

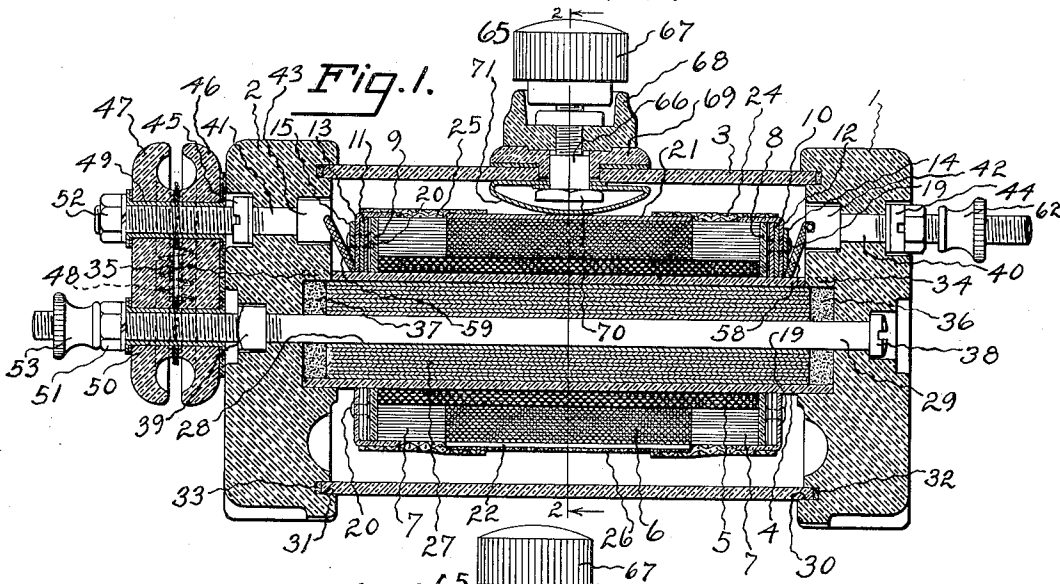
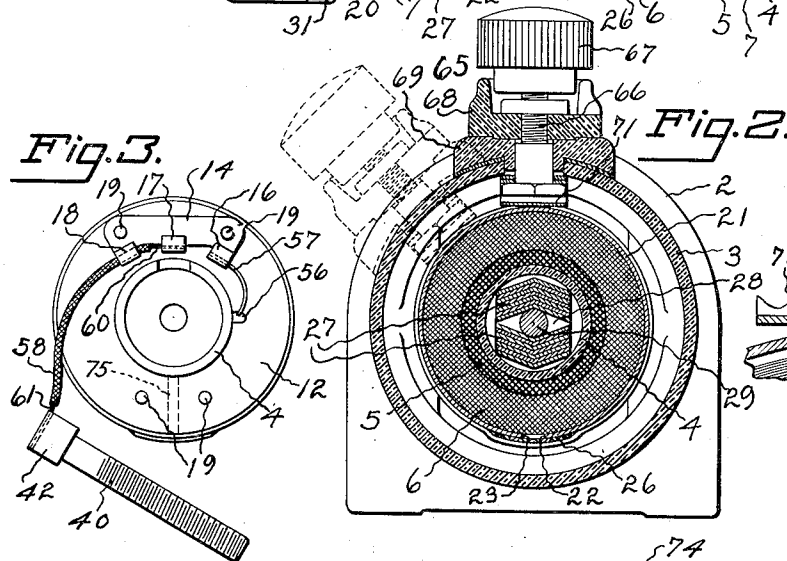
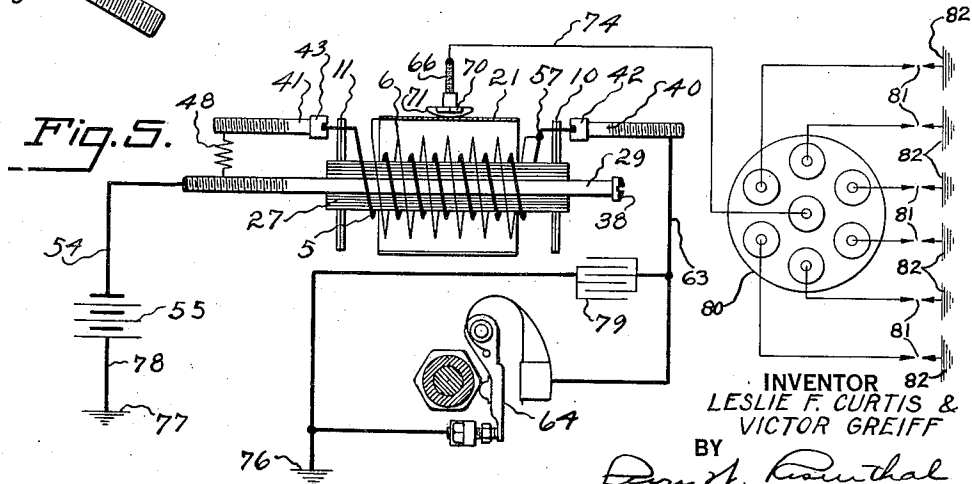
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V. GREIFF ET AL

