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2,180,420

INSULATED SPOOL FOR ELECTROMAGNETS

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FIG. 1

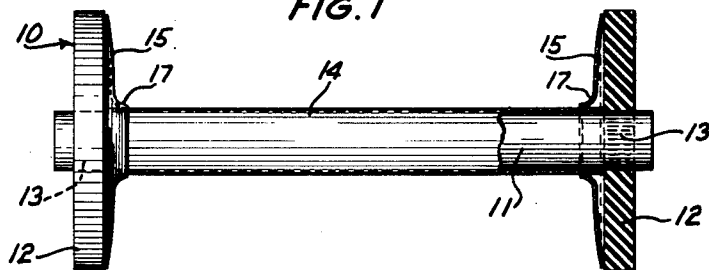


FIG. 2

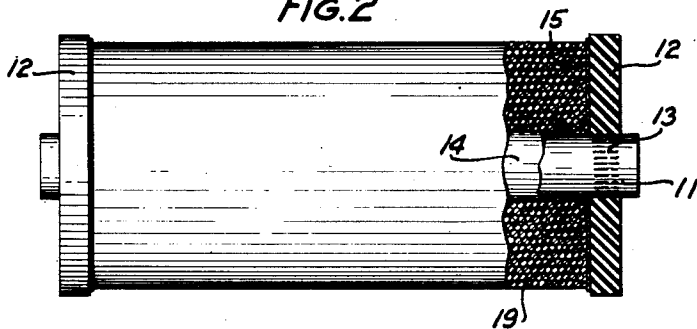


FIG. 3

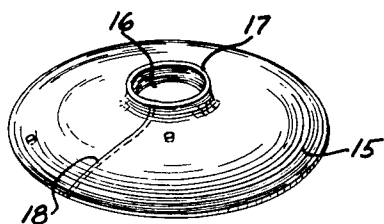


FIG. 5

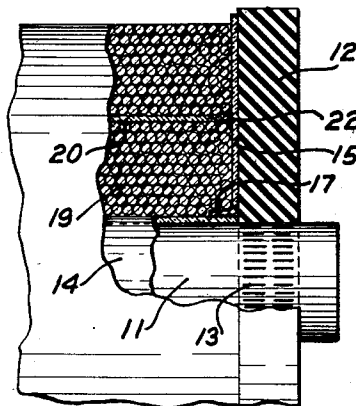
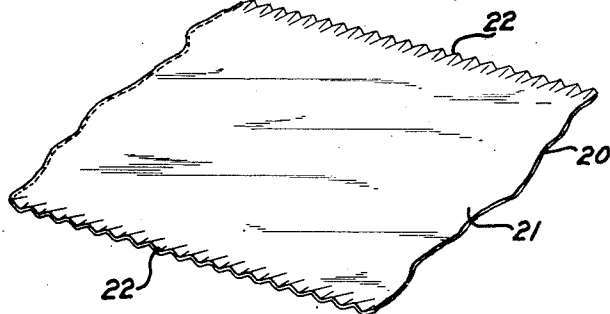


FIG. 4



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INSULATED SPOOL FOR ELECTRO-
MAGNETS

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6 Claims. (Cl. 175—21)

This invention relates to insulation, and more particularly to insulated coil spools and a method of producing insulated spools.

Certain types of electromagnetic coils are wound on preformed spools having cores of magnetic material and complete and effective insulation is required between the spool and the wire wound thereon as well as between successive windings of the coil. Because of their superior dielectric properties and stability, certain derivatives of cellulose, such as cellulose acetate, are particularly suitable for this purpose. When insulating a spool with these materials, which are most conveniently applied in sheet form, it is difficult to provide adequate insulation at the juncture between the core and the spool heads. In some cases this joint has been sealed with a plastic, such as pyroxylin cement, which is costly to apply and not entirely satisfactory from a service standpoint because any excess cement interferes with the subsequently applied winding and lack of uniformity in the seal may result in service failure of the coil.

