa, Okla.	Southwestern Sales Corp.		5 KW
WMMN	Fairmont, W. Va.	Holt-Rowe Novelty Co.		250 500†	KGGF	Picher, Okla.	D. L. Connell, M. L.	WNAD	500	KJVS	San Francisco, Calif.	Julius Brunton		100*
WMAZ	Macon, Ga.	Mercer University	WGST	250 500†	WNAD	Norman, Okla.	University of Oklahoma	KGGF	500	WHAM	Victor Township, Stromberg-Carlson Tel. Mfg. Co.			5 KW
WGST	Atlanta, Ga.	Georgia Sch. of Technology		500†	WSIS	Sarasota, Fla.	Sarasota Co. Chamber of Commerce		250	KGDM	Stockton, Calif.	(Changed to 1,100 kc., q.v.)		
KGJF	Little Rock, Ark.	First Church of the Nazarene		500†	KQW	San Jose, Calif.	First Baptist Church		500	1150 KILOCYCLES				
WILL	Urbana, Ill.	University of Illinois	KUSD-KFNF	250 500†	1020 KILOCYCLES					1160 KILOCYCLES				
KUSD	Vermillion, S. D.	University of S. Dak.	WILL-KFNF	500 750†	WRAX	Philadelphia, Pa.	Barachah Church, Inc.		250	WWVA	Wheeling, W. Va.	West Virginia Brdcastg. Corp.		C. P. issued for 5 KW.
KFNF	Shenandoah, Iowa	Henry Field Seed Co.	WILL-KUSD	500 1 KW†	KYW-GFKX	Chicago, Ill.	Westinghouse Elec. & Mfg. Co.		5 KW	WOWO	Ft. Wayne, Ind.	Main Auto Supply Co.		C. P. issued to move & inc. pr. to 10 KW.
900 KILOCYCLES					1030 KILOCYCLES—(Canadian Exclusive)					1170 KILOCYCLES				
WFBL	Syracuse, N. Y.	The Onondaga Co., Inc.	WMAK	750	WKEN	Grand Island, New York	Radio Station WKEN, Inc.		1 KW†	WCAU	Byberry, Pa.	Universal Brdcastg. Co.		1 KW
WMAK	Martinsville, N. Y.	WMAK Brdcastg. System, Inc.	WFBL	750	WKAR	East Lansing, Mich.	Michigan State College		500†	KTNT	Muscataine, Iowa	Norman Baker		5 KW†
WKY	Oklahoma City, Okla.	WKY Radiophone Co.		1 KW	WFAA	Dallas, Tex.	The Dallas News & Dallas Journal	KRL	500	KEJK	Beverly Hills, Calif.	R. S. MacMillan		500†
WFLA	WSUN—Clearwater, Fla.	Clearwater Chamber of Commerce & St. Petersburg Chamber of Commerce		750	KRLD	Dallas, Tex.	KRLD, Inc.	WFAA	10 KW	1180 KILOCYCLES				
WLBL	Stevens Point, Wis.	Dept. of Markets		2 KW*	KNX	Los Angeles, Calif.	Western Brdcastg. Co.		5 KW	WGBS	Astoria, L. I.	General Broadcasting System, Inc.		500†
KHJ	Los Angeles, Calif.	Don Leo, Inc.		1 KW	KFKB	Milford, Kas.	Dr. John R. Brinkley		5 KW†	WJJD	Moosheart, Ill.	Supreme Lodge of World, Loyal Order of Moose		20 KW†
KSEI	Pocatello, Idaho	KSEI Brdcastg. Assn., Inc.		250	WBAL	Glen Morris, Md.	Cons. Gas, Elect. Lt. & Power Co. of Baltimore	WTIC	10 KW	KEX	Portland, Oregon	Western Broadcasting Co.		KOB
KGBU	Ketchikan, Alaska	Alaska Radio & Service Co., Inc.		500	WTIC	Hartford, Conn.	Travelers Brdcastg. Corp.	WBAL (C.P. 50 KW)		KOB	State College, N. M.	N. M. College of Agri. & Mech. Arts	KEX	10 KW
910 KILOCYCLES—(Canadian Exclusive)					1050 KILOCYCLES					1190 KILOCYCLES				
WWJ	Detroit, Mich.	The Detroit News		1 KW	WJAG	Norfolk, Nebr.	Norfolk Daily News		500 \$500	WICC	Easton, Conn.	Bridgeport Brdcastg. Station, Inc.		500*
KPRC	Houston, Tex.	Houston Printing Co.		1 KW	KWJJ	Portland, Ore.	Wilbur Jermain		500†	WOAI	San Antonio, Tex.	Southwestern Equipment Co.		5 KW
WAAF	Chicago, Ill.	Drovers Journal Pub. Co.		500*	1070 KILOCYCLES					1200 KILOCYCLES—(Canadian Shared)				
KOMO	Seattle, Wash.	Fisher's Blend Station, Inc.		1 KW	WAAT	Jersey City, N. J.	Bremer Broadcastg. Corp.		300 Day till 6 P. M. but not after sunset at Cleveland,	WABI	Bangor, Maine	First Universal Church of Bangor		100
930 KILOCYCLES—(Canadian Shared)					1080 KILOCYCLES					1210 KILOCYCLES—(Canadian Shared)				
WIBG	Elkins Park, Pa.	St. Paul's P. E. Church		50*	WTAM	Cleveland, Ohio	WTAM & WEAR, Inc.	WEAR	3½ KW	WCAX	Burlington, Vt.	University of Vermont		WNBX
WDBJ	Roanoke, Va.	Richardson-Wayland Electrical Corp.		250 500†	WEAR	Cleveland, Ohio	WTAM & Wear, Inc.	WTAM	1 KW	WNBX	Springfield, Vt.	First Cong. Church Corp.		WCAJ
WBRC	Birmingham, Ala.	Birmingham Brdcastg. Co., Inc.		500	WCAZ	Carthage, Ill.	Carthage College		500*	WEPS	Gloucester, Mass.	Matheson Radio Co., Inc.		WKBE
KGBZ	York, Nebr.	Dr. George R. Miller	KMA	500 1 KW†	WDZ	Tuscola, Ill.	James L. Bush		100*	WKBE	Webster, Mass.	K & B Electric Co.		WEPS
KMA	Shenandoah, Iowa	May Seed & Nursery Co.	KGBZ	500 1 KW†	1090 KILOCYCLES					1220 KILOCYCLES—(Canadian Shared)				
KFWM	Oakland, Calif.	Oakland Educational Society	KFWI	500	KMOX-KFQA	Kirkwood, Missouri	Voice of St. Louis, Inc.	WLWL	5 KW	WFBX	Cincinnati, Ohio	Parkview Hotel (Geo. W. Martin, Lessee)		100
KFWI	San Francisco, Calif.	Radio Entertainments, Inc.	KFWM	500	WPG	Atlantic City, N. J.	Municipality of Atlantic City		5 KW	WBHC	Canton, Ohio	St. John's Catholic Church (St. John's Parish)		10
940 KILOCYCLES					1100 KILOCYCLES					1230 KILOCYCLES—(Canadian Shared)				
WCSH	Portland, Maine	Congress Square Hotel Co.		500	WLWL	Kearny, N. J.	Missionary Society of St. Paul the Apostle	WPG	5 KW 5*	WLAP	Louisville, Ky.	American Brdcastg. Corp. of Kentucky		30
WFIW	Hopkinsville, Ky.			1 KW	KJBS	San Francisco, Calif.	changed to 1150 Kc., q.v.			WLBG	Petersburg, Va.	Robert Allen Gamble		100
KOIN	Sylvan, Ore.	KOIN, Inc.		1 KW	KGDM	Stockton, Calif.	E. F. Peffer			WLBG	Petersburg, Va.	(C.P., moved to Ettricks, Va. increase power to 250†)		100
KGU	Honolulu, T. H.	Marion A. Mulroy		500	1110 KILOCYCLES					1240 KILOCYCLES—(Canadian Shared)				
KFEL	Denver, Colo.	Eugene P. O'Fallon, Inc.	KFXF	250	WRVA	Richmond, Va.	Larus & Bro. Co., Inc.		1 KW	WNBO	Washington, Pa.	John Brownlee Spriggs		15
KFXF	Denver, Colo.	Pikes Peak Brdcastg. Co., Inc.	KFEL	250	KSOO	Sioux Falls, S. D.	Sioux Falls Brdcastg. Assn.		1 KW†	WPRC	Harrisburg, Pa.	Wilson Printing & Radio Co.		WKJC
950 KILOCYCLES					1120 KILOCYCLES—(Canadian Shared)					1250 KILOCYCLES—(Canadian Shared)				
WRC	Washington, D. C.	Radio Corp. of America		500	WDEL	Wilmington, Del.	WDEL, Inc.		250 350†	WCOA	Pensacola, Fla.	City of Pensacola, Florida		500
KMBC-KLDS	Independence, Missouri	Midland Brdcastg. Co., Inc.		500	WCOA	Pensacola, Fla.	City of Pensacola, Florida		500	WTAU	College Station, Tex.	Agri. & Mech. College of Texas		500
WHB	Kansas City, Mo.	Sweeney Automobile School Co.	KMBC-KLDS	2½ KW†	KUT	Austin, Tex.	English & Stacy	WTAU	500	WISN	Milwaukee, Wis.	Evening-Wisconsin Co.		250
KFWB	Hollywood, Calif.	Warner Bros. Brdcastg. Corp.	KPSN	1 KW	WISN	Milwaukee, Wis.	Marquette University	WISN	250	KFSG	Los Angeles, Calif.	Echo Evang. Assn.		KMIC
KPSN	Pasadena, Calif.	Pasadena Star-News Pub. Co.	KFWB	1 KW	KMIC	Inglewood, Calif.	James R. Pouch	KFSG	500	KRSC	Seattle, Wash.	Radio Sales Corp.		50*
KGHL	Billings, Mont.	Northwestern Auto Supply Co., Inc.		500	1130 KILOCYCLES					1260 KILOCYCLES—(Canadian Shared)				
960 KILOCYCLES—(Canadian Exclusive)					1140 KILOCYCLES					1270 KILOCYCLES—(Canadian Shared)				
WCFL	Chicago, Ill.	Chicago Federation of Labor		1½ WK†	WCOA	Pensacola, Fla.	City of Pensacola, Florida		500	WTAU	Austin, Tex.	English & Stacy		500
KJR	Seattle, Wash.	Northwest Radio Service Co.		5 KW	WTAU	Austin, Tex.	English & Stacy		500	WISN	Milwaukee, Wis.	Marquette University		250
980 KILOCYCLES					1150 KILOCYCLES					1280 KILOCYCLES—(Canadian Shared)				
KDKA	Wilkins Township, Pa.	Westinghouse Elec. & Mfg. Co.		50 KW\$	WISN	Milwaukee, Wis.	Marquette University		250	WISN	Milwaukee, Wis.	Evening-Wisconsin Co.		250
990 KILOCYCLES					1160 KILOCYCLES					1290 KILOCYCLES—(Canadian Shared)				
WBZ	East Springfield, Mass.	Westinghouse Elec. & Mfg. Co.	WBZA	15 KW	WISN	Milwaukee, Wis.	Marquette University		250	WISN	Milwaukee, Wis.	Evening-Wisconsin Co.		250
WBZA	Boston, Mass.	Westinghouse Elec. & Mfg. Co.	WBZ	500	1170 KILOCYCLES					1300 KILOCYCLES—(Canadian Shared)				
1000 KILOCYCLES					1180 KILOCYCLES					1310 KILOCYCLES—(Canadian Shared)				
WHO	Des Moines, Iowa	Bankers Life Co.	WOC	15 KW	WISN	Milwaukee, Wis.	Marquette University		250	WISN	Milwaukee, Wis.	Evening-Wisconsin Co.		250

