

MARCH
16th,
1929

RADIO

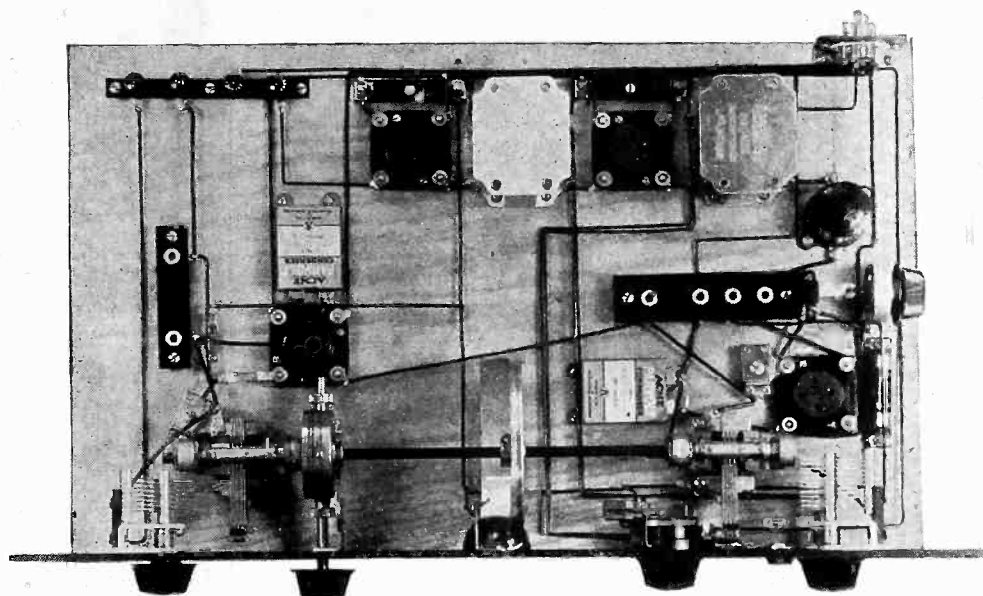
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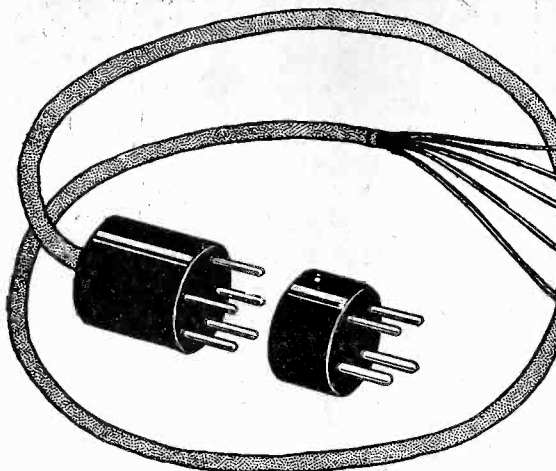
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422 SCREEN GRID

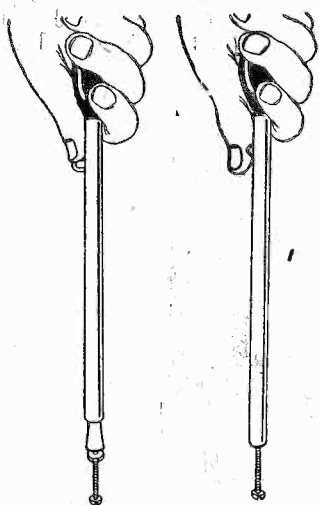
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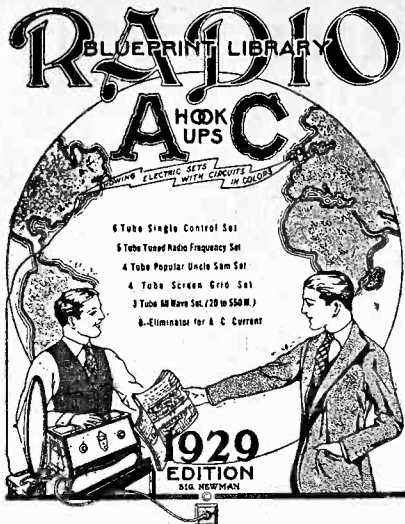
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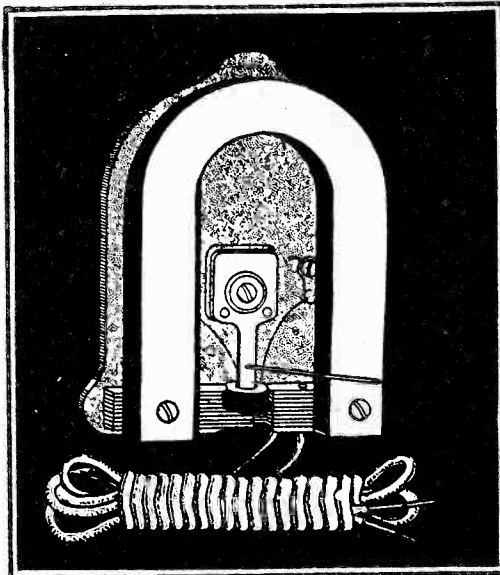
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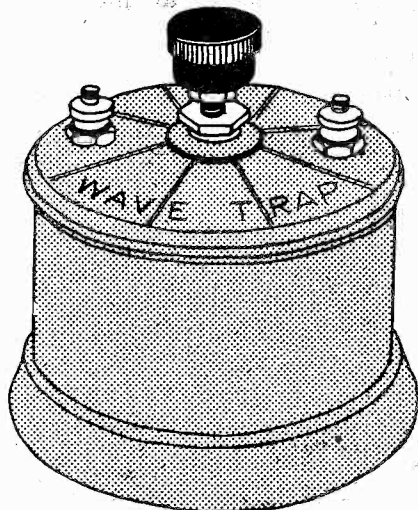
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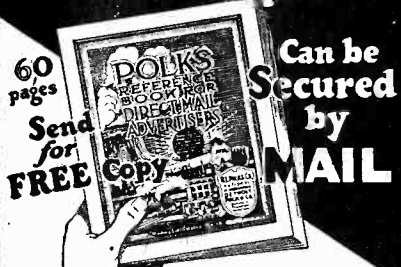
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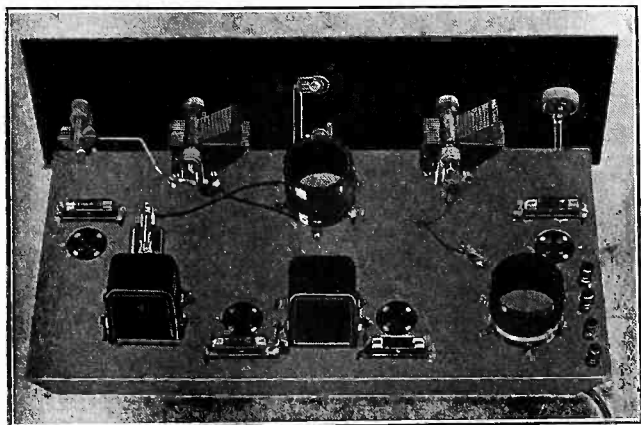
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HOW much can one achieve on only four tubes? The new Screen Grid Universal is the answer. It meets all the requirements of the wavelength reallocation, brings in distant stations distinctly, affords exceptional tone, and is easy to build. You'll be surprised at the results. Your friends, too, will admire your receiver. You can sit them down in your parlor and give them loud-speaker reception of distant stations they never heard of—100-watt stations, too!

The screen grid tube is used as a radio frequency amplifier in a new and most efficient manner. Correct circuit design and co-ordinated parts make this circuit outstanding. Build it now!

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Two dials tune in the entire wavelength band, using either .0005 mfd. or .00035 mfd. tuning condensers. The circuit affords all the selectivity you need, separates stations excellently and without "background reception," and despite this fine selectivity, affords more than enough volume, so that you must tone it down with the volume control, even on far-distant stations!

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Screen grid coils especially designed for this receiver permit you to obtain any desired degree of selectivity, but always with a high level of reproduced sound. The primary of the interstage coupler is tuned, while the secondary doubles the voltage by step-up ratio.

The circuit is stable, easy to build, easy to tune. Build it from the official blueprint and the theoretical expression and constructional details in the December 1st, 8th and 15th issues. This blueprint was made directly from the laboratory model of this receiver as constructed by Herman Bernard, the designer. It is a remarkable blueprint, because the wiring that is done on top of the subpanel is shown just as you want it, in the actual manner of its appearance. Also, the wiring underneath the subpanel is shown as it actually appears. Hence there are two separate, clear life-sized views on one sheet, not just one view, made to appear "transparent."

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Front panel, drilled for National Drum Dial, volume control switch, and for "dummy".....\$2.35

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SPEAKERELAY

Pat. No. 121

\$2

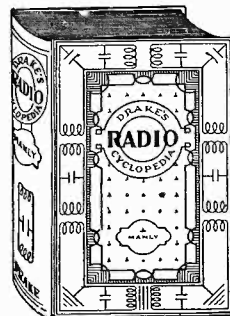
For connecting two speakers by turn of knob so that at No. 1, left, you operate one speaker alone; at No. 2 you operate both speakers together; at No. 1, right, you operate the other speaker alone. Excellent for store demonstrations or home use. Earphones may be substituted for one speaker.
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DRAKE'S RADIO CYCLOPEDIA (New Edition)



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BOOK IS 2 1/2" THICK,
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ILLUSTRATIONS.

Each rule, fact, method, plan, layout and diagram is instantly picked out and separated from everything else by placing all subjects in alphabetical order with cross references for every imaginable name under which the information might be classed. This alphabetical arrangement lets the experienced worker refer directly to the one thing in which he is interested at the moment without hunting through non-essentials. The needs of the beginner are cared for.

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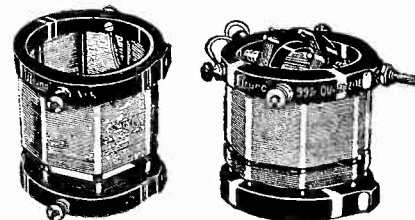
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1025 Illustrations, Diagrams, Layouts and Graphs
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OF THE PRINCIPAL ARTICLES

159 common service men, 129 help the set builder, 182 note the experimenter, 155 interest the student, 75 assist in sales work, 73 interest set owners.
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RADIO WORLD

Vol. XIV, No. 26 Whole No. 364
March 16th, 1929
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CALDWELL, AS EDITOR, SIZES UP PROBLEMS

Editor, "Radio Retailing," Former Federal Radio Commissioner

By Orestes H. Caldwell

I have some suggestions to make regarding improvement of broadcasting service and the retention of ground already won.

I recommend that the present separations of 10 kilocycles between channels be maintained, and 50 to 100 kilocycles between all stations in the same community.

Experiments looking forward to dependable synchronization of broadcasting stations should be encouraged. Aside from power increases on cleared channels, synchronization of the stations on one or more waves offers the only method for increasing the service to the public.

Canada Sharing Approved

The present numerical basis of sharing the broadcasting band with Canada should be maintained. Having now radio facilities totaling 20 per cent of ours, Canada's population (9 per cent of ours) is certainly liberally provided for.

Those in charge of radio should secure the elimination of the wasteful zone system required under the 1928 Davis-Dill amendment as soon as possible. This zoning plan is indefensible on any geographic basis, and creates limitations and inequalities of broadcast service far more serious than those it is designed to correct.

The Case of Television

Reserve adequate places in the spectrum for prospective new services, such as television and picture transmission.

While television is still in the laboratory, it may shortly develop a public demand that will equal that of aural broadcasting. However, in the event of retarded development, the television reserve will be valuable for other uses.

But above all, it should be remembered that a broadcasting use of a channel (either visual or aural) where impulses go out to thousands or millions of receivers is always a higher use of such channel than to devote it merely to point-to-point communication between only two parties.

CALDWELL EDITOR AGAIN

Orestes H. Caldwell, who resigned as Federal Radio Commissioner, is again editor of "Radio Retailing" and "Electrical Merchandising," two trade papers published by the McGraw-Hill Publishing Company, Inc., New York City.

Reasons for Brief Revealed in Letter

Washington.

D. D. Hughes, as acting general counsel of the Federal Radio Commission, filed with the Court of Appeals of the District of Columbia a "posthumous" brief in the case involving WGY. A letter of transmission, addressed to the clerk of the court, Henry W. Hodges, set forth the reasons for filing the brief although the case had been decided. The Commission seeks a rehearing, it was explained, and the brief will facilitate reference to arguments which will pertain to the rehearing plea.

The letter of transmission set forth: "The brief was already in the printer's hands, and the printing was about half completed, when we received word that the court had rendered its decision.

"The brief covers points which we believe are of vital importance to the case and as to which the Commission's points of view have either not been brought to the court's attention at all, or have only been partially presented in advance of any opportunity to inspect appellant's briefs.

"Our chief reason for asking that our brief be accepted for filing is that without it we are tremendously handicapped in preparing the petition for rehearing which we have in course of preparation and intend to file within the period specified in the court's rules.

"Another reason for our request is our desire to protect ourselves against any claim that we have not complied with the court's rules as to the date of filing."

RCA 1928 NET, \$23,661,990

A total gross income of \$101,851,603 and net income of \$23,661,989.72 for the Radio Corporation of America, during the year ended December 31, 1928, was reported to the stockholders by Owen D. Young, chairman of the board, and General James G. Harbord, president of the corporation.

After reserves for amortization of patents, Federal income tax, foreign investments and the Employees' Pension Fund, the net amount of \$19,834,799 remains to be transferred to surplus.

The comparative figures for 1926, 1927 and 1928, are summarized as follows:

	Gross Income	Net Income	To Surplus
1928	\$101,851,603.18	\$23,661,989.72	\$19,834,798.85
1927	65,418,620.62	11,799,650.28	8,478,319.87
1926	61,157,286.64	7,396,487.18	4,661,397.35

Total current assets at the end of 1928 were \$55,577,250 and total current liabilities were \$16,073,015, a ratio of nearly 3½ to 1. In 1927, total current assets were \$33,379,916 and total current liabilities were \$10,910,619.

LIVELY FACTS IN POSTHUMOUS BRIEF ON WGY

Washington.

Asserting that the Court of Appeals of the District of Columbia rendered a decision in the case of WGY, Schenectady, N. Y., while the Radio Commission had time under the rules of the court to file a brief, the Commission sent the brief to court, even though the case had been decided.

The court had held WGY entitled to broadcast full time on 790 kc. and to use 50,000 watts. The Commission had put WGY on a part time basis in the reallocation, as sharing the channel with KGO, Oakland, Calif., also owned by the General Electric Company.

Part of the brief contains an argument against the claim made by WGY, through its counsel, Charles Evans Hughes, that WGY, by long use, had a property right in the 790 kc. channel, of which it could not be deprived without compensation, due to the guarantee of the United States Constitution.

This particular contention by WGY was overridden by the court in its decision, which was based solely on the ground that the public interest would be better served by WGY having full time than by sharing time with KGO, and consequently remaining off the air at night. Thus was another "moot question" introduced—the reply to the decided point on "proprietary right."

Another "Moot Question"

The other "moot question" which was propounded by the Commission's counsel, was that WGY's station license had expired, pending determination of the case, so that the court was without power to act on the appeal. This contention was made in the new brief, but as the decision was rendered before the brief was filed, the court was not persuaded by the argument, in fact, did not even mention this point in the decision.

The Commission had sought to show the court how the Commission's rules could upset the provision of the radio law that the court actually had review powers that continued beyond the life of a three-month license.

The WGY case aroused some bitterness. From the very beginning the WGY officials did not like the treatment they received, since the position of WGY was belittled by the denial of full time under the reallocation. Much effort was devoted to keeping personalities out of the quarrel, but the intense feeling was there, just the same, and the WGY officials de-

WGY ASSAILED IN COURT FIGHT FOR FULL TIME

cided to pick the strongest legal talent available, "hang the cost," so Hughes appeared as their spokesman.

(Continued from preceding page)

At the same time the Commission felt that not only was its learned decision being trampled upon, but that its very authority was being challenged, so the Commission set up the cry that if WGY won there would be a collapse of the reallocation with consequent likelihood of chaos in the air, as prevailed two years ago.

After the decision was "suddenly" announced by the court—following three months of deliberation—the Commission's counsel waxed eloquent on the failure of the court to wait for a brief the Commission still had time to file, and also mildly chided the court for failing to follow the obviously compelling arguments that made almost ridiculous any idea of giving WGY what it wanted.

Followed then the filing of the post-humous brief, with the warning contained in the letter of transmission to the clerk of the court, that the brief covers points "of vital importance."

