J. B. REPLOGLE.

SPARK COIL AND METHOD OF MAKING SAME.

APPLICATION FILED NOV. 25, 1916.

1,367,988.

Patented Feb. 8, 1921.

2 SHEETS—SHEET 1.

Fig. 1

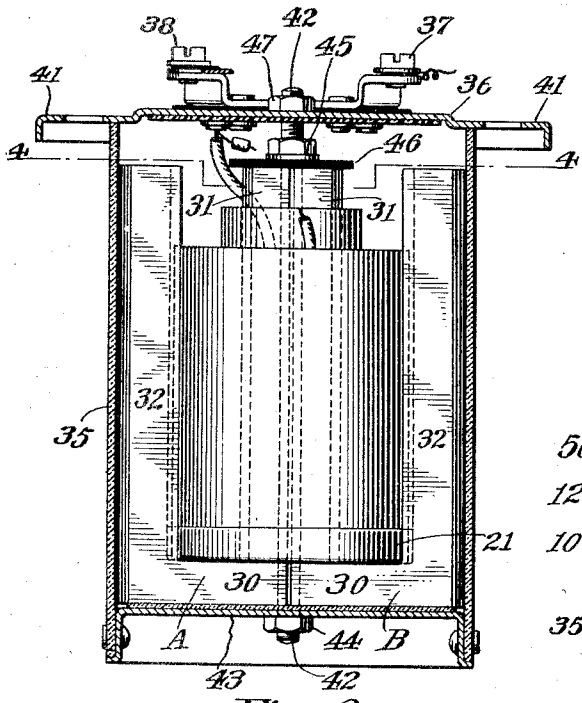


Fig. 3

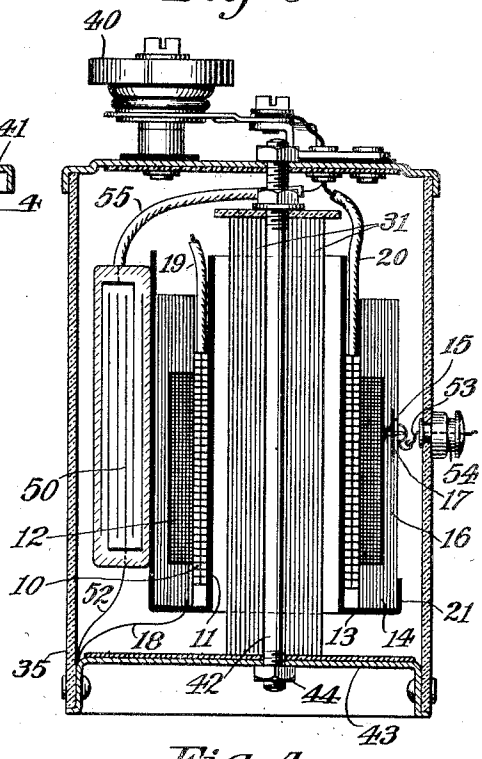


Fig. 2

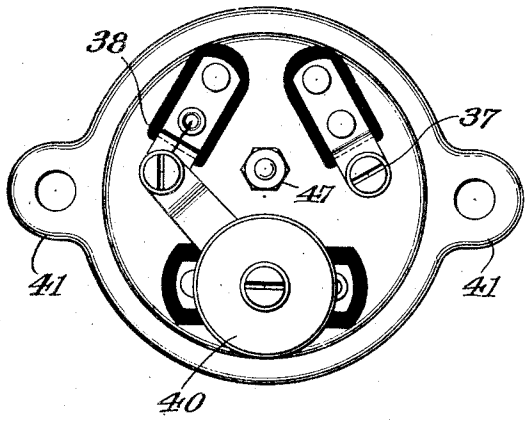
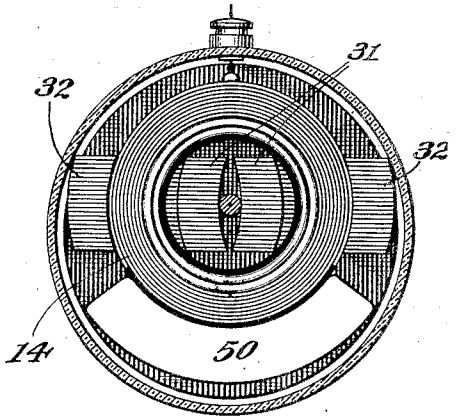


Fig. 4



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2 SHEETS—SHEET 2.