Call	Location	Owner	Sharers	Power	Call	Location	Owner	Sharers	Power	Call	Location	Owner	Sharers	Power
KGDE	Fergus Falls, Minn.	L. Jaren (Jaren Drug Co.)		50	KFKU	Lawrence, Kans.	University of Kansas	WREN	1 KW	WBBR	Rossville, N. Y.	People Pulpit Assn.		1 KW
KGFK	Hallock, Minn.	J. E. Bouvette & C. W. Bouvette, Pubs. (Kittson County Enterprise)		50	1230 KILOCYCLES					WHAP	Carlstadt, N. J.	Defenders of Truth Society, Inc.		1 KW
WCLO	Kenosha, Wis.	C. E. Whitmore		100	WNAC	Woburn, Mass.	Shepard Norwell Co. (The Shepard Stores). C. P. issued to move & incr. pr. to 1 KW		500	WHPA	Carlstadt, N. J.	Defenders of Truth Society, Inc.		1 KW
WHBY	West DePere, Wis.	St. Norber's College (Sunday 10 to 11 A.M. & 5 to 6 P.M. Daily 12 to 1 P.M. & 6 to 8 P.M.)		100	WPSB	State College, Pa.	Penna. State College		500	WBBR	New York, N. Y.			1 KW
KFWC	Ontario, Calif.	James R. Fouch		100	WSBT	South Bend, Ind.	South Bend Tribune		500	WEVD	Woodhaven, N. Y.	Debs Memorial Radio Fund		500
	Pomona, Calif.		KPPC	100	WFBM	Indianapolis, Ind.	Indianapolis Power & Light Co.		1 KW	WBBR	New York, N. Y.			500
KPPC	Pasadena, Calif.	Pasadena Presbyterian Church		50	KYA	San Francisco, Calif.	Pacific Brdcastg. Corp.		1 KW	WHAZ	Troy, N. Y.	Rensselaer Poly. Inst.		500
KXO	El Centro, Calif.	E. R. Irey & F. M. Bowles		100	KFIO	Spokane, Wash.	North Central High School		100	KFH	Wichita, Kans.	Rigby Gray Hotel Co. (Hotel Lassen) C. P. issued for 1 KW		500
KMJ	Fresno, Calif.	The Fresno Bee		100	KFOD	Anchorage, Alaska	Anchorage Radio Club		100	WIBW	Topeka, Kans.	Topeka Brdcastg. Assn., Inc.		1 KW
KSMR	Santa Maria, Calif.	Santa Maria Valley R. R. Co.		100	1240 KILOCYCLES					KGEF	Los Angeles, Calif.	Trinity Methodist Church South		1 KW
KWG	Stockton, Calif.	Wireless Tel. Co., Inc.		100	WGHP	Fraser, Mich.	American can Broadcasting Corp.		750	KTBI	Los Angeles, Calif.	Bible Inst. of Los Angeles		750
KGEK	Yuma, Colo.	Beehler Electrical Equip. Co.		50	KTAT	Ft. Worth, Texas	Texas Air Transport Brdcast. Co.		1 KW	KFJR	Portland, Ore.	Ashley C. Dixon & Son		500
KGSEW	Ft. Morgan, Colo.	City of Ft. Morgan		100	WJAD	Waco, Texas	Frank P. Jackson		1 KW	KTBR	Portland, Ore.	M. E. Brown		500
KFHA	Gunnison, Colo.	Western State College of Colorado		50	WQAM	Miami, Fla.	Miami Brdcastg. Co. C. P. issued to move & incr. pr. to 1 KW		1 KW					
KVOS	Bellingham, Wash.	L. Kessler		100	WIOD	Miami Beach, Fla.	Isle of Dreams Brdcastg. Co.		1 KW	1310 KILOCYCLES				
KGY	Lacey, Wash.	Saint Martin's College		10	WRBC	Valparaiso, Ind.	Immanuel Lutheran Church		500	WKAV	Laconia, N. H.	Laconia Radio Club		100
				50	1250 KILOCYCLES					WEBR	Buffalo, N. Y.	H. H. Howell		100
1210 KILOCYCLES—Local (Canadian Shared)					WGCP	Newark, N. J.	May Radio Broadcast Corp.		250	WOL	Washington, D. C.	American Brdcastg. Co.		100
WJBI	Redbank, N. J.	Robert S. Johnson		100	WODA	Paterson, N. J.	Richard E. O'Dea		1 KW	WGH	formerly WNEW, Virginia Brdcastg. Co., Inc., Newport News, Va.			100
WGBB	Freeport, N. J.	Harry H. Carman		100	WAAM	Newark, N. J.	WAAM, Inc.		500	WRK	Hamilton, Ohio	S. W. Doran & John C. Slade		100
WINR	Bayshore, N. Y.	Radiotel Mfg. Co., Inc.		100	WLB	Minneapolis, Minn.	University of Minn. WRHM-KFMG-WCAL		1 KW	WAGM	Royal Oak, Mich.	Robt. L. Miller		100
WCOH	Greenville, N. Y.	Westchester Brdcastg. Corp.		100	WRHM	Fridley, Minn.	Rosedale Hospital Co., Inc.		1 KW	WFDF	Flint, Mich.	Frank D. Fallain		50
WOCL	Jamestown, N. Y.	A. E. Newton		25	KFMX	Northfield, Minn.	Carleton College		1 KW	WNAT	Philadelphia, Pa.	Frederick Lennig (trading as Lennig Bros. Co.)		100
WLCI	Ithaca, N. Y.	Lutheran Assn. of Ithaca, N. Y.		50	WCAL	Northfield, Minn.	St. Olaf College		1 KW	WFKD	Frankford, Pa.	Foulkrod Radio Eng. Co.		100
WPAW	Pawtucket, R. I.	Shartenberg & Robinson Co.		100	KFOX	Long Beach, Calif.	Nichols & Warriner, Inc.		1 KW	WNAT	Philadelphia, Pa.			50
WDWF	WLSI—Cranston, R. I.	Luett W. Flint & The Lincoln Studios, Inc.		100	KXJ	Portland, Ore.	KXJ Broadcasters, Inc.		500	WFBP	Johnstown, Pa.	Johnstown Auto Co.		100
WMAN	Columbus, Ohio	W. E. Heskett		50	KIDO	Boise, Idaho	Frank L. Hill & C. G. Phillips		1 KW	WFBG	Altoona, Pa.	William F. Gable Co.		100
WLBV	Mansfield, Ohio	John F. Weimer, owner (Mansfield Brdcastg. Assn.)		100	1260 KILOCYCLES					WRAW	Reading, Pa.	Avenue Radio & Electric Shop		15
WEBE	Cambridge, Ohio	Roy W. Walker		100	WJAX	Jacksonville, Fla.	City of Jacksonville		1 KW	WGAL	Lancaster, Pa.	Lancaster Elec. Sup. & Cons. Co.		15
WBAX	Wilkes-Barre, Pa.	John H. Stenger, Jr.		100	KWWG	Brownsville, Tex.	Chamber of Com., City of Brownsville		500	WSAJ	Grove City, Pa.	Grove City College		100
WJBU	Lewisburg Pa.	Bucknell University		100	KRGV	Harlingen, Tex.	Valley Radio Corp.		500	WBRE	Wilkes-Barre, Pa.	Louis dale Baptist Church		100
WTAZ	Richmond, Va.	W. Reynolds, Jr., & T. J. McGuire		15	KOIL	Council Bluffs, Ia.	Mona Motor Oil Co.		1 KW	KRMD	Shreveport, La.	Robert M. Dean		100
WMBG	Richmond, Va.	Havens & Martin, Inc.		100	1270 KILOCYCLES					WMBI	Lakeland, Fla.	Fred T. Benford		100
WTAZ	Richmond, Va.	Havens & Martin, Inc.		100	WEAI	Ithaca, N. Y.	Cornell University (C. P. only)		500*	WBBC	Birmingham, Ala.	R. B. Broyles Furniture Co.		50
WSIX	Springfield, Tenn.	638 Tire & Vulcanizing Co.		100	WBFR	Baltimore, Md.	Baltimore Radio Show, Inc.		250	KKGHG	McGehee Ark.	Charles W. McCollum		15
WRBU	Gastonia, N. C.	A. J. Kirby Music Co.		100	WASH	Grand Rapids, Mich.	Baxter Laundries, Inc.		250	WOBT	Union City, Tenn.	Tittworth's Radio & Music Shop		50
WJBY	Gadsden, Ala.	T. C. Edwin (owner) Electric Cons. Co.		50	WOOD	Furnwood, Mich.	Walter B. Stiles, Inc.		500	WNBK	Knoxville, Tenn.	Lonsdale Baptist Church		50
WMBR	Tampa, Fla.	F. J. Reynolds		100	WASH	Grand Rapids, Mich.			500	KRMD	Shreveport, La.	Robert M. Dean		50
WRBQ	Greenville, Miss.	J. Pat Scully		100	WDSU	New Orleans, La.	Joseph H. Uhalt		1 KW	KTSL	Cedar Grove, La.	Bates Radio & Elec. Co.		50
WGCM	Gulfport, Miss.	Gulf Coast Music Co., Inc.		100	KWLC	Decorah, Iowa	Luther College		100*	KFPM	Greenville, Tex.	The New Furniture Co.		15
KWEA	Shreveport, La.	William Antony		100	KGCA	Decorah, Iowa	Chas. W. Greenley		50*	WDAH	El Paso, Tex.	Trinity Methodist Church		100
KDLR	Devils Lake, N. D.	Bert Wi Wick & Harold Serurgard (Radio Electric Co.)		100	KWLC	Decorah, Iowa	Chas. W. Greenley		50*	KGFI	San Angelo, Tex.	San Angeles Brdcastg. Co. (C. P. issued for 100 watts to Eagle Brdcastg. Co. to remove to Corpus Christi, Tex., at 1,500 Kc.)		15
KGCF	Brookings, S. D.	Cutler's Radio Brdcastg. Service, Inc. C. P. to move to Watertown, S. D.		100	KTW	Seattle, Wash.	First Pres. Church		1 KW	KFXR	Oklahoma City, Okla.	Exchange Ave. Baptist Church		100
KFOUR	Lincoln, Nebr.	Howard A. Shuman		100	KOL	Seattle, Wash.	Seattle Brdcastg. Co.		1 KW	WKBS	Galesburg, Ill.	Permil N. Nelson		100
WHBU	Anderson, Ind.	Citizens Bank		100	KFTW	Colorado Springs, Col.	W. D. Corley		1 KW	WLBO	Galesburg, Ill.	Frederick A. Trebbe, Jr.		100
KFVS	Cape Girardeau, Missouri	Oscar C. Hirsch, (owner, Hirsch Battery & Radio Co.)		100	1280 KILOCYCLES					WEHS	Evanston, Ill.	Victor C. Carlson		100
WKQB	Harrisburg, Ill.	First Trust & Savings Bank		50	WCAM	Camden, N. J.	City of Camden		500	WCLS	Joliet, Ill.	WCLS, Inc.		100
WSBC	Chicago, Ill.	World's Battery Co.		100	WCAP	Asbury Park, N. J.	Radio Industrie Brdcast. Co.		500	WKBB	Joliet, Ill.	Sanders Bros.		100
WCRW	Chicago, Ill.	Clinton R. White		100	WOAX	Trenton, N. J.	Franklyn J. Wolff		500	WKBI	Chicago, Ill.	Fred L. Schoenwolf		50
WEBC	Chicago, Ill.	Emil Dene-mark, Inc.		100	WDOA	Chattanooga, Tenn.	Chattanooga Radio Co., Inc. C. P. issued to move & incr. pr. to 1 KW (2 1/2 KW)		500	WHFC	Cicero, Ill.	Goodson & Wilson, Inc.		100
WCBS	Springfield, Ill.	Chas. Messter & H. L. Dewing		100	WRR	Dallas, Tex.	City of Dallas		500	KWCR	Cedar Rapids, Ia.	Harry F. Paar		100
WTAX	Streator, Ill.	Williams Hardware Co.		50	WDAY	Fargo, N. D.	WDAY, Inc.		1 KW	KFJY	Ft. Dodge, Ia.	C. S. Tunwall		100
WHBF	Rock Island, Ill.	Beardsley Specialty Co.		100	WEBC	Superior, Wis.	Head of the Lakes Brdcastg. Co.		1 KW	KFGQ	Boone, Ia.	Boone Biblical College (Sunday Only)		100
WIBA	Madison, Wis.	Capital Times-Strand Theatre Station		100	WDAY	Superior, Wis.	Head of the Lakes Brdcastg. Co.		1 KW	WBOW	Terre Haute, Ind.	Banks of Wabash Brdcastg. Assn.		100
WOMT	Manitowoc, Wis.	Francis M. Kadow		100	1290 KILOCYCLES					WJAK	Kokomo, Ind.	Marmon Brdcastg. Co.		50
KPO	Seattle, Wash.	Archie Taft & Louis Wasmer		100	WBNZ	Saranac Lake, N. Y.	Smith & Mace (C. P. 50 watts*)		10*	WLBC	Muncie, Ind.	Donald A. Burton		50
KPCB	Seattle, Wash.	Pacific Coast Biscuit Co.		100	WJAS	Pittsburgh, Pa.	Pittsburgh Radio Supply House		1 KW	WJAK	Poynette, Wis.	William C. Forrest		100
				100	KTSA	San Antonio, Tex.	Lone Star Brdcast. Co., Inc.		1 KW	(Continued on next page)				
1220 KILOCYCLES					KFUL	Galveston, Tex.	Will H. Ford, C. P. issued for incr. pr. to 1 KW		2 KW					
WCAD	Canton, N. Y.	St. Lawrence University		500*	KFUL	Galveston, Tex.	Will H. Ford, C. P. issued for incr. pr. to 1 KW		2 KW					
WCAE	Pittsburgh, Pa.	Kaufman & Baer Co.		500	KTSA	Blytheville, Ark.	C. L. Lintzenich		50*					
WREN	Lawrence, Kans.	Jenny Wren Co.		1 KW	KDYL	Salt Lake City, Utah	Intermountain Brdcastg. Corp.		1 KW					

(Continued on next page)

