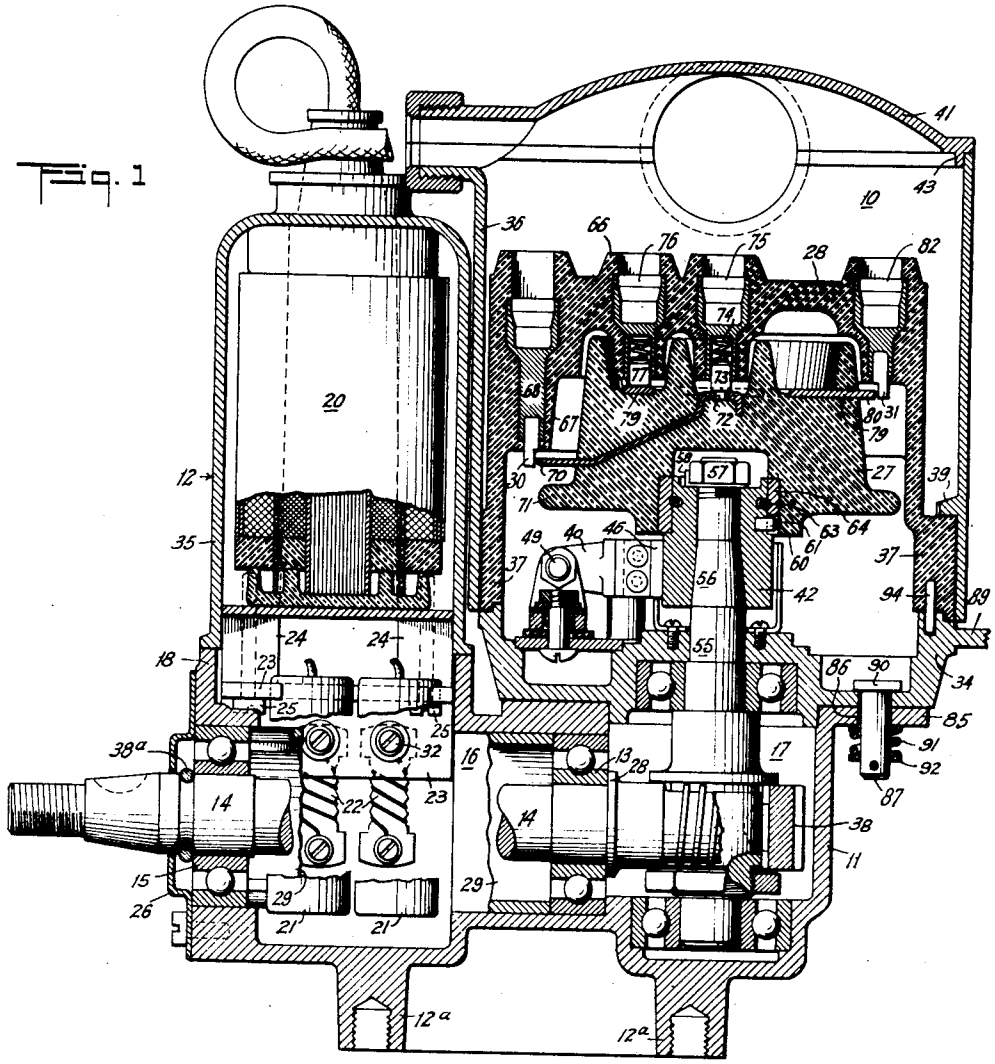
June 27, 1939. R. P. LANSING ET AL 2,163,843

IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 25, 1932 2 Sheets-Sheet 1

Fig. 1



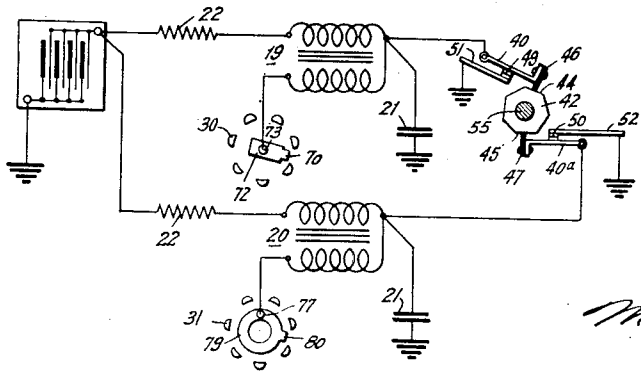


Fig. 2

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Filed Jan. 25, 1932 2 Sheets-Sheet 2

