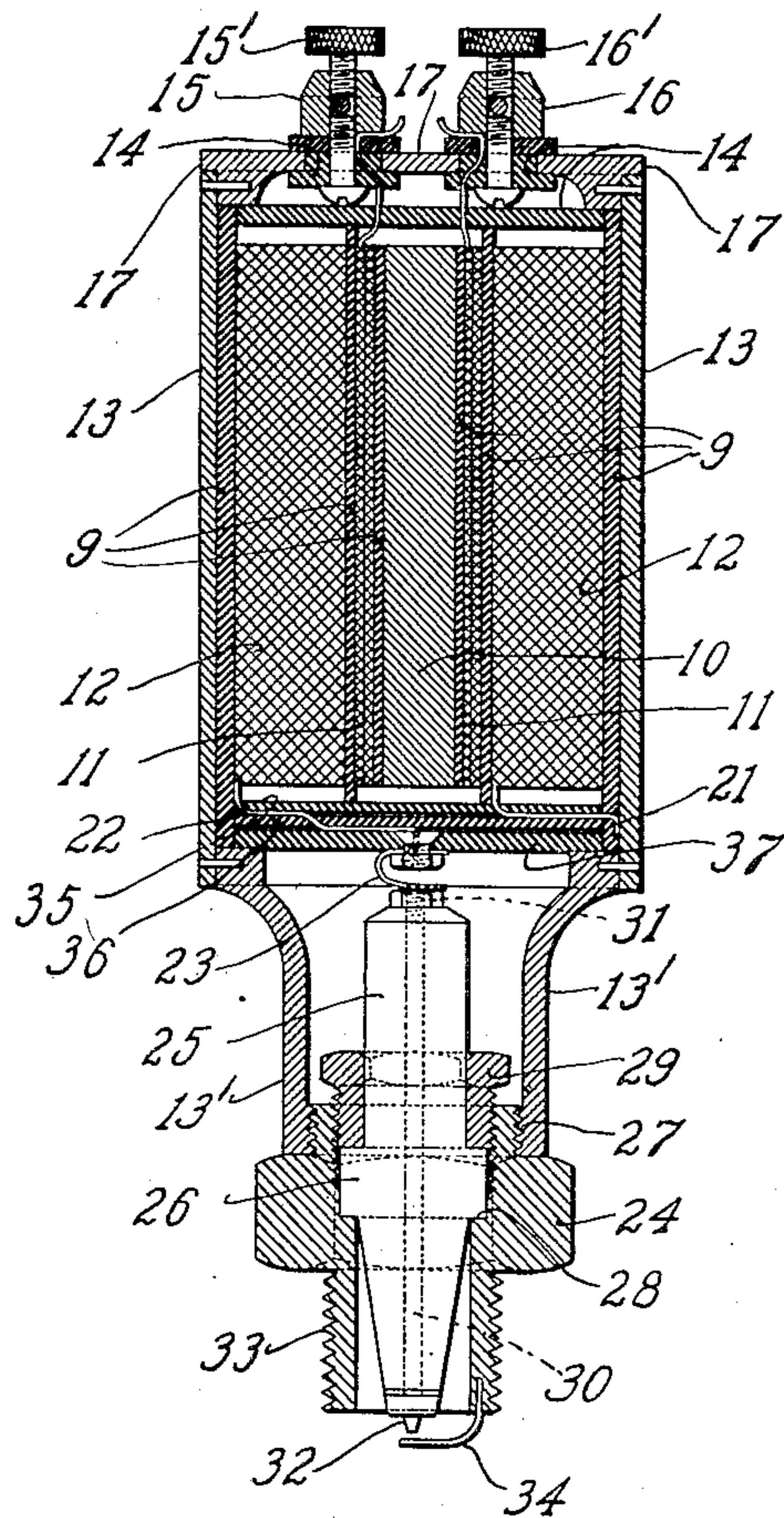


A. E. ENGLAND.  
IGNITION APPARATUS.  
APPLICATION FILED MAY 22, 1907.

964,007.

Patented July 12, 1910.



