January 12th, 1929 15 Cents

RADIO WORLD

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The First and On'y National Radio Weekly

355th Consecutive Issue—Seventh Year

Quality in AC

Screen Grid Uses

Dynamic Power Supply

Furor Over $500,000 Stock Sold via Air

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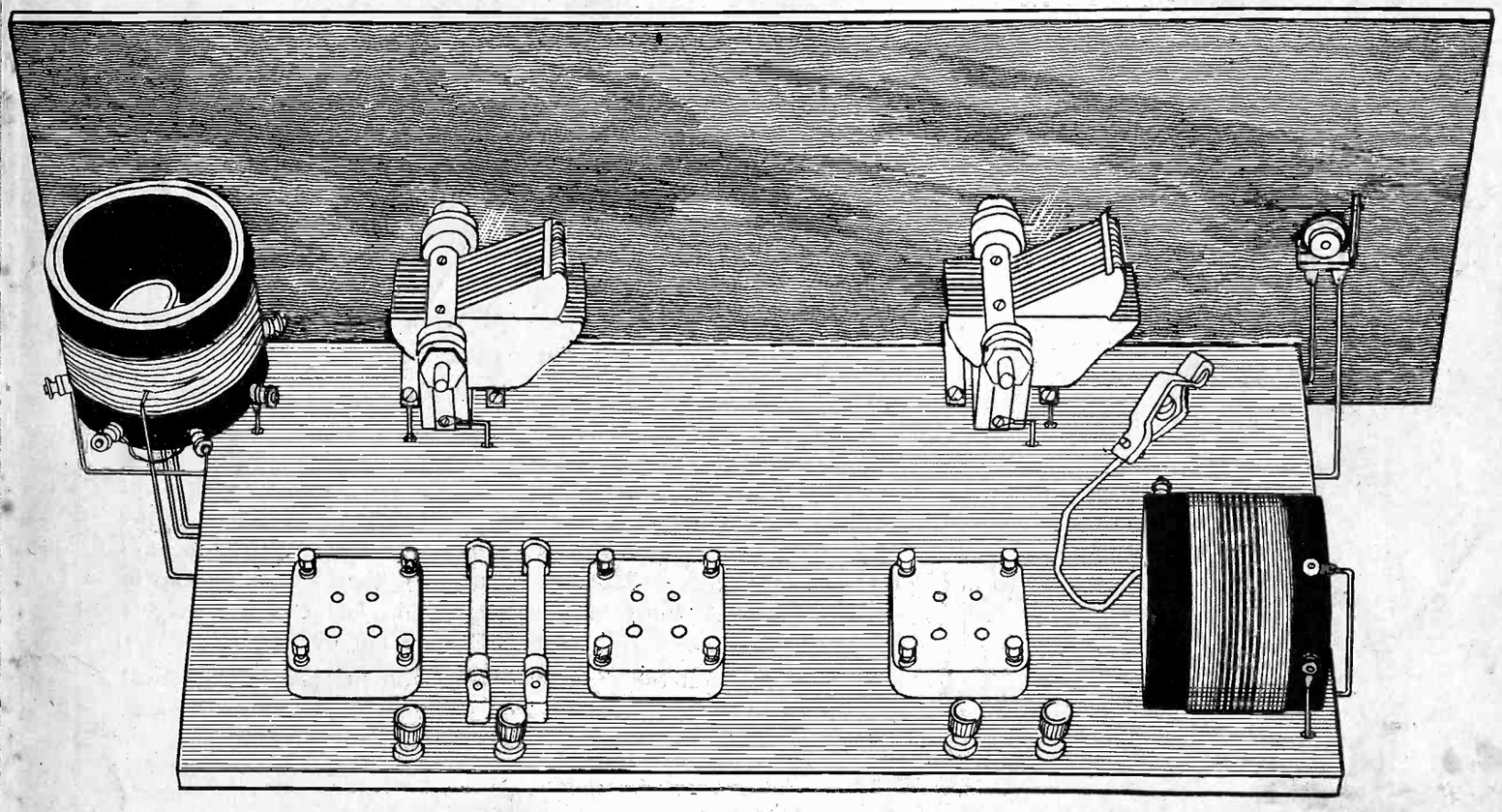


The Economy Three, in Simplified Form, for Broadcast Wavelength Reception. **See page 8**

BLUEPRINT FREE!

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

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

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

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

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

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

Name .....

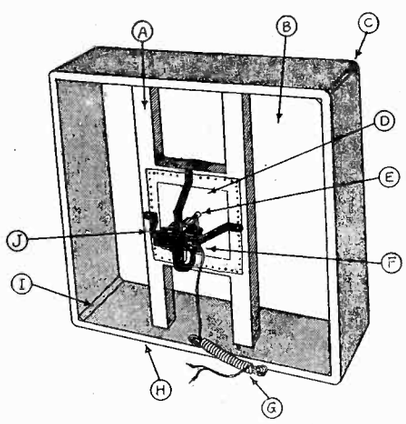
Address .....

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

☐ Renewal.

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

HBH SPEAKER AT $17.00



The HBH Speaker has imported Irish sheer linen front diaphragm for best tone and an HBH unit that is the most sensitive.

FOR unsurpassed tone quality, high sensitivity and rugged construction the HBH Speaker at $17.00 offers the best buy on the market. Those who relish purity of tone want just such a speaker as this. No matter what your audio output is, this speaker will take care of it faithfully and unfailingly.

The construction consists of an upright support (A), imported Irish sheer linen front diaphragm (B), metal-sprayed wooden decorated frame with rounded corners (C), airplane cloth rear diaphragm (D), rigid apex (E), HBH high-sensitivity, non-rattling unit (F), 10-ft. cord (G), 1-inch thick wood all around (H), splice joints (no nails) I, moulded metal bracket (J).

The speaker is shipped in a special "Safe-T" carton, all ready to play.

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

Please ship at once C.O.D. one HBH Speaker for which I will pay $17 plus a little extra for cartage.

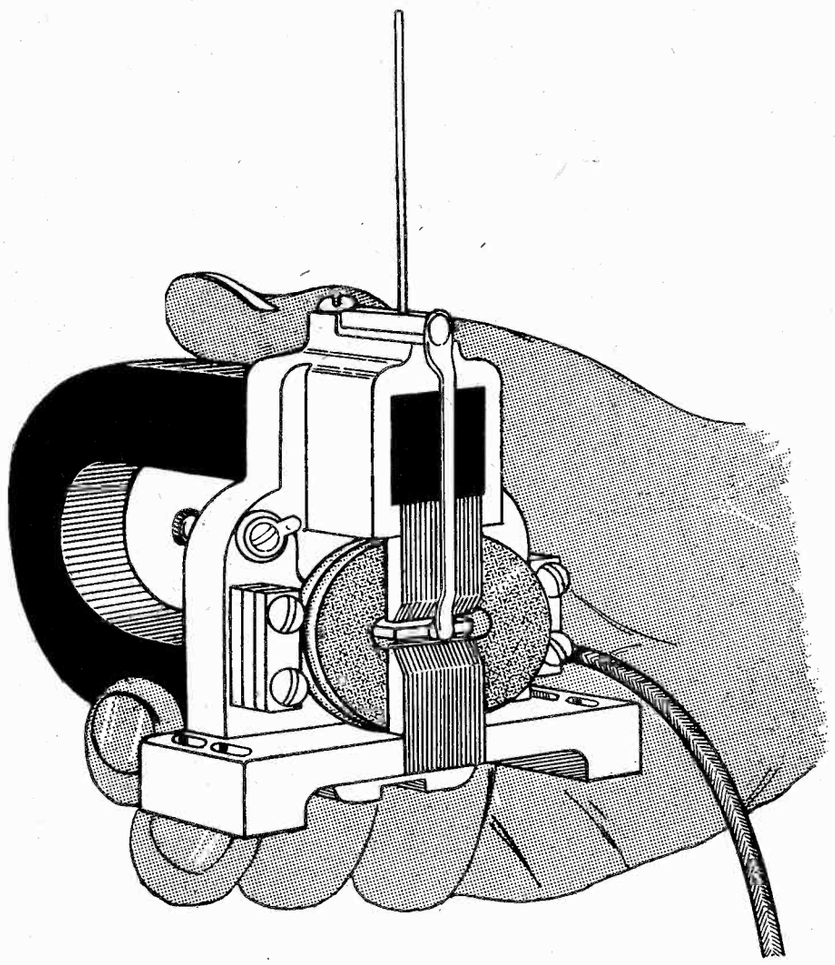
Name .....

Address .....

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

Ten-Day Money Back Guaranty

New HBH Unit
Sets World Standard!



Any degree of volume is kept well in hand by the new HBH loudspeaker unit, for cones, cloth diaphragm speakers, etc. The unit is shown full size.

TWO years' intensive investigation of the minute details of construction that lend superiority to a magnetic type Unit have resulted in the combination of all the known assets into the new HBH unit. The result is something so far superior to anything you have ever heard or dreamt of, that we sum it up in six words: The finest unit in the world. Get one *now*—try it for ten days—money right back if you're not overjoyed!

This unit has won the enthusiastic acclaim of leading acoustical experts. There are eleven secret reasons for its uncanny performance. And now these advantages are yours at last!

Unheard-of Performance at an Unheard-of Price

$5.50 NET

Manufactured Under BBL License

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

Check off proper squares below:

☐ Please find $5.50 enclosed, for which ship AT ONCE on 10-day money-back guarantee one HBH unit with 10-ft. cord.

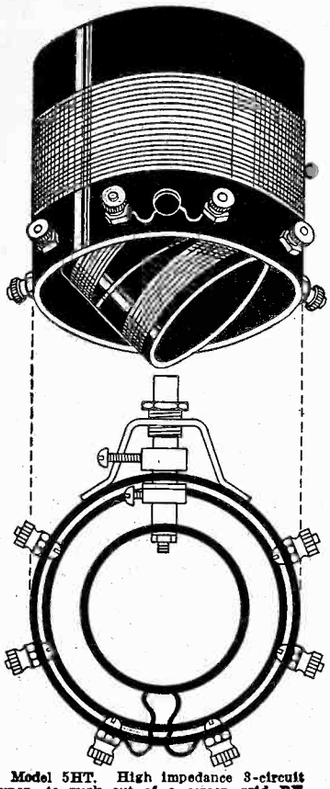
☐ 65c extra for moulded mounting bracket.

NAME.....

ADDRESS.....

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

HOW TO USE SCREEN GRID COILS



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

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

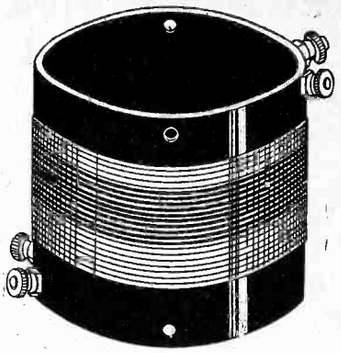
The antenna coil to use in screen grid circuits is 5A or 3A (upper right), because it is so designed as to equalize tuning. The low, almost zero, capacity between grid and filament of the tube is compensated by extra turns of wire, so that if the tube following the screen grid is of another type, for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

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

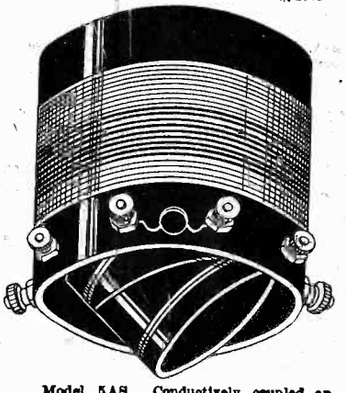
Model 5TPS Interstage coupler to screen grid tubes, with inductive trimmer. For .0005 mfd. $2.25

Model 3TPS, same as above, except it is for .00035.....$2.50

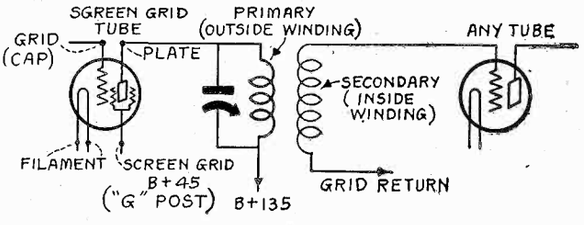
ALL ROTOR COILS HAVE SINGLE HOLE PANEL MOUNTING FIXTURE



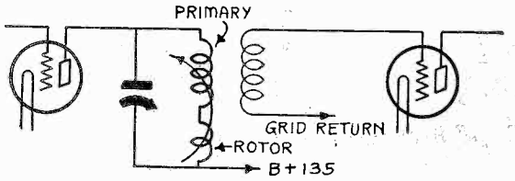
Model 5A. Conductively coupled antenna coil for input to screen grid radio frequency amplifier. For .0005 mfd. condenser. Price $1.75
Model 3A. Same as above, but for .00035 .....$2.00



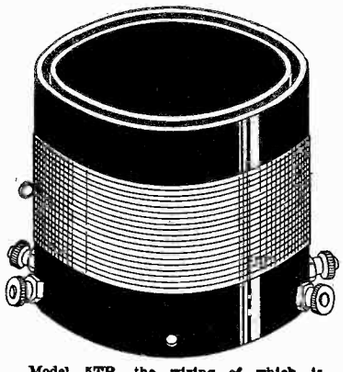
Model 5AS. Conductively coupled antenna coil for single tuning control screen grid sets. Rotor is an inductive trimmer. For .0005 mfd. $2.75
Model 3AS, same as above, but for .00035 .....$3.00



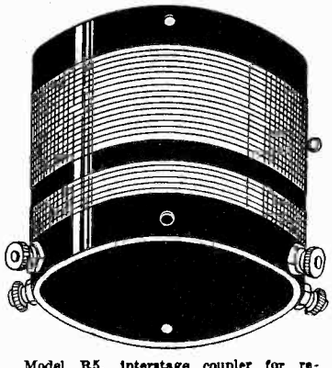
How tuned primary in plate circuit is wired for a screen grid tube This illustrates the use of Model 5TP or 3TP, also Model 5HT and 3HT, except for the rotor coil connections.



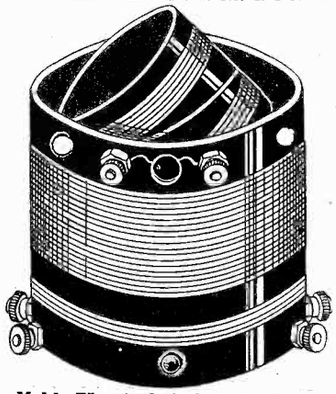
In single control circuits Model 5TPS is used as shown, for interstage coupling. The rotor is an inductive trimmer. The tube at left is a screen grid.



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



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



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

Coils for Other Than Screen Grid Tubes

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

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

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

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

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

USE THIS COUPON

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

(Specify Quantity in the Squares)

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

☐ Model..... ☐ Model..... ☐ Model..... ☐ Model..... ☐ Model.....

Name .....

Address .....

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

SEND NO MONEY!

RADIO WORLD, a weekly paper, published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y. Phone: BRYant 0558 and 0559. 15c per copy, $6 per year. This issue is dated January 12th, 1929, and is Vol. XIV, No. 17. Whole No. 355. Entered as second-class matter, March 1922 at the post office at New York, N. Y.

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RADIO WORLD

Latest News and Circuits
Technical Accuracy Second to None

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

Big Haul by Stock Sellers Who Advertised Over Air

NETWORKS WIN PUBLIC HEART, EXPERT FINDS

By Frank A. Arnold

Director of Development, National Broadcasting Company

Radio is the greatest factor from the outside that is today entering the American home.

Twelve million homes in the United States are at this moment supplied with radio receiving sets, sufficiently modern and up-to-date to acceptably receive universal broadcasts. This constitutes the largest potential audience in the world.

No longer is there a promiscuous turning of the dial with a hodgepodge of results, but more and more certain worthwhile programs are looked forward to and heard regularly, and plans for these broadcasts are made in much the same way that one anticipates attending some great musical or dramatic event.

