June 11, 1968 R. R. NOVICK 3,388,363

ENCAPSULATED ELECTRICAL COIL AND METHOD OF MAKING

Filed Feb. 8, 1966

FIG. 1

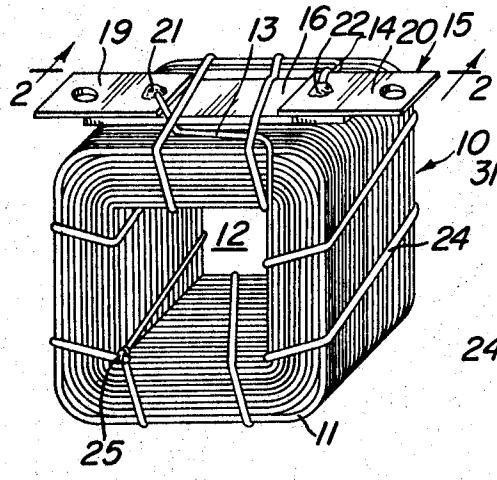


FIG. 2

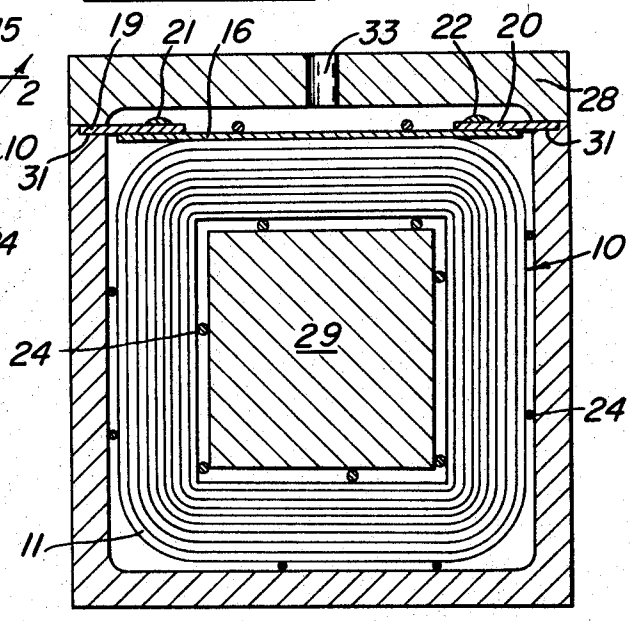


FIG. 3

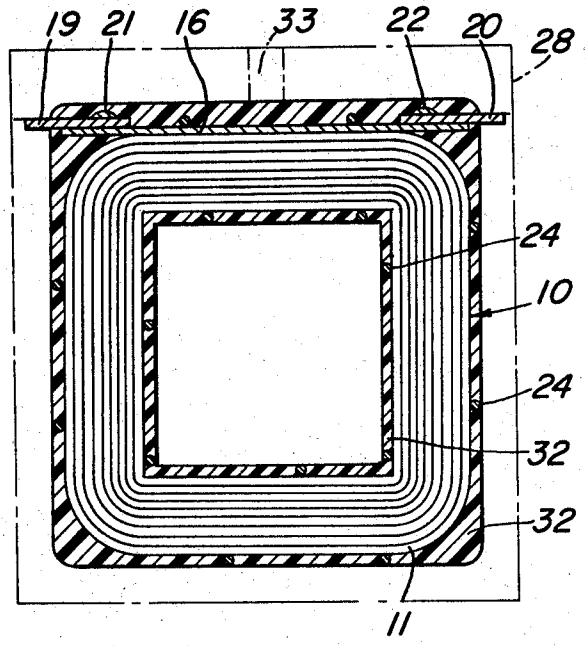
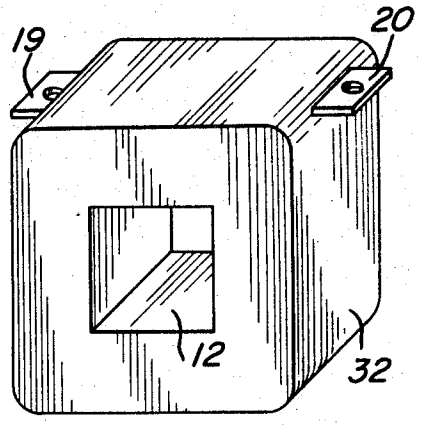


