

THE HAMMARLUND-ROBERTS HI-Q 29 MASTER

DEC. 1st, 1928

15 CENTS

RADIO

REG. U.S. PAT. OFF.

WORLD

The First and Only National Radio Weekly

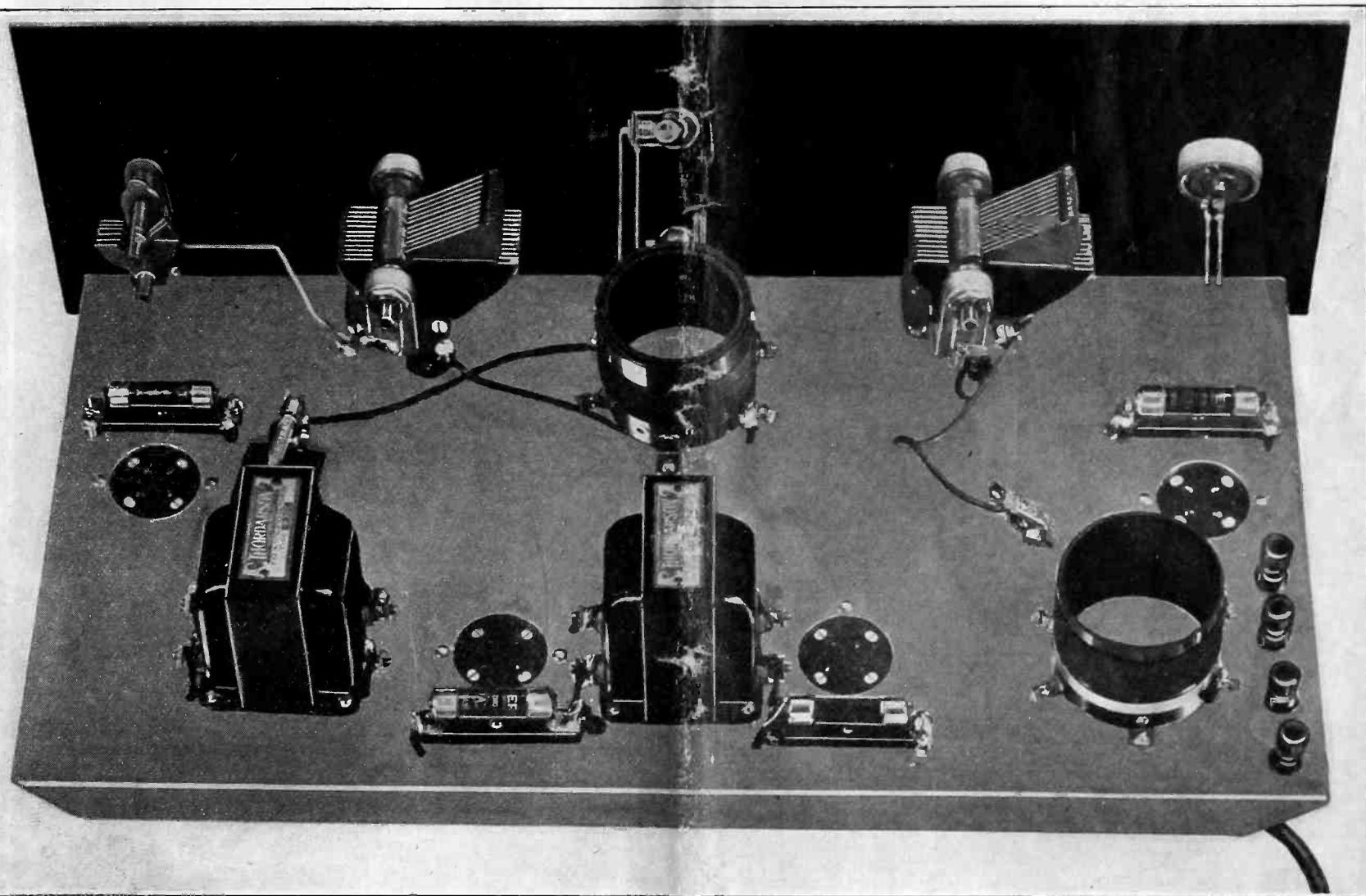
349th Consecutive Issue—Seventh Year

HOOVER WOULD END BOARD
SAY HIS FRIENDS

SHORT WAVE TELEVISION
CHANNELS ARGUED

REALLOCATION FACES
CLEANING-UP PROCESS

THE SCREEN GRID UNIVERSAL



New and Wonderful is the Screen Grid Universal, Reaching a Height of Selectivity and Volume Seldom Attained on Only Four Tubes.

NEW AC USE FOR DC TYPE TUBES

FREE BOOK



New Hook-ups. This book shows how to make Short-Wave Receivers, and Short-Wave Adapters.
 How to use the new screen-grid tube in D.C. and A.C. circuits.
 How to build Power Amplifiers, and ABC Eliminators. Up-to-the-minute information on all new radio developments.
 Set Builders, Fans, Dealers, send for it today!

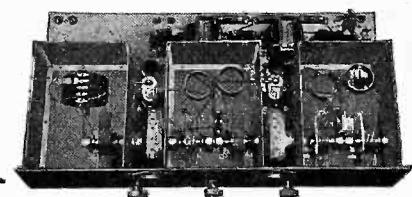
KARAS ELECTRIC COMPANY 4039-L1
 4039-L1 N. Rockwell St., Chicago, Illinois
 Please send me your Free Book!

Name

Address

City State

NEW HI-Q RECEIVERS



Custom-Built to Any Pocketbook!

TO say that these four new Hi-Q Receivers are the greatest instruments ever produced in Hi-Q History is equivalent to saying that they are the most efficient, most selective, most sensitive and most beautifully toned radios in the world.

Q 29 at \$54.35; the Junior A.C. Hi-Q 29 at \$101.50; the Master Hi-Q 29 at \$99.50 and the Master A.C. Hi-Q 29 at \$151.50 — four wonderful receivers which meet practically every range of pocket-book. All these instruments are the joint creation of America's ten leading parts manufacturers. All are stage-shielded, built on steel chassis from the finest parts available in the industry.

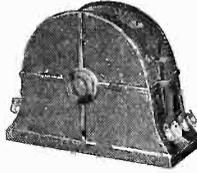
*If You Want Real
Radio Value Write for
Our New 80-Page Book*

The new 80-page Construction Manual is the biggest and most complete book of its kind ever published. Tells how to build all 4 new Hi-Q Receivers. Photos and diagrams illustrate every detail. Covers power amplifiers, tube and battery combinations, antennae, installation, short-wave adapters, house wiring and a wealth of other data on custom-built radio. Price 25c.

For example, there is no receiver, to our knowledge, which employs the Band Pass Filter—an entirely new system used exclusively in the Master Hi-Q 29 models. This new development effects absolute flat-top square cut-off tuning for the first time in radio history. It assures positive 10 K. C. selectivity. "Cross talk" cannot occur. Oscillation, buzzing, humming and background noises are totally eliminated. Stations don't simply "swish" in—they snap in, clear and positive.

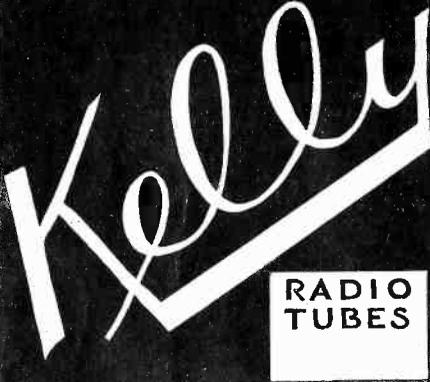
There are FOUR Hi-Q Receivers for 1929—the Junior Hi-

**VICTOREEN
Super Coils**



Write for Free Blueprints of New Victoreen Circuits

Geo. W. Walker Co.
 2825 Chester Avenue
 Dept. B Cleveland, O.



**RADIO
TUBES**

**LONGER LIFE
BETTER TONE
MORE VOLUME**

A guarantee slip is contained in each carton. Fill this out and earn FREE tube insurance. Built to excel, KELLY TUBES open new vistas of radio reception.

401A	\$1.00
4X Special Detector	2.00
412A	2.00
471A	2.00
UX499	1.25
426AC	2.00
427AC	3.50
440 (high mu)	1.50
422 (screen grid)	3.50
480	3.50

**422 SCREEN
GRID**

Our 422 stands up.

**440 HIGH
MU**

*great for resistance or
Impedance audio*

KELLY TUBE COMPANY
 8718 Ridge Boulevard, Brooklyn, N. Y.

Associate Manufacturers

**Hammarlund
Roberts
Custom Built
Radio**

Associate Manufacturers

Sangamo Electric Co.
 Thordarson Elec. Mfg. Co.
 Hammarlund Mfg. Co.
 Yaxley Mfg. Co.
 Benjamin Elec. Mfg. Co.
 Arcturus Radio Co.

Acme Wire Co. (Parvot)
 International Resistance Co. (Durham Resistors)
 Radial Co. (Amperite)
 Electrad, Inc. (Truvolt)
 Westinghouse Micarta

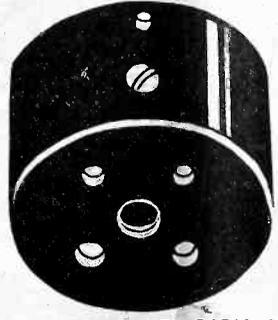
HAMMARLUND-ROBERTS - - - - 1182-V Broadway, New York

BLUEPRINT OF SCREEN GRID 4-TUBE UNIVERSAL - \$1.00

Connections Doubly Clear Because Wiring Done on Top of the Subpanel is Shown Separately, and wiring done underneath the subpanel is shown separately. All leads shown in the same direction in which they are physically connected. You don't have to reverse the blueprint mentally to visualize the practical connections. Crystal-clear blueprint safeguards against error. Order your print today. Prompt delivery. Price of complete kit, \$35.00 (less tubes, cabinet and speaker).

PHILIP COHEN, 236 Varet Street, Brooklyn, N. Y.

SAVE THOSE TUBES!



Many persons have sets with Navy type sockets—the kind with the collar on and the bayonet hinge for the pin on the base of the tube. If you put a UX base tube in a Navy type socket a short may blow out all the tubes. Play safe and have fine contact besides. Use our adapter that fits UX tubes into Navy sockets (Cat. No. UX). Price 20 cents each.

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

**BUILD YOUR OWN
DYNAMIC SPEAKER**

Complete set of blueprints and instructions for building your own Dynamic cone speaker. Easy and inexpensive to build at home with few tools. Guaranteed to work; thousands now enjoying Dynamic reproduction. Mail \$1.00 today and you will receive complete set, postpaid.

FANSPEAKER RADIO COMPANY
 74 Dey Street - - - New York, N. Y.

RADIO WORLD, published every Wednesday, dated Saturday of same week, from publication office, Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y., just east of Broadway. Roland Burke Hennessy, President; M. B. Hennssy, Vice-President; Herman Bernard, Secretary. Roland Burke Hennessy, Editor; Herman Bernard, Managing Editor; J. E. Anderson, Technical Editor; Anthony Sodaro, Art Editor

RADIO WORLD, a weekly paper, published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y. Phone: BRYant 0558 and 0559. 15c per copy, \$6 per year. This issue is dated December 1, 1928, and is Vol. XIV, No. 11, Whole No. 349. Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March, 1879.

HAMMARLUND means QUALITY!

And nowhere is Hammarlund quality more convincingly expressed than in the four new Hammarlund-Roberts "HiQ-29" Receivers. Here you have radio at its best—in appearance, in design, in performance.

A custom-built receiver is a better receiver when it is built around a circuit of proved efficiency—and built with parts of unquestionable reputation. Eighteen years of manufacturing precision instruments for radio, telegraph and telephone use are back of every Hammarlund Product.

That experience is your protection. You will find it in abundance in the new "HiQ" receivers and in the individual parts of Hammarlund manufacture.

Send 25c.
for
"HiQ-29"
Manual

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

For Better Radio
Hammarlund
PRECISION
PRODUCTS

FERRANTI Audio Frequency TRANSFORMERS and RADIO PRODUCTS

receive preference
by engineers who KNOW

Real audio transformers with flat curves. Special output transformers for all speakers and tubes. High grade iron core chokes for "B" Eliminators. Three range portable meters. 100 ohms per volt. 10/50/250 scale. Three range portable meters. 200 ohms per volt. 150/7 1/2 volt and 15 Mill. scale with switch. By-Pass condensers—2MF—400 volt and 200 volt.

Circulars sent on request

Send 15c in coin for copy of
1929 Ferranti Year Book

FERRANTI, Inc.
130 West 42nd St., New York N. Y.
FERRANTI, LTD. FERRANTI ELECTRIC
Hollinwood Limited
England Toronto, Canada

SHORT WAVE ADAPTER \$10.17

Completely built-up, ready to receive; includes three plug-in coils, also built-in plug and cable and tunes 18 to 78 metres. Requires no extra tube. Chart tells just where each wavelength comes in DC model (for all sets except AC tube sets). List price, \$18.50; our price, \$10.17. AC model for AC sets. List price, \$19.50; our price, \$10.72.

Order One Now C.O.D.
Ten-Day Money-Back Guarantee!
RADIO SUPPLY COMPANY
217 Havemeyer Street, Brooklyn, N. Y.

SET Builders FREE
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. 1312 Canal St., CHICAGO, U. S. A.

Be a RADIO EXPERT
Radio, a new big industry wants trained men. The work is fascinating, interesting, pays big. We send you six outfits of Radio parts to give you practical experience building and repairing sets. Write for 64-page book "Rich Rewards in Radio." It tells you how you can learn at home in spare time to become a Radio Expert. No obligation. National Radio Institute, Dept. RW Washington, D.C.

BLUEPRINT FOR Bernard's Economy 3 Price \$1.00 PHILIP COHEN
236 VARET STREET BROOKLYN, N. Y.

AIR COLUMN HORNS ARE SPLENDID!

Especially Those Made of Molded Wood

EVERYBODY who uses a horn loud speaker of the latest type, consisting of an air column design, with long tone travel, agrees that the tone is splendid. Our Model 595 has a travel distance of 8 feet from the unit to the large end of the "bell." If you must economize on space, use Model 570, with a 6-foot tone travel, with not quite as strong reproduction of low notes. But No. 595 is better and, if you've the room (21 1/4" high, 18" wide, 15" deep), choose that one. Every purchaser is a delighted customer. Order one of these specially moulded wood horns. Try it for 90 days. If not delighted, return it and get back your money, including any shipping charges you paid! (Note: Not a single one of these horns has ever been returned to us, though we've sold many hundreds!)

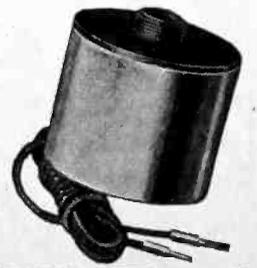


Model 595 (Illustrated above) Baffle board (not shown) FREE with each order. List price \$18.00. Our price (40% and 2% off list price) —

\$10.58

Model 570, size 15" high by 12" wide by 12" deep, 6-foot tone travel. FREE baffle board. List price \$13.00. Our price (40% and 2% off list price) — \$7.64

Model 112 horn motor stands 250 volts without filtering (Illustrated at right). List price \$8.00. Our price (40% and 2% off list price) — \$3.53



ACOUSTICAL ENGINEERING ASSOCIATES
143 West 45th St., New York City. (Just East of Broadway)

Please ship me at once the following (check off):
 One No. 595 at \$10.58, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
 One No. 570 at \$7.64, plus a little extra to defray shipping costs; send it already mounted in FREE baffle board.
 One No. 112 horn motor (universal nozzle) at \$3.53, plus a few cents extra for shipping.

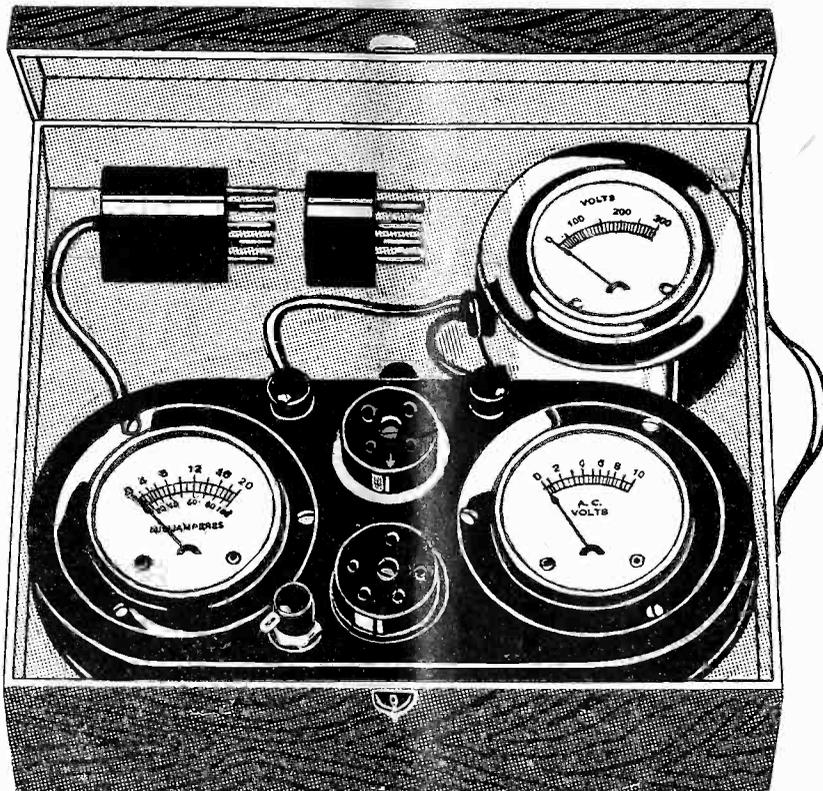
NAME.....
 ADDRESS.....
 CITY..... STATE.....
90-DAY MONEY-BACK GUARANTEE!

De Luxe Carrying Case **FREE**

With Each Jiffy Tester Combination!

This Meter Outfit Makes Thirteen Vital Tests in Only 4½ Minutes!

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 inserting 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.

Jiffy Tester Combination, shown one-third size, includes 0-10 voltmeter reading AC or DC (same meter reads both); 0-20, 0-100 milliammeter, with change-over switch; cord and plug with 4-prong adapter; 0-300 high resistance voltmeter. Price \$13.50. Complete instruction booklet and de luxe carrying case **FREE** with each order.

Jiffy Tester a Scientific Trouble Shooter

Every service man, custom set builder, home experimenter, student or teacher needs one of these Jiffy Tester Combinations. Ample accurate for this class of work. You will be well satisfied with assured 5% plus or minus accuracy. Jiffy Tube and Set Tester, consisting of 0-20, 0-100 combination milliammeter, 0-10 AC and DC voltmeter and 0-300 high resistance voltmeter. De luxe carrying case and instruction booklet **FREE** with each order. Jiffy Tester Combination A.

\$13.50

The 0-300 high resistance voltmeter in "Jiffy Tester Combination A" is accurate to 5% plus or minus, so that at maximum reading it is not more than 15 volts off. Those desiring a more accurate 0-300 high resistance meter, never more than 3 volts off, at maximum reading, should order "Jiffy Tester Combination B," which has a 0-300 meter accurate to 1%, at a cost of \$1 extra. Order "Jiffy Tester Combination B." De luxe carrying case and instruction booklet **FREE**.

\$14.50

Here Are the Thirteen Vital Tests!

- (1) to measure the filament voltage, up to 10 volts, of AC and DC tubes;
- (2) to measure the plate current of any one tube, including any power tube, from less than 1 milliamperes up to 100 milliamperes;
- (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.]

Note All That You Get!

For \$13.50 you receive:

- (1) One Two-in-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
 - (2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
 - (3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
 - (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.
- If 0-500 volt 5% accuracy high resistance meter is preferred to 0-300 volts, add \$1.00, and order Combination C at \$14.50.
If 0-500 volt 1% accuracy high resistance meter is preferred to 5% accuracy 0-500 voltmeter, add \$2.00, and order Combination D at \$15.50.
[Note—A pair of adapters for UV199 tubes, Cat. No. 999, at \$1.00 extra. These are not sold except with Jiffy Tester Combination.]

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

Please ship at once your Jiffy Tester Combination for which I will pay post-man advertised prices, but no shipping charges. (Check off below.)

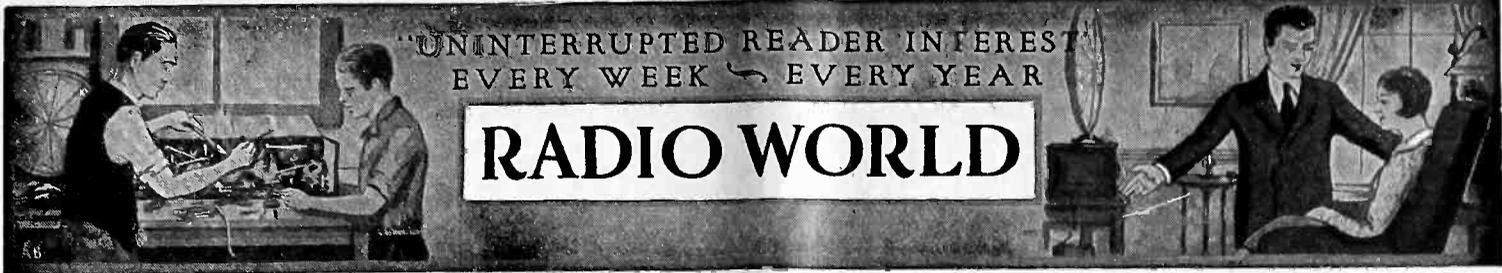
- One Jiffy Tester Combination A (0-10 v., 0-20, 0-100 m. a., 0-300 v., carrying case, instruction booklet **FREE**.....Price \$13.50
- One Jiffy Tester Combination B (same as above, but with 0-300 voltmeter accurate to 1%). Price.....\$14.50
- One Jiffy Tester Combination C (same as A, except 0-500 voltmeter replaces 0-300). Price.....\$14.50
- One Jiffy Tester Combination D (same as C, except 0-500 voltmeter is accurate to 1%). Price.....\$15.50
- Set of 199 adapters. Price.....\$1.00

NAME.....

