Sept. 6, 1927. 1,641,374

W. A. CHRYST

INDUCTION COIL

Original Filed Dec. 16, 1924

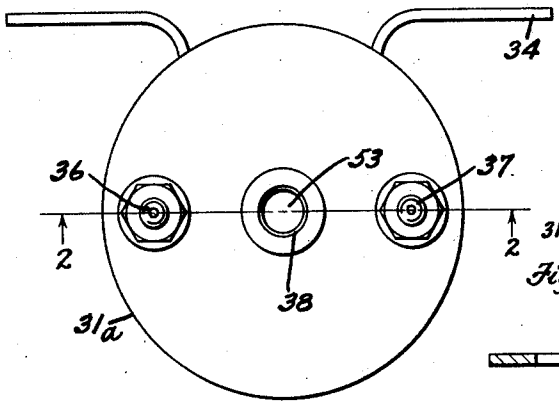



Fig. 1

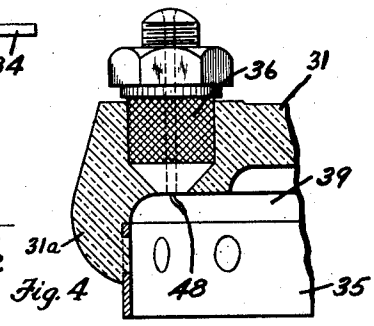



Fig. 4

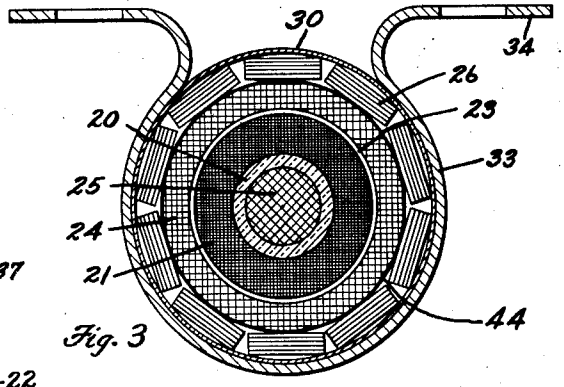



Fig. 3

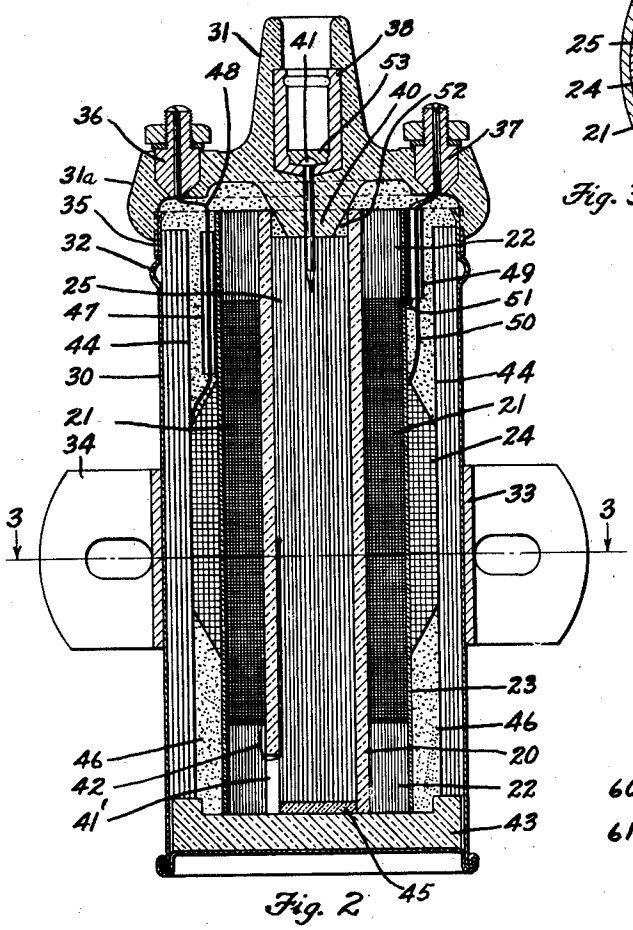



Fig. 2

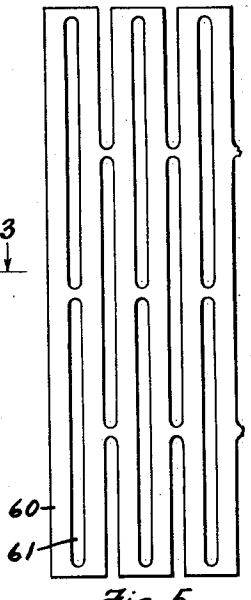



Fig. 5

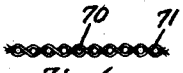



Fig. 6

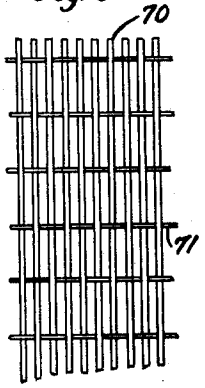



Fig. 7

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# UNITED STATES PATENT OFFICE.

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## INDUCTION COIL.

Application filed December 16, 1924, Serial No. 756,352. Renewed April 11, 1927.

This invention relates to induction coils especially for ignition apparatus on automobiles, and includes among its objects simplification of construction and improved efficiency whereby the cost of manufacture may be materially reduced.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of an ignition coil embodying the present invention.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view on an enlarged scale of a portion of the ignition coil can cover.

Fig. 5 is a fragmentary view of a modified form of material adapted to provide the external magnetic circuit of the coil.

Figs. 6 and 7 are end and plan views respectively of a still further form of material for providing the external magnetic circuit.

Referring to the drawings, upon a non-conducting tube 20 there are wound a plurality of layers of fine wire which provide the secondary winding 21. These layers are insulated from each other by thin strips of non-conducting material such as paper 22. The margins of the paper strips 22 extend beyond the secondary windings 21 as clearly shown in Fig. 2.

Upon a non-conducting tube 23 there are wound a plurality of layers of relatively heavy wire to provide the primary winding 24. As shown in Fig. 2 the primary winding 24 encircles the tube 22 at substantially its middle portion. The over-all length of the primary 24 is considerably shorter than the tube 23, the latter being substantially equal in length to the tube 20.

