

NOV. 17th, 1928

15 CENTS

RADIO

REG. U.S. PAT. OFF.

WORLD

The First and Only National Radio Weekly

347th Consecutive Issue—Seventh Year

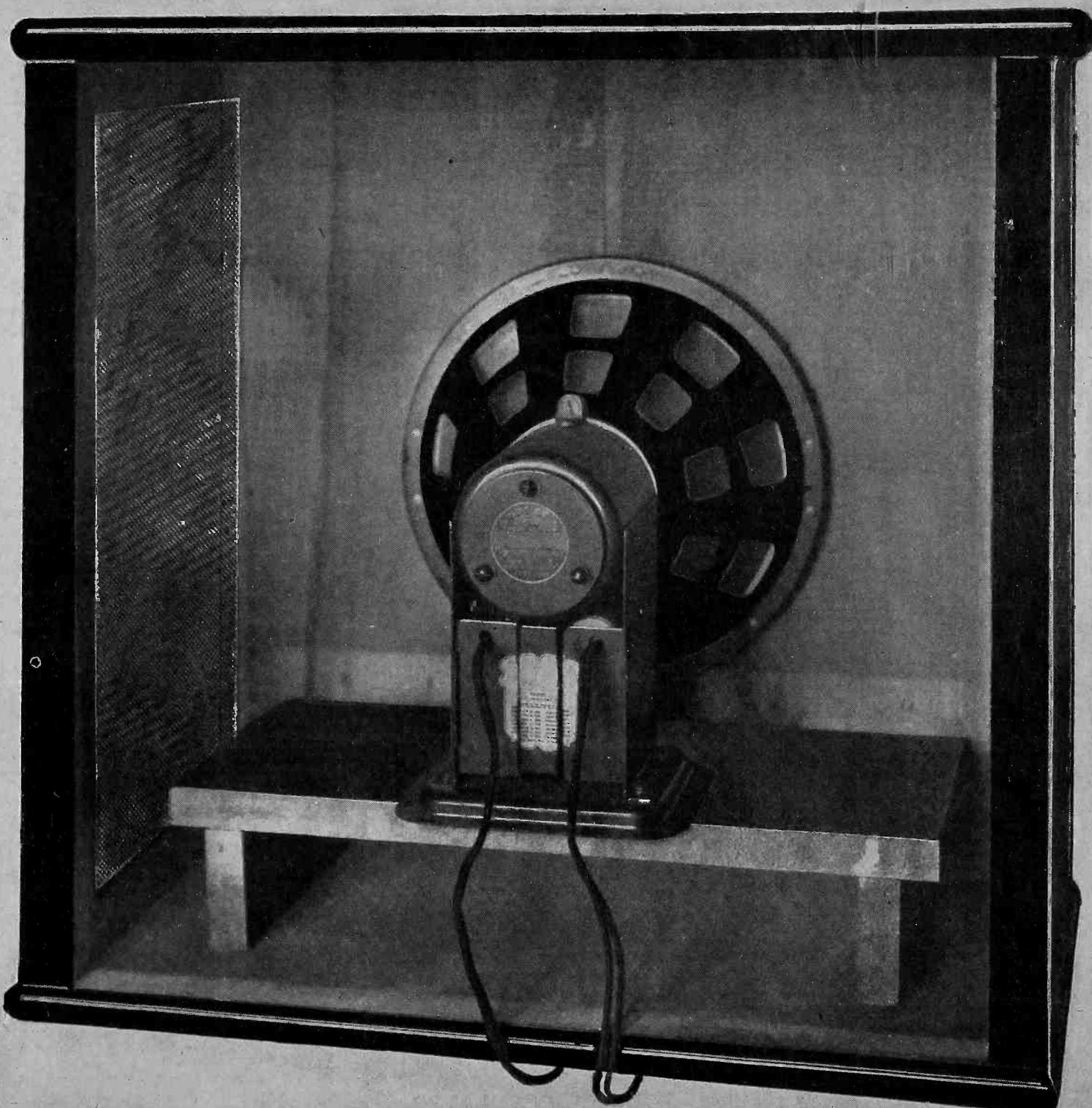
Distortionless Audio,
0 to 10,000 Cycles!

Wonders of Radio

Ferranti 250 Push-Pull
Audio and B Supply

Seven Pages of News

AN OPEN-BOX BAFFLE FOR DYNAMIC SPEAKERS



See pages 12 and 13 for Article on Construction of this Baffle

"JIFFY TESTER" Pays You Profits!

"Something wrong with my set!"

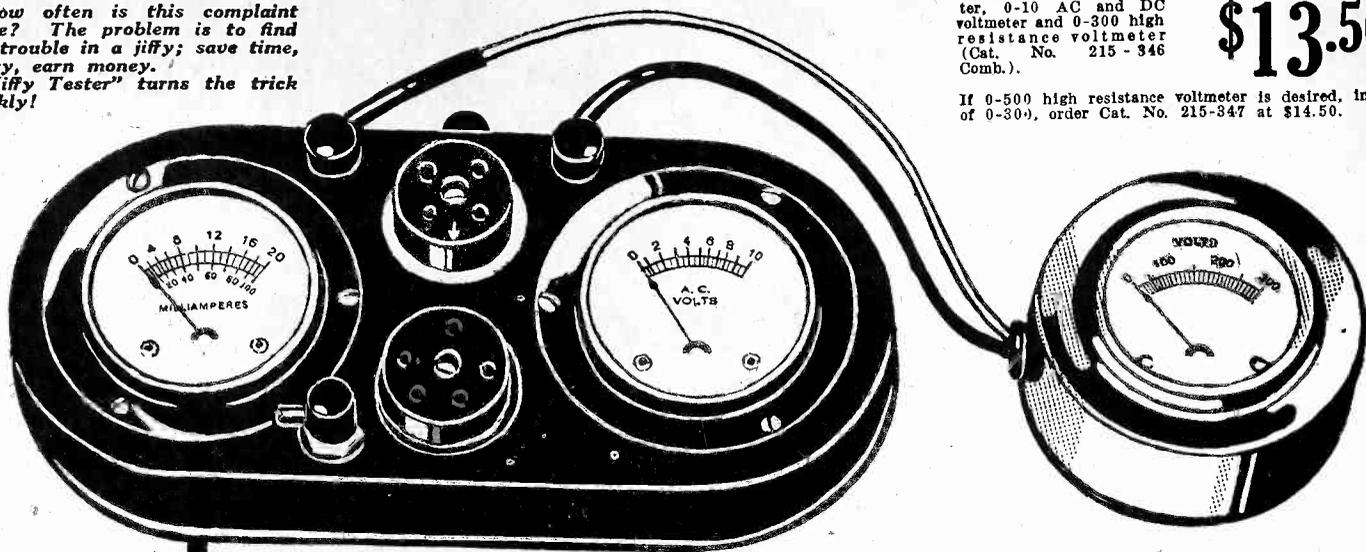
How often is this complaint made? The problem is to find the trouble in a jiffy; save time, worry, earn money.

"Jiffy Tester" turns the trick quickly!

Jiffy Tube and Set Tester, consisting of 0-20, 0-100 combination milliammeter, 0-10 AC and DC voltmeter and 0-300 high resistance voltmeter (Cat. No. 215-346 Comb.).

\$13.50

If 0-500 high resistance voltmeter is desired, instead of 0-300, order Cat. No. 215-347 at \$14.50.



The 5-prong plug fits 5-prong AC tube socket of receiver. The 4-prong adapter converts the plug for tests of 4-prong tubes.

The 215 Jiffy Tester makes twelve vital tests in 4 1/2 minutes, locates trouble, ends fuss, saves you time and nerves, and makes money for you, because you get the same pay for doing the same job quickly and scientifically as you can get for doing it slowly and unscientifically. The Tester is built to withstand hard knocks and rough usage.

Even More Accurate than Your Work Requires

The meters are accurate to 5% plus or minus, which is more than ample for service work, home experimenting, and all other needs, except commercial laboratory testing.

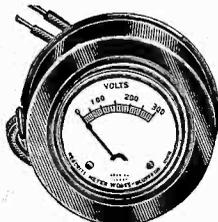
Twice as great accuracy costs four times as much. Note how extremely low the price is. You cannot buy any other such Tester at anywhere near that price. Great production makes possible our low price.

Cat. No. 215-346 Comb. Consists of:

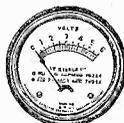
- (1) One newly-designed Two-in-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1/2 to 7/2 volts. This meter reads the AC and DC filament voltages.
- (2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
- (3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
- (4) One 5-prong plug with 30" cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
- (5) One grid switch to change bias.
- (6) One 5-prong socket.
- (7) One 4-prong socket.
- (8) Two binding posts.
- (9) One handsome noise metal case.
- (10) One instruction sheet.

[Note: A pair of adapters for UV199 tubes, Cat. No. 999, at \$1 extra. These are not sold except with 215-346 Comb. on 215-347 Comb.]

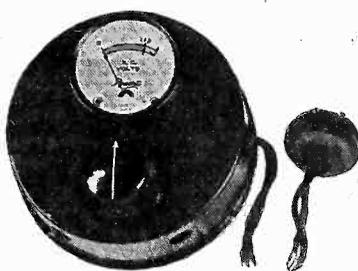
Individual Meters for Portable or Panel Use



0-300 high resistance voltmeter, for testing all B voltages up to 300. 30" tipped cord. Nickel finished case. Cat. No. 346 \$4.50



Cat. No. 326 The panel voltmeter Cat. No. 326 reads DC voltages, 0-6. Put one on any set you build, using DC tubes.....\$1.65
 Cat. No. 390 The panel milliammeter, Cat. No. 390, reads 0-100. This is much more current than any set is likely to draw, so you can read the total B current drain of any set.....\$1.65



Cat. No. 218 Voltage Regulator, to save life of AC tubes.....\$5.00

POCKET AND PORTABLE VOLTMETERS

- No. 8—For testing A batteries, dry or storage, 0-8 volts DC scale.....\$1.65
- No. 10—For testing A batteries, dry or storage, 0-10 volts DC scale..... 1.65
- No. 13—For testing A batteries, dry or storage, 0-16 volts DC scale..... 1.65
- No. 50—For testing B batteries, dry or storage, but not for B eliminators, 0-50 volts DC scale..... 1.65
- No. 39—For testing B batteries, dry or storage, but not for B eliminators, 0-100 volts DC scale..... 1.85
- 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.. 2.25
- No. 42—For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale..... 2.00
- No. 346—For testing B voltage, including eliminators. High resistance water 0-300 volts DC scale..... 4.50
- No. 347—Same as No. 346, except that scale is 0-500 volts..... 6.50
- No. 348—For testing AC current supply line, portable, 0-150 volts..... 4.50

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 0-6 volts AC..... 2.25
- (See No. 348 under "Pocket and Portable Voltmeters.")

PANEL VOLTMETERS

- No. 335—For reading DC voltages, 0-8 volts, \$1.65
- No. 310—For reading DC voltages, 0-10 volts, 1.65
- No. 316—For reading DC voltages, 0-16 volts, 1.65
- No. 326—For reading DC voltages, 0-6 volts, 1.65
- No. 337—For reading DC voltages, 0-50 volts, 1.65
- No. 338—For reading DC voltages, 0-100 volts, 1.75
- No. 342—For reading DC voltages, 0-150 volts, 1.75
- No. 349—For reading DC voltages, double reading, 1-8 volts, 0-100 volts..... 2.25

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.....\$1.85
- 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..... 2.00

PANEL MILLIAMMETERS

- No. 311—For reading 0-10 milliamperes DC..\$1.95
- No. 325—For reading 0-25 milliamperes DC.. 1.85
- No. 350—For reading 0-50 milliamperes DC.. 1.65
- No. 390—For reading 0-100 milliamperes DC.. 1.65
- No. 399—For reading 0-300 milliamperes DC.. 1.65
- No. 394—For reading 0-400 milliamperes DC.. 1.65

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, 0-40 amperes DC scale pocket meter.....\$1.50

DC PIN JACK VOLTMETERS

No. 306—For Radiolas No. 25 and 28, 0-6 volts DC.....\$2.50
 No. 308—For No. 20 Radiola, 0-6 volts DC.. 2.50
 No. 307—Desk type voltmeter with cord, 0-6 volts DC..... 2.50

6-VOLT A BATTERY CHARGE TESTER

No. 23—For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times.....\$1.85

PANEL AMMETER

No. 338—For reading amperage, 0-10 amperes DC..... \$1.65

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

Please send me at once, by parcel post, on a 10-day money-back guaranty, one Jiffy Test Outfit, consisting of one No. 215 and one No. 346 combination, for which I will pay the postman \$13.50, plus a few cents extra for postage.

- If 0-500 volts, high resistance voltmeter No. 347 is preferred, put cross in square and pay \$14.50 plus postage, instead of \$13.50, plus postage.
- One No. 215 and one No. 346, with two adapters, for UV199 tubes, \$14.50.
- One No. 215 and one No. 347, with two adapters for UV199 tubes \$15.50.
- One No. 215 alone, \$10.00.
- One No. 346 alone, \$4.50.
- One No. 347 alone, \$5.50.

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

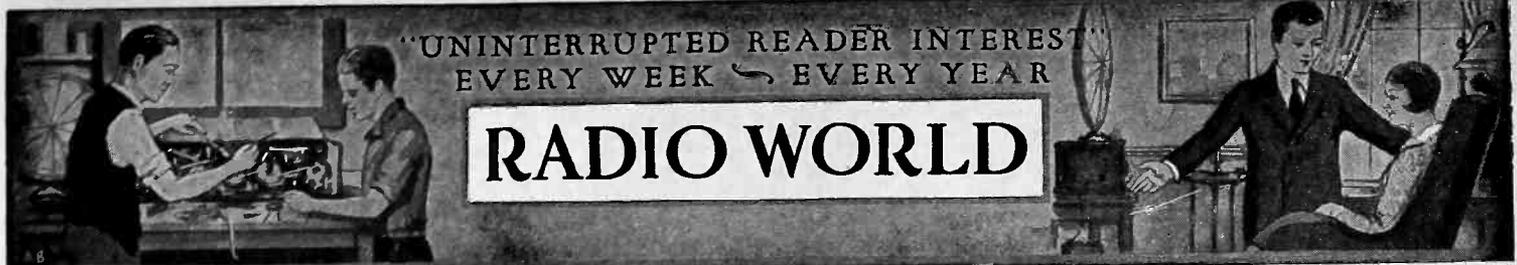
<input type="checkbox"/> Cat. No.	<input type="checkbox"/> Cat. No.	<input type="checkbox"/> Cat. No.
<input type="checkbox"/> Cat. No.	<input type="checkbox"/> Cat. No.	<input type="checkbox"/> Cat. No.

NAME

ADDRESS

CITY STATE.....

TEN-DAY MONEY-BACK ABSOLUTE GUARANTY!



UNINTERRUPTED READER INTEREST
EVERY WEEK ~ EVERY YEAR

RADIO WORLD

NOVEMBER 17, 1928
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Technical Accuracy Second to None

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(Just East of Broadway)
Phone: BRyant 0558 and 0559

Dead Spots Ascribed to Rocks

REALLOCATION HERE TO STAY, SAYS LAFOUNT

By Harold A. Lafount
Federal Radio Commissioner

You have become accustomed to your auto, electric range, sewing machine, etc. Millions of people have also become accustomed to and acquainted with the radio. It responds readily to your touch and your favorite stations immediately accept your invitation to present their programs in your home.

Sets Are Standard Now

You know exactly where to locate them on the dial of your receiving set, but you were slightly inconvenienced on November 11th because of the rearrangement of broadcasting stations in the country effective at that time. You found it necessary to remark your dial or to learn new points at which your favorite stations will respond.

During the past few years many changes and improvements have been made, until today a radio receiving set is almost as standard as an electric range, automobile, etc. With a rather modern set the advantages expected to result from the new rearrangement of radio stations will be readily detected, and, without doubt, appreciated.

40 Cleared Channels

In making assignments of radio stations under this new plan, some 40 were assigned to operate on exclusive channels. No interference should be experienced in the reception of their programs. Your ability to hear these stations will depend upon their distance from you, their power, and favorable reception conditions. In order to make these particular programs available to the largest possible audience some of the stations will be permitted to use 50 kilowatt power.

This done in order that the Radio Commission may have an opportunity to determine the effect of high-power transmission.

Will Not Disturb Assignments

The new arrangement of stations will not have to be disturbed except individual cases, in other words, when you mark your dial it will likely be unnecessary to do so again for a few years, depending of course upon the broadcasting stations themselves.

Public Backs Roxy on 'Heavier' Music

The policy instituted by S. L. Rothafel (Roxy), of broadcasting symphony concerts for the Sunday afternoon hour from the studio of the Roxy Theatre, has won the approval of the radio audience. Letters have reached him from radio fans, indorsing this departure, and although there have been a few requests from some for a return to the old policy of the "Stroll," song and instrumental music in a lighter vein, those who favor the symphony concerts on Sunday afternoons are in the majority.

