Dec. 14, 1954 R. W. FINHOLT 2,697,055

METHOD OF INSULATING AN ARMATURE COIL

Filed June 22, 1953

Fig. 1.

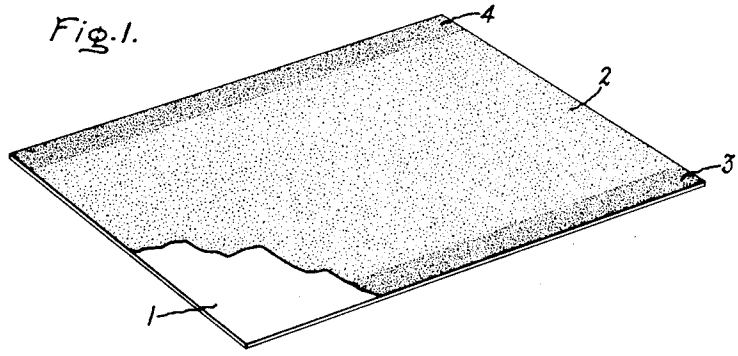


Fig. 2.

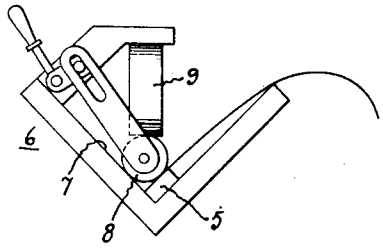
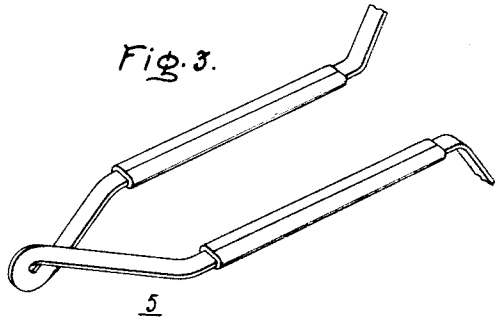


Fig. 3.



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METHOD OF INSULATING AN ARMATURE COIL

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2 Claims. (Cl. 154—80)

My invention relates to armature coil insulating means.

The insulation of formed armature coils which are designed to be fitted into slots in the rotors of large electrical machines presents a number of problems. One of these is that the insulation, while meeting rather stringent electrical requirements in high voltage machines, should take up as little space in the rotor or armature slot as possible. Another is that the insulation must be mechanically strong and tightly fitted about the armature coils in order that it will not break or tear when the coil is forced into the slot. One desirable way of applying the insulation is to wrap on the straight sides of the formed coil a few turns of a relatively wide tape or sheet. Regenerated mica sheet material has been found to meet the electrical requirements very successfully, and, when it is backed with a cloth or other material having a relatively high tensile strength, it may be economically applied by a wrapping machine. However, the presence of the backer is generally undesirable since it adds to the overall thickness but contributes little electrical strength.

It is an object of my invention to provide an improved method of wrapping an armature coil with regenerated mica sheet material.

It is a further object of my invention to provide an improved regenerated mica sheet insulating material having a relatively high strength without the addition of a cloth or other relatively thick backer thereto.

It is a still further object of my invention to provide an armature coil having an improved insulating wrap which is capable of being tightly applied by machine methods.

In accordance with my invention a regenerated mica sheet insulating wrap is coated with a rubber type cement which is capable of being solvent reactivated. After the adhesive has dried to the point where it is no longer sticky or tacky, the flexibility and tear strength of the mica sheet are greatly increased. A low boiling point solvent is then applied along one end portion of the wrap and this edge of the wrap is placed in contact with the length of an armature coil also covered with dry adhesive, whereupon it instantly adheres to the coil. The sheet is then tightly wrapped around the coil side, the remainder of the adhesive which is not solvent reactivated acting as a strong flexible backer which prevents the mica sheet from tearing or breaking despite the tensions involved in wrapping the sheet and maintaining its alignment. The insulating layers thus formed are compact and relatively thin.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing in which:

Fig. 1 represents a sheet of regenerated mica material which has been prepared in accordance with my invention;

Fig. 2 illustrates a coil being wrapped with the sheet of Fig. 1; and

Fig. 3 is a wrapped armature coil.

Referring now to Fig. 1, the sheet **1** is made of a regenerated or reconstituted mica material. Such a material is suitably prepared from finely divided mica particles in a conventional manner in sheet form. The sheet may be impregnated with a suitable resin such as a silicone varnish. The resulting material, while possessing excellent insulating qualities has a relatively low tensile strength and easily breaks or tears when sharply bent. Accordingly, for many winding applications, sheets of this type of material are provided with a glass cloth or other backer sheet for added tensile strength. However, as shown in Fig. 1, the sheet **1** has no additional cloth or paper layer but instead is provided with a coating **2** of a rubber-type cement which is allowed to dry. It is characteristic of this type of adhesive that it may dry so that it becomes substantially non-tacky and that it can be reactivated by a low boiling point solvent such as acetone or other organic solvents having a boiling point suitably between 35 to 80 degrees centigrade. Immediately before beginning the wrapping operation narrow strips **3** and **4** along opposite ends of the sheet **1** are moistened with a low solvent of the type mentioned above, such as acetone, to temporarily make that portion of the coating tacky or sticky.