Call	Location	Owner	Sharers	Power
KFBK	Sacramento, Calif.	James McClatchy Co.		100
KOY	Phoenix, Ariz.	Neilson Radio Supply Co.		100
		(C.P. inc. power to 500w on 1390 Kc.)		250†
KFIU	Juneau, Alaska	Alaska Elec. Light & Power Co.		10
KGEZ	Kalispell, Mont.	Flathead Brdcastg. Assn.		100
KFUP	Denver, Colo.	Fitzsimmons Hospital	KFXJ	100
KFXJ	Edgewater, Colo.	R. G. Howell	KFUP	50
KMED	Medford, Ore.	Mrs. W. J. Virgin		50
1320 KILOCYCLES				
WADC	Akron, Ohio	Allen T. Simmons		1 KW
WSMB	New Orleans, La.	Saenger Theatres, Inc., & Maison Blanche Co.		500
WID	Idaho Falls, Idaho	Jack W. Duckworth, Jr.	KGIO	250
KGIO	Twin Falls, Idaho	Stanley M. Soule	KID	250
KGHF	Pueblo, Colo.	Curtis P. Ritchie & Joe E. Finch		250
KGHB	Honolulu, Hawaii	Radio Sales Co.		250
1330 KILOCYCLES				
WDRC	New Haven, Conn.	The Doolittle Radio Corp.		500
WTAQ	Township of Washington, Wis.	Gillette Rubber Co.	KSCJ	1 KW
		(Eau Claire, Wis.)		
KSCJ	Sioux City, Iowa	Perkins Bros. Co. (Publishers the Sioux City Journal)	WTAQ	1 KW 2½ KW†
1340 KILOCYCLES				
WSPD	Toledo, Ohio	Toledo Brdcasting Co.		500
KFPW	Siloam Springs, Ark.	Rev. Lannie W. Stewart		50*
KMO	Tacoma, Wash.	KMO, Inc.	KVI	500
KVI	Des Moines, Wash.	Puget Sound Brdcastg. Co.	KMO	1 KW
1350 KILOCYCLES				
WBNY	New York, N. Y.	Barrachrome Corp.	WMSG-WCDA-WKBQ	250
WMSG	New York, N. Y.	Madison Sq. Garden Brdcastg. Corp.	WBNY-WCDA-WKBQ	250
WCDA	New York, N. Y.	Italian Ed. Brdcastg. Co., Inc.	WBNY-WMSG-WKBQ	250
WKBQ	New York, N. Y.	Standard Cahill Co., Inc.	WBNY-WMSG-WCDA	250
KWK	St. Louis, Missouri	Greater St. Louis Brdcastg. Co.		1 KW
1360 KILOCYCLES				
WLEX	Lexington, Mass.	Carl S. Wheeler Co.	WMAF	500
WMAF	S. Dartmouth, Mass.	Round Hills Radio Corp.	WLFX	500
WQBC	Utica, Miss.	Utica Chamber of Commerce, Inc.		300
WJKS	Gary, Ind.	Johnson Kennedy Radio Corp.	WGES	500
WGES	Chicago, Ill.	Oak Leaves Brdcastg. Sta., Inc.	WJKS	500
KFBB	Great Falls, Mont.	Buttery Broadcast, Inc.	KGIR	500
KGIR	Butte, Mont.	Symons Brdcasting Co.	KFBB	250
KGB	San Diego, Calif.	Pickwick Broadcasting Corp.		250
1370 KILOCYCLES				
WMBO	Auburn, N. Y.	Radio Service Laboratories		100
WSVS	Buffalo, N. Y.	Seneca Vocational School		50
WCBM	Baltimore, Md.	Baltimore Broadcasting Corp.		100
WBBL	Richmond, Va.	Grace Covenant Pres. Church		100
WHBD	Bellefontaine, Ohio	First Pres. Church		100
WHDF	Calumet, Mich.	Chas. C. MacLeod		100
WJBK	Ypsilanti, Mich.	James F. Hopkins	WIBM	50
WIBM	Jackson, Mich.	C. L. Carrell	WJBK	100
WRAC	Erie, Pa.	Clarence R. Cummins		50
WELK	Philadelphia, Pa.	Howard R. Miller		100
WJBO	New Orleans, La.	Valdemar Jensen		100
WHBQ	Memphis, Tenn.	Brdcastg. Station WHBQ, Inc.		100
WRBT	Wilmington, N. C.	Wilmington Radio Assn.		50
		(C. P. for 100 watts)		
KGFG	Oklahoma City, Okla.	Faith Tabernacle Assn., Inc.	KCRC	100
KCRC	Enid, Okla.	Champlain Refining Co.		100
KGCI	San Antonio, Tex.	Liberto Radio Sales	KGRC	100
KGRC	San Antonio, Tex.	Eugene J. Roth	KGCI	100
KFJZ	Fort Worth, Tex.	Henry Clay Allison		100
KGKL	San Angelo, Tex.	KGKL, Incorporated		100
KFLX	Galveston, Tex.	George Roy Clough		100
WFBJ	Collegeville, Minn.	St. Johns University		100
WGL	(formerly WCWK) Fort Wayne, Ind.	Fred C. Zeig (Allen Wayne Co.)		100

Call	Location	Owner	Sharers	Power
KGDA	Dell Rapids, S. D.	Home Auto Co.		50
KFJM	Grand Forks, N. D.	University of North Dakota		100
KWKC	Kansas City, Missouri	Wilson Duncan Brdcastg. Co.	KGBX	100
KGBX	St. Joseph, Missouri	Foster-Hall Tire Co.	KWKC	100
WRJN	Racine, Wis.	Racine Brdcastg. Corp.		100
KGAR	Tucson, Ariz.	Tucson Motor Service Co.		100
KFUR	Ogden, Utah	Peery Building Co.		50
KOH	Reno, Nevada	Jay Peters, Inc.		100
KZM	Hayward, Calif.	Leon P. Tenney	KRE	100
KRE	Berkeley, Calif.	First Cong. Church of Berkeley	KZM	100
KOOS	Marshfield, Ore.	H. H. Hanseth (C. P. only)		100
KFBL	Everett, Wash.	Leese Bros.	KVL-KKP	50
KKP	Seattle, Wash.	City of Seattle, Harbor Dept.	KVL-KFBL	15
KFEC	Portland, Ore.	Meier & Frank Co.	KFJI	50
KVL	Seattle, Wash.	Arthur C. Dailey	KEBL-KKP	100
KFJI	Astoria, Ore.	George Kincaid	KFEC	50
		(C.P. to increase to 100w.)		
KGFL	Raton, N. M.	Hubbard & Murphy		50
KGGM	Albuquerque, N. M.	Jay Peters		100
1380 KILOCYCLES				
WSCO	Springfield, Ohio	Wittenberg College	KQV	500
KQV	Pittsburgh, Pa.	Doubleday-Hill Elec. Co.	WSCO	500
KSO	Clarinda, Ia.	Berry Seed Co.	WKBH	500
		(C.P. issued for 1KW)		
WKBH	LaCrosse, Wis.	Jos. Calloway (Calloway Music Co.)	KSO	1 KW
1390 KILOCYCLES				
WHK	Cleveland, Ohio	Radio Service Corp.		1 KW; 2KW
KLRA	Little Rock, Ark.	Arkansas Brdcastg. Co.	KUOA	500
		(C. P. issued for 1KW)		
KUOA	Fayetteville, Ark.	University of Arkansas	KLRA	1 KW
WDGY	Minneapolis, Minn.	Dr. Geo. W. Young	WHDI	500
WHDI	Minneapolis, Minn.	Wm. Hood Dnnwoody Ind. Institute	WDGY	500
KOW	Denver, Colo.	Associated Industries, Inc., Broadcasting		500
KOY	Phoenix, Ariz.	See 1310 Kc.		500
KWSC	Pullman, Wash.	State College of Wash.	KEPY	500
KFPY	Spokane, Wash.	Symons Investment Co.	KWSC	500
1400 KILOCYCLES				
WCGU	Coney Island, N. Y.	U. S. Brdcastg. Corp.	WSGH-WSDA-WBBC	500
WSGH	Brooklyn, N. Y.	Amateur Radio Spec. Co.	WCGU-WLTH-WBBC	500
WLTH	Brooklyn, N. Y.	Voice of Brooklyn, Inc.	WCGU-WSGH-WSDA-WBBC	500
WBBG	Brooklyn, N. Y.	Brooklyn Bdg. Corp.	WCGU-WSGH-WSDA-WLLTH	500
WBAA	W. Lafayette, Ind.	Purdue University	WCMA-WKBF	500
WCMA	Culver, Ind.	Culver Military Academy	WBAA-WKBF	500
WKBF	Indianapolis, Ind.	Noble Butler Watson	WBAA-WCMA	500
1410 KILOCYCLES				
WBCM	(formerly WSKC) Hampton Township, Mich.	James E. Davidson		500
		(Bay City, Mich.)		
KGRS	Amarillo, Texas	E. B. Gish (Gish Radio Service)	WDAG	1 KW
WDAG	Amarillo, Texas	J. Laurance Martin	KGRS	250
KFLV	Rockford, Ill.	A. T. Frykman	WHBL	100
		(C. P. issued for 500w. night & WHBL-Sheboygan, Wis., Press Pub. Co. & C. L. Carrell)	KFLV	500
1420 KILOCYCLES				
WHDL	Tupper Lake, N. Y.	Geo. Franklin Bissell		10*
WAIS	Bluefield, W. Va.	Daily Telegraph		100
WLBH	Farmingdale, N. Y.	Nassau Brdcastg. Corp.	WHPP-WMRJ	30
		(C. P. move to Patchogue, N. Y., incr. D power to 100)		
WHPP	Englewood Cliffs, N. J.	Wm. Elster & Herman Rubin doing business as Bronx Broadcasting Co.	WLBH-WMRJ	10
WMRJ	Jamaica, N. Y.	Peter J. Prinz	WLBH-WHPP	10
WLEY	Lexington, Mass.	Lexington Air Station	WSSH	100
				250†
WTBO	Cumberland, Md.	Cumberland Electric Co.		50
WSSH	Boston, Mass.	Tremont Temple Baptist Ch.	WLEY	100
				250†
WSRO	Middletown, Ohio	Harry W. Farhlender	WAAD	100
WIBR	Stuebenville, Ohio	Thurman A. Owings	WQBZ	50
WAAD	Cincinnati, Ohio	Ohio Mechanics Inst.	WSRO	25
WEDH	Erie, Pa.	Erie Dispatch Herald Brdcastg. Corp.		30

Call	Location	Owner	Sharers	Power
WMBC	Detroit, Mich.	Michigan Broadcasting Co., Inc.		100
WKBP	Battle Creek, Mich.	Enquirer News Co.		50
WOBZ	Weirton, W. V.	J. H. Thompson	WIBR	60
KGFF	Alva, Okla.	Earl E. Hampshire		100
KOCW	Chickasha, Okla.	Oklahoma College for Women		100
KTAP	San Antonio, Tex.	Alamo Brdcastg. Co.		100
KTUE	Houston, Tex.	William John Uhalt (Uhalt Electric)		5
KFYO	Abilene, Tex.	T. E. Kirksey (Owner Kirksey Bros.)		100
KICK	Red Oak, Iowa	Red Oak Radio Corp.		100
WIAS	Ottumwa, Iowa	Poling Electric Co.		100
KGCN	Concordia, Kans.	Concordia Brdcastg. Co.		50
WIL	St. Louis, Missouri	Missouri Brdcastg. Corp.		100
				250†
WLBF	Kansas City, Kans.	Everett L. Dillard		100
WMBH	Joplin, Mo.	Edwin Dudley Aber		100-250†
KGFW	Ravenna, Nebr.	Otto F. Sothman		50
KFIZ	Fond du Lac, Wis.	Fond du Lac Commonwealth Reporter		100
KGKX	Sand Point, Idaho	C. E. Twiss		15
KFFY	Flagstaff, Ariz.	Mary M. Cosrigan		100
KGFI	Los Angeles, Calif.	Ben S. McGlashan		100
KFOU	Holy City, Calif.	W. E. Riker	KGGC	100
KFOZ	Hollywood, Calif.	changed to 860 Kc. q. v.		
KGCC	San Francisco, Calif.	Golden Gate Brdcastg. Co.	KFQU	50
KFXD	Jerome, Idaho	Service Radio Co.		50
KGHD	Missoula, Mont.	Elmore Nash Brdcastg. Corp.		50
KGIW	Trinidad, Colo.	Trinidad Creamery Co., Inc.		100
KGCX	Vida, Mont.	First State Bank of Vida		10
1430 KILOCYCLES				
WFIF	Portland, Oregon	Benson Polytechnic School		100
KORE	Eugene, Oregon	Eugene Broadcast Station		100
KFQW	Seattle, Wash.	KFQW, Inc.		100
KXRO	Aberdeen, Wash.	KXRO, Inc.		75
1440 KILOCYCLES				
WBR	Tilton, N. H.	Booth Radio Laboratories, Inc.		500
		(C.P. to move to Manchester, N.H.)		
WBMS	Lemoyne, Pa.	Mack's Battery Co.	WBAK-WCAH	500
WBAK	Harrisburg, Pa.	Penna. State Police Com. of Penna.	WBMS-WCAH	500
WCAH	Columbus, Ohio	Commercial Radio Service Co.	WBMS-WBAK	250
WGBC	Memphis, Tenn.	First Baptist Church	WNBR	500
WNBR	Memphis, Tenn.	John Ulrich	WGBC	500
WHEC	WABO-Rochester, N. Y.	Hickson Electric Co., Inc.	WOKO	500
WOKO	Mt. Beacon, N. Y.	Harold E. Smith	WHEC-WABO	500
		(Poughkeepsie, N. Y.)		
WCBA	Allentown, Pa.	D. Bryan Musselmann	WSAN	250
WSAN	Allentown, Pa.	Allentown Call Pub. Co., Inc.	WCBA	250
WNRC	Greensboro, N. C.	Wayne M. Nelson		500
WTAD	Quincy, Ill.	Ill. Stock Medicine Brdcastg. Corp.	WTAD	500
WMBD	Peoria, Hts., Ill.	E. M. Kahler (owner Peoria Heights Radio Lab.)		1 KW*
1450 KILOCYCLES				
WBMS	Fort Lee, N. J.	WBMS Broadcasting Corp.		See Note 250
WNJ	Newark, N. J.	Radio Investment Co.		See Note 250
WIBS	Elizabeth, N. J.	New Jersey Brdcastg. Corp.		See Note 250
WKBO	Jersey City, N. J.	Camith Corp.		See Note 250
WSAR	Fall River, Mass.	Doughty & Welch Elec. Co., Inc.		250
		Note: WBMS, WNJ, WIBS and WKBO divide time with each other.		
WJAY	Cleveland, Ohio	Cleveland Radio Brdcastg. Corp.	WFJC	500
WFJC	Akron, Ohio	W. F. Jones Broadcasting, Inc.	WJAY	500
KSBA	Shreveport, La.	Elliott & Steere		1 KW
WTFI	Toccoa, Ga.	Toccoa Falls Institute		500
1460 KILOCYCLES				
WJSV	Mt. Vernon Hills, Va.	Independent Pub. Co.		10 KW
KSTP	Westcott, Minn.	National Battery Brdcastg. Co.		10 KW
		(St. Paul, Minn.)		
1470 KILOCYCLES				
WKBW	Amherst, N. Y.	Churchill Evang. Assn., Inc.		5 KW
		(Buffalo, N. Y.)		
KFJF	Oklahoma City, Okla.	Na-		