FULL NIGHT RIGHT ASKED FOR WSAI

Cincinnati.

False assurance that WSAI would be allowed to operate with full time on a cleared channel has been given the station's supporters by the revised reallocation order of Federal Commission.

According to the announcement, WSAI was given "full time" on 800 kilocycles. However, the statement later was made that this announcement was a "mistake" and that WSAI would be allowed full time operation only in the daytime, being forced to close down as soon as darkness linked Cincinnati and Ft. Worth, Texas, where the 800 kilocycle wave also is given to station WBAP which shares time with KTHS, Hot Springs, Arkansas.

Powel Crosley, Jr., president of the Crosley Radio Corporation, which operates WSAI and owns WLW, said:

"Giving WSAI permission to operate only in the daytime in no way takes care of the people in this part of the country who depend on the station for chain programs and the other diversified programs and the other diversified programs of WSAI.

"The Commission does not yet seem to recognize that what listeners have been asking for is the right to operate WSAI as a regional station with full time."

CANADIAN CHAIN GROWS

Montreal, Canada

Further extension to the chain broadcasting of the radio department of the Canadian National Railways was achieved when CJGX, Yorkton, Saskatchewan, formed a new link in the western section of the service.

GEOLOGY CHIEF THINKS FADING DUE TO GRANITE

Washington.

Much interest is now being shown by radio engineers and geologists in the theory that fading, "dead spots" and kindred phenomena are caused by conditions in the ground rather than in the air. It has been discovered that freakish radio reception is usually associated with large areas of granite and other igneous rocks.

Most of the New England country is granite, much of the Rockies and the Sierra Nevadas is also granite or other igneous rocks. Much granite exists also along the Southern Seaboard in the Appalachians. Reception is generally poor and freakish in these areas. But on the great plains in the Mississippi Valley, where there is practically no granite, radio reception is exceptionally good.

Recommends Investigation

Dr. George Otis Smith, director of the United States Geological Survey, states that the connection between radio transmission and geologic structure must be investigated and that the work will be undertaken as soon as ways and means are found. Commissioner Orestes H. Caldwell, who is an amateur geologist as well as a radio engineer, urges that the work be undertaken, and the Naval Research Laboratory, Bellevue, D. C. is considering an investigation.

Dr. John H. Dellinger, chief engineer of the Federal Radio Commission, thinks that the findings of such surveys should be collated with existing knowledge of the peculiarities of radio waves with the object of solving the maze of scientific problems in the radio field.

The present belief is that lack of distant reception in certain localities is due to regional atmospheric conditions, to geographical contour of certain sections of the country, to the magnetic effects of metal deposits and to extensive steel structures.

Cites WBZ Instance

In connection with the possible effects of geological structure on radio reception, Commissioner Caldwell points out that WBZ, Springfield, Mass. could not be heard satisfactorily in Boston, only 90 miles away, and that it was necessary to establish WBZA in Boston and send the programs by synchronized land wire from the station in Springfield. The rock in this section is mostly granite.

LIVING BOARD USED WOODEN ONE FOR WAVES

Washington.

A breadboard, such as formerly was popular for a subpanel, was used as the working model for determining the re-allocation that went into effect Sunday, November 11th, except that the working board was much larger—7¾ ft. by 2¾ ft. Pencil marks designated the 90 channels into which the 619 stations were to be put. This board was hung from the ceiling of the allocation room of the Federal Radio Commission.

There were 96 channel markings or divisions, as there are six exclusive Canadian channels. These six had to be reckoned with, because of proximity of some United States stations to Canadian channels.

Hooks and Tags Used

From each channel division were suspended metal hooks, each one tagged for a station to be accommodated. There was much shifting of hooks and tags before anything resembling a workable structure was created.

Only one man was permitted to shift the hooks and tags, and then only with the assent of the full membership of the Commission, to avoid "spoiling the whole works."

Engineers were consulted in perfecting the reallocation. They included Dr. John H. Dellinger, chief engineer of the Commission, on temporary leave from the Bureau of Standards; John V. L. Hogan, of New York, inventor of the ganged condenser; and Prof. C. M. Jansky, of the University of Minnesota.

There has been some talk of ultimately

Dynamic Speaker Officially Defined

The Radio Manufacturers Association, Inc., has defined a dynamic speaker as follows:

"A Dynamic Speaker is one in which a portion of the conductor carrying the alternating signal current is a part of the moving system, the force producing the motion being due to the location of this conductor in a magnetic field."

putting the board in the National Museum.

A smaller board is hung in Commissioner Orestes H. Caldwell's private office. He made it himself.

DAVIS LAW CALLED WASTER OF WAVES

Washington.

Greater discretionary powers to the Federal Radio Commission in the assignment of frequencies, power and periods of operation was urged in a unanimously adopted resolution by the National Association of Broadcasters at the final session of their convention here. An amendment to the Radio Act granting this increase was suggested.

The Association declared that under the Davis amendment the Radio law imposes too drastic limitations on the Commission, and that the changes sought would permit the Commission to "better serve public interest, convenience and necessity." The Association declared in its resolution that the broadcast facilities of the country are being subjected to wastage in the inflexible assignments of frequencies to States in the various zones.

BETTER DEAL WANTED FOR STILL PICTURES

Washington.

Edgar H. Felix, a radio engineer of New York, has written to Commissioner Orestes H. Caldwell urging that the "very radical differences" between still picture and television radio transmission should be taken into consideration by the Federal Radio Commission in its proposed regulation of visual transmission in the broadcast band.

The two modes of visual transmission, said Mr. Felix, "are considered as one problem by the Commission, but they differ so radically in technical aspects and prospective fields of service that their respective statuses should be established separately."

Mr. Felix points out that still pictures can be transmitted successfully over a broadcast channel simultaneously with the tonal program without any interference, while acceptable television images cannot be broadcast at all in the width of channel established for broadcasting. Therefore he urges that still pictures be permitted in the broadcast band and channels for television transmission be established in the short wave region where adequate frequency bands can be provided for it. He further pointed out that still pictures can be received with ordinary broadcast receivers with only a simple attachment, whereas television images required a more complex arrangement for successful reception.

Stations' Power Low Near Canadian Border

Washington.

The Federal Radio Commission through Commissioner Orestes H. Caldwell has advised C. P. Edwards, Canadian Director of Radio, that under the reallocation plan, which went into effect November 11th, "no station within approximately 250 miles of the border is using more than 250 watts."

"On the United States-shared channels," Mr. Caldwell said in a telegram to Mr. Edwards, "the Commission has established a policy of granting to three times the night power for use during daytime until local sundown."

Minister Gets Permit for Pittsburgh Station

Washington.

The Federal Radio Commission granted the application of Rev. John Sproul of Pittsburgh for construction permit to erect a 100 watt station in Pittsburgh to operate on 1,500 k.c.

The Commission granted XVI of Takoma, Wash., 90 days extension on its construction permit, the time specified in the original permit having not yet expired.

PAT KILEY EXPANDS

Pat Kiley is in new quarters at 140 Liberty Street, New York City. Growing business forced this manufacturers' representative to expand to larger quarters. The telephone number is Rector 2386. He represents the B. B. I. products and Aimone furniture.

Talkers Make Hot Stuff Out of Cold Statistics

Washington.

Members of the Department of Agriculture staff in Washington are learning radio speaking.

Each week-day noon except Saturday, said Morse Salisbury, Chief of the Radio Service, department workers are speaking to an audience of some 400,000 farm families in the daylight reception areas of a network of 15 stations associated with the National Broadcasting Company, which is sponsoring an official 15-minute information program by the Department.

Many of the speakers have had no previous radio experience, although all of them are accustomed to addressing audiences from the platform in the course of their work. Under the direction of the Department Radio Service, the novices at radio speaking are rapidly mastering the technique, however.

Learn the Tricks.

"We have been pleased by the uniformly high quality of the voices of the Department of Agriculture speakers," Frank E. Mullen, agricultural director of the National Broadcasting Company, told him, Mr. Salisbury said.

Preparation of the talks, Mr. Salisbury said, is a new experience to many Departmental workers. They are assisted

by writers of the Department Radio Service and editorial workers of the bureau.

They have found that columns of statistics simply cannot be put across in brief radio talks; that devices of wording and of repetition, rather than emphatic style of delivery, serve to drive home important facts; and that every word must count, for effective radio talk is somewhat slower than usual speed of reading aloud, about 120 words a minute.

Stations on List.

The noonday program is broadcast from 12:15 to 12:30, Central Standard Time, which means 1:15 to 1:30 for listeners of KDKA, Pittsburgh, the only Eastern time belt station on the network; and 11:15 to 11:30 for the audience of KOA, Denver, likewise the only Mountain Time belt station.

The complete list of stations broadcasting the noontime Department of Agriculture program follows: KYW, Chicago; KDKA, Pittsburgh; WCCO, Minneapolis-St. Paul; WOC, Davenport; WHO, Des Moines; WOW, Omaha; WDAF, Kansas City; KWK, St. Louis; KVOO, Tulsa; WOAI, San Antonio; WHAS, Louisville; WSM, Nashville; WSB, Atlanta; and KOA, Denver.

Broadcast Band Open to Television

Limited Use Authorized in Higher Frequencies, Too

Washington. Television and picture transmission will be permitted on the broadcast band until January 1, 1929, but under "rigid conditions designed to prevent interference with reception from broadcasting stations," the Federal Radio Commission announced in General Order No. 50.

The question which has been before the Commission, in connection with the order, was whether to permit visual broadcasting in the broadcast band, within the reach of listeners, or assign it to the short wave band, where technical equipment is needed for reception.

Full Text of Order.

The full text of the order follows:

"Picture and television transmission for general reception by the public will be referred to herein by the Commission as picture broadcasting and television broadcasting.

"Picture broadcasting and television

broadcasting will be permitted (but only upon written application to, and, formal authority from, the Commission) on frequencies above 1,500 kilocycles, the exact frequencies, or bands of frequencies, to be determined by further order of the Commission.

Broadcast Band Opened.

Between the date of this order and January 1, 1929, picture broadcasting and television broadcasting will be permitted to a limited extent (but only upon written application to, and from authority from, the Commission) in the broadcast band between 550 and 1,500 kilocycles, subject, however to rigid conditions designed to prevent interference with reception from broadcasting stations. Among such conditions will be the following:

"1. That the band of frequencies occupied by any such transmission shall not be wider than 10 kilocycles, and

"2. That such picture broadcasting and television broadcasting be limited to periods of not more than one hour per day at a time of the day other than between 6 p. m. and 11 p. m.

Results Will Tell

"The extent to which picture broadcasting and television broadcasting in the broadcast band of frequencies will be permitted to take place after January 1, 1929, if at all, will be determined by later orders of the Commission, which will depend on investigation by the Commission of the results of permitting such operation with respect to interference and the popularity of such transmission with the general public, and will further depend upon the interpretation which the Commission shall be advised is proper of the obligations of the United States under the International Radio Telegraph Convention of 1927 with respect to permitting anything other than telephonic transmission in the broadcast band."

HEADWAY WON ON STANDARDS FOR TELEVISION

Chicago.

The leading figures in television invention and experiments in the United States and Great Britain met here under the auspices of the Radio Manufacturers Association to consider the standardization of television practices and terminology. Among the prominent figures in the radio industry and television experimentation who attended the "first-time-in-history" meeting were President H. H. Frost, of the R. M. A.; H. B. Richmond, of Cambridge, Mass., Director of the R. M. A. Engineering Division; Dr. C. Francis Jenkins, of Washington, D. C.; and Captain W. G. Jarrard of the Baird Television System of Great Britain.

Vision by Radio

Television was officially defined by the meeting as "vision by radio," which includes various forms of the new radio art being developed by the television experiments. In terminology the R. M. A. committee followed in part the terminology developed in the motion picture industry. Thus the term "frame" was adopted for the unit picture seen in the television receiver.

It was evident to the committee that the art of television was too new to attempt at this time any definite standards. It was equally obvious, to the committee, however, that carefully-thought-out working recommendations would be of great value to television development. With this in mind, the committee made several recommendations which the various experimenters agreed to follow.

"Natural" Development Chosen

Regarding the method of developing the picture, the committee found it best to follow the accepted practice with which we are all familiar from reading and writing, namely, that the picture be developed

Portable Transmitter Used in Beating Races

Baltimore, Md.

A portable transmitter, with a key, to send code, is said to be used by a frequenter of the horse races at Laurel, to get the results to customers, so they can "eliminate the hazards."

Bookmakers noticed that "killings" were being made and are reported to have fought shy of strangers for several weeks.

in uninterrupted sequence from top to bottom and from left to right.

The number of lines per frame recommended was 48, as this has found widest acceptance and seems to be a satisfactory one.

15 Pictures Per Second

The number of frames per second recommended was fifteen. While sixteen was a desirable number from the view point of optics, it was not suitable from the view point of synchronization on 60 cycle electric power lines. Since the number 15 can be obtained easily with standard gear ratios and standard synchronous motors, that was chosen. Thus the number of lines per second will be 720 in the system adopted.

The various members of the R. M. A. on television standardization will make further studies on the subject and will report their findings at another meeting.

Yale-Princeton Game On Air on Saturday

The National Broadcasting Company will send out two football games, Saturday, November 17th. The game between University of Chicago and University of Illinois, at Chicago, will begin at 2:45 p. m., E. S. T. Graham McNamee will announce over WJZ, WHAM and KYW. Yale-Princeton at Princeton, at 1:45 p. m., E. S. T., with Phillips Carlin announcing, will go over WEA, WEEL, WTIC, WLIT, WRC, WGY, WGR, WCAE, KSD, KPRC and WHAS.

DISSENT MADE ON TELEVISION BY CHAIRMAN

WASHINGTON

The television assignment order of the Federal Radio Commission was adopted over the objection of the chairman, Ira Robinson. He said in dissenting:

"I regret that the commission has admitted television to the broadcasting band. The best engineers say that the time has not yet arrived for this, notably Dr. Goldsmith of the Radio Corporation of America.

Dellinger Dubious

"Our own chief engineer, Dr. Dellinger of the Bureau of Standards, has cautioned us against too forward an action in this particular. Besides, our own knowledge of affairs should dictate a delay. The American public have for several years been entertained by broadcast programs of speech and music." Why give them a whistle or blur as to a part of the time in which they have received so long something intelligible and entertaining? "The merest minority of the public have receivers for pictures. When one gets the picture, as far as developed today, what utility is it? It is of no value compared with the spoken word.

Post-Midnight Suggested

"A dark silhouette means little in entertainment and interest to the American public.

"All the necessary experimentation to forward and perfect television could take place between the hours of midnight and six in the morning. Why disturb that which the public has become used to, by freak whistle or confusion?"

A. ATWATER KENT has broken ground for a new \$3,000,000 factory which will double the size and capacity of his present 16½-acre plant, making it the biggest radio factory in the world and one of the largest industries in the United States.

Contractors are under penalty to complete the building by May 1, 1929.

MESSAGE FROM MARS IS STILL ONLY A PLAY

London.

Dr. Mansfield Robinson, world's champion experimenter in the realm of radio communication with Mars, now turns to America in his confident effort to determine what's doing on the great planet.

He paid seven shillings sixpence to send some dots and dashes on 18,700 meters, the message being directed toward Mars by the British Post Office, as well as may be. Professor A. M. Low said he felt he ought to place at Dr. Robinson's disposal the facilities of the laboratory for such a noble experiment.

Wrong Wavelength.

An all-night vigil was maintained, but not a peep from Mars was heard. This convinced Dr. Robinson that his own message had not gone through, but he was not surprised, since Mars was assigned to 30,000 meters in the celestial reallocation, and it is useless to send on 18,700. He obtained his information about the wavelength through telepathic communication with a woman on Mars, he explained.

"The Post Office wavelength does not penetrate the Heavyside layer, anyway," continued the doctor. "Therefore the signals, instead of going straight on to Mars, are diverted around the world.

Looks to America

"My hope is that some American millionaire will erect a station that will be specially high powered, and be tuned to the proper wavelength of 30,000 meters, so that we can allay the disappointment of the Martians, who want to receive our messages, but who laugh at our back-

Uniform Serial Law Proposed by Trade

To protect better the public, which the radio industry is endeavoring to serve, the Federated Radio Trade Association has compiled a survey of Serial Number Laws throughout the United States. It is found that legislation protecting radio merchandise from removal and defacement of serial numbers is totally lacking. Should the consumer have his set stolen, he has no means whatever of identifying it if the serial number has been removed. Also there is no means of tracing sets to the dealers and jobbers who sold them, whereby the factory would be justified in backing up its guarantee. The Federated is drafting a model bill for presentation in State legislatures.

