B. DICK.

SPARK COIL.

APPLICATION FILED MAR. 10, 1919.

1,361,232. **Patented Dec. 7, 1920.**

2 SHEETS—SHEET 1.

Fig.3.

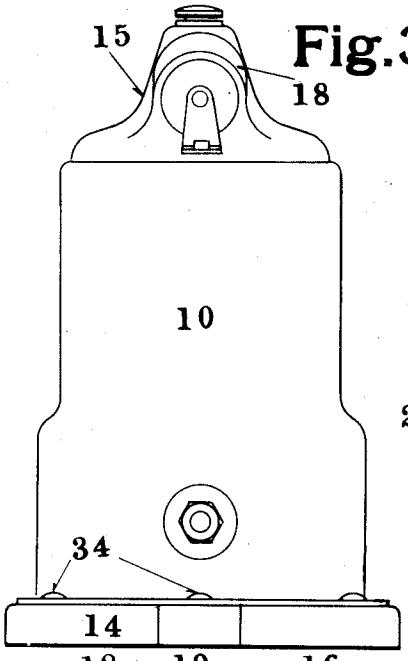


Fig.4.

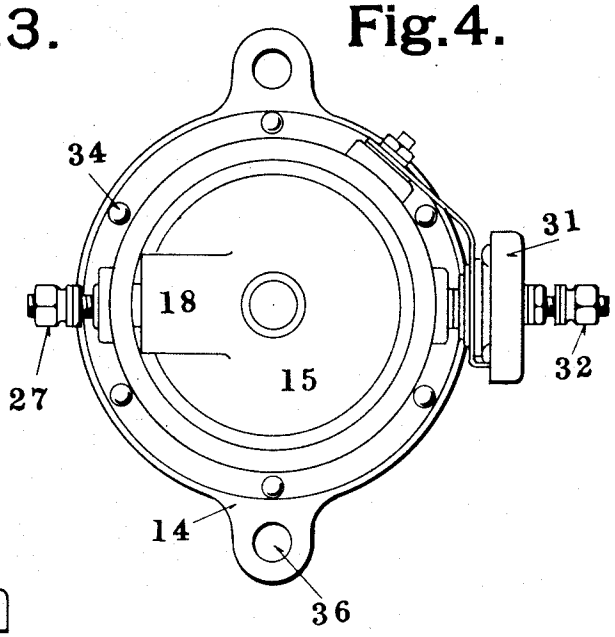


Fig.1.

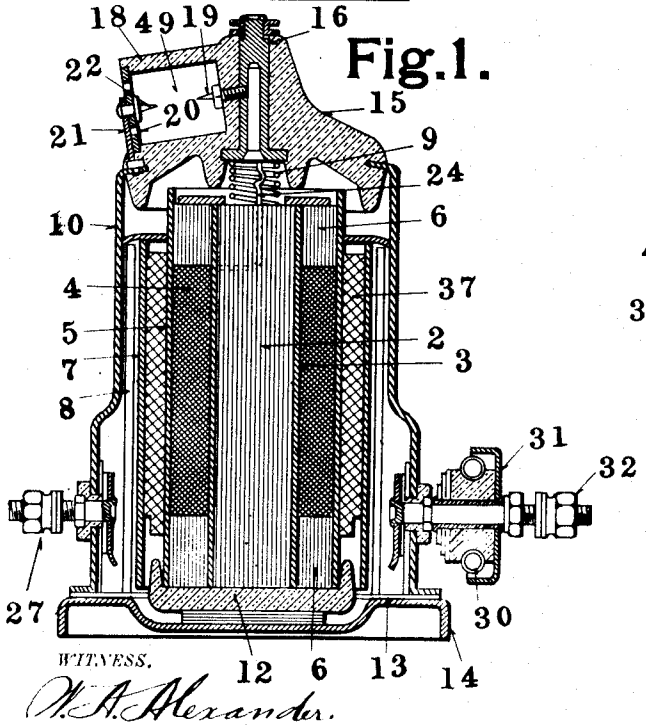
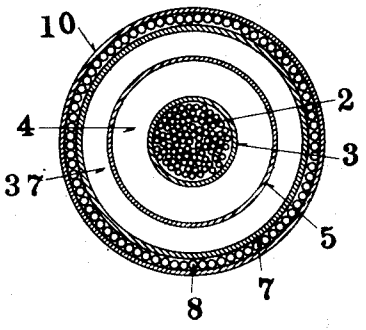


Fig.2.