FIG. 4



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ENCAPSULATED ELECTRICAL COIL AND METHOD OF MAKING

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ABSTRACT OF THE DISCLOSURE

An insulative cord helically wound about the wall of an annular coil body holds a terminal plate and serves to space the coil body from a mold during encapsulation.

This invention relates to an encapsulated electrical coil having improved means for providing predetermined and uniform spacing between the body of the coil and the walls of a mold during encapsulation of the coil body to form the completed coil, and to a method of making the completed coil.

One of the problems encountered in the manufacture of encapsulated electrical coils is the difficulty of providing uniform spacing between the surface areas of the coil body and the walls of the mold during encapsulation thereby to insure that the encapsulating material is of the proper thickness throughout. This problem is solved, in accordance with the present invention, by means of an insulative cord wound helically several times about the coil body prior to encapsulation. The several convolutions of the cord serve as a spacing means between the coil body and the mold during encapsulation. The cord also reinforces the encapsulating material and, in the preferred embodiment, also holds a treminal board for the the coil in position.

An object of this invention is to provide an improved encapsulated electrical coil having an insulative cord wound several times about the coil body, the cord serving as a spacer during encapsulation of the coil body.

Another object is to provide an improved encapsulated electrical coil having a terminal board secured to the coil body by an insulative cord wound about the terminal board and coil body and serving also as a spacing means between the coil body and the walls of a mold during encapsulation of the coil.

A further object is to provide an improved method of manufacture of an encapsulated electrical coil.

Further objects and advantages of this invention will become apparent from the following specification wherein reference is made to the drawings, in which:

FIG. 1 is a perspective view of a coil body and terminal board of an electrical coil in accordance with this invention, a cord being wound about the terminal board and the coil body preparatory to encapsulation;

FIG. 2 is a sectional view taken generally as indicated at 2—2 in FIGURE 1 and showing the coil body within a mold prior to encapsulation;

FIG. 3 is a sectional view similar to FIGURE 2 but after encapsulation and with the mold shown in phantom; and

FIG. 4 is a perspective view of a completed coil.

Referring to FIGURE 1, there is shown an annular coil body **10** preferably of generally rectangular configuration and comprising a plurality of layers of closely-spaced turns of a continuous strand of insulated wire **11**. The coil body **10** is preferably formed by winding the wire **11** upon a removable bobbin (not shown) defining and received within a central opening **12**. Opposite terminal portions **13** and **14** of the wire **11** extend from

the coil body **10** and, in the illustrated embodiment, are electrically connected to a composite terminal board **15**.

The terminal board **15** comprises an elongated rigid insulating strip **16** having a pair of perforated metal terminal plates **19** and **20** secured to its opposite end portions, respectively, as by an adhesive or rivets not shown). The terminal portions **13** and **14** are electrically connected to the terminal plates **19** and **20**, respectively, as by soldered joints **21** and **22**. In accordance with this invention, an insulative cord **24** formed of vegetable fiber or synthetic material is wound about the coil body helically as indicated, the convolutions of the cord **24** passing through the central opening **12** and some passing over the insulating strip **16** to the hold the terminal board **15** in assembled position on the coil body **10**. The cord **24** may be knotted where necessary as at **25** if vegetable fiber is used, or the necessary junctions of the cord may be heat sealed if a plastic cord having the proper thermal characteristics is used. The cord **24**, if of vegetable fiber, may be impregnated with a suitable insulating varnish or the like to improve its dielectric properties. Although the cord **24** preferably is continuous, as shown, it is apparent that more than one length of cord may be used as desired.

