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May 4th, 1929

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WORLD

The First and Only National Radio Weekly

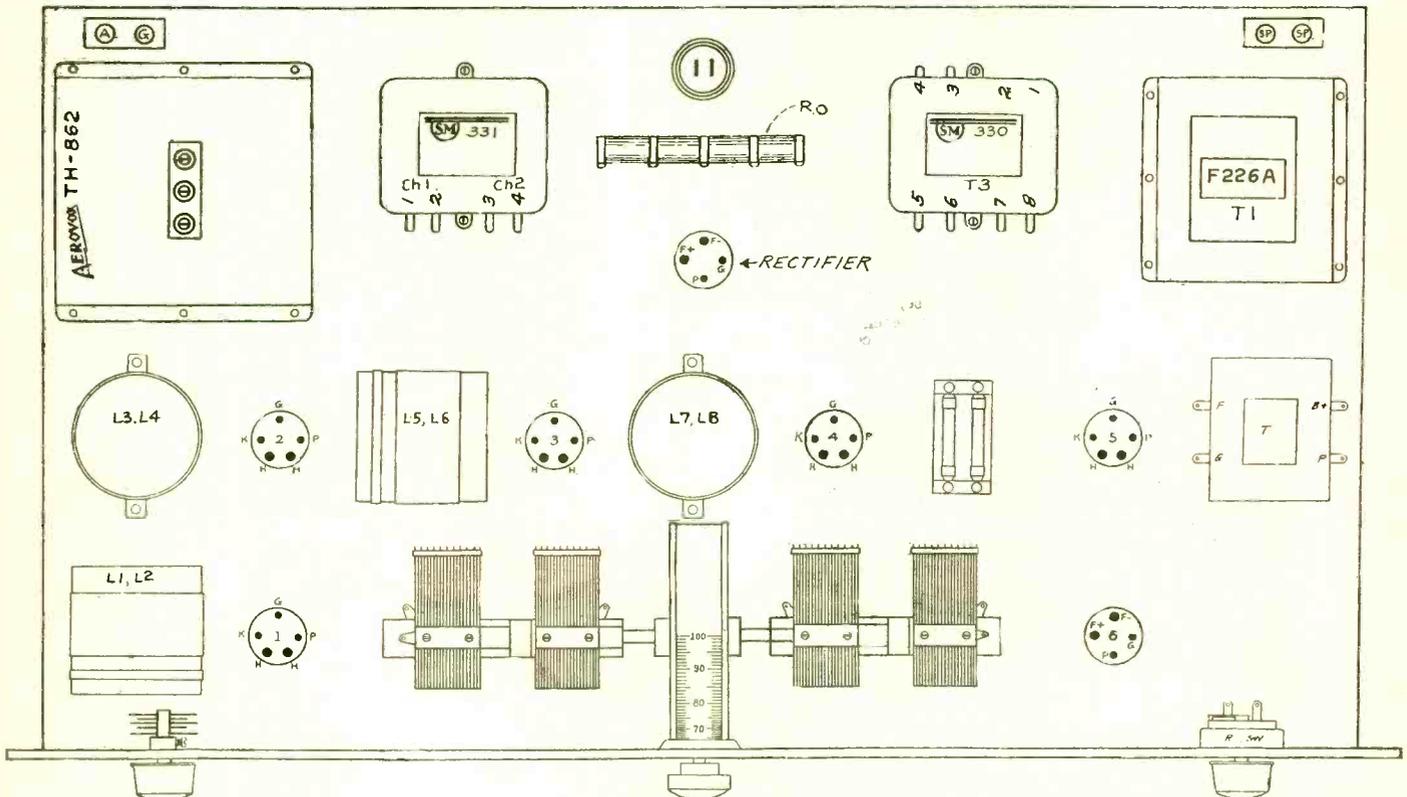
371st Consecutive Issue — Eighth Year

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AN ORDERLY ARRANGEMENT OF PARTS OBTAINS ALL FIVE HEATER TUBE SOCKETS ARE SIMILARLY DISPOSED AND SO ARE BOTH THE POWER TUBE SOCKET (LOWER RIGHT) AND THE RECTIFIER.

See page 8

BOARD STUDIES
THE EFFECT OF
CIGARETTE ADS

TUBE PRICES
HARRASS SOME
INDEPENDENTS

TRADE GROWS
KEENER ABOUT
TELEVISION

DIRECT KC
READING FAVORED
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For Best Results
With Your
GIANT SIX-1
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HAMMARLUND
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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.

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Install Amperite for every tube and smooth out "A" current wobble that ruins reception. Amperite adjusts itself to the exact need of each tube. A type for every tube—A. C. or D. C.

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FREE "Amperite Blue Book" of modern circuits and valuable construction data. Write Dept RW9

AMPERITE
The "SELF-ADJUSTING" Rheostat

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

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LATEST RADIO GUIDE

FOR ADDITIONAL VOLTAGE TAPS

Do you need additional taps on your B-eliminator? That's easy. Use a DUPLEX CLAROSTAT and a pair of by-pass condensers, and you have two additional voltage taps, adjustable to any desired values with an ordinary screw-driver.

There are countless ways in which CLAROSTATS may be used. Ask your dealer for details.

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

CLAROSTAT

VICTOREEN Super Coils

Write for Free Blueprints of New Victoreen Circuits

Geo. W. Walker Co.
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Dept. B Cleveland, O.

Aluminum Subpanel
for the New, Highly Selective
SG Diamond

Battery or AC Model (specify which)

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

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** or **CITIZENS RADIO CALL BOOK** AND **SCIENTIFIC DIGEST** or **RADIO ENGINEERING**.

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

If you want to select only one from among the four other magazines, you may obtain this one for TWO years, so that you will be subscribing for **RADIO WORLD** for two years and for the other magazine for TWO years, all for only \$10.00 (both mailed to one address only). These offers are rightly regarded as among the most liberal ever made, but as they are limited as to expiration date (see notice below) you must act now.

Please use the attached coupon.

SPECIAL TWO-FOR-PRICE-OF-ONE COUPON

RADIO WORLD, 145 West 45th Street, New York City (Just East of Broadway):

Enclosed please find \$10.00, for which send me **RADIO WORLD** each week for two years (104 numbers), and also send me, without extra cost, each month for one year each of the following TWO magazines—total, 34 issues—grand total, 128 numbers:

<input type="checkbox"/> RADIO NEWS	<input type="checkbox"/> RADIO (San Francisco)
<input type="checkbox"/> SCIENCE AND INVENTION	<input type="checkbox"/> BOYS' LIFE
<input type="checkbox"/> CITIZENS RADIO CALL BOOK, ETC.	<input type="checkbox"/> RADIO ENGINEERING

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 .

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

THIS OFFER EXPIRES AT NOON ON JUNE 15TH, 1929

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

Enclosed please find \$3.00 for which please send one aluminum subpanel 10x20" for the new battery model 4-tube SG Diamond of the Air, with sockets built in, and with self-bracketing front and side and rear supports; also send hardware and insulating washers.

Enclosed please find \$2.35 for which please send 7x21" drilled Bakelite front panel for the new battery model Diamond.

Enclosed please find \$3.25 for the 10x20" aluminum subpanel, etc., for the new AC Screen Grid Diamond.

Enclosed please find \$2.35 for the 7x21" drilled Bakelite front panel for the new AC Screen Grid Diamond.

Enclosed please find \$5.00 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the battery model.

Enclosed please find \$5.25 for both the aluminum subpanel, etc., and the drilled Bakelite front panel of the AC model.

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

Quick Action Classified Ads
Radio World's Speedy Medium for Enterprise and Sales
10 cents a word — 10 words minimum — Cash with Order

AGENTS AND SALESMEN WANTED
Sell \$5.00 Men's Daily Necessity for 50c. Cost quantities 20c. Sample postpaid 30c. Catalog hundreds household articles free. Mills Sales Co., 901 Broadway, New York.

RADIOLA 18 AC.—All-electric special \$70. Radiola 100 A speaker, special \$21. Act quick. Offer limited. A. S. Cooke, 1304 Pacific Street, Brooklyn, N. Y.

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

AMAZING! NEW! Wondertone, connects between speaker and set. Gives you that rich, vibrant, mellow tone. Practically eliminates hum, static and other noises. \$2.00 postpaid. Literature on request. Wondertone Mig. Co., 311 Gratiot, Detroit, Mich.

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

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

RADIOS FOR SALE
RADIO FANS—Would you like to purchase the latest electric Coast to Coast Screen Grid Radio for less than the cost of a battery set? If so address Economy Sales Co., Pa. Ave. Sta., Wash., D. C.

PRINTING
500 GUMMED STICKERS 25c
name and address printed
SUNPRINTERS
9379 Pryor—Detroit



Vol. XV, 7. Whole No. 371
 May 4th, 1929
 15c per Copy, \$6.00 per Year
 [Entered as second-class matter, March 1922, at the Post Office at New York, N. Y., under Act of March, 1879.]

Latest News and Circuits
 Technical Accuracy Second to None
EIGHTH YEAR

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

FERRANTI GIVES NEW COUPLING THEORY FOR AF

Those who are looking for high quality transformer coupled audio amplifiers will be interested in a couple of booklets issued by Ferranti, Inc., 130 West 42nd St., New York. These booklets discuss audio frequency transformers and the proper way of connecting them in circuits so as to take advantage of the characteristics.

Many points are treated in these booklets which are not found elsewhere, but which clearly indicate that the transformers as well as the circuits are the result of much laboratory work and much study of the requisites of good audio amplification.

It is stated that for true realism it is necessary that the transformers be capable of a flat frequency response from 25 to 8,000 cycles.

Stress Filtration

The booklets are illustrated by oscillograph curves showing that a pure sine wave remains pure after it has passed through the transformers. Experimental curves are given to show the actual response of the various transformers over the essential frequency range.

The circuits given stress the importance of filtering the different stages in an amplifier so as to eliminate motorboating and distortion resulting from incipient oscillation.

The discussion relating to coupling the loudspeaker to the tube is of special interest, in that it calls attention to a common fallacy relating to matching of impedances. It has been held generally that to get maximum power out of the last tube the primary impedance of the output transformer should be equal to the plate resistance of the tube, or that to get maximum undistorted output, the primary impedance should be equal to twice the plate resistance of the tube.

Theory Verified

It is pointed out that this wastes a great deal of power in the power tube. When the impedances are equal, half is wasted and when the load impedance is twice the resistance of the tube one-third is lost. It is also shown that the power delivered to the speaker increases as the primary impedance is increased.

This startling theory announced by the Ferranti engineers at first seemed contrary to well-established facts about transformers, but a close analysis of the problem showed that it is quite consistent with known principles.

[A full technical analysis of the theory will be given in RADIO WORLD next week in an article by J. E. Anderson, Technical Editor. He will not only expound the theory in detail but will corroborate it mathematically.]

Dill Wants Mikes On Senators' Desks

Washington
 The public is so greatly interested in Senatorial debates that these events should be put on the air, according to Senator Dill, of the State of Washington, who introduced a resolution for installation of microphones and radio outlets in the Senate Chamber. The desk of each Senator is to be equipped with "proper electrical connections to which a microphone for radio broadcasting may be attached," and also a microphone control switchboard is to be installed "to enable connection of each microphone with the broadcasting station as may be desired during the Senate proceedings."

The resolution was referred to Committee.

DICTION MEDAL GOES TO CROSS

Milton J. Cross, National Broadcasting Company announcer, received the first award by the American Academy of Arts and Letters for good diction over the radio.

The presentation was made on the twenty-fifth anniversary of the Academy. Medals for good diction on the stage and distinction in arts and letters were awarded Julia Marlowe and Edith Whar'on, respectively.

Mr. Cross, attached to WJZ, is thirty-two years old. He was born in New York and educated at the DeWitt Clinton High School. He received his musical training at the Danrosch Institute of Musical Art. Before his entry into radio, in 1922, Cross was a tenor soloist.

Good diction can be acquired through study and hard work, Cross told members of the Academy in accepting the honor conferred upon him. He answered the statement of Hamlin Garland, who presented the medal, that radio is a tremendously potent factor in improving American speech, by saying that NBC announcers are studying to improve their work. "We are taking our work seriously, and this annual award still further brings home to us a realization of our responsibilities to the public," Cross declared.

"Radio work is not only a profession, it is a life, and the serious-minded announcer virtually orders his whole mode of living to conform to the requirements of his work. In my own case, I have been on the air so long, and have so constantly applied myself to making my speech habits conform to microphone technique, that my wife tells me I cannot even say 'good morning,' or 'good night,' or 'please pass the butter' without it sounding like a station announcement.

"But seriously speaking, the announcer should keep his voice in the best possible condition and in order to do so he must not only live up to the rules required for general physical fitness but should take a certain amount of vocal exercises."

BOARD ORDERS HEARINGS HELD ON 'LUCKY' ADS

Washington
 The petition of the National Food Products Protective Committee for the revocation of existing licenses of thirty-eight broadcasting stations that send out "Lucky Strike" cigarette programs, has prompted the Federal Radio Commission to make an investigation of the broadcasts. Proof will be adduced and hearings held.

The committee, through Adrian W. Kelly, charged that the American Tobacco Company made a particular "play" to induce young boys and girls to become cigarette addicts, by purchasing and reading "tainted testimonials" of celebrities who are heroes and heroines in the eyes of youth. Also, objection was made to the attempt to induce listeners to smoke a "Lucky" instead of reaching for a sweet, on the ground cigarette-smoking was advocated as a substitute for wholesome food.

Board's Statement

The Commission issued the following statement:

"The Commission has carefully considered the petition of National Food Products Protective Committee and numerous affidavits, complaining against a form of advertising employed by American Tobacco Company in the sale of Lucky Strike cigarettes, and praying that broadcasting stations using such material be denied further use of wavelengths.

"The General Counsel has held that programs including the alleged improper, misleading and dangerous advertising might be considered by the Commission in deciding whether public interest, convenience, or necessity warrants renewal of the licenses in question at the end of the present license period. Without passing upon the merits of the complaints, and in view of the excellent performance generally rendered by these stations, the Commission for the present has decided to renew the licenses in question for the license period beginning April 30th, 1929, and ending July 31st, 1929.

"The petition and affidavits now on file will receive further serious consideration, additional proof will be obtained, and, if warranted by the available proof, the Commission will, pursuant to Section 11 of the Act, deny applications for renewal as of July 31st, 1929, and hold a public hearing at which proof on this subject can be offered and considered."

WTAM Cancels Program

WTAM, Cleveland, O., which carried the program for several months each Saturday night, as an outlet of the National Broadcasting Company chain which originated the transmission, has cancelled the program for ethical reasons.

RCA TUBE PRICE GIVES JOLT TO INDEPENDENTS

The tube market has undergone a big change due to price reductions recently announced by Radio Corporation of America and E. T. Cunningham.

Most independent manufacturers, consisting of all those other than RCA and Cunningham, have always been in a precarious position, because they not only had to follow RCA on tube types but also on prices.

A recent price jolt was RCA's reduction of the 245 tube. Brought out at \$4.25 list, after a few weeks it was reduced to \$3.50 list. Some independents report they can't afford to make the 245 to list at \$3.50, if they leave the tube on the pumps long enough to make it a good tube, especially as most give larger discounts to the trade than does RCA or Cunningham.

The UY224, the AC screen grid tube, out only a few days, is listed at \$4, according to telegrams that RCA set-making licensees received, or about 50% less than the original price of the 222 battery type screen grid tube.

How Price Is Determined

What price to put on a tube depends on its cost to produce, and this is determined by the quantity made. RCA has learned that the 245 tube will be used in a substantial percentage of manufactured receivers for initial equipment. On this basis large production of 245s is under way. This reduces the personnel and labor cost, and confines the factory cost largely to material and testing.

While the capabilities of the 224 have not been fully explored by all set manufacturers, enough of its performance has been learned to justify inclusion of this tube in new designs.

RCA has been waging a running fight on tube independents on the basis of patent infringement, and actually started a few suits, but as final determination of a patent takes about four or five years, the change in tube prices is expected to prove a more satisfactory weapon, because immediately effective.

All attempts by RCA to compel its receiver and power supply licensees to use only RCA or Cunningham tubes for initial equipment were abandoned, following a court decision that the license "clause nine" was contrary to the anti-monopoly laws. Thereupon independents, who started the injunction suit against RCA in which the decision was rendered, pounced on the receiver and power supply manufacturers anew, quoting prices that were calculated to keep RCA and Cunningham out of that market. The objective failed, but independents signed up enough manufacturers to make the situation interesting. Set manufacturers bought independent tubes in quantity.

Some Sold 60% Off

Some set manufacturers found themselves with more tubes on hand than they required. These were independents' tubes. Large lots were "dumped" in the New York and Chicago markets, some makes being sold at 60% off list price by the stores to the consumer—"these tubes not guaranteed, all sales final." Sonatron tubes were among these.

At the same time cut prices on RCA and Cunningham tubes of current produc-

Hits in the Studio Fail on Air

Oakland, Calif.

Radio plays which are big hits in the studio seldom are outstanding from the listeners' standpoint, according to Howard Milholland, studio manager of KGO.

Wilda Wilson Church, director of the plays at the General Electric station, in explaining this condition says "that when performers become group conscious and play to one another and get a good response from one another and the visitors in the studio, the listening audience feels shut out."

Mail received by KGO bears out Mrs. Church in her contention that when the KGO Players stop "acting" up to each other and studio visitors and think only of the listener outside, the work goes out much better.

tion were omitted from retailers' advertising appearing in newspaper radio supplements.