Fig. 3

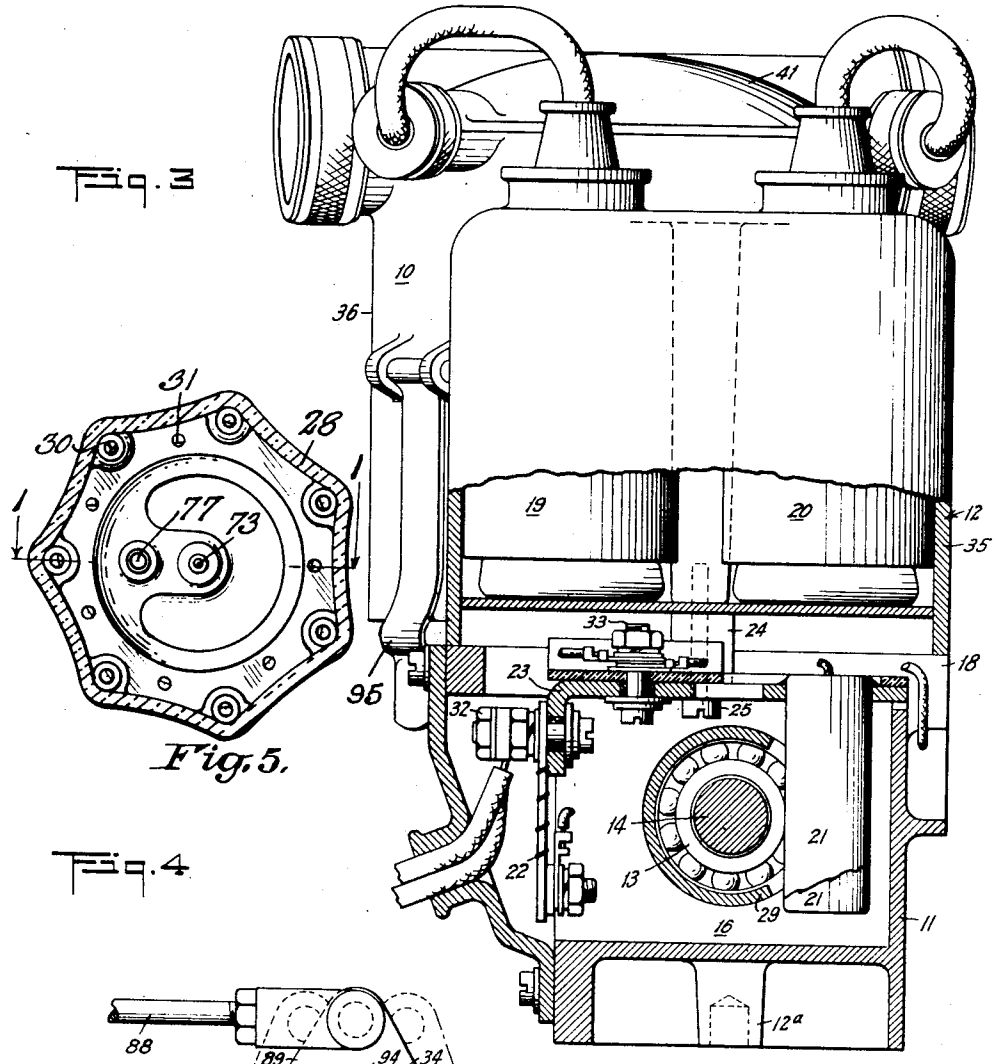


Fig. 5.