ADDRESS.....

CITY..... STATE.....

5-DAY MONEY-BACK GUARANTY



UNINTERRUPTED READER INTEREST
EVERY WEEK ~ EVERY YEAR

RADIO WORLD

Vol. XIV. No. 11 Whole No. 349
DECEMBER 1st, 1928
15c per Copy, \$6.00 per Year
[Entered as second-class matter, March,
1922, at the Post Office at New York,
N. Y., under Act of March, 1879]

Latest News and Circuits
Technical Accuracy Second to None

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

Stations Cry for Justice

1,500 COMPETE IN FREE DEBUT

With a list of applicants totaling 1,500, auditions for the free concert-radio debuts offered by the National Broadcasting Company for new young artists selected by the National Music League has begun. An audition committee of ten, chosen by the League, will pass on the candidates.

George Engles, director of the National Broadcasting and Concert Bureau, which is arranging for the debuts, said that final decision as to the winners will rest on a double audition heard by two groups of judges. One group, seated in the auditorium with the artist; will decide on his abilities as a concert performer; the other group will hear the performance over an amplifier and pass upon the artist's broadcasting qualifications. Such a final test is essential, Engles explained, because the debuts will be of a combined concert and radio nature.

Practically every state in the country is represented on the list.

Arthur Moss Rises to Electrad Presidency

Arthur Moss, treasurer of Electrad, Inc., in charge of sales and advertising since the company was formed, has been elected president of the company.

Electrad, Inc., about five years ago began manufacturing a wide range of high-class radio parts at 428 Broadway, New York City, which address was retained until the beginning of last year. From the very inception of the company its line met a ready acceptance on the part of both the general public and of radio set manufacturers.

Under Mr. Moss' management, the company's sales have rapidly increased, until it is now recognized as one of the leaders in the industry. Since January, 1927, the company has been located at 175 Varick Street, in much more commodious space and with greatly expanded factory facilities.

Mr. Moss' accession to the presidency of Electrad, Inc., was hailed as indicating a distinctly progressive policy within the organization that points to still further growth.

FREED-EISEMANN Radio Corporation announces the appointment of Philip Van Doren Stern as advertising manager. He was the company's first advertising manager when broadcasting began.

Blind Man's Log Is in Raised Letters

Cincinnati

When the simple erasure of penciled figures and the writing in of a few more will remake a radio log, reallocations of radio stations mean little to the dial-twister.

Changing a radio log becomes an undertaking, however, when a blind listener must tabulate stations in raised letters known as New York Point.

Writing to station WLW, a Danville, Ind., man describes his raised-letter radio log and his elaborate method of listing his favorite stations.

"One chart lists the daily features by station call letters and hours of broadcast from the most dependable stations," he writes. "The other chart lists the weekly feature in a similar manner."

SPLITDORF REIN GOES TO EDISON

Thomas A. Edison & Co. acquired "a substantial interest" in the Splitdorf Radio Corporation. Splitdorf products will be taken off the market by the end of the year. The company will devote itself almost entirely to making radio equipment for the controlling company.

The new officers of the Splitdorf Radio Corporation will be Charles Edison, chairman of the board; Walter Rautenstrauch, president; Donald Ross, vice-president and secretary; Arthur L. Walsh, vice-president in charge of sales; Ralph H. Allen, vice-president in charge of finance and operation; H. F. Miller, treasurer, and Henry Lanahan, general counsel. The newly created finance committee, consisting of Charles Edison, Mr. Allen and Mr. Ross, will control the finances of the Splitdorf Radio Corporation and the Splitdorf Bethlehem Electrical Company, parent company of all Splitdorf interests.

A RADIO INFORMATION clearing house is announced by John F. Rider, president of the Radio Treatise Co., 270 Madison Ave., N. Y. City, to supply radio data of all nature, in addition to a regular consulting service. Wiring diagrams of old and present-day manufactured receivers, and also of the popular kit receivers, have been compiled.

Reallocation Severe on Some Big Broadcasters with Many Hundreds of Thousands of Dollars Invested—Board Lis- tens to Appeals from Re- assignment Effect.

That there are kinks in the reallocation, principally as to wavelength and time on the air, and to a lesser degree as to power allotment, and that these deficiencies must be ironed out, or great dissatisfaction will result, was obvious from recent hearings held by the Federal Radio Commission.

The Commission expected some injustices would become apparent as the reallocation was tried out. Some of the problems presented are so knotty that, under the Davis law, it may be fairly said there is no solution, but it is a case of equal distribution of necessary injustice. Big stations are as hard hit as small ones.

Washington.

Representatives of three Illinois broadcasting stations, two of them in Chicago and the third in Zion, appeared before the Federal Radio Commission on applications for increased broadcasting time, all on the 870 kilocycle channel. One of the stations, WENR, owned by seven public utility corporations in Chicago, also requested permission to operate with 50,000 watts, instead of the present assignment of 5,000 watts.

Spent \$750,000

WLS, owned by The Prairie Farmer Publishing Co., and WCB D, Zion, also were heard on their applications for modification of their licenses.

John E. Wing, counsel for WENR, told the Commission that approximately \$750,000 had been expended for new transmitting and other equipment and that under the new allocation the station was allowed only two-sevenths of the broadcasting time.

Wilbur Glenn Voliva, overseer of Zion City, on behalf of WCB D, requested return of the 870 kilocycle channel with five hours of night broadcasting during the week. Under the new allocation which went into effect November 11th, WCB D

WLS and WENR in Hot Fight

was placed on 1,170 kilocycles for daylight operation only.

Favors No Particular Station

William R. Dawes, President of the Association of Commerce of Chicago, and brother of Vice-President Dawes, testified that his organization was interested in having for the city and the Central West the largest amount of broadcasting facilities possible to obtain. Explaining that the organization favored no particular station, he said that WENR, with its new facilities, is capable of serving the entire Central West.

Referring to the utilities companies owning WNER, Mr. Dawes said:

"They would not use the station in any manner that would be harmful to the people. The Insull companies are desirous of developing facilities to the utmost in order to perform the greatest public service."

Personal Friendship

Replying to a question asked by counsel for WCBD, the Zion City station, he said:

"Personal friendship with Mr. Insull is not the cause of my presence here. We want to get the best broadcasting facilities possible for the Radio Commission to give."

John V. L. Hogan, consulting engineer of New York, appeared for WENR and testified as to the technical details of reception on the 870 kilocycle channel. He said that interference that would be produced by a 50 kilowatt station would be less on the 870 kc channel than on other cleared channels and that the value to the public would be enhanced in that millions more people would be within reach of the station. A 50 kilowatt station would have a service range of 1,000 miles whereas a 5,000 watt station would have a range of only 300 miles.

Senators Norris of Nebraska, Brookhart of Iowa and Walsh of Montana, were present in the interest of WLS, which also asked full time on the 870 kc channel.

The Commission heard the appeal of WNYC, New York municipal station, that it be allowed to operate full time on the 570 kilocycle channel, which it is now sharing under the reallocation with WMCA.

The delegation for WNYC was headed by Grover A. Whalen, who was Commissioner of Plant and Structures at the time the station was installed. Mayor James J. Walker was detained in New York, but George P. Nicholson, Corporation Counsel, told the Commission that the mayor was "heart and soul in favor of the station." He also said that the station does not enter into any commercial contracts.

Educational Advantages

Mr. Whalen argued that the station was a vital educational factor in the life of the people.

Albert Goldman, present Commissioner of Plant and Structures, explained the "City Air College," conducted over WNYC, benefits those people who had no educational opportunities in their younger days. He also said that the station was needed for experiments in conducting fireboats and to keep in touch with the police stations throughout the city.

Dr. Frederick B. Robinson, president of the College of the City of New York, William A. Boylan, Assistant Superintendent of Schools, and Dr. Henry T. Fleck, of Hunter College, testified to the educational benefits of WNYC. Others who testified for the station were Dr.

SENATORS CALL WENR SELFISH

Washington

Three United States Senators, before the Federal Radio Commission, opposed granting full time to WENR, Chicago, on the ground it was owned by the public utility interests that wanted to broadcast propaganda. The Senators were Norris, of Nebraska, Walsh, of Montana, and Brookhart, of Iowa.

The Great Lakes Broadcasting Corporation operates the station. This corporation is composed of seven public utility companies. At present WENR shares time with WLS, formerly owned by Sears-Roebuck, but now owned by "The Prairie Farmer."

"The power trusts have controlled a good part of the earth," said Senator Norris. "They ought to let us have the air."

Senator Norris referred to the disclosures before the Federal Trade Commission of dubious practices by utility companies in spreading propaganda. Senator Walsh went into this subject in detail.

John A. Wing, attorney for WENR, said the three Senators knew very little, if anything, about the station's programs. Mr. Wing submitted telegrams from Governor Small and Governor-elect Emerson, as well as from other Illinois officials, commending WENR as a station of public service, convenience and necessity.

Shirley Wynne, Health Commissioner of New York City; Gilbert T. Hodges, president of the Advertising Club of New York; General Robert Lee Bullard and John D. Flynn, representing the National Security League; Hugh Lynch of the Merchants Association of New York; William J. Russell, secretary of the Chamber of Commerce of the Borough of Queens, Christie R. Bohnsack, managing director of the station, and Representative Emanuel Celler of New York.

"Useless Tax Burden"

Eight witnesses appeared for station WMCA. Frank D. Scott, counsel, called Thomas J. Noonan of the Rescue Society, New York, Oswald G. Villard, editor of "The Nation," Milton Remer, Charles T. Root, and John A. Meeker, representatives of the Christian Scientists of New York, George Edelhertz, editor of "The American Hebrew"; Edgar Felix, a radio engineer; W. K. Wing, editor of "Radio Broadcast"; and Harry Mack, studio director of WMCA.

The witnesses for WMCA attacked WNYC on the grounds that it was a useless burden on the taxpayers of the city, that it was lacking in technical perfection, that it was defective in transmission and that it lacked continuity of good programs.

Satisfaction Not General

New York and Chicago are not the only large cities in which there is much dissatisfaction over the reallocation. Word comes from Cincinnati, Ohio that although reports of the Radio Commission label the new arrangement of wavelengths as in general "satisfactory," listeners in Cincinnati and in all of the Ohio Valley are working themselves into a frenzy of

desperate disfavor because of the loss of the night programs of WSAI.

Newspapers in Cincinnati and in surrounding cities began sending a renewed barrage of vitriolic telegrams to the Radio Commission as WSAI fans reported that Sunday night's first thrill of getting the signals of a few distant stations would in no way compensate for the loss of consistently good radio reception.

Numerous reports from listeners all over the United States indicate that to many set owners, station WLW with its new 50 kilowatt transmitter is the one bright spot in an otherwise dreary broadcast outlook.

Enough word has been received at the Crosley station to indicate conclusively that practically the whole United States is depending on the high powered transmitter for 75 per cent of its programs.

Immensely Popular

Contributing to the immense popularity of the station at the moment of the reallocations probably is the fact that WLW was permitted to continue broadcasting on the 700 kilocycle wave band it has occupied since the radio allocations of 1926. Dealers experienced no difficulty in locating the station in its accustomed place while other radio stations were forced to change their frequency.

Little opportunity to measure the efficiency of WSAL on its new 800 kilocycle location has been given the Crosley corporation since simultaneously with its change from 830 kilocycles, it was limited to daylight operation and its programs were greatly curtailed.

Lynch Ends Work As CeCo's Agent

In a letter, addressed to all the CeCo jobbers in the New York Metropolitan District, Arthur H. Lynch announces that his relations with CeCo have terminated.

Lynch says that he approves of this move on the part of the CeCo Manufacturing Co. He makes no bones about the fact that the change is not of his own choice. He expresses his thanks for cooperation and the support jobbers gave him.

Edward Fiske, formerly assistant sales manager for CeCo, is taking over the metropolitan territory.

15% of AC Homes Have AC Receivers

Cincinnati.

Although there are approximately 9,500,000 American homes equipped with alternating current, only about 15% of them, at most, are provided with AC radio receivers, said H. Curtiss Abbott, general sales manager of the Crosley Radio Corporation.

Most of those who have electric sets obtained them during the present year and every radio manufacturer has been taxed to his production ability to provide this output.

THE GEORGE W. WALKER CO., merchandizers of Victoreen products, has opened quarters at 25 West Broadway, New York City, for the convenience of fans and the trade at large. Here a complete stock of the Victoreen products is carried and complete sets, amplifiers and power packs are on display.

HEARING HELD ON SHORT WAVE FOR TELEVISION

Washington.

Argument on an application for a construction permit for permanent operation of a television transmitter was presented before the Federal Radio Commission by WNAC, the Shepard Norwell Co., Boston, proprietor. At the same hearing experimental television transmitting licenses were requested by Aero Products Co., of Chicago, and Frank L. Carter, Long Island City, N. Y.

All three applications were for use of short waves for television.

John Shepard, for WNAC, explained to the chairman, Ira E. Robinson, and Commissioner O. H. Caldwell that WNAC, if granted the television license, proposes to synchronize visual broadcasting with audible broadcasting. Pictures of an orchestra leader directing his orchestra would be transmitted by short waves for reception by the special televisor equipment, while the loudspeaker would bring in the music on the regular broadcast wave.

Speeches, vocal solos and other simple combinations of motion pictures with audible broadcasting can be transmitted at the present stage of television development, he declared.

A short wave band of frequencies 100 kilocycles wide, in the vicinity of 5,000 kilocycles, is desired at this time, said Mr. Shepard. Later, through development, it may be possible to reduce the width of the band to 10 kilocycles, the same as at present used for audible broadcasting. A power assignment of 1,000 watts is desired, Mr. Shepard said, because this amount of power will reach out only as far as 500 watts on regular broadcasting.

Is It a "Utility"?

John Stewart, radio editor of the Boston Post, declared that a television station is desired for Boston, because the visual broadcasting signals from WLEX, at Lexington, just 10 miles outside of Boston, "do not get into Boston at all."

Chairman Robinson asked whether picture broadcasting was a "utility" and devoted to the public interest. Mr. Stewart replied that he considered the transmission of the picture of an artist as he is broadcasting to be a utility. The chairman said he could see the utility value of transmitting the picture of an escaped prisoner to facilitate recapture.

Mr. Carter said he desired to convert his amateur short wave station into an experimental television station.

Still Experimental

Explaining that he is employed by the Ludwig Bauman Company, chain store owners, he said that there have been numerous inquiries regarding television equipment, and that therefore he wished to promote television experimentation.

"Television," he said, "is strictly experimental at this time."

On behalf of the Aero Products Company, of Chicago, Bert Smith, chief of the technical laboratory of that company, said that an experimental license is sought to ascertain the practicability of television and further its development. At present, he said, television has not reached the practical stage, and the object is to experiment within the laboratory and, if the results seem to warrant, to "put it on the air."

Scientists Invited to Teach via Radio

Addressing the Associated Business Paper Editors, at their Fall conference in New York City, M. H. Aylesworth, president of the National Broadcasting Company, said he hoped that "prominent educators and scientists will step out of their hermitages and speak to every red schoolhouse in the country, over the radio."

He said that radio will decide future elections, and declared the recent big vote in the Presidential contest was due largely to interest in the campaign fostered through radio addresses. He found that the radio served to inform women of the issues better than they were informed previously, hence they took a great interest in voting.

U. S. TO CHECK WAVELENGTHS

Washington.

Whether radio stations are maintaining their assigned frequencies is a question which the Department of Commerce soon will be able to answer with accuracy.

In his annual report to the Secretary of Commerce, W. D. Terrell, Chief of the Radio Division, points out that special radio receivers and frequency measuring equipment have been ordered which will permit placing in operation a system of accurate frequency measurements.

One constant frequency station will be installed in a centrally located mid-Western State. Radio receivers as sensitive as any obtainable will be a part of this apparatus, together with equipment which will permit measurements of frequencies to be made, on any radio signal received, with a high degree of accuracy. The useful frequency ranges over which it will be possible to make measurements will be from 10 to 30,000 kilocycles.

This monitoring station will be able to measure the frequencies of a large portion of the United States radio stations as well as foreign stations whose signals are capable of interfering with American stations. On the higher frequencies the latter consideration is already of great importance and is becoming a serious matter.

To supplement the work to be done by the constant-frequency stations located in the geographic center of the United States, secondary standards of frequency and receivers will be installed in the offices of the supervisors of radio and sub-offices of the division. With this equipment it will be possible to make highly accurate measurements of frequency over a range between 100 and 30,000 kilocycles.

Three new radio test cars have been added to the equipment of the division, the report reveals, making a total of four in active operation in the field. Through the use of these cars, it is pointed out, considerable money has been saved the Government in the performance of the duties required under the radio laws.

These cars constitute traveling laboratories and offices, equipped to perform any duties pertaining to district headquarters. They carry frequency-measuring apparatus, radio-field intensity measuring equipment, apparatus for the examination of radio operators and all other equipment necessary for the proper performance of any work required under existing radio laws.

The importance of amateurs in the development of radio is emphasized in the report. A new system of amateur calls to indicate nationality is one of the provisions of the international radio agreement which goes into effect the first of next year.

HOOVER PLANS TO END BOARD, INTIMATES SAY

Washington.

There has been much discussion among radio men in Washington as to what Herbert Hoover as President will do about the broadcasting situation.

Some are of the opinion that he will recommend that the Federal Radio Commission will be abolished and that control of radio be returned to the Department of Commerce, where it was before Congress created the Commission. As Secretary of Commerce, Mr. Hoover was in direct charge of radio.

Robinson's Comment

Commenting on the suggestion that Hoover would abolish the Radio Commission, Chairman Ira E. Robinson of Commission said:

"Hoover is too big a man to commit himself to such action before he was sure of all the facts."

Judge Robinson further pointed out that Congress would determine radio control and not the President. He personally thought that the Radio Commission should be continued whether or not he himself continued to be a member, and he would so recommend to Congress when the proper time came.

Commissioner Sam Pickard of Kansas is of the opinion that Mr. Hoover had not made any suggestion about abolishing the Commission, as when Mr. Hoover was Secretary of Commerce he did not want the administration of the radio law to remain in that department. For that reason, Mr. Pickard thought, Mr. Hoover did not take active measures to prevent the enactment by Congress of the law creating the Commission. Commissioner Pickard further stated that he did not think that the new administration would want to be burdened with radio problems in the cabinet.

Visitor Gives His Side

One leading radio man, who had discussed the subject with Mr. Hoover, said:

"Mr. Hoover is opposed to the Radio Commission. I firmly believe he is justified in that viewpoint, as I have worked in close contact with the Federal Radio Commission and I realize, as does Mr. Hoover, that some of the members do not understand the problems that confront them and they are blocking progress."

"There is no doubt that radio controlled by the Department of Commerce will be handled on a business basis. It will be a good thing for broadcasting because the Commissioners representing various zones are continually wrangling for the stations in their own territories and that stirs up discord and impedes progress. The Department of Commerce will have no partisan views and will have the interest of the entire country at heart."

THE Philadelphia Storage Battery Company, makers of Philco all-electric radios, announced the purchase of an additional 100,000 square feet of ground with a large factory building, which will enable the company to double its output of radio sets. Improvements to cost nearly \$750,000 already have begun on the property and buildings, which are located at Allegheny and C Streets, just one block from the present Philco factory, in Philadelphia.

KOLSTER SIGNS BIG CONTRACTS IN WIRED RADIO

Through the ingenuity of Rudolph Spreckels, Pacific Coast millionaire, owner of the majority stock in the Kolster Radio Corporation, the North American Company, largest publicity utility company in the United States, signed two contracts with the Kolster Corporation, putting Kolster into the wired radio field. Wired Radio, Inc., a subsidiary of the North American Company, actually signed the contracts.

Gets 600 Patents

Kolster is to get 600 patents and at least one-third of the orders for apparatus, and bids fair to obtaining about \$35,000,000 a year business from the North American Company.

Some regard wired radio as a coming field for national distribution of choice features. The newly signed contracts prove that the North American Company, with its vast interests covering the entire continent, and the Kolster Company, believe there is an enormous future in serving programs to consumers over the electric light wires. In Cleveland extensive trials are being made now.

Discussed Five Months

The contracts were signed only after five months of negotiation. Meanwhile other interests were seeking the 600 patents held by North American and subsidiaries, and covering radio in both the entertainment and commercial message and facsimile fields. General Electric and Western Electric were said to have been among the bidders.

Ellery W. Stone, president of Kolster, said that the 600 patents include many widely infringed in the radio transmission and receiver fields today, and that the Kolster Company expects to receive large royalties, as well as to enjoy a stronger position in the radio, electric phonograph, and talking movie fields.

The Kolster sets are now installed in Columbia electric radio-phonograph models.

Spreckles' Institute

Mr. Spreckles, chairman of the board of Kolster, and also of the Federal Telegraph Company, a North American subsidiary, said the newly signed contracts were in line with the greater diversification of the Federal Company's activities, his own idea. The first step was the acquisition of C. Brandes, Inc., manufacturer of headsets and speakers.

