Nov. 13, 1923. 1,474,152

A. A. KENT

INDUCTION COIL

Filed Jan. 8, 1921

Fig. 1.

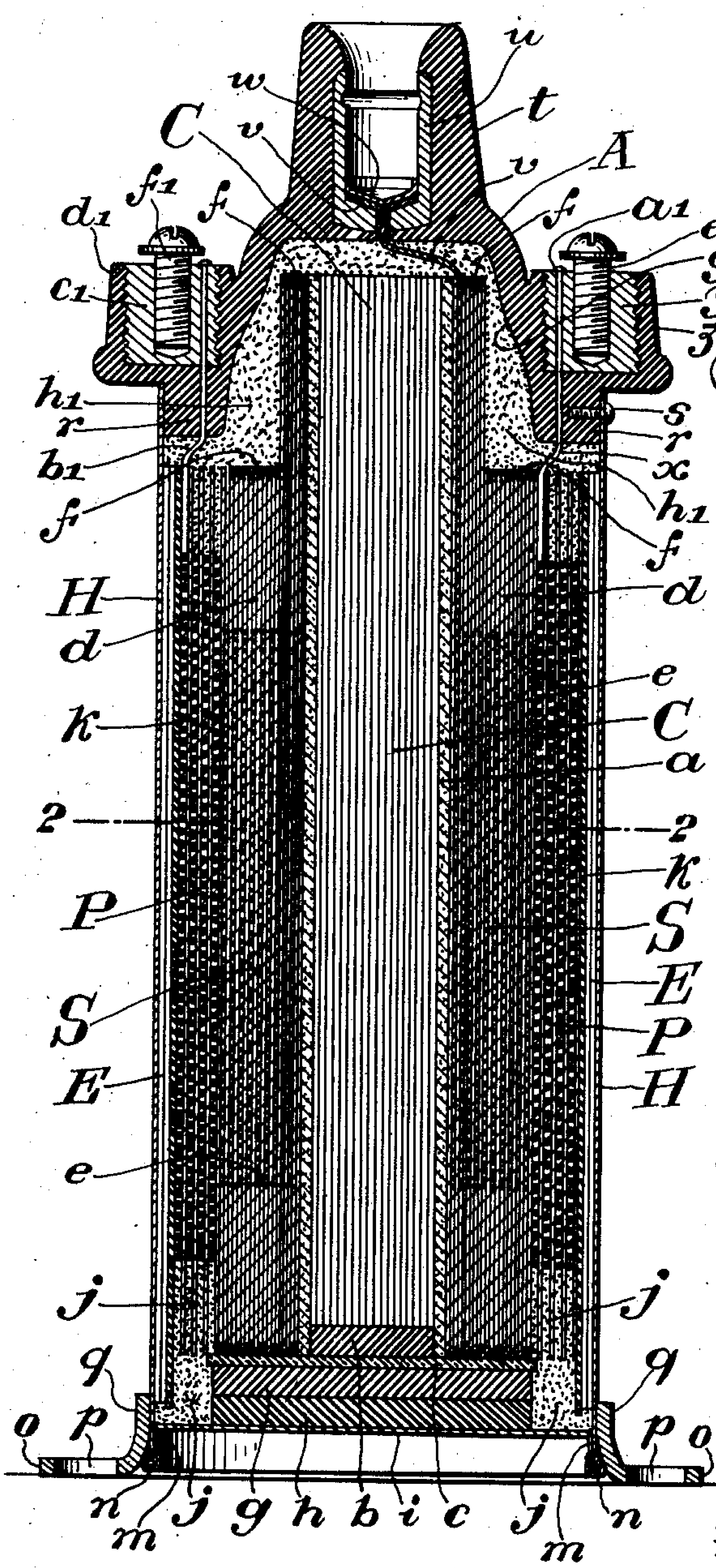


Fig. 3.

