Nov. 20, 1923. 1,474,597

A. A. KENT

INDUCTION COIL

Filed June 25, 1921 2 Sheets-Sheet 1

Fig. 1.

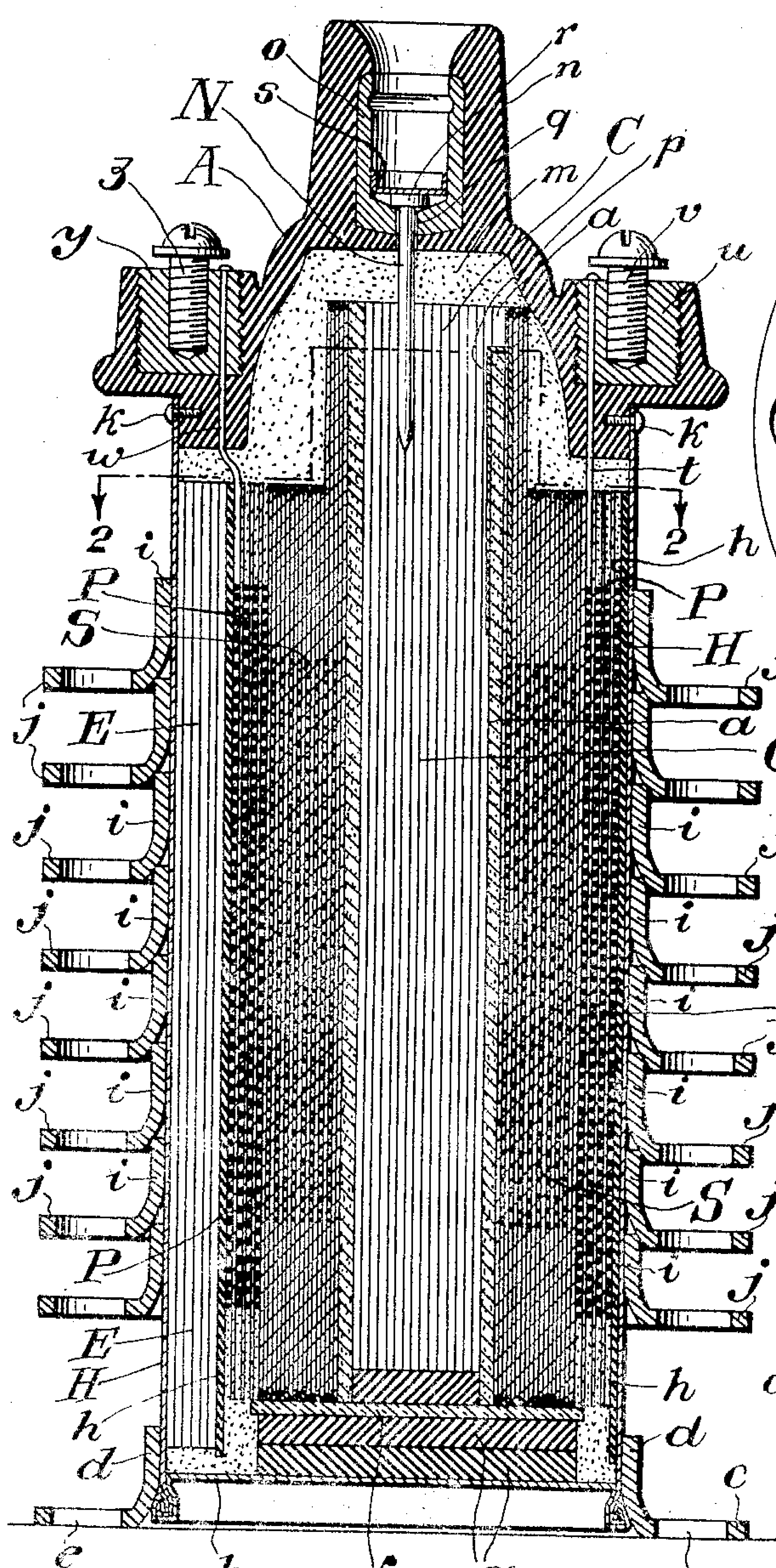


Fig. 2.