The annual Convention will be held in Buffalo, February 18, 19, and 20.

wardness in science, since they have got rid of static, and as yet we have no remedy for this."

WGBS Night Studio Established in Hotel

WGBS, the Gimbel Bros. station in N. Y. City, has opened new studios in the Hotel Lincoln, on 44th Street. The familiar "Crystal Studio" in the Gimbel Bros. store building, 33d Street and Sixth Avenue, continues as the scene of activity by day, for all WGBS programs between 9 a.m. and 5 p.m. On WGBS' "long nights" (Sunday, Monday, Wednesday and Friday) the staff is transferred to the hotel studio, to hold forth from 5 p.m. until midnight or later. It is from the hotel studio that Herman Bernard, managing editor of RADIO WORLD, broadcasts on radio topics each Friday at 5.40 p.m.

YOUTH OF 17 IS RADIO BOSS OF EXPLORERS

Although not yet 17, Eric Palmer, Jr., is in charge of radio for the American-Brazilian Scientific Expedition to the Amazon Valley, en route to South America on the steamship Vandyck. The expedition is headed by Dr. Jose Tozzi Calvao of Rio de Janeiro and New York. The expedition will search for a lost ancient Phoenician city, explore the little known Aripuana River, and penetrate into the jungle farther than either the Fawcett, Dyott, or Roosevelt expeditions.

Young Palmer will transmit messages on 20 and 40 meters from a portable wireless outfit under the call JTC, from 11 P.M. to 1 A.M., Eastern Standard Time, once the travelers get 1,000 miles inland.

Put to Bed

Last year the Federal Radio Commission suspended the young man's license to operate his amateur station, 2ATZ, in Brooklyn, N. Y., for three months because he stayed awake all night at the key and missed meals and school. Since then he has been graduated from the Radio Institute of America and has a speed of 35 words a minute in code.

Eric Palmer, Sr., is Vice-President of the Allied Broadcasting Companies, Inc., and Eastern Manager of the American Broadcasting Company, operating a Pacific Coast network of high power stations from Los Angeles to Spokane.

Got Son's Messages

While visiting the main station, KJR, in Seattle, the father received daily messages via short waves from his son, aided by members of the Amateur Radio Relay League on the West Coast.

Large Baffle Affords Advantages, Says R.C.A.

The Radio Corporation of America made the following announcement:

A new cabinet model receiver with an electro-dynamic speaker, for operation from the lighting circuit, was announced by the Radio Corporation of America.

The circuit of the new Radiola 41 is of the tuned radio frequency type, utilizing four UX-226, one UY-227, and one 210.

An entirely new type of electro-dynamic speaker is used in Radiola 41. Direct current for the field of the pot magnet is delivered by a junction type rectifier attached to the speaker unit. The loudspeaker grilled opening is in the upper portion and the tuning and volume controls below for convenient chair-height operation. This arrangement provides the loudspeaker with an unusually large baffle area which has decided advantages for electro-dynamic type producers.

WLW NOW ON 50 KW

Cincinnati.

Thirty-nine spectacular radio features, including 29 originating in Cincinnati and ten radio acts presented as a courtesy to the Crosley Radio Corporation by the National Broadcasting Company and originating in their New York studios, made up the five hours of gala radio entertainment, with which the new 50,000 watt transmitter of WLW was recently dedicated.

Pep Up Your Set Now for the Reallocation

On November 11th the new wavelength, power and time allocations of the Federal Radio Commission went into effect. It now is up to us to get our sets in best condition. Many receivers have grown insensitive during long use.

Perhaps the easiest manner to improve the sensitivity of the usual receiver is to begin with the antenna and ground system. While almost any kind of antenna will serve for powerful local signals, it takes an efficient antenna to bring in the DX signals. Furthermore, even the good antenna may become a poor one in time, especially if it has bare wire which can accumulate a high-resistance coating of soot, dirt and oxide from exposure to the elements.

Ground is Important

The ground is usually of greater importance than the antenna. Some radio enthusiasts make use of several grounds, with a switching system for selecting any single or combination ground in DX work.

Much trouble can be saved if a good socket antenna plug is used, especially where the locality is known to be a poor one for radio. The antenna plug clarostat serves to provide the electric wiring as the wave interceptor, in some cases including the

electric distributing system for miles. Furthermore, an excellent ground may be had by connecting to the screw of the usual brass plate of the wall outlet. In this way, no outside antenna and long ground lead are required for DX activities.

With the maximum signal pick-up possible, the next step is to look over the receiver. The first point which attracts our attention to the RF amplifier. It is operating at the proper plate voltage? It is surprising how much more sensitive the receiver becomes with the proper plate voltage on the RF tubes.

Detector Circuit

This may be realized by using a suitable variable high resistance, such as the volume control clarostat, in the plus RF lead, shunted by a 1 mfd. condenser.

Another point is the detector. In order to avoid overloading, many set manufacturers use a rather low grid leak value, so as to drain off the charge on the grid before it can distort the tone even necessary for powerful signals; it mitigates against sensitivity when endeavoring to work with weak signals. What is advisable, then, is an adjustable grid leak, like the grid leak clarostat.

TALK IS CLEAR AT 9,000 MILES ON SHORT WAVE

Schenectady, N. Y.

A two-way radio telephone conversation over a distance of 9,000 miles between this city and Sydney, Australia, was carried out recently on the General Electric Company's short wave station W-2XAF, operating on 31.4 meters, and the Australian station 2-ME, operating on 28.5 meters.

The experiment was scheduled for 6 o'clock in the morning, corresponding to 9 o'clock in the evening Australian time, but the atmospheric conditions prevented clear communication until 7 o'clock. Reception seemed to be better at the Australian end than at the American, for many of the questions and answers from Australia had to be repeated.

Voices Often Clear

At times the voices were as clear and intelligible as if they had come from the other end of a short land line, and at other times they were lost or rendered unintelligible by static. Apparently, little trouble was experienced in Sydney.

A. S. Macdonald, chief engineer of Amalgamated Wireless Australasia, Ltd., presided at the Australian end and introduced the various speakers there. At the American end, Maurice Prescott and A. B. Bitt, engineers of the General Electric Company, conducted the tests.

D. M. Dow, secretary of the Australian Commission to the United States conversed with E. M. Lawton, American Consul at Sydney, having been introduced by R. A. Rowlands of the International General Electric Company. Mr. Dow gave the bush cry, "Coo-ee," well known to all his countrymen.

WGY Rebroadcasts

Others participating in the conversations were A. D. Rothman, of the Australian Press Association, L. J. Deer of "The Daily Guardian," Errol Knox of "The News," Stuart Hawkins, of The New York "Herald-Tribune," Harry C. Shaw, of the Keene (N. H.) "Sentinel," Charles Rochester, of Schenectady, and Harold Phelps Stokes of the New York "Times."

The conversations were broadcast in this country over WGY, the General Electric Company's station in Schenectady.

N. Y. State Admitted to Hearing on WGY

Washington.

Counsel for the Federal Radio Commission, answering the request of Attorney-General Ottinger, of New York State, for permission to represent the State at any hearing to be held on an application by WGY, Schenectady, for a clearer channel, replied welcoming such representation.

THE STOCKHOLDERS of the Chas. Freshman Co. ratified the merger of Freshman Co. with the Freed-Eisemann Radio Corporation.

The identity of Freed-Eisemann will not be lost, but the same relations of both lines with the trade will continue.

Dr. Weeks New Chief of Raytheon Engineers

After being identified for many years past with the tube development activities of the Westinghouse organization, Dr. Paul T. Weeks has joined the Raytheon Manufacturing Company of Cambridge, Mass., as Chief Engineer.

Dr. Weeks graduated from Oberlin College in 1913, and gained his Ph. D. degree at Cornell in 1917, followed by research work with the Bureau of Standards. During the War he served in the Radio Development Section of the U. S. Signal Corps. In 1919 Dr. Weeks joined the Westinghouse organization and was assigned to radio tube and radio development tube work. Last May, he resigned to join the Raytheon organization for developing improved filament and other types of tubes. Dr. Weeks has several patents on tube construction, incorporated in the new Raytheon vacuum tubes.

REALLOCATION STUDIED

A survey of the broadcast reallocation and other orders of the Federal Radio Commission and of radio legislation, with a view to amendment of the law if it is deemed necessary to perfect broadcast reception, is being undertaken by the Radio Manufacturers Association, Inc.

T R A D I O G R A M S

IN ADDITION to having completed the organization of a nation-wide chain of dealers handling the entire line of Aerovox products, the Aerovox Wireless Corporation announces the following chain of metropolitan dealers now having Aerovox parts in stock at all times: Todd Electric Co., 174 Greenwich Street, 78 Cortlandt Street and 85 Cortlandt Street; Wireless Egert, 179 Greenwich Street; Heins & Bolet, 68 Cortlandt Street; Greenwich Radio, 185 Greenwich Street; Sun Radio, 64 Vesey Street; S. & S. Radio, 305 West 125th Street, and Perfection Radio, 58 Cortlandt Street. A copy of The Research Worker may be had free upon application to the Aerovox Wireless Corporation, 70 Washington Street, Brooklyn, N. Y. Mention RADIO WORLD.

ERNEST V. AMY, Julius G. Aceves, and Frank King have formed the firm of Amy, Aceves & King, Inc., consulting engineers specializing in radio, with offices at 55 West 42nd Street, New York City.

The firm aims to serve radio manufacturers, broadcasters and others in the capacity of consulting engineers, designers, and research staff.

ROBERT B. ROSE has been appointed manufacturer's representative for A. H. Grebe & Company, Inc. His territory includes New York City and the following other New York Counties: Westchester, Sullivan, Dutchess, Orange, Putnam, Rockland, Nassau and Suffolk. He conducted the radio departments of large New York stores.

A STANDARD WARRANTY was adopted by the Radio Manufacturers Association, Inc., 11 West Forty-second street, New York City, of freedom from defective material and workmanship, with a 90-day replacement clause. It is applicable to parts as well as to sets and other built-up devices.

EAST'S DX AIM INCLUDES SIX MORE IN WEST

A charter has been granted to Allied Broadcasting Companies, Inc., with offices at 551 Fifth Avenue, New York City. This concern will act as representatives of the ABC network, owned and operated by the American Broadcasting Company. It includes KJR, Seattle, Wash.; KGA, Spokane, Wash.; KEX, Portland, Ore.; KYA, San Francisco, and KPLA and KMTR, Los Angeles, all with preferential channels under the reallocation and using high power.

Adolph F. Linden is president of the Allied Broadcasting Companies, Inc., G. A. Coats, vice-president and treasurer, Eric H. Palmer, vice-president, and Max Chopnick, secretary. Mr. Palmer also will be eastern manager.

"With cleared avenues for these stations, we believe that these stations will become favorite DX targets for listeners on the Atlantic seaboard," said Mr. Linden.

A NEW BRANCH sales office has been established by the Radio Corporation of America in Dallas, Texas. M. S. Tinsley, a native of Texas, and formerly connected with the New York office, is in charge as Southwestern District sales manager. In addition to the executive offices, large warehouse space has been engaged in Dallas, from which shipments of radio apparatus will be made direct to the southwestern territory. The states which will be served by the new sales and distribution center include Arkansas, Oklahoma, Texas, New Mexico and the western part of Louisiana. District offices of the Radio Corporation are now located in New York, Chicago, San Francisco and Dallas.

S. J. KESSLER resigned from Allen-Rogers-Madison to take hold of the new mail order division established by the Royal-Eastern Electrical Supply Co., 16-18 West 22nd street, New York City. Royal-Eastern is one of the largest radio distributors and has been in business thirty-one years. Besides the main offices and store rooms, there are branches in Jamaica, L. I. Brooklyn, N. Y., Long Island City and New Rochelle, N. Y. A new catalogue will be ready in a few days. Address Mr. Kessler. Mention RADIO WORLD.

THE RE-ELECTION of Gordon C. Sleeper as president of the Sleeper Radio and Manufacturing Corporation of Long Island City was announced recently by representatives of the organization. Other officers are Howard M. Van Clean, Vice President; Louis Oppenheimer, Treasurer, and E. A. DuCasse, Secretary and Assistant Treasurer. These and A. E. Doyle are to serve as directors of the corporation for one year.

THE Third Annual Radio Trade Show will be held next year at Chicago, June 3, 1929, at the Stevens Hotel.

WGY OBJECTS TO ATTACKING ANY STATION

Washington

The correspondence between Martin P. Rice, broadcasting manager of WGY, and Louis G. Caldwell, general counsel of the Federal Radio Commission, on the subject of WGY's request for a cleared channel and its efforts to obtain a hearing to that end, was given out by the Commission.

Mr. Rice referred to WGY's first application for a hearing, turned down because the Commission's rules require that the applicant specify a desired frequency, even, as in this instance, where a cleared channel is desired; and that the frequency in such case be one assigned to the zone in which the station is located. Mr. Rice said WGY, as the leading development station in the world, was entitled to a cleared channel and desired 960 kc., its longstanding assignment, or, inferentially some other frequency.

Mr. Rice said that a rule requiring specification of some certain frequency required "that we select some station in our own zone for attack and apply for its wavelength."

Mr. Caldwell's reply sought to justify the Commission's rules on applications for amendment of the reallocation provisions and discussed certain statements in Mr. Rice's letter that were "open to misinterpretation."

Letter Rice Wrote

Mr. Rice's letter follows:

"Referring to your letter in which you say that WGY should have applied for one of the channels assigned to the first zone, I call your attention to the fact that the Commission's order, effective November 11, assigns WGY to part-time on a channel which the same order transfers to Zone five.

"Our application for modification asked that WGY be permitted to operate full-time on this channel, as we have for the past five and a half years, or if this channel is not available, our application implied that we wanted some other equal-

ly good full-time channel on which we might continue to serve the public.

"The power requested was the same as in the application for our present license. We have not changed our power specifications.

Talks on Real Issue

"The application was written on the forms provided by the Commission, and we earnestly endeavored to make it conform to the requirements in every detail. You state that our application did not comply with your rules, and you infer for that reason it would not be considered by the Commission. Disregarding for the moment the regularity of our application, let us consider the real issue.

"For six and a half years WGY has reliably served the listening public in the States of New York, Massachusetts, Vermont, New Hampshire and in more distant States. Only nine stations in the whole United States have as long a service record as WGY. The area served by our station includes three million people—for many of whom it is the only dependable station. More than a million dollars has been spent in building WGY, operating it, and supplying it with the latest in equipment. It is without question, the leading developmental station of the world. It has consistently furnished the listening public with the best in music, drama, education, entertainment, religion, statesmanship, health, news and science.

Order "Incomprehensible"

"For some reason incomprehensible to us, the Commission's order effective November 11 ignored all these facts and WGY's wavelength was transferred to Zone 5. No substitute was provided, but WGY was told to operate as a part-time station on the same wavelength subservient to the requirements of the Pacific Coast. We asked for a modification of this order, but are told that we can not be heard.

"The Commission proposes to take our wavelength and deprive 3,000,000 people of dependable broadcasting. We hope to find some way to bring the real issue to the attention of the Commission, in such form as will receive their consideration, and we hope that this end can be accomplished without adopting your suggestion that we select some station in our own zone for attack and apply for its wavelength. We have no quarrel with any other station and do not feel that we should be compelled to start such a quarrel."

Byrd Expert to Study Fading in Antarctic

Washington

Study of fading phenomena and concentration of the earth's magnetic field at the south magnetic pole is to be made by L. V. Berkner, assistant radio engineer of the Bureau of Standards, a member of the Byrd Antarctic Expedition. A Department of Commerce statement follows in full:

"L. V. Berkner, assistant radio engineer, Bureau of Standards, is now on board the ship City of New York of the Byrd Antarctic Expedition enroute to the Antarctic region. Mr. Berkner, in addition to his duties as a radio officer of the expedition, will make an investigation of fading phenomena, particularly of high-frequency transmissions.

"The equipment for this work consists of two special high-frequency receiving sets, loaned by the Westinghouse Electric & Manufacturing Co., to which fading

recorders have been adapted by the bureau. These recorders are similar to those used by the Bureau of Standards in previous fading investigations, and the method used will be the same.

"It is expected that this investigation will give information on the effect of the concentration of the earth's magnetic field at the south magnetic pole, of auroras, temperature, height of the radio reflecting layer, and many other phenomena which affect radio transmission. Mr. Berkner will make observations upon selected stations, and some special transmissions may be arranged.

"The expeditions will be in the Antarctic regions for sufficient time to give observations throughout both the daylight and dark months of an Antarctic year. The bureau will keep in touch with the work by means of radio communication."

FACTS GARBLED ON WGY, SAYS BOARD COUNSEL

The full text of Louis G. Caldwell's response to Martin P. Rice follows:

"I acknowledge receipt of your letter. There are certain statements contained in it which, while I am sure you did not intend them to be misleading, are open to misinterpretation by the public and I am therefore writing to call your attention to them.

