Dec. 22, 1925. 1,566,792

F. E. FIELD

INDUCTANCE DEVICE

Filed April 17, 1922

Fig. 1.

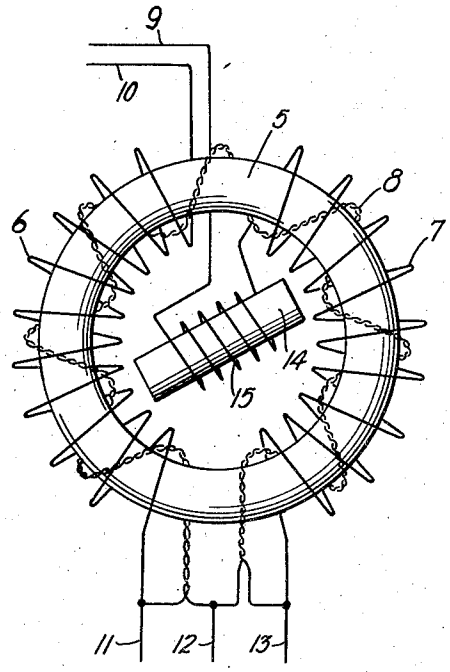


Fig. 3

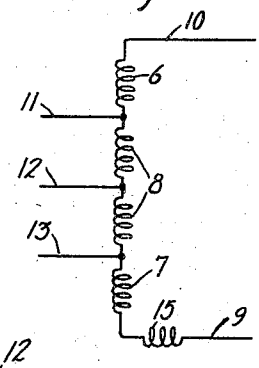
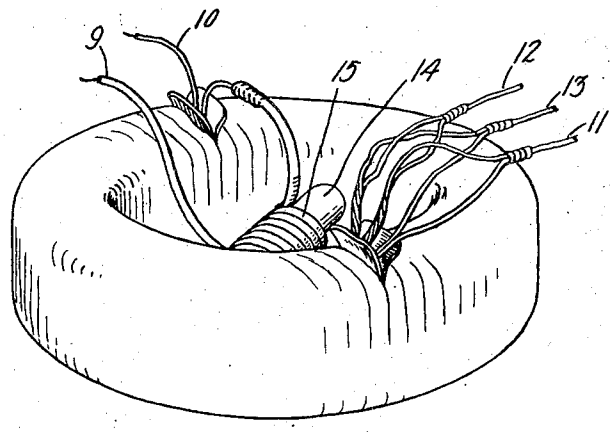


Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANK E. FIELD, OF SOMERVILLE, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

INDUCTANCE DEVICE.

Application filed April 17, 1922. Serial No. 553,619.

To all whom it may concern:

Be it known that I, FRANK E. FIELD, a citizen of the United States, residing at Somerville, in the county of Somerset, State of New Jersey, have invented certain new and useful Improvements in Inductance Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to inductance devices and particularly to auto-transformers or repeating coils adapted for use in phantomed telephone circuits.

An object of this invention is to provide a method and means for accurately adjusting the reactances of two inductive windings in order that a desired relation may exist therebetween.

Another object is to provide a method and means for locating an intermediate tap for a transformer winding at such a position that the tap will be located in the exact inductive center of the winding.

This invention will be hereinafter described as embodied in an auto-transformer such as is used in reducing reflection losses in phantom telephone circuits.

In such a transformer an intermediate tap is usually provided to which phantom circuit connections are made. If this phantom tap is not located at the exact impedance center of the transformer winding, cross talk between the side circuit currents and the phantom circuit currents is liable to occur—a result which is highly objectionable. This invention provides a simple and reliable method and means for insuring that the two halves of the transformer winding are balanced electromagnetically.

In accordance with this invention the two halves of the winding to be balanced against each other are wound on different parts of a substantially closed magnetic circuit core. An adjustable core piece having a few winding turns thereon connected in circuit with one of the halves of the main winding is provided which can be moved to such a position that the flux produced by the auxiliary winding produces the same change in flux in both halves of the main winding or a greater change in one half than the other. By varying the position of this auxiliary core piece the desired equality between the inductance values of the two halves may be readily realized to any desired degree of accuracy.

Referring to the drawings, Fig. 1 discloses an auto-transformer with its winding schematically shown in order to illustrate the invention.