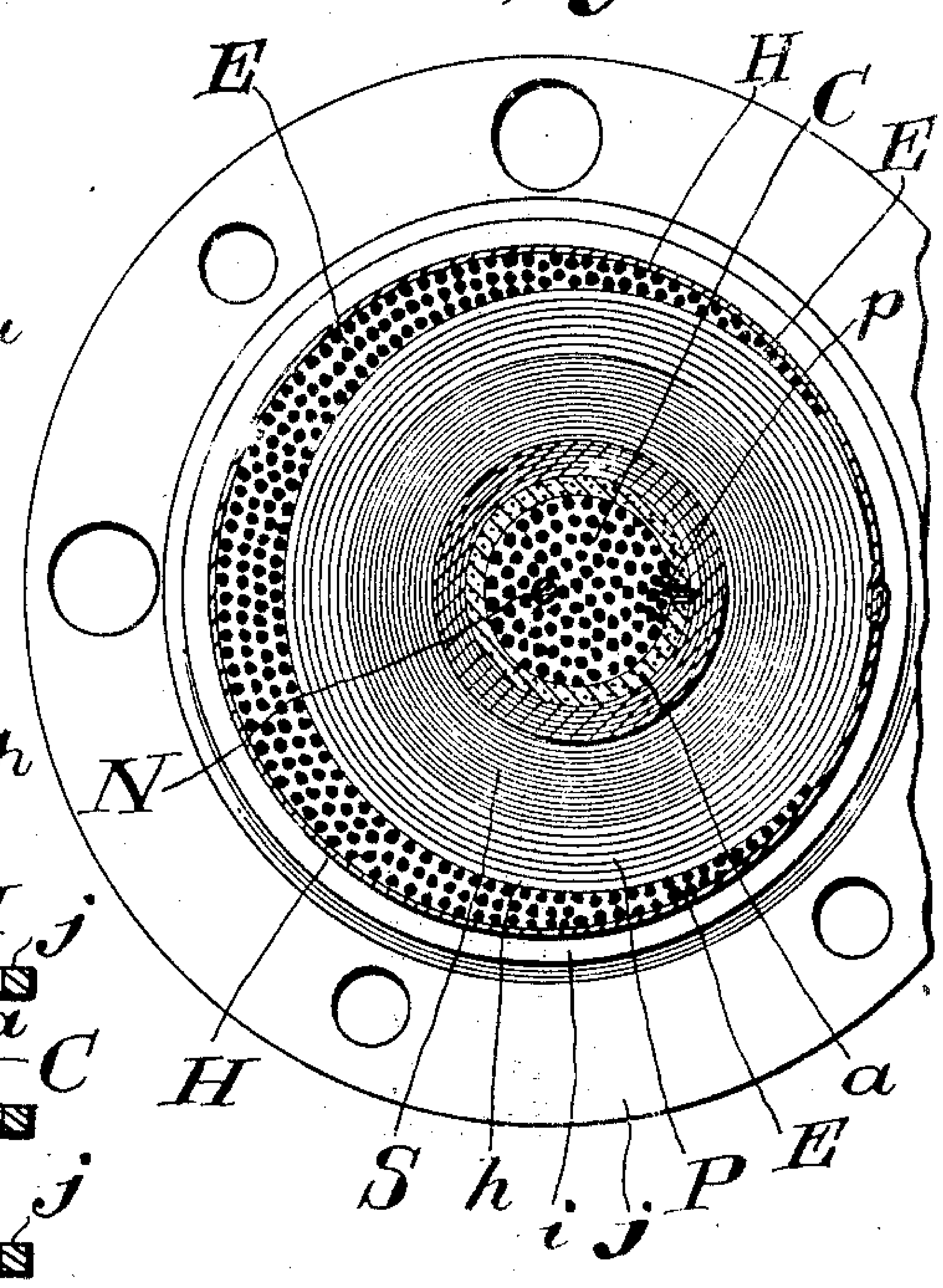
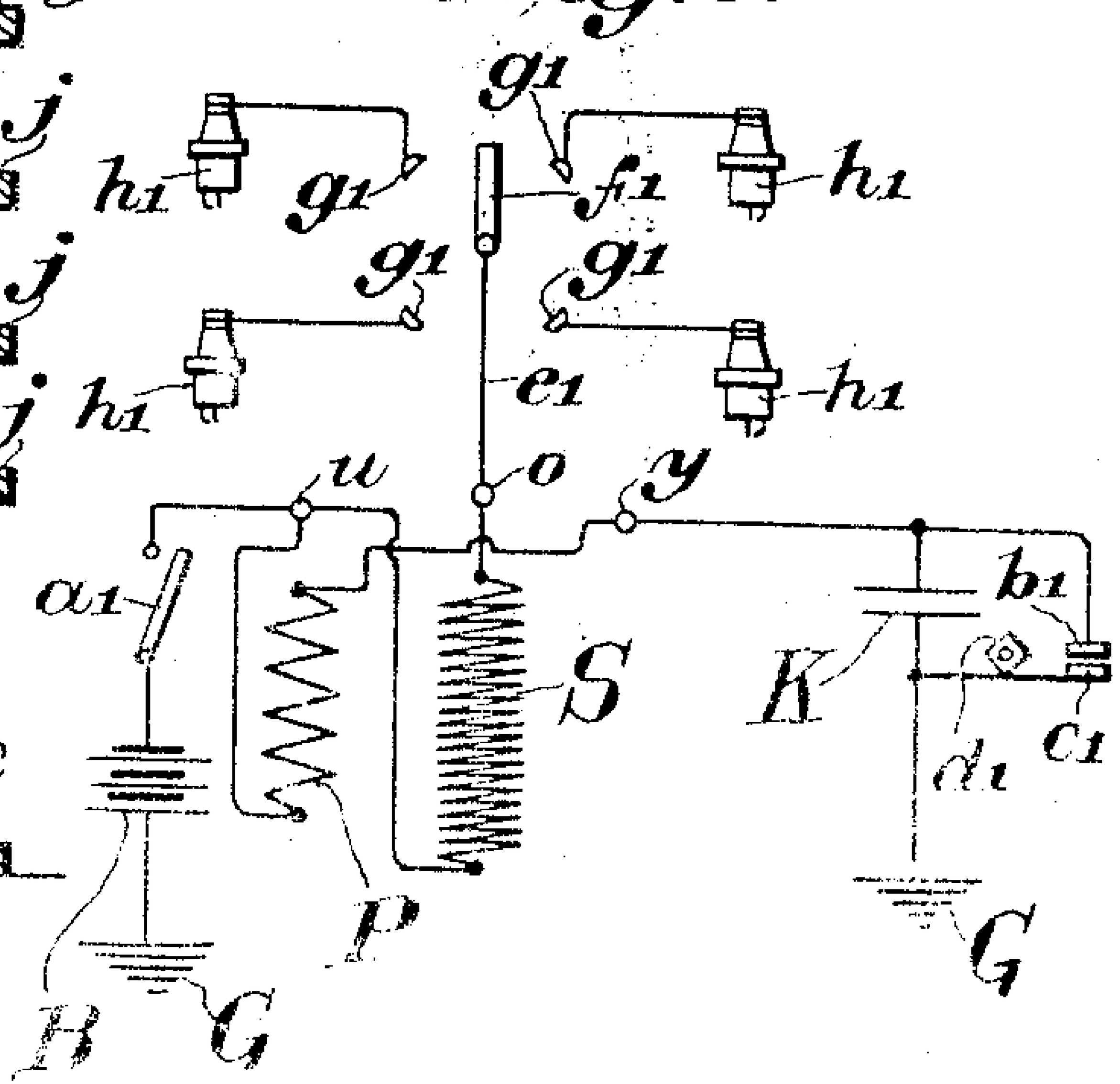