"When you state that the Commission proposes to deprive 3,000,000 people of dependable broadcasting, you, of course, did not mean that your station WGY, is to be shut down entirely or, indeed, in any respect except for a small curtailment in your hours of operation in the late evening.

Rules Not Followed

"When you state that you have been told that you cannot be heard, you must have intended to say that the Commission was unwilling to grant you a hearing on an application for a cleared channel assigned to the Fifth Zone during hours when operation by your station would destroy reception of the Fifth Zone station's program over a large portion of the country because of heterodyne interference; you did not intend to say that the Commission had refused to entertain or grant a hearing on any application from you which complies with the rules and regulations of the Commission, and specifies a channel which is available to the First Zone.

Promise of Hearing

"As you already know, from previous communications from the Commission, you have only to make a proper application and a hearing will follow as a matter of course.

"In your letter you complain that the Commission is in effect requiring you to attack another station.

"Is it not true that the application which you have already filed not only attacked another station, but if it had been granted would have resulted either in moving that other station away from the channel in question or else subjecting it to fatal heterodyne interference?"

Hearing for Others

"If the Commission had required the Fifth Zone station to change to some other channel, then still other stations would have suffered. In effect, therefore, you are asking that other stations be deprived of broadcasting privileges without a hearing.

"The regulation of the Commission requiring a complaining station to specify what channel or other privilege it desires is not a new one, but has been in force since the Commission first began to hold hearings in the spring of 1927. The justice of this requirement is fundamental.

Board's Reason

"The reason for this is not that the Commission desires to force any station to attack another but that, first, an applicant be required to state clearly (as he would have to in any law suit or legal controversy) what he is applying for, and, secondly, that anyone who would be affected by granting the application be given a hearing before such action is taken."

Caldwell Says WGY Can Send at Night

Washington

The controversy over the effect the reallocation will have on WGY's night transmission has brought out that Commissioner Orestes H. Caldwell believes with his fellow-members that nothing prevents WGY from broadcasting until 10 p.m.

Commissioner Caldwell wrote to Dr. Richard L. Cook, medical officer, Veterans Tubercular Hospital, Tupper Lake, N. Y., assuring him and the patients who feared they would lose their precious night programs, that WGY's assignment under the reallocation produces no such result.

Commissioner Caldwell was "at a loss to understand where you and your patients could have obtained the idea. Certainly not from the Commission. And certainly not from Station WGY or the General Electric Company officials."

What Rice Had Said

Martin P. Rice, manager of broadcasting, WGY, in a statement a fortnight previously discussed a form letter the Commission's secretary was sending to persons protesting the assignment of WGY to a "supplementary" right to its 790 kc. frequency.

Mr. Rice then said:

"The letter is not clear. The first sentence says that WGY is authorized to operate until 10 o'clock in the evening, but a footnote explains that WGY's wavelength was transferred to the Pacific Coast as a cleared channel, and that WGY can operate until sunset at Oakland, Calif., corresponding to about 7:45 p.m. Eastern time during the Winter." The footnote in the secretary's letter is made by Commissioner Caldwell a footnote to his own letter to Dr. Cook.

Caldwell's Letter

Commissioner Caldwell's letter follows in full:

"Dear Dr. Cook: I note statements from yourself and a number of your patients, expressing fear that your favorite radio entertainment from Station WGY, which you enjoy nightly until 'lights out' at 10 p. m., may after November 11, be interfered with by some action from Washington.

"So far as the Federal Radio Commission is concerned, let me say that, under the new allocation Station WGY will be heard in its same accustomed place, 790 kilocycles, every evening until 10 p. m., and on special occasions, until later.

"The schedule proposed by the Commission will interfere in no way with your patients' customary enjoyment at the head phones from 6 p. m. till 'lights out' at ten.

At Loss to Understand

"Of course the authority of the Commission can be only permissive. It can merely authorize a broadcaster to operate but cannot order that the station utilize the time or power placed at its disposal. So far as the Radio Commission is concerned, however, Station WGY under its new assignment, may operate all day long and nightly to 1 a.m.,—or later, at the discretion of its management.

"I am at a loss to understand where you and your patients could have obtained the idea that your nightly 6 to 10 entertainment was to be interfered with in any way. Certainly not from the Commission.

"And certainly not from Station WGY, or the General Electric Company officials, who, I am sure, are desirous of giving their up-State neighbors the fullest possible radio service. In this they have the cooperation of the Commissioners,

and particularly the heartfelt sympathy and energetic help of those of us who have, at first hand, studied the hospital situation in your vicinity.

Tells of Personal Visit

"Within the past 60 days it happens that I have made a personal inspection of the Saranac region of New York State. In the Saranacs, in August, I stood at the bedside of patient after patient, and was deeply touched at the dependence everywhere placed upon radio for whiling away the hours and for bringing inspiration, encouragement, and a happy frame of mind on which to rebuild physical health.

"No experience I have ever had in all the eventful months of the Commission has so deeply impressed upon me my personal responsibilities in administering the radio channels, as did this day spent among the hospitals and camps in your vicinity.

"I learned what radio means to thousands of active-minded men and women, temporarily in 'dry dock.' And I came away determined to apply all possible personal effort to improving the radio situation for the Saranac country.

Disagrees with Fellow Members

"The first of these steps was to urge my associates on the Commission to increase the power of WGY to 150,000 watts, (three times its present power), so that its programs would override the static which is the bane of reception both summer and winter in your country. Power is needed to drive through to Saranac from Schenectady.

"The 150,000 watt equipment is all installed and only awaits the Commission's authority. But we are five men on the Commission, and three of my associates are not yet convinced that any station should have more than 25,000 watts, or at best an experimental total of 50,000 watts. So the difference between clear signals to you and noisy reception must wait until these three gentlemen will accept the consensus of all engineering opinion that higher power on a clear channel gives better service to all, and interferes with no one.

Confident of Success

"But I am convinced that eventually, the true scientific facts will be understood, and you will get your 150,000 watts for WGY, which I hope will bring loud-speaker volume into regions where the

limit is now head-set reception. Meanwhile, authority has been secured for WGY, to experiment with 200,000 watts, after midnight, and I believe these tests will show the value of high power during regular broadcasting hours.

"The second step to improve radio among your hospitals was in the direction of providing local broadcasting during the daylight hours, when WGY or any other station does not come through. I found that the little Saranac Lake 10-watt transmitter, WNBZ — playing mostly phonograph records, but with an occasional visiting artist — was rendering a service to the hearts, the minds and the bodies of the sick in the vicinity, all out of proportion of its tiny wattage!

Pledges Help

"Its owners, two radio men, Messrs. Smith and Mace, who operate it as a public obligation (and with that sense of public duty that seems to characterize the radio fraternity), wanted more daylight time and an increase to 50 watts, in order better to reach several outlying camps and hospitals.

"Accordingly, I immediately secured the Commission's consent to let WNBZ run all day long instead of only two hours as before. And, later, when WNBZ can arrange for funds to finance the larger transmitter, I will urge that they get their 50 or 100 watts power.

"If you or any other physician or resident of the hospital community will suggest other ways to improve the radio service to those temporarily confined by illness, I pledge you my energetic help.

The Footnote

"P. S.—Channel 790 kilocycles is assigned primarily to the General Electric Company Station KGO, at Oakland, Calif., in Zone V, with a supplementary assignment to General Electric Company Station WGY, at Schenectady, N. Y., the latter being authorized to operate at all hours when interference will not be caused with KGO. Because of clock-time difference, and reduced transmission while daylight intervenes between the two stations, this means that Station WGY can operate all daylight hours and three hours into the night (or until sunset at Oakland), without any possibility of interference.

"After nightfall at Oakland, there will be interference unless the two stations divide time (or synchronize). The Commission has indicated that in order to conserve wave lengths and to give maximum radio to the largest number of people at popular listening hours, it will make no objection but will approve KGO's standing-by from sunset to 7 p.m. at Oakland, in order that WGY may continue until 10 p. m. with full power on an exclusive channel."

U. S. Message Chain Planned by R.C.A.

Washington.

The Radio Corporation of America is planning to establish a radio communication company in the United States in direct competition with the wire telegraph service of the Western Union and the Postal companies.

As presented to the Federal Radio Commission, the plan considers the extension of the Radio Corporation's system from New York and San Francisco to thirty of the principal commercial centers of the country.

In furtherance of this plan the Radio Corporation, through its counsel, Col. Manton Davis, has asked for sixty-seven short wave channels. The Radio Corporation says it has been unable to make

satisfactory arrangements with the wire telegraph companies for delivering or receiving messages for the Radio Corporation.

W. A. Winterbottom, traffic manager for the Radio Corporation, pointed out that Western Union had 25,000 offices and that the Postal had 3,000 offices in the United States, whereas the Radio Corporation had only four, in New York, Washington, Boston and San Francisco. The corporation, he added, is at present receiving 10,000 messages daily over the Atlantic and 2,000 over the Pacific. The corporation desires to establish the domestic radio system to distribute these messages quick over the entire country, and thus improve the service.

The Morgan Amplifier

Flat Curve in Resistance AF; No Stopping Condensers

By J. E. Anderson

Technical Editor.

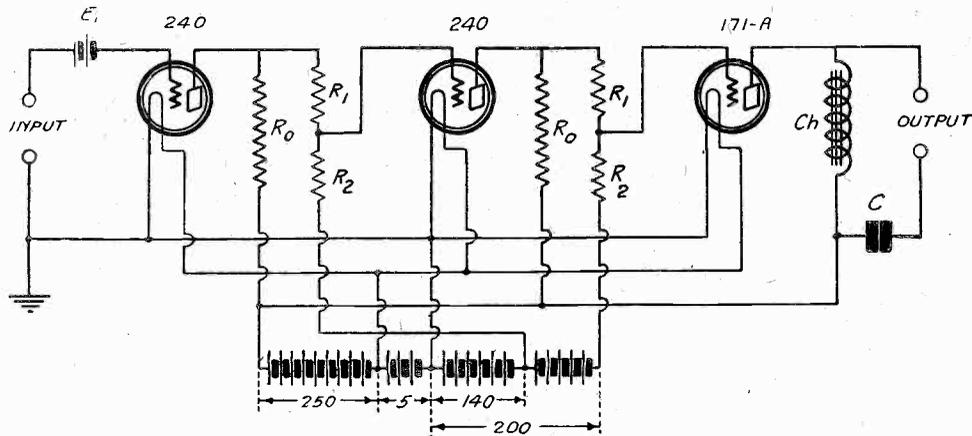


FIG. 1. THE CIRCUIT DIAGRAM OF A DIRECT COUPLED AMPLIFIER IN WHICH NO STOPPING CONDENSERS ARE USED, A NEW DEVELOPMENT BY PROF. JOSEPH MORGAN.

A UNIQUE resistance coupled amplifier without any stopping condensers has been designed by Joseph Morgan, research engineer. This circuit, which is shown in Fig. 1, is capable of amplifying direct currents as well as alternating and it has a straight line characteristic from zero frequency up to very high audio frequencies. The only reason it does not amplify super-audible frequencies equally well is that the inter-electrode capacities of the tubes partially short-circuit the inputs and the outputs so that high voltage transfer cannot be effected at frequencies around 10,000 cycles per second.

A modification of this circuit, employing screen grid tubes, in which the inter-electrode capacities are very small, and a special equalizer circuit, is capable of equal amplification from zero frequency up to about 15,000 cycles per second, and has only a small suppression between 15,000 and 100,000 cycles. Such a circuit is suitable for television reception and for other purposes where high fidelity is required over an unusually wide range of frequencies.

Theory of Amplifier

Only the amplifier primarily suited for broadcast reception is shown. This has the widest interest.

The advantage of the amplifier is that a single voltage source is used. In most other direct coupled amplifiers without stopping condensers one plate voltage source is used for each stage. An exception is the amplifier suggested by G. H. Paris and published in RADIO WORLD, September 15th issue, and in subsequent issues. The Paris circuit, when used in a single-sided amplifier, has many points in common with Morgan's circuit.

The theory of the circuit can be explained with the aid of a simplified drawing of a single stage like that of Fig. 2. R in this circuit represents the AC resistance of the tube, E_0 the signal voltage impressed on the tube, u the amplification factor of the tube, R_0 , R_1 and R_2 load resistances, A , B and C the filament, plate and grid batteries, and E represents the output voltage impressed on the next tube.

This circuit must be regarded both as an AC and a DC network. As an AC network the ratio of E to E_0 , or the amplification, may be determined. As a DC network the voltages and the resistors

must be treated so that the second tube gets the proper grid bias.

The Amplification

If there is any AC resistance in the A and B batteries, assume that it is included in R_0 , and if there is any AC resistance in the C battery, assume that it is included in R_2 . With this assumption the amplification becomes $E/E_0 = uR_0R_2 / (RR_0 + RR_1 + RR_2 + R_0R_1 + R_0R_2)$. Assume the following values: $u=30$, $R=.04$, $R_0=.5$, $R_1=.75$, $R_2=1.00$, all resistances being measured in megohms.

With these values substituted in the formula the amplification becomes nearly 17 times. If there are two such stages, and a power stage with a voltage amplification of 2, the total voltage amplification is approximately 576 times. This is equivalent to 27.6 transmission units. In terms of power amplification this is 55.2 transmission units. A gain at low frequencies of 60 transmission units is claimed for the Morgan amplifier with the same tubes and resistors. The difference may well be accounted for by assuming that the amplification factors of the tubes were a little higher than 30.

Grid Bias Adjustment

The adjustment of the grid bias on the second tube must be made by properly

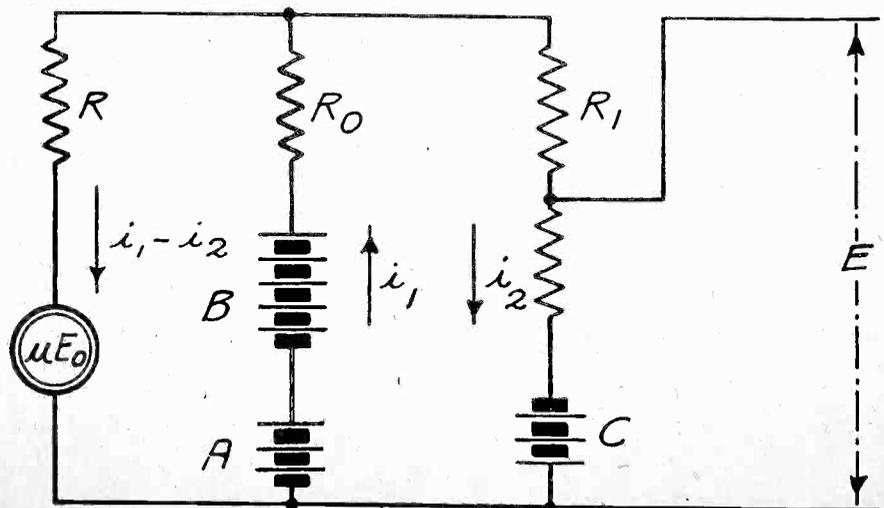


FIG. 2. A SIMPLIFIED DIAGRAM OF ONE COUPLER, WITH EQUIVALENT PLATE RESISTANCE, AS USED IN THE NEW CIRCUIT BY PROF. MORGAN.

LIST OF PARTS

- R_0 —Two .5 megohm metallized resistors.
- R_1 —Two .75 megohm metallized resistors.
- R_2 —Two 1.0 megohm metallized resistors.
- Ch—One 30 henry choke coil to carry at least 20 milliamperes.
- C—One 4 mfd. Tobe condenser, 200 volt test.
- E1—One 1.5 volt battery.
- Four binding posts.
- Three UX sockets.
- One 6 volt storage battery.
- Two high voltage storage B batteries or substitutes.

choosing the resistance values and the A, B and C voltages. The DC plate resistance of a tube may be taken as approximately twice the AC resistance. Hence when the circuit in Fig. 1 is solved, $2R_2$ must be used instead of R_2 . Let us assume the same values of resistors as for the AC problem and further that A plus B is 255 volts and C is 140 volts. What then is the effective grid bias on the second tube?

The current through R_1 and R_2 is 96.3 microamperes and it flows toward the filament of the second tube. Thus the bias on the grid of this tube is the value of C less the drop in R_2 . Since R_2 is one megohm, the drop in it is 96.3 volts. C is 140 volts. Hence the bias on the second grid is 43.7 volts. Obviously, this is too high for a -40 type tube. If the DC resistance of the tube had been assumed larger the bias on the second tube would have come out smaller. The best way of adjusting it is to adjust the value of C until the bias on the tube is correct for the plate voltage used.

Recommended Values

The values recommended by Mr. Morgan, the designer of the circuit, who is employed by the International Resistance Company, are as follows:

R_0 , .5 megohm, R_1 , .75 megohm, R_2 , 1 megohm. Ch, 30 henries, C, 4 mfd., E1, 1.5 volts. The filament, plate and grid voltages are shown in Fig. 1, as are the type of tubes.