A sidelight on the tube situation was a compliment paid by Clarence A. Earl, president of Chas. Freshman Co., Inc., set manufacturers. In a publicity release sent out by the trade paper news department of Freshman, entitled "Modern Tendency in Radio Sales Which Is to Have the Stated Price Include All Extras," Mr. Earl is quoted as follows:

"Heretofore, as an example [of the unsoundness of selling a receiver other than complete] the practice has been to let the customer buy his own tubes, from any source. With our sets we have made exhaustive tests and have found the Arcturus line of tubes the most efficient and satisfactory. Hence we are supplying these tubes as an integral part of each set we build."

The Freshman corporation, with its merger-adjunct, Freed-Eisemann Corp., is a set licensee of RCA. Mr. Earl's statement that Arcturus tubes are "the most efficient and satisfactory," aroused considerable interest at RCA because Mr. Earl had recently signed a testimonial to be used in an advertisement of RCA tubes. Mr. Earl's previous experience was in the automobile business.

Broadcast Institute Proposed in Belgium

Washington.

The Belgian government will study the economic, financial and juridical problems of broadcasting, the American Attache at Brussels reported to the Department of Commerce.

A large broadcasting organization inspired from the German or English systems and a national broadcasting institute with all modern improvements are to be created, according to proposals.

It is proposed to create a company without commercial aim which would be autonomous and directed by a committee and a government consulting committee. The institution would be authorized to make loans and the managing committee would be presided by the Minister of Railways, Posts, Telegraphs, Telephones and Marine. The necessary funds would be raised by a tax on receiving sets or by a tax raised at the source, for instance of the sale of lamps.

The cabinet is expected to make a decision on the matter in the near future.

RUMANIA'S FIRST SHOW

Washington.

Rumania's first radio exposition will be held from August 15th to October 1st at Bucharest under the auspices of the Minister of Communications, the Commercial attaches at Bucharest, Sproull Fouche, has written to the Department of Commerce.

WORD "RADIO" FREE IN BRAZIL AFTER TUSSLE

Protests by the Radio Manufacturers' Association against two attempts in Brazil to obtain exclusive trade mark rights to the word "radio" have been successful.

Ambassador Morgan received an official certificate from the Brazilian Department of Commerce giving assurance that the word has not been given trade mark registration in connection with any radio products or service.

The negotiations of the State Department and Ambassador Morgan at Rio de Janeiro with the Brazilian Government were designed to protect the right of American manufacturers in the generic term of "radio." Members of the RMA, in developing their export trade, were concerned over the trade mark applications in Brazil which might have interfered with the sale there of American radio products. The RMA protested on the ground that no individual should have a monopoly of the general word and that such a trade mark registration would be a violation of the Santiago Trade Mark Convention of 1923, to which the U. S. and Brazil are parties.

New Diamond 'a Wow'; Selectivity is Stressed

Editor RADIO WORLD:

Thanks for the hook-up of the New Screen Grid Diamond. It's a wow. I have never heard a more selective set even up to seven tubes. I have a new receiver opposing me in the house but the owner can't come near me with the new Diamond. I can get every local in New York and New Jersey and plenty of DX with volume to spare. Take notice:

WODA—Paterson, N. J.—30½-30½.
WIOD—Miami Beach, Fla.—31½-31½.
WFBM—Indianapolis—32½-32½.
WCAU—Philadelphia—37½-37.
WAPI—Birmingham, Ala.—40-39.

These are only a few and I can cut out without any trouble.

LOUIS ROTH, JR.,

58-41 Fresh Pond St., Maspeth, N. Y.

NEW INCORPORATIONS

Radio Cinemavision Corporation—Atty., Rubien & Bregog, 1440 Broadway, New York, N. Y.
Ogdenburg Radio Sales & Service, Ogdenburg, N. Y.—Atty., W. D. Ingram, Ogdenburg, N. Y.
Wireless Service Corporation, Wilmington, Del.—Corporation Trust Co.
Kent Radio Corporation—Atty., E. M. Ladden, 19 West 4th St., New York.
Homecrest Radio Shop—Atty., A. Greenberg, 1457 Broadway, New York, N. Y.
Cears Radio-Hearing Device Corp., Wilmington, Del.—Corporation Trust Company of America.
Satz Radio & Electric Co.—Atty., J. T. Goldberg, 1819 Broadway, N. Y.
Mutual Radio Stores—Atty., I. Leavitt, 50 Court St., Brooklyn, N. Y.
Strauss Stores Corporation, radio sets—Atty. S. V. Ryan, Albany, N. Y.
Westfield Radio Service, Inc., Elizabeth, N. J.—Atty. Otto E. Adolph, Elizabeth, N. J.
Duvall Radio Corporation, Dover, radios—U. S. Corp. Co., Dover, Del.
Colonial Radio Corp., New York—Atty., Van Amringe & Gildersleeve, 350 Madison Ave., New York.
Robertsons Radio Shop, Inc., Spring Lake—Atty. Gilbert H. Vannote, Spring Lake, N. J.
Barney Schoeffer, Inc., Paterson, radio supplies—Atty. Allan H. Kobalkin, Passaic, N. J.
President Radio Renting and Service Corp.—Atty. R. R. Hochman, 280 Madison Ave., New York.

DIALS IN FAVOR THAT GIVE ONLY THE KC READING

Marking of dials of new, modern radio receiving sets with only a single scale, that of kilocycles, is an established manufacturing practice, according to a statement just issued by the Engineering Division of the Radio Manufacturers' Association.

H. B. Richmond, of Cambridge, Mass., director of the RMA Engineering Division, states that the kilocycle designation on receiving set dials is becoming general and follows the adoption of the kilocycle standard by the Federal Radio Commission and scientific organizations.

Practice Established

"The use of kilocycles as the approved method of designating the location of a broadcast station has become established beyond doubt," said Mr. Richmond. "This is just the logical development of advances in the refinement of radio receiver design.

"Radio sets were first marked in numbers only. Sometimes dials used the 0-100 system. At other times the dials were graduated in geometric degrees. Both of these methods served only as reference points. They both made it necessary for the operator to fish for a new station. With the improvement of receiver design, it became practical to calibrate the dials. These dials were marked sometimes in wavelengths, sometimes in kilocycles, and occasionally in both. A few manufacturers went so far as to include not only kilocycles and wavelengths, but also added a reference scale. The use of this multiple system was often confusing.

Serves Double Purpose

"The Federal Radio Commission and scientific organizations have adopted the use of kilocycles only. No cross-reference is being made to wavelengths. The broadcast band has been laid out on the basis of a 10-kilocycle separation between stations. The band extends from 550 to 1,500 kilocycles.

"This uniform spacing makes a kilocycle dial a convenient reference dial as well. The tendency in new receiver design is decidedly in favor of marking dials with but a single scale, that of kilocycles."

Horn Now NBC Engineer

C. W. Horn, formerly of the Westinghouse Electric and Manufacturing Company of Pittsburgh, joined the engineering staff of the National Broadcasting Company as general engineer. His duties include mechanical development and experimentation in the radio field. He sailed to study conditions and systems in the British Isles and on the Continent.

McCord Is Appointed

The Jaynson Laboratories, 57 Dey Street, New York City, under the direction of W. J. McCord has been appointed the official service station on the new "Everyman 5" AC and battery models, by the Leslie H. Muter Company of Chicago. Mr. McCord is one of the pioneers in radio. The Jaynson Laboratories service all types of sets, do custom building and test and repair all types of eliminators, power packs and speakers.

Announcer Vainly Seeks Call Letters

San Francisco
A radio announcer is often a radio bug, says Mrs. Charles Park, wife of one of the announcers at KGO.

Park got a new radio set, and sits up until 2 and 3 o'clock every morning fishing for distance.

Radio listeners have just cause for complaint about radio stations not giving their call letters at least every fifteen minutes, according to Park, who says that never again will he be guilty of such an offense.

BLIND, TEACHES BLIND, VIA AIR

San Francisco.

What is believed to be the largest blind class in existence assembles every Saturday afternoon at 4:30 o'clock before loudspeakers throughout half a dozen Western States to hear Kate M. Foley, California state teacher of the blind, speak over KGO.

Miss Foley, herself blind, in her radio talks is trying to bring back lost confidence to the sightless by teaching them how to read with their fingers and do other things.

Miss Foley intends to bring before the KGO microphone other blind people who have succeeded in various lines of endeavor in spite of their affliction.

For more than a decade Miss Foley traveled up and down California, voluntarily teaching the blind to read, serving without compensation. About twenty years ago she was designated official teacher by the State. Due to the great number of blind, Miss Foley finds it impossible to visit those living in the remote districts, many of whom she has been teaching to read by correspondence. By extending to Miss Foley the facilities of KGO, the General Electric Company has enabled her to supplement her correspondence course with radio talks.

Radio gives Miss Foley a new ally in spreading her work far and wide. She looks upon it as one of the most potent factors in rehabilitating persons handicapped by blindness.

On being asked what should be given one suddenly deprived of eyesight, Miss Foley immediately answered: "A radio."

Trade Show Means to Break Record

The fifth annual Convention and Trade Show of the Radio Manufacturers' Association will be held at Chicago during the week of June 3. With the Music Industries Chamber of Commerce meeting at Chicago coincident with the radio meetings, a record gathering of trade folk interested in radio is expected. Last year about 25,000 persons attended, making it the largest industrial gathering.

LANDAY ON CORTLANDT ST.

Landay Bros., owners of radio chain stores in the East, will open a store at 85 Cortlandt Street, New York City, with a total floor space of 3,400 square feet. The area is on the street level.

SILVER ARRAYS TECHNIQUE OF NEW RECEIVER

Technical features of the new Silver Radio, which will be exhibited at the Trade Show in Chicago in June, were disclosed by McMurdo Silver, of Silver-Marshall. Said he:

"In designing Silver Radio, an attempt was made to incorporate every worthwhile feature that would make for a really fine radio—and to take full advantage of the eighteen months of practical screen grid experience behind the S-M laboratories—in a word, to build the finest radio that could be built.

"The eight-tube Silver Radio chassis contains three stages of AC screen grid RF amplification, employing a band selector tuner, together with conventional transformer coupled RF stages, compensated toward uniform amplification at all waves by a peaked input coupler, which automatically compensates for differences between the small screen antenna recommended, and such other antennas as might be used.

Quantity of Selectivity

"Thus is obtained RF gain sufficient to bring in any station above the prevailing noise level at good home volume, and selectivity so great as to give positive 20 kc. separation between local and distant stations, and positive 10 kc. separation between out-of-town stations.

"The three-stage RF amplifier is followed by an AC screen grid power detector, resistance coupled to a 227 first AF stage tube. The conversion efficiency of this detector is nearly five times greater than of the usual 227 power detector, and its frequency characteristic from detector grid to first AF grid is practically a straight line from 40 to 5,000 cycles.

"The first AF tube is coupled to a pair of 245 output tubes in push-pull through a 1:1 transformer having a flat curve from 50 to 5,000 cycles. The undistorted power output of the push-pull stage is between three and four watts. This is fed to a dynamic speaker head especially designed to reproduce the high tones so faithfully preserved by the RF band selector and the flat-curve audio amplifier.

Box Resonance Avoided

"The speaker is so baffled as to avoid cabinet resonance, and to faithfully reproduce notes down to 50 cycles or lower, and up to 5,000 cycles or higher.

"The overall amplification is so great that usually the only antenna needed is a small copper-mesh screen about 12x24 inches contained inside the console cabinet housing set and loudspeaker.

"With this antenna, the receiver has regularly out-performed standard six- and seven-tube tuned radio frequency sets using an outdoor antenna. Using an outdoor antenna, no commercial receiver has been found so far that can equal the Silver Radio in sensitivity. No loss of selectivity is suffered upon the addition of a large antenna, as is usual with most sets.

"Two models of Silver Radios will be available, one a lowboy, at \$155 list, and the second a highboy with sliding doors, at \$195 list. Both are of Sheraton design. Striped walnut, finished in durable and beautiful gloss lacquer, is used in both models, while the sliding doors of the highboy are of matched diamond-grain walnut."

INDUSTRY NOW IN A NEW ERA, SAYS TRUST CO.

Cleveland, O.

The production of radios in the United States, through standardization of parts and stabilization of engineering principles, has reached the same stage as automobile production, The Union Trust Co., of Cleveland, reports.

"The immediate development of radio should follow the line of further refinement of the present product rather than the introduction of revolutionary innovations," the bank says in the current issue of its magazine, "Trade Winds."

"As with the automobile, virtually all makes of radio offer the same specifications; the difference is in the quality of material and skill of manufacture.

Television May Take Years

"However, the industry reports that some prospective customers are delaying the purchase of receiving sets in anticipation of sight being added to sound in the service to the home through radio communication. Television, radio engineers declare, is still in the experimental stage and it may be some years before it becomes a commercial possibility."

The bank adduces figures showing that while the annual retail sales of receiving sets mounted from \$5,000,000 in 1922 to \$306,000,000 in 1928, the sales of parts dropped from \$40,000,000 to \$12,000,000. This is explained by the facts that during the novelty stage of the radio, the majority of sets were assembled by their owners from parts, and that since 1924 the trend of retail prices of manufactured sets has been steadily downward.

Look for More Profit

"Most of the leaders of the industry agree that the industry has crossed the threshold of a new era—one in which the manufacturer will not be so absorbed as heretofore with technical problems, nor the retailer with service problems, but both will concentrate on merchandising," the article concludes. "Sales will be largely replacement sales. Sales methods will be more intensive, perhaps modelled closely after those of the automobile retailer.

"In general, radio executives look for more profit in the industry in the future than there has been in the past. More care in gauging production, virtual standardization of the product and increasingly intensive merchandising should eliminate the necessity of liquidations which have greatly reduced profits in the past."

Four Stations Unite in One Corporation

Buffalo.

The Buffalo Broadcasting Corporation has been formed by union of four stations, said James Clemenger, representative of the organization. The stations are WGR, WKBW, WMAK and WKEN. Headquarters are to be on the top floor of the new Rand Building in Buffalo. The transmitters, except that of WGR, which is in the city, are all on the outskirts of Buffalo.

Ernest E. Chappell, formerly of the Columbia Broadcasting System, is vice-president of the corporation.

\$5,000 in Stamps for Roxy Radio Mail

With the celebration of the second anniversary of the Roxy Theatre, a tabulation of figures for the year reveals that Roxy's radio activities for that period cost more than \$5,000 in postage stamps alone. Approximately \$3,000 in stamps were stuck on replies to individual fans. More than \$2,000 were required for postage on pictures of the Gang. Two secretaries are constantly employed to give the letters individual attention, and an additional one to see that photographs are sent.

In some instances Roxy's correspondents ask him to settle domestic troubles. Business men have consulted him on the soundness of their new ventures. One of the most frequent questions is whether he thinks some prima donna would "have a chance" on the New York stage.

The secretarial staff comprises only part of the radio personnel that Roxy requires, aside from the artists and musicians themselves. There are three technicians, whose duty it is to see that the music is properly transmitted to the 10,000,000 listeners who form the weekly radio audiences. The technicians work in a sound-proof room next to the studio, and regulate the volume according to the requirements of the particular composition.

A vocal coach is occupied throughout the week, training the singers in the "radio voice." Three men are employed to arrange the scores for the various instruments and singers. The copying of the scores after the arrangements are made is the duty of six additional men

HALF OF SALES IN 4 MONTHS

Information compiled by the Merchandising Division of the Radio Manufacturers' Association indicates that the public buys 56 per cent of its radio products in the last four months of the year. The three Summer months of June, July and August account for a total of only 14 per cent of the year's sales.

An analysis of 1928 retail radio sales, which approximated \$650,000,000, shows that the monthly percentages are divided as follows: January, 6%; February, 7%; March, 8%; April, 5%; May, 4%; June, 4%; July, 3%; August, 7%; September, 13%; October, 17%; November, 12%, and December, 14%.

A comparison of the 1928 sales curve with the curves of previous years shows that more radio business is being done in the warm weather, while the Winter peaks are tapering off.

Previous to 1928 an average of only 9% of the total yearly sales was done in Summer, while the Fall and Winter months accounted for almost 75% of sales to the public.

Thus it will be seen that, while the yearly curve is slowly straightening out, the radio industry still has much to do to strengthen the sale of radio in the Summer months.

RMA APPOINTS ALLEY

Herbert H. Frost, president of the Radio Manufacturers' Association, announced the appointment of William Alley, former managing editor of "Radio Retailing," a trade magazine, as merchandising manager for the newly established Merchandising Bureau of the RMA at its New York headquarters.

BIG PROGRESS IN TELEVISION EXCITES TRADE

Recent developments in television are to be considered by the Television Committee of the Radio Manufacturers' Association, May 15, at Washington, D. C. H. B. Richmond, director of the RMA Engineering Division, announces that a meeting of the Television Committee and also of members interested in television has been called by D. E. Replogle, of Cambridge, Mass., chairman of the RMA Television Committee.

Last October in Chicago the Radio Manufacturers' Association held an organization meeting of its Television Committee, the first committee meeting ever called to consider television developments. Progress was made at that meeting in Standards of television apparatus.

There have been so many recent developments and much progress in television that it is now deemed desirable to hold another meeting. The effect upon television development of the Federal Radio Commission's orders removing television from the regular broadcast band and giving it a definite status in the short wave band also will be considered by the RMA Committee at its May 15 meeting.

Electrad to Show Spain a Few Tricks

With the appointment of General Harbord, president of the Radio Corporation of America, to the American Industrial Committee to Spain, radio will play a prominent role at the Barcelona International Exhibition to open May 15 under the auspices of the King of Spain.

The Committee, announced recently by the Spanish ambassador, Senor Alexandro Padilla, was appointed by the Marquis de Foronda, president of the exhibition, after consulting with the ambassador to act in advisory capacity to the exhibition and to study problems of Spanish-American cooperation based on sympathetic understanding between the two countries.

