Coil Eliminates Much Frequency Resistance and Dielectric Loss

Less Wire Required to Produce Given Inductance Than in Type "D" or "8" Coils.—Inductors May be Wound and Mounted as Self-Supporting Units

BY G. N. GARRISON, I. R. E.

In this article I will discuss certain factors involved in the use in radio circuits of the "D" coil, and I shall confine myself largely to a discussion of what the "D" coil will not do rather than what it will do, and as there has been plenty written of late concerning what the "D" coil is supposed to do when used in radio receiving circuits.

In the first place, the D-coil is not new, for the "age" of this particular type of inductor may be stated in terms of years! I have in my laboratory now a number of "D" coils which I built as far back as 1908—and which I later discarded for something better! The "original inventor" of the D-coil remains, to this day, unknown.

It is freely admitted that the usual type of "D" coil has less external field and less distributed capacity than most other inductors—but is this sufficient reason to use it in preference to all other forms of inductors; and for all purposes? We think not; for if we do, we are scheduled for a bitter disappointment. Especially since these two properties—small external field and small distributed capacity—are gained at an increase in radio equally important energy-waster—high frequency resistance.

As far as can be ascertained, the sponsors of the "D" coil claim no distinguishing characteristics other than those above named.

It should be kept in mind that any coil will have the greatest inductance only when its turns are parallel and close together; and the closer together they are, other things being equal, the greater will be the self-inductance of the coil for a given length of wire.

However, suppose, as in Fig. 1, we had two coils, both wound in the same direction and connected together as shown. When placed in inductive relation to each other the total inductance will be found to be greater than the sum of the inductors; for both inductors are then said to be "assisting" each other and the formula applies as shown in the equation,

$$M = L + L' - 2M$$

the value (2M) depending upon the closeness together or "coefficient of coupling," of the two coils.

The same reasoning and formulae apply to the coils of Fig. 3, providing only that they are in inductive relation to each other and that their diameters are great compared to their length.

When inductively coupled, the spiral coils shown in Fig. 5 also follow the rule above stated and are governed by the same formulae.

In each of these cases the total inductance is always greater than the sum of the separate inductors. This means, in plain English, that, for a given value of inductance, such an arrangement, whatever may be its faults, uses less wire than would a single coil of equal inductance.

Suppose that we wound the two coils in opposite directions and connected them as shown in Figs. 2, 4 or 6. The total inductance would then be expressed by the formula:

$$M = L + L' + 2M$$

The fields of the two coils are now said to "oppose" each other and the total inductance, as may be readily seen, is always less than the sum of the separate inductors. For a given value of inductance, this arrangement will require more wire than would a single coil of equal inductance.

Both of these properties of ordinary inductors, when electromagnetically coupled, are made use of in the variometre, but their application to the "D" coil will be explained a little later.

Now, Fig. 7-a shows the usual form of "D" coil and, for all practical purposes, this device may be considered as two separate inductors, (A) and (B) inductively coupled to each other. The arrows show the flow of current through the winding at any given instant. It will at once be seen that the current in coil (A) is flowing in the opposite direction from the flow in coil (B); in other words, their fields are opposing each other and, consequently, must be governed by the formula above. Therefore, the same length of wire, if wound with its turns close together on an ordinary cylindrical tube of the same diameter, will give a greater inductance than our "D" coil.

At first consideration this may not appear important, but the high-frequency resistance of a conductor of circular cross section is proportional to its length and, other things being equal, the less wire used to obtain a specific value of inductance, the smaller will be the high-frequency resistance.

In addition, our "D" coil of Fig. 7-a has a considerable section of very small self-inductance; that section consisting of straight crossed wires from (W) to (X) and from (Y) to (Z). This but adds to the length of wire required in this form of winding to produce a given inductance; adding, also, to the coil's high-frequency resistance.

Fig. 7-b is a side view of the same coil. It will be noted that there is a space (B) equal to the diameter of the wire (A) between each turn. In the "D" coil this is necessarily so and its only redeeming attribute is that, by virtue of such spacing, it tends to reduce the distributed capacity of the inductor. But it accomplished this by requiring still more wire to obtain the required inductance; since the turns, though parallel, are not close together, and still more high-frequency resistance is added to the circuit.

An then again, for a given inductance, the "D" coil of Fig 7-a and 7-b will require more than twice as much winding space on a tube than will the ordinary, single-layer, close-wound coil. Requiring more than twice as much winding space, it will require more than twice as much dielectric in the field of the coil and the additional dielectric losses caused thereby are considerable.

When all things are considered, it must be evident that the smaller external or stray field and less distributed capacity of a "D" coil is more than compensated for by an increase in both high-frequency resistance and dielectric losses. In short, any superiority of this coil over a carefully designed "standard" inductor, is more imagined than real.

If, as is done in Fig. 8, we make use of two cylindrical forms, winding between them a single layer of wire, after the fashion of a true figure "8," as shown, the efficiency of such an arrangement will be slightly increased over what it was in the "D" coil, for less high frequency and dielectric losses will occur.

This is made possible by the fact that, for a given value of inductance, the coil of Fig. 8 will require less wire than that coil has been wound with the requisite number of turns, the bottom of coil (A) is connected with the top of coil (B) and they are permanently mounted in inductive relation to each other.

The pair of coils of Fig. 9 is the practical application of the diagram of Fig. 1, and obeys the formula given in connection therewith governing inductively-coupled "assisting" coils.

Such an arrangement has less high frequency resistance and less dielectric losses than either the type "D" or "figure 8" coils, for the reason that less wire is required to produce a given inductance and less dielectric is used in the field of the coil.

In addition, these inductors may be wound and supported, the dielectric loss is reduced to a minimum—much less than that of the "D" coil.

The inductors shown in Fig. 9 may be used in any circuit where any coil is required, beside being used to replace the ordinary inductor, and their use will generally be found far superior, especially when wound self-supporting, to the coils which they replace.