Call	Location	Owner	Sharers	Power
tional	Radio Mfg. Co.			5 KW
WRUF	Gainesville, Fla., Univ. of Florida			5 KW
KGA	Spokane, Wash., Northwest Radio Service Co.			5 KW

1480 KILOCYCLES

WCKY	Harrison, Ohio, S. Covington, Ky., L. B. Wilson	WSOA-WJAZ-WORD	5 KW
WIAZ	Mt. Prospect, Ill., Zenith Radio Corp.	WSOA-WORD-WCKY	5 KW
WSOA	Deerfield, Ill., Radio-Phone Brdcastg. Corp.	WJAZ-WORD-WCKY	5 KW
WORD	Batavia, Ill., Peoples Pulpit Assn., Chicago, Ill.	WJAZ-WSOA-WCKY	5 KW

1490 KILOCYCLES

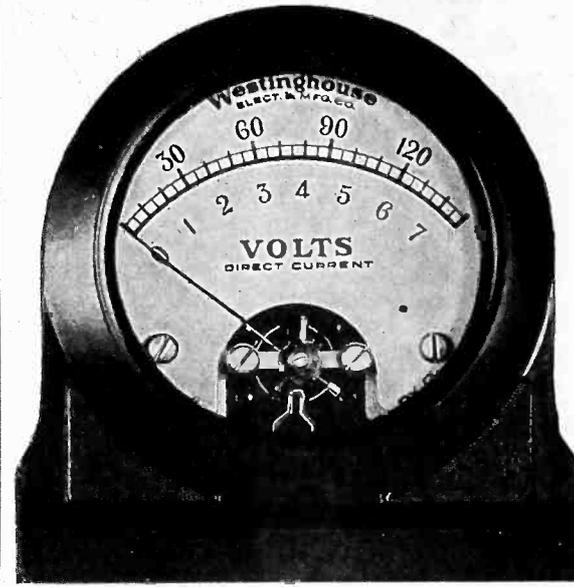
WBAW	Nashville, Tenn., Waldrum Drug Company	WLAC	5 KW
WLAC	Nashville, Tenn., Life & Casualty Ins. Co. of Tennessee	WBAW	5 KW
KPWF	Westminster, Calif., Pacific Western Brdcastg. Federation (C. P. only)		5 to 10 KW

1500 KILOCYCLES

WMBA	Newport, R. I., LeRoy Joseph Beebe		100
WLOE	Chelsea, Mass., Boston Brdcastg. Co.	WMES	100 250†
WMES	Boston, Mass., Mass. Educational Society	WLOE	50
WNBF	Binghamton, N. Y., Howitt-Wood Radio Co., Inc.		50
WMBO	Brooklyn, N. Y., Paul J. Gollhofer	WLBX-WCLB-WWRL	100
WLBX	Long Island City, N. Y., John N. Brahy	WMBQ-WCLB-WWRL	100
WCLB	Long Beach, N. Y., Arthur Faske	WMBQ-WLBX-WWRL	100
WILM	Wilmington, Del., Delaware Brdcastg. Co., Inc.		100
WWRL	Woodside, N. Y., William H. Reumann	WMBQ-WLBX-WCLB	100
WAFD	Detroit, Mich., Albert B. Parfet Co.		100
WKBZ	Ludington, Mich., K. L. Ashbacher		50
WMPC	Lapeer, Mich., First Meth. Protestant Church		100
WMBJ	Wilkinsburg, Pa., Rev. John W. Sproul		100
WALK	Willow Grove, KPa., Albert A. Walker	WHBW-WPSW	50
WHBW	Philadelphia, Pa., D. R. Kienzle	WALK-WPSW	100
WPSW	Philadelphia, Pa., Philadelphia Sch. of Wire. Tel.	WALK-WHBW	50
WIBZ	Montgomery, Ala., Alexander D. Trum		15
KGHI	Little Rock, Ark., Berean Bible Class, First Baptist Church		100
WRBJ	Hattiesburg, Miss., Woodruff Furn. Co., Inc.		10
KGKB	Brownwood, Texas, Eagle Pub. Co.		100
KGDR	San Antonio, Texas, M. A. & D. W. English. C. P. issued for 100 watts		15
KGFL	Corpus Christi, Tex.	See 1310 Kc.	
KGHX	Richmond, Texas, Ft. Bend County School Board		50
WKBV	Brookville, Ind., Knox Battery & Elec. Co.		100
KPJM	Prescott, Ariz., Frank Wilburn		100
KWBS	Portland, Ore., Schaeffer Radio Co.		15
KWTC	Santa Ana, Calif., Pacific-Western Brdcastg. Federation		100
KDB	Santa Barbara, Calif., Santa Barbara Brdcastg. Co.		100
KUJ	Long View, Wash., Fred W. Lovejoy & R. W. Kerfoot (D-B as Columbia Valley Brdcastg. Co.)		10

Westinghouse 0-7½ 0-150 volts

Double Range Table Model Voltmeter FREE!



THE Westinghouse double-range (0-7½, 0-150 volts) table model voltmeter, illustrated at left in full size, is a precise and sturdy instrument, a product of the famous Westinghouse laboratories. Each meter bears the imprint "Westinghouse Electric & Mfg. Co.," as illustrated, and is packed in a red box bearing the Westinghouse registered trade mark as well as the Westinghouse Company's name and address, while the box contains an instruction sheet published by Westinghouse.

The meter is contained in a black, highly polished, moulded bakelite casing, tilted back a little, in which natural position the extreme accuracy of reading is obtained. The meter has the attractive appearance of a boudoir clock.

The scale is read through a sturdy crystal.

There is a mirror strip between the low-reading numbers and the base line of the scale, for closest observation. The needle is read in respect to its own reflection in the mirror strip to insure utmost accuracy of reading. The knife-edge pointer is another aid to precise reading.

Double range table model voltmeter; scales, 0-7½ volts and 0-150 volts; made by the Westinghouse Electric & Manufacturing Company. Accurate to 1% plus or minus. Equipped with built-in zero corrector. 34" connecting cable with tip jacks furnished with each meter. Illustration is actual size.

Meter Employs Dynamic Principle

THE mechanism consists of a strong, permanent magnet of aged steel, a moving coil (d'Arsonval movement), and a knife-edge pointer counterbalanced in two directions. The needle comes quickly to rest on the silver-etched dial.

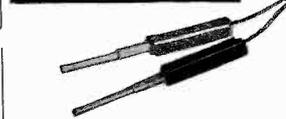
End-stops are built in. The low scale (0 to 7½ volts) reads ¼ of a volt per division, with ample room for closer reading, while the high scale (0 to 150 volts) reads 5 volts per division, with closer definition equally easy.

At rear are three binding posts, equipped with lock washers and anchor bevels, so that the lugs of the 34" connecting cable are held tightly in place. The other end of this cable has tip jacks. The cable is external to the meter, but is furnished with each meter.

Due to 100 ohms resistance per volt, the meter may be used to measure any direct current voltage source, up to 150 volts, including B eliminators, B batteries, storage A and B batteries, dry cells, Edison cells, house electric current (110 volts DC) etc. It will not measure alternating current.

Send \$6.00 now for one year's subscription for RADIO WORLD and this meter will be sent free.

This offer is revocable without notice! Act NOW to avoid disappointment. If we receive your \$6 too late for you to cash in on this offer, we will return the money to you the same day it is received.



Rear view of meter, with connecting cable attached. The center post is always minus. The post at right is for 0-150 volts reading, the one at left for 0-7½ volts. Each post is plainly marked on the casing.

RADIO WORLD, 145 West 45th Street, New York City

Enclosed find \$6.00 for one year's subscription for RADIO WORLD, (52 numbers, one a week) and send as a premium one Westinghouse double scale table model voltmeter (0-7½ and 0-150 volts direct current).

Present subscribers may take advantage of this offer by putting a cross in the square above, remitting \$6 and signing coupon. Subscription will be extended one year.

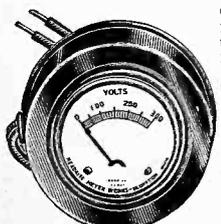
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0-300 v. in portable type, full nickel case, 80" tipped cord (illustrated at left). (Cat. No. 846) \$4.50

0-500 v. Tests ALL power packs, B eliminators, etc. Same casting as above. (Cat. No. 847) \$5.50

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You can find no magazine that better caters to your needs than Radio World, which specializes in most intimate revelations of the ins and outs of the best circuits, with technical accuracy second to none. Enjoy the weekly companionship of Radio World's famous contributors, and glean the news of radio, from the four quarters of the earth.

Short waves? Radio World will tell you all about them. Extremely sensitive broadcast receivers? Their construction and operation are fully discussed with confident regularity. Power supplies—push-pull or otherwise? AC receivers? Screen grid tubes? Large receivers that give a super-abundance of performance—small, economical receivers that give performance out of all comparison to their size? Are you interested in these? Then you're interested in Radio World. Send \$1.00 now for a ten-week subscription for Radio World (regularly \$1.50), and in addition you will be sent FREE any one of the following panel meters:

- 0-6 Voltmeter D.C.
- 0-50 Voltmeter D.C.
- 6-Volt Charge Tester D.C.

- 0-10 Amperes D.C.
- 0-25 Milliampers D.C.
- 0-50 Milliampers D.C.

- 0-100 Milliampers D.C.
- 0-300 Milliampers D.C.
- 0-400 Milliampers D.C.

Put a cross in the square next to the meter you desire, and return this slip with one dollar, whereupon we will send you Radio World by mail each week for ten weeks. Present mail subscribers may renew their subscription under this remarkably generous offer by putting a cross in this square.

15c per copy
\$6 per year

RADIO WORLD
145 West 45th St., New York City

Published Weekly

Choose Your Speaker from This Complete Array!

EXPONENTIAL TYPE HORNS

Modern acoustical science is striving to equal the performance of a large air column horn with powerful unit, while the horn enjoys its rightful popularity with trained experts. The larger the horn, the better, hence we offer two models: one with 7 1/2 ft. tone travel, the other (where space permits) with 10 ft. tone travel. The material used is patented Racon. Nozzle is standard size.

