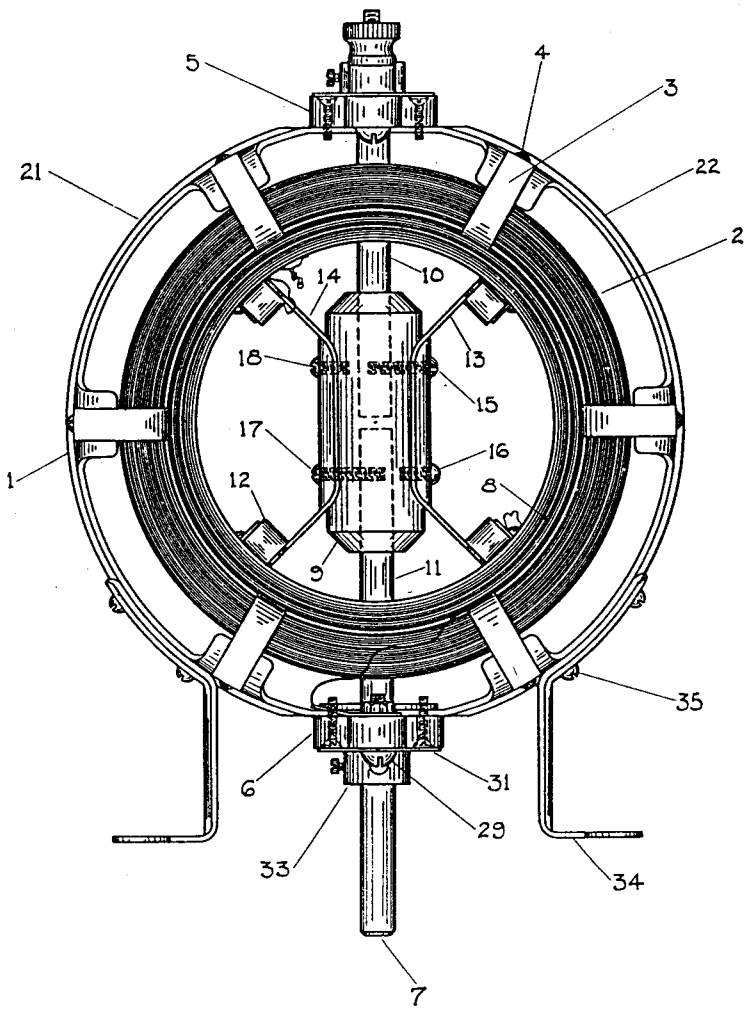
Sept. 22, 1925. 1,554,728

L. C. F. HORLE

VARIABLE INDUCTANCE

Filed Oct. 20, 1924 2 Sheets-Sheet 1

Fig 1



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Filed Oct. 20, 1924 2 Sheets-Sheet 2

