G. HONOLD.

CONSTRUCTION OF COILS FOR ELECTRICAL APPARATUS.

APPLICATION FILED DEC. 3, 1910.

986,291. Patented Mar. 7, 1911.

Fig. 1.

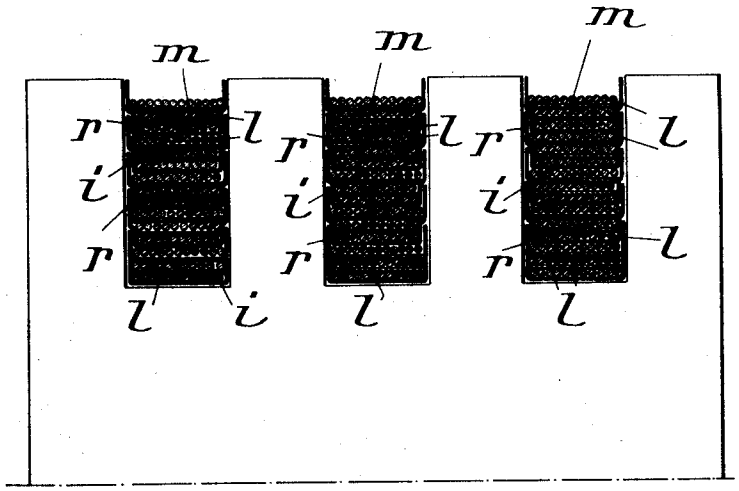
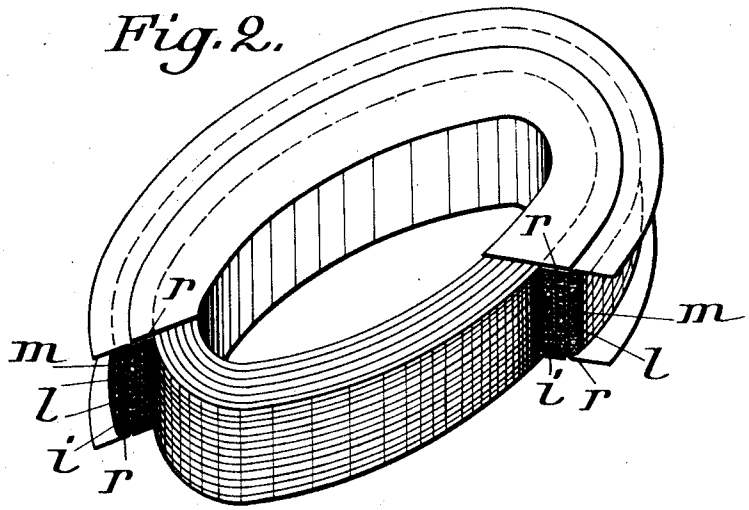


Fig. 2.



WITNESSES

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CONSTRUCTION OF COILS FOR ELECTRICAL APPARATUS.

986,291. Specification of Letters Patent. Patented Mar. 7, 1911.

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To all whom it may concern:

Be it known that I, GOTTLOB HONOLD, a subject of the Emperor of Germany, residing at Stuttgart, Germany, have invented certain new and useful Improvements in Construction of Coils for Electrical Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to a system of winding and insulating coils for electrical apparatus, and more particularly for the armatures of ignition machines for combustion engines. It is well known that in coils of this kind very high voltages are suddenly generated, so that there is imminent danger of breaking down the insulation, and more especially near the edge of the coils, rather than near the center, because in the more usual forms of construction, a spark more readily jumps from this point to the surrounding metal and then to another part of the winding. Moreover, the tendency for the spark to jump to the metal parts is aggravated by the fact that ordinarily one terminal of the armature winding is grounded on the frame of the ignition machine or engine.

There is no fundamental difficulty in eliminating the danger of edge discharges, if more insulating material be provided at these places, or if insulation of greater dielectric strength be used there. However, in windings of this kind it is of prime importance to utilize all the available space, and at the same time to produce a winding having requisite insulating properties together with a simple and commercially practical construction. To meet these requirements, various systems of insulating and winding the coils have heretofore been proposed, wherein attention has been principally directed to separating the layers of winding by layers of insulation as thoroughly as possible, and by increasing the thickness of the insulation at the edges in the form of swellings or the like where the wires are adjacent to the surrounding metal parts, as the armature iron, for instance. Although these prior methods of construction meet the requirements of practice to the extent of preventing breakdown of the insulation, especially by edge discharges, nevertheless they fail to satisfactorily fulfil to the desired degree the second condition specified, since they do not afford the necessary reliability in operation unless they are constructed with special care by skilled workmen. The present invention fully satisfies these conditions.