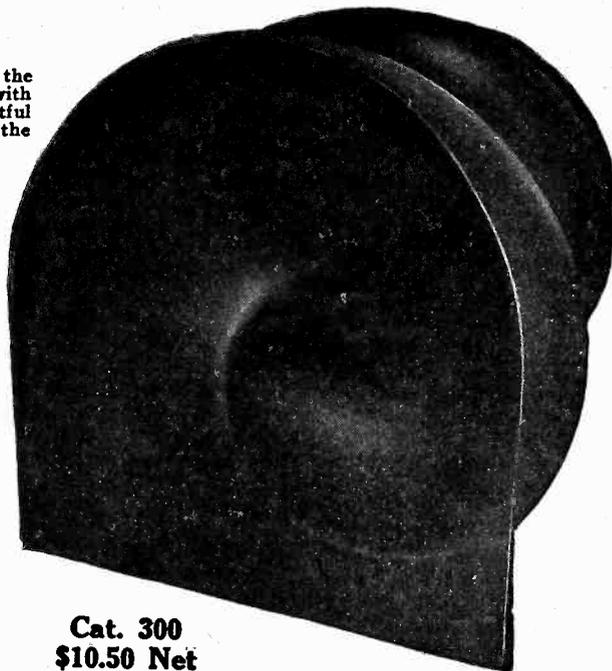


Cat. 200
\$7.50 Net

This horn has a 92-inch air column. No resonance peaks. Front, 18"x18". Depth, 13 1/2". Weight, 5 lbs.



Driving motor, the unit needed to work the air column horns. Standard size thread. Cat. 203. Price, \$3.50 net.



Cat. 300
\$10.50 Net

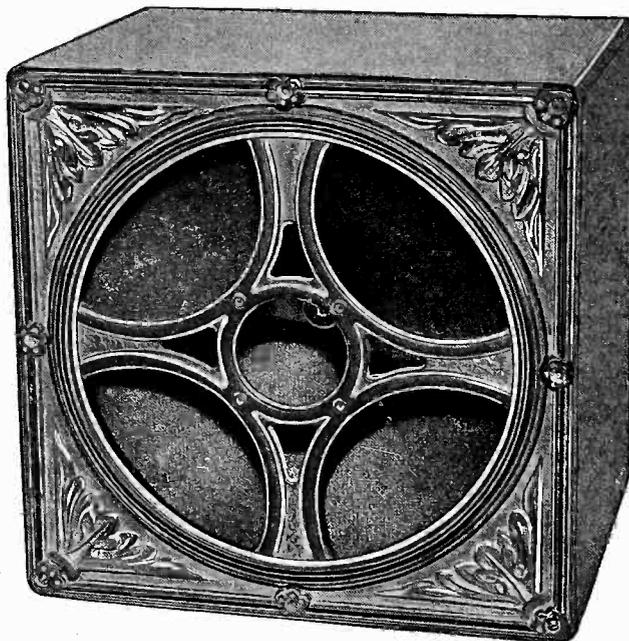
The larger horn is preferable, where space permits. Air column, 120". Front, 18"x18". Depth, 13". Weight, 7 lbs.

DYNAMIC CHASSES and Baffle

The dynamic speaker is the most popular one by far, and here is your opportunity to get a real fine chassis at a low price. Cat. 110 A.C. operates directly from the 110-volt A.C. (alternating current) lamp socket, to which built-in plug is connected, while the tipped cords go to your receiver output. Dry rectifier and output transformer built in this model.

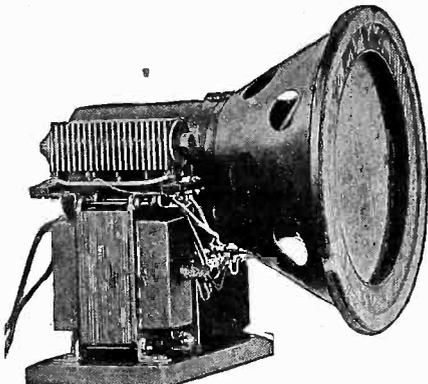
Those whose place is wired with 110-volt D.C. (direct current) should use Cat. 110 D.C. @ \$17.50 net. Those who have no electricity should use the model that works from a 6-volt storage battery. Cat. 6 D.C. @ \$14.75 net.

At left is illustrated an "18"x18" baffle, Cat. 111, with cane sides and top, for any dynamic speaker. Specify speaker. Walnut 5 ply veneer. Price \$11.00 net.

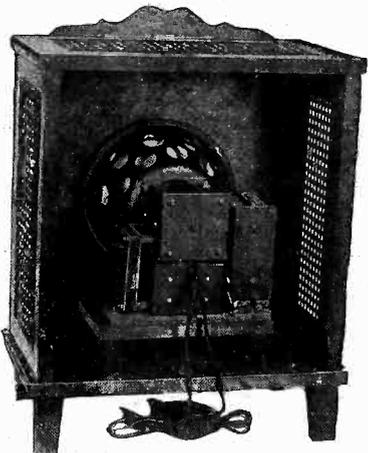


Cat. 113
Price, \$13.50 Net

New Model Polo Speaker, with five-ply veneer walnut housing, moulded, decorated metal front piece, and containing Polo Twin Magnet Unit and Textile Cone. All ready to play. Stands 150 volts without filtering. Will work fine from any output tube, from 201A to a pair of push-pull 250s, without rattling.



Cat. 110 A.C.; Price, \$20.50 Net



Cat. 111; Price, \$11.00 Net

Cat. 110 A.C., shown inside, \$20.50 extra.

FILL OUT AND MAIL COUPON

ACOUSTICAL ENGINEERING ASSOCIATES,
143 West 45th Street, N. Y. City
(Just East of Broadway)

Please send me at once on 5-day money-back guarantee the following (check off):

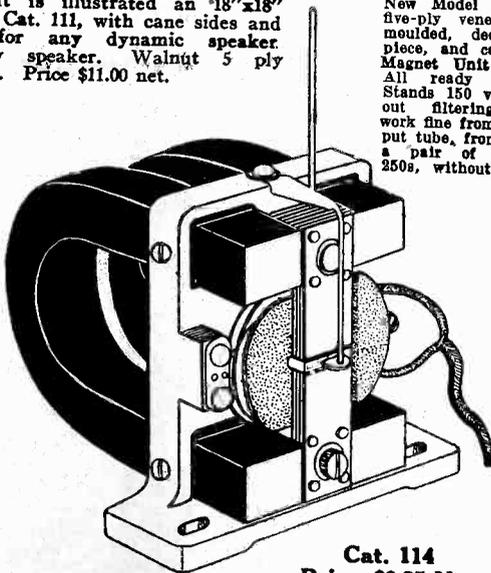
- | | |
|---|---|
| <input type="checkbox"/> Cat. No. 200 | <input type="checkbox"/> Cat. No. 111 |
| <input type="checkbox"/> Cat. 300 | <input type="checkbox"/> Cat. No. 113 |
| <input type="checkbox"/> Cat. No. 110 A.C. | <input type="checkbox"/> Cat. No. 114 |
| <input type="checkbox"/> Cat. No. 110 D.C. | <input type="checkbox"/> Cat. 114A |
| <input type="checkbox"/> Cat. No. 6 D.C. | <input type="checkbox"/> Cat. 115 |
| <input type="checkbox"/> Cat. No. 300 | <input type="checkbox"/> Cat. 116 |
| <input type="checkbox"/> Please send C.O.D. | <input type="checkbox"/> Cat. No. 203 |
| <input type="checkbox"/> Remittance enclosed. | <input type="checkbox"/> Please send prepaid. |

Name

Address

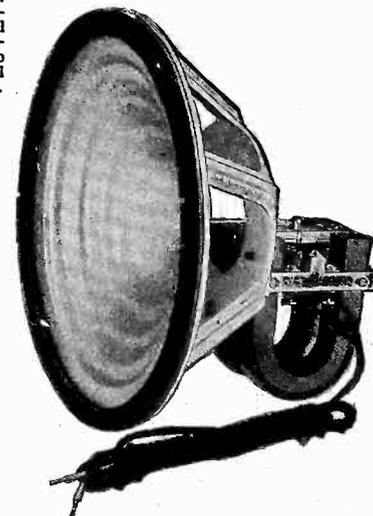
City State

5-DAY MONEY-BACK GUARANTEE



Cat. 114
Price, \$9.25 Net

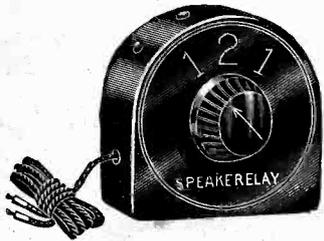
Polo Twin Magnet Unit—weight, 3 1/2 lbs., or twice as heavy as ordinary unit. Twin magnets double sensitivity. This unit gives more volume, clearer tone, and stands the gaff. Supplied with 10-ft. cord. Cat. 114. Tri-foot moulded unbreakable metal mounting bracket and apex constitute Cat. 114A @ \$0.75.



Cat. 115; Price, \$11.50 Net

Molded 9" spider, unbreakable metal, with Textile cone and felt ring and apex, and Polo Unit mounted on the assembly, which stands on own feet. Cat. 115.

\$100.00 WORTH
of Pleasure and Convenience
for Only **\$2.00**



If you have two loudspeakers and want a convenient method of playing both at the same time, or one at a time, the Speakerelay gives you that service at the turn of a knob. Simply connect the Speakerelay cord tips to the output (speaker posts) of your receiver, and put the cord tips of one speaker in the first two holes (shown on top in illustration) and the cord tips of the other speaker in the remaining two holes (not shown). Then point the knob to "1" at left to play the speaker whose cords are at left, or point the knob to "1" at right to play the other speaker. Or, to play both together, point the knob at "2".

Instead of using two speakers you may use one speaker and one pair of earphones. This is a great asset when tuning in DX, for with earphones you may readily discern the call letters that might not be so plain on the speaker. Also, any weak station may be tuned in with more accurate sharpness with earphones—and remember the speaker may be going all the while!

Another fine advantage is that anybody hard of hearing can listen to any program on the earphones, while the others hear it from the speaker—all simultaneously, remember!

Or you might want to listen in late at night on earphones alone, so as not to disturb anybody. Your set may have no detector listening post. Simply cut out the speaker—by a mere turn of the Speakerelay knob—and adjust the volume control of your receiver until reception is just comfortably loud on earphones.

Get one of these Speakerelays today, at only \$2. It is sturdily built in a molded bakelite casing, only 2 3/4" high. Positive, unerring contact affords dependable results. It offers instantaneous convenience. There is no loss in volume when this device is used.

Members of the trade, service men, salesmen, etc., use the Speakerelay to compare two speakers in a store or in the home.

You can get \$100 worth of service out of one of these \$2 products
Cat. No. 121 (illustrated).....\$2.00

If you desire a Speakerelay that enables comparison of four different speakers so any one may be played at a time, but all connected in the casing, then order Cat. No. 1234.

Cat. No. 1234.....\$2.50

We stock the Speakerelays in quantity and sell them singly or in multiple lots, on an immediate delivery basis. We also have them on display at our office, so, if convenient, come in and see them.

A five-day money-back guaranty attaches to each purchase of a Speakerelay.

Guaranty Radio Goods Co.
145 West 45th Street
New York City
(A few doors East of Broadway)

PARTS FOR THE AC 4

Complete Kit of Parts for the AC4, less B eliminator\$36.75
Complete Kit of Parts for AC4, with National B eliminator (180 v.) including 280 tube\$54.75
Complete Kit of Parts for AC4, with National B eliminator, 280 tube, cabinet, three 227 tubes, one 171A tube and Table Model Polo Speaker (nothing else to buy)\$75.00

GUARANTY RADIO GOODS CO.
143 West 45th Street
New York City

Front and Subpanel for the

AC 4

Front panel, drilled for National Drum Dial, volume control switch, and for "dummy".....\$2.55

Subpanel, 6x19", cut milk label shape, to permit room for B eliminator; 4 sockets built into subpanel; other holes drilled.....\$3.65

SPECIAL: We carry National Velvet B (type 3580) in stock, also 280 tube. Get our prices on these. Blueprint for AC4.....\$1.00

GUARANTY RADIO GOODS CO.
143 W. 45th St., N. Y. City

COILS FOR THE NEW AC 4

Two AC5 (for .0005 mfd.) @ \$1.50 each....\$3.00

Two AC3 (for .00035 mfd.) @ \$1.75 each.... 3.50

SCREEN GRID COIL CO.
143 West 45th Street
N. Y. City

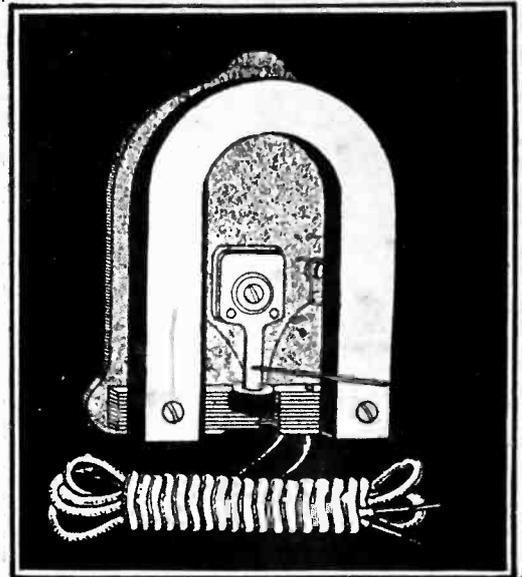
(Just East of Broadway)

New **Powertone**

Cone or Cloth Diaphragm Speaker

Unit

With 5-foot cord, less bracket, apex, chuck and nut. Cat. PA. **\$3.00**



New Moulded tri-foot bracket, fits Powertone, Polo, B.B.L., Brielle, Paratone and other units. Cat. BA.....5c
Apex, Thumbscrew and Chuck. Cat. AA.....10c
(Note: Cat. AA not sold alone.)

