May 18th, 1929 15 Cents

RADIO WORLD

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WORLD

The First and Only National Radio Weekly

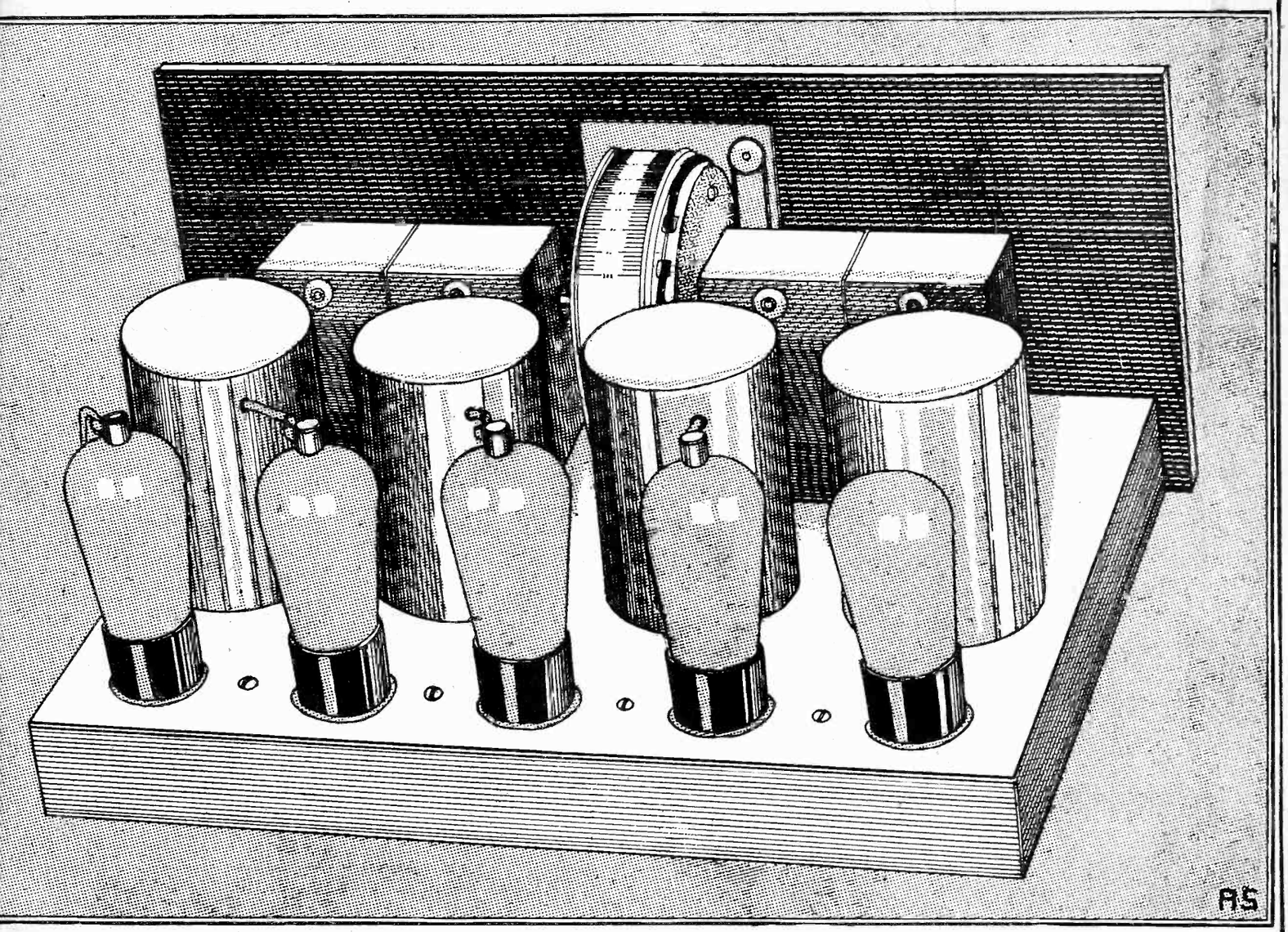
373rd Consecutive Issue—Eighth Year

Board Threatens Stations With Axe

Silver-Marshall Abandons List Prices on Parts

Test of How You Read A Circuit Diagram

REMARKABLE DX ACHIEVED!



The new MB29, using National parts in an AC Screen Grid Design, brought in nine different stations on coast-to-coast reception, speaker volume, in one night. See Pages 10 and 11.

HOW TO MEASURE RESISTANCE

RADIO WORLD, owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, President and Treasurer, 145 West 45th Street, New York, N. Y.; Herman Bernard, Secretary, 145 West 45th Street, New York, N. Y

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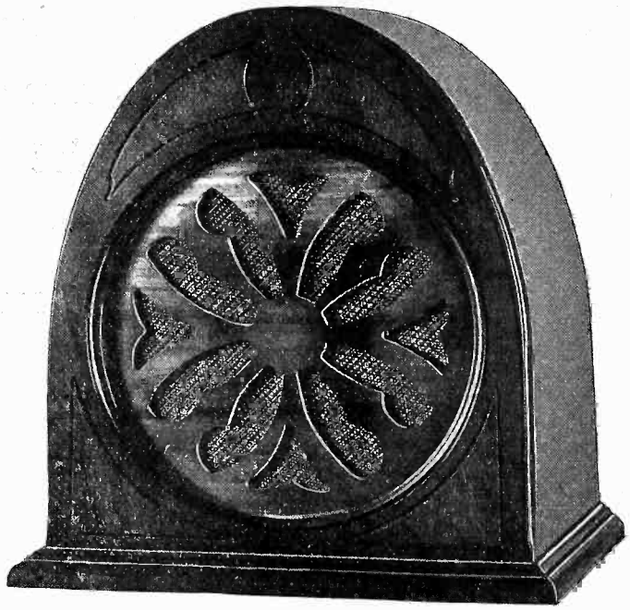

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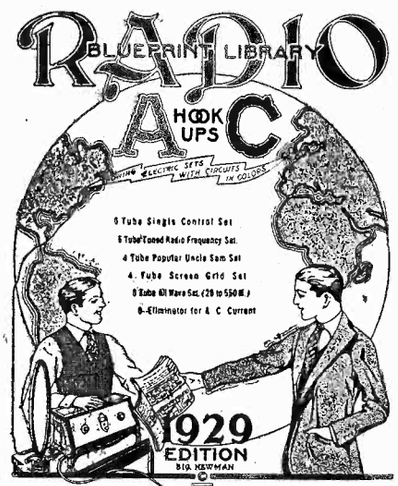

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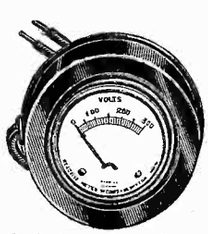

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RADIO WORLD
145 West 45th St., New York City

Published Weekly

"UNINTERRUPTED READER INTEREST"
EVERY WEEK — EVERY YEAR

RADIO WORLD

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Latest News and Circuits
Technical Accuracy Second to None
EIGHTH YEAR

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S-M PARTS PUT ON A NET PRICE 40% OFF LIST

Silver-Marshall, Inc., has made a radical change in its sales policy as affecting parts. The former list prices are eliminated, and instead only the net prices are stated.

The net prices are aproximately 40% under previous list prices. For instance, a part that had a $100 list price will have no list price, but only a net price, of $6. This gives all set-builders and the trade the equivalent advantage of "forty off" when they purchase at the net price.

New Catalogue Issued

A new catalogue of component parts has been issued by Silver-Marshall in which the net prices are quoted, with no list prices. Wired models of circuits are the basis of the same method of pricing, except that allowance has been made for the 7½% royalty S-M pays the Radio Corporation of America on wired models.

These wired models are not the new 8-tube factory made receiver, as that is known as Silver Radio and the pricing and merchandising of that model are done along different lines. The catalogue previously referred to does not include Silver Radio, which will be covered by separate literature. Silver Radio, the same set, comes in two models, a highboy listed at $195 and a lowboy listed at $160, and will be ready for distribution this month.

This is Silver-Marshall's first year in the factory-made set business. In the parts business alone last year the corporation reported sales of $1,250,000 net billing.

Includes New Parts

Several new parts will be found in the "component parts" catalogue this year, but no kits. Instead of dividing existing facilities to sell both parts and sets, the corporation has more than doubled its sales activities, so that more attention than ever will be paid to the sale of parts, while a great organization to sell Silver Radio has been built up.

The business executive and engineering director of S - M is McMurdo Silver, whose efforts built up the business to the $1,250,000 level from a modest start. The corporation has put up a large new factory —the third largest exclusive radio plant in the Chicago area. The new address is 6401 West 65th Street, Chicago, Ill. A new catalogue is obtainable from that address by mentioning RADIO WORLD.

EXTRA HOUR FOR WEAF

Due to daylight saving time in New York, programs of the National Broadcasting Company distributed throughout the nation have been extended to 1:00 A.M., Eastern Daylight Time, instead of nidnight. WEAF is on till 1.

DX Demonstration Succeeds Too Well

London.

Philip Paddon, an amateur, invited some friends to his home to prove his proud boast that he receives the United States regularly on short waves. He tuned in the program of WGY, Schenectady, N. Y., being broadcast on W2XAF, the short wave transmitter of the General Electric Co.

It was just before midnight. Paddon felt that a time signal was due.

"Listen and you'll hear the Americans announce it is exactly 7 o'clock, although it will be midnight here," said Paddon, who lives only twenty-five miles from the famous Big Ben clock.

His friends listened carefully and all they heard was the striking of Big Ben. His friends thought he was teasing them with local reception. They pointed in the direction of Big Ben and smiled. In fact, the short wave station of the British Broadcasting Company was being picked up by W2XAF in the United States, and was being rebroadcast, so that the radio waves crossed the Atlantic on a round trip before reaching the amateur's receiver.

The signals faded and Paddon's friends left his home, still as doubtful as when they had entered it.

RADIO UPLIFTS LIFE STANDARD

Radio exercises a wide socializing influence, says the National Bureau of Economic Research. It will publish this month a complete report of a survey. Meanwhile it issued this statement:

"The influence of this new medium of communication ramifies widely.

"For the farmer the radio not only acts as a source of general news and crop information, but also as a solvent of the differences between the wants and interests of urban and rural population. Enormous influence of unforeseen significance is also being exerted by it in such districts as the lower East Side of New York City. On the roof of practically every tenement house, numerous radio antennas are now in evidence.

"There is every indication that this new method of communication is already extensively installed in homes that so often have been looked upon as somewhat impervious to the rapid spread of new ideas.

"The socializing influence and the possible effects of such a development on the standards of living of large numbers of consumers are subjects for interesting speculation."

AXE TO FALL ON STATIONS THAT VIOLATE RULES

Washington.

The Federal Radio Commission, with "a great deal of courage," has warned stations that the penalty for violation of licenses will be inflicted "by effective use of the axe." Wave wobblers, heterodyne and cross-talk interference creators, assignees of station licenses not approved by the Commission, and other violators will be ruled off the air.

The Commission issued a statement containing this warning, following its ouster of four stations for failure to serve "public interest, convenience and necessity." This was the first infliction of a summary penalty.

Adherence to the assigned frequency will be required without fail, and offenders will be notified and hearings held prior to disciplinary action.

Three More Silenced

The four stations ordered off the air, and which are regarded as permanently silenced, were WSRO, Middletown, O.; WHBW, Philadelphia; WAAD, Cincinnati, and WSMD, Salisbury, Md. The precise reason was persistent deviation from assigned frequency.

Besides, it is now revealed, three stations have been silenced, at least temporarily, for unauthorized transfer of licenses. They are KGFH, Glendale, Calif.; KMIC, Inglewood, Calif., and WHB, Kansas City, Mo. Section 12 of the Radio Law requires the consent of the Commission prior to an assignment of a license, so that persons or corporations that are not deemed fit to own a license can't obtain one by purchase any more than by direct application to the Board.

In its statement the Board pays a compliment to its own courage as follows:

"Undoubtedly the action of the Commission and the stand it has taken with regard to the elimination of interference from the careless or improper operation of stations has required a great deal of courage.

"The Commission's position, according to its General Counsel, is sound and, upon his advice, the Commissioners here, individually and collectively, decided that the only way to eliminate undesirable broadcasting is to make an effective use of the axe."

29 on Probation

Twenty-nine stations have been given conditional licenses for 46 days, instead of renewal for 90 days, because of wobbling or interference creation.

[*Full text of Commission's statement on next page.*]

FULL TEXT OF BOARD THREAT TO WIELD AXE

The following is the full text of the Federal Radio Commission's statement warning stations that if they violate their licenses they will be permanently ruled off the air:

Much of the heterodyne and cross talk interference with which the radio listener has to contend is due in part either to the irresponsibility of some broadcasters or their inability to control the emissions from their stations, i. e., to maintain operation constantly on the frequency assigned by the Radio Commission.

In the first case, the fault is with the broadcaster, and the Commission has taken the position that the only remedy is to eliminate those broadcasters who will not operate their stations in conformity with the law and the terms of the licenses which each of them holds.

In the second class of cases, the Commission has determined to require the use of such apparatus as is capable of operating strictly within the limits of frequency deviation allowed by the Commission.

No Excuse for Persistence

The Commission has taken the stand that there is no excuse for any broadcasting station repeatedly to deviate from its assigned frequency, and, as a result, the Commission has refused to renew licenses to the following stations:

WSRO, owned by Harry W. Farlander, Middletown, O.
WHBW, owned by D. R. Kienzle, Philadelphia, Pa.
WAAD, owned by Ohio Mechanics Institute, Cincinnati, O.
WSMD, owned by Tom F. Little, Salisbury, Md.

In a large number of other cases the Commission has received reports that stations have deviated from their frequencies but, pending substantiation of said reports by further investigation, the Commission has refused to grant the usual renewal of license but has renewed the license in each case for a period of 46 days beginning April 30, 1929.

If it is found that the reports are true and that the licensees of these stations either will not or can not operate their stations in accordance with the rules of the Commission, undoubtedly their applications for a further renewal will be denied.

Must Assume Burden of Proof

In any event, where the Commission finds that there has been repeated deviation from frequency, an applicant for renewal of license will be required, at a hearing before the Commission, to affirmatively show that his station in the future will be operated upon its assigned frequency and that apparatus will be used capable of maintaining a constant frequency.

Stations whose licenses have been renewed temporarily pending further investigation are as follows:

KFWI—Radio Entertainments, Inc., San Francisco, Cal.
KGFJ—Ben. S. McGlashan, Los Angeles, Cal.
KFQW—KFQW, Incorporated, Seattle, Wash.
KGER—C. Merwin Dobyns, Long Beach, Cal.
KGGC—Golden Gate Broadcasting Co., San Francisco, Cal.
KOL—Seattle Broadcasting Co., Seattle, Wash.
KMO—KMO, Inc., Tacoma, Wash.
KPQ—Archie Taft & Louis Wasmer, Seattle, Wash.
KGA—Northwest Radio Service Co., Spokane, Wash.
WAGM—Robert L. Miller, Royal Oak, Mich.
KWTC—Pacific-Western Broadcasting Federation, Santa Ana, Cal.
WICC—Bridgeport Broadcasting Sta., Inc., Easton, Conn.
WORO—Harold E. Smith, Mt. Beacon, N. Y
KFBL—Leese Bros., Everett, Wash.

Undoubtedly the action of the Commission and the stand it has taken with regard to the elimination of interference from the careless or improper operation of stations has required a great deal of courage.

In most of the stations there are many thousands of dollars invested. Many of the stations are operated by business concerns and are invaluable to those concerns as advertising mediums. No doubt, a strenuous effort will be made to secure the renewal of licenses in practically all of the cases above-mentioned.

The Commission's position, according to its General Counsel, is sound and, upon his advice, the Commissioners have, individually and collectively, decided that the only way to eliminate undesirable broadcasting is to make an effective use of the axe.

Another practice at which the Commission has aimed a blow, is that of transferring licenses or rights thereunder in violation of section 12 of the radio act of 1927. There have been many cases in which the ownership of stations has changed without the matter having been properly brought to the attention of the licensing authority.

The right to operate a broadcasting station is personal. It pertains only to an individual or corporation holding a license, the rights or privileges of which, under the law, may not be assigned or transferred without the written consent of the Radio Commission.

This provision was wisely included in the act in an effort to give the Commission power to keep the control of radio communication in capable hands, willing to properly serve the public.

A Necessary Safeguard

If it were not for this provision unscrupulous parties whom the Commission does not see fit to license, might, by purchase, acquire licenses or rights thereunder which practice in the opinion of the Commission, would be detrimental to the public; through purchase of licenses, etc., monopolies in radio Broadcasting and communication might be acquired in violation of the law; and it would be possible for aliens or their representatives, or even alien governments or the representatives thereof, to come into control of radio stations contrary to the intention of Congress.

There are two recent examples of this unlawful practice in California: Station KGFH, formerly owned by R. L. Rust at Glendale, was sold and the new owner continued to operate the station without having secured the permission of the Commission or a formal license to do so. The same purchaser acquired Radio Station KMIC, formerly owned by James R. Fouch at Inglewood, and continued to operate this station also without permission of the Commission.

Radio Station WHB, formerly owned and operated by the Sweeney Automobile School, Kansas City, Mo., has recently gone through two successive transfers, and, without the permission of the Commission, the station has continued in operation.

The application of this station for renewal of license has been designated for hearing, as have been the two applications of the California stations above-mentioned. The Commission has announced that no renewal licenses will be issued to any of these stations unless and until the licensees in each case, or their assignees, have proved that the stations have not been operated in violation of the law, and, further, that public interest will be served by their operation in the future.

Until such showing is made, Stations according to Williiam Kelin, attorney, who KGFH, KMIC and WHB will be off the air.

WBAP OBTAINS 50 KW ORDER; CLEARING WAVE

Washington.

The Federal Radio Commission assigned 50,000 watts to WBAP, Fort Worth, Tex.

The station will broadcast on its present frequency of 800 kilocycles, and later will enter a working arrangement with WFAA, at Dallas, Tex., now operating on another channel. Other stations in this channel will be relocated.

The Commission announced that it has set June 5th as the date for hearing in the case of the National Radio Press Association, headed by Herbert Bayard Swope, former executive editor of the N. Y. "World," for the twenty intracontinental short-wave channels allocated the nation's press for news distribution. The association lost its case to prevent the Commission from allocating these channels in the Supreme Court of the District of Columbia recently.

New station applications follow: Brodie E. Cain, Denton, Texas, requests authority to erect a station using 740 kilocycles, 250 watts. Some evening hours and some morning hours.