The Radio Corporation of America has reserved 196 square metres of space in the Palace of Construction and the Atwater Kent Company 84 square metres. Radio parts and accessories will be displayed by Electrad, Inc., of New York, and radio aerial equipment by Swan-Haverstick, Inc., of Trenton, N. J.

Variation of Bias Controls Feedback

Regeneration can be controlled to a considerable extent by a variation in the negative bias placed on the grid of a radio frequency tube.

Increasing the grid bias on the grid of a tube, that is, making it more negative, results in a decrease in mutual conductance and an increase in plate resistance, which has the effect of reducing the flow of current in the plate circuit and reducing the feedback, thereby limiting the tendency toward oscillation.

The advantages of this method of oscillation control lie in the fact that it does not result in the broad tuning which usually results from methods in which additional resistance is added in the tuned circuits, to damp undesired oscillation.

FIVE REQUEST NEW STATIONS; CHANGES ASKED

Washington.

Station changes were authorized by the Federal Radio Commission, and applications were received, including five new stations, as follows:

WIBS, Elizabeth, N. J., granted renewal of license, previously denied, as means of maintaining a steady frequency have been provided.

WRNY, operated by Irving Trust Co., trustee for Experimenter Publishing Co., Inc., Coytesville, N. J., was granted an assignment of license to Aviation Station, Inc. This is due to sale of the station.

W2XAL, Irving Trust Co., trustee for W2XAL, Experimenter Publishing Company, Inc., Coytesville, N. J., was granted an assignment of license to Aviation Radio Station, Inc. W2XAL are the call letters of WRNY's short-wave transmitter.

WOBV, Charleston Radio Broadcast Co., Ferry Branch Hills, W. Va., was granted permission to move main studio. (Street address changed.)

New Stations Sought

WGHP, The American Broadcasting Corp., Fraser, Mich., requests increased power from 750 watts power to 1 kilowatt.

WJBY, Chas. J. Black, Gadsden, Ala., requests authority to transfer the license of T. G. Erwin, trade name, Electric Construction Company, to applicant listed above.

New station, George Ber, H. J. Killmer and B. H. Baily, jr., doing business as KKB Advertising Co., Rayne, La., requests authority to erect a new station using 820 kilocycles, 150 watts power and full time.

New station, Spence Hardware Company, Kennett, Mo., requests the authority to erect a new station using 1,350 kilocycles, 7½ watts power and 3 hours daily.

KGDY, J. Albert Loesch, Oldham, S. Dak., requests increased power from 15 watts power to 100 watts power.

Savannah Seeks Station

WPTF, Durham Life Insurance Company, Raleigh, N. C., requests authority to install a new transmitter, from composite to Western Electric.

WPTF, Durham Life Insurance Company, Raleigh, N. C., requests change in hours of operation from limited time to full time on same frequency, 680 kc.

New station, Chamber of Commerce of Savannah, Savannah, Ga., requests authority to erect a station using 920 kc. 500 watts power and evening and daytime hours time.

New station, George P. Hutchinson & John H. Carter, Chanute, Kans., permit requests the authority to erect a station using 950 kc. 300 watts power and five hours daily.

New station, KXRO, Inc., Lee Hotel, Port Angeles, Calif., requests authority to erect a station using 1310 kc. 10 watts power and full time on Monday, Tuesday and Wednesdays, and Sundays from 2 to 4 p. m.

Frequency Changed

KFPY, operated by the Synons Investment Company, Spokane, Wash., was authorized to transfer from 1390 to 1340 kc., with half time, sharing with KMO.

KVI, operated by Puget Sound Broadcasting Co., Inc., near Des Moines, Wash., authorized to transfer from 1340 to 700 kc., limited time.

W6XG, General Electric Company, Oakland, Calif., authorized for experimental test with portable station during 90 days.

WKY, Radiophone Company, near Oklahoma City, television construction permit 1 to 6 a. m. approved.

WIOD, Isle of Dreams, Broadcasting Co., Miami, Beach, Fla., was granted modification of station license from 1 kw. day and night on 1,240 kc. to 1,000 watts day, 500 watts night and 500 watts night additional experimental basis, on 560 kc.

KFUL, Will H. Ford, Galveston, Tex., granted construction permit to rebuild; 1,000 watts day, 500 watts night and 500 watts night additional experimentally.

WOL, American Broadcasting Company, Washington, D. C., requests increased power from 100 watts to 250 watts power. Requests a change in frequency from 1,310 to 1,270 kc.

WMBM, Seventh-Day Adventist Church, Memphis, Tenn., requests permission to move and build a new transmitter, also requests increased power from 10 watts power to 100 watts power and a change in frequency from 1,500 kc. to 1,310 kc.

WDAY, WDAY, Inc., Fargo, N. D., requests change in frequency from 1,280 kc. to 1,070 kc. and full time from sharing with WBCB.

KHQ, Louis Wasmer, Spokane, Wash., requests authority to install new equipment and increased power from 1 kw. to 2 kw. night and 1 kw. to 5 kw. day time.

New Buffalo Station

New station, Buffalo Evening News, Orchard Park, Erie County, N. Y., requests authority to erect a station using 1 kw., 1,120 kc. full time.

WTBO, Cumberland Broadcasting Company, Ft. Cumberland Hotel, Cumberland, Md., requests in-

Full Time to WSAI, Less Power, New Wave

Cincinnati.

WSAI is on the air again full time, but on a new frequency, 1330 kc. (225.4 meters) and with 500 watts. The station was assigned under the November 11th reallocation to 800 kc. (374.8 meters), daylight operation only. It is equipped for 5,000 watts and hopes that authority to use that power will be granted.

WSAI will synchronize with WDRC, New Haven, Conn., and if this works out successfully is expected to be given permanent assignment to 1330 kc. The present situation is temporary.

WSAI is owned and operated by the Crosley Radio Corporation, as is WLW. WSAI will carry programs of the National Broadcasting Company's Red Network, besides local programs.

Increased power from 50 watts power to 500 watts, and requests change in frequency from 1,400 kc. to 620 kc.

New station, Thomas Neal McGown, Bowling Green, Ky., requests authority to erect a station using 15 watts power, 1,310 kilocycles; daytime hours stated only.

KMBC, Midland Broadcasting Company, Independence, Mo., requests increased night power from 500 watts to 1 kw. and increased time from sharing with WHB to unlimited time.

KMED, Mrs. J. W. Virgin, Medford, Oreg., requests change in frequency from 1310 kc. to 1150 kc.

WGBS Seeks New Wave

WGBS, General Broadcasting System, Inc., Astoria, Long Island, N. Y., requests change in frequency from 1180 kc. to 620 kc. Requests full time from limited time.

New station, League Electric Co., Houston, Tex., requests authority to erect a station, using 20 watts power, a frequency of 1120 kc. and day and evening hours every day.

WREC, WREC Incorporated, Whitehaven, Memphis, Tenn., requests the authority to increase power from 500 watts power to 500 watts night and 1 kw. daytime and full time from dividing with WOAN.

Full Time for WSAI

WSAI, Crosley Radio Corp., Cincinnati, O., full time operation granted, 500 watts, 1330 kc. Was assigned 800 kc. and daylight operation under reallocation. Is equipped for 5,000 watts.

WOI, Iowa State College of Agriculture and Mechanical Arts, Ames, Ia., applied for increased power from 3,500 watts to 5,000 watts.

WRBM, Rosedale Hospital Company, Inc., at Friedly, Minn., applied for increased power, from 1,000 watts to 2,500 watts.

WLAC, Life & Casualty Insurance Company, Nashville, Tenn., was denied full time on 1,490 kc. The Commission ordered the following division of time with WBAW: WLAC to operate two-thirds time as following: 6 to 10 a. m., 12 noon to 4 p. m., and 6 to 10 p. m.; Station WBAW to operate one-third time as follows: 10 to 12 a. m., 4 to 6 p. m., and 10 to 12 p. m.

The Commission denied the following applications for new stations: James H. Bennet, Chester, Pa.; S. Ernest Philpitt & Son, Miami, Fla.; C. C. Crawford, Haynesville, La.; A. C. Busch & Searcy M. Rhodes, Corpus Christi, Tex.

Applications Denied

WAAT, Brenner Broadcasting Corporation, Tersey City, N. J. Modification of license to 1,070 kilocycles with 300 watts day and 1,000 watts night (present assignment 1,070 kilocycles, with 300 watts day), denied.

WABF, Marble Broadcasting Corporation, Pringle Borough, Pa. Renewal of license denied.

WMBR, F. J. Reynolds, Tampa, Fla. Construction permit (1,190 kilocycles with 100 or 1,000 watts), denied.

WLTH, Voice of Brooklyn, Inc., Brooklyn, N. Y. Modification of license to share with WBBC on 1,400 kilocycles, 500 watts night, 1,000 watts day. (Present assignment, share with WCC, WSGH, WSDA, WBBC on 1,400 kilocycles, 500 watts.) Denied.

WBBC, Brooklyn Broadcasting Corporation Brooklyn, N. Y. Modification of license, to share with WLTH on 1,400 kilocycles with 500 watts day, 1,000 watts night. (Present assignment, shares with WSGF, WSDA, WCGU, WLTH on 1,400 kilocycles with 500 watts.) Denied.

KTSA, Lone Star Broadcasting Co. near San Antonio, Tex. Full time on 1,290 kilocycles denied. (Present assignment, shares with KFUL at Galveston, Tex.)

KFUL, Will H. Ford, Galveston, Tex., full time on 1,120 kilocycles with 1,000 watts denied. (Present assignment, shares with KTSA on 1,290 kilocycles with 500 watts.)

WIBQ, Broadcasting Station, Inc., Memphis, Tenn., unlimited time on 1,290 kilocycles with 500 watts denied. (Present assignment 1,370 kilocycles.)

New station, Abe Cohen, Lynchburg, Va., applied for a station license but as he did not specify frequency and power desired the application was returned to him.

WCOC, Crystal Oil Co., Jackson, Miss., requests increased power from 500 watts to 1 kilowatt daytime and 500 watts night; also change in location from Columbus, Miss.

LABOR STATION CALLS BOARD UNFAIR TO IT

Washington.

The application of the Chicago Federation of Labor for permission to operate WCFL full time on a cleared channel, with 50,000 watts, was the subject of hearings before the Federal Radio Commission.

Witnesses contended that the Federation has the right, in the public interest, to a high-powered station operating full time, to "promulgate its ideals, theories and doctrines." WCFL now operates during daylight hours only with 1,500 watts of power on the 970-kilocycle channel. It desires to use 770 kilocycles, now occupied by KFAB, Lincoln, Neb., and WBBM, Chicago, Ill.

Former Representative C. L. Reaves, of Lincoln, Neb., counsel for KFAB, protested against the nature of the testimony of witnesses for the labor station. He contended that most of it was immaterial.

"Already Recognized"

Chairman Ira E. Robinson of the commission agreed that much of the evidence presented regarding the ideals, policies, aims and purposes of the labor organization was common knowledge.

"While we are disposed to be liberal in admitting testimony, we have already recognized labor's claims for broadcasting facilities by granting a license to WCFL," said Chairman Robinson.

He suggested to Hope Thompson, counsel for WCFL, that the testimony of witnesses be curtailed as much as possible, but Mr. Thompson insisted that his clients be given ample time to present their case.

"This is a big issue, involving the interests of millions of people," he said, declaring that many smaller cases had consumed weeks.

Victor O'Lander, secretary and treasurer of the International Seamen's Union, offered in evidence a resolution passed by his organization, declaring that practically all desirable wavelengths had been allocated to "capitalistic interest and metropolitan newspapers."

Commissioner E. O. Sykes took issue with the statement.

Cry of Unfair Treatment

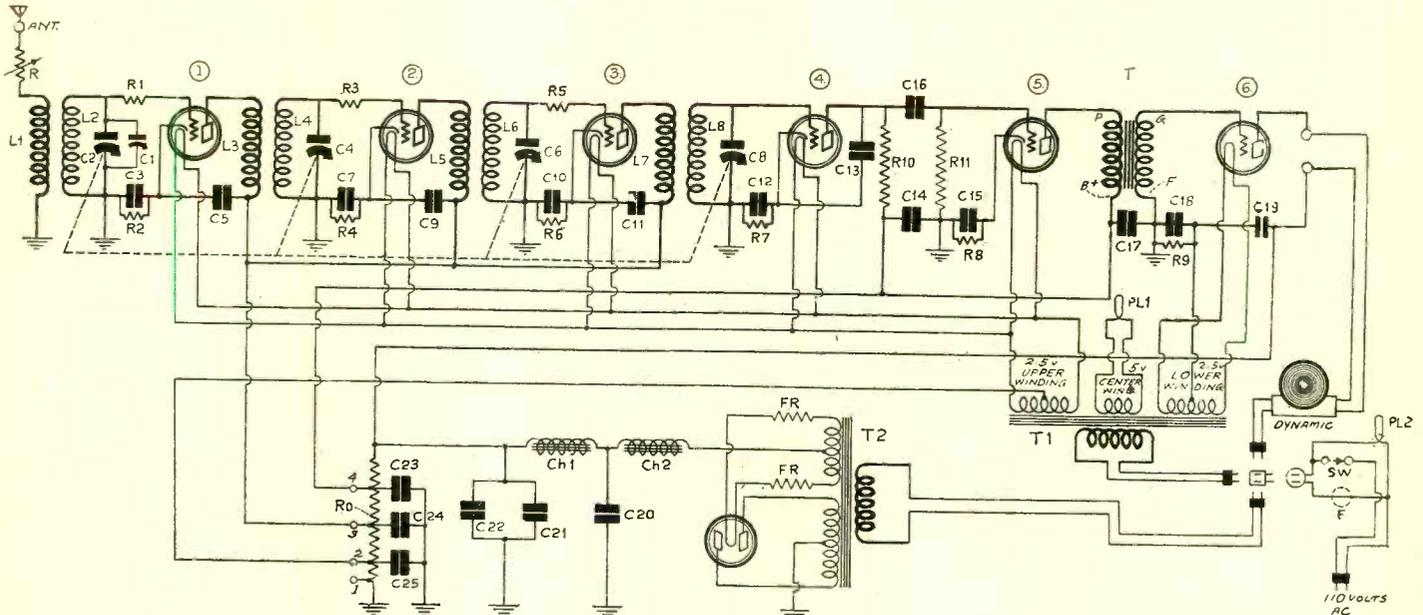
Mr. O'Lander added, however, that labor feels that WCFL has not been given "fair treatment" by the Commission, because it is kept off the air at night when the workers could listen.

"It is my opinion that all great national organizations should be allowed the privilege of broadcasting their views to the public," said Hope Thompson, counsel for the station. "I cannot understand why this Commission should say this great invention cannot be used for propaganda purposes. You might as well say that the printing press cannot be used for propaganda. There can be no progress without lucid and spirited controversy. To prevent radio stations from using so-called propaganda is to put a damper on progress and to stifle intellectual growth.

"I have no patience with the argument that radio should be used exclusively for entertainment."

The Giant 6-1, a High-G

By Herman
Managing



THE GIANT 6-1 IS SO-CALLED BECAUSE IT HAS SIX TUBES IN THE RECEIVER, ONE IN THE B SUPPLY, AND IS BUILT ON A 36 x 20" BASEBOARD. IT REPRODUCES REMARKABLY WELL AND IS HIGHLY SENSITIVE.

MANY who have a large table top available would like to build a high-powered AC receiver. Three stages of tuned radio frequency amplification are shown, a grid bias detector, a stage of resistance coupled audio and a stage of transformer-coupled audio, the last tube being the new 245, to gratify a demand. This is a man-sized receiver, as is evident from the dimensions—36-inch width for the front panel and 20-inch depth for the baseboard. Plenty of room is taken, but the layout is excellent for ventilation purposes. A six-tube receiver, with high-powered B supply and its 280 rectifier, are contained on the baseboard, a few parts being mounted underneath.

How High Gain Is Handled

For an installation of this kind, with a powerful tube at the output, a real receiver is essential, and the one diagrammed fills the bill nicely. The three stages of tuned radio frequency amplification give you all the selectivity and sensitivity you will require in any except in the most extraordinary locations for which there is usually no remedy except to move.

Because the radio frequency amplification is high, the detector should be operated on the negative grid bias principle, accomplished by putting a 50,000-ohm resistor between grounded B minus and the cathode of the detector tube (number 4 in the chain).

The zero potential of the output of the rectifier resistor will be referred to as B minus, since all biasing voltages are obtained through drops in independent resistors. The audio and detector circuits are stable, hence with independent biasing, special filtration is not vital.

For the same reason of high amplification at radio frequencies, we may use an audio channel that includes a stage of resistance coupling. This will maintain the quality of the detected signal and afford a practical gain of about eight times for this stage. Then follows an audio

stage with a quality transformer as the coupler, feeding the last tube, 245.

The circuit as shown is intended primarily for use with a dynamic speaker of the AC type, one having rectifier built in. Therefore the speaker is shown with its input cord tips going direct to the plate of the power tube and to B plus, since these cords connect to an output transformer in the dynamic speaker. The AC cable emerging from the speaker is represented with a plug at the end.

A consolidated convenience outlet is located in the receiver—at center rear—and into this is connected a three-way plug-socket, which in turn receives the plugs of the filament transformer, the power transformer and, as mentioned, the dynamic speaker. The switch SW, lower right in circuit diagram, intercepts one side of the 110-volt AC line and goes to the outlet shown at center rear in the pictorial diagram. The other side of the AC line goes to the other side of this outlet. Hence the one switch, built into the volume control by the way, controls the turning on and off of the entire receiver and the speaker.