INDUCTION COIL

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UNITED STATES PATENT OFFICE.

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INDUCTION COIL.

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To all whom it may concern:

Be it known that VICTOR GREIFF and LESLIE FORREST CURTIS, citizens of the United States, residing at and whose post-office addresses are, respectively, 202 West 79th Street, New York city, county and State of New York, and 11 Welcome Place, Springfield, county of Hampden, and State of Massachusetts, have invented certain new and useful Improvements in Induction Coils; and we 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 present invention relates to induction coils having primary and secondary windings mounted on a core.

In some cases, such coils had a closed magnetic circuit made up of the core and continuous extensions embracing the windings at the ends and outside thereof, or else an incomplete magnetic circuit with one or both of the end portions omitted. In coils with the closed magnetic circuits, the primary current does not rise sufficiently rapidly to produce a satisfactory sparking voltage in the secondary winding at some necessary high speeds of interruption, and where one or both of the end plates is omitted, the core is not sufficiently magnetized to produce a satisfactory sparking voltage with the desired primary winding. In accordance with this part of our invention, a more suitable magnetic circuit is obtained for producing ignition sparks at the spark plugs of an internal combustion engine into various numbers of cylinders and operating at various speeds, by providing a peripherally discontinuous magnetic shell around the windings in combination with a magnetic plate at either or both ends, said end plate or plates being spaced from said shell, and preferably also from the core, to form a plurality of air gaps in the magnetic circuit, and also being, preferably, angularly discontinuous to form air gaps whereby eddy currents in the end plates will be avoided.

Whether or not the shell is of magnetic material, and whether or not the end plates are used, the invention also comprehends using the shell as a contact member which may be electrically-connected to the terminal

of the secondary winding so as to form a connecting element between the secondary winding and the high tension binding post of the coil. For the purpose of conveniently attaching the ignition lead to the high tension binding post, the latter may be adjusted in position by adjustably mounting the tube to which the post is connected. To obtain a simple and efficient electrical connection, a contact spring, preferably in the form of a bow-spring, presses against the shell which in turn is pressed against the terminal of the secondary winding.

In the accompanying drawings illustrating our invention in application, as an example to an induction coil for ignition systems for internal combustion engines:

Fig. 1 is a longitudinal sectional view of the coil; Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1; Fig. 3 is an end view of the coil showing the mode of connecting the terminals; Fig. 4 is a fragmentary sectional view showing the mode of making electrical connection with the terminal of the secondary winding, and Fig. 5 is a diagrammatic view showing the wiring diagram of the circuits connected to the coil and parts of an ignition system.

Referring more particularly to the drawing, the coil comprises an encasing structure having end caps 1 and 2 and an interposed tube 3 adapted to surround the coil proper. The latter comprises a tube 4 of insulating material upon which is wound the primary winding 5. Upon the latter is wound the secondary winding 6 which, as is clearly shown in Fig. 1, is of shorter length than the primary winding and with the insulating papers thereof forming projecting portions 7 extending beyond the ends of the secondary winding to the ends of the primary winding. The spaces between the projecting portions 7 of the paper may be filled with insulating material in any suitable manner, if desired. Abutting the ends of the primary winding and the paper portions 7 and upon the tube 4 are located insulating washers or discs 8 and 9, and adjacent these washers are located end plates 10 and 11 each composed of a pair of discs of magnetic material, and also being preferably cut radially to provide a radial slot or air gap whereby eddy currents in these discs will be avoided. Adjacent these end plates

are located cup-shaped paper members 12 and 13 with the flanges thereof extending inwardly toward each other for a short distance to cover the ends of the paper portions 7. These members 12 and 13 also have adjacent thereof, metal clip plates 14 and 15 each provided with clip portions 16, 17 and 18 for connection with the terminals of the windings, as will more fully hereinafter appear. Each of the end plates 10 and 11, the members 12 and 13 and the plates 14 and 15 are connected together by rivets 19 and 20, whereby the connected members form unitary members located at the ends of the windings.

