Nov. 7, 1939. H. L. HARTZELL ET AL 2,178,687

IGNITION COIL

Filed May 31, 1938

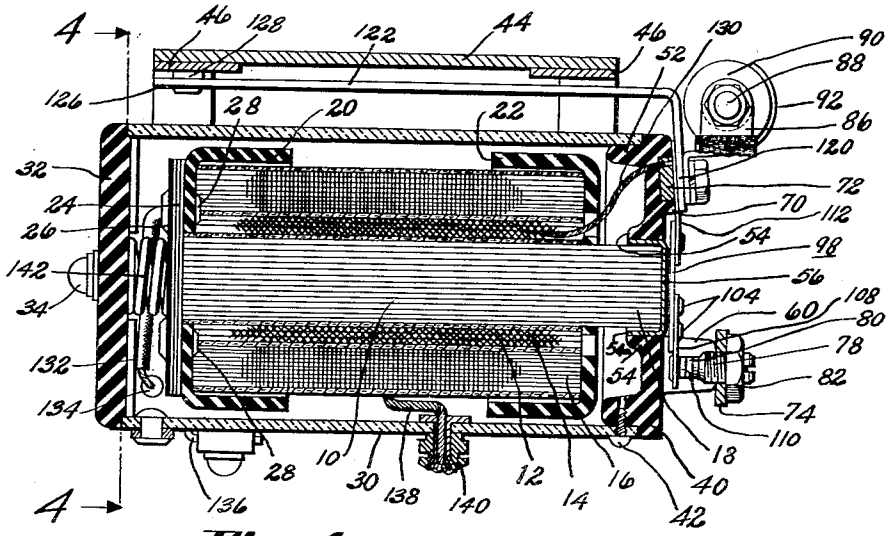


Fig. 1

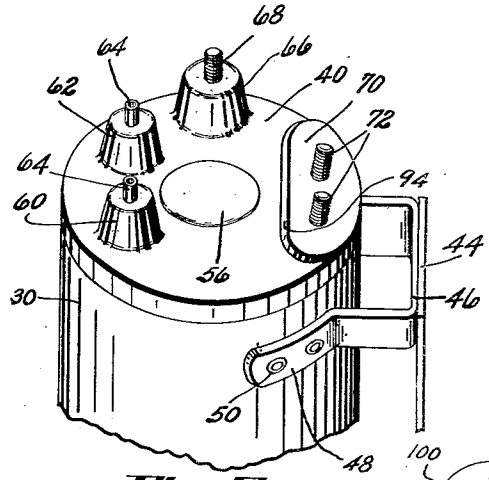


Fig. 2

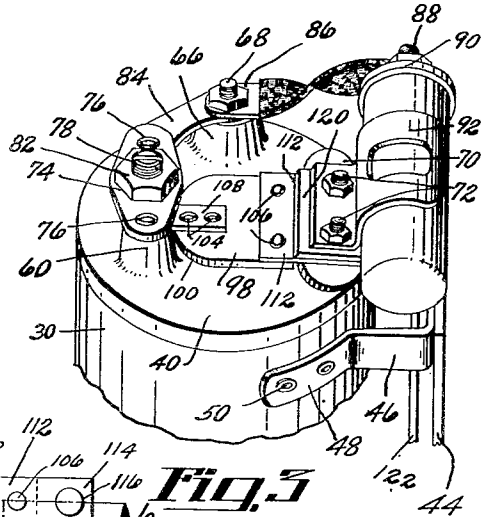


Fig. 3

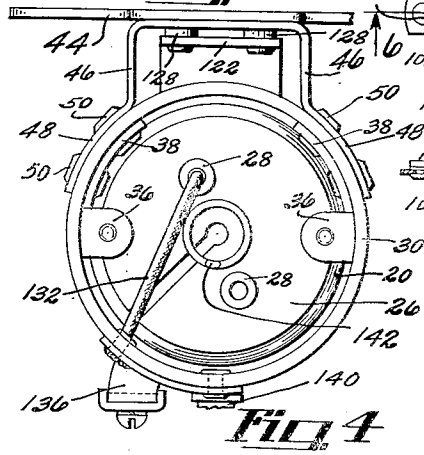


Fig. 4

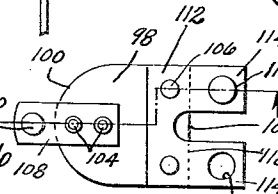


Fig. 5



Fig. 6

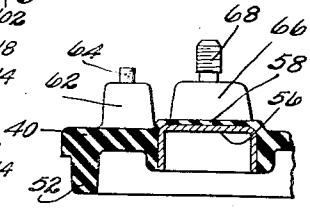


Fig. 7

INVENTOR
HERMAN L. HARTZELL
DALPHIN L. HITTLE
BY Pearson, Hardman & Fish
ATTORNEY