How Big a Victory?

Meanwhile WGY found itself with a decision in its favor, but with no provision made for the ripe enjoyment of full time on the air, since KGO was not affected by the court decision, and as things stood both stations might be on the air at the same time day and night. There was danger of heterodyne interference in the intervening area, especially at night, when the signals travel at greater strength.

The question to be determined therefore was whether any interference over a wide area would create a worse situation than the denial of night-time privileges to WGY.

The victory was not as complete as it might have been, from a practical viewpoint. In fact, WGY gained "a hollow victory," according to Dr. Alfred N. Goldsmith, vice-president and chief broadcast engineer of the Radio Corporation of America, a corporation associated with General Electric in several enterprises, including the National Broadcasting Company.

Aylesworth's Testimony

Another sidelight on the general situation arose during the testimony before the Senate Interstate Commerce Committee by Merlin Hall Aylesworth, president of the NBC. Mr. Aylesworth mentioned that New York City is the center of artistic talent, since gifted singers and instrumentalists from all over the country make an early bee-line for New York and its possibility of big money.

He mentioned casually, in his testimony, that he did not see any good reason why WGY should have high power, since it had only local talent to draw from, and there was adequate service of superb talent through the chains, with which WGY tied in. This, from the president of a corporation partly owned by General Electric, proprietor of WGY, caused a few blinks, and Dr. Goldsmith's "hollow victory" statement added to the general good feeling.

Recognition of Worth

Meanwhile, however, WGY has in its cap the feather of court recognition of its importance because of experimental and developmental work performed by the station in the radio field and because of the \$1,500,000 capital invested.

Hollow Victory, Goldsmith's View

Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America, called the court decision won by WGY over the Federal Radio Commission a "hollow victory."

"WGY and KGO will sap the strength of each other if they operate at their respective powers simultaneously on the same wave," Dr. Goldsmith said, "so the WGY victory is a hollow one, which under best operating conditions will cause interference to some listeners of each station. A 50,000-watt station in Winter, during the night hours, has a nation-wide occasional range. Therefore two stations such as WGY and KGO could not operate together in the United States without causing beat note interference over relatively large areas in intervening territories. Accordingly, if WGY is to use the 790-kilocycle channel at night, station KGO will have to receive a different frequency." Dr. Goldsmith also said that the "zone system of radio equalization has largely outlived its usefulness" and that "any law based on an arbitrary division of the radio facilities between zones is illogical, unscientific and not in the public interest."

THEATREGOERS TO PICK TALENT

Theatregoers throughout the United States will select their own favorite artists for the Radio-Keith-Orpheum Hour to be given April 2d over the National Broadcasting Company System. The program on that night will be chosen by the listeners themselves from among the star attractions at Radio-Keith-Orpheum Theatres all over the country.

Balloting has already begun in vaudeville houses from Boston to San Francisco and Ottawa to New Orleans, and early returns indicate that one or more of the headliners on that night will have to enter the program from the far west.

It is a unique experiment in building radio programs, and was decided upon by officials of Radio-Keith-Orpheum and the National Broadcasting Company after a deluge of requests to hear certain favorite singers and entertainers.

The requests may be left at any of the R-K-O theatres, and the local managers will forward them to the New York headquarters. The entire program of April 2d will be built upon requests sent in from the whole country.

The R-K-O Hour broadcasts are heard each Tuesday night over a national network of the NBC System, introducing to radio listeners the outstanding stars of the vaudeville stage. WEAf is the New York outlet.

STEVENS CORP. MOVES

After some thirty years in the loft building at 46-48 East Houston Street, New York City, the Stevens Manufacturing Corporation, manufacturers of speakers and diaphragms, has moved to larger quarters at 46-48 Spring Street in Newark, N. J.

A THOUGHT FOR THE WEEK

*It can't be chance!
Why are more copies of RADIO WORLD sent by the publishers on paid-in-advance subscription orders, to radio editors of daily papers throughout the North American continent, than are mailed to these editors by all other radio publications combined?
No, it can't be chance!*

SET MAINTAINS SAME VOLUME ALL OVER DIAL

A type of Super-Heterodyne receiving set featuring an automatic volume control was described in a paper presented before a recent meeting of the Institute of Radio Engineers held in the Engineering Societies Building, 33 West Thirty-Ninth Street, New York City.

The paper had been prepared by G. L. Beers, of the Westinghouse Electric and Manufacturing Company, and W. L. Carlson, of the General Electric Company.

Meets New Conditions

The new receiver has been developed to meet the conditions imposed by the rapid radio developments in the last few years, which have made obsolete receivers that were made several years ago. The circuit was especially developed to compensate for the increasing number of broadcast transmitters and the advent of high power.

The most interesting feature of the receiver is its automatic volume control.

Quantity of Sound Optional

The operator may set the adjustments for any desired volume, and the set will maintain that volume regardless of the power of the stations tuned in or their distance away, provided that the stations have a certain field strength in the neighborhood of the receiver. Thus there can be no sudden bursts of sound from local stations, as happens in other types when the receiver, in adjustment for distant stations, is tuned past a local station's wave.

The set can be tuned without in any way touching the volume control, but various volumes may be obtained by setting the control.

Correct Voltage for A Eliminators

Thousands of fans have built working A eliminators, but find difficulty in the precise regulation of the voltage, which should be exactly six volts. On the average A eliminator, however, the voltage may run up to ten volts, if few tubes are fed, which spoils reception by choking the tubes as well as shortening their lives. A filament range (0 to 10 ohm) Power Clarostat is easily inserted into the home-built or purchased eliminator, thus solving the problem.—J. H. C.

Polymet Creates An Export Division

Increasing foreign business prompted the opening of an export division by the Polymet Manufacturing Corporation, makers of electric radio set essentials.

This department will be under the direction of Arthur Rock, with offices at 154 Nassau Street, New York City.

Majestic Considers Making of Tubes

Roger M. Wise, for several years chief engineer of E. T. Cunningham, Inc., is now with the Grigsby-Grunow Company of Chicago, makers of Majestic radio sets and loudspeakers. It is said that a tube manufacturing division will be added to the activities of the company.

RADIO WILL GO BACK TO DEPT. OF COMMERCE

Washington.

The Federal Radio Commission will continue as an administrative body until December 31st, 1929, and thereafter, until February 23d, 1930, the members will act in an appellate capacity while the administrative duties are performed by the Department of Commerce.

The time during which the administrative duties of the Commission were to be performed under the original condition of the bill would have expired on March 16th, 1930, but on a filibuster by Senator Copeland, of New York, two and a half months were cut off. The Senator opposed the idea of an administrative body later acting as a sort of appellate court on its own decisions.

Problems to Tackle

Much work remains to be done on the reallocation, in the adjustment of differences and in the solution of legal problems arising because of suits instituted by stations dissatisfied with the reallocation plan as it affects them. Also short waves and point-to-point communication present problems which the Commission will attempt to solve before its administrative life ceases.

As part of his filibuster plan, in which he was aided by Senator Blease, Copeland spoke four hours continuously, then took a respite for a bite to eat, while Senator Blease continued the harangue.

Those who backed the bill in its original form did not refuse to vote for the amendment offered by Senator Copeland, but voted for it reluctantly, since if they had voted against it there would have been no radio legislation.

Way Paved for Fees

The Commission was instructed by the Senate to prepare a schedule of fees to be charged for licenses. This is part of a plan to tax stations for their licenses, to raise the revenue to defray expenses of radio administration.

NEW CORPORATIONS

Radiotype Corporation, wireless—Attys., Munn, Anderson & Munn, 24 W. 40th St., New York, N. Y.

Monarch Radio Co.—Attys., J. Weil, 36 West 44th St., New York, N. Y.

American Radio & Television Stores Corp., New York, radio supplies—Corp. Trust Co. of America, Dover, Del.

Ellmar Radio & Television Corp.—Attys., Hull & Hammond, Buffalo, N. Y.

Radio Treatise Co., advertising—Attys., M. Krinsky, 1440 Broadway, New York.

Try Me Radio Company—Attys., B. Kagan, 170 Broadway, New York, N. Y.

Falstar Radio Company—Attys., G. Cohen, 217 Broadway, New York, N. Y.

Tourist Radio Corporation—Attys., I. Ehrman, 41 Park Row, New York, N. Y.

Universal Radio Corp., Camden—New Jersey Corp. Guarantee and Trust Co., Camden, N. J.

Heights Radio Company—Attys., Hyams & Hyams, 292 Madison Ave., New York, N. Y.

Dynatron, Inc., Newark—Attys., Frankel & Distler, Newark, N. J.

The Poole System, Inc., broadcasting apparatus—Corporation Trust Co. of America, Wilmington, Del.

General Broadcasting Corp., operate radio broadcasting stations—Attys., Franklin L. Mettler, Wilmington, Del.

Ajax Radio Shop, Summit, N. J.—Attys., Wolber & Gilhooly, Newark, N. J.

Radio Corporation of America, New York, capital changed from 1,500,000 to 8,313,365 shares, no par.

R. C. A. Photophone, Inc., New York, capital changed from 200,000 to 1,000,000 shares, no par.

S. & S. Radio Stores—Attys., P. D. Kaufman, 48 W. 48th St., New York, N. Y.

Commission Power Hinges on WNYC

Washington.

WNYC, the municipal station of the City of New York, which seeks full time, whereas it now shares 526 meters equally with WMCA, is not entitled to affirmation of its petition, the Federal Radio Commission said in a brief filed with the Court of Appeals of the District of Columbia. The petition is being pressed hard by New York City's corporation counsel, acting under direction of Mayor James J. Walker. The Commission had heard the appeal as a judicial body but denied it, and the city took the case to court.

The Commission states the brief, objects to the introduction of additional evidence, contending, first that the evidence desired to be adduced is cumulative, and second, that no reason was assigned for appellant's failure to adduce the additional evidence before the Commission.

"To admit the evidence desired to be adduced is to nullify the work of the Commission and oust it of its proper jurisdiction by substituting the Court of Appeals for the Commission in the application of the standard of public convenience, interest or necessity," the Commission's brief sets forth.

BOARD ATTACKS FIVE APPEALS

Washington.

Motions to dismiss five appeals of radio broadcasting stations filed with the Court of Appeals of the District of Columbia, and challenging the decisions of the Federal Radio Commission in changing the assignments of the stations, were filed with the court by the Commission.

Three of the motions were on the appeals made by WENR, Chicago, WLS, Chicago, and WCBD, Zion City, Ill., which sought improved assignments on the 870-kilocycle channel, now used by the two Chicago stations on a time-sharing basis.

WCBD, operated by Wilbur Glenn Voliva, overseer of Zion City, was on this channel prior to the reallocation, and was denied its application to a return. The other stations sought increased time and power, which was denied in the case of WLS, while WENR received an increase in power from 5,000 to 50,000 watts.

The Commission also asks the court to dismiss the appeal of the City of New York, which operates WNYC, and which appealed to the court from the Commission's decision denying it increased broadcasting time on 570-kilocycle channel.

The fifth case, says "The United States Daily," is that of former radio station WTRL, Midland Park, N. J., which was operated by the Technical Radio Laboratory. This appeal involves a decision of the Commission made on August 23, 1928, "denying an application filed by appellant on January 16, 1928, seeking renewal of its license."

ABBOTT IS APPOINTED

H. Curtiss Abbott, of Chicago, has been appointed sales manager of the radio division, National Carbon Company, Inc. Mr. Abbott is a graduate of Yale. He was general sales manager of the Crosley Radio Corporation. He will be associated with George C. Furness, manager.

PREDICTS NEW COMMISSION OF WIDER POWERS

Washington.

A Federal communication to regulate both wire and wireless communication was predicted by Representative Davis (Dem.), of Tullahoma, Tenn., ranking minority member of the House Committee on Merchant Marine and Fisheries.

"The next (71st) Congress," Mr. Davis said, "in my opinion, will place on the statute books a law creating a communications commission, having the same jurisdiction over radio, telegraph, telephone, and cable services that the Interstate Commerce Commission has today over the railroads of the country. Of course there will be opposition to it, but so there was opposition from the railroads at the time the original Interstate Commerce Act, creating the Interstate Commerce Commission, was passed.

Willing To Help

"Senator Watson (Rep.), of Indiana, chairman of the Senate Committee on Interstate Commerce, already has introduced such a bill and he has the cooperation of Senator Dill (Dem.), of Washington, active in radio legislation in Congress. I shall be glad to cooperate with Representative White (Rep.), of Lewiston, Me., chairman of the House Committee on Merchant Marine, the Committee having in charge radio legislation, and with other leaders of the House, including the Interstate Commerce Committee, in any legislation affecting interstate commerce matters.

"Leaders in radio legislation on both sides of the House are in favor of such a commission but whether it should be an entirely new organization or a conversion of the Federal Radio Commission, which expires by limitation December 31st, will have to be determined. Such a commission, however, is the logical outcome of the rapid development and differences of views and confusion in the radio situation of today."

Broadcasting's Growth

Speaking of the growth of broadcasting he said:

"The first broadcasting station was established in 1921, less than eight years ago. Today, it is estimated there are 12,000,000 radio-receiving sets in American homes through which it is estimated that there are listening approximately 40,000,000 American citizens.

"There are billions of dollars invested in radio apparatus. The sales of radio apparatus in this country were estimated at \$650,000,000 to \$750,000,000 last year, with the figures mounting each year. The commercial field of radio is more important than are the broadcasting features. That is a matter that is of even greater development and potential use than the broadcasting feature. There is a general demand for these facilities and there is talk of frequencies that are worth \$1,000,000 each."

SUTHERLAND WITH WLW

Cincinnati.

George Sutherland, formerly of WDBO, Orlando, Fla., WMFB, Miami Beach, Fla., and WLBW Oil City, Pa., has been added to the staff of WLW announcers.

BATCHELLER, JANSKY, FAIL TO GET OFFICE

Washington.
The nominations of Arthur Batcheller of Massachusetts, Federal Radio Supervisor of the Second Radio Inspection District, New York, and Cyril M. Jansky of Minnesota, professor of radio at the University of Minnesota for members of the Federal Radio Commission failed of ratification. When the Senate adjourned without having taken action the nominations then expired automatically.

Old Members Confirmed

The Senate had previously confirmed the the renominations of Ira E. Robinson, Eugene E. Sykes and Harald A. LaFount as commissioners. This left the commission with only three confirmed members, all of whom are non-technical men. Mr. Lafount is a business man and the other two are lawyers and former judges.

President Hoover will make appointments to the two vacancies and may even select the same men.

Webster Appointed

The Commission has appointed Bethuel M. Webster, Jr., general counsel to succeed Louis G. Caldwell of Chicago. Mr. Webster has been special assistant to the Attorney General since April, 1927, and is a member of the New York bar.

Si-Len-Ser Booklet to Reveal Secrets

The list of Si-Len-Ser jobbers continues to grow and begins to resemble the proportions of a blue book or Who's Who in radio.

This device kills line noises generated by electrical appliances on the line, in AC operated receivers. It has taken a strong hold on the radio public. The factories of the Trutone Radio Sales Co., under the direction of Julian J. Proskauer, 114 Worth Street, New York City, are working night and day to supply the demand.

In connection with the work of smoothing out line noises and the various uses and installations of the Si-Len-Ser, Mr. Proskauer is working on a book that will be highly valuable to all. This soon will be available to all who need it, and will reveal some important secrets. Those who seek special information on line-noise problems may obtain it by addressing the above concern. Mention RADIO WORLD.—J. H. C.

Radio in Aviation Discussed by Parley

Washington.
A conference was held by the Federal Radio Commission and applicants for aeronautical radio stations, for the discussion of radio problems as they concern commercial aviation.

The purpose of the conference, the invitation stated, was to coordinate the views of the various aviation operating companies and others interested in the establishment of communication between aircraft and ground. The Commission at the same time considered pending applications for stations in connection with aeronautical activities.

N. Y. Police Study Radio Alarm Plan

Police Commissioner Whalen is investigating the possibility of using the municipal broadcasting station of New York City, WNYC, to describe criminals and their course of flight immediately after a crime, or even during it, by having a set in each station house, tuned to a confidential and exclusive frequency.

The Commissioner revived an inquiry into the practicability of such radio alarms he explained, because he believed the advances made since such receiving sets were bought and declared impractical after tests a few years ago may make the plan a great aid now.

The Commissioner made it clear that the tentative inquiry so far was confined to determining the extent to which such plans might be used.

CANADIAN PACT NOW IN EFFECT

Washington.
The United States and Canada entered into an agreement on wave channels recently.