Fig. 3.



INVENTOR.
Arthur Atwater Kent
BY Cornelius D. Ehret
his ATTORNEY.

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Fig. 4.

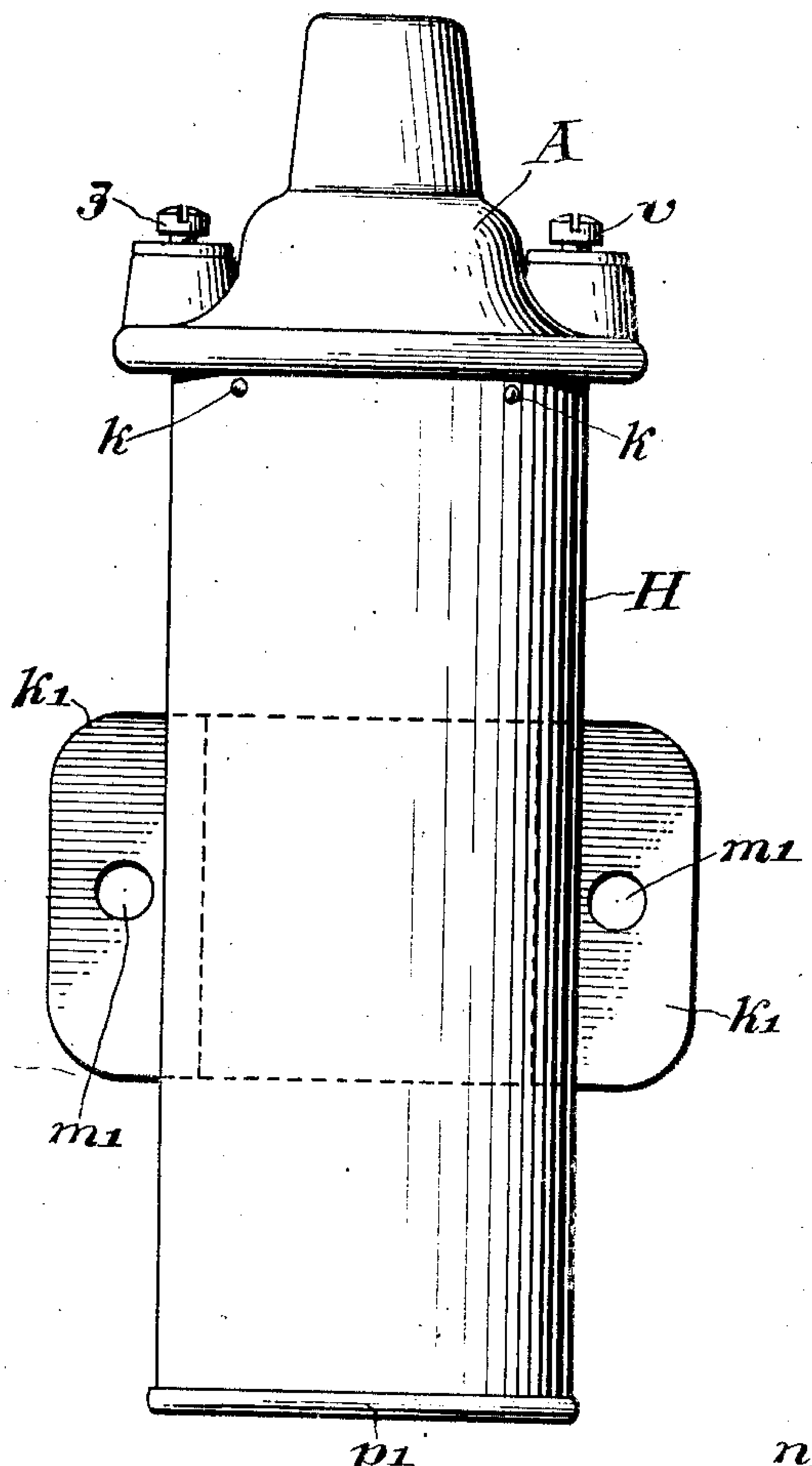


Fig. 5.