Lamar Life Insurance Company, Jackson, Miss. No power or frequency specified.

Jack W. Duckworth, Lewiston, Idaho, requests authority to erect a station using 1,370 kilocycles 500 watts power and unlimited time.

W. E. Green & Sons (W. E Green & W. O. Green), Manila, Arkansas, requests authority to erect a station using 900 kilocycles, 10 watts, one hour daily except Sunday, more hours requested Sunday.

WOR Play Critic Called Prejudiced

Open animus toward the Shubert Theatre Corporation is charged against Martin Mooney because of his theatrical review broadcasts from WOR, New York, according to William Klein, attorney, who wrote the station a letter demanding that this "defamation of Shubert productions" cease, otherwise suit will be brought.

Klein stated that Mooney never has a good word to say for Shubert shows, and not only knocks them, but uses abusive language, even when discussing plays the newspaper theatrical critics praise highly. Plays mentioned are "Jonesy," "The Love Duel," and "Before You're 25". Mooney's position is that he reviews all shows fairly and that his reports on the Shubert shows represent his honest opinion, which he is entitled to broadcast.

NEW CORPORATIONS

Emsheimer Brothers, radios—Atty. H. S. Van Arsdale, 233 Broadway, New York.
Essbee Radio Sales—Atty. M. Silverman, 264 Echo Place, The Bronx, New York.
Sunnyside Music Shop, radio instruments—Atty. A. Mazzei, Queens, New York.
Cable Radio Tube Corp., Wilmington, Del., radio supplies—Corporation Trust Co. of America.
Meyer's Radio Music Stores, instruments—Atty. W. H. Siebrecht, Jr., L. I. City, Queens, N. Y.
American Sound Recording Corporation, Yonkers, N. Y.—Corporation Trust Company of America, Wilmington, Del.
Commonwealth Radio Distributing Corp.—Atty. H. Ascher, 475 5th Ave., New York, N. Y.
Marvin Radio Tube Corp., Wilmington, Del.—Corporation Trust Company of America.
Neon Radio Corporation—Atty. I. Ehrman, 41 Park Row, New York. N. Y.
Perryman Electric Company, Inc., Larchmont, N. Y., radios—Corporation Trust Company of America.

SALTZMAN AND STARBUCK FILL FEDERAL BOARD

Washington.

President Hoover signed the commissions of Maj.-Gen. Charles McK. Saltzman and William D. L. Starbuck to be members of the Federal Radio Commission. Secretary of State Stimson countersigned the commissions and the two members were sworn in and took office. Hoover appointed the pair.

The Senate had previously confirmed these two appointments, Saltzman having disposed of stock he owned in the American Telephone & Telegraph Company and the General Electric Company.

The board membership thereby became complete for the first time since February 1st. There had been only three members since February 23d.

Saltzman is retired chief of the Army Signal Corps. He is a Republican and a native Iowan. He succeeds Sam Pickard, who resigned to become a vice-president of the Columbia Broadcasting System.

Represents Mid-West

He represents the Middle Western Zone on the Board. He is 58 years old and a graduate of the United States Military Academy at West Point. In 1906 he was an honor graduate of the Signal School and in 1921 was graduated cum laude from the War College.

He served in the Philippines and Moro campaigns. During the World War his services resulted in two citations from Congress for "gallantry in action" and in the receipt of the Distinguished Service Medal for "exceptionally meritorious and conspicuous" service.

He was a delegate to the International Radio Conference in London in 1912, the International Telegraph Conference at Paris in 1925 and the International Radio Telegraph Conference at Washington in 1927.

Disposed of Stock

General Saltzman testified before the Senate Committee that was holding hearings on the nominations that he owned 105 shares of stock of the A. T. & T. and 80 shares of stock of G. E. These he disposed of and his nomination then was recommended to the Senate for confirmation. The radio law prohibits a Board member from having any financial interest in any company in the radio business.

Starbuck a Democrat

The law also requires that no more than three of the five members be of the same political party, and Starbuck, a Democrat, was appointed. He testified before the committee that he had been recommended to President Hoover by James W. Gerard, former Ambassador to Germany, under the Wilson administration, and by Arthur Batcheller, Radio Supervisor of the Department of Commerce, stationed at New York.

Mr. Batcheller himself had been nominated by President Coolidge, but the Senate adjourned without confirming him. He had stated he did not desire the appointment, because of the possible shortness of tenure of office.

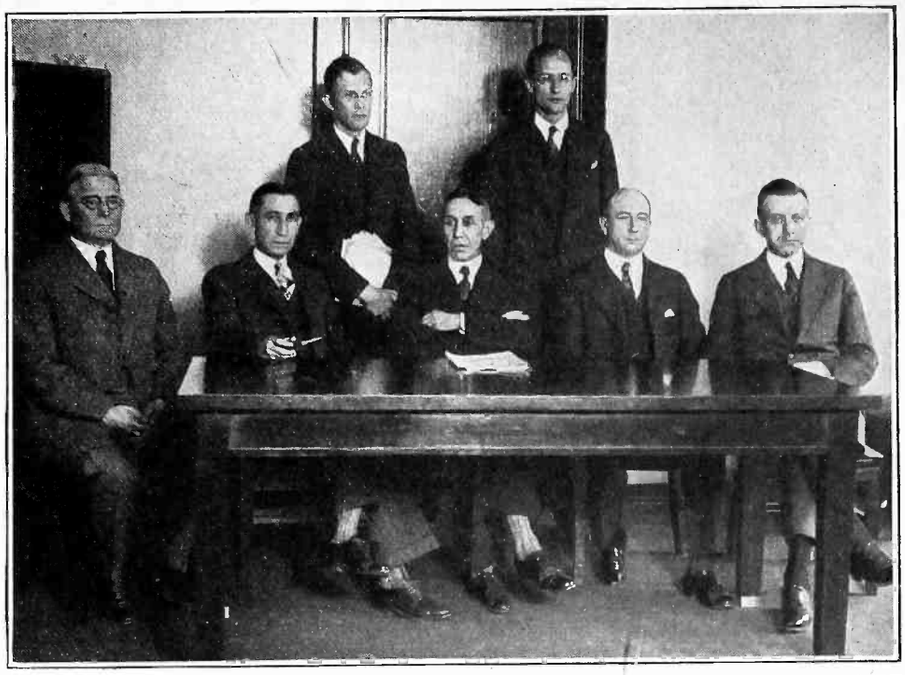
Although Mr. Starbuck did not mention the fact, it was learned that William Donovan, close friend of President Hoover, and formerly Assistant Attorney General, located at New York, also had recommended Starbuck. Donovan and Starbuck were in the same class at Columbia University, New York. Orestes H. Caldwell, whom Starbuck succeeds, also recommended the nominee.

Has Engineering Training

Starbuck, who is 43, was born in New York City, and studied law and engineering. He became a patent lawyer, specializing in radio. He told the committee he voted for Wilson for President and Alfred E. Smith for Governor of New York State, but did not vote for anyone for President in 1928 because he had moved from New York City to Sound Beach, Conn., and had not established his residence in the new location long enough to be entitled to vote. After he had obtained his degree as an engineer he practised this profession until the World War, serving then as Lieutenant in the Ordnance Department. After the war he studied law and was admitted to practice in 1925. In August, 1926, Mrs. Frances Sayre Bryan was married to him.

As Commissioner, Starbuck represents the Eastern Zone.

The three other Commissioners are Ira Robinson, chairman; Harold A. Lafount, and Eugene Sykes.



LEFT TO RIGHT, SEATED: MAJ. GEN. CHARLES MCKINLEY SALTZMAN, REPRESENTING THE FOURTH ZONE; EUGENE O. SYKES, THIRD ZONE; IRA E. ROBINSON, CHAIRMAN, REPRESENTING THE SECOND ZONE; HAROLD A. LAFOUNT, FIFTH ZONE, AND WILLIAM D. L. STARBUCK, FIRST ZONE. STANDING, CARL H. BUTMAN, SECRETARY TO THE COMMISSION, AND BETHUEL WEBSTER, GENERAL COUNSEL Henry Miller

MOVE TO CURB BLURBS ON AIR

Resolutions deploring excessive commercialism in some sponsored programs were adopted unanimously by the Board of Directors of the Radio Manufacturers Association. Support was pledged to chain and other broadcasters in efforts to reduce undue commercialism. Greater public enjoyment of radio and also greater returns to advertisers sponsoring broadcast programs are objects of the RMA. Believing that the public's good will is impaired by excessive commercialism in some announcements, the Board adopted the following resolution:

"WHEREAS, the listening public has clearly indicated to the radio industry its disapproval of details of advertising matter and reiteration thereof in announcing radio programs, and

"WHEREAS, the good will of the public is of interest alike to the industry and to the sponsors of radio programs,

"RESOLVED, that the Board of Directors of the Radio Manufacturers Association recommends, in the interests of the listening public, that broadcasters confine announcements to the names of the sponsors of the broadcasting program and a brief statement of the products marketed without details or other advertising matter."

TWO MORE ARE SYNCHRONIZED

Chicago.

Synchronization of KYW with its sister station, KYWA, has been effected. KYWA is in the Edgewater Beach Hotel, Chicago, in the heart of the district which had experienced difficulty in the reception of KYW's programs. The KYW transmitter is located on the Congress Hotel.

This not only marks the first synchronization of two stations in the Middle West, but introduces the use of a low basic synchronizing frequency tone to effect the simultaneous broadcasting on a single channel. The Westinghouse Company's other synchronization, that of WBZ in Springfield, Mass., and WBZA in Boston, uses a high synchronizing frequency.

Although the new transmitter is licensed to broadcast with a power of 500 watts, experiments have been carried on during the past month with a power of about 100 watts. The parent station is licensed to use 5,000 watts.

Stations are going right ahead with synchronization tests over long distances. Even WGY, Schenectady, N. Y., and KGO, Oakland, Calif., on the same wave, with 3,500 miles between, synchronize without a heterodyne heard in the Mid-West.

BROADCASTING CALLED JOB OF A STATESMAN

London.

While here on his inspection trip of radio conditions in Europe, M. H. Aylesworth, president of the National Broadcasting Company, intimated that Cardinal Wolsey would not have been too big a man for the job of management of broadcasting.

Mr. Aylesworth's message to the British listeners was broadcast by the British Broadcasting Company he said in part:

"At Hampton Court I saw not only the old English garden at its best, but also a symbol of business government—for was not Cardinal Wolsey one of the first, if not **the** first, statesman who can be called a statesman of the modern type?

Requires a Statesman

"I am tempted to wonder how this Cardinal Wolsey of yours—of ours—would have handled the most modern problems of statesmanship, the management of radio broadcasting? No one can make much of a guess, but whatever he did he would have had a clear distinction in his mind between questions of where he was going and questions of how he meant to get there.

"For, after all, it is a statesman—of a new sort—who controls and operates the policy of radio programs. And I am sure no broadcasting executive would say that the old Cardinal would have found his job too small for him.

"When one buys a book, a ticket to a theatre or a newspaper or magazine, he purchases by selection, but we broadcasters must serve the entire people and are well aware of our inability to please everyone with each program.

Alternate Programs

"In America people have many different tastes. Some prefer symphony and grand opera, others jazz and popular music, while still another important group of listeners demands interesting talks and discussions on educational matters and public affairs. We have helped to overcome the particular likes and dislikes of our listeners through the development of the alternative program and to-night in America the listener can turn from a program of instrumental music to one of public affairs, or to the opera or drama.

"I have been particularly impressed by the progress of British broadcasting in the development of school and adult program, which I believe superior to similar endeavors in the other countries with which I am familiar."

Much More Power Urged On France

Paris.

In a speech to French broadcasters M. H. Aylesworth, president of the National Broadcasting Company, said:

"There are three 'musts' to radio development. First, France must build the most powerful broadcasting stations possible. Second, she must have the best receiving sets. Third, her stations must offer the best programs.

"It was by bearing those not-to-be-disobeyed rules in mind that America owed her achievements in the radio field."

Eleven Stations Seek No Renewal

Washington.

In a statement the Federal Radio Commission announced that eleven broadcasting stations had failed to file applications for renewal of the licenses which expired May 1st. The stations:

WAAM, WAAM, Inc., Newark, N. J.;
WFBE, Park View Hotel, Cincinnati, Ohio.
WFBL, The Onondaga Co., Inc., Syracuse, N. Y.
WHPP, Bronx Broadcasting Co., Englewood Cliffs, N. J.
WQAN, The Scranton Times, Scranton, Pa.
KGCN, Concordia Broadcasting Co., Concordia, Kans.
KGHB, Radio Sales Co., Honolulu, Hawaii.
KQV, Doubleday-Hill Elec. Co., Pittsburgh, Pa.
WLBO, Frederick L. Trebbe, Jr., Galesburg, Ill.
KFEY, Union High School, Kellogg, Idaho.
WTHS, Atlanta Tech. High School, Atlanta, Ga.

EDUCATIONAL RADIO GAINING

The first actual demonstration of a new system of "centralized radio" for schools took place in the New Utrecht High School, Brooklyn, N. Y. The auditorium was wired with a single-channel control panel, hooked up to a master receiver combined with an electric phonograph, and an arrangement of ten dynamic loudspeakers located in the wall organ recesses. Additional loudspeakers were installed in an office and in the boys' gymnasium. As many loudspeakers as are desired in the various classrooms may be connected to the master control panel, without any mechanical changes in the centralized radio system.

A time clock automatically started and stopped the programs. A simple buzzer system in the principal's office or in the rear of the auditorium was used to notify the operator at the control panel when to change the radio program or switch over to the phonograph mechanism.

Other schools were interested in the demonstration because of the part radio is expected to play in supplementing methods of teaching. Hundreds of schools throughout the country are receiving the Damrosch educational concerts regularly as a part of the curriculum. Other organized efforts for education by radio are well under way in Cleveland, O., Columbus, O., Dallas, Tex., and San Francisco. The Board of Education of New York City recently approved plans which will provide wiring facilities for radio reception in eight schools about to be constructed.

A THOUGHT FOR THE WEEK

"MIKE fright," which is no stranger to the beginner in broadcasting, has been described by one of the recent sufferers as "an awful something that seems to be made up equally of a bad attack of mal de mer and a feeling that you're at the top of the Woolworth Building and that somebody is pulling it from under you." That accounts for some strange noises we have heard over the air during otherwise pleasant winter evenings.

EUROPE TO PUT REALLOCATION IN USE JUNE 30

Prague.

Wavelengths have been reallocated for use by European stations, so as to minimize interference, yet provide a place on the air for all. The stations now broadcasting were taken for granted, and the system worked out to accommodate them. This is diametrically opposed to the method used in the United States, where the channels were set apart as exclusive, semi-exclusive or mutual, and stations assigned to places in the spectrum. The European method is to fit the system to the stations rather than to fit the stations into the system.

The Union Radio Conference, at which the reallocation was adopted, was attended by 118 delegates, representing thirty governments and twelve companies. The reallocation is known as the Prague plan and supplements plans adopted at Geneva and Brussels.

American's Statement

Gerald G. Gross, a member of the American delegation to the conference, and who is attached to the engineering staff of the Federal Radio Commission, issued a statement outlining the accomplishments of the convention. In part he said:

"The Prague Plan is to be effective June 30th, 1929.

"The broadcasting problems in Europe are very different and somewhat more complicated than in North America. The many different languages, and strong nationalistic spirit evidenced in particular by the small nations, make it necessary to set aside many more exclusive channels than would otherwise be the case.

"The tendency shown at the Prague conference was to permit all stations then existing or under construction to continue operating, and this being once accepted, it was necessary to find channels on which these stations could be placed. This seems to be in direct contradiction to the American allocation method, under which the first step was to select a sound engineering channel system and then allocate stations to the various channels thus set aside.

Channels Used

"Summarizing, the Prague Plan provides the following broadcast allocation for Europe (frequency range shown in kilocycles):

"160-194 kilocycles—Five channels exclusive: broadcasting previously in operation.

"194-224 kilocycles—Three channels exclusive broadcast; two channels, aviation-weather: Broadcasting Europe.

"224-550 kilocycles—Thirteen channels exclusive; two shared by two each: Not for broadcasting—assignments are as follows: 1, U. R. S. S.; 2, noninterfering; 3, temporary; 4, one old station.

"550-1,500 kilocycles—Ninety-one channels exclusive, two shared by two each; one shared by three each; one common; one free; 14 extra, insert.

"Total number of exclusive channels, 129; shared channels, 15; grand total, 144.

"American participation in the conference, while not very active in the actual question of broadcast allocation, provided a valuable starting point for preparation work incidental to the coming conference at The Hague in September, which will have vital interest for America."

CECO DEFEATS WESTINGHOUSE FILAMENT SUIT

A suit for injunction and damages, brought by Westinghouse Lamp Company, against C. E. Manufacturing Company, for alleged infringement of the Anton Lederer patent on filaments made of tungsten with a little oxygenized thorium added, was dismissed in Federal Court, District of Rhode Island, by Judge Letts. The patent, No. 1180264, was declared of doubtful validity, since it hardly comprised an invention.

The defendant, which has changed its name to CeCo Manufacturing Company since the suit was begun, gained a victory principally because the Lederer patent was on a mere assembly of prior known uses of thoria with other metals, even tungsten, although Lederer was the first to point out the use for mechanical strength and durability.

Patent Assigned

Lederer was an Austrian. In 1916 he assigned his patent to Westinghouse. The Chemical Foundation, which had acquired seized patents of aliens, also assigned to Westinghouse. CeCo's attack on the validity of plaintiff's title to the patent failed.

The patent was issued when squirted paste was the manner of wire formation and quantities of addition uncertain. CeCo uses drawn wife, of which use Lederer never heard of, and the additions are in exact predetermined quantities and for electrical, not mechanical, advantages. Electrical advantages include 20-fold electron emission.

The testimony disclosed that CeCo did not make its own filaments but bought drawn filament from the Callite Products Company.

Court Strongly Convinced

Others had sold filament wire to CeCo, so Ernest Kauer, CeCo manager, could not tell who made the filament in the lots of tubes purchased by plaintiffs. However, the Callite wire was taken as the basis and testimony adduced accordingly.

The CeCo type A (201A) tube, was the basis of the suit.

In dismissing the complaint and holding there was no infringement the court said of Westinghouse's argument for an injunction:

"To uphold such a contention, would not further, but would impede the progress of the art. It would necessitate a disregard of the intendment of the patent law."