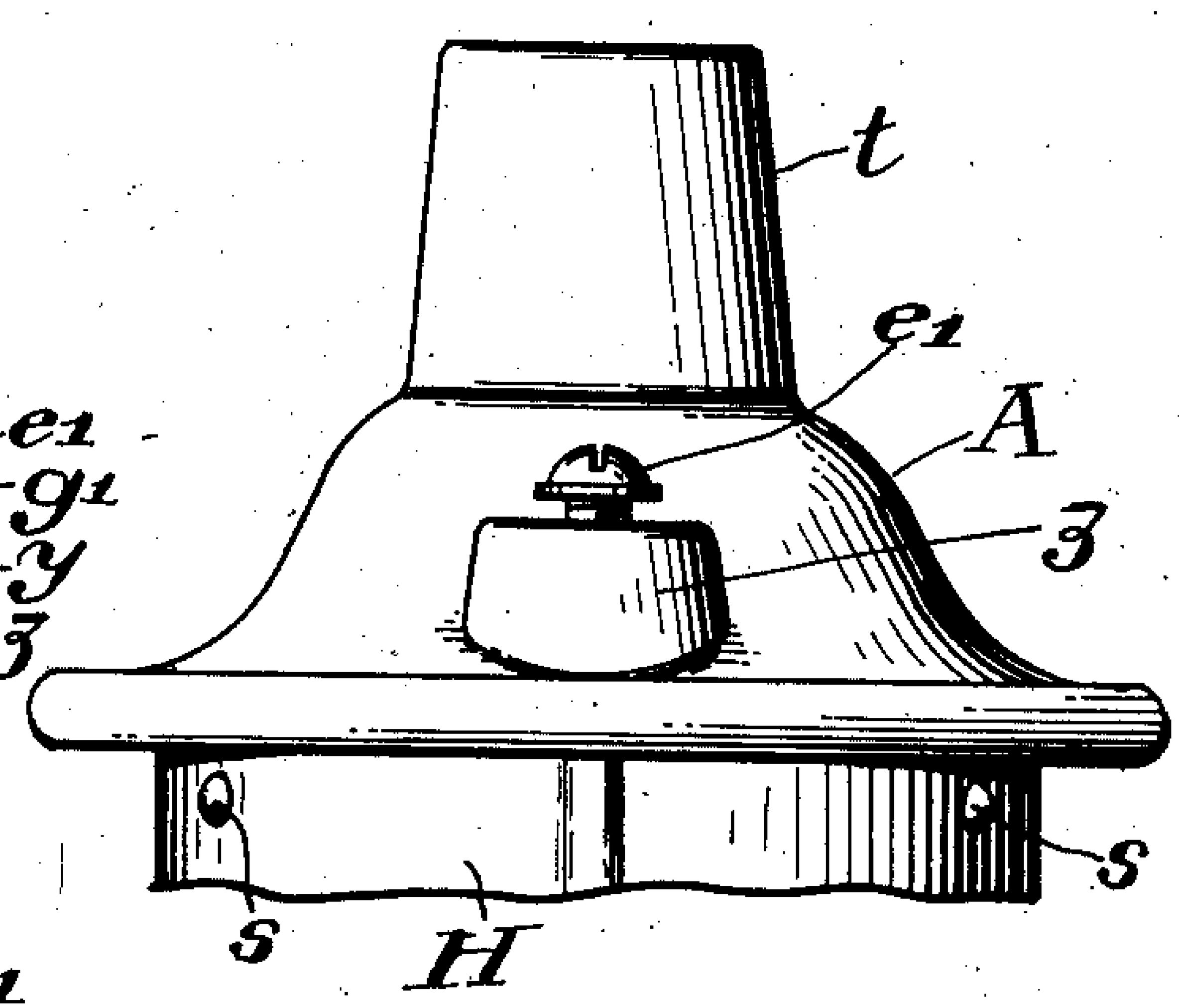


Fig. 2.