WITNESSES

Arthur G. Lewis  
Elliott B. Church

INVENTOR  
ARTHUR E. ENGLAND  
BY HIS ATTORNEY

Ernest E. Kent



# UNITED STATES PATENT OFFICE.

ARTHUR E. ENGLAND, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO ARTHUR A. MAXWELL, TRUSTEE, OF WORCESTER, MASSACHUSETTS.

## IGNITION APPARATUS.

964,007.

Specification of Letters Patent.

Patented July 12, 1910.

Application filed May 22, 1907. Serial No. 375,042.

*To all whom it may concern:*

Be it known that I, ARTHUR E. ENGLAND, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Ignition Apparatus, of which the following is a specification.

This invention relates to improvements in ignition apparatus, and particularly to the construction of spark plugs and induction coils for internal combustion engines.

It is among the objects of the invention to simplify the construction of such apparatus, reducing the cost of manufacture, and at the same time rendering it immune to injury from heat or water; to extend the life of the spark plug beyond the common experience with plugs now in use, and to reduce the expense of renewal.

In the accompanying drawing, which represents one specific embodiment of the invention, the figure represents a sectional elevation of the apparatus complete.

Referring to the drawing: 10 represents the core of an induction coil surrounded successively by the primary wires 11, the secondary wires 12 and an external casing 13, all these parts being suitably separated by insulating material 9 in the manner well known. The casing preferably is of aluminum, or other non-magnetic material which is also a conductor of electricity. At the upper end of the casing are disks of mica or other suitable insulating material 14, through which wires from the primary coil pass to binding posts 15, 16, mounted and insulated on a piece 17, which closes the end of the casing. The binding posts 15, 16 may be of any ordinary or suitable construction, and may have screws 15', 16' respectively for connection of wires leading through an outside circuit which may contain a battery, condenser and vibrator for making and breaking the primary circuit in the customary manner. The terminals 21, 22, of the secondary coil may be led out at the lower end thereof through mica insulating disks, as shown, one wire being attached to the casing of the apparatus and the other led to a contact point located axially outside the lowest mica disk. This contact point is preferably in the form of a spring 23 projecting downward. The casing 13 has a downward extension 13' beyond the end of the coil, thus inclosing the mica disks and contact point

23, and is provided with an internal screw 27 into which the spark plug 24 fits. This spark plug comprises a central tubular piece of porcelain 25 or other insulating material which is not affected by heat, having a flange 26 formed thereon and adapted to be clamped between the interior shoulder 28 of the plug and the screw sleeve 29. After unscrewing the spark plug from the main casing 13' the porcelain core can be easily removed by taking out the screw sleeve 29.

Within the porcelain core is a conductor 30 terminating at its upper end in a contact point 31 adapted to press against the contact spring 23 when the spark plug is inserted in the main casing, and having at its lower end a point 32 of German silver, platinum or other suitable material, for the jump spark which is to perform the ignition in the engine. The lower end of the spark plug is provided with an external screw 33 for screwing into the engine in the customary manner; and the other terminal 34 for the jump spark is set in the end of the plug.

In operation, the current from the secondary coil passes through the conductor 22 to the spring contact point 23, thence through conductor 30 to point 32, thence across the air gap of the spark plug to the other point 34, thence back through the metal of the spark plug and casing to the conductor 21, which forms the other terminal of the secondary coil. During this circuit the positive and negative sides are carefully and completely insulated from each other at ample distance apart by the tubular core of porcelain. When the parts are in place the upper portion of the porcelain is inclosed tightly within the casing which surrounds the induction coil. As it is tightly shut into this chamber no air currents can enter to cause cracking of the porcelain; no water can enter to break down the insulation, and the porcelain remains unaffected by heat, no matter how great. The space surrounding the lower side of the porcelain communicates with the engine and is subject to the conditions of heat therein, and is likewise free from danger of breakage or sudden changes of temperature. The spark plug may be removed from its induction coil at any time by simply unscrewing the plug at 27; and the porcelain core can be removed and renewed by simply unscrewing the sleeve 29 which holds it in place. Upon replacing the plug



in the casing, contact is automatically made with the axial spring 23; and until replaced no contact can be made, because the central terminal is so well separated from the casing and is so inaccessible except in the normal manner. When assembled the plug and the casing may be safely handled, notwithstanding the fact that part of the circuit lies through them.

