No. 822,332. PATENTED JUNE 5, 1906.

M. M. WOOD.

INDUCTION COIL.

APPLICATION FILED NOV. 15, 1904.

Fig. 1.

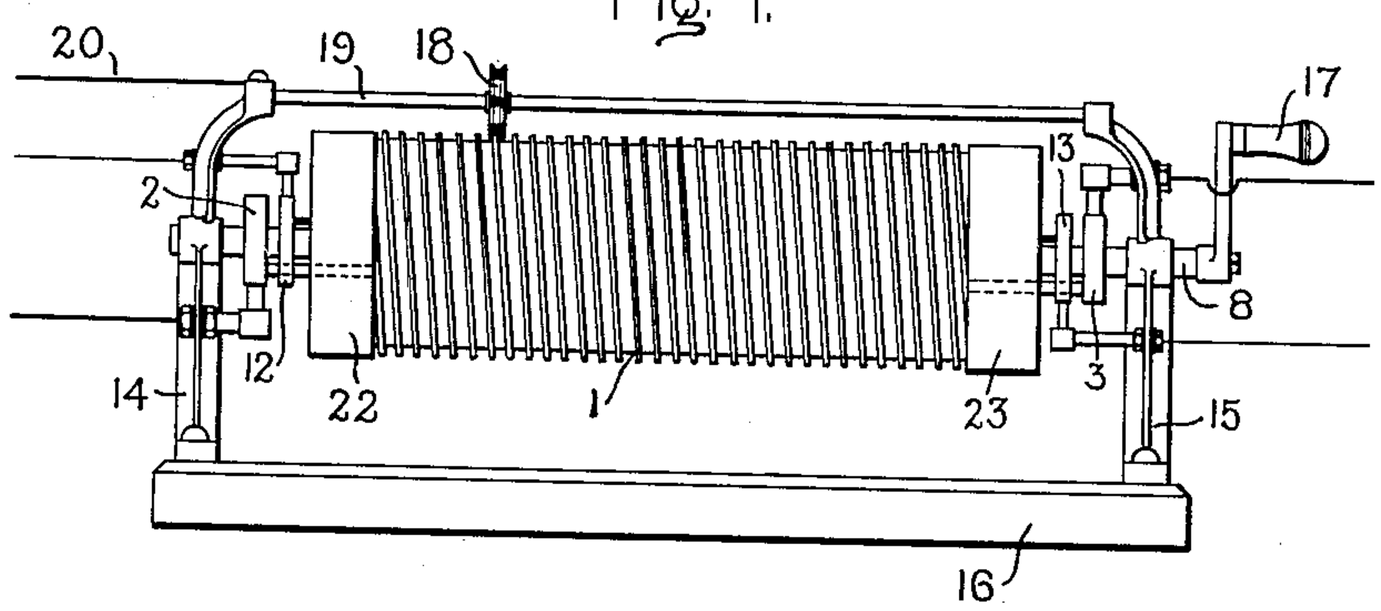


Fig. 2.