The voltages are somewhat critical, but small changes in the battery voltages due to part discharge are not important.

Dynamic Curiosities

Residual Magnetism Produces a Phenomenon

By Byron W. Weeks

MANY of those who use electric-magnetic speakers have noted that signals may be reproduced even when no current flows in the field coil, but that the sound intensity is much weaker when no current flows. They have also noted that as the current increases, the intensity of the sound increases.

If sound is reproduced without a field current, why cannot a dynamic speaker be built without any field? Also, if the sound increases as the field current increases, why cannot the current be increased to such a value that a small receiving tube would suffice to give sufficient volume of sound?

The observation that sound will be reproduced when no field current flows might lead to the conclusion that no field is necessary. That would be a false deduction, for the armature will not move under the influence of the signal current unless it is suspended in a magnetic field. It is the force of interaction between the magnetism of the field and the magnetism set up by the signal current around the turns of wire which impels the armature. The intensity of sound is proportional to the product of the two magnetic fields. If either is zero the sound is zero.

Residual Magnetism

Why then is sound produced when no current flows in the field coil? The answer is that there is some residual magnetism in the field structure. The iron or steel used in the structure retains some of the magnetism it got when a current did flow. This residual magnetism is very small in the case of soft iron and silicon and certain other high permeability materials. It is large in the case of steels used for permanent magnets.

In nearly all dynamic speakers iron or steels of low retentivity and high permeability are used. Hence the sound produced for a given signal current is weak when no field current flows. Also, it is strong for a given field current and the same signal when high permeability material is used in the field structure.

Why cannot the field current be increased so that a small receiving tube would give sufficient volume? Theoretically it could. Since the intensity of the sound is proportional to the product of the two magnetic fields, the magnetic structure could be made such that the output of a —99 tube would give as much sound as that of a —50 tube. The limitation is a practical one.

Current Limitation

There are many reasons why the field current cannot be increased indefinitely in a given unit. First, the wire used in the field coil can only carry a certain current. If the current is too large, the wire will heat up to a dangerous point. The insulation might burn, or even the wire itself might fuse.

Second, the core might become magnetically saturated. To increase the current beyond that which produces saturation of the core would not result in increased sound. It would merely result in power loss. As the saturation point is approached the increase in sound intensity is not proportional to the current because the magnetism is not proportional to the current. Hence for a

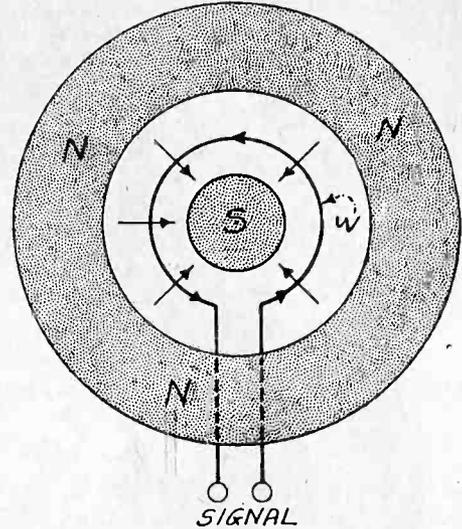
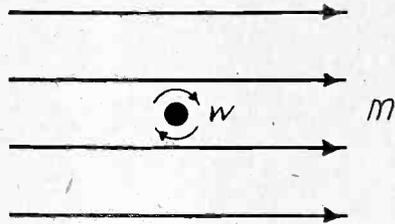


FIG. 1
A DIAGRAM ILLUSTRATING THE ELECTRIC MOTOR PRINCIPLE (LEFT) AND ITS APPLICATION TO THE ELECTRO-DYNAMIC SPEAKER (RIGHT).

given design there is a practical limit to the current.

Of course the unit could be designed so as to be operated efficiently on a small signal current and a large magnetic field. But the unit would be large and costly.

The principle of the electro-dynamic speaker is illustrated in Fig. 1. At the left is shown the principle of any electric motor, of which the dynamic speaker is a special type. Let the long arrows represent the magnetic field M , with the arrow heads indicating the direction. Let the black dot W be the cross section of a wire in this field. Assume that the direction of the current in this wire at some instant is away from the observer.

The magnetic lines set up by this current around the wire are circles concentric with the wire, and their direction is as indicated by the small curved arrows. It will be observed that above the wire the magnetism set up by the wire is in the same direction as the magnetism of the field and that below the wire it is in the opposite direction. Hence above the wire the magnetic field is strengthened by the magnetism around the wire and below the wire it is weakened.

The result of this differential effect is that the wire is urged downward, at right angles to the magnetic field M . The magnetic field M , the motion and the current in the wire form a right angled system which might be remembered by the "left hand" rule. If the index finger of the left hand points in the direction of the magnetic field and the middle finger in the direction of the current, the thumb points in the direction of the motion.

Some prefer to use this rule, but it is not easy to remember which finger should represent the current and which the magnetic field. Another way of remembering the direction of the motion is to use the idea of magnetic pressure and magnetic suction. On the side of the wire where the magnetic lines add up there is pressure on the wire and on the side where the magnetic lines are reduced there is what might be called suction. The wire will move in the direction in which it is both pushed and drawn.

At the right in Fig. 1 is shown how the

motor principle is applied to a dynamic speaker. The annulus marked NNN represents the north pole of the magnetic structure and the solid circle marked S represents the south pole. The magnetic field set up by this magnetic structure is from N to S across the intervening gap as indicated by the radial arrows.

In the middle of the air gap is a single turn of wire W in which the signal current flows in the direction indicated by the arrows around the loop. It is assumed that the loop is connected by flexible wires and so mounted that it can move up and down as a whole.

Now by comparing this case with that on the left and making due allowance for the difference in the points of view, it will be noted that the magnetic lines around the loop will strengthen the radial field under the loop and that it will weaken it above the loop. Hence the loop will move upward. If the signal current is reversed, the field remaining the same, the loop will move down.

In some dynamic speakers there is only one loop or turn on the armature coil. In others there are more. It makes little difference how many turns are used for every turn will be urged in the same direction at any given instant.

Of course the transformer between the output tube and the armature coil must be designed for the number of turns used. The impedance of the secondary of the transformer must be the same as that of the armature coil. The primary of the transformer must be wound so that it matches the tube with which the speaker is to be used, and this impedance must be measured with full load, that is, with the speaker operating.

Matching the impedance of the tube with that of the primary does not mean that these impedances should be equal. It has been found that the maximum undistorted output of a tube is obtained when the load impedance is twice that of the tube. Hence the primary impedance, with full load on the secondary, should be twice that of the tube impedance. In the secondary, however, the impedances of the two circuits should be equal.

When a Noise Annoys Try These Remedies

An Open

Better Tone Quality Achieved

By Br

DON'T blame all the noise in a radio receiver on static, for only a small portion of the noises is due to it. In the Summer, when thunderstorms are in the air, static may contribute to the sparks and crackles that mar the reception of music and speech.

Perhaps service men are the originators of the prevalent misunderstanding that static is to blame for all noise in the receiver that cannot be identified with any intelligible signal. For them to say that the noise is static is the easiest way out of trying situations, when the owners of receivers demand flawless reception in the midst of a hot-bed of electrical noise, much of which may originate in the apartments of the complainants.

Three Classes of Noise

The noise in a radio receiver can be put into three different classes. First, static or atmospheric noise. Second, radio system noises. Third, external electrical noise.

Of these three, static probably is responsible for the least amount of noise, except perhaps on rare occasions in Summer when thunderstorms are in the air or when extreme DX reception is attempted. There is nothing yet that anybody can do about it when it appears, so we shall not attempt the impossible here.

Electrical disturbances external to the radio system are probably responsible for most of the noise that is heard. It is man-made static and is particularly severe in crowded districts where electrical appliances abound. Since it is of the same type as static there is nothing that anyone individual can do about it. It requires the concerted action of all the listeners or of their legislative and executive representatives. Since this is a type of artificial static, and static is beyond the service man's power to fix, we shall leave it.

Transmitter Noises

Much of the noise heard comes in on the signal and with the signal. It is picked up before the audio signal goes on the radio wave. This, of course, is a part of the radio system noise. Its removal is beyond the set owner or service man and is a problem for the broadcaster to solve.

Occasionally the receiver delivers a terrific amount of noise which can be traced to no external source. It is strictly of receiver origin, and hence belongs to the radio system noise. Over this noise the skillful service man or set owner has control. He can leave it to mar the entertainment the receiver is supposed to bring in or he can banish it.

Trouble Traced Down

The first thing to do in the case of noise in the receiver is to try to determine what type the noise is. Does it come in over the antenna or is it of receiver origin. The simplest way to tell is to remove the antenna from its post. The noise either disappears or it remains. Of course, the signal disappears too, if there happened to be one. This test is not sufficient to completely convict or acquit the receiver, for as soon as the antenna is removed part of the receiver is removed also. That is, the noise might have originated in the antenna if it disappeared when the antenna was removed.

Suppose the noise did disappear when the antenna was removed. It is first necessary to determine whether or not the antenna is in good condition. A careful inspection of the antenna from the far end to the receiver binding post is usually sufficient to determine its condition. See that it is clear of all other objects, that it is well insulated at all points where it is attached, that it is not broken, and that it does not swing and scrape against anything when the wind blows. When these points have been determined favorably return to the set.

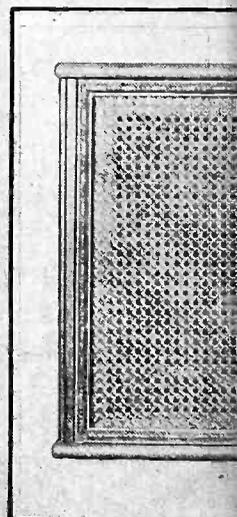
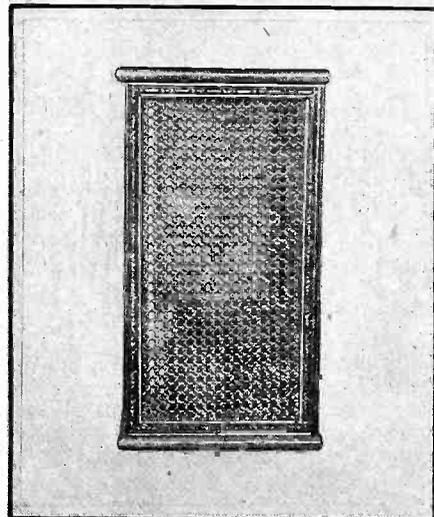
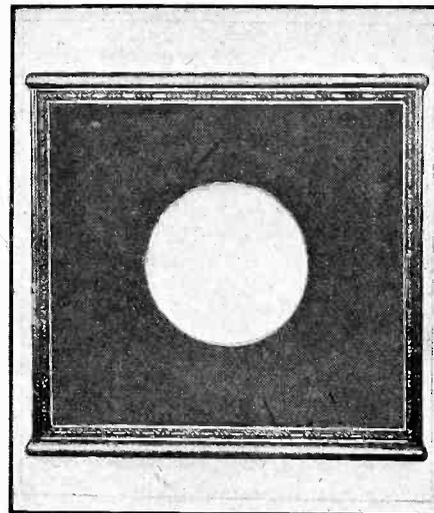
Noise in Set

Now suppose that the noise in the set remains when the antenna is removed. The origin of the noise then is in the set without doubt. It remains to find the source or sources of the racket. There may be 1,000 possible seats of the trouble. The most prolific sources are defective contacts and resistors. Wherever two conductors meet without being soldered there is a chance for noise. Tube sockets and battery terminals are the most probable places. Defective resistors give rise to the same kind of noise, and with almost as much frequency. When noise appears in a set that cannot be attributed to an outside source, the thing to do is to overhaul the receiver and test every point and part susceptible of suspicion.

If the set is battery operated begin at the battery terminals. The contacts might have become corroded, causing an irregularity of current flow. Of course, the storage battery is the most susceptible to this trouble. Wipe off the top of the battery with a rag moistened with ammonia. Use terminal clips of lead covered iron.

If the batteries are of the dry type, corrosion is not so likely but it is possible. Make sure the contacts are clean. Noise usually develops inside a dry cell battery towards the end of its useful life.

Noises often develop in the resistors in a B battery eliminator, as well as the resistors in the set. Usually wire wound resistors are noiseless.



THE FRONT, SIDE AND REAR VIEWS OF THE NON-CANE SPEAKER BOX ARE SHOWN. THE PRINCIPLE FEATURE CONSISTS IN THE EXIT OF SOUND WAVES THROUGH THE CANE SIDES. THE BACK MAY BE LEFT ENTIRELY OPEN, SINCE IT IS TURNED TO THE WALL, OR THE CANE MOTIF MAY BE USED HERE, TOO.

IT was only this season that the dynamic speaker sprang into its rightful place of popularity, but in the rush not enough attention was paid to the baffle. Effectually a baffle is an extended diaphragm.

The dynamic chassis consists of the field coil, the voice coil or armature, and the diaphragm. In all dynamic speakers the diaphragm is small, the largest diameter in the popular models being about 9 inches.

The sound waves radiated from such a diaphragm include some that slip back over the circumference, and to minimize or prevent such slippage a baffle is required. This consists usually of a board with a hole in it the size of the cone's outside diameter. Thus the sound radiation is kept in a generally forward direction, maintaining a more even frequency response and obliterating acoustical back coupling, including the trans-

mission of sound waves to the motor itself.

This motor, as a rule, has the field coil and the voice coil is the electro-magnetic coil and is attached to the

Board A

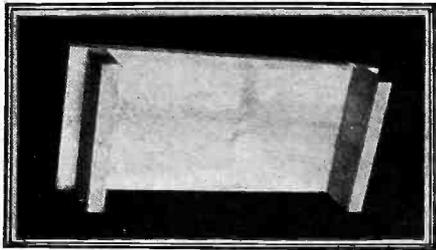
The size of the baffle is important. It should be large enough to cover the speaker board is used except that of course the form must be proper. The speaker chassis is centrally located on the board.

While a board is not much to look at, it is a good-looking addition to add sides even a cabinet. Now, the

Baffle Box

Equipped with Dynamic Chassis

by Lee



THE PLATFORM CONSISTS OF THREE PIECES OF WOOD NAILED TOGETHER TO SUPPORT THE CHASSIS.

a good-looking box into which to put the chassis. But after you have said a word in favor of its appearance you must stop, because the box does more to injure the effect of a dynamic speaker than could possibly be achieved by omitting the baffle board entirely.

A dynamic speaker is well worth listening to, even when it has no baffle, and is even then superior to nearly all magnetic type speakers. But the moment you box it up you are lost. Box resonance sets up booming frequencies usually three or four disastrous ones, that will shake any man out of his boots, if he has a critical ear.

That is why some apartment house dwellers, who can hear their neighbors sets through "soundproof" walls and across courtyards, complain that some one is forever beating drums in a neighboring apartment. It isn't that. The drum frequencies are so desperately favored in the baffle boxes that you can hear them at a distance when the other frequencies are inaudible.

Therefore beware of closed boxes, particularly small boxes, preferably all boxes.

It is better to use no baffle than to use a closed box.

A Solution.

Good appearance may be well preserved, and box resonance avoided, but constructing an "open box," one through which air can flow at the sides and rear. The cane grillwork used as seats for chairs serves this purpose admirably, although it is a bit expensive. Cane looks fine, gives plenty of ventilation to sound waves, and gets rid of box resonance while still treating the eye to the semblance of a box.

Such a baffle board, constructed with a 24" square front, with rich conservative design around the edges, the wood and the cane sprayed a rich green, maroon or brown in de luxe style, takes up more room than the lady of the house is willing to concede at first, but turns out to be such a wonderful acoustical asset, and such a good-looking piece of furniture, that it occupies its important position for good.

An easy test of the effect of the baffle is to place the cone tightly against the inside of the baffle board opening, and listen for a while. Then, as the program is kept tuned in, tilt back the speaker chassis, about 45 degrees or more,

Low Notes Require Most Amplification

"WHAT is the use," ask many radio men, "of designing and building an audio amplifier capable of amplifying the low notes as well as the notes in the middle register, when no loud speaker is able to reproduce them?"

There would be no use whatsoever. But where is the speaker that does not bring out the low notes if low notes are put into it? Such a speaker does not exist. It is true that most speakers are not able to bring out the low notes so well as the high and middle notes. But that fact is not an excuse for building an amplifier which is equally deficient. On the contrary, it is a good reason for building amplifiers which accentuate the low notes. If the amplifier accentuates the low notes, then the deficiency of the speaker is fully or partly compensated, and the overall result will be good reproduction.

A Bass Drum Solo.