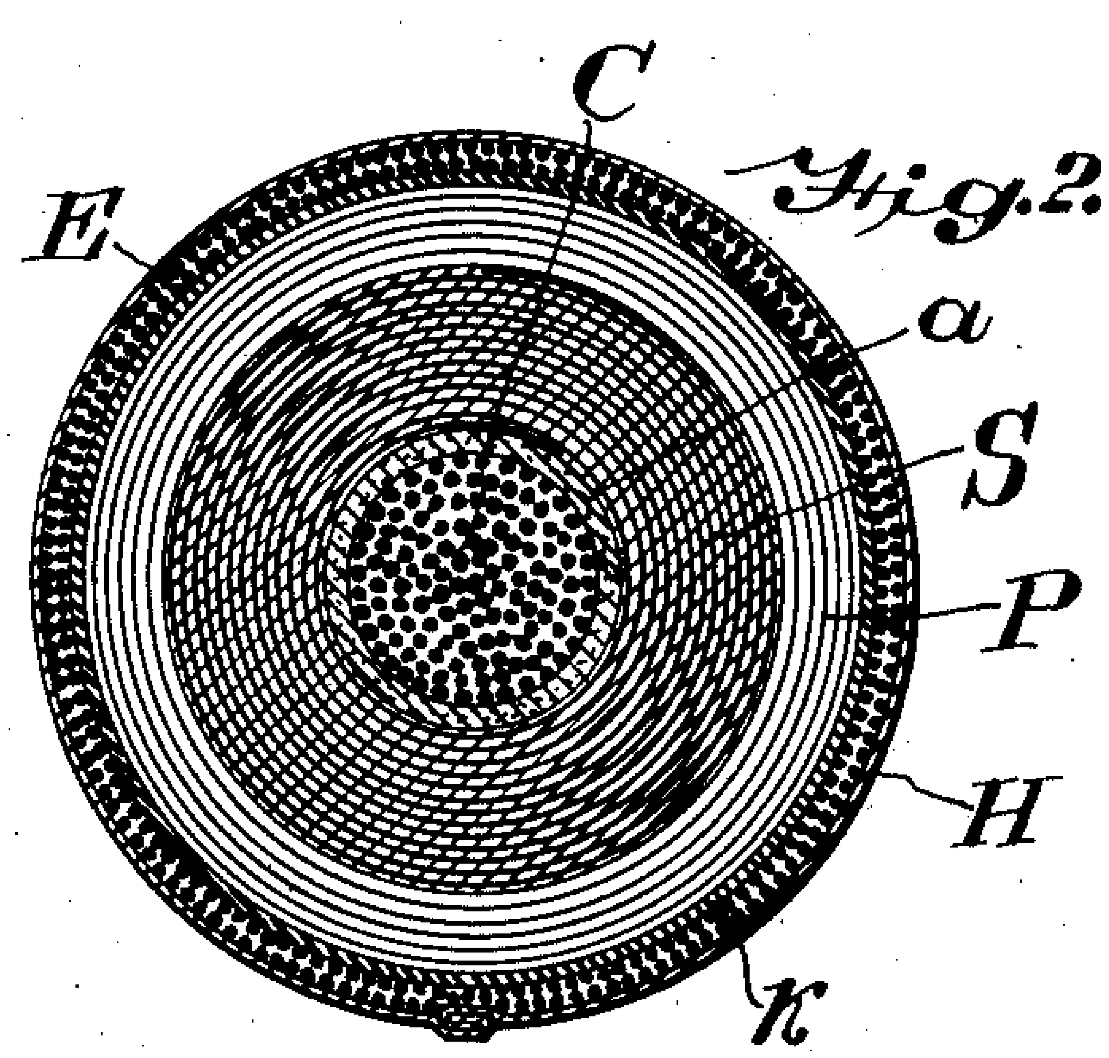
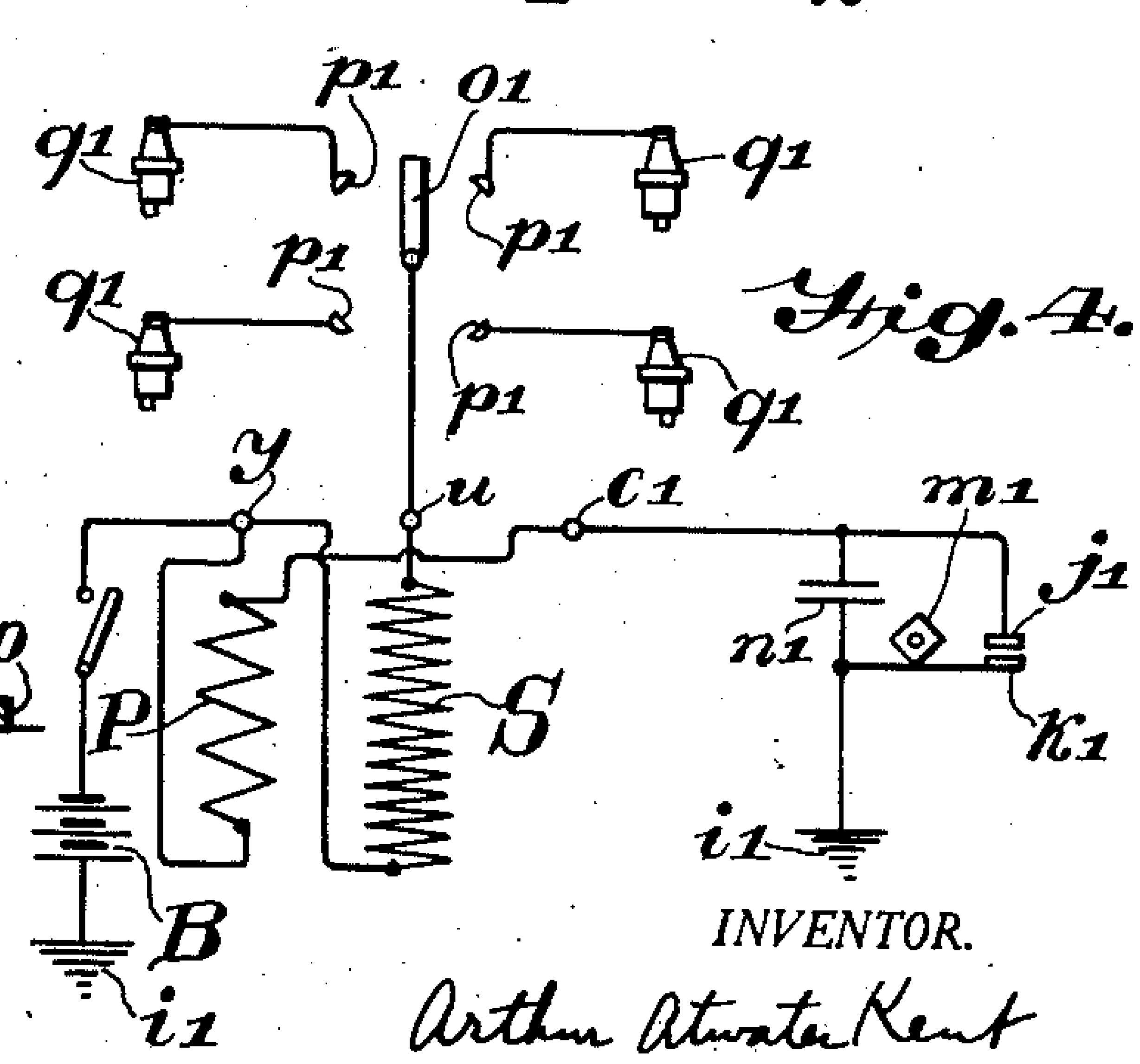