It consists in making the insulating material wider than the winding layer and in bending upwardly the edges, so as to form a trough. The sides of the trough insulate the sides of the winding from the surrounding metal and form a series of partly telescoped boxes in which each box contains a group of the winding layers insulated from the superjacent group by the bottom of the superjacent trough. By making the sides of the troughs correspondingly high, the outer conductor of each group is separated from the adjacent parts of the metal body by as many layers of insulating material as may be desired.

Inasmuch as the danger point for the edge discharges exists at the bending place of the upwardly bowed parts of the insulation layers, and since the edges themselves must be capable of a certain expansion in order that the sides of the troughs may lie flat against the edge surface of the coils, the choice of the insulating material is not entirely a matter of indifference. The desired result is best secured by employing fabric for this purpose, and more especially silk fabric provided with a suitable impregnation, the strips being cut on the bias, to wit, diagonally to the weave. In this manner the drawing apart of the threads of the fabric at the point of bending is prevented and at the same time, the desired expensibility for the outer edges is obtained.

In the accompanying drawings forming a part of this specification, Figure 1 is a longitudinal section through one-half of the winding of a coil constructed in accordance with the invention, wherein the coils are divided into separate groups and wound in slots of the iron core. Fig. 2 is a perspective view of a coil wound in accordance with the invention, the coil being shown partly in section to illustrate the construction.

In the exemplification of the invention illustrated, the winding is divided into

groups of coils, each of three layers *l*. In accordance with the degree of security desired, the number of layers in each group is made greater or less. The adjacent layers of each group are separated in the usual manner by a layer of insulation *m*, which reaches to the edge of the layer. Under each group there is a broader insulating strip *i*, whose sides *r* are bent upwardly. The sides *r* are, in this case, of sufficient width to cover the edge surfaces of the two lowermost layers of the superjacent group, so that at the bending places at the bottom of the trough, which are the main points of danger, the side insulation is double in thickness. The bending places of the lowermost troughs in each slot may have additional thickness of insulation in order to compensate for the fact that only a single layer of insulation exists at these points; or the coils may be so connected electrically that the voltage there is less than in the wires above, as will be readily understood.

In order to provide more space for the windings, I form a ledge in each trough, as shown, in such manner that upon completion of the winding the tops of the sides of the trough extend to the ledge of the superjacent trough. In this way the layer of coils above the ledge of its own trough may contain an additional number of turns, as shown in Fig. 1, thereby further improving the construction for the purpose specified.

It is obvious that as the number of layers *l* in each group is reduced or as the height of the sides *r* of the insulation is increased, the number of thicknesses of insulation between the coils and adjacent metal at the side may be increased as desired, in a simple and practical manner.

Having thus described my invention, what I claim is:

1. In a winding for electrical apparatus, a plurality of groups of coils each consisting of layers of insulated wires, and an insulating trough inclosing each of said groups and extending upwardly on the sides so as to inclose superjacent layers of coils also, thereby increasing the protection to the winding against edge discharges; substantially as described.

2. In a winding for electrical apparatus, a plurality of groups of coils each consisting of layers of insulated wires, and an insulated trough of fabric inclosing each of said groups and extending upwardly on the sides so as to inclose superjacent layers of coils also, thereby increasing the protection against edge discharges, said fabric being cut on the bias; substantially as described.

3. In a winding for electrical apparatus, a plurality of groups of coils each consisting of layers of insulated wires, and an insulating trough inclosing each of said groups and extending upwardly on the sides so as to inclose superjacent layers of coils also, each of said troughs having a ledge formed along each of its sides so that the winding space is increased in the trough above the ledges; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

GOTTLOB HONOLD.

Witnesses:

MAX ANSCHUTZ,

REINHOLD ELWERS.