Patented Nov. 7, 1939 2,178,687

UNITED STATES PATENT OFFICE

2,178,687

IGNITION COIL

Herman L. Hartzell and Dalphin L. Hittle, Anderson, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application May 31, 1938, Serial No. 210,928

7 Claims. (Cl. 175—357)

This invention relates to ignition coils of the vibratory type and has among its objects to improve the sensitivity and performance of the unit.

A further object is to improve the magnetic path through the armature assembly.

A further object of the invention is to provide a low reluctance magnetic path through the interrupter mechanism.

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

In the drawing:

Fig. 1 is a longitudinal sectional view through the improved ignition coil, the interrupter mechanism being shown in elevation.

Fig. 2 is a perspective view of the ignition coil, the interrupter mechanism having been removed.

Fig. 3 is a perspective view of the improved ignition coil with the interrupter mechanism in place.

Fig. 4 is an end view of the ignition coil with the base member removed.

Fig. 5 is a plan view of the armature and contact assembly.

Fig. 6 is a longitudinal sectional view through the armature assembly substantially as indicated by the line and arrows 6—6 of Fig. 5.

Fig. 7 is a fragmentary view illustrating in section details of construction.

With particular reference to the drawing, 10 indicates a core that comprises a bundle of wires, that support a primary winding 12 in inductive relation with a secondary winding 14, both windings comprising successive layers of wire separated by layers of paper or insulators 16, that extend on both sides of the windings, all as is the usual practice and well known to those experienced in the art. The core 10 is sufficiently long to extend out of each end of the coil body thus formed, one end of which is indicated at 18. A pair of end bells 20 and 22, comprising shallow cups of insulating material, are inverted over each end of the coil assembly substantially as shown, each of the cups 20 and 22 having centrally disposed apertures in their bottom walls permitting the passage of the core 10. To the bottom wall of the end bell 20, a plurality of end irons 24 and an insulator 26 are secured by tubular rivets 28, such that the end irons 24 substantially overlie the central aperture of the end bell 20 and engage one end of the core 10.

A casing of dielectric material is provided for the coil body, and may comprise a tube 30, one end of which is closed by a base 32, secured by screws 34, threaded into offset ears 36 of clips 38. The other end of the case is closed by a head member 40 that is secured in place by drive screws 42. A bracket member 44 is provided with yokes 46 at each end thereof, each of whose leg ends 48 conform to the surface contour of the tube 30 and are secured thereto by rivets or similar devices 50, there being a yoke at each end of the plate 44, the legs of which are in turn secured at opposite ends of the tube 30. In securing the yoke 46 to the base end of the coil, the rivets 50 on the inside of the tube 30 also pass through the clips 38, and operate to secure them in place for reception and retention of the base member 32.

With particular reference to the head member 40, provision is made for lowering the reluctance of the magnetic path through the vibrating assembly, which allows for greater spring pressure on the contact points, and permits of higher frequency operation. Making for this end, the head member 40, aside from having a circumferential skirt 52 telescopically receivable within the end of the tube 30 for receiving the drive screws 42, has an inwardly extending central boss 54 of recessed construction, that is cast or molded about the side wall 54*a* of a non-magnetic cup member, whose bottom wall 56 is substantially flush with the outside surface or plane of the head member 40. Fig. 7 illustrates the relation of the parts as the head member with its cast insert comes from the press. As respects the insert, it is found convenient to form the molding or cast with a thin sheet of non-conducting material 58 overlying the outside surface of the cup-wall 56, and subsequently remove by disc grinding, or otherwise, to leave the non-magnetic wall 56 exposed on the outer surface of the head member 40, substantially as illustrated in Fig. 1.

