Feb. 13, 1934. W. P. LOUDON 1,946,631

ELECTRICAL APPARATUS

Filed May 4, 1931

Fig. 1.

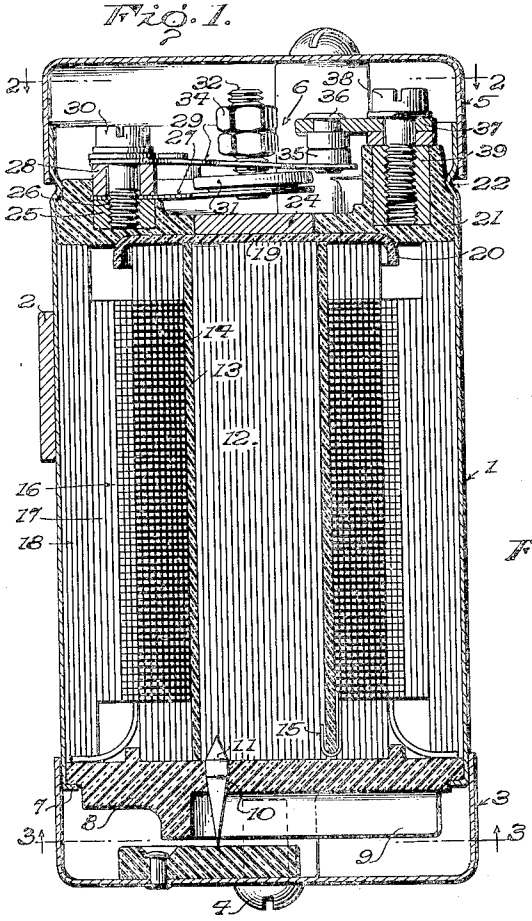


Fig. 2.

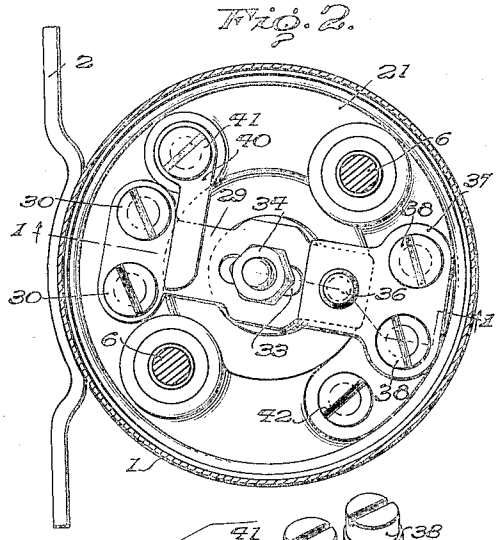
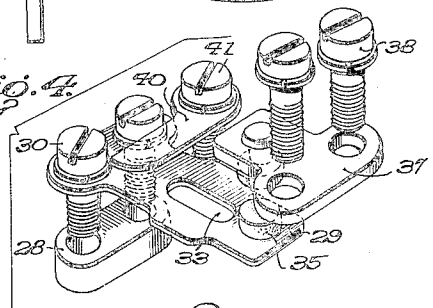


Fig. 4.



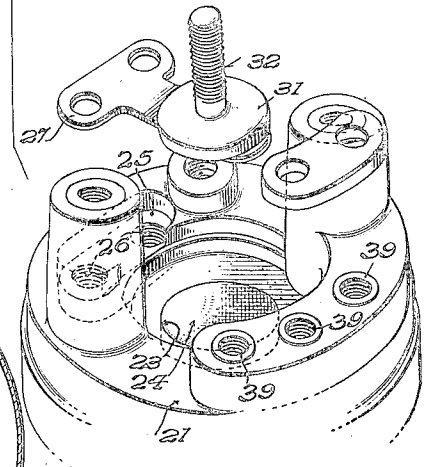
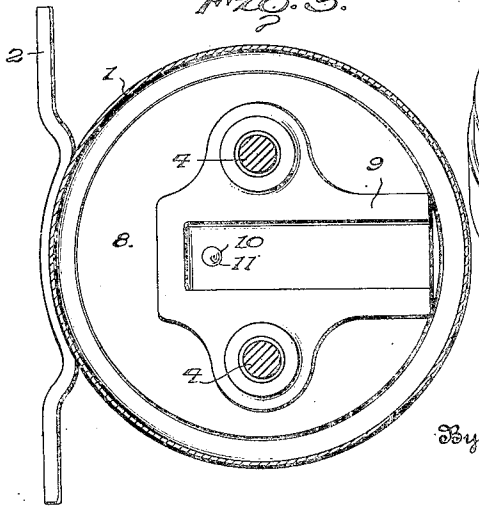


Fig. 3.



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ELECTRICAL APPARATUS

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11 Claims. (Cl. 175—357)

This invention relates to induction coils and more particularly to a combined coil and interrupter for producing high voltage energy suitable for use in the ignition systems of internal combustion engines or in radio apparatus.