To provide the internal magnetic circuit of the coil, a predetermined number of iron wires 25 are bundled together preparatory to assembling the coil. The external magnetic circuit as shown in Figs. 2 and 3 consists of a plurality of bundles of flat strips of magnetizable material such as sheet iron. As shown in Fig. 3 each bundle 26 includes five strips of laminæ which preparatory to assembly are baled together with wire, then dipped in non-conducting varnish and baked. The baking operation causes the varnish to harden sufficiently to hold the laminæ together without other fastening means. Then the baling wire is removed from the bundle.

The coil case includes a can 30 and a cover including a body or head 31 of non-conducting material. The can is formed from sheet metal in the usual manner so as to provide a tubular side wall and a flat bottom wall. The side wall is provided with an annular bead 32, and is attached to a molding bracket 33 provided with apertured ears 34. The can cover includes also an annular metallic flange 35 preferably of sheet iron having a number of holes to provide for anchoring the flange 35 to the insulating body 31. The body 31 is formed of molded insulating material, such as bakelite, the flange 35 being set in the mold as an insert and the molding material being tamped in the mold and subjected to heat and pressure in order to give it permanent form and to cause it to be anchored to the flange 35. The body 31 provides a thick flange $31^a$ which surrounds the metal flange 35 and extends over the side of the can 30 a considerable distance to reduce the liability of a short circuit between the can 30 and the terminals carried by the body 31. The body 31 is molded also around two metallic parts 36 and 37 which provide terminals of the primary winding, and also around a tubular sleeve 38 which is located centrally with respect to the flange 35. The body 31 is formed to provide an annular recess 39 which extends within body 31 beyond the edge of the flange 35 as shown in Fig. 4. The recess 39 surrounds the lug 40 which is frustro-conically shaped and is located centrally with respect to the flange 35. The cover body 31 is provided with a central aperture for receiving a nail or metallic peg 41 for a purpose to be described.