Acceptance of Chains

I see everywhere a growing acceptance of network broadcasting, bringing, as it does, the world's choicest programs within easy geographical reach of the individual set, no matter where located. There is also a marked tendency toward an appreciation on the part of this huge audience of better programs—programs that in quality and performance approximate the best.

There is a marked appreciation on the part of the unseen audience for the sponsored program. The universal appreciation is undoubtedly due in large measure to the high-grade programs that are furnished.

An Important Trend

This is a very important trend in radio broadcasting and makes possible in its final results a wider expansion in the field of development, and increasing better programs.

Speaking broadly, the tendencies of broadcasting are toward a favorable consideration of all the elements that enter into giving the best, most intelligent, and most widely distributed service possible. It is very likely that many changes and modifications will take place during the ensuing months—probably as many if not more than in the twelve months just past.

Inspiring Tribute Is Paid to Radio

A listener wrote to the National Broadcasting Company expressing the general character of radio in the following apostrophized names:

"I am a gift from the world's laboratories. I am a fruit of the patience and wisdom of the scientist. I emanate from centers of refinement. I travel in the skies, over rivers and mountains. I reach the lonely, the sick and those who long for uplift. I bring them good cheer, education and recreation. I am the world's newest form of entertainment, its most modern method of communication, its greatest medium for unifying and uplifting forces, I am Radio."

SHORT WAVE DECISION MADE

Washington.

The Federal Radio Commission, after more than a year of study of the short-wave allocation problem, has announced its decision allocating the channels available between 1,500 and 6,000 kilocycles.

Channels have been assigned for Federal, marine, commercial and press service, for geophysical exploration, aviation, railroads, amateurs, visual radio and experimental work.

The total number of channels available in the band is 639. Of these the Commission allocated 551. The assignment of the remaining channels will be discussed with Canada and other nations in North America.

KVL and KGA Cited for Wave Deviation

Washington.

KVL, of Seattle, Wash., and KGA, of Spokane, Wash., have been cited for being off their assigned frequencies by more than 500 cycles. The following telegram was sent to both stations:

"According to information received by the Commission your station has been repeatedly deviating from assigned frequency more than one-half kilocycle in violation of General Order 7. The Commission has therefore set your pending application for renewal of your existing license for hearing. Notice of date and place for hearing being mailed."

Scooped in Listeners' Money by Armful While Come-on Talk Flowed Over WABC, WGCP, WAAT, WMAK and Other Stations—$500,000 in Two Cities Alone—Investment Co. and Selling Agents' Offices Raided, Directors Held.

Essex County (N. J.) officials raided the offices of the Financial Investment Corporation and the Universal Finance Corporation, both of Newark, N. J., who sold more than $500,000 stock by talks from radio stations.

The Financial Investment Corporation was the operating company, stock for which was sold by the Universal Finance Corporation, through broadcast appeals sent over WABC, New York City; WGCP and WAAT, Newark, N. J.; WMAK, Rochester, N. Y., and a Buffalo station.

The Universal Finance Corporation bought time on the air from these stations. Speakers broadcast offers of stock in the Financial Investment Corporation at $10 a share, with the "teaser" that the price would be advanced on a certain date, but those sending in their money "now" would get the shares at the old price.

Still More Inducement

As an extra inducement listeners were told that the Universal Finance Corporation was in the banking and loan business, described as "the most profitable business in the world today."

"Dale Davis," speaking over a Jersey station, asked listeners:

"Why be content with 4½ per cent. interest from a savings bank, or 5 or 6 per cent. or a little more from ordinary stock, when you can invest soundly in the banking and loan business and obtain larger and just-as-safe revenue?"

He said some investments in banking, trust company and loan company stock had paid 300 and 400 per cent., and that 18 per cent. on one's original investment was not uncommon. He proudly referred to the dividend-paying aspect of the stock he was selling, and hinted at a nice, juicy dividend just in the offing.

False Inducements Charged

The raid on the offices of the two joint companies resulted from disclosures made by the Davis Legislative Committee, investigating small loan companies in New Jersey. The committee is authorized by the State of New Jersey to conduct the inquiry.

A receiver is asked for the companies, also an injunction to prevent them from doing business on the ground that usuri-

Sellers Used Fake Names

MADE SPECIAL PLEA TO TEASE AWAY SAVINGS

Scoffed at 4½ Per Cent on Deposit Money, Pointing to 18 Per Cent as "Not Unusual" from Bank and Loan Company Stock (Like Theirs)—Paid Dividends Out of Capital, Instead of Out of Earnings, is Charge — Jersey Orders Facts Submitted to Radio Commission.

ous interest rates were charged to borrowers by the Financial Investment Corporation, while stock in this corporation was sold under false pretenses by the Universal Finance Corporation.

Richard C. Plumer, special assistant to the New Jersey Attorney General, charged that dividends from stock were paid from capital invested, instead of from earnings, profits or surplus, and that the advertising of these "dividends" was used to stimulate the sale of more stock.

The books and papers of the two concerns were seized by the raiders. Three officers of the Financial Investment Corporation (operating company) were placed under civil arrest and released on $10,000 bond each. They were:

Alexander Edwards, president; Walter O. Cawthorne, treasurer, and Charles Perry, secretary.

Besides, directors of the Universal Finance Corporation (the selling agency of the other) were held in $2,500 bond each. They were: Dale Davis Hollenbaugh, D. T. Evans and Elmer Hardy.

Hollenbaugh broadcast the glib come-on talks under the name of "Dale Davis."

State Stationery Used

Evans, as security examiner for the New Jersey Attorney General's office, is said to have indorsed the integrity of the Universal Finance Corporation, on stationery of the Attorney General's office, these letters being addressed principally to radio stations, before whom was the question of the propriety of permitting the stock sellers to broadcast their sales promotion talks. Evans has since resigned his State position.

Hardy was manager of the Universal Finance Corporation.

Hollenbaugh was only one of several who spoke over the radio under other than their own full names. "Dale Davis" is his given name and "Hollenbaugh" his real family name. But others—"Mr. Gordon," "Mr. Carter" and "Mr. Allen," for instance,—are said to have used names wholly fictitious and in no away even remotely resembling their own names.

The committee brought out that the Universal Finance Corporation paid out $3,684.95 in dividends, while it earned $1,510.65, basing this on what the books revealed and witnesses stated.

D. Frederick Burnett, counsel for the committee, said that the Universal Finance Corporation had received about $500,000 from investors in Buffalo and Newark. Much of the stock was sold in one, two and three-share blocks, and, as it represented $10, $20 and $30, is said to have come from persons of very small means.

When word first came out that the two corporations were under investigation, the office of Joseph L. Smith, Essex County Prosecutor, was stormed by persons who said they had invested money on the strength of the broadcast sales talk.

Confidence Shaken

They cited the confidence they had in the radio stations that nothing except the highest type of investment would be permitted to be offered over the air. Also some of the stations that ask listeners to write to them direct on how they enjoy programs, heard from investors in a manner other than complimentary.

The sales talk put on the air three times a week by the stock-selling corporation was just that. No music, no features, no specialties. Nothing but talk constituted the program. The talk took only twelve minutes, thus showing economy in one direction, as music would have run into money.

The committee instructed Mr. Burnett, its counsel, to lay all the facts before the Federal Radio Commission, so that the Commission may decide whether the stock sellers were properly investigated before the pockets of the stations' listeners were turned over to the stock sellers. If the stations were lax they may suffer penalty. On behalf of some of the stations it was said that the O. K. of the State Attorney General's office was deemed by them sufficient, for they did not know, until too late, that the Attorney General, Edward L. Katzenbach, was unaware that Evans had used office stationery, or any other, to aid the stock sellers.

Stations' Side

When shown the reports from the committee, Arthur S. Clark, manager of WABC, made the following explanation regarding the programs of the Universal Finance Corporation:

"When the feature was first considered we investigated it and also asked the Better Business Bureau to look over the printed material. But if another examination shows us that there is anything about the program or sponsor which is not in keeping with the reputation of WABC we will drop the account immediately."

Joseph Goustin, manager of WAAT, said he investigated the Financial Investment Corporation before permitting the talks to go on the air and found nothing wrong.

Class Licenses Get Month's Extension

Washington.

The Federal Radio Commission has extended until January 31st all existing communication licenses which were to have expired December 31st, 1928. These licenses wereg ranted by the Department of Commerce before the creation of the Commission but have been continued in force by that body. The order covers all coastal, point-to-point, ship and experimental transmitting stations. The extension of time was merely for public convenience and the Commission reserved the right to change frequency assignments at any time.

WEATHER TOLD BY MEASURE OF RADIO SIGNALS

Dr. Robert Cameron Colwell, professor of Physics at West Virginia University in a paper on "Weather forecasting by the Intensity of Radio Signals," read before the American Physical Society at a meeting in Columbia University, New York City, showed that more precise weather forecasts may be made by observing radio reception than by the old method of observing barometric pressure, wind intensities and directions and temperatures.

"In April, 1927," Dr. Colwell said, "observations made with a Shaw recorder at Morgantown, W. Va., showed that in some cases the night signals from KDKA at Pittsburgh were below the days signals in intensity. A short time later it was noticed that a falling intensity after sunset is followed by clearing weather the next day, while a rising curve indicates cloudiness or rain.

Took Forty Curves

"On this basis weather prognostications were made from forty curves taken during the past autumn. Thirty-eight of these were correct, the percentage of correctness being 95. The weather forecast as published in the evening newspaper from the Weather Bureau was correct for twenty-eight days, or 70 per cent."

Dr. Colwell emphasized that forecasts were for Morgantown only, while the Weather Bureau forecasts covered the entire State, but added that the observations covered the months of September, October and November, and thus indicated validity over a wide range of weather and temperature conditions.

First Accurate Record

This is not the first time that the propagation of radio waves has been associated with weather conditions but it is probably the first time that accurate records of the relationship between radio reception and weather have been kept over such an extended period with the view of predicting future atmospheric conditions. Considerable work has been done in predicting weather by the changes in the intensity and frequency of occurrence of static and atmospheric discharges. Dr. Colwell's observations were on continuous waves transmitted by a broadcasting station.

Westerlund Joins Polymet

Geo. E. Westerlund, until recently purchasing agent of the Charles Freshman Co., Inc., now heads the purchasing department of the Polymet Manufacturing Corporation, makers of Polymet fixed condensers and resistances.

Mr. Westerlund was with the New York Edison Company in a designing and testing capacity. He just returned from a four-month tour of Europe. Mr. Westerlund's office is at 599 Broadway, New York City.

NEW ANNOUNCER AT WBAL

Baltimore.

Harris E. Kirk, Jr., a graduate of Johns Hopkins University, has been added to WBAL's announcers.

DX SETS AID IN HUNT FOR BEST OF ANNONCERS

Fifty eminent judges of spoken English have begun the task of weighing the talents of the 1,500 radio announcers in the country. This aural inspection is being made in connection with the gold medal to be awarded in April by the American Academy of Arts and Letters to the announcer with pre-eminence in diction. In some instances distance-getting receivers aid the judges.

George Engles, of the National Broadcasting Company, said:

"Every effort will be made to bring stations in distant parts of the country within range of the judges so that announcers in smaller communities may have as fair consideration as those in large metropolises.

May Go to An "Unknown"

"It is entirely possible that the medal may go to a comparatively unknown announcer associated with a minor station. Personal popularity does not enter into this competition. Only excellence in diction, quality of tone and cultural effect are considered.

"Announcers will not know when they are being heard by the judges. Their routine hour-by-hour speaking is just as likely to represent the deciding test as their effect on some special elaborate program.

"As has been previously announced, the judges are the entire fifty members of the American Academy. Their examination of announcers is now under way and will continue until the last day of March. The award will be publicly made April 23d in connection with the twenty-fifth anniversary of the Academy."

Meets Broadcasters' Goal

Engles said the decision of the Academy to award the medal represents what the various broadcasting companies have been trying to achieve.

"The broadcasting companies are well aware of the tremendous influence announcers can exert," said Engles. "The broadcasters for some time have been trying to raise the level, so that every announcer can be looked to by the public as a model of correct diction, pronunciation and culture.

"Announcing nowadays is a highly specialized art. Recently the National Broadcasting Company has made it a requirement that its announcers be college men. They are also required to know some French, German, Italian and Spanish, since names and phrases in these languages frequently occur in announcements.

The Five Qualifications

"The five qualifications considered by the American Academy judges are the same as those considered when the would-be announcer is examined for employment at the studios of the National Broadcast Company—pronunciation, articulation, quality of tone, accent and general cultural effect.

"It undoubtedly will be a long time before nation-wide perfection of radio announcing is achieved. But with the awakening of the companies to the value of good announcing, the standard has of late been rising rapidly.

"Each year better men are being attracted to the profession. The emphasis which the action of the **Academy places** on announcing is a symbol of the attitude which the broadcasting companies themselves are taking toward this art."

Columbia Buys WABC as Sole Key

The board of directors of the Columbia Broadcasting System has approved the purchase of WABC, New York, to act as the sole key station of the Columbia System after September. At that time WOR, Newark, acting as alternate key station, will drop out of the system and will operate independently.

Since January 6th at 9 P. M. the Columbia system has included forty-seven stations.

WABC has just opened a new 5,000-watt transmitter in the heart of Jamaica Bay, Long Island. This location was selected after a long series of tests to find the most suitable place. The location approaches the ideal in that it is five miles from centers of population and is on flat, marshy ground, where radiation will be excellent.

The new location materially increased the service range of WABC.

The main 5,000-watt transmitter, together with a 500-watt emergency set and short-wave set 2XE, is housed in a modern fireproof building. Two 165-foot steel lattice towers support a four-wire antenna.

COAST-TO-COAST PROGRAM FEAT

The most intricate radio program in history will be broadcast from Coast to Coast by the National Broadcasting Company on January 12th. A nation-wide radio dedication will be made of the new $14,000,000 tunnel through the Cascade Mountains east of Seattle, Wash., for which President Coolidge blasted the final hole by pressing a golden key.

Engineers of the N. B. C. will pay their tribute to master builders by switching a radio audience from New York studios to San Francisco and Washington, and to mountain points between—all synchronized with the running time of the Oriental Limited, on its maiden trip through the eight-mile shaft.

The voice of Mme. Schumann-Heink on the Pacific Coast, George Olsen and his music in New York, and world-famous figures in politics, engineering and industry at Washington, New York and at the tunnel's mouth in the Cascades, will be heard.

Stop watches will be synchronized with electric clocks on the Atlantic and Pacific Coasts, adjusted to the second with the clocks that govern the operation of the Oriental Limited.

The program will go on the air at 9 p. m., Eastern Standard Time; 8, Central Standard Time; 7, Mountain Standard Time; 6, Pacific Standard Time.

The thirty-seven stations to carry the program will be: WEAF, New York; WEEI, Boston; WTIC, Hartford; WJAR, Providence; WCSH, Portland, WFI, Philadelphia; WRC, Washington; WGY, Schenectady; WGR, Buffalo; WCAE, Pittsburgh; WTAM, Cleveland; WWJ, Detroit; KSD, St. Louis WHO, Des Moines; WOW, Omaha; WDAF, Kansas City; KSTP, St. Paul-Minneapolis; WTMJ, Milwaukee; KOA, Denver; WHAS, Louisville; WMC, Memphis WSB, Atlanta; WBT, Charlotte; KVOO Tulsa WFAA, Dallas; KPRC, Houston; WOAI, San Antonio; KSL, Salt Lake City; WEBC, Duluth-Superior; KPO and KGO, San Francisco; KGW, Portland; KFI, Philadelphia; KOMO, Seattle; KHQ, Spokane; KYW, Chicago.

MESSAGE FIRM OBTAINS FORTY SHORT WAVES

Washington.

One of the surprises of the short wave allocations by the Federal Radio Commission was the granting of forty short-wave channels to the Universal Wireless Corporation of Buffalo. These channels are to be used for message service between various American cities in competition with existing telegraph companies.

The assignment of these channels to the Universal Corporation was made after the corporation had pledged itself to construct ten stations in as many cities before December 31st, 1929, and three stations a month thereafter until 110 stations in 110 cities are in operation by December 31st, 1931.