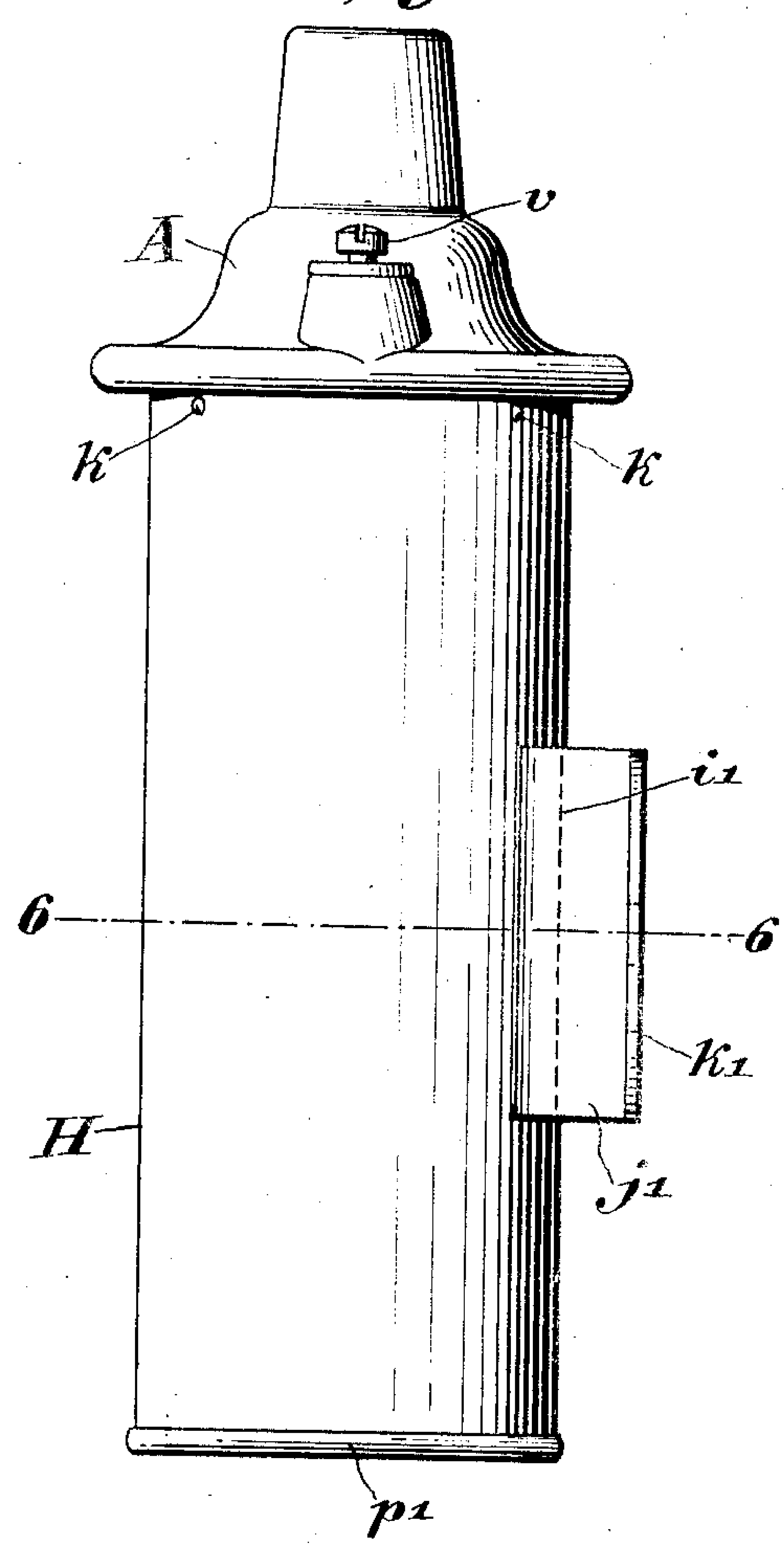