The United States obtains 146 of the 228 general communication channels, of which 112 are for its exclusive use, and the remaining 34 are shared with Canada and Newfoundland.

Canada is allocated 38 exclusive channels to be shared with Newfoundland, and 48 channels shared with other nations. Newfoundland receives 17 channels shared with United States, Cuba 5 exclusive and 15 shared with Canada, and Mexico and "other nations" 8 exclusive and 16 shared with Canada.

The arrangement is in the nature of a "gentleman's agreement."

The purpose is to avoid interference in communication on these channels by an equitable allocation and understanding between the governments involved. The agreement was consummated at a conference in Ottawa in January between delegations of the various nations, but was submitted to the various governments concerned for their approval.

Aside from the 228 communication channels allocated, the agreement sets aside a general allocation of the 639 channels in the continental short-wave spectrum, ranging from 1,500 to 6,000 kilocycles. Other allocations are: 190 for mobile services; 134 for amateurs; 84 for experimental visual broadcasting including television; and 3 for experimental work. These will be shared by all of the nations.

WBAL Is Licensed to Use 10,000 Watts

Baltimore.
WBAL has received a license to use 10,000 watts.

WBAL has been using substantial power since last November when the engineers of the station installed crystal oscillator equipment on the 5 kw transmitter, thereby increasing the effectiveness of its power. The necessary technical improvements are being made permanent to avoid any shutdown of the station. This work is being done under the direction of G. W. Cooke, engineer-in-charge.

STATIONS USE NEW RECORDS AS OWN MUSIC

A new method of supplying program to radio stations, known as "electrical transcription," is now in use by about sixty stations throughout the country. A special type of phonograph machine, known as the orchestraphone, is used for playing records supplied to the stations by a central bureau.

Two identical records are revolving at the same time to prevent any possible interruption.

Need Not Be Identified

There is no necessity to announce the fact that mechanical reproduction is used, in accordance with Order 52 of the Federal Radio Commission, because ordinary records are not used. The records have been made for the exclusive use of the broadcasters and they contain their own announcements. Six records are needed for a half hour program.

The device recently was demonstrated by the National Radio Advertising Company of Chicago at the Hotel Commodore in New York City. J. W. Schaffer, representative of the company, said that some of the largest stations in the country were equipped to use the new method.

Used In Big Cities

He cited stations in Chicago, Boston, Buffalo, Cleveland, Detroit and Denver. Some stations on cleared channels are using the method, prominent among them being KDKA, Pittsburgh, he said. The records contain mostly dance and symphonic music, but the library is being extended to a more varied field.

The orchestraphone is not played into the microphone but a pickup must deliver the audio component direct to the station's modulator.

Lower Power, More Stations, Dills Plea

Washington.
Senator Dill (Dem.) of the State of Washington commenting on the WGY decision, said these principles were involved: "First, that no station has any property or vested right in the air; and, second, that any decision by the Radio Commission must be reasonable and in the public interest.

"The Commission can undoubtedly serve the public interest better by keeping down the power allotments and thus permitting more stations to go on the air."

WABC's Modulation Is Boosted to 90%

WABC, the key station of the Columbia Broadcasting system has installed a new modulation panel at the Jamaica Bay plant. Better reception has been reported by fans as a result.

The increase in volume is not due to an increase in power, it was said, but to an increase in modulation, which was raised from 40 to 90 percent. A new cage type of aerial will also be erected.

FOUR "TALKIE" FIRMS SIGNING RADIO ARTISTS

Radio performers are being invited by the motion picture industry to take part in talking films. During the past few weeks the demand has grown to such an extent that the National Broadcasting and Concert Bureau found it necessary to organize a special department to take charge of this development.

Four of the largest film companies are negotiating for the services of National Broadcasting Company artists, both for the making of long features and short special talkies.

Casting Is Difficult

"These companies are finding it difficult to assemble adequate casts for talking films from among the ranks of their own actors," explained George Engles, director of the National Broadcasting and Concert Bureau.

"They are in need of artists who combine speaking and acting ability. Many of our radio performers have had experience on the stage. Added to that, their voices are trained for microphone reproduction, a most essential requirement for talking films.

No Exodus to Hollywood

"It will not be possible for us to release our broadcasting artists to go to Hollywood for extended periods. However, most of the larger film companies are reestablishing studios in the east. In as many cases as it can be satisfactorily arranged, our artists will be permitted to combine film activities with their radio work."

Fifteen Short-Wave Licenses Held Up

Washington.

The applications for licenses or construction permits for short waves by the following were not denied but were held up pending further information:

- The Great Lakes Broadcasting Corporation, Chicago, Ill.
- John Milo Lutts, Los Angeles, Calif.
- Dudley R. Hooper, Rutherford, N. J.
- Radio Air Service Corporation, Cleveland, Ohio.
- Charles A. Johnson, Philadelphia, Pa.
- T. L. Kidd, San Antonio, Tex.
- Harold E. Smith, Beacon, N. Y.
- Ben S. McGlashan, Los Angeles, Calif.
- Stewart Warner Speedometer Corporation, Chicago, Ill.
- Alfred N. Hubbard, Seattle, Wash.
- Crocker Research Laboratories, San Francisco, Calif.
- Nelson Brothers Bond and Mortgage Company, Chicago, Ill.
- Robert B. Parrish, Los Angeles, Calif.
- Durham and Company, Inc., Philadelphia, Pa.
- Western Broadcast Company, Los Angeles, Calif.

Microphone Stand Is Gift to Coolidge

Washington.

Calvin Coolidge, just after the inauguration of Herbert Hoover, was presented with the "President's microphone stand" by officials of the National Broadcasting Company. The microphone stand was built three years ago by the NBC especially for the use of President Coolidge.

A similar stand has been constructed for the exclusive use of President Hoover.

Mr. Coolidge always has been particular about the arrangement of his manuscript before the microphone. To have the "mike" at the proper distance from his lips and to have the manuscript at the preferred distance from his eyes, the special stand was built to order.

When the President spoke in the Washington studios of the NBC the stand was available. On broadcasts from his study in the White House or from public buildings in Washington and elsewhere, the stand went along as part of the essential equipment for the broadcast. When not in use it was kept carefully shrouded in a green cloth in the studios of WRC in Washington.

Once when President Coolidge had a short address to make, though not into a microphone, he sent a White House attache to the radio studios to borrow the stand.

The stand has an iron base and a wooden top. It resembles a music stand, though it is built to accommodate a microphone as well as a manuscript.

DOG IN NORTH LISTENS A LOT

Glacier Park, Mont.

Way up in the wilds of Glacier National Park, at the Belly River ranger station, a United States ranger has a huskie dog that has become a radio fan.

This is a lonely Rocky Mountain post during the Winter and the dog Nellie has become accustomed to join with her master listening to the programs offered daily by the "great outside world." The dog likes orchestra music best but will listen attentively to the spoken human voice.

The ranger fastens the receivers to the dog's ears.

The other evening while the ranger was preparing his supper the dog pawed the earphones off a table and got one of her ears on the floor against the headpiece, listening patiently for sound. The ranger watched her in amusement for a time and then turned on the set. There was a sudden burst of growls from the huskie as her neck hair stood up straight. Suddenly she sprang upon the receiver but her master dragged her away.

The unwelcomed program upon the air happened to be a duet by trained seals, being broadcast from New York.

The ranger is even careful now in selecting a suitable program for his wolf dog of the North. For he can't step across the street and buy a new receiver whenever he wants one.

7 YEARS OLD, RADIO WORLD TO CELEBRATE

As the issue of RADIO WORLD you are now reading is the 364th weekly consecutive one, seven years of publication have been completed, and next week's issue, dated March 23d, will begin our eighth year. It will be the Seventh Anniversary Number, and, befitting the celebration of a happy birthday by a healthy (and gifted) child, it will have extra "trimmings." You are cordially invited to participate in this "party."

You may redole yourself with circuits, news and humor, all abundantly illustrated, and profit immensely, both intellectually and financially, by perusing the text and advertising pages of the Seventh Anniversary Number.

You will be treated to a complete and accurate list of the broadcasting stations in the United States, giving call letters, frequency, wavelength, owner, location and power.

First AC Diamond

You will see what the AC 4-Tube Screen Grid Diamond of the Air looks like, and will be told about its performance. Single tuning control is used. This circuit is indeed a splendid one, well worth your while to build. At least you owe it to yourself to read about it. The author is Herman Bernard. The Diamond has never before been shown as an AC receiver.

Maybe you don't know as much about band pass filters as that fascinating subject warrants. You're interested in tone quality. A band pass filter affords that, while maintaining high selectivity. There is no other way of achieving both, at least without a separate selectivity control. Get up-to-date and learn from J. E. Anderson, technical editor, the theory and operation of band pass filters in tuned RF circuits. Mr. Anderson, former instructor of physics in the University of Wisconsin, and former Western Electric engineer, is well qualified to inform you on this important technical subject.

Sound Films Discussed

"How Sound is Recorded on Films" is a fitting, timely topic, since acoustical principals, and tubes, familiar to radioists are involved. The author is Capt. Peter V. O'Rourke, contributing editor. "Which Tubes Should Follow Which" will be disclosed by Herbert E. Hayden. A glance at some circuit designs compels the remark that such a topic bears immediate investigation. Mr. Hayden has the right answer. You'll want to know what it is.

"Dirty Deals That I Regret," being the confession of an ex-service "gyp," is interesting reading from the pen of a young man who has become a respected service worker in another field—social service—since he pulled some raw ones on the customers. Honesty marks radio service men's work these days, but any who seek to fool their customers will find the going harder if the prospective victim has read the reformed "gyp's" article.

Host of Features

The seriousness of radio work being heavy at times, especially when filaments are accidentally shorted across 180 volts, a page of comic relief is apropos. You'll find that page in RADIO WORLD next week—the Seventh Anniversary Number—dated March 23d. And you'll find a host of other attractive features, mostly serious, curse the luck!

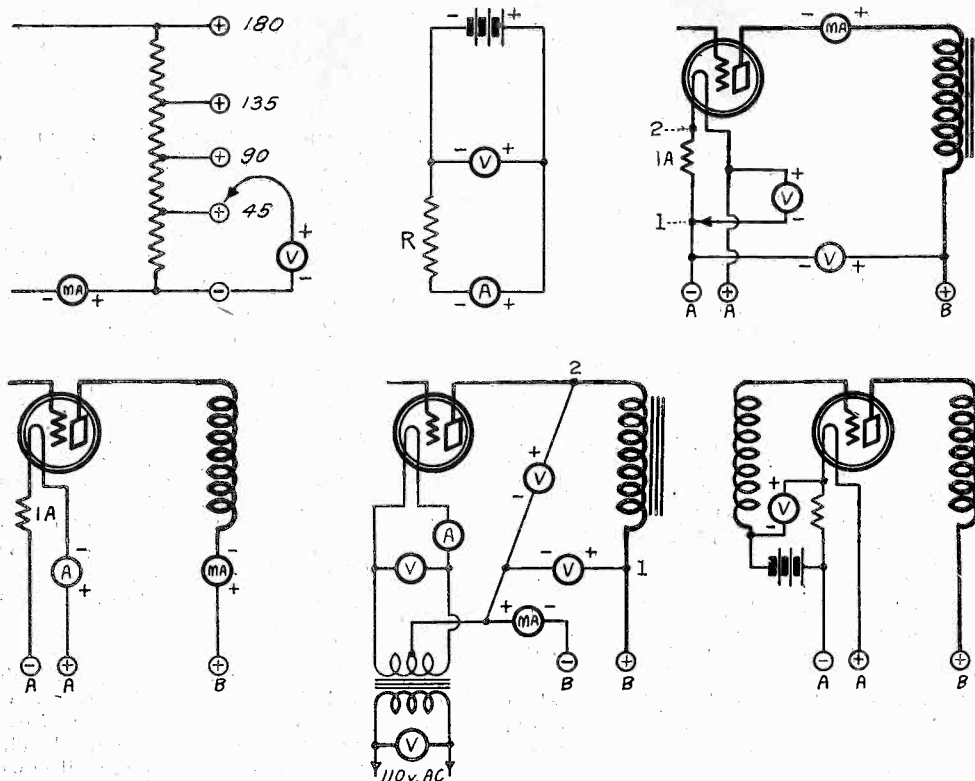
—EDITOR.

NOTICE TO SUBSCRIBERS

Look at the date of the label pasted on the wrapper containing your subscription copies. If this date on wrapper is older than the date of the issue received, then your subscription has expired and should be renewed. Subscription Dept., Radio World, 145 West 45th St., N. Y. C.

The Scientific W

By Spencer



POWER TUBE AND RESISTANCE COUPLED MEASUREMENTS

Fig. 1, upper left, shows how to connect a voltmeter for measuring the output voltage of a B battery eliminator, and also how to connect a milliammeter for measuring the total current delivered.

Fig. 2, upper center, shows how to connect a voltmeter for measuring the voltage of a battery, and also how to connect an ammeter for measuring the resistance of a resistor.

Fig. 3, upper right, shows how to connect voltmeters for measuring the filament and applied plate voltages, and also how to connect a milliammeter for measuring the plate current.

Fig. 4, lower left, shows how to measure the filament current with an ammeter and another method of measuring the plate current with a milliammeter.

Fig. 5, lower center, shows where to connect meters in an AC set for measuring the AC line voltage, the AC filament current, the plate current, the applied plate voltage and the effective plate voltage.

Fig. 6, lower right. In transformer coupled circuits the grid bias can be measured by connecting a voltmeter from F minus on the socket, or from the cathode, to the F minus terminal of the coupling transformer.

How to Determine Correct Voltages and Currents — Limitations and Precautions Cited—The Calculation of a Meter's Resistance Per Volt.

N EARLY every radio fan has come to realize that current and voltage meters are handy and useful accessories to a radio receiver. He knows that only by meters can troubles in the receiver be diagnosed in a scientific and positive manner. He knows that a service man with a few meters can locate a source of trouble in a few minutes which has defied detection for weeks by the hit-and-miss method of changing leads, condensers, coils, tubes and other details.

The radio fan also knows that he too can do such work if he has the proper instruments, or at least he knows he can learn. For this reason every radio fan is accumulating meters and set testers.

Use of Meters

Most fans get the meters first and then they learn how to use them. And as soon as they have become familiar with the first meter they look around for another. And the more meters of different types any one fan has, the more tests he can perform on his receiver, the more completely will he have his set in control at

all times, and the more enjoyment will he get from his receiver.

Fans who have just acquired meters often ask for information on how to use them. It is the object of this article to point out some of the uses and measurements.

One of the most frequent tests is that for voltages delivered by a B battery eliminator. How this test is carried out is shown in Fig. 1. The resistors shown in this figure are built into the eliminator and they are not accessible without opening the device. But the binding posts are accessible.

Voltage of Battery

The voltmeter V should be a high resistance instrument, for an ordinary voltmeter will not give correct readings. Also the voltages should be measured while the eliminator is furnishing current to the receiver. The negative terminal of the voltmeter is connected to the negative post on the B battery eliminator and the positive terminal of the meter to the terminal at which the voltage is desired.

The voltage of a battery is measured as in Fig. 2. The meter is connected directly across the battery, plus to plus, and minus to minus. There should be no resistance included in the circuit formed by the meter and the battery, because, if there is, the reading will be less than the voltage of the battery by the amount of the voltage drop in the resistance.

Any voltmeter may be used for measuring the voltage of a battery, provided that its range is suitable for the battery. In case the battery is of the dry cell type and it is partly exhausted, the reading obtained with a low resistance meter will be less than that obtained with a meter of high resistance. This is because there is a high internal resistance in the battery, and the meter measures the difference between the actual voltage and the voltage drop in the battery resistance.

For testing the condition of a dry cell battery it is better to use a voltmeter of relatively low resistance because the thing that is really wanted is the internal resistance, but the meter in such an instance should be connected only momentarily. If the voltage of the battery is measured while it is delivering current to a radio set, a high resistance meter is preferable. A high resistance meter may be connected for any period of time.

The idea is that the battery should be tested while it is delivering approximately the current which it does in actual operation.

Measuring Voltages in a Set

Fig. 3 shows how the voltages applied to a tube in the set can be measured. It is assumed that a double range meter is available, or two meters, one for high voltage and the other for low.

Suppose first the filament voltage is desired. Two of these voltages are of interest in battery operated sets: first the voltage across the battery leads as they enter the set and second the voltage across the terminals on the socket. The positive terminal of the meter is connected to the positive side of the filament line at any point between the battery and the plus post on the socket. To get the voltage across the supply line the negative terminal of the meter is connected to the negative side of the line, at the point marked (1). To get the voltage applied to the filament the negative terminal of the meter should be connected to the minus post on the socket, or to point (2). The difference between the two readings, if any, is the drop in the ballast resistor 1A.