You Cannot Buy a Better Unit at Anywhere Near This Price!

The 1929 Model Powertone Unit, that drives any cone or similar type speaker, is an extremely sensitive and faithful reproducer. The magnet coil (the black ring under the pin in illustration) is wound to higher impedance than is ordinarily encountered. Volume is greater. The unit has an adjustable armature.

Guaranty Radio Goods Co.
145 West 45th Street, N. Y. City
(Just East of Broadway)

Please mail me at once C.O.D. (Check off).
 One Powertone Unit alone, Cat. PA. @ \$3.00.
 One Tri-foot Bracket, Cat. BA @ 5c.
 One Apex, one Chuck, one Thumbscrew, Cat. AA. @ 10c.

Name
Address
City State

Twice as Much for Your Money!

Send \$6.00 for one year's mail subscription for RADIO WORLD (52 numbers, one each week), and you will be given **one full year's subscription for any one of the following six magazines:**

- | | |
|---------------------------------|-----------------------------|
| Radio News (monthly) | Radio Engineering (monthly) |
| Science and Invention (monthly) | Youth's Companion (weekly) |
| Radio, San Francisco (monthly) | Boys' Life (monthly) |

SPECIAL TWO-FOR-PRICE-OF-ONE COUPON

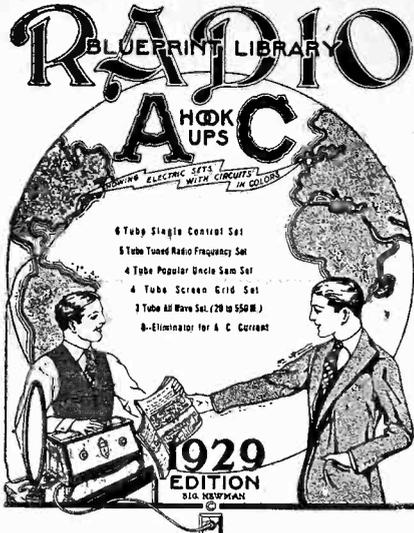
RADIO WORLD, 145 West 45th Street, New York City (Just East of Broadway):
Enclosed please find \$6.00, for which send me RADIO WORLD each week for one year, 52 numbers, and also send me, without extra cost, for one year ONE of the following magazines as indicated:

- | | |
|--|--|
| <input type="checkbox"/> RADIO NEWS | <input type="checkbox"/> RADIO ENGINEERING |
| <input type="checkbox"/> SCIENCE AND INVENTION | <input type="checkbox"/> YOUTH'S COMPANION |
| <input type="checkbox"/> RADIO (San Francisco) | <input type="checkbox"/> BOYS' LIFE |

[Put a cross in the proper square above. Fill out coupon and send \$6.00. If you are a subscriber for RADIO WORLD or for the other magazine you select, or both, check off squares below, at left.]

Present RADIO WORLD subscribers may renew under this offer. If renewing, put a cross here Name.....
If renewing for the other magazine you select, put a cross here also Street Address.....
City..... State.....

THIS OFFER EXPIRES AT NOON ON APRIL 30TH, 1929



Fourteen Circuits

Each Shown in Colored Picture Diagram, Colored Schematic Diagram and Front Panel Layout

Get This **FREE** Book!

Complete AC electric receivers, with B eliminators included, also AC receivers without B eliminators, also battery operated models, all easy-to-build circuits, using your own parts.

Colors Prevent Error

Red lines are used in all the diagrams to denote filament leads, light blue lines for grid connections, green lines for plate leads and heavy and light black lines for the rest. You can't make a mistake if you let the colors be your guide.

The Radio Blueprint Library of AC and Battery Hookups, one volume, in **FOUR COLORS**, is a veritable encyclopedia of tested DX hookups, with 45 illustrations of fourteen different circuits, and a textual explanation of each circuit. Besides, the booklet contains the Story of Radio, lists of parts for all fourteen circuits, and a Station Log Chart on which to record the stations you receive and the dial settings.

This is the very volume you've been wanting for a long time, and you can get a copy of the latest edition (1929), just off the press.

RADIO WORLD, 145 W. 45th St., N. Y. City.
(Just East of Broadway)

Gentlemen: Enclosed please find \$1.00 for which please send me Radio World each week for eight weeks (regular price, \$1.20) and besides send me a **FREE** copy of the 1929 edition of The Radio Blueprint Library of AC and Battery Hookups.

Name

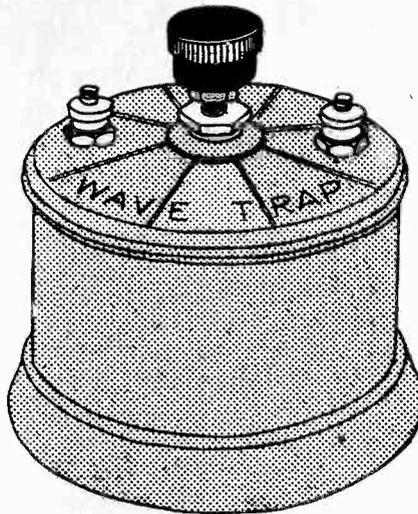
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City..... State.....

Note: Present mail subscribers may take advantage of this offer by putting a cross in this square. Your subscription will be extended eight weeks.

Recent Issues of RADIO WORLD, 15 cents each. Any number published in 1928 available for a short while. Six issues 75 cents, 10 issues \$1.00. Send stamps, coin or money order NOW, before the issues are sold. RADIO WORLD, 145 West 45th Street, New York City.

Reallocation Requires Greater Selectivity



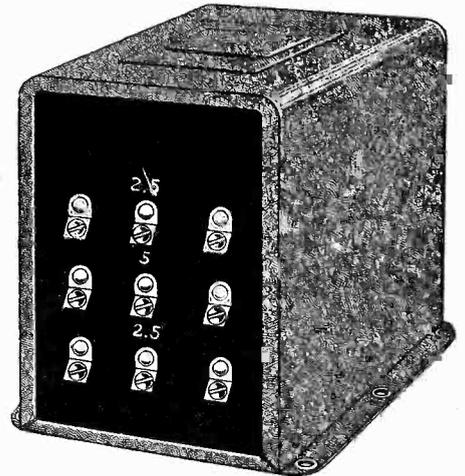
Use a Wave Trap. Spend \$1.50 to get clear reception.

How to hook up wave trap: disconnect aerial lead from set. Connect aerial to either post of the trap, other trap post to "Ant." post of set. Turn trap knob until interference disappears. Each different wave requires a different adjustment.

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City
(Just East of Broadway)

New Heavy-Duty Filament Transformer

for AC Heater Type Tubes and One Power Tube, including new AC Screen Grid and 245



The heater type tube draws 1.75 ampere at 2.5 volts. If several such tubes are used a heavy-duty filament transformer is necessary. The top 2.5-volt winding of this filament transformer easily carries **NINE AMPERES**, or enough current for five heater type tubes. The bottom 2.5-volt winding stands four amperes, or enough current to heat **TWO MORE** such tubes, a total of **SEVEN TUBES!** The power tube, if of the 5-volt type, may be heated from the 5-volt central winding. 5-volt power tubes in push-pull may be heated from this winding.

All three windings are tapped at the exact electrical center. This precision location, made with the aid of an impedance bridge, accounts for absence of hum otherwise caused by the last tube when heated directly with AC. The heater type tubes are *indirectly* heated by AC, since the filament that glows is fed by AC but communicates heat to the cathode or electron emitter.

The heater type tube is represented by the 227, excellent as radio amplifier and audio amplifier, and the exclusive type of AC detector tube. Also the new AC screen grid tubes, with the same filament voltage and current, are of the heater type.

The new power tube, 245, that at only 250 volts on the plate has the undistorted maximum power output of a 210 with 350 volts, uses 2.5 volts on the filament, at 1.5 ampere. Therefore the lower 2.5 volt winding of this filament transformer may be used for the new power tube. The 245 is not a heater type tube.

Other options include the heating of 7½-volt power tube by series-aiding connection of the 5-volt and the bottom 2½-volt windings. Connect the right-hand posts of these two windings with No. 18 insulated wire. Connect a 50-ohm center-tapped resistor across the remaining posts of these windings. The voltage across the posts at left is then 7½, while the grid return goes to the center tap of the extra resistor. In such a case disregard the center taps of the two windings themselves, as they are not centered in respect to 7½ volts.

Every B supply rectifier tube, or pair of tubes, requires a separate winding, that is, you can't use a winding that also feeds a tube in the receiver proper. But the 5-volt winding of this filament transformer may be used for a 280 rectifier tube, or the 7½-volt series connection for 281 tube or tubes, in which case the top 2½-volt winding would be used for the 227 tubes and the 245 power tube in the set.

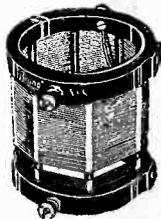
The transformer is beautifully finished in crackled glossy black, with bakelite front, and comes equipped with 5/2-inch AC cable with plug. Six riveted mounting holes for baseboard or subpanel. Size, 3¼ in. high, 2½ in. wide, 3 in. deep. Shipping weight, 6 lbs.

Cat. F226A, for 50-to-60 cycles, 105-to-120 volts AC, Net Price

Guaranty Radio Goods Co.
145 West 45th St.
N. Y. City

"BRUNO" COILS

Wound on quartzite glass; low-loss construction; high gain per stage.



99RF
\$2.50



99 TUNER
\$3.75

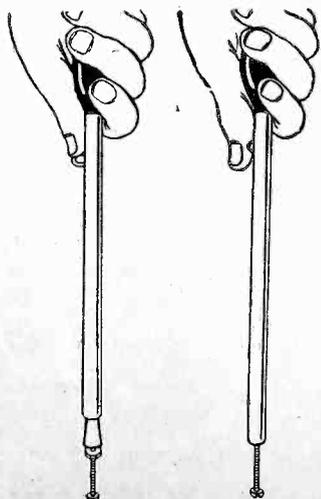
99RF is useful as an antenna coil where high selectivity is desired and as an inter-stage coupler for all tubes, battery or AC, except screen grid tubes. Tunes with .0005 mfd. only.

99 Tuner is a three-circuit coil for any standard circuit using a rotatable winding. Tunes with .0005 mfd. only.

Guaranty Radio Goods Co.
145 West 45th Street, New York City

SOCKET WRENCH

FREE



Push out control lever with knob (as at left) and put wrench on nut. Push down on handle only (at right), then turn nut left or right.

ONE of the handiest tools for a custom set builder, service man or home constructor is a **BERNARD** socket wrench.

It consists of a 6½" long metal tubing in which is a plunger, controlled by a knob. The plunger has a gripping terminal (called a socket, hence the name "socket wrench") that may be expanded or contracted to fit 6/32, 8/32 and 10/32 nuts, the most popular sized nuts in radio.

Use the knob to push out the plunger, press down on the handle to grip the nut, then turn the nut to left for removal or to right for fastening down. Total length, distended, including stained wooden handle, 10". Gets nicely into tight places. Send \$1 for 8 weeks' mail subscription for RADIO WORLD and get this wrench **FREE**.

No other premium with this offer. Present subscriber may extend subscription by stating he is one, and entitle himself to this **FREE** premium, making \$1 remittance.

RADIO WORLD
145 WEST 45TH ST., N. Y. CITY
A few doors east of Broadway

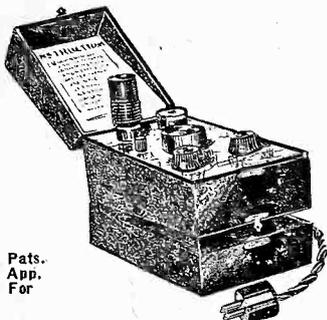
Tune in on the World

ON A

BAIRD

Shortwave Adapter

HEAR EUROPE—AUSTRALIA—
SOUTH AMERICA—ANYWHERE



Pats. App. For

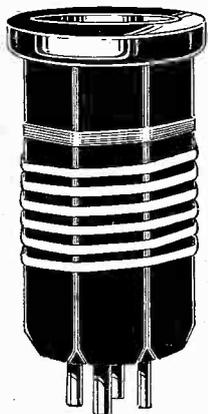
Change your own receiver into a shortwave set in 30 seconds and get the thrill of a lifetime. Just remove your detector tube and plug the adapter in its place. Remove aerial from your set and connect to binding post on adapter—and you are ready to tune in undreamed-of distances. We have authentic reports of getting KGO, Oakland, Calif., from Boston in the daytime and holding it for three hours; 5SW, London, and PCJJ, Holland, from Denver. We absolutely guarantee no AC hum interference on AC sets.

TWO MODELS

Same chassis. Same guarantee.
Only difference is the cabinet.

DE LUXE MODEL
\$20.00 AC or Battery

STANDARD MODEL
\$15.00 AC or Battery



Price Complete with 4 Octocoils.
Wave length range—
16 to 225 meters.