"The apparatus contract," according to Frank L. Dame, president of the North American Company, "forecasts the arrival of the industry's latest development, wired radio, which in the future will supplement but not displace present broadcasting on the air.

"When plans have been completed wired radio will become available to all of the major public utilities of the United States."

A central sending station, to cover the United States and Canada by land wires, is under contemplation.

NEXT WEEK—issue of December 8th—the Holiday Gifts Number of Radio World. Key to Christmas radio shopping. Bigger in size, with fourteen special treats. Get this issue for sure!

Police to Use Sets to Trap Burglars

Cincinnati

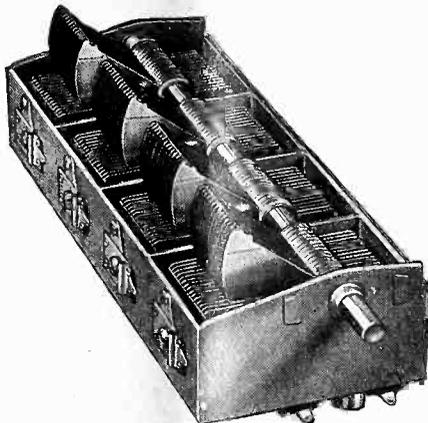
Radio as a police service is to be instituted in this city, Grove C. Smith, Safety Secretary, announced. There will be a radio set in each police and fire station as part of a plan developed by Col. Sherrill, City Manager.

"The equipment of fire and police stations as well as fire and police vehicles with radios is part of the development plan of Colonel Sherrill, to bring the Fire Department within the cooperative scope of the Police Department." Mr. Smith said.

"Colonel Sherrill favors the plan of giving firemen police powers and thereby doubling the police force without additional cost to the city."

Mr. Smith said the radio system would be especially valuable in catching burglars and highwaymen.

Hammarlund's New Fleet of Capacities



In line with the new shielded sets built like battleships, the Hammarlund Manufacturing Co., Inc., 424 West 33rd Street, New York City, has brought out a new 1929 multiple "midline" condensers in battleship models, marvels of ruggedness and accuracy. This new Hammarlund "Battleship" Multiple is the finest condenser job this concern, famed for its quality production, has ever turned out. Beautifully finished, with die-cast frame, plates permanently aligned, free-moving rotor, and recesses in the frame permit direct attachment of an equalizing condenser to balance each unit with absolute precision. The sections of these condensers are within $\frac{1}{2}$ to $\frac{1}{4}$ of 1% (plus or minus) of each other at all points. This is the closest matching obtainable. Shaft $\frac{3}{8}$ inches, turned down to $\frac{1}{4}$ on dial end. These condensers will answer every need of manufacturer and fan alike. They come in two, three and four-gang models. Informative literature on these and other Hammarlund products will be sent upon application to the above concern. Mention Radio World.—J. H. C.

A NEW BRANCH OFFICE with warehouse and service station facilities has been opened in Atlanta, Ga., J. L. Ray, general sales manager of the Radio Corporation of America, announced. Pierre Boucheron, formerly advertising and publicity manager of the R. C. A., has been appointed southern district sales manager in charge of the new office. C. R. Westbrook, formerly connected with the New York sales offices, has been appointed assistant district sales manager.

* * *

SPLITDORF Radio Corporation announced its purchase of the Park City Electric Company at Bridgeport, Conn.

MINES CHIEF BACKS RADIO QUEST OF OIL

Washington

Use of geophysical methods in prospecting for oil is advocated by the Acting Director of the Bureau of Mines, O. P. Hood in a statement filed with the Federal Radio Commission in support of the application of oil companies for short wave radio channels with which to carry on geophysical explorations.

Mr. Hood quoted Scott Turner, director of the Bureau of Mines, who had said:

"I wish to call to your attention two important uses for radio for which provision should be made before the practicable bands are finally apportioned. These uses are (1) for geophysical prospecting and (2) for experimentation in the possible use of radio as an aid to the rescue of entombed miners.

Easy Ways Known

"The easily found mineral deposits, both of metals and of oil and gas, have apparently been located. The remaining deposits are mostly those which are deeply covered or of which the structures are obscured.

"It is, therefore, plain that means for finding them other than the methods heretofore in use must be developed. The newer methods are known as geophysical methods because they deal with the physical characteristics of the earth's crust. The methods are becoming more and more refined and must continually be improved.

"A number of these methods depend on a signal from a central location which is received through the earth at stations some distance away.

"The retardation or acceleration of the signals through the earth gives a clue to the structures below, and thus to the location of a desired deposit. In order to ascertain the retardation or acceleration of the signals through the earth, use is made of radio waves to signal simultaneously to the various stations.

Measured by Signals

"The radio signals are so nearly instantaneous in their flight to the stations that they make a good yardstick for measuring the speed of the earth waves. The power used is small, probably never over 100 watts, and the range of the waves is ordinarily less than 50 miles. Most of the prospecting is done in regions remote from radio stations, and therefore offers a minimum of interference.

"The continuing discovery of ore, oil, and gas deposits is a matter which concerns the public welfare to an enormous extent, and is comparable in its importance to the continuance of transportation facilities. The need of the reservation of powers up to 100 watts is very great and will probably increase with time. Representatives of the National Research Council, private corporations, and of the Geological Survey have all urged the Bureau to use its good offices in this matter."

DUE TO increased business of the Silver-Marshall Company in the New York and Philadelphia territories, William G. Davis has been appointed Philadelphia representative, with headquarters at the M. & H. Sporting Goods Company, 512 Market Street, Philadelphia, Pa.

Temporarily Mr. Davis will be under the supervision of F. Edwin Schmitt, 136 Liberty Street, New York, N. Y.

The Bounty of the Air

How Broadcasting Grew and Prospered

By Louis B. F. Raycroft

CLARK MAXWELL was the Columbus of Radio in the middle fifties of last century, while Heinrich Hertz was the Amerigo Vespucci in 1864. Hertz' name is given to the new phenomena on which radio is based. Then came Marconi in 1896 as the first colonizer of the new field of human endeavor; again in 1901 as the Lindbergh of trans-Atlantic radio communication; and thereafter as a leader in the development of the commercial possibilities as we now know them. These are the high spots in early radio history.

Eight years ago broadcasting was born and introduced to the American public by KDKA of Pittsburgh—owned and operated by the Westinghouse Electric & Manufacturing Company. The first regular broadcast service program was in a Presidential election and consisted of reports of the count of the votes cast for the candidates. Today we are impressed by the tremendous use of radio facilities by contending political parties.

Startling Growth

Beginning with the one station of November, 1920, there followed nearly 125 broadcast stations by the Spring of 1921. The number grew to some 733 stations by March, 1927. The dollar value of business in radio receiver apparatus and devices grew from \$2,000,000 in 1921 and \$5,000,000 in 1922, to sixty million in 1923 and to \$500,000,000 in each of the years 1926 and 1927. The number of receivers is variously estimated as now being from 8,000,000 to 12,000,000 and the radio audience at from 40,000,000 to 60,000,000 people. The figures are for American radio exclusively.

This growth has been brought about under the compelling pressure of a public enthusiasm which has abundantly rewarded such producers as have survived the pitfalls of quickly shifting demand for changes in construction and design.

All this has constituted a kind of revolution, producing in itself and because of its rapid effect upon the social structure, new problems requiring new legislation. Congress first acted in 1910, but in 1912 rewrote and enlarged the radio law to cover the needs of the day.

While not ignoring the drastic changes

caused by broadcasting, Congress passed no new legislation until heavy public pressure was brought to bear on it, resulting in the Radio Act of 1927. That act was amended in the Spring of 1928 by the so-called Davis Amendment. The Federal Radio Commission, created by the Act of 1927, thus acquired the problem of adjusting the facts of radio broadcasting first to the amended act and second to the requirements of public convenience, interest and necessity.

Commissioners' Terms End

All this, however, according to the provisions of the Davis Amendment, must be accomplished not later than March, 1929, because the amendment automatically discharges the present personnel of the Commission from office.

The Federal Radio Commission has large responsibilities entirely to one side of the broadcasting situation. But the popular problems in radio today are broadcasting or how to give seven hundred licensed stations, and a large additional number of applicants room to broadcast simultaneously on 89 American channels. The problem has its cheerful side, but it is getting more and more difficult to get the Commission to see it. And Congress, collectively, not content with badly fumbling the ball, insists on individually acting as 531 assistant Radio Commissioners, some doing double or treble duty for those who are less active.

Engineering vs. Politics

Speaking with the utmost seriousness, the problem in radio broadcasting has two principal phases—the engineering phase and the political phase. Under the laws of human nature and the practices of politicians both phases must necessarily be taken into consideration.

The Federal Radio Commission adopted the new Allocation Plan after most adequate consideration of numerous problems. Prior to the plan a long period of compromise and experiment adequately demonstrated that to relieve one case of congestion in one area inevitably made the conditions worse in another. Extraordinary ingenuity was displayed by the Commission in an effort to bring about a gradual betterment of broadcast-

ing conditions without making necessary a radical step equivalent to cleaning house and beginning all over again.

We realize that the Federal Radio Commission inherited chaos precipitated by a presumptuous Chicago broadcaster who seized a Canadian channel in the summer of 1926 and successfully upset the authority of the Department of Commerce to regulate broadcasting.

Successful Despite Obstacles

Great progress in correcting the subsequent confusion has been made by the Federal Radio Commission without cancelling any substantial number of broadcasting licenses. Only after exhausting every avenue of escape and studying the evidence of qualified engineers was the conclusion reached that the eighty-nine available broadcast channels could not successfully carry the load which broadcasting stations sought to impose upon it.

Many of the stations contributing to congestion were established during the period when the Department of Commerce was restrained by injunction against refusing licenses.

Successful Plan

In spite of obstacles the Commission has worked out successfully a definite spectrum of national, regional and local stations giving a fair balance to each type of service and assuring the highest possible quality of broadcasting, not only in congested areas within the high-grade service range of broadcasting stations, but in rural districts which necessarily depend upon some degree of distant reception for the enjoyment of essential and important broadcasting services.

Amendment Hampers

Restricted by the requirements of the Davis Amendment to equalize the division of powers and channels of each class to each zone and to States within the zones according to their populations, the Commission naturally found its most difficult problems the first and fourth zones, which have far above the average number of stations.

Extensive time-sharing has been necessary in these zones to equalize conditions.

Schools Hard Pressed for Sets for Lessons

Every possible means of obtaining radios is being resorted to by schools throughout the country to listen to Walter Damrosch's R. C. A. Educational Hour for school children.

Casual references in the thousands of letters received at the offices of the Radio Corporation of America and the National Broadcasting Company reveal that radio equipment is being borrowed from private homes for school use, bought by individual teachers out of their own savings, loaned by public-spirited business men, and even home-constructed by pupils, so that the Friday morning musical programs given by the dean of American conductors may be heard.

Also the sale of sets and parts has been accelerated.

Birds in Voice Test for California Honors

Oakland, Calif.

Twenty-two birds will assemble before KGO microphones during the next six months, each presenting its own qualifications for the high office of state bird of California.

Bert Harwell, who has had a hand in starting the movement for a California state bird, will be the radio spokesman for feathered candidates who might become temperamental and refuse to whistle.

So that an intelligent vote may be cast by the public, Harwell is using radio to acquaint listeners with the various birds, their songs and their habits. He speaks over KGO every Tuesday at 6:30 p. m.

Netherlands, Norway, Canada Ratify Pact

Washington

J. H. Van Royen, the Netherlands Minister; Alexis H. G. O. Lundh, Charge d'Affaires, Norway; and Vincent Massey, the Canadian Minister, have deposited with the State Department ratifications of the International Radio Telegraph Convention and the general and supplementary regulations relating to it, in behalf of their governments. The ratification of the Netherlands included Dutch East Indies, Surinam and Curacao. The United States ratified the Convention on October 8th.

The Convention was drawn here at international conference taken part in by most of the countries of the world and it was designed to regulate international radio communications. It was signed November 25th, 1927 and goes into effect January 1st, 1929.

A New Easy Way with Hum

WHEN the filaments or the cathodes of amplifier and detector tubes are heated by alternating current taken from the power lines a hum arises. The frequency of most of this hum is twice that of the supply and part of it has the same frequency as the supply. For example, if the frequency of the supply current is 60 cycles, most of the hum has a frequency of 120 cycles per second and part has a frequency of 60 cycles.

The heater type of tube is relatively free from hum, but it does produce some. The so-called filament type tubes produce considerable hum, and when the so-called DC tubes are heated by AC the hum is intolerably great, except when AC is used on the last tube only.

But the DC tubes are very desirable because of their favorable amplifying characteristics. Many devices have been brought out with a view of solving the problem of heating the filaments with power taken from the AC line. The more successful of these involve rectifiers. In one case the rectifier takes the form of an A battery eliminator. A heavy duty charger is interposed between the AC line and the radio receiver filament circuit, and the heavy rectified current is filtered as well as may be by low inductance choke coils and electrolytic condensers.

In another case the filaments of the tubes are connected in series and then supplied with rectified and filtered current of low amperage and high voltage.

Disadvantages of Methods

While these two general methods are used quite extensively with good results, they bring up certain points for discussion. The A battery eliminator may be subject to difficulty of filtering heavy currents. But this method is the more successful.

The series filament method has the disadvantage that the receiver circuit requires radical changes. And these changes usually lead to many complications.

It is very difficult to construct a circuit with series filaments without introducing regeneration in both the radio and audio frequency levels. Consequently there is much hum, oscillation and frequency distortion. Besides these troubles, the method is wasteful of power and renders

the circuit inflexible with respect to type of tubes that can be used.

A New Method

But there is one possible method which is relatively more efficient than the series connection method and is less subject to hum than any other method that has been suggested, at least for the same efficiency and cost. This method has not been published heretofore, but it has been used experimentally for some time.

The advantages of the method should commend it to engineers who are looking for new developments.

The method is simple in conception and in application. And it is as flexible as the direct method of heating filaments with AC. In fact, it is based on heating the filaments with AC, not with AC of commercial frequencies, but with frequencies of such magnitude as to render the hum inaudible, yet not so high as to constitute radio frequencies.

Super-audible Hum

Since the highest frequency that any human ear can hear is somewhat below 20,000 cycles, and since the main hum component has a frequency twice that of the supply current, it would seem that if the filaments were supplied with a current of 10,000 cycles there would be no audible hum in the output.

The question now is how such a frequency can be produced with sufficient power to heat the filaments of DC tubes ordinarily used in a radio receiver, and to produce it with reasonable efficiency. The solution is available.

We have a tube, the -50 type, which as an oscillator is rated at 25 watts. Certainly an oscillator generating a 10,000 cycle frequency could be assembled which would make a wattage of 10 watts available for the filaments. That is much more than most receivers require.

250 Tube is Used as 10,000 Cycle Frequency, Tubes or Any Other— Never Before

By J. E.
Technical

Let us assume a six-tube receiver using three screen grid tubes, or tubes having the same filament requirements, two of the -01A tubes, or other tubes requiring a filament power of 1.25 watts, and one power tube, the filament of which can be heated by 60-cycle current. Such a receiver would require a total 10,000 cycle wattage of 3.8 watts. That could easily be extracted from a -50 type oscillator, with some power to spare for additional tubes, when the rating of this tube as an oscillator is 25 watts.

In order to get a considerable power from such an oscillator, it is necessary to supply the plate of the tube with a high, steady voltage, say 450 volts or more. This can be obtained from a plate power supply such as is used for high-power amplifiers. If two -81 type rectifiers are used, sufficient current could be obtained for the oscillator as well as for the tubes in the amplifier, including one or two -50 type tubes.

The 10,000 Cycle Oscillator

The oscillator circuit may be any one of a number of well known circuits; for example, the one illustrated in Fig. 1. The oscillating circuit consists of the largest center-tapped winding on transformer T2 and the condenser C9, both of which are

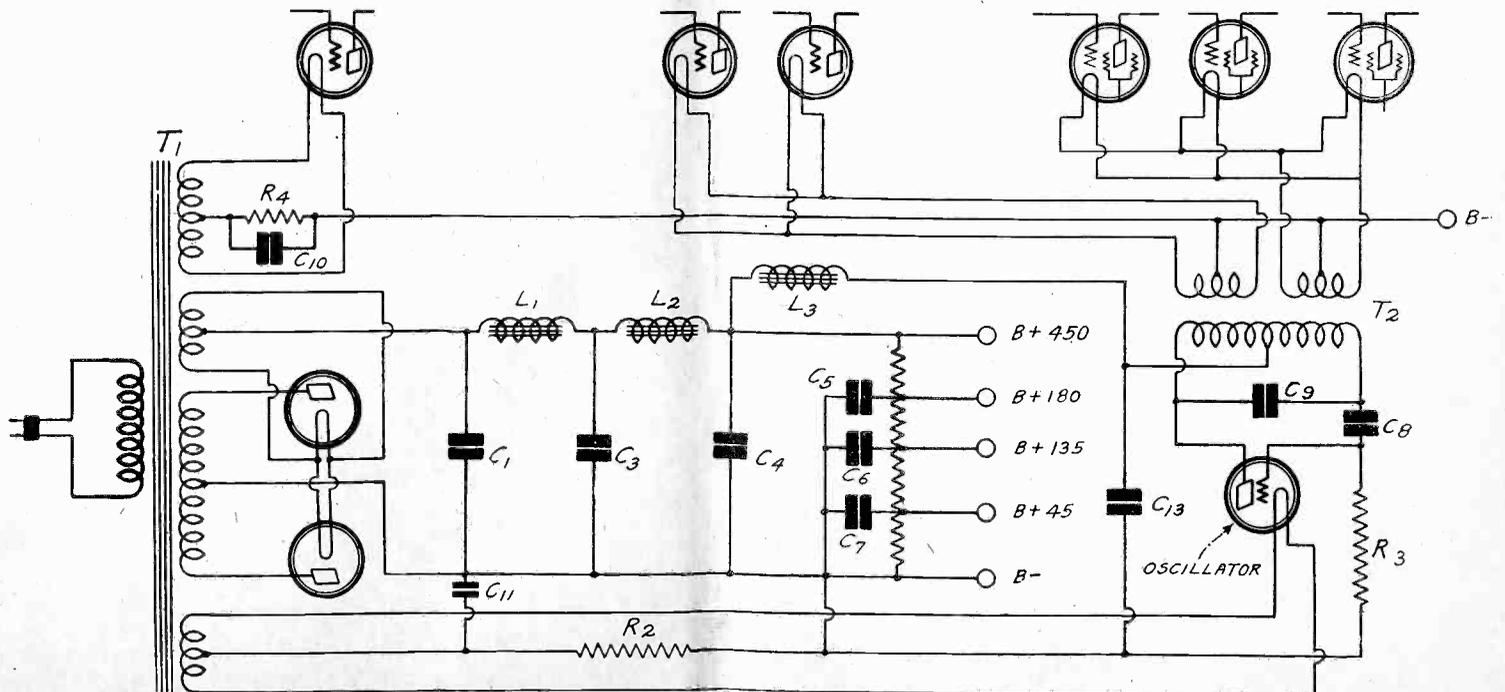


FIG. 1

A CIRCUIT ILLUSTRATING A NEW TYPE OF A BATTERY SUBSTITUTE. AN OSCILLATOR, DERIVING ITS PLATE POWER FROM A B BATTERY ELIMINATOR, IS USED TO SUPPLY A 10,000 CYCLE CURRENT TO THE FILAMENTS OF THE TUBES IN THE RECEIVER. THIS IDEA WAS CONCEIVED AND TESTED BY J. E. ANDERSON IN DECEMBER, 1926.

to Heat Any Filamentless AC

Oscillator, to Generate Deliver 10 Watts to DC An Absorbing Invention Published

Anderson

Editor

connected between the grid and the plate of the oscillator tube. A condenser C8 is used to isolate the grid from the plate voltage and R3 is a suitable grid leak. The plate voltage is applied through a choke coil L3 to the center-tap on the oscillating coil. Condenser C13 may be used as an additional filter condenser.

Resistor R2 is used to supply a negative bias to the oscillator tube, and condenser C11 by-passes this resistor. Neither of these two parts may be necessary, for in this type of circuit the grid leak maintains the grid at the required bias.

Transformer T2 should be of special construction. Its core may be air, laminated iron or compressed iron dust. If the laminated core is used the laminations should be much thinner than those used in 60-cycle transformers. Low voltage windings should be placed on the core as well as the oscillating winding. The ratio of turns should be adjusted so that the required filament voltage is maintained across the smaller windings. There might be one winding for 3.3 volt tubes and another for 5-volt tubes, or there may be a winding of suitable voltage for each tube in the receiver. These low voltage windings should be center-tapped in order that the filament circuits may be balanced for the heating current.

If the plate current supplied to the oscillator tube contains a ripple, this will appear as a modulation on the 10,000-cycle output of the oscillator. One might think that this would defeat the purpose of the arrangement; that is, that it would introduce a 120-cycle hum into the amplifier. But this ripple will only produce a periodic rise and fall in the amplitude of the 10,000 current, and hence in the heating effect of the current. It has been proved that the proportion of hum from this effect is negligible when the filaments are heated by 60-cycle AC. And in this case the rise and fall of the current is from zero to maximum. The ripple will produce only a very small rise and fall in the amplitude of the 10,000-cycle AC. Hence the modulation will not produce any audible hum. It is for this reason that the extra filter section L3C13 may not be at all necessary.

Filament Current Control

If the AC line voltage varies, the 10,000-cycle filament current will vary in the same proportion. Hence if the line voltage remains reasonably constant the filaments will not be subjected to dangerous variations. The filament current will be of about the same constancy as if the heating current were taken directly from a 60-cycle transformer.