On the outside of the secondary winding so as to almost completely surround it, is located a shell 21 of magnetic material, the opposed edges 22 and 23 of which, however, are spaced from each other, as is clearly shown in the lower portion of Fig. 2 of the drawing, the shell being in the form of an open cylinder split along one side thereof. This shell is thus made peripherally discontinuous in order to prevent eddy currents. It will also be observed that this shell is preferably of the same length as the secondary winding, whereby spaces are provided between the ends of the shell 21 and the margins of the end plates 10 and 11, to form air or reluctance gaps and electrical clearances therebetween. Strips of tape 24 and 25 may then be wound about the coil assembly over the ends of the shell 21 and the flanges of the members 12 and 13, so as to maintain the end caps and connected parts in fixed spaced relation with respect to the ends of the shell 21. Strips of tape 26 may also be laid over the opposed edges 22 and 23 and with the ends thereof included beneath the wound strips 24 and 25.

Within the tube 4 are located two groups of magnetic laminations 27 of angle form in cross-section so arranged so as to provide between said groups a fixed passage 28 through which extends a tie bolt 29, the latter being thus centrally located. It will thus be observed that the end plates 10 and 11 being located upon the tube 4 will also be spaced from the core 27 by at least the thickness of the tube 4 so as to form therebetween reluctance gaps. The end caps 1 and 2 are of identical structure and are provided with annular grooves 30 and 31 in which extended the ends of the tubular member 3, suitable packing 32 and 33, such as felt, being provided in said grooves at the ends of the tube 3. The caps 1 and 2 are also centrally recessed to receive the ends of the tube 4 and are provided with projections 34 and 35 extending radially inwardly in said recess and into end slots formed in the ends of the tube 4 whereby rotation of the latter with respect to the caps 1 and 2 is prevented. Within the open ends of the

tube 4 and in abutting relation to the ends of the core laminations 27 are located felt washers 36 and 37 adapted to maintain said laminations from longitudinal movement in said tube.

The caps 1 and 2 are centrally apertured to receive the bolt 29 which is provided at one end with a screw head 38 reposing in a suitable recess formed therefor in the cap 1, and threaded at the other end to receive a nut 39 located in a similar recess in the head 2. The caps 1 and 2 are also eccentrically apertured to receive binding posts bolts 40 and 41 having heads 42 and 43 located in suitable recesses formed on the inner side of the caps, and threaded at the outer ends to receive nuts 44 and 45 also located within suitable recesses formed in the outer portion of the caps 1 and 2. The threaded ends of the bolts 29 and 41 are of sufficient length to receive thereon a pair of grooved porcelain pieces 46 and 47, which when located adjacent each other with the grooves in juxtaposed relation, form a recess for a ballast coil 48. Within apertures, formed in the porcelain members 46 and 47, for receiving the bolts 29 and 41, are contained sleeve members 49 and 50 which are in metallic contact with the threaded portion of said bolts. The ballast coil is connected at its ends to these sleeves whereby current passing therethrough may pass from one bolt to the other. Upon the outer ends of the bolts 29 and 41 are provided nuts 51 and 52 for binding the porcelain pieces 46 and 47 with the cap 2, while the nut 39 and the head 38 of the bolt 29 serve the purpose of binding the caps 1 and 2 against the ends of the tubes 3 and 4, as is readily apparent from the illustration made in Fig. 1 of the drawing. The outer end of the bolt 29 also has a binding nut 53 for the connection of a lead 54 running to the battery 55. The terminals of the primary winding extend through slots 56 formed in the washers 8 and 9, end plates 10 and 11 and members 12 and 13 with the bared portion 57 of such terminals extending into the clip 16 which is compressed about the end of such terminal to permanently hold the same fixed thereto. Short cable pieces 58 and 59 are clamped on the respective plates 14 and 15 by means of clips 18 and have a bared end 60 clamped in clip 17 and the other bared end 61 located in slots suitably provided in the heads 42 and 43 and soldered or otherwise suitably fastened thereto, as is clearly shown in Fig. 3. On the threaded end of the bolt 40 is also provided a binding nut 62 between which and the nut 44 may be secured, the terminal for a lead 63 running to an interrupter 64.