The plate voltage applied to the tube is measured by using the high range of the meter, or by using the separate high range meter, and connecting the meter between A minus and B plus. In this case B plus means the B terminal on the coupling transformer.

Measuring Current

Sometimes it is desirable to know the total current delivered by a B battery eliminator. The proper connection of the milliammeter is shown in Fig. 1. The meter ma is placed so that the current through the voltage divider as well as through the tube flows through it. The plus terminal of the meter should always be toward the B minus terminal. To make this measurement it is necessary to cut a lead in the eliminator, and hence to open up the instrument.

Of course, the total current also can be measured in the positive side of the

How to Use Meters

J. Breed

line. Sometimes that line is more accessible. The negative terminal of the meter then should be toward the 180-volt terminal and the voltage divider.

If the current delivered to each voltage tap is desired, the milliammeter can be inserted in series with the tap and the lead to the set.

At times it is desirable to measure the resistance of a resistor. This involves both current and voltage measurements. Fig. 2 shows the set-up. The voltmeter is connected next to the battery and the ammeter or milliammeter **A** is connected in series with the unknown resistance **R**. The polarities are indicated. Before this measurement is carried out an approximate value of the resistance should be known to select the proper value of the voltage and a suitable range of the meter. If not even an approximate value is known, start with a very low voltage and increase it until the reading on the current meter is maximum. A meter's resistance in ohms is obtained by dividing the voltage reading in volts by the current reading in amperes. Divide by the full scale of the meter to obtain the resistance per volt. If the meter is double reading, test each scale for resistance per volt.

Plate Current of a Tube

If the plate current of one tube is desired, the milliammeter may be connected as in Fig. 3. The negative terminal of the milliammeter **ma** is connected to the plate post of the tube socket. Another way of connecting the milliammeter is shown in Fig. 4, in which the meter is below the transformer. The negative terminal is still connected toward the plate of the tube, or to the transformer.

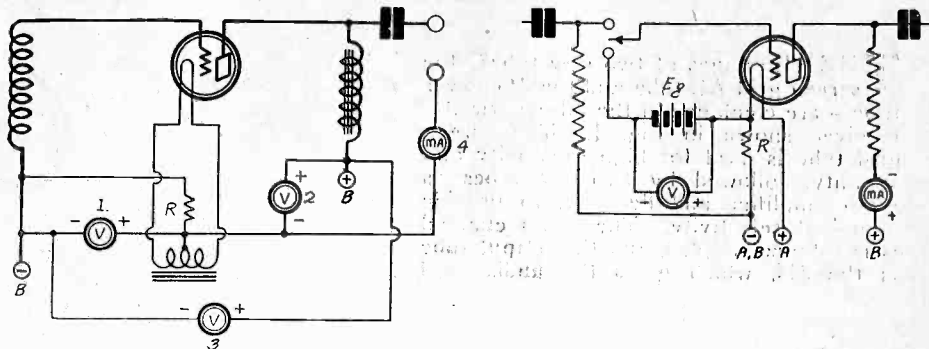
How to measure the filament current in a DC tube is shown in Fig. 4. The ammeter is connected in the positive side of the line. Of course, it may be connected in the negative side just as well. The more convenient connection is used.

Fig. 5 shows various measurements on a tube heated by AC. There are many currents and voltages that you may desire to know in this circuit. First there is the line voltage impressed on the primary on the heating transformer. For this an AC voltmeter is necessary, and it is connected directly across the primary. But these points are rarely accessible. About the only place where this voltage can be measured is at the outlet where the primary is plugged into the line. Usually not many AC voltmeters suitable for this voltage are available. In that case it is necessary to measure the secondary voltage. After all, that is the more important. This voltage is measured by connecting a low range AC voltmeter across the filament winding. If the measured voltage is not off more than 5 per cent. above or below the rated voltage of the tube in question, all is well.

Measuring AC Current

If the filament current flowing in the AC tube is desired, the AC ammeter **A** is connected in series with the filament as indicated. Low priced, low range meters are available which will measure both AC and DC.

When measuring plate voltage on AC tubes the negative terminal of the voltmeter should be connected to the midtap on the filament transformer, or to the midtap of the balancing resistor. The positive terminal may be connected either to point (1) to get the voltage applied, or to point (2) to get the voltage on the



HOW VARIOUS VOLTAGES AND CURRENTS ARE READ

Fig. 7. Three DC voltages are important on a power tube and this figure shows how they can be measured. Those voltages are the grid bias, the plate voltage and the sum of these voltages.

Fig. 8. In a resistance coupled circuit any tube may be used for measuring the actual grid bias on that tube by an arrangement like this.

plate. The voltmeter **V** should be one of high resistance or the indication obtained will be too low. The reading at point (2) especially will be low. If the coupling device is a resistance instead of a transformer or choke coil the voltage at point (2) will be practically nothing. Even when a high resistance meter is used the voltage indication at (2) will be very low. It is no indication of the performance of the resistance coupled stage.

When the plate current in the AC tube is desired the meter **ma** can be connected as indicated. The positive terminal of the meter is connected toward the transformer. The meter may be connected also in series with the lead from the plate, or in series with the lead from the coupling unit. In any instance the positive terminal of the meter should be pointed toward the filament, the negative toward the plate.

Measuring Grid Bias

Sometimes it is necessary to know the grid bias applied to a tube. How this is done in a battery set is shown in Fig. 6. The positive terminal of the meter should be connected to the minus post on the tube socket and the negative to the **F** minus post on the transformer, or to the corresponding point on other types of coupling units. If a grid battery is used, any voltmeter of suitable range may be used, but if the bias is obtained by a drop in a resistor, as in AC sets, it is necessary to use a high resistance instrument. Even then the reading obtained will be in error by a small amount.

The actual grid bias on the tube is not necessarily the same as that obtained by this method. The actual bias would be obtained by connecting the meter between the negative end of the filament and the grid post. But this voltage cannot be obtained with any except a vacuum tube voltmeter. If a current-drawing meter is used not even a rough approximation to the true voltage is obtained in the grid-to-filament method. This is due to the voltage drop in the secondary of the transformer or the grid leak. A method of getting a correct bias value will be explained later.

Measuring a Power Tube

Many errors are committed in measuring grid and plate voltages on the power tube, or in any other tube similarly connected. The proper connections are shown in Fig. 7. Only high resistance voltmeters should be used.

The voltmeter in position No. 1 measures the grid bias, or rather the drop in the grid bias resistor **R**. The meter in

No. 2 position measures the applied plate voltage. The meter in No. 3 position measures the sum of the grid bias and the plate voltage. Of course, the reading in No. 3 position should equal the sum of the readings in the other two, but a very close correspondence should not be expected, especially if the three voltages are measured consecutively.

It will be observed that the voltage usually measured on a power tube is that given by No. 3. Many have expressed surprise when the reading obtained here is 220 volts instead of 180 volts. When the power tube is 171A the plate voltage should be 180 volts and the grid bias about 40 volts. Hence the voltage in No. 3 position should be 220 volts. If it is less than that the power tube does not get sufficient voltage for greatest undistorted power output.

Measurement of Output

In Fig. 7 is shown a milliammeter in position No. 4, which is in series with the loudspeaker. This meter measures the signal current which flows through the loudspeaker. Since this current is alternating, the milliammeter must be an AC instrument. Of course, this meter is not needed for routine tests, but it is useful for taking performance characteristics on amplifiers.

Measurements on resistance coupled amplifiers are the most difficult. The currents involved are so small that very sensitive meters are required. Voltages on the grid and on the plate cannot be measured with current-drawing voltmeters because the resistances in the circuit are, of the same order of magnitude as those in high resistance meters. The only accurate way of measuring the voltages is by a vacuum tube voltmeter. The tube and circuit under test may be used as the voltmeter for the grid bias by a slight change. A sensitive milliammeter **ma** is inserted in series with the plate coupling resistor. This meter should have a 0-1 milliampere range if it is in series with a high resistance.

Suppose it is desired to measure the actual grid bias on the tube. First connect the grid to the top of the grid bias resistor, as in Fig. 8. Note the reading on the milliammeter in the plate circuit. Then switch the grid over to the grid battery and the voltmeter **V**. Adjust the battery **Eg** until the milliammeter reads the same as it did when the grid was connected as before. Note the reading on the voltmeter. This is the bias sought.

If the grid return goes to the negative terminal of some biasing battery instead
(Continued on page 15)

The Two New Tubes 6-Tube AC

By Herbert

THE advantages of two new tubes—the screen grid AC tube and the 245 power tube—are combined in the all-electric AC receiver shown in Fig. 1. The screen grid tube is used for high sensitivity and stability, followed by two 227 tubes as radio amplifier and detector, to provide abundant selectivity. The audio channel is resistance coupled, and the output tube is the 245, which gives the undistorted

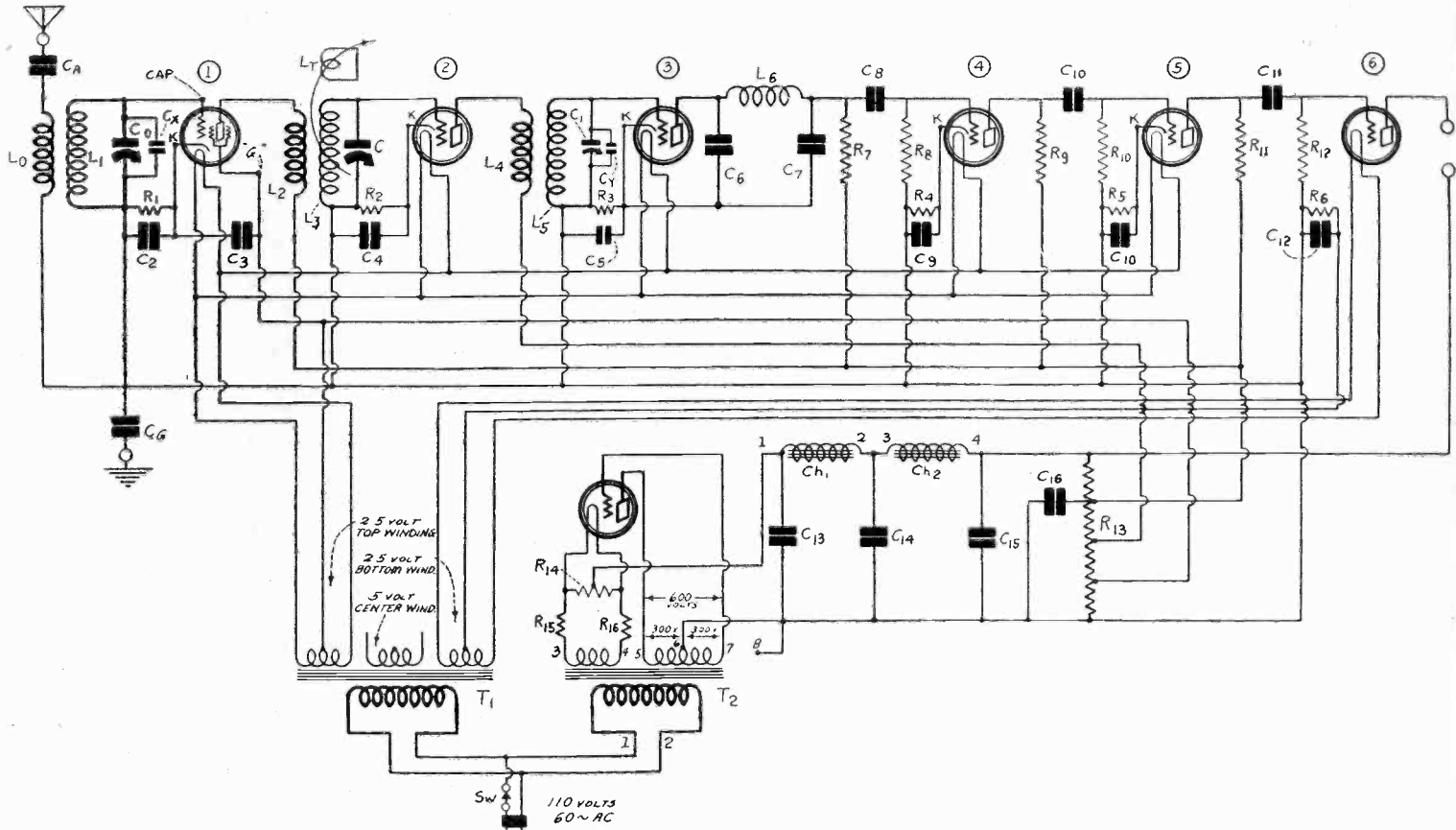


FIG. 1

SENSITIVITY, SELECTIVITY, TONE QUALITY, COMPACTNESS AND CONVENIENCE CHARACTERIZE THIS SIX TUBE RECEIVER

maximum power output of the 210, but at 250 plate volts instead of 350 volts.

Virtues Aplenty

Single control is provided, by use of a ganged condenser and the inclusion of two equalizing condensers of very small capacity, placed across the first RF and detector tuning sections of the ganged unit. These small condensers, once set, are not molested thereafter. Their purpose is to provide an extra capacity equal to the capacity developed across plate and filament of the screen grid tube, so that accurate multiple tuning by single control is made thoroughly practicable.

More Than Enough

The circuit in every respect is standard. It follows the best practice—the tried and true course—and attempts nothing novel. Its performance is really worth while. This is the kind of receiver that gives you more than enough selectivity to tune out a powerful local and bring in a distant station on an adjoining channel, more than enough undistorted power output for any home, more than enough volume due to amplification at radio and audio frequencies, hence the volume control is necessary; and more than the average fidelity of reproduction, yes, ever so much more that it is not far from the truth to say

there isn't any audio channel that provides better tone quality.

The whole thing was built into a 7x21x12-inch cabinet space, and the output fed into a dynamic speaker, hence no output transformer is shown. Every dynamic speaker has such a transformer built in. If, however, a magnetic type speaker is to be used with this receiver, include an output transformer or filter.

Five type 227 tubes are used. As each filament draws 1.75 amperes at 2.5 volts it is absolutely necessary to have a filament transformer that will carry all this current. The filament transformer used in this receiver has two 2.5 volt windings, one at top, which will stand up to six 227 tubes with absolute safety and without even heating, and one at bottom, which will take care of the 245 power tube filament.

Remarks About Windings

Of course, it is not necessary to use this second winding for the power tube filament, since the other winding will carry the extra load nicely. It is practical to pass the plate current of the last tube through the winding that serves the filaments (heaters) of the 227 tubes, since the midtap remains positive by the amount of the grid bias developed in R6. In that event the connection of the midtap to B

plus 45 volts (shown in the diagram) would be omitted, since about this same positive voltage is on the midtap due to the biasing resistor connection. It is simpler to use the two windings, hence the diagram shows this use.

The output tube may be a 5-volt type, e.g., 171 or 171A, or a 7½-volt type. You may have output tubes you'd like to use up, knowing that the shift over to the new 245 tube may be made at any time, by introducing wiring changes that take only ten minutes to complete, that is, ten minutes by the clock.

For a 5-volt output tube use the 5-volt (central) winding of the filament transformer, and connect the biasing resistor R6 to the midtap of this winding, thus leaving the lower 2.5 winding entirely free, even as to midtap. Therefore to change over to the new 245 tube, simply move these three connections from the 5-volt winding to the lower 2.5 volt winding, to the position shown in the diagram.