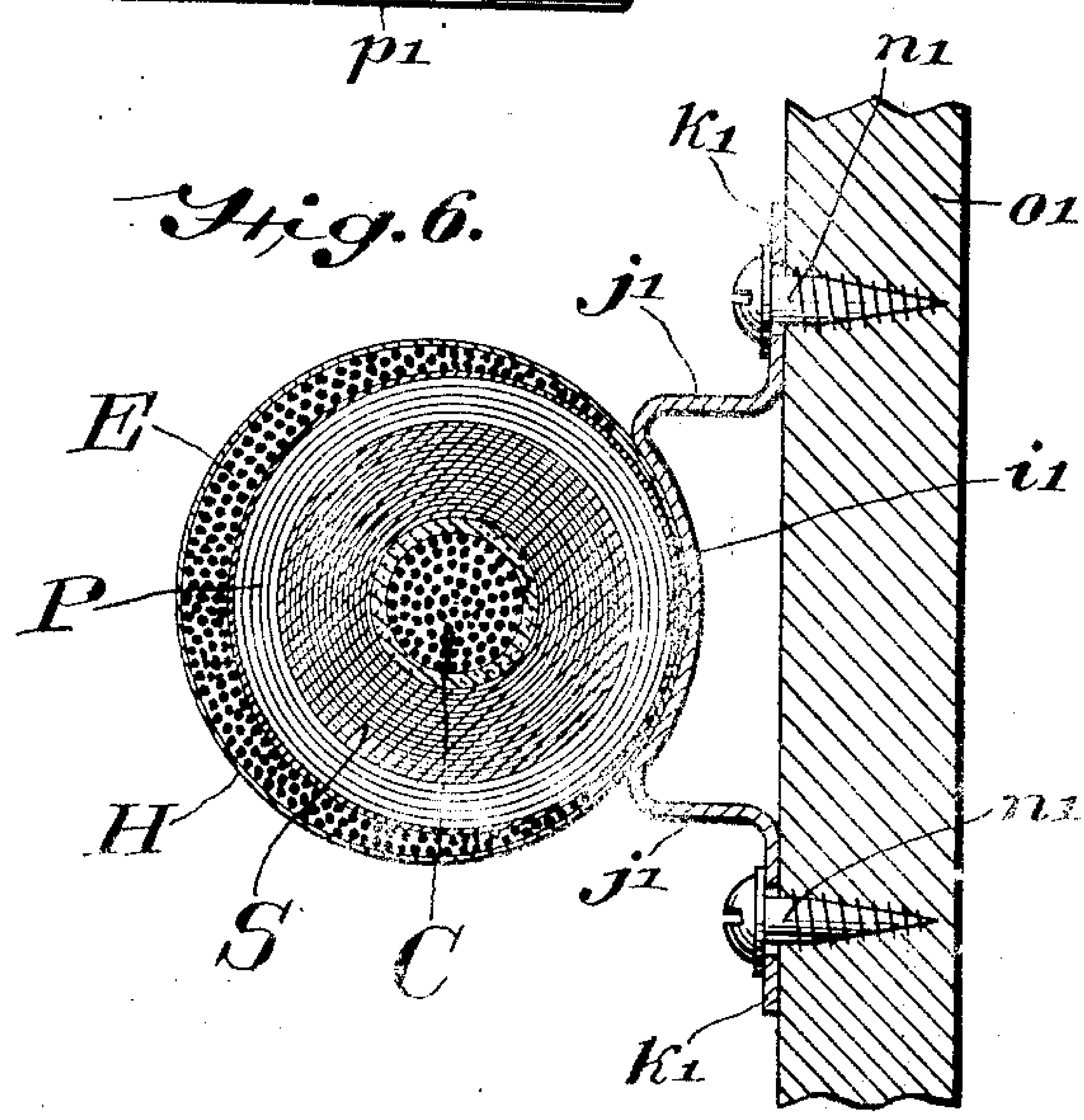