Fig. 4.



INVENTOR.

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BY

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His ATTORNEY.

Patented Nov. 13, 1923. **1,474,152**

UNITED STATES PATENT OFFICE.

ARTHUR ATWATER KENT, OF ARDMORE, PENNSYLVANIA

INDUCTION COIL.

Application filed January 8, 1921. Serial No. 435,792.

To all whom it may concern:

Be it known that I, Arthur Atwater Kent, a citizen of the United States, residing in Ardmore, county of Montgomery, and State of Pennsylvania, have invented certain new and useful Improvements in Induction Coils, of which the following is a specification.

My invention relates to induction coils, and particularly to those suitable for producing the ignition sparks in internal combustion engines.

My invention resides in an induction coil structure entirely housed within a casing, preferably of metal, closed by a cap of insulating material carrying coil terminals, the structure of the cap, and the structure of the induction coil proper and other features being hereinafter more particularly described.

My invention resides in the structure hereinafter described and claimed.

For an illustration of one of the various forms my invention may take, reference is to be had to the accompanying drawing, in which:

Fig. 1 is a vertical sectional view through an induction coil embodying my invention.

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

Fig. 3 is a fragmentary side elevational view of the structure shown in Fig. 1.

Fig. 4 is a circuit diagram.

Referring to Figs. 1, 2 and 3, C is the inner core composed of numerous iron wires confined within the spool or wrapping *a* of insulating material. Within the lower end of the member *a* is a mass *b* of insulating material.

The secondary coil or winding S comprising alternate layers of paper *d* and layers of fine wire *e* may be wound upon the member *a*, or may be wound separately as a unit; and then slipped over the tube *a* to the position indicated. Masses of asphalt or equivalent insulating material may be applied to the ends of the secondary unit S, whereby the asphalt percolates to some extent between the layers of paper *d*, it being understood that the layers of the secondary conductor *e* do not extend the full length of the secondary unit. The asphaltic material serves to bind the ends of the paper together.

Insulated from and surrounding the secondary coil S is the primary coil P, which may be separately wound and slipped upon the secondary S or may be wound as a structural unit with and upon the secondary S. Around the primary P is disposed a wrapping or layer of insulating material *k*.

