May 5, 1942. J. A. DORAN 2,282,040

IGNITION COIL

Original Filed Sept. 10, 1932

Fig:1.

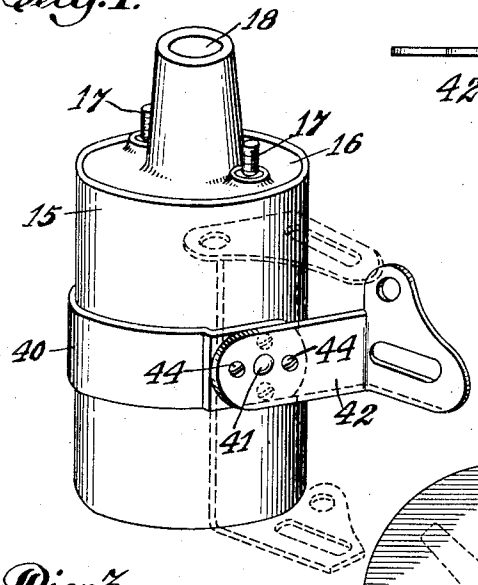


Fig:2.

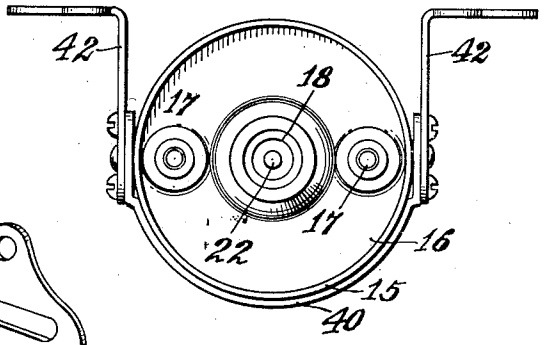


Fig:4.

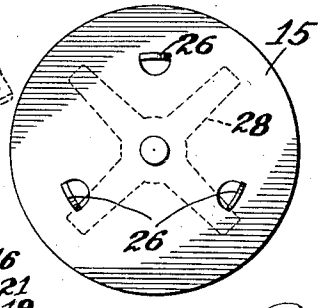


Fig:5.

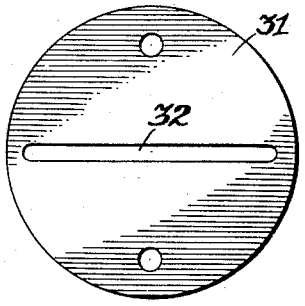


Fig:3.

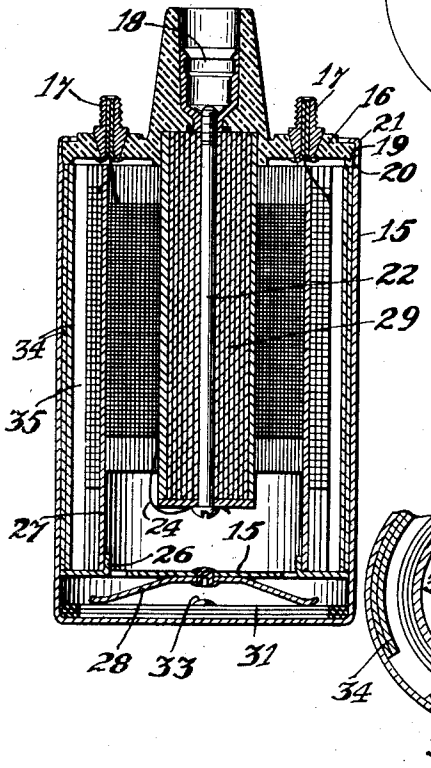
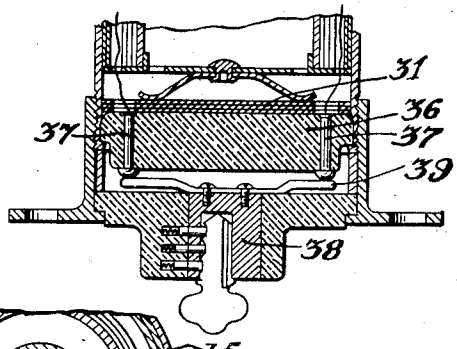


Fig:7.



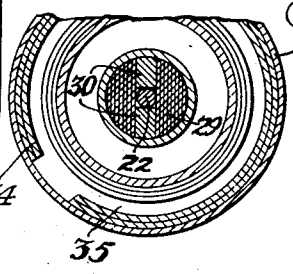


Fig:6.