In order to encapsulate the assembled coil body **10** and terminal board **15** of FIGURE 1 with a coating of insulating material, the assembly is placed in a two-part mold **28** as shown in FIGURES 2 and 3. Although only one part of the mold **28** is shown, it will be understood that the two parts of the mold are identical, each having a central projection **29** which enters the opening **12** in the coil body **10** and defines an annular chamber **30** for receiving one-half of the coil body **10**. Preferably, notches **31** formed in the mold receive respective opposite end portions of the terminal plates **19** and **20**. The outer surfaces of the coil body **10** are spaced from the bottom and side walls of the mold by the convolutions of the cord **24** and the surfaces of the coil body **10** defining the central copening **12** are spaced from the side walls of the projecting portions **29** of the mold **28** by the portions of the convolution of the cord **24** passing through the central opening **12**.

After the assembled coil body and terminal board are placed in the mold **28**, a suitable encapsulating material **32** in liquid form and compatible with the insulation on the wire **11** and with the cord **24** is introduced into the chamber **30** as by being poured through an orifice **33** at the top of the mold **28**. The encapsulating material **32** flow between the outer peripheral surfaces of the coil body **10** and the outer walls of the mold as well as between the surfaces defining the opening **12** and the side walls of the projections **29** because of the clearance spaces provided by the cord **24**. It is to be noted that because the cord **24** is helically wound about the coil body **10**, passages are provided for the liquid **32** to flow into and fill all spaces between the coil body **10** and the walls of the mold **28**. The material **32** may be thermosetting or it may be of the type that hardens at room temperature, with or without the addition of a hardener, such as an epoxy compound.

After the material **32** has solidified, the mold **28** is removed and the finished coil as shown in FIGURE 4 has a solid coating of insulating material **32** of substantially uniform thickness covering the entire coil body **10**, except for the upper surface above the terminal board **15**. In the illustrated embodiment, the coil body **10** and the mold **28** are so proportioned that a thicker layer of the material **32** may be provided above the terminal board **15** by completely filling the mold **28** during the pouring operation. It will be understood that if the terminal board **15** is not used, the mold could be proportioned so that

the coating 32 would be of uniform thickness throughout.

Although, for illustrative purposes, a simple pouring operation has been described for filling the mold 28 with an encapsulating material 32, it will be understood that other well-known methods for introducing encapsulation material into mold may be used without departing from the scope of the invention.

I claim:

1. A method of making an encapsulated electrical coil which comprises winding a strand of insulated wire into a multi-turn annular coil body having an outer periphery and a central opening, electrically connecting the ends of the strand of wire to a terminal board after the coil is wound and positioning the terminal board against a portion of the outer periphery of the coil body, winding an insulative cord helically about the coil body with the convolutions of the cord passing through the central opening and at least one of the convolutions of the cord passing over the terminal board to thereby hold the terminal board in its position on the periphery of the coil body, placing the coil body with the terminal board and cord wound thereon in a mold with the cord defining a space between the coil body and at least some of the walls of the mold, introducing encapsulating material into the mold to the extent necessary to fill the space between the coil body and the walls of the mold, allowing the encapsulating material to solidfy, and removing the encapsulated coil from the mold.

2. An encapsulated electrical coil comprising: an annular coil body formed of a plurality of turns of an insulated electrical conductor and having an outer periphery and a central opening, a terminal board electrically connected to a pair of ends of the electrical conductor, an insulative cord forming a plurality of spaced convolutions about the periphery of the coil body and and passing through the central opening with at least one of the convolutions positioning the terminal board on the outer periphery of the coil body, and a layer of insulating material encapsulating the coil body, the terminal board and the cord to provide a completed coil, said layer of insulating material providing an outer surface for the completed coil and having a thickness substantially equal to the diameter of the cord throughout most of the surface area of the completed coil.

3. A coil in accordance with claim 1 characterized in that the cord is formed of flexible synthetic material.

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