Rather than present anything radically new in the above, we trust that our discussion has caused the reader to think along new lines and if we have but succeeded in inducing him to forsake the "beaten path" of least resistance in thought and action, the object of this article will have been fulfilled.

Simply Trying to be Courteous

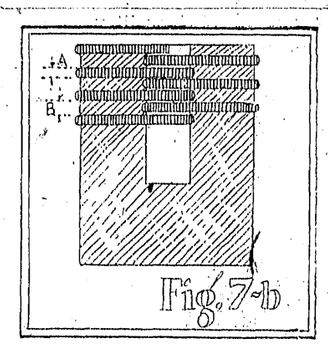

Fig. 7-b

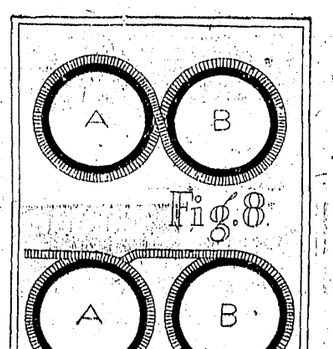

Fig. 8

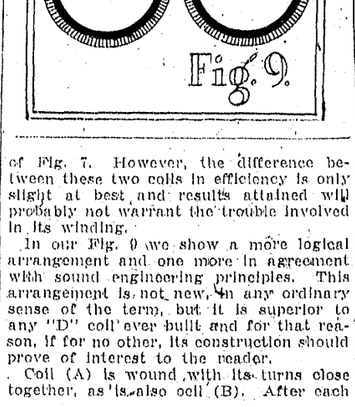

Fig. 9

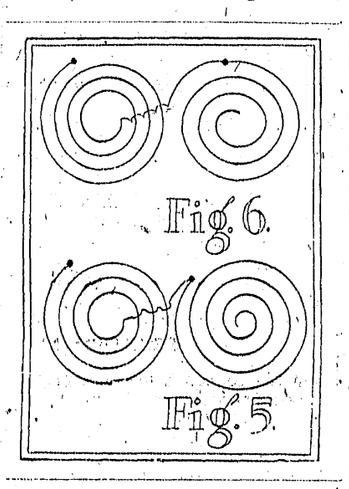

Fig. 6

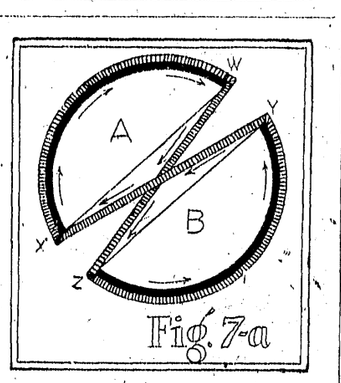

Fig. 5

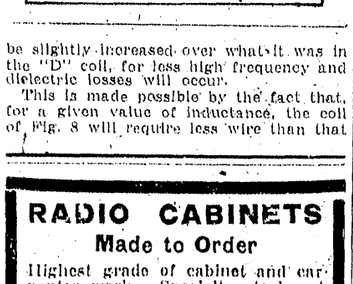

Fig. 7-a

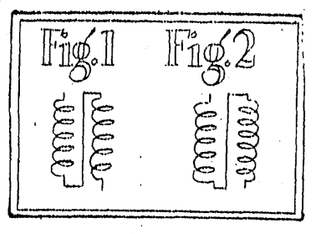

Fig. 1

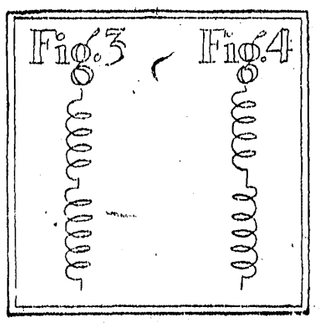

Fig. 2

Fig. 3

Fig. 4

NEW LONG DISTANCE CRYSTAL GIVES REMARKABLE RESULTS

A recent invention in crystals is amazing Reflex and Crystal Set owners everywhere. It is stated that this marvelous Crystal gets distant stations loud and clear, and there is no disagreeable "hunting" for spots because the entire surface is sensitive. Many are finding it far superior for reflex work and claim it is the last word in mounted synthetic crystals.

A Trial Costs You Nothing

In order to introduce his invention, the owner, Mr. Hick, offers you two $1.00 Crystals for the price of one. Sell one, and put the other on your own set without cost to you. Just send name and address to Mr. Hick, Dept. 104, 1018 S. Wabash ave., Chicago. Pay postman $1.00 (plus postage). Unless you are absolutely satisfied, write Mr. Hick, and money will be cheerfully refunded.

LOUD SPEAKERS ON BOATS

Radio Devices Used to Relay Orders On U. S. Navy Vessels

When John Paul Jones, commanding the Bonhomie Richard, the original American man o' war, ordered "all hands to quarters," a hardy bo's'n blew the call on his little metal pipe and followed it up with a lusty shout down the main hatch. But it is a long time since Jones and his crew, on Sept. 23, 1779, captured the British frigate Serapis, and now the battleships of the United States Navy are so large that it would take several minutes to sound a call in every part of the ship.

The first of the American battleships to be equipped with telephones and loud speakers was the Arizona. This was done in 1916, and the results, despite the fact that loud speaker construction was in its infancy, were so encouraging that the navy equipped all subsequent large ships with these systems.

As the result of the co-operative endeavor of naval officers and civilian engineers specializing in telephony, the super-dreadnaught West Virginia has a telephone communication system that includes 100 loud speakers so placed that every part of the ship is within earshot of the commanding officer's orders.

This system is divided into five circuits which can be operated singly or all together, and there are three "talking stations," one on the bridge for use while at sea, another on the main deck aft for use while in port, and the third in the ship control room for use during target practice or battle. This, however, has not rendered the bo's'n or his pipe obsolete. Instead, Chief Boatswain's Mate Samuel Conover, tootles the calls just as they have always been piped and then for the benefit of any aboard who are not able-bodied seamen and can't understand, he sounds the command into the receiver at the "talking station."