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Patented May 5, 1942 2,282,040

UNITED STATES PATENT OFFICE

2,282,040

IGNITION COIL

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Original application September 10, 1932, Serial No. 632,483. Divided and this application September 25, 1939, Serial No. 296,367

16 Claims. (Cl. 175—357)

This invention relates to improvements in ignition coils, and this application is a division of my application Serial Number 632,483, filed September 10, 1932.

An object of the invention is the provision of an ignition coil which is practically unaffected by moisture.

Another object of the invention is the provision of an ignition coil in which the parts are rigidly secured to one of the heads before insertion into the casing.

Other objects are directed towards: arrangements to facilitate the conduction of heat from the windings to the outside air, breaking of the primary circuit by a second set of contacts in an inert medium, and other features which will be familiar to those skilled in the art.

The present practice is to construct ignition coils by mounting the complete coil in a tin can, the coil being imbedded in a material such as asphalt, in an effort to obtain protection against moisture and to secure an increased solidity for the tin container. The tin container has a cover consisting of an insulating head in which has been molded terminals and a metal ferrule which is soldered or otherwise secured to the upper edge of the container. Another common construction utilizes a fibre tubing having head and bottom plates bolted thereto.

These types of ignition coils have had certain disadvantages: (1) they have not been moisture proof, (2) the tin container lacks strength, (3) supporting brackets are not welded to the container, but instead must be clamped and bolted, and (4) it has been found difficult to mount a switch and lock assembly on the base of such containers. The present invention eliminates all of these disadvantages. A seamless steel housing forms a container for the ignition coil which may be drawn as a cup or formed as a tube. I have devised a novel solderless method for securing the insulation head to the steel container to make it permanently air tight and moisture proof. Fracture or leakage because of temperature changes or mechanical abuses is also eliminated.

An object of the invention is the provision of a soft steel container to assist in shielding the ignition coil whereby there is practically no escape of magnetic flux. The heavy wall of the container permits welding of the necessary support brackets thereto, and may be threaded to facilitate attachment of a switch and lock housing.

This novel securing of the insulation head to the container permits mounting the coil and the terminal wires directly on the head prior to assembly in the container, facilitates the assembly and assures permanent attachment of lead wires to terminals without risk of short circuiting. It also eliminates need for an asphalt filler, and provides an air space around the coil which facilitates cooling, and permits expansion and contraction of the windings assembly.

Furthermore, this construction provides a container that is leak proof and sealed, so that it may be filled with a cooling liquid such as transformer oil, and thereby be protected against overheating with consequent "burning out" of the windings.

Referring to the drawing:

Figure 1 is a perspective view of the novel ignition coil, a support bracket therefor having different positions indicated;

Figure 2 is a top plan view of the ignition coil;

Figure 3 is a vertical section therethrough;

Figure 4 is a plan view of the centering plate;

Figure 5 is a plan view of the lower coil disks;

Figure 6 is a transverse section through the ignition coil; and

Figure 7 is a fragmentary section showing a modified form of ignition coil with switch lock.

This improved ignition coil is devised for long life and improved operation. The long life is obtained by using a shell of soft steel into which an insulating head piece is secured, so as to eliminate all entry of air, moisture or vapor into the windings. The improved operation is obtained by utilizing the steel shell to eliminate flux leakage, by providing an annular air circulation passage around the windings, and by positioning steel segments in the air circulation passage to facilitate and control the flux flow. The improved construction also permits assembling permanently all the members to the head piece, thus facilitating the connecting of lead wires to terminals without risk of short circuiting, and permitting inspection and approval of the complete assembly before it is sealed in its container.

Referring to the drawing, Figure 1 shows the improved coil in perspective. The shell 15 is preferably cup form and of seamless drawn steel. The insulating head 16 is mounted in the open end; and is provided with primary terminal inserts 17 and a central secondary terminal socket 18.

The head has a bevelled periphery 19, and the shell 15 has a correspondingly bevelled seat 20 terminating in an upstanding flange 21 which is curled over the upper edge of the head to rigidly lock the head in the shell with the two bevels in

pressure engagement. This engagement is watertight, and serves as a substantial support for the head to prevent fractures or other mechanical injuries.

The coil windings are locked to the head by a bolt 22 passing through the core and is secured to the secondary terminal insert 23 in any suitable way, preferably by threaded engagement. This construction permits assembly of the winding to the head, and thus facilitates mounting of the secondary lead wire 24 and eliminates danger of improper connection and short circuiting.

A centering plate 15 below the windings fits snugly within the shell, and carries upstanding lugs 26 which fit into the downwardly projecting insulating tube 27 to support the windings against sidewise movement induced by external vibration. A supporting spring 28 mounted on the centering plate cushions the windings against shock, and permits the coil to expand or contract under changes of temperature. The centering plate is spaced a suitable distance below the central bolt to provide a safety spark gap therebetween. The distance between the central bolt head and the centering plate is less than the distance between the secondary terminals, thereby permitting a discharge from the bolt to the plate and to the ground if an accidental open circuit should occur in the high tension winding. This, therefore, prevents a discharge across the terminals under the insulating head.