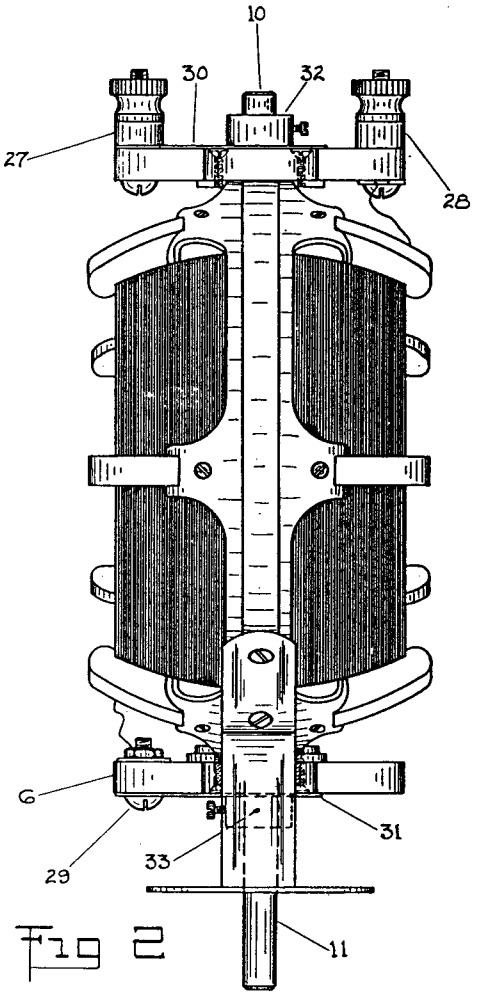


Fig 2

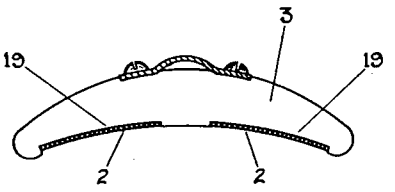


Fig 3

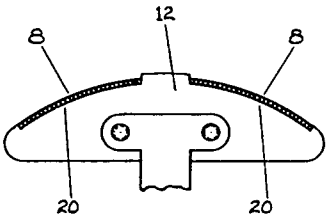


Fig 4

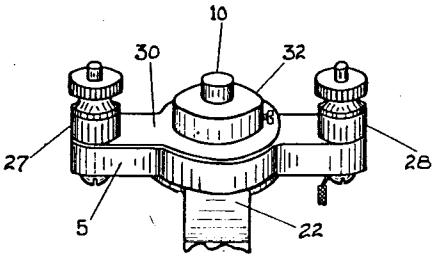


Fig 8

Fig 7

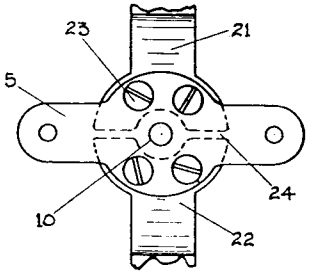


Fig 5

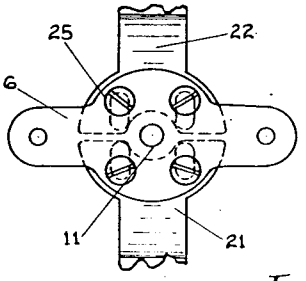
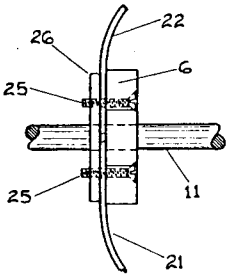


Fig 6



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Patented Sept. 22, 1925. 1,554,728

UNITED STATES PATENT OFFICE.

LAWRENCE C. F. HORLE, OF NEWARK, NEW JERSEY, ASSIGNOR TO FEDERAL TELEPHONE MANUFACTURING CORPORATION, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

VARIABLE INDUCTANCE.

Application filed October 20, 1924. Serial No. 744,693.

To all whom it may concern:

Be it known that I, LAWRENCE C. F. HORLE, a citizen of the United States, residing at Newark, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Variable Inductances, of which the following is a specification.

This invention relates to variable inductances as used in radio receiving systems, and more particularly to an improved construction and mounting arrangement of such inductances.

The invention is particularly directed to the variometer and variocoupler type of variable inductance.

In such instruments as heretofore commonly constructed, the stator and rotor coils have been wound on semi-spherical forms of insulating material. The stator and rotor thus constituted concentric shells, each shell comprising a layer or layers of wire in close proximity to a sustaining continuous sheet of the insulating material.

This method of supporting the windings introduced considerable losses, and it is the general object of the present invention, while retaining the advantages inherent in the spherical type of variometer and variocoupler construction, to provide an improved construction of this type which largely reduces these electrical losses heretofore present and due to the insulating material in proximity to the windings.

It is a further object to provide a variometer and variocoupler construction ensuring low loss operation which is at the same time rugged and capable of satisfactory performance under severe service conditions, such as are met with for example in portable radio receiver use.

Further objects are to provide reliable and convenient electrical connections to the rotating coil member, and to provide means for a mounting of the instrument in various positions in any receiver in which it is used. Other objects will appear in the description of the invention.

In accordance with this invention the windings are mounted within a frame in such a manner that they are practically air insulated over their entire surfaces except where held by a few narrow supporting members. As compared with previous variometer constructions in which the windings are in or on a form of insulating material coextensive with the winding, the area of winding in contact with insulating material in the construction provided by this invention is very small. The result is a reduction of the losses due to the presence of insulating material in proximity to the windings to a negligible amount.

For further explanation of construction and operation reference is made to the following description and to the accompanying drawings which illustrate a preferred embodiment of the invention.

Figure 1 is a side elevation of a preferred form of the invention.

Figure 2 is an end elevation of the form shown in Fig. 1.

Figure 3 is a detail view of a stator winding supporting member.

Figure 4 is a similar view of a rotor winding supporting member.

Figures 5 and 6 are plan views showing the fastening of two terminal blocks to two frame pieces which form a frame member.

Figure 7 is a side elevation of the plan view of Fig. 6 showing further details of frame and block fastening means.

Figure 8 is a perspective view of one of the terminal blocks and related parts.

Referring particularly to Figures 1 and 2, a frame member 1 carries a stator winding 2. This winding bears against the inside surfaces of a number of narrow supporting members 3 of insulating material which are fastened by screws 4 to the frame. At opposite sides of the frame are set insulating members 5 and 6 which serve as terminal blocks. These insulating members 5 and 6 serve also as bearing members for a shaft member 7 which is the supporting and rotating shaft member for a rotor winding 8. Shaft member 7 comprises a sleeve member 9 of insulating material and two metal shafts 10 and 11, the inner ends of which are enclosed and held in alignment by the sleeve but which are insulated from each other therein. This construction is shown, partially in dotted line, in Fig. 1. The winding 8 bears against the outside surfaces of a number of narrow supporting members 12 of insulating material which are fastened to two brackets 13 and 14 in any suitable manner. As shown, partially in dotted line,

in Fig. 1, bracket 13 is fastened to sleeve 9 by screw 15 which acts as a connection member between bracket 13 and shaft 10 and by screw 16 which is out of contact with shaft 11. Bracket 14 is fastened similarly to sleeve 9 by screw 17 which acts as a connection member between bracket 14 and shaft 11 and by screw 18 which is out of contact with shaft 10.