Reason for Pilot Lights

Two pilot lights are shown—PL1 and PL2. The first is across the 5-volt winding of the filament transformer. The second is across the AC line immediately after the switch. The reason for two is that trouble is more readily located if tubes do not light. A fuse F also is shown, and this may be .5 ampere, 110 volts, but this value is hard to get, even in the cartridge type, so a 1-ampere fuse may be used.

If the 110-volt pilot light is included it should be of the small type that screws into a candelabra base, and it may be placed behind the switch. This lamp is not shown in the layout of parts.

The fact that the ampere rating of the fuse is much less than the total number of amperes in the four secondaries is accounted for by the difference in volt-

age at which the currents flow. The current is always stepped down in proportion to the extent that the voltage is stepped up. It is really a question of wattage (volts times amperes), but as the voltage in each instance is known, the current is all that need be considered additionally.

Precaution About Suppressors

The symmetry of the layout is virtually irreproachable, and the performance of the receiver is scarcely less so. Stability at radio frequencies is obtained by use of grid suppressors, which are resistors connected between the stator of a tuning condenser and the grid of the socket. The secondary of the tuning coil has one terminal going to this stator, and the suppressor continues the route to grid. It is important not to include the suppressor directly in the tuned circuit. If the diagram and the textual directions are followed this mistake will not be made. Should it be made your selectivity will be greatly diminished.

What the values of these grid suppressors should be can not be foretold for every installation, but an indication of their value is obtainable from the list of parts. In general, the resistance should decrease after the first stage, or at least should not increase. In many instances the same value of resistance for all three suppressors, about 2,000 ohms, will work out nicely. As these suppressors are very inexpensive you can always have enough at hand to make suitable experiments in suppression.

Without some means of stabilization the circuit would be virtually inoperative at radio frequencies, because three stages of tuned RF are good for plenty of squealing unless properly squelched.

High Gain Insured

All the tubes except the last are 227. These have independent heaters that go to 2.5 volts AC. The heat is communicated by the heater to the cathode, which

Gain Complete AC Circuit

Bernard

Editor

is the electron emitter. This method of transfer of heat is known as thermal radiation.

As might be expected, the hum component is exceptionally low. Besides, the 227 is a very good amplifier. As a grid bias detector it is most excellent.

Just because the 227 has a little higher gain per stage the total amplification at radio frequencies becomes much greater than one is accustomed to with 226, 201A or similar tubes, because the slight increment becomes a substantial total amount after all the amplification has been accomplished—at the output power tube. Amplification is calculated by multiplication, so the small repeated gain per stage becomes important. So great is the volume on many locals that the full 5,000 ohms of the volume control R must be used by those who like "soft" music.

The tuning is accomplished by a pair of two-section condensers, either .0005 mfd., as used in the laboratory model, or .00035 mfd. These must turn in opposite directions to be workable by a drum dial, or must have removable shafts, so that the shaft can be pushed through to accomplish the equivalent of this reversal.

Difference in Direction

Why there must be a difference may be understood by reference to the pictorial diagram. Note that the condensers are shown with plates totally enmeshed. Take the left-hand pair. Imagine yourself standing in front of this double condenser and turning the shaft. You would have to turn from *right to left* to decrease capacity.

Now, look at the other double condenser, and imagine this placed side by side with the other, protruding shafts parallel. You would have to turn this from *left to right* to decrease capacity. If their shafts are in opposite directions, as in the pictorial layout, the turning must be exactly opposite.

This reversal is easily accomplished by using the Hammarlund Midline condensers, which have removable shafts. Push the shaft through one condenser pair until enough of the shaft emerges from the opposite end to engage the National drum dial.

Only one difference will be noted. One end of the condenser is primarily intended to take the shield furnished in each box, but the other end of the condenser—which would be the useful end if the shaft were pushed through—has a nut extending a trifle, and one of the shield mounting holes is displaced in respect to the condenser frame holes on this end. Solve the problem by cutting away the shield so as to pass the interfering nut completely, and use the available mounting hole, disregarding the other.

You do not have to use the shields at all in this circuit, but the directions are given in the event you desire to include them. Put them at extreme left and right, that is, facing the extreme sockets.

Quality Depends on Stability

The quality of reproduction obtainable from this installation is as good as is obtainable for home use to-day, providing stability is maintained. The grid suppressors will prevent oscillation at radio frequencies. At audio frequencies there is a possibility of oscillation, due to feed-

LIST OF PARTS

For the Receiver

- R, SW—One Electrad 0-5000 Royalty variable resistor with 110-volt AC Hart & Hegeman switch built in.
- C2C4, C6C8—Two Hammarlund double condensers, each section .005 mfd.
- C1—One Hammarlund junior condenser, 32 mmfd.
- L1L2, L3L4, L5L6, L7L8—Four radio frequency transformers, as described (commercial coils, AC5 model of Screen Grid Coil Co.)
- R1, R8—Two Electrad strip resistors, 2,000 ohms each.
- (1), (2), (3), (4), (5)—Five five-spring sockets.
- (6)—One four-spring socket.
- R2, R3, R4, R5, R6—Five Electrad strip resistors, 900 ohms each.
- R7—One Lynch metallized 50,000 ohm fixed resistor with mounting.
- R9—One Electrad 1,500 ohm type B resistor (wire wound).
- R10—One Lynch .5 meg. metallized fixed resistor.
- R11—One Lynch .1 meg. metallized fixed resistor.
- C3, C7, C10, C16—Four Aerovox .02 mica fixed condensers.
- C5, C9, C11, C14, C17, C19—Five 1 mfd. Aerovox bypass condensers.
- C12, C15—Two Aerovox 1 mfd. condensers (essential).
- C13—One Aerovox .0005 mfd. fixed mica condenser.
- C18—One Aerovox 4-mfd. condenser (not shown in pictorial layout).
- PL1—One National type E drum dial with pilot light.
- T—One National A100 audio transformer.
- TI—One filament transformer 2½, 5, 2½ volts, Cat. F 226A (Guaranty Radio Goods Co.).
- Four binding posts (Ant., Grid, Speaker+ and Speaker-).
- One 7"x36" front panel.
- One 20"x34" baseboard.
- Three subpanel brackets, 1" high (Karas).
- Five 227 tubes and one 245 tube.
- One convenience outlet socket and 3-way socket-plug.
- One 1-ampere to ¼-ampere cartridge fuse, with clips.
- One roll of Corwico Braidite wire.
- One special cabinet for 36" front and 20" depth.

back through the resistance in the B supply common to the pair of audio circuits. But this feedback can be reduced by making the plate resistor R10, in the detector circuit, a greater proportion of the common resistance. Usually the .1 meg. so often recommended will prove troublesome in this circuit, whereas .25 meg. or .5 meg. will afford stability. Incidentally, the volume is increased by increasing the load resistance, and this is a strange example of increased volume being accompanied by increased stability. Incidentally by this method the hum likewise increases.

The greater the capacity of the condenser C12 across the detector biasing resistor R7, the greater the volume. This is not so strange, even though another exception of increased stability accompanying increase in volume exists. The strangeness is removed by recognition of

the biasing resistor as an impedance carrying direct current, and the larger the capacity across this pure resistance, the lower the AC impedance of the combination. The condenser bypasses the fluctuating component while not affecting the direct current through the resistor.

Quality Achieved

Quality requires that the detector be not overloaded. It is easy enough to cause overload by working the detector up to the volume hilt, but it is highly advisable to let the detector lag behind its utmost capabilities by using a biasing resistor of 50,000 ohms. If you have .1 meg. you may use that, but if there is a broadcasting station in your city you will prefer the result obtained from 50,000 ohms.

All the bypass condensers are placed under the baseboard, since the board is elevated an inch by a pair of brackets, except the condensers in the Aerovox bank, one of which is across the biasing resistor of the last tube. No bypass condenser across a resistor can be safely omitted from this circuit, but if economy requires some eliminations, then C5, C9, C11, C14 and C17 may be omitted, as they are substantially, although not entirely, in parallel with an existing capacity across these points, in the B supply proper. The shortness of the leads from the supply makes it possible to dispense with these condensers if economy requires, but the resistance of the grid suppressors may have to be increased. Also, as diagrammed, equalizing condensers may be omitted if the coils are all equal, as they would be if factory-made. But if you wind your own coils by hand or by using a hand winder, include these small condensers. They are of the book type, not with rotary plates. (Hammarlund EC70). They connect as follows: One side automatically to stator of the tuning condenser, the other side, by using an extra wire connection, to grounded B minus, which is the rotor of the condenser. Three would be required. The trimmer C1 is on the front panel.

More Sensitivity

You always get a little more sensitivity by including the equalizers. Set them for some wavelength around 250 meters, testing for greatest volume. They are not disturbed thereafter.

The filament resistors FR are Clarostat strip resistors of 1 ohm each (Cat. FW1) to carry the 1¼ amperes of the 280 tube filament. The resistors drop the 7.5 volts of the filament winding on the SM-330 to 5 volts. The difference between 7½ volts and 5 volts is 2½ volts, and the current is 1.25 ampere, therefore the resistance is 2.5 (the voltage) divided by 1.25 (the amperage), or 2. The difference between AC and DC voltage may be disregarded in this instance. These two ohms are equally distributed, for minimum hum, each of the two resistors of 1 ohm carrying all the current but dropping only half the voltage.

If the 330 transformer has no center tap, provide an equivalent with a center-tapped 30-ohm resistor of the variable type (Clarostat humdinger).

[Part II, the conclusion, will be published next week.]

Separate Filter System

B Supplies Made Safe for Resistance, Impe

By H. B.

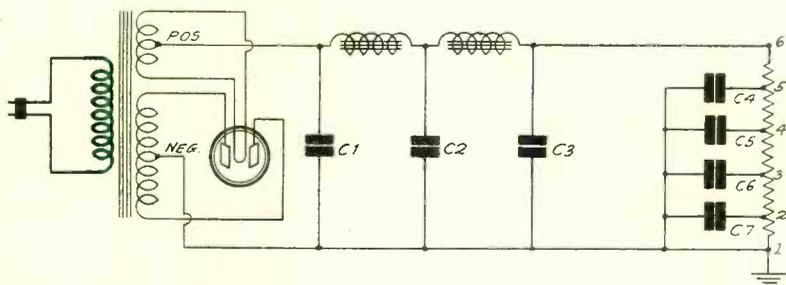


FIG. 1
A CONVENTIONAL B BATTERY ELIMINATOR CIRCUIT WHICH CAUSES
OSCILLATION AND DISTORTION IN MOST AMPLIFIERS.

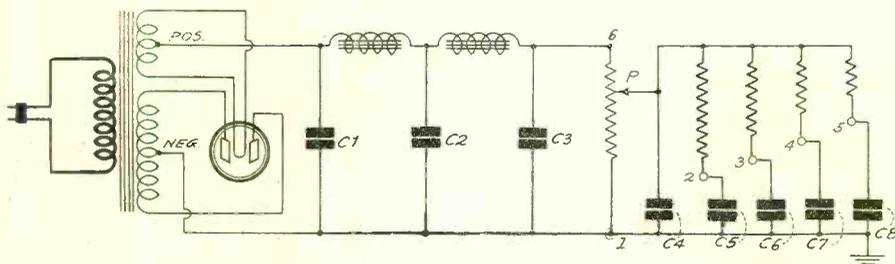


FIG. 2
A MODIFIED B BATTERY ELIMINATOR CIRCUIT IN WHICH A RE-
SISTANCE-CAPACITY FILTER IS USED FOR EACH TUBE IN THE AMPLI-
FIER AS A MEANS OF STOPPING OSCILLATION AND REGENERATIVE
DISTORTION.

PLATE voltage supply circuits have become standardized, and any deviation from common practice is looked upon with a frown. Perhaps it would be more nearly correct to say that eliminator design is running in a rut, rather than dignify common practice by calling it standard. The term standard ought to be reserved for practice which has been agreed upon after considerable thought on the subject. Running in a rut is doing something just because somebody ahead did the same thing.

Now and then a little kink is suggested with respect to B battery eliminators which shows that improvements may be effected by getting out of the rut.

In Fig. 1 is shown a common B battery eliminator which runs in the rut from beginning to end, at least as far as it goes. Is that circuit the ultimate for all kinds of service? Far from it. If that eliminator is connected to a resistance coupled amplifier of good design, the amplifier is certain to oscillate. It does not make so much difference how good the parts in the eliminator are. It makes little difference how large the condensers are, provided they are of reasonable and practical dimensions. It makes little difference how good the choke coils are.

Circuit Put-Puts

The resistance coupled amplifier of good straightforward design is sure to put-put or misbehave in some other manner. Even a good impedance coupled amplifier will misbehave in the same manner when tied to the eliminator in Fig. 1.

And what will a first-class transformer coupled amplifier do? The odds are overwhelmingly against good behavior. And the better the amplifier the greater the odds. The odds favor put-putting, slow swinging of the volume, or rapid oscillation. Some circuits will appear to be well-behaved. But are they? Not at all! There will be frequency distortion of a grievous nature, and the flat amplification characteristics of the transformers used will be severely mutilated.

Is the amplifier to blame for all this noise and distortion? If it is, all the best amplifiers must be blamed equally. The amplifiers are quite innocent. They do their work as well as they should be expected to do it. Perhaps they do it too well. It is their faithfulness to the designers' aim which is indirectly responsible.

The real culprit in the case is the B battery eliminator. It serves the amplifier poorly, and the amplifier merely shouts or grumbles for better and better service.

Getting Out of Rut

So it is high time to get out of the rut in designing B battery eliminators. But where is the track that leads out of it? That involves an understanding of the causes of the oscillation and distortion.

There is no mystery about that. It was recognized in the radio end of the receiver a long time ago, and it was called regeneration. Means were devised for controlling regeneration and stable radio frequency amplifiers resulted. Regeneration accounts for the oscillation in audio amplifiers as well as

in radio. And means have been found for controlling it.

In a radio frequency amplifier the main cause of oscillation is the capacity between the grid and the plate. In the audio amplifier it is the common impedances introduced by the B battery eliminator. To stop the audio frequency oscillation or the distortion, the common impedance must be minimized. And it must be made a very low minimum if oscillation is to be banished from certain good amplifier circuits. The greater the amplification in the circuit, the smaller the remaining common impedance must be made.

Modified Eliminator

One method of eliminating the cause of regeneration in the audio amplifier is by the use of resistance-capacity filters in each stage. These may be built in the amplifier, or they may be made a part of the B battery eliminator. Fig. 2 shows a modified eliminator having such filters built in. It is supposed to be used with a resistance coupled amplifier, but it is not limited to that. For a transformer coupled circuit other values of resistors in the filters would be used. That is the only difference.

In Fig. 2 there are eight bypass condensers, only one more than in Fig. 1. But they are very much more effective, especially those to the right of C3. Why are they more effective? Not because of the values used but because of the manner in which the audio amplifier is coupled to the voltage supply circuit.

In Fig. 2 only one detector or audio plate circuit is supposed to be connected to each of the binding posts numbered (2) to (5). If two or more are connected to any one of those binding posts, we slip back into the rut again. Suppose the plate coupling resistor is connected to point (2), the B plus

Right or

[Answers on page 17]

1. The best volume control in any circuit is a variable resistor across the loudspeaker terminal.
2. The best volume control for an electrical pick-up is a variable resistor across the pick-up terminals.
3. —No frequencies higher than 5,000 cycles are transmitted over a broadcast station.
4. —A screen grid tube makes a radio receiver less selective.
5. A different grid bias may be given every tube in an AC beater type tube receiver even when all the grid returns are connected to the same point in the circuit.
6. —The selectivity of a receiver may be increased by attaching a vernier control on the dial.

RESCUE YOURSELF AT ONCE FROM THE
H. B. Herman Tells How in a Series of

Outclasses Potentiometer

and High-Class Transformer Coupling

Herman

terminal of the resistor. There is a signal voltage at that point due to the fact that there is an impedance in the B battery eliminator, and also to the fact that there is a signal current flowing.

The idea is to reduce the voltage difference at the signal frequency so that no signal current will flow through the eliminator. Condenser C5 serves that purpose. If the condenser is large enough there will be no signal voltage across it and the B plus terminal of the coupling resistor is at ground potential.

Practical Condensers

But it is not practical to use a larger condenser than about 2 or 4 microfarads. Either is so small that at the very lowest frequencies the signal current will find it easier to get through the eliminator than through the condenser. So a suitable resistor is connected between (2) and the point P on the main resistor. P may be placed wherever necessary to put the right voltage on the plate of the tube. The resistor between (2) and P forces the signal current to go through the condenser rather than through the eliminator, and hence the resistor and the condenser constitute a filter.

The plate return of the next tube is connected to point (3). C6 serves this tube just the same way that C5 served the detector. And the resistor between (3) and P does the same thing for the second tube that the previous resistor did for the detector.

The third tube is served by the next condenser and the next resistor, and so on as far as it is necessary to go to supply all the tubes with individually filtered plate current.

