Mercury Detector Device May Be Improved by Experimenter

Refinements Suggested by Engineer Provide Greater Flexibility and Simplicity.—Battery Current and Signal Strength Changed With Oscillation

BY G. N. GARRISON.

Luckily radio numbers among its ardent followers thousands upon thousands of earnest experimenters—that vast army who are interested in radio, not so much for its entertainment or educational value, but rather for radio's sake and for the mental exhilaration and alertness which are among the rewards of such activities.

Now a rudimentary radio device may be brought to a state of perfection by at least three different channels: By the inventor himself, in strict secrecy; by follow-up work carried on by the few who may have been privileged to witness the rudimentary invention or by the hundreds of thousands of radio experimenters all working with the determination that such invention shall be perfected.

Judging by the results attributable to the radio experimenter in the past, the latter way is by far the speedier method. It is for that reason that this additional article on "Tubeless Receivers" has been written.

Readers will remember that in the Sunday Journal Radio Section of Dec. 28 there was an article about a receiver which operates without crystal or vacuum tubes. The experimental device therein described was a cylindrical glass container, stoppered at one end and in which was placed a quantity of mercury (sometimes erroneously called "quicksilver"), a circular grid and an anode.

In this device a constant positive potential, derived from "B" batteries, was applied to the anode, while the mercury which acted as the cathode was connected in the negative lead of the high voltage supply. When thus connected the device performed the same function as but in a different manner from the familiar three-electrode vacuum tube now in universal use.

Even though the resultant signal strength is less with the new device than when standard thermionic vacuum tubes are used, the fact that the former entirely eliminated the use of a filament and an "A" battery made it possible considerably to increase the number of stages of amplication such devices could use.

Such a device was by its very nature, rather crude; therefore the following refinements and experimnts should prove interesting and instructive.

In Fig 1 is shown the first refinement and in its general shape and action it remains virtually the same in the two drawings following.

Fig. 1, (A) represents the glass tube bent as shown, (B) represents a side or end view of a circular wire-mesh grid disposed in the glass tube (A) as illustrated, (D) shows the connecting lead wire from the wire-mesh grid, while (D1) and (D2) are the connecting lead wires from the cathode and anode.

The letters (E) and (E1) show a quantity of mercury, the action of which, possibly not entirely clear in our former article, will be explained more in detail later. The connecting lead wires (D), (D1) and (D2) pass through cork or some other form of stopper, the stopper (C) having been pushed into the open ends of the tube, while stopper (C1) closes the opening in the neck (G).

The wire-mesh grid "B" is preferably made fast to the under side of stopper (C1) and together with stopper (C1) is inserted in neck (G). This procedure gives greater stability to that element and prevents a certain amount of mechanical vibratory phone noises otherwise present.

Fig. 2 is identical with Fig. 1 with the exception of the fact that in Fig. 2 both ends of the glass tube are sealed. The illustration shows the ends sealed flat, but this is not necessary, and these ends may be tapered without affecting the operation of the device.

The ends were flattened simply that the device might have a surface upon which to stand. It is essential that the mercury in each "leg" of the tube be virtually level and be of nearly equal height. The quantity of mercury required is best determined by experiment and will vary with the "B" battery voltage used as well as with the cross-sectional area of tube (A) and vertical height of the grid (B) above the surface of the mercury.

The terminals connecting the mercury (E) and (E1) with the connecting lead wires (D1) and (D2) pass through the end seals of the tube.

This operation, of course, is accomplished before the mercury is introduced and the terminals are inserted while the glass seals are at a red heat. The wire-mesh grid (B) is attached to stopper (C1) and inserted as in Fig 1.

Fig. 3 is an improvement over the devices shown in the drawings in that here the neck (G) and stopper C1) have been eliminated. The connecting lead wire (D) is now passed through the glass wall of the tube in much the same manner as was the terminals connecting (E) and (E1) with (D1) and (D2) of Fig. 2.

The wire-mesh grid (B) is pushed into place by means of tweezers before either end of the tube is sealed. The mercury is then poured in and the ends sealed as formerly. The tip (F) is formed during the operation of exhausting the tube, or filling it with gas, as will be later explained.

The operation of this device is very similar to that described by the writer in the issue of Dec. 28. The superiority of the device described in this article over that previously considered is a flexibility and simplicity which permits experimenters more latitude in their work.

In the devices described in this article either (E) or (D1) may act as cathode and the other as anode, depending upon the polarity of the high potential used.

Assume that the device was connected to a standard regenerative circuit, as shown in Fig. 4. The incoming oscillations are applied through (L) and (C) between (B) and (E). Since (E) is connected to the negative and (E1) to the positive side of our high potential, then the former will act as the cathode and the latter as the anode. The mercury vapor in endeavoring to pass from (E1) to (E) must pass through (B), which is connected to one end of our oscillating circuit.

During the half cycle (that our incoming oscillation is negative it will assist the flow of current from the "B" batteries, through the phones, tickler, mercury vapor and back to "B" batteries. Such assistance will have the effect of increasing the "B" battery current when the incoming half cycle is negative. The reason for this is that unlike charges attract each other and in this assumed case (E1) is positive while both (B) and (E) are negative.