Windings 2 and 8 are of the usual semi-spherical variometer form and are so placed that the rotor winding may turn inside of and close to the stator winding for the purpose of varying the inductance in the usual manner. Before assembling in the instrument these windings are preferably made up on a suitable form, and given a thin coating of varnish to cause the adjacent turns of wire to adhere strongly together, and the windings as a whole to retain their proper shape.

The method of supporting these windings, which are preferably single layer, will be better understood by reference to Figures 3 and 4. The supporting members 3 are formed on their inner surfaces with depressions 19 on either side of the center. When in place in the instrument the stator winding 2 lies snugly in the depressions of members 3, of which, in the present embodiment, six are disposed about the frame 1. The winding 2 is preferably arranged in two sections, as shown in Figure 3, to allow space for shafts 10 and 11. The supporting members 12 are likewise formed on their outer surfaces with depressions 20 on either side of the center. The rotor winding 8 lies snugly in these depressions of members 12 of which four are spaced about the rotor, in the form of the invention herein illustrated. As in the case of the stator winding 2, the rotor winding 8 is arranged in two sections, as shown in Figure 4, to allow space for shafts 10 and 11.

Frame 1 is built up of two similar sections 21 and 22. The ends of the sections are formed as shown in Figures 5 and 6, which show in plan view the frame ends at terminal blocks 5 and 6 respectively. At terminal block 5 the frame pieces are held in alignment and connected to the block by preferably four screws 23 which pass through the block and are screwed directly into frame pieces 21 and 22. The ends of the frame pieces are so placed with reference to the block that a gap 24 is left between them. This gap is also of such shape that the shaft 10 is out of contact with frame pieces 21 and 22. At terminal block 6 the form of fastening is preferably somewhat different from that shown at block 5. Instead of screwing the block directly to the frame pieces 21 and 22, the ends of the said pieces are clamped to the block 6 by fastening means as preferably four screws 25 which are screwed into a plate 26 as shown in Fig. 7, the block and plate forming a pair of clamping members. The ends of pieces 21 and 22 thus clamped to block 6 are slotted, recessed, or otherwise shaped so that when screws 25 are slightly loosened the said ends may be moved toward or from shaft 11 for adjustment purposes. The tightening of screws 25 clamps the ends of the pieces 21 and 22 firmly in any desired position. The ends of these pieces and also the plate 26 are further formed so that shaft 11 is at all times out of contact with frame and plate.

In the preferable form of construction of frame, terminal blocks and shaft member as above described, it is seen that the frame is insulated from the shaft member, and, further, that a gap is provided in the ring shaped frame at block 5 so that no free path exists for eddy currents around the frame.

In one of the terminal blocks, as 5, are set two terminal members as binding posts 27 and 28, as shown in detail in Fig. 8, arranged in the usual manner for connection to terminal wires. In the other terminal block 6 is set a terminal member as screw 29, as shown in Figs. 1 and 2. Two terminal spring contact plates 30 and 31 are so placed as to be held respectively to blocks 5 and 6 by post 27 and screw 29. These spring contact plates extend respectively to shafts 10 and 11 and bear against collars 32 and 33. One end of stator winding 2 is connected to binding post 28, which has no connection with contact plate 30. The other end of the stator winding is connected to screw 29 which is in connection with contact plate 31. The ends of the rotor winding 8 are each connected in any suitable manner to one of the brackets 13 and 14, which are screwed to sleeve 9 of shaft member 7.

The circuit through the instrument is from binding post 28 through stator winding 2 to terminal screw 29; across spring contact plate 31 to collar 33 and shaft 11; through shaft 11, screw 17 and bracket 14 to one end of rotor winding 8; through rotor winding 8 to bracket 13; through bracket 13, screw 15, shaft 10, collar 32 to spring contact plate 30; across spring plate 30 to binding post 27.

The instrument as shown in the figures is arranged for panel mounting, with two brackets 34 secured to the frame 1, as by screws 35. These, or other suitable mounting members, may be placed in other positions on frame 1 to provide for any desired placing of the instrument.

The connections as described are for use of the instrument as a variometer. For variocoupler use the stator winding may be disconnected from terminal 29, and con-

nected elsewhere, as for example, to another binding post (not shown) inserted in block 6 and out of connection with spring plate 31. The rotor winding is then separated from the stator and its terminals are binding post 27 and screw 29, which latter may be replaced by another binding post similar to posts 27 and 28.