JOHN SMITH AND HIS RADIO

RADIO'S WAY—OR NONE.

The temporary antenna proved to be a valuable experience for Smith, for it demonstrated to him the importance of details. And that is half the story.

He found that when you take the ends of two wires and twist them together with your fingers the contact thus afforded isn't going to be the sort that helps a radio set perform at its best. He discovered that though the lead-in wire may saw against a cornice of the house and not stop proceedings altogether it will cut reception radically, also causing what often passes for static.

The variations in performance occasioned by his constant rearrangement of the lead-in and his fussing with the makeshift connections told him very plainly that one of the first things is to prevent high loss through good insulation, good connections and low resistance wiring. But here, like thousands of other radio fans, he carried the idea too far and made an interesting error.

As I told him, when explaining the situation, "You're favoring yourself, not radio."

Smith tried to get away from all interference by stringing his antenna from high poles above the roof, never realizing that while this appeals to the human being as an ideal method of getting results it doesn't fit in with radio's own ideas along this line. A high antenna is not as selective as a lower one, though the latter does not give as good results in volume or in range.

Accordingly the aerial, when completed, ran about 10 feet above the roof. The lightning arrester was installed about six inches from the side of the house between the lead-in and an insulated wire leading straight down to the earth and grounded. Just before the arrester the lead-in was tapped for a direct lead-in to the set itself.

The lightning arrester, Smith came to learn, is more of a protection against damaging the set than against fire damage from lightning. He could readily appreciate that the small wire of the aerial is even less of an attraction to lightning than the electric light wires or the metal water leaders and that, if actually struck, the aerial would burn to pieces instantly.

"The arrester," I explained, "provides protection against weak lightning action and protects your set when there is an electrical storm. If the potential in the aerial reaches too high a point a spark jumps the gap of the arrester and is grounded.

"Connect with the steam radiator for your set ground. And remember that the ground lead should be as short as possible. Keep it within six feet for best results. And be sure to scratch off the radiator paint where you attach the clamp."

Then, having made sure that the arrester was well insulated and that the lead-in tube through the window frame wasn't cracked, he proceeded to make a very neat job of tacking the insulated extension of the lead-in around the surbase of the room until the set was reached. It was a fine job, and even Mrs. Smith approved of his effort to hide all unnecessary paraphernalia.

"Now it ought to work like magic," he enthused. "That's the way I like to have things."

"Yes, but I wonder whether the radio likes it," I retorted. "I'm willing to bet you a new set of tubes that you've added just enough frills to keep the set from working."

And right I was. In disgust Smith ripped off the elaborate lead-in, ran it straight to the set under the carpet, as he had done before, and found that the set worked perfectly.

"That's funny!" he declared.

"That's radio!" I reminded him. "You've got to go it radio's way—or none at all."

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ENGLAND ON ONE-TUBE.

To the Editor of the Sunday Journal:

Will you please tell in the Sunday Journal if England has ever been received in Providence by a one-tube set and by whom. N. J.

Lakewood.

(Robert Davies of 51 Mitchell street has reported that on Nov. 25 he enjoyed the programme broadcast from Station 2-LO (London) and also heard the announcers in Aberdeen and Glasgow. He used a one-tube set with a tuning coil chemically treated. Reception was clear, after considerable fading.—Ed.

RADIO PROGRAMMES

Truth Week talks, grand opera and Lenten services are among the offerings on varied programmes to be given during the week by local broadcasting stations. Truth Week talks by local men will be put on the air daily by all stations, according to present plans. Wednesday evening WJAR will relay from New York a presentation of "Cavalleria Rusticana," and on the following night there will be another in the series of Victor concerts by opera singers. During the week WEAN will broadcast several of the noon-day Lenten services from Grace Church.

WEAN, THE SHEPARD STORES

(270 METRES)

TO-DAY.

10:15 a. m.—Entire service, broadcast from Grace Church.

7:30 p. m.—Mathewson Street Methodist Church service: Organ prelude, "Improvisation," Hall; Gray Brass Quartet, "Quartet from Martha," Flotow; hymn, Lancashire; prayer; chant, "The Lord's Prayer," Novello; soprano solo, "Come Unto Him" (from "Messiah") Handel; pastor, "Eighth Sunday Evening;" Gloria Patri, Greatorex; Gray Brass Quartet, "Sweet and Low," Barnby, "The Palms," Faure; offertory, anthem, "Lamb of God" (intermezzo), Bizet-Ryder; doxology, sermon, R. D. Hollington, "Washington, the Man Who Made the City;" quartet, "Hark Hark My Soul," Shelley; benediction; amen, Neukomm; organ postlude, "Warrior's Son," Heller-Biggs.

10:00 p. m.—Special broadcast by WEAN Noonday Club, with selections by the following members: Fred Weaks, Fred Prentice, Fred Travers, Herbert Tarryton, Fred Warren, George Gaskin, Florence Brown, Julie Benoit, Lila Day, Peggy Green, Joseph Doak. WEAN Noonday Club Quartet, Kalua Hawaiian Troupe.

MONDAY

11:55 a. m.—Time signals.
12:00 p. m.—Colonial Concert Orchestra.
12:10 p. m.—Weather report.
12:15 p. m.—WEAN Noonday Club.
1:00 p. m.—Organ recital by Prof. Edward Benedict, broadcast from Emory's Majestic Theatre.
4:15 p. m.—Colonial Dance Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Saxophone and Clarinet solos by Samuel D. Strauss; saxophone solos by Isabelle Strauss.
8:00 p. m.—Address by Samuel D. Robbins, Better Speech Week talk on "Prevention of Speech Defects."
8:10 p. m.—Concert programme 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.
1:00 p. m.—Colonial Dance Orchestra.
4:10 p. m.—Incidental music by the Emery Theatre Concert Orchestra, William J. Faucher, director.
4:30 p. m.—Weather report.
4:35 p. m.—Mezzo soprano solos by Mary Bennett, Eleanor T. Gormley, pianist.
6:30 p. m.—Shepard Colonial Orchestra, tenor solos by Leroy Goodwin.
8:10 p. m.—Orchestra, relayed from Boston.