The head member 40 is further fashioned to provide a pair of contact supporting bosses 60 and 62 each of which carries an insert 64, and a terminal boss 66 carrying a threaded insert 68, as well as an elongated boss 70 provided with a pair of studs 72, as inserts therein. The bosses 60 and 62 constitute a pair and are located on the opposite side of the end wall 56 from the elongated boss 70, such that the inserts 64 are contained in a line substantially parallel with a line through the inserts 72. Disposed over the inserts 64 there is a fixed contact supporting plate 74 that is firmly secured to the bosses by peening over or riveting down the inserts 64, as indicated at 76. A screw 78 supports a fixed contact 80, and is

threaded through the contact support 74 where it is held in adjusted position by a lock nut 82. A conductor strap or link 84, inserted beneath one end of the contact support 74, makes circuit connection with the threaded stud 68, upon which is also carried a conductor, strap or lead 86 having appropriate connection with an insulated terminal 88 of a condenser 90, the condenser having a mounting bracket 92 constituting a second terminal and supporting the condenser, as will later be explained.

The elongated boss 70 is designed for mounting one end of an interrupter assembly, by reason of which the boss includes a sharply rising straight wall 94 adjacent the end wall 56, the upper face of the boss 70 being at a slight incline to the plane of the head 40, substantially as indicated in Fig. 1, an inclination of 5° being found to be satisfactory. The inclined face of the boss 70 provides for mounting the armature assembly, and serves to introduce a definite bias of the assembly toward the contact closed position.

Figs. 5 and 6, in addition to Figs. 1 and 3, illustrate the interrupter mechanism or armature assembly, that includes an armature plate 98 of magnetic material, having a rounded end 100 opposite a square end 102. At each end of the plate 98 there is provided a pair of squirts or extrusions 104, 106, the extrusions 104 fitting within apertures of a leaf spring 108, after which they are peened over or riveted to hold the parts in assembly, thus rigidly supporting a movable contact 110 at the end of the leaf spring 108 adapted to cooperate with the fixed contact 80. Upon the squirts 106, there is secured a hinge plate 112, which is secured thereto in a similar manner by turning over the ends of the squirts 106 as shown. The hinge plate 112 is of bifurcated or U-formation, wherein the two extensions or legs 114 on either side of a slit 115 are provided with apertures 116 adapted to pass over the inserts 72 of the boss 40, and each leg of the spring is creased transversely as 118 substantially coincident with the square end 102 of the armature plate, which creasing inclines each leg 114 to the general plane of the plate 98. An inclination of 10° is found to be satisfactory. With the parts so constituted, it will be noted that when the armature is adjusted in place and the legs 114 clamped against the face of the boss 70, the normal inclination of the plate 98 with respect to the plane of the head member 40, if it were unrestrained by the contact mechanism, would be something like 15°, or the equivalent of the inclination of both the boss face and the hinge extension. When so clamped in place, with the movable contact 110, disposed beneath the fixed contact 80, a spring potential is stored up in the hinge member 112 that continually urges the contacts into engaging relation with considerable force, and makes provision for juxtaposing the armature plate 98 in extremely close relation with the end wall 56 of the non-magnetic cup. It should be noted, that when the armature assembly is installed, the hinge plate is flexed backward along the crease 118, through an angle of inclination reverse to that of the initial forming of the hinge plate.

Clamping and retention of the armature assembly in the desired relation is effected by means of an end portion 120 of a return flux pole 122, that is disposed over the insert 72 against the legs 114 of the hinge plate, which end portion 120 extends substantially to the creasing line 118 of the hinge plate, but on the side of the hinge plate opposite to the armature plate 98, which brings the end of the clamp portion 120, the crease line 118, and the end 102 of the armature in substantial transverse alignment. That relation of the parts tends to limit the flexing portion of the hinge plate to that line of coincidence of the several parts or to that zone adjacent to the creasing 118. Next comes the bracket 92 of the condenser that is also disposed over the inserts 72 and retained in place by nuts 124.

The end portion 120, or rather the flux pole 122 provides an additional function to that of clamping the end of the hinge plate and limiting the flexure of the hinge, in that its main portion 122 provides a magnetic flux pole disposed within the magnetic circuit of the coil, since the pole 122 extends along the outside of the coil casing and within the enclosure of the bracket portion to end near the bottom end of the coil assembly at 126 substantially opposite the edge of the end irons 24. In order to insure its insulation as respects the supporting bracket, the end 126 supports a pair of non-conducting bumpers 128, that, under the influence of the spring pressure of the pole 122, are urged against the yoke member 46 to prevent rattling and to maintain the air gap between the end 126 of the pole and the end iron 24 substantially constant.