Conditions Imposed

The Universal Corporation, according to the Commission, "must operate and keep in order the finest equipment and the most accurate frequency controlling apparatus available. The communication systems of this company must communicate and co-operate with stations authorized to operate on frequencies assigned to agricultural, fire, police and air field communications services."

Commissioner Harold A. Lafount, who advocated the making of the assignments, said that after having made a study of the communication field, he was convinced that "the Universal Wireless Corporation is financially able and technically equipped to use the radio channels in such a way as to provide the greatest possible public service to the largest number of people situated in almost every State in the Union."

Assignments to Come

The Commission has not yet decided which frequencies will be assigned to the Universal Corporation, but the engineers of the Commission are working on the details.

Reallocation Effective In Europe To-morrow

London.

The Plan de Bruxelles, framed by the technical committee of the Union Internationale Radiophonie, goes into effect January 13th.

This plan is an allocation of the broadcast channels to the nations of Europe, designed to eliminate interference caused by the simultaneous use of the same frequency by two or more European broadcast stations, and to improve radio reception generally.

Radio's Speed Saves Wait of Three Hours

Los Angeles.

Seymour Johnson, of KFI, has estimated that if radio waves traveled at the same speed as sound waves, a word spoken in New York would be heard on the Pacific Coast exactly three hours and sixteen minutes later.

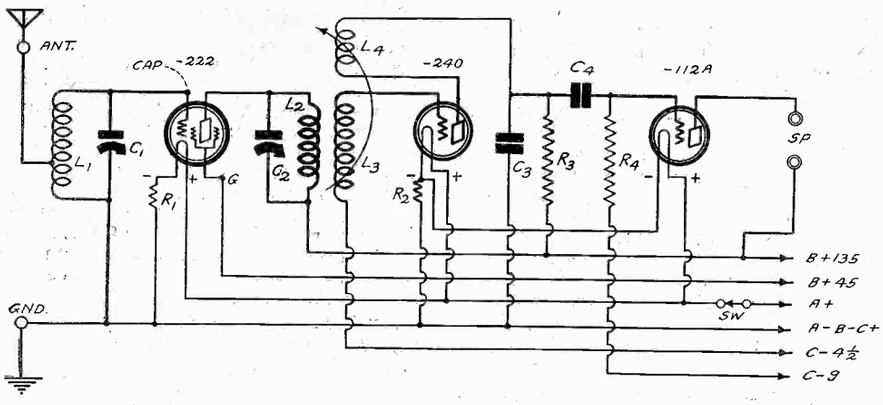
As it is, no perceptible time elapses between the time a word is spoken and the time it is heard on the Coast.

Simplest Speaker Set

The Economy Three for Broadcast Wavelengths Alone

By Captain Peter V. O'Rourke

Contributing Editor



FOR loudspeaker operation on three tubes we must choose a tuner for detector, with two stages of audio, or a stage of radio frequency amplification, a tuner detector stage and one stage of audio. The reflex is not included in the choice, since instability and distortion characterize it.

The Economy Three is shown as a TRF, detector and single audio stage, using a screen grid tube for RF, since the two tuned stages and regenerative detector are needed for selectivity. Only the broadcast band is to be tuned in, hence switching arrangements in a previous model, affording some short wave reception, are omitted.

The screen grid tube is followed by a high mu negative grid bias detector. This permits operation of the 112A power tube without detector overloading.

Why It Works Speaker

The fact that speaker reception is obtained is due to the high amplification obtained from the screen grid tube by tuning the primary in the plate circuit and to the use of a high mu detector with a rather large resistive load (.25 meg.). The amplification is as great on a resistance coupled stage used this way as in a transformer coupled stage used in the conventional manner. The tone is excellent indeed, in fact, cannot be excelled in the present state of the art, due to absence of distortion caused by coupling media.

The direct or conductive method of antenna coupling is used, for largest signal strength. The antenna coil used was a screen grid coil, model 5A, which has four terminal binding posts on it. The winding is continuous. Therefore connect either end of the winding to the ground, the other end to grid, while antenna is connected to either of the two remaining posts, depending on which one gives dial readings closer to the readings of the detector dial. Hence one post of the coil is left unconnected.

Coil Data

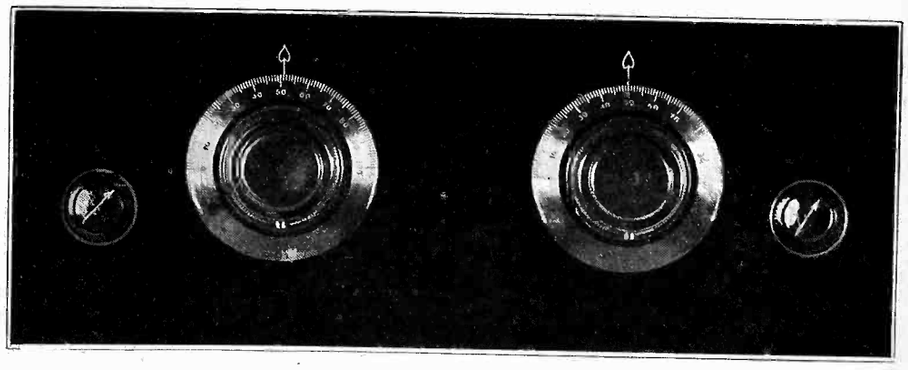
If the constructor desires to wind his own coils he may wind 60 turns of No. 24 single silk wire on a 2½ inch diameter tubing and tap at the 14th and 30th turns. Usually the best results are obtained with the ground connected to the post (14) turns away from the aerial connection. The tuner may consist of 48 turns on a 2½ inch diameter and 30 turns on a 2 inch diameter. The same size wire is used. The smaller coil is secured inside the other. The tickler has 38 turns on a 1¼ inch diameter, using any small sized insulated wire. The 30 turns as the secondary constitute adequate coupling and keep dial readings more nearly alike. Also, selectivity is improved.

How Circuit Works

The circuit is selective, stable in operation, and productive of moderate speaker volume. The tickler is the volume control. The circuit is especially desirable for those desiring to get speaker reception of stations not more than 250 miles away. Greater distance does not come in loud enough to work a speaker well, but can be heard plainly on earphones.

LIST OF PARTS

L1—One conductively coupled antenna coil (continuous winding). Screen Grid Coil Model 5A for .0005 mfd.
L2, L3, L4—One high impedance tuner. Screen Grid Coil Model 5HT for .0005 mfd.
C1, C2—Two Hammarlund Midline tuning condensers, .0005 mfd.
R1—One 622 Amperite with mount.
R2—One 112 Amperite with mount.
C3—One Aerovox mica fixed condenser, .0005 mfd.
C4—One Aerovox mica fixed condenser, .01 mfd.
R3—One Lynch .25 meg. metalized fixed resistor with mount.
R4—One Lynch 5 meg. metalized fixed resistor with mount.
Ant., Gnd., Sp.—four binding posts.
SW—One switch.
Two dials.
One 7x18 inch front panel.
One 7x16 inch subpanel.
Two dial pointers.
One 8-lead battery cable.
Two knobs (one for tickler, one for switch, so they match).
One Peewee clip for screen grid tube cap.
Three sockets.



Listener Lets Station Fill in Check Amount

Chicago.

A listener in Blunt, South Dakota, mailed to WBBM in a signed check with the amount left blank, requesting one of the WBBM radio logs in return.

Hammarlund Junior Shield

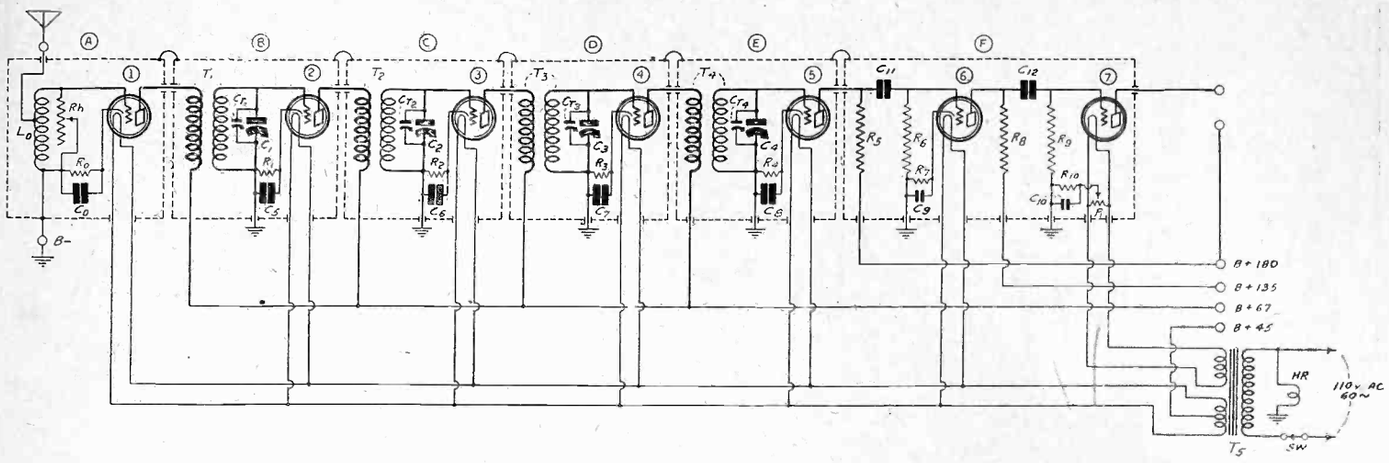
For those particular about their shielding the Hammarlund Junior Shield will fill the bill. This shield, Code A-S-1, is the same as the A-S-29 designed for the Hammarlund-Roberts "Hi-Q 29" Master Model, except for its inside measurements, which are 6x7x6" high. The Junior Shield is used in the Hammarlund-Roberts "Hi-Q" 29 Junior Model because of the perfect contact between sections. This Junior Shield is equally efficient in all types of receivers and is highly recommended by experts for use in precision laboratory apparatus such as oscillators, wavemeters, vacuum-tube voltmeters, etc. Those desiring the full list of precision Hammarlund parts should write at once to the Hammarlund Manufacturing Co., Inc., 424 West 33rd Street, New York City. Mention RADIO WORLD.—J. H. C.

A THOUGHT FOR THE WEEK

IF all the stations got the wavelengths and channels they want and if all radio listeners-in got exactly the kind of programs they want—and if everybody were happy—wouldn't life be just a little bit too easy and sugary? Where there's contention there's activity, anyway.

Coupling in AC Sets

How to Eliminate Disastrous Effects in Modern Receiver



DESIGN OF AN AC RECEIVER, LESS B ELIMINATOR, SHOWING THE USE OF INDIVIDUAL TRIMMERS.

THE use of heater tubes in tuned multi-stage circuits has not been investigated to the extent of direct current tubes of the three electrode type. There are many reasons why the heater tubes should be more successful in this respect. It is true that these tubes have practically the same characteristics as the O1A type tubes as regards amplification and coupling between the plate and the grid.

But there is not the same coupling through the cathodes, that is the filaments. In the DC tubes the cathodes, or filaments, are connected to the same source of voltage, and this source and the leads constitute a considerable coupling between stages which contributes greatly to the feed back which causes oscillation. In the heater type tube there is no such coupling between the cathodes, for each tube has its own cathode which is entirely independent of the cathodes of the other similar tubes.

The fact that the several heater tubes are heated by the same transformer does not increase the coupling. It decreases it if anything.

Thus one source of coupling between tubes has been eliminated. Now if each stage, with tube and associated tuning devices and grid resistors, be placed in a separate shield with thick enough walls not only to eliminate electric but magnetic coupling, one of the main sources of interstage coupling is eliminated. This is very easily done now when very good shielding cans of aluminum are available.

Further Isolation

In AC circuits, as well as in DC circuits, it is customary to use the same source of grid bias for several tubes. This is not in the interest of reduction of interstage coupling. Hence individual sources of grid bias should be used. This is possible by the use of individual grid bias resistors in the various tubes, each placed between the cathode and the negative side of the plate voltage supply line.

If there is any common coupling in the plate circuit this will be reflected in the grid bias resistors so that the use of even individual resistors is no guarantee of elimination of all coupling. But individual grid bias resistors is a step in the right direction. In some of the radio stages it is not necessary to use any bias. Whenever it can be omitted it should be done in order to minimize common coupling. In case the volume level is such that bias is necessary each resistor should be by-passed by a large condenser, as has been done in the multi-stage circuit shown herewith. The larger the condenser the better will it prevent coupling. Certainly, it should never be smaller than .001 mfd. in a radio stage.

The coupling in the plate circuit cannot be avoided by using individual sources of plate voltage, because it would be unpractical. But there are methods of reducing this coupling. An RF choke may be put in each plate circuit. If this is used it should be by-passed by a condenser at least .001 mfd. This choke should be placed in the shield can with the primary winding with which it is connected. The condenser also should be put in the can, and it should be connected from the junction of the choke and the primary to ground or to the shield. These chokes are not shown in the drawing.

Common By-Pass

Whether or not individual filters are used a large common by-pass condenser should be connected from ground to the plate voltage tap which serves the tubes, that is the 67 volt tap in the drawing. It should be not smaller than 1 mfd. Even this condenser has an impedance of .29 ohm at 550 kilocycles, which constitutes a considerable coupling when there is high amplification in the circuit. Therefore it is well to use a much larger condenser.

We have not yet said anything about the main source of coupling between the plate of a tube and its grid, that is the capacity between the grid and the plate. This cannot be eliminated by chokes or condensers. But it can be neutralized by methods well known. The simplest method is that which employs a small condenser between the grids of two adjacent tubes. The capacity of this condenser is adjusted to the same value as the effective capacity between the grid and the plate of the tube neutralized, or a little larger.

If there are more than three tuned stages it may be that this method will not be effective. In that event grid suppressors may be resorted to, which are resistors in the grid circuits having values of about 1,000 ohms. They should not be larger than absolutely necessary to stop oscillation. But all the other methods of reducing coupling mentioned before should be exploited to the limit before this method is used.

Four Tuned Circuits

It will be observed that the circuit in Fig. 1 contains four tuned circuits, all of which are interior. The input to the first tube is not tuned. The input impedance is simply a radio frequency choke coil. A variable resistor is connected across this coil for varying the volume. This is about the only practical volume control in an AC set. An alternative method is to put a high variable resistor in the plate circuit of one or more of the tubes. But not two tubes should be put on the same resistor. This would spoil the isolation of the stages.

Floyd Neale a Hit as WEAF Announcer

Floyd Neale has been added to the staff of National Broadcasting Company announcers. Mr. Neale is assigned to WEAF and his announcements of the Hoover Sentinels', the Contraltones and Dolores Cassinelli and Los Sevillanos, as well as of other chain features, are now well known to the country-wide radio audience.


FLOYD NEALE

Mr. Neale left WGBS, where he was chief announcer and studio director, to go with WEAF, about the time Aloys Havrilla left WEAF to join the Judson Program organization as announced to be "hired out."