But some control of the filament current undoubtedly will be necessary. Any control of the intensity of the oscillations will control it. The oscillations may be controlled by controlling any one of the three voltages applied to the oscillator tube. For example, it may be controlled by inserting a rheostat in the filament circuit of that tube, or by inserting a high variable resistor in the plate supply lead. Again, it may be varied by varying the value of the grid leak R3, or by varying the resistor R2, if this is used. When the filament currents in the varying tubes supplies with 10,000-cycle current has been adjusted once it should not be necessary

to readjust as long as the oscillator tube holds out.

Suggested Circuit

Fig. 1 indicates all the necessary connections. First there is a power transformer T1, which has three 7.5 volt windings. One of these is for the filaments of the rectifier tubes, one for those of the power amplifier tubes and another for that of the oscillator. There is also a high voltage winding to supply the current to be rectified. All should be center-tapped.

The filter and voltage divider are standard. R4 is a resistor to supply the grid bias for the power tube or tubes. C10 by-passes it. If a separate grid voltage supply is used, both R4 and C10 are unnecessary.

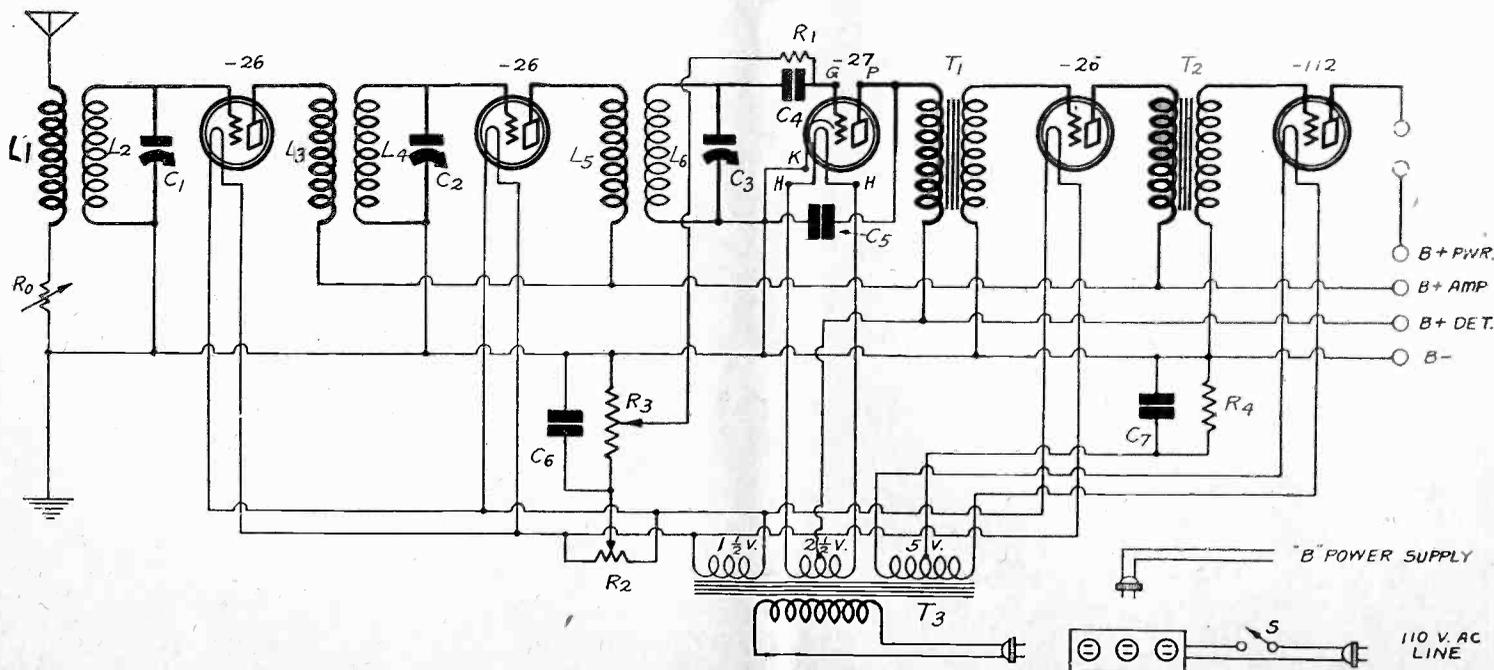
Three screen grid tubes and two -01A type tubes are indicated in Fig. 1. But only the filament circuits are outlined in order that the connections to the 10,000-cycle source may be shown.

It is believed that the oscillator, including all the parts, will be much cheaper both to buy and to operate than any other type of filament current supply which has yet been suggested. And it is further believed that the hum in a receiver operated with it will be so low that no other battery substitute can approach this one.

It is not necessary to give the constants indicated in Fig. 1 except those strictly pertaining to the oscillator, since this part alone is new in this application. If the frequency of the current generated in the oscillator is to be 10,000 cycles, the product of the effective inductance of the oscillation winding on T2 and the capacity of condenser C9 should be .25, the inductance being measured in millihenries and the capacity in microfarads. For example, if C9 is .01 microfarad, the inductance should be 25 millihenries.

The value of R3 may be from 5,000 to 25,000 ohms. C8 may be a .25 or a .1 mfd. condenser. It must stand voltages at least up to 600 volts. C9 should be a mica condenser and it should be able to withstand voltages about as high as C8. Transformer T2 must be designed for the job with which it is to work.

[Further discussion of this absorbing topic will be published next week.]



THE PRESENT METHOD OF USING AC ON THE FILAMENTS, AS CONTRASTED WITH THE ANDERSON METHOD.

The Hammarlund-R

PART I

THERE is an old adage, "If you want a thing done right, do it yourself," but in these modern days the latter portion might be amended to read—"have it done under your own supervision." This old saying and its modernized version apply particularly to radio receivers—either build one yourself or see that it is built according to your own requirements.

For the man who wants a receiver that will bring in the station to which he wishes to listen and bring it in so that it sounds as nearly like the original performance as is possible, the new Hammarlund-Roberts Hi-Q 29 Master Model is the end of his search.

Here is a set in which is incorporated a new circuit—using band-pass filters in the radio-frequency amplifier—and an audio-frequency amplifier insuring reproduction of the highest quality. The set can be installed in any one of a number of different model cabinets or consoles, so that it can be made to fit in with almost any type or style of home decorations.

Come of Fine Ancestry

Hammarlund-Roberts receivers need little introduction to the radio fraternity as a whole, because for nearly five years they have been considered among the front rank of receivers developed in the United States. The receiver herein described is by far the most efficient set bearing this name, as may be ascertained by reading the theoretical description. Improvements are included in this new model, as well as features that, as far as is known, are not to be found in any other set, regardless of price.

The Master Hi-Q 29, when built ac-

ording to specifications, is a genuine "coast-to-coast" instrument. In selectivity nothing like it has ever been produced outside of certain laboratory instruments, which are far too costly for general use. This receiver, for the first time, as far as is known, employs a band-pass filter which insures flat-top, square cut-off tuning with a selectivity of 10 kc. "Cross talk" is thereby eliminated. Only a single station can be tuned in at one time, even in large cities where many high-powered stations are broadcasting at once. Stations do not slide in gradually, with a gradual increase in volume. They *snap* in—clear and undistorted.

Little Effort to Build It

Fidelity and tonal quality and absence of distortion have always been features of Hammarlund-Roberts receivers and again this year the Master Hi-Q 29 will bear the same scrutiny as would its forerunners. The signals are clear and can be modulated to whatever degree of volume desired.

The Master Hi-Q 29 has been so designed that it can be constructed with a minimum of effort on the part of the builder. The accompanying diagrams and illustrations will furnish the builder with complete details, which should be adequate to the enthusiast of average experience.

It is well known that the prime requisites for a first-class modern receiver are quality of reproduction, selectivity and sensitivity, and that they are by no means independent of each other. They are closely bound theoretically with the design of the whole and it is for this reason that only the best receivers have all three

**Both Plate and Grid Circuits
Tuned, Affording Band-Pass
Selectivity that Still
—Battery Operated Model
Theory Reveals Why**

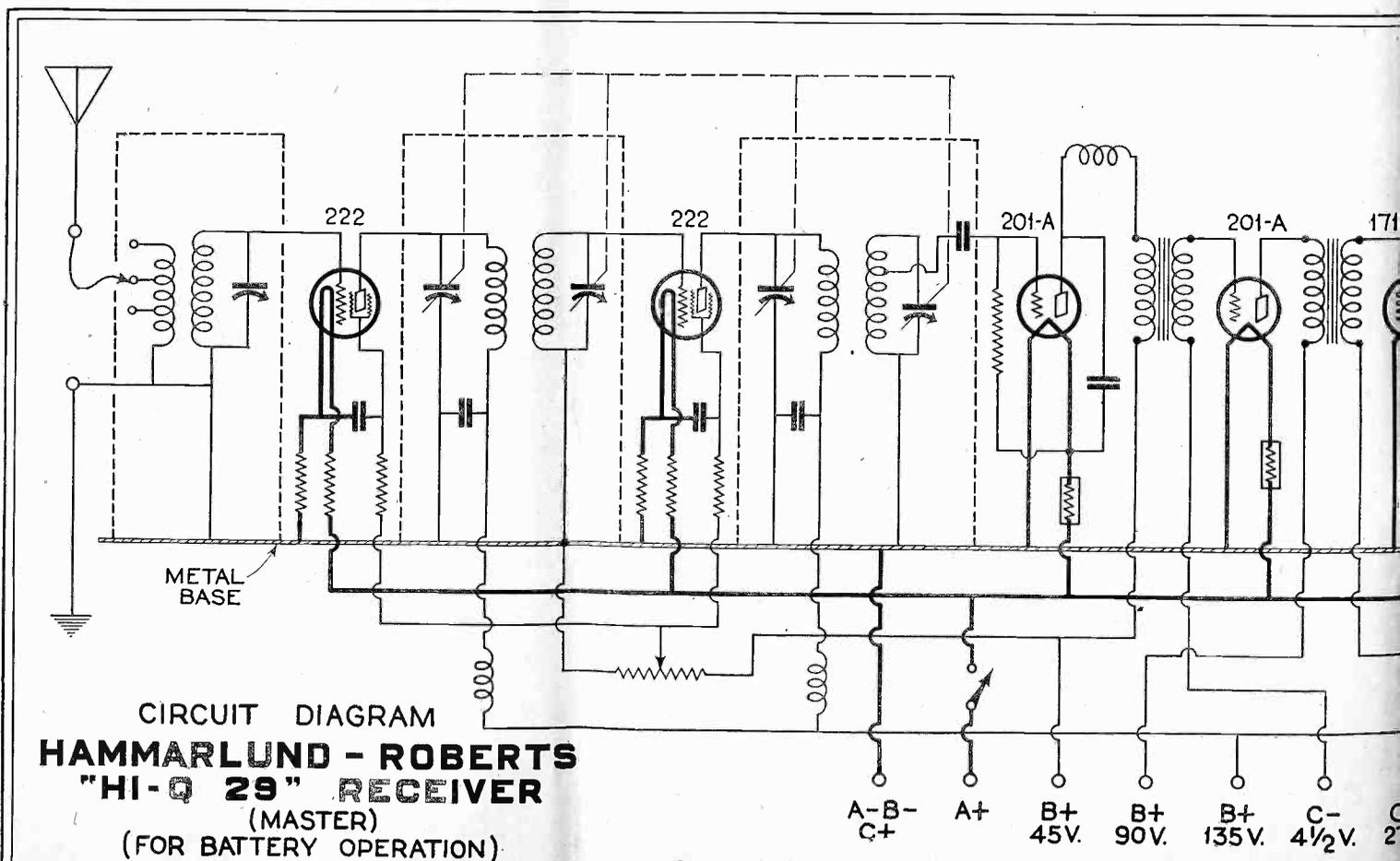
By Leslie

features. The new Hammarlund-Roberts receiver possesses these three requisites to a remarkably high degree, and a careful study of the principles employed in the design will reveal the reasons for the exceptional operating qualities.

Circuit Remarkable Innovation

The Master Hi-Q 29 uses a remarkable circuit which is entirely new in radio receiver design. The underlying principle is described by Morecroft in his book "Principles of Radio Communication," in the section devoted to "coupled circuits." When such a circuit is used in a receiver it is quite obvious that the result is less radio-frequency distortion and greater selectivity. Until the advent of the shield-grid tube this type of circuit was not practical, and even with these tubes the layout is quite elaborate and therefore only adaptable to high-quality receivers in the higher price class.

Briefly, the tuning system used in the Hi-Q Master provides selectivity greater even than the old-fashioned "hair-trigger" regenerative set *expertly operated*; sensitivity (amplifying power) equal to a Su-



Roberts Master Hi-Q

of Screen Grid Tubes are
Filter for Extraordinary
reserves all the Modulation
Described — Fascinating
This New Circuit Excels

Biles

er-Heterodyne, and an output from the
loudspeaker as distortionless as that ob-
tained from a crystal and headphones.

To start at the beginning, the layman
readily will agree that good selectivity is
a highly desirable attribute of any radio
set. Good selectivity, however, has hith-
erto been understood to mean sharpness
of tuning, which is not conducive to qual-
ity of reproduction. For example, the
modern high-quality audio transformers
now available make possible the construc-
tion of a practically perfect audio ampli-
fying system. If a power tube is used
in the last stage of such an amplifier and
its output fed into one of the better type
speakers, the audio amplifying and repro-
ducing system leaves little to be desired.

The Conflict

However, this system can amplify and
produce only what is fed into it by the
detector tube, which in turn receives the
signal from the radio-frequency amplifier.
Hence it is evident that even a perfect
radio system cannot provide a high qual-
ity output from a loudspeaker if distor-
tion is introduced in the RF amplifier,



FIG. 1

THE CIRCUIT DIAGRAM
OF THE HAMMARLUND-
ROBERTS MASTER HI-Q
29 RECEIVER. THE CIR-
CUIT EMPLOYS TWO
SCREEN GRID TUBES
WITH SPECIAL BAND
PASS FILTERS BETWEEN
STAGES, WHICH MAKE
THE SELECTIVITY EX-
CEPTIONALLY SHARP
WITHOUT CUTTING THE
HIGH FREQUENCY SIDE
BANDS.

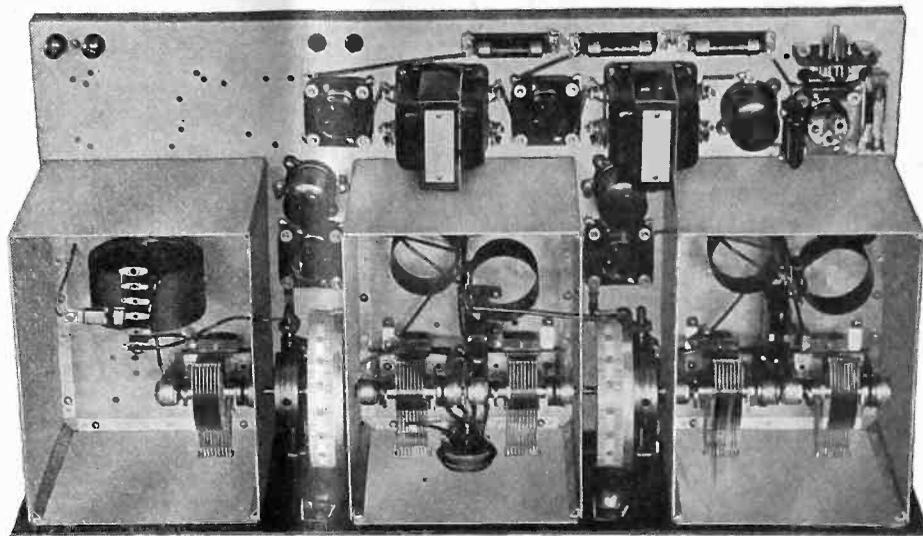


FIG. 2

THIS SHOWS THE LAYOUT AND STRUCTURAL FEATURES OF THE HAMMARLUND-ROBERTS MASTER HI-Q 29 RECEIVER.

due, let us say, to excessively sharp tun-
ing, technically known as "side band cut-
ting."

This illustrates the conflict between the
two desirable characteristics, quality and
selectivity.

Also the attainment of a high degree of
radio frequency amplification (sensitiv-
ity) is a distinct asset, if it can be attained
without instability (tendency toward self-
oscillation of one or more tubes) which
impairs the quality of reproduction.

Want High Gain

High amplification is desirable because
it enables the set owner to receive pro-
grams from very distant stations when he
feels so inclined, and also because it makes
possible quite satisfactory reception from
local and moderately distant stations on
a small indoor antenna even in unfavora-
ble locations.

However, selectivity and sensitivity are
also incompatible.

One of the reasons for this condition is
not generally understood, and is even
more seldom taken into consideration. The
average receiver owner or experimenter
bases his judgment almost entirely on the
"apparent" selectivity.

This is quite natural, since the actual
selectivity of a receiver can only be de-
termined by a series of very careful
measurements. The apparent selectivity
of the ordinary radio set decreases as its
sensitivity increases.

Where Broadness Sets In

Therefore, of two receivers having ex-
actly similar "actual" selectivity and one
having say three times the sensitivity of
the other, the set having the higher sensi-
tivity (or amplification) will invariably
seem broader or less selective.

The enormous amplification and ex-
tremely low plate-to-grid capacity of the
new screen grid tube at first glance would
seem to make it almost ideal for use as
radio frequency amplifier. The manu-
facturers of these tubes state that a volt-
age set-up of forty or more per stage is
obtainable at broadcast frequencies. In
addition the plate-to-grid capacity is said
to be of the order of one-fortieth of one

mmfd., or about one four-hundredth as
great as that between the plate and grid
of the 201A type tube.

Since it is this plate-to-grid capacity
of the ordinary tube that is so trouble-
some in the design and construction of
multi-stage radio frequency amplifiers,
many schemes have been devised to neu-
tralize this capacity.

None of these schemes has been entirely
successful, however.

[Other phases of this circuit will be dis-
cussed next week, issue of December 8th.]

LIST OF PARTS

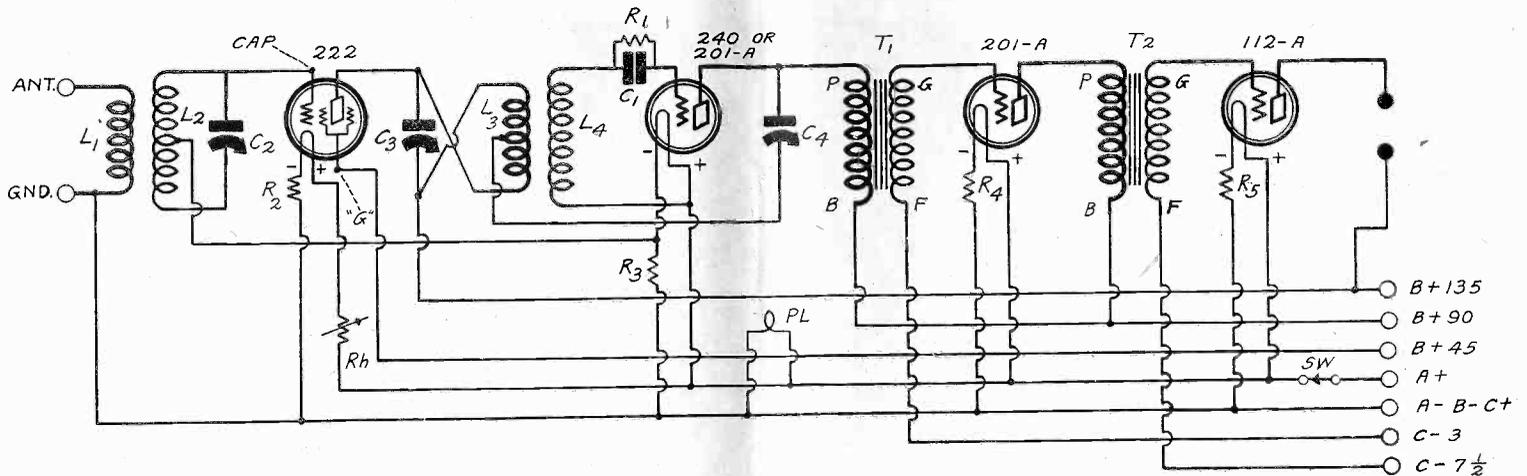
- Five Hammarlund No. ML-17 .00035 mfd. Midline Condensers.
- One Hammarlund No. "Hi-29" Coil Set.
- Two Hammarlund No. SDW Knob-Control Drum Dials (walnut).
- Three Hammarlund No. RFC-85 Radio Frequency Chokes.
- Five Benjamin Cle-Ra-Tone Sockets, No. 9040.
- One Sangamo .00025 mfd. Fixed Mica Condenser.
- One Sangamo .001 mfd. Fixed Mica Condenser.
- One Carter No. 11S "Hi-Pot" Potentiometer with switch, 100,000 ohms.
- Two Thordarson No. R-300 Audio Transformers.
- Four Parvult .5 mfd. Series 200 By-pass Condensers.
- One Durham Metallized Resistor, 1/2 megohms.
- Two Amperites No. 1-A.
- One Amperate No. 112.
- One Yaxley No. 660 Cable Connector and Cable.
- One pair Yaxley No. 422 Insulated Phone Tip Jacks.
- Two Eby Engraved Binding Posts.
- One "Hi-Q 29" Master Foundation Unit (containing drilled and engraved Westinghouse Micarta panel, three complete aluminum shields, drilled steel chassis, shafts, binding post strips, Fahnestock clips, fixed resistance units, resistor mounts, brackets, clips, wire screws, nuts, washers and all special hardware required to complete receiver). Hammarlund Mfg. Co., Inc.