The tube 3 carries a binding post construction 65 comprising a bolt 66, a thumb nut 67, threaded thereon at its outer end,

insulating members 68 and 69, and a head 70 formed upon the inner end of the bolt 66. The head 70 extends within the interior of the tube 3 and has clamped between it and the inner surface of the tube 3 a bow-spring 71 which constantly bears or presses against the outer surface of the magnetic shell 21. One of the terminals 72 of the secondary winding extends over the outer surface of this winding and is connected to a conducting strip 73 folded upon itself and located between the outer surface and the secondary winding and the inner surface of the magnetic shell 21. It will thus be observed that the bow-spring 71 constantly presses against the magnetic shell 21 which in turn presses upon the contact strip 73 so as to provide, at all times, an intimate contact between the strip 73 and the shell 21, as well as between the shell 21 and the spring 71, irrespective of the position to which the tube 3 is adjusted by turning it in the grooves 30 and 31 about the axis of the bolt 29 and the caps 1 and 2. The other end of the secondary circuit has its lead connected to the terminal 57 of the primary winding, as is clearly shown in Fig. 5.

When installing the induction coil in an ignition system, it is often required to locate it in different positions and in different relations to the parts of the system, and it has been found that when the high tension binding post 65 is connected in fixed relation to the coil structure, that it is often very inconvenient to connect the high tension lead 74 running from the coil to the distributor. For the purpose of convenience, the tube 3 has been made angularly adjustable so that it may be located in the position shown in full lines in Fig. 2 of the drawing or in any other position, such as is shown in dotted lines of said figure. During such adjustment, however, the bow-spring 71 will always maintain contact with the magnetic shell 21 so that the electrical connection between the secondary winding and the high tension binding post will not be changed.

By making the core of laminated sheets or strips of angle form, it is possible to so arrange and locate the same within the tube 4, so as to provide a permanently shaped passage between the groups thereof, so that the bolt 29 may be easily introduced lengthwise through the core without in any way disturbing the elements of the core. In order to obtain the proper reluctance in the magnetic circuit of the core, the end plates and the magnetic shell, the end plates are spaced from the core and the shell to provide air gaps of suitable size, so that when the primary circuit is interrupted and the current drops therein, the induction of potential in the secondary circuit will be more effective. This greater effectiveness is ob-

tained by reason of the fact that the reduction of the flux, from a maximum to a value when no current is flowing in the primary circuit, will be greater and more rapid. By use of the air gaps, poles are created on portions of the magnetic material, thus exerting a more rapid demagnetizing effect.

Referring to the diagram shown in Fig. 5, the primary circuit includes the battery 55, lead 54, bolt 29, ballast coil 48, bolt 41, primary winding 5, bolt 40, lead 63, interrupter mechanism 64, grounds 76 and 77, and lead 78 connected to the battery. A condenser 79 is connected across the contacts of the interrupter mechanism 64 as in the usual manner. The secondary circuit includes the connection 57 with the primary winding, the secondary winding 6, terminals 72 and 73, magnetic shell 21, bow-spring 71, high tension post 65, lead 74, distributor 80, spark plugs 81 and ground 82. The operation of the device is believed to be otherwise clear.

Having thus described our invention what we claim is:

1. An induction coil having a core with primary and secondary windings mounted thereon, an encasing structure including a tube and a high tension binding post, a magnetic shell around said windings and electrically connected to the terminal of said secondary winding and said binding post.

2. An induction coil having a core with primary and secondary windings mounted thereon, an encasing structure including a tube and a high tension binding post, a peripherally discontinuous magnetic shell around said windings and electrically connected to the terminal of said secondary winding and said binding post.

3. An induction coil having a core with primary and secondary windings mounted thereon, an encasing structure including an adjustable tube carrying a high tension binding post, a contact member around said windings and electrically connected to the terminal of said secondary winding and said binding post in any adjusted position of said tube and post.

4. An induction coil having a core with primary and secondary windings mounted thereon, an encasing structure including an adjustable tube, a contact member around said windings, a high tension binding post carried by said tube and having a contact spring pressing against said contact member for maintaining the same in intimate contact with the terminal of said secondary winding in an adjusted position of said tube and post.

In testimony whereof we affix our signatures.

VICTOR GREIFF.
LESLIE FORREST CURTIS.