Fig. 6.



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Arthur Atwater Kent

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Patented Nov. 20, 1923. **1,474,597**

UNITED STATES PATENT OFFICE.

ARTHUR ATWATER KENT, OF ARDMORE, PENNSYLVANIA.

INDUCTION COIL.

Application filed June 25, 1921. Serial No. 480,316.

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 more particularly to those suitable for producing the ignition sparks in internal combustion engines, such as employed upon motor vehicles or the like.

My invention resides in induction coil structure wherein electrical connection between a winding of the induction coil, as the secondary winding, and a terminal is effected by connecting the winding to a core member of subdivided magnetizable material and completing the connection to the terminal by a conducting pin, rod or the like extending into the subdivided core and connecting with the terminal.

My invention resides also in an induction coil comprising primary and secondary windings housed within a casing and provided with an external core structure of subdivided magnetizable material disposed between the casing and the winding structure, the outer core material being ununiform or eccentric as regards distribution around the coil windings.

My invention resides further in induction coil structure of the character hereinafter described provided with means for facilitating transfer or radiation of heat developed therein.

My invention resides in the features 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 induction coil structure embodying my invention.

Fig. 2 is a view, partly in plan and partly in section, on the line 2—2 of Fig. 1.

Fig. 3 is a circuit diagram.

Figs 4 and 5 are side elevations of a modified coil structure.

Fig. 6 is a sectional view on the line 6—6 of Fig. 5.

Referring to Figs. 1 and 2, C is the inner core composed of numerous iron wires substantially parallel with each other and confined in a bundle, as by a surrounding spool or wrapping *a*, preferably of insulating material. Surrounding or wound upon the member *a* is the secondary coil or winding S formed in any suitable way, as by alternate layers of small insulated wire or conductor and paper or other insulating material. The secondary coil S may be wound upon the member *a* or may be wound separately as a unit and then slipped over the tube or member *a* to the position indicated. Insulated from and surrounding the secondary winding S is the primary coil or winding P of relatively coarser wire and fewer turns, which may constitute a unit with the secondary S or may be separately wound and placed in the position indicated. As shown, the primary P may have greater longitudinal extent than the secondary S, the core C preferably being longer than either primary or secondary winding. The induction coil structure comprising the core C and the primary and secondary coils P and S is placed within a casing H, preferably of metal, having the bottom closure member *b*, also preferably of metal. Secured to the casing or housing member H at its lower end is the base member *c* having the upstanding flange *d* secured to the housing or casing H in any suitable manner. The base flange *c* may be provided with holes *e* through which screws or other fastening means may extend. The induction coil structure preferably rests at its lower end upon insulating members, as a sheet of mica *f* resting in turn upon disks *g*, of insulating material, in turn resting upon the bottom member *b*. Surrounding the primary P is preferably provided the sheet of insulating material *h*.

To facilitate and cheapen the introduction and placing of the iron or other wires of an external core structure, without, however, detracting materially from the electrical and magnetic characteristics of the induction coil, and in some cases even improving the characteristics, the structure comprising the inner core C and the primary and secondary windings is displaced laterally, as indicated in Figs. 1 and 2, preferably to the extreme position where, as indicated, the outer winding is disposed immediately adjacent the casing H. In the example illustrated, this leaves a crescent-shaped gap between the inside of the casing H and the winding structure, into which space are then introduced, preferably filling such space, numerous parallel iron wires forming the external core structure E, which with the inner core C forms part of the magnetic circuit of the induction coil. By so disposing the winding structure and the external core wires, the latter are more easily and quickly, and therefore cheaply, placed in position than in the case where the winding structure is placed substantially co-axial with the housing or casing H and the external core structure made of substantially uniform thickness entirely surrounding the winding structure, as indicated, for example, in my copending application Ser. No. 435,792.

The core structure E as herein provided serves also to conduct heat from the winding structure, particularly the primary winding P, to and through the casing H.