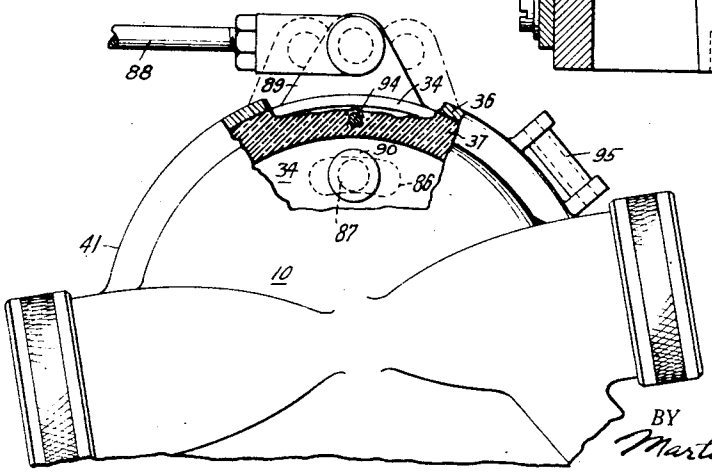


Fig. 4

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UNITED STATES PATENT OFFICE

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IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES

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Application January 25, 1932, Serial No. 588,754

10 Claims. (Cl. 123—148)

This invention relates to ignition devices for internal combustion engines and particularly to those of the type especially adapted for use on aviation engines. In many respects, however, the invention is applicable to internal combustion engines of all classes and designs, as will be obvious.

An object of the invention is to provide a novel and efficient ignition device of the type in which a relatively low tension ignition current is brought from an outside source and transformed into a high tension current by induction.

Another object of the invention is to provide a device of great advantage for the purpose intended by reason of its concentration in a unitary and novel structure of a number of parts which, in former ignition systems, were separately housed.

A further object is to provide in an ignition system of the induction coil type, novel means for mounting the timer, distributor, drive shaft, condensers, resistor elements and induction coils so as to form a unitary structure, the base of which supports all of said elements.

Another object is to provide a compact, efficient, and easily adjustable device of the character indicated which not only involves novelty in the assembled organization, but has certain of its parts constructed along novel lines possessing inherent advantages in themselves as well as in their mutual relationship.

Another object is to provide novel shielding means for an ignition device of the foregoing character.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawings, wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a sectional view of a device embodying the invention;

Fig. 2 is a schematic illustration of the electrical phases of the invention;

Fig. 3 is a view in elevation, with parts broken away and in section, of the device shown in Fig. 1;

Fig. 4 is a plan view, with parts broken away and in section, of a portion of the device shown in Figs. 1 and 2; and

Fig. 5 is a cross-section of the distributor head showing the contact arrangement.

Referring to the drawings, the invention is shown embodied in three interlocking sections 10, 11 and 12, the unit 10 being in the shape of an irregular cylinder or bowl supported by the lower section 11 on which are formed bosses 12a centrally bored and threaded to receive attaching pins or screws by which the unit may be supported on the frame of the associated engine. As shown, the interior section 11 is divided by a bearing 13 and shaft 14 into two main chambers 16 and 17, the chamber 16 having an upwardly extending portion 18 supporting the section 12 which houses the induction coils 19 and 20, while the chamber 17 houses the mechanical driving connections for rotating the interrupter and distributor. The condenser unit 21 and resistors 22 are preferably contained in chamber 16 where they are supported on a bracket 23 suspended from bosses 24 on the coil casing by suitable fastening means 25. This bracket 23 also serves as a mounting plate for terminals 32 and 33, the latter being coil terminals. This novel construction has the advantage of permitting removal of the coils, terminal plate, resistors and condensers as an assembled unit, such unit being removable through the opening in the extension 18 without in any way disturbing the remainder of the mechanism. The bearing 13 is held against shoulder 28 by the provision of a spacer sleeve 29, a second bearing 15, and a retainer cap 26; and the shaft 14 is held properly meshed with gear 38 on the interrupter shaft by the combined action of a shoulder 28 and ring 38a.