Two NBC Publicity Workers Get Married

Miss Florence Utley Pierce was married to Walter C. Stone. Both work in the Press Relations Department of the National Broadcasting Company in New York City. Their engagement had been announced, but the wedding was not expected for several months.

Mrs. Stone is the daughter of Dr. Frederick Pierce, psychologist, and Mrs. Elizabeth Brown Pierce. She has been connected with the NBC for two years. She frequently plays dramatic parts in NBC broadcasts.

Mr. Stone is in his second year with the NBC and is night press representative. He is a native of Camden, N. Y.

Literature Wanted

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

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

Name .....

Address .....

City or town .....

State .....

Ovie B. Hall, 531 W. 19th St., Connersville, Ind.
J. C. Miller, Care The Electric Clavier Co., Parsons, Kans.
Floyd E. Waterfield, Jr., Box 1458, Muskogee, Okla.
John Gurney, 1139 Fitzgerald St., Philadelphia, Pa.
E. W. Buck, care Mr. J. Scott, 390 St. Mark Pl., Tompkinsville, S. I., N. Y.
Leo. F. Durlauf, 3715 W. Market St., Louisville, Ky.
Wm. H. Goetz, 3730 Rokeby St., Chicago, Ill.
P. W. Espenship, 15768 Wisconsin Ave., Detroit, Mich.
Clarence D. Bussius, 104 17th St., S. E., Washington, D. C.
John H. Dahms, 2419 E. Letterly St., Phila., Pa.
J. Harle Gray, 306 Olive St., Apt. 3, Knoxville, Tenn.
W. A. Robeck, Dept. of Elec. Eng. & Physics, U. S. Naval Academy, Annapolis, Md.
Geo. Kordian, 1028 Welser Way, N. S., Pittsburgh, Pa.
H. W. Lambert, 16 Westmoreland Ave., Bellemoor, Richardson Park, Del.
G. B. Lusby, 132 W. 122nd St., N. Y. City.
W. C. Massett, Shakespeare Drive, Box 34, R. F. D. No. 2, Berea, Ohio
E. J. Clarke, 3110 Jule St., St. Joseph, Mo.
E. Schulthers, Darlington, Wis.
Carl R. Lamb, S. Williamstown, Mass.
John S. Bilek, 5 Alsace Court, West Pennside, Reading, Pa.
Albert A. Neely, 2037 E. Fletcher St., Phila., Pa.
Paul Schlek, 4237 Barnes Ave., Bronx, N. Y. City.
The Bailey Radios, 3333 Bailey Ave., Buffalo, N. Y.
L. A. Laurent, 5th & Main Sts., Davenport, Iowa.
Arthur W. Stewart, Amherst College, Amherst, Mass.
Jas. C. Somers, 1265 Broadway, Somerville, Mass.
G. M. Gibson, Box 25, Big Spring, Tex.
Anthony More, 170 Cabot St., Holyoke, Mass.
L. A. Laurent, 5th & Main Sts., Davenport, Iowa.
Wallace Graham, 9 Fairmount St., Marlboro, Mass.
H. C. Backofen, 2 Temple St., New Haven, Conn.
Chas. C. Peugh, 110 Broadway, Schenectady, N. Y.
Robert S. Guise, 792 Broadway, Bayonne, N. J.
Harry L. Evans, 83 Eldridge St., Binghamton, N. Y.
A. C. Stewart, Waterloo, Iowa.
Harold Chute, 16 Boynton St., Eastport, Maine.
L. J. Trowbridge, Room 202 Babb Bldg., 132 Pine St., Long Beach, Calif.
Bert Griffith, 1224 W. Cedar, Denver, Colo.
H. R. Richardson, 260 Northampton St., Buffalo, N. Y.
Emil Flick, 1236 38th Ave., Oakland, Calif.
E. C. Grau, Box 104, Tracy, Minn.
E. R. Mathews, Room 131-B, 75 West St., New York City.
William Gilbert, Jr., Pres., The Buckeye Foundry Co., Cincinnati, Ohio.
C. Philips, 45 Broadway, New York City.
F. Donlan, 11037 S. Troy St., Chicago, Ill.
David Hedlin, 1121 12th St., Saskatoon, Sask., Can.
A. F. Cartside, 1298 Michigan Ave., Buffalo, N. Y.
William Painter, 161 E. 99th St., New York City.
J. F. Doering, 20 Union St., E., Waterloo, Ont., Can.
Robt. J. Edwards, 1121 12th St., E., Saskatoon Sask., Can.
B. R. Crocker, 32 N. Church St., Carbondale, Pa.
J. F. Geppert, 14005 Glenside Rd., Cleveland, Ohio
Sidney McMeen, Gregory, S. Dak.
F. J. Logan, R. No. 2, Keener, Ala
Edgar Combs, 6 Waverly Pl., Baldwin, L. I.
P. H. Hall, Chula Vista, Calif.
A. D. Woods, 12 Carter Lake Club, Omaha, Nebr.
B. Brenner, 152 Van Horne Ave., Apt. 3, Montreal, P. Q., Can.
J. B. Clement, 195 Columbus Ave., N. S, Cohoes, N. Y.
Joseph Oaker, 133 W. Dauphin St., Phila., Pa.
Ulis Wolf, Ulis Wolf Hardware, Republican City, Nebr.
Jas. E. Layrath & Co., Box 67, North, S. C.
Joseph O'Connor, Box 362, Sheldon, Ill.
C. E. Hauer, 925 Gallier St., New Orleans, La.
Mrs. Geo. F. Lockwood, Putnam, Conn
T. F. Newbov, Bethlehem, Pa.
Mrs. V. T. Burt, Enosburg Falls, Vt.
R. M. English, High Point, N. C.
Dr. B. P. Jones, Danville, Va.
Franklin Hirt, 5 Grandview Ave., Danbury, Conn.

LISTENERS GET FINE PROGRAMS THIS SUMMER

By J. L. RAY,
President, Radio-Victor Corporation of America.

As the warm weather approaches we are reminded of the early days of broadcasting when the advent of Summer meant a virtual suspension of interest in radio. Radio had not yet assumed the position of importance in our daily lives that it now holds. The conditions of reception coupled with a general let-down and disorganization in the program efforts of the broadcasters during the hot season discouraged many.

But now the whole picture is changed. The eighth Summer in the eventful history of radio broadcasting comes unheralded and almost unnoticed by the broadcast listener. A good part of this change is due to the remarkable organization and development of broadcasting. With the establishment and continued expansion of network broadcasting, the highest grade of entertainment from the principal program centers was made available to a collective audience numbering in the tens of millions, in practically every section of the country.

Carry On During Summer

The development of the commercially sponsored program has come as a logical solution of the problem of how the costly burden of broadcasting is to be borne. Through the sponsored program business provides high-grade radio talent of diversified interest in return for public goodwill. Conscious of the benefit of a repetitious and cumulative message, most of the large commercial program sponsors are carrying their radio efforts through the Summer months, in distinct contrast to the earlier days of broadcasting.

Broadcasters for their own part are featuring outdoor events prominently during the Summertime. These will include accounts of the baseball series, important boxing matches, and racing classics of the turf and track. Besides an abundance of the lighter variety of entertainment, outdoor presentations like band concerts will be brought to music lovers regularly.

Technical Advance

Not the least important factors contributing to the wider appreciation of radio in the Summertime are the technical advances in broadcasting and broadcast reception. Most stations are now operating with greatly increased transmitting power, sufficient to override atmospherical disturbances. The prevalent use of improved power amplifier vacuum tubes provides a greater undistorted power output in present-day receivers. More efficient circuits have come into use; and refinements in loudspeaker design have done their share in furnishing realistic reproduction.

LAW ENFORCEMENT PLAN

Clarence A. Earl, president of the Chas. Freshman Co., Inc., addressed a letter to figures in the radio and broadcasting world urging them to confer with him on the use of broadcast time to bring the importance of law enforcement before the entire nation. He suggests that one minute in every program broadcast shall be given over to calling the attention of the radio fans to the results of disregard for the law.

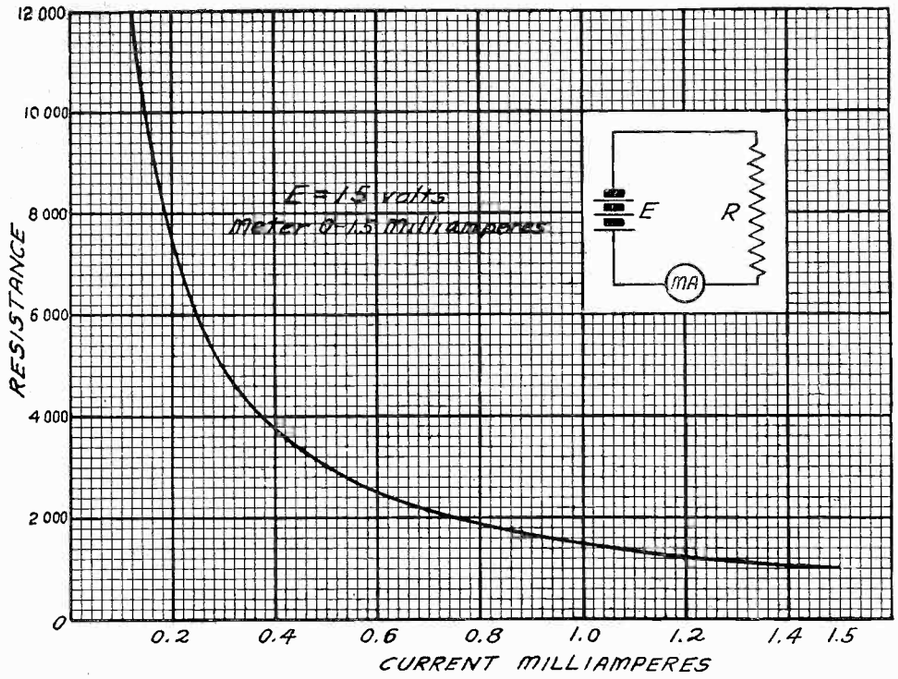


FIG. 1

A CALIBRATION CURVE OF A MILLIAMMETER USED AS AN OHMMETER. IT GIVES THE RELATION BETWEEN THE CURRENT AND RESISTANCE FOR CONSTANT VOLTAGE IN THE CIRCUIT. THE INSERTED DIAGRAM SHOWS THE CONNECTIONS. E = 1.5 VOLTS, NOT 15 VOLTS.

How to Resis

Constant Voltage-Variable ployed, Using Ammeter, Mil as Direct Reading Ohmmeter— Expla

By J. E.

Technical

THE problem of finding the resistance of a conductor often arises in radio experimenting. For example, a certain resistor is available, the resistance of which is unknown, and it is desired to find its value in ohms. How can it be found with apparatus available in most radio work shops? There are several methods, any one of which can be used.

All resistance measurements are based on an application of Ohm's law, which states that the voltage in a circuit is equal to the product of the resistance and the current flowing. If the voltage and the current are known, the resistance is also known. Hence the simplest way of measuring a resistance is to connect a battery of known voltage in series with the unknown resistance and a suitable milliammeter. The meter will give the current, and since the voltage is known the resistance is also known.

For example, suppose that the battery used has a voltage of 1.5 volts and that the current reads 1.5 milliamperes when connected in series with the unknown resistance. Then the resistance is 1.5/.0015, or 1,000 ohms.

Direct Reading Ohmmeter

If the voltage in the circuit remains constant, the current flowing depends only on the resistance in the circuit. This fact makes it possible to construct a direct reading ohmmeter. All that is necessary is to calibrate the dial of the current meter in ohms instead of in current units. The resistance scale may be made of the same size as the scale on the meter and placed directly over it. This is the way, in effect, that commercial ohmmeters are constructed.

The sensitivity of the current meter depends on the range of resistances to be measured, as well as on the current carrying capacity of the resistances. For measuring resistances of the order of one megohm, a microammeter should be used. For resistances of the order of 1,000 ohms, a milliammeter is the proper instrument. And if the resistance is of the order of 10 ohms, an ammeter is suitable.

The voltage of the battery used with the ohmmeter should always be the same, or integral multiples thereof. A suitable voltage source is a No. 6 dry cell, which has a voltage of 1.5 volts. Two, three, or four dry cells can also be used.

The ohmmeter is calibrated in terms of the smallest unit, that is, a single dry cell. When this is used the meter is direct reading. When two dry cells are used in series the resistance indications on the meter should be doubled. When more dry cells are used the indications should be multiplied proportionately.

Extending the Range

The range of the meter for any one voltage is approximately 10 to 1. For example, it may read from 1,000 to 100,000 ohms, or from 10 to 100, depending on the sensitivity of the meter. By using more cells the range may be extended. If two cells are used, the 1,000 to 100,000 range may be extended to 2,000 and 200,000 ohms, and so on for the other multipliers. The resistance indicated by the needle of the meter is simply multiplied by the number of cells used.

While it is possible to calibrate any scale to cover a range wider than 10 to 1 it is not desirable because the resistance readings will be crowded at the higher end and the readings will not be accurate. It is better to extend the range by using more battery units, for then any resistance may be measured near the more accurate end of the scale.

The battery used with the ohmmeter should be in good condition so that its effective voltage does not change with the current it delivers. If dry cells are used, they should be fresh for otherwise the voltage cannot be depended on.

The following table gives the currents for various resistances with a 0-1.5 milliampere meter and a fixed voltage of 1.5 volts:

Current	Resistance	Current	Resistance
1.500	1,000	.250	6,000
.750	2,000	.214	7,000
.500	3,000	.1875	8,000
.375	4,000	.1667	9,000
.300	5,000	.150	10,000

From these figures the resistance scale for a 0-1.5 milliammeter may be constructed. If it is not desired to put the scale on the meter the data may be used as an auxiliary calibration chart for the meter. This is not so convenient as to have it directly on the meter, but it leaves the meter free for current measurements. The calibration chart is shown in Fig. 1. This also shows the circuit arrangement. This graph can be used equally well with a milliammeter having a 0-1 milliampere range since it simply gives the relation between the current and the resistance when the voltage applied is 1.5 volts, the only difference being that when the more sensitive meter is used the lowest resistance that can be measured is 1,500 ohms, since at that point the needle runs off the scale. In fact, the more sensitive meter permits greater accuracy because the current can be read more acurately.

Bridge Methods

In laboratories resistances are usually measured by means of Wheatstone

Quality Dictates

There are inherent advantages in a separate C supply for AC receivers, although an extra tube is required. The B supply voltages are not affected and common coupling of plate and grid circuits is avoided. But the separate C supply never won popularity. Constructors of power supplies preferred to obtain C bias directly from the current of the B supply.

The first method in popular use was to lift the common connection point of filament and B supply, so that below this so-called "B minus" point there were available voltages negative in respect thereto. Hence these voltages negative in respect to filament were C minus.

A good enough method this proved to be until the public demanded better and better tone. The mixing of plate current and voltage with grid voltage did not produce the best tone. Sometimes it made the audio channel oscillate, e. g., motorboat, howl or squeal. The by-pass condenser across an AF biasing resistor was usually 2 mfd., or only half large enough for the plate current of a single output tube, and perhaps quarter large enough for the total plate current of all receiver tubes, which current flows through such a biasing resistor.

Then came the practice of independent bias resistor for each audio tube. At radio frequencies a resistor common to all RF tubes (excluding detector) is sound practice, but at audio frequencies it has come to be regarded as bad business.

This separation of biasing resistors, one for each tube, led to the incorporation of capacity-resistance filters for plate circuits. Now they are being used also in grid circuits. Again the object is isolation of any given tube circuit, so far as practical, to prevent feedback while maintaining cascaded coupling.

The capacity-resistance filter is merely a resistor of about 20,000 ohms interrupting

Measure

ance

urrent Method Easily Em- ammeter or Micro-Ammeter Wheatstone Bridge System Also ed.

Anderson

ditor

bridges. The simplest bridge is that known as the slide wire bridge, which is used in school laboratories for instruction purposes. With this type of bridge only one known resistor is needed, and that may have a fixed value. A slide wire bridge is shown in Fig. 2. Rl is the known resistance, Rx is the resistance to be measured, and AB is a resistance wire of suitable length, stretched straight over a scale. The longer the resistance wire the better, but it is not necessary to make it longer than one meter. A longer wire would make the bridge awkward to handle.

A battery E of any convenient voltage is connected across the straight wire. There should be a switch S in series with the battery for convenience in opening and closing the circuit.

A balance indicator is connected between the juntion of Rl and Rx and the slider P on the wire. This indicator may be any sensitive meter such as a voltmeter or a milliammeter. If a milliammeter is used care must be exercised against overload. A variable shunt may be put across it for this purpose. When balance is approached the shunt may be opened so that all the current in the bridge circuit flows through the indicator.

Balancing the Bridge

The bridge is balanced by sliding P over the wire until there is no current in the meter. When that point has been found, the distances AP and PB are measured with any convenient scale. Suppose the distance AP is x and the total length of the wire is L. Then the distance PB is L—x. The value of Rx, when the bridge has been balanced, is then given by $Rx = Rl\ (L-x)/x$.

Suppose the total length of the wire is 100 cm and that the distance x is found to be 40 cm at balance. The value of L—x is then 60 cm. And the value of $Rx = 1.5Rl$. Hence Rx is known as soon as Rl is known. If Rl is a standard 1,000 ohm resistor, Rx is equal to 1,500 ohms.

Use Cross-Section Paper

It is not convenient to stop to measure the distance x after the bridge has been balanced. The bridge should be constructed so that x is known as soon as the balance point has been found. This can be done by placing a strip of cross-section paper under the wire, one meter long, and divided into decimeters, centimeters and millimeters. Such cross-section paper can be purchased in stationery school supply stores. If the largest sheets are not one meter long, a strip one meter long can be made by joining smaller sheets. If the strip is made one meter long, the wire should be made the same length and the ends of the wire should be made to coincide exactly with the ends of the cross-section paper strip.

When the scale has been made of such cross-section paper, and if the slider is a knife edge, it is possible to read the scale directly to one millimeter, and to estimate at least to one half millimeter.

Standard Resistances

The value of Rl should be accurately shown. Standard resistances are available which are accurate to at least one percent. A set of them should be provided, such as 10, 1,000 and 10,000 ohms. For rough work commercial resistors used in radio circuits may be used for Rl. The value of each one may be determined with a known voltage and a milliammeter. Or the resistances may be obtained by measurement on a bridge in some school or electrical laboratory.

The resistance of each standard should be marked on it so that it is available quickly.