All the filter resistors are connected to one point on the eliminator. This is permissible in resistance coupled amplifiers, for the plate voltage may be as high as 180 volts. And

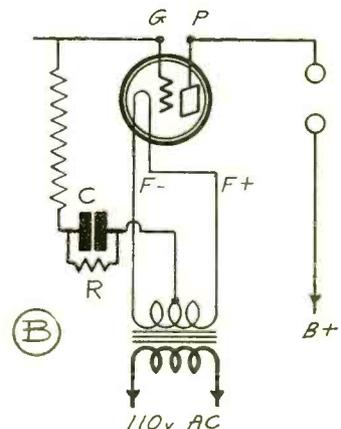
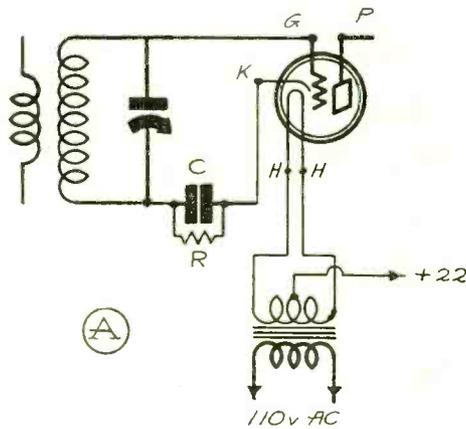


FIG. 3
(A)—THE PROPER METHOD OF CONNECTING THE GRID BIAS RESISTOR R AND THE BYPASS CONDENSER C IN A HEATER TYPE TUBE CIRCUIT. (B)—THE PROPER METHOD OF CONNECTING THE GRID BIAS RESISTOR AND ITS BYPASS CONDENSER IN ANY OTHER TUBE HEATED WITH AC.

the filter resistors cut the effective voltage down a little while the tubes are in operation. Different values of resistors may be used if desired. It may be well to use a higher resistor for the detector than for the others, because not so much voltage is needed and a more thorough filtering is desirable.

If the highest voltage is over 180 volts it is best to connect the plate return for the power tube to (6) and the others to P. It is not quite safe to apply 250 volts on the plates of the high mu tubes, and the full voltage will be applied to the plates when the set is first turned on. The drop in the filter resistors does not become effective until plate current flows.

Condenser C4 is connected from point P to ground to minimize the coupling in the upper portion of the potentiometer resistance and the impedance of the rectifier and the filter. This condenser is desirable because no matter how well the individual circuits are filtered there will be some signal voltage difference between P and ground. All the tubes will contribute to this because all will send some signal current through the supply. C4 admits this current to ground and thus lowers the coupling among the tubes. The larger C4 is, the better it will function.

Condenser C3 aids in reducing coupling but it is not fully effective when P is set at a point below (6). C3 is more effective in reducing the coupling than in reducing the hum from the voltage supplies. Each of C3 and C4 should be a 4 mfd. or larger unit.

When the grid bias for the various tubes is obtained from a voltage drop in the voltage divider on the eliminator there is danger of serious coupling among the grid circuits. When battery heated tubes are used there are only two ways to get the bias, one by means of a grid battery and the other by means of a drop in the voltage divider. Batteries are unpopular and therefore the drop method is used in most circuits. This

practice has been carried over to circuits using AC heated tubes.

There is little excuse for staying in the rut, for each AC heated tube can be biased with an individual resistor. This will eliminate practically all coupling among the tubes as far as the grid circuits are concerned.

But the grid bias resistor used for a single tube will reduce the amplification in that tube. To prevent this a condenser of adequate capacity should be connected across the resistor. The capacity should be 2 mfd. or more for audio frequencies, including the detector.

Fig. 3A shows how the grid bias resistor for a heater type tube should be connected and Fig. 3B shows the connection for any other tube. The B minus terminal in each instance should be connected to the left end of the resistor R.

Should it be necessary to provide additional grid filtration, this may be done by connecting a resistor of from 10,000 to 25,000 ohms between the grid return of each tube and grounded B minus. This resistor should then be bypassed with a condenser from the grid return to the cathode or the midtap of the filament. This filtration is similar to that illustrated in Fig. 2 for the plate circuits. The biasing resistor would remain between the cathode and ground.

As a test of the relative merits of the two circuits in Figs. 1 and 2 they were tried on a resistance coupled amplifier of good design. The circuit in Fig. 1 made it oscillate violently. The circuit shown Fig. 2 produced no oscillation.

[Next week, issue of May 11th, H. B. Herman will contribute a noteworthy article on "A Quality Amplifier a Sound Investment in Happiness." This is part of a series on B supplies and amplifiers, begun in the present issue. He will analyze and compare audio circuits and show a diagram of a three-stage power amplifier. This is one of his most trenchant articles.—Editor.]

Wrong?

7. The DC voltage at the output of a power pack cannot exceed the effective voltage across the high voltage terminals of the power transformer.
8. To get the highest possible step-up of voltage from one tube to the next by means of transformer coupling, assuming a fixed turns ratio, the primary impedance should be as high as possible.
9. To get the highest possible step-up of voltage in resistance coupled amplifiers, the plate coupling resistance should be equal to the internal plate resistance of the tube.
10. A dynamic speaker in which the field current is obtained from a low voltage rectifier is more sensitive than one in which the field current is obtained from a 90-volt source.

RUT OF POOR AMPLIFIER PERFORMANCE!

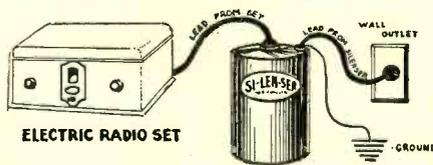
Articles of Which Above is the First

At Last-you can *Real*



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

at the Set



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

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

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

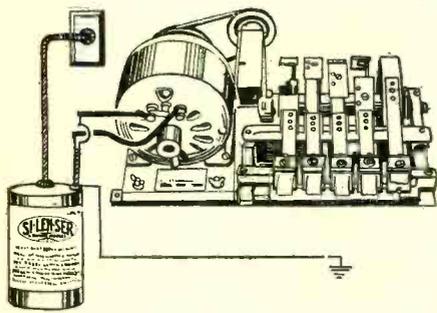


FIG. 1

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

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

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

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

The method of using a combined inductive and capacitive filter either at the set or at

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

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

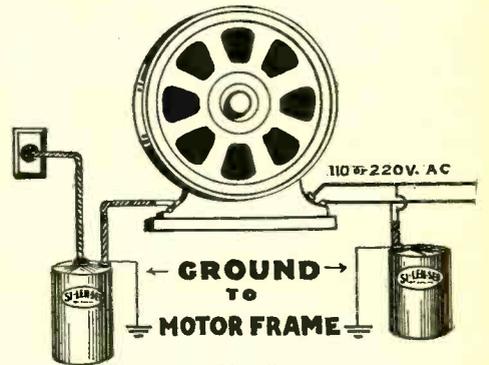


FIG. 2

ASK YOUR DEALER! IF NONE IN YOUR TERRITORY WRITE OR WIRE FOR SAMPLE

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

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

LIST PRICE \$12.50

SO YOU MAY KNOW

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

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

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

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

TRUTONE RADIO SALES CO.

M. SI-L. C.

Enjoy your Radio!



The Original
Band Pass Filter
 For Use



SEPARATES STATIONS ON
 LOW WAVE LENGTHS

On Electric or Battery Sets

Reduces Static!

Eliminates Aerial Interference

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

The CE-LECTOR is a band pass filter with a new, novel and patent method of cutting off any infringing side bands. It is particularly effective on low wave lengths. It also

balances the aerial and tunes the first tube. The band pass features in the CE-LECTOR prevent more than one frequency being passed at a time.

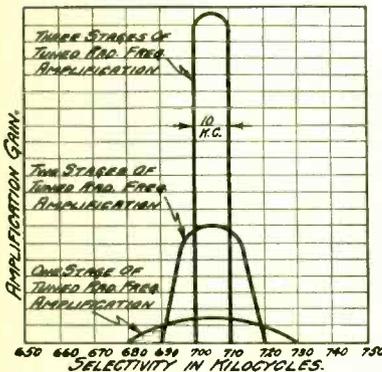
Another great feature of the CE-LECTOR is that it reduces static. We do not claim that it will eliminate static, there is nothing that will do this, but on actual tests the CE-LECTOR does decrease the noises heard in a radio loud speaker attributed to "static." If it entirely eliminated static, which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

electric energy as the signal, it would take out the program.

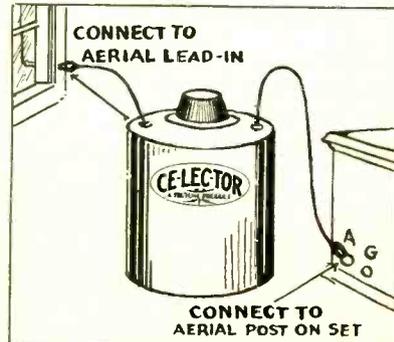
Absolutely no tools are necessary to attach the CE-LECTOR to any radio. The CE-LECTOR comes completely self-contained in a beautiful bakelite container, which is 3 1/8 in. in diameter. From it are two wires, one to be attached to the aerial binding post and the other on the lead-in of **\$6.50** the aerial

You Gain Selectivity with the

EASY TO HOOK-UP



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



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

MAKERS OF
 SEN-SER and
 CE-LECTOR

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

Resistance Problems

In Volume Control for Multiple-Connected Speaker

By J. E. Anderson

Technical Editor

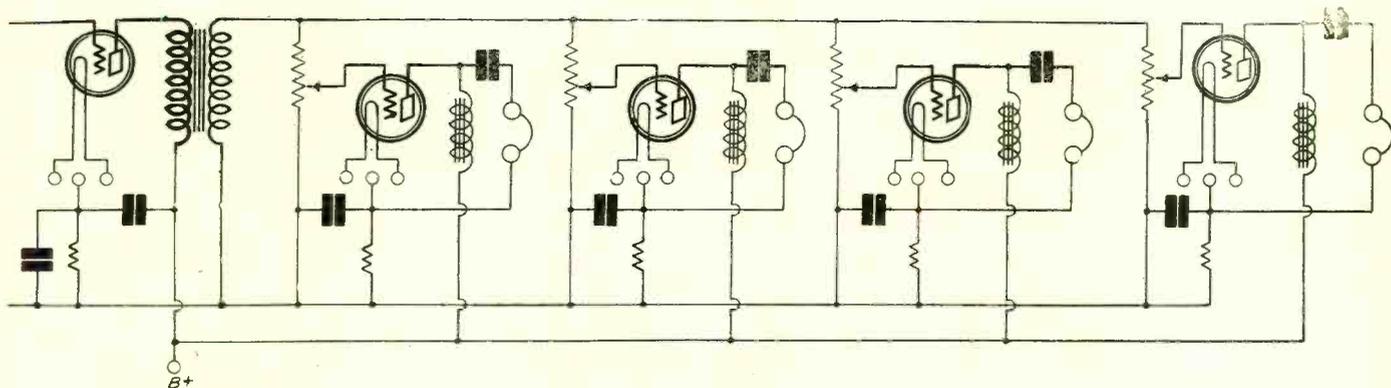


FIG. 4

FOUR SPEAKERS CONNECTED TO THE SAME RECEIVER BY MEANS OF A LOCAL COUPLING TUBE. THREE LEADS OR MORE SHOULD BE RUN FROM THE RECEIVER, ONE FOR GROUND, ANOTHER FOR THE PLATE VOLTAGE AND THE THIRD FOR THE SIGNAL VOLTAGE.

[The first part of this discussion on the connection of loudspeakers appeared last week on page 17 of the April 27th, issue.—Editor.]

IF all speakers are connected in parallel, any one may be taken off the line by opening its circuit. But when this is done the power received by the remaining speakers will increase. Again an individual volume control is required. And this control must be such that it neither short-circuits the line nor puts resistance in series.

Problem is Complex

The problem is complex as soon as there are many speakers, no matter which connection is used. Each problem has to be solved separately.

One way of treating the series-parallel connection is shown in Fig. 3. Any one of the four speakers may be turned off by short-circuiting it and leaving the resistance in series with the other. But this method does not conserve power, for there is much lost in the resistors.

This method is applicable both when the speakers are connected in series and when in parallel.

Possibly the best method of distributing the output of a receiver among several speakers is to use a separate output tube for each speaker. The output tube for each speaker would be placed near that speaker, and it would have a volume control built into its grid circuit. The leads running from the last tube in the common receiver would not need to be made of heavy wire, but they would have to be separated to reduce shunt capacity. The volume control would take the form of a high resistance potentiometer across the line. The method is shown in Fig. 4.

In this system three connecting leads are required, one for the high signal voltage, one for the ground and one for the high plate voltage. If the line is not long the three leads may be cabled. Each one of the extension amplifiers connects to each of the three leads in the cable. In addition each amplified is connected to the nearest AC outlet for its filament current.

Problem of Resistance

It is clear that when many speakers are connected as in Fig. 4 the resistance of each potentiometer must be high or the combined resistance will be so low as to take considerable current from the

transformer. This would reduce the signal. Suppose each of the four potentiometers has a resistance of 0.5 megohm. The combined resistance would then be 125,000 ohms.

While this is not too low it would not do to decrease the resistance to 250,000 ohms for each potentiometer, for the signal strength decreases rapidly when the resistance across the transformer secondary falls below 100,000 ohms. It would be preferable to make the resistance of each potentiometer 1 megohm, so that the combined load on the transformer would not be less than 250,000 ohms.

This raises the question as to where such potentiometers may be obtained. Potentiometers ordinarily do not come in higher resistances than 500,000 ohms. One way of solving this problem is to connect fixed resistors in series and using enough of them to make up the desired total resistance. But that complicates the matter from one point of view. The volume can be varied in steps only, whereas it is desirable to have a continuous variation.

Fixed and Variable Resistors

The continuously variable potentiometer could be retained and a fixed resistance connected in series with each one. If that is done the whole volume range is not available. If the fixed resistor is placed above the variable maximum volume can-

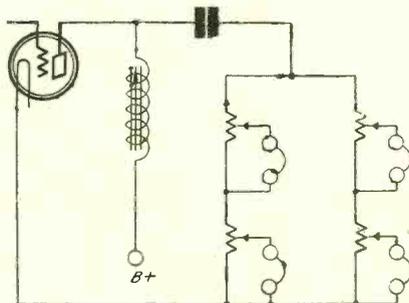


FIG. 3

When four loudspeakers are connected to the same power tube and the four speakers are to be placed at different places, the volume of each might be controlled as shown in this circuit.

not be attained. If it is placed below, it may not be possible to reduce the volume to the desired degree.

So the best way is to procure the highest resistance potentiometers and use no fixed resistors. The reduction in the volume which might result may be made up for by turning up the volume ahead of the last common tube. Or again, an output transformer having a very good regulation might be selected for use between the last common tube and the multitude stage. For example, a one-to-one output transformer designed to operate between a power tube and a loudspeaker might be employed. Since this does not afford any step-up of the voltage it would be necessary to have a greater amplification ahead of the last common tube. Naturally one would not choose a low mu tube for the final common tube, but either a 112A or a 210 tube. Or even a -27 heater type could be used.

The potentiometer problem is not serious unless more than four tubes are used in the last stage. It is not likely that a greater number will be used in any home.

Plate Power Supply

If a common plate power supply is used as indicated in Fig. 4, it is clear that it must have a large current capacity. Suppose each of the power tubes is a 171A and that the tube ahead of them is a -27 tube. The total plate current with proper grid bias would then be close to 100 milliamperes. The other audio tubes and the radio tubes would take an additional current of 20 milliamperes. This is the limit of the 280 double rectifier tube, and it is far above the limit of most eliminator chokes. Two 280 rectifiers or two 281 tubes should be used, and the power transformer and the choke coil should be built on the same proportions as the equipment used with 250 push-pull amplifiers.

A separate grid bias resistor is used for each of the tubes in the final multiple stage. If the tubes are -71A each resistor should be 2,000 ohms. Each resistor should have a 4 mfd. condenser across it.

Of course, it is not necessary that all the four tubes be of the same type. One might be a 112A, another a 171A, another a 245 and still another a 250.

A Band Pass Filter Trap

Tunes Out RF Interference While Improving Quality

By *J. E. Anderson*

Technical Editor

THERE is a real need for a device to be placed ahead of any receiver which will cut out interference. Fans are always complaining that they cannot tune out certain stations which interfere with their favorites. This cry against interference has grown louder since single control receivers came into general use. Some fans live close to powerful stations which blanket all others, and these fans, regardless of the receiver used, are unable to get any other station in the background. Indeed, in some instances the local station is much louder than the desired station.

Julian J. Proskauer, of the Trutone Company, who has specialized in interference elimination, realized this condition and set about to find a remedy. He tried the usual wave trap arrangements and discarded them as being inadequate and as being inadequate to meet the situation. He tried many new circuit arrangements, and subjected each to rigid tests, but found most of them unsuitable or inadequate for the requirements.

Band Pass Selector

Realizing the desirable qualities of the band pass filter system described by Karl Vreeland in the Proceedings of the Institute of Radio Engineers, he began experimenting with coupled circuits with the view of developing an interference eliminator based on the band pass properties of this system. Success was not immediate, for the theory could not be applied to the new conditions and specialized requirements. However, persistent experimenting finally yielded promising results.

Mr. Proskauer built many models of the band pass pre-selector, being guided by the experimental results he had obtained and supported by the theory of coupled circuits, with the view of getting the best combination.

When he had found a satisfactory model from the electrical point of view, he set about designing a container which would be compact and convenient. When the final model was completed he again tested it to make sure that the assembly had not vitiated any of the desirable electrical properties. The result of his painstaking work is a preselector or interference eliminator, which, he claims, meets all the requirements imposed on it. And it is a device handsome in appearance, easy to manipulate, and simple to install.

Using Selector

The interference eliminator, which is called Ce-Lec-Tor, is contained in a black bakelite cylinder three inches in diameter and three and a quarter inches high. A single knob is mounted on the top so that the overall height is approximately four inches. The condensers and coils are immersed in a good insulating wax which is impervious to moisture, thus insuring constancy of characteristics in all kinds of weather.

The Ce-Lec-Tor looks like a wave trap, is used like a wave trap, connects to the circuit like a wave trap, but is no wave trap. It is an interference eliminator based on the band pass filter principle.