Heretofore there have been proposed induction coils having relatively movable contacts in the primary or low tension circuit thereof. However, in these coils some difficulty has been encountered in properly insulating the low tension circuit from the high tension circuit without decreasing the efficiency of the coil or rendering the same wholly inoperative. This is particularly true in installations wherein the coils and contacts form a self-contained unit, and especially in instances wherein the core is connected to the secondary winding and consequently forms a part of the high tension circuit.

It is accordingly one of the objects of the present invention to provide a novel induction coil in which the relatively movable contacts in the low tension circuit are properly and efficiently insulated from the high tension circuit.

Another object is to provide in an induction coil of the type wherein the core forms a part of the high tension circuit, novel means for reducing the magnetic reluctance of the air gap between the core of the coil and the movable contact member.

Another object is to provide in a device of the above character, a novel arrangement of parts in axial alignment with the core of the coil in order to reduce the magnetic reluctance of the air gap between the core and the movable contact member and also to efficiently insulate the last two named parts from each other.

A further object is to provide an induction coil of the above character which is unusually efficient in operation, compact, light in weight, and accordingly particularly adapted for use on aircraft.

Other objects and features of novelty will appear more fully hereinafter from the following description taken in connection with the accompanying drawing which illustrates one embodiment of the invention. It is to be expressly understood, however, that the drawing is for purposes of illustration only, and is not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

Referring to the drawing, wherein like reference characters refer to like parts throughout the several views:

Fig. 1 is a vertical section on line 1—1 of Fig. 2 of an induction coil embodying the present invention;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1; and

Fig. 4 is a perspective view of the upper part of the coil with the parts in disassembled position.

Referring more particularly to Fig. 1 of the drawing, an induction coil constructed in accordance with the principles of the present invention is illustrated therein as being constituted by a cylindrical casing 1, preferably formed of sheet metal, on which is rigidly secured, as by spot welding, brazing, or other suitable means, a supporting bracket 2. A closure 3 is provided for the bottom of the casing securely held in position by screws 4 and a similar closure 5 is provided for the top of the casing housing an interrupting mechanism denoted generally at 6. The lower edge of the casing 1 is preferably upset to form an annular flange 7 adapted to support a bottom member 8 formed of suitable insulating material. This bottom member 8 is provided with downwardly extending flanges 9 forming a semi-circular groove, and with an opening 10, for supporting a metallic needle 11, for a purpose which will appear more fully hereinafter.

Coaxially arranged with casing 1 and resting on the member 8 is a core 12 formed of suitable flux conducting material such as, for example, iron, and this core may, if desired, be formed of a plurality of iron wires bundled together in the shape of a cylinder. An insulating sleeve 13 of paper or other suitable insulating material is placed around the core 12 in order to insulate the core from a secondary winding 14. This latter winding is electrically connected to the core by a connection 15 extending through the sleeve 13, it being thus apparent from this construction that the core forms a part of the secondary or high tension circuit. A primary winding 16 is wound around the secondary winding and a condenser 17 is preferably placed around the primary winding. Interposed between the condenser and the casing 1 is an annular core 18 formed of any suitable flux conducting material and which forms a portion of the magnetic circuit.

In order to effectively insulate the interrupting mechanism 6, disposed in the upper portion of the casing, from the high voltage core, an insulating member 19, preferably formed of a plurality of sheets of mica, is placed immediately above the core 12 and may be turned down around its edge as shown at 20. Above this insulating member and substantially closing the top of

casing 1 is a member 21 formed of suitable insulating material and retained in place by a bead 22 in the casing 1, and this member has provided therein an axial opening 23 for reception of a flux conducting disc 24, for a purpose which will appear more fully hereinafter.

Upon one side of the member 21 a metallic member 25 is securely fastened within a suitable aperture and this member is preferably provided with a plurality of spaced tapped holes 26. Mounted on the member 25 is a leaf spring 27 having a plurality of openings in one end thereof which are adapted to register with the tapped holes 26. A second member 28 similar to the member 25 except that the holes therein are not tapped, is mounted above the leaf spring 27 and a resilient spring arm 29 is mounted thereon. The above mentioned parts are held in assembled position by screws 30, which may be separated from the leaf spring 29 by a suitable washer.

The leaf spring 27 carries near its free end a disc 31 formed of iron or other suitable material and is fastened to the leaf spring by a screw 32 extending through the disc and leaf spring and projecting thereabove through an elongated slot 33, Fig. 4, in the resilient member 29, and preferably a pair of nuts 34 is threaded thereon above the member 29.

As illustrated a contact 35 constituting the movable contact of the interrupting mechanism 6 is secured to the end of the leaf spring 29 and cooperates with a stationary contact 36 secured to an arm 37 which is rigidly held in place by screws 38 extending therethrough and threaded into tapped sleeves 39 in the member 21. Referring to Fig. 2, a metallic arm 40 is secured by a screw 41 to the member 21 and extends over and in contact with the resilient arm 29, the screw 41 serving as a terminal for connecting a lead from a battery to one side of the primary winding.