From the foregoing it is apparent that the lower section 11 of the unitary structure constitutes not only the housing for the driving connections, resistors and condenser units, but also the supporting means for the coils 19 and 20, the interrupter mechanism, and the distributor rotor 27, as well as the distributor head 28. The latter, which is shown as carrying a plurality of distributor terminals 30 and 31 arranged in staggered relation in two concentric circular paths with the same number of contacts in each path, is constructed of suitable insulating material such as the usual phenolic condensation product, and is removably secured to the base 34 of the unit 10 with the aid of the novel means now to be described.

As is well known to those conversant with the art, the high tension alternating currents in an ignition system for internal combustion engines have an interfering inductive effect on the electrical circuits of adjacent electrical apparatus, which effect is particularly objectionable in the

case of radio receiving or transmitting sets in aeroplanes. In order to eliminate this inductive interference by "shielding" the ignition system, that is, by completely enclosing all parts, including the leads, within an electrically continuous metallic covering, grounded on the engine, and thus "capture" the inductive effects and prevent their affecting adjacent electrical circuits, the present invention includes the provision of a two-part casing which, in conjunction with the casing 35 surrounding the induction coils and the continuous metallic casing of the section 11, completes the enclosure of all parts of the mechanism.

As shown, such two-part casing comprises a cylindrical member 36 of the proper diameter to fit snugly about the lower portion 37 of the distributor cap, this cylinder member having formed on its inner periphery a plurality of ears 39 adapted to rest on an externally formed ledge on the distributor cap. At its upper edge the cylindrical shield turns outwardly at four points (two of which are indicated in Fig. 1 and all of which are indicated in Fig. 3) to form, with the capped portion 41 of the shield, points for entrance of the conductor carrying cables of the system, two of such cables being indicated in Fig. 3. The cap 41 is also provided with a downwardly extending rim 43 adapted to fit snugly around the upper edge of the cylindrical portion 36 and thus provide a completely shielded unit.

As above suggested by the description of the two concentric series of distributor terminals 30 and 31, the embodiment of the invention herein illustrated is of the "dual ignition" type, wherein each cylinder of the engine is supplied with a pair of spark plugs adapted to receive a high tension current simultaneously, one of such currents being induced in the secondary winding of the coil 19 and the other in the secondary winding of the coil 20.

In order to produce this simultaneous generation of two distinct high tension currents, the invention provides an interrupter mechanism of novel construction in which a single rotating cam having the same number of actuating cam edges as there are cylinders in the associated engine, is adapted to produce double that number of breaks in the primary circuits during each revolution thereof, one half the number of breaks being effected in the primary winding of the coil 19 and the other half in the primary winding of the coil 20. As shown, this result is obtained by the provision of two separate but preferably identical circuit breaker assemblies as shown schematically in Fig. 2. In Fig. 1, only one of these assemblies is shown; but it will be understood that the associated assembly is of like construction and is disposed almost diametrically opposite the assembly shown, and functions therewith to break the primary circuit of one of the induction units simultaneously with the breaking of the primary circuit of the other induction unit.

Since in the embodiment shown there are assumed to be seven cylinders in the associated engine, the interrupter cam 42 is shown as having the form of a regular heptagonal prism, with its seven faces constituting "dwells"; but it will be obvious that the shape of the cam will be varied to correspond to the number of cylinders in any desired installation, and that the two breaker assemblies will be disposed relatively to each other in such a manner as to be in contact simultaneously with those surfaces of the cam mechanism which are closest to diametric opposition, as for example, the surfaces 44 and 45 as indicated in Fig. 2. The contacting portions or followers of each breaker assembly are constructed of suitable insulating material, as indicated at 46 and 47 in Figs. 1 and 2, said follower portions being suitably secured to the respective breaker arms 40 and 40a, the latter being pivotally supported on pins and carrying intermediate their ends contact points 49 and 50 adapted to be normally held in engagement with the associated contact arms 51 and 52 by the provision of suitable spring clips of the usual construction (not shown), the said springs being adapted to quickly return the contacts to the closed position following each separation thereof, by the passage of one pair of approximately opposite cam corners out of contact with the associated followers 46 and 47.