The induction coil structure comprising the core C and the primary and secondary coils rests upon the washer *c*, of mica or other suitable material, which in turn rests upon the washers or disks of insulating material *g* and *h*, the latter resting upon the metal bottom *i* of the casing H, which is preferably of metal, as tinned iron or other suitable material.

After the core, primary and secondary coils and parts *b*, *c*, *g* and *h* are brought into their relative positions indicated, asphaltic or other insulating material *j*, preferably in fluid state, is applied, and upon cooling sets or hardens. The structure with the applied material *j* is then introduced into the casing H to the position indicated.

Between the coil structures, that is, between the outer insulating sheet *k* and the inner wall of the metal tube or casing H, are inserted the additional or outer core wires E, preferably in heat transfer contact with the metal tube or casing H.

The inner core C will be observed to be materially longer than either of the primary or secondary windings, and in the example illustrated, at its upper end extends materially above the upper end of the casing H.

The casing H may be of any suitable structure. In the example illustrated, its bottom *i* has the upstanding flange *m*, which is formed into a channel *n* into which extends the lower edge of the tube H, the bottom *i* being secured by pressing, rolling, welding or otherwise to the tube H, and soldered or welded to flange *q* of base member *o*. The base member *o*, having apertures *p* to receive screws or other fastening means, has the upstanding flange *q*. Through the opening surrounded by the flange *q* the tube H is inserted, upwardly as viewed in Fig. 1, the channel structure *n* of the bottom *i* being of too large a diameter to pass through said opening, and thereby coming into engagement with the inner end of the flange *q* as indicated. The bottom *i* is then soldered, welded or otherwise secured to the base member *o*.

The casing H is closed by a cap member

A, preferably of molded insulating material, as condensation product, the cap having the integral flange *r* fitting into the tube H, and secured thereto in any suitable way, as by pins or rivets *s* extending through the tube H into the flange *r*.

Within the central upstanding lug or boss *t* is molded the metallic insert socket member *u* adapted to receive the terminal of a high tension cable leading to the usual high tension distributor. The inner end of the secondary coil S is connected by conductor *v* to the insert *u* by extending through a hole in the bottom thereof, in register with a similar hole in the cap A, the conductor *v* being held in any suitable way, as for example, by the inserted plug *w*. The outer end of the secondary S may be connected to the inner end of the primary P, which is connected by conductor *x* with the metallic insert *y* molded in the boss or upstanding lug *z* of the cap A, the conductor *x* extending through a hole in the flange *r* and into a hole extending through the insert *y*, and then soldered or otherwise secured thereto at a^1. Similarly, the outer end of the primary P is connected by conductor b^1 to a second insert c^1 in a second boss d^1. Into the inserts *y* and c^1 are threaded the binding screws e^1 and f^1 by which conductors of the primary circuit of the induction coil are connected to the primary coil P. As indicated in Figs. 1 and 3, the cap A extends a considerable distance over the edge of the casing H, and the inserts *y* and c^1 are, without sacrifice of compactness of structure, suitably widely separated, particularly from the high tension terminal or insert *u*.

Within the cap A is the deep recess or cavity g^1, of depth and diameter suitable to receive the upper end of the inner core C which, as aforesaid, projects beyond the casing H.

In placing the cap in position, there is placed therein or over the end of the core C and adjacent core structure a mass of asphalt or equivalent material h^1, and as the cap is placed in its final position, this insulating material flows into all cavities and recesses affording high insulation and also affording mechanical binding and support.

Referring to Fig. 4, there is shown a circuit arrangement in which the structure described may be employed.

One terminal of the battery B, as a storage battery, or other source of current, is connected to the frame of the motor vehicle or other apparatus with which used, such connection being indicated by ground at i^1. The other terminal of the battery B is connected through switch r^1 to either terminal of the primary P, that is, to either the insert *y* or insert c^1. In the example illustrated, the battery is shown as conected to the insert *y*, to which is also connected the outer terminal of the secondary S. The other terminal of the primary P connecting with the insert or binding post c^1 connects with the stationary contact j^1 of the timer or interrupter, whose movable contact is indicated at k^1, and as grounded at i^1. The movable contact k^1 is operated, as well understood in the art, by a cam m^1 driven in definite relation with the shaft of the engine for which the apparatus is affording ignition. As usual, the interrupter contacts are shunted by a condenser n^1. The inner end of the secondary S connected to the terminal or insert *u* is connected with the high tension rotary distributor o^1, rotating in synchronism with the cam m^1, and coming successively into high tension current transfer relation with the stationary distributor contacts p^1, each connected with a spark plug q^1.