The coil has the usual primary and secondary windings, and has a core which may be of any form, however, I prefer to use the core shown in Figures 3 and 6, which consists of a series of laminations 29 of varying widths to completely fill the bore of the windings. The central portion is formed by two blocks 30 of soft steel, of such dimensions as to provide an open space for the bolt 22. The material for the core is preferably soft silicon steel, or an alloy such as is best adapted for such use.

To facilitate the flux flow, a series of disks 31 is positioned beneath the spring 28, each disk having a diametral slot 32 to reduce eddy currents and hysteresis losses. The disks are preferably riveted together at 33 to maintain the slots in alignment. A series of segments 34 are mounted between the windings and the side walls of the shell, to provide additional paths for the flux.

An annular air space 35 of sufficient volume to permit circulation and prevent the coil from overheating, is provided between the segments and the windings. This protects the coil when it is used for long periods of time at high speed, or when it is accidentally short circuited by closure of the switch for several nours. The air chamber permits expansion and contraction of the windings during use, and thus protects the windings and the insulation material between the windings, permits free contraction of the coil in cold weather, and acts as an insulator against extreme temperature changes in the surrounding atmosphere. The container may be slit longitudinally to provide space for an insulating strip, thus further reducing the magnetic losses resulting from eddy and direct currents.

The coil may be provided in some instances with an ignition lock as shown in Figure 6, by mounting an insulating block 36 below the plates 31 and having contact pins 37 therethrough, an ignition lock 38 being provided to place a metallic cross bar 39 in contact with the pins 37 for completing the primary circuit.

A further constructional feature is the provision of a welded bracket. This is possible because of the strength and the thickness of the wall of the steel shell. A welded bracket is more rigid and more reliable than the conventional type of bracket that is attached by a bolted yoke strap.

While any suitable style of bracket may be welded to my container, I prefer the novel universal bracket shown in Figure 1 in which 40 is a curvilinear band welded to the side wall of the shell, and having a central stud 41 and four tapped holes at each side. The studs are preferably in the center line of the shell. Riveted to each stud is an angle piece 42 adapted to be turned to any desired position and locked by screws 44. This feature permits the angles to form a base mounting, a side mounting, or a "through the dash" mounting, as indicated by the dotted line positions shown in Figure 1. This bracket has the advantage of being changeable to any standard form without having any detachable parts to lose. Instead of welding a band 40 to the container, an equivalent construction may be obtained by welding two circular plates on opposite sides of the container as foundations to carry the studs 41 and screws 44.

It is therefore clear that the improved coil construction is air, moisture and vapor proof. It is strong and sturdy; is protected against all temperature changes, and against accidental short or open circuits; and facilitates manufacture and assembly by permitting a complete assembly of the windings on the head prior to mounting of the head in the shell.

While the coil and modifications have herein been described by way of example for ignition purposes, it must be understood that they are also applicable to various other electrical apparatus which come within the scope of the appended claims.

I claim:

1. In an ignition coil, a seamless metallic container, oppositely disposed bracket bases on said container, support brackets rotatably mounted on said bases, and means for locking said brackets against rotation in one of a plurality of selective positions relative to said container.

2. In an ignition coil, a seamless metallic shell counterbored at one end to form a beveled seating surface, an insulating terminal head of a diameter to fit the counterbored portion of said shell and having a beveled surface to cooperate with said beveled seating surface and form a tapered seal, and means locking said head in said shell with said seating surfaces in engagement.

3. An ignition coil including, a tubular steel shell, an insulator head carrying terminal inserts, threads formed on one end of said shell, a core secured to said head, a primary winding and a secondary winding on said core, and means cooperating with said threads, for locking said head to said shell in sealed relation and permitting said head, said core, and said windings to be bodily removed from said shell for inspection and test.

4. An ignition coil including a tubular shell, an insulator head carrying terminal inserts, a core, a screw securing said core to said head before said head is inserted into said shell, a primary and a secondary winding carried by said core, terminals on said head respectively connected to

said windings, and means for securing said head to the shell with a pressure seal therebetween.

5. In an ignition device, a steel-alloy core having a longitudinal passage formed therein, side blocks adjacent to said opening, and laminated plates on each side of said blocks.

