(No Model.)

E. E. RIES.

INDUCTION COIL.

No. 380,138. Patented Mar. 27, 1888.

Fig. 1.

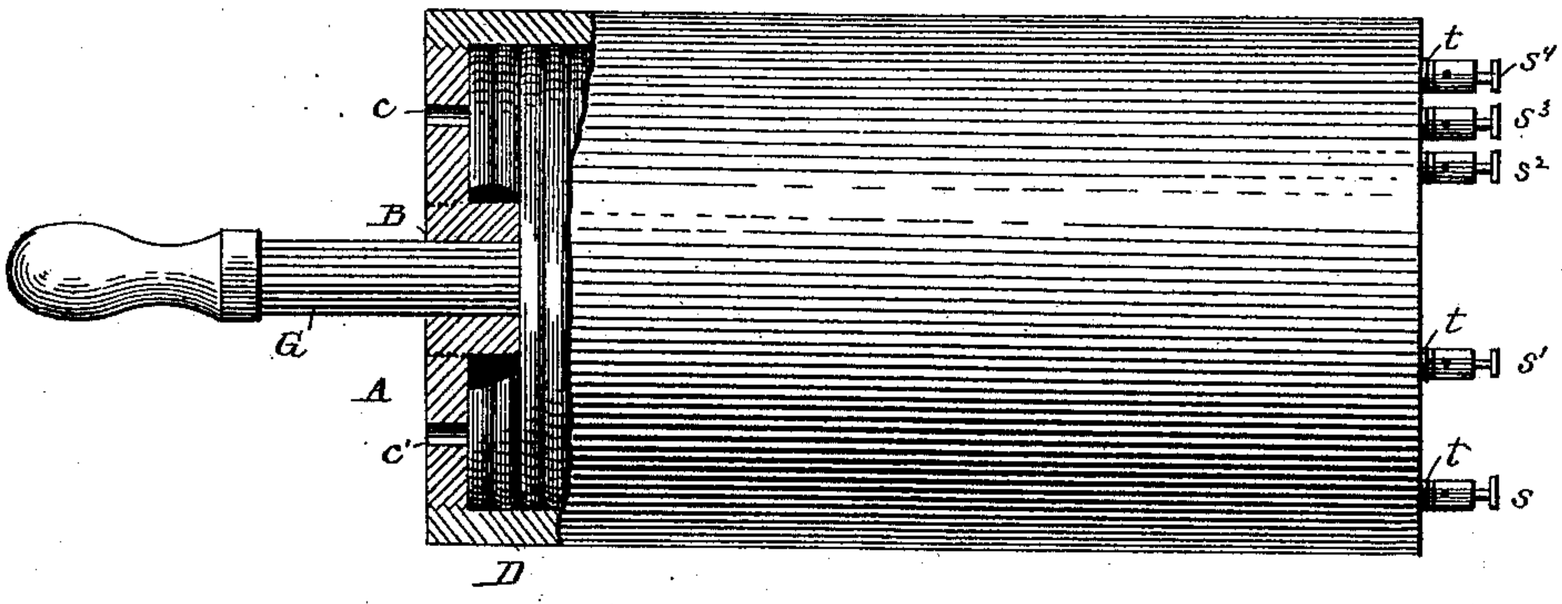
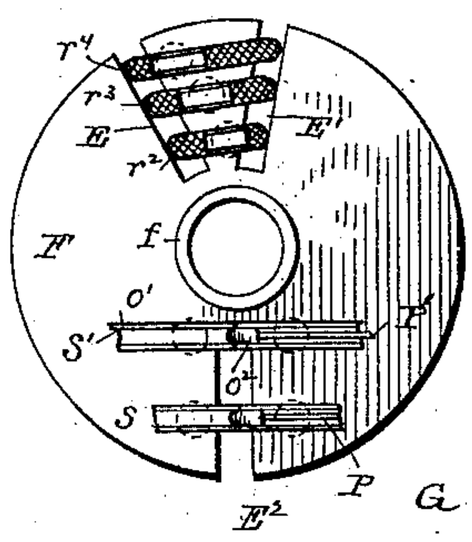


Fig. 2.