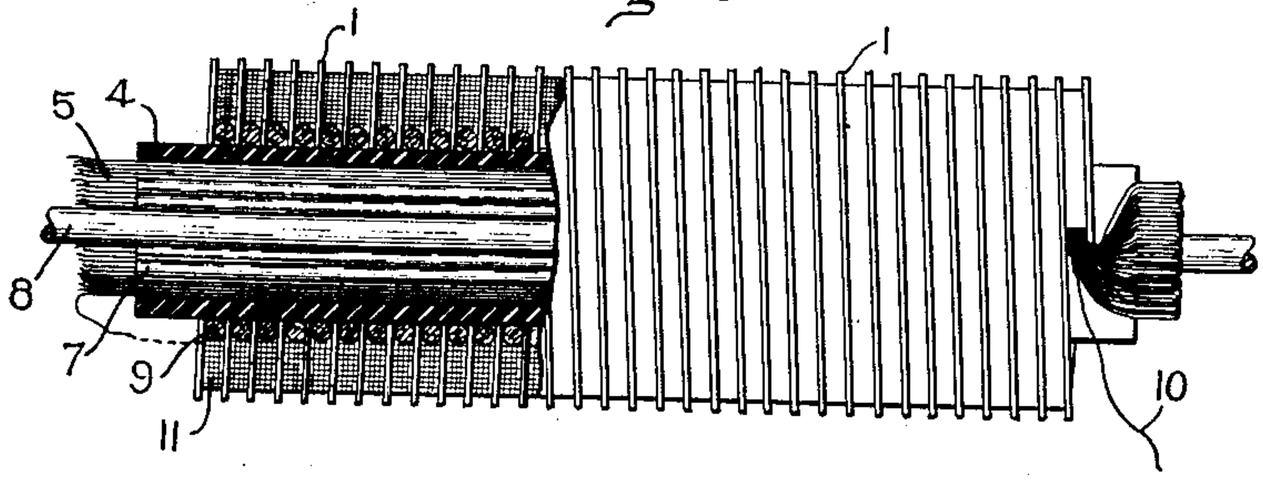


Fig. 4.

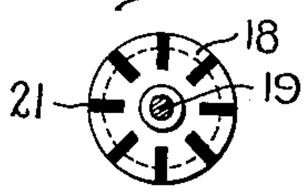
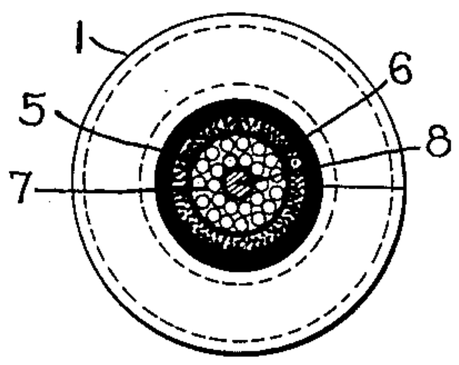


Fig. 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

MONTRAVILLE M. WOOD, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INDUCTION-COIL.

No. 822,332. Specification of Letters Patent. Patented June 5, 1906.

Application filed November 16, 1904. Serial No. 232,869.

To all whom it may concern:

Be it known that I, MONTRAVILLE M. WOOD, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

It is the object of the present invention to provide an induction-coil or transformer suitable for transforming electrical energy, and particularly for transforming small quantities of power for use in resistance measurements and similar operations. The windings of the induction-coil are in the form of helices, and one of the windings consists of a bare conductor so arranged that the outer edge may be used as a contact-surface for an adjustable contact-wheel. The other winding has the peculiarity of consisting in whole or in part of a conductor having magnetic properties—such, for instance, as iron—with a view to utilizing these magnetic properties to strengthen the magnetic flux through the coils.

In the accompanying drawings, Figure 1 is an elevation of my improved form of induction-coil mounted on a suitable support and provided with collector-rings and with a contact-wheel for the bare conductor and means for rotating the induction-coil to move the contact-wheel along the edge of the bare conductor. Fig. 2 is a partial transverse section of the coil with the end caps removed. Fig. 3 is a transverse section of the same. Fig. 4 is a detail view of the contact-wheel.

The primary or low-potential winding 1 of the induction-coil consists, preferably, of a bare edge-wound conductor arranged in the form of a helix and connected at its terminals to the collector-rings 2 and 3. Through the center of this helix extends a tube 4, of mica or other insulating material, within which is a group of iron wires 5, insulated from each other with silk or other good insulating material. The wires are arranged within the insulating-tube 4, but outside of a smaller insulating-tube 6, as shown in Fig. 3. Within this inner insulating-tube 6 is the usual iron core, consisting of soft-iron rods 7 of the kind commonly used in such apparatus. A shaft 8 passes through the center of this core and serves as a means for rotating the induction-coil about its central axis. A cord 9, of insulating material, is placed between the successive turns of the winding 1 and serves to suitably space the successive turns. The secondary winding is wound in the helical slot formed by the successive turns of the edge-wound primary; but as it is desirable to have many more turns in the secondary than in the primary some special means is necessary for preserving the continuity of this secondary winding. Thus if the conductor passes in at the right-hand end of the spiral, as shown at 10 in Fig. 2, it will finally come out in the left-hand slot 11, and some provision must be made for returning it to the right-hand end of the coil. To accomplish this return, I solder or otherwise connect the end which emerges from slot 11 with one of the insulated iron conductors 5, thus completing the circuit to the right-hand end of the coil and permitting a repetition of the winding throughout the length of the helical slot until the desired number of secondary turns has been obtained. The insulated iron wires 5 serve not only to complete the electrical circuit; but, owing to their high magnetic permeability, provide a suitable path for a portion of the magnetic flux threading the coils. If desired, the entire secondary winding may consist of insulated iron wire; but, owing to the relatively low electrical conductivity of iron, I prefer to use copper for that part of the secondary which lies in the helical slot. Likewise, if high electrical efficiency is necessary the entire secondary conductor may consist of copper, though this construction can be made only at the sacrifice of the magnetic path afforded by the iron wires 5. To the terminals of the secondary winding are connected two collector-rings 12 and 13 for connecting the coil in circuit, and insulating-caps 22 23 protect the ends of the coils from injury. Suitable standards 14 and 15, mounted on the base 16, support the shaft 8 and permit the induction-coil to be rotated by means of a crank 17, secured at one end of the shaft 8. A contact-wheel 18 is supported loosely on the rod 19, joining the two standards, and is adapted to rotate in contact with the outer edge of the primary winding 1 and at the same time to move longitudinally on the rod 19, and thus move progressively from one turn of the winding to the next as the coil is rotated by means of the crank 17. A conductor 20 is