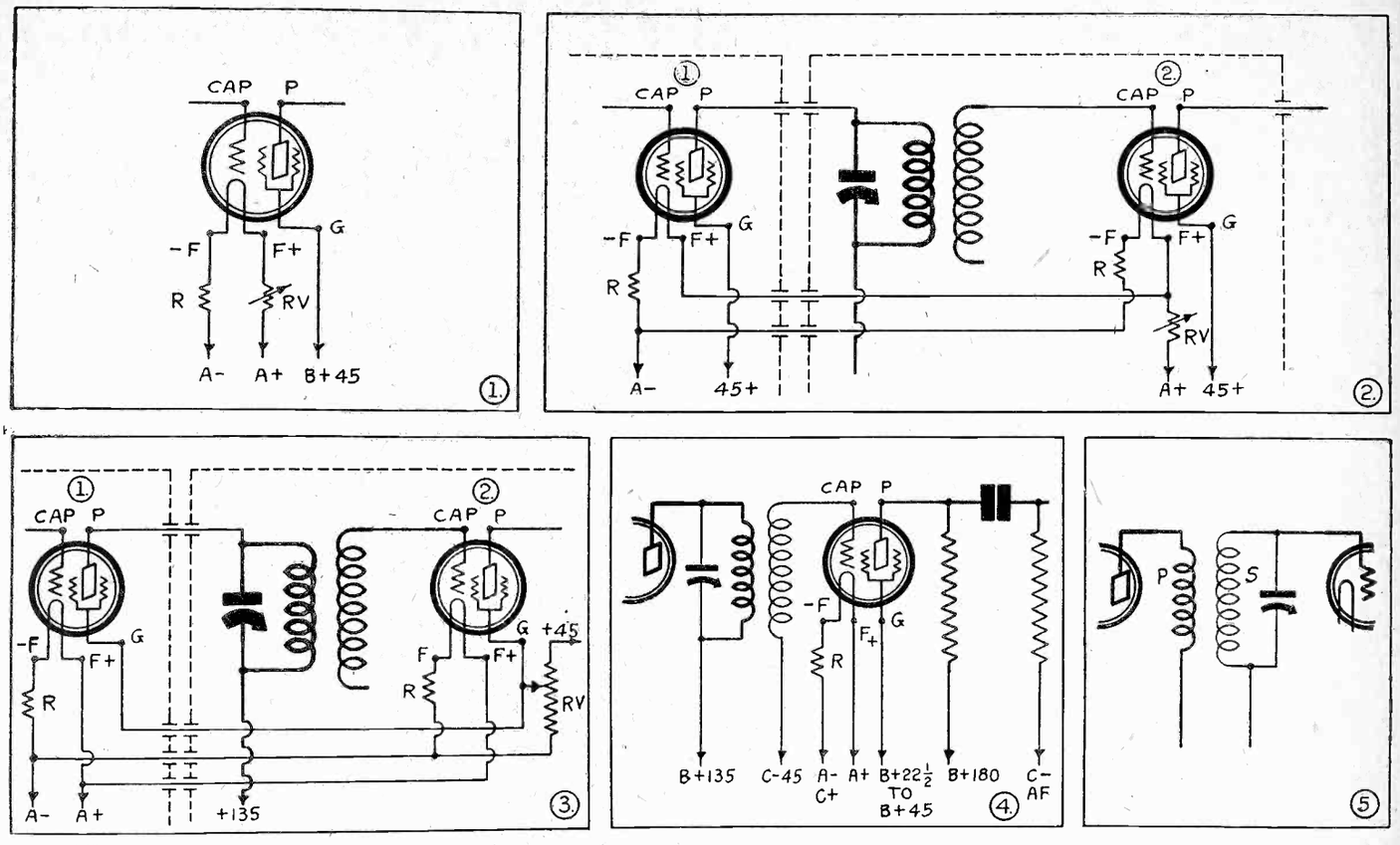
Mr. Neale, a Harvard graduate, made a notable success of his work with the Gimbel Bros. station. Shortly after he had made arrangements to transfer his activities WGBS was sold to other interests. But the N.B.C. had noted his excellent work and obtained his services at the first opportunity.

Mr. Neale has devoted his life to welfare work and musical organization. In the social service field he ranks as an expert, no less than in the musical and elocutional fields. He is a gifted pianist and an authority on musical lore.

His voice is utterly distinctive, possessing rich inflection and musical intonation. His diction is scholarly, but without being a bit stiff. Spontaneity and a fluent "twinkle" in his voice endow him with the knack of turning a tight moment into a flash of easy grace.

His work at WEAF has carried his rare speaking voice over the continent many times during the short period of his attachment at that station, and sponsors of programs have been no less alert to his fine gifts of poise, voice and expression than has his admiring public.

A Clinical Study of S



FIVE DIFFERENT MODIFICATIONS OF SCREEN GRID TUBE USE ARE SHOWN IN THE DIAGRAMS.

Fig. 1.—A variable filament resistor RV is a good volume control for a single stage.
Fig. 2—Where two screen grid tubes are used the filament resistor is a poor volume control.
Fig. 3.—Varying the positive voltage on the screen grid is excellent in smoothness and effectiveness.
Fig. 4.—Grid biased detection.
Fig. 5.—Method of coupling for multiple RF stages.

By Herman Bernard

THE circuit requirements of the screen grid tube vary with the use to which the tube is put and the number of screen grid tubes in the circuit.

The most popular use of this tube is in a four-tube design, where the -22 is the radio frequency amplifier, followed by a regenerative detector of the high mu, special detector or --01A type, and then by two stages of audio, in which at least one audio stage is transformer coupled.

When such a circuit is employed the volume control may be a rheostat, but due to the high amplification and sensitivity, this rheostat should be of a higher resistance value than the usual 20 ohms, even though a fixed resistor is in series. About 50 ohms is preferable for the rheostat.

With such a range—20 to 70 ohms, when including a 20-ohm fixed resistor—the volume may be varied from a whisper to full amplification. The stability of the circuit is excellent, besides.

Fullest Strength Developed.

No neutralization is needed in such a circuit and no shielding. The inter-electrode capacity of the screen grid tube is so low that no oscillation arises from such capacity back-coupling, while the amplification is still kept within workable bounds. The tube may be utilized at its fullest capabilities.

The volume control in the positive filament leg is the variable resistor RV in Fig. 1. The fixed resistor, in the negative filament leg, is a 622 Amperite.

The usual voltage, about 45 volts, is placed on the screen grid (G post of socket). The ordinary grid connection, this being known as the control grid to distinguish it from the screen grid, is made to the cap of the tube with a clip.

Just the moment you add another screen grid tube as a radio frequency amplifier you must resort to shielding. One reason is that the amplification and sensitivity become so high that much interference may be picked up directly, due to the loop effect of the coils, the leads running to the input or respective caps and the capacity between high radio frequency potentials and ground.

Also the two tubes compose a circuit that, if worked anywhere near full amplification, without shielding, will become oscillatory. This shield must be grounded to be effective.

The tuned primary in the plate circuit, with step-up ratio to the untuned secondary in the succeeding grid circuit, constitutes an efficient method of coupling.

Filament Control Poor Here

Without shielding there would be considerable inductive coupling, particularly between the antenna coil and the detector input coil, since the first and third tubes are worked in phase, a condition ripe for generation of oscillations.

Fig. 2 shows the elements of the circuit using two screen grid tubes at high amplification on the dotted line suggesting the shielding. Note that RV is a variable resistor, a volume control, but it would be found inadequate, since the circuit would break into oscillation below 350 meters and the volume control would become also a critical regeneration control, which it should not be.

A far better method of volume control, where two or more screen grid tubes are used as radio frequency amplifiers, is to vary the screen grid voltage. This may be done, as shown in Fig. 3, by leaving the filament voltage constant, and by placing a potentiometer from A minus to B plus 45 volts.

By Bars Condenser and Choke

The sliding arm of the potentiometer goes to the screen grid (G post) of the two sockets. This affords smooth control. The resistance may be 5,000 up to 25,000 ohms maximum. One may put a fixed condenser of .006 mfd. or higher capacity across the total potentiometer, and may even add an RF coil in series with the plus 45 volt lead, but these are optional. If the circuit has any tendency to oscillate the omission of the condenser and choke will act as a stabilizer. It would be inconsistent to include them, and incorporate grid supressors in the circuit to kill off self-oscillation, for instance. But if the potentiometer shows a detuning effect, as it may, if wire-wound, hence inductive, the bypass condenser will cure this nuisance.

The screen grid tube used as a dector is diagrammed in Fig. 4. An unusual feature is the high negative bias employed. The screen grid tube will detect around 6 volts negative on the grid, with 180 applied to the plate resistor, which

creen Grid Tube Uses

is a .25 meg. or .5 meg. But the negative detection curve has two flat portions, the other being in the region of 45 volts negative, and it is the second position that affords greatest sensitivity. But the stability is not good if there is much RF amplification preceding.

Resistance Audio Suitable

If the screen grid tube is used as detector the first audio stage well may be resistance coupled, since the resistor is a high impedance, and this is what is wanted. A suitable addition to the detector circuit would be a .0005 mfd. fixed condenser from plate to negative F to bypass radio frequencies, so that the impedance, looking out of the detector tube, will be high to audio frequencies and low to radio frequencies. Of course the succeeding grid resistor is in parallel with the plate resistor, hence if it is lower in resistance value than the plate resistor, the net impedance is considerably reduced. The grid resistor should be at least 2 meg. That also protects the low notes, which would be strongly bypassed by a low value of grid leak.

Of course, when biased detection is used with any type of tube, there is no grid leak condenser in the detector circuit. The absence of these two devices tends to equalize the tuning, helping to make the dial readings the same, since a grid condenser, particularly if of low value, say, .00025 mfd. or less, slightly reduces the natural frequency for any value of tuned capacity and inductance in the grid circuit, or, if the preceding plate circuit is tuned, then in that circuit. Any effect in the grid circuit is reflected back into the plate circuit by the coupling coil.

Space Charge Detection

Another type of detection, using a screen grid tube, is space charge detection. This makes the screen grid tube function much like any other tube, except of course that the mu is very high. The fundamental circuit is to reverse the connections to the control grid and the screen grid. Whereas now (as in Fig. 4) the positive medium positive voltage is applied to the screen grid or G post, while the RF input is made to the control grid circuit, when space charge detection is used the medium B voltage goes to the control grid or cap, while the G post is the RF input. In using space charge detection, be sure to have at least 180 volts at the low end of the plate resistor, while the cap may be given 22 volts, instead of 45.

Because of the geometry of the screen grid tube, when space charge detection is used there is some tendency toward microphonism in the detector, and when grid biased detection of the regular screen grid variety is used there is also some such tendency, although to a smaller extent. It is therefore advisable to put a metal container over the detector tube in either instance, to act as a damper.

Also the speaker should be put several feet away from the set, or at least placed at such an angle that acoustical coupling will not arise, as it is likely to do under any circumstances of extraordinarily high amplification. Try tilting a speaker or turning it around by easy stages and you will often get rid of any stray acoustical coupling or microphonism. Moving the speaker farther away from a receiver, a few inches at a time, may bring about the same good result. When absence of coupling is attained the speaker is left thus.

Avoid Flashing the Filament

If the space charge detection method is used be careful to have the clip on the cap of the tube—the B plus 22 lead—when you turn on the set. Never leave the lead unconnected. Never turn on the set first and then put the clip in place. This will shock the tube and may ruin the filament.

The methods of coupling a screen grid tube are very interesting. It is well known by this time that a tuned primary makes for highest RF amplification. Where few tubes are used the tuned primary excels. The impedance at resonance is regarded as infinite, therefore the tuned primary in the plate circuit approaches the ideal.

Where multiple stages of TRF are used, all of them screen grid, the tuned primary develops such tremendous amplification that serious problems in stabilization and selectivity arise. Therefore it is well to use a fixed primary of a larger number of turns than usual, and tune the secondary, as in Fig. 5. About 24 turns on the primary, and 48 on the secondary (for .0005 mfd.) on a 2½ inch diameter tubing would give good results. For .00035 mfd. tuning the directions are the same, except that the secondary has 56 turns. The wire is No. 24 single silk covered.

The screen grid tube, although brought out in this country fifteen months ago, is still the most interesting of all the tubes, and all its effective uses have not been thoroughly explored yet. Its chief value is as a radio frequency amplifier. Where only one stage of audio is to be used, even resistance coupling, by using three tuned stages and negative grid bias detection on a screen grid tube, with a —71A or 112A output tube, overloading may be avoided at all points, and wonderful quality obtained.

A Big Problem

In the audio stages the tube works best into a resistive plate load or high inductive impedance. But like all high amplification tubes it brings about certain conditions that have to be respected in the circuit design to prevent instability.

At radio frequencies the cure for such instability (RF oscillation) is not difficult. Shielding, proper voltaging, neutralization, grid suppression and other remedies come to mind. But low-frequency regeneration, commonly called motorboating, is a problem of higher magnitude.

Another point is that the screen grid tube as an amplifier of any sort will not stand a high negative bias, which is true of all high mu tubes, therefore its position in the audio circuit will have to be next to the detector, to prevent all possibility of overloading this tube in its audio service.

The tube has not won popularity as an audio amplifier but as a radio amplifier, while its use as a grid biased detector has been limited because of microphonic efforts that builders do not always know how to overcome, and because there are several types of tubes that make good detectors and that do not cost nearly so much as the screen grid tube.

In brief, therefore, the screen grid tube enables far greater sensitivity than general purpose tubes, in the radio channel, and therefore enables better results from a four-tube design than would be obtained from a 5-tube circuit that had not only the additional tube but the extra tuned stage, with the RF transformer and condenser that go with it.

The current drain being low, 132 milliamperes at 3.3 volts on the filament, and the plate and screen grid voltages being within reach of all, with low current drain here, too, the only extra cost is that of the tube itself, and since, roughly speaking, it does the work of two tubes, the total drain is about half of what would be experienced by the additional tube method. And when the circuit is properly designed the selectivity is just as good in one stage of screen grid as in one stage of any other type of tube.

Complaints of Poor Selectivity

Some complaint has been heard that the screen grid tube is not selective. A better way of stating the complaint would be to say that the way the screen grid tube was used reduced the selectivity. It is not due to mere high amplification, because the screen grid tube, properly used, is more selective than an —01A tube at equal volume handling. Higher amplification with no additional tuning facilities usually spells lessened selectivity, but the proper grid screen voltage, proper C bias and good coil design will provide about as much selectivity at increased amplification when the screen grid tube is used.

One of the reasons for the complaint about poor selectivity when using a screen grid tube is due to the ganging of the tuning devices, without regard to the differences in the circuits tuned. For instance. a screen grid tube as the RF amplifier, and a detector of the high mu or —01A type, provide utterly different conditions. In the first stage you have the reflected capacity of the antenna circuit, showing up as a parallel capacity across the first tuning condenser. Just what this reflected capacity is nobody who builds a set is likely to know. Contrasted with this additive capacity is the lower elemental capacity of the screen grid tube—extremely low, almost immeasurably low, between plate and grid, and still low between grid and filament. Assumptively, the screen grid tube in the first stage, counting the reflected capacity of the antenna-ground system, will have a higher natural frequency, requiring higher dial seting, than an —01A in a succeeding stage of RF, where the antenna capacity does not show up, but where the grid-to-filament capacity is substantially higher than that of the screen grid tube in the preceding stage.

Detector Pecularities.

If the second tube is the detector, especially a high mu tube, and most especially any tube working into resistance coupling for the first audio, and particularly with a bypass condenser from plate to negative filament, there will be extra capacity for these reasons, which shows up in the grid-to-filament circuit, and is known therefore as the input capacity. The resistance itself builds up a capacity effect, and it is high enough at high audio frequencies to bypass some of these, thus giving the same cutoff at 5,000 to 8,000 cycles and beyond as is found in audio couplers of the magnetic type especially designed for such cutoff to subdue hissing strays, tube noises, rushing sounds generally and the rattling of speakers due to signal strength at high audio frequencies in regions where the speakers have constructional components that would response with a rattle.

The bypass condenser from plate to negative filament is in series, but it is extremely large compared with the capacity it is in series with, which is the plate to grid capacity, hence even mathamatically it could not reduce the grid-to-filament capacity, whereas practically it increases the capacity across the preceding grid input, due to dieletric leakage.

Hence there are two tuned circuits with unknown values and unlike conditions, and their compensation is a problem all by itself. When compensation fails, poor selectivity and low volume result.