In place of the usual fixed connection which has been used heretofore to hold the distributor in predetermined angular relationship to the engine driven operating shaft, the present invention provides means permitting angular variation of the position of the distributor with respect to such shaft, thereby making it possible to set up the distributor mechanism in proper relation to the valve and piston movements of the engine without the necessity of moving or changing the relative position of any of the engine driven shafts or gears through which the distributor receives its motion. Heretofore the method employed has been to key or otherwise rigidly secure the distributor rotor against any angular movement with respect to the distributor shaft, and then correct any improper alignment by changing the setting of the cam shaft of the engine or other shafts or gearing controlling the relative angular position of the distributor and engine crankshaft.

In the present invention, the necessity of such adjustments of the other parts of the engine is eliminated by the provision of a construction which permits the person setting up the distributor mechanism to turn the cam 42 freely with respect to the operating shaft 55 and thus set the cam in proper relation to the followers 46 and 47 as the associated piston reaches the firing point of the stroke. The cam 42 is then held firmly wedged in position on the tapered portion 56 of the operating shaft 55 by tightening the nut 57 and lock washer 58 on the threaded end of said shaft. It is not until this operation is completed that the distributor rotor 27 is inserted in place, its angular relationship to the cam 42 being determined by the registry of pin 60 with the vertical slot 61 of the distributor. In addition to the pin 60, an expanding ring 63, engaging cooperating peripheral grooves in the cam 42, and the collar 64 imbedded in member 27, is provided to insure a detachable axial association of the distributor and cam as a unit.

In addition to the above described novel feature associated with the distributor rotor 27, it remains to be pointed out that the means for simultaneously distributing separate high tension currents to the separate sets of cylinder spark plugs involves further novelty in the manner of conducting these currents through the distributor and properly insulating them from each other. As shown, this is accomplished by providing the upper wall 66 of the distributor cap 28 with a downwardly extending rim 67 of sufficient thickness to receive at regularly spaced intervals the connector sockets 68 which receive the conductors leading to one set of spark plugs

and at their opposite ends serve to retain the terminals 30 above referred to, the said terminals being adapted to successively coact with the rotating current conducting finger 70 extending from the surface of the rotor 27 at a point near the lower flange 71 thereof, the body of the finger being moulded in the rotor and emerging at the central point of the upper surface thereof as indicated at 72, where it is in constant engagement with a spring pressed contact pin 73 held in the lower recess 74 of the central socket 75, which receives the high tension lead from one of the induction units, the corresponding lead from the other induction unit being received in the associated socket 76. The latter is likewise provided with a spring-pressed contact pin 77 held in constant engagement with an annular current conducting ring 79 which, like finger 72, is moulded in the rotor 27. From this ring 79 extends a finger 80, integral therewith and adapted to successively coact with the terminals 31, which, as indicated, are arranged in a circular path concentric with the path of the terminals 30, but of smaller radius, the said pins 31 being received in the socket members 82 from which emerge the conductors connecting with the second set of spark plugs. This arrangement of the distributor terminals is not claimed per se, in this application, as it constitutes the sole invention of Raymond P. Lansing and is claimed in his co-pending application, Serial No. 2,106 filed January 16, 1935.

Another novel feature of the invention resides in the method and means for producing a limited advance or retardation of the time of ignition in the successive cylinders in relation to the position of the pistons therein. For this purpose, there is provided in the flanged portion 85 of the supporting casing 11, one or more arcuate slots 86 of suitable length (Fig. 4) in which slot a pin 87 is movable by manipulation of a link 88 pivotally secured to an ear 89 formed upon the distributor base 34, the said base being provided with an opening of just sufficient size to receive the pin 87, and the latter being normally held with its head 90 in firm engagement with said base by provision of a compression spring 91 engaging a collar 92 on the said pin. Since the base 34 is detachably doweled to the distributor cap 28, as indicated at 94, in Figs. 1 and 4, it is evident that on actuation of the link 88, the angular position of the distributor cap, and hence the relation of the terminals 30 and 31 to the fingers 70 and 80, respectively, will be varied (within the limits of the slots 86) to advance or retard the spark. The usual latching members, one of which is indicated at 95 in Fig. 3, are preferably provided for readily removable attachment of the distributor to the base 34.