WEDNESDAY

11:55 a. m.—Time signals.
12:00 p. m.—Lenten noonday service broadcast from Grace Church.
12:30 p. m.—Weather report.
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.—Evening service from Cathedral Church of St. Paul, relayed from Boston.
10:15 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.—Lenten noonday service broadcast from Grace Church.
12:30 p. m.—Weather report.
4:00 p. m.—Colonial Dance Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Baritone solos by Hugh Curry, Mrs. Hugh Curry, pianist.
6:50 p. m.—The Kalua Troupe Hawaiian String Quartet tenor solos by Harold Stronz; Vaughan Kazarian, baritone; Rose Duart, violinist; Margaret Williams, soprano; George Gaskins, pianist.

FRIDAY.

11:55 a. m.—Time signals.
12:00 m.—Lenten noonday service broadcast from Grace Church.
12:30 p. m.—Weather report.
12:35 p. m.—WEAN Noonday Club.
4:00 p. m.—Organ recital by Prof. Edward Benedict, broadcast from Emory's Majestic Theatre.
4:15 p. m.—Colonial Concert Orchestra.
4:30 p. m.—Weather report.
4:35 p. m.—Saxophone and Clarinet solos by Samuel D. Strauss; saxophone solos by Isabelle Strauss.
8:00 p. m.—Address by Samuel D. Robbins, Better Speech Week talk on "Prevention of Speech Defects."
8:10 p. m.—Concert programme from Boston.

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.—D. and L. Slade Spice Orchestra, relayed from Station WNAC, Boston.
10:00 p. m.—Copley Plaza Orchestra, direction W. Edward Boyle; popular songs, Irving Crocker and George Rogers, relayed from Station WNAC.

WJAR, THE OUTLET COMPANY

(306 METRES)

TO-DAY.

7:20 p. m.—Musical programme by "Roxy and His Gang" direct from the Capitol Theatre, New York city, by courtesy of the Capitol Theatre management and S. L. Rothafel (Roxy). The first part of the programme will be taken 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 direct from the chapel at Columbia University, New York city.

MONDAY

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

1:05 p. m.—Truth Week luncheon under auspices of Town Criers of Rhode Island, direct from Biltmore Hotel.

7:30 p. m.—Talk on the Daughters of the American Revolution by Miss Bertha Vaugh.

7:35 p. m.—Mrs. Harvey J. Flint, President of the Rhode Island Federation of Women's Clubs, will speak on "The Better Business Bureau and Its Relation to the Community."

7:40 p. m.—Maurice Iacchero and quartet; Miss Virginia Marshall, pianist; Gertrude Caulfield, soprano, accompanied by Helen Donahue.

8:50 p. m.—Mrs. Gertrude Wilcox Harrop in one of the series of talks on the Red Cross.

9:00-10:00 p. m.—Music by the A. and P. Gypsies.

TUESDAY

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

7:30 p. m.—Prof. Ralph Badger, Brown University, will speak on "Truth in Education."

7:35 p. m.—Programme under the direction of Florence Corley Hurley; Mrs. Waldron, soprano.

8:00 p. m.—Troubadour Orchestra under the direction of Lester Donault.

8:15 p. m.—Troubadour Orchestra.

8:30 p. m.—"The Gold Dust Twins."

9:00 p. m.—"Everoady Hour."

10:00 p. m.—The Silvertown Cord Orchestra under the 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.—Brown University Jazz Team under the direction of Philip Bronstein, Gardner T. Swarts, Chief Crier of the Town Criers, will speak on "Truth and the Public."

7:30 p. m.—This programme will come direct from New York studio. 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.—Modena Scoville, concert pianist.

8:50 p. m.—Bessie Richards, soprano.

9:00 p. m.—"Atwater Kent Radio Artists."

10:00 p. m.—Rizzi Grand Opera Company, consisting of Mme. Gemma Rizzi, soprano; Marguerite Warnoke, contralto; Guiseppe di Benedetto, tenor, and Imerio Ferrari, baritone.

THURSDAY

1:05 p. m.—Arthur Rothman's Radio Orchestra; Miss Alice McHugh, reader.

8:00 p. m.—Winifred Mauer, pianist.

8:15 p. m.—Guiseppe De Benedetto, operatic tenor.

8:30 p. m.—Oscar Nicastro, 'cellist.

8:50 p. m.—Guiseppe De Benedetto.

9:00 p. m.—"Victor Presentation" under the auspices of the Victor Talking Machine Company; Victor Concert Orchestra; Mme. Toti, Dal Monte, coloratura soprano; Guiseppe de Luca, baritone of the Metropolitan Opera Company.

10:00 p. m.—The Silvertown Chord Orchestra under the direction of Joseph Knecht.

FRIDAY.

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

10:00 a. m.—Talk on Red Cross work.

1:05 p. m.—The Woodstock Orchestra under the direction of Martin J. Casey. Virginia Campbell, reader; Juliana Allen, soprano; Eddie Bourne, pianist; Carl Agronick, violinist.

2:00 p. m.—Carl B. Marshall of Brown, Lisle & Marshall, "Protecting Unwary Investors."

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

7:45 p. m.—John J. Collins of Ostby & Barton will talk on "Standards of Practice."

7:50 p. m.—William J. Carrigan, tenor. Programme selected.

9:00 p. m.—B. Fischer & Co.'s Astor Coffee Dance Orchestra.

11:00 p. m.—Providence Biltmore Hotel Orchestra under the direction of Edwin White.

SATURDAY.

1:05 p. m.—Twin Elm Orchestra.

2:00 p. m.—Flint Grinnell of the Better Business Bureau of Providence will talk on "Better Business Bureau Movement."