What is claimed is:

1. In a variable inductance, a stator winding, a second winding adapted to be moved relatively to said stator winding for varying the inductance, supporting means for the stator winding comprising a metallic frame member and a plurality of narrow supporting members carried by the frame member, supporting means for the second winding comprising a shaft member and a plurality of narrow supporting members carried by the shaft member, said frame member comprising two frame pieces and two insulating members located at opposite sides of the frame and connected respectively to an end of each of said frame pieces, said shaft member passing through said insulating members and having a bearing therein.

2. In a variable inductance, a stator winding, a rotor winding within the stator winding and adapted to be rotated for varying the inductance, supporting means for the stator winding comprising a metallic frame member enclosing the stator winding and further comprising a plurality of narrow insulating and supporting members carried by the frame member, said stator winding being spaced from said frame member by said insulating and supporting member, and supporting and actuating means for the rotor winding comprising a shaft member and a plurality of narrow insulating and supporting members carried by the shaft member, said frame member comprising two frame pieces, and two insulating members located at opposite sides of the frame member and connected respectively to an end of each of said frame pieces, said shaft member passing through said insulating members and having a bearing therein.

3. In a variable inductance, a stator winding and a rotor winding adapted to be rotated therein for varying the inductance, supporting and connecting means for the rotor winding comprising a shaft member and a plurality of bracket members insulated from each other, the shaft member comprising two shafts insulated from each other, one end of the rotor winding and one of the shafts being electrically connected to one of said bracket members, the other end of the rotor winding and the other shaft being electrically connected to another of the bracket members, whereby an electrical connection to the rotor winding is provided through the shafts and the bracket members.

4. In a variable inductance, a stator winding and a rotor winding adapted to be rotated therein for varying the inductance, supporting and connecting means for the rotor winding comprising a shaft member and a pair of bracket members, the shaft member comprising a sleeve member and two shafts partially enclosed by the sleeve and insulated from each other therein, the bracket members being mounted on the sleeve and insulated from each other thereon, means for electrically connecting one of the bracket members to one of the shafts and for connecting the other bracket member to the other shaft, one end of the rotor winding being connected to one of the bracket members and the other end of the rotor winding to the other bracket member.

5. In a variable inductance, a stator winding and a rotor winding adapted to be rotated therein for varying the inductance, supporting and connecting means for the rotor winding comprising a shaft member and a pair of bracket members, the shaft member comprising a sleeve member of insulating material and two shafts partially enclosed by the sleeve and insulated from each other therein, the bracket members being mounted on the sleeve and insulated from each other thereon, and fastening means for the bracket members comprising a metallic connection member between one of the bracket members and one of the shafts and a metallic connection member between the other bracket member and the other shaft, one end of the rotor winding being connected to one bracket member and the other end to the other bracket member.

6. In a variable inductance having a stator winding, a frame member supporting the winding and comprising two frame pieces, one end of one frame piece being adjacent an end of the other frame piece, and clamping means for said ends of the frame pieces comprising means whereby the pieces may be adjusted toward or away from each other.

7. In a variable inductance having a stator winding, a frame member supporting the winding and comprising two frame pieces, one end of one frame piece being adjacent an end of the other frame piece, clamping and adjusting means at said ends of the frame pieces comprising two clamping members and fastening means therefor, the ends of the frame pieces being shaped to permit motion of said ends toward and away from each other between the clamping members.

8. In a variable inductance, a stator winding and a rotor winding adapted to be rotated therein for varying the inductance, supporting means for the stator winding comprising a frame member, supporting and electrically connecting means for the

rotor winding comprising a shaft member, two bearing and insulating members mounted on opposite sides of the frame member, the shaft member comprising two shafts, each shaft having a bearing in and projecting through one of the bearing and insulating members, a terminal member on each of the bearing and insulating members, and a spring contact plate fastened to each bearing and insulating member by a terminal member and in electrical connection with the terminal member and with one of the shafts.

9. In a variable inductance, a stator winding and a rotor winding adapted to be rotated therein for varying the inductance, a supporting frame member for the stator winding comprising two frame pieces, supporting and electrically connecting means for the rotor winding comprising a shaft member, two bearing and insulating members mounted on opposite sides of the frame member and each fastened to adjacent ends of the frame pieces, the shaft member comprising two shafts each having a bearing in and projecting through one of the bearing and insulating members, the shafts being electrically insulated from the frame pieces, a terminal member on each of the bearing and insulating members, and a spring contact plate fastened to each bearing and insulating member by a terminal member and in electrical connection with the terminal member and with one of the shafts.

In witness whereof, I hereunto subscribe my name.

LAWRENCE C. F. HORLE.