With the parts so fabricated, the coil body is inserted within the casing, where the inside lead 130 of the primary winding is threaded through one of the inserts 72 with the outside of the primary winding and the inside of the secondary winding joined to a common lead 132 that is brought into electrical contact with a rivet 134, operating to secure a terminal bracket 136 to the tube 30. The outside secondary lead 138 is threaded through a terminal member 140 also carried by the casing 30, the leads thence being bonded to the respective terminals to effect good electrical connections. The coil body being thus disposed within the casing, and having its leads connected with respective terminal members, it is adjusted such that the end 18 of the core 10 is contained within the end cup and resting against the end wall 56 thereof, whereupon a relatively stiff spring 142 is placed against the insulator 26 of the end bell 20, and against which spring is in turn placed the coil base 32 that is thence pressed into place within the end of the tube 30 where it is secured by the holding screws 34. This operates to press the core 10 continually against the end wall 56, and diminish the air gap between the core end 18 and the armature 98, while the flux pole 122 ending at 126 near the edge of the pack of end irons 24 substantially completes a metallic path for the magnetic flux, thus permitting greater initial spring pressure on the contacts which coupled with the close relation of the armature 98 and core 10, make for higher frequency of interrupter operations.

While the 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. In an ignition apparatus, the combination, with an electromagnetic core, a non-conducting casing comprising a base and a head, means including a centrally disposed socket of the head for supporting one end of said core, magnetic laminae engaging the opposite end of the core, and spring means disposed between the base and the laminae for pushing the core into the recess of the head member.

2. In an ignition apparatus, the combination, with an electromagnetic core, a casing of dielectric material surrounding the core and providing an end member for locating one end of said core, said end member providing a non-magnetic cup telescopically receiving the end of said core, means yieldably forcing the end of the core into said cup, an interrupter mechanism including an armature secured to said head member, said armature being disposed over the outside of the cup in close proximity to the end of the core, and a flux pole engaging the armature support and extending along the outside of the casing to end in proximity to the opposite end of the core.

3. In an ignition coil, the combination, with a core having windings thereon, of an end bell comprising an apertured shallow cup and end irons secured thereover, said end bell adapted to telescopically engage the core and windings, a dielectric casing surrounding the core and bell, yieldable means disposed between the end bell and a part of the casing for maintaining the core of the coil against an opposite wall of the casing, an interrupter support carried by said opposite wall, and a flux pole extending from the interrupter support along the outside of the casing to a point opposite the end iron.

4. In an induction coil for internal combustion engine ignition, the combination, with an iron core, of an end support recessed to receive one end of the core, said end support incorporating a non-magnetic cup inverted over the end of the core, and an interrupter mechanism having an armature disposed in close proximity to the bottom of said cup, said interrupter mechanism comprising a resiliently mounted contact and a U-shaped spring hinge, and means for mounting the legs of said spring hinge in a plane at an angle to the plane of said cup.

5. In an induction coil for internal combustion engine ignition, the combination, with an iron core, of an end support recessed to receive one end of the core, said end support incorporating a non-magnetic cup inverted over the end of the core, and an interrupter mechanism having an armature disposed in close proximity to the bottom of said cup, said armature plate having a pair of upstanding squirts at each end thereof, a contact supporting spring secured to the armature by one pair of said squirts and a hinge plate secured to the other pair of said squirts, and means for securing the hinge plate to the end support whereby the armature plate will be closely adjacent the cup but biased away from the same.

6. In an ignition coil of the vibratory type, the combination comprising, a non-conducting head member providing a plurality of upstanding bosses, one of said bosses comprising an elongated elevated plane along one side of the head member and inclined at an angle to the plane of the head member, a pair of inserts carried by said elongated boss, an armature plate having a bifurcated hinge member secured thereto, said hinge member having its legs normally inclined from the plane of said plate and apertured to engage the inserts of said elongated boss, said armature when mounted on the head member and unflexed having an inclination to the plane of the head member equivalent to the combined inclination of the face of the boss and the legs of the hinge member, and means for flexing the armature hinge so that the armature will lie in a position substantially parallel to the plane of the head member.

7. The combination set forth in claim 6, wherein a clamping member is carried by the bosses of the insert and extends over the legs of the hinge member to a point approximately coincident with the end of the armature but on the opposite side of the hinge member therefrom, whereby flexing of the hinge plate is localized along a line substantially coincident with the end of the hinge plate.

DALPHIN L. HITTLE.
HERMAN L. HARTZELL.