While the adhesive does not impregnate the mica sheet as would binder materials added either during the sheet forming process or afterwards to help bring up the tensile strength to a minimum acceptable level, the dried adhesive as an adhering coating prevents cracking or breaking of the sheet when it is stressed and increases its tear strength. One such adhesive material that may suitably be employed is a rubber type cement marketed by the Goodyear Tire & Rubber Company, under the trademark "Pliobond." Thus a sheet of regenerated mica material of 5 mils (0.005 inches) thickness has its tensile strength effectively doubled by the presence of a dried 1 mil layer of the rubber type adhesive. The tear strength of a strip one inch wide with an ⅛" deep nick was increased to 12 pounds from its original 2 pounds.

Referring now to Figs. 2 and 3, a formed armature coil **5** is shown. This coil has straight side sections having a rectangular cross section to fit within the armature slot of a machine rotor, each such coil usually being built up of a number of conductors. Before being wrapped the coil sides are also coated with the rubber type adhesive and allowed to dry. Fig. 2 shows a coil being wrapped by a machine **6** suitably comprising an elongated jig member having a V-shaped groove **7** therein into which a straight portion of a coil is placed. A cylindrical roller **8** is placed within the groove **7** of the jig on top of the side of the coil **5** and suitably biased against it by a spring means **9** so as to press the insulating sheet against the coil sides as the coil is rotated within the groove. It is important also that the unwrapped portion of the sheet be manually or otherwise guided to maintain the wrapped layers in alignment with each other.

To start the winding operation the sheet **1** of Fig. 1 is positioned with the solvent reactivated portion **3** thereof along one surface of the straight side of a coil **5**. The mica sheet immediately adheres to the coil side so that upon turning the coil on the lengthwise axis of the coil side, the remainder of the sheet **1** is wrapped about the coil side. Due to the fact that the solvent which is employed to reactivate the end strip portion **3** of the adhesive layer **2** has a low boiling point it evaporates quickly, requiring the portion **3** to be immediately placed in contact with the coil side after being reactivated. By the same token, the tacky surface **3** adheres instantly without slippage to resist the force necessary to pull the layers of the sheet as they are formed under the roller **8**. The main body of the sheet **1**, however, does not have its adhesive layer **2** reactivated and hence retains its enhanced flexibility and tensile strength. In this way the sheet or wrap withstands the forces caused by a substantial roller pressure and by tension applied to maintain the sheet in alignment so that the edges of the wrapped turns exactly overlie each other. I have found, for example, that with material of the thickness described in Fig. 1, about four turns or layers are sufficient to provide a mechanically strong and compact yet electrically adequate insulation. The wrap is self-sealed in position by adhesion of the other reactivated strip **4** to the wrapped turns. If desired, the strip **3** may be reactivated by applying the solvent directly to the dried adhesive on the coil.

The coil thus insulated, as shown in Fig. 3, may be suitably bound with a tape designed to protect the high voltage insulation provided by the mica wrapper from rough handling and destruction during fitting of the armature coil into the armature slot. After installation the machine is usually required to run at elevated temperatures as much as 200 to 300 degrees centigrade, and could be run as high as 500° C. as far as the coil insulation is concerned. At such temperatures the adhesive decomposes, but after installation this does not affect the satisfactory operation of the armature coil assembly providing that a heat stable resin has been used to impregnate the regenerated mica sheet. Likewise the residue remaining does not affect the insulating properties and since the adhesive layer is very thin, the resulting insulation is essentially the thickness of the mica sheet material itself.

Thus it may be seen that by the use of my invention the added bulk usually required for a cloth or strong paper backer is avoided and the dried thin adhesive layer imparts sufficient flexibility and strength to the mica sheet during the winding or wrapping process to prevent mechanical failure of the sheet which might otherwise occur due to misalignment as the winding progresses. An additional advantage is also provided that the adhesive layer is reactivated to enable the wrap to be conveniently started on the coil to form and may also be reactivated along the end portion to prevent the sheet from becoming unwrapped.

While I have shown and described a specific embodiment of my invention, it will of course be understood by those skilled in the art that other modifications may

be made without departing from the principles of the invention. I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of insulating an armature coil which comprises coating a regenerated mica sheet with a rubber-type adhesive, allowing the coating to dry to thereby strengthen the sheet, reactivating a narrow strip of said sheet along one end thereof with a solvent to attach said sheet to the coil, and wrapping the sheet around the coil.

2. The method of insulating an armature coil which comprises coating a regenerated mica sheet with a rubber-type adhesive, allowing the coating to dry to thereby strengthen the sheet, reactivating a narrow strip of said sheet along opposite ends thereof with a solvent, attaching one of said reactivated ends to the coil, and wrapping the sheet around the coil for a plurality of turns until the other of said reactivated ends is attached to the underlying turn.

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