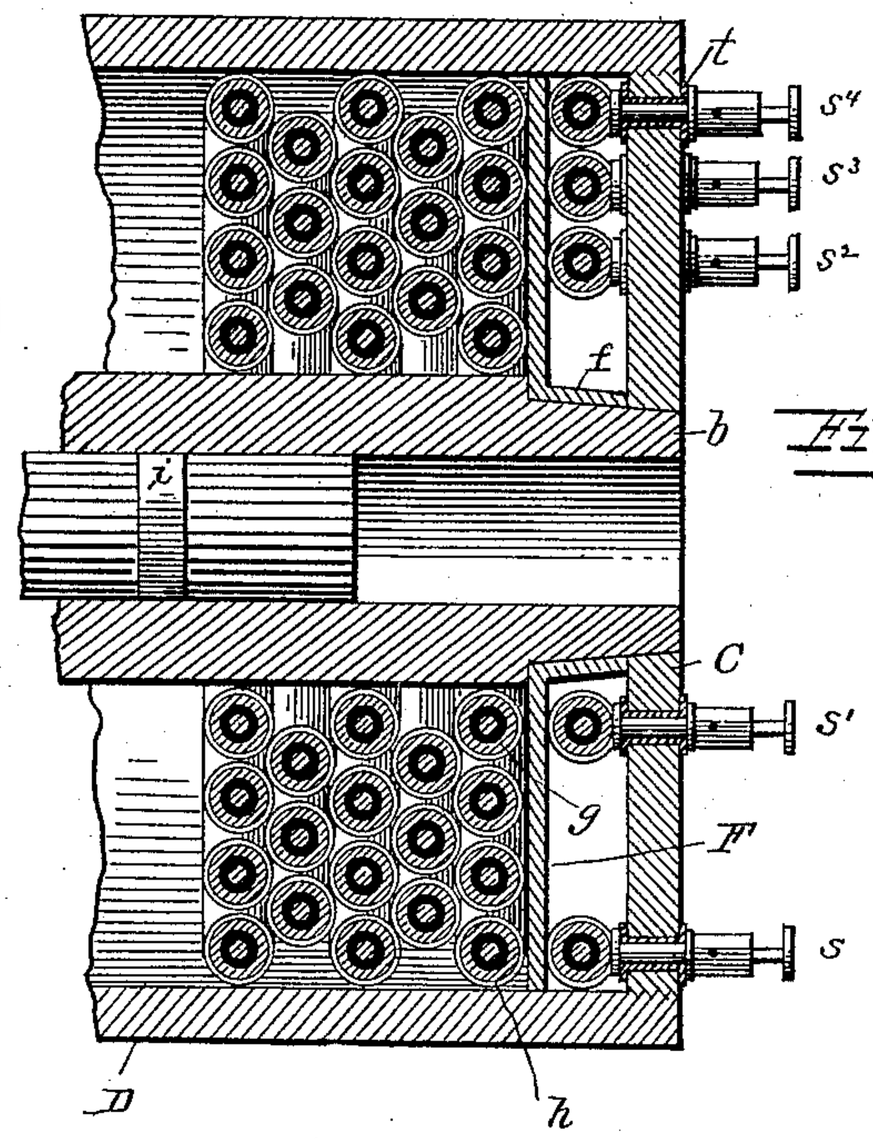
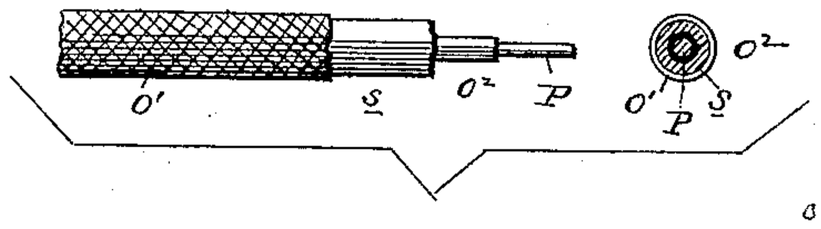


Fig. 3.

Fig. 4.



WITNESSES

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INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 380,138, dated March 27, 1888.

Application filed July 15, 1887. Serial No. 244,357. (No model.)