During the half cycle that the grid (B) is positive the charge on (B1), (B) and (E) tend to neutralize each other, resulting in an interruption or checking of the "B" battery current. It can be seen that the "B" battery current and therefore the diaphragm pulsations and signal strength are made to vary in accordance with the incoming oscillations. The tickler coil in this circuit is used for the same purpose as that in any three-element vacuum-tube circuit, that is, to cause regeneration and increased signal strength.

In experimenting with these devices it is suggested that at least one each of the devices shown in Fig. 1, 2 and 3 be built and that the result of experiments therewith be carefully noted.

Fig. 3 is especially adapted for different degrees of exhaustion, as well as for the insertion of various gases. The tube is "sealed off" at the tip (F).

What was said about the operation of the earlier device applies equally here, success or failure depends very largely upon the proper size, proportioning and placing of the various elements.

In any event, in experimenting with the above devices the experience gained, if it but serves to keep the experimentor off the "beaten path," wil be hours profitably and enjoyably spent. And then, again, you may be the successful experimentor!

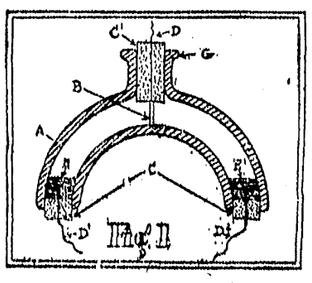


Fig. 1

Refinement of Tube

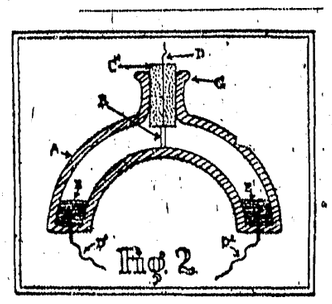


Fig. 2

Ends of Tube Sealed

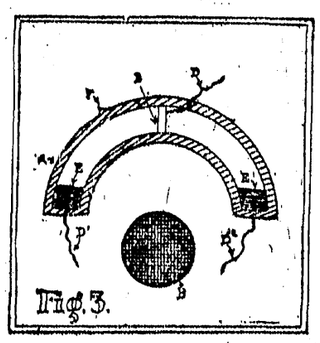


Fig. 3.

Neck and Stopper Eliminated

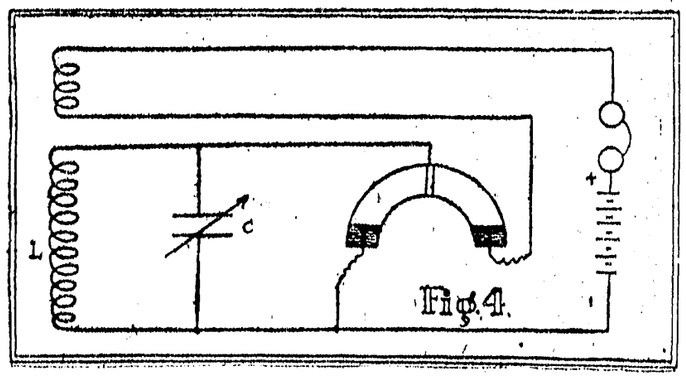


Fig. 4.

Device Connected to Regenerative Circuit

To-day's Hook-Up

He Would Prefer a Talk on How to Reduce

Women Head 3 Radio Stations in the U. S.

Three women hold the distinction of being broadcast directors in the United States, and all three are said to be conspicuously good in the service they render to the listening public. They are: Eleanor Poehler, who manages station WLAG, Minneapolis; Miss Judith Waller of station WMAQ, Chicago; Miss V. A. L. Jones, station KSD, St. Louis.

There are many women broadcast announcers, but out of the some 550 stations throughout the country only three are known to be run entirely by women.

All three, for this reason, have gained popularity in the radio world, says the Milwaukee Journal. Mrs. Poehler, for instance, not only manages her station, but is called upon to write special radio articles for newspapers and magazines and to deliver lectures to clubs and classes.

As head of WLAG, she has complete charge of the programmes and business arrangements, and she frequently announces her evening concerts. She is a widow, with one son, an accomplished musician and a soprano of European as well as American training.

Miss Waller is responsible for the operas broadcast through station WMAQ at Chicago by the Chicago Civic Opera Company. She has planned educational programmes for WMAQ fans and is well known for her musical concerts.

Training for this job came to Miss Waller from the field of advertising and office management.

Not only is Miss V. A. L. Jones director of station KSD, St. Louis, but she retains her control over her own advertising concern in that city. She is a musician and a critic, graduate of the University of California. She announces her own programmes, besides managing the business end.

All three stations are in Class B and of the highest grade officially. Their directors compete good-naturedly among themselves for highest honors in broadcasting. Yet they have never met.

Keep Battery Right Side Up.

Because a dry battery is built so that it can stand more acid at the bottom than anywhere else, it should never be laid upon its side. When on its side the acid will quickly destroy that portion of the zinc which is underneath and shorten its life.

To Correct Uneven Phones.

When headphones give off an uneven sound, it means that one of the phones has changed in some way. The most common cause of this trouble is a loose diaphragm, which is the small metal disc, due to a loose ear cap. Tighten the caps.

WJAR HEARD IN DISTANT LANDS

Reception of Local Programmes Reported from Overseas.

Applause Cards Also Received from Listeners in Northwestern Canada, Central America and Nova Scotia.—No Fading, Says English Fan.