6. An ignition transformer, a tubular steel shell, an insulator head mounted in said shell, said head having at least one terminal insert embedded therein, and a primary and secondary coil assembly rigidly mounted on said head and movable therewith, said coil assembly being positioned in said shell in space relation with the inner walls of said shell, thereby providing an annular air space thereabout for freely permitting unrestricted expansion and contraction of said coil assembly.

7. In an ignition coil, a seamless metal case having one end counterbored to form a tapered sealing ledge within the case, an insulating terminal head mounted in said counter-bored end and having a tapered sealing annulus in sealed engagement with said ledge, means for retaining said head in said sealed engagement with said ledge under pressure, a core rigidly secured to and carried by said head, primary and secondary windings on said core, means within said case for additionally supporting said windings, and a fluid within said case in heat transfer relation with said windings and core for conducting heat therefrom to said case.

8. An ignition coil including a seamless metal casing having one end counterbored to form a beveled sealing shoulder, an insulating terminal head having a beveled surface adapted to cooperate with said beveled shoulder, and a square annular shoulder about its periphery adjacent to its outer surface whereby the outer portion of the counterbored end of said casing may be spun over said last mentioned shoulder to retain said head with its beveled surface in sealing contact with said beveled shoulder.

9. An ignition coil sub-assembly including a terminal head having primary terminals and a center secondary terminal socket, a core formed of closely spiraled ribbon of magnetic material and having all convolutions thereof along one side severed by a slit extending through to a longitudinal passage in the center of said core, thereby reducing eddy current losses in said core, primary and secondary windings carried by said core, a long screw positioned in said passage and engaging a threaded center hole in said socket, whereby said core together with the primary and the secondary windings thereon may be rigidly secured to said head, and connections made to said terminals before said sub-assembly is mounted in its casing.

10. In an ignition coil, a switch lock mechanism, a terminal head, a core carrying primary and secondary windings, means for positively securing said core to said terminal head, a seamless tubular shell having one end internally counterbored and the other end externally threaded, said head with the core secured thereto being adapted to be mounted in said counterbore and retained by spinning over the thinned counterbored end of said tube, and detachable means for securing said lock mechanism to the opposite or externally threaded end of said shell.

11. The combination set forth in claim 10 in which the threaded end of the shell has the threads formed on its outer surface, and in which said detachable means is a short tubular member, internally threaded to engage the threads on said shell and having an inwardly disposed bezel formed at one end to engage a rim formed on the lock mechanism for movably supporting the latter on said coil.

12. In an ignition coil, a seamless metallic container formed of a cup having an annular shoulder adjacent to its open end, and a sub-assembly adapted to be positioned in air sealed relation with said shoulder comprising, an insulator head having a high tension terminal and low tension terminals, a magnetic core positively secured to said head, a high tension winding on said core having one end connected to said high tension terminal, a primary winding on said core having its ends connected to said low tension terminals, and a connection from the other end of said high tension winding to said primary winding, said core being secured to said head and all said connections being made before said sub-assembly is positioned in said container.

13. In an ignition coil, a sub-assembly including a primary winding, a secondary winding, a core supporting said windings, an insulating head carrying a high tension terminal socket including a threaded hole and a pair of primary terminals, and a screw for positively securing said core to said head whereby said primary and said secondary windings may be connected to said terminals before said head is finally mounted in an enclosing vessel.

14. In an ignition coil, a sub-assembly including a head formed of insulation material, primary terminals on said head, a high tension socket centrally located on one face of said head, a metallic insert in said socket having a central threaded hole formed therein, a cavity formed in said head centrally located in the opposite face of said head, a laminated core having primary and secondary windings thereon and a longitudinal hole extending therethrough, and a screw extending through said longitudinal hole and engaging said threaded hole for securing said core and said windings to said head so that connections between said windings may be completed before said sub-assembly is mounted in a casing, said core having a portion extending beyond said windings on one end for entering said cavity and thereby centrally locating the latter with respect to the axis of said head.

15. In an ignition coil, a tubular casing having one end counterbored to form an inwardly projecting tapered sealing shoulder, a terminal head having a tapered sealing shoulder adapted to cooperate with said first shoulder, a transformer centrally located on and positively secured to said head thereby forming a sub-assembly adapted to be bodily mounted in said casing with said sealing shoulders in contact, and means for maintaining the cooperating surfaces of said shoulders in intimate contact with each other.

16. In an ignition coil, a tubular casing closed at one end and having its other end counterbored to form a tapered sealing shoulder, a terminal head having a sealing shoulder matching said first shoulder, an ignition transformer secured to said head in concentric relation to the tubular wall of said casing with one end of the transformer adjacent to said head, and means within said casing adjacent to the closed end thereof for resiliently engaging the other end of said transformer and holding it in substantially concentric relation with said tubular wall.

JAMES A. DORAN.