While either end of the secondary coil may be connected to the casing, it is preferable to connect the end which lies nearest the axis of the coil to the casing, and the end which issues at the periphery of the coil to the axial contact point 23, owing to the direction in which the coils are customarily wound, thus making the casing of negative polarity with respect to the spark gap. In order to carry the axial conductor 21 to the periphery and the peripheral conductor 22 to the axis, and keep them well insulated, I employ three disks of mica, 35, 36 and 37. The conductors 21 and 22 pass through holes in the first opposite the points where they issue from the coil, and 21 is then carried between disks 35 and 36 to the periphery, and connected to the casing. 22 pierces the second disk, 36, and reaches the axial contact 23 piercing disk 37 at a point well separated from the adjacent conductor 21 by the disks 36 and 37. Thus, these high tension conductors of opposite polarity are kept well separated within the apparatus.

While the invention is shown as applied to a jump spark apparatus with an induction coil having a primary coil and a secondary coil, it is obvious that the principle might readily be applied to a spark coil having but one winding and operating upon the principle of self induction in the well known manner; and in the claims the word "induction" coil is used in its broad sense as covering both kinds of coils.

The induction coil may be made of such form and size as are most convenient, and need not protrude much from the engine; or, on the other hand, the plug and neck 13' may be made as long as desired to hold the coil at a distance from the engine for cooling purposes, without thereby sacrificing the perfection of insulation. By removing the pins or screws which fasten the end piece 17 to the casing 13 that end of the casing may be opened and the entire coil may then be slipped out of the casing for examination or repair; and upon replacing it the contacts of its terminals 21 and 22 are automatically connected with the electrodes of the spark gap. Thus, the invention embodies apparatus by which both the coil and the conductors to the spark gap are firmly arranged and effectively insulated, and not likely to cause trouble; but in which either plug or coil may be easily removed and re-

placed without the use of special tools or special skill.

I claim:

1. Ignition apparatus, comprising a casing; an induction coil therein; a series of insulating disks within the casing at one end of the coil; an exposed terminal supported thereby; connections to said terminal and to the casing from the coil terminals, comprising wires placed among the disks; and a circuit from said exposed terminal through a spark gap to the casing.

2. Ignition apparatus comprising a casing having a single chamber with an electrically conductive surface exposed internally therein; means to attach a spark plug to the casing with one pole in electrical contact with said surface and the other pole exposed within said chamber and insulated from said surface; an induction coil adapted to be inserted removably in said chamber; said coil having its secondary terminals so exposed that one is forced into contact with said surface by insertion of the coil into the chamber and the other into contact with said exposed terminal of the spark plug.

3. Ignition apparatus comprising a casing; an induction coil insertible therein from one end, having a terminal set laterally and rubbing against the casing as the coil is inserted and another terminal exposed; and a spark plug attachable at the other end, having a terminal adapted to touch said exposed terminal within the casing, and having another terminal making electrical contact with the casing, the casing being a conductor.

4. Ignition apparatus comprising a casing having a single chamber with an electrically conductive surface exposed internally therein; means to attach a spark plug to the casing with one pole in electrical contact with said surface and the other pole exposed within said chamber and insulated from said surface; an induction coil adapted to be inserted removably in said chamber; there being an insulating casing surrounding said coil adapted to fit the portion of chamber occupied by the coil and bear against the wall thereof; one secondary terminal being set in the side of said insulating casing and adapted to bear against said internally exposed surface in the first mentioned casing; and the other secondary terminal being arranged centrally in the end of said insulating casing and adapted to engage the second mentioned pole of the spark plug.

In testimony whereof I hereto affix my signature, in presence of two witnesses, this eighteenth day of May, 1907.

ARTHUR E. ENGLAND.

Witnesses:

EVERETT E. KENT,  
JOHN BAXTER.