Filament Voltage Drop

The power transformer is one originally intended for the 281 tube, but is excellently converted to use of the 280, so that full-wave rectification is obtained by the use of only one tube, the tube's current carrying capacity being sufficient at the maximum voltage of 300. This maximum

es in an All-Electric Circuit

E. Hayden

LIST OF PARTS

- L0L1, L4L5—Two AC5 coils, manufactured by Screen Grid Co.
 L2L3LT—One SGT5 coil, manufactured by Screen Grid Coil Co.
 L6—One Hammarlund choke coil, 85 millihenries.
 Co. C, C1—One Hammarlund battleship model condenser, three sections, .0005 mfd. each.
 Cx, Cy—Two Hammarlund equalizers, 70 mmfd. each.
 CA, CG—Two Aerovox .0005 mfd. fixed condensers.
 C6, C7—Two Aerovox .00025 mfd. fixed condensers.
 C2, C3, C4, C5, C9, C10A, C10B, C11—Eight Aerovox fixed condensers, .02 mfd.
 C12—One Aerovox 4 mfd. condenser.
 R1, R2—Two Electrad resistance strips, 900 ohms each.
 R3, R9, R11—Three Lynch metallized resistors, 0.1 meg.
 R6—One Electrad 1,500 ohm resistor B 15.
 R7—One Lynch metallized resistor, 50,000 ohms.
 R8, R10, R12—Three 5 meg. Lynch metallized resistors.
 One 7x21 inch Bakelite front panel.
 One 12x20 inch baseboard.
 Five 5-prong sockets and one 4-prong socket.
 One dial.
 One small knob, 1/4" shaft.
 One 110-volt AC switch with vol. control.
 Four binding posts: Ant., Gnd., Speaker+, Speaker—.
 Seven resistor mountings.
 T1—One filament transformer (2.5 volt winding at 9 ampere rating or more; 5 volt winding at 2 ampere rating or more). Guaranty Radio Goods Co.
 T2—One Silver-Marshall power transformer 230.
 Ch1, Ch2—One Silver-Marshall Unichoke, 231.
 C13, C14, C15, C16—Mershon condensers in one copper can; 9, 9, 9, and 9 mfd.
 One Aerovox Pyrohm resistor, type CC (with eight taps; four of which are used for connections in this circuit).
 R15, R16—Two 1-ohm resistors at 1.5 ampere rating or more (Yaxley, Carter, Frost).
 One 4-prong socket.

is made up of 250 volts on the plate of the last tube and 50 volts negative bias, the circuit diagram taking care of this distribution automatically. The filter condensers are Mershons, four condensers of 9 mfd. each in one can. The can is negative.

The 7½-volt winding of the power transformer, originally intended for the 281, is dropped to 5 volts for the 280 by inserting R15 and R16 at the position shown in the diagram. These resistors are 1 ohm or 1¼ ohm, if you can get the odd value. A center-tap is provided through the midtapped resistor, R14.

But if you want to use a 210 as the output tube, or even a 250 (but at total 300 volts only), you may use the 7½-volt winding on the power transformer, T2, omitting the resistors, R15 and R16, and applying the terminals of the winding directly to the output tube, the center tap on the resistor R14 being used for completing the circuit of the biasing resistor R6. Then the 5-volt winding on the other or filament transformer, T1, is used for heating the rectifier tube, the center-tap becoming the positive B line.

The rectifier tube, by the way, is drawn in Fig. 1 as if it had a grid, whereas it really has two plates and a filament as the three elements. However, the grid symbol is used because it represents the G post of the socket, and this fact makes identification easier. The two ends of the high-voltage winding are interchangeable, however.

Cable Connections

The AC cable leads of the filament transformer and the power transformer are united by connecting a separate cable to a male plug, the other end of the cable going to one side of the switch, as to one lead, and the second terminal of the cable remaining open temporarily. Then the cables of the two transformers are cut and joined, the junction including a lead from the free side of the AC switch and the hitherto open side of the outlet cable. As many will infer, the cable cut from either transformer may be used as the outlet cable. The result finally is that the switch turns the set on and off as a whole.

An interesting connection is that of the radio frequency filter circuit in the detector plate lead. This consists of two .00025 mfd. mica fixed condensers and an RF choke coil. The first condenser, C6, bypasses most of the radio frequency current that is bypassed, while the choke coil augments this filtration about 35 per cent., while any stray radio frequency currents, which are objectionable in the audio channel at all times, are eliminated by the second condenser, C7. This RF filter circuit also aids detection about 40 per cent. The return is made to the cathode K, instead of to ground, as the effect is much better that way. The detector is of the grid bias type, hence no leaky condenser is shown.

Capacity Values

As for the values of receiver constants, except for the condenser across the power tube's biasing resistor, R6, the two condensers in the detector filtering system and the antenna-ground series condensers CA and CG, all capacities are .02 mfd., about the highest capacity readily obtainable in mica condensers. It is well to use mica dielectric here, and most especially in the audio circuit as plate-to-grid condensers, because of the extremely low leakage, virtually nil. Paper condensers might cause leakage that would effectively destroy the intended biasing effect of R4, R5 and R6.

The capacity of the antenna series con-

denser is .0005 mfd. and that of the ground condenser the same. Their main purpose is to avoid a directly conductive path between aerial and receiver, ground and receiver and aerial and ground. Therefore if a high-voltage wire fell on your aerial, it would do no harm to your receiver, nor could any ground connection to a cold water pipe or radiator complete a connection with the high voltage side to short the AC house line if the plug is inserted in the wall outlet the "wrong" way. With the two condensers in circuit it makes no difference, in point of safety, which way the plug is connected to the convenience outlet. But one way sometimes gives noticeably more volume than the other, so choose the louder method.

227 Tubes Fine for RF

The 227 tubes will be found superior as radio frequency amplifiers to the 226, affording a little more volume, and removing all trouble from hum, because there is no AC on a directly heated filament. The 227 has a heater that is fed by the AC, stepped down by the filament transformer to 2.5 volts from 110 volts. The cathode or electron emitter gets its heat from the heater by thermal radiation.

The circuit design was chosen because it affords excellent results with relative simplicity in building and utter simplicity in operation. The front panel is a cinch. The baseboard is another matter. The parts should be accurately placed and the wiring made as neat and short as possible. There is plenty of room for all the parts, despite the 7x20x12-inch size of the baseboard (one inch narrower than the front panel).

No Shielding

No shielding is necessary, since only one screen grid tube is used, but the coils should be placed at electrical right angles. It is important to have a large winding for the primary L2, which accounts in part for the capacity effect that requires compensation, this capacity being reflected into the succeeding tuned secondary, and showing up on the dial as equal to about three degrees off register in the middle of the scale, unless corrected by the equalizers.

The cabinet to house this receiver is standard. Virtually all the large radio cabinet makers who cater to home-constructors have 7x21x12-inch cabinets.

Handy Cable

Then the only thing necessary is the speaker. This may be a dynamic, in a decorative baffle, placed anywhere, an extension cord making this possible. There is on the market a 50-foot extension cable that has leads for the speaker posts of the receiver, and plug for the convenience outlet, and which at the other end has a plug for receiving the AC cord of the dynamic and the leads for the speaker's tipped cords, as well. An AC switch is built into this convenient extension cable, so that this switch may be used for turning the set and dynamic on and off from any point within fifty feet from the set, including of course your bedside. The device renders the same service if a magnetic speaker is used, or if two speakers are used in series, but the set must be AC all-electric.

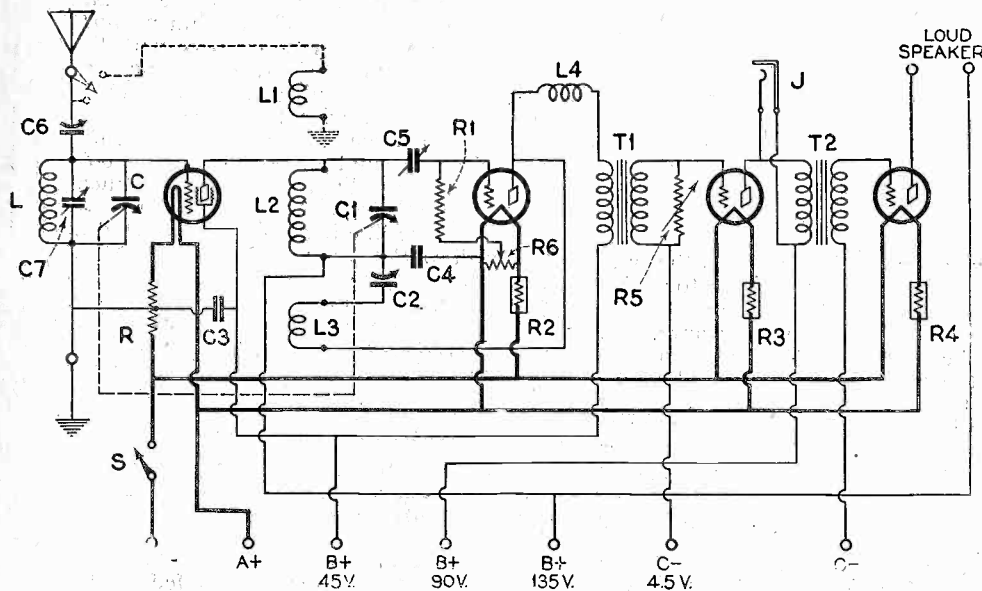
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(Part II of this article will be published next week, issue of March 23, Seventh Anniversary Number.)

A Short Wave

Oscillation at All Obtainable Frequencies

By Lewi



THE CIRCUIT DIAGRAM OF THE RECEIVER.
FIG. 2

Parallel Feedback Design Used, Following a Tuned Antenna Circuit with Screen Grid RF Amplifier—50 to 215 Meters Covered with Plug-in Coils.

[The two-tube short wave receiver described in the March 2nd and 9th issues is here described with two transformer stages of audio added, for speaker operation. The two-tube model is a receiver-adaptor, whereas the present circuit is complete for speaker operation.]

FOR those who want a single-unit loud-speaker short wave receiving set with unusual sensitivity from 50 to 215 meters, the set diagrammed in Fig. 1 was designed.

A tuned antenna system with its attendant high impedance is used for feeding the screen grid 222 tube. High degree of selectivity is also assured by this method. Because of the use of a special

trimmer condenser C7 it is possible to gang the tuning condensers C and C1 in the grid circuits, permitting actual one-knob control, and still maintaining the advantage of a tuned input circuit.

This trimmer is a special low capacity variable condenser, adjustable by means of a screw. Once it is adjusted, it need never be bothered with again. In other words, when a signal is tuned in by the gang-condensers, the trimmer is adjusted for maximum volume and then set.

The midget condenser C6 is a valuable aid to bringing in weak signals. It acts as an extra antenna tuner.

In the detector circuit the same parallel feedback system as was employed in the two-tube short wave receiver de-

LIST OF PARTS

C, C1—Two Hammarlund ML-7 .00014 mfd. variable condensers.

C2—One Hammarlund MC-23 .0001 mfd. midget variable condenser.

C3, C4—Two Parvovolt .5 mfd. bypass condensers.

C5—One Hammarlund EC-80 80 mmfd. equalizing condenser.

C6—One Hammarlund MC-15 .000065 mfd. midget condenser.

C7—One Hammarlund EC-35 35 mmfd. equalizing condenser.

L—One Hammarlund SWI-3 coil set, and one SW-120 coil.

L2, L3—One Hammarlund SWC-3 coil set, and one SWT-120 tuning coil.

L4—One Hammarlund RFC 250 radio frequency choke.

R—One 20-ohm midtapped fixed resistor.

R1—One grid leak with mounting.

R2, R3, R4—Three type 1-A Amperites.

R5 and S—One Electrad type WP Tonatrol.

R6—One 400-ohm midget potentiometer.

T1, T2—Two audio transformers.

J—One Yaxley midget type open circuit jack.

One Hammarlund SDB knob control drum dial.

One cable connector and plug.

Four sockets, No. 9040.

One 7x21x3/16" Westinghouse Micarta panel.

One binding post strip.

Four binding posts.

One 3/4x20x11 1/2" baseboard.

scribed last week, is used. This circuit permits smooth regeneration control, so necessary in short wave work.

The volume control R1 has the advantage of permitting a zero volume control, even if there is a direct pick up in the detector coils. This system of volume

New 245 Tube Out; Handles Large Power

A new power amplifier tube for supplying large undistorted output to the loudspeaker, was announced by the Radio Corporation of America. Radiotron UX245, as the tube is designated, is capable of delivering a power output equal to that of the UX210, but at a plate voltage not exceeding 250 volts. It is not interchangeable with the UX171A or any other power amplifier Radiotron.

The new tube can be used only with apparatus especially designed for it, and is intended for use in the last audio amplifying stage of power line operated sets which supply not more than 2.5 volts to the last audio socket, as well as proper grid and plate voltages.

The filament in the new UX245 is of the coated ribbon type, which assures great strength and high emission. To keep the exceedingly high plate current of this Ra-

diotron from the loudspeaker windings, it is essential to use some form of loudspeaker coupling such as an output transformer or a choke coil and condenser.

The characteristics of the UX245 follow:

- Plate voltage, 180; volts, 250.
- Negative grid bias, 33; volts, 50.
- Plate current, 26; milliamperes, 32.
- Plate resistance, 1,950; ohms, 1,900.
- Mutual Conductance, 1,800; micromhos, 1,850.
- Amplification factor, 3.5; 3.5.
- Undistorted power output, 750; milliwatts, 1,600.
- Filament—Volts, 2.5; amperes, 1.5.
- Maximum overall—Length, 5 5/8"; diameter, 2 3/16".
- Base—Standard large UX.

The public release date for the tube was set at around March 15th.

Literature

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. Either this blank may be used, or a post card or letter will do instead.

- Jos. H. Mitchell, 205 N. Palafox St., Pensacola, Fla.
- Henry's Radio Clinic, 4640 14th Ave. S., Minneapolis, Minn.
- Rex M. Kirton, 12 27th Ave. S.E., Minneapolis, Minn.
- Rudolph Zahalka, Route 1, Rupert, Idaho.
- J. B. Taylor, 496 S. 16th St., Newark, N. J.
- R. I. Thomas, 2927 Tex. St., Greenville, Tex.
- Roy M. Molino, 1134 53rd St., Oakland, Calif.
- Clayton Hendeck, 1110 James Ave., Niagara Falls, N. Y.
- C. E. Metcalf, 45 Hatherley Rd., Toronto, Can.
- S. B. Smith, care of Metro. Edison Co., Dock St., Easton, Pa.
- W. F. Villenave, Am. Railway Exp., Donora, Pa.
- J. G. Jernberg, 127 Lincoln Ave., Wollaston, Mass.
- H. G. Johnson, 1007 Staples St., Corpus Christi, Tex.
- Geo. F. Klersy, 223 N. 16th St., East Orange, N. J.
- Ellis Watson, 2544 Warren Blvd., Chicago, Ill.
- Cecil M. Hurlbut, 1773 Elingrove Drive, Elmwood Park, Ill.

Speaker Circuit

Assured by Proper Choice of Parts

Winner

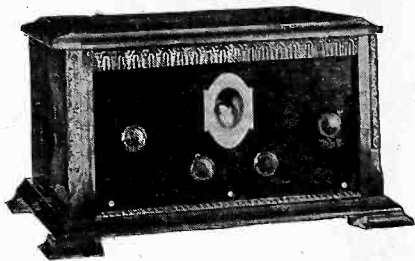


FIG. 3
THE RECEIVER IN A CABINET

control minutely changes the characteristic of the audio frequency transformer. It has been found, though, that the signal level is very rarely high enough to necessitate so low a resistance setting as to make any practical difference. If the signal is too great, the regeneration condenser may be detuned a bit.

Use of Proper Coils

On short waves there is nothing so vital to successful operation as the use of low resistance coils with a low distributed capacity.

Since dielectric losses increase very rapidly with the frequency, the absolute minimum must be obtained. This is done by space-winding the turns (even spacing to secure uniform current distribution), over a continuous film of special dielectric, with No. 16 wire. The coil is wound ten turns to the inch, so that the spacing between the successive turns is slightly more than the diameter of the wire itself. The distributed capacity and the high frequency resistance of the coil thus are reduced further.

Another unit of short wave sets which must be correct is the radio frequency choke.

The distributed capacity must be at minimum, since the frequency range is great and the choke is usually operated below its resonant frequency. That is, it is operating at a frequency where the

LIST OF PARTS

For the Tuner alone, as described March 2d and 9th.

- C—One Hammarlund .00014 mfd. ML-7 condenser.
- C1—One Hammarlund MC-23 midget condenser.
- C2—One Hammarlund EC-80 equalizer condenser.
- C3, C4, C5—Three Sprague Type F .1 mfd. condensers.
- L2, L3—One set of Hammarlund SWC-3 short-wave coils.
- L4—One Hammarlund RFC-250 radio frequency choke coil.
- R—One Electrad Type P Tonatrol.
- R1—One Yaxley No. 820 C, 20-ohm mid-tapped resistor.
- R2—One Yaxley No. 804 4-ohm resistor.
- R3—One Durham metallized grid leak, 2 to 9 megohms.
- One Yaxley No. 10 midget battery switch.
- One Hammarlund SDW Knox control drum dial with light.
- Three Hammarlund SDWK walnut knobs.
- One Hammarlund SWAP adapter plug and cable.
- Two Eby No. 12 sockets.
- One Westinghouse Micarta 7x14 inch panel.
- One package containing necessary hardware.

only radio frequency current that passes through goes through the distributed capacity.