Measuring Speaker Winding

Suppose it is desired to measure the resistance of a loudspeaker winding with this slide wire bridge. It is known that the resistance is approximately 1,000 ohms. The standard resistance to use is then 1,000 ohms. Suppose that the one available has a certified or measured value of 1,040 ohms. The loudspeaker is connected in the Rx position and the bridge is balanced by finding the position of P for which there is no current in the milliammeter. Suppose further that the balance point is found at 36.25 cm. The distance L—x is then 100—36.25, or 63.75 cm. Substitution of these values in the formula gives $Rx = 1{,}040 \times 63.75/36.25$, or 1,830 ohms, which is the direct current resistance of the loudspeaker.

The slide wire bridge can also be used with AC voltage supply and a telephone or amplifier for detector. This is shown in Fig. 3. T is a transformer which takes the place of the battery E. The primary of this transformer may be connected to a 60 cycle power line or it may be connected to the output of a radio receiver which is playing. It makes little difference what kind of transformer it is, but if it is connected to a high voltage source, such as the 110 volt line, it should be a step down transformer. This is merely in order to keep the secondary voltage at a safe value.

Balanced as for DC

The AC bridge is balanced just as was the DC bridge. But in this case it may not be possible to eliminate completely the sound in the head set. There will be capacity coupling which will transfer some of the sound to the speaker. But the balance is effected when the sound is minimum. If the output of a loudspeaker is used as the supply for T it is best to listen to the low notes. The slider side of the head set should be grounded before the balance is obtained.

Instead of using a head set directly as the indicator, an amplifier may be used. The grid of the first amplifier tube is connected to the junction of Rl and Rx and the filament to the slider. Or the circuit may be coupled as in Fig. 4. For ordinary work in the experimenter's laboratory is it not necessary to have a very sensitive indicating device so that either the head set alone or the milliammeter is sufficient.

Biasing Method

the plate load on its way to B plus or the grid load on its way to C minus. Always a condenser, at least 2 mfd., goes from the new junction to ground or equivalent. Thus quality is improved to such an extent that little more may be expected in this direction in the best amplifiers.

The demand for quality has naturally given rise to the use of large capacities for rectifier filtration and independent audio tube filtration. The greater the direct current the greater the capacity needed. Whereas 2 mfd. was once considered a fair-sized capacity in the rectifier output filter, for each condenser, capacities many times this amount are common nowadays.

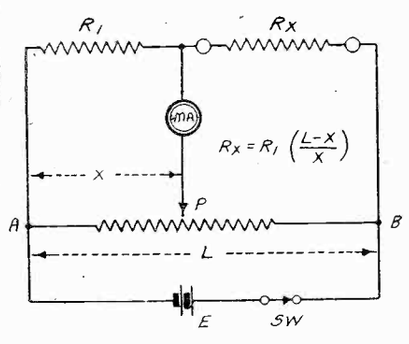


FIG. 2.

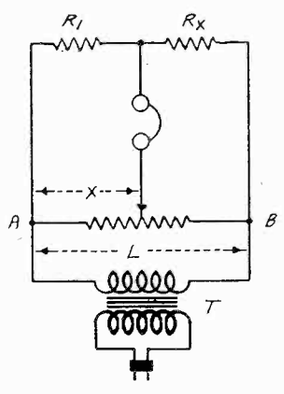


FIG. 3.

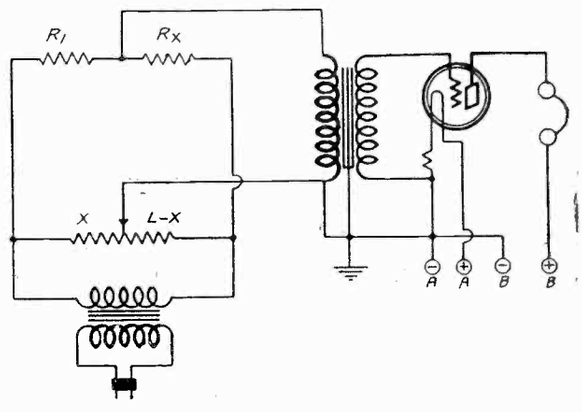


FIG. 4.

FIG.2—A SIMPLE WHEATSTONE SLIDE WIRE BRIDGE FOR MEASURING RESISTANCES. THE BALANCE INDICATOR IS A SENSITIVE MILLIAMMETER AND THE VOLTAGE SOURCE IS A BATTERY.
FIG. 3—A SLIDE WIRE BRIDGE FOR MEASURING RESISTANCES, THE INDICATOR BEING A HEAD SET AND THE VOLTAGE SOURCE A TRANSFORMER COUPLED TO ANY SUITABLE SOURCE.
FIG. 4—THIS DIAGRAM SHOWS HOW AN AMPLIFIER CAN BE USED AS BALANCE INDICATOR WHEN THE VOLTAGE SOURCE IS ALTERNATING.

New MB29 Brings Coast to Coast

Screen Grid AC Tuner An Outstan

By J. E.

Technical

[The MB29 is an outstanding receiver in symmetrical and aesthetic design and in performance. It is new, and is presented herewith for the first time anywhere. It comprises a tuner only, that is, radio frequency amplifier and detector. A power amplifier is to be built separately, or you may use any good amplifier you have.

The whole layout and parts used in the circuit are new, including the National modernistic dial, the National ganged condensers and the National coils, shields and metal sub-base. Professor Browning designed the coils and contributed much to the circuit formation.

the desirable features enumerated above have been incorporated.

First, the receiver contains four AC type screen grid tubes, the best radio frequency amplifier tube made. Second, it has four sharply tuned circuits. Third, it contains ganged condensers, all turned by a single knob. Fourth, every tube in the circuit is of the heater type operated directly from a single transformer winding. Fifth, the shielding and filtering are thorough. Sixth, it has been designed by James Millen and Professor Glenn H. Browning, two of the most outstanding radio engineers in the field.

Not one of these facts is an absolute guaranty that the circuit will meet fantastic demands. But all combined point to an outstanding receiver.

Mr. Millen, the designer of the mechanical features of the receiver and some of the circuit, has never been known to become unduly enthusiastic over any radio device in the design of which he had a hand. Yet he states this receiver brought in nine Pacific Coast stations in one evening at Malden, Mass., a distance of nearly 4,000 miles, and that there was no interference from any other station which was not operating on the same frequency. That achievement indi-

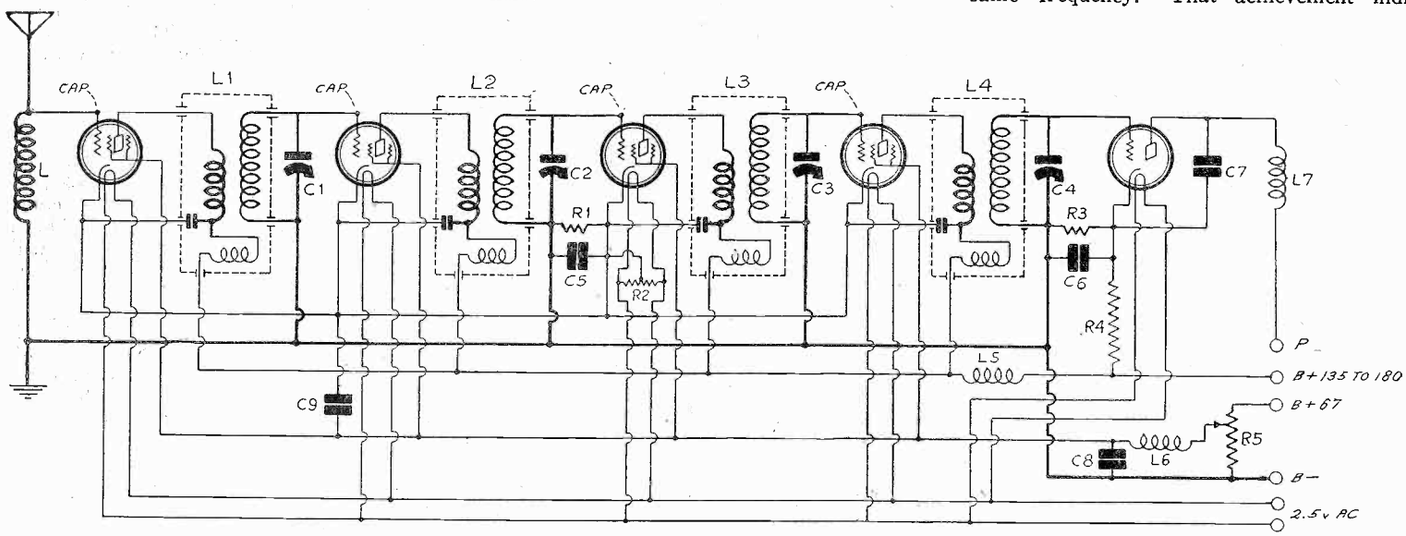


FIG. 1.
SCHEMATIC DIAGRAM OF THE NEW MB-29, DESIGNED BY JAMES MILLEN AND PROFESSOR GLENN H. BROWNING

Any questions regarding the circuit or parts therefor should be addressed to J. E. Anderson, Technical Editor, Radio World, 145 West 45th street, New York City.—Editor.]

THOSE looking for a highly sensitive receiver should turn to circuits embodying screen grid tubes. Those looking for a highly selective receiver should turn to circuits having several sharp tuners. Those looking for a receiver simple to operate should turn to circuits in which the tuning condensers are ganged. Those looking for a receiver that does not require constant attention should turn to electric receivers. Those looking for a receiver that does not oscillate uncontrollably should turn to receivers that are well shielded and filtered. And those looking for a receiver that combines all these desirable features should turn to receivers that have been designed by acknowledged experts.

Scrutinize This One

And none of those looking for a receiver that approaches perfection should fail to scrutinize closely the MB29 receiver about to be described. Let none fail to note how

LIST OF PARTS

L, L5, L6, L7—Four National radio frequency choke coils
L1, L2, L3, L4—Four National S. G. R. F. transformers with by-pass condensers and RF chokes inside shields
C1, C2, C3, C4—Four National tuning condensers for the S. G. R. F. transformers
C5, C6, C8, C9—Four mfd. by-pass condensers
C7—One .001 mfd. by-pass condenser
R1—One 100 ohm resistor
R2—One 60 ohm, center-tapped resistor
R3—One 1,800 ohm grid bias resistor
R4—One 20,000 ohm resistor
R5—One 50,000 ohm wire wound potentiometer
One National drum dial with modernistic escutcheon
One National aluminum MB-29 chassis
Four 224 type screen grid tubes
One 227 type detector tube
One 7x18 in. front panel

cates a sensitivity and selectivity of a high order, and indirectly it points to stability and quietness, for with only a stable and quiet receiver could this be done.

Those who can read a circuit diagram, and from it judge the probable performance of the receiver represented, can readily see from Fig. I that this new Millen-Browning MB-29 receiver gives great performance.

Analysis of Circuit

Let us examine the circuit. All the condensers are ganged, as has been stated already. Every condenser section is exactly like any other. And all the sections are similarly placed. The rotor of each is grounded. Therefore exact tuning and high selectivity are possible, provided that the tuning coils connected across the condensers are also equal.

Identical Coils Used

There are four coil units in the receiver, each one inclosed in a separate shield. Each shield contains a primary winding suited to the screen grid tube preceding it, a secondary winding matching the tuning condenser

in Nine Stations from in One Night

ding Design by Millen and Browning

Anderson

Editor

associated with it, a by-pass condenser joining the low potential side of the primary with the cathode of the tube ahead, and a radio frequency choke coil in series with the primary lead. This choke is mounted at right angles to the tuning transformer so that there is no coupling between the two coils.

The shield around the coil unit is grounded so as to eliminate any capacity coupling and most of the inductive coupling between any two coils in the receiver. The coil units are identical electrically and mechanically. This insures accuracy in tuning.

A feature of the circuit is the untuned grid circuit of the first tube. The signal input is taken off a choke coil L, which is so proportioned that it remains a choke for all the frequencies in the tuning range of the receiver. The amplification is so enormous in the screen grid tubes that a tuned input is neither necessary nor desirable. The untuned input also makes it practical to gang the condensers without trimmers, as the antenna constants can have no effect on the tuning.

Stabilization

Stability of the circuit has been achieved by thorough shielding of the tuning coils, the condensers and the radio frequency choke coils, as well as by filtering. Note that each plate circuit is separately filtered and that the control grid and screen circuits are jointly filtered. No radio frequency current in the plate circuit can get through the chokes to the plate voltage supply. The current must go directly to the cathode through the condenser.

There is also a common radio frequency choke coil L5 to prevent the radio frequency current from entering the B battery eliminator.

L6 is a radio frequency choke coil which serves all the screen grids. No screen grid fluctuations can get into the voltage supply through this coil and no fluctuations in the plate voltage can get through it to the screen grids. This filtering is aided by condensers C8 and C9, one of which by-pass the screen grid leads to the cathodes, and the other to ground.

Single Volume Control

The volume is controlled by adjusting the voltage applied to the screen grids. This has been found to be an exceptionally satisfactory method for screen grid tubes. The adjustment of the voltage is effected by means of a 50,000 ohm potentiometer R5 connected between B minus and plus 67 volts on the B battery eliminator. Thus the voltage can be varied between zero and 67 volts positive.

Grid bias for the screen tubes is provided for by the drop in a single resistor R1, the value of which is 100 ohms. Under normal adjustment of the screen grid and the plate voltages the drop in R1 will be approximately 1.5 volts. C5, a condenser of 1 mfd., by-passes R1.

Grid bias, or plate bend, detection is employed in the circuit. This method is becoming increasingly popular due to its faithfulness and high output. Both a high plate and high grid voltage are used on the tube, making the circuit what is called a power detector.

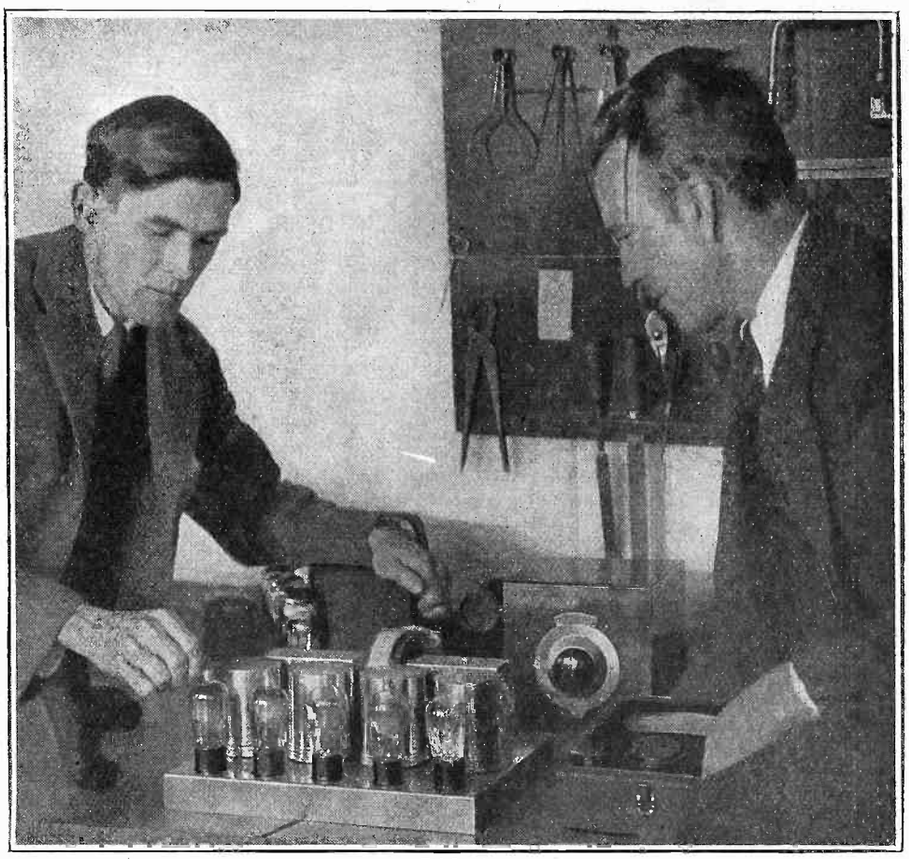


FIG. 2.

JAMES MILLEN (LEFT) AND PROFESSOR GLENN H. BROWNING WITH THE MB29 THAT BROUGHT IN NINE COAST-TO-COAST STATIONS IN ONE NIGHT

A Novel Feature

A novel feature has been introduced in the grid circuit to obtain a high bias without depending solely on the plate current in the tube itself. R3 is the grid bias resistor, the value of which is 1,800 ohms. Ordinarily, this would not give enough bias for detection because the plate current in a detector is too low. Hence R4 is connected between the plate voltage lead and the cathode. A comparatively high current flows through R4 and R3, which is added, in R3, to the plate current of the detector tube. Hence, for a given bias R3 need not be nearly so large as if the plate current of the tube alone flowed through it. The value of R4 is 20,000 ohms. This value, in conjunction with the 1,800 ohms for R3 and 180 volts applied, gives the bias for which the tube is most sensitive as a plate bend detector at the plate voltage obtained by the detector when an audio frequency transformer follows it.

By-passes Both

Condenser C6 by-passes the radio as well as the audio frequency currents which may exist in the circuit. R4 is not by-passed but it is understood that there is a condenser across the plate voltage tap used in the eliminator.

With this remarkable tuner a special word of caution is necessary: use a first-class power amplifier, perferably with single 245 or push-pull 245 or larger power tubes.

The plate circuit contains a by-pass condenser C7 of .001 mfd. This goes directly from the plate to the cathode, which is an accessible and effective connection. A radio frequency choke coil L7 is connected in series with the lead to the first audio transformer to prevent the radio frequency currents from getting into the plate supply or the audio amplifier.

Other illustration on front cover.

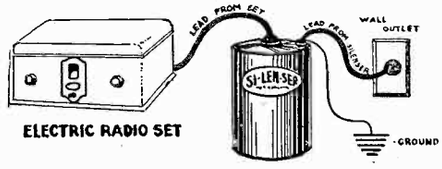
[This concludes the first instalment on the theory of the new MB29. Other phases of the circuit and its construction will be published next week, issue of May 25th.]

At Last-you can Re

SI-LEN-SER
A TRUTONE PRODUCT

The Original
Line Noise Eliminator
For Use
On Electric and Electrified Sets

at the Set



The SI-LEN-SER takes line noises out any electric or electrified set. It silences stray energy which enters the receiv through the power packs of electric sets eliminators. The SI-LEN-SER eliminates A. hum. The SI-LEN-SER kills all knocks a noises that emanate from such devices electric refrigerators, oil burners and moto Used at the set, as illustrated to the left, will stop about 75% of the offending noi When properly used at the source, as lustrated below, it will completely kill noise.