Fig. 5

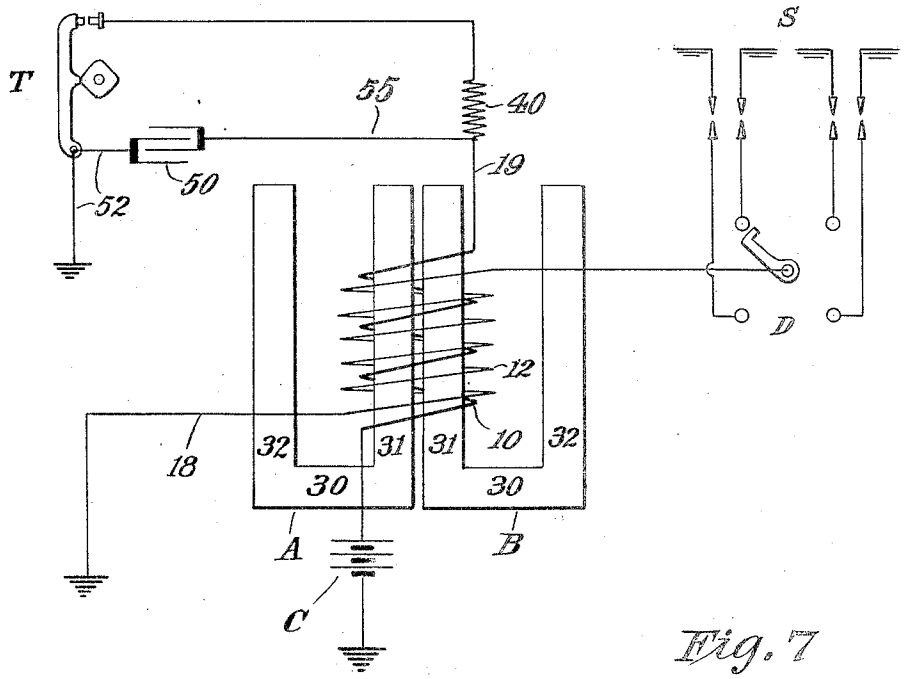


Fig. 6

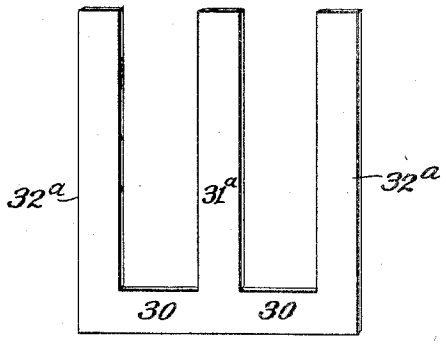
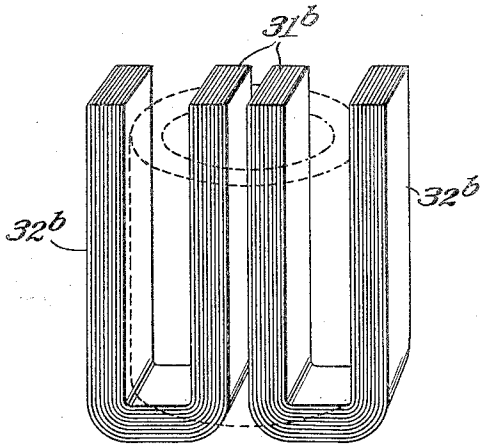


Fig. 7



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UNITED STATES PATENT OFFICE.

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SPARK-COIL AND METHOD OF MAKING SAME.

1,367,988. Specification of Letters Patent. Patented Feb. 8, 1921.

Application filed November 25, 1916. Serial No. 133,483.

To all whom it may concern:

Be it known that I, JAMES B. REPLOGLE, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Spark-Coils and Methods of Making Same, of which the following is a full, clear, and exact description.

This invention relates to certain new and useful improvements in spark coils, and has for its objects the provision of a coil which produces an efficient spark with a minimum of current. The construction is also such that the amount of winding is materially reduced over previous constructions and the cost of manufacture is thereby materially decreased.

The present invention also relates to improved methods of manufacturing coils, and these methods will be more explicitly pointed out hereafter.

The invention also relates to certain details of construction and arrangements of parts which will be more fully described in the specification shown in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings:

Figure 1 shows an elevation of my improved coil, the casing being shown in section.

Fig. 2 is a top plan view of the coil, and shows the arrangement of the terminals.

Fig. 3 is a sectional elevation view being taken at right angles to the view shown in Fig. 1.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is a diagrammatic view showing the relation of the primary and secondary windings to the laminated core pieces and showing in connection herewith an ignition circuit. The spark coil is particularly adapted for such use, but it is to be understood that it may be used for other purposes than ignition.

Fig. 6 is a detail view of a modified core construction.

Fig. 7 is a detail view of another modified core construction.