Upon the exterior of the casing H, preferably throughout or at least in part within the longitudinal extent of the primary coil P, or (and) external core E, is applied a plurality of metallic heat radiating members each comprising the cylindrical flange *i* in good heat conducting contact or relation with the casing H and the outwardly extending flange *j*. These heat conducting or radiating members in the example illustrated are similar to the above described base member *c* with its upstanding flange *d*. Such heat radiating structure is of particular advantage in an induction coil in which the primary winding surrounds the secondary and in which the housing or casing H is metal, and particularly when an external core structure is employed which, however, may or may not, as desired, be eccentric or non-uniform as herein shown.

Closing the other end of the casing H is a cap A of molded insulating material, as condensite, bakelite or other suitable material. In the example illustrated the cap A is secured to the casing H by pins or screws *k*. The cap A, in the example illustrated, has a central inside recess *m*, and co-axial with such recess the cap is provided with a boss *n* within which is molded the metallic insert or secondary terminal *o*, with which engages any suitable conductor, as a flexible cable, connecting to the distributor structure of the high tension or spark-producing circuit. The inner end of the wire or conductor of the secondary winding S is passed through a slit in the spool or tube *a*, and the bare end of such wire or conductor is passed between the wires of the core C, as indicated at *p*, whereby one end of the secondary winding S is electrically connected to the core C. With the cap A in position as indicated, a metal nail, pin, rod or other member N is inserted through the hole *q* in the insert *o* and aligned hole *n* in the material of the cap A and driven or otherwise forced downwardly between the wires of the core C, thereby making electrical contact therewith and thereby completing connection between one end of the secondary S and the secondary terminal or insert *o*.

This structure affords a simple and extremely cheap mode of connecting an end of the secondary winding to the secondary terminal of the induction coil. The connection at *p* to the core C is made before the core C and winding structure are introduced into the casing H; such connection may be made, for example, at the time the core wires C are introduced into the spool or tube A, or at the time the secondary winding S is wound upon the tube *a* in which may have previously been placed the wires of the core C. The final connection to the terminal *o* is then made at any later time when the cap A is applied to the casing H after previous introduction of the core C and the winding structure.

The connector N is preferably provided with a head *r*. Above the member N, or its head *r* if provided therewith, is disposed a cup-shaped cap or member *s* forced downwardly in the bore of the terminal *o* to position indicated to confine the conductor or connector N in its operative position indicated.

The other end of the secondary winding S may be connected to the inner end of the primary P and both connected by conductor *t* with the terminal or metallic insert *u* molded in the cap A and threaded to receive a binding screw *v*. The other or outer end of the primary P is connected by conductor *w* to the metallic terminal or insert *y* molded in the cap A and threaded to receive a binding screw *z*.

For one of the various modes of connecting the induction coil structure in an ignition circuit, reference may be had to Fig. 3, wherein a battery or other source of current B has one of its terminals connected to ground or conducting frame G of the engine or motor vehicle, or to a return conductor. The other terminal of the source B is connected through ignition switch a^1 with one or the other of the terminals or inserts *u* or *y* above described. In the example illustrated the connection is made to the terminal *u*, and from the other primary terminal *y* connection is made to one of the co-operating interrupter contacts b^1, c^1, one of which is actuated by the usual timing cam d^1, driven in definite relation with and by the engine shaft. One of the interrupter contacts is connected to ground or return conductor G, and shunting the contacts is the usual condenser K. The secondary terminal *o* is connected by conductor e^1, as the above mentioned flexible conductor or cable, to the rotary distributor contact f^1 also rotated by and in definite relation with the engine shaft and co-acting in succession with the stationary terminals g^1, connecting, respectively, with the spark plugs h^1 of the different engine cylinders.

In Figs. 4, 5 and 6 the coil structure is shown as provided with heat conducting or radiating structure comprising the saddle i^1 attached to the metal casing H and having the outwardly extending heat conducting or radiating extensions j^1 terminating in outwardly turned flanges k^1, also serving as means for conducting or radiating heat from the coil structure. The flanges k^1 may be provided with holes m^1 through which may extend screws or any other suitable fastening means n^1 for securing the flanges k^1 to any suitable support, as o^1, which may be of metal, wood or other suitable material, and when of metal assists in conducting heat away from the coil structure.

This heat conducting or radiating structure is also preferably located, at least in part, within the longitudinal extent of the primary P or external core E, though it will be understood, as in connection with the structure *i*, *j* of Fig. 1, that the structure may extend throughout the entire longitudinal extent of the primary P or external core E, or may be disposed beyond the primary P or core E, or in fact, in any suitable relation upon the casing H.