Fig. 2 is a view of the transformer of Fig. 1 after the windings have been placed thereon and surrounded by insulating tape.

Fig. 3 is a circuit diagram illustrating how the auto-transformer may be connected in a phantomed telephone circuit.

The auto-transformer illustrated in Fig. 1 comprises a substantially closed magnetic circuit core 5, one portion of which is surrounded by a winding 6 and another portion of which is surrounded by a winding 7. A twisted pair winding 8 is also disclosed surrounding the entire core structure. The manner in which the terminals 9, 10, 11, 12, and 13 are employed in connecting the auto-transformer in a phantomed telephone circuit, is shown in Fig. 3, terminals 9, 10 leading to one section of the telephone line, terminals 11, 13 leading to another section of the telephone line, and terminal 12 leading to phantom circuit connections whereby phantom currents are impressed upon the telephone line section connected to terminals 9 and 10. As shown in Fig. 3, winding 6 and half of the twisted pair 8 are located on one side of phantom tap 12 while the other half of the twisted pair 8 and the winding 7 are located on the opposite side of the phantom tap.

In order that cross-talk between the phantom circuit currents and the side circuit currents may be prevented it is highly desirable that the phantom circuit tap 12 be located at the exact inductive center of the transformer. This invention provides a convenient and simple arrangement whereby the auto-transformer may be balanced in spite of inductance differences between the windings 6, 7, and 8. As shown in Fig. 1, a bar 14 of magnetic material is located within the core 5 and is surrounded by a few turns 15 of the terminal wire 9. The effect of the flux in bar 14 passing through a portion of core 5 and returning to the bar 14, upon the inductance balance of the transformer will depend upon the relative position of bar 14 with respect to the windings 6 and 7. Depending upon the position of the bar 14 the flux therefrom will produce unequal changes of any desired degree of the flux flowing through the two halves of

the core 5 surrounded by windings 6 and 7. A position for the adjustable bar 14 may then be readily found in which the unequal effect upon the two halves of core 5 will serve to correct the differences in the inductances of windings 6 and 7. When the most satisfactory position for the bar 14 has been found, the bar may be suitably fastened so that it may be permanently retained in that position.

Bar 14 will also serve as a path for any leakage flux from the main transformer windings so that the leakage flux can aid the flux produced by winding 15 in correcting for the inductive unbalance of the transformer. In some cases the leakage flux may be found to be sufficiently great to correct for the inductive unbalance in which case no winding turns will be needed on bar 14.

It is to be understood that this invention is applicable to transformers of other types than auto-transformers and furthermore that the specific embodiment above described may be variously modified without departing from the spirit of the invention, as defined in the appended claims.

The invention claimed is:

1. An inductance device comprising a substantially closed magnetic circuit core, a plurality of windings on said core, and adjustable means extending across said core for increasing the leakage of that winding having the greater inductance.

2. An inductance device comprising a substantially closed magnetic circuit core, a winding on one portion of said core, a second winding on a second portion of said core, an adjustable bar of magnetic material extending between said portions and a supplementary winding on said bar and connected in circuit with said windings.

3. An inductance device comprising a substantially closed magnetic circuit core, independently wound windings on different parts of said core, and means for adjusting the relative values of the inductance of said windings, said means comprising a bar of magnetic material movable relative to said core and having one end adjacent a portion of said core surrounded by one of said windings and having its other end adjacent a portion of said core surrounded by another of said windings, and an auxiliary winding on said bar in circuit with said other windings.

4. The method of balancing transformer windings wound on different portions of a core in which a supplementary winding on a movable corepiece is employed connected in circuit with said windings, which method comprises determining by trial that position of the movable core with respect to the main core where the effect of the supplementary winding will substantially cause an inductive balance of said transformer windings, and securing said movable core in said position.

5. The method of locating a connection at the inductive center of a transformer winding wound on a substantially closed magnetic circuit core in which a supplementary winding on a movable bar is employed connected in circuit with said winding, which method comprises moving said bar by trial to such a position that unequal leakage losses from the two halves of said winding produced by said bar cause the connection to be located approximately at the inductive center of said winding, and securing said movable core in said position.

In witness whereof, I hereunto subscribe my name this 14th day of April A. D., 1922.

FRANK E. FIELD.