Octocoils:

These shortwave coils have created a sensation—rugged—beautiful—efficient. Highly colored Bakelite Moulded forms space wound with Nos. 12, 14 and 16 bare copper wire.

Wave length range—
16 to 225 meters.

\$4.00

Per Set of 4 Coils

If your dealer cannot supply you, use coupon below.

SHORTWAVE & TELEVISION LABORATORY, Inc., Dept. W—104 Brookline Avenue, Boston, Mass. Gentlemen: Please send me C.O.D. Baird SW Adapter(s) with set of four OCTOCOILS: De Luxe . . . Standard . . . model for AC . . . battery set. [Cross out what you do not want.] I understand you give an unconditional guarantee of satisfaction.

Please send me set(s) OCTOCOILS C.O.D., together with blueprint for which you are to make no extra charge.

COMPLETE KIT OF PARTS
for the New, Highly Selective

SCREEN GRID DIAMOND

(Four-Tube Battery Model)

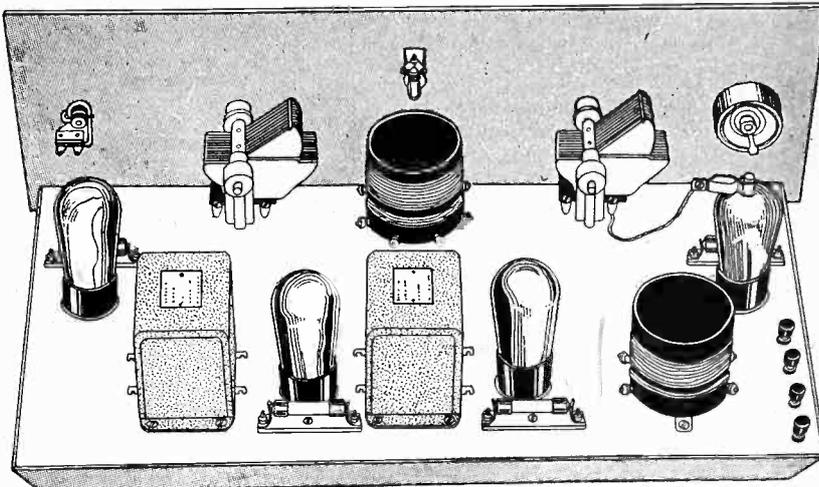
Exactly as Specified by Herman Bernard

\$29.00
Net

Guaranty Radio Goods Co.
145 West 45th Street
New York City
Just East of Broadway

Most Selective

DIAMOND



See what a dandy appearance this simple, efficient receiver makes! One SG tube, two 201A and one 112A (or 171A) are used. Aluminum subpanel shown.

Follow Blueprint

THIS IS THE BATTERY MODEL

Here is the circuit of circuits—the design that makes a neighboring cleared-channel, high-power broadcaster snap out of audibility at a slight turn of the dial.

No need to worry about the selectivity requirements imposed on receivers by the reallocation.

Volume "to fill the house"—even on distance. Tone quality excellent.

Get the official blueprint of the laboratory model of the new SG 4-tube Diamond, exactly as built by Herman Bernard, the designer.

RADIO WORLD
145 W. 45th St., N. Y. City
(Just E. of B'way)
 Enclosed please find \$1.00 for which please send at once the official blueprint of the new, highly selective 4-tube screen grid Diamond of the Air battery model.
 60 cents extra for the February 9th, 16th, 23rd and March 2nd (1929) issues of Radio World, containing Bernard's articles on the construction of this receiver.
 \$3.00 for 6 months (26 numbers) subscription for Radio World. Send Diamond blueprint and four Diamond issues FREE, in addition to 26 current issues.

Name
Address
City State

Blueprint of the AC Diamond

BUILD this 4-tube receiver, using one 222 tube, two 227 and one 112A (or 171A), and enjoy tone quality, selectivity and ease of control. The official blueprint gives the picture diagram life size, both top and bottom views; also schematic diagram and list of parts. You can use your present B eliminator externally, but the filament transformer is a part of the circuit.

Enjoy the convenience of AC operation, and still have just as selective and sensitive receiver, by building the AC Diamond. If you have 110-volt, 50 to 60 cycle AC house current, then this is the circuit for you. Fine performance. No hum.

Radio World, 145 W. 45 St., N. Y. City (Just East of Broadway)
 Enclosed please find \$1.00 for which send at once official blueprint of the 4-tube AC Diamond.
 30c for the March 23d and 30th issues (1929) describing this circuit.
 \$3.00 for 6 months subscription for Radio World. Send blueprint and two AC Diamond issues FREE.

NAME
ADDRESS
CITY STATE

Aluminum Subpanel

for the New, Highly Selective

SG Diamond

Battery or AC Model (specify which)

The best appearance of the New Diamond of the Air results from using the official aluminum subpanel, 10 x 20 inches, with the four sockets built in, and with self-bracketing front. Hardware and insulating washers supplied with each sub-panel. The aluminum sub-panel is exactly the same as the one used in the laboratory models of the battery operated and the AC Screen Grid Diamonds. Holes are drilled for mounting parts, but as this aluminum drills like bakelite you can drill any holes you want.

Front Panels

The front panels for the battery model or the AC Diamond are of Bakelite, 7x21 inches, and are drilled with all necessary holes, each in exactly the right place. High-polish finish.

RADIO WORLD, 145 W. 45th St., N. Y. City.
(Just East of Broadway)

Enclosed please find \$3.00 for which please send one aluminum subpanel 10x20" for the new battery model 4-tube SG Diamond of the Air, with sockets built in, and with self-bracketing front and side and rear supports; also send hardware and insulating washers.
 Enclosed please find \$1.35 for which please send 7x21" drilled Bakelite front panel for the new battery model Diamond.
 Enclosed please find \$3.25 for the 10x20" aluminum subpanel, etc., for the new AC Screen Grid Diamond.
 Enclosed please find \$1.35 for the 7x21" drilled Bakelite front panel for the new AC Screen Grid Diamond.
 Enclosed please find \$5.00 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the battery model.
 Enclosed please find \$5.25 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the AC model.

Name
Address
City State

FILTERS

(Continued from page 11)

cal band should always be made a little wider than desired band for, due to resistance, the cut-off points will not be sharp. For example, if the desired band is 10,000 cycles the theoretical band might be 11,000 cycles wide. This would allow all side frequencies up to 5,000 cycles above and below the carrier to be transmitted.

It is not always practical to use one low pass and one high pass filter to get the band pass effect. It is desirable to have filter sections which in themselves have a band pass characteristic. Such sections are obtained by making suitable combinations of the elements in the low pass and high pass filters. Figs. 8 and 9 show such filters. Each of these consists of two sections but neither is terminated at mid-series or mid-shunt. In fact, the termination at left is full series and that at the right is full shunt.

The attenuation characteristics of these filters are shown at the right of the filters.

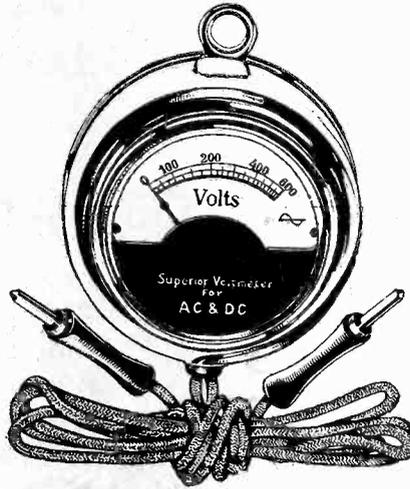
The curve in Fig. 8 is essentially an inverted tuning characteristic on an ordinary resonant circuit, except that it is steeper. From the relation given between the series and shunt elements it is clear that the series element is a series tuned circuit at the same frequency at which the shunt element is a parallel tuned circuit. Hence in the middle of the transmission band the series element offers no impedance, except resistance, and the shunt element offers infinite impedance, or it permits no by-passing. At frequencies remote from the mid-band frequency the series element offers high impedance and the shunt element bypasses freely. This explains the main features of the attenuation curve.

Fig. 9 shows a more complex band pass filter. This has two high attenuation peaks near the transmission band, and it gives the same characteristic as the combination filter in Fig. 6. The series element in this filter is the same as the corresponding element in Fig. 8. Each shunt element consists of two series tuned circuits, connected in parallel.

[Next week, issue of March 30th, the four types of filters will be discussed from a different viewpoint, and with the requirements of the novice particularly in mind.]

O-600 V. AC and DC High Resistance Meter

Same Meter Reads Both AC and DC Accurate to 1 per cent.



The O-600 volt AC and DC meter (Cat. No. 600), with 3-ft. cord, de luxe tips and hanger \$7.00.

THE output voltages of all B eliminators, the voltages of all B batteries, as well as the house current line voltage, whether AC or DC, and the voltage across power transformer secondaries, can be accurately measured by this meter. The full scale is 0-600 volts, and this same meter measures both AC and DC. Since it is a high resistance meter, of extraordinary range, and accurate to 1% plus or minus, it is advisable to get this meter for your testing purposes, since it is like two meters in one—AC and DC. You can find trouble more quickly. Without it you can't tell if a power transformer secondary is delivering voltage. 10-day money-back guaranty.

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 I will pay postman \$7.00 plus few cents extra for postage.

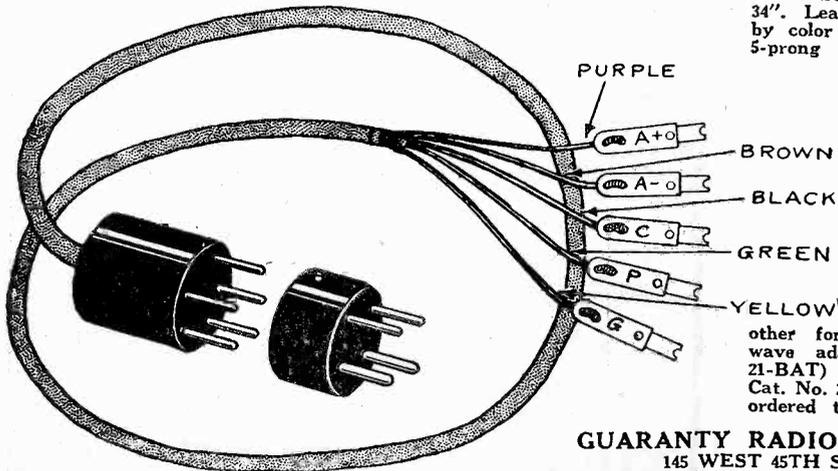
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PLUG AND CABLE for any SHORT WAVE ADAPTER

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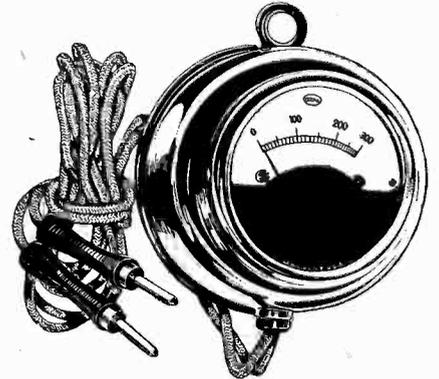


Handiest thing for ANY short-wave adapter. Put detector tube of your present set in socket of any short-wave adapter you build, put plug in detector socket of your broadcast receiver. Cable 34". Leads identified both by color scheme and tags 5-prong plug and 5-lead cable for AC short wave adapter. May be used as 5-lead battery cable plug with UY socket (Cat. No. 21AC) \$1.50 4-prong extra plug only necessary addition to other for battery short-wave adapter (Cat. No. 21-BAT) \$0.50. Cat. No. 21AC and 21-BAT ordered together \$1.75.

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For Portable or Panel Use



High resistance 0-300 Voltmeter, accurate to 1%. Measures any DC voltage to 300, including B eliminators. Provided with 30" cord, with luxurious jack tips and hanger. Meter full nickel de luxe finish. No. 346F. \$4.50
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- No. 40—For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale.. 1.75
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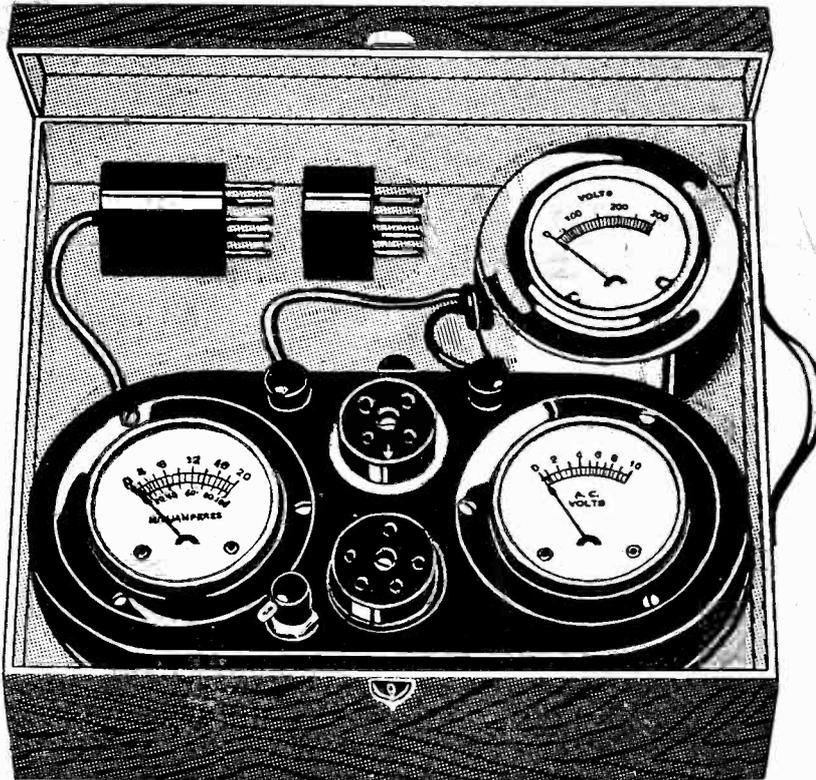
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This Meter Outfit Makes Thirteen Vital Tests in Only 4½ Minutes!