There is thus provided an ignition device involving novelty in the manner of combining and supporting a number of units of an ignition system in a single compact structure possessing advantages in the simplicity thereof, in the readiness with which the device can be set up and timed with the engine to which it is to be applied, in the ease with which the component parts may be removed, inspected and replaced, and in the simplicity of the means for advancing and retarding the spark.

While it is evident that the embodiment herein disclosed possesses considerable practical merit, it is of course understood that changes may be made in the shape, construction, and relative positioning of the parts, and in the use of certain of the novel features without necessarily using the others. Reference is accordingly to be had to the appended claims for a definition of the limits of the subject matter claimed.

What is claimed is:

1. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, and means supported by said head for shielding all of said parts against inductive radiation, said shielding means comprising a casing having a cap portion and a sleeve portion each provided with registering surfaces and each being apertured at registering points to receive the cables by which ignition current is conducted to and from the distributor.

2. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, said head having a downwardly extending wall surrounding said rotatable portion, and means supported by said wall for shielding all of said parts against inductive radiation, said shielding means comprising a cap and body portions having registering openings adapted to receive the cables leading to and from said distributor.

3. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, means supported by said head for shielding all of said parts against inductive radiation, said shielding means comprising cap and body portions having registering openings adapted to receive the cables leading to and from said distributor, and means for joining said cap and body portions along a plane passing through the centers of each of said openings.

4. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, and means supported by said head for shielding all of said parts against inductive radiation, said shielding means comprising cap and body portions having registering openings adapted to receive the cables leading to and from said distributor and being further provided with registering surfaces disposed in a plane passing through the centers of said openings.

5. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, closure means for said distributor parts including cap and body portions having registering openings adapted to receive the cables leading to and from said distributor, means for joining said cap and body portions along a plane passing through the centers of each of said openings, an induction coil electrically connected with said distributor parts, and a casing enclosing said induction coil, said casing having one end thereof disposed substantially in said plane and the other end adjacent the lower end of said body portion.

6. In a device of the class described, in combination, a drive shaft, an ignition distributor rotatable with said shaft, a relatively stationary distributor head, closure means for said distributor parts including cap and body portions having registering openings adapted to receive the cables leading to and from said distributor, means for joining said cap and body portions along a

plane passing through the centers of each of said openings, an induction coil disposed with its axis parallel to the axis of rotation of said distributor, a housing enclosing and supporting said drive shaft, said housing having upper surfaces disposed in substantially the same plane for supporting said coil and distributor parts.

7. In a device of the class described, a unitary structure including an induction coil and a distributor, a conductor electrically connecting said coil and distributor, a housing including cap and body portions enclosing said distributor, a housing for said coil disposed in juxtaposition with respect to said distributor housing and having one end thereof terminating in a plane substantially coincident with the plane of intersection of said cap and body portions of the distributor housing.

8. In a device of the class described, a unitary structure including an induction coil and a distributor, a conductor electrically connecting said coil and distributor, a housing including cap and body portions enclosing said distributor, a housing for said coil disposed in juxtaposition with respect to said distributor housing and having one end thereof terminating in a plane substantially coincident with the plane of intersection of said cap and body portions of the distributor housing, and means for joining said cap and body portions along said plane.

9. In a device of the class described, a unitary structure including an induction coil and a distributor, a conductor electrically connecting said coil and distributor, a housing including cap and body portions enclosing said distributor, a housing for said coil disposed in juxtaposition with respect to said distributor housing and having one end thereof terminating in a plane substantially coincident with the plane of intersection of said cap and body portions of the distributor housing, said cap and body portions having registering openings adapted to receive said conductor.

10. In a device of the class described, a unitary structure comprising a plurality of interlocking housings, two of which are disposed in juxtaposition to constitute closure means for an induction coil and a distributor respectively, a cable electrically connecting said coil and distributor, said distributor housing including cap and body portions having registering openings adapted to receive said cable, and means for joining said cap and body portions along a plane substantially coincident with one end of the housing of said coil.

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