Also when the choke is used in a regenerative circuit, as here, the impedance of the choke must be high. Otherwise the output of the circuit will be shorted at some frequency and thus prevent the circuit from oscillating at that frequency. The Hammarlund RFC250 fully complies with these requirements, having an inductance of 250 millihenries, a capacitance of 2 mmfds. and a direct current resistance of 420 ohms.

Shielding Not Essential

The question of shielding arises. If the layout is followed carefully, there is no need for shielding. The leads, also, must

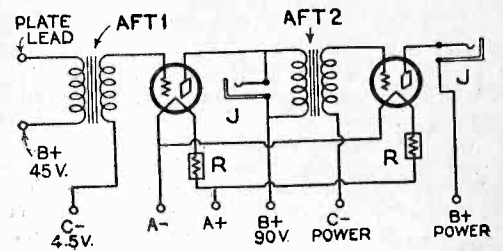


FIG. 4
THE AUDIO AMPLIFIER ALONE.

be kept not only as short as possible but as direct as possible.

If desired, however, the radio frequency stage may be shielded by following this plan. The entire radio frequency circuit, which includes the antenna coil, condensers, tube socket and resistor, must be placed in the shield. The detector socket must be placed right next to that part of the shield through which the plate lead of the radio tube will come from. The antenna post connection should be made directly on the shield with the aid of a piece of hard rubber.

The proper bias for the detector tube for the maximum sensitivity is procured with the aid of the potentiometer R6. The value of the grid leak, which varies from 2 to 9 megohms according to the tube characteristics, averages 5 megohms.

First Audio Jacked

As will be noticed from the diagram, a jack is included in the output of the first audio tube to permit listening in to stations which are just about audible in the detector output circuit. The control R5 prevents any blasting.

The tuning directions outlined last week should be followed for the tuning of this set.

The 112A is best for the detector circuit. In the audio circuit, the 201A tubes may be used.

A point about the antenna. Install an antenna 20 to 60 feet long, as high as possible. The signals are much louder with one of this type than with the standard broadcast aerial.

Batteries work better than rectified alternating current for filament, plate and grid supply.

Wanted

RADIO WORLD,
5 West 45th St., N. Y. City.
I desire to receive radio literature.

Name
Address
City or town
State

- H. W. Ideler, 3153 Ogden Ave., Chicago, Ill.
- B. B. Ward, care of Gen. Del., Houston, Texas.
- Clarence King, 1607 Crump St, Ft. Worth, Texas.
- V. S. Robson, 3052 15th Ave. So., Minneapolis, Minn.
- Wm Hoewischer, 621 E High St, St Marys, Ohio.
- Edward J. Mayfield, 1933 Marmion Ave., Bronx, New York City.
- R. J. Sullivan, 1804 N. Mason Ave., Chicago, Ill.
- Louis Lasota, 4928 Homerlee Ave., East Chicago, Ind.
- Carroll Spicer, Ivy Depot, Va.
- A. Sutton, R. D. 57, Box 364, Sharon, Pa.
- L. W. Embby, 414 N Prince St, Lancaster, Pa.
- John E. Townsend, 1855 Chapel St., New Haven, Conn.
- John Allen, 8217 Fort Hamilton Ave., Brooklyn, N. Y.
- E. J. Eckman, 721 1/4 W. 10th Pl., Los Angeles, Calif.
- W. L. Goodheart, Crescent Studio, 326 W Jefferson St., Louisville, Ky.
- John Chelmowski, 283 17th St., Brooklyn, N. Y.

Tester Tells Quickly What's Wrong In Set

(Continued from page 11)

of to minus A the same process is followed. The battery Eg is necessary in either case. Usually it will be found that the actual grid bias is different from the applied bias.

Choke Coil Coupling

Suppose a resistance coupled stage is followed by an impedance or transformer coupled stage. The same method as above may be used for measuring the actual bias by merely substituting a milliammeter which will handle the higher plate current which will flow. The method is applicable to any kind of coupling both ahead of the tube and after it. It is also applicable to AC circuits. But then the positive terminals of the battery Eg and voltmeter V should be connected to the midtap of

the filament transformer, or to the midtap of the balancing resistor.

No heater type tube has been included in the figures. But this tube does not offer any special difficulties because the cathode takes the place of the negative terminal of the battery tube filament or the midtap of the AC filament.

While the foregoing discussion relates to meters used separately, several excellent testers are on the market that have meters built into them permanently. A cable with plug connects to a socket in a receiver to be tested, so that receiver circuit and the tube put in the tester are subjected to analysis. Such a tester should read 0-10 volts AC and DC; 0-20, 0-100 milliamperes, and 0-300 or 0-500 or 0-600 volts (high resistance meter).

How Many Turns?

Table and Text Answer Inductance Questions

By J. E. Anderson

Technical Editor

COIL winding data are always in demand. Fans want to know how many turns to wind for a given coil in a given circuit. Rarely do these fans give the necessary specifications for the coils. Many seem to think that the size of the condenser is enough. The condenser is only one of the necessary specifications. Of equal importance is the size of the tubing on which the turns are to be wound. The size and insulation of the wire, also the spacing of the turns, enter.

In view of the many requests received for information on coil winding, the following table will be found useful. It contains winding data for various sizes of tubing ranging from 1.5 to 3.5 inches in diameter, in steps of one fourth of an inch. These are all standard tubing sizes.

Effect of Distributed Capacity

The turns data given in the table have been obtained on the assumption that the distributed capacity in the coil and in the circuit is negligible. It never is, except when the coil is used as a wavetrap. But neglecting the distributed capacity leads to a coil having more turns than will be required. It is for this reason that the capacity was neglected. It is easier to wind too many turns and then to remove the required number than to wind the coil too small and then add more turns to make up for the deficiency.

All the coils have been determined on the basis of a tuning range covering the broadcast frequencies, that is, from 550 to 1,500 kilocycles.

Size of Wire Used

The size of wire used for each size of form is that which gives approximately the correct shape to the winding. In every instance the insulation is DCC wire. This insulation is the thickest and therefore for a given number of turns gives the least inductance. This insulation was purposely selected for the same reason that the distributed capacity was neglected. The number of turns required to give a specified inductance is greater when DCC wire is used than when any other is used. Hence when any other wire is used the inductance will be slightly too large. But, as before, it is easy to remove a turn or two to get the correct inductance in any one case.

The table contains winding data for two sizes of condensers, namely, .0005 mfd., requiring an inductance of 167.1 microhenries, and .00035 mfd., requiring an inductance of 239 microhenries. The number of turns given is the nearest whole number which gives the inductance specified.

The first column in the table gives the diameter *D* of the tubing on which the coils are wound. The second column gives the number of double cotton covered wire used. The third column gives the number of turns per inch *N* of this wire.

It is assumed that the turns are close wound. The fourth column gives the number of turns *N* required to give 167.1 microhenries, and the fifth column gives the number of turns required to give an inductance of 239 microhenries.

Examples of Winding

Suppose the size of the tubing is 3 inches in diameter. The most suitable wire

Table of Turns For RF Circuits

<i>D</i>	Wire Size	<i>N</i>	<i>n</i> (.0005)	<i>n</i> (.00035)
1.5	32	60	76	100
1.75	30	54	66	88
2.00	28	47	61	78
2.25	28	47	53	68
2.50	26	41	50	65
2.75	26	41	44	58
3.00	24	34	44	57
3.25	22	29	43	56
3.50	20	23	43	56

There is a tendency to make coils of smaller diameters. Requests for such coils of one inch diameter which will cover the broadcast band with .0005, .00035 and .00025 mfd. tuning condensers are often received. Of course such coils can be wound to the required inductance for any tuning condenser. But they are not always practical, particularly when it is desired to use heavy wire. Imagine a coil of one inch diameter wound with No. 18 double cotton covered wire. It would take the approximate shape of a broom handle.

There may be some gain in compactness by using small coils but it must be admitted that a few broom handles stuck into a set would not make a very attractive or compact set. A one-inch diameter coil wound with this size wire for either .0005 or .00035 mfd. condenser would not be quite so long as that wound for the .00025 mfd. condenser.

Coils should be wound with the wire which is most suitable for the diameter of the form. The smaller the diameter the smaller should the wire be. But the reduction in the diameters of the wire and of the form should not be carried too far, for as the wire is decreased in size the resistance goes up rapidly. If the circuit is to be at all selective, a reasonable size wire must be used, and it follows that the form should be of reasonable size.

is No. 24 DCC and the required number of turns to give an inductance of 167.1 is 44, and to give an inductance of 239 microhenries 57 turns. Suppose the diameter of the form is only 2 inches. The wire suitable for that is No. 28 DCC. The number of turns for the .0005 mfd. is 61 and that required for the .00035 mfd. is 78 turns.

It will be observed that in several instances the number of turns is the same for different sizes of diameters. This is due to the difference in the number of turns per inch.

Turns per Inch Count

The coils for the .0005 mfd. condenser have a better space factor than those for the .00035 mfd. condenser, and therefore they will be slightly more selective. But the longer coils have a slightly lower distributed capacity, and that is just what is needed for the smaller condenser. The coils were purposely selected with this in view. All of the coils have a space factor smaller than the theoretically optimum

but this was done to get a low distributed capacity and a small magnetic field.

It should be observed that it is not the size of the wire that determines the inductance, but rather the turns per inch as given in the third column. If larger size of wire with a thinner insulation but having the same number of turns per inch as the wire listed, that may be substituted without any change in the inductance, provided that the actual number of turns is kept the same.

Also, if fine wire of spaced turns is used, the inductance will be the same if the number of turns per inch and the total number of turns are kept the same.

The coils listed in the table are only for the tuned circuit. Nothing is given for the primaries or the ticklers. These depend on the tubes with which the coil is to be used. While the actual number of turns for these windings cannot be given, some general principles can be stated for guidance.

Importance of Fine Wire

If the primary is placed in the plate circuit of a tube the resistance of the coil is of no importance. Therefore very fine wire may be used. Several advantages accrue from the use of fine wire. It takes little room and therefore makes the oil compact. It has little capacity and therefore it reduces the distributed capacity of the primary and the secondary, or of the secondary to ground. It has only a small amount of metal and therefore there will be very little eddy current losses. The selectivity of the secondary will be greater as a consequence.

The fine wire may be used for any primary connected in the plate circuit of a tube, provided that the primary is not to be tuned. If it is, the secondary should be wound with fine wire. The fine wire can be used for any tickler winding since this is always in the plate circuit of a tube.

The only primary which should not be made of fine wire is that which is connected in the antenna circuit. This should be no smaller than the wire used in the secondary.

If the coil follows a screen grid tube the primary should have a larger number of turns than untuned otherwise.

Turns On Tickler

The number of turns on the tickler cannot be stated either, for it depends on the tube that is used as well as on the plate voltage, the grid voltage, the load resistance in the plate circuit, the losses in the tuned circuit and on many other conditions. The correct number usually lies between 1/3 and 2/3 of the number of turns on the secondary. This applies also for the plate coil in an oscillator.

A coil cannot be designed so that it will cover any given wave band. The condenser and the inductance determine only one point, and that is taken as the upper wavelength limit of the broadcast band. The lower limit to which the combination will reach depends on the distributed capacity in the tuned circuit. The only way to get a low minimum, with a given tuning condenser, is to keep the distributed capacity down to the lowest possible value. In this respect it is better to use a .0005 mfd. condenser than a smaller one.

However, for practical purposes the table of turns may be followed with assurance of success.

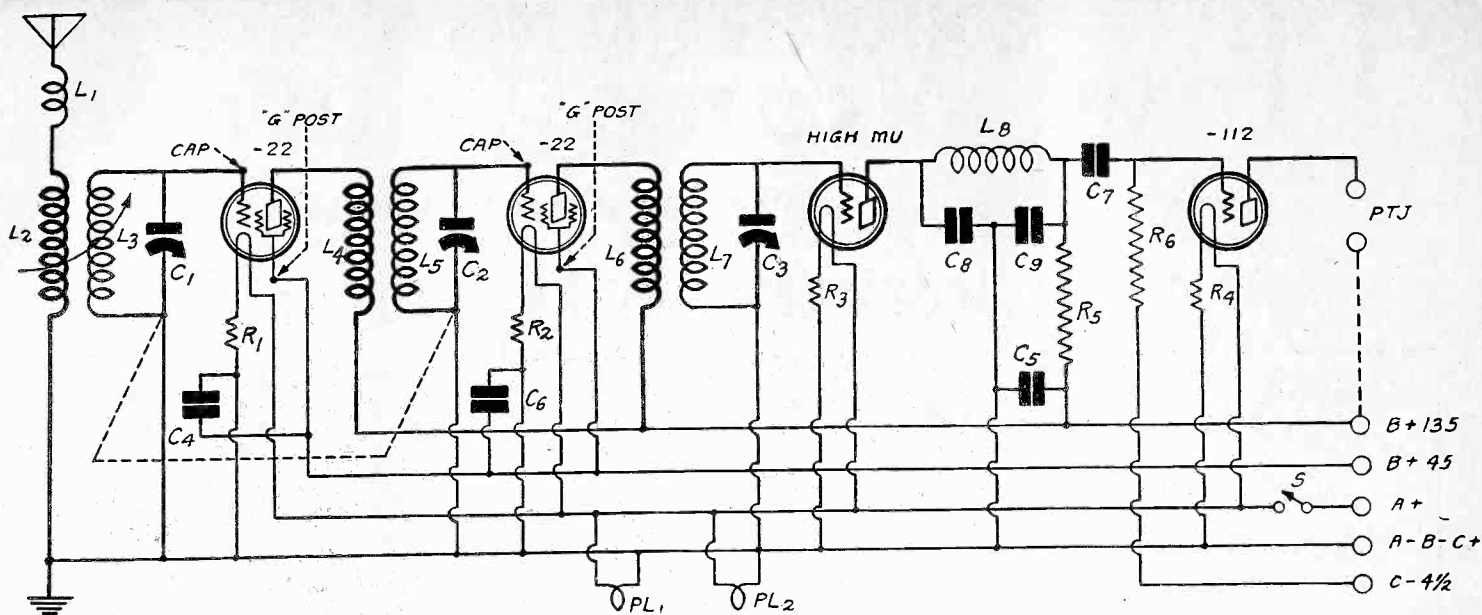


FIG. 736

THIS CIRCUIT IS SUITABLE FOR PUTTING AHEAD OF A PUSH-PULL STAGE OF AUDIO AMPLIFICATION. IT HAS HIGH SENSITIVITY, HIGH SELECTIVITY AND IS FREE FROM DISTORTION. REQUESTED BY CRAIG STEWART.

Radio University

I HAD VERY good results with my 5-tube set until I moved to a house where I could not use an indoor aerial. Now I cannot get the local stations either with an indoor antenna or a loop. What can I do to improve the sensitivity?

(2)—Will the screen grid tube help much in this case?

(3)—Is it practical to install a screen grid tube? My set has one TRF, regenerative detector and three audio.

JOSEPH WILKINS,
The Bronx, New York City.

(1)—You may increase the number of turns on the primary of the first RF transformer (antenna coil) as well as on the primary of the three circuit tuners.

(2)—The screen grid tube is your best chance of getting good results.

(3)—Yes, by changing the three circuit tuner so as to fit the screen grid tube. Follow the diagram of the new screen grid Diamond.

* * *

I HAVE a magnetic pick-up with which I play records. The sounds from the phonograph record played with this instrument are muffled in comparison with the sound from the same record played on a regular machine. The amplifier is not at fault, for it sounds all right on radio reproduction. What is the cause of the muffling?

(2)—Could this muffling be due to the volume control connected across the leads from the pick-up?

(3)—Is it a fact that the pick-up unit rapidly ruins a record?

MARTIN P. CASEY,
New Bedford, Mass.

(1)—The muffling is undoubtedly caused by the pick-up unit itself. It may be damped too much. The damping is more effective on the high notes, and hence the output appears muffled, just as if the music were heard through a wall.

(2)—The volume control may contribute some of the muffling, but only to a minor degree.

(3)—If the unit is too heavy it will engrave the record rapidly and ruin it in a short time. The pick-up unit should be light or counter-balanced.

* * *

I WISH to obtain a home talking movie outfit on a miniature scale. Can such be obtained at this time? If so, please put me in touch with the makers.

(2)—Can the audio amplifier in an or-

dinary radio receiver be used for playing the record?

MILTON SEVERIN,
Detroit, Mich.

(1)—Such an outfit may be obtained in a very compact form. It is made by one of the best known moving picture projector makers. It plays 16 millimeter films and a phonograph record of standard sizes.

(2)—Yes, any good audio amplifier will do.