Public demand for low notes was much stronger than the excuses and the evasions of manufacturers of poor amplifiers and parts. The low notes were brought out and the public got radio receivers with plenty of bass notes. In fact, there are amplifiers and radio receivers which bring out very little but the bass notes. There are some receivers which are so "bassy" that one hundred feet from the receiver orchestral music sounds like a bass drum solo. The high and middle notes are so weak that they cannot be heard at all at a short distance from the speaker.

The tom-tom effect is obtained by lifting the overall amplification to a very high level and then inserting filters to cut out most of the volume on notes higher than those of the bass drum or the lowest note on the bull fiddle. The filter may be a simple condenser across the line or it may be a choke coil in series with the line in addition. There are countless ways of introducing the suppression of the higher notes. In some cases the result gives the impression that not a single one has been omitted.

High Notes Essential.

The low notes give fullness and richness to the output of the speaker. The high notes give crispness and timbre. The high notes are just as essential as the low. Just how high it is necessary to reproduce notes is often a matter of personal opinion. Some say that 5,000 cycles is the upper necessary limit. Others contend that 10,000 cycles per second must be reproduced in full relative intensity to give the illusion of reality.

It is said that it is useless to reproduce notes higher than 5,000 cycles per second, because no broadcasting station sends out any higher notes. This statement has been made by those closely connected with the development of broadcasting stations, and it has been repeated by those who make parts the upper limit of which is 5,000 cycles.

These statements may be relatively true. They cannot be absolutely true, because most speakers and receivers do reproduce sounds as high as 10,000 cycles. If these sounds were not transmitted at all, no receiver and no speaker could produce them. And no reproduced music or speech can be natural unless they are present.

An Amplifier of Fidelity

It would seem a logical method of designing radio equipment so that each component part is as faithful to the signal as possible. If any frequency distortion remains in the complete receiver this should be compensated for at a single place. For example, any residual frequency distortion could be compensated by putting a suitable equalizer between the last tube and the loud speaker. If a receiver is designed as well as it can be at this time, and if it is used with a speaker of the best modern construction, no equalizer should be necessary.

thereby losing the effect of the baffle, and note the difference. Then restore the chassis to its proper place tightly against the opening. Richness, mellowness, naturalness, beauty—all these and more are present to a delightful degree when the baffle is used as such, while the reception sounds thin by comparison when the baffle effect is omitted. And yet with no baffle, as was said before, the dynamic speaker performs in a manner superior to that of most magnetic type speakers.

It therefore behooves everyone possessing a dynamic chassis, or about to purchase one, to give earnest thought to the baffle. It is an easy thing to make, if one has a carpentry knack, or it may be obtained factory-built from any of several manufacturers.

As the speaker will naturally be placed near a wall, no back is necessary for appearance's sake, and of course none is necessary for acoustical reasons; but if a back is included it must be "open work," and not a closed, resonating chamber.

The construction of the baffle consists of selecting a suitable front board, cutting the center hole to accommodate the type dynamic speaker you are to insert, and providing the ventilated sides and perhaps back, also a platform just high enough to bring the cone circumference in position against the circular opening in the baffle.

NONANT BAFFLE OF THE FREE BACK. EITHER IS NORMALLY BE EMPLOYED

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Magnetic vs. Dynamic

A Comparison of Quality and Cost of Both Speakers

By H. B. Herman

THE cloth diaphragm speaker, which this year runs to a sheer linen for the front, because of superior tone quality, but which has a small piece of airplane cloth at the back, where strength is the principal need, by its very construction enables the enjoyment of superior results.

The fundamental purpose of constructing such a speaker is to have the driving pin of the armature balanced against the tension of the two surfaces, so that sensitivity is high. The front cloth pulls in one direction, the rear piece pulls in the opposite direction, so that when there is equal pull in opposite directions the armature that the pin is attached to, and which moves back and forth in the miniature space between pole pieces, responds readily to the slightest impulse.

Protection for Unit.

This state of balance not only accounts for the high sensitivity but also relieves the unit of overstrain which in time might put the armature of some units out of adjustment. When a cloth diaphragm speaker is properly constructed the armature adjustment, made at the factory, is amply safeguarded.

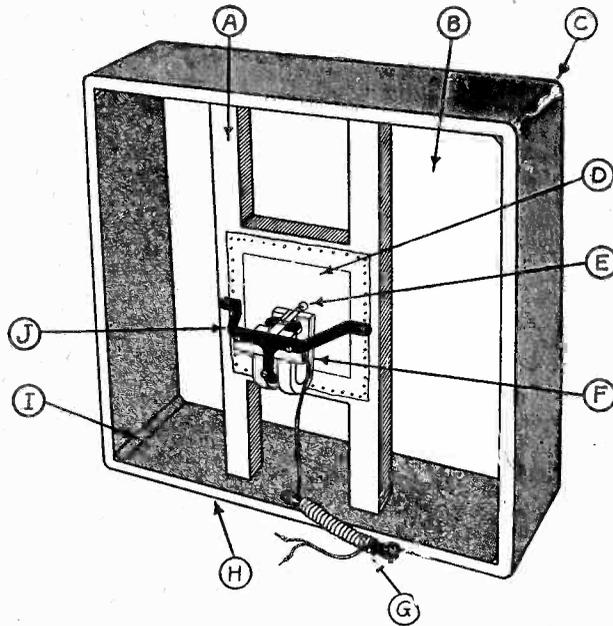
The frame and front 24x24" diaphragm serve also as a baffle. The front diaphragm area is large, which is an asset, since low notes require an easy road to travel, low-note amplification being weakest in most receivers. The large area gives the low notes their well-deserved chance.

Also the high notes and the middle register get adequate treatment from the very stretching of the front diaphragm, although the "highs" are slightly aided by the small rear cloth. The main purpose of this small piece of airplane cloth, however, is not diaphragmatic. This is just an accidental advantage. The outstanding purpose of the 8x8" cloth is to provide the counter-tension.

Good-Looking Now.

Those who appreciate fine tone quality are fond of this type of speaker. True, it takes up more room than a small cone. True, the speaker formerly had an un-gainly appearance, but this has been remedied, for rounded corners, and a deluxe finish cure the ill-appearing exterior of other days.

The unit employed is electro-magnetic.



THE LINEN DIAPHRAGM SPEAKER PRODUCES EXCELLENT RESULTS, IF SHEER LINEN IS USED, AND PROPERLY "DOPED" AFTER THE CLOTH IS STRETCHED TIGHT. THE CONSTRUCTION IS SUCH THAT THE ARMATURE OF THE UNIT HAS LITTLE STRESS AND STRAIN UPON IT, AND IS THUS FREE TO MOVE BACK AND FORTH, RENDERING THE SENSITIVITY HIGH. THE CONSTRUCTION OF THE SPEAKER IS AS FOLLOWS: (A), UPRIGHT SUPPORT, FASTENED BY TWO NAILS ON TOP AND TWO ON BOTTOM; (B), FRONT DIAPHRAGM OF SHEER LINEN, SO TIGHTLY STRETCHED AS TO BE HORN-LIKE IN ITS INTERIOR SHAPE; (C), ROUNDED EDGES OF FRAME FOR BETTER APPEARANCE; (D), AIRPLANE CLOTH FOR BACK DIAPHRAGM, WHERE STRENGTH IS GREATEST NEED; (E), APEX INTO WHICH ARMATURE DRIVING PIN IS INSERTED; (F), UNIT; (G), UNIT CORD; (H), FRAME, 24x24"; (I), SPLICE JOINT; (J), MOUNTING BRACKET FOR UNIT.

That is still the most popular type of unit, because it is the most efficient and the least expensive in purchase cost and upkeep. It requires no power to run, save that derived from the receiver itself in the usual way, whereas the dynamic speaker requires the powering of a field coil, where often 40 watts are dissipated. Besides, every dynamic speaker needs a good baffle for best performance, whereas the cloth speaker is its own baffle, and stands comparison with the admittedly fine dynamic speakers.

Utmost rigidity of parts is required in every speaker—except for the free-moving armature—and to attain that high degree of firmness and mechanical strength in the cloth speaker there must be an accurate bracket.

Accurate Bracket

Best accuracy is easily achieved if the bracket is molded specially to fit the unit with which it is to be used.

Then the frame must share in this distribution of strength. If the joints are nailed there is always danger of warpage affecting the security of the joints, and besides the appearance is impaired. Splice jointed frames stand up despite temperature and climatic changes.

Devoted Enthusiasm.

The advantages of strength, beauty of appearance and tone, plus fine sensitivity are combined in several kit combinations and factory-made cloth type speakers.

The linen diaphragm speaker, of balanced tension construction, will ever remain a favorite with those who know their tone quality, and who appreciate a fine-appearing reproducer as well.

That accounts for the growing popularity of such type, even among those who have carefully tested the dynamic by comparison, and have found that, everything considered, the cloth type speaker was preferable to them.

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Radio Contributes Largely to Telephony, Television and Talkies

By S. M. Kintner

Manager, Research Department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

PROOF that electrical energy could be detached from an electrical circuit and radiated through space was supplied by Hertz in Germany in 1888. This was the beginning of radio.

It is, however, a far cry from the classical experiments of Hertz to our present day systems of radio operations. This has been made possible by the brilliant discoveries and inventions of a number of other workers whose names will always live as the founders of the art.

Fortunately, the benefits of a discovery or invention relating primarily to one art are frequently enjoined by other arts. This condition is generally spoken of as a "by-product" benefit.

It is my purpose to point out some of the "by-product" benefits that have resulted from radio developments.

The outstanding instrumentality that radio has produced is the vacuum tube. This device performs three radically different services: (1) It is a rectifier of alternating currents, (2) it performs the inverse operation of producing alternating current from direct current, and (3) it amplifies feeble currents and makes them strong.

Use in Wire Telephony

When applied in suitable circuits, the vacuum tube not only performs these functions better than any other means but also reaches to certain fields not otherwise attainable.

These tubes, and others perfected as by-products, have made possible long-distance telephony by wire lines. In a transcontinental conversation the voice currents will be amplified at intervals of 40 or 50 miles; thus new energy is added to the system about 60 times. In spite of these many repetitions, the final result is so good that one has no hesitancy in recognizing the voice of a friend.

Any process that will permit the accumulation of all its deficiencies for each of 60 operations, and yet give a result in which the combined error is scarcely discernible, has reached a high state of perfection.

Made Picture Transmission Possible

Other tubes—fundamentally the same, however—have brought to a realization the dream of more than a quarter century—of pictures transmission by wire and radio. Tubes and their related circuits have supplied the principal deficiencies that were required to make these old ideas workable. Today this is a successful system in commercial use.

Television—an idea suggested 40 years ago—is also drawing upon radio tubes and accessories in its efforts to become a reality. The systems that have thus far attained some measure of success would be, in my opinion, still better if even greater reliance were placed in radio methods in place of the crude mechanical mechanisms now used.

Now the Talkies!

When the life of the phonograph industry was threatened by radio a few years ago, it was to radio that its rescuers turned for help. Again the radio tubes and circuits were called into use to get better recording and better reproduction, and the industry was saved.

Radio appliances are now entering the

motion picture field and the silent drama is giving way to the speaking images. What is now being shown should not be criticised too severely, as both equipment and its methods of use are undergoing their initial development. It should be recognized that new instrumentalities have been placed in the hands of the directors of the art which greatly extend the possibilities of their recordings.

Doubtless a new art, different from any we now know, will grow up and utilize them to our increased enjoyment.

Radio, in some instances, has been a great trial to the electric power companies because of the complaints about radio interference. While this no doubt was annoying at the time, it was in reality a blessing in disguise. The radio set, in effect, was simply observing the "blood pressure" of the power company's system and, when interference was observed, was warning them that there was a part of the system that was weak and in imminent danger of failure. Who can question that this is a real service—just as pain is to the individual—warning against keeping on without removing the source of trouble.

The perfection of special radio "by-product" tubes and circuits has placed in the hands of the designers means so sensitive, so selective, and yet so reliable, that it is now possible to telephone instructions to a machine and have it perform any number of prearranged operations.

Life-Like Machine

The actions of this machine are so life-like that in the popular press—it has been called the mechanical man. Such machines are now rendering effective service in power companies' sub-stations, taking the place of human station attendants.

Many other applications of radio appliances have been made to other arts.

One of the great debts owed to radio is the new knowledge that has resulted from studies of radio phenomena. Each new art brings with it new relations which either confirm our existing theories or

cause us to revise them to take into account the new phenomena. As we know nothing absolutely, it is not surprising that our theories are undergoing frequent revisions.

Only a short time ago an atom was thought to be the smallest thing in the world. But a theory founded upon the atom as the ultimate of divisibility fails to explain many of the phenomena observed in the radio tube. An electric current, so modern theories picture it, is a movement of electrons, each carrying its charge. An electron weighs only about 1/1,800 as much as an atom of hydrogen, lightest known gas.

Electrons by Weight

Perhaps some appreciation of these proportions can be had from a calculation of the cost of an ounce of electrons. If electric power is furnished at 6c. per kw hour—a fair average domestic rate—once ounce of electrons would cost approximately \$10,000. From this it is apparent that the average family never requires an ounce. If a monthly bill of \$10 is assumed—\$120 per year—it would require 83 years to get that much.

It would appear therefore that, on a weight basis, the commodity dealt in by electric power companies is very expensive. In fact, it is even more costly than appears from what has just been stated, for the electrons are never sold—only their service is sold.

Weight, however, is not always the best way to determine values, and this is a striking instance where such is the case.

Better Understanding

Without enumerating at length the benefits from knowledge gained in radio studies, suffice it to say that much better understandings of electrical equipment of all kinds has resulted.

As our knowledge is increased by continued studies, our applications will be correspondingly improved and doubtless new applications made that are now beyond the flights of our wildest fancy.

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By Clifford

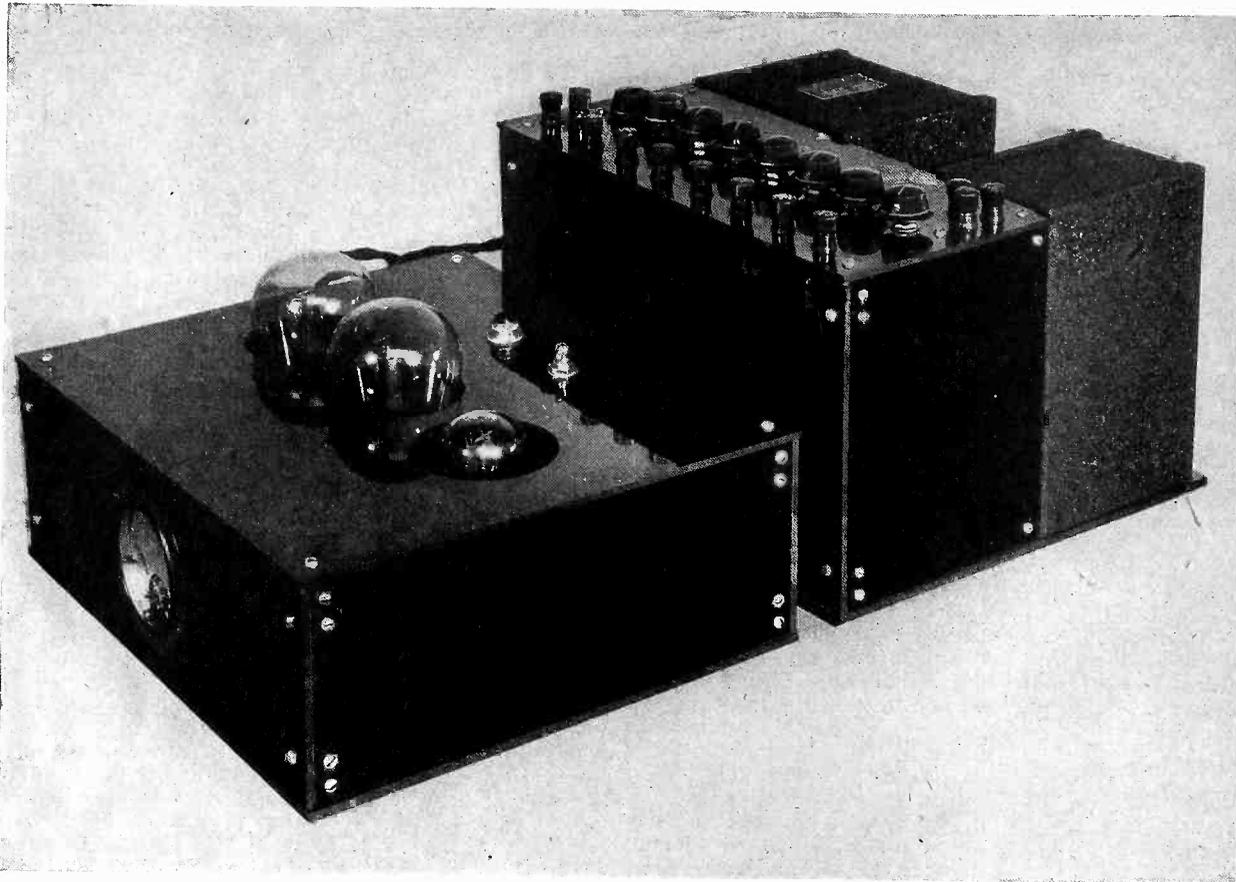


FIG. 3
A general external view of the completed Straight Line Amplifier and power supply unit. The amplifier is in front and the power supply at the rear. A milliammeter, shown on the amplifier, is used to indicate the plate current and any possible overloading.