By the structure described, it will be apparent that both the primary and secondary windings may be completely insulated or ungrounded. Thus, neither primary nor secondary winding is connected to the metal casing H, which generally is secured to the metal or conducting frame of the apparatus with which employed. The two terminals of the secondary S are insulated from the casing H and from each other and carried by the cap A. Similarly, both terminals of the primary P are insulated from the casing H and from each other and carried by the cap A, one of the cap terminals being common to both primary and secondary windings.

The inner core C is completely insulated, though it will be understood that there may be a connection thereto from the secondary S, and particularly from the inner end of the secondary S.

As well understood in the art, the primary and secondary windings are preferably impregnated with insulating material by the usual vacuum process.

When the high tension secondary coil is adjacent to the core C, as illustrated, and there is no potential equalizing connection between the core C and the secondary, that is, when the core C remains completely insulated, it too may be subjected to the vacuum impregnation process, whereby substantially all the air is removed and replaced by insulating material. Under these circumstances, notwithstanding complete isolation of the core C from the high tension secondary winding, any static or other discharge as between secondary S and the core C will not produce or cause corrosion of that part of the secondary S adjacent the core, as might otherwise occur if substantial quantities of air were present.

The casing H, when of tinned iron, has substantially no effect upon the magnetic circuit of the induction coil, and such material is chosen merely because of cheapness, the function of the casing being merely protection and waterproofing for the structure contained therein, and for transmitting to the surrounding atmosphere heat imparted thereto from the structure within it.

It further will be noted that the inserts *u*, *y* and c^1 in the cap A do not extend entirely through the cap to the lower surface thereof, a substantial thickness of the cap material intervening.

What I claim is:

1. An induction coil comprising a magnetizable core, a secondary winding surrounding said core and insulated therefrom, a primary winding surrounding said secondary winding, a metallic enclosing casing insulated from said windings and from said core, a cap of insulating material closing said casing, a secondary terminal carried by said cap and connected to one end of said secondary winding, and two primary terminals carried by said cap, one of said primary terminals connected with the other end of said secondary winding.

2. An induction coil comprising a magnetizable core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an enclosing casing, a connection from the outer end of said secondary winding to said primary winding, a cap of insulating material closing said casing, a pair of primary terminals on said cap, and a secondary terminal on said cap connected to the inner terminal of said secondary winding.

3. An induction coil comprising a magnetizable core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, a metallic enclosing casing insulated from said windings, a connection from the outer end of said secondary winding to said primary winding, a cap of insulating material closing said casing, a pair of primary terminals on said cap, and a secondary terminal on said cap connected to the inner terminal of said secondary winding.

4. An induction coil comprising primary and secondary windings and a core therefor, a casing, said core extending materially beyond one end of said casing, a cap of insulating material having a central recess receiving said core and closing said end of said casing, and a secondary terminal at substantially the center of said cap connected to one end of said secondary winding.

5. An induction coil comprising primary and secondary windings and a core therefor, a casing, a cap of insulating material closing one end of said casing and having a recess into which said core extends, and a filling of insulating material in said recess surrounding said core and intervening between its end and said cap.

6. An induction coil comprising primary and secondary windings and a core therefor, a casing, said core extending materially beyond one end of said casing, a cap of insulating material having a recess receiving said core and closing said end of said casing, and a filling of insulating material in said recess surrounding said core and intervening between its core and said cap.

7. An induction coil comprising primary and secondary windings and a core therefor, a metallic casing insulated from said windings and from said core, a cap of insulating material closing one end of said casing and having a central recess into which said core extends, a central secondary terminal on said cap in alignment with said recess and core, a connection from one end of the secondary winding to said secondary terminal, primary terminals on said cap, and a connection from the other end of said secondary winding to one of said primary terminals.

8. An induction coil comprising primary and secondary windings and a core therefor, a casing, said core extending beyond one end of said casing, a cap of insulating material having a central recess receiving said core and closing said end of said casing, said cap having a central secondary terminal adjacent one end of said recess, and primary terminals on said cap on opposite sides of said end of said core.