Radio programmes put on the air in Providence are entertaining listeners from Alaska south to Central America and from the Pacific coast east to Europe, according to the numerous applause cards which have been received recently by station WJAR. Several of the messages from fans in distant places indicate that the signals of the local station have been received with sufficient volume so that the listeners could bring in the programmes for considerable periods of time.

Among cards from the far North is one on which the writer states that his message would be carried 300 miles on a dog sled and then sent by boat to the nearest railroad station, before it could be mailed. WJAR has been heard in every province in Canada, and a letter from J. E. Murdock, Cadogan, Alberta, states that the Providence civic celebration, broadcast Christmas Eve, came in clearly and with considerable volume in the little town on the Pacific coast, 600 miles from Vancouver, B. C.

Another communication came from Central America. The writer, Jose Velasco of Santa Ana, El Salvador, has this to say about his reception of music from the local station: "I am taking pleasure to inform you that you station, WJAR was heard here, transmitting dance music. It is quite a pretty distance which separates us, and I thought you would like to know what a long way travel your signals."

From places bordering on both sides of the Atlantic messages acknowledging reception of WJAR signals are frequently received. Within recent weeks Rhode Islanders, as well as people from other States, who have gone to Florida to escape the vagaries of winter weather experienced in the North, have reported that concerts sent out from this city have been received with good volume on loud speakers. Cards have also been received from places north of Nova Scotia, according to James A. Reilly, WJAR studio manager and announcer.

Applause cards bearing the postmarks of various European countries have also reached WJAR this winter. Claude Shephard of Draycott, North Derby, writes that he has heard WJAR signals for an hour at a time without any trace of fading or without losing a single part of the programme.

A Brown University alumnus, H. C. Wardwell, '98, has notified the station that while in Belgium he tuned in on WJAR one night and heard "Daddy" Jim Coombs, who is also a Brown man, singing one of his well-known selections, "Polly put the kettle on, and we'll all take tea."

Basil T. Edwards, a resident of Lakewood, who is chief engineer on the SS. Joseph Seep, has reported that he heard the local station while he was in Italy. He wrote, "I heard you finely all the way from Galveston, Tex., until passing through in Gibraltar, and then picked you up again in the Adriatic. You certainly have good modulation."

Increasing Selectivity.

To increase the selectivity of a receiver using a variocoupler with a secondary tuned by a condenser, simply turn the rotor coil so that the turns of the primary are almost at right angles of those on the secondary. Bring the plate variometer up to maximum regeneration.

Drilling Holes in Glass.

One of the newest and quickest ways to drill holes in glass is to use a brass or copper tube with thin walls instead of a triangular file. The tube is placed in a brace and drilling is accomplished with powdered carborundum as a cutting agent. A guide of wood keeps the tube properly centred.

Importance of Good Aerial.

The direct cause of the comparatively poor results obtained by some of the receiving sets is the aerial system. Some are improperly placed, some have poor and unsoldered connections, while others are of a length far from suitable.

FILAMENT CONTROL JACKS VALUABLE

Automatically Light Necessary Number of Tubes.

Construction of Device, Which Makes Possible Connection of 'Phones or Speaker Into Circuit at Proper Points, Explained.—Easy to Wire Into Set.

By G. C. REES.

If you operate a receiving set exclusively for your loud-speaker or for your headphones alone, a simple battery-switch suffices for turning the filament current on and off. This device is convenient for switching the battery current on and off.

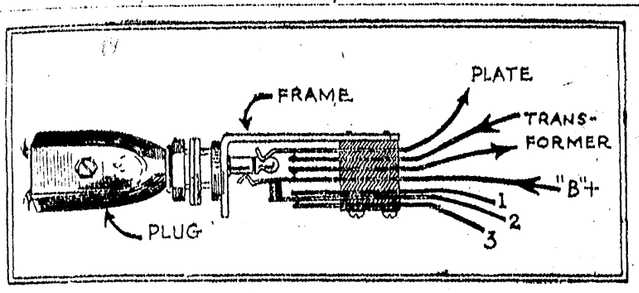
When you have use for both phones and speaker you "plug-in" on the detector tube, first or second amplifier tubes, or, perhaps, to a power amplifier. Filament control jacks not only permit you to connect your phones or speaker into the circuit at the proper points, but at the same time automatically light the necessary number of tubes.

The filament-control jack is the same construction as the ordinary phone jack, it having, however, some extra contact springs for the "A" battery connections. In the case of the double-circuit jack illustrated in the accompanying diagram, the connections to the first four springs are made just in the same manner as when a plain four-spring jack is used. With the plug inserted, the current from the "B" battery enters through one of the long springs, traverses the phone leads and phones and goes to the plate by way of the other long spring.

When the plug is withdrawn the current passes to the audiotransformer and returns from it over the inner and shorter springs. Let us assume that the jack illustrated is inserted in the detector circuit. With one phone plug in the jack the phones are connected to the detector. What happens to the filament portion of the circuit while this is going on? As the plug is pushed into the jack, spring (2) of the filament control section of the jack is brought into contact with spring (3), the necessary pressure being exerted through a small length of insulating rod attached to one of the plate circuit springs.

Contact (3) goes to the "A" battery and (2) to the rheostat of the detector. Hence the detector tube is lighted. With the plug withdrawn, however, contacts (2) and (3) are opened and the tube put out. But, at the same time, contact (1) and (2) come together. No. 1 is joined to the rheostat of the first amplifier tube, so that as the plug is pushed into the next jack the battery circuit to both rheostats is closed automatically and two tubes are lighted.