Silent night.

WSAD, FOSTERS.

(256 METRES)

MONDAY.

2:30 p. m.—Musical programme.

3:45 p. m.—Truth Week talk by Flint Grinnell, director of the Better Business Bureau of Providence, "The Work of the Better Business Bureau."

3:50 p. m.—Musical programme continued.

6:00 p. m.—Radio Pals story by Fosters' Story Lady.

6:15 p. m.—Concert by "Billy Cahill's Superb Dance Orchestra."

7:00 p. m.—Truth Week talk by Carl B. Marshall, "Separating the Wheat from the Chaff."

7:10 p. m.—Continuation of concert by "Billy Cahill's Superb Dance Orchestra."

TUESDAY.

2:30 p. m.—Instrumental music.

3:15 p. m.—Truth Week talk by H. Harold Price: "A Jewel Above Price."

3:20 p. m.—Instrumental music continued.

6:00 p. m.—Radio Pals story by Fosters Story Lady.

6:15 p. m.—Truth Week talk to be announced.

WEDNESDAY.

2:30 p. m.—An Edison programme.

3:15 p. m.—Truth Week talk by Rabbi Samuel Gup: "Observation on Truth."

3:20 p. m.—Edison programme continued.

6:00 p. m.—Wednesday evening Radio Pals entertainment by Fosters Story Lady, assisted by Dolly Gibb and Marion Tanner.

6:20 p. m.—Concert by "Cole's Snappy Six."

7:00 p. m.—Truth Week talk to be announced.

7:05 p. m.—Continuation of programme by "Cole's Snappy Six."

THURSDAY.

2:30 p. m.—Instrumental music.

3:15 p. m.—Truth Week talk, to be announced.

3:20 p. m.—Instrumental music.

No evening programmes.

FRIDAY.

2:30 p. m.—Musical programme.

3:15 p. m.—Truth Week talk, to be announced.

3:30 p. m.—Musical programme continued.

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

6:15 p. m.—Concert by the "Belvedere Trio."

7:00 p. m.—Truth Week talk by Gardner T. Swarts, Jr., Chief Crier of the Town Criers of Rhode Island: "Truth and the Public."

7:05 p. m.—Continuation of concert by the "Belvedere Trio."

SATURDAY.

2:30 p. m.—Dance music by the Brunswick Dance Orchestra.

3:15 p. m.—Truth Week talk, to be announced.

3:20 p. m.—Continuation of dance music by the Brunswick Dance 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.

7:00 p. m.—Last in the series of Truth Week talks, to be announced.

7:05 p. m.—Continuation of dance music by Lar Potter's Orchestra.

WDWF, DUTEE W. FLINT, INC.

(441 METRES)

TO-DAY.

10:00 a. m.—Chimes.

5:00 p. m.—Radio recital. Part 1: Venetian Serenaders; Part 2: Organ recital by E. Rupert Sircom.

TUESDAY

8:30 p. m.—Arcadia Dance Orchestra.

WEDNESDAY

7:00 p. m.—Rhode Island Bankers' Dinner, Providence-Biltmore Hotel.

FRIDAY

8:00 p. m.—Lecture by member of Brown University faculty, followed by piano recital by Dorothy Brown.

KGO, OAKLAND, CAL.

(360 METRES)

TO-DAY.

2:00 p. m.—Service of the First Presbyterian Church, Oakland; Rev. Frank M. Silsley, D. D., pastor.

6:30 p. m.—Concert by the KGO Little Symphony Orchestra, Carl Rhodehamel, conductor; Arthur S. Garbett, musical interpretative writer; guest artists.

10:30 p. m.—Service of the First Presbyterian Church, Oakland, Rev. Frank M. Silsley, D. D., pastor.

WSAR, FALL RIVER, MASS.

(254 METRES)

TO-DAY.

10:30 a. m.—Service of Union M. E. Church, including sermon by Rev. Robert Colpitts, and singing by the regular choir.

4:30 p. m.—Nepekio Trio—violin, piano and 'cello.

4:45 p. m.—Tenor solos by Kenneth Simmons.

4:55 p. m.—Talk, "Character Building and Girls," by Miss Marion Hope.

5:10 p. m.—Elsie Houlker, mezzo-soprano, in solo numbers.

5:20 p. m.—Result of Fall River-Brooklyn soccer game.

KFI, LOS ANGELES, CAL.

(469 METRES)

TO-DAY.

1:00 p. m.—L. A. Church Federation service.

7:00 p. m.—Vesper services, June Evans, mezzo-soprano, and others.

9:45 p. m.—KFI editorial and music appreciation talk.

10:00 p. m.—Metropolitan Theatre Programme.

11:00 p. m.—Special classic recital.

12:00 p. m.—Los Angeles Examiner programme.

1:00 a. m.—Packard Eight Orchestra, under direction of William Hennessy.

KOA, DENVER, COL.

(323 METRES)

TO-DAY.

1:00 p. m.—Service of Trinity Methodist Episcopal Church, Denver, Rev. Loren M. Edwards, D. D., minister.

9:45 p. m.—Service of Trinity Methodist Episcopal Church, Denver, Rev. Loren M. Edwards, D. D., minister.

KYW, CHICAGO, ILL.

(536 METRES)

TO-DAY.

12 m.—Central Church service will be broadcast from Orchestra Hall, Chicago. Dr. F. F. Shannon, pastor. Musical programme will be arranged under the direction of Daniel Protheroe.

5:00 p. m.—Studio concert will be broadcast from Hearst square. Artists and detailed programme will be announced by radio.

8:00 p. m.—Chicago Sunday Evening Club service will be broadcast from Orchestra Hall, Chicago. The musical pro-

Continued on Page Twelve.

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.
4:00—Concert, WEAN.
5:00—Recital, WDWF.
7:20—Concert, WJAR.
7:30—Church, WEAN.
9:15—Organ recital, WJAR.
10:00—Concert, WEAN.