* * *

MY RECEIVER is constructed of the best parts obtainable. I have a first class power pack and a push-pull amplifier. Yet the output is not good and there is always a high-pitched squeal. What is the trouble?

(2)—What would you suggest to take out the hum in my AC dynamic speaker? The hum is not severe but unpleasant.

(3)—I notice that the hum is louder when I use a baffle board. Would you recommend using the speaker without the baffle?

STUART MACINTOSH,
Brooklyn, N. Y.

(1)—It is possible that the squeal is due to an unbalance in the pushpull stage on the higher frequencies. This is a common occurrence. Connect a small condenser across one side of the secondary of the push-pull input transformer. Which side you have to find by experiment. Use a condenser of .00025 to .001 mfd.

(2)—An electrolytic condenser of large capacity across the field winding has proved a very satisfactory remedy in such cases.

(3)—Don't omit the baffle board. Its object is to bring out all the low notes.

* * *

THERE IS A TERRIFIC scratching noise in my loudspeaker at times. I have tested everything in the set and cannot find anything defective. The scratching disappears when I remove the antenna, or when the station stops broadcasting. It happens on all stations, particularly on the loud ones. Can you explain?

THOMAS ROSS,
Denver, Colo.

The noise is probably due to a swinging antenna that rubs against something. You will probably find that the noise is worst in wet and windy weather.

* * *

Show a circuit to feed push-pull.

CRAIG STEWART,
Alberta, Canada
See Fig. 736

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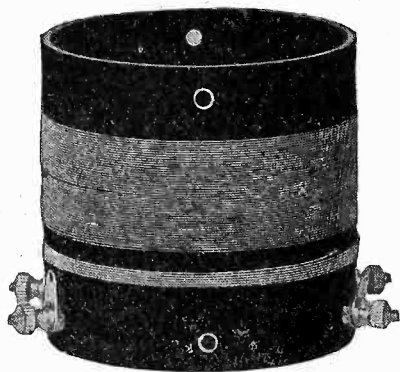
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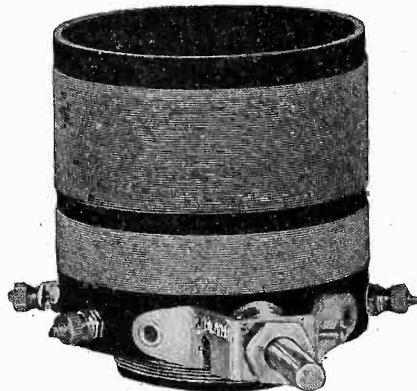
They Meet the Needs of Battery-Operated or AC Screen Grid Tubes, and General Purpose Tubes of Battery or AC Types.

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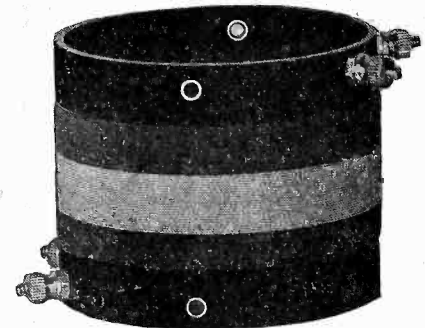
The DIAMOND Pair



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



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



A5 \$1.75

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

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

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

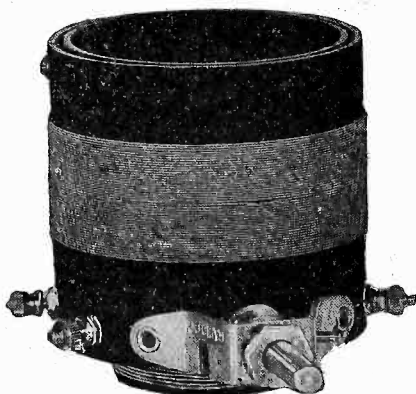
The radio frequency tube is a screen grid which requires a high impedance load on the plate circuit, provided by SGT5 having a 24-turn fixed, untuned primary. The secondary is tuned.

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

And, remember, the dials track nicely!

Data on Coils

The coils are wound on blood-orange bakelite, with tuned windings in blue silk insulation, untuned windings in strawberry silk insulation and tickler in Litzendraht, with gold insulation. The outside diameter is 2 1/2 inches. All tuners (i. e., three-circuit coils with rotor winding) have single hole panel mount. All other coils have holes for perpendicular or horizontal mounting, and hardware to accomplish this. All tuned windings are center-tapped. All coils are sold on a five-day money back guarantee. If you're not delighted with them, for any reason, send them back in five days and get your money back.



HT5 \$3.00

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

The UNIVERSAL Pair



RF5 \$1.50

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



TP5 \$3.00

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

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

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- L1L2—Antenna coil (AC5).
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- C1—Aerovox .0005 fixed.
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- C3, C4—Two Aerovox .008 mfd.
- C5—Hammarlund .0005 mfd. Midline.
- C6—Aerovox .00025 mfd. with clips.
- C7—Aerovox .0005 mfd. fixed.
- A1—622 Amperite with mount.
- A2, A3, A4—Three 1A Amperites, three mounts.
- R1—50 ohm Frost rheostat.
- R2—5 meg. Lynch metallized leak.
- T1, T2—Two National A100 audios.
- Ant. Gnd., Sp., Sp. + posts.
- Pl—Jewel window and lamp.
- Sw—A battery switch.
- 7 x 21 inch front panel.
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- Two dials with pointers.
- Two knobs.
- One roll stranded Braiddite.
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- Send \$7.50 for set of four tubes for this receiver.
Specify whether power tube wanted is 412A or 471A
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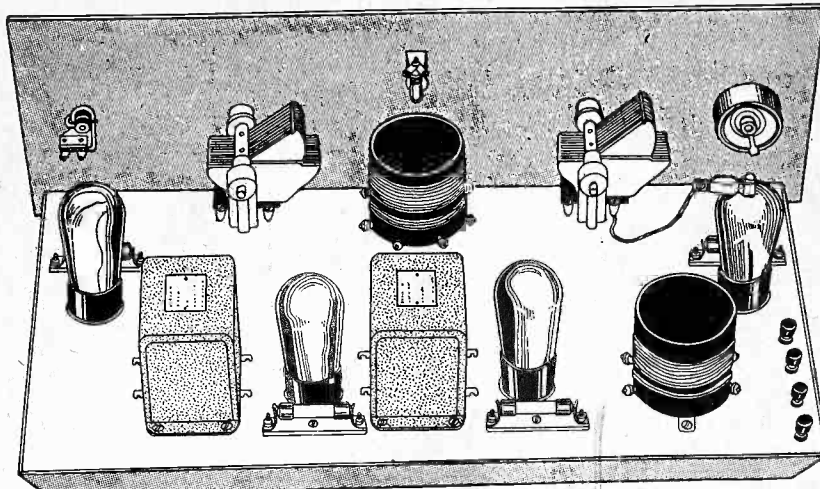
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145 West 45th Street New York City
Few Doors East of Broadway

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. Hennessy, Vice-President; Herman Bernard, Secretary. Roland Burke Hennessy, Editor; Herman Bernard, Managing Editor; J. E. Anderson, Technical Editor; Anthony Sodaro, Art Editor

Most Selective
is the new 4-Tube Screen Grid
DIAMOND



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

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

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Enclosed please find \$1.00 for which please send at once the official blueprint of the new, highly selective 4-tube screen grid Diamond of the Air, as designed by Herman Bernard.

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

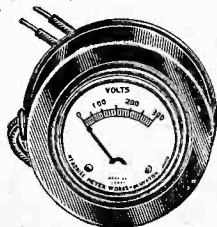
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RADIO WORLD

145 West 45th St., New York City

Published
Weekly

HIGH-RESISTANCE
VOLTMETERS



0-300 V., in portable type, full nickel finish, 30" tipped cord (illustrated at left). (Cat. No. 846) **\$4.50**

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

Just the thing for service men custom set builders, home experimenters.

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

HBH Unit

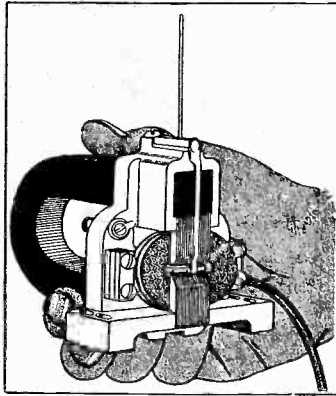
ALL acoustical and radio engineers agree that the balanced armature type of loudspeaker unit is the best, the most sensitive and the most faithful of all magnetic units. But it is only in the HBH unit that superior designing skill, scrupulous care in the selection of the best materials, and extreme accuracy of manufacture have been combined and co-ordinated so as to bring out all the possibilities of the principle of the balanced type unit.

Any magnetic speaker requires a strong permanent magnet for its operation. The strength of the HBH unit is assured by the use of a long magnet of large cross-section, made of specially selected, high coercive-force steel, forged under the lowest heat possible, scientifically tempered in oil and aged.

The making of a permanent magnet requires a highly specialized skill. It must be forged, cut and tempered with as few heatings as possible, and no heating must exceed a certain temperature if the magnet is to retain its strength and permanence. Another important feature of the magnet which enhances its strength and permanence is that NO HOLES ARE CUT IN IT. The magnet is one solid piece of steel and the pole pieces are clamped firmly to the steel by screws in the die cast harness holding the pole pieces and the armature.

The sensitivity and efficiency of the unit are enhanced by the use of laminated, properly tapered silicon steel pole pieces. Eddy current losses are thus reduced to a vanishing minimum and all the force is concentrated on the ends of the armature.

The armature itself is made of carefully annealed soft iron, thus eliminating any residual magnetization and reducing eddy currents and hysteresis losses to a very small percentage of the energy involved in the operation of the unit. The armature is made short and heavy to enhance its effectiveness in translating electro-magnetic energy into sound.



The HBH Unit, representing the most skillful and sturdiest magnetic unit design. Mfgd. under BBL License.

Price \$5.95
Moulded bracket (extra) 65c

This Armature Stays Put

THE armature is firmly mounted on a steel spring of great permanence, which in turn is mounted rigidly on the die-cast harness. At one end of the suspension spring is a rocker arrangement provided with two set screws, one on each side of the fulcrum, by means of which the armature quickly and accurately may be adjusted to the neutral position between the pole pieces. This is one of the fine improvements which determine the usefulness and efficiency of a loudspeaker unit. An accurate and permanent adjustment of the armature between the pole pieces is necessary for both sensitivity and great volume. This armature is permanently adjusted at the factory and stays put!

Two large armature coils, mounted so that they cannot interfere with the movements of the armature and the spring, surround the armature. These coils are connected in series aiding and are proportioned so that they afford the proper impedance for the regular power tubes employed for loudspeaker reception. The armature coils have bakelite ends and cores and are rugged and provide adequate insulation for the armature coils.

The armature is connected to the reduction lever by means of an extremely light yet rigid coupling rod. Two points of flexure are provided on this rod so that the armature and the reduction lever may move freely. The central portion of the rod is made so that it cannot vibrate at right angles to its length. This eliminates local resonance and vibration which often give rise to false sounds in units.

The reduction lever is provided with a single point of flexure, near its pivot. The rest of the lever is rigid but extremely light. It cannot bend except at the point provided for flexure.

The steel driving rod connecting the reduction lever with the apex of the cone is short and stiff, yet light in weight, so that it cannot vibrate at right angles to its length. It is attached to the reduction lever to the center of gyration, which is a requirement for transferring most efficiently the power to the cone.

The die-cast harness which holds the entire unit together is rugged and holds the parts without any chance of parasitic vibrations. It is provided with four elongated mounting holes for attaching the speaker to the frame of any cone speaker. Two binding posts for the terminals are also mounted on the harness. These are insulated from the frame by bakelite and bushings with sufficient insulation to withstand the highest voltages which will be encountered in practice.

The HBH unit is the most sensitive and hence gives the greatest volume for a given input. It is the most efficient and hence does not waste any power but gives it all out as sound. It is capable of great output power and will work on any tube, from a 199 to two 250 tubes in push-pull. Its impedance is correct for the usual power tubes used in sets.

It does not give out any false tones or rattles and therefore it produces the best quality, purest tone.

Nobody ever returned an HBH unit because of dissatisfaction with its performance! It stands up and delivers and continues to deliver. You can put 150 volts right through the magnet coils, steadily, without danger of the coil breaking. You don't need any extra power to operate this unit—as you do with dynamics—but get full efficiency at lowest cost and greatest economy.

Put this unit in your cone or cloth speaker in place of the unit now there and marvel at the difference! You will then recognize the technical superiority of this unit in terms of tone value and volume. It produces so much more volume than most other units that it makes distant stations sound like locals.

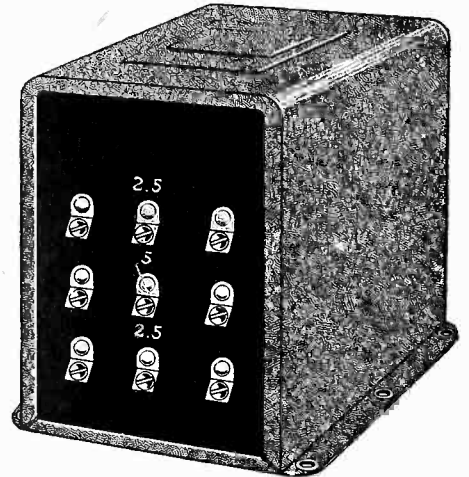
Order a unit today! Send \$4.00. Try the unit ten days. If not overjoyed, return it for full refund. Otherwise take 90 days to pay the extra \$1.95.

10-day money back guaranty!

90 days to pay in full!

New Heavy-Duty Filament Transformer

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



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

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

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

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

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

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

The transformer is beautifully finished in cracked glossy black, with bakelite front, and comes equipped with 52-inch AC cable with plug. Six riveted mounting holes for baseboard or subpanel. Size, 3¾ in. high, 2½ in. wide, 3 in. deep. Shipping weight, 6 lbs.

Cat. F226A, for 50-to-60 cycles, 105-to-120 volts AC, Net Price\$6.00

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

Please ship one HBH Unit only on 10-day money-back guaranty; at \$4.00 down, balance of \$1.95 in 90 days, unless I return the unit in 10 days for full refund of \$4.00.

Please ship moulded bracket also at 65c.

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DYNAMIC BAFFLE

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

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Your name will be put on the mailing list free of charge on request.

A COMPLETE CATALOG with illustrations and detailed descriptions may be obtained free of charge on request.

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10 words minimum
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PATENT YOUR IDEAS. Easy terms. Booklet Free. Established 25 years. H. Sanders, Rand McNally Building, Chicago, Ill.

\$5 STARTS YOU in printing business. Five hundred cards printed in three colors. Samples FREE.—Frank B. Ashley, Room 1517, No. 461 Eighth Avenue, N. Y. City.

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

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Reliable, prompt, accurate, in every-day language, 25c per question. Radio Information Bureau, 1426 South Clifton Park, Chicago.

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ALFALFA SEEDS, hardy common varieties \$8.40, \$10.20, \$12.60, bushel; Grimm variety Alfalfa seed \$18. Scarified sweet clover \$3.90, \$5.20; Alsike or red clover \$15. Bags Free. Send for samples and catalogue. Kansas Seed Co., Salina, Kan.

WHO HAS a 350-meter loose coupler formerly made by William Duck of Cincinnati? This coil had five taps and the primary had a sliding connection across bare wires. Address Tom W. Searle, Cascade, Mont.

MARVELOUS NEW pick up for phonograph. Only twelve left, all pippins. Money-back 10-day guarantee. Send \$13.50.—P. Cohen, Room 1214, at 143 W. 45 St., N. Y. C.

AGENTS

AGENTS averaging \$17 daily showing new amazing household device that washes and dries windows, sweeps floors, cleans walls, scrubs, mops. Cleans autos. Very attractive price. Over 100 per cent profit. Harpers, 633 3rd St., Fairfield, Iowa.

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GARAGE door holders. Large profits. Specialty Manufacturers, 524 Hall Bldg., Kansas City, Mo.

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

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SEVENTH ANNIVERSARY NUMBER

of Radio World, extra number of pages, special features, extra circulation, will be published next week, MARCH 23rd.