WITNESS.

W. A. Alexander.

INVENTOR.

Burns Dick

BY

E. E. Huffman

ATTORNEY.

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2 SHEETS—SHEET 2.

Fig.5.

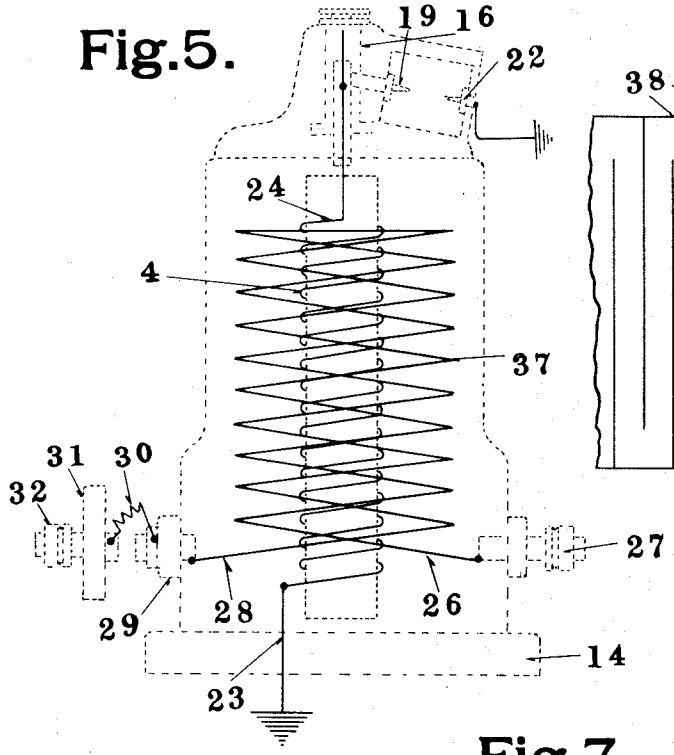


Fig.6.

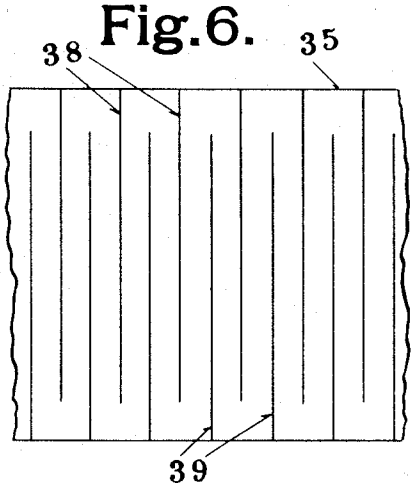
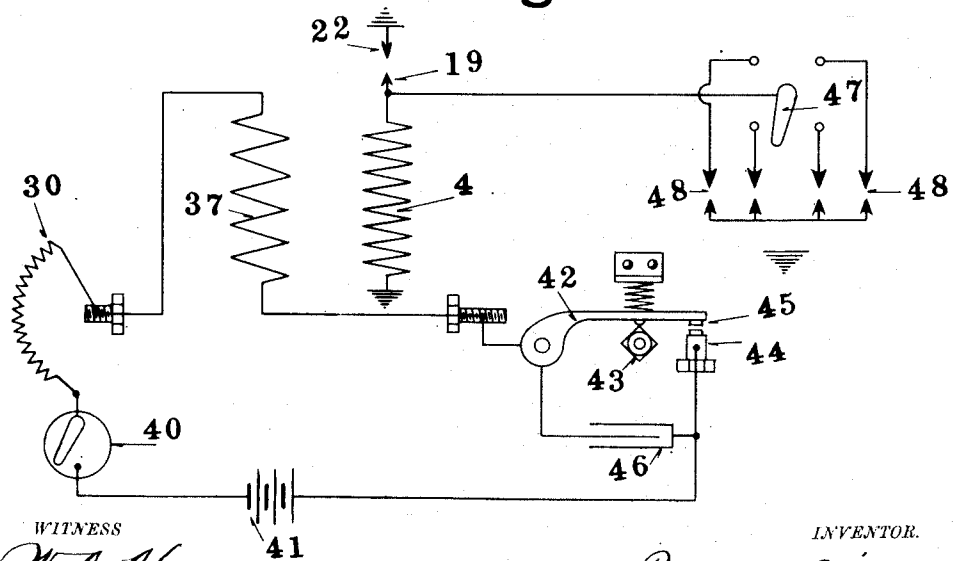


Fig.7.