The SI-LEN-SER is by no means a "cure all," and bas nothing to do with static nois that come through in the aerial, but is without doubt the most efficient electric line noise kill that has ever been devised.

Or at the Source of Interference Such as...
Flasher Signs – Electric Refrigerators – Motors, Etc

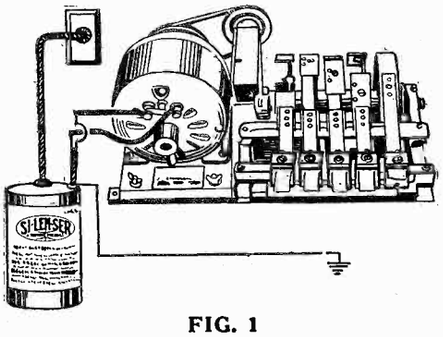


FIG. 1

The SI-LEN-SER line noise eliminator should be attached to flasher signs (as illustrated to the right) when the interference emanates from that source.

As illustrated in fig. 2 (to the right), are two optional hook-ups to motors, such as are used on oil burners and electric refrigerators.

To the left on fig. 2 is shown the SI-LEN-SER attached to the input of a motor. The SI-LEN-SER is simply plugged into the light socket and the lead to the motor plugged into the SI-LEN-SER.

To the right is shown the SI-LEN-SER with its plug removed, crossing the motor leads of the output

The method of using a combined inductive and capacitive filter either at the set or at the source to stop line noises is an invention by Trutone engineers. In the SI-LEN-SER are patented wound coils making it operative at the set in many cases, but always effective at the source for 100% cure. The SI-LEN-SER has nothing to do with aerial pick-up or static received over the aerial. To properly use the SI-LEN-SER find out whether the disturbing noises are in aerial or power line.

The Trutone laboratory engineers are ready, willing and anxious to do everything they can to help drive man-made static from the air. Any problems which you have connected with line interference that you care to write our Service Department, will be promptly and explicitly answered.

MAXIMUM POTENTIAL.....220 VOLTS
MAXIMUM CURRENT.....5.5 AMPERES
MAXIMUM LOAD.....650 WATTS

LIST PRICE $12.50

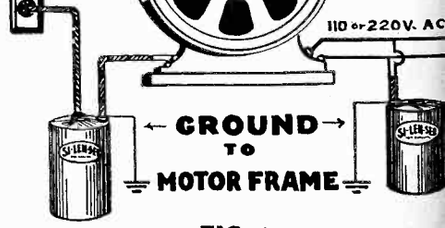


FIG. 2

EVERY SI-LEN-SER SOLD ON 100% GUARANTEE AGAINST DEFECTS

ASK YOUR DEALER! IF NONE I YOUR TERRITORY WRITE O WIRE FOR SAMPLE

SO YOU MAY KNOW

Both the Si-Len-Ser and the Ce-Lec-Tor are sold by all good dealers everywhere. If your dealer does not have the Si-Len-Ser or Ce-Lec-Tor, write us for name of nearest dealer and jobber. The Trutone Products are sold by best dealers everywhere.

Write direct giving us his name and we will send you full and complete particulars of both Si-Len-Ser and Ce-Lec-Tor, including interesting information on line noise elimination and aerial interference discussing in particular the separation of interfering stations.

Every Trutone item is guaranteed an tested and is sold on an absolute mone back basis. When you trade with Trutone you take no chances. Dealers and Jobber write for proposition.

IF IT'S A TRUTONE PRODUCT—IT MUST BE RIGHT!

TRUTONE RADIO SALES CO.

lly enjoy your Radio!

CE-LEC-TOR

TRADE MARK

A TRUTONE PRODUCT

SEPARATES STATIONS ON LOW WAVE LENGTHS

The Original
Band Pass Filter
For Use
On Electric or Battery Sets

Reduces Static!

Eliminates Aerial Interference

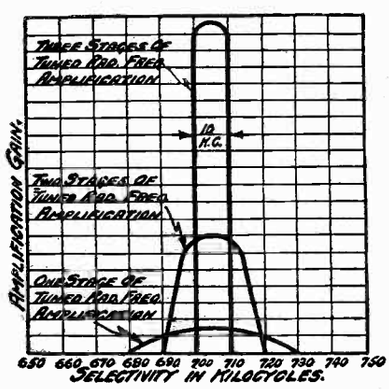
As fundamental as the basic principles of radio is the band pass filter system. Trutone engineers have been working for years to combine it with the wave trap principle and have at last achieved their goal. The perfected product is "THE CE-LEC-TOR."

The CE-LEC-TOR is a band pass filter with a new, novel and patent method of cutting off any infringing side bands. It is particularly effective on low wave lengths. It also balances the aerial and tunes the first tube. The band pass features in the CE-LEC-TOR prevent more than one frequency being passed at a time.

Another great feature of the CE-LEC-TOR is that it reduces static. We do not claim that it will eliminate static, there is nothing that will do this, but on actual tests the CE-LEC-TOR does decrease the noises heard in a radio loud speaker attributed to "static." If it entirely eliminated static,which is of the same electric energy as the signal, it would take out the program.

Absolutely no tools are necessary to attach the CE-LEC-TOR to any radio. The CE-LEC-TOR comes completely self-contained in a beautiful bakelite container, which is 3⅛ in. in diameter. From it are two wires, one to be attached to the aerial binding post and the other on the lead-in of the aerial **$6.50**

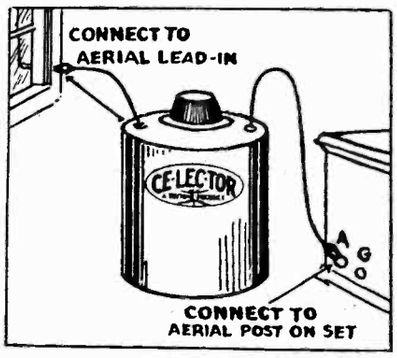
You Gain Selectivity with the



CE-LEC-TOR
A TRUTONE PRODUCT

This chart shows the selectivity of adding stages of tuned radio frequency. Selectivity increases rapidly, as the chart shows, after each new stage of R.F. is added. The Ce-Lec-Tor adds practically two stages of tuned radio frequency because it tunes the aerial. By the addition of the Ce-Lec-Tor the increase in selectivity is shown in the chart.

EASY TO HOOK-UP



There are only two connections to make to use the Ce-Lec-Tor. These are illustrated above. Simply connect one of the wires to the aerial binding post of your set and the other wire to the aerial lead-in. You are now ready to use it. One minute's work—no tools, no wires needed.

IAKERS OF LEN-SER and E-LEC-TOR

114-116 Worth St., New York, N. Y.

Good Parts Alone Don't

You Have to Use Your Sober Head

By H. B.

[This is the second of a series of articles on power amplifiers, by H. B. Herman. A general discussion of audio was published last week, issue of May 11th. Next week, issue of May 25th, another branch of the subject will be discussed.—Editor.]

THE quality obtainable from a broadcast receiver depends almost entirely on what follows the detector. That is, it depends on the audio amplifier, the loudspeaker and the power supply. The tuner in sharply tuned circuits discriminates against the higher audio frequencies, but the distortion from this cause in the average receiver is very small compared with the distortion possible in the audio frequency end of the circuit.

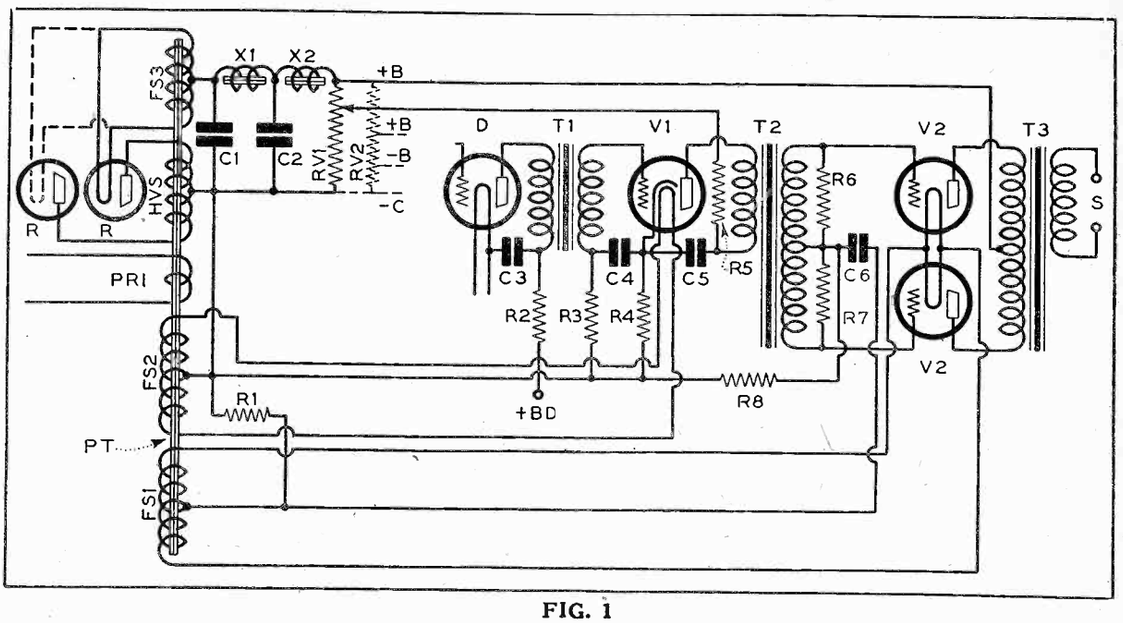


FIG. 1
A WELL DESIGNED PUSH-PULL AUDIO FREQUENCY AMPLIFIER WITH ITS POWER SUPPLY ARRANGED SO THAT THERE CAN BE NO FEEDBACK

While it is of first importance to build the audio system of good parts, it is no assurance against distortion simply to select the best parts. Co-ordination of the parts is just as important. The very best audio transformer as judged by laboratory measurements may be the indirect cause of the greatest dissatisfaction. A poor audio transformer in the same circuit may give tolerable results. But the tolerable results obtained with the poor transformer are not enjoyable results to the discriminating listener.

Quality Requisites

The first requisite for realistic quality in the broadcast receiver is the selection of the very best parts obtainable. The second requisite is the selection of the correct components and the right amount. The third requisite is the co-ordination of the parts into a working amplifier which will give the results predicted by the laboratory measurements.

This co-ordination is largely a matter of filtering the plate current supply to every stage in the circuit to insure that each stage acts independently of all other stages. At no place should the signal current have an opportunity to cross over from one stage to another, either backwards or forwards. In other words, any common impedance in the circuit should not be permitted to act as a coupler. If any signal curent flows in any common impedance the quality of the output of the amplifier will not be an amplified copy of the input, but will contain frequency distortion.

Deceptive Stability

The absence of oscillation in the circuit is no assurance that there is no feedback and consequent distortion. The feedback may be in such phase as to depress the amplification in a certain region of the audible scale and such that it will cause regeneration in another region. Yet this regeneration may not be sufficient to maintain oscillation at any frequency. It takes an extremely small amount of feedback in a circuit of high amplification to produce great distortion, or to render the output of an amplifier built of the best parts as poor as that of an amplifier built of the cheapest parts.

Hence if the output of an amplifier built of superior parts is to be of a high order of fidelity, every trace of feedback must be eliminated.

Good Example of Co-Ordination

A splendid example of proper co-ordination of components in an audio frequency amplifier is shown in Fig. 1. It comprises a detector tube, a stage of single-sided, and one stage of push-pull amplification, together with the necessary plate power supply device.

Let us examine this circuit in detail to find out the purpose of the various components, especially those which are not found in ordinary amplifiers.

In the plate circuit of the detector is a condenser C3 connected from the low potential side of the primary of T1 and the filament of the tube. The object of this condenser is to lead the signal current flowing in the primary directly to the filament of the tube, or to the cathode, in the event the detector is a heater tube. If this condenser is large, very little of the signal current is forced through the plate supply. Two microfarads or more should be used in this position.

There is a resistance R2 in series with the lead to the primary, one object of which is to aid C3 to prevent the signal current from entering the plate supply. The signal current at the low end of the primary encounters two impedances, that of C3 and R3. If R2 is present more current will flow through C3 and hence less through the plate supply.

Works Both Ways

Suppose some signal current has found its way into the plate supply from the succeeding stages. There will then be a voltage fluctuation at the signal frequency on the lower end of R2. This would cause a feedback current to flow up through R2 and through C3 and the primary. A condenser should therefore be connected from BD to the filament, or to B minus. This condenser is usually built into the eliminator. For any given fluctuation of the voltage at BD a smaller current will flow through the primary if R2 and C3 are present. Hence R2 and C3 act as a filter from both directions, that is, they prevent the detector tube from feeding its signal current into the common supply and they prevent any signal current from the other tubes from entering the primary of the first transformer.

Careful Filtration to Keep Each Both Input and Output, a Pull Power Amplifier Embodies

The plate circuit of the detector tube is the most critical point with respect to feedback, because any signal voltage introduced at this point will be amplified by all the succeeding tubes.

Grid Bias Filter

That it is necessary to by-pass the grid bias resistor in any tube has been discussed many times. It has been shown that the grid bias resistor causes a negative feedback from the plate to the grid of that tube. The only thing that can be used to prevent this reverse feedback is to use a condenser across the resistor. Hence C4 is employed in this circuit, R4 being the grid bias resistor.

But it is not enough merely to use a condenser across the resistor. While no current would flow in the secondary of the transformer R1 if the tube following were perfect, in an actual tube there is some current. This must not be permitted to enter the common portions of the circuit. Hence R2 is used in series with the grid return. C4 and R3 serve exactly the same purpose in the grid circuit as C3 and R2 serve in the plate circuit. Note

Make a Good Amplifier

s Well As Your Impulsive Hands

Herman

LIST OF PARTS

T1—One Ferranti AF-5 transformer.
T2—One Ferranti AF-5c transformer.
T3—One Ferranti OP-4cc for dynamic or OP-8c for magnetic speakers.
R1—One Ferranti 700 ohm, 100 milliampere resistor, with mountings.
R2, R5—Two Ferranti 10,000 ohm resistors, with mountings.
R3, R8—Two Ferranti 20,000 ohm resistors.
R4—One Ferranti 2,000 ohm, 20 milliampere resistor, with mountings.
R6, R7—Two 250,000 ohm resistors.
C1—One 2 mfd., 600 volt condenser.
C2—One 4 mfd., 400 volt condenser.
C3, C4, C5—Three 2 mfd., 200 volt condensers.
C6—One 4 mfd., 200 volt condenser.
RV1—One 30,000 to 35,000 ohm wire wound resistor with adjustable taps.
RV2—One 15,000 to 20,000 ohm wire wound resistor with adjustable taps.
R—One type-80 full wave rectifier tube.
V1—One type-27 amplifier tube.
V2—Two type 245 amplifier tubes.
X1, X2—Two Ferranti 30 henry, 100 to 150 milliampere chokes.
PT—One power transformer having one 110, 60 cycle primary, one 750 volt, 100-150 milliampere secondary with center tap, one 2.5 volt secondary with center tap, one 2.4 volt secondary with center tap and five one volt secondary with center tap.
If the three additional condensers are used they should be as follows:
Across R4, 2 mfd., 200 volts, across R1, 4 mfd., 200 volts, across B plus and FS1 center, 2 mfd., 600 volts.

be's Circuits Independent, ıality Factor—Ferranti Push- pert Design

that C4 goes from the low end of the secondary directly to the cathode. This is the most effective connection.

Some improvement might result if another condenser were connected directly across R4. But the need for this by-pass condenser is reduced by the presence of C5 in the plate circuit. C5 leads the signal current in the primary of T2 directly to the cathode and thus keeps it out of R4.

In the plate circuit of the second tube is a filter exactly like that in the plate circuit of the first tube. It serves the same purpose and works in the same way. As in the case of the detector, a condenser might also be connected from the B plus end of R5 to the cathode or to B minus. But this should be built into the eliminator, and usually is.

Filtering in Push-pull

Two equal resistors R6 and R7 are connected across the halves of the secondary of T2, the object of which is to provide a definite load on the transformer. These resistors provide a decided improvement in the frequency characteristic of the amplifier. But they should not be smaller stage is not quite so great as in a single-sided circuit. If the circuit is absolutely symmetrical there would be no need for filtering at all, for the circuit would neither feed any signal current into the common plate power supply, nor would it be affected by any signal current existing therein.

Unbalance Exists

But it is not possible to get a perfectly symmetrical push-pull amplifier. Hence the push-pull stage will affect the signal current in the common supply, and it will be affected by any current already there. Therefore some filtering is necessary.

There is R8, a filter resistor in the grid return lead of the amplifier, and C6, a condenser which leads the signal current in the secondary directly to the cathode, or mid-tap of the filament. It is only the unbalance current which flows through C6, that due to any dissimilarity between the two sides of the amplifier. R8, of course, forces the current through the condenser and prevents it from entering the common portions of the circuit.

Shunt Bias Resistor

R1 serves to give the tubes in push-pull a grid bias. While very little signal current flows through this resistor due to the push-pull arrangement, it would be desirable to have a condenser directly across R1, because any current that does flow through increases the unbalance. Again, there should be a condenser from the mid-tap of the output transformer to the mid-tap of the filament. These two suggested condensers have been omitted from the circuit because the balance was nearly perfect in the model receiver built up. Any unbalance will be due to the tubes used, and since everybody does not have an unlimited number of tubes to choose from, it is well to insert the condensers as a precaution against possible distortion or motorboating.

Power Supply Unit

Even the best amplifier circuit will not work satisfactorily unless it be powered with an adequate supply unit. Not only must the voltage be high enough but it must not fluctuate as the current requirements change with the signal. That is, the supply unit must have good regulation. That means that the rectifier tube or tubes used should be capable of delivering the necessary current, that the power transformer must be built on generous lines so that there will be no voltage drop in it, and that the filter choke coils be wound with heavy wire. The core must be large so that it will not saturate when the direct current flows through the winding. The condensers also must be large enough to take out the ripple in the rectified current.

The kind of rectifier tube or tubes, to use depends directly on the voltage and the current. For a high-power amplifier employing two 250 tubes in the last stage, the rectifier should contain two —81 tubes. The connection of these is shown in Fig. 1. If the final tubes are two 245s one —80 type full wave rectifier can be used with good results. The connection of this is also shown in Fig. 1. It is only necessary to disregard the dotted line and assume that both the plates are in one tube.