To all whom it may concern:

Be it known that I, ELIAS E. RIES, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Induction-Coils; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to produce an induction-coil in which the primary and secondary conductors will be brought into close inductive proximity and be capable of easy winding and unwinding; in which the relative disposition of the magnetic core and the inducing and induced conductors is so disposed as to obtain an efficient and at the same time compact, simple, and symmetrical form of apparatus; in which the capacity of the magnetic system may be varied to fully utilize varying strengths of exciting-currents; in which the various elements of the induction-coil may be connected or disconnected without difficulty when necessary, and in which greater safety and immunity from escape of current from the smaller or high-tension conductor is secured.

To this end my invention consists in providing an induction-coil with a compound or duplex conductor, the two conducting portions of which are insulated from one another and one is inclosed by the other; in providing means for raising or lowering the point of saturation of the magnetic system of the coil; in so winding the coil itself that the terminal turn of each helical layer may be exposed for purposes of making contact therewith, and yet will be firmly held in its place contiguous to the next preceding turn; in so constructing the various parts of the coil that it may be readily assembled or taken apart, and in certain details of structure, which will hereinafter be fully described in this specification, and then definitely indicated in the claims.

In the accompanying drawings, which illustrate my invention, Figure 1 is an elevation with part broken away, to better illustrate the structure of a coil embodying my improvements. Fig. 2 is a detached view of a disk used on one end of the coil, showing the manner of arranging a partial turn of successive alternate layers, so that said layers may be grouped in multiple arc or multiple series, and showing, also, the manner of disposing of the primary and secondary terminals. Fig. 3 is an enlarged central longitudinal section of part of Fig. 1. Fig. 4 shows in elevation and section the multiple conductors used in my coil.

B is a tubular core of soft iron, provided with end flanges, A C, of the same material. Each flange has a thread cut on its periphery, over which screws the inclosing iron cylinder D. The flange A may be made integral with the tubular core, or may be screwed thereon, as indicated in dotted lines. Within the core B is a sliding auxiliary core, G, which may consist, as shown, of a bundle of annealed iron wires. By adjusting this supplemental core to different depths within the tubular core the magnetic capacity of the core is increased or decreased as the point of saturation of the magnetic system rises with an increase of the mass of iron and falls with a decrease of the same. With any given strength of current traversing the inducing-conductor therefor the maximum inductive effect will be produced when the core G is shifted to such a position that the combined cores will be just saturated.

The flange A is perforated, as shown at *c c'*, the perforations permitting the insertion of the tines of a bifurcated key to unscrew the parts when it is so desired. The tubular core is reduced at one end and tapered, as shown at *b*, Fig. 3, to facilitate sliding the flange or head C into its seat when the casing is placed over the coil.

The primary and secondary conductors are made in a duplex form. The structure of this multiple conductor is shown in Fig. 4. It consists of two concentric conducting parts carefully insulated throughout their whole length. The central one is an ordinary well-insulated wire, P, and this is surrounded by the other, S, which may be simply a ribbon of copper or other conductor bent around the central conductor, or any form of multiple conductor in which one member is inclosed by and insulated from the other. The two are then braided with an insulating fabric, or simply coated with an insulating compound in a manner well understood.

In the familiar uses of the induction-coil the secondary current would traverse the wire of

the less sectional area, while in the modern systems of conversion of high-tension into low-tension currents the primary or high tension current would traverse it. Several material advantages result from the employment of a compound conductor of the kind just described. The primary and secondary conductors are brought into close inductive relation throughout their entire length and the induced conductor is brought close to the central core, where the magnetic field is strongest; besides this, perfect uniformity of distance throughout the entire length of the conductors is secured and the labor of winding a coil is tremendously abridged, while the small interior conductor is thoroughly protected by the exterior one against all damage or abrasure of its insulation. A centrally-flanged disk of insulating material (shown in elevation in Fig. 2) is used on the end of the coil to facilitate making electrical connection between the several binding-posts on the head C and particular layers of the coil. The central opening of this disk is tapered to fit snugly on the tapered end of the core. This disk is slotted, as shown, to accommodate the entrance of the compound wire. In winding, the free end of the first layer is allowed to project a short distance through the slot E^2, and the final turn of the return-layer is carried through the slots E E′ around the web of insulating material between these slots. In the drawings these alternate layers are shown carried over the disk at their last turn, the end of the conductor after the final turn being secured in the slot E^2. In this way the layers of the coil are firmly fixed in position and will not be disarranged when the insulation is removed to make the connections about to be described. The insulating-covering to the conductor can then readily be scraped away from the outer conductor, as shown at r^2 r^3 r^4. At the two ends of the compound wire the outer conductor is slashed or unwound and the two conductors bent in opposite directions and laid smoothly on the disk, as shown in Fig. 2. The coil is then in condition to have the casing applied. The head C is tapped with as many holes as it is desired layers of the coil shall be provided with external electrical connection, and binding-posts S S′ S^2 S^3 S^4, suitably insulated by rubber washers or gaskets, are then secured in the openings in the head C.