THE Universal Circuit, using a screen grid tube as the radio frequency amplifier, is shown herewith for the first time anywhere, and moreover is presented with the full confidence that it will rank as one of the outstanding four-tube receivers.

It does about all that can be expected of a four-tube set; in fact, a little bit

The Screen

By Herman



CENTER TAPS ON THE TUNED WINDINGS OF THE COILS, PHASE REVERSAL IN THE SCREEN GRID PLATE CIRCUIT AND FEEDBACK THROUGH A JUNIOR CONDENSER OF 50 MICRO-MICROFARADS MAKE THE NEW SCREEN GRID UNIVERSAL A "BEARCAT."

more, because it is strong indeed on distance reception, while possessing tone that is bound to please.

Let us discuss one of the difficulties and show how it turns out to be a delight.

Local stations come in so loud that at first we don't know exactly what to do about cutting down the volume to comfortable limits. It is rather annoying. On the other hand, when we bring in a distant station, and far distant ones may be confidently expected of this receiver, we want the volume to be "as loud as a local." How can that be done? Only by having the locals come in altogether too loud, with easy means of reducing the volume to an enjoyable limit, and then, when tuning in a distant station, give the set the full works—maximum volume. Then the same comfortable volume to which the local was reduced will be present in the received distant signal.

Too Much Is Just Enough

In other words, locals must come in too loud, if distance is to come in loud enough. That is the rule for any receiver. And that is the main reason why a volume control is imperative in any receiver that produces this plethora of local volume.

The usual 20-ohm rheostat will not do as volume control, in the present receiver, because the volume is so enormous; therefore, a 50-ohm rheostat is used. It performs its necessary work excellently.

The woods are full of four-tube sets, some of them with a screen grid tube in front, so it is pertinent to inquire into the reasons why the present receiver ranks with the very best of them, and is far better than most.

It would be rather presumptuous to assert it is the best of all, since only one Screen Grid Universal is in existence, and while it has been tried out with conscientious pains, given the practical test of reception, there still remains the question whether it will prove, besides a wonderful receiver, something easy to build and to work.

Simplified by Blueprint

There is a blueprint available, and anybody can follow that. Besides, this article is intended not only to induce radio enthusiasts to rally to a new and outstanding development, but also to inform them on the making, operating and re-

pairing of the circuit. With a pierced aluminum subpanel, with sockets affixed and with self-bracketing front, as the starter, and with a drilled front panel, there is nothing to it except to follow the simple blueprint to the logical conclusion of a superlative receiver, one that has tuned in a 500-watt transmitter 1,000 miles away, night after night, without fail.

It is all right for a receiver to bring in distance on eccentric occasions, for all favors are thankfully received, but the real test is that of repetition—not mere occasional repetition, but nightly repeti-

tion, unending repetition! And in that direction the Screen Grid Universal casts its winning beam.

The Screen Grid Universal takes most of the enormous extra gain afforded by the screen grid tube for amplification purposes, but uses the excess for increasing selectivity. This sounds rather puzzling, perhaps. If you have a device that affords unusual amplification, under conditions that may also require unusual selectivity, you might use all the amplification as amplification and not have nearly as much selectivity as is needed. It can be said fairly about four-tube sets that they have been sensitive enough, as a rule, but rather shy on selectivity.

The Happy Compromise

If one desires greater selectivity, with the same number and type of stages, he can obtain it only at the expense of volume. The broader tuning is the louder; the closer tuning is the softer. Indeed, the volume declines at a faster rate than the selectivity increases.

Now, it is all right to use the screen grid tube for maximum volume, in multi-tube circuits, if you can devise some way of controlling the receiver.

In a four-tube set you can use a screen grid radio amplifier as a maximum amplifier, but what about selectivity? Surely you want that to be better than what you've been used to in four-tube sets. Then, too, you want more amplification than with an ordinary RF tube. The Screen Grid Universal does both—gives both greater selectivity and still increases the sensitivity and volume enormously.

One of the attractive points about a home-constructed or custom-built set is that it may be suited to the location in which it will be used. It has flexibility. If it is moved to a different type of location, where the requirements are different, a few minutes and the simple changes are perfected, and the receiver works just as well as it did in the other place. Yet take a factory-made receiver that works well in one location. It lacks versatility, perhaps, to make it work just as well in another location, because it is a standardized, mass-application product, not suited to individual needs.

Here, in the Screen Grid Universal, we have a wide range of selectivity—good, to start with, much greater, if needed. For instance:

(a) The grid return of the screen grid

LIST OF PARTS

- L1, L2—One Screen Grid two-winding RF transformer, with center-tapped secondary; Model 5RF for .0005 mfd. or Model 3RF for .00035 mfd.
- L3, L4—One Screen Grid high impedance interstage coupler, with center tapped primary; Model 5TP for .0005 mfd. or Model 3TP for .00035 mfd.
- C1—One .00025 mfd. Aerovox grid condenser, with clips.
- C2, C3—Two Hammarlund Midline .0005 mfd. or .00035 mfd. tuning condensers.
- C4—One Hammarlund junior condenser. Cat. No. MC11 (50 mmfd.)
- R1—One Lynch metallized grid leak, 2 to 10 mg.
- R2—One No. 622 Amperite, with mount.
- R3, R4, R5—Three No. 1A Amperites with three mounts.
- Rh—One 50-ohm rheostat.
- T1, T2—Two Thordarson R-300 audio transformers.
- SW—One filament switch.
- PL—One pilot light bracket with lamp. Two dials. Two knobs.
- Four binding posts (Ant., Gnd., Speaker plus, Speaker minus).
- One 10x20-inch aluminum self-bracketing subpanel, with sockets affixed, and including hardware and insulating washers.
- One 7x21-inch drilled bakelite front panel.
- One nine-lead battery cable.
- Four Kelly tubes as follows: One 422 screen grid, two 401A and one 412A (for 135 volts maximum), or one 471A (for 180 volts maximum).
- A, B and C supplies; cabinet and speaker.

Grid Universal

Bernard

tube may be made to the center-tap on the two-winding coil used as the antenna coupler, as shown in the diagram, which approximately doubles the selectivity.

(b) The condenser C4, a junior type, by reverse feedback center-tap connection, may increase the selectivity as much as a thousand percent, even on top of the previous selectivity gain.

(c) A series fixed condenser may be connected in the aerial lead.

(d) The primary winding of the antenna coil may be halved by removing turns.

Still Enough Volume

Even after you have used maximum selectivity, you still have good signal strength, due to tuning the primary circuit in the screen grid output, to the step-up ratio to the untuned secondary, to regeneration, and to transformer coupled audio, which gives the greatest possible stable volume that a two-stage amplifier affords.

Looking at the diagram, the simplicity of the circuit is apparent, and one would say there's "nothing to it"—meaning, it is hoped, nothing that approximates a difficulty. And yet there are two strange connections: the grid return of the screen grid tube, which goes to the F minus post of a 5-volt tube, and the twisted connections in the screen grid plate circuit.

The grid return to F minus of a 5-volt tube is simply an easy means of obtaining a negative grid bias of 1.7 volts on the screen grid tube, represented by the difference between minus 3.3 volts and minus 5 volts. This point has arisen in previous circuits published in RADIO WORLD.

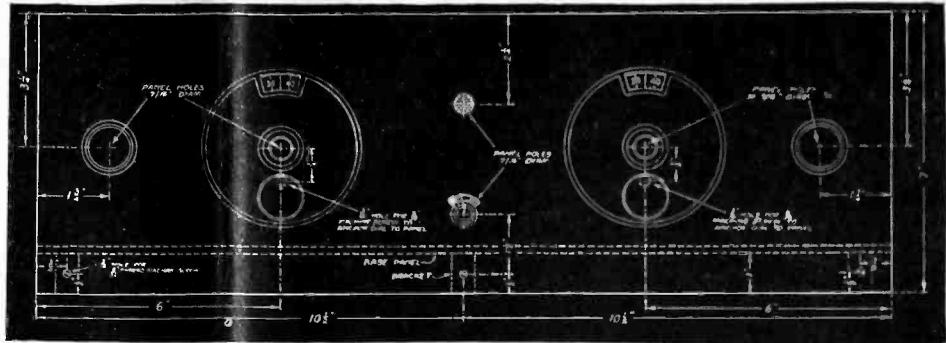
The reverse feedback through the junior condenser C4 is made possible by reversing the leads of the primary winding L3 in the plate circuit of the screen grid tube. If this reversal were not made the condenser C4 would act solely as a damper or neutralizer, whereas with the reversal established the effect is that of a very superior order of regeneration in the detector tube. This arises from the feedback being put in phase with the grid circuit of the detector tube.

Each stage reverses the phase 180 degrees, when the coil windings are in the same direction and the respective connections are made in the same relative order, with plate and grid winding terminals and B plus and grid return winding terminals in the same relative positions.

Therefore the grid circuit is out of phase with the plate circuit, unless the phase is reversed, and that's exactly what is done by turning the connections around in the winding L3. It simply means connecting the plate where B plus otherwise would go, and connecting B plus where you would otherwise connect the plate.

Coil Connections

Considering the interstage coil used, which is a Screen grid coil, Model 5TP for .0005 mfd. and 3 TP for .00035 mfd., the primary winding is on the outside. The secondary, which is on a separate form on the inside, is wound in the same direction. When the coil is mounted upright, with binding posts on bottom, the primary or outside winding's binding posts should be to the right, as you look at the coil from the rear of the subpanel. The binding post nearer the front panel goes to plate of the screen grid tube, the corresponding one at right, nearer the rear, goes to B plus 135 volts, while the sec-



THE DIMENSIONS FOR THE FRONT PANEL OF THE NEW SCREEN GRID UNIVERSAL, A GREAT DX GETTER OF FINE TONAL QUALITY.

ondary, represented by the two remaining binding posts, is connected with grid to the post nearer the rear of the subpanel and grid return (A plus) to the post nearer the front panel.

You will notice that in the antenna circuit the secondary is tuned, while in the interstage circuit the primary is tuned. In both instances there is a step-up ratio.

The antenna coil consists of a 14-turn primary and a 51-turn secondary, with $\frac{1}{4}$ inch space between the two windings, which are of No. 24 single silk-covered wire on a 3-inch diameter. The secondary is center-tapped. The interstage coupler consists of a 48-turn primary on a 3-inch diameter, and a 75-turn secondary on a $2\frac{3}{4}$ -inch separate form, inserted in the primary form, using the same kind of wire. These directions apply to .0005 mfd. tuning.

Center Taps Important

For .00035 mfd. the secondary of the antenna coil has 59 turns and the primary of the other coil also has 59 turns, but the untuned secondary L4 would have 100 turns. Do not forget the center taps, if you wind the coils yourself. If you buy factory-made coils they will have the center tap provided, also the mounting fixtures.

The Screen Grid coils, model 5RF for .0005 mfd. antenna tuning, or 3RF for .00035 mfd., and model 5TP for .0005 mfd. interstage coupling or 3TP for .00035 mfd. interstage coupling, tune splendidly with the Hammarlund Midline condensers. Both the Screen Grid coils and the Hammarlund condensers were used in the laboratory model, as illustrated on the front cover.

When you build the receiver you may use any form of layout you desire, but it is much easier to follow the layout as represented in the front cover illustration which is the same as contained in the full-sized blueprint. That order is, as you face the front panel: Left to right, RF tube, extreme left; detector tube, extreme right; first audio tube at right rear and final audio tube at left rear, thus conforming to the letter U. In such an instance, instead of connecting the grid return of the screen grid tube to F minus of the detector socket, you may connect it to F minus on the final audio socket, because that adjoins the screen grid tube, and the lead is thus shortened.

Subpanel Is A Minus

To construct the receiver, purchase the self-bracketing aluminum subpanel with perpendicular. There will be no trouble due to interaction.

sockets affixed, and the drilled bakelite front panel, or prepare your own front and subpanel. The front panel is 7x21 inches and the dimensions are given on the panel view herewith. The subpanel is 20x10 inches.

The coils may be mounted on the subpanel as shown on the front cover, both

If the aluminum subpanel is used, as recommended, it is connected to ground and A minus, and the subpanel itself is used as the A minus lead, connections being made by fastening a lug to the top of the subpanel with machine screw and nut, and soldering to the lug. This makes for neatness and simplicity.

The aluminum subpanel is pierced, so that connections that run underneath the subpanel from the top are most easily made, but if for any reason you desire to use parts that call for somewhat different position of holes, it is easy to drill the aluminum. Hardware and insulating washers are provided with the aluminum subpanel, to take care of any new holes you desire to drill. A collar insulator goes on top of the subpanel and a flat round insulator on bottom, where you want to avoid connection to A minus.

The usual order of wiring is to connect the A plus and A minus circuits first, wiring up the filaments so that you may test for lighting before proceeding. As a nine-lead battery cable is used, connect two leads to A plus and A minus respectively.

After this part of the work is done you may proceed from the antenna circuit to the last audio output, doing the wiring carefully and also soldering well.

Tubes Discussed

The tubes to use are one 422 or 222, two 401A or 201A, and one 412A or 112A. Two exceptions are:

(1) If you want still greater volume, but do not care so much for DX, you may use a 440 or 240 high mu tube detector, if the audio transformer is of 1-to- $3\frac{1}{2}$ ratio or less; the high mu tube does not oscillate so readily, which accounts for less DX, when the leaky-condenser method of rectification is used, as here.

(2) If you have a B supply of 180 volts, use a 471A output tube, as the volume is enough to tax even that tube on locals; of course, the negative grid bias then would be around 40 volts, not $7\frac{1}{2}$ as shown, as $7\frac{1}{2}$, really $8\frac{1}{2}$, counting the voltage drop in R5, is for the 412A.

The voltage of 90 on the detector is for use with a high mu tube only. If a 401A is used, make this voltage common with the screen grid voltage (45) instead of common with the first audio voltage (90).

If you have opportunity to choose tuning condenser values, favor .0005 as against .00035 mfd., although the difference is admittedly slight.

[This concludes the instalment on the theory and construction. Next week, issue of December 8th, Holiday Gifts Number, operation will be disclosed.]

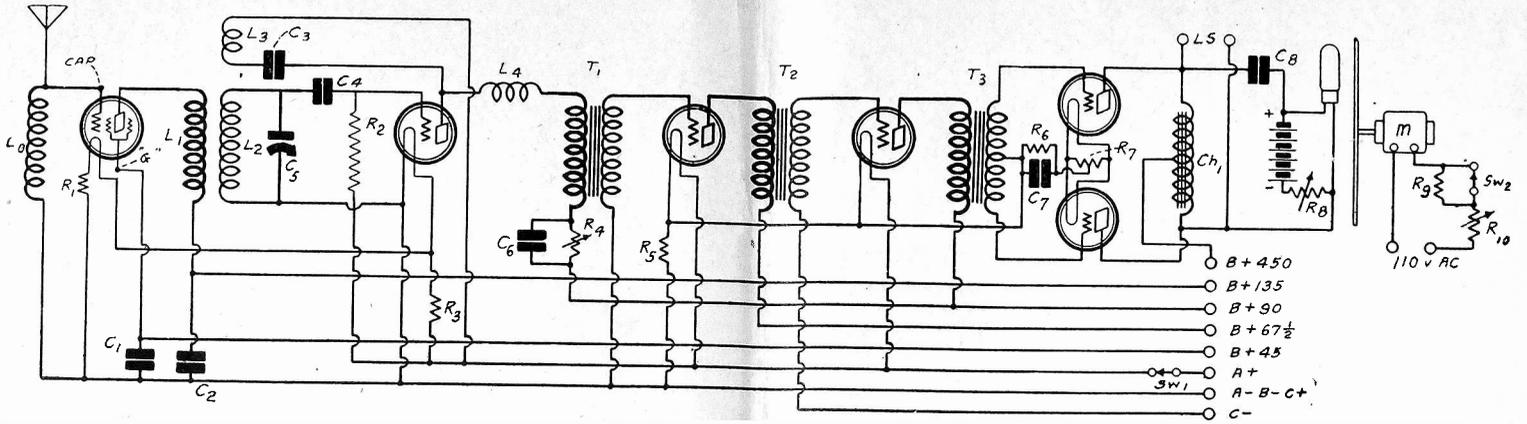


FIG. 712

A RECEIVER SUITABLE FOR THE RECEPTION OF TELEVISION IMAGES. A NEON LAMP IS CONNECTED TO THE OUTPUT OF THE LAST TUBE AND IT IS SCANNED BY A NIPKOW DISC. THE LINE OF SIGHT IS DISTRIBUTED.

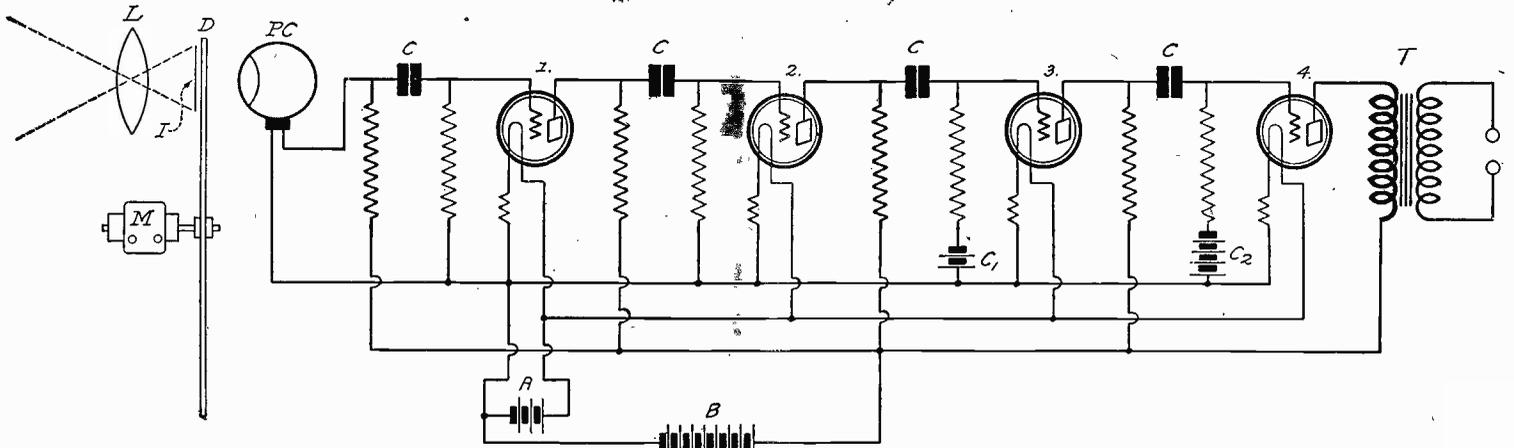


FIG. 713

THE TRANSMISSION SCHEME USED BY THE BELL TELEPHONE LABORATORIES FOR SENDING OUTDOOR SCENES BY THE DIRECT, OR NATURAL, METHOD OF ILLUMINATION. L IS A WIDE APERTURE LENS FORMING AN IMAGE I WHICH IS SCANNED BY A LARGE DISC D. THE LIGHTS ARE PICKED UP BY THE SUPERSENSITIVE PHOTO-ELECTRIC CELL PC. THE OUTPUT OF WHICH IS AMPLIFIED ENORMOUSLY BY A FOUR TUBE RESISTANCE COUPLED AMPLIFIER.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., New York City.

When writing for information give your Radio University subscription number.

WHY ARE the high audio frequencies suppressed in a resistance coupled amplifier?

(2)—What are the causes of high audio frequency suppression in the radio amplifier and detector?

(3)—Does the B battery eliminator contribute to the suppression of audio frequencies above 5,000 cycles.

(4)—What gives rise to the hiss and crackle in the output of a receiver?

HUGH A. MILLER, Sheboygan, Mich.

(1)—Because of the capacity between the plate and the grid in the amplifier tubes. The effective capacity in a high mu tube with resistance coupling is many times greater than the apparent capacity.

(2)—The tuners are responsible for most of the cut-off. The grid condenser also contributes some.

(3)—The B battery eliminator usually does not contribute to the suppression. The only way it could do so is by way of feedback reverse. The by-pass condensers prevent this effectively.

(4)—Hisses and crackles are caused by irregular detection, by defective resistors, by old batteries and by leakage through insulation.

* * *

IS IT NOT possible to operate a type 222 screen grid tube with AC on the filament?

(2)—It is my understanding that a com-

mercial receiver has been built in which an ordinary screen grid tube is heated with AC. How is it done?

(3)—Is it necessary to return the grid to the center of the filament as in the case of —26 tubes?

EUGENE RAPP, St. Augustine, Fla.

(1)—Yes, but not effectively.

(2)—The commercial receiver using AC on the filament of the screen grid tube employs a high negative bias on the control grid so that the AC on the filament cannot modulate with the signal. Some amplification is lost thereby.

(3)—Yes, the grid return must be connected to the exact center of the filament.

* * *

I HAVE a variable resistor designed for heavy duty, being rated at 50 watts and 50,000 ohms. Why does it get red hot when a current of only 40 milliamperes flows through it?

(2)—Please show how the wattage dissipated in the resistor can be determined from the current flowing in it.

(3)—If a resistance or rheostat is rated at a certain wattage has any part of it the same rating?

(4)—Should a rheostat run cool when it dissipates the rated wattage?

FRANK SANDERS, Butte, Mont.

(1)—It gets hot because you dissipate more power in it than the rated value. In fact you dissipate 80 watts.