Inasmuch as the "A" battery is always wired to the (3) contact of the filament jack no tube can be illuminated until the plug is inserted somewhere, and when it is pushed into one of the jacks all the necessary tubes are immediately lighted.



Filament Control Jack Connections

RADIO PROGRAMMES

Special musical events and educational talks are featured on the programmes of local broadcasting stations this week. Addresses on the Red Cross, the Child Labor Amendment and music are to be given at WJAR. This station also offers a concert by the United States Army Band and a recital by Mme. Charlotte Lund, operatic singer, Wednesday evening. A programme by Clan MacKinlay, Order of Scotch Clans, will be relayed from Boston to-morrow night by WEAN, which also offers orchestra and vocal music each day. The Hope Trio and the Fairlawn Entertainers will give a musical programme at WSAD Thursday night. The last in a series of "radio journeys to the homes of great musicians" is scheduled by WDWF Thursday night.

WJAR, THE OUTLET COMPANY
(360 METRES)

TO-DAY

7:20 p. m.—Musical programme by "Roxy and His Gang" direct from the Capitol Theatre, New York City, courtesy of the Capitol Theatre management and S. D. Rothafel (Roxy). The first part of the programme will be taken direct from the stage of the theatre and will consist of music by featured artists and the Capitol Grand Orchestra. The second part of the programme will consist of a special presentation by Mr. Rothafel of vocal and instrumental artists direct from the broadcasting studio in the theatre.

9:15 p. m.—Organ recital from the Chapel at Columbia University.

MONDAY

10:00 a. m.—Housewives' radio exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—Theresa Del Rossi, pianist.

8:00 p. m.—Programme under the direction of Arthur E. Gonyea assisted by Mrs. Gonyea.

8:25 p. m.—Mariana M. Tallman, poet-reader.

8:30 p. m.—Mrs. Gertrude Wilcox Harrop will give the second of the series of talks on Red Cross work.

9:00 p. m.—Gypsy Ensemble relayed from New York city studios.

TUESDAY.

1:05 p. m.—Providence Biltmore Hotel Orchestra direct from the hotel under the direction of Erwin White.

2:00 p. m.—Dr. Worth M. Tippy, Executive Secretary, Federal Council of Churches of Christ in America, will talk on "Federal Child Labor Amendment."

7:45 p. m.—Fern Kingsford, pianist.

7:55 p. m.—Speaker from Providence Safety Council.

8:00 p. m.—Overseas Male Quartet, consisting of Stanley D. Rogers, Walter L. Rogers, Robert A. Lawder, Ray A. Gardiner, assisted by George Faulkner, pianist.

9:00 p. m.—Specialty.

10:00 p. m.—Orchestra under direction of Joseph Knecht.

WEDNESDAY.

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—Studio programme.

7:30 p. m.—Concert by the United States Army Band, under the direction of Warrant Officer William J. Stannard, direct from Washington, D. C.

8:30 p. m.—The Three Peasants, Sicilian dance music.

9:00 p. m.—Concert by the Waldorf-Astoria Orchestra direct from the lobby of the hotel, under the direction of Joseph Knecht.

9:45 p. m.—Mme. Charlotte Lund, operatic star. Programme: "Puccini Memorial."

10:00 p. m.—Gladys Allen Trio.

10:15 p. m.—Justin Lawrie, tenor.

THURSDAY.

1:05 p. m.—Studio programme.

FRIDAY

10:00 a. m.—Housewives' Radio Exchange. A department conducted by Mrs. Wood on all matters of household interest.

1:05 p. m.—Woodstock Orchestra, under the direction of Martin J. Casey.

7:15 p. m.—Piano, "Musik Tawkalog," by Mabel Woolsey. The second of an educational series especially arranged for piano students.

7:45 p. m.—Concert by Miss Agnes A. Lafayette, contralto; J. Harold O'Keefe, tenor; Lillian E. Levitre, pianist.

8:45 p. m.—Talk.

9:00 p. m.—Orchestra, relayed from New York.

SATURDAY

1:05 p. m.—Studio programme.

WEAN, THE SHEPARD STORES
(270 METRES)

TO-DAY

10:45 p. m.—Service, broadcast from the Beneficent Congregational Church.

3:30 p. m.—Old South Forum, broadcast from Old South Meeting House, relayed from Boston.

7:30 p. m.—Service, broadcast from the Mathewson Street Methodist Episcopal Church. Organ prelude, "Andantino in D-Flat," Lemare; hymn, Weston; prayer; chant, "The Lord's Prayer," Gilbert; soprano solo, "I Will Lay Me Down in Peace," Buck; psalter, Third Sunday Evening; Gloria Patria, Greatorex; offertory anthem, "Peace I Leave with You," Roberts; Doxology; sermon, Dr. Nehemiah Boynton; hymn, Ellsdle; benediction; Amen; organ postlude, "Festival March," Foote.

MONDAY.

11:55 a. m.—Time signals.

12:00 p. m.—Colonial Concert Orchestra.

12:10 p. m.—Weather report.

12:15 p. m.—Musical programme.

4:00 p. m.—Organ recital by Prof. Edward Benedict, broadcast from Emery's Majestic Theatre.

4:15 p. m.—Colonial Dance Orchestra.

4:30 p. m.—Weather report.