OUT-OF-TOWN STATIONS

9:00—Children's hour, WJZ.
10:30—Church, WSAR.
10:45—Church, WIP.
Church, WCAE.
Church, KDKA.
10:55—Church, WBZ.
11:00—Church, WGY.
Church, WJZ.
Church, WHAS.
Church, WNAC.
11:20—Church, WCCO.
12:00—Music, WEMC.
Church, WSB.
Church, KYW.
12:40—Sermon, WEMC.
1:00—Church, KFI.
Church, KOA.
1:30—Church, KGW.
2:00—Church, KGO.
Songs, WEAF.
Orchestra, WWJ.
Mothers' Day, KDKA.
2:30—Music, WOO.
Bible class, WJZ.
Church, WCAE.
Concert, KDKA.
2:45—Services, WEAF.
3:00—Concert, WLIT.
Services, WHN.
Vespers, WGR.
3:25—Concert, WBZ.
3:30—Matinee musicale, WGBS.
Music, WJZ.
3:35—Orchestra, WGY.
3:45—Men's conference, WEEI, WEAF.
4:00—Vespers, WJZ.
Music, WCAE.
Organ recital, KDKA.
Band, WHN.
Concert, WNAC.
Organ recital, WGR.
4:30—Lecture, WSB.
Y. M. C. A., WIP.
Music, WHN.
Concert, WSAR.
5:00—Organ recital, WGY.
Concert, KYW.
Recital, WHAS.
Orchestra, WHN.
5:10—Church, WCCO.
5:15—Organ recital, WGR.
5:20—Soccer game, WSAR.
5:30—Orchestra, WLIT.
Song service, WHAS.
String trio, WHN.
6:00—Concert, KGW.
Vespers, WFAA.
Recital, WOO.
Choir, WSB.
6:30—Concert, KGO.
Concert, WCAE.
Concert, KDKA.
6:45—Church, WNAC.
7:00—Vespers, KFI.
Bible class, WFAA.
Orchestra, WJZ.
Music, WLIT.
Orchestra, WBZ.
7:30—Church, WOO.
Roxy, WEAF, WEEI, WCTS.
Recital, WLS.
Church, WWJ.
Church, WGR.
7:45—Church, WGY.
Church, KDKA.
8:00—Church, WFAA.
Services, KYW.
Sermon, WJZ.
Bible stories, WLIT.
Forum, WBZ.
8:15—Concert, WJY.
8:30—Church, WSB.
Lecture, WJZ.
8:45—Church, WCCO.
Orchestra, WJZ.
9:00—Church, KGW.
Orchestra, WGY.
Forum, WLIT.
9:15—Music, WEMC.
Recital, WEAF, WEEI, WCTS.
9:30—Opera, WGBS.
9:45—Music talk, KFI.
Church, KOA.
9:45—Sermon, WEMC.
Talk, WHN.
10:00—Theatre, KFI.
Church, KGW.
Talk, WJY.
Quartet, WJZ.
Lecture, WBZ.
Concert, WHN.
10:15—Concert, WCCO.
10:30—Church, KGO.
Music, WFAA.
10:45—Orchestra, WHN.
11:00—Recital, KFI.
11:15—Music, WHN.
12:00—Music, KFI.

RADIO PROGRAMMES

Continued from Page Eleven.

gramme will be arranged by Edgar Nelson. The speaker of the evening will be announced by radio.

KGW, PORTLAND, ORE.

(492 METRES)
TO-DAY.

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

6:00 p. m.—Municipal concert by wire telephony from auditorium.

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, Nellie Torgler, pianist.

WCAE, PITTSBURGH, PA.

(461 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.

WCCO, MINNEAPOLIS-ST. PAUL.

(417 METRES)
TO-DAY.

11:20 a. m.—Plymouth Congregational Church, Minneapolis, Rev. H. P. Dewey, D. D., pastor.

5:10 p. m.—House of Hope Presbyterian Church, St. Paul, Rev. H. C. Swearingen, D. D., pastor.

8:45 p. m.—Central Lutheran Church, Minneapolis, Rev. J. A. O. Stub, D. D., pastor.

10:15 p. m.—Classical concert.

WEAF, NEW YORK CITY.

(492 METRES)
TO-DAY.

3:00 p. m.—"Sunday hymn sing" under the auspices of the Greater New York Federation of Churches.

3:45 p. m.—Interdenominational services under the auspices of the Greater New York Federation of Churches, Rev. William B. Millar, general secretary, presiding. Address by Rev. S. Edward Young, D. D., pastor of Bedford Presbyterian Church, Brooklyn, N. Y. Music by Federation Radio Group and male quartet, with Arthur Billings Hunt, baritone and musical director; Gladys G. Hill, soprano; Mildred Bryars, contralto; Louis Caton, tenor; Paul Morritt, baritone; George Vause, pianist, and William H. Brewster, organist and basso, together with Aida Brass Quartet, consisting of Clara Haven, Helen Batchelder, Eleanor Betts and Cora Sauter.

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

7:20 to 9:15 p. m.—Musical programme by "Roxy and His Gang," direct from the Capitol Theatre, New York city, by courtesy of the Capitol Theatre management and S. L. Rothafel (Roxy). The first part of the programme will be taken 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 sudio in the theatre.

9:15 p. m.—Organ recital direct from the chapel at Columbia University, New York city.

WEEI, BOSTON, MASS.

(476 METRES)
TO-DAY.

3:45 p. m.—Men's conference in the Bedford Branch, Y. M. C. A., Brooklyn, N. Y.

7:20 p. m.—"Roxy and his Gang," New York Capitol Theatre.

9:15 p. m.—Organ recital, chapel at Columbia University, New York city.

WEMC, BERRIEN SPRINGS, MICH.

(485 METRES)
TO-DAY.

12:00 m.—Sacred music by the Radio Lighthouse Choir; Cecil Woods, bass; Miss Tottie Kressin, soprano.