A Dynamic ABC Supply

Completely AC Operated, Compact and Efficient is S-M Unit

By F. Edwin Schmitt

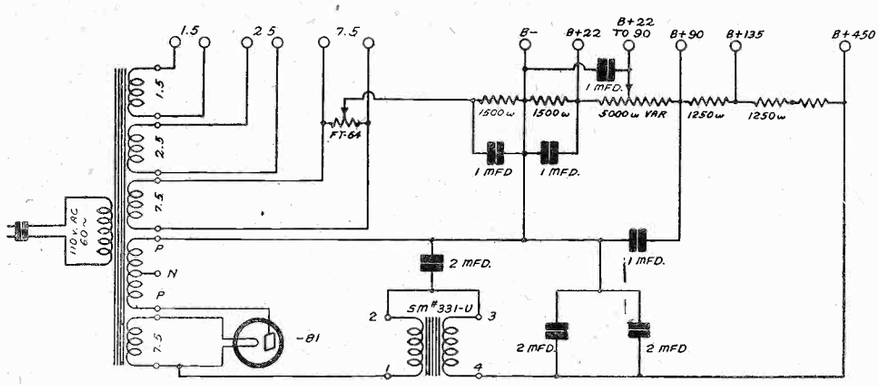


FIG. 1.—THE CIRCUIT DIAGRAM OF S-M 675 ABC POWER UNIT, WHICH SUPPLIES PLATE VOLTAGES UP TO 450 VOLTS, 84 VOLTS FOR THE GRID BIAS OF A —50 TYPE POWER TUBE AND THE NECESSARY FILAMENT VOLTAGES FOR THE RECEIVER.

WHEN a dynamic or other high power loudspeaker is used, a 250 type tube should be used to bring out the possibilities of both the speaker and the radio receiver. But the 250 type tube requires high voltage on the plate and 7.5 volts on the filament, as well as a rather high grid bias potential. Thus a good power supply is required. But it is not necessary that this be separate from the device supplying the filament, plate and grid voltages for the other tubes in the receiver. The high voltage device can be designed so that it will not only supply the voltages for the power tube but also for the other tubes.

Such a device should be compact so that it will not take much room. The power transformer in the device should have two 7.5 volt windings, one for the rectifier tube and one for the power amplifier. Besides these windings it should have a 2.5 volt winding for a —27 type detector tube and a 1.5 volt winding for amplifier tubes. Of course, it should also have a high voltage winding which will supply the 450 volts for the plate and the 84 volts or more for the grid of the power tube.

Requisites of Voltage Divider

Besides the 450 volt maximum the device should be designed to supply several intermediate voltages such as 22, 90 and 135 volts, together with a variable voltage to cover the requirements of the screen grid and the detector plate.

All these conditions are met by the ABC battery eliminator shown schematically in Fig. 1. In this circuit an —81 type rectifier tube is used because this is designed for high voltage service. Since this is a half wave rectifier and also since a high voltage is required, the entire high voltage winding on the power transformer is used, the mid-tap being left unconnected.

The voltage divider is made up of two tapped resistors and a 5,000 ohm potentiometer connected in series. A resistance of 1,500 ohms is required for the 84 volt bias and another of the same value for the 22 volt drop.

The 5,000 ohm potentiometer supplies the drop between 22 and 90 volts and a 1,250 ohm sector of the resistor strip supplies the drop between 90 and 135 volts. The remainder of the total resistance supplies the drop between the 135 and the 450 volt taps. The connection and the placement of the taps are clearly shown in Fig. 1.

Measured Voltages

When the high voltage supply is idling, that is, when it is not connected to a set so as to furnish any current except that which flows through the voltage divider, the following voltages should be obtained with a high resistance voltmeter, all measured from B minus:

At the 22 volt post, 55 volts; at the 22 to 90 volt post, 55 to 210 volts; at the 90 volt post, 210 volts; at the 135 volt post, 250 volts; at the 450 volt post, 510 volts; at one of the 7.5 volt AC terminals, no voltage. These are approximate values only.

When the circuit is delivering power to a radio receiver, including a 250 power tube, the voltages should be very near the rated voltages. The actual voltages obtained depend on the amount of current that is drawn from the power supply, that is, on how much current the receiver takes. When the set is in operation the voltage between B minus and the mid-tap of the 7.5 volt winding should be about 84 volts.

Assembly and Wiring

If the AC voltages across the three filament windings are measured with an AC voltmeter the readings should be the rated values, or slightly less.

The wiring diagram of the power supply is shown in Fig. 2, which also shows the layout of the parts. The panel and the resistors are laid horizontally in order to show more clearly the connections. A photographic view of the actual assembly is shown in Fig. 3.

INSULATE WELL

Attention is called to the order in which the various parts are laid out. The Unichoke coil 331U is put at the back. Then follows the condenser block, then the power transformer and finally the rectifier tube and the voltage divider. This layout is followed because all leads carrying heavy current can be made short, as well as the leads from the binding posts to the resistors in the voltage divider.

It is important to use well insulated, substantial conductors in view of the high voltages between some of the conductors.

LIST OF PARTS

One S-M 327U power transformer (Manufacturers' type)
One S-M 331 Unichoke (Manufacturers' type)
One S-M 511 tube socket.
One S-M 675ABC case, chassis and panel.
Two S-M 672 resistors.
One FT64 balancing resistor.
One Potter 673 condenser bank.
One Yaxley 5,000 ohm potentiometer.
Twelve moulded binding posts.
One cord and plug.
One set of hardware, hook-up wire, etc.

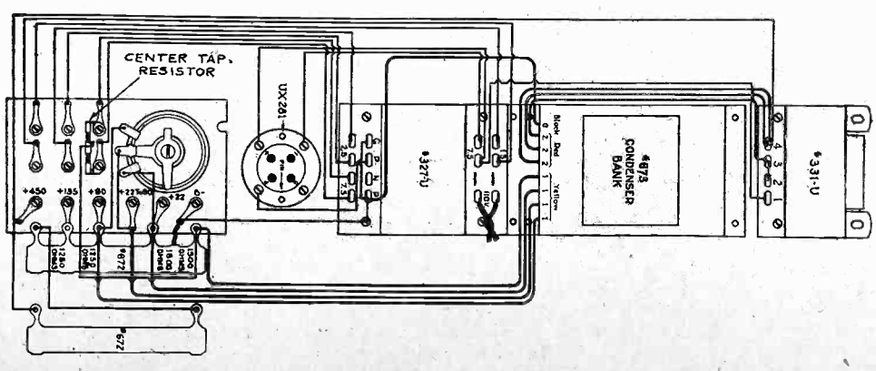


FIG. 2.—THE WIRING DIAGRAM AND THE LAYOUT OF THE S-M 675 ABC POWER SUPPLY FOR AC SETS, USING ONE —50 TYPE POWER TUBE.

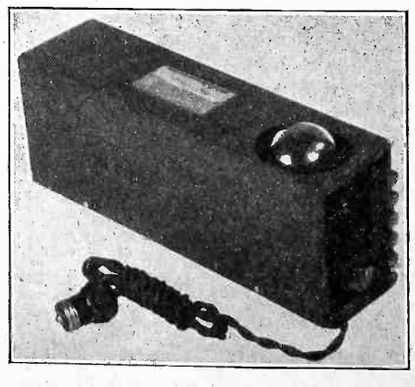


FIG. 3.—THE COMPLETED S-M 675-ABC POWER SUPPLY UNIT. IT IS BUILT SO AS TO TAKE THE LEAST POSSIBLE ROOM CONSISTENT WITH GOOD VENTILATION AND ACCESSIBILITY.

Switch in Short Waves

Same Dial Used for Broadcast and Higher Frequencies

By Raymond Aspinleaf

AN arrangement for combining a short wave and a broadcast receiver is suggested by Chas. D. Leonard of Walth m, Mass. This arrangement eliminates the usual short wave adapter by merely incorporating a single pole double throw switch and a socket for short wave coils in the broadcast receiver. When the scheme is used the tuning condenser for the short wave receiver and the condenser, or condensers, are put on the same shaft and are controlled by the same knob. It is particularly adaptable for drum dial tuning.

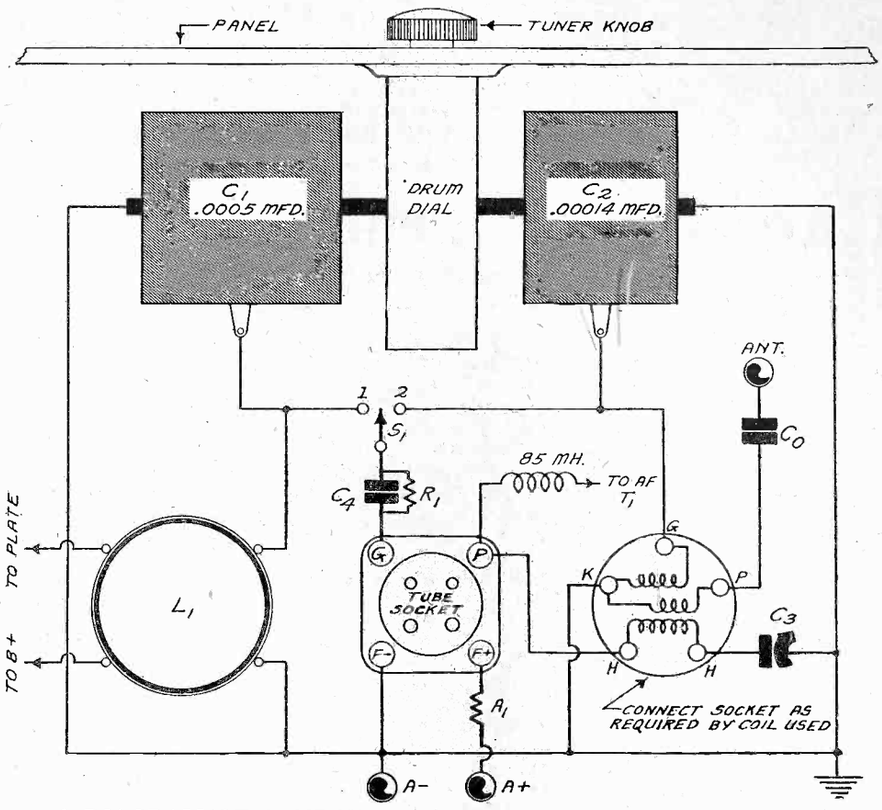
The scheme is illustrated in Fig. 1. L1 is the broadcast tuning coil preceding the detector in the circuit and C1 is the variable condenser tuning the secondary. L2 is a short wave coil, the secondary of which is tuned with condenser C2. A switch S1 is put in the grid lead of the detector, by means of which this lead may be connected either to the broadcast coil, on point (1), or to the short wave coil, on point (2).

This selector switch should be placed on the high potential side of the circuit rather than on the ground side in order to reduce as much as possible the zero capacity of either circuit. While S1 may be placed on the panel for convenience of selection it is better to place it inside the set so as to make the leads as short as possible, and hence to reduce the zero setting capacity of the condensers.

A coil socket is provided in the set for plugging in any desired short wave coil. A binding post is also provided for the antenna when the receiver is converted to a short wave set. This antenna should be short, or if the regular antenna is to be used a condenser C0 of about .0001 mfd. should be inserted in series with the lead to the short wave coil as shown.

Regeneration may be provided in the short wave circuit in the usual way. For controlling the regeneration a condenser C3 is used. This might be a variable condenser of about .00025 mfd., which should be put on a separate shaft. This condenser will serve as the by-pass when the circuit is used for broadcast reception. The choke coil Ch serves both at short and broadcast wave reception.

A two-stage audio frequency amplifier is shown in the circuit just to indicate the connections. Of course, any type of audio amplifier may be used. Only one broadcast tuner is shown, the one preceding the detector. This does not mean that others may not be used. In fact, the arrangement may be used on any broadcast receiver regardless of how many tubes are used in it.



A DIAGRAM OF A CIRCUIT COMBINING BOTH SHORT WAVE BROADCAST TUNING.

The short wave adapter may be installed in any broadcast receiver provided there is room for the extra parts and also provided that the short wave condenser C2 can be attached to the shaft of one of the larger tuning condensers.

It should be pointed out that the short wave tuner will not interfere with the broadcast tuner, or vice versa, because the two will not cover the same range.

Assuming that choke coil Ch is already used in the broadcast receiver the new parts needed to install the short wave adapter are as follows:

LIST OF PARTS

C0—One .0001 mfd. fixed condenser.
L2—One set of plug-in coils for short waves.
C2—One .0014 mfd. variable condenser.
C3—One .00025 mfd. variable condenser.
S1—One double throw single pole switch.
One UY type socket for plug-in coils.
One antenna binding post.

Gas Tube Rectifier Circuit Improved

Two new circuit improvements have been recently developed by the Raytheon Laboratories to reduce the size and manufacturing costs of Raytheon-equipped power units, both for A C set use and as separate B-eliminators.

The first deals with the use of the buffer condensers. The function of these devices is to absorb any periodic disturbance that might be set up by the break down of the gas in the BH or BA rectifier tube itself. In the original Raytheon circuit, two high-voltage 0.1 mfd. condensers, connected across the transformer secondaries, were employed for this purpose. It has been found, however, that by employing two .02 mfd. condensers between the two anodes and the single cathode, it is possible to obtain superior performance.

This improved performance with smaller capacities results from the placing of the condensers at a more advantageous place in the circuit, namely, as close as possible to the electrodes of the tube within which the disturbance is set up, and also by the operation of the buffer condensers at a higher voltage than when in their former location.

In addition, there has been added an R.F. choke in the cathode lead, comprising an air-core unit of 100 turns of No. 34 double cotton covered wire, wound on a one-inch diameter, for keeping any radio frequency disturbances out of the filter circuit. In commercial application, the two small buffers and the R.F. choke may be mounted directly on the tube socket itself so as to provide extremely short leads. In fact, much of the effectiveness of the new arrangement depends upon the use of short, direct connections. A marked saving in condenser cost is a further advantage of this new buffer condenser arrangement.

The greatest gain in the new Raytheon B-power circuit concerns the filter choke coils. In the customary type of filter chokes, a large air gap is provided so as to prevent DC saturation. As a result, it is necessary to employ a large amount of both copper and iron to obtain sufficient inductance.

The Raytheon engineers, however, have found it possible to place the two choke coils on the same core, so that their DC flux cancels out and thus prevents core saturation without the use of an air gap.

As a result of this flux-bucking choke, a saving of from 15 to 25 per cent. is obtained, without decreasing the effectiveness of the chokes. Elimination of the necessity for shielding or of careful placing of the chokes is also accomplished.

The performance of the Raytheon B-power circuit is thus much improved.

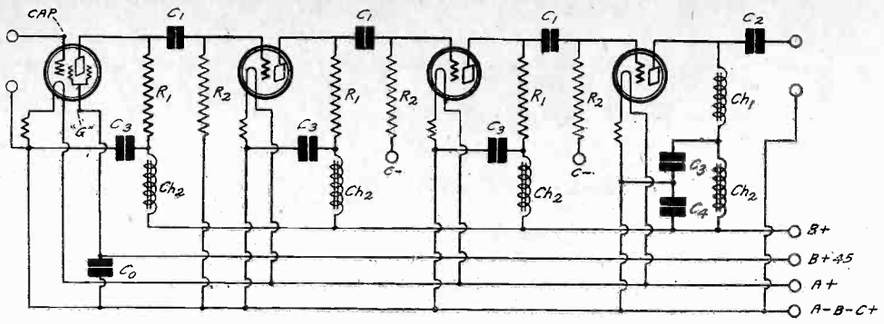


FIG. 722
THE CIRCUIT DIAGRAM OF A RESISTANCE COUPLED AMPLIFIER IN WHICH A FILTER IS PUT IN EACH PLATE LEAD TO PREVENT MOTORBOATING. CIRCUIT REQUESTED BY WILLIAM A. JONES.

Radio University

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WHAT IS the best volume control for an AC operated receiver? Is a variable resistor in the antenna circuit suitable?

(2)—Is a high variable resistor in the plate lead of the first RF tube satisfactory?

(3)—How about a resistor in the primary of the supply transformer?

MURRAY JEROME,
Council Bluffs, Iowa.

(1)—There is no best volume control. A variable resistor in the antenna circuit is about as good as any.

(2)—Yes, this is also a good way of controlling the volume.

(3)—No, this method is not good. It results in distortion.

* * *

PLEASE PUBLISH a circuit diagram of a resistance coupled amplifier in which filters are put in the different plate circuits for eliminating motorboating when used on a B battery eliminator.