To-day's Programmes in Brief

For the convenience of radio fans, the following hourly schedule of broadcasting to-day is given in brief form, the complete programme being given under the regular listing of announcements.

The hours are based on Eastern Standard Time.

LOCAL STATIONS

10:00—Chimes, WDWF.
10:45—Church, WEAN.
11:30—Forum, WEAN.
6:00—Recital, WDWF.
7:20—Concert, WJAR.
7:30—Church, WEAN.
9:15—Organ recital, WJAR.

OUT-OF-TOWN STATIONS

9:00—Children's hour, WJZ.
10:00—Chimes, WREO.
10:30—Church, WREO.
Church, WOO.
10:45—Church, WCAE.
Church WBZ.
11:00—Church, WJZ.
Church, WCCO.
Church, WCAP.
Church, KDKA.
12:00—Church, KYW.
12:45—Concert, WJZ.
1:00—Church, KOA.
1:30—Church, KGW.
2:00—Church, KGO.
Orchestra, WDAR.
Hymns, WEAF.
2:30—Bible class, WJZ.
Concert, KDKA.
Music, WOO.
2:45—Religious service, WEAF.
3:00—Religious service, WHN.
Church, WCAE.
Vespers, WGR.
3:25—Orchestra, WBZ.
3:30—Talk, WJZ.
Musicale, WGBS.
3:45—Men's conference, WEAF.
Men's conference, WBEI.
4:00—Organ recital, KDKA.
Concert, KYW.
Talk, WIP.
Church, WCAP.
Orchestra, WFAA.
Recital, WGR.
Recital, WCAE.
Vespers, WJZ.
4:10—Church, WCCO.
4:45—Vespers, KDKA.
5:00—Orchestra, WHN.
5:30—Trio, WHN.
6:00—Recital, WOO.
Concert, KGW.
6:15—Concert, KDKA.
6:30—Concert, WCAE.
Orchestra, KGO.
7:00—Orchestra, WJZ.
Religious service, KYW.
Bible class, WFAA.
Orchestra, WBZ.
7:15—Organ recital, WGR.
Church, WIP.
7:20—Concert, WEAF.
Concert, WCAP.
Concert, WBEI.
Concert, WDBH.
Church, WCCO.
7:30—Church, WGR.
Organ recital, WLS.
7:45—Church, KDKA.
8:00—Talk, WJZ.
Recital, WBZ.
8:15—Concert, WJY.
8:30—Church, WFAA.
8:45—Orchestra, WJZ.
9:00—Church, KGW.
Concert, WNYC.
Forum, KDKA.
9:15—Concert, WCCO.
Organ recital, WEAF.
Organ recital, WCAP.
Organ recital, WDBH.
Concert, WBZ.
9:30—Orchestra, WIP.
9:45—Church, KOA.
10:00—Concert, KGW.
Concert, WFAA.
Recital, WJZ.
Talk, WJY.
Specialty, WHN.
10:30—Concert, WFAA.
11:00—Revue, WHN.
Church, KGO.
11:30—Orchestra, WHN.
12:00—Entertainers, WHN.

4:35 p. m.—Colonial Dance Orchestra.
8:00 p. m.—Scottish Night, Clan MacKinley, Order of Scotch Clans, relayed from Boston.

TUESDAY.

10:00 a. m.—Message to housewives by Miss Gladys J. L. Peckham.
11:55 a. m.—Time signals.
12:00 p. m.—Colonial Concert Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—Musical programme.
4:00 p. m.—Colonial Dance Orchestra.
4:10 p. m.—Incidental music by Emery Theatre Concert Orchestra, William J. Faucher, director.
4:30 p. m.—Weather report.
4:35 p. m.—Colonial Dance Orchestra.
6:30 p. m.—Colonial Orchestra, Harold Sheffers, director; soprano solos by Elizabeth M. Dussault; piano solos and readings by Lois A. Dussault; vocal solos by Irving Crocker.
7:00 p. m.—Talk, "Thrift in Homes," by Doris B. Datson.
8:10 p. m.—Orchestra and Robert Isensee, baritone soloist, relayed from Boston.
11:30 p. m.—Programme by artists who will appear at the theatrical employes' ball, relayed from Boston.

WEDNESDAY.

11:55 a. m.—Time signals.
12:00 p. m.—Colonial Concert Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—Musical programme.
4:00 p. m.—Organ recital by Prof. Edward Benedict.
4:30 p. m.—Weather report.
4:35 p. m.—Colonial Dance Orchestra.
8:00 p. m.—Sixth annual dinner and reception to National Commander James A. Drain, relayed from Boston.
10:45 p. m.—Organ recital by Prof. Edward Benedict.

THURSDAY

10:00 a. m.—Message to Housewives by Miss Gladys J. L. Peckham.
11:55 a. m.—Time signals.
12:00 m.—Colonial Concert Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—Musical programme.
4:00 p. m.—Colonial Dance Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Colonial Dance Orchestra.
6:30 p. m.—Dinner dance. Solos by Frank Bernier, Alice Murray and Mary Carberry.

FRIDAY

11:55 a. m.—Time signals.
12:00 m.—Colonial Dance Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—Musical programme.
4:00 p. m.—Organ recital by Prof. Edward Benedict.
4:15 p. m.—Colonial Dance Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Talk, "Book Brevities," by a member of the Providence Public Library.
8:00 p. m.—Concert programme.
10:00 p. m.—Emery Theatre Orchestra.