Objects of this invention are to improve the insulation of spools for electromagnetic coils and to provide economical and efficient methods for their manufacture.

In accordance with one embodiment of the invention, insulation is provided for a coil spool of conventional construction having a core of magnetic material and a pair of heads of insulating material secured thereto. A sheet of cellulose acetate is wrapped around the core and a split washer of cellulose acetate is mounted against the inner face of each spool head, said washer having a slightly concave surface abutting the spool head, a central aperture encircling the core, and a peripheral ferrule extending therefrom over the insulation on the core. Windings placed on the core are insulated with a sheet of cellulose acetate inserted between the windings and having corrugated edge portions compressed against the spool heads.

A complete understanding of the invention may be had from the following detailed description taken in conjunction with the appended drawing, in which:

Fig. 1 is a side elevation, partly in section, of a coil spool provided with insulation in accordance with one embodiment of the invention;

Fig. 2 is a view, partly in section, of a completed coil wound on the spool shown in Fig. 1;

Fig. 3 is a perspective view of an insulating washer shown in Fig. 1;

Fig. 4 is a perspective view of a sheet of insulating material embodying an alternative form of the invention, and

Fig. 5 is an enlarged partial section of a coil insulated with the corrugated sheet shown in Fig. 4.

Referring now to the drawing, the invention is particularly adapted to a spool 10 of the type used extensively for relays and other electrical apparatus. The spool has a core 11, usually a soft magnetic metal or alloy, and a spool head 12 or flange, generally made of fibre or other non-conducting material, mounted on knurled end portions 13 at each end of the core or otherwise rigidly secured thereto.

To insulate the metal core effectively from the subsequently applied winding, the section of the core between the heads is covered with a sheet 14 of cellulose acetate or other material having satisfactory dielectric properties. Thin sheet material is used for this purpose and preferably applied in a plurality of layers to develop maximum breakdown strength. In one type of coil employed in communication equipment relays three layers and a lap of .002" thick cellulose acetate sheet were used on the core with satisfactory results.

After the sheet material is wrapped around the core it is coalesced with acetone, other suitable solvent or heat, leaving the end portions immediately adjacent to the heads unsealed. A split disk or washer 15 made of cellulose acetate and having a slightly concave or dished body is placed around the core and abutted against the inner side of each spool head with the concave surface of the washer against the head. The washer has a central aperture 16 (Fig. 3) conforming with the core insulation contour and an integral ferrule or flange 17 extending from the aperture towards the center of the spool over the core insulation.

In mounting the washer, it is spread at the split portion 18, placed around the core and slid along the core against the head. When the washer is compressed against the head its periphery initially engages the head and this frictional contact forces the ferrule against the unsealed end portion of the cellulose acetate sheet on the core. The sheet material flares out and is compacted under the ferrule to provide a smooth, well insulated support for the end helices of the bottom layer of the winding 19. Tension due to the concavity of the washer holds its periphery tightly against the spool head and prevents the wire from passing between the washer and the head during the winding operation. In a sense the ferrule serves as a sleeve to hold the unsealed ends of the insulating strip 14 in place and the body portion of the washer is an integral flange on the sleeve to insure an impervious layer of insulation at the juncture of the strip and the head. Since the washer extends over the whole inner face of the head, the latter may be made of a material having strength as its dominating property and less attention need be paid to its insulating properties.

Although the insulating sheet and washers can be made of various cellulose derivatives or other insulating materials, such as paper or fabric, cellulose acetate is preferred because of its superior electrical characteristics, suitability for forming and adaptability for sealing.

The insulating washers are formed from cellulose acetate sheet rapidly and economically in heated dies shaped to the proper contour. Material removed to provide the central aperture is formed or extruded into the flange thus avoiding waste and the concave shape is impressed in the washers during the forming operation. The dimensions of the washers are determined by the size and service requirements of the coil in which they are used. For certain types of relay coils washers formed from .010" thick cellulose acetate sheet are satisfactory, but widely varying thicknesses can be used for other applications. The degree of concavity required in the washer body will also vary but for small light washers very slight dishing is adequate.