[This is the second and concluding installment of the Ferranti Straight Line Audio Amplifier and power supply unit. The first part of the description appeared last week, in the November 10th issue. That dealt with the theory of the circuits and the construction of the amplifier. This part deals mainly with the constructional features of the power supply.]

A UNIQUE feature of the Ferranti Straight Line amplifier is the method used in isolating the plate and grid circuits so as to eliminate all common coupling between stages. This elimination avoids all distortion due to feedback and prevents motorboating and oscillation at high audio frequencies. The amplifier is further characterized by equal gain for all frequencies essential to the faithful reproduction of radio and phonograph signals, by high amplification and great power handling capacity.

The power supply unit is so designed as to supply the necessary power for the Straight Line amplifier when two tubes as large as the -50 type are used in the last stage, with sufficient surplus to power the radio frequency tubes in the receiver and to supply the current and voltage required for the field coil of a dynamic speaker. It automatically supplies the necessary filament, plate and grid voltages.

Connection of Minus Lead

Referring to the circuit diagram of the Straight Line amplifier and power supply shown in Fig. 5, it will be seen that no connection is indicated between B— of the power supply and the filament circuit of the amplifier. This has been omitted to avoid ambiguity. In some radio frequency circuits B— and A plus are joined. In

others B— and A— are joined. B— of the power supply should be connected to A— or A+ according to the way it is connected in the radio frequency circuit used with the amplifier.

The Ferranti Straight Line amplifier and the power supply are built in two separate units. This method of construction is rapidly gaining in favor because of the ease and thoroughness with which coupling between them may be removed. Yet the two units are proportioned so that they fit nicely together, making as compact an assembly as is consistent with good performance. An important feature of both the amplifier and the power supply is that they are well ventilated so that all heat developed can escape quickly. Thus the units operate at a cool temperature and no parts are endangered by overheating. Only those can appreciate fully the advantage of this who have seen insulation soften, resistors fuse, condensers puncture and transformers and coils smoke for lack of ventilation.

When a circuit is properly designed and operated only the tubes should be so hot as to be uncomfortable to the touch. Other parts may be comfortably warm, as they are in the Ferranti units.

The milliammeter shown in the photographs of the Ferranti Straight Line amplifier should be connected in series with the supply line to the two power tubes at the point marked M. At this point the meter indicates the total plate current supplied to the two power tubes, and thus any fluctuation in the meter on loud signals indicates overloading. Small changes in the position of the needle are to be expected. It is only when the swing of the needle from its mean position exceeds about 10 percent of the mean value that distortion is excessive. This

will not occur on any volume tolerable in a home, or even a small hall.

Constructional Information

Now we will resume the constructional directions where we left off last week.

Next mount all the parts on the base and proceed with the wiring. Run leads as shown in the photo, using twisted pair for the AC leads to the filaments of the rectifier tubes and to the hum adjuster, and use rigid insulated leads for the other conductors. The insulation must be sufficient to withstand voltages up to 600 volts.

The 7½ volt AC filament supply for the power tubes is taken from the transformer posts at the rear of the amplifier.

The amplifier unit works successfully with the Pacent phonograph pick-up without extra matching transformer. Any other pick-up may be used also provided that a suitable matching transformer between the pick-up used and the input of the amplifier.

Check all connections and if correct, connect the power supply making sure to have a 3-ampere fuse in the circuit. Turn on the power and see that transformer is alive. Turn off power and insert both type 287 rectifier tubes. Turn on power with top of unit thrown back and watch carefully to see that there are no short circuits as evidenced by overheating of resistors.

If all goes well check B & C voltages with a high resistance voltmeter. The Ferranti type 1,000 which has a resistance of 1,000 ohms per volt is recommended for these tests.

If voltages are correct see that varying the resistors give the proper voltage range. When the power unit is fully tested, make the necessary connections to

Push-Pull Supply

Denton

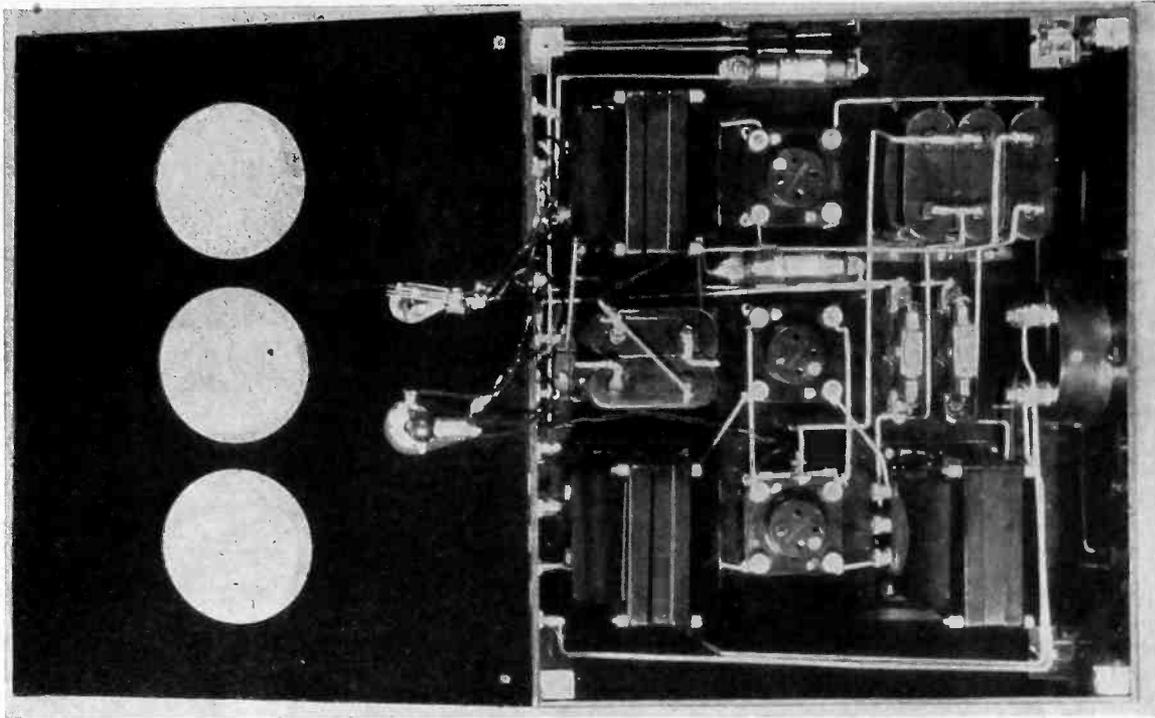


FIG. 4
 INTERIOR OF THE FERRANTI STRAIGHT LINE AMPLIFIER WITH THE LID THROWN OPEN. THE THREE HOLES IN THE LID REGISTER WITH THE TUBE SOCKETS SO THAT THE TUBES MAY EXTEND THROUGH THE HOLES. LOCATIONS OF CONDENSERS, TRANSFORMERS, SOCKETS AND THE PLATE MILLIAMMETER ARE CLEARLY SHOWN.

the amplifier. The filament supply for the first audio tube may be a battery or any of the numerous types of A eliminators such as Tobe.

Turn on power supply and see that no short circuits or grounds are present. Insert tubes one at a time, noting whether filaments have proper current. Adjust filament current of first audio tube, by means of its variable resistor.

Connect input leads to radio (or phonograph pick-up) and test out one at a time, throwing the amplifier switch to the proper position. The grid bias of the power tubes must be adjusted to give the correct plate current, 110 mills for 250 tubes and others according to rating. Bias

of first audio tube is then adjusted to critical value giving best results, which is approximately 6 volts.

Turn the hum adjuster, (last left and knob) to give minimum hum. Successful completion will be indicated by sharp, clear undistorted reproduction of great volume with absence of hum, and if such results are not secured, check all circuits and voltages until the trouble is found. The unit will be entirely free from motor-boating if properly connected and supplied with correct voltages.

Whatever type of power tube may be used, matched pairs are recommended.

The performance of a push-pull amplifier, both with respect to freedom from

distortion and freedom from feedback through the plate voltage supply, is closely related with the exactness with which the power tubes are matched. If they are matched exactly there is no signal current in the common B supply for the signal in one side just cancels that in the other. Hence there can be no feedback at all. But if the signal is greater in the output of one tube than in the other, there will be some signal current in the common lead and there will be feedback. This might be such as to reduce the amplification of the circuit or such as to increase it, depending on which of the two tubes is the more efficient.

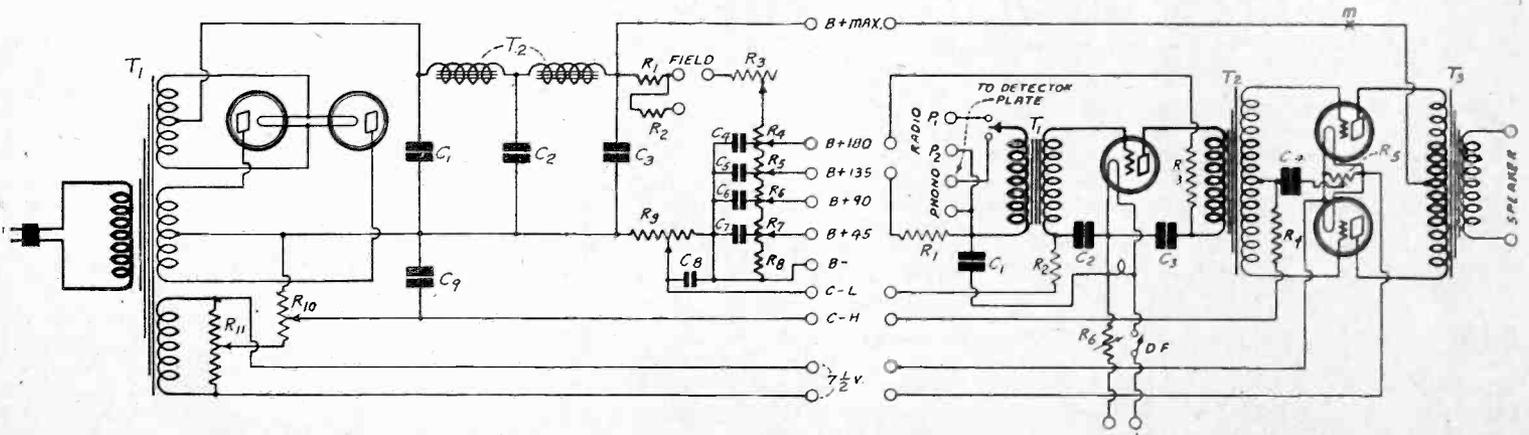


FIG. 5
 THE DIAGRAM OF THE FERRANTI STRAIGHT LINE AMPLIFIER AND POWER SUPPLY WHICH SHOULD BE SCUPULOUSLY FOLLOWED IN WIRING THE UNITS FOR OPTIMUM RESULTS. FOLLOW THIS DIAGRAM IN BUILDING THE CIRCUIT.

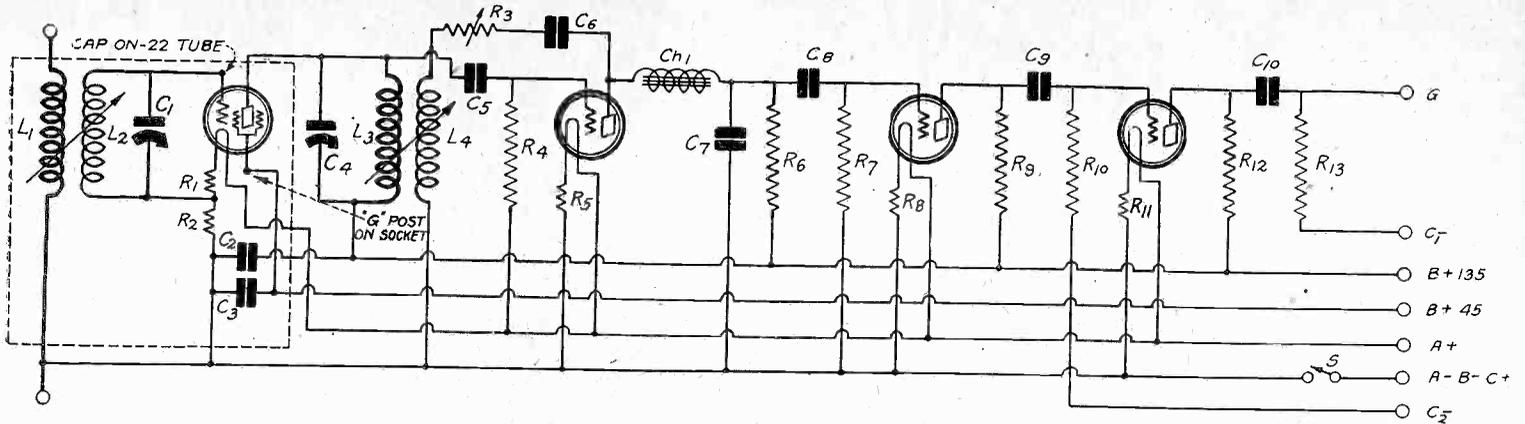


Fig. 714

A SENSITIVE RECEIVER EMPLOYING ONE SCREEN GRID RF AMPLIFIER, A REGENERATIVE DETECTOR AND TWO STAGES OF RESISTANCE AUDIO, SUITABLE FOR FEEDING A POWER TUBE IN THE POWER PACK. REQUESTED BY THOMAS P. WILLIAMS.

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PLEASE PUBLISH the diagram of a four-tube circuit employing one screen grid RF amplifier, a regenerative detector and two stages of resistance coupled audio, to be used with a power tube built into the B battery eliminator.

THOMAS P. WILLIAMS,
Dallas, Texas.

(1)—See Fig. 715.

* * *

I HAVE a high resistance voltmeter, but don't know the ohms per volt. Can you suggest a method of determining this value without the use of another meter?

EDWARD SEYMOUR,
Tulsa, Okla.

(1)—Connect a high known resistance in series with the meter and with a suitable voltage. First measure the voltage of the battery with the resistor short-circuited and then with the resistor in series. From the two voltage readings and the known resistor the resistance of the meter can be determined. Divide the known resistance value times the lower voltage reading by the difference between the two voltage readings. The result is the total resistance of the meter. Divide this by the voltage range of the meter to get the ohms per volt.

HOW CAN I calculate the power taken from the line by my receiver and power

pack and the cost of operation? I have no meters with which I can measure the voltage and the current in the supply line.

HERBERT CHESTER,
Sheboygan, Wis.

First count up all the wattages in the filaments. The wattage in each filament is the product of the current by the voltage. Then get the wattage in all the plate currents by multiplying the maximum voltage by the maximum current. Add all the wattages and increase the sum by about 20 per cent. The cost per hour is then obtained by multiplying the number of kilowatts by the cost of electric power per kilowatt hour. Suppose the total wattage adds up to 54 watts, as it did in one particular receiver, and that the cost of electricity is 8.5c per kilowatt hour. The cost is then nearly half a cent per hour.

* * *

WHAT IS the power required for heating the cathode of a -27 type tube?

(2)—What power is required to heat the filament of a -71A? A -50?

(3)—Would it be possible to heat the cathode of a tube by a gas flame instead of by electricity?

LOUIS ROBINSON,
Des Moines, Iowa.

(1)—The wattage required to heat the

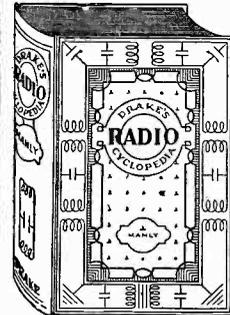
cathode of the -27 tube is 4.375 watts.

(2)—It requires 1.25 watts to heat the filament of the -71A and 9.375 watts to heat the filament of the -50 tube.

(3)—It is quite possible to heat the cathode of a tube by a gas flame provided that the tube structure were so arranged that the cathode was accessible. For example, the cathode could be a metal cylinder housing the plate and the grid structures.