SATURDAY

10:00 a. m.—Message to Housewives by Miss Gladys J. L. Peckham.
11:55 a. m.—Time signals.
12:00 m.—Colonial Concert Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—Musical programme.
4:00 p. m.—Colonial Dance Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Colonial Dance Orchestra.
4:45 p. m.—Recital by Prof. Edward Benedict.
8:00 p. m.—Marion Chase Players, relayed from Boston.
9:00 p. m.—Concert programme.
10:00 p. m.—Copley Plaza Orchestra, direction of W. Edward Boyle, popular songs, Rogers and Rogers, relayed from Boston.

WSAD, FOSTERS
(236 METRES)

MONDAY.

2:30 p. m.—Instrumental music.
6:00 p. m.—Radio Pals story by Fosters Story Lady.
6:15 p. m.—Regular Monday evening programme of "Dance Hits of Other Days" by the WSAD Orchestra.

TUESDAY.

2:30 p. m.—Afternoon of music.
6:00 p. m.—Fosters Story Lady will talk to her Radio Pals.
6:15 p. m.—Fifteen minutes of music.

WEDNESDAY.

2:30 p. m.—Instrumental music.
6:00 p. m.—Regular weekly Radio Pals entertainment by Fosters Story Lady, assisted in songs and dialog by Dolly Gibb, piano accompaniment by Marion Tanner.
6:15 p. m.—Concert by Al Thornton's Nightingale Orchestra.

THURSDAY.

2:30 p. m.—Instrumental music.
3:15 p. m.—Song recital by Charles Morgan, tenor of Bristol, accompanied by Miss Frances M. Ostiguy.
3:30 p. m.—Instrumental music.
8:30 p. m.—Musical evening by the Hope Trio; Hope Hammett, violin; Victoria Johnson, 'cello; Miriam Stafford, piano. Programme will consist of en-

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RADIO PROGRAMMES

Continued from Page Seven

semble and role numbers. The Fairlawn Entertainers, Eugene de Lomba, first tenor; Jimmy Cotton, second tenor; George Piggott, bass; Thornton Gill, baritone, and accompanist; Miss Alice Spotwood, reader.

FRIDAY.

2:30 p. m.—Afternoon of music.

6:00 p. m.—Safety talk for children by Fosters Story Lady in co-operation with Providence Safety Council.

6:05 p. m.—Stories for the Radio Pals by Fosters Story Lady.

6:15 p. m.—Musical programme to be announced.

SATURDAY.

2:30 p. m.—Saturday afternoon dance music by the Sunset Orchestra.

6:00 p. m.—Saturday night story for the Radio Pals by Fosters Story Lady.

6:15 p. m.—Regular Saturday evening dance music by Lar Potter's Orchestra.

WDWF, DUTEE WILCOX FLINT, INC.

(286 METRES)

TO-DAY.

10:00 a .m.—Chimes.

3:00 p. m.—Concert, Venetian Serenaders and John J. Fitzpatrick, organist.

WEDNESDAY.

9:30 p. m.—Arcadia orchestra.

THURSDAY.

8:00 p. m.—Third, and last, radio journey to the homes of great musicians; subject, "Liszt." This will be followed by a talk, "The Holy Year at Rome," by Prof. John F. Greene of Brown University.

WBZ, SPRINGFIELD, MASS.

(337 METRES)

TO-DAY.

10:45 a. m.—Church services transmitted from the Church of the Unity, Rev. Charles A. Wing, pastor. Music by the Philharmonic Male Quartet: Raymond C. Hodge, first tenor; Howard I. Smith, second tenor; William H. Lippmann, baritone; George B. Dowd, bass; Robert W. Field, organist and director.

3:25 p. m.—Broadcast from the St. James Theatre of the concert by the People's Symphony Orchestra.

7:00 p. m.—Concert by the Copley-Plaza Orchestra under the direction of W. Edward Boyle.

8:00 p. m.—Programme to be announced.

9:15 p. m.—Concert by the Steinert Quartet broadcast from the Steinert Organ studio.

WDBH, WORCESTER, MASS.

(268 METRES)

TO-DAY.

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

WHN, NEW YORK CITY

(360 METRES.)

TO-DAY.

3:00 p. m.—Queens County Christian Endeavor programme, represented by the Rev. George Drew Egbert of the Flushing Congregational Church.

5:00 p. m.—Roseland Dance Orchestra.

5:30 p. m.—Olcott Vail and his string trio.

10:00 p. m.—Entertainers.

11:00 p. m.—Vanity Club revue.

11:30 p. m.—Connie's Inn revue, featuring Leroy Smith's Orchestra.

12:00 midnight—Club Richman revue, featuring Harry Richman and his entertainers with Eddie Elkins and his orchestra.

12:30 a. m.—El Foy revue.

WNAC, NEW YORK CITY

(526 METRES.)

TO-DAY.

9:00 p. m.—Programme from the Brooklyn Mark Strand Theatre under the direction of Edward L. Hyman.

KDKA, EAST PITTSBURGH, PA.

(309 METRES.)

TO-DAY.

11:00 a. m.—Services of the First Presbyterian Church, Pittsburgh, Rev. J. Alvin Orr, pastor.

2:30 p. m.—Concert.

4:00 p. m.—Organ recital by Dr. Charles Heinroth, director of music of Carnegie Institute, Pittsburgh, broadcast directly from Carnegie Music Hall, Pittsburgh.