The present invention comprises broadly the usual primary and secondary windings disposed coaxially with respect to each other and preferably having the secondary outside of the primary winding in combination with a novel core construction.

This core in its preferred form is made up of a plurality of U-shaped stampings arranged in sets, each set having one branch extending upwardly within the windings and having another branch extending upwardly outside of the windings. The yokes of the U-shaped pieces connect the inner and outer branches at the bottom thereof, as shown in Figs. 1, 5 and 7.

Windings.

The primary winding 10 is wound upon a paper tube 11, and thereafter the secondary winding 12 is wound thereon. The secondary winding is made of a number of layers of fine wire, each succeeding layer being insulated from the adjacent layer in any desired manner, as by a layer of paper 14. The primary extends slightly above the secondary winding, as shown. After the winding of the secondary has been completed the outer end of the secondary wire is fastened to a pointed tack 15. A number of layers of paper 16 are then wound around and outside of the secondary, the tack successively perforating each layer of paper during the winding operation. Just before one of the last layers of paper perforates the tack a mica washer 17 is placed over the tack. The paper winding is then completed covering the washer. The tack now affords a convenient means of attaching a secondary lead which can be done by soldering a wire to the tack. The mica washer serves to anchor the tack more rigidly in the paper insulation at the outside of the coil, and protects the underlying layers against charring during the above mentioned soldering operation.

In winding the coil the inner end of the secondary is brought out at the bottom adjacent the fiber tube 11, as shown at 18, and the primary leads are brought out at the top at 19 and 20. When the winding of the paper layers 16 has been completed, a fiber cup 21 is placed over the bottom of the coil. The wound coils are then placed in a vacuum impregnator and a vacuum is maintained until all the air and moisture have been removed from the interstices of the coils. A heated insulating compound is then drawn into the impregnator by vacuum. This heat-

ed compound is of such character that it has relatively low viscosity at high temperatures and which solidifies by a gradual increase of viscosity rather than by crystallization from a mother liquid. As an example of such a substance, I may mention a mixture of 15% beeswax and 85% rosin. The liquid when turned in on the coils is heated to such a point that it has a low viscosity. The impregnator is kept closed and pressure is applied and the temperature of the liquid is kept high until the thin compound has filled all the interstices in the coils. The temperature is then decreased until the viscosity of the insulating compound has increased to such an extent that the coils may be safely withdrawn without having the insulating liquid run out. The coils are then ready for complete assembly with the cores within the casing.

Core construction.

As previously stated in brief at the opening paragraph of the specification, the core comprises in its preferred form a number of stamped U-shaped pieces or laminæ. These pieces have lower or yoke portions 30 and branches 31 and 32. A number of the U-shaped pieces are grouped together, and the set A thus formed is slid into position with branches 31 inside the fiber tube 11 and branches 32 outside the outer layer of paper covering the secondary winding. A second set of core pieces B is then slid into position with branches 31 inside and branches 32 outside the windings. The assembly of core pieces and coil is then ready to be placed in the casing. This casing comprises an open ended fiber cylinder 35, which cylinder is capped at its upper end by a metallic cover plate 36, having binding terminals 37 and 38 and a rheostat or resistance 40 thereon. This cover plate is provided with bosses 41 to attach the coil to any frame or fixed part. The cover plate 36 is apertured to receive a threaded rod 42. This rod passes through the space between the branches 31 of the two sets of core pieces A and B, as shown in Figs. 3 and 4, and passes through a hole in a bottom plate 43 and into a nut 44 as shown. By tightening down nut 45 a washer 46 (preferably of insulating material) may be clamped down tightly on the tops of the branches 31 of the core pieces. In this manner the core and the windings may be securely held in place in the casing, and by tightening nut 47 the top cover plate may be held in position against the top of the casing 35. By locating the holes in the cover and bottom plates which receive the rod 42 off center, the coil and core will be supported within the casing 35 at one side thereof. This provides space within the casing to receive a condenser 50 (see Figs. 3 and 4). This condenser may be curved to conform to the contour of the casing. The core described possesses several advantages over a core composed of E-shaped laminæ, in that the core composed of U-shaped laminæ may be manufactured with less waste of material. The two sets of U-shaped laminæ may be spaced apart to provide space for the central bolt 42 which secures the sets of laminæ together in position within the coil casing and which also secures the parts of the casing together; and the sets of laminæ may be arranged so as to conform substantially to the cylindrical surface of the coil, whereby to conserve space. This arrangement would not be possible with a single set of E-shaped laminæ.