12:40 p. m.—Sermon, Pastor W. R. French.

9:15 p. m.—Sacred music by the Radio Lighthouse Choir; Ernest Hurd, tenor; Miss Martha Hutchinson, soprano.

9:55 p. m.—Sermon, Pastor John Knox.

WFAA, DALLAS, TEX.

(476 METRES)
TO-DAY

6:00 p. m.—Vesper service at Westminster Presbyterian Church, Dr. T. O. Perrin, pastor; Miss Daisy Polk, soloist and director.

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

8:00 p. m.—Service at Central Congregational Church, Dr. Thomas H. Harper, pastor; Mrs. Clarence R. Hamilton, organist.

9:30 p. m.—Dr. Robert A. Hunt, pastor First Methodist Church, in sacred song recital and hymnologue.

10:30 p. m.—McDowell Sisters in Hawaiian and sacred music recital.

WGBS, NEW YORK CITY.

(316 METRES)
TO-DAY

3:30 p. m.—Matinee musical from Piccadilly Theatre.

9:30 p. m.—Rossini's "Barber of Seville," second in series of complete radio operas presented by WGBS and Corriere D'America.

WGY, SCHENECTADY, N. Y.

(379.5 METRES)
TO-DAY.

11:00 a. m.—Service of St. Peter's Episcopal Church, Albany; sermon by the Rev. Dr. Charles Harriman.

3:35 p. m.—WGY Symphony Orchestra, Leo Kliwon, conductor; Ben Franklin, tenor soloist.

5:00 p. m.—Organ recital by Dr. Frank Sill Rogers, assisted by T. Roy Keefer, violinist, from St. Peter's Episcopal Church, Albany.

7:45 p. m.—Service of First Presbyterian Church, Albany; address, "Washington," by Prof. Adna W. Risley, New York State College for Teachers.

9:00 p. m.—Waldorf-Astoria Orchestra, New York, Joseph Knecht, conductor; also broadcast by WJZ.

WIP, PHILADELPHIA, PA.

(509 METRES)
TO-DAY

10:45 a. m.—Morning service, broadcast direct from Holy Trinity Church, Rittenhouse square, Philadelphia, Rev. Floyd W. Tomkins, D. D., rector.

4:00 p. m.—Services under the auspices of the Germantown Y. M. C. A., broadcast direct from the Germantown Theatre. "The Master Thought," a lecture by William Rainey Bennett, the man who brought down the house last year.

WJY, NEW YORK CITY

(405 METRES)
TO-DAY.

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

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

WJZ, NEW YORK CITY

(455 METRES)
TO-DAY.

9:00 a. m.—Children's hour: Original stories by the authors, music by the composers, comic stories by the originators of famous comedies.

11:00 a. m.—St. Thomas Episcopal Church services; sermon by Dr. E. M. Stires.

2:30 p. m.—Radio Bible class, under auspices of Greater New York Federation of Churches; "A Coward's Verdict," Rev. Basil D. Hall; Elsie Kiesewetter, soprano; Grace Helene Force, contralto.

3:30 p. m.—Edna Walter, pianist.

4:00 p. m.—St. George's Episcopal Church vesper services, Sixteenth street and Stuyvesant square; rector, Dr. Karl Reiland; George W. Kemmer, organist and choirmaster; Mozelle Bennett, violinist.

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

8:00 p. m.—"Practical Religion," Dr. Harry Emerson Fosdick.

8:30 p. m.—"George Washington," by Gen. Oliver B. Bridgeman, of Sons of American Revolution.

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

10:00 p. m.—Hampton Institute Quartet.

WLS, CHICAGO, ILL.

(345 METRES)
TO-DAY.

7:30 p. m.—Emerson at Barton organ; special musical programme.

WOO, PHILADELPHIA, PA.

(509.0 METRES)
TO-DAY.

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

6:00 p. m.—Sacred recital on the Wanamaker grand organ, Clarence K. Bawden at the console.

7:30 p. m.—Evening services from Bethany Presbyterian Church, Twenty-second and Bainbridge streets, Philadelphia. Broadcasting will include an organ recital from 7:30 to 7:45 with Miss Caroline Quigg at the console; sermon by the pastor, Rev. Dr. A. Gordon MacLennan.

WSB, ATLANTA, GA.

(429 METRES)
TO-DAY.

12 m.—First Presbyterian Church service.

4:30 p. m.—Christian Science lecture at Loew's Grand Theatre.

6:00 p. m.—Baptist Tabernacle Church choir.

8:30 p. m.—Wesley Memorial Church service.

WBZ, SPRINGFIELD

(333 METRES.)
TO-DAY.

10:55 a. m.—Church services 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.—Concert by the People's Symphony Orchestra, direct from the St. James Theatre, Boston.

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

7:30 p. m.—Edward Botner, baritone, broadcast from Ford Hall, Boston, through Hotel Brunswick.

8:00 p. m.—Broadcast of Ford Hall forum meeting. Address by Mrs. Frank B. Gilbreath, "The Effect of Scientific Management on the Worker," through the Hotel Brunswick, Boston.

10:00 p. m.—Lecture on "Paths of Adventure," Hotel Brunswick, Boston.

WWJ, DETROIT, MICH.

(352.7 METRES)
TO-DAY.

7:30 p. m.—Services at St. Paul's Episcopal Cathedral; broadcast from the cathedral.

2:00 p. m.—The Detroit News Orchestra.

WCTS, WORCESTER, MASS.

(268 METRES.)
TO-DAY.

7:20 p. m.—Musical programme by "Roxy and His Gang," direct from the Capitol Theatre, New York city, by courtesy of the Capitol Theatre management and S. L. Rothafel (Roxy).

9:15 p. m.—Organ recital direct from the chapel of Columbia University, New York city.

WHAS, LOUISVILLE, KY.

(400 METRES)
TO-DAY

10:57 a. m.—Organ music.