Only two leads emerge from the container. One of these is connected to the antenna and the other to the antenna

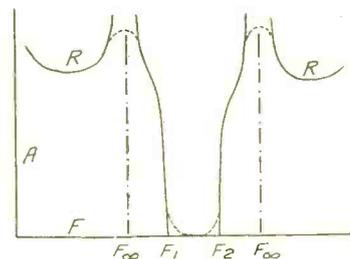
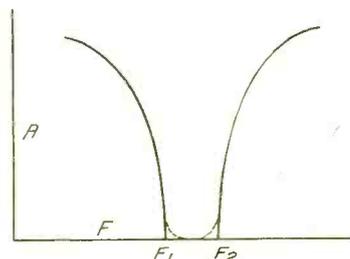
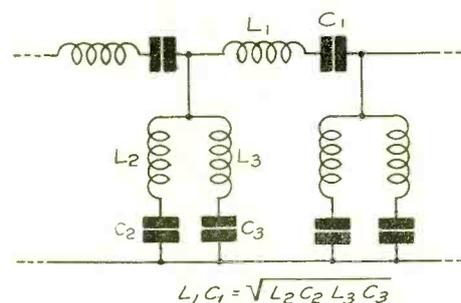
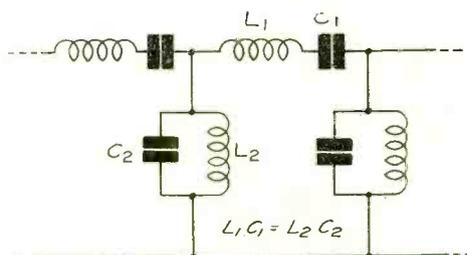


FIG. 1
TWO TYPES OF BAND PASS FILTER WITH THEIR CHARACTERISTIC CURVES. THE TRANSMISSION OF THE CE-LEC-TOR IS SIMILAR TO THE UPPER CURVE ALTHOUGH DIFFERENT CIRCUIT IS EMPLOYED.

binding post on the receiver. When the Ce-Lec-Tor has been connected in the antenna circuit, the receiver is tuned to the desired station just as if the Ce-Lec-Tor were not in the circuit. Then if there is any interference from another station, the knob on the Ce-Lec-Tor is adjusted until the interference disappears, or until its intensity is a vanishing minimum. The adjustment is as simple as to turn a volume control or a tuning condenser. Indeed, the principal element in the unit is a variable condenser.

Principle of Band Pass Filter

There are many types of band pass filter. That described by Mr. Vreeland, and used by Mr. Proskauer in the design of the Ce-Lec-Tor, makes use of the characteristics of coupled circuits. As is well known, a single tuned circuit accepts or rejects a single frequency, according to the manner in which it is used. When two tuned circuits are used it is possible to accept or reject two frequencies. If the coupling between the two tuned circuits is suitably chosen the two response frequencies may be placed close together so that the response peaks, or rejection hollows, almost merge.

When the two peaks are very close together, they approach a single peak with the peculiar characteristic of being practically flat on top and with very steep sides. Therein lies the value of the arrangement. The steep sides permits the use of the device as an interference eliminator when the interference and the desired signals are very close in the frequency range. If it were not for the steep sides the device would not only eliminate the interference but it would also reduce the strength of the desired signal, when the device is used as a rejector.

The wide top of the characteristic curve of such a band pass filter, when used as a suppressor, permits blotting out a wider band of the interference. Incidentally,

this has a tendency to reduce static to some extent. But the principal use of the device is as an acceptor.

Simple in Principle

While the band pass circuit is simple in principle, it is not so simple in application. Considerable skill is required to design an effective circuit that will do what the theory says it is capable of. This is particularly true when it is applied to special cases like interference elimination in the antenna circuit. But once some one has gone through the experimental work and overcome all the difficulties, the use of the device is as simple as tuning a gang-tuned receiver. Just turn the knob, the designing engineer has already done the rest.

The addition of a Ce-Lec-Tor to any radio receiver is said to excel in selectivity gain the addition of another tuner in the receiver and that it has the added advantage of not cutting the side bands.

Band Pass Characteristics

The nature of band pass characteristics for certain types of filter is shown in Fig. 1. While the filter circuits shown in the figure are not suitable for connection in the antenna circuit without modification, the curves are pertinent. Note particularly the steep sides of the curves in the transmission or acceptance region between F_1 and F_2 , and the broad bottom of the curves. The curves show attenuation and therefore they are plotted upside down as compared with ordinary resonance curves.

It must be remembered that broadness of the bottom of the curves does not indicate that the band pass filter is broad in tuning. The distance between F_1 and F_2 may be made as narrow as desired. In the interference eliminator the width approaches 10 kilocycles, which is most desirable width for high selectivity and transmission of the side bands.

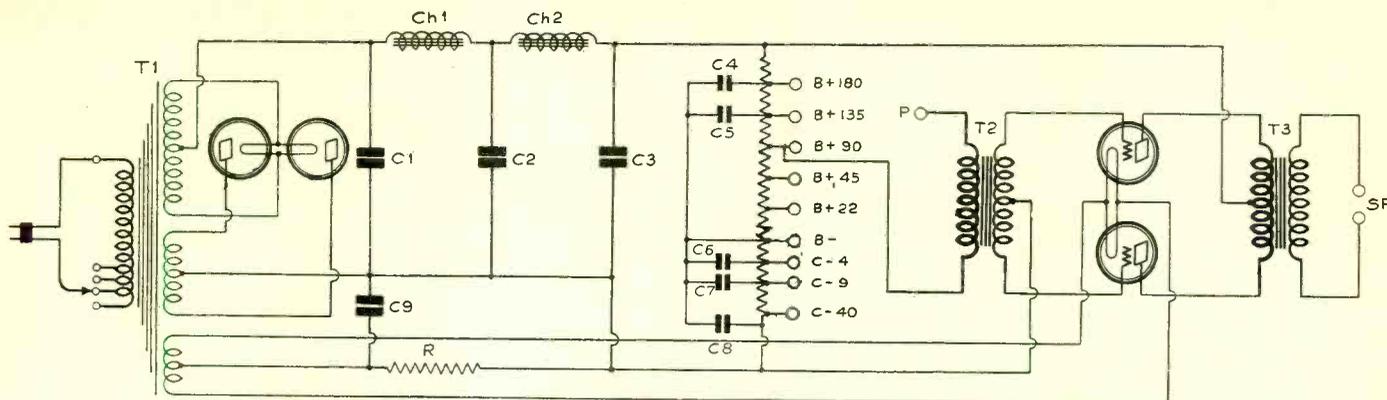


FIG. 749

THIS IS A CORRECTED SCHEMATIC DIAGRAM OF THE POWER PACK FOR THE RE-29 RECEIVER, TWO HALF-WAVE RECTIFIER TUBES ARE USED IN THE CIRCUIT INSTEAD OF ONE FULL-WAVE RECTIFIER

Radio University

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CAN THE VOLUME on the long waves be increased by adding a loading coil in the antenna circuit?

(2)—If so, what kind of coil do you recommend?

PAUL HOLLISTON,
Akron, Ohio.

(1)—Yes, if the antenna is not too large already.

(2)—An old type variometer would be all right because you could adjust the value of the inductance to suit the antenna you have.

* * *

PLEASE EXPLAIN how to determine the capacity of two condensers connected in series when the capacity of each is known.

(2)—Is there any method of measuring the capacity of a condenser with a voltmeter and ammeter? If so, please explain.

(3)—Is the inductance of two coils connected in series equal to the sum of the two inductances?

(4)—What is the inductance of two coils connected in parallel in terms of the two inductances?

(5)—If there are two windings on an iron core transformer may the inductance of the two windings connected in series be determined the same way as in (3)?

BRYANT FULLER,
Butte, Mont.

(1)—Take the reciprocal of each of the two capacities, add them and then take the reciprocal of the sum. The result is the capacity of the two condensers connected in series. For example, let the two capacities be .0005 and .00025 mfd. The reciprocals are, respectively, 2,000 and 4,000. The sum is 6,000, the reciprocal of which is .000167 mfd.

(2)—If you have an AC voltmeter and an AC ammeter the capacity can be measured just as a resistance is measured with direct current. Connect the condenser in series with an alternating voltage and with the AC ammeter. Connect the AC voltmeter across the condenser. Take both the current and the voltage readings. Divide the current reading by the voltage reading and by 6.2832 times the frequency. Suppose the current is .2 amperes and the voltage 110 volts. If the frequency is 60 cycles, the capacity of the condenser is 4.8 mfd.

(3)—Yes, if they are far apart or placed so that there is no coupling between them.

(4)—If the coils are placed far apart or so that there is no coupling between them the inductance of the two in parallel is determined in the same way as the capacity of two condensers connected in series.

(5)—No. The coupling between the coils must be considered. If the coupling is very close, the inductance of the two windings in series is $L1+2Lm+L2$, where Lm is the geometric mean of the two inductances $L1$ and $L2$. Lm is positive if the two windings are in series aiding and negative if in series opposing.

* * *

HOW MANY TURNS should be wound on a two inch diameter to tune the broadcast band with a .0005 mfd. condenser?

(2)—What is the best size of wire for the primary and the secondary windings?

(3)—Is a small coil as efficient as a large one?

ARTHUR KELFORD,
Los Angeles, Calif.

(1)—See article in the March 16th issue of Radio World.

(2)—This is answered in the same article.

(3)—Usually a small coil is not as selective as a larger one, but in many circuits the smaller coil will give better overall results.

* * *

WHAT IS the hydrometer reading for a fully charged lead plate storage battery? For the discharged battery?

(2)—Is it safe to use water from the city mains to replenish the water in the storage battery, or must distilled water be used under all circumstances?

(3)—Is gassing of the battery during charge indicative of full charge?

COLWELL MATHEWS,
Indianapolis, Ind.

(1)—The fully charged battery should read from 1.250 to 1.300. When the battery reads 1.150 or less it is discharged.

(2)—In some cities the water from the mains is safe as it is practically free of all mineral and acid, but before using the water in any case it should be tested. It is always safe to use distilled water.

(3)—The battery should not be considered charged until it has been gassing freely from 2 to 4 hours.

* * *

I HAVE an electrical pick-up unit for my phonograph. On certain high frequencies and loud volumes there is a very disagreeable noise. What causes it, and how can it be remedied?

(2)—Do you recommend the use of a transformer between the pick-up unit and the tube?

HILMER MOSSE,
Chicago, Ill.

(1)—The record may be defective at the point in question, or there may be a natural frequency of vibration of the armature of the unit. There is usually

no remedy for it except to get a unit which is not subject to this trouble.

(2)—There is little to be gained by using the transformer. In certain cases the quality becomes poor when the transformer is used. Of course, it depends on the transformer.

* * *

WHAT IS the difference between a side band and a side frequency?

(2)—What is the meaning of "zero level" when used in connection with the power in a broadcasting station?

(3)—What is the meaning of such expressions as "volume is down" and "volume is up?" How can the volume be below the "zero level?"

(4)—What percent modulation is used in the better broadcasting stations?

ERIC SEAMAN,
Rockford, Ill.

(1)—A side band frequency is a single frequency produced by the interaction of the carrier frequency and the modulating frequency. The process of modulation of a carrier frequency by another frequency produces two side frequencies, one of which is the sum of and the other the difference between the two interacting frequencies. A side band is a group of frequencies produced when more frequencies than one are impressed on the carrier, or it is the band in which the side frequency may lie when the frequency impressed on the carrier may vary in a definite, lower frequency band.

(2)—"Zero level" refers to an arbitrary level of power delivered by a transmitter or other device. It is simply a convenient reference point. For example, it may represent a power of 5 milliwatts, or 5 kilowatts.

(3)—When the volume is "down" it means that the power is less than the "zero level" and when it is "up" it means that the power is greater than the "zero level." The power is measured in transmission units, or decibels, with respect to the "zero level." The volume can be below the "zero level" provided that this level is chosen greater than absolute zero.

(4)—The percent modulation varies from about 40 to 100. The tendency is to increase the percentage of modulation in broadcast stations.

* * *

IN THE APRIL 20th issue of RADIO WORLD you publish a pictorial circuit diagram of the R. E. Lacault power supply and on the opposite page a schematic wiring diagram of the same circuit. The pictorial diagram contains two rectifier tubes, while the schematic diagram contains a single tube, both for two-way rectification. Which is correct?

WILLIAM BURTON,
New York, N. Y.

(1)—The pictorial diagram is correct. The other is correct as to the circuit but is wrong in that a single full-wave rectifier, instead of two half-wave rectifiers, is used. See Fig. 749 for schematic showing the two rectifier tubes.

PLEASE NAME some of the materials which are suitable for cores in transformers and relays.

(2)—What are the best alloys for permanent magnets? What are their advantages?

(3)—Is it necessary to have first class core material for the field in dynamic speakers? What material is suitable?

(4)—Why is it necessary to build the cores of transformers of thin sheets of the material? Why is this not done in speaker fields as well?

WALTER JOHNSTON,
Topeka, Kansas.

(1)—The best materials are silicon steel, Ajax metal and permalloy.

(2)—Chrome, tungsten and cobalt steels. They retain their magnetization a long time and resist demagnetization. They are listed above according to their permanence, cobalt steel being the best.

(3)—Desirable but not at all necessary. Any magnetic material is all right and that includes cast iron.

(4)—It is necessary to laminate the material in order to decrease eddy current losses. Eddy currents would heat the core and result in heavy power loss. It is not necessary to laminate the field winding of a dynamic speaker because the magnetizing current is unidirectional. It is only necessary to laminate where alternating current is involved.

* * *

IF THERE IS a mechanical analogy for a transformer please mention it and explain the corresponding elements.

(2)—What is meant by leakage flux in a transformer? If this can be explained by means of the analogy, please do so.

(3)—What is meant by an open secondary?

MARTIN KELLY,
New Bedford, Mass.

(1)—A simple mechanical analogy of a transformer is a lever. The core might be considered the fulcrum. The force exerted at one end of the lever corresponds to the voltage across the primary and the motion of that end to the primary current. The force resulting at the other end corresponds to the secondary voltage and the motion at that end to the secondary current.

(2)—The leakage flux in the transformer is that flux set up by the primary current which does not thread the secondary turns. It is lost motion, to speak. In the lever analogy it may be compared with the slipping of the fulcrum.

(3)—An open secondary may mean that the wire in secondary winding has broken, but usually it means that nothing has been connected across the secondary terminals, or that something which does not draw any current has been connected across the terminals, for example, the grid circuit of a vacuum tube.

* * *

I HAVE an AC operated receiver on which there is no adequate volume control. Please suggest some method for controlling the volume which does not affect the tuning appreciably. All RF tubes are 27s.

(2)—When I tune two the short waves there is a considerable hum and a roar. The set is quite on the longer waves. What causes the hum and noise?

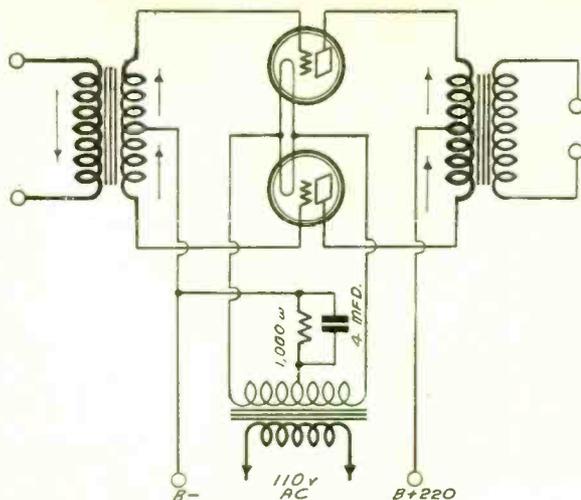
(3)—Please suggest remedies.

ALFRED MOREHOUSE,
Jacksonville, Fla.

(1)—One of the best ways is to vary the grid bias on the first RF tube. This can be done by means of a 10,000 ohm variable resistor connected in series with the cathode lead. Connect a .01 mfd. or larger condenser across it. Choose a resistance with a very low minimum.

(2)—The hum and the roar are caused by oscillation or excessive regeneration. The volume control suggested in (1) is effective in stopping this in most cases.

(3)—If this does not stop the hum it



PLEASE show a push-pull audio output stage, with input and output transformers. Please show by arrows the direction of current flow at any instant. I understand the current is equal but opposite in phase.

J. C. BURR,
Deposit, N. Y.
See Fig. 751. Yes, the current is equal but opposite in phase.

FIG. 751
Diagram of a push-pull output stage.

is well to ground the cases of the power transformers as well as those of the audio transformers. Connect the midpoint of the 2.5 volt winding to the cathode or to

plus 45 volts on the eliminator. Placing a grounded metal shield between the tuners and the power devices is also helpful.

Right or Wrong?

[Questions on pages 10 and 11]

1.—Wrong. A variable resistor across the speaker is the worst possible form of volume control placed at the worst place in the circuit. It permits all the tubes to overload.

2.—Wrong. A variable resistor across the pickup unit alters the characteristics so that the quality of the output will depend on the volume.

3.—Wrong. If no frequencies above 5,000 cycles were transmitted, they could not be heard in the receiver. They are heard up to the limit of audibility. It is true, however, that the high frequencies are attenuated.

4.—Wrong. The screen grid tube is inherently just as selective as any other tube because it has a high input impedance, and that is the only thing in the tube that affects the selectivity. However, due to the high amplification of the screen grid tube, circuits in which it is used seem to be less selective.

5.—Right. The bias depends on the value of the grid bias resistor placed between the grid return and the cathode or filament of the tube, as well as on the current that flows through this resistor. The voltage drop, which is the product of the plate current and the grid bias resistor, is the bias, and that may be different for all the tubes.

6.—Wrong. The selectivity of the circuit has nothing to do with the mechanical features of the dials controlling the tuning condensers.