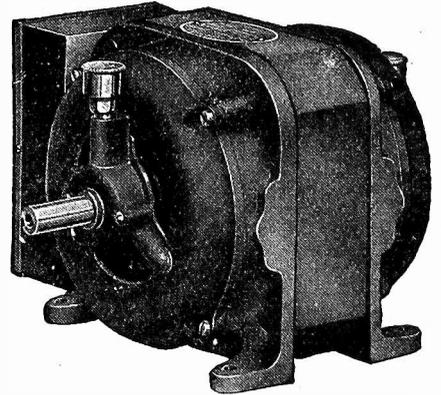


FIG. 714

AN INDUCTION TYPE MOTOR, USED CONSIDERABLY IN TELEVISION WORK, PROVIDING VARIETY OF SPEED, CONTROLLED BY A SEPARATE TELEVISION CLAROSTAT. THE MOTOR IS 1/8-HORSEPOWER AND EASILY HANDLES DISCS EVEN LARGER THAN 24 INCHES

(2)—The wattage dissipated in a resistance is obtained by squaring the current in amperes and multiplying by resistance in ohms. Thus $.04 \times .04 \times 50,000$ equals 80 watts.

(3)—No, it has a rating proportional to the resistance used.

(4)—Most rheostats and resistors are rated so that they run warm, but not hot, when they dissipate the rated wattage.

* * *

WHAT IS MEANT by magnetostriction? This term has been used much lately in radio literature.

(2)—I have noted that it is often used in connection with piezo crystals. Is there any connection between magneto-

striction and piezo crystals? If so, what?

(3)—I have observed also that there are magneto-strictor oscillators. What are they and how do they work?

(4)—What are they used for?

MALCOLM STUART,
Halifax, Nova Scotia.

(1)—Magneto-strictor refers to the change in dimensions that certain metals undergo when they are subjected to magnetization. Iron, cobalt, nickel, and alloys containing one or more of these metals are magneto-strictive.

(2)—There is only an analogy relationship between the behavior of piezo crystals and magneto-strictive metals and alloys. Piezo crystals change their dimensions when subjected to electric forces, magneto-strictive substances when they are subjected to magnetic forces.

(3)—A magnetic-strictor oscillator is one in which the coupling between the grid and the plate circuits is by means of a rod of the magneto-strictive material.

(4)—The magneto-strictor oscillator is used to some extent as a frequency standard, but not nearly so much so as the piezo crystal oscillator.

* * *

PLEASE SHOW a circuit diagram of receiver suitable for television reception, particularly the connection of the neon lamp and its relation to the scanning disc.

(2)—Also please show a circuit diagram of an amplifier suitable for transmission of television signals, particularly the connection of the photo-electric cell and the arrangement of the scanning disc in relation to it.

(3)—What type of motor is most suitable for driving the discs at either end of a television circuit?

(4)—Is it necessary to have the same type of motor for both the transmitter and the receiver?

(5)—If a synchronous motor is used is it necessary to have a speed control at the receiving end?

FRANCIS J. MURPHY,
Cambridge, Mass.

(1)—Fig. 712 shows a six tube receiver which has been used successfully for receiving television images. This circuit employs a screen grid tube for RF amplification and high grade transformers in the audio amplifier. Push-pull output is used to improve the quality and increase the volume.

(2)—Fig 713 show an amplifier used in the most successful transmission of television so far achieved.

(3)—A synchronous motor is best, provided that both the transmitter and the receiver are on the same power system. If they are on different systems an induction motor should be used at the receiving end. Such a motor is illustrated in Fig. 714.

(4)—No.

(5)—It is not necessary to use a speed control, but it is necessary to use a phase control. A phase control in this case is simply a mechanical arrangement by which the frame of the motor can be rotated through an angle of 360 degrees. This is necessary to frame the image properly.

* * *

PLEASE PUBLISH a circuit diagram of a B battery eliminator with a power amplifier built in. I prefer one in which the -80 type rectifier is used.

(2)—Please give the necessary parts.
HILMER BOSTEDT,
Chicago, Ill.

(1)—Fig. 715 shows the circuit.

(2)—T1 is a power transformer with two center-tapped 5 volt windings and one center-tapped 600 volt winding, or higher voltage. L1, L2 are two 30 henry choke coils to carry 85 milliamperes or more. C1, C2 are two 2 mfd. 600 volt condensers. C3 and C7 are two 4 mfd.,

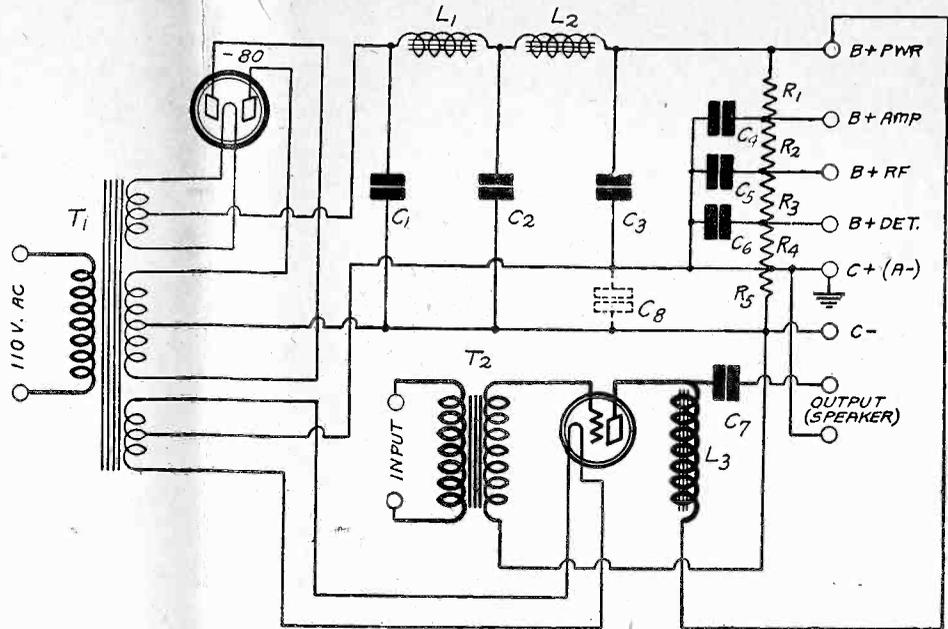


FIG. 715
THE CIRCUIT DIAGRAM OF A B BATTERY ELIMINATOR AND POWER AMPLIFIER DESIGNED FOR AN -80 TYPE FULL WAVE RECTIFIER AND A -71A TYPE POWER TUBE. REQUESTED BY HILMER BOSTEDT.

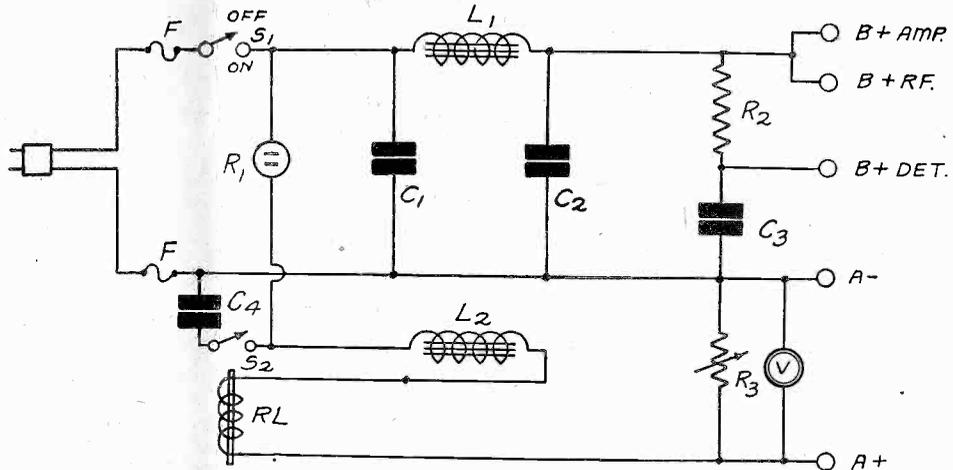


FIG. 716
A DIAGRAM OF A SIMPLE DC FILAMENT AND PLATE BATTERY ELIMINATOR TO BE USED WITH A 110-VOLT LINE. PUBLISHED AT THE REQUEST OF PATRICK GIBBONS.

600 volt condensers. C4, C5, C6 are three 1 mfd. 250 volt condensers. L3 a 30 henry choke to carry 40 milliamperes or more. C8 a 4 mfd. low voltage condenser, if used. T2 is a high grade audio transformer. The resistors R1 to R5 are standard voltage divider resistors with a total of 12,000 ohms or more, preferably the type which has sliding taps. With such a voltage divider the resistance

values of the various sections can be adjusted correctly.

* * *

PLEASE SHOW the circuit diagram of a DC filament and plate battery eliminator. I have such a circuit but have lost the diagram. I wish to rewire it.

PATRICK GIBBONS,
Los Angeles, Calif.

(1)—See Fig. 716 for such a circuit.

Join RADIO WORLD'S University Club

And Get Free Question and Answer Service for the Coming 52 Weeks
This Service for Yearly Subscribers Only

Have your name entered on our subscription and University lists by special number. Put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put at the head of your queries. If already a subscriber, send \$6 for renewal from close of present subscription and your name will be entered in Radio University. No other premium given with this offer.

[In sending in your queries to the University Department please paragraph them so that the reply can be written under or alongside of each query. Write on one side of sheet only. Always give your university number.]

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

Enclosed find \$6.00 for RADIO WORLD for one year (52 nos.) and also enter my name on the list of members of RADIO WORLD'S University Club, which gives me free information in your Radio University Department for 52 ensuing weeks, and send me my number indicating membership.

Name

Street

City and State

A THOUGHT FOR THE WEEK
"The Voice of the World" is what a noted divine called radio the other day. This was in course of an address in which he told of the great call to humanity that went out from battered ships at sea as they sent their appeals for help to willing hearts at every point of the compass.
 "The Voice of the World"—there's an epic in those five words!

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

TELEPHONES: BRYANT 0556, 0559

PUBLISHED EVERY WEDNESDAY

(Dated Saturday of same week)

FROM PUBLICATION OFFICE

HENNESSY RADIO PUBLICATIONS CORPORATION

145 WEST 45TH STREET, NEW YORK, N. Y.

(Just East of Broadway)

ROLAND BURKE HENNESSY, President

M. B. HENNESSY, Vice-President

HERMAN BERNARD, Secretary

Kansas City, Mo.: E. A. Samuelson, 300 Coca Cola Bldg.

Los Angeles: Lloyd Chappel, 611 S. Coronado St.

European Representatives: The International News Co.,

Breams Bldgs., Chancery Lane, London, Eng.

Paris, France: Brentano's, 8 Avenue de l'Opera.

EDITOR, Roland Burke Hennessy

MANAGING EDITOR, Herman Bernard

TECHNICAL EDITOR, J. E. Anderson

ART EDITOR, Anthony Sodaro

CONTRIBUTING EDITORS:

James H. Carroll and Capt. Peter V. O'Rourke

SUBSCRIPTION RATES

Fifteen cents a copy, \$6.00 a year, \$3.00 for six months, \$1.50 for three months. Add \$1.00 a year extra for foreign postage; Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7 1/4" x 11"	462 lines	\$300.00
1/2 Page, 7 1/4" x 5 1/2"	231 lines	150.00
1/2 Page, 8 1/2" D. C.	231 lines	150.00
1/2 Page, 4 1/2" D. C.	115 lines	75.00
1/2 Page, 4 1/2" S. C.	57 lines	37.50
1 Column, 2 1/4" x 11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
13 times consecutively or E. O. W.	12 1/2%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities, 10 cents per word. \$1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Hoyt and Ball Move

Manufacturers' Sales Company, formerly at 377 Fourth Avenue, New York City, has moved to larger quarters at 25 West Broadway, New York City. Greater space also will enable a full showing of lines. Among the lines handled by this well-known concern are the complete line of Hagel Power and Cable plugs, Corbett cabinets, consoles and de-luxe consoles, Isotone and H. F. L. products, Duro Metal Products, including the Duro loop, specified for many leading circuits, and the complete new line of 1929 Lignole panels in a wide variety of beautiful designs. Information on any or all of these lines may be had upon application to the above concern. Mention Radio World.—J. H. C.

Televised Shows

Nothing in Sight Yet; Invention Needed

THE public is expecting another kind of broadcasting service popularly known as television. The Federal Radio Commission is even now considering the formulation of regulations to govern this field of endeavor.

The great public interest in television is founded upon exaggerated newspaper reports of brilliant laboratory demonstrations rather than upon the actual practical status of this virgin field which is as yet entirely unprepared for commercial development.

A diligent study of the subject leads to the inevitable conclusion that the premature stimulation of public enthusiasm in television is misleading and dangerous to the progress of radio because there is no means of satisfying the demand for reliable home television equipment.

Television remains a laboratory experiment with a number of major and vital problems still unsolved. There are certain specific technical obstacles to practical television which cannot be overcome unless a fundamental and original invention or inventions are made.

How Television Works

The process of transmitting television images is a matter of reflecting a ray of light from the subject of the reflected energy point by point. This process is continued in a progressive and predetermined manner until the entire subject has been subjected to an immense number of electrical observations.

An electrical impulse is radiated for each point so examined or scanned. Thousands of these "intensity impressions" are required to send one complete image or subject. The amount of detail and realism attainable at the receiving point is proportionate to the number of impressions to which the subject is resolved.

In the reception of still pictures, these electrical intensity impressions are converted to light and collected on sensitive photographic paper so that several minutes may be used to assemble a single picture consisting of hundreds of thousands of separate image impressions.

In television, as with motion pictures, to give the impression of motion, however, the entire scanning of the subject must be repeated each sixteenth of a second. This rigorous requirement of television is fundamental and imposes an obstacle, to this time, insuperable, to sending anything other than the crudest and simplest kind of image.

Speeding-up No Easy Matter

The ability to send a television subject of 1,000 image impressions has led the public to expect that simplification by hundred-folding is a relatively easy matter. An improvement that would make possible a television reproduction of eight or ten square inches, of average magazine quality, would itself fall far short of any layman's conception of television. Hundred-folding the speed of any process, whether it be a man's walking pace changed from four to four hundred miles an hour, or an automobile from 70 to 7,000 miles an hour, is a tremendously ambitious scientific evolution.

In appraising the commercial future of television we must not overlook the fact that we are still limited to sending crude subjects consisting of a few hundred image points. Building more elaborate transmitters is quite feasible, but this involves the utilization of enormously increased frequency bands.

If every broadcast station were shut down and the entire radio broadcast band given over to a single television service, the 1,000,000-cycle ether space thus made available could accommodate the transmission of an image equivalent to that obtained with a home motion picture projector, and the cost of the experiment would stagger human imagination.

As a specific example, assuming a transmission having the maximum detail possible in the broadcast band with a modulation frequency of 5,000 cycles, we are limited to the transmission of 624 image points in each sixteenth of a second. The crudest reproduction to which we are accustomed is half tones in newspapers which are of 55 screen or 55 points per lineal inch.

A newspaper picture, one inch square, consists of 2,965 image points. The best television image of that size which we can send on a 5,000-cycle carrier has but one-fifth of that number of image points.

The entertainment value of such so-called television reception is of an extremely low order and entirely unworthy of consideration from any but the experimental viewpoint.

Calls for New Method

I do not wish to imply in any sense of the word that television will never be accomplished or that its numerous problems are beyond the ingenuity of the American inventor. My position is merely that the methods now being employed do not offer a reasonable hope that television will ever be more than a laboratory experiment.

Only when we learn to combine visual impressions in the same manner that sound impressions are molded into a single audio frequency, permitting us to abandon the method of sending an electrical impression successfully for every point of the transmitted image each sixteenth of a second, an entirely new phase of the situation will be entered upon. In the absence of some such invention which effects the essential conservation in carrier channels necessary to make television practical, it is an injustice to the public at large to encourage it to expect television in the immediate future and a duty to warn it that, rapid as has been recent progress, television is now only in the status of development that aviation was in 1910 and the motor car in 1905.

—R. B. Raycroft.

Acme Apparatus Has New Dynamic

Pearcy W. Mack, "the Acme man," was caught on the fly on a visit to his New York representative, Perry Saftler, 122 Greenwich Street, New York City. He said that Acme Apparatus Company had a wonderful year, and he looks forward to a continuation of good radio business right through the coming Winter and Spring and possibly right through the Summer. All Acme lines are going well.

Of great interest to all who recall the wonderful tone quality of the Acme K1 and K3 speakers is the news that Acme Apparatus Company engineers have perfected a new dynamic speaker. Its performance, said Mr. Mack, is "beyond compare." A limited number of samples are being made up. Full information may be had from Percy Mack, care of Acme Apparatus Company, Cambridge, Mass. Mention Radio World.—J. H. C.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank at right may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name

Address

City or town

State

Louis Johnson, 792 Rademacher, Detroit, Mich.
Maxwell Rouff, 87 W. Harris St., Atlanta, Ga.
Joseph Goiyoria, 2011 W. Superior St., Chicago, Ill.
Clarence Doty, 306 Bauregard St., Charleston, W. Va.
J. E. Kirk, 2165 Kimball St., Bklyn., N. Y.
Frederick Woodward, 191 Tremont St., Malden, Mass.
E. K. Kelley, 3327 College Ave., Kansas City, Mo.
Harold Lewis, 239 Lake St., Newark, N. J.
R. R. Eckart, c-r Cty National Bank, Dallas, Texas.
Max L. Deena, 222 E. Superior St., Chicago, Ill.
B. A. Hernandez, 6 Riverside Viaduct, Jacksonville, Fla.
N. E. Spicklemire, 1804 Locust St., Chico, Calif.
Ray Lee Defries, 65 McCall St., Memphis, Tenn.
Ed. Schreiver, 76 Charles St., Englewood, N. J.
S. A. Mason, General Delivery, Petersburg, Va.
Edw. Perkins, 412 So. Oakland Ave., Indianapolis, Ind.
Edward Roche, 3027 Agnes, Kansas City, Mo.
Chas. Suydam, Hotel Bittner, Columbia, Pa.
Henry Thyhsen, Jr., 61 Heckman St., Phillipsburg, N. J.
Wayne Benham, No. 4 Engine House, Grand Rapids, Mich.
E. L. McNeill, Box 434, Elkhart, Kansas.
Arthur Mitchell, 30 Dublin St., Montreal, P. Q., Canada.
Carl Anderson, 212-73 St., Niagara Falls, N. Y.
B. G. Martin, 400 S. Palm, Ponca City, Okla.
G. Solojeff, 684-46 Ave., San Francisco, Calif.
Thomas Johnston, 40 Progress St., Pawtucket, R. I.
H. Walter Witt, 1927 Ramsey, Dallas, Texas.
E. M. Arnold, 1528 Grace St., Chicago, Ill.
Milton Loeb, 634 S. Rendon St., New Orleans, La.
John W. Bader, 96 Oakwood Ave., Troy, N. Y.
R. W. Ellison, 14 S. Ft. Harrison Ave., Clearwater, Fla.
J. C. Edmundoz, Zolfe Springs, Fla.
H. Morgan Harris, 327 Monroe Ave., Scranton, Pa.
Geo. N. Engert, 1511 Poplar St., Terre Haute, Ind.

Wm. Hausell, Ottumwa Optical Co., Ottumwa, Iowa.
Wm. Dudley, R. 1, Box 158, Herrin, Ill.
Chas. Filippone, Virginia & Graisbury Ave., Audubon, N. J.
F. L. Dungan, 3286 Adeline St., Berkeley, Calif.
Chas. Slaughter, 72 Barrow St., N. Y. C.
John Benzur, 7 W. 45 St., N. Y. C.
Geo. Parker, 173 E. Chicago St., Coldwater, Mich.
A. G. Niederlander, 5424 Main St., Williamsville, N. Y.
H. F. Hickman, 11 E. 39 St., Bayonne, N. J.
E. C. Stone, P. O. Box 173, Cosmopolis, Wash.
J. Raymond Cormany, 216 Radford Pl., Knoxville, Tenn.
Wm. Williams, 1244 Gates Ave., Bklyn, N. Y.
E. Whitker, 2048 Marlindale Rd., Cleveland Heights, Ohio.
James Durie, 906 Eagle Ave., N. Y. C.
Glenn D. Northrop, 208 Clark Terrace, Cliffside Park, N. J.
G. Philip Saxer, Box 30, Fleetville, Pa.
John Dobrowski, 202 Palmetto St., Bklyn., N. Y.
W. L. Connet, 234 E. San Fernando Blvd., Burbank, Calif.
A. Green, 6229 Market St., Phila., Pa.
E. Clifford, 880 No. Hamline Ave., St. Paul, Minn.
Fred Haynes, 123 Hillside Ave., Englewood, N. J.
J. L. Hill, 1034 E. State, Rockford, Ill.
Geo. W. Mesher, 405 Locust St., San Francisco, Cal.
P. L. Larson, 3410 W. North Ave., Chicago, Ill.
J. C. Repcik, 651 Rhodes Ave., Akron, Ohio.
Concord Radio Shop, 1774 Concord Ave., Detroit, Mich.
C. H. White, 2312 Jackson Ave., Portsmouth, Ohio.
QRH Radio Laboratories, Lutesville, Mo.
Harold Argenbright, 72 S. Main St., Chambersburg, Pa.
Geo. Wolff, 5500 W. Grace St., Chicago, Ill.
H. N. Willmatt, 57 Staples St., Kingston, N. Y.
J. W. Corriston, 118 W. Springfield Rd., Springfield, Pa.
C. B. Trim, 528 Stathmore Blvd., Toronto, Ont.

