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J. J. VIENNEAU
HIGH VOLTAGE WINDING
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2,194,338

Fig. 1.

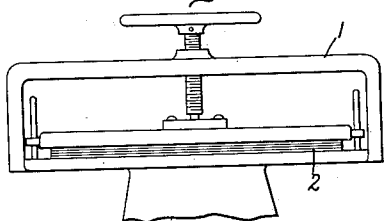


Fig. 2.

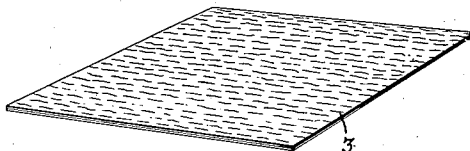


Fig. 3.

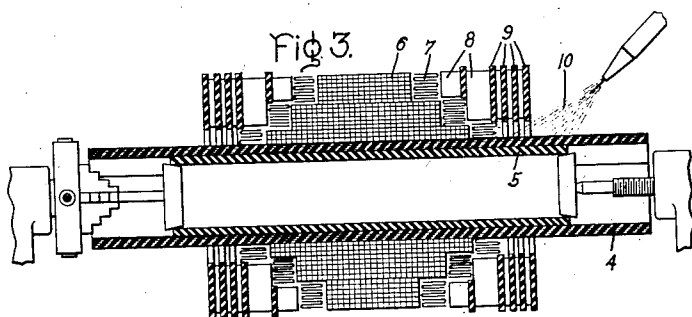


Fig. 4.

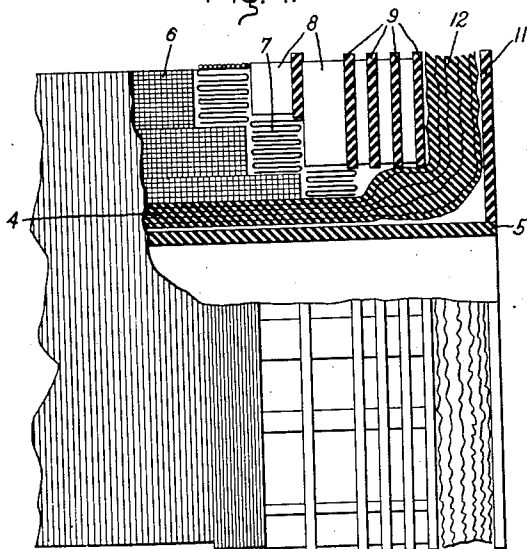
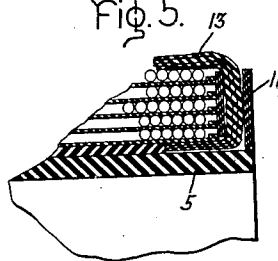


Fig. 5.



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UNITED STATES PATENT OFFICE

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HIGH VOLTAGE WINDING

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4 Claims. (Cl. 175—362)

My invention relates to electrical windings and particularly to the method of forming the coil structure of a high voltage transformer winding. The object of my invention is the provision of an improved method of forming such a coil structure employing crepe paper for supporting and insulating the winding whereby a smaller space factor and greater insulation at points of greatest voltage stress are possible.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, Fig. 1 represents a press by which sheets of crepe paper may be pre-compressed; Fig. 2 shows a sheet comprising a number of superposed layers of crepe paper after they have been pre-compressed; Fig. 3 represents that step in the method which comprises the moistening of portions of the crepe paper cylinder; Fig. 4 is an enlarged portion of Fig. 3 showing the crepe paper after it has been moistened and turned outwardly to form a flange, and Fig. 5 shows a modification.

In order to reduce the thickness of the crepe paper which is employed to support and insulate the high voltage winding and upon which the winding is wound I first compress it, the amount of such compression being dependent upon various factors which amount may, for example, be sufficient to reduce the thickness of the paper to approximately 50 per cent or less of its original thickness. This has the important advantage that it provides a better space factor for the winding. Various means may be employed for giving the crepe paper the desired amount of compression and preferably a number of superposed sheets are compressed in one operation. For the purpose of illustrating this step I have shown in Fig. 1 the hand press 1 the pressure plates of which preferably are heated for effecting this compression of the sheets of crepe paper represented at 2; however, it will be understood that in actual practice I prefer to employ a power press for obvious reasons. In assembling the several sheets of crepe paper in the press prior to compressing them care is to be taken to arrange the sheets with the corrugations thereof all extending in the same direction. As a result of the compression the several sheets of crepe paper become united with each other to form a firm laminated sheet whose thickness is only a fractional part of the sum total thickness of the sheets of crepe paper before compression.