9. An induction coil comprising a core, primary and secondary windings, a casing enclosing said core and windings, a cap of insulating material closing one end of said casing, a secondary terminal insert molded in said cap adjacent the center thereof and connected to the inner terminal of said secondary winding, and primary terminal inserts molded in said cap adjacent the edges of said cap on opposite sides of said secondary terminal insert.

10. An induction coil comprising a core, primary and secondary windings, a casing enclosing the same, a molded cap of insulating material closing one end of said casing, lateral bosses on said cap adjacent the edge thereof, primary terminal inserts molded in said bosses, a central boss on said cap projecting above said first named bosses, and a secondary terminal insert molded in said central boss.

11. An induction coil comprising a core and primary and secondary windings, a tubular casing enclosing the same, a molded cap of insulating material closing one end of said casing and projecting over the end of said casing, and a primary terminal insert molded in said cap and disposed over and projecting laterally outwardly beyond the end of said casing, material of said cap intervening between the end of said casing and said insert.

12. An induction coil comprising a core and primary and secondary windings, a tubular metal casing enclosing the same, a molded cap of insulating material having a circumferentially extending flange fitting into and closing the end of said casing, a terminal insert molded in said cap above said flange, and a connection from one of said windings extending through said flange and into said insert.

13. An induction coil comprising a core and primary and secondary windings, a metallic tube enclosing the same, a metallic base member having an opening, an upstanding flange on said base member forming a wall of said opening, and a bottom for said tube secured thereto and extending laterally beyond the end of said tube, said tube extended through said opening and beyond said flange to position in which said bottom engages said base member.

14. An induction coil comprising a magnetizable core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an enclosing casing, a conducting base on said casing, said core and secondary winding insulated from each other and from said base, a cap of insulating material closing the other end of said casing, a secondary terminal on said cap connected with one end of said secondary winding, and primary terminals on said cap, one of said primary terminals connected to the other end of said secondary winding.

15. An induction coil comprising a core and primary and secondary windings, a metallic tube enclosing the same, said core and said windings insulated from said tube, a molded cap of insulating material closing one end of said tube, said cap having a recess into which said core extends, said secondary winding being adjacent said core, a secondary terminal carried on said cap above said core and connected to the inner terminal of said secondary winding, and primary terminals carried by said cap.

16. An induction coil comprising a core and primary and secondary windings, a metallic tube enclosing the same, said core and said windings insulated from said tube, a molded cap of insulating material closing one end of said tube, said cap having a recess into which said core extends, said secondary winding being adjacent said core, a secondary terminal carried on said cap above said core and connected to the inner terminal of said secondary winding, primary terminals carried by said cap, the outer end of said secondary winding connected to one of said primary terminals.

17. An induction coil comprising a core, a secondary winding adjacent the core, a primary winding outside the secondary winding, a tubular casing enclosing said core and windings, a molded cap of insulating material enclosing the end of said casing, a secondary terminal carried by said cap and connected to the inner end of said secondary winding, primary terminals carried by said cap, and a connection from one of said primary terminals to the outer end of said secondary winding and to the inner end of said primary winding.

18. An induction coil comprising a metallic tubular casing, a core and primary and secondary windings within said casing and insulated therefrom, a cap of insulating material closing one end of said casing, the secondary winding being adjacent said core and the primary winding surrounding said secondary winding, primary and secondary terminals carried by said cap, one of said terminals connected to the outer end of said secondary winding and to the inner end of said primary winding.

19. An induction coil comprising a core and primary and secondary windings thereon, a metallic casing therefor insulated from said core and said windings, a cap of insulating material closing one end of said casing and having a central recess into which said core extends, a secondary terminal on said cap in alignment with said recess and said core and connected to one end of said secondary winding, primary terminals on said cap adjacent the outer edge thereof, said primary windings surrounding said secondary winding, one terminal of said primary winding connected to one of said primary terminals, and a connection from the other primary terminal to the other ends of said secondary and primary windings.

20. An induction coil comprising a core and primary and secondary windings thereon, said primary winding surrounding said secondary winding, a metallic casing enclosing said core and windings and insulated from said windings, a cap of insulating material closing one end of said casing and having a central recess, a secondary terminal on said cap disposed centrally thereof in alignment with said recess and core, a connection from the inner end of said secondary winding to said terminal, primary terminals on said cap, a connection from the outer end of said primary winding to one of said primary terminals, and a connection from the outer end of said secondary and the inner end of said primary to another of said primary terminals.