WITNESS

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BY

E. E. Huffman

ATTORNEY.

UNITED STATES PATENT OFFICE.

BURNS DICK, OF ST. LOUIS, MISSOURI, ASSIGNOR TO WAGNER ELECTRIC MANUFACTURING COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

SPARK-COIL.

1,361,232. Specification of Letters Patent. Patented Dec. 7, 1920.

Application filed March 10, 1919. Serial No. 281,734.

To all whom it may concern

Be it known that I, BURNS DICK, a subject of the King of England, residing at the city of St. Louis, State of Missouri, United States of America, have invented a certain new and useful Spark-Coil, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to a form of induction coil known as a "spark coil" and used in connection with battery ignition systems for internal combustion engines.

It has for its objects to reduce the cost of such apparatus, to increase its efficiency, and to make it more rugged and better able to withstand the trying conditions under which such coils are used, particularly when mounted on automobiles and the like.

In the preferred embodiment of my invention, I arrange the high tension winding next to the core, ground the outside end of this winding and connect the inside end to the high tension terminal, and preferably also to the core. I further place the low tension winding of heavier wire in the outside of the high tension winding, and surround same with magnetic material, adapted to coöperate with the core and form a nearly closed magnetic circuit surrounding both windings. The coils, the core, and the shell are located in a metal case provided with a cover or cap made of highly insulating material, in which the high tension terminal is embedded, and the core is carefully insulated from the case. One end of the low tension winding may be grounded, or not as desired. Connection between the high tension winding and the high tension terminal is brought about by a member which is supported and guided by the core of the coil, and preferably makes resilient contact with the terminal.

My improved construction reduces the amount of high grade insulation required to a minimum, makes it possible to readily assemble coil and protecting metallic case, and allows of very readily adapting coils to widely differing conditions while using the same high tension winding.

In the accompanying drawings, Figure 1 is a longitudinal section through a coil embodying my invention; Fig. 2 is a transverse section of the same coil; Figs. 3 and 4 show a side elevation and a top view of the same apparatus, while Fig. 5 is an illustration of the inner connections of the coil; Fig. 6 shows a modified construction of the outer magnetic circuit, and Fig. 7 is a connection diagram for a complete ignition system including one of the improved coils.

Referring more particularly to Fig. 1 the inner magnetic core 2 is formed of a number of straight iron or steel wires, bound with tape or otherwise held together. In the figure they are surrounded by a tube 3, which may be of insulating material, such as paper, and on the tube is wound the high tension coil 4, composed of very fine and highly insulated wire, the layers of which are separated by thin sheets of paper which are allowed to project at 6 beyond the layers of wire. Concentrically surrounding this secondary is a low tension primary or exciting coil 37, composed of few turns of relatively large wire and separated from the high tension secondary by means of an insulating cylinder 5. Surrounding the primary, but insulated therefrom by the tube 7, is a layer or shell of magnetic material in the shape of iron or steel wires 8, held in place by tape or otherwise. The inner magnetic core 2 rests at one end on the cup 12, made of insulating material and which also supports the secondary coil 4. This cup rests on the metal base 14 which supports the whole apparatus and to which is riveted the metal casing 10 surrounding the primary 37 and the outer magnetic circuit 8. The small end of the tubular casing 10 is turned in to form a lip which engages the cap 15. This casing 10 is fastened to the base 14 by means of the rivets 34, with the interposition of a sheet of packing material 13, after the core, the secondary, the primary, and the outer magnetic circuit have been assembled within the case 10. The cap 15, made of insulating material, is enlarged at 18 so as to form a hollow chamber

