C. SCOTT.

ELECTROMAGNET.

APPLICATION FILED JULY 30, 1906.

961,805. Patented June 21, 1910.

Fig. 1

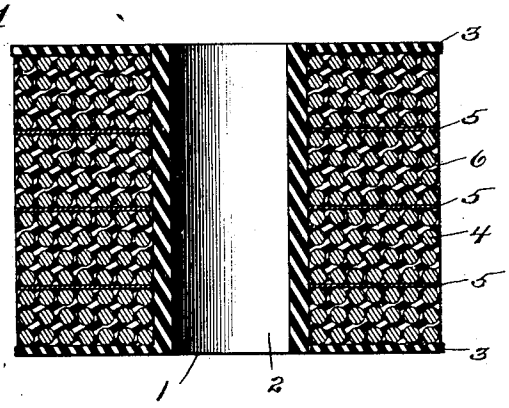


Fig. 2

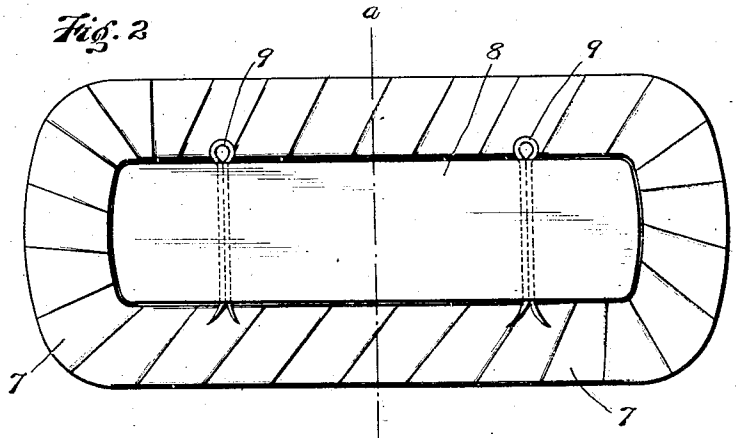
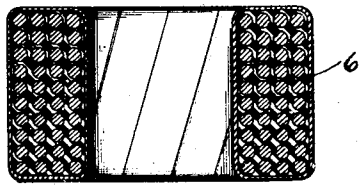


Fig. 3



Attest:

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UNITED STATES PATENT OFFICE.

CAMPBELL SCOTT, OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ELECTROMAGNET.

961,805. Specification of Letters Patent. Patented June 21, 1910.

Application filed July 30, 1906. Serial No. 328,300.

To all whom it may concern:

Be it known that I, CAMPBELL SCOTT, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Electromagnets, of which the following is a specification.

My invention relates to electrically-conductive coils or solenoids, particularly adapted for electro-magnets, and one of its objects is the provision of efficient, durable, and inexpensive coils or solenoids of such type.

A further object of my invention is the provision of electrically-conductive coils or solenoids which shall be self-sustaining and impervious to moisture as well as insulated to a high degree.

Other objects of the invention will appear hereinafter, the novel combinations of elements being found in the claims.

In the accompanying drawings, Figure 1 represents a sectional elevation of one form of a magnet solenoid embodying the features of my invention; Fig. 2 illustrates a modified form of solenoid in which the means for temporarily supporting the wires or conductors in proper position comprises a spirally wound insulated tape; and Fig. 3 is a section of Fig. 2 on the line *a*—*a*.

Obviously the coil or solenoid may be wound in any desired manner and made to assume any desired shape, but for the purposes of illustration, I have shown in Fig. 1 a symmetrical solenoid comprising a spool 1, of fibrous material, such as paper, for example. The core 2 is preferably cylindrical and hollow so that when the solenoid is completed and properly insulated, as hereinafter stated, it may be slipped over a fixed or movable iron plunger, or otherwise placed in proper relation thereto in well known ways.

Preferably the core 2 is composed of what is commonly known as "straw board tubing" which need be of only sufficient strength to support the convolutions and layers of wire wound thereon. The flanges 3—3 are preferably composed of the same material and may be integral with the core 2 or secured thereto by friction, shellac or glue. When the spool of fibrous material is completed, the insulated wire 4 is wound on, preferably by means of a winding machine, in even, compact layers. The wires may be electrically separated from each other in any desired manner, but they are preferably single or double, cotton or silk covered wires. If the wires are well insulated, as by means of two layers of cotton or silk, such insulated wire may be wound on the spool until it is filled to the desired amount. But if the wires or conductors 4 are single cotton covered or not so well insulated, I prefer to place paper or sheets of insulation 5—5 so as to divide the coil into sections as indicated in Fig. 1. Such paper or strips of insulation may, however, be placed between the layers longitudinally, either between each layer and the next, or only between every third and fourth layer. If the strips of insulation 5—5 divide the magnet into sections, such sections may be connected with a source of power in permutations.