INSTRUCTION SHEET GIVES FULL DETAILS OF THESE THIRTEEN TESTS

The Jiffy Tester in its Case is a Testing Laboratory All by Itself. Leave the meters in the case. Simply lift out the plug, attaching the four-prong adapter, if testing a four-prong tube. Put plug in socket of receiver to be tested; put tube in Tester socket. The B voltmeter automatically connects to the proper points when its tipped leads are inserted in the two binding posts at rear.



This housed Jiffy Tester, with high resistance voltmeter for measuring B voltages, including those of eliminators, is a service kit of the highest value. The case is furnished in a de luxe finish, with handle. A patented snaplock makes it impossible for the lid to open accidentally. The Tester and high resistance meter fit so snugly in place that they will not jar in transportation. A 5-day money-back guaranty attaches to each sale.

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- (3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly any set draws more);
- (4) to measure the B voltage applied to the plate of tube; the voltage across B batteries or B eliminators, up to 300 volts;
- (5) to determine the condition of a tube, by use of the grid bias switch;
- (6) to measure any tube's electronic emission;
- (7) to regulate AC line, with the aid of a power rheostat, using a 27 tube as guide;
- (8) to test continuity of resistors, windings of chokes, transformers and circuits generally;
- (9) to find shorts in bypass and other condensers, as well as in inductances, resistors and circuits generally;
- (10) to read grid bias voltages, including those obtained through drops in resistors;
- (11) to determine the presence of distortion and overloading;
- (12) to test for correct bias;
- (13) to determine starting and stopping of oscillation.

[Note—Instruction booklet fully informs you how to make each and every one of these tests in a jiffy.]

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 (4) One 5-prong plug with 30" cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
 (5) One grid switch to change bias.
 (6) One 5-prong socket.
 (7) One 4-prong socket.
 (8) Two binding posts.
 (9) One handsome moire metal case.
 (10) One instruction sheet.
 (11) One de luxe carrying case.
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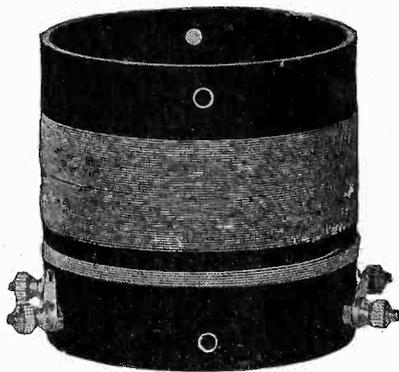
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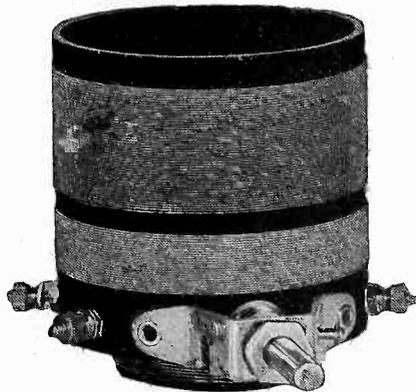
They Meet the Needs of Battery-Operated or AC Screen Grid Tubes, and General Purpose Tubes of Battery or AC Types.

Fascinating Color Adorns the Bakelite Form as Well as the Wire Insulation

The DIAMOND Pair



AC5 \$1.50
Highly selective antenna coil for any circuit, and interstage coil for AC circuits. Step-up ratio, 1-to-8. Tunes with .0005 mfd. Model AC3, for .00035 mfd. \$1.75



SGT5 \$2.75
Tuner to work out of a screen grid tube. The large primary is fixed and is connected in the plate circuit of the screen grid tube. Tunes with .0005 mfd. Model SGT3, for .00035 mfd. \$3.00



A5 \$1.75
Conductively coupled antenna coil, for maximum pickup, where selectivity is not the main consideration. Continuous winding in two colors. Tunes with .0005 mfd. Model A3, for .00035 mfd. \$2.00
The maximum volume is obtained by conductively coupling the antenna to the grid. This coil, with a continuous winding, delivers the antenna current and voltage to the grid without inductive transfer or through a condenser. The volume is so great that you think you added another stage of audio. However, the selectivity is less. Also the length of the antenna affects the tuning. So two taps are provided—both brought out to binding posts—and you connect the coil as follows: Select either terminal of the winding, and connect it through the binding post to the grid. Connect the opposite terminal, through its binding post, to ground. Then connect the antenna to either of the two remaining binding posts—the one that makes the dial readings more nearly correspond to those of the next tuned circuit.

COILS with a purpose, like people with a purpose, succeed best. For a highly selective four-tube receiver, as great selectivity as you can command on four tubes with ample speaker volume, the two coils, AC5 and SGT5, make an unbeatable combination. Dials will track nicely. Distance will come in easily and loud. Full sensitivity is readily attained.

The AC5 coil is used in the antenna circuit and has a small primary—six turns—while the secondary has 48 turns, a step-up ratio of 1-to-8.

The radio frequency tube is a screen grid which requires a high impedance load on the plate circuit, provided by SGT5 having a 24-turn fixed, untuned primary. The secondary is tuned.

Selectivity is what you need, especially with a high-gain circuit, such as one using a screen grid tube, and this combination of coils not only gives you that but permits retention of ample—even more than ample—volume.

And, remember, the dials track nicely!

Data on Coils

The coils are wound on blood-orange bakelite, with tuned windings in blue silk insulation, untuned windings in strawberry silk insulation and tickler in Litzendraht, with gold insulation.
The outside diameter is 2½ inches.
All tuners (i. e., three-circuit coils with rotor winding) have single hole panel mount.
All other coils have holes for perpendicular or horizontal mounting, and hardware to accomplish this.
All tuned windings are center-tapped.
All coils are sold on a five-day money back guarantee. If you're not delighted with them, for any reason, send them back in five days and get your money back.



HT5 \$3.00

Tuner to work out of a screen grid tube, like TP5, only tickler is added. Tunes with .0005. Model HT3, for .00035 mfd. \$3.50.

The UNIVERSAL Pair



RF5 \$1.50
Excellent selective antenna coil for any circuit, and interstage coil for any battery operated receiver, excepting output of screen grid tube. Tunes with .0005 mfd. Model RF3, for .00035 mfd. \$1.75



TP5 \$3.00
Interstage coupler to work out of a screen grid tube, where the primary in the plate circuit is tuned, the secondary, in the next grid circuit, untuned. Tunes with .0005. Model TP3, for .00035 mfd. \$3.25

Enormous amplification, with more than moderate selectivity, is achieved by circuits using these two coils—RF5 and TP5. The primary of the interstage coil, TP5, is on the outside and is tuned. It is center-tapped. The secondary, on the inside, is untuned.

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Radiola 28

**8-Tube Super-Heterodyne,
Always Sold at \$260.00
Our Price While They Last **\$75!****

See All You Get for Only \$75.00

WHEN you purchase a Radiola 28 eight-tube Super-Heterodyne, with R. C. A. loop, eight tubes and table included, you are buying at almost 70 PER CENT OFF the previous price of \$260, and are buying the product of the world's leading radio and acoustical engineers, a product in which the talents of R. C. A., Westinghouse and General Electric are combined. Here's what you get:

- (1) An 8-tube Radiola 28 Super-Heterodyne, in beautiful solid mahogany two-tone cabinet.
- (2) A solid mahogany table that is an integral part of the cabinet construction.
- (3) An R. C. A. loop especially designed for this receiver, with solid mahogany frame.
- (4) Eight R. C. A. Radiotrons, consisting of seven UX199 tubes and one UX120 power tube.

ALL IN A FACTORY SEALED CARTON!



Radiola 28, an 8-tube Super-Heterodyne, of the Radio Corporation of America, in solid mahogany cabinet, with RCA solid mahogany loop and eight RCA Radiotron tubes; solid mahogany table is included. Everything exactly as illustrated. Always sold at \$260.00. All in factory-sealed cartons at our special price of \$75.00.

EVERYBODY wants a Super-Heterodyne because it is so selective that you do not have to worry about separating stations—10 kc. separation is yours at last.

You are almost ready to demonstrate this set to your admiring family and friends the moment it is received, since only the A and B supplies and the speaker are necessary for operation.

And when you turn on the set—oh, what a thrill! The most sensitive receiver design is yours, and how proud you are of your smart "buy"! In all the length and breadth of the United States—indeed, all the world over—there is no bigger or better radio bargain than this! A Super-Heterodyne! Eight tubes! Self-contained operation! (No outdoor aerial needed!) You

can move this receiver, with the self-contained A and B sources and speaker you furnish, into any room—so conveniently—and there she plays, beautifully, clearly!

You will need 135 volts maximum B supply, 22½ volts maximum C bias and a 4½-volt A source, plus speaker, to operate the set. The B supply may be a B eliminator or B batteries. The A supply may be a 4½-volt storage battery. Or you may use a 6-volt storage battery with 5 ohms in series with the negative A battery post. Or you may use six No. 6 dry cells connected three each in series, and the two series pair in parallel. There is plenty of room in the compartment for A battery, dry cells, B batteries and C battery. Another option is a 4½-volt A eliminator and a 135-volt B eliminator to make the set electrified (except for C batteries).

You can check up on the filament voltages by using a 0-6 volt tip jack voltmeter (price, \$2 extra). The voltmeter jacks are on the front panel. The filament voltage for the tubes should be from 3 to 3.3 volts.

The Thirteen Lucky Features!

- 1 Radiola 28 uses the famous RCA 8-tube Super-Heterodyne circuit which gives remarkable sensitivity, selectivity, volume and quality of reproduction.
- 2 Unusual selectivity is provided which permits the separation of powerful broadcast stations even when the Radiola 28 is located in their immediate vicinity, this selectivity having been carried to an extremely fine degree by the employment of two stages of tuned radio frequency amplification ahead of the super-heterodyne circuit. Only one control is required for these two tuned circuits, illustrating the extreme manufacturing precision employed on RCA Radiolas.
- 3 The extreme sensitivity of Radiola 28 makes it possible to receive over great and unusual distances under favorable conditions.
- 4 Audio frequency transformers have uniform acoustical properties.
- 5 Ideal for country clubs, lodges, auditoriums or living rooms in the home.
- 6 The "Uni-Control" tuning mechanism has been grouped in the center of the sloping panel, and is surrounded by a bronze escutcheon plate of fascinating appearance.
- 7 The rotating loop gives additional selectivity in that it may be turned at right angles to undesired, interfering signals. The loop fits into a specially designed socket.
- 8 The set is extremely easy to operate. Tuning is accomplished by moving the "Station Selectors," which takes the form of two drums, calibrated in kilocycles. For most purposes, local or distant stations can be tuned in by operating both drums together as a unit, with a finger. The two drums may also be operated separately for extremely fine tuning. Thus we have a radio receiver with true uni-control.
- 9 Radiola 28 can be readily moved from room to room as no external connections for batteries, aerial or ground are necessary.
- 10 Station call letters may be marked on the Station Selector Drums.
- 11 The "Volume Control" provides regulation without detuning.
- 12 All the parts are enclosed and sealed in a strong metal case or "cafacomb."
- 13 Radiola 28 is equipped with "straight line frequency" condensers. The figures of the station selector drums are spaced 10 kilocycles apart. Each division on the drums corresponds to a broadcast station.

Guaranty Radio Goods Co.,
145 West 45th Street, N. Y. City.
(Just East of Broadway.)

Please send me at once one 8-tube Radiola 28 Super-Heterodyne, in solid mahogany cabinet, with solid mahogany table affixed; RCA loop, seven RCA Radiotrons UX199, and one Radiotron power tube UX122. All in a factory-sealed carton, at only \$75.00.

Please find remittance of \$75.00 enclosed. You are to pay cartage.

Please ship C.O.D. I will pay cartage.

One 0-6 volts plug-in type tip jack voltmeter for Radiola 28, at \$2.00 extra.

Name

Address

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

THIS OFFER REVOCABLE WITHOUT NOTICE!

If your remittance arrives too late we will return money the day after receipt.

GUARANTY RADIO GOODS CO.

145 West 45th St.

Just East of Broadway

N. Y. City