The manner of assembling the ignition coil is as follows: The non-conducting tube 20 is slit as indicated at 41′ in Fig. 2 and the inside lead 42 of the secondary 21 is pulled through the opening provided by this slit and is located against the inside wall of the tube 20. The inside core 25 is pushed through the tube 20 in a direction such as to push the terminal 42 further into the tube, the baling wires which temporarily bundled the core wires 25 having first been removed.

A base 43 of non-conducting material such as porcelain is placed in the bottom of the can 30. The primary 24 and its core 23 are placed within a non-conducting tube 44 which is represented in Fig. 2 of the drawings, by two heavy lines through which the lead lines from the numeral 44 extend. The parts 23, 24 and 44 are placed within the can 30 and upon the porcelain base 43. The previously provided bundles 26 of iron strips are placed in the space between the tube 44 and the can 30 as clearly shown in Fig. 3. The parts which have been assembled within the can are raised about one inch from the base of porcelain 43 and a predetermined quantity of filling pitch such as hydrolene in a hot liquid state is poured through the tube 23. Then the primary winding, the paper tubes and the iron strips are forced against the base 43. While the hydrolene is still hot the assembly of central core wires 25, tube 20, secondary 21 and a non-conducting button or disc 45 is moved through the tube 23 until the assembly rests upon the base 43. This operation causes the hydrolene to fill the space between the base 43 and the primary winding 24 as indicated by numeral 46.

An insulating tube 47 is placed around the primary lead 48, and an insulating tube 49 is placed around the primary lead 50 and the outside secondary lead 51. The predetermined quantity of hot hydrolene or other suitable filling compound is poured into the recess 52 provided within the tube 20 and adjacent one end of the bundle of wires 25 and into the annular recess between the tube 44 and the tube 23. The quantity of hydrolene should be slightly greater than that required to fill the can. The lead wire 48 is threaded through the aperture in the terminal 36 and the lead wires 50 and 51 are threaded through the aperture in the terminal 37. While the hydrolene at the top of the can is still semi-fluid, the can cover is placed upon the can and telescopically engaged therewith so that the lower edge of the flange 35 will engage the bead 32. The lug 40 of the cover body 31 will extend into the recess 52 and will force the hydrolene in this recess out into the space provided by the cover body 31 above the upper edge of the can 30. The lead wires are soldered to their respective terminals 36 and 37. A nail 41 is driven through the previously prepared orifice through the center of the cover body 31 until the head of the nail engages the metallic sleeve 38 and the point thereof projects to a substantial distance within the bundle of wires 25. A metallic button 53 is pressed into the sleeve 38 to make a good electrical connection between the sleeve and the nail. The flange 35 is soldered to the can 30 in the head 32.

Instead of using bundles of strips of sheet iron 26 the external magnetic circuit may be provided by rolling into a tube a strip of sheet material 60 which is provided with staggered slots 61, the function of the slots being to reduce eddy current losses. Figs. 6 and 7 show a still further form of material which may be used to provide the external magnetic circuit. This material is formed by interweaving relatively large wires 70 which extend cross-wise of the strip, with relatively fine wires 71 which extend lengthwise. The length of this material is wound up to form a tube which is placed between the can 30 and the paper tube 44. The wires 70 are larger than the wires 71 and are placed much closer together than the wires 71. Obviously the wires 70 carry the flux of the magnetic circuit while the wires 71 serve to space the wires 70 in order to reduce eddy current losses and provide a wire fabric which is sufficiently flexible to be formed into a cylinder.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An induction coil comprising, in combination, windings and a tubular metallic case surrounding the windings, terminals for the windings, and a cover for the case comprising a body of molded insulating material supporting the terminals and providing a flange extending substantially beyond the sides of the case to reduce liability of short circuit, and a metal ring surrounded by said flange and telescopically engaging the case, the metal ring being permanently anchored to the insulating material.