In certain coils, a plurality of windings are applied to the spool and complete insulation is required between adjacent layers of the successive windings. Sheet insulating material has been employed for this purpose, but with this method the end helices of the wire are difficult to insulate adequately because the edges of the sheet did not conform to the surface of the wire adjacent to the heads. To overcome this difficulty an insulator sheet 20 of cellulose acetate is formed as shown in Fig. 4. A flat body 21 of the sheet conforms approximately to the length of the winding and terminates in a series of continuous corrugations 22 formed along each end of the sheet and extending beyond the body portion. As the end layer of the wire is applied over the sheet, the surplus material in the corrugations nests around the wire against the head, as shown in Fig. 5, to adequately insulate this portion of the coil.

In the preparation of the interleaving sheet the corrugations are readily impressed in the sheet by means of a heated die or by running the sheet through a pair of heated meshed gears or suitably shaped rolls engaging the edge portions of the sheet.

An insulator of this description can also be used on the cores in conjunction with the formed washers and is also suitable for insulating lead out wires, resistance wires or other areas within the coil or for other purposes. The increased length of material at the edges of the strip due to the corrugations lessens very markedly the danger of stresses occurring which would be of sufficient force to start a tear in the sheet.

Other modifications and adaptations of the specific embodiments disclosed herein are feasible, and it is to be understood that the invention is limited only by the scope of the appended claims.

What is claimed is:

1. A method of insulating a spool having a core and spaced heads on the core comprising the steps of wrapping a sheet of cellulose acetate around the core portion between the heads, coalescing the cellulose acetate sheet at the center of the core, and anchoring each unsealed end portion of the cellulose acetate sheet with a split concave washer of cellulose acetate material mounted against the inner surface of the spool

head, said washer having a periphery lying in a plane and adapted to lie against the inner surface of the spool head with the portion of the washer adjacent to the periphery dished away from the plane of the periphery.

2. A method of insulating a spool having a core and a head secured thereto preparatory to winding wire on the spool, comprising the steps of inserting a split concave washer formed of insulating material over the core with the concave surface of the washer against the spool head, and moving the washer into close engagement with the head, said washer having a periphery lying in a plane against the inner face of the spool head and the adjacent portion of the washer being dished away from the plane of the periphery to compress the periphery of the washer closely against the head out of the path of the subsequently applied wire.

3. A method of insulating a spool having a core and spaced heads secured to the core preparatory to winding wire on the spool, comprising mounting a split apertured circular disk of cellulose acetate material against the inner surface of each head with the apertured portion of the disk engaging the core, the disk being preformed into a concave shape having a periphery lying in a plane and adapted to lie against the inner surface of the spool head with the remaining portion of the disk being dished away from the plane of the periphery for holding the disk in close engagement with the head and preventing the subsequently applied wire from passing between the disk and the head.

4. An insulating washer for a coil spool having a core and a head secured to the core, comprising a split body with a central aperture for encircling the core, the periphery of said body lying in a plane and being adapted to lie against the inner face of said head and the portion of said body adjacent to the periphery being dished away from the plane of the periphery, and a flange extending from the body at the aperture for engaging the core.

5. In an electromagnetic device, a spool having a head and a core, and an insulating washer adjacent to the inner face of the head, comprising a peripheral portion lying in a plane and engaging the inner face of said spool head, a central portion engaging the core, and an intermediate portion extending from the periphery of the washer to the core-engaging portion dished away from the plane of the periphery into a normally concave shape which is distorted when the washer is positioned against the head for urging the peripheral and central portions of the washer respectively into close contact with the head and core.

6. In an electromagnetic device, a coil spool having a metal core and heads secured thereto, a strip of insulating material wrapped around the core, and a split concave washer of cellulose acetate material for insulating the spool at the juncture between the core and the head, said washer having a periphery lying in a plane against the inner face of the spool head with the remaining portion of the washer being dished away from the plane of the periphery for the purpose of preventing wire that is subsequently applied to the spool from passing between the washer and the head.

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