7.—Wrong. The DC voltage across the output of the power pack can be 1.41 times as great as the AC voltage across the power transformer. If the transformer is center-tapped and full-wave rectification is used, the voltage across each half of the high voltage winding is considered.

8.—Right. The old idea that the impedance of the primary of the transformer should be equal to the plate impedance of the tube was due to an error. The correct statement of the condition is that the primary impedance should be as high as practicable. In the design of the transformer, capacity across the windings must be considered, especially that across the secondary.

9.—Wrong. The impedance in the plate circuit should be as high as practicable for greatest voltage step-up. The impedance in the plate circuit that counts is the impedance of the plate resistor and the grid leak in parallel.

10.—Wrong. If the speaker field contains the same number of ampere turns in the two instances there is no difference in the sensitivity.

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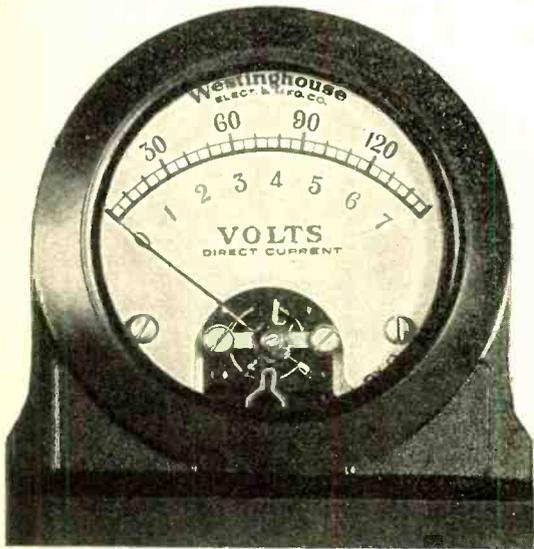
Street

City and State

Alphabetical List of Stations by Call Letters, Location and Frequency

Station	Location	Frequency	Station	Location	Frequency	Station	Location	Frequency	Station	Location	Frequency			
WAAD	Cincinnati, O.	1420	WGWS	New York City	1180	WMAF	Dartmouth, Mass.	1360	WTAM	Cleveland, O.	1070	KGHD	Missoula, Mont.	1420
WAAP	Chicago, Ill.	920	WGCM	Gulfport, Miss.	1210	WMAK	Buffalo, N. Y.	900	WTAQ	Eau Claire, Wis.	1330	KGHP	Pueblo, Colo.	1320
WAAM	Newark, N. J.	1250	WGCP	Newark, N. J.	1250	WMAJ	Washington, D.C.	630	WTAR	Worcester, Mass.	780	KGHC	McGehee, Ark.	1310
WAAT	Jersey City, N. J.	1070	WGES	Chicago, Ill.	1350	WMAK	Columbus, Ohio	1210	WTAW	College Station, Tex.	1120	KGHI	Little Rock, Ark.	1500
WAAW	Omaha, Neb.	660	WGH	Newport News, Va.	1310	WMAO	Chicago, Ill.	670	WTAX	Streator, Ill.	1210	KGHL	Billings, Mont.	950
WABC	WBOQ—N.Y. City	860	WGH	Newport News, Va.	1310	WMAZ	Macon, Ga.	890	WTBO	Cumberland, Md.	1420	KGHX	Richmond, Tex.	1500
WABZ	Bangor, Me.	1200	WGL	Ft. Wayne, Ind.	1370	WMB	Newport, R. I.	1500	WTFI	Toccoa, Ga.	1450	KGIO	Twin Falls, Idaho	1320
WABZ	New Orleans, La.	1200	WGM	See WLB-WGMS		WMBD	Detroit, Mich.	1420	WTR	Hartford, Conn.	600	KGIR	Butte, Mont.	1360
WADC	Akron, O.	1320	WGN	See WLB-WGMS		WMBE	Peoria Hts., Ill.	1440	WVAA	Hammond, Ind.	1200	KGIV	Trinidad, Colo.	1420
WAFD	Detroit, Mich.	1500	WGR	Buffalo, N. Y.	550	WMBH	Miami Beach, Fla.	560	WVW	Detroit, Mich.	920	KGJF	Little Rock, Ark.	890
WAGM	Royal Oak, Mich.	1310	WGST	Atlanta, Ga.	890	WMBI	Richmond, Va.	1210	WVW	New Orleans, La.	850	KGKB	Brownwood, Tex.	1500
WAIU	Columbus, O.	640	WGY	Schenectady, N. Y.	790	WMBL	Joplin, Mo.	1420	WVW	Asheville, N. C.	570	KGK	San Angelo, Tex.	1370
WALK	Willow Grove, Pa.	1500	WHA	Madison, Wis.	570	WMBL	Addison, Ill.	1080	WVW	Woodside, N. Y.	1500	KGKX	San Point, Idaho	1420
WAPI	Birmingham, Ala.	1140	WHAD	Milwaukee, Wis.	1120	WMBP	Pittsburgh, Pa.	1500	WVW	Wheeling, W. Va.	1160	KGKO	Wichita, Falls, Tex.	570
WASH	Gd. Rapids, Mich.	1270	WHAD	Milwaukee, Wis.	1120	WMBL	Lakeland, Fla.	1310	WVW	Enid, Okla.	1370	KGLO	Oakland, Calif.	790
WBAW	W. Lafayette, Ind.	1400	WHAM	Rochester, N. Y.	1150	WMBL	Auburn, N. Y.	1370	KDB	Santa Barbara, Cal.	1500	KGRC	San Antonio, Tex.	1370
WBAL	Baltimore, Md.	1060	WHAP	N. Y. City	1300	WMBL	Brooklyn, N. Y.	1500	KDKA	Pittsburgh, Pa.	980	KGRS	Amarillo, Tex.	1410
WBAP	Fort Worth, Tex.	800	WHAS	Louisville, Ky.	820	WMBR	Tampa, Fla.	1210	KDLR	Devils Lake, N.D.	1210	KGU	Honolulu, Hawaii	940
WBAP	Nashville, Tenn.	1490	WHAZ	Troy, N. Y.	1300	WMBR	Memphis, Tenn.	780	KDYL	Salt Lake, Utah	1290	KGW	Portland, Ore.	620
WBAX	Wilkes-Barre, Pa.	1210	WHB	Kansas City, Mo.	950	WMC	Memphis, Tenn.	780	KEJK	Beverly Hills, Calif.	1170	KGW	Lacey, Wash.	1200
WBBC	Brooklyn, N. Y.	1400	WHBC	Canton, Ohio	1200	WMCA	New York, N. Y.	570	KFAB	Lincoln, Neb.	770	KHJ	Los Angeles, Calif.	900
WBBL	Richmond, Va.	1310	WHBD	Bellefontaine, O.	1370	WMES	Boston, Mass.	1500	KFAD	Phoenix, Ariz.	620	KID	Idaho Falls, Idaho	1320
WBFB	WJBT—Chicago, Ill.	770	WHBF	Rock Island, Ill.	1210	WMMN	Fairmont, W. Va.	890	KFBF	Great Falls, Mont.	1360	KIDO	Boise, Idaho	1250
WBFR	Rossville, N. Y.	1300	WHBL	Sheboygan, Wis.	1410	WMP	Lapeer, Mich.	1500	KFBF	Sacramento, Calif.	1310	KJBS	San Francisco, Cal.	1150
WBYY	Charleston, S. C.	1200	WHBT	Johnstown, Pa.	1310	WMR	Jamaica, N. Y.	1420	KFBF	Everett, Wash.	1370	KJR	Seattle, Wash.	970
WBBZ	Ponca City, Okla.	1200	WHBU	Anderson, Ind.	1210	WMSG	New York, N. Y.	1350	KFDY	Brookings, S. Dak.	550	KKP	Seattle, Wash.	1370
WBCM	Bay City, Mich.	1410	WHBW	Philadelphia, Pa.	1500	WMT	Waterloo, Iowa	1200	KFDM	Beaumont, Tex.	560	KLCN	Blytheville, Ark.	1290
WBET	Boston, Mass.	1360	WHBY	W. De Pere, Wis.	1200	WNA	W. De Pere, Wis.	1200	KFDY	Brookings, S. Dak.	550	KLDS	KMBC—See KMBC	
WBMS	Fort, Lec., N. J.	1450	WHDF	Calumet, Mich.	1370	WNA	Philadelphia, Pa.	1310	KFEL	Denver, Colo.	940	KLRA	Little Rock, Ark.	1390
WBNY	New York, N. Y.	1350	WHDH	Gloucester, Mass.	830	WNA	Yankton, S. D.	570	KFEL	Denver, Colo.	940	KLS	Oakland, Calif.	1440
WBOW	Terre Haute, Ind.	1310	WHDI	Minneapolis, Minn.	560	WNB	Binghamton, N. Y.	1500	KFEL	Denver, Colo.	940	KLX	Oakland, Calif.	880
WBRC	Birmingham, Ala.	930	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KLZ	Dupont, Colo.	560
WBRE	Wilkes-Barre, Pa.	1310	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMA	Shenandoah, Iowa	930
WBRL	Manchester, N. H.	1430	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMED	Ind'p'dnce, Mo.	950
WBRO	Wellesley Hs., Mass.	780	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMG	Medford, Ore.	1310
WBTV	Charlotte, N. C.	1080	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMJ	Fresno, Calif.	1120
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMMJ	Clay Center, Neb.	740
WBZA	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMO	Tacoma, Wash.	1090
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KMTR	Hollywood, Calif.	570
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOA	Hollywood, Calif.	1050
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOC	Corvallis, Ore.	560
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOB	State College, N.M.	1180
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOCW	Chickasha, Okla.	1420
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOH	Reno, Nev.	1370
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOIL	Council Bluffs, Ia.	1260
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOIN	Portland, Ore.	940
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOL	Seattle, Wash.	1270
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOMO	Seattle, Wash.	920
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOOS	Marshfield, Ore.	1370
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KORE	Eugene, Ore.	1420
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOW	Denver, Colo.	1390
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KOY	Phoenix, Ariz.	1390
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPCB	Seattle, Wash.	1210
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPJM	Prescott, Ariz.	1500
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPLA	Los Angeles, Calif.	570
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPO	San Francisco, Cal.	680
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPOT	Denver, Colo.	880
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPPC	Pasadena, Calif.	1200
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPQ	Seattle, Wash.	1210
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPRC	Houston, Tex.	920
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPSN	Pasadena, Calif.	950
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KPWF	Westminster, Calif.	1490
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KQV	Pittsburgh, Pa.	1380
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KQW	San Jose, Calif.	1010
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KRE	Berkeley, Calif.	1370
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KRGV	Hartlingen, Tex.	1260
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KRLD	Dallas, Tex.	1040
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KRMD	Shreveport, La.	1310
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KRSC	Seattle, Wash.	1120
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSCA	Manhattan, Kans.	580
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSBA	Shreveport, La.	1450
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSIC	Sioux City, Ia.	1330
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSD	St. Louis, Mo.	550
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSEI	Pocatello, Idaho	900
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSL	Salt Lake City, U.	1130
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSMR	Santa Maria, Calif.	1200
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSO	Clarinda, Iowa	1380
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSQO	Sioux Falls, S. D.	1110
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KSTP	St. Paul, Minn.	1460
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KTAB	Oakland, Calif.	550
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KTAP	San Antonio, Tex.	1420
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	940	KTAT	Ft. Worth, Tex.	1240
WBZ	Boston, Mass.	990	WHDF	Gloucester, Mass.	830	WNB	Wilmington, N. C.	1370	KFEL	Denver, Colo.	9			

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



This beautiful Westinghouse meter given FREE! Read generous offer!

Double range direct current meter, 0-7½ volts legible to ¼ volt, and 0-150 volts, legible to 5 volts. The d'Arsonval Movement (dynamic principle) is used. Resistance is about 100 ohms per volt. A mirror strip, for observing the needle so as to hide its own reflection, facilitates closest reading, in conjunction with knife-edge. End-stops are built in. So is a zero corrector. The casing is moulded bakelite. The meter is illustrated full size. At rear are three posts—the common minus and the two positive posts. A connecting cable is furnished with each meter, lugs at one end, tip plugs at other. Send \$6 for year's subscription for Radio World (52 numbers) and get this genuine Westinghouse table model meter FREE! Present subscribers may renew under this offer by stating subscription expiration date and enclosing \$6.

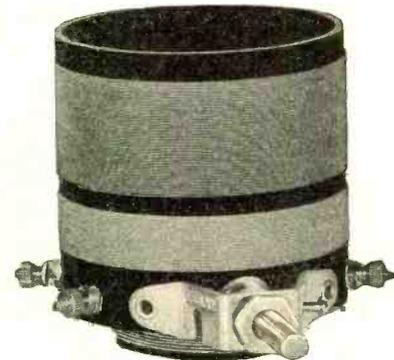
Radio World, 145 W. 45th St. New York City

DIAMOND Pair



AC5 \$1.50

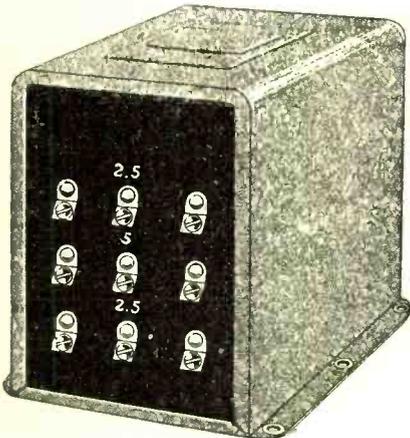
Highly selective antenna coil for any circuit, and interstage coil for AC circuits. Step-up ratio, 1-to-8. Tunes with .0005 mfd. Model AC3, for .00035 mfd. \$1.75



SGT5 \$2.75

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

Filament Transformer



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

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

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

The transformer is beautifully finished in cracked glossy black, with bakelite front, and comes equipped with 52-inch AC cable with plug. Six riveted mounting holes for baseboard or subpanel. Size, 3¼ in. high, 2½ in. wide, 3 in. deep. Shipping weight, 6 lbs.

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

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145 West 45th St.
N. Y. City

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



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

\$6.00

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

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145 WEST 45TH STREET
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For the Answer to Your Radio Resistance Problems Write Dept. RW1.
175 Varick St., New York, N.Y.
ELECTRAD
INC.

List of Radio Stations

RADIO WORLD dated March 23d carried a full and thoroughly up-to-date list of broadcasting stations as they stood at the time of going to press. This list contained the stations in the order of frequency and gave the owner, location, power and time sharers.

Mailed for 15c a copy; or subscribe now and start with the March 23d issue.

Radio World, 145 W. 45th St. N. Y.

Please look at the subscription date stamped on your last wrapper, and if that date indicates that your subscription is about to expire, please send remittance to cover your renewal.

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

Subscription Department, Radio World, 145 West 45th Street, New York, N. Y.

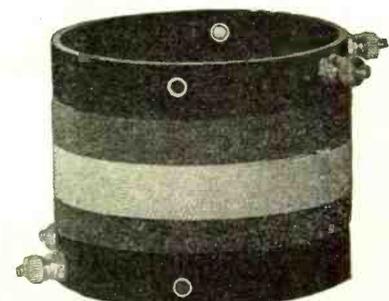
UNIVERSAL Pair

TP5 \$3.00

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

RF5 \$1.50

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

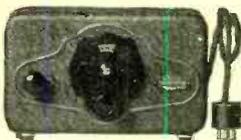


A5 \$1.75

Conductively coupled antenna coil, for maximum pickup, where selectivity is not the main consideration. Continuous winding in two colors. Tunes with .0005 mfd. Model A3, for .00035 mfd. \$2.00

Screen Grid Coil Co., 143 W. 45th St., N. Y. City

Hear The Aero-Call



SHORT WAVE CONVERTER

Factory-Built, Ready to Plug into Your Set This amazing instrument now makes it possible for you to reach 'round the world. Geo. Morcroft of Pa. tuned in Holland, England and Australia

on his initial test. Gets stations your regular receiver cannot get. What a thrill it is to plug this into a tub socket on your regular set and instantly be in another world. No change or wiring required. All complete, ready to operate, tubes and coils hidden, no apparatus in sight, except the neat, golden brown, compact metal cabinet in crackle finish. Size, 9x5½x2½ in. The only converter we know of that really works on all sets. Two models—A.C. and D.C. Write for Catalog and literature, or send \$25.00 and name of your dealer.

AERO PRODUCTS, INCORPORATED
4611 E. Ravenswood Ave., Dept. 1259, CHICAGO, ILL.

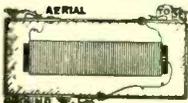
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Metallized. Permanently accurate. Noiseless. All sizes. 50c up. Use DYNOHMIC Type for heavier duty. 85c up.

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1775 Broadway New York City
Send for free book on Resistance in Radio

"Kill" That Static

Cash Bonus if Kilostat Fails



25c plus your money back if Kilostat does not improve your radio reception 50%. Kilostat is a powerful new Magnetic type Unit that "traps" the howls and crash of static AHEAD of any set. Easily attached. Greatly improves tone and selectivity, too. Proved by thousands.

Send no money—just your name to 20th Century Radio Co., 9528 Coe Cola Bldg., Kansas City, Mo., and you will be sent this regular \$3.00 Unit, postpaid, for only half-price on 15 Days' Trial. If you would part with it, the \$1.50 you pay the postman PLUS 25c for your trouble, will be cheerfully mailed you. So write today and enjoy "summer radio." Live dealers wanted.