Where the voltage is high and the current requirements moderate, a single —81 tube in half wave connection can be used. This connection is shown directly in Fig. 1, omitting the dotted line.

The list of parts herewith refers to an amplifier employing two 245 power tubes in the push-pull stage.

Right or Wrong?

(Answers on page 19.)

1—The power expended in an induction coil is equal to the AC voltage across the coil multiplied by the current flowing in it.

2—Induced currents of metal bodies in the vicinity of a tuning coil reduce the selectivity and the signal strength of the receiver.

3—The energy in a sound wave is proportional to the square of the product of the amplitude and the frequency.

4—The impedance of the primary of a transformer is the same whether the secondary is open or closed.

5—A push-pull amplifier does not pick up so much noise from the B battery eliminator as a single-sided circuit and it does not require a plate voltage as thoroughly filtered.

6—A push-pull amplifier eliminates the even harmonics generated by overloading the tubes ahead of the push-pull amplifier.

7—Harmonics of broadcasting stations often picked up by short wave receivers are transmitted by the station.

8—The baffle board of a loudspeaker prevents the sound radiated backwards from coming around to the front to interfere with the forward sound.

9—We buy electric power from the electric company.

10—There is no external field around a toroidal inductance coil.

Station Is Sued For Sending a Song

WLTH, Brooklyn, N. Y., is defendant in a suit for an injunction and $250 damages, instituted by the American Society of Composers, Authors and Publishers, on the ground that the station permitted the unauthorized broadcasting of the song, "My Angeline," on February 1st. Both Gene Buck, as president of the Society, and Leo Feist, Inc., as publisher of the song, filed suit as co-plaintiffs. The suit is based on alleged infringement of the copyright law.

The injunction sought would prohibit the station from sending out the song without permission.

NEW CROSLEY SALES CHIEF

Cincinnati.

Neal E. Newman is the new general sales manager of Crosley Radio Corporation. He formerly directed sales of comptometers. Crosley will manufacture airplanes as well as radio sets and apparatus.

ADDS FURNITURE LINE

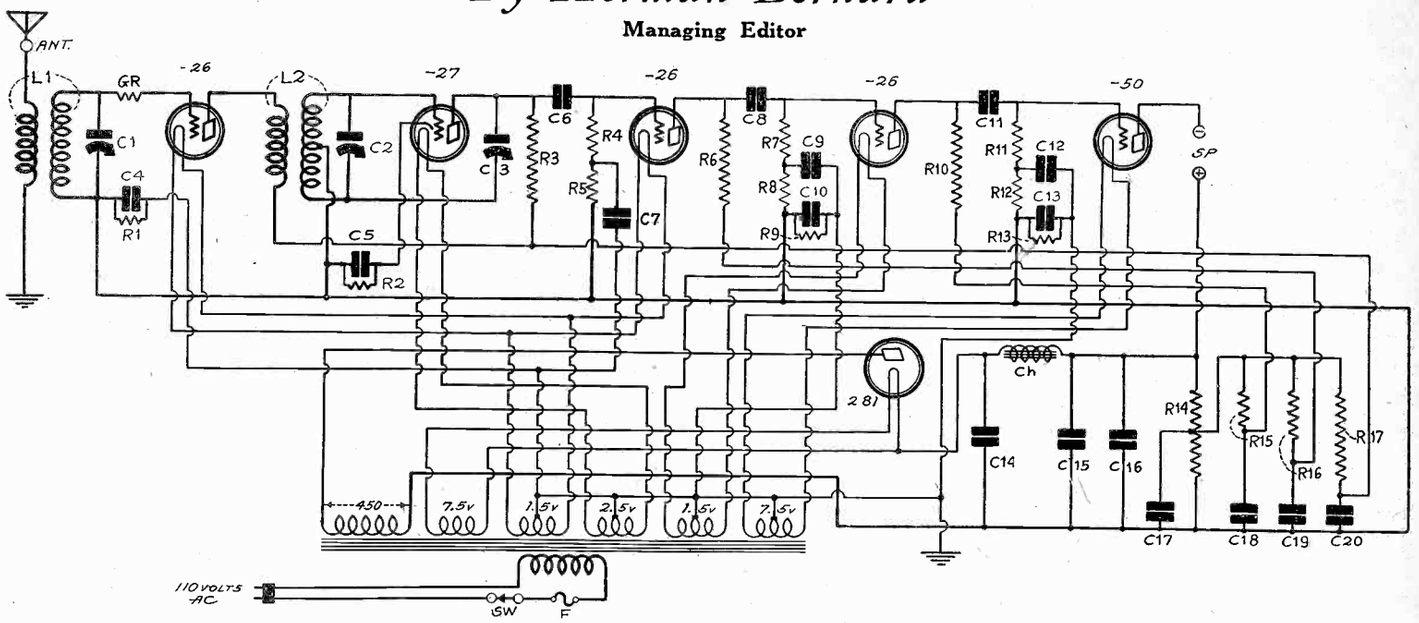
The Caswell-Runyan Co., of Huntington, Ind., manufacturers of radio cabinets, announced the appointment of The Friedman-Snyder Co., 15 Park Place, New York City, as their representatives in the Metropolitan area.

You Read Diagrams

Quick Glance Reveals Surface, Close Study the Intimate Lore

By Herman Bernard

Managing Editor



WHAT DO YOU KNOW ABOUT READING A DIAGRAM?

ARE you able to read a schematic diagram of a circuit?

Take the diagram printed herewith. What does it mean to you?

No mattter what the connections are, you should be able to make them out. They are made to resistors, coils and condensers. You should be able to tell how the current flows, where, why, and the purpose of the connection.

The diagram at a glance discloses the following:

First: A 5-tube AC receiver with B supply, in which is a half-wave rectifier tube.

Second: One stage of RF amplification, regenerative detector and three stages of resistance coupled audio.

That is all that a quick glance reveals.

Now, scanning the circuit, we see that grid bias is afforded to each tube by a resistor. All grid returns are to B minus; hence, all biases are negative.

R1 biases the first tube, a 226. The same resistor biases the first audio tube. The 1.5 volt winding third from left in the power transformer feeds these two tubes directly with AC for the filament, hence only one bias is obtainable. The plate currents of the two tubes must flow through the same filament winding, hence if independent resistors were across each filament they would be merely in parallel. The center-tap therefore may well be used.

How does the bias arise?

The plate current flows from the plate of the tube across the inside of the tube, past the grid to the filament. It takes the name of space current. It must find its way back to the starting point, B minus, or there would be no circuit. This it does by flowing through the filament to the secondary of the power transformer, dividing here, so that the current meets at the midtap and proceeds through the biasing resistor to B minus. The current in the resistor causes a voltage difference and this is the bias, due to connection of filament to positive side of the bias resistor, and grid return to negative side. Hence the grid is negative in respect to average filament center.

GR is a resistor that does not bias. Why not? Because no direct current flows through it. Used as a suppressor, to stabilize the RF stage, it is in series with the tuned circuit. It increases the resistance of the grid circuit, not, however, of the tuned circuit. It is outside the tuning arrangement L1C1. High input resistance (called input impedance) improves selectivity. The resistance of GR should be equal to the negative RF resistance caused by regeneration. Then, and for higher resistance values, the circuit will not self-oscillate.

The detector is negatively biased too. Rectification takes place because the bias is high. Since the detector is only indirectly heated by AC, and is directly heated by thermal radiation from the heater, the biasing resistor now goes from cathode (electron emitter) to B minus. The resistor is R2. It is very large, because, though the plate current is low in a detector, the bias must be high. R2 is 50,000 ohms, whereas R1 is only 1,000. R2 gives 10 volts bias at a plate current of .2 milliampere. The current is so low because of the voltage reduction in R3 and in R2. The plate current of the detector flows through both.

Regeneration is provided by a form of Hartley oscillator that splits a single coil to combine it in plate and grid circuits, to produce "parallel feed."

Look at the resistance coupled audio amplifier. It has plate resistors (R3, R6, R10) and grid leaks (R4, R7 R11), also plate-to-grid condensers. Look at those condensers now. They are C6, C8, C11. Plate to grid! Does that mean they *couple* the plate of a preceding tube to the grid of a succeeding tube? Think! Can't say?

Well, for R3, R4, R6, R7, R10, and R11 use very small resistance—1,000 ohms each, for instance. No signals are heard. It is a fact the condensers C6, C8 and C11 do not couple the respective stages. Resistance coupling is just that—coupling by and through resistors. R3 is in the plate circuit. R4 is in the next grid. They are in parallel. But if nothing intervened, then the positive plate voltage would go directly to grid of the next tube, and we want the grid negative. Therefore we use isolating or stopping condensers, not to couple one stage to another, but to keep the positive voltage off the grid. The condensers, however, form part of a resistance-capacity filter, since in series with parallel resistors. Therefore C6, C8 and C11 should be of large capacity (.02 mfd. or more), lest low notes be cut off. To safeguard amplification the leaks should be of a high order, 1 meg. or more.

The plate resistor R3 may be high, up to 1 meg., or more. But the other plate resistors showed not exceed 100,000 ohms, because a larger flow of plate current is desired in the stages that have to handle greater voltage. The signal has only this plate current to "ride on," so if the plate current is less than the maximum swing of the signal, distortion and blocking arise.

The grid circuits of the AF channel are filtered. R5 is no grid leak, for C7 bypasses the signal to ground. It is a filter circuit to keep the signal out of the B supply. Any slippage would have to be through R5, and that would be a good stopper of truant currents, because whittling them down so much. Contrast this with R4, which, the larger it is, increases the voltage drop across it, hence the input to grid-filament. But remember that the preceding plate resistor is in parallel, and that the net resistance of the two is going to be less than the resistance of the smaller!

Resistors in parallel equal the reciprocal of the sum of the reciprocals. 100,000 ohms in the plate circuit and 1,000,000 in the grid circuit equal:

$$\frac{1}{\frac{1}{100{,}000}+\frac{1}{1{,}000{,}000}} = \frac{1}{\frac{11}{1{,}000{,}000}} = \frac{1{,}000{,}000}{11} = 90{,}909 \text{ ohms}$$

The resistance-capacity filter is used in the B supply also. The B voltage is dropped through a resistor (e. g., R15), and immediately this circuit is bypassed by C18. The reason is the same: prevention of audio feedback, which if present would cause slow oscillations (motorboating) or medium ones (howling) or high ones (steady squeal.)

Note in a half-wave rectifier that filament is positive, plate negative. A plate in any tube always is negative in respect to the B+ source feeding it, but only in a rectifier is the plate negative in respect to filament.

An Automatic Stabilizer

Data on Winding Coils for Self-Neutralization at RF

[*A new method of stabilization at radio frequencies was discussed last week, issue of May 11th. This consists of a rotating coil anchored to the protruding shaft of the tuning condenser, and in inductive relationship to the antenna coil. By providing plate circuit connection of this coil to the first tube varying degrees of feedback, positive or negative, are obtainable. As the dial is rotated the tickler coil turns automatically. Last week a schematic of a receiver using this system was published. The author discussed using the coil at full negative feedback with condenser plates "out," so that at 50 on the dial the phase angle would be zero, while at 100 it could be full positive. The second instalment is published herewith.—Editor.*]

* * *

TRY this method. If too much resistance is introduced put on the fourth winding, already referred to, and marked "fixed" in the diagram. Remove the tickler end from L3 and put it to the terminal of the new winding that occupies the same relative position as does the grid connection of the tube, that is, in positive feedback fashion. The two windings may be so constituted that the fixed tickler affords positive feedback and the rotatable tickler negative feedback. This is when the system worked "too well." For cases where stability was not resultant, reverse the connections to the fixed fourth winding. Data on the number of turns will be given presently.

Can Change Phase

With either the single tickler arrangement or the tickler in series with a fourth but fixed winding, the angle of rotation, being 180 degrees, or half a circle, will permit you to change the phase as needed. The tickler alone, no fourth winding included, permits a full 180-degree change of phase, but the tickler plus the small fixed winding reduces the scope, which is sometimes helpful.

The Angular Dissection

Considering any tickler coil, if it is at maximum positive regeneration it is parallel with the secondary, both physically and electrically. The change in phase is from 90 to 0 for all the available positive feedback and from 0 to 90 for all the available negative feedback, hence half one way, half the other. But if you start with the tickler set at right angles to the secondary, the phase shift is from 0 to 90 in one direction (say, positive), and also from 0 to 90 in the other direction. The feedback can never be maintained wholly positive or wholly negative so long as the tickler coil rotates through an angle of 180 degrees, and the only mechanical method of reducing the angle would be to introduce a retarding gear or drive that makes the tickler move slower than the condenser shaft, hence confines the tickler rotation to a narrower limit.

May Leave Net Negative

An electrical method of meeting the problem is the one previously discussed, where a small fixed winding is used for positive feedback, while the tickler introduces varying negative feedback that always exceeds, but by different amounts for different dial settings, the positive feedback, leaving a net negative all the time.

Coil Data

An existing three-circuit coil may be rewound. Leave the primary as it is for antenna-ground. This is about 10 to 15 turns on the 2½ to 3 in. The secondary also is unmolested. For 2½ in. the turns may be 50 of No. 24 single or double silk insulation. The tickler is reduced to eight turns. The fourth winding, if used, may have four turns. These data apply to .0005 mfd. tuning. For .00035 mfd. the directions are the same, except that the secondary has 60 turns instead of 50.

[*Diagrams and photographs showing the physical construction and layout of this system will be published next week, issue of May 25th.*]

Cooke Will Manage Direct Sale of Sets

Chicago.

The Club Aluminum Company and associates has an all-electric radio receiving set and will sell it direct to the home through salesmen and not through dealers, William A. Burnette, president of the company, announced.

This phase of the company's business is termed the radio division and Douglas H. Cooke, of New York City, is general manager. Mr. Cooke was business manager of "Popular Radio." There will be three standard models, all being nine-tube sets.

H. P. DAVIS IN NEW POST

H. P. Davis, formerly in charge of Westinghouse Manufacturing, has been assigned exclusively to radio operations. He is known as "the father of broadcasting" for his development of KDKA. J. S. Trittle took charge of manufacturing. W. C. Evans has been appointed superintendent of radio operations.

KENT PROGRAMS ALL SUMMER

Seventeen vocalists and instrumentalists will be heard during the new series of the Atwater Kent Radio Hour, which began May 11th and will last 21 weeks. Plans include a concert every four weeks by the Atwater Kent Quartet.

Ce-Lec-Tor Tunes Out Strong Locals to Bring in DX

By James H. Carroll

Contributing Editor

Nowadays, with so many stations on the air at one time, the interference in some sections, even with good receivers, is intolerable. In some locations it is impossible to get more than a few stations without interference or, at the best, conflicting music or song in the background of the station which is tuned in.

A device such as the Ce-Lec-Tor, the newly perfected band pass filter station separator, devised and marketed for the purpose of meeting modern conditions of interference, cuts out crosstalk interference and reduces heterodyne interference.

The designer of the Ce-Lec-Tor, Julien J. Proskauer, inventor of the Si-Len-Ser, the successful line-noise eliminator, advises that the Ce-Lec-Tor be used in the aerial circuit, where it will probably give the best results. However, there are many types of circuits and many varying conditions to be met. Therefore, there is no harm in trying different methods of connecting it, besides the thrill that comes with experimentation.

The aerial circuit should first be tried, and this is a simple connection. The lead from one side of the Ce-Lec-Tor is connected to the aerial, the other to the antenna binding post of your receiver. Then the receiver is tuned to the wanted station and the interfering station is tuned out by carefully turning the knob.

In pulling in distance past a powerful local, the writer tuned the local in at full power, then tuned it out with the Ce-Lec-Tor, then, by varying the tuning dial of the receiver, brought in a couple of otherwise elusive DX stations very easily. Do not turn the juice on full at this point.

This is the easiest, and probably the best way to install and work the Ce-Lec-Tor, but if for any reason, you have trouble, especially on the lower wavelengths, try it on the ground circuit. For this conection, one lead from the Ce-Lec-Tor is connected to the ground wire and the other is run to the ground connection on the receiver. Tuning is accomplished in the same way as before, going slowly and with the utmost care as it is quite easy to pass over a signal as every DX fan knows. This method should be especially efficient for low wave interference elimination.

Super-heterodyne fans and those using loops on tuned radio frequency receivers may find the Ce-Lec-Tor a useful aid. The writer has used it, in testing a sample model, very effectively in cutting out interference. The simplest method is to cut in on one side of the loop, taking care to have the leads as short as possible. Each side of the loop should be tried, or the loop rotated 180°.

Another method is to connect the Ce-Lec-Tor in the grid circuit without disturbing the loop connections and leaving the loop connected as it is, in this means the Ce-Lec-Tor is connected in the grid circuit between the oscillator or condenser and the grid post of the socket. This is the best method. To dominate and extinguish extremely powerful circuits in close vicinity to the receiver, the aerial and ground shunt may be tried. To do this, the Ce-Lec-Tor leads are attached to the antenna and ground binding posts without disconnecting the aerial and ground. No tuning can be done with it in this way, it merely functions then as an excellent trapping system. As a trap circuit the Ce-Lec-Tor should be tuned very carefully to the interfering station.

Radio University

QUESTION and Answer Department conducted by RADIO WORLD, by its staff of experts, for University members only.

When writing for information give your Radio University subscription number.

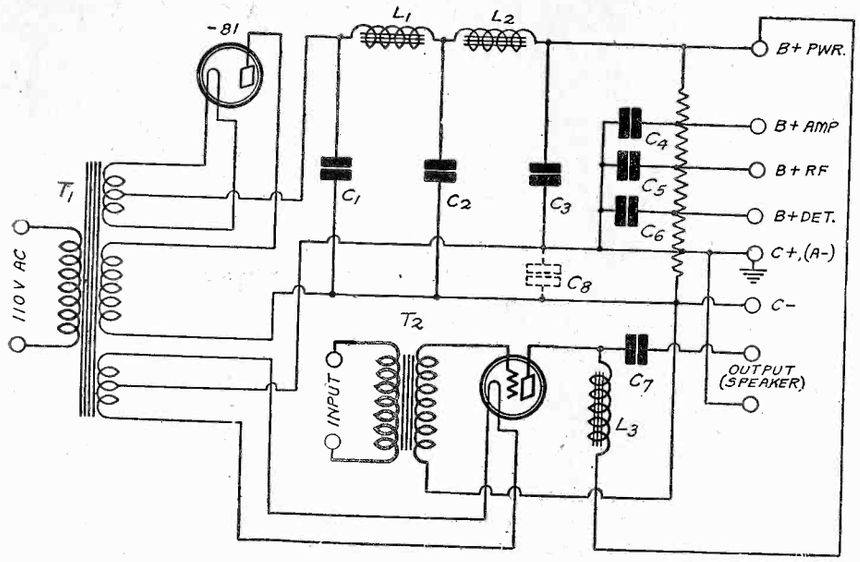


FIG. 753
THE CIRCUIT DIAGRAM OF A HALF WAVE RECTIFIER EMPLOYING AN —81 TUBE AND A STAGE OF POWER AMPLIFICATION. CIRCUIT ASKED FOR BY ARNOLD A. JAHN.