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- Andrew M. Jenkins, 139 Rex Place, Sharon, Pa.
- Jack Momack, Box 606, Liberal, Kans.
- James K. Hubbard, 790 East Pike St., Martinsville, Ind.
- Chas. Michaloske, Butt Ave. (R. D. 2, No. 87), Oxford, N. J.
- Fred Shanon, Box 154, Richlandtown, Pa.
- L. C. Gillam, Radio Sets, 504 Monroe St.—Rear, Buffalo, N. Y.
- F. W. Hammond, 1743 Lincoln St., Berkeley, Calif.
- U. G. Danner, 421 Hazlett Ave., N. W., Canton, Ohio.
- D. M. Heath, R. F. D. Box 205 Knox Ave., San Leandro, Calif.
- A. D. Webster, 50 Loop Road, Kingfield, Woking, Surry, England.
- H. Clements, Box 216, Oyster Bay, N. Y.
- Charles Habrey, 39 Crescent St., Cambridge, Mass.
- C. D. Reed, Claton, W. Va.
- J. P. Walsh, 1174 Gouin Blvd., East, Montreal, Can.
- John Biesiadecka, 580 Sixth Avenue, Brooklyn, N. Y.
- Geo. N. Engert, 1511 Poplar St., Terre Haute, Ind.
- David Donner, 860 Elizabeth Ave., Elizabeth, N. J.
- T. F. Parker, 4641 W. 17th St., Los Angeles, Calif.
- B. L. Flagg, Wolf Junior High Sch., Easton, Pa.
- F. M. Neff, Neff's Radio Exch., Red Men's Bldg., Salisbury, Md.
- A. J. Collins, 620 West 6th St., Erie, Pa.
- J. Walter Banfield, 347 E. Pike St., Houston, Pa.
- H. O. Cram, c/o The Bridgeport Motor Co., Inc., 105 Kossuth St., Bridgeport, Conn.
- F. Rahmstock, 722 Buckeye, Toledo, Ohio.
- M. J. D'Angelo, 127 E. Houston St., New York City.
- W. Jones, 9408 Piatt Ave., Cleveland, Ohio.

The New HBH

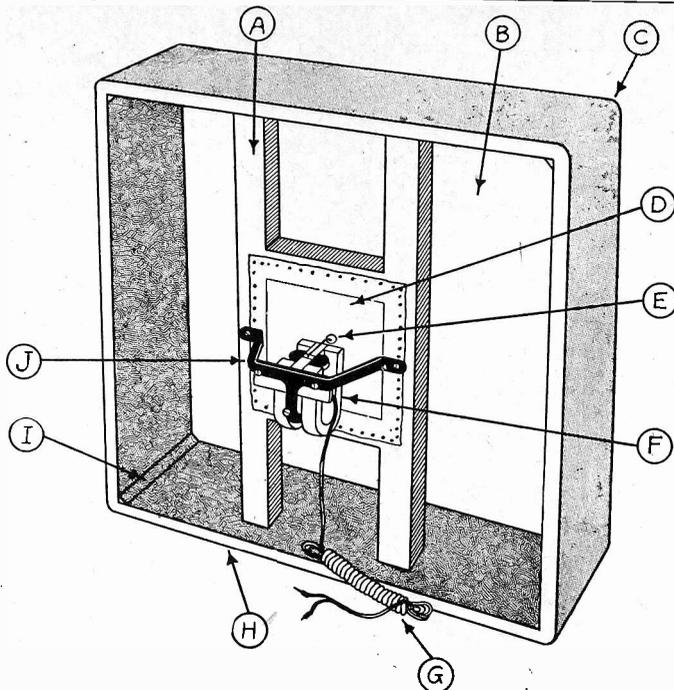
Irish-Linen Diaphragm Speaker

DeLuxe Finish; Built-up, Ready to Play

(Cat. A No. 1DLB)

\$19.50

Beautiful to Eye and Ear



Symbolic Rear View of the New HBH Speaker

- A—Upright "H" Support
- B—Front Cloth (thinnest linen).
- C—Rounded Edges.
- D—Rear Cloth (airplane cloth).
- E—Apex.
- F—Polo Unit.
- G—10-Foot Cord.
- H—Rigid De Luxe Frame, 24x24"
- I—Splice Jointed.
- J—Moulded Metal Bracket.

Enjoy the *Big Thrill!*

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

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

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

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

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

Strikingly Beautiful

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

The mechanical construction is perfect.

PARTS PRICE LIST

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

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

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

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

Name

Address

City State

SEND NO MONEY!

Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

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

TAKE Your Choice of 4 Other Publications for New Radio World Subscribers Ordering Now. Radio World has made arrangements to offer, with one year's subscription for Radio World, a year's subscription for any one of the following publications FREE: Radio News or Science and Invention or Boys' Life or Radio (San Francisco).

Send \$6.00 — now. State which other listed publication you desire. Radio World, 145 W. 45th St., N. Y. City.

RECENT issues of Radio World, 15 cents each. Any number published in 1928 available.

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

Three Stations Lose Plea for New Wave

Washington. The applications of WBNY and WOV, both of New York City, for assignment to 900 kc, 333 meters, was denied by the Federal Radio Commission, because to grant the application would have deprived Buffalo and Syracuse, N. Y., of deserved facilities.

Other applications denied were: WHAC-WBIS, the Shepard Stores, Boston, Mass., for 590 kc, 508 meters, now assigned to WEEI; WIBS, New Jersey Broadcasting Corporation, Elizabeth, N. J., for increase in power and hours of broadcasting; construction permit for Pickwick Broadcasting Corporation, to erect stations in San Francisco, Los Angeles, and in Phoenix, Ariz.

WBBM Getting Ready to Use 25,000 Watts

Work has begun on a 25,000 watt transmitter for WBBM, Chicago, following the issuance of a constructional permit by the Federal Radio Commission. The new equipment will be located at the same place as the present sent, approximately twenty-five miles Northwest of the city.

BLUEPRINT FREE!

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

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

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

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

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

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

Name

Address

City State

Renewal.

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

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

Bakelite Drilled Front panel and aluminum self-bracketing, socketed Subpanel of the

REVELATION 4

Immediate shipment \$5.00
(Subpanel alone, self-bracketing, socketed, \$3.50)
(Drilled Front panel alone 2.00)

Front and subpanel for 4-tube Screen Grid Diamond of the Air, same prices.

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

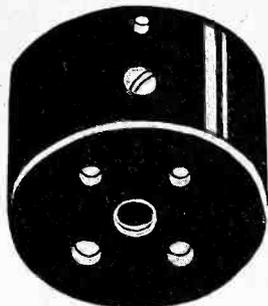
RADIO WORLD, published every Wednesday, dated Saturday of same week, from publication office. Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y., just east of Broadway. Roland Burke Hennessy, President; M. B. Hennessy, Vice-President; Herman Bernard, Secretary. Roland Burke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

Be a RADIO EXPERT

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



SAVE THOSE TUBES!



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

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

SPEAKERELAY

Cat. No. 121

\$2



For connecting two speakers by turn of knob so that at No. 1, left, you operate one speaker alone; at No. 2, right, you operate the other speaker alone. Excellent for store demonstrations or home use. Earphones may be substituted for one speaker.

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

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Look at the Expiration Date on Your Wrapper

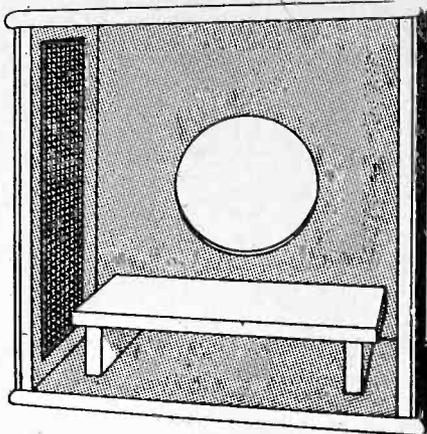
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In this way you will get your copies without interruption and keep your file complete.

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

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

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



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Manufacturers of highest quality condensers and resistors that are—
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"Built Better"

Write for the Research Worker, a free monthly publication.

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BROOKLYN, N. Y.

AIR COLUMN HORNS ARE SPLENDID!

Especially Those Made of Molded Wood

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



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

\$10.58

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

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

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

Model 112 horn motor stands 250 volts without filtering (illustrated at right). List price \$6.00. Our price (40% and 2% off list price).....\$3.53

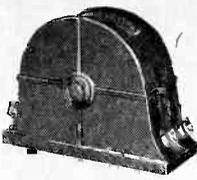


NAME.....
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LYNCH

resistance-coupled amplifier kit for quality television reception. Complete with mount. **\$9.00**

ARTHUR H. LYNCH, INC.
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Send for free Lynch radio manual



VICTOREEN Super Coils

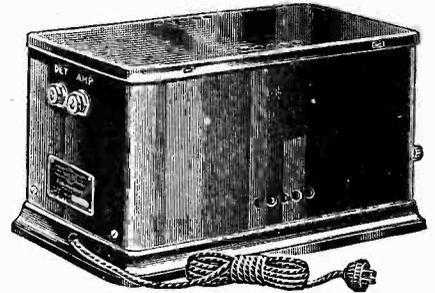
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Geo. W. Walker Co.
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ELIMINATE BATTERIES!

NO Change in Set Wiring
NO Change in Tubes

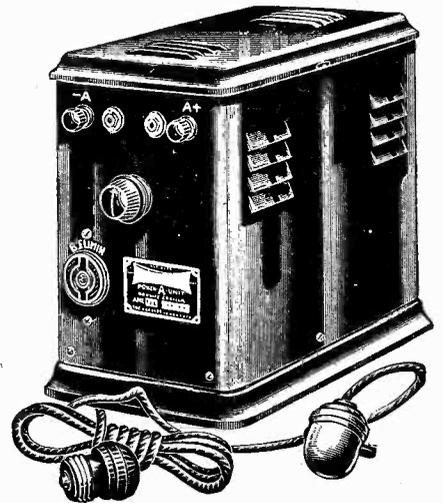
"B" Eliminator, Using Raytheon Tube, Replaces "B" Batteries and Gives Great Satisfaction.



No. B16—"B" Eliminator for 50 to 60 cycle, 105 to 125-volt AC house current. Max. voltage, 180, with one variable detector and one variable intermediate voltage. Weight, 16 lbs. Size, 6 x 6 1/2 x 11 1/2". Quiet, economical. Requires no attention. Sold only with Raytheon tube. Price, including Raytheon BH125 mil. tube and built in connector cord and plug. **\$16**

Famous Raytheon Tube With Each "B" Eliminator

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



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

POLO ENGINEERING LABORATORIES,
57 Dey St., N. Y. City
Please ship at once—

- One 180-volt maximum "B" eliminator, with variable detector and variable intermediate voltage (three different voltages in all); equipped with one Raytheon BH tube, 125 milliamperere rating. I will pay \$18, plus a little extra for freight, on receipt of goods, which are to be on approval for ten days (money back, if desired after 10-day trial).
 - One "A" eliminator, 2 1/4-ampere maximum at 6 volts, using dry plate rectification, large choke and large capacity condenser, AC switch, receptacle for any "B" eliminator plug, variable resistor, all built in for which I will pay \$22, plus a little extra for freight.
 - Both the "B" eliminator and the "A" eliminator, at total of \$36, on same approval basis.
- Note: If fast express shipment is preferred, rather than slower freight, put a cross here .

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

ALL SHIPMENTS MADE ON APPROVAL FOR TEN DAYS
All prices quoted are NET!

Cash in on This Offer Now!

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

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

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

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

Please use the attached coupon.

SPECIAL TWO-FOR-PRICE-OF-ONE COUPON

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

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

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

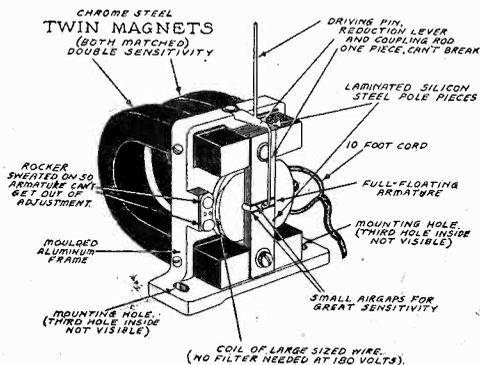
If you prefer to pay \$6.00 for only one year's subscription for **RADIO WORLD** (52 numbers) and get one of the other magazines for one year, without extra cost, put one cross in one square in front of the name of one magazine.

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

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

THIS OFFER EXPIRES AT NOON ON DECEMBER 15TH, 1928

MOST REMARKABLE OFFER!



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

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

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

Compare!

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

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

We guarantee immediate shipment.

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

YOU MUST USE THIS COUPON

POLO ENGINEERING LABORATORIES

(Tel. Cortlandt 5112)

57 Dey Street, New York City

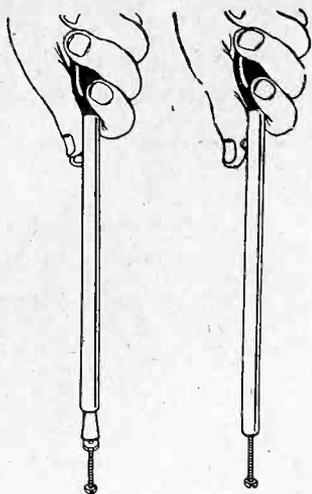
Enclosed please find \$6.00 on account, for which please send me at once one Polo Twin Magnet Unit, mounting bracket, 10-ft. cord, apex, chuck and hardware. I will send you the extra \$4 (making total of \$10) within 90 days after your date of shipment, to complete the purchase; or within 90 days will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

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

NINETY-DAY Money-Back Guarantee

SOCKET WRENCH

**F
R
E
E**



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

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

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

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

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

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

for GREATER EFFICIENCY—

Do you want more selectivity? Simply reduce the signal pick-up by placing a VOLUME CONTROL CLAROSTAT across antenna and ground connections.

Do you want DX detection? Simply increase detector grid leak to 6 to 10 megohms by means of GRID LEAK CLAROSTAT. That means the proper grid leak for any condition.

Do you want better R.F. Amplification? Simply adjust your r.f. B or plate voltage by means of the DUPLEX CLAROSTAT, which provides two variable taps.

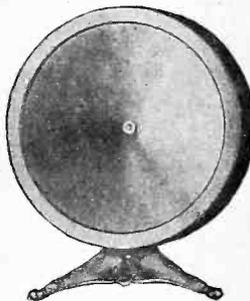
Do you want extreme sensitivity? Simply introduce regeneration in detector circuit by means of a home-made feedback coil and VOLUME CONTROL CLAROSTAT as shunt resistance.

Do you want good quality on loud signals? Simply reduce signal strength by shunting TABLE TYPE CLAROSTAT across antenna and ground.

To make a long story short, Invest 25 cents in "The Gateway to Better Radio," obtainable from your dealer or direct from us. 88 diagrams, over 20,000 words of practical information—all for a quarter.

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

CLAROSTAT
Pat. Off. Reg. U.S.



Circular Model

\$10.00

Ideal for multi-tube high-power sets, and is the perfect Speaker for Electric Receivers in every price class.

Sent prepaid if cash with order, or plus postage if C.O.D.

Pausin Engineering Co.
727-739 Frelinghuysen Ave.
Newark, New Jersey

7 Years of Perfect Service

AMPERITE, the self-adjusting filament control has been time-tested by the world's leading radio designers. Entirely unlike fixed resistors. A type for every tube—battery or A.C. 81.10, with mounting (in U.S.A.) at all dealers.

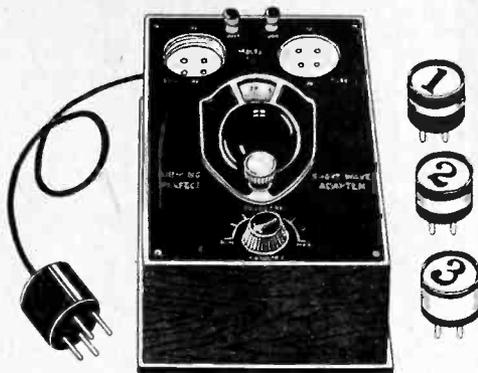
Demand AMPERITE.

FREE "Amperite Blue Book" of latest circuits and construction data. Write Dept. R.W.22 RADIALL CO. 50 Franklin St. New York



AMPERITE
The "SELF-ADJUSTING" Rheostat

SHORT WAVE ADAPTER \$10.17



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

The Adapter plugs into the detector socket of your present broadcast receiver and brings in the short waves, including foreign stations, on the speaker. Bakelite panel, handsome real mahogany cabinet. Full directions with each adapter. Any novice can work it. Immediate delivery.

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

New Powertone Unit Brilliant to Eye and Ear! 1929 Model Far Excels Anything Else in Its Price Class!

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

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

GOLD AND VAN DYKE

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

WHAT YOU GET:

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



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

SEND NO MONEY!

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

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

36" OR 24" KIT

You can use this unit on any type cone or other diaphragm speaker you prefer. If you want to build a 36" or 24" cone yourself, specify which, and unit, paper, bracket, apex, nut, thumbscrew, cement, pedestal, cord and instructions will go forward at \$4.00 C. O. D. plus small cost of cartage.

You will be overjoyed with the new 1929 model improved Powertone Unit. Order one TO-DAY!

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