49. The insulating cap 15 carries a metal terminal 16. The end 24 of the high tension winding 4 is carried around or through the core 2 to the brass spring 9 and soldered to it. This spring rests on the core 2 and is adapted to contact with the high tension terminal. It serves the double purpose of establishing an electrical contact between the high tension end of the winding 4 and the terminal 16, and of holding the core in place after assembling. This construction makes it particularly easy to assemble the apparatus because the workman is relieved of the necessity of handling the very fine high tension wire. A screw 19, tapped into the terminal 16, projects into the chamber 49 within the cap 15. This chamber is closed by a metal disk 20 provided with openings and attached to the metallic support 21 by means of the rivet 22 provided with a sharp point projecting into the chamber 49. The support 21 is held in place by means of rivets which place it and the rivet 22 in metallic connection with the casing 10 and base plate 14. On one side of the metallic casing 10 is a terminal 27, insulated therefrom and connected to the end 26 of the primary 37. The other end 28 of said primary is connected to the terminal 29, also insulatingly mounted on the metallic casing 10 in the position shown in Fig. 4. This terminal is connected to the terminal 32, also insulatingly mounted on the case 10 through a resistance 30 protected by a metallic cap 31. The end 24 of the secondary 4 is connected to the terminal 16, as already stated, while its other end 23 is grounded by being connected to the base-plate 14, and through it to the tubular casing 10. The base 14 is extended at two diametrically opposite points and provided with openings 36 which permit of same being readily fastened to a suitable support.

Instead of using wires for the outer magnetic circuit, indicated in Figs. 1 and 2, I can use a sheet of magnetic material, such as 35 of Fig. 6, in which case I prefer to provide same with a number of slots 38 and 39, cutting through almost the whole width of the sheet of metal from alternate sides and in the direction in which the magnetic lines would take in passing through said sheet.

The inner connections of the spark coil are best shown in Fig. 5. Terminal 27 is connected to one end of the primary while terminal 32 is connected to the other end thereof through the resistance 30. This circuit is insulated from the secondary. The outer end 23 of the secondary is grounded by being connected to the base 14 while the inner end is connected to the core, to the terminal 16 and to the terminal 19 of the safety spark gap 19, 22, the terminal 22 of which is permanently grounded by being connected to the case 10 and through it and the rivets 34 to the base 14.

By grounding the outer end of the secondary instead of the inner the necessary amount of expensive high grade insulation is considerably reduced and the risk of breakdown is minimized because of this reduction of necessary insulating material. A further advantage in this respect is secured by insulating the core from the frame and connecting the high tension end 24 of the secondary 4 to this core, for it is then unnecessary to insulate the inner layer of the high tension coil from the core.

Fig. 7 shows one way of incorporating this improved coil in an ignition system. The secondary 4 is grounded at one end while at the other it is connected to the terminal 19 of the safety spark gap 19, 22 and the high tension distributer 47 driven from the engine and making alternate connection with the engine spark gaps 48. The primary 37, together with its resistance 30, is connected in series with the ignition switch 40, the secondary battery 41 and the interrupter 42 comprising the stationary contact 44, the movable contact 45 and the engine-operated cam 43 adapted to separate the contacts 44 and 45 at the proper time and thus produce a spark at one of the cylinder spark gaps 48. The contacts 44, 45 are bridged by a condenser 46. In case the voltage at the terminals of the secondary 4 rises beyond a predetermined limit, the safety spark gap 19, 22 comes into operation and thus safeguards the insulation of the system.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a spark coil for internal combustion engines, the combination of a central core of magnetic material, a high tension secondary winding for producing ignition sparks, a low tension primary winding, said windings being concentric and the high tension winding being adjacent to the core and having its outer end grounded, a magnetic shell surrounding the primary winding, and a metallic protecting case surrounding the magnetic shell.

2. In a spark coil, a magnetic core, a high tension spark producing winding surrounding and adjacent to the core, the outer end of said winding being grounded and the inner end connected to the core, a low tension exciting winding surrounding the high tension winding, and a metallic case inclosing said windings and insulated from the core.

3. In a spark coil, the combination of a case, a high tension secondary and a low tension exciting winding in said case, a magnetic core, contacting means supported by the core and connected to one end of the high tension winding, an insulating cap

closing one end of the case and provided with a high tension terminal positioned to engage with the contacting means on the core when the core is in position in the case.

4. In a spark coil, the combination of a case, a high tension secondary and a low tension exciting winding in said case, a magnetic core, resilient means for holding the core in position in the case, a cap closing one end of the case and bearing upon the resilient core holding means when the core is in position in the case.

In testimony whereof, I have hereunto set my hand and affixed my seal.

BURNS DICK. [L. S.]