4:45 p. m.—Vesper services of the Shadyside Presbyterian Church, Pittsburgh, Rev. Hugh Thomson Kerr, pastor.

6:15 p. m.—Dinner concert by Scalzo's Orchestra, playing at the Pittsburgh Athletic Association, Pittsburgh.

7:45 p. m.—Services of the Calvary Episcopal Church, Rev. E. J. Van Etten, pastor.

9:00 p. m.—Open forum from the East End Christian Church, Rev. John Ray Bowers, pastor.

KGO, OAKLAND, CAL.

(312 METRES)

TO-DAY.

2:00 p. m.—Service of the First Church of Christ, Scientist, San Francisco.

6:30 p. m.—KGO Little Symphony Orchestra concert, Carl Rhodehamel conducting, assisted by guest artists.

11:00 p. m.—Service of the First Church of Christ, Scientist, San Francisco.

KGW, PORTLAND, OR.

(492 METRES)

TO-DAY.

1:30 p. m.—Service from First Presbyterian Church, Dr. Harold Leonard Bowman, pastor.

6:00 p. m.—Municipal concert.

9:00 p. m.—Church services provided by the Portland Council of Churches.

10:00 p. m.—Dinner concert by Colburn Concert Orchestra of Hotel Portland; intermission solos.

KOA, DENVER, COL.

(323 METRES)

TO-DAY.

1:00 p. m.—Service of the First Baptist Church, Denver; Dr. A. H. C. Morse, pastor.

9:45 p. m.—Service of the First Baptist Church, Denver; Dr. A. H. C. Morse, pastor.

KYW, CHICAGO, ILL.

(536 METRES

TO-DAY

12:00 noon—Central Church service broadcast from Orchestra Hall, Chicago, Dr. F. F. Shannon, pastor.

4:00 to 5:00 p. m.—Studio concert.

7:00 p. m.—Chicago Sunday Evening Club service. The musical programme will be arranged by Edgar Nelson. The speaker of the evening will be Dr. John Gardner, First Presbyterian Church, Riverside, Cal.

WCAE, PITTSBURGH, PA.

(462 METRES)

TO-DAY

10:45 a. m.—Services from Rodef Shalom Temple.

3:00 p. m.—People's Radio church services.

4:00 p. m.—Piano recital by Prof. Otto Kaltels.

6:30 p. m.—Dinner concert transmitted from William Penn Hotel.

WCAP, WASHINGTON, D. C.

(469 METRES)

TO-DAY.

11:00 a. m.—Service from the All Souls Church, Unitarian, of Washington. Dr. Ulysses G. B. Pierce, pastor, will deliver the sermon, his subject being "Beyond the Strife of Tongues." Musical numbers will be rendered by Gretchen Hood, soprano; Charles Trowbridge Tittman, bass; Richard Lorleberg, cello, and Lewis Corning Atwater on the Green memorial organ.

4:00 p. m.—Service at Bethlehem Chapel of the National Episcopal Cathedral at Mt. St. Alban, Washington. The Rt. Rev. James E. Freeman, bishop of Washington, will deliver the sermon.

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

WCCO, MINNEAPOLIS-ST. PAUL

(417 METRES)

TO-DAY.

11:00 a. m.—Westminster Presbyterian Church, Minneapolis, Rev. J. E. Bushnell, D. D., pastor.

4:10 p. m.—House of Hope Presbyterian Church, St. Paul, Rev. H. C. Swearingen, D. D., pastor.

7:20 p. m.—Second Church of Christ, Scientist, Minneapolis.

9:15 p. m.—Clasiscal programme.

WDAR, PHILADELPHIA, PA.

(395 METRES.)

TO-DAY.

2:00 p. m.—Arcadia Concert Orchestra.

WEAF, NEW YORK CITY.

(492 METRES.)

TO-DAY.

2:00 p. m.—"Sunday Hymn Sing," auspices Greater New York Federation of Churches.

2:45 p. m.—Interdenominational services, auspices Greater New York Federation of Churches. Address by Rev. John L. Davis, pastor of Grace Methodist Episcopal Church, New York city. Music by Federation Radio Group, Aida Brass Quartet, Federation Male Quartet, with Arthur Billings Hunt, baritone, and musical director; Mildred Bryars, contralto; Louis Caton, tenor; George Vause, pianist; Frank Penney, violinist, and William H. Brewster, organist.

3:45 p. m.—Men's conference in the Bedford Branch Y. M. C. A., Brooklyn, N. Y. Address by Dr. S. Parkes Cadman, "The Eternal City—Rome." Answers to questions by Dr. Cadman follow the address. Special music, Gloria Trumpeters, Howard Wade Kimsey, song leader; Mrs. Howard Wade Kimsey, accompanist; George Betts, chime soloist.

7:20 p. m.—Same as WJAR.

9:15 p. m.—Same as WJAR.

WEEI, BOSTON, MASS.

(476 METRES.)

TO-DAY.

3:45 p. m.—Men's conference.

7:20 p. m.—Same as WJAR.

WFAA, DALLAS, TEX.

(476 METRES.)

TO-DAY.

4:00 p. m.—Grand Symphony Orchestra the Palace Theatre, Nicholas Mirskey directing.

7:00 p. m.—Radio Bible class, Dr. William M. Anderson, pastor of the First Presbyterian Church, teacher; Bible study and gospel song.