In Figs. 2 and 3 I have illustrated a coil of wire oblong in shape and held in proper position by means of insulating tape 7. For simple magnets such as may be used in a potential switch apparatus on a controller board of an elevator system, the form shown in Fig. 1 may be found sufficient. But for other purposes, as for example, to operate accelerating switches, an oblong magnet may become necessary. The insulated wires are first wound on a fibrous spool or form so that the central opening of the coil will conform to the magnet core or plunger. Then when the magnet has been impregnated with insulating material, as hereinafter explained, the solenoid will fit such plunger or core snugly.

In Fig. 2 I have illustrated an oblong solenoid placed over a core 8 and prevented from slipping out of position by means of cotter pins 9, 9, which pass through an extension of the pole piece. This method of supporting the solenoid is particularly useful when the magnet is placed in a horizontal position on an elevator controller board.

After the spool of fibrous material has been wound with insulated wire, as shown in Fig. 1, or after an oblong coil has been

made, as shown in Fig. 2, such coils are placed in a vacuum tank for the purpose of extracting all moisture and air from the interstices of the fibrous material composing the spool covering or insulation. Liquid insulating material heated to any suitable temperature and having peculiar qualities hereinafter enumerated, is then allowed to be forced into the vacuum tank containing the coils, so that the latter will have their fibrous parts thoroughly impregnated and all interstices filled with such insulating material. That is, after all moisture is taken from the coils by any desired vacuum process, all the interstices of the coil are completely filled with liquid insulating material, not only as to the outer layers, the fibrous spools and insulating tape, but also as to the innermost layers. The insulating material found best adapted for this purpose is any composition which will melt or become liquid at a high degree of temperature, and which when the heat is reduced, will dry into a solid mass impervious to moisture and of sufficient adhesive strength to firmly hold the wires in close proximity to each other and thus effect a self-sustaining magnet coil. In actual practice it is found that one form of insulating material, black in appearance, will thus dry into a solid mass and hold the convolutions and layers of the wires firmly together and also attach securely to the spool or tape, as the case may be. Furthermore, such liquid insulating material, after it has filled all the interstices of the preliminary insulating material, and has been dried, will be absolutely impervious to moisture. The di-electric strength of such impregnating material is also great so that not only may a high voltage be applied to the finished product, but by reason of the excellent insulating quality of the material, there will be little leakage and consequent loss of current in the use of the magnet. Also such impregnating material may be of such composition that it will withstand a high degree of heat if once thoroughly dried.

I have not herein shown any means for carrying out the impregnating process as the process herein referred to is well known to the art. The important feature of my invention is the construction of a simple, efficient and inexpensive coil or solenoid for electro-magnets, self-sustaining, impervious to moisture, and otherwise possessing a high degree of insulation to electric currents or to high voltage static discharges, or to heating.

By the use of the spool of fibrous material for the winding or windings, the expense of the solenoid is very much reduced, as brass or similar material has heretofore been found to be necessary to give the solenoid the requisite strength and durability. If metal spools are employed, however, additional insulation is required between the covered wires and the core of the spool, and also between such wires and the flanges. Whereas, by the use of a fibrous spool, shown in Fig. 1, or by the use of insulating tape, as shown in Fig. 2, no such additional insulation is required. It should also be noted that the plunger or fixed iron core for the solenoid may be brought nearer to the windings than when a metal spool is used. The magnet will therefore be more efficient in that for a given number of ampere turns, more lines of force will be effective in coacting with the iron core to do the work required by the magnet.

Without limiting myself to any of the details of construction or arrangement of parts as defined by the claims, what I desire to have protected by Letters Patent of the United States is:—

1. The combination with a coil of conducting material wound in a plurality of layers, means for electrically separating the convolutions and successive layers of said coil, means for holding the convolutions of said coil in close proximity, and insulating material impregnating said holding means, said separating means, and the interstices between the respective convolutions and layers, said insulating material being impervious to moisture and of sufficient strength to hold the convolutions and layers rigidly together.

2. The combination with a spool of fibrous material, of a conductor wound thereon, insulation for electrically separating the convolutions and successive layers of said conductor, and a body of insulating material filling the interstices of the said convolutions and layers, and impregnating said fibrous material and the said insulation of the conductor.

3. The combination with a spool of fibrous material, of an electrically conductive coil wound spirally thereon in superimposed layers, fibrous insulation separating such layers, and a body of hard, strong, moisture-proof insulation impregnating the fibrous spool and fibrous insulation and filling the interstices between the successive convolutions and the successive layers of the coil.

4. The combination with a paper spool, of covered wire wound thereon spirally and in superimposed layers, and a moisture-proof, strong, adhesive insulation impregnating said paper spool and filling, substantially, all the interstices between the wire and the spool, and between the successive convolutions and layers of the wire.

5. As an article of manufacture, a fibrous support, an electrically-conductive coil

wound thereon, fibrous insulation for said coil, and adhesive, moisture-proof insulation impregnating said fibrous support and fibrous insulation and filling substantially all of the interstices between the support and coil and between the successive convolutions of the coil.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

CAMPBELL SCOTT.

Witnesses:
GEO. D. KILBERRY,
A. L. BABBS.