It will be noted that the primary and secondary windings are less in height than the branch portions 31 and 32 of the cores A and B, that is, the distance between the ends of these coils when formed is less than the length of the branch portions. It will be noted that the coil windings 10 and 12 are located nearer to the yoke portions 30 of the cores A and B than to the outer free ends of these branch portions. Locating these coils in this manner causes the turns of the coils to be surrounded by as large a number of lines of magnetic flux as possible. However, these coils should be separated from the yoke portions sufficiently to minimize the possibility of a short circuit, particularly of the secondary winding.

Primary leads 19 and 20 are then connected to the terminals 37 and 38 on the top plate; secondary lead 18 and wire 52 leading to one side of the condenser are brought out of the casing and grounded on the bottom plate 43; a secondary lead 53 is attached to the tack 17 and attached to a binding post 54 on the outside of the casing. One condenser lead 55 is attached to a binding post on the top of the casing.

The connections to the various coils will be clearer by referring to Fig. 5. Here T represents a timer from the grounded side of which wire 52 leads to the condenser 50. The other side of the timer is connected through resistance 40 to the primary 10, which has connected thereto the grounded battery C. One side of the secondary 12 is grounded and the other end is connected to the usual distributer D leading to the spark plugs S.

Fig. 7 shows another modification in which the branches 32^b and 31^b are bent into planes parallel with each other.

It is understood that my invention is susceptible of various modifications, as will occur to those skilled in the art. What I claim as my invention is more particularly pointed out in the appended claims.

I claim:

1. A spark coil comprising a core having branch portions and a connecting yoke portion; and coil windings surrounding one

of the branch portions, said windings being less in length when formed than the height of the branch portions, and located nearer to the yoke portion than to the outer free ends of the branch portions; said branch portions being separated beyond the windings whereby to provide an air gap outside of said windings.

2. A spark coil comprising a plurality of U-shaped laminated core members each having branch portions and a connecting yoke portion; and coil windings surrounding adjacent branches of said core members and being less in height when formed than the height of the branch portions, and located nearer to the said yoke portion than to the free outer ends of the branch portions; said branch portions being separated beyond said windings whereby to provide an air gap outside of said windings.

3. The herein described method of making spark coils, which consists in winding the secondary winding of the coil in the usual manner, attaching a pointed tack to the end of the winding and then winding a plurality of layers of material outside the coil in such a manner as to cause the tack to successively perforate the said layers of material during the winding operation.

4. A spark coil having concentric primary and secondary windings, a plurality of layers of insulating material outside the secondary winding, a tack perforating the said layers and connecting with the end of the secondary winding, said tack forming a terminal to which a lead may be attached at the outside of the said layers of insulating material.

5. A spark coil having concentric primary and secondary windings, a plurality of layers of insulating material outside the secondary winding, a terminal extending from the end of the secondary winding radially through the layers of insulating material and having a mica washer embedded in the layers of material and associated with the terminal to aid in anchoring the same in the insulating material.

6. A spark coil comprising concentrically disposed primary and secondary winding, a core therefor having U shaped core pieces, a casing comprising a cylinder member having a base secured thereto, a cover plate adapted to coöperate with the cylinder, and a rod extending from base plate to cover within the casing and having provisions for retaining the core pieces in position upon the base plate, and the cover upon the cylinder.

7. A spark coil including a core comprising a plurality of sets of superimposed U-shaped laminæ; primary and secondary windings surrounding adjacent branches of said sets of U-shaped laminæ; a casing; and a common means adapted to secure both sets of laminæ in correct relation to each other and in fixed position upon a portion of the casing.

8. A spark coil including a core comprising a plurality of sets of superimposed U-shaped laminæ, the adjacent branches of said U-shaped laminæ being spaced apart; primary and secondary windings surrounding the said adjacent branches of the sets of U-shaped laminæ; a casing including a cylindrical member and base secured thereto and a cover adapted to coöperate with the cylindrical member; a rod having threaded end portions extending through the base member and the cover member of the casing, and between the adjacent branches of the core sets; nuts engaging the threaded portions of the plate to secure the cover member in position upon the cylindrical member; and a washer and a threaded nut engaging the plate and adapted to coöperate with one of the first mentioned nuts to secure the core in position upon the base member.

9. A spark coil including a core comprising U-shaped core members; coil windings surrounding adjacent legs of said core members; a casing having a supporting portion; and means for securing both core members in fixed position upon the said supporting portion of the casing, and in correct relation to each other.

10. An induction coil comprising a core having branch portions and a connecting yoke portion; and a winding in inductive relation to said core, said winding being less in height than the height of the branch portions of the core, and located nearer to the yoke portion of the core than to the outer free ends of said branch portions; said branch portions being separated beyond the windings whereby to provide an air gap outside of said windings.

In testimony whereof I affix my signature.

JAMES B. REPLOGLE.