2. An induction coil comprising, in combination, windings surrounding a central non-conducting tube, a can-like case surrounding the windings, a central core within the tube and terminating short of the end of the tube adjacent the open end of the case so as to provide a recess at this end of the tube, and a cover for the case having an annular flange telescopically engaging the case and having a centrally disposed lug adapted to be received by the recess and to engage the end of the non-conducting tube whereby to center the windings and core with respect to the case and to prevent movement of the windings relative to the case.

3. An induction coil comprising, in combination, a can-like case, windings within the case and surrounding an insulating tube, a central magnetizable core within the tube and electrically connected with an end of one of the windings and terminating short

of the end of the insulating tube at the open end of the case to provide a recess, and a quantity of filling compound for filling the voids within the case and the recess, a cover for the case including a lug adapted to be received by the recess and having a recess surrounding the lug for receiving the filling compound forced from the recess by the entry of the lug into the recess when the cover is assembled upon the case.

4. An induction coil comprising in combination, windings included in a tube of non-conducting material; a metal tube surrounding said non-conducting tube so as to provide a space between said tubes; a base of insulating material for the metal tube and upon which the non-conducting tube rests; a plurality of bundles of magnetic metal laminæ in spaced relation in the space between the said tubes, one end of each bundle resting on the base and the other ends of said bundles terminating adjacent the end of the metal tube, each of said bundles being coated with an insulating varnish to hold the laminæ of each bundle together; and a filling compound in the space between the two tubes to hold the bundles in spaced relation.

5. An induction coil comprising in combination, a core; windings about the core; non-conducting material about said windings; a plurality of bundles of magnetic metal laminæ substantially the length of the core, arranged about said windings; and a container surrounding the said bundles.

6. An induction coil comprising, in combination, windings; a plurality of bundles of magnetic metal laminæ arranged about said windings; a casing about said bundles; a cover at each end of the casing; and a filling compound in the casing to hold the bundles in spaced relation.

7. An induction coil comprising in combination, a core; windings about said core; a plurality of bundles of magnetic metal laminæ substantially the length of the core and arranged longitudinally thereof about the windings; a container surrounding the bundles; a cover at each end of the casing; and a filling compound in the casing to hold the bundles in spaced relation.

8. An induction coil comprising in combination, windings surrounding a tube; a case surrounding the windings; and a cover of insulating material for said case, having a central portion telescopically engaging the tube, and a metallic flange anchored to the cover which is adapted telescopically to engage the case to secure the cover to said case.

9. An induction coil comprising in combination, windings surrounding a tube; a case surrounding said windings; a cover for said case comprising a body of molded insulating material having a metallic flange anchored thereto said flange being adapted telescopically to engage the case for securing the cover thereto; and a central extending portion on the cover adapted telescopically to engage the tube.

10. An induction coil comprising in combination, a tube surrounded by windings; a case surrounding the windings; a base, forming a cover for one end of said case; a core within the tube, electrically connected to one of the windings; a cover of insulating material for the case, having a flange telescopically engaging the case and also being provided with a centrally extending portion telescopically engaging the tube; a cable receiving socket member formed on the cover coaxial with the centrally extending portion; a metallic conducting sleeve in said socket member; and means, engaging said sleeve and extending through the centrally extending portion, for electrically connecting the core and sleeve.

11. An induction coil comprising in combination, a tube; windings about said tube; a core in said tube, a case surrounding the windings; a cover of insulating material for said case; a lug, coaxial with the case, extending from the one side of the cover and telescopically engaging the tube; a cable receiving socket member extending from the other side of the cover, and coaxial with the lug; a conductor in the socket member; and means passing through the lug for electrically connecting said conductor and one of the windings.

In testimony whereof I hereto affix my signature.

WILLIAM A. CHRYST.