The sheet of compressed crepe paper illus-

trated at 3 in Fig. 2 is then bent or rolled up in the form of a cylinder 4 preferably by rolling it on a cylinder of insulation, as shown at 5, the outer end being suitably secured to prevent un-rolling. In so bending or rolling the sheet of compressed paper the paper is arranged so that the corrugations extend axially of the cylinder.

The winding represented at 6 is then wound on the paper cylinder in the usual manner, the ends of the cylinder being left projecting beyond the winding. For convenience in applying the winding and for a further reason to be explained later, I have shown the insulation cylinder 5 supported on centers whereby it may be rotated as desired. The winding having been completed, the folded-edge paper 7, the spacers 8, and the insulating rings 9 are applied in accordance with the well known construction of windings of this type.

The next step of the process is to moisten the end portions of the crepe paper cylinder, i. e. those portions which extend beyond the limits of the winding. A convenient way of moistening these end portions is to apply a spray or jet of water thereto while the complete winding assembly is rotated. The compressed crepe paper quickly soaks up the water which causes it to swell to approximately its original thickness and make it sufficiently flexible that it can be readily deformed without breaking the paper.

While the end portion of the paper cylinder is in a moistened condition, it is flared outwardly to form an end flange. This step may be performed by the use of a suitable tool applied to the end of the cylinder which will cause it to flare or what is preferable may be produced by centrifugal force as the result of rotating the entire assembly with sufficient speed. The flared end portion of the paper cylinder will thus lie along the side of the outer ring 9 as shown for example at Fig. 4. The moistened portion of the paper may be allowed to dry by the evaporation of the moisture without movement of the assembly but I prefer to hasten it by continuing the rapid rotation of the assembly by which the surplus moisture is thrown off and drying takes place quite rapidly. For holding the flared portion in proper position after it becomes dry, I have shown an additional end ring 11 which may be pushed over the inner insulation ring 5.

By reference to Fig. 4 it will be seen that the crepe paper insulation is continuous from that portion beneath the winding to that portion forming the flange 12. Also, that part of the insulation namely at the juncture of the cylindrical part and the flanged part is approximately

twice the thickness of the cylindrical part. This is an important advantage inasmuch as it is well known to those skilled in the art that the most difficult part of a structure of this kind to insulate is that part comprising the juncture between the flange and the cylinder. As a result of this construction the dielectric strength at the point where insulation is the most necessary is substantially increased over the dielectric strength of the solid insulation directly below the winding, in other words, between the winding and the yoke, inasmuch as the dielectric strength in a given space is higher, when occupied by oil and laminated paper, than when there is only a single dense barrier in combination with an oil duct in the remaining space.

The above described process for expanding and forming an integral flange at one end of the paper cylinder obviously is employed for producing a similar flange at the other end of the cylinder.

In certain cases and in certain forms of winding it is not necessary to have the cylinder of compressed paper extend the entire length of the winding but need extend only for a few turns at the ends of the winding. In certain cases also it is desirable that the expanded part of the compressed paper should not only form a flange at the end of the winding but also overlie some of the outer turns at the end of the winding. This has been illustrated by Fig. 5 where the paper in its compressed form supports the end turns of the winding, and the expanded portion of the paper forms the end flange and overlying portion 13.

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

1. The method of forming a flanged member of crepe paper for supporting and insulating a high voltage winding which comprises initially compressing a sheet of said paper to reduce its thickness, bending the compressed sheet into cylindrical form with the line of the corrugations of the paper extending axially, moistening an end portion of the cylinder thereby restoring the paper substantially to its original thickness and turning the moistened portion outwardly to form a flange.

2. The method of forming a high voltage coil structure employing crepe paper as a supporting and insulating medium which comprises initially compressing a sheet of the paper uniformly to increase the density thereof, bending the compressed paper into cylindrical form with the corrugations extending axially, applying a winding to cover a part only of said cylinder, moistening another part thereof substantially to restore its original density and turning said other part outwardly to form a flange.

3. The method of forming a high voltage coil structure employing crepe paper as a supporting and insulating medium which comprises initially compressing a sheet of said crepe paper uniformly to materially reduce its thickness, wrapping the compressed sheet of paper about a cylindrical support with the corrugations extending axially, winding a conductor on a part only thereof, moistening a part of the paper cylinder projecting beyond the winding whereby its thickness increases and bending said thickened part outwardly to form a flange.

4. The method of forming an insulating cylinder having a thick flange employing crepe paper extending in continuous layers throughout the cylindrical and flange portions which comprises initially and uniformly compressing a sheet of said paper, forming the compressed sheet into a cylinder with the corrugations extending axially, wetting an end portion of the cylinder thereby to cause said portion to soften and swell and turning outwardly said end portion to form the thick flange.

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