(2)—Also please give the inductances of the chokes and the capacities of the condensers in the filters.

(3)—Do the filters affect adversely the quality of the receiver?

WILLIAM A. JONES,
Astoria, L. I., N. Y.

(1)—See Fig. 722 for such an amplifier.

(2)—The capacity of each of the condensers C3 may be 1 or 2 mfd. The larger the condensers, the better. Each of the first three chokes Ch2 may be the secondary of an old audio transformer or an impedance coupler. The fourth Ch2 should be a 30 henry choke of the same type as Ch1. That is, it should be capable of carrying the current for the power tube.

(3)—No, the filters will improve the quality because they will eliminate distortion due to regeneration in the amplifier.

* * *

PLEASE PUBLISH a circuit diagram of a four-tube receiver in which the first two tubes are screen grid type. I prefer a receiver having three tuned circuits with only two tuning controls.

(2)—Can such a circuit be built successfully without trimmers in the two tuned circuits which are tuned by the same control?

(3)—Which is better, an inductive trimmer or a capacity trimmer?

MILTON B. SHORT,
Paterson, N. J.

(1)—The circuit is shown in Fig. 723.

(2)—Trimmers should be used in the two ganged circuits, or at least one in one of them. The circuit will not be selective enough without trimming.

(3)—As far as effectiveness is concerned, one is as good as the other. The inductive trimmer has the advantage that the inductance in the tuned circuit can both be increased and decreased with it. The capacity trimmer has the advantage of being simpler to install. The circuit in Fig. 723 shows an inductive trimmer in the middle tuned circuit and a capacity trimmer in the third.

* * *

I HAVE a five-tube Diamond which has given good service for two years, but now produces a hissing sound which is very objectionable. What could be the cause of the noise? It continues when the antenna is removed.

(2)—Could the hissing be due to a bad tube?

(3)—Is there any chance the fixed condensers in the circuit would cause the hiss?

ALBERT MOORE,
Minneapolis, Minn.

(1)—Hissing noises in a receiver are usually caused by poor contacts, bad resistors, defective or old batteries, carbon dust and current leakage.

(2)—Gaseous tubes often cause a hiss. All tubes hiss to some extent, but the intensity is negligible unless the amplification is very great.

(3)—Yes, if the insulation or dielectric is poor, condensers might cause a hiss due to irregular leakage.

* * *

THE VOLTAGE applied to the plate of my 250 type power tube is about 550 volts. I use a 2,000 ohm grid bias resistor. But the plate of the tube gets red hot. How can I remedy this conditions?

(2)—Is there much danger to the tube if it is operated with a cherry red plate?

(3)—Could the voltage be reduced by inserting a resistor in the primary of the power transformer?

(4)—The grid bias resistor also gets very hot. How can that be prevented?

FRANCIS X. COLLINS,
Cambridge, Mass.

(1)—Reduce the voltage applied to the plate or increase the grid bias.

(2)—Yes, the life of the tube will be shortened.

(3)—Not very well, because that would also reduce the other secondary voltages on the transformer. If these voltages are also proportionately too high, a resistor in the primary would solve the problem, or if the secondary voltage is too high because the primary voltage is higher than it should be.

(4)—You need a grid bias resistor designed for heavier current. Perhaps when the plate voltage has been reduced the resistor will be able to carry the current without overheating. Determine how much you want to cut the plate voltage and then put a resistor in series with the plate lead, which will drop the required amount. The current through the resistor should be taken as .055 ampere. Hence, if it is required to drop the voltage 55 volts, a resistor of 1,000 ohms should be used.

* * *

WHAT IS MEANT by the horizontal component of a broadcast wave? Is it not a fact that all of the magnetic field is always horizontal and all of the electric always vertical?

(2)—What is meant by the angle of tilt when referred to a radio wave?

FRANK SUMNER,
Chicago, Ill.

(1)—It is the horizontal component of the electric field that is meant. The wave leaves a vertical antenna so that the electric field is vertical and the magnetic horizontal, but the wave does not stay that way. The top of the wave travels faster than the bottom, hence the wave tilts forward, thus giving a horizontal component to the electric and a vertical component to the magnetic field.

(2)—The angle of tilt is the angle between the horizontal line and the actual direction of the electric field. When the wave tilts it does not travel parallel to the earth, but runs into it.

* * *

DOES THE DISTRIBUTED capacity of a multi-layer coil increase or decrease as the number of layers is increased?

(2)—Is there a simple way of estimating the distributed capacity of a solenoidal coil? If so, what is the rule?

(3)—Can iron dust cores be used successfully at broadcast frequencies? At intermediate frequencies of the ordinary super-heterodyne range?

SHELDON FERGUSON,
El Paso, Texas.

(1)—The distributed capacity decreases as the number of turns is increased.

(2)—Yes. The distributed capacity in mfd. is about 7 per cent. of the circumference in centimeters. Thus the capacity of a three-inch coil would be .07x3.1416x3x 2.54 mmfd., or about 1.68 mmfd.

(3)—Cores made of pure iron dust mixed with insulating cement and compressed under terrific pressure are not good for frequencies in the broadcast band, but they are very good for intermediate frequencies as used in super-heterodynes. They are effective from about 1,000 to 100,000 cycles.

* * *

WHAT IS the difference between a hard and a soft photo-electric cell?

(2)—Which type is the more sensitive to variations of light intensity?

(3)—Are photo-electric cells equally sensitive to all light colors? If not, for what color is a cell most sensitive?

ARMOND LESEUR,
New Orleans, La.

(1)—The hard tube has been evacuated much more than the soft. There is considerable gas left in the soft cell. The difference is the same as the difference between a hard and a soft vacuum tube.

(2)—The soft cell is much more sensitive, but it is not suitable for purposes requiring permanence of characteristics.

(3)—Cells are not equally sensitive for all colors, but each cell has a definite color for which it is most sensitive. The color of maximum sensitivity depends on the material of the electrodes in the cell. For some the maximum falls in the red, for others in the green-yellow, for still others it falls in the violet.

* * *

WHAT ARE the Kirchhoff laws? I see them referred to in radio literature.

(2)—Is there any relation between the Kirchhhoff laws and Ohm's law?

SOREN ANDREASEN,
Bismark, N. D.

(1)—There are two Kirchhoff laws. One states that the total voltage drop in any one circuit in a complex electrical network is equal to the electromotive force in that circuit. The other states that the sum of all currents flowing to, or away from, a point of junction of many con-

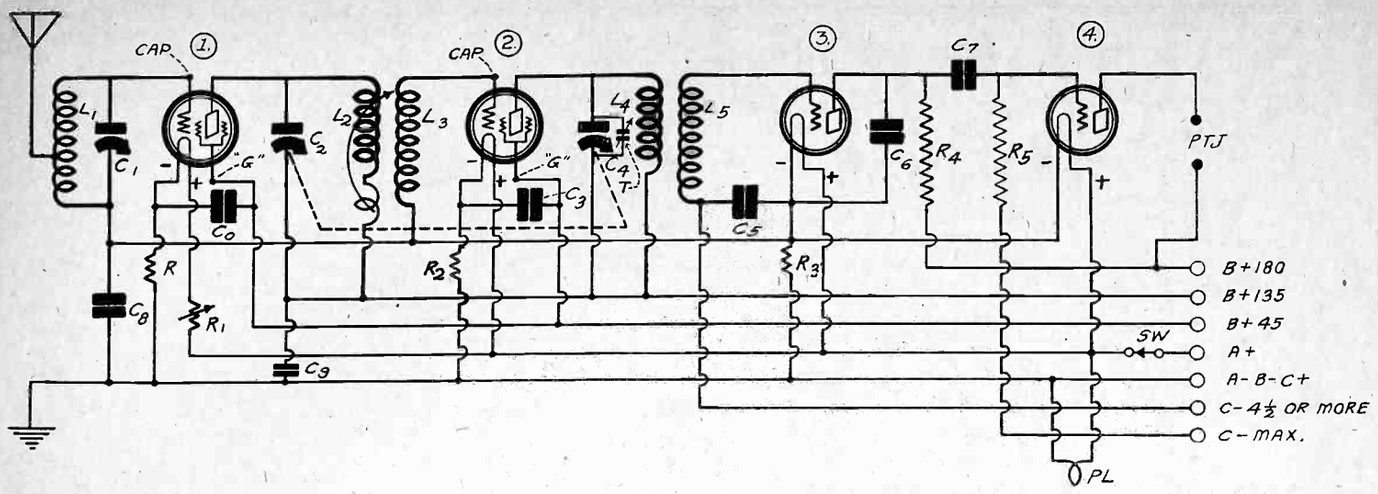

FIG. 723

THE CIRCUIT DIAGRAM OF A FOUR-TUBE RECEIVER USING TWO SCREEN GRID TUBES, THREE TUNED CIRCUITS AND TWO TUNING CONTROLS, WITH TRIMMERS IN THE TWO GANGED CIRCUITS. CIRCUIT REQUESTED BY MILTON B. SHORT.

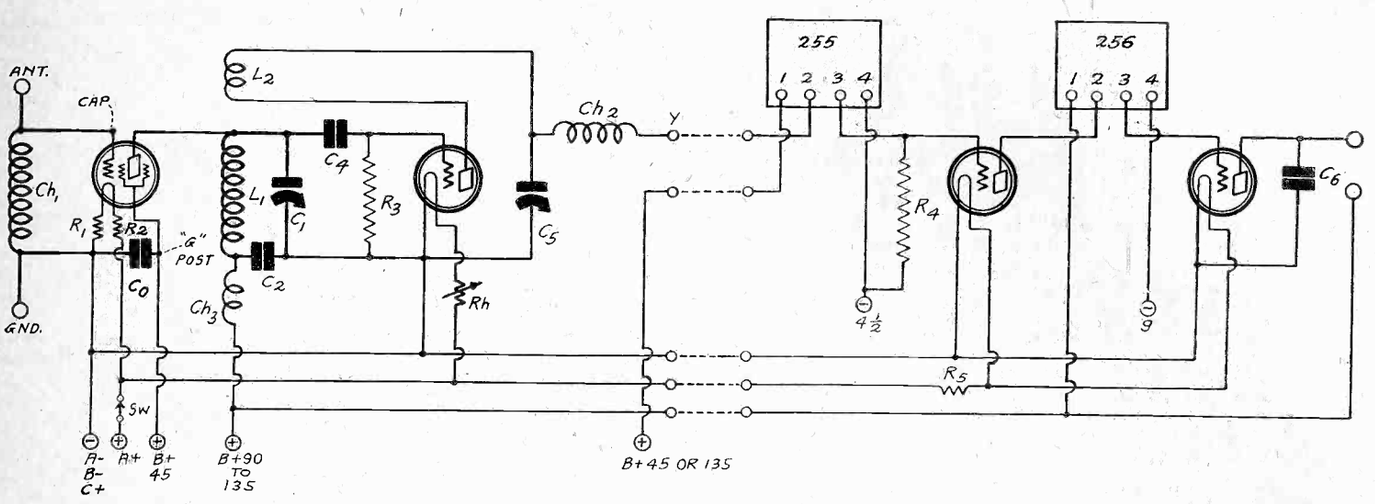

FIG. 724

THE CIRCUIT DIAGRAM OF A SENSITIVE SHORT WAVE RECEIVER INCORPORATING A SCREEN GRID AMPLIFIER. THE CLOUGH SYSTEM OF AUDIO AMPLIFICATION IS USED. ASKED FOR BY WILLIAM SUNDERLAND.

ductors is zero. This is the same as to say that no current accumulates at the point.

(2)—The first of the Kirchoff laws mentioned above is Ohm's law generalized.

* * *

I WISH TO BUILD a wave trap for cutting out a local station which interferes with my reception of other station. Please describe how one may be made. Also tell how to connect it.

ANTONIO SALAMANCA,
New Haven, Conn.

Wind 43 turns of No. 22 double cotton covered wire on a bakelite tubing. Connect a .0005 mfd. variable condenser across this winding. Also put on 10 turns of the same wire. Connect this 10 turn winding in the antenna lead of the receiver. Tune the condenser to the interfering station, or until the signal from that station disappears or becomes weakest. Accurate tuning is required.

* * *

PLEASE PUBLISH a circuit diagram of the S-M four tube short wave receiver. I have all the parts and need only the sketch.

(2)—Can this circuit be operated with ear phone without using the audio amplifier? If so, please say where to connect the phones.

WILLIAM SUNDERLAND,
Marion, Ohio.

(1)—See Fig. 724.

(2)—Yes, cut the dotted lines and connect the speaker between the point marked y and the point directly under it.

I HAVE A LOOP on my receiver. It has been my understanding that the loop had to be upright if it was to receive signals, but I find that I get some signals when the loop is flat on a table. Please explain.

EDMUND SESSIONS,
Rockford, Ill.

There are two reasons why a horizontal loop can pick up signals. The first is that there is capacity between the loop and ground. Thus it acts the same as a small vertical antenna. The other reason is that the radio wave may arrive to the receiver tilted forward or that it may arrive in a line which is not horizontal. Vertically polarized waves, for instance, sometimes arrive at a point horizontally.

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Line Noises in Set Killed

New Device Eliminates at Receiver End

By James H. Carroll

Contributing Editor

SINCE the advent of electrically operated radios, many radio engineers and large laboratories have been working to find a simple device which, when connected with a source of current, would eliminate all AC and DC line noises, due to power house generators, outside electric interference and other sources that mar reception.

Such a device has now been perfected in the laboratories connected with the Truetone Radio Sales Company, 114 Worth Street, New York City, according to Julian J. Proskauer, associate member of the I. R. E. Under Mr. Proskauer's direction the research has been conducted.

A special filter bloc was designed as shown in the diagram which crosses to coils made of a special coated wire wound in a peculiar and novel manner. The secret of the noise eliminator, which is marketed commercially under the name of Si-Len-Ser, lies in both the cutting and winding of these coils, and the filter block with leads to two condensers, with ground tapped at the common lead.

This commercial product is 5" high and is made in the form of a cylinder 3⅞" in diameter and weighs 4½ lbs., the wire weighing the major part.

It is claimed that the Si-Len-Ser, in addition to eliminating outside electric interference, not due to antenna pick-up, kills all line noises, hum, heterodyning due to electric noises, leaky transformers inside or outside the house when on the line which feeds the set, spark interference from leaky apparatus or any of the various household electric appliances.

Because of the two condensers made with peculiar characteristics giving unusual strength and marked filtering ability, the Si-Len-Ser can be used on such apparatus as electric refrigerators, vacuum cleaners, oil burners, and a hundred and one other noise-producing household apparatus.

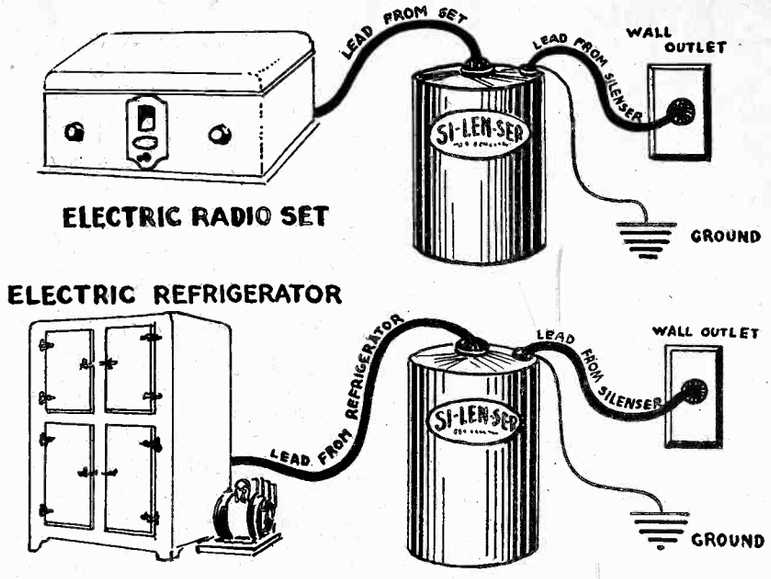
As with the radio set, the Si-Len-Ser is simply attached to the light socket and the plug of the radio or the plug of the household apparatus placed in the Si-Len-Ser.