When employing the heat transfer structure indicated in Figs. 4–6, the casing H may terminate at its lower end in a simple metallic bottom member p^1 the members *c*, *d* of Fig. 1 in this instance being omitted.

What I claim is:

1. Induction coil structure comprising a core consisting of a bundle of substantially parallel wires, primary and secondary windings, a connection from said secondary winding to said core, a member of insulating material, a secondary terminal carried thereby, and means for connecting said terminal with said secondary winding comprising a member carried by and electrically connected with said terminal and projecting therefrom between said core wires.

2. Induction coil structure comprising a core consisting of a bundle of substantially parallel wires, primary and secondary windings, a connection from said secondary winding to said core, a member of insulating material, a secondary terminal carried thereby and having a perforation, and means for connecting said terminal with said secondary winding comprising a conducting member carried by and contacting with said terminal and projecting through said perforation into and terminating in said core between the wires thereof and contacting with said wires.

3. Induction coil structure comprising a core consisting of a bundle of substantially parallel wires, primary and secondary windings, a connection from said secondary winding to said core, a member of insulating material, a secondary terminal carried thereby and having a perforation, an elongated conducting member having a head and a shank projecting through said perforation into and terminating in said core between the wires thereof and contacting therewith, and means co-acting with said terminal and the head of said conducting member for holding said contacting member in position.

4. Induction coil structure comprising a core consisting of a bundle of substantially parallel wires, a secondary winding surrounding said core, a connection from said secondary winding to said core, an enclosing casing, a cap of insulating material forming a closure for said casing, a secondary terminal on said cap, and a conducting member carried by and connecting with said terminal and projecting therefrom into and terminating in said core between said wires and contacting therewith.

5. Induction coil structure comprising a core consisting of a bundle of substantially parallel wires, a secondary winding surrounding said core, a connection from the inner layer of said secondary winding to said core, a primary winding surrounding said secondary winding, a casing enclosing said core and windings, a cap of insulating material forming an end closure for said casing, a secondary terminal carried by said cap and having a perforation, and a conducting member carried by said terminal projecting through said perforation into and terminating in said core between the wires thereof and contacting therewith.

6. Induction coil structure comprising an inner core, primary and secondary windings surrounding said core, an enclosing housing, and a straight external core having its ends spaced from said inner core and comprising divided magnetizable material disposed between said windings and said casing in a mass diminishing in thickness around said windings.

7. Induction coil structure comprising an inner core, primary and secondary windings disposed one upon the other around said core, an enclosing housing, the outer winding disposed eccentrically within said casing, and a straight external core having its ends spaced from said inner core and comprising subdivided magnetizable material disposed in the space between said outer winding and said casing.

8. Induction coil structure comprising an inner core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an enclosing casing, said core and windings disposed eccentrically within said casing with said primary

winding closely approaching said casing on one side whereby there is left a space of crescent form between said primary winding and said casing, and an external core comprising subdivided magnetizable material disposed in said space.

9. Induction coil structure comprising an inner core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an enclosing casing, said core and windings disposed eccentrically within said casing with said primary winding closely approaching said casing on one side whereby there is left a space of crescent form between said primary winding and said casing, and an external core comprising substantially parallel wires disposed in and substantially filling said space.

10. Induction coil structure comprising a metallic casing, core structure and windings within said casing, and a heat radiating structure comprising heat radiating members spaced longitudinally of and surrounding said casing and in heat transfer relation therewith.

11. Induction coil structure comprising a metallic casing, core structure and windings within said casing, and heat radiating structure comprising a plurality of heat radiating members on the exterior of said casing, each of said members comprising a flange extending substantially parallel with said casing and in heat conducting relation therewith, and an integral outstanding flange.

12. Induction coil structure comprising a metallic casing, a core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, and a heat radiating structure comprising heat radiating members on said casing and spaced from each other longitudinally thereof, at least some of said members located between the ends of said primary winding.

13. Induction coil structure comprising a metallic casing, a core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an external core between said primary winding and said casing, and heat radiating means comprising heat radiating members on said casing, at least some of said members located between the ends of said external core.

14. Induction coil structure comprising a metallic casing, a core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, and a heat radiating structure upon the exterior of said casing and disposed at least in part between the ends of said primary winding.

15. Induction coil structure comprising a metallic casing, a core, a secondary winding surrounding said core, a primary winding surrounding said secondary winding, an external core between said primary winding and said casing and in contact with said casing, and heat radiating structure upon the exterior of said casing and disposed at least in part between the ends of said external core.

In testimony whereof I have hereunto affixed my signature this 23rd day of June, 1921.

ARTHUR ATWATER KENT.