BLUEPRINT of the New, Highly Selective Screen Grid DIAMOND

(Four Tubes)
\$1.00

RADIO WORLD
145 West 45th Street New York City
Few Doors East of Broadway

Gothic Polo Speaker, \$15.00

Housed in a beautiful Gothic structure of genuine walnut; hand-rubbed to an attractive finish, the Polo driving mechanism and cone combine best quality reproduction with finest appearance. The grille is specially constructed for two-tone effect, so popular in walnut these days. The Polo Speaker in the Gothic housing is an adornment, besides being an outstanding speaker in performance. The design of the cabinet is exclusive. The height is 12½". Shipping weight, 10 lbs. Cat. No. T.M.P.G.....



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

Most Selective DIAMOND

Follow Blueprint

THIS IS THE BATTERY MODEL

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

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

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

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

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

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

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

SPECIAL TWO-FOR-PRICE-OF-ONE COUPON

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

- RADIO NEWS
- SCIENCE AND INVENTION
- RADIO (San Francisco)
- RADIO ENGINEERING
- YOUTH'S COMPANION
- BOYS' LIFE

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

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

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THIS OFFER EXPIRES AT NOON ON JUNE 15TH, 1929

New Powertone

Cone or Cloth Diaphragm Speaker
Unit

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

New Moulded tri-foot bracket, fits Powertone, Polo, B.B.L., Brielle, Paratone and other units. Cat. BA.....65c
Apex, Thumbscrew and Chuck. Cat. AA.....10c
(Note: Cat. AA not sold alone.)

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

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

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Please mail me at once C.O.D. (Check off).
 One Powertone Unit alone, Cat. PA. @ \$8.00.
 One Tri-foot Bracket, Cat. BA @ 65c.
 One Apex, one Chuck, one Thumbscrew, Cat. AA. @ 10c.

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CONE ASSEMBLY WITH DOUBLE MAGNET UNIT

\$6.00



An excellent magnetic type speaker for installation in any cabinet. The unit is a double-magnet Paratone, with two magnet coils, for utmost sensitivity. Each horseshoe magnet is 3/4" thick. The magnet coils are forever protected against dust and other foreign, injurious substances, by special bakelite housings. The pin is reverse drive. The cone frame is metal. The 9" cone is specially treated buckram.

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

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

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- 3 Tube An. Hex. Set, 220 or 550 Hz.
- B-Eliminator for A. C. Current

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Fourteen Circuits

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

Get This FREE Book!

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

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Blueprint of the AC Diamond

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

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

Radio World, 145 W. 45 St., N. Y. City (Just East of Broadway)

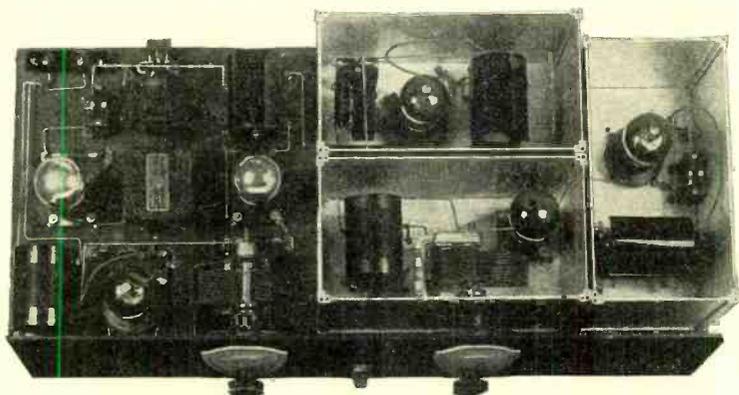
- Inclosed please find \$1.00 for which send at once official blueprint of the 4-tube AC Diamond.
- 30c for the March 23d and 30th issues (1929) describing this circuit.
- \$3.00 for 6 months subscription for Radio World. Send blueprint and two AC Diamond issues FREE.

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Build the Greatest Circuit—RE 29!



The neat and efficient arrangement of parts in R. E. Lacault's RE29.

Lacault's Last and Best Receiver!

FOR sheer sensitivity the screen-grid receiver, the RE29, surpassed any circuit he ever tried, R. E. Lacault said, just before his death. So that this extreme sensitivity could be utilized properly, Mr. Lacault spent many trying months until he developed the circuit to a remarkably high point of selectivity, with utter stability. That done, he knew he had a wonderful receiver, one that his large following, eagerly awaiting a screen grid adaptation of his original modulation system, would build with delight and operate with ecstasy! The RE29, successor to a long line of successful Lacault receiver designs, is here. His last circuit,

his best circuit, may now be duplicated by constructors!

THE receiver consists of six tubes (including first audio) in the table chassis and two tubes (a push-pull output) in the B supply and power amplifier. Hence the receiver proper uses eight tubes. Two 281 tubes are used as rectifiers. So well are each independent stage and the group of stages designed that abnormally high amplification prevails. Distant stations "roll in" easily, with volume to spare. The master designer of DX circuits took good care of that!

Build this receiver and the Push-Pull Power Amplifier B supply from the official blueprints.

Send for your free copy of the Builders' Information Sheet today!

BLUEPRINTS!

BUILD the RE29 and the Push-Pull Power Amplifier B Supply from the official blueprints! The price of the blueprint for the 6-tube receiver RE29 (including first audio) is \$1.50. The price of the Push-Pull Power Amplifier B Supply blueprint is \$1.00. All orders filled promptly. Get your FREE copy of the Builders' Information Sheet TODAY!

All Parts in Stock for Receiver and Amplifier.

Estate of R. E. Lacault (Alice Lacault, Adm'trix) 1931 B'way, N. Y. City (65th Street).

- Enclosed please find \$1.50 for which please send at once blueprint of the 6-tube RE29 Receiver.
- Enclosed please find \$1 additional for blueprint of the Push-Pull Power Amplifier B Supply.
- 50c for construction article.
- Please send FREE copy of the Builders' Information Sheet on the complete RE29.

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LACAULT'S BOOK

"Super-Heterodyne Construction and Operation," giving the master's most masterful exposition of the theory, performance and construction of this fascinating type of circuit, is a necessity to every serious radio experimenter. More than 100 pages and more than 50 illustrations. Buckram cover. This book by R. E. Lacault, FREE if you send \$1.00 for an 8-weeks subscription for Radio World. Present subscribers may accept this offer. Subscription will be extended.

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 Just East of B'way

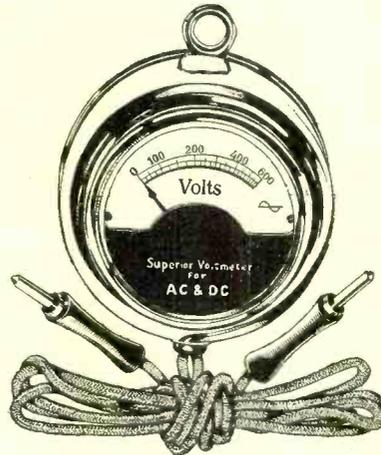
DYNAMIC BAFFLE

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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O-600 V. AC and DC High Resistance Meter

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



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

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

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

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THE CRAFTSMAN Dollar Speaker Filter is guaranteed to relieve speaker of the plate direct current, up to 250 volts. \$1.00 postpaid. Refund if not satisfactory. Attach dollar to This Ad and receive FREE Solid-molded grid-leak, 1 to 3 megohm. Craftsman Radio Products, 351 Halsey St., Newark, N. J.

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HIGH RESISTANCE VOLTMETERS



O-300 V., in portable type, full nickel finish, 30" tipped cord (illustrated at left). (Cat. No. 346) \$4.50

O-500 V., Tests ALL power packs, B eliminators, etc. Same casing as above. (Cat. No. 347) \$5.00
 Just the thing for service men, custom set builders, home experimenters.

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- 0-300 Milliamperes D.C.
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Put a cross in the square next to the meter you desire, and return this slip with one dollar, whereupon we will send you Radio World by mail each week for ten weeks. Present mail subscribers may renew their subscription under this remarkably generous offer by putting a cross in this square.

15c per copy
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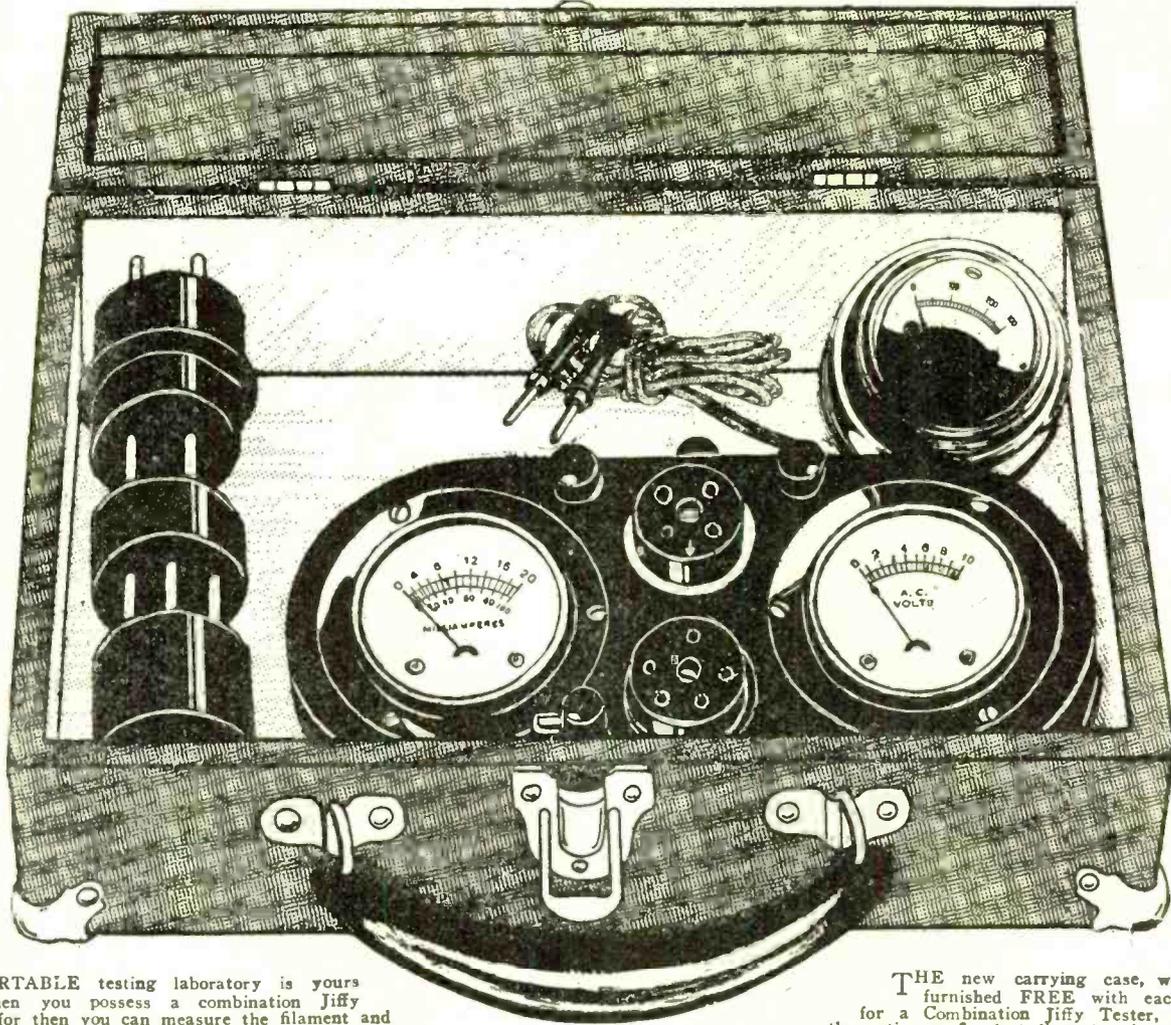
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Published Weekly

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

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



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

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

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

THE new carrying case, which is furnished FREE with each order for a Combination Jiffy Tester, contains the entire outfit, including the three meters, cable and plug, and three adapters (one for 4-prong tubes, two for 199 tubes). This case is 10½ x 7¾ x 3¼" and has nickel corner pieces and protective snap-lock. The case is made of strong wood, with black leatherette overlay.

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

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

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

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

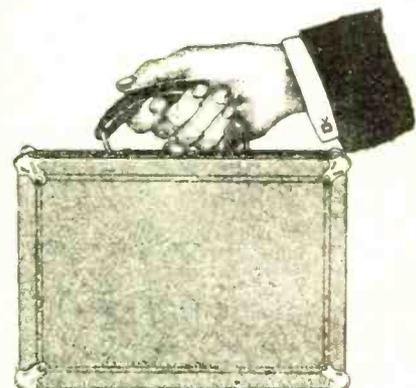
- Please ship at once on 5-day money-back guaranty one "Jiffy 500," at \$14.50, consisting of
 - (1) One Two-in-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
 - (2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with change-over switch. This reads plate current.
 - (3) One 0-500 volts high resistance voltmeter, 99% accurate; with tipped 30" cord to measure B voltages.
 - (4) One 5-prong plug with 30" cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
 - (5) One grid switch to change bias.
 - (6) One 5-prong socket.
 - (7) One 4-prong socket.
 - (8) Two binding posts.
 - (9) One handsome moire metal case.
 - (10) One instruction sheet.
 - (11) One de luxe carrying case.
 - (12) One screen grid special cable.
- If 0-300 DC high resistance 99% accurate voltmeter is preferred to 0-500, put check here. Price is same, \$14.50.
- Same as above, except substitute a 0-600-volt AC and DC high resistance 99% accurate voltmeter (same meter reads both) for the 0-500 DC meter. Price \$15.50.

NAME

ADDRESS

CITY STATE

FIVE-DAY MONEY-BACK GUARANTY



The new de luxe leatherette carrying case is compact and handy. Size 10½" long, 7¾" wide, 3¼" deep.

Choose Your Speaker from This Complete Array!

EXPONENTIAL TYPE HORNS

Modern acoustical science is striving to equal the performance of a large air column horn with powerful unit, while the horn enjoys its rightful popularity with trained experts. The larger the horn, the better, hence we offer two models: one with 7½ ft. tone travel, the other (where space permits) with 10 ft. tone travel. The material used is patented Racon. Nozzle is standard size.



Cat. 200
\$7.50 Net

This horn has a 92-inch air column. No resonance peaks. Front, 18"x18". Depth, 13¼". Weight, 5 lbs.



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



Cat. 300
\$10.50 Net

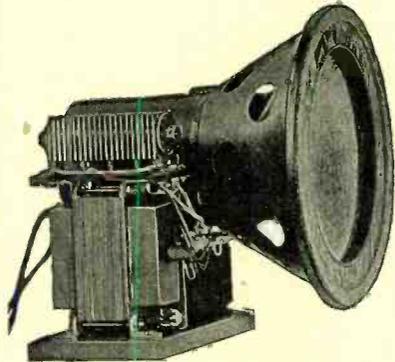
The larger horn is preferable, where space permits. Air column, 120". Front, 18"x18". Depth, 13". Weight, 7 lbs.

DYNAMIC CHASSES and Baffle

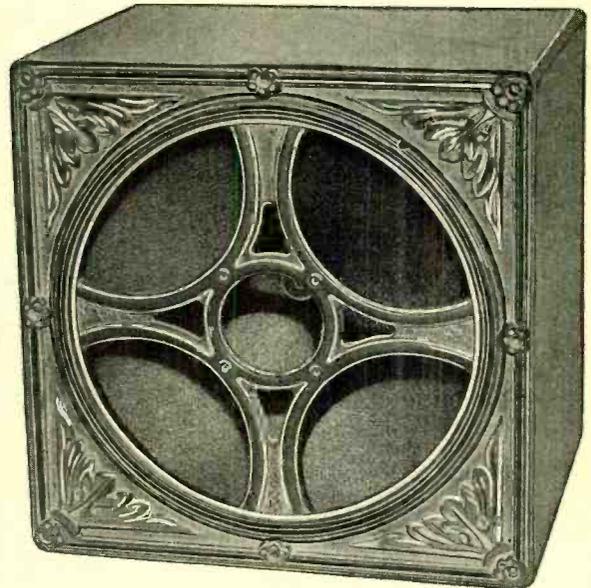
The dynamic speaker is the most popular one by far, and here is your opportunity to get a real fine chassis at a low price. Cat. 110 A.C. operates directly from the 110-volt A.C. (alternating current) lamp socket, to which built-in plug is connected, while the tipped cords go to your receiver output.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

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

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



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



Cat. 113
Price, \$13.50 Net



Cat. 111; Price, \$11.00 Net

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

FILL OUT AND MAIL COUPON

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

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

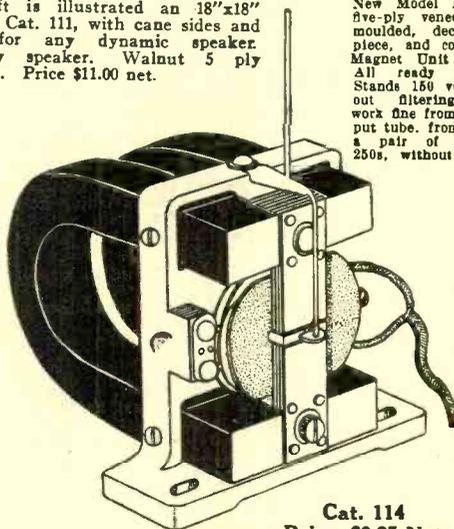
- | | |
|--|---------------------------------------|
| <input type="checkbox"/> Cat. No. 200 | <input type="checkbox"/> Cat. No. 111 |
| <input type="checkbox"/> Cat. 300 | <input type="checkbox"/> Cat. No. 113 |
| <input type="checkbox"/> Cat. No. 110 A.C. | <input type="checkbox"/> Cat. No. 114 |
|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

Name

Address

City State

5-DAY MONEY-BACK GUARANTEE



Cat. 114
Price, \$9.25 Net

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

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



Cat. 115; Price, \$11.50 Net

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