connected to the rod 19, and thus serves as a means for connecting the wheel 18 with a power or test circuit. If current is supplied through the slip-ring 3 and wheel 18, any desired pressure may be secured at the high-potential terminals by varying the ratio of transformation of the transformer by turning the crank 17. The contact-wheel 18 is provided with a plurality of slots 21, filled with mica or other insulating material, so that if direct current is supplied through conductor 20 the contact-wheel will automatically make and break the circuit as the wheel moves along the edge of the primary conductor, and thus generate an alternating current in the high-potential winding of the transformer. The four slip-rings furnish a ready means for connecting the transformer in a variety of ways for test purposes, and while I contemplate using the device herein described for measuring the resistance of rail-joints on electric roads it is obvious that it may be used for a great variety of purposes.

Although the novel forms of the windings herein described are believed to be well adapted for use in transformers and induction-coils, I do not wish to be limited to such specific use, as such windings may be used to advantage in a great variety of ways, as will be readily understood by persons skilled in the art.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A composite winding, comprising an edge-wound conductor in the form of a helix, and a circular conductor lying between successive turns of said helix.

2. A composite winding, comprising an edge-wound conductor in the form of a helix, and a winding lying between successive turns of said helix and having a return portion in the space inclosed by said helix.

3. An electrical winding having a part in the form of a helix and having a second part consisting of magnetic material and extending through the space inclosed by said helix.

4. An electrical winding having a part comprising a plurality of turns and a second part consisting of a plurality of magnetic conductors in inductive relation to said turns and electrically connecting certain of said turns.

5. A transformer having a winding consisting of a bare conductor wound in the form of a helix, and a second winding having turns which lie between the successive turns of said first-named winding, said second-named winding having a greater number of turns than said first-named winding.

6. A transformer having a winding consisting of a bare conductor wound in the form of a helix, and a second winding for said transformer, said second winding having a plurality of turns between successive turns of said helix and having a return portion threading through said helix from end to end.

7. A transformer having a primary winding, and a secondary winding in inductive relation thereto, said secondary winding consisting in part at least of magnetic material and having a portion lying in the path of the magnetic flux which threads said winding, said portion extending substantially from end to end of said primary winding.

8. A transformer having a winding and means for establishing a magnetic flux therethrough, said winding consisting in part at least of magnetic material arranged to furnish a continuous path of high permeability for said magnetic flux.

9. In a transformer, a winding, one part of which is in the form of a helix and a second part of which has a high magnetic permeability and extends longitudinally through said helix.

10. In a transformer, a primary winding wound in the form of a helix, and a secondary winding having one part in the form of a helix and lying between the successive turns of said primary winding, and a second part threading longitudinally through said helices and consisting of a plurality of conductors of magnetic material insulated from each other.

In witness whereof I have hereunto set my hand this 14th day of November, 1904.

MONTRAVILLE M. WOOD.

Witnesses:

ALEX. F. MACDONALD,

HELEN ORFORD.