Stockline Rupard, 519 N. Penn., Shawnee, Okla.
H. Melchior Bishop, 3709 Chatham Rd., Baltimore, Md.
C. S. Moffitt, Box 223, Willits, Calif.
C. L. Price, 1 River St., Cohoes, N. Y.
Geo. Wilkinson, 411 Buffington St., Fall River, Mass.
J. Albert Garcean, 6787 Christopher Columbus, Montreal, P. Q., Can.
H. L. Floyd, 219 Catoma St., Montgomery, Ala.
Wm. Pudas, 1023 Fernhill Ave., Detroit, Mich.
W. C. Love, Sparks Hill, Ill.
H. L. Wright, 632 Mog Ave., Windsor, Ont., Can.
Matlock Cawthon, Box 142, De Funiak Springs, Fla.
R. J. Bryant, P. O. Box 1847, Winston-Salem, N. C.
H. M. Goodrich, Box 1301, Ft. Lauderdale, Fla.
E. C. Bryan, 736 Bernal Ave., Los Angeles, Calif.
R. C. Hauf, 449-7 Ave., Bklyn., N. Y.
James Smith, 62 Main, Geneva, N. Y.
J. C. Sadler, 835 Locust St., Missoula, Mont.
E. M. Hutcheson, Hutcheson Hdw. Co., Sandersville, Ga.
M. W. Cole, Box 503, Rt. 2, Little Rivers St., Miami, Fla.
Mr. H. Vaughn, Box 281, Corbin, Ky.
Walter Newman, 330 E. Ridge St., Nanticoke, Pa.
F. E. Manning, Box 244, Universal Cty, Calif.
Wm. Adams, 138 West End Ave., Binghamton, N. Y.
Albert Hankey, 150 Orlin Ave., S. E., Minneapolis, Minn.
H. E. Swanson, 5300 Calaveras Ave., Oakland, Calif.
O. C. Roush, 83 W. Ninth Ave., Columbus, Ohio.
Peter Henderson, Gen. Del., Hempstead, N. Y.
Frank Flandera, 4025 Muriel Ave., Cleveland, Ohio.
H. G. Haders, 3434 Memphis Ave., Cleveland, Ohio.
E. H. Franklin, 31 Roseridge Ave., Bellevue, Pittsburgh, Pa.
P. R. Colon, 18 E. 116 St., N. Y. C.
W. A. Sorg, 26 Elizabeth St., Danville, N. Y.
Ernest Vogt, Box 24, Boerne, Texas.
A. W. Hunter, 66 Ellerbeck Ave., Toronto 5, Ont., Canada.
J. H. Vallett, c-r New Haven Tow Boat, Box 1707, New Haven, Conn.
D. Riche, P. O. Box 143, Pine Bush, N. Y.
Frederick Keats, 353 Union Ave., Elizabeth, N. J.
Chas. English, Box 54, Cohoes, N. Y.
C. V. Slack, Nash Rd., R. 2, North Tonawanda, N. Y.
W. H. Skelton, Governor & Oregon St., Evansville, Ind.
Maurice Price, 1118 W. 7 St., Chester, Pa.
Jess Clark, Box 204, Trenton, N. J.
J. P. Geiger, Orwigsburg, Pa.
Thomas Ward, 210 Parks de Ave., Mt. Lebanon, Pitts., Pa.
Wm. Hausell, Ottumwa, Iowa.
Edward Fulton, 9734-90 St., Woodhaven, L. I.
F. Crossaid, 577 Second Ave., N. Y. C.
Geo. Smoyer, Newport, Pa.
Klindworth Drug & Conf., Hamberg, N. Dak.
Fred Hutchins, Stratton, Maine.
R. F. O'Neil, 1230 Wellington St., Ottawa, Ont., Canada.

New Powertone Unit Brilliant to Eye and Ear!

1929 Model Far Excels Anything Else in Its Price Class!

Having won highest repute last season, the Powertone Unit, which gave maximum volume and quality reproduction at lowest price, again wins leadership because, without any increase in price, it assures still better performance.

The coil is wound a new way, with double the former impedance, giving remarkably faithful low-note reproduction, a region in which many units are deficient. The middle and high notes are faithfully reproduced, too.

GOLD AND VAN DYKE

The magnet is gold-dipped, giving it a rich and handsome appearance. The dipping is done before the "horseshoe" is magnetized, so there is no detrimental effect on flux. The back frame is sprayed with a Van Dyke finish—deepest brown, a splendid color combination. Imagine gold against Van Dyke! Use this unit for its superior performance and fetching appearance!

WHAT YOU GET:

At \$3.75 each, this unit represents the utmost you can obtain at anywhere near this price. Not only do you get the unit, but also a mounting bracket, apex, chuck, thumb-screw nut and 5-foot cord.



\$3.75

This unit will drive any type of cone, airplane cloth, linen or similar speaker, but will not work a horn. The Powertone Unit will stand 150 volts without filtering and is fully guaranteed against ALL defects for one year. The armature is adjustable to power tube impedance. Order a unit NOW!

SEND NO MONEY!

Just order one new Powertone Unit with equipment. It will be mailed at once C. O. D. You will pay postman \$3.75 plus a few cents extra for postage.

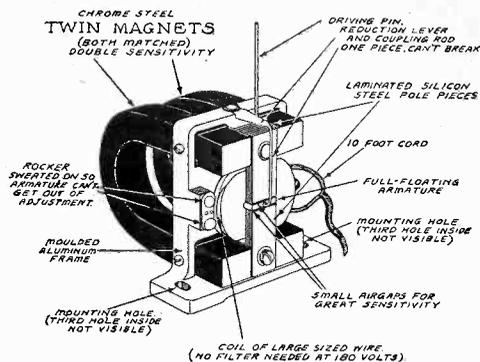
Try it for five days. If you don't think it superb, simply return the unit with a letter asking for refund, and your purchase money will be returned immediately! You run no risks! All you can do is win!

36" OR 24" KIT

You can use this unit on any type cone or other diaphragm speaker you prefer. If you want to build a 36" or 24" cone yourself, specify which, and unit, paper, bracket, apex, nut, thumbscrew, cement, pedestal, cord and instructions will go forward at \$6.00 C. O. D. plus small cost of cartage. You will be overjoyed with the new 1929 model improved Powertone Unit. Order one TO-DAY!

GUARANTY RADIO GOODS CO., 145 W. 45th St., New York City. Just East of Broadway

MOST REMARKABLE OFFER!



Polo Unit (With Bracket, Cord, Apex, Chuck and Hardware)
List Price, \$10.⁰⁰

Compare!

Make your comparisons all-inclusive, even against dynamic speakers. If you have a 171, 171A, 210, or 250 output tube, or any of these in push-pull, there won't be so much difference between the \$10 Polo Unit and the considerably more expensive dynamic speakers. But if you use 112, 112A, 120 or other similar power tube, or no power tube, the Polo Unit, with any cone or cloth speaker, will far outclass even the dynamic.

Take immediate advantage of our liberal offer. You must use attached coupon. Send \$6 and try out this marvelous Polo Unit at OUR risk.

We guarantee immediate shipment.

THE POLO Duo-Magnetic Unit has been acclaimed the outstanding unit.

Satisfy yourself it is louder, clearer, stronger, purer, better. Compare it with anything else in the world. Take **NINETY DAYS** for your trial: At the end of that time, if you want to keep the unit—and you will—then send the extra \$4. Otherwise return the unit in 90 days and get your \$6 back.

Just think of it! **NINETY-day trial!**

YOU MUST USE THIS COUPON

POLO ENGINEERING LABORATORIES

(Tel. Cortlandt 5112)

57 Dey Street, New York City

Enclosed please find \$6.00 on account, for which please send me at once one Polo Twin Magnet Unit, mounting bracket, 10-ft. cord, apex, chuck and hardware. I will send you the extra \$4. (making total of \$10) within 90 days after your date of shipment, to complete the purchase; or within 90 days will return the unit for complete, quick refund of purchase money.

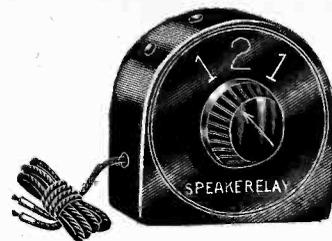
Name.....

Address.....

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

NINETY-DAY Money-Back Guarantee

JUST TURN KNOB



to switch from one speaker to another, or to operate both together! **Instantaneous Convenience!**

Those who have two loudspeakers in their home or store have been without a simple method to switch from one to another. When they wanted two loudspeakers to play at the same time, they had to make certain connections. And then when they wanted only one speaker to play they had to change the previous connections.

This new Speakerelay (illustrated) is enclosed in a bakelite case and is so constructed as to make two loudspeakers operate separately or together from your radio set, without any loss in volume. By merely turning a small knob to the left one loudspeaker operates, when the knob is turned to the right, the other loudspeaker operates, disconnecting the first one. When the knob is placed at position marked "2" both loudspeakers **\$2.00** operate together. Price **\$2.00**

Send no money! Order C. O. D. Five-day money-back guaranty!

Guaranty Radio Goods Co.

145 W. 45th St., N. Y. City
 (A few doors east of Broadway)

SUBSCRIBERS!

Look at the Expiration Date on Your Wrapper

please send remittance to cover your renewal.

In this way you will get your copies without interruption and keep your file complete.

SUBSCRIPTION DEPARTMENT

RADIO WORLD

145 WEST 45TH ST., N. Y. CITY

A few doors east of Broadway

Please look at the subscription date stamped on your last wrapper, and if that date indicates that your subscription is about to expire,

COMPLETE ADVANCE STATION LIST—Nov. 3d issue of RADIO WORLD contained complete advance list of stations compiled according to the new allocation plan of the Federal Radio Commission, effective Nov. 11. Mailed for 15 cents a copy, or send \$1.00 for trial subscription of 8 weeks, including Nov. 3d issue. RADIO WORLD, 145 W. 45th Street, New York City.

NEW LINEN DIAPHRAGM speaker, superior tone quality, no details as yet published in radio press, but to alert inquirers the whole absorbing story will be unfolded. Uses new super-sensitive unit, beautiful splice-jointed frame, 18x24", with decorative moulding; absolutely a wonderful speaker. Put together in ten minutes. Rich-looking job. Write for details. Guaranty Radio Goods Co., 145 West 45th Street, New York City.

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

ARTISTS and Art Students are printing 250 signs or pictures an hour without machinery. Sample and particulars 10c. Straco, 1014 Mulberry, Springfield, Ohio.

FREE BLUEPRINTS! GET YOUR SHARE! National Short Wave Circuit blueprint, exact circuit used by James Millen for tuning in television, voice, code, music, programs. National Screen Grid Five (broadcast receiver circuit) blueprint FREE also. John F. Rider's B Eliminator blueprint free. Send separate request for each of the above free blueprints you desire. Custom Set Builders Supply Co., 57 Dey Street, N. Y. City.

QUICK SERVICE. Order radio goods now, shipments made day following receipt. All merchandise pre-tested. Set of Screen Grid Coils for Bernard's Economy Three, consisting of antenna coil Model 2A and High Impedance Tuner, Model 5 HT, \$4.75. One screen grid tube, one high mu tube, one -12A tube, total for three tubes, \$7.00. Blueprint for Bernard's Economy Three, \$1.00. Front panel and subpanel for 4-tube Screen Grid Diamond of the Air, \$5.00. All merchandise guaranteed on five-day moneyback basis. Send remittance and I pay carrying and shipping charges. Philip Cohen, 236 Varet Street, Brooklyn, N. Y.

POSITION WANTED by licensed radio operator. Ivan Fry, Minerva, Ohio.

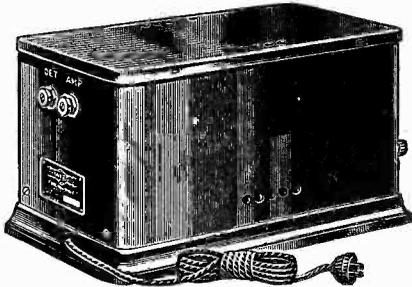
TAKE Your Choice of 4 Other Publications for New Radio World Subscribers Ordering Now. Radio World has made arrangements to offer, with one year's subscription for Radio World, a year's subscription for any one of the following publications FREE: Radio News or Science and Invention or Boys' Life or Radio (San Francisco). Send \$6.00 —now. State which other listed publication you desire. Radio World, 145 W. 45th St., N. Y. City.

Holiday Gifts Number of Radio World Out Next Week

ELIMINATE BATTERIES!

NO Change in Set Wiring
NO Change in Tubes

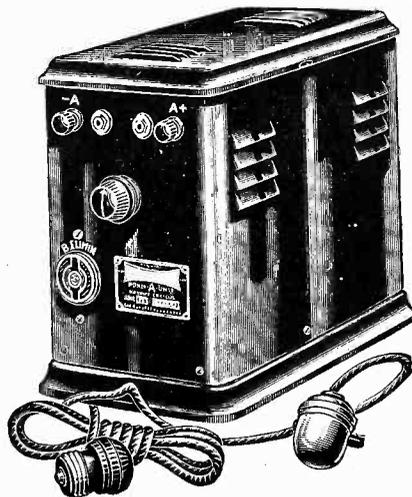
"B" Eliminator, Using Raytheon Tube, Replaces "B" Batteries and Gives Great Satisfaction.



No. 816—"B" Eliminator for 50 to 60 cycle, 105 to 125-volt AC house current. Max. voltage, 180, with one variable detector and one variable intermediate voltage. Weight 16 lbs. Size, 6 x 6 1/2 x 11 1/2". Quiet, economical. Requires no attention. Sold only with Raytheon tube. Price, including Raytheon BH125 mil. tube and built in connector cord and plug. **\$16**

Famous Raytheon Tube With Each "B" Eliminator

"A" Eliminator, Using Dry Plate Rectification, Current Well Filtered; Replaces "A" Battery.



No. A22—"A" Eliminator. Supplies up to 2 1/2 amperes at 6 volts. Variable resistance permits adjustment to number of tubes in set. Supplies A current and voltage to sets using from 4 to 10 quarter ampere tubes, or equivalent current drawn by any other combinations. Tip jacks for voltmeter readings. Receptacle for "B" eliminator plug. Pendant switch controls everything. Set switch needn't be touched. Device requires no attention. Uses no tube. Size: 10 1/2" high, 6 1/4" wide, 11 1/2" long. Shipping weight, 27 lbs. **\$22**

POLO ENGINEERING LABORATORIES, 57 Dey St., New York City.

- Please ship at once—
- One 180-volt maximum "B" eliminator, with variable detector and variable intermediate voltage (three different voltages in all); equipped with one Raytheon BH tube, 125 milliamperes rating. I will pay \$16, plus a little extra for freight, on receipt of goods, which are to be on approval for ten days (money back, if desired after 10-day trial).
 - One "A" eliminator, 2 1/2-ampere maximum at 6 volts, using dry plate rectification, large choke and large capacity condenser, AC switch, receptacle for any "B" eliminator plug, variable resistor, all built in for which I will pay \$22, plus a little extra for freight.
 - Both the "B" eliminator and the "A" eliminator, at total of \$36, on same approval basis.
- Note: If fast express shipment is preferred, rather than slower freight, put a cross here .

Name.....
Address.....
City..... State.....

ALL SHIPMENTS MADE ON APPROVAL FOR TEN DAYS

All prices quoted are NET!

The New HBH

Irish-Linen Diaphragm Speaker

DeLuxe Finish; Built-up, Ready to Play

(Cat. A No. 1DLB)

\$19.50

Beautiful to Eye and Ear

Enjoy the Big Thrill!

THE new HBH Irish-Linen Diaphragm Loud-speaker, using the new Polo Unit, is designed to produce more volume and handle more power than any other electro-magnetic type speaker! The volume is so stupendous as to be utterly amazing. You would think you had added a couple of more audio stages, whereas all you did was to substitute the HBH Speaker for some other type.

The tone is pure throughout the audio range, and the low notes get specially favorable treatment, to equalize their final intensity with that of the higher audio frequencies.

Matching the finest unit with the finest diaphragm, tightly stretched on a rigid baffle and properly "doped," produces the outstanding results.

Listen to this speaker and enjoy the big thrill of your radio life!

If the results are not louder, clearer, better than anything else you have heard in this line, using your own individual judgment, in five days return the speaker, and we will refund your money at once. No delay! No questions asked!

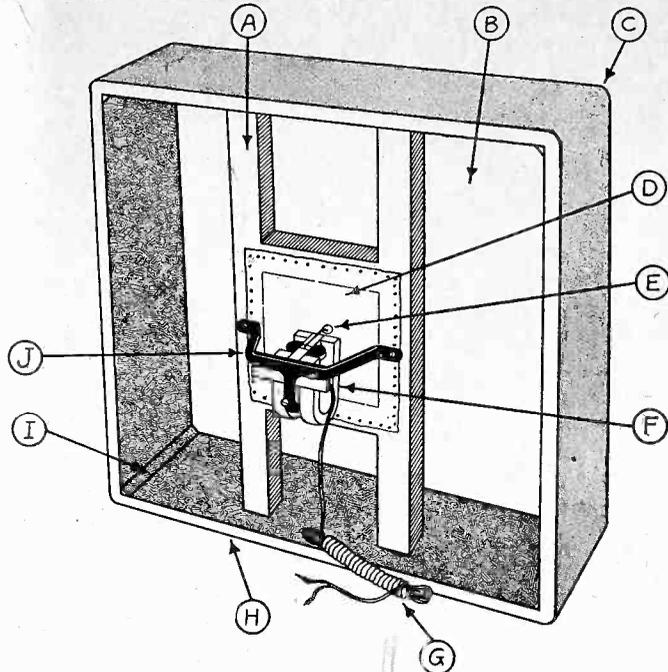
GUARANTY RADIO GOODS CO. 145 W. 45 St., N. Y. City. (Just East of Broadway)

Please ship at once O.O.D. express, at advertised price plus little extra for cartage, the following, on 5-day money-back guaranty, including refund of cartage cost:

- Cat. A. No. Cat. A. No.
 Cat. A. No. Cat. A. No.

Name
Address
City State

SEND NO MONEY!



Symbolic Rear View of the New HBH Speaker

A—Upright "H" Support
B—Front Cloth (thinnest linen).
C—Rounded Edges.

D—Rear Cloth (airplane cloth).

E—Apex.
F—Pole Unit.
G—10-Foot Cord.

H—Rigid De Luxe Frame, 24x24"
I—Splice Jointed.
J—Moulded Metal Bracket.

Strikingly Beautiful

THE mottled finish on the splice-jointed (not nailed) frame, in mellow tones, with conservative gold edging, plus the gracefully rounded corners, makes the speaker beautiful to behold. A thrown-together appearance characterized such speakers in the past, but here is one so different you'll be proud to exhibit. The woman of the house will appreciate its beauty, too.

The mechanical construction is perfect.

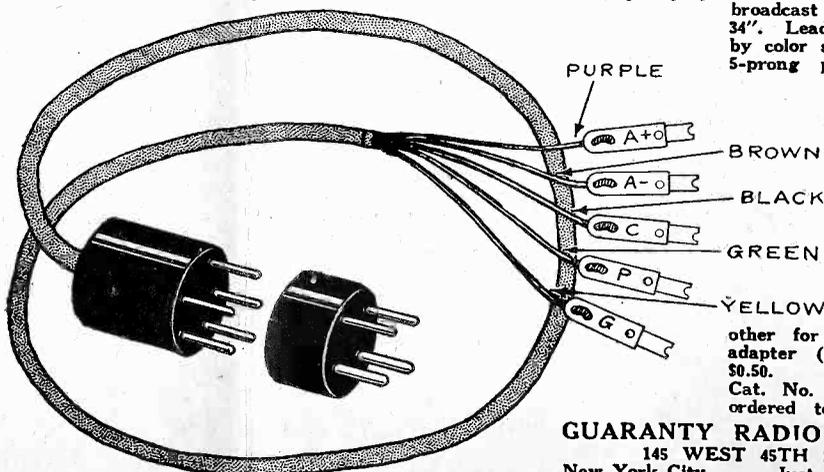
PARTS PRICE LIST

- Cat. A No. 1. DLNB. Entirely complete kit for same speaker, with Pole Unit, dope, constructed de luxe frame, linen, etc. \$17.50
- Cat. A No. 1. DLF. Built-up, high-grade, rounded-edged de luxe frame, splice-jointed, not nailed; size 24x24 inches with moulding; also H-shaped upright support, splice-jointed; also hardware for attaching upright to frame. 5.50
- Cat. A No. 5. Thinnest Irish linen for front diaphragm, 26x26 inches. 2.00
- Cat. A No. 6. Airplane cloth 8x8 inches for rear piece. .25
- Cat. A No. 7. Polo Duo-Magnetic Unit, with factory-adjusted and sealed armature, apex, thumbscrew, chuck, nut, 10-foot cord, moulded mounting bracket. 10.00
- Cat. A No. 9. One can finest "dope" (good for three thin coats). 1.25
- Cat. A No. 10. Two cans "dope" (for five good coats). 2.00
- Cat. A No. 11. Apex, chuck, thumbscrew, nut. .25

PLUG AND CABLE for any SHORT WAVE ADAPTER

Handiest thing for ANY short-wave adapter. Put detector tube of your present set in

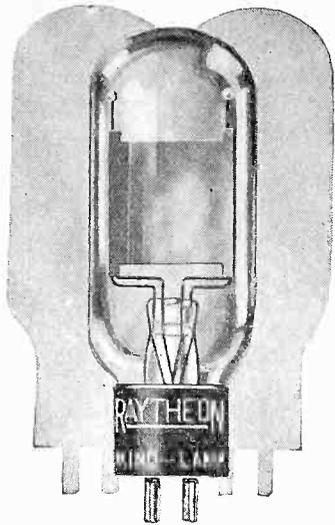
socket of any short-wave adapter you build, put plug in detector socket of your broadcast receiver. Cable, 34". Leads identified both by color scheme and tags. 5-prong plug and 5-lead cable for AC short wave adapter. May be used as 5-lead battery cable plug with UY socket. (Cat. No. 21AC) \$1.50. 4-prong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



other for DC short-wave adapter (Cat. No. 21DC) \$0.50.
Cat. No. 21AC and 21DC ordered together \$1.75.