There is a ground lead coming out of the condensers and led from the top of the Si-Len-Ser. This ground can be used or not, depending on the particular circumstances surrounding the noise-giving apparatus. As a matter of experimentation, the Si-Len-Ser is tried both without and with the ground attached. Any common ground such as a cold water pipe, radiator or ordinary radio ground pipe can be used.

Reports from experimenters in various parts of New York and Connecticut show that distance reception is improved in some localities by the use of the Si-Len-Ser because of the pick-up of the ground, which is fed through several hundred feet of special wire.

Other good points about the Si-Len-Ser is that there are only two wires to connect. One is the light socket plug, which fits into any standard socket, and the other the ground wire, which is made sufficiently long for connection to any ground clamp.

Harold Shevers, famed for his work on the Espey eliminators and as a scientist with great experience in condensers and coils, and known as a consultant because of his knowledge of eliminators both for AC and DC operation, worked with the designers in making the filter block and coils so that the Si-Len-Ser could be used with any eliminators, either in old style or new style, and to him goes the credit for making the Si-Len-Ser absolutely universal, for use with electric sets, eliminators or electric household apparatus.



Actual tests of the Si-Len-Ser in DC districts eliminated generator noises where DC was being converted to AC for use with the new AC sets. The generator noises were silenced immediately without appreciable loss of volume, but with considerable gain in tone quality.

Tests made near Danbury, Conn., where there are a constant line noise and generator hum, proved that the Si-Len-Ser eliminated all noise of electric interference, and samples sent to various laboratories for test have all proved that the Si-Len-Ser was commercially perfected.

Of course, there have been hundreds of filter blocks, condensers and other schemes worked out to eliminate interference and hums, but none of these, according to the designers of the Si-Len-Ser, has done the work. The small size of the Si-Len-Ser, and its convenience as a universal device, apparently supplies the great demand for a universal electric interference eliminator for owners of electric radios.

The Si-Len-Ser can be used on any voltage and with either alternating or direct current. It silences all stray power-line noises which enter the loudspeaker through the power pack of either an electric set or eliminator. This includes elimination of bell-ringing noises and clicking on and off of lights. With the Si-Len-Ser, regardless of the voltage used, an electric set or an electrified set performs as quietly as a set using all batteries.

[*The foregoing account is based on information furnished by the Trutone Radio Sales Co., 114 Worth Street, which will be glad to furnish further details on request.—Editor.*]

Langmuir, Tube Genius, Heads Chemical Society

Dr. Irving Langmuir, assistant director of the Research Laboratory of the General Electric Company, Schenectady, N. Y., has been elected president of the American Chemical Society for 1929. He succeeds Prof. Samuel W. Parr of the University of Illinois.

Langmuir was born in Brooklyn, N. Y., January 31st, 1881, and was graduated from the School of Mines of Columbia University in 1903. He received the degree of doctor of philosophy from the University of Gottingen in 1906. He is a former instructor of the Stevens Institute of Technology. In 1909 he entered the General Electric Research Laboratory. Notable among his achievements are his invention of the nitrogen or gas-filled incandescent lamp, of the pilotron and kenotron, used in radio, and fundamental to the perfection of the Coolidge X-ray tube.

WBBM Has New Home in Wrigley Building

Chicago.

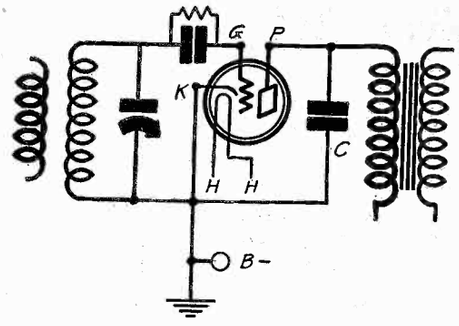
The new home of WBBM will be in the Wrigley Building, 410 North Michigan Ave., Chicago.

The new quarters are located on the lower level floor of the North Wrigley Building.

A move was necessitated because of plans for the development of the station. This is the fifth move made by WBBM. The original studio was at Lincoln, Ill. When the station was moved to Chicago a studio was provided in the Broadmore Hotel. Later a studio was built in the offices of the Stewart Warner Speedometer Corporation. In September, 1927, WBBM moved to Kimball Hall in the loop.

Concurrent with the use of the new quarters WBBM organized an improved program offering as a continuous advance.

Tone Quality Improve



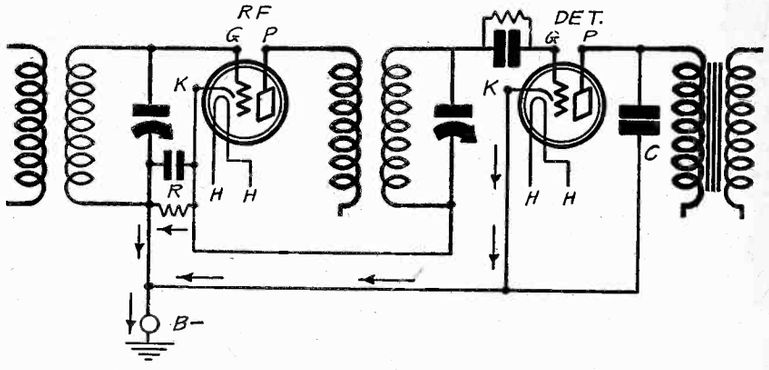


FIG. 1 (LEFT)—THE CUSTOMARY DETECTOR HOOKUP FOR A TYPE —27 TUBE. THE BIAS IS ZERO. THE BY-PASS CONDENSER C, OF .0005 MFD. CAPACITY, IS VERY HELPFUL.
FIG. 2 (RIGHT)—HOW A POSITIVE BIAS MAY BE IMPRESSED ON THE DETECTOR TUBE, EQUAL TO THE NEGATIVE BIAS ON AN RF TUBE. ARROWS DENOTE THE DIRECTION OF CURRENT FLOW.

THE detector circuit in an AC receiver is receiving greater attention, and deservedly so, because the tube commonly used as the detector, type —27, does not readily lend itself to various biases, and has been usually shown with a zero bias.

The conventional detector hookup for an AC receiver, where the first audio stage is transformer coupled, is shown in Fig. 1. Since the cathode K and B minus lead are common, the bias is approximately zero. Actually there is just a tiny negative bias, due to the voltage drop in the secondary S and in the K lead.

The leak-condenser method of rectification is most common. With a battery operated detector tube the grid return is made to the positive filament leg, and as the —27 tube has much the same characteristics as the —01A, one might expect greater sensitivity by obtaining a positive bias.

Some ingenuity is necessary to obtain this, since any resistor interposed between K and B minus in the detector would impress only a negative bias, B minus being always the most negative point. There could be a connection to a positive point on the B eliminator, to give a positive grid return, but this is complicated and besides the bias voltage would be directly subtracted from the plate voltage.

Less Hum in the —27

The —27 tube has five prongs. Two are for the heater, which is independent of the filament or cathode element of the tube. The two other prongs are for plate and grid. A five-spring socket must be used.

Because the power source or heat producer is independent of the heat receiver, or cathode, there is considerably less hum, hence only the heater type tube is used as detector.

But it is not imperative to employ a zero bias for the grid of this tube. In Fig. 2 is shown a method for obtaining a positive bias for the detector equal to the negative bias on an RF tube. When an RF tube (here also shown as one of the heater type) has 90 volts or even 67½ on the plate, a negative grid bias of about 4 volts will work well. This bias is obtained from the voltage drop in the resistor R, which constant is placed in series with the grid return. The tuned secondary is returned to B minus, and the grid is therefore negative in respect to the cathode or filament to the extent of the voltage difference between the two ends of R.

Considering the RF stage now, the plate current is supplied by the B eliminator to the plate of the tube, is transferred through the grid to the cathode by means of the space current in the evacuated bulb, and flows to B minus, the direction being registered by the arrows in Fig. 2. If the plate current is 5 milliamperes when a resistor of 800 ohms is in circuit, the negative grid bias is RxI, or 4 volts.

In the detector circuit, which follows, the plate current is directed immediately to ground, without passing through any impedance, so no bias results. But if the B minus and K points are reversed in the detector circuit, in respect to what they are in the RF stage, using the RF resistor, the bias will be reversed, hence 4 volts positive bias will be on the grid.

Higher Sensitivity

This arises because the cathode K is made most negative, being B minus, hence any bias must be positive. The voltage drop in R is the same because no extra current is passed through R. It will be noted, too, that no common coupling arises from this dual utilization of the voltage drop in R, where for an RF stage the bias is negative and for the detector it is positive.

With a positive bias the sensitivity is higher.

In any AC circuit it is better to obtain these voltage drops through independent resistors, in the manner portrayed in Figs. 2, 3 and 4, than to have an output potentiometer network that affords various biases, since with the common resistor all the plate currents are made to flow through the resistor or parts of the resistor, this being the means of obtaining bias. Both the plate and grid circuits thus are common, and different stages are also made common to that extent, which often gives rises to distortion, motorboating and other troubles.

Use independent biasing resistors and bypass each. For radio frequencies a condeser of .006 mfd. or higher will do nicely for audio circuits, and this includes the detector, but particularly the last audio stage, the condenser should have a much higher capacity. For the last audio stage no less than 4 mfd. should be used, while for any preceding AF stage 1 mfd. will suffice.

Better Tone Quality

Negative grid bias is obtained in the detector stage in exactly the same manner as in an amplifier stage, hence it is easy to use negative grid bias detection. This may prove not quite so sensitive as the zero or positive bias, but the distortion is much less, hence tone quality is improved.

Fig. 3 shows a negative grid bias detector, using a heater tube. R is an independent resistor, bypassed by a 1 mfd. or higher capacity, and with an extra RF bypass condenser connected from plate to cathode, a really necessary addition in the case of the —27 type tube. This bypass condenser is shown as C in Figs. 1, 2 and 3, and should be .0005 mfd.

Detector overloading may take place even when negative grid bias detection is used, but you may govern the extent of the bias, hence the overload of the detector, by tuning in the strongest signal receivable, and inserting a resistor R of such value as will give you clearest reception. This is usually between 50,000 and 100,000 ohms, since the plate current is small in the detector circuit, even when the applied plate voltage is more than the usual 45 used with the heater type tube in conjunction with leak-condenser rectification.

More than 90 volts may be applied, if the first audio stage is transformer coupled, whereas if it is resistance coupled the voltage may be 180 on the detector, and the biasing resistor still 50,000 to 100,000 ohms.

Only the Biases Differ

One point to remember is that incorrect value of resistor will maintain the supposed detector tube as an amplifier, since actually the circuit is the same for amplification as for detection, the difference in operation being established only by the difference in bias.

Especially if one has a good audio amplifier does he desire to encourage best tone quality by feeding an undistorted signal into the AF channel, and negative grid bias is a great help. Those who have constructed their own AC sets, or who are familiar enough with radio technique to make the slight change necessary to convert the detector to negative grid bias in any AC receiver, really should do so, and determine for themselves whether they are better pleased with the newer method.

To make the change in an existing receiver, connect a piece of wire across the grid condenser, thus shorting out both leak and condenser, assuming they are in the circuit as shown in Fig. 2, which is usually so. Sever the connection established from the cathode to B minus, and interpose in this gap the biasing resistor R, across which is the fixed condenser of

ment in AC Circuits

1 mfd. or higher capacity. Increase the plate voltage, as already outlined.

If you are short on resistors you may insert one of approximately the value stated, and vary the plate voltage to obtain detection, rather than leave the plate voltage fixed and alter the value of the biasing resistor. But if possible favor the higher values of plate voltage.

The frequency response will be more nearly even, yet the hum will not be increased. The heater type of tube of itself contributes only a slight amount of hum, although it would be far-fetched to say that it does not hum at all.

The —27 Increases in Popularity

When an AC set hums badly this is usually due to some reason other than the mere use of heater type tubes. Of course, the other type of AC amplifier, the —*26* tube, will hum more, or at least it is more difficult to eliminate the hum than with the —*27* tube.

The use of the —*27* tube as a radio frequency amplifier, rather than the —*26*, is growing, and the day may not be far distant when most AC receivers will incorporate the —*27* type throughout, except for the output tube.

One way of reducing hum is to connect to some positive voltage the midtap of the 2.5 volt winding which feeds the heater terminals H and H. A good average voltage is *22*, although up to 45 may be used. The lead is brought from the midtap of the filament transformer to the desired post on the B eliminator.

All AC sets have B eliminators, either separately made contrivances introduced, or built up as a component part of the receiver, the difference being in location.

The Center-Tapped Resistor

Fig 4 shows the midtap of the filament transformer connected to B plus *22*. If the transformer has no midtap for this winding, a center-tapped resistor of about 20 or 30 ohms may be connected across the 2.5 volt winding, the midtap going to the positive voltage (Fig. 5). This will slightly reduce the plate current, since that current must flow through the resistor. The plate current actually divides, so that half flows through one side and half through the other side of the center-tapped resistor, but as the halves are electrically in parallel, and are equal, the resistance encountered by the plate current is one-quarter of the total resistance of the center-tapped device.

While none of the heater current flows through the resistor R in Fig. 5, current from the power transformer itself does flow through the resistor. Using 30 ohms total for the center-tapped resistor R, 15 ohms on each side of center, the current drain equals E divided by R, or 2.5 divided by 30, or a trifle more than 80 milliamperes (.08 amp). This of course is tiny compared with the 1.75 amperes drawn by the heater at 2.5 volts, and hardly need be considered in determining what power the filament transformer should be able to handle.

Watch the Last Audio Tube

In line with the desire for best quality the last audio stage should be carefully considered. The negative bias on this power tube should be obtained through the drop in an independent resistor R, Fig. 6. The by-pass condenser C is the one that should be no less than 4 mfd.

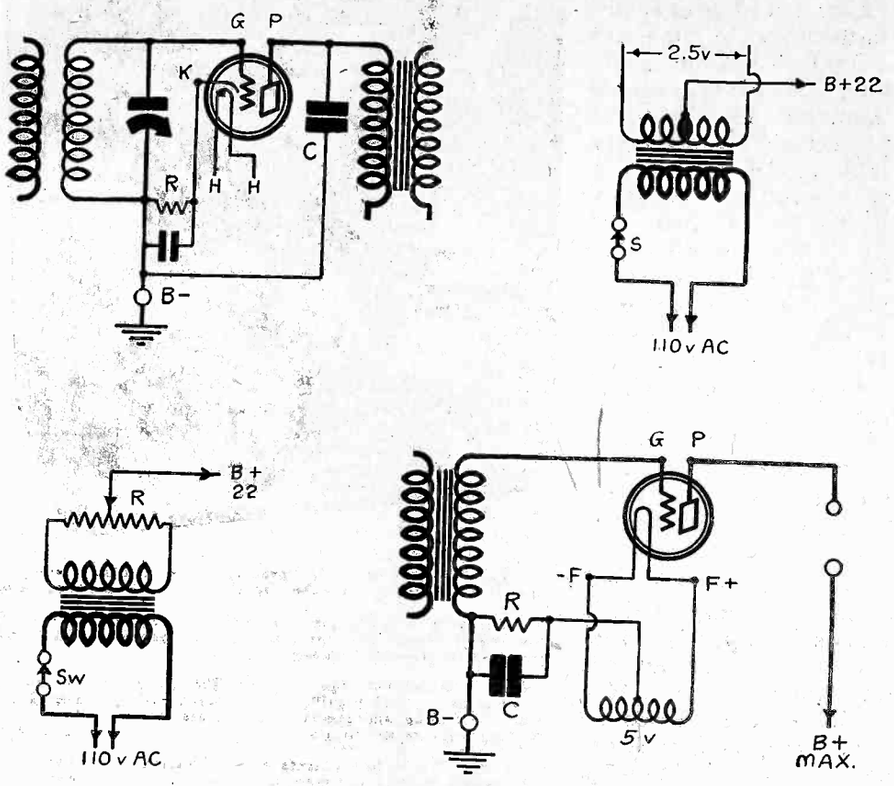


FIG 3 (TOP LEFT)—NEGATIVE GRID BIAS USED FOR DETECTION. THE RESISTOR R MAY BE 50,000 TO 100,000 OHMS, THE CONDENSER ACROSS IT 1 MFD. OR LARGER.