In practice, one of the battery terminals may be connected to screw 41 and the other terminal connected to a similar screw 42. Battery current flows from screw 41 through arm 40, leaf spring 29, contacts 35 and 36 and arm 37, to one of the screws 38 which is connected to one side of the primary winding, and thence through this winding and back to the screw 42. The flow of current through the primary winding magnetizes the core 12 which attracts the disc 31, pulling down the screw 32 secured thereto so that the lower nut 34 contacts with leaf spring 29 pulling it down and separating the contacts 35 and 36 to interrupt the primary circuit. As well understood in the art, the interruption of the primary circuit will induce a high voltage in the secondary circuit. The condenser 17 is connected in the primary circuit in parallel with contacts 35 and 36 to prevent arcing when these contacts are separated. After the primary current has been interrupted, the resilient members 27 and 29 carry the contact 35 back into engagement with contact 36, the primary circuit being thus restored and the cycle repeated. It will be apparent to one skilled in the art that the connection between the resilient members 27 and 29 constitutes a lost motion connection and that by adjusting the nuts 34 the length of travel of the member 31 relative to spring 29 can be varied which will effect a variation in the frequency with which the primary circuit is interrupted.

One side of the secondary winding 14 is preferably grounded to the casing 1, the other side being connected to core 12 by the wire 15 as heretofore pointed out. The core 12 is connected through the needle 11 with a suitable cable leading to the point of use, such as an engine spark plug or radio apparatus.

It will be apparent from the above construction that the mica disc 19 serves to insulate the core 12, which is energized by the high voltage secondary winding, from the resilient member 27 when the latter is drawn downwardly and that the disc 24 serves to decrease the reluctance of the air gap between the insulating member 19 and the disc 31 so that the latter will be readily responsive to the magnetism in core 12.

There is thus provided by the present invention a novel induction coil in which the movable contacts for interrupting the primary circuit are properly and efficiently insulated from the secondary circuit and in which the reluctance of the air gap between the magnetized core and the movable contact is reduced to such a low value that the movable contact is readily responsive to the magnetism in the core. The construction and arrangement of parts provides an unusually compact and light structure, which features render the device especially adaptable for use in connection with aircraft.

While there has been shown and described only one embodiment of the invention, it is to be understood that the same is not limited thereto, but may be embodied in several forms. For example, the windings might be arranged differently about the core than that illustrated or contact members other than those shown and described might be employed without departing from the spirit of the invention. Reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. An induction coil comprising a casing housing a magnetizable core forming a portion of an electric circuit, primary and secondary windings around said core, means within the casing and responsive to the magnetism in said core for interrupting the circuit to said primary winding and insulating means interposed between said core and said interrupting means within the casing.

2. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, means spaced from said core and responsive to the magnetism in said core for interrupting the circuit to said primary winding, insulating means between said core and said interrupting means, and means between said insulating means and said interrupting means for reducing the magnetic reluctance of the air gap therebetween.

3. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, means spaced from said core and responsive to magnetism in said core for interrupting the circuit to said primary winding, insulating means between said core and said interrupting means, and a flux conducting member between said insulating means and said interrupting means.

4. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, means responsive to magnetism in said core for interrupting the circuit to said primary winding, a mica insulating member between said core and said interrupting means, and a flux conducting member between said mica member and said interrupting means.

5. An induction coil comprising, a metallic

casing, a magnetizable core in said casing, primary and secondary windings in said casing around said core, means in said casing responsive to magnetism in said core for interrupting the circuit to said primary winding, insulating means between said core and said interrupting means, and flux conducting means between said insulating means and said interrupting means.

6. An induction coil comprising, a metallic casing, a magnetizable core in said casing, primary and secondary windings in said casing around said core, means in said casing spaced from said core and responsive to magnetism in said core for interrupting the circuit to said primary winding, a mica insulating member between said core and said interrupting means, and means between said core and said interrupting means for decreasing the magnetic reluctance of the air gap therebetween.

7. An induction coil comprising, a magnetizable core, primary and secondary windings about said core, said core being connected in series with said secondary winding, means responsive to the magnetism in said core for interrupting the circuit to said primary winding, and insulating means between said core and said interrupting means.

8. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, said core being connected in series with said secondary winding, means spaced from said core and responsive to the magnetism in said core for interrupting the circuit to said primary winding, insulating means between said core and said interrupting means, and means between said insulating means and said interrupting means for decreasing the magnetic reluctance of the air gap between said core and said interrupting means.

9. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, said core being connected in series with said secondary winding, means spaced from said core and responsive to the magnetism in said core for interrupting the circuit to said primary winding, insulating means between said core and said interrupting means, and a flux conducting member between said insulating means and said interrupting means.

10. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, said core being connected in series with said secondary winding, contact members movable in response to magnetism in said core for interrupting the circuit to said primary winding, said contact members being adjustable to vary the frequency of interruption of said primary circuit, and insulating means between said core and said contact members.

11. An induction coil comprising, a magnetizable core, primary and secondary windings around said core, said core being connected in series with said secondary winding, contact members movable in response to magnetism in said core for interrupting the circuit to said primary winding, said contact members being adjustable to vary the frequency of interruption of said primary circuit, insulating means between said core and said contact members, and a flux conducting member between said insulating means and said contact members.

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