GUARANTY RADIO GOODS CO. 145 WEST 45TH STREET New York City Just East of Broadway

How Many Lives has a TELEVISION TUBE ?



Kino-Lamp List Price \$7.50

The name Raytheon on any type of tube assures a service-life so long that it is often equivalent to the lives of two or three ordinary tubes.

The principles of sturdiness and strength developed in the production of Raytheon sound-reception tubes have been applied to the manufacture of Raytheon television tubes.

The Raytheon Kino-Lamp is the long-life television receiving tube—adapted to all systems, and made in numerous types.

Foto-Cell Information and Prices upon application

The long-life television sending tube, in either hard-vacuum or gas-filled types, and in two sizes of each.

Correspondence is invited from all interested in television

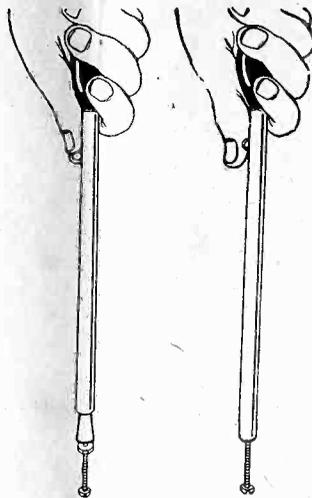
RAYTHEON MFG. CO.
CAMBRIDGE . MASS.

EXCELLENT unit for phonograph attachment. to play records. Connects to speaker terminals nozzle to phonograph, \$4.20. P. Cohen, 236 Varet St., Bklyn., N. Y.

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.

SOCKET WRENCH

**F
R
E
E**



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.

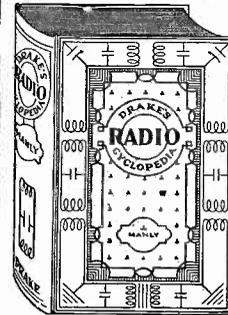
Use the knob to push out the plunger, press down on the handle to grip the nut, then turn the nut to left for removal or to right for fastening down. Total length, distended, including stained wooden handle, 10". Gets nicely into tight places. Send \$1 for 8 weeks' mail subscription for **RADIO WORLD**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

YOU MUST GET THIS BOOK!

DRAKE'S RADIO CYCLOPEDIA
(New Edition)



BOOK IS 2½" THICK, WEIGHS 3¼ LBS., 1,025 ILLUSTRATIONS.

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.

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 Layouts

OF THE PRINCIPAL ARTICLES

159 concern service men, 129 help the set builder, 162 help the experimenter, 158 interest the student, 75 assist in sales work, 73 interest set owners.

Radio World: "The most suitable volume for those who want the facts stripped as far as possible of intricacies. Useful addition to any library."

Radio Broadcast: "The reviewer does not believe that a more satisfactory addition to the experimenter's library in any one volume can be made."

QST: "The information is so put as to be of most immediate use to the constructor and repair man, and, remarkably enough, includes apparatus of most recent origin."

Radio: "Seldom is any subject so comprehensively and practically explained."

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 \$8.00 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!

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 \$5.00, so you gain the extra dollar 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"/> RADIO NEWS | <input type="checkbox"/> RADIO (San Francisco) |
| <input type="checkbox"/> SCIENCE AND INVENTION | <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

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 DECEMBER 31ST, 1928

BUILD A 36-INCH CONE—LOWEST COST FOR FINEST TONE!



NEW POWERTONE UNIT

with 5-ft. cord
Designed Front Sheet
Plain Rear Sheet
Radio Cement
Mounting Bracket
Apex
Chuck
Nut
Tri-Foot Pedestal
Instruction Sheet
ALL FOR ONLY

\$6.00

Note: If 24" kit is desired, order Cat. No. 24; same price.

Cat. No. 36

REMARKABLE GUARANTY!

This 36" Cone Speaker Kit is sent complete, as listed, carefully packed. Order one sent **C. O. D.**

SEND NO MONEY!

Build the speaker. If not overjoyed at results, return the built-up speaker in five days and get **ALL** your money back!

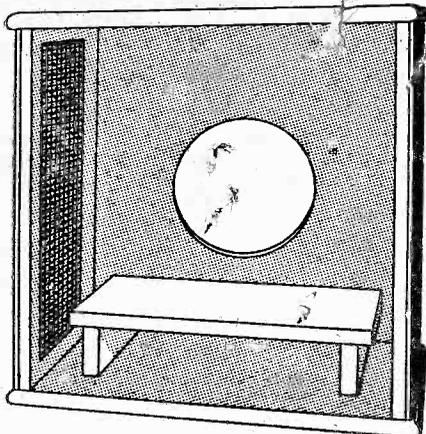
GUARANTY RADIO GOODS CO.
145 WEST 45TH STREET
N. Y. City Just East of Broadway

LYNCH

dynamic resistors easily carry heavy currents without noise or loss of accuracy. **\$12.50**

ARTHUR H. LYNCH, INC.
1775 Broadway New York City
Send for free Lynch radio manual

DYNAMIC BAFFLE



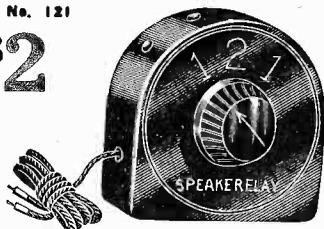
Completely built up, for any type dynamic chassis. State what make dynamic you want it for. Cane sides, open back. De luxe finish. Size, 24x24 inches. **\$12.00**

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

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. Excellent for store demonstrations or home use. Earphones may be substituted for one speaker.

GUARANTY RADIO GOODS CO.
145 WEST 45TH STREET
NEW YORK CITY Just East of Broadway

BLUEPRINT FREE!

4-Tube Screen Grid Diamond of the Air Blueprint, full sized picture wiring diagram; also schematic diagram and panel layout.

At 15c per copy RADIO WORLD costs you 60c for four weeks. But if you send 50c NOW you get the first and only national radio weekly for four consecutive weeks and this handsome official blueprint FREE!

This blueprint is life-sized and shows in easy picture diagram form how to mount parts and wire this super-sensitive receiver. One screen grid tube is used as radio frequency amplifier. The rest of tubes are two—01A and one 112A.

This circuit gives you distance, tone quality, ease of performance. No shielding, no neutralizing required!

Radio World, 145 West 45th Street, New York City

Enclosed please find 50 cents (stamps, coin, check or money-order) for which send me RADIO WORLD for four weeks, and free Diamond S. G. blueprint.

Name

Address

City State.....

Renewal.

If you are already a mail subscriber for RADIO WORLD you may extend your subscription four weeks and get free blueprint, but put a cross in the square.

The Ounce of Prevention

AMPERITE automatically prevents "A" current fluctuations, lengthens tube life; improves set operation. Entirely unlike fixed resistors. A type for every tube—battery or A.C.

Radiall Company
50 FRANKLIN ST., NEW YORK

FREE New "Amperite Blue Book" gives latest construction data. Write Dept. R.W.23

AMPERITE

REG. U.S. PAT. OFF.

The "SELF-ADJUSTING" Rheostat

For That Extra Voltage Tap—

Do you need an extra voltage tap for that R-eliminator? That's easy. Just use a STANDARD CLAROSTAT or a DUPLEX CLAROSTAT between maximum tap and desired tap, with by-pass condenser of 1 or 2 mfd. from the new tap to minus B tap. You can then obtain any voltage from maximum down to zero. And there are many other ways of applying the Clarostats.

Your dealer carries the Standard and the Duplex Clarostats, as well as other types. Ask him for literature and suggestions, or write to

CLAROSTAT MFG. CO., Inc.
Specialists in Variable Resistors
291 N. 6th St. Brooklyn, N. Y.

CLAROSTAT
Reg. U. S. Pat. Off.

Bakelite Front and Aluminum Subpanel

for the
4-Tube Screen Grid
Universal; also

\$5.00

DIAMOND OF THE AIR - -

Five-Day Money-Back Guaranty

Finest eye appeal results from construction of the 4-tube Screen Grid Diamond of the Air when you use the official panels. The front panel is bakelite, already drilled. The subpanel is aluminum, with sockets built-in, and is self-bracketing. Likewise it has holes drilled in it to introduce the wiring, so nearly all of it is concealed underneath set. Make your set look like a factory job.

Front panel alone, bakelite, drilled \$2.35
Aluminum subpanel alone, drilled, with sockets built-in 3.00

GUARANTY RADIO GOODS CO.

145 WEST 45TH STREET

NEW YORK, N. Y.

AC DYNAMIC CHASSIS

110 volt 50-60 Cycle Model, with Built-in Rectifier and Output Transformer

YOU simply must get a dynamic speaker. There's nothing more important to your radio installation. Everybody's getting one. Why deny yourself the advantages of most superior tone realism? Your set can't overtax a dynamic speaker. You can't buy anything at anywhere near our prices that will give you such satisfaction.

All you need is the chassis. It plays splendidly just as it is. You may put it in a baffle box, or in a cabinet, if you like.

If your home is wired for electricity of the alternating current type, 110 volts, 50 to 60 cycles, then get the AC model at \$23.52. It has a plugged cord for connection to the lamp socket or convenience outlet. The two extra leads, with tips on, go to the output posts of your receiver—the speaker posts.

The AC model has a built-in rectifier that changes the AC (alternating current) to DC (direct current) and filters it. The rectifier is

shown at right in the illustration. Also there is a built-in output transformer, (at left in illustration). Your receiver therefore needs no output transformer—there is one in the dynamic chassis.

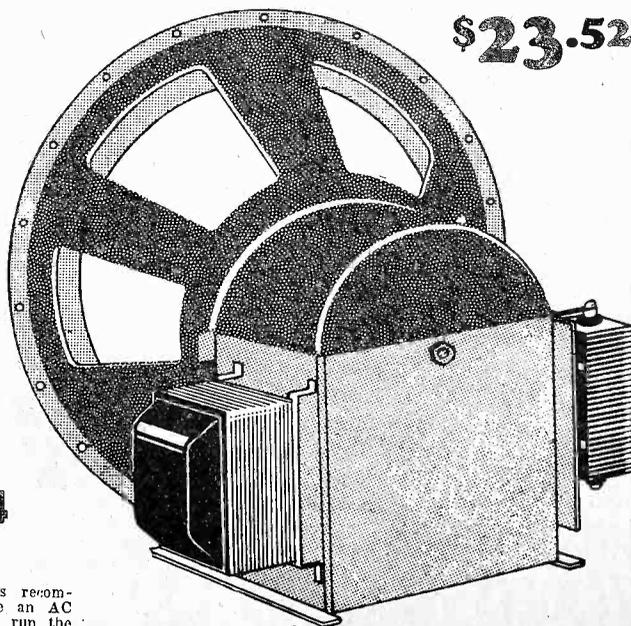
For best results use as the output tube of your receiver any of the following power tubes—120, 171, 171A, 210, 250, or two in push-pull. If your set has a 112 power tube put in a 171 and increase the negative grid bias. If your set has a 112A or a 201A for the output tube, put in a 171A and increase the negative grid bias. No other changes are necessary.

Remember that the dynamic is this year's supreme contribution to radio, and you must share in this fine advantage to enjoy the best and be thoroughly up-to-date.

6-VOLT MODEL

If you have a 6-volt storage battery to heat the filaments of your tubes you may use the 6-volt model dynamic chassis with equal results. The current drain is low. But if you have AC house supply of electricity, even if you use a storage battery, the AC model dynamic chassis is recommended, because if you decide at any time to have an AC set you'd have to retain the storage battery just to run the 6-volt model. If you have no electricity in your home, then you must use the 6-volt model. It looks exactly like the other model, except that the rectifier is omitted as unnecessary. The current used is already direct. The output transformer is built-in, however. Both models perform alike.

\$17.64



\$23.52

The AC model, 110 volts, 50 to 60 cycles, is illustrated. It has built-in rectifier and filter and built-in output transformer. Price, \$23.52

Acoustical Engineering Associates,
143 West 45th Street, N. Y. City
(Just East of Broadway)

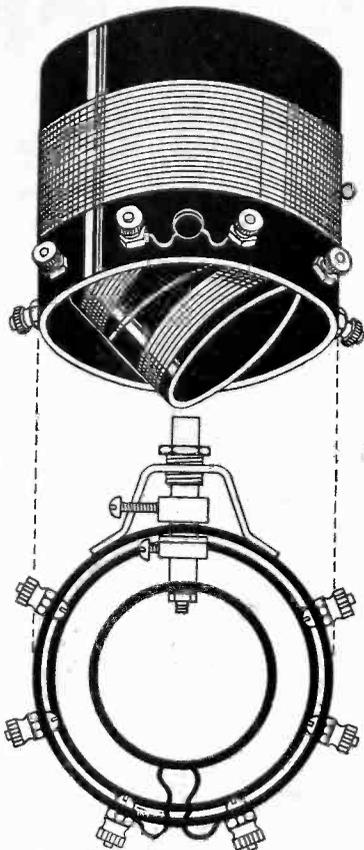
- One 110 volt, 50-60 cycle AC Model dynamic speaker chassis at \$23.52, plus cartage cost.
- One 6-volt Model dynamic speaker chassis at \$17.64, plus cartage cost.

Name

City State.....

Address

HOW TO USE SCREEN GRID COILS



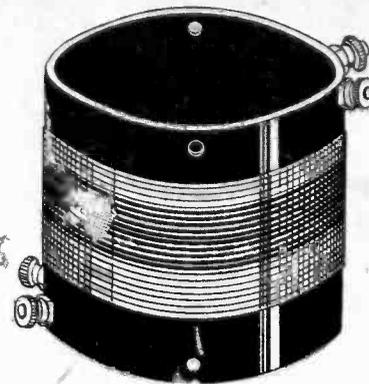
Model 5HT. High impedance 3-circuit tuner, to work out of a screen grid RF tube. For .0005 mfd.\$3.00
Model 3HT. Same as above, but for .00035\$3.25

WHEN a screen grid tube is used as a radio frequency amplifier, the maximum gain, the best amplification, the most volume and the most DX are obtained by tuning the plate circuit. Then this enormous amplification is itself doubled by providing a secondary with twice as many turns as the primary has. The secondary is not tuned. The high impedance 3-circuit tuner at left (Model 5HT) is an example, as is the two-winding coil (Model 5TP) at lower left. The primary in these two instances is the outside winding and the tuning condenser goes across it. The secondary is wound on a separate form that is riveted inside the primary form. Preferably mount coils with binding posts at bottom for short leads. Then the connections for Models 5HT, 3HT, 5TP and 3TP are, from right to left as you look at the back of the coil: B+135, near front panel; plate of screen grid tube; two rotary leads (for tuner only); grid and (next to panel) grid return.

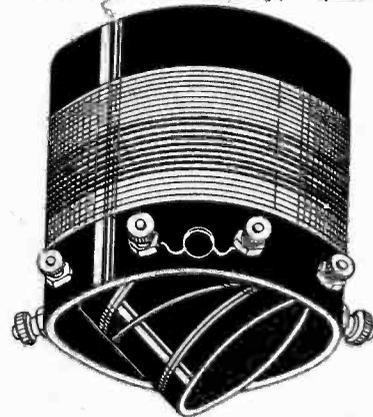
The antenna coil to use in screen grid circuits is 5A or 3A (upper right), because it is so designed as to equalize tuning. The low, almost zero, capacity between grid and filament of the tube is compensated by extra turns of wire, so that if the tube following the screen grid is of another type, for instance a regular detector, the elemental capacity difference is nullified. The antenna coupler has a continuous winding in shaded colors. The end with the larger number of distinctive turns goes to grid, the opposite end to ground. Either of the two remaining binding posts goes to antenna.

For single control screen grid sets the inductive trimmer type of antenna coupler (Model 5AS or 3AS, at right) should be used. The inductive trimmer coil for interstage coupling is Model 5TPS or 3TPS (not illustrated), but its connections are shown in the diagram at lower right. An inductive trimmer adds to or subtracts from the reactance, which is very important for resonance in single control sets. Trimming condensers only increase reactance, hence fail where decrease is needed.

Model 5TPS Interstage coupler to screen grid tubes, with inductive trimmer. For .0005 mfd.\$2.25
Model 3TPS, same as above, except it is for .00035\$2.50

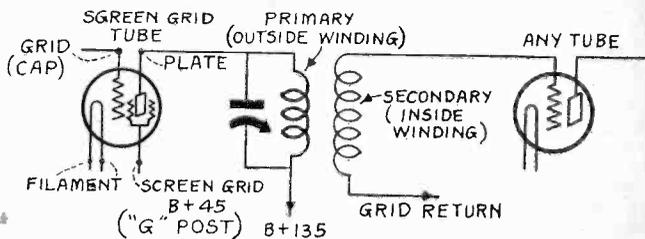


Model 5A. Conductively coupled antenna coil for input to screen grid radio frequency amplifier. For .0005 mfd. condenser. Price\$1.75
Model 3A. Same as above, but for .00035\$2.00

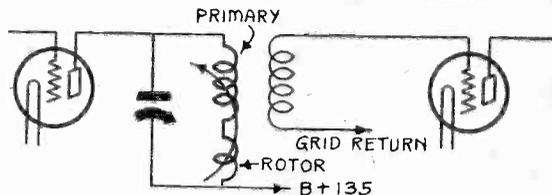


Model 5AS. Conductively coupled antenna coil for single tuning control screen grid sets. Rotor is an inductive trimmer. For .0005 mfd.\$2.75
Model 3AS, same as above, but for .00035\$3.00

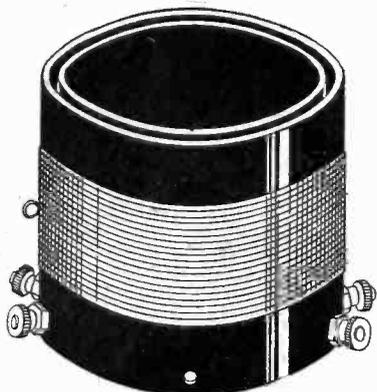
ALL ROTOR COILS HAVE SINGLE HOLE PANEL MOUNTING FIXTURE



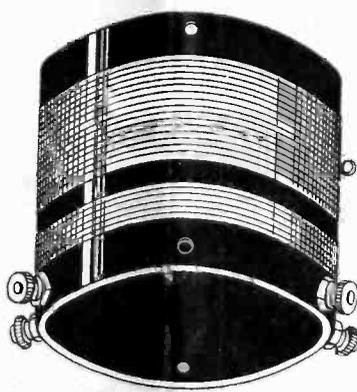
How tuned primary in plate circuit is wired for a screen grid tube. This illustrates the use of Model 5TP or 3TP, also Model 5HT and 3HT, except for the rotor coil connections.



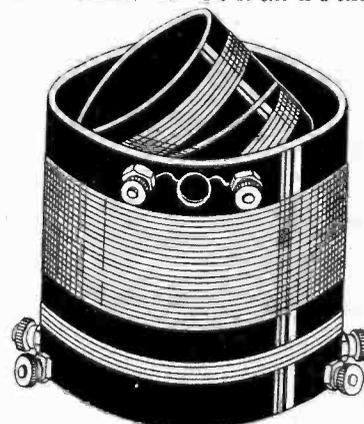
In single control circuits Model 5TPS is used as shown, for interstage coupling. The rotor is an inductive trimmer. The tube at left is a screen grid.



Model 5TP, the wiring of which is shown in the diagram directly above, is an interstage coupler for screen grid tubes. For .0005 mfd.\$2.00
Model 3TP. Same as above, but for .00035\$2.25



Model R5, interstage coupler for replacing present coil in existing receiver when screen grid tube is substituted. For .0005\$1.50
Model R3. Same as above, but for .00035\$1.75



Model T5, standard 3-circuit tuner, not for screen grid tubes, but for all others. For .0005\$2.50
Model T3, same, but for .00035\$2.75

Coils for Other Than Screen Grid Tubes

When any tubes other than screen grid tubes are used as radio frequency amplifiers, standard coils are used, for instance Models T5 and T3, the three-circuit tuner shown above at right.

For the antenna coil in such a circuit use one with two separate windings, the familiar radio frequency transformer, with about 14 turns on the primary. This RF transformer is therefore used as antenna coil and as an interstage coil.

The resultant loose coupling of antenna reduces the capacity effect of the antenna and thus the standard TRF coils, with 201A, 112A, 226, 227, 199 or 240 tubes, providing the same RF tubes are used throughout, may be used in single control sets without trimming devices. This is true if the coils are absolutely matched, as Models RF5 and RF3 are.

The small winding (primary) is connected in the antenna-ground circuit, or, for interstage coupling, in the plate circuit. The large winding (secondary) is tuned and is put in the grid circuit.

Model RF5. Antenna coil or interstage coupler for any and all tubes, excepting only screen grid tubes. For .0005\$1.00
Model RF3, same as above, but for .00035\$1.25
Model T5, standard 3-circuit tuner for .0005\$2.25
Model T3, standard 3-circuit tuner for .00035\$2.50

USE THIS COUPON

Screen Grid Coil Co., 143 W. 45th St., N. Y. C. (Just East of Broadway)

(Specify Quantity in the Squares)

Please mail me at once your following coils, for which I will pay postman the advertised prices, plus a few cents extra for postage.

Model..... Model..... Model..... Model..... Model.....

Name

Address

City State

SEND NO MONEY!