FIG. 4 (TOP RIGHT)—THE MIDTAP OF THE FILAMENT TRANSFORMER SECONDARY IS CONNECTED TO B + 22. THIS POSITIVE VOLTAGE IS NOT CRITICAL, BUT SHOULD NOT EXCEED 45 VOLTS. IN SOME INSTANCES GROUNDING THE MIDTAP PRODUCES BETTER RESULTS. THEN THE POSITIVE VOLTAGE CONNECTION IS OMITTED. THE OBJECT IS HUM REDUCTION.

FIG. 5 (LOWER LEFT)—IF THE SECONDARY HAS NO MIDTAP, A LOW-RESISTANCE POTENTIOMETER, ADJUSTABLE OF FIXED, WITH CENTER TAP, MAY BE USED

FIG. 6 (LOWER RIGHT)—THE VOLTAGE DROP IN R BIASES THE LAST AUDIO TUBE NEGATIVELY. C SHOULD BE NO LESS THAN 4 MFD.

Anything lower reduces the volume considerably. For instance, ½ mfd. gives only half as much volume as 2 mfd.

As the capacity is increased beyond 2 mfd. the volume increase is not proportional to the foregoing, but there still is some increase. The main reason for recommending a minimum of 4 mfd. is for tone quality. The low note suppression due to the high audio impedance of the biasing resistor is severe, unless adequate bypassing is provided to reduce this impedance.

The bypass condenser may be any type, since the voltage drop never will be more than 100, even for the largest power tube and (type—50); usually will be about 40 volts for the —71A tube. Hence the 200 DC volts continuous test type of condenser is all sufficient.

If the capacity is made more than 4 mfd. there is some further improvement, but it is slight, while beyond 6 mfd. there is no appreciable gain whatever, due largely to speaker limitations in showing up the effect. But below 4 mfd. there is a distinct loss both in volume and in tone quality.

Hum In the Output Tube

The output tube has considerable to do with the amount of hum present. The 112 and 112A power tubes show a rather substantial hum component, the —71 and —71A power tubes considerably less, and the —10 and —50 power tubes still less. Therefore even if you do not need a bigger power tube than the —71 or —71A, you may well use the —10 or —50 for hum reduction, raising the filament voltage of 5 volts up to the 7½ usually recommended for these two tubes, and working either of the tubes at 180 plate volts, with a negative bias that affords a current flow of about 20 to 30 milliamperes.

The proper value of resistor for any AC tube may be readily determined without mathematics by using a Jiffy Tester. Remove a tube from the socket of the circuit under test, put the tube in the Jiffy Tester and the Tester plug in the vacant socket of the receiver.

Insert a biasing resistor (R in Figs. 2, 3 and 6) that gives the proper value of plate current for the applied plate voltage. The high resistance meter reads the plate voltage, the milliammeter reads the plate current, while the constant filament voltage is read by the filament meter. A tube chart published in the instruction sheet furnished with the Tester gives the values of plate current equivalent to stated values of negative bias.

—*HERMAN BERNARD.*

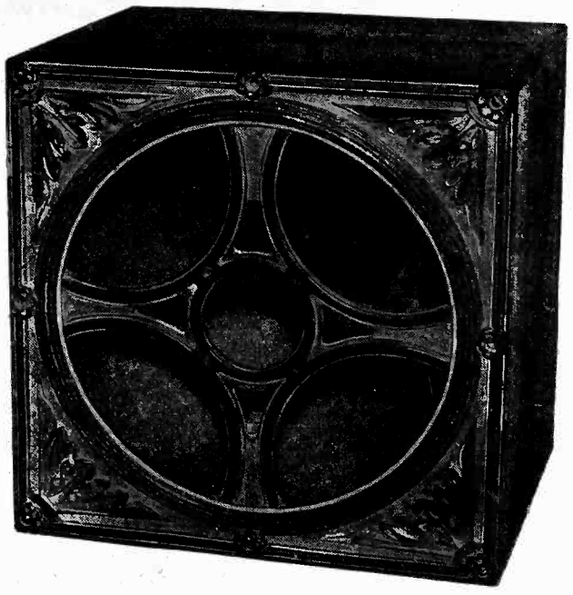
ACROSS LAST AUDIO RESISTOR!

An Extraordinary Speaker

THE super-sensitive and acoustically faithful twin magnet POLO UNIT in a de luxe housing, with moulded metal front piece, makes a first-class table model speaker. It will stand the heaviest load — even two 250 tubes in push-pull without rattling—yet is so sensitive it will work well from *any* output tube, even a 201A!

Compact and handsome, this table model graces any living room or parlor, is inconspicuous to the eye but alluringly predominant to the ear.

The unit is mounted on a special bracket that makes it impossible for the unit to get out of adjustment. The table model, of the free-edge cone type, is furnished completely built-up, ready to play.



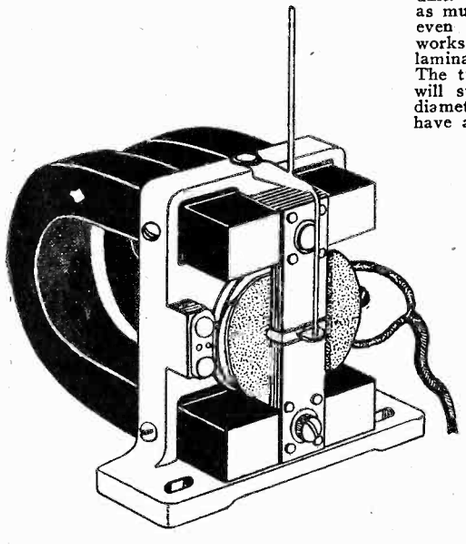
The Table Model Polo Speaker, an outstanding example of the magnetic type of speaker, is shown one-third actual size.

The grill or front piece is moulded, while the rest of the housing is wood. Both grill and housing are furnished in rich, conservative two-tone brown spray.

Table Model Polo Speaker, Cat. TMP, consisting of de luxe housing and moulded grill, with sprayed finish; mounted Polo Unit, with cone and special bracket; also 10-ft. cord
All built-up, ready to play.....$13.50

[Note.—Those who possess a Polo Unit and desire the housing, special bracket and cone, may obtain these by ordering Cat. HO at $5.00.]

THE Polo Unit, using two magnets, to double sensitivity, is regarded by many experts as the best magnetic unit. It weighs three full pounds—almost three times as much as an average unit—and will stand the strain of even two 250 tubes in push-pull without rattling. It works well out of any type tube. The pole pieces are laminated and the armature can't get out of adjustment. The two magnet coils are housed in bakelite. This unit will stand 180 volts without filtering, due to the large diameter wire used on the special coils. All Polo Units have a bronze-green casing and black twin magnets.



Polo Unit, shown one-half actual size. Furnished complete with unit, apex, chuck, nut, 10-ft. cord, bracket and hardware. Cat. PU $10.00

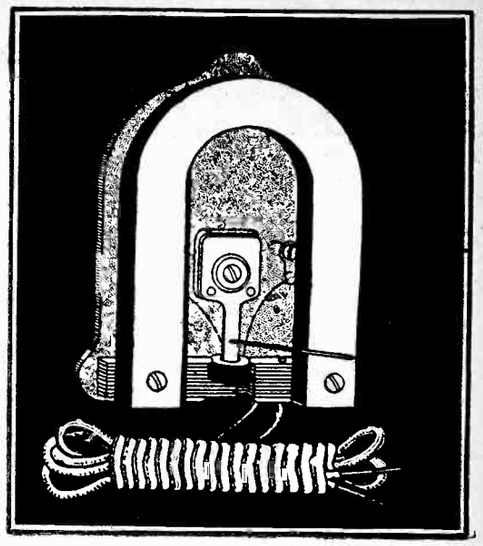
Acoustical Engineering Associates,
143 West 45th Street, N. Y. City.
(Just East of Broadway)
Please ship at once C.O.D.:
☐ One Cat. TMP at $13.50.
☐ One Cat. PU at $10.00.
☐ One Cat. HO at $5.00.
[Put cross in proper square above.]

Name .....

Address .....

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

Ten-day Money-back Guarantee.



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

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.
Both the tone and the appearance are brilliant! You may order a new model Powertone Unit with perfect safety. It's a pippin, say those who use it. If you don't agree with that, return the unit ten days after receipt and get your money back promptly. No questoins asked—but all questions gladly answered. Immediate shipment guaranteed.

Guaranty Radio Goods Co.
145 West 45th Street, N. Y. City
(Just East of Broadway)
Please mail me at once C.O.D. (Check off).
☐ One Powertone Unit alone, Cat. PA. @ $3.00.
☐ One Tri-foot Bracket, Cat. BA @ 65c.
☐ One Apex, one Chuck, one Thumbscrew, Cat. AA. @ 10c.

Name .....

Address .....

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

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SHARE OUR SUCCESS in 1929. A genuine opportunity to gain financial independence by engaging in our profession. For particulars address: Artcraft Sign Works, 200 E. 47th St., New York City.

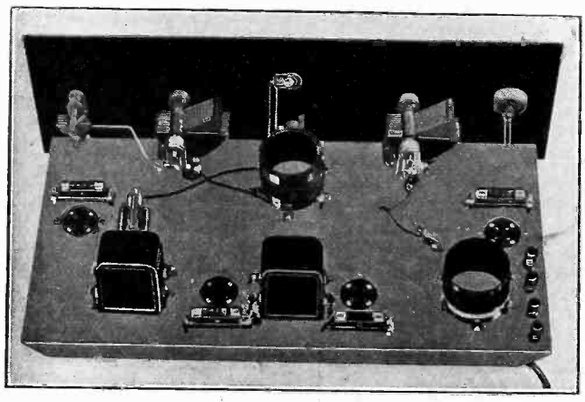
I HAVE twelve dynamic chassis speakers—AC models—fine speakers, brand new. Be one of the lucky dozen to get these at $17.50. Guaranty money back in 5 days. P. Cohen, R 1214, at 143 W. 45th St., N. Y. C.

EIGHTEEN microfarads of capacity, using Mershon condensers that will not ruin, because they're self-healing in case of puncture. This large capacity gives stability and humless quality in a marvelous new B eliminator, using the —80 full-wave rectifier tube on 50-60 cycle 105-120 v. AC maximum output voltage at 35 milliamperes is full 180 volts for —71 or —71A power tube, or lower voltage may be used for —12 or —12A power tube. The voltages are (B—) (B+22 to 45 variable) (B+67 to 85 variable) (B+90 to 135 variable) (B+180). Size 6¼ inches high by 7 inches wide. Equipped with finger-tip adjusters and insulated binding post strip. Price, all built up in de luxe metal housing with crackled gloss finish, including tube, $18.00. Immediate shipment. Send remittance and we pay cartage. Order C.O.D. and you pay cartage—Custom Set Builders Supply Co., 57 Dey Street, N. Y. City. Tel., Barclay 8659.

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

Build the New

SCREEN GRID UNIVERSAL!



Unusual Results on Four Tubes!

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

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

Very Selective, Yet Lots of Volume!

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

The screen grid RF tube is followed by two -01A tubes, while the output tube may be a —12A or —71A power tube, depending on whether you have 135 volts or 180 volts maximum at your disposal.

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

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

When you turn the subpanel upside down for underneath wiring you don't have to imagine the direction the leads take. Nothing is left to the imagination.

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

Enclosed please find $1.00 for which send me at once a blueprint of the 4-tube Screen Grid Universal Receiver, as designed by Herman Bernard.

45c extra for Dec. 1st, 8th, 15th issues of Radio World.

Name.....

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

FILL OUT AND MAIL NOW

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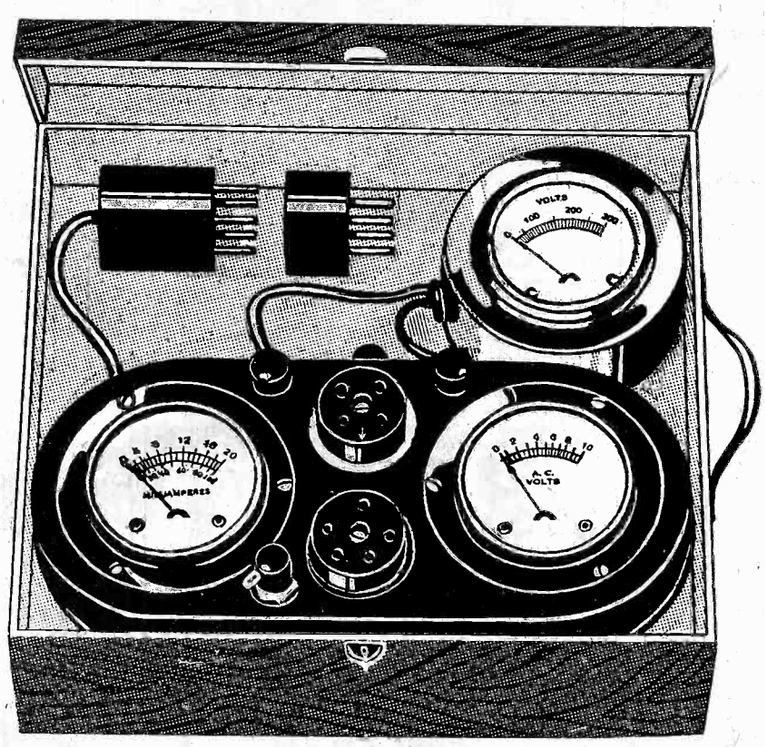
De Luxe Carrying Case FREE

With Each Jiffy Tester Combination!

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

INSTRUCTION SHEET GIVES FULL DETAILS OF THESE THIRTEEN TESTS

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



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

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

Jiffy Tester a Scientific Trouble Shooter

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

$13.50

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

$14.50

Here Are the Thirteen Vital Tests!

(1) to measure the filament voltage, up to 10 volts, of AC and DC tubes;

(2) to measure the plate current of any one tube, including any power tube, from less than 1 milliampere up to 100 milliamperes;

(3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly any set draws more);

(4) to measure the B voltage applied to the plate of tube; the voltage across B batteries or B eliminators, up to 300 volts;

(5) to determine the condition of a tube, by use of the grid bias switch;

(6) to measure any tube's electronic emission;

(7) to regulate AC line, with the aid of a power rheostat, using a 27 tube as guide;

(8) to test continuity of resistors, windings of chokes, transformers and circuits generally;

(9) to find shorts in bypass and other condensers, as well as in inductances,

(10) to read grid bias voltages, including those obtained through drops in resistors;

(11) to determine the presence of distortion and overloading;

(12) to test for correct bias;

(13) to determine starting and stopping of oscillation.

[Note—Instruction booklet fully informs you how to make each and every one of these tests in a jiffy.]

Note All That You Get!

For $13.50 you receive:
(1) One Two-In-One 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale especially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
(2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
(3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
(4) One 5-prong plug with 30" cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
(5) One grid switch to change bias.
(6) One 5-prong socket.
(7) One 4-prong socket.
(8) Two binding posts.
(9) One handsome moire metal case.
(10) One instruction sheet.
(11) One de luxe carrying case.

If 0-500 volt 5% accuracy high resistance meter is preferred to 0-300 volts, add $1.00, and order Combination C at $14.50.
If 0-500 volt 1% accuracy high resistance meter is preferred to 5% accuracy 0-500 voltmeter, add $2.00, and order Combination D at $15.50.
[Note—A pair of adapters for UV199 tubes, Cat. No. 999, at $1.00 extra. These are not sold except with Jiffy Tester Combination.]

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145 West 45th Street, New York City.
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Please ship at once your Jiffy Tester Combination for which I will pay postman advertised prices, but no shipping charges. (Check off below.)

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

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