8:30 p. m.—Service at the First Methodist Episcopal Church, South, Dr. Carl C. Gregory, pastor.

10:00 p. m.—Dr. Robert A. Hunt, pastor of the First Methodist Episcopal Church, in sacred song recital, with his musical family.

10:30 p. m.—Jack Gardner and his orchestra in popular music recital.

WGBS, NEW YORK CITY

(316 METRES.)

TO-DAY.

3:30 p. m.—Matinee Musicale.

WGR, BUFFALO, N. Y.

(319 METRES)

TO-DAY

3:00 p. m.—Vesper services, Second United Presbyterian Church.

4:00 p. m.—Organ recital, George Albert Bouchard.

7:15 p. m.—Pre-service organ recital, direct from Central Presbyterian Church, William Wall Whiddit, organist.

7:30 p. m.—Evening service, direct from Central Presbyterian Church, R. J. MacAlpine, D. D., minister.

WIP, PHILADELPHIA, PA.,

(509 METRES)

TO-DAY

4:00 p. m.—Services, under the auspices of the Germantown Y. M. C. A. "The Powder and the Match," lecture by the Hon. George D. Alden of Boston.

7:15 p. m.—Evening service, broadcast direct from Holy Trinity Church, Rittenhouse square, Philadelphia; Rev. Floyd W. Tomkins, D. D., rector.

9:30 p. m.—Ben Stad and his WIP Symphony Orchestra, with Karl Bonawitz at the organ.

WJY, NEW YORK CITY,

(405 METRES)

TO-DAY.

8:15 p. m.—Bernhard Levitow's Hotel Commodore Orchestra.

10:00 p. m.—"Reminiscences of a Reporter," William H. Crawford.

WJZ, NEW YORK CITY

(455 METRES.)

TO-DAY.

10:00 a. m.—Children's Hour. Original stories by authors, music by composers, comic stories by originators of famous comedies.

11:00 a. m.—West End Presbyterian Church service; sermon by Dr. A. B. Kiegwin.

12:45 p. m.—Sunday Symphonic Society Concert direct from Cohan Theatre.

2:30 p. m.—Radio Bible Class, auspices Greater New York Federation of Churches; Church Community Chorus, under direction of Clarence W. Allen; Rev. F. N. Evans.

3:30 p. m.—"Practical Religion," Rev. Harry Emerson Fosdick.

4:00 p. m.—St. George's Episcopal Church Vesper Service; Rector, Dr. Karl Rolland; organist and choirmaster, G. W. Kemmer; soloists, Rebecca Pharo, soprano; Miss Mozelle Bennett, violinist; Harry T. Burleigh, baritone.

7:00 p. m.—Nathan Abas's Hotel Pennsylvania Orchestra.

8:00 p. m.—Share With Others Day: "The Other Fellow's Share," by Dr. Ernest M. Stires.

8:10 p. m.—Gotham National Bank Quartet.

8:45 p. m.—Joseph Knecht's Waldorf Astoria Orchestra; WGY will also broadcast.

10:00 p. m.—Hampton Institute Quartet. WGY will also broadcast.

WLS, CHICAGO, ILL.

(345 METRES.)

TO-DAY.

7:30 p. m.Organ recital.

WOO, PHILADELPHIA, PA.

(509.0 METRES)

TO-DAY

10:30 p. m.—Morning services from Bethany Presbyterian Church. Organ recital from 10:30 to 10:45, Miss Caroline Quigg at the console. Sermon by Rev. A. Gordon MacLennan.

2:30 p. m.—Musical exercises opening the regular Sunday afternoon session of Bethany Sunday school.

6:00 p. m.—Old time hymns and melodies and sacred chimes recital on grand organ by Clarence K. Bawden.

WREO, LANSING, MICH.

(286 METRES)

TO-DAY

10:00 a. m.—Chimes from the Belfry, Plymouth Congregational Church.

10:30 a. m.—Services from First Presbyterian Church, Rev. Guy W. Simon, pastor; Dwight Steere, organist.

RADIO RESEARCH VALUABLE

Navy Concentrates on Elimination of Interference.

The achievements of the Naval Research Laboratory at Bellevue, D. C., as disclosed by its annual report, are considered by experts to be noteworthy in the matter of contributing to interference elimination.

How is the laboratory report in so far as it deals with radio experiments:

"The laboratory makes a monthly check of shore-station transmitting frequencies, thus assuring their working on designated wave-lengths. Apparatus has been developed to give a ready means of frequency calibration for all vessels afloat, and this will not only speed up communication between any two stations, but, with improved apparatus, will make available more communication channels in the range of frequency bands assigned for naval use.

"Incident to the phenomenal growth of broadcasting, it has been found that some of the naval high-power transmitting stations cause interference in reception of radio programmes in their immediate vicinity. These stations were constructed at great expense, and money is not available to replace them at once with more modern equipment. An extended study of such interference is being made to find means of removing this objectionable feature without excessive cost to the Government.

Apparatus reducing excessive losses on board ships has been developed and it has been found that such apparatus also has an important application to shore stations, as it permits increasing the number of antennae available without corresponding increase in expensive radio towers.

A means of multiple reception on a single antenna has been worked out, and trial in service installations show that vessels were able to receive several messages simultaneously over a single antenna, at the same time permitting tube transmitting on most frequencies without interference with this reception. This alone more than doubles the communication efficiency of vessels so fitted.