More Profits To Set Builders

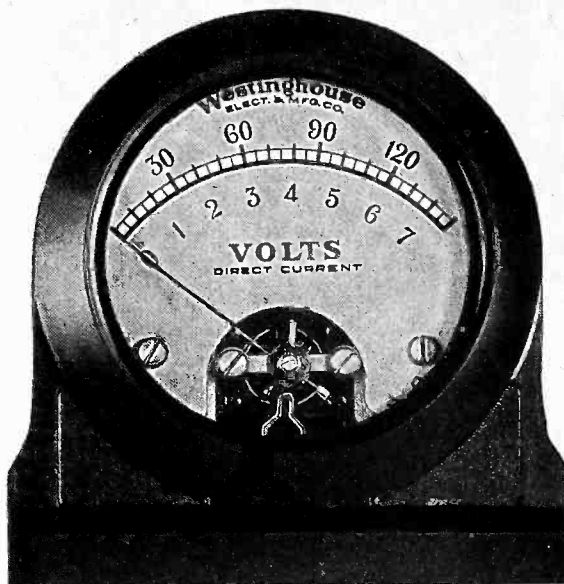
One good radio idea may be worth millions. Barawik has thousands of ideas for radio set builders to make more money. Barawik's Big Radio Book will help you while elections are on and big national events stir the world.



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BARAWIK CO. 133B Canal Station, CHICAGO, U. S. A.

Westinghouse 0-7½ 0-150 volts

Double Range Table Model Voltmeter FREE!



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

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

The scale is read through a sturdy crystal.

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

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

Meter Employs Dynamic Principle

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

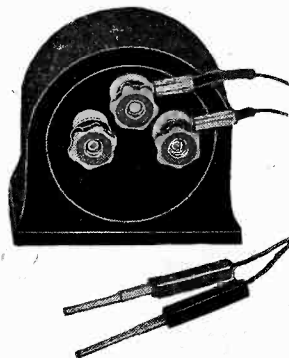
End-stops are built in. The low scale (0 to 7½ volts) reads ¼ of a volt per division, with ample room for closer reading, while the high scale (0 to 150 volts) reads 5 volts per division, with closer definition equally easy.

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

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

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

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



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

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

Enclosed find \$6.00 for one year's subscription for RADIO WORLD, (\$2 numbers, one a week) and send as a premium one Westinghouse double scale table model voltmeter (0-7½ and 0-150 volts direct current).

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

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City State

THIS OFFER EXPIRES MARCH 23RD, 1929

FILL OUT AND MAIL NOW SUBSCRIPTION BLANK

RADIO WORLD

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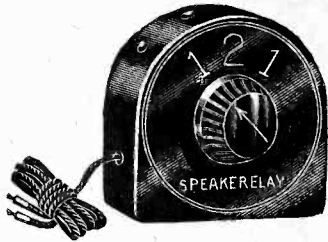
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please find enclosed

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Add \$1.00 a Year for Foreign Postage; 50c for Canadian Postage.

\$100⁰⁰ WORTH of Pleasure and Convenience for Only \$2⁰⁰



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

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

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

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

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

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

You can get \$100 worth of service out of one of these \$2 products

Cat. No. 121 (illustrated).....\$2.00

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

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

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

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

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

PARTS FOR THE AC 4

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

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New York City

COILS FOR THE NEW AC 4

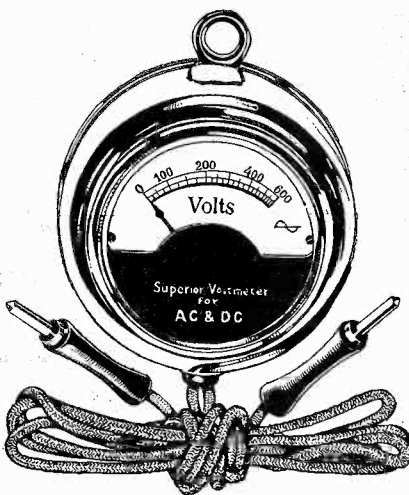
Two AC5 (for .0005 mfd.) @ \$1.50 each....\$3.00

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

SCREEN GRID COIL CO.
143 West 45th Street
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O-600 V. AC and DC High Resistance Meter

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



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

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

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

Please ship at once one 0-600 volts AC and DC high resistance voltmeter, accurate to 1% plus or minus (Cat. No. 600); meter equipped with 3-ft. cord, moulded tip receptacles, tips and hanger.

[Put cross in proper square below.]

\$7.00 enclosed

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

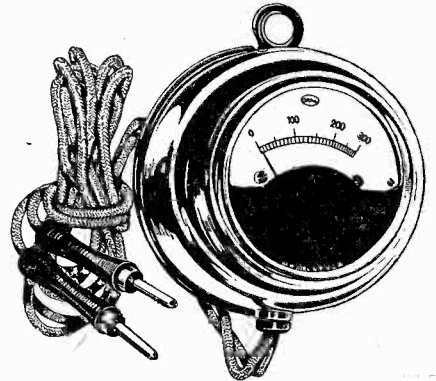
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Individual METERS

For Portable or Panel Use



High resistance 0-300 Voltmeter, accurate to 1%. Measures any DC voltage to 300, including B eliminators. Provided with 30" cord, with luxurious jack tips and hanger. Meter full nickel de luxe finish. No. 348F. \$4.50
No. 347F, same as above, but 0-500 volts, \$6.00

POCKET AND PORTABLE VOLTMETERS

- No. 8—For testing A batteries, dry or storage, 0-8 volts DC scale.....\$1.00
- No. 10—For testing A batteries, dry or storage, 0-10 volts DC scale..... 1.00
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- No. 50—For testing B batteries, dry or storage, but not for B eliminators, 0-50 volts DC scale..... 1.00
- No. 39—For testing B batteries, dry or storage but not for B eliminators, 0-100 volts DC scale..... 1.25
- No. 40—For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale.. 1.75
- No. 42—For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale..... 1.50
- No. 348—For testing AC current supply line, portable, 0-150 volts..... 4.00

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- No. 352—For reading 0-10 volts AC..... 2.25
- No. 353—For reading 0-6 volts AC..... 2.25
- (See No. 348 under "Pocket and Portable Voltmeters.")

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- No. 335—For reading DC voltages, 0-8 volts, \$1.00
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- No. 326—For reading DC voltages, 0-8 volts, 1.00
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- No. 18—For testing amperage of dry cell A batteries and voltage of dry or storage A batteries, double reading, 0-8 volts, and 0-40 amperes DC.....\$1.25
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- No. 311—For reading 0-10 milliamperes DC..\$1.75
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VOLTAGE REGULATOR

- No. 218—For preventing excess voltage on the filament and cathode of AC tubes, by compensating for excess line voltage.....\$5.00

POCKET AMMETER

- No. 1—For testing dry cells, 0-50 ampere DC scale pocket meter.....\$ 7.50

Immediate Shipment

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Just East of Broadway

Send me the following individual meters (quantity in square):

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

NAME

ADDRESS

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

TEN-DAY MONEY-BACK ABSOLUTE GUARANTY!

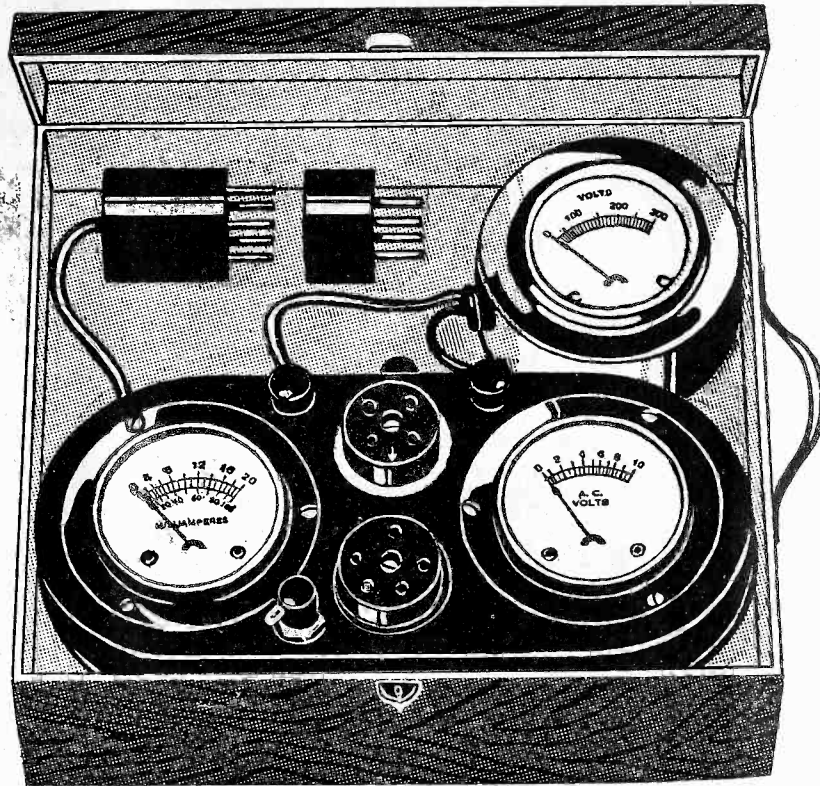
De Luxe Carrying Case **FREE**

With Each Jiffy Tester Combination!

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

INSTRUCTION SHEET GIVES FULL DETAILS OF THESE THIRTEEN TESTS

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



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

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

Choose Your Speaker from This Complete Array!

EXPONENTIAL TYPE HORNS

Modern acoustical science is striving to equal the performance of a large air column horn with powerful unit, while the horn enjoys its rightful popularity with trained experts. The larger the horn, the better, hence we offer two models: one with 7 3/8 ft. tone travel, the other (where space permits) with 10 ft. tone travel. The material used is patented Racon. Nozzle is standard size.

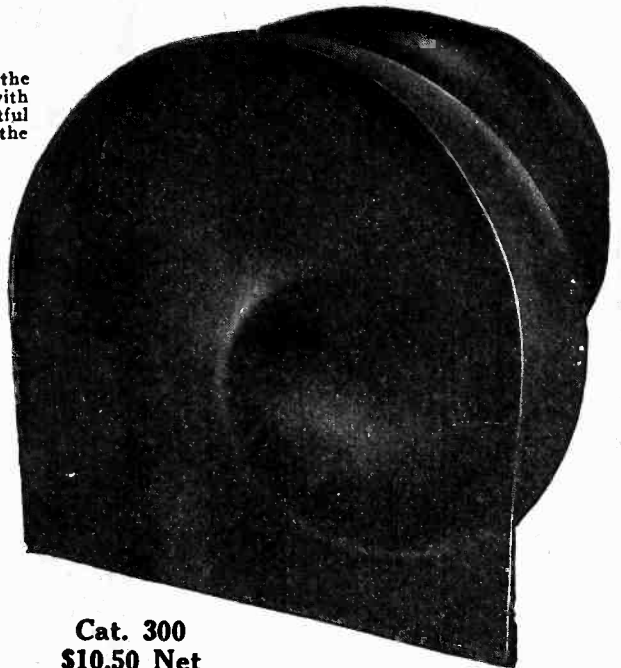


Cat. 200
\$7.50 Net

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



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



Cat. 300
\$10.50 Net

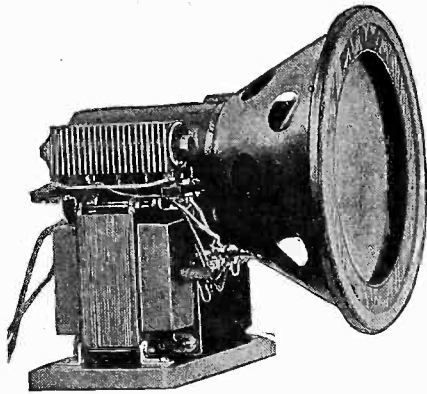
The larger horn is preferable, where space permits. Air column, 120". Front, 18"x18". Depth, 13". Weight, 7 lbs.

DYNAMIC CHASSES and Baffle

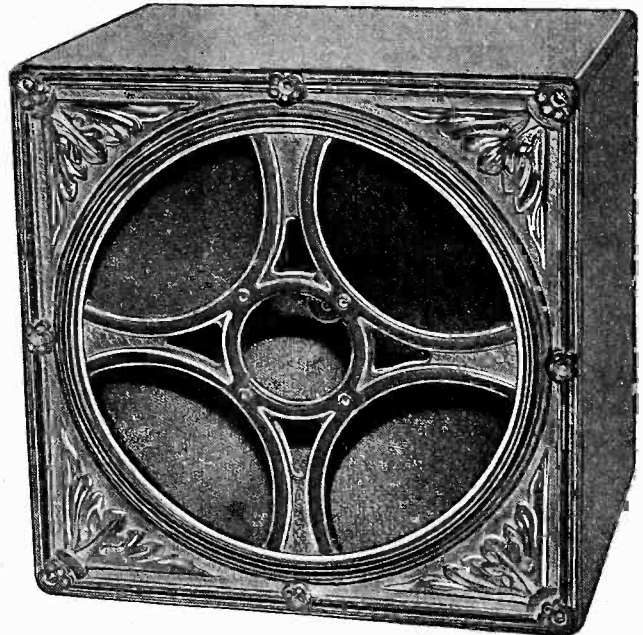
The dynamic speaker is the most popular one by far, and here is your opportunity to get a real fine chassis at a low price. Cat. 110 A.C. operates directly from the 110-volt A.C. (alternating current) lamp socket, to which built-in plug is connected, while the tipped cords go to your receiver output.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

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

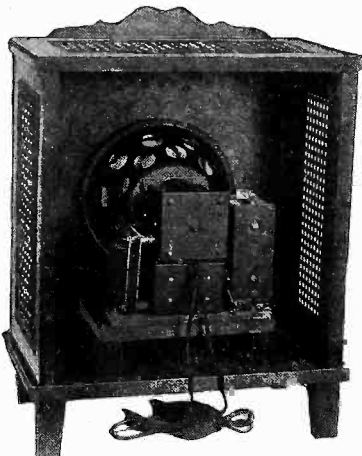
At left is illustrated an 18"x18" baffle, Cat. 111, with cane sides and top, for any dynamic speaker. Specify speaker. Walnut 5 ply veneer. Price \$11.00 net.



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



Cat. 113
Price, \$13.50 Net



Cat. 111; Price, \$11.00 Net

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

FILL OUT AND MAIL COUPON

ACOUSTICAL ENGINEERING ASSOCIATES,
143 West 45th Street, N. Y. City
(Just East of Broadway)
Please send me at once on 5-day money-back guarantee the following (check off):

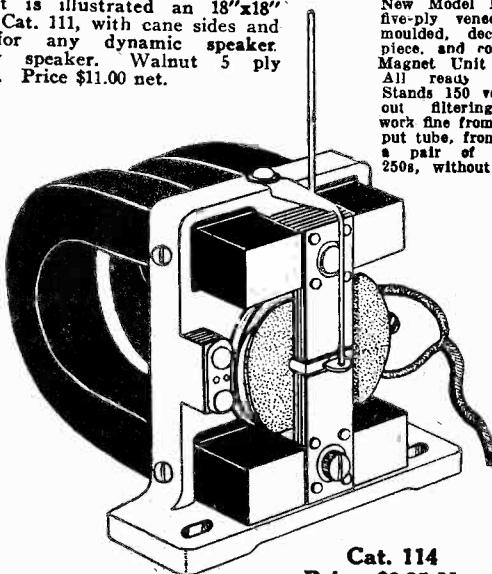
- | | |
|---|---|
| <input type="checkbox"/> Cat. No. 200 | <input type="checkbox"/> Cat. No. 111 |
| <input type="checkbox"/> Cat. 300 | <input type="checkbox"/> Cat. No. 113 |
| <input type="checkbox"/> Cat. No. 110 A.C. | <input type="checkbox"/> Cat. No. 114 |
| <input type="checkbox"/> Cat. No.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

Name

Address

City State

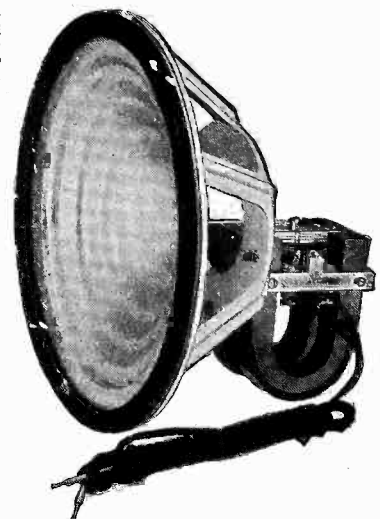
5-DAY MONEY-BACK GUARANTEE



Cat. 114
Price, \$9.25 Net

Polo Twin Magnet Unit—weight, 3 1/4 lbs., or twice as heavy as ordinary unit. Twin magnets double sensitivity. This unit gives more volume, clearer tone, and stands the gaft. Supplied with 10-ft. cord. Cat. 114. Tri-foot molded unbreakable metal mounting bracket and apex constitute Cat. 114A @ \$0.75.

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



Cat. 115; Price, \$11.50 Net

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