21. An induction coil comprising a core and primary and secondary windings thereon, a metallic tubular enclosing casing insulated from said windings, a cap of insulating material closing one end of said casing, means directly securing said cap to said casing, said secondary winding lying adjacent said core and surrounded by said primary winding, a secondary terminal on said cap

connected to the inner end of said secondary winding, primary terminals on said cap, a connection from the outer end of said secondary winding and the inner end of said primary winding to one of said primary terminals, and a connection from the outer end of said primary winding to the other primary terminal.

22. An induction coil comprising a core, a secondary winding surrounding said core adjacent thereto, a primary winding surrounding said secondary winding, a metallic tubular casing enclosing said core and windings and insulated from said windings, a cap of insulating material closing one end of said casing and having a recess into which said core extends, a secondary terminal carried by said cap in alignment with said recess and said core, a lead from the inner layer of said secondary winding to said secondary terminal, insulating material overlying said lead along the end of said core disposed in said recess, primary terminals carried by said cap beside said recess, and a connection from the outer end of said secondary winding to one of said primary terminals and separated from said secondary lead by said insulating material.

23. An induction coil comprising a core consisting of subdivided magnetizable material impregnated with insulating material, a secondary winding surrounding said core adjacent thereto, and a primary winding surrounding said secondary winding.

24. An induction coil comprising inner and outer magnetizable cores, primary and secondary windings disposed around said inner core between it and said outer core, the secondary winding surrounded by the primary winding, a casing enclosing said cores and windings, a cap of insulating material closing one end of said casing, said inner core extending longitudinally beyond said outer core and into said cap, and primary and secondary terminals carried by said cap.

25. An induction coil comprising inner and outer magnetizable cores, primary and secondary windings disposed around said inner core between it and said outer core, the secondary winding surrounded by the primary winding, a casing enclosing said cores and windings, and a cap of insulating material closing one end of said casing and having a recess, said inner core extending longitudinally beyond said outer core and into said recess.

26. An induction coil comprising a casing, a core therein, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, said secondary winding comprising layers of conductor separated by sheets of insulating material, said sheets extending longitudinally beyond said conductor layers, and a cap of insulating material closing one end of said casing and having a recess into which extend said core and said sheets of insulating material.

27. An induction coil comprising a casing, a core therein, primary and secondary windings upon said core, one of said windings comprising layers of conductor separated by sheets of insulating material, said sheets of insulating material extending longitudinally beyond said conductor layers, and a cap closing one end of said casing and into which said sheets of insulating material extend.

28. An induction coil comprising a casing, a core therein, primary and secondary windings upon said core, one of said windings comprising layers of conductor separated by sheets of insulating material, said sheets extending longitudinally beyond said conductor layers, some of said sheets adjacent said core having greater longitudinal extent than sheets more remote from said core, and a cap closing one end of said casing and into which said sheets of greater length extend.

29. An induction coil comprising a casing, a core therein, primary and secondary windings upon said core, one of said windings comprising layers of conductor separated by sheets of insulating material, said sheets extending longitudinally beyond said conductor layers, some of said sheets adjacent said core having greater longitudinal extent than sheets more remote from said core, and a cap closing one end of said casing and into which said core and said sheets of greater length extend.

30. An induction coil comprising a core a secondary winding surrounding said core adjacent thereto, a primary winding surrounding said secondary winding, an enclosing casing, a cap of insulating material closing one end of said casing, a secondary terminal and primary terminals carried by said cap, a connection from the inner end of said secondary winding to said secondary terminal on said cap, a connection from the other end of the secondary to one of said primary terminals, and an insulating filler confined by said cap and embedding said first named connection.

31. An induction coil comprising a core, primary and secondary windings thereon, an enclosing casing, a cap of insulating material forming an end closure for said casing and into which the end of said core extends in spaced relation thereto, a secondary terminal carried by said cap and having a connection to one terminal of said secondary winding, and an insulating filler disposed in said cap and embedding the end of said core and surrounding said connection.

32. An induction coil comprising a core, primary and secondary windings thereon,

a metallic enclosing casing, said core insulated from said casing, a cap of insulating material forming an end closure for said casing, a secondary terminal on said cap, a connection from one end of said secondary winding to said terminal, primary terminals on said cap, a connection from one of them to the other end of said secondary winding, and an insulating filler between said cap and said windings and embedding said first named connection.

In testimony whereof I have hereunto affixed my signature this 23rd day of December, 1920.

ARTHUR ATWATER KENT.