I HAVE a Super-Heterodyne receiver which is satisfactory both for sensitivity and selectivity, but it makes a terific noise as soon as I turn up the volume. What causes this noise and how can it be remedied?

(2)—Is there any particular advantage in using an intermediate frequency which is not a whole multiple of 10 kilocycles over one in which the intermediate frequency is an integral multiple of this number?

(3)—Is there any advantage is a frequency which is not an integral multiple of either 10 or 5 kilocycles?

(4)—What frequency would you recommend as the most suitable for a Super-Heterodyne?

WALTER TERRY,
Lincoln, Nebraska.

(1)—The blasting noise which is often heard is due to overloading of the final tube in the circuit, and any means which limits the signal will stop it. Approach the tuning points on the dials carefully and turn the volume down as it increases with more exact tuning. There are, of course, many other types of howling, but this is the one that is usually associated with tuning.

(2)—There is some advantage in having an intermediate frequency which is an integral multiple of 5 kilocycles and not of 10 in that this would reduce image interference to some extent.

(3)—The object of having an intermediate frequency which is neither a multiple of 5 nor 10 kilocycles is to reduce image interference, but it is of doubtful advantage.

(4)—It is better to use a high intermediate frequency, which may be a whole multiple of 10 kilocycles. When the intermediate frequency is high, say between 100 and 200 kilocycles, it is easy to tune the radio frequency circuit so sharply that image interference will not be troublesome.

* * *

IS IT POSSIBLE to utilize the grid bias on the power tube for the plate voltage on the detector tube or for the radio frequency tubes? I refer to AC heated circuits in which the power tube gets its bias from a drop in a resistor.

(2)—If this is possible, would there be any undesirable coupling between the detector and the power tube?

MYRON TYNDALL,
Louisville, Ky.

(1)—Such a connection is possible provided that the bias on the power tube is high enough to give the plate of the detector sufficient voltage. To make the connection, connect the cathode of the detector to the same point as the grid return of the power tube and connect the plate return of the detector to the positive end of the bias resistor for the power tube. The plate voltage on the detector will then be the same as the bias on the power tube.

(2)—There will be considerable coupling between the tubes and it will result in either oscillation or distortion unless the bias resistor is by-passed thoroughly.

* * *

WHAT ARE the frequencies of the highest and the lowest notes on a piano?

(2)—What are the corresponding frequencies on an organ?

MAURICE WILSON,
New York, N. Y.

(1)—All pianos do not have the same number of keys and all are not tuned to the same pitch. On the physical scale the lowest key has a frequency of 27 cycles, but on most pianos the frequency is slightly higher. The highest frequency is around 4,000 cycles.

(2)—The larger organs have a frequency range from 16 to 16,000 cycles. Thus they virtually cover the entire audible scale. Many persons will not be able to hear the highest.

* * *

WHY ARE SOME tubes microphonic and others of the same type all right?

(2)—What can be done to overcome microphonism in a tube?

(3)—Could the trouble be remedied by changing the voltages on the tube without impairing its amplification efficiency?

JACQUES BARBIER,
New Orleans, Fla.

(1)—The difference between tubes of the same type in this respect may be due to a difference in rigidity of the element supports. Or there may actually be a broken support in the microphonic tube. The trouble is due to relative vibration between the elements. For example, the plate may be fixed and the filament may vibrate, or vice versa. Or the vibration may be between the plate and the grid or between the grid and the filament.

(2)—The only thing that can be done is to prevent the sensitive tube from vibrating. It may be placed on spring or sponge rubber supports, it may be loaded down with a lead cap, or it may be isolated from all sound vibrations. Very often the vibrations are transmitted from the loudspeaker to the tube through the supports rather than through the air. Loading the tube and at the same time mounting it on "dead" supports will be effective in such cases. Use the tube in another socket.

(3)—Nothing can be done by changing the voltages.

* * *

IS IT FEASIBLE to use the same filament winding for all the tubes in an AC receiver when all these tubes require 2.5 volts?

(2)—How would it be possible to provide the proper grid, plate and screen voltages from the same B battery eliminator?

(3)—What is the essential difference between wet and so-called dry electrolytic condensers? If they are electrolytic must they not be wet?

THEODORE OSGOOD,
Los Angeles, Calif.

(1)—It is quite feasible.

(2)—Just as in any other circuit. The only thing to guard against is the voltage between cathodes and the heaters of the AC screen grid tubes. This voltage should be about 9 volts with the negative on the heater. The other heater tubes require a positive voltage on the heater.

(3)—The difference lies in the amount of liquid electrolyte. In the so-called dry electrolytic condensers the liquid is mixed with solid inert substance, just as it is in dry cells. The distinction should be moist and wet.

* * *

WHAT IS the purpose of the thorium in the filaments of certain radio tubes?

(2)—Why are oxide coated filaments operated at a cherry red temperature while the thoriated tubes are operated at a white temperature?

(3)—Will you kindly describe a circuit arrangement for reactivating tubes having oxide coated filaments and specify the required flashing and boiling voltages?

LEO MOULTON,
Scranton, Pa.

(1)—The thorium helps to release the electrons so that it is not necessary to burn the filament so brightly as if the pure tungsten were used.

(2)—The oxide coating on the filament enables the electrons to escape freely from the filament at a much lower temperature, and therefore the filament is operated at a dull red heat rather than at a white heat.

(3)—Tubes with oxide coated filaments cannot be reactivated. When they have lost their emission there is nothing to do but to replace them.

* * *

WILL YOU please publish a B battery eliminator and a power amplifier employing an 81 rectifier and a 250 tube?

(2)—Which type of output device do you recommend, a choke and condenser or a transformer?

(3)—I have a power transformer with two five-volt windings and one center-tapped 1,000 volts. Can this transformer be used for the circuit?

ARNOLD A. JAHN,
Milwaukee, Wis.

(1)—See Fig. 753 for such a drawing.

(2)—The drawing shows a choke and condenser. The type to use depends on the tube and on the speaker. A magnetic speaker having a high impedance works well with the output device shown. A dynamic should have a transformer between the tube and voice coil. Such a transformer is a built-in part of the dynamic.

(3)—This transformer is suitable as far as voltages go.

Right or Wrong?

(Questions on page 15)

1—Wrong. This yields the power associated with the coil, but not the power expended. The power expended is product of the voltage across the coil and the component of the current which is in phase with the voltage. For a good choke coil this power is very small as compared with the total power associated with the coil.

2—Right. Induced currents introduce resistance in the coil and therefore they reduce both the selectivity and the signal strength.

3—Right. This holds true for any wave motion such as sound, light and water waves.

4—Wrong. If that were true, the power line in an alternating circuit could be short circuited without danger. When the secondary is open the impedance of the primary is that of the primary winding acting as a choke coil. When the secondary is short-circuited the primary has practically no impedance.

5—Right. If any disturbance takes place in the supply it affects the two tubes equally as to amount, but opposite as to phase. Any residual hum in the plate voltage supply is just one form of disturbance.

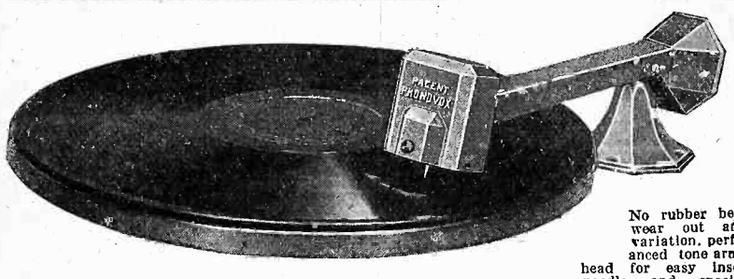
6—Wrong. The even harmonics generated by overloading any tube ahead of the push-pull stage are fundamentals to the push-pull amplifier and as such they are amplified just as any other signal impressed.

7—Wrong. While broadcasting stations do radiate a little energy on the harmonics, they are not to blame for much of the interference with short wave stations. The receiver generates most of the harmonics from the carrier wave of the broadcast station. This view is not yet orthodox.

8—Wrong. The baffle board is used to put a load on the speaker piston, that is, to give the piston a chance to take hold of the air. If the interference of the forward and backward waves were the object the baffle would not help much, for no matter what size of baffle board were used there would be constructive interference at some frequencies and destructive interference at others.

9—Wrong. We buy electrical energy in kilowatt-hour units. Power is the time rate at which we buy it, and we cannot buy a time rate.

10—Wrong. The field around well-constructed toroidal coils is very weak. Essentially it is equal to the field around a single turn of wire having a diameter equal to the mean diameter of the toroid. This field could be neutralized by running a single turn of this mean diameter around the coil in the opposite direction to that in which the toroidal winding advances along the ring.



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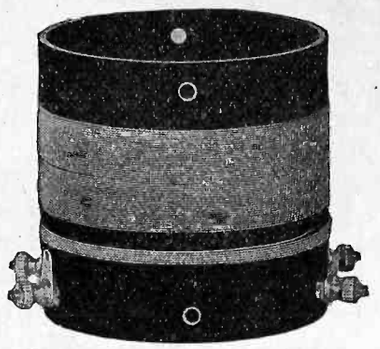

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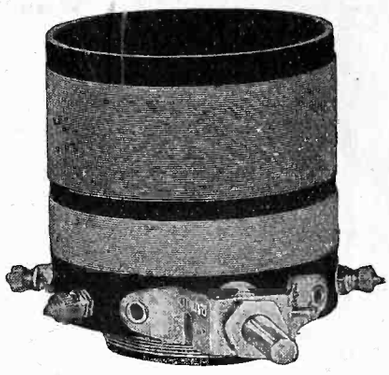
Model AC3, for .00035 mfd.....$1.75



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

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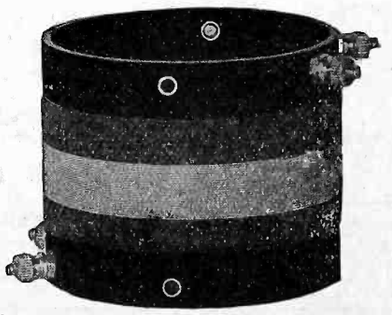
Model RF3, for .00035 mfd..... $1.75



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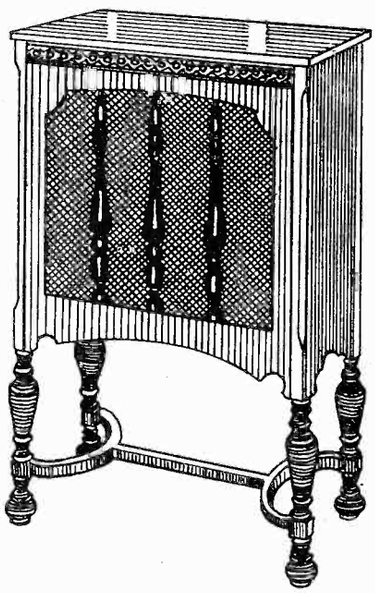

The speaker cabinet is walnut finish, 33" high, 24½". wide,. 17½". deep,. with. carved. legs. Golden cloth grille covers front opening. .Built inside is No. 595 molded wood horn with baffle and No. 203 driving motor unit that stands 250 volts without filtration. Horn and motor removable. Table alone is worth price asked. Remit with order and we pay cartage on Aristocrat Floor Speaker.

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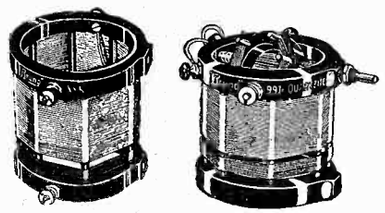

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Plain Rear Sheet
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Build the speaker. If not overjoyed at results, return the built-up speaker in five days and get ALL your money back!

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The Only Tubes with 5-Day Money-Back Guarantee in Each Box

222 Screen Grid Tube $3.50

AFTER having tried many screen grid tubes, many specialists have made Kelly 222 their choice. Our 222 stands up! Filament is not critical, but 3.3 volts work best. Plate voltage may be from 90 to 180, but negative bias of 1.5 volts remains the same. The screen grid voltage, G post of socket, may be 22 to 45 volts, depending on how much amplification you want. A working amplification of 60 is easily obtainable (60 mu.).

The plate current is virtually independent of plate voltage in the recommended range, 90 to 180 volts. This aids stability.

The cap at top of the tube is for familiar grid connection.

This tube is for battery or A-eliminator operation.

240 High Mu Tube $1.25

Great for Detector or in audio channels where a resistor or impedance coil is in the plate circuit. Fil. 5 volts DC, plate 90 to 180 volts.

POWER TUBES

250	$6.00	210	$4.50
171A	1.50	112A	1.50

OTHER TYPES

280	$2.50	281	$3.50
227	2.25	226	1.25
201A	1.00	199	1.25

KELLY TUBE COMPANY
Walter J. McCord, Manager
57 DEY STREET, NEW YORK CITY
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Please look at the subscription date stamped on your last wrapper, and if that date indicates that your subscription is about to expire, please send remittance to cover your renewal.

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ORIGINAL BALDWIN PHONES, tested and guaranteed, $3.65, postpaid, Blan, the Radio Man, 89 Cortlandt Street, New York City.

RADIO RECEIVING TUBES, by Moyer and Wostrel, first edition just off the press. No radio service man, experimenter or student of radio should be without this authoritative book on the principles and applications of vacuum tubes. It answers all your questions relating to receiving, amplifying and rectifying tubes. Price postpaid, $2.50 Radio World, 145 W. 45th St., New York.

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DYNAMIC SPEAKER
Build your own with our castings. Set of machined castings, $8.00; not machined, $5.00. Full set blue prints and instructions included. Prices of complete parts on request.
IMPERIAL RADIO SPEAKER CO.
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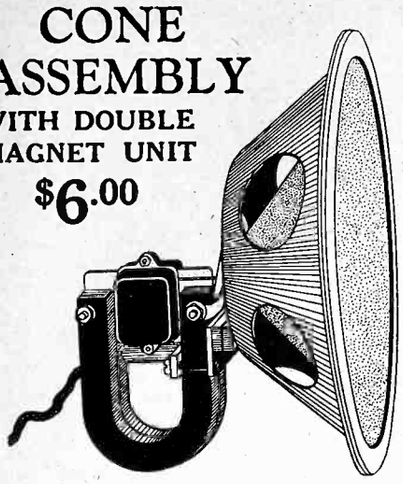
The Famous Tyrman '60' Super Kit, $42.89 postpaid. Willard Stahl, 225 Highland Street, Grand Rapids, Michigan.

CONE ASSEMBLY

WITH DOUBLE MAGNET UNIT

$6.00



An excellent magnetic type speaker for installation in any cabinet. The unit is a double-magnet Paratone, with two magnet coils, for utmost sensitivity. Each horseshoe magnet is ¾" thick. The magnet coils are forever protected against dust and other foreign, injurious substances, by special bakelite housings. The pin is reverse drive. The cone frame is metal. The 9" cone is specially treated buckram.

All assembled, with long cord, ready to play, Shipping weight 6 lbs. (Cat. CAS) Net **$6.00**

The unit alone (cord included). It will operate any type sounding surface, including paper, cloth, wood, etc. Shipping weight 4 lbs. (Cat. UA). Net **$3.50**

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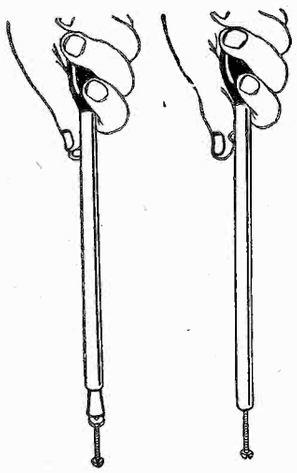
SOCKET WRENCH

FREE



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

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

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

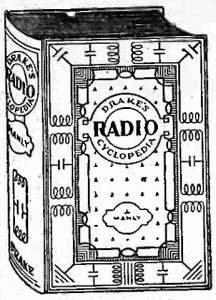
Use the knob to push out the plunger, press down on the handle to grip the nut, then turn the nut to left for removal or to right for fastening down. Total length, distended, including stained wooden handle, 10". Gets nicely into tight places. Send $1 for 8 weeks' mail subscription for RADIO WORLD and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

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

RADIO WORLD

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

YOU *MUST* GET THIS BOOK!



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DRAKE'S RADIO CYCLOPEDIA (New Edition)

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

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

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

The important articles deal primarily with receivers and reception. They do not stop with the electrical end, but go also into the mechanics of construction.

Every new thing in radio is covered in detail.

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159 Concern service men, 129 help the set builder, 162 help the experimenter, 155 interest the student, 75 assist in sales work, 73 interest set owners.

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Gentlemen: Please mail me at once the new (second) edition of "Drake's Radio Cyclopedia," by Harold P. Manly, just published, with all the latest technical information in it. I will pay the postman $6.00 plus a few cents extra for postage. If I am not delighted, I may return the book in five days and you will promptly refund my purchase money.

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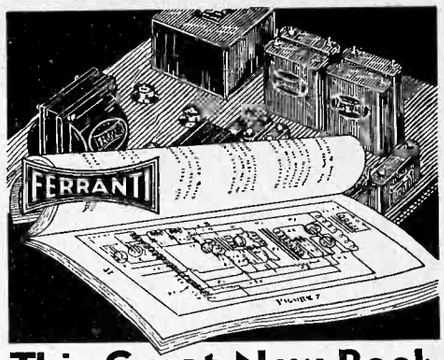

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THIS OFFER EXPIRES AT NOON ON JUNE 30TH, 1929

Choose Your Speaker from This Complete Array!