11 a. m.—Church service under the auspices of the Calvary Episcopal Church; the Rev. Dr. Harris Mallinckrodt, pastor. Lawrence Cook, organist and choir director.

5 p. m.—Organ recital by George Latimer, playing at Christ Church Cathedral.

5:30 p. m.—Choral evensong service at Christ Church Cathedral. The Very Rev. Richard L. McCready, dean; the Rev. Frank W. Hardy, senior canon; the Rev. J. M. Nelson, canon missionary. Ernest Arthur Simon, organist and choirmaster. Men and boys' choir of 60 voices.

WLIT, CHICAGO, ILL.

(305 METRES)
TO-DAY

3:00 p. m. to 5:30 p. m.—Specially arranged Sunday concert by the Arcadia Cafe Concert Orchestra, Ferl Sarkozi, director.

7 p. m.—Dinner music direct from the Benjamin Franklin Hotel, by the Concert Orchestra, W. Irving Openheim, director.

8:30 p. m.—Bible stories for the children by "Dream Daddy."

9:00 p. m.—The WLIT Forum, including round table discussions and direct broadcasts of important concerts and meetings, under the auspices of the Forum.

KDKA, EAST PITTSBURGH, PA.

(309 METRES)
TO-DAY.

10:45 a. m.—Services of the Point Breeze Presbyterian Church, Pittsburgh, Rev. Percival H. Barker, pastor.

2:00 p. m.—"Mothers' Day," Miss Etta Jarvis, founder of Mothers' Day.

2:30 p. m.—Concert by the Westinghouse Symphony Orchestra, under the direction of Victor Saudek.

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

6:30 p. m.—Dinner concert from the Pittsburgh Athletic Association Orchestra under the direction of Gregorio Scalzo.

7:45 p. m.—Services of the Sixth Presbyterian Church, Rev. B. F. Farber, pastor.

WHN, NEW YORK.

(360 METRES)
TO-DAY.

3:00 p. m.—Queens County Christian Endeavor programme, represented by the Rev. Charles Worner, pastor of the Springfield Dock Christian Church.

4:00 p. m.—Manhattan Elks Band, No. 45, direction of Henry Hammel.

4:30 p. m.—Collegiate Dance Club.

5:00 p. m.—Roseland Dance Orchestra.

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

9:55 p. m.—"How to Recharge a Battery in Ten Minutes."

10:00 p. m.—Gem razor entertainers.

10:45 p. m.—Janssen's Hofbrau Commanders Orchestra.

11:15 p. m.—Vanity Club revue.

11:45 p. m.—Connie's Inn Revue.

12:15 a. m.—Harry Richman and his entertainers with Eddie Elkins and his orchestra.

WNAC, BOSTON, MASS.

(280 METRES)
TO-DAY.

11:00 a. m.—Morning service, broadcast from the Cathedral Church of St. Paul.

4:00 p. m.—Broadcast from Boston Square and Compass Club—White's Concert Company.

6:45 p. m.—Evening service, broadcast from Park Street Congregational Church.

WGR, BUFFALO.

(319 METRES)
TO-DAY.

3:00 p. m.—Vesper services, First Trinity Lutheran Church.

4:00 p. m.—Organ recital, Randolph Maynard, organist.

5:35 p. m.—Organ recital, direct from Central Presbyterian Church.

7:30 p. m.—Evening service, R. J. MacAlpine, D. D., minister.

TUBES REPLACE SPARKS

U. S. Lighthouse Service Reports Successful Experiment.

"The value of radio as an aid to navigation, especially as protection against fog, the greatest of all dangers to the mariner, has been further demonstrated during the last year," according to George R. Putnam, Commissioner of Lighthouses, in his annual report to the Secretary of Commerce.

"The United States Lighthouse Service now has 12 radio fog-signal stations in operation, with three lightships equipped for relief, and is proceeding with the establishment of other stations as rapidly as funds permit. This relatively new aid to navigation has met with great favor with mariners, as evidenced by the demand for additional installations and the equipment of vessels with radio compasses.

"The United States leads the world in this form of aid, having been the first to establish successful radio fog signals and now having more stations in operation than all the countries of Europe combined. Canada has also made important progress in radio aids to navigation.

"An important advance has recently been made in the radio aid to navigation by the introduction of tube transmitters, designed to take the place of spark transmitters. After test, one of these was installed on Ambrose lightship, and is in successful use. On Nantucket lightship a more powerful submarine signal, the oscillator, has been installed.

"The total number of aids to navigation operated by the Lighthouse Service at the close of the fiscal year number 17,288, an increase of 305 over the preceding year. This number included 147 new automatic lights, of which 75 were changed from attending lights."

PLAN RADIO MEET

Amateurs Preparing for International Conference in March.

Amateurs of all countries are preparing for the great international meeting in March, coincident with the juridical congress of the international wireless telephony committee. Hiram P. Maxim will represent the United States in the meeting, M. G. Marcuse will represent Britain, M. le Docteur Corret will represent France; M. Heinrotay, Belgium; Sr. Balta Elias, Spain; Sr. Giullo-Salom, Italy; M. Cauderay, Switzerland, and M. De Groot will represent Luxemburg.

The delegates form the organization committee and will prepare the work of the meeting and seek the membership of other nations beside their own in a proposed international union of wireless amateurs.

NEW BROADCASTING METHOD

Carrier Wave Silent in System Perfected by WRM.

Using a new method which dispenses with the carrier wave upon which to impress the voice wave, station WRM, of the University of Illinois, sent out details of the Illinois-Indiana basketball game recently.

The non-carrier system was perfected in the university laboratories by H. A. Brown and C. A. Kessner, and by its use it is claimed much transmitter noise is eliminated and sharpness of tuning by the receiver is increased.

Under the double-wave system in use the carrier is audible at all times in the receiver. By the non-carrier system, the university experimenters explain, the carrier wave goes out only when a note is sounded or a syllable spoken, and between notes or words the carrier wave is silent, resulting, it is claimed, in greater distance and purer reception.