The binding-posts P P′ S S′ are distanced and arranged about as indicated in Figs. 1 and 2, while S^2 S^3 S^4 are placed in different circumferential as well as radial positions, so as to give ample room for coupling. By properly connecting these several layers by means of the posts just mentioned the electro-motive force of the low-tension current can be varied at will in a manner that will be readily understood, and the ratio of current traversing the two conductors adjusted to suit different requirements. The head C is screwed into the cylinder D. The latter is then slipped over the coil and screwed upon A. As the head C is brought toward the disk F, the stems of the binding-posts engage the projecting conductor, as shown in dotted lines in Fig. 2 and in full lines in Fig. 3, P P′ representing the terminals of one conductor and S S′ those of the other. The normal circuit traverses the coils in series; but if any part of the coil should be desired cut out the circuit-connections could readily be shifted on the binding-posts to accomplish that end. I have shown only one conductor provided with the means for coupling in any desired manner. It will of course be evident that any additional set of binding-posts might be furnished for the other.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an induction apparatus, a compound conductor, one member inclosing but insulated from the other, the inclosing member being formed of a single piece of conducting material, the axis of the compound conductor extending circumferentially about a central line of the apparatus.

2. In an induction apparatus, a compound primary and secondary conductor, one member inclosing but insulated from the other, the inclosing member being formed of a single piece of conducting material, said compound conductor forming a helix about a central line of the apparatus.

3. In an induction apparatus, a compound primary and secondary conductor, one member inclosing but insulated from the other, the inclosing member being formed of a single piece of conducting material, the axis of the compound conductor extending circumferentially about a central line of the apparatus, said compound conductor being inclosed in an insulating-sheath.

4. In an induction apparatus, a compound primary and secondary conductor, one member inclosing but insulated from the other, the inclosing member being formed of a single piece of conducting material, the axes of the two being coincident and extending circumferentially about a central line of the apparatus.

5. In an induction apparatus, the combination of an iron core and a compound primary and secondary conductor surrounding said core, one member of the compound conductor inclosing but insulated from the other, the inclosing member being formed of a single piece of conducting material.

6. An induction-coil provided with a tubular iron core and a supplemental iron core sliding within the tube, whereby the limit of saturation of the magnetic system may be varied.

7. In an induction-coil, the combination of an iron core, iron flanges on the ends of the core, and an inclosing iron tube surrounding the coil in magnetic circuit with the flanges, the tube connecting with the flanges by a screw-joint.

8. In an induction-coil, the combination of

an iron core, iron flanges on the ends of said core, and an iron casing engaging the flanges, one of said flanges being provided with detents for an unlocking-key.

9. A coil of insulated wire having one or more terminal turns of its layers bent out of its plane of curvature, whereby contact may be readily made with the layer of the coil containing said exposed portion.

10. The combination, with an iron core and its coiled exciting-conductor, of a radial projection secured to the core, a series of end turns of the coil being carried around the projection, whereby the layers of the coil may be connected in circuit as desired.

11. The combination, with an iron core and its coiled exciting-conductor, of an end disk secured to the core, said disk being provided with radial slots, and a series of end turns of the coil being carried around the web between the slots.

12. In an induction-coil, the combination of the primary and secondary windings, a central iron core, flanges on said core, an iron inclosing-cylinder detachably secured to the flanges, a slotted disk located between one flange and the coils, through which the end turns of the layers project, and binding-posts secured on said flange, engaging the projecting end turns when the flange is adjusted into position.

In testimony whereof I affix my signature in presence of two witnesses.

ELIAS E. RIES.

Witnesses:

LEOPOLD RIES,

JNO. T. MADDOX.