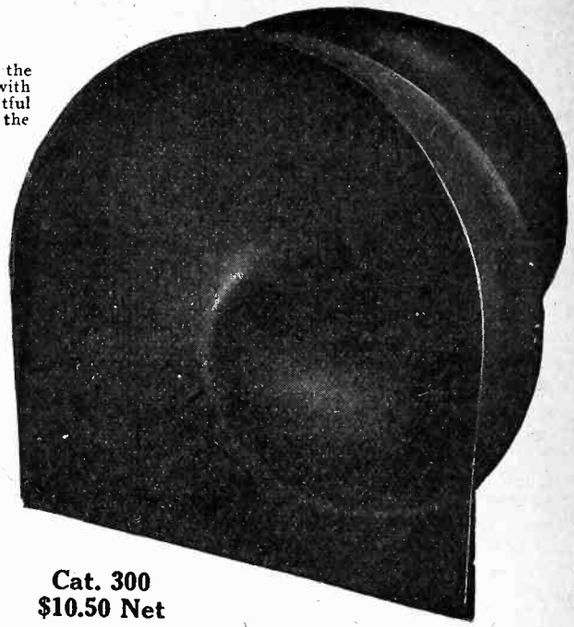
EXPONENTIAL TYPE HORNS

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 7⅞ 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, 13⅛". Weight, 5 lbs.

Driving motor, the unit needed to work the air column horns. Standard size thread. Cat. 208. 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.

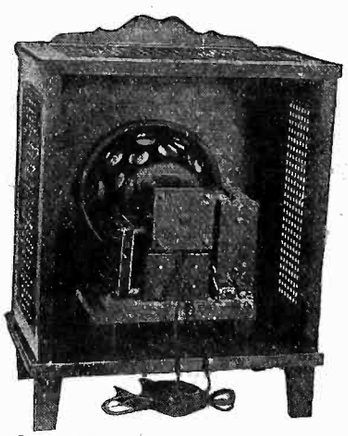
Cat. 110 A.C.; Price, $20.50 Net

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.

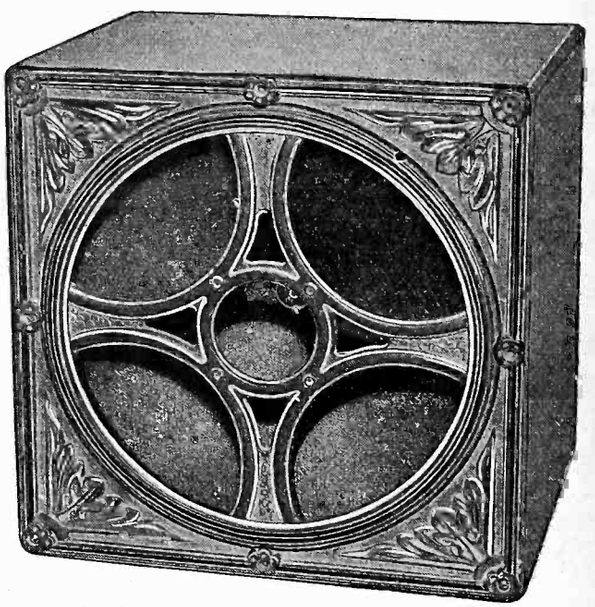
Those whose place is wired with 110-volt D.C. (direct current) should use Cat. 110 D.C. @ $17.50 net. Those who have no electricity should use the model that works from a 6-volt storage battery. Cat. 6 D.C. @ $14.75 net.

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.



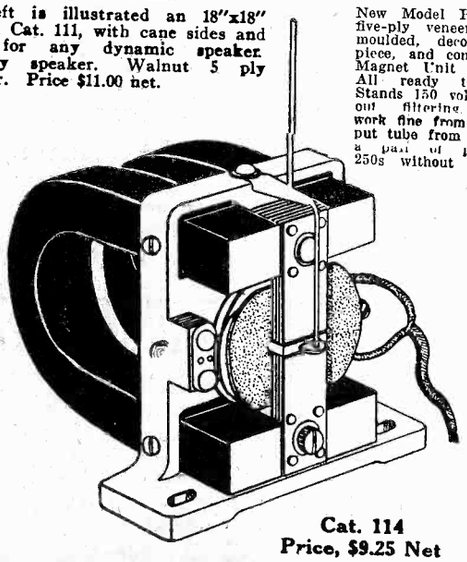
Cat. 111; Price, 11.00 Net

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



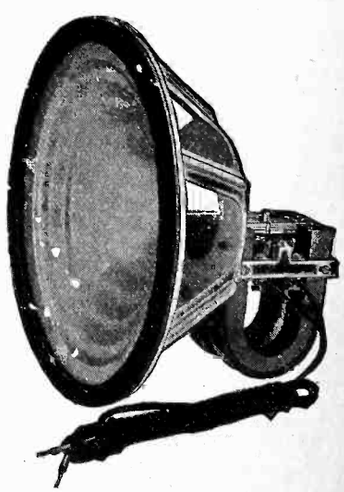
New Model Polo Speaker, with five-ply veneer walnut housing, moulded, decorated metal front piece, and containing Polo Twin Magnet Unit and Textile Cone. All ready to play. Stands 150 volts without filtering. Will work fine from any output tube from 201A to a pair of push-pull 250s without rattling.

Cat. 113
Price, $13.50 Net



Cat. 114
Price, $9.25 Net

Polo Twin Magnet Unit—weight, 3½ lbs., or twice as heavy as ordinary unit. Twin magnets double sensitivity. This unit gives more volume, clearer tone, and stands the gaff. Supplied with 10-ft. cord. Cat. 114. Tri-foot molded unbreakable metal mounting bracket and apex constitute Cat. 114A @ $0.75.



Cat. 115; Price, $11.50 Net

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

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

- ☐ Cat. No. 200
- ☐ Cat. 300
- ☐ Cat. No. 110 A.C.
- ☐ Cat. No. 110 D.C
- ☐ Cat. No. 6 D.C.
- ☐ Cat. No. 300
- ☐ Please send C.O.D
- ☐ Remittance enclosed. Please send prepaid.
- ☐ Cat. No. 111
- ☐ Cat. No. 113
- ☐ Cat. No. 114
- ☐ Cat. 114A
- ☐ Cat. 115
- ☐ Cat. 116
- ☐ Cat. No. 203

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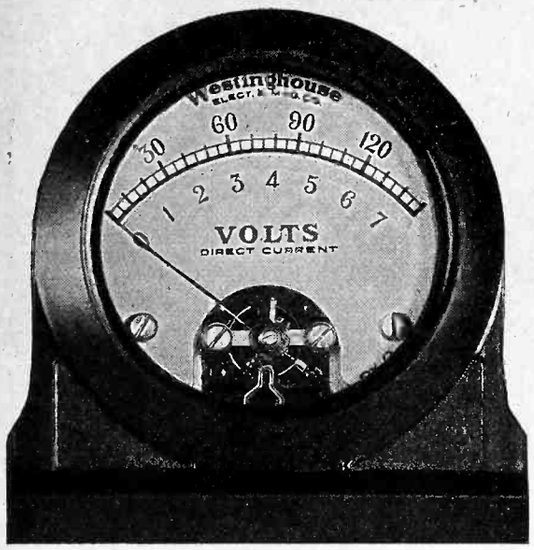
5-DAY MONEY-BACK GUARANTEE

Westinghouse 0-7½, 0-150 VOLT-METER FREE!

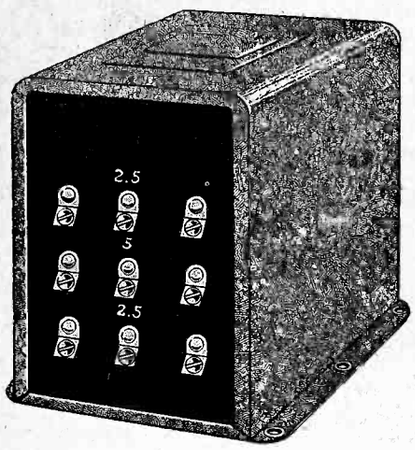


This beautiful Westinghouse meter given FREE! Read generous offer!

Double range direct current meter, O-7½ volts legible to ¼ volt, and O-150 volts, legible to 5 volts. The d'Arsonval Movement (dynamic principle) is used. Resistance is about 100 ohms per volt. A mirror strip, for observing the needle so as to hide its own reflection, facilitates closest reading, in conjunction with knife-edge. End-stops are built in. So is a zero corrector. The casing is moulded bakelite. The meter is illustrated full size. At rear are three posts—the common minus and the two positive posts. A connecting cable is furnished with each meter, lugs at one end, tip plugs at other. Send $6 for year's subscription for Radio World (52 numbers) and get this genuine Westinghouse table model meter FREE! Present subscribers may renew under this offer by stating subscription expiration date and enclosing $6.

Radio World, 145 W. 45th St.
New York City

Filament Transformer



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 transformer is beautifully finished in crackled 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, 2⅝ 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.
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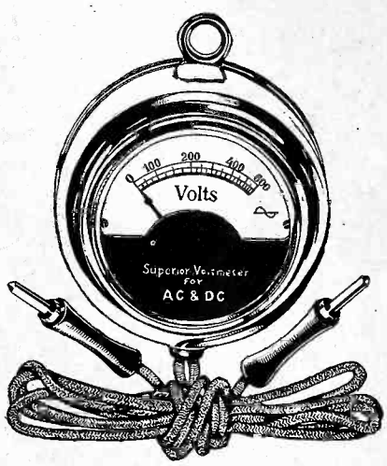
O-600 V. AC and DC
High Resistance Meter

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.,
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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

Name .....

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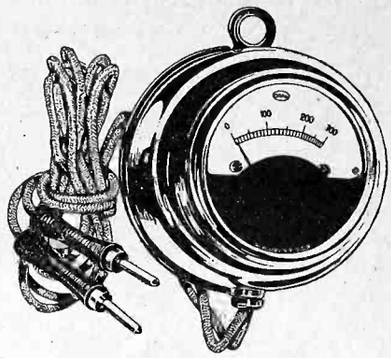
DYNAMIC BAFFLE

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

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

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. 346F. **$4.50**

No. 347F, same as above, but 0-500 volts, $6.00

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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
No. 13—For testing A batteries, dry or storage. 0-16 volts DC scale..... 1.00
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

PANEL AC VOLTMETERS
(Panel meters take 2-5/64" hole)

No. 351—For reading 0-15 volts AC.....$2.25
No. 352—For reading 0-10 volts AC..... 2.25
No. 353—For reading 0-8 volts AC..... 2.25

(See No. 348 under "Pocket and Portable Voltmeters.")

PANEL VOLTMETERS

No. 335—For reading DC voltages, 0-8 volts, $1.00
No. 310—For reading DC voltages, 0-10 volts, 1.00
No. 316—For reading DC voltages, 0-16 volts, 1.00
No. 326—For reading DC voltages, 0-6 volts, 1.00
No. 337—For reading DC voltages, 0-50 volts, 1.00
No. 339—For reading DC voltages, 0-100 volts, 2.25
No. 342—For reading DC voltages, 0-150 volts, 2.25
No. 340—For reading DC voltages, double reading, 1-8 volts, 0-100 volts..... 1.50

VOLTAMMETERS

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
No. 35—For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC 1.50

PANEL MILLIAMMETERS

No. 311—For reading 0-10 milliamperes DC..$1.75
No. 395—For reading 0-20 and 0-100 ma. DC.... 1.50

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.....$ .75

Immediate Shipment

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

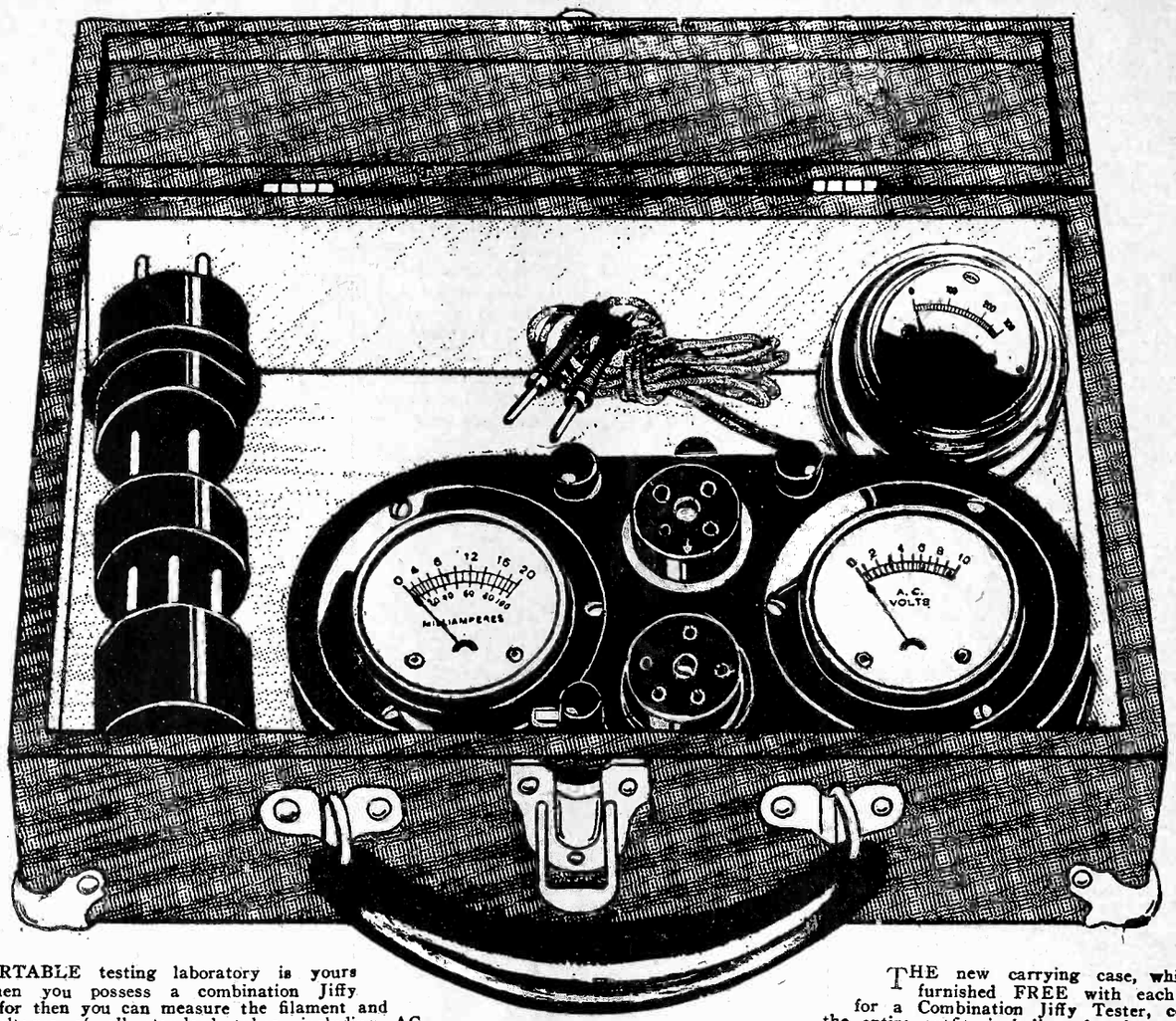
VICTOREEN
Super Coils

Write for Free Blueprints of New Victoreen Circuits

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

New Style DeLuxe Leatherette Carrying Case FREE with each Jiffy Tester!

This combination of meters tests all standard tubes, including the new AC screen grid tubes and the new 245 tube, making thirteen tests in 4½ minutes! Instruction sheet gives these tests in detail.



A PORTABLE testing laboratory is yours when you possess a combination Jiffy Tester, for then you can measure the filament and plate voltages of all standard tubes, including AC tubes, and all standard battery-operated or AC screen grid tubes; also plate voltages up to 500 volts on a high resistance meter that is 99% accurate; also plate current.

The Jiffy Tester consists of a 0-20, 0-100 milliammeter, with change-over switch and a 0-10 volt AC and DC voltmeter (same meter reads both), with two sockets, one for 5-prong, the other for 4-prong tubes; a grid bias switch and two binding posts to which are attached the cords of the high resistance voltmeter; also built-in cable with 5-prong plug and 4-prong adapter, so that connections in a receiver are transferred to the Tester automatically. Not only can you test tubes, but also opens or shorts in a receiver, continuity, bias, oscillation, etc. The instruction sheet tells all about these tests.

In addition you can test screen grid tubes by connecting a special cable, with clip to control grid (cap of tube) and other end of special cable to the clip in the set that went to the cap before the tube was transferred to the tester.

THE new carrying case, which is furnished FREE with each order for a Combination Jiffy Tester, contains the entire outfit, including the three meters, cable and plug, and three adapters (one for 4-prong tubes, two for 199 tubes). This case is 10½x 7¾x3½" and has nickel corner pieces and protective snap-lock. The case is made of strong wood, with black leatherette overlay.

To operate, remove a tube from the receiver, place the cable plug in the vacant receiver socket, put the tube in the proper socket of the Tester, connect the high resistance meter to the two binding posts, and you're all set to make the thirteen vital tests in 4½ minutes!

The Combination Jiffy Tester is just the thing for service men, custom set builders, experimenters, students, teachers and factories. Order "Jiffy 500." The price is only $14.50.

If a 0-600 AC and DC high resistance meter (99% accurate) is desired, so house electricity line voltage and power transformer voltages can be measured, as well as plate voltage, instead of the 0-500 DC voltmeter, order "Jiffy 600" at $15.50.

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

☐ Please ship at once on 5-day money-back guaranty one "Jiffy 500," at $14.50, consisting of
(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 change-over switch. This reads plate current.
(3) One 0-500 volts high resistance voltmeter, 99% accurate; 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.
(12) One screen grid special cable.

☐ If 0-300 DC high resistance 99% accurate voltmeter is preferred to 0-500, put check here. Price is same, $14.50.

☐ Same as above, except substitute a 0-600-volt AC and DC high resistance 99% accurate voltmeter (same meter reads both) for the 0-500 DC meter. Price $15.50.

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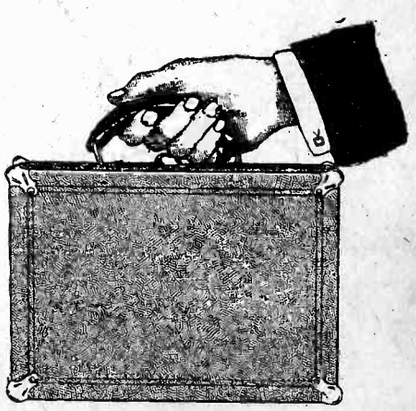
FIVE-DAY MONEY-BACK GUARANTY



The new de luxe leatherette carrying case is compact and handy. Size 10½" long, 7¾" wide, 3½" deep.