(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 895 641 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.06.2005 Bulletin 2005/23

(21) Application number: **97918475.1**

(22) Date of filing: **22.04.1997**

(51) Int Cl.[7]: **H01B 19/00**, H01B 17/26

(86) International application number:
PCT/SE1997/000677

(87) International publication number:
WO 1997/040505 (30.10.1997 Gazette 1997/46)

(54) **INSULATING CORE BODY OF HIGH VOLTAGE RESISTANT DEVICE**

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CORPS CENTRAL ISOLANT RESISTANT AUX HAUTES TENSIONS

(84) Designated Contracting States:
CH DE FR GB IT LI

(30) Priority: **22.04.1996 SE 9601524**

(43) Date of publication of application:
10.02.1999 Bulletin 1999/06

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EP 0 895 641 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a method of producing an insulating core body of a high voltage resistant device, e.g. a bushing, a measurement transformer, a switching device, a breaker or the like, the core body being produced by winding a web of insulating material, such as paper, onto a mandrel and impregnating the wound web material with a curable resin in a mould.

[0002] There are many types of high voltage resistant devices for outdoor and/or indoor use. As an example, in a bushing, a high voltage current is passed through a partition, such as a wall or a tank, via a central conductor extending inside a hollow insulating core body. The latter is normally produced by winding a strip of paper onto a mandrel and impregnating the wound paper with a curable resin in a mould.

[0003] Consequently, for each kind of bushing, and for each particular dimension, a specific set of moulds have to be prepared and stored. Since there are many kinds and many different dimensions, a great number of moulds have to be procured, which is costly and time consuming.

[0004] The object of the present invention is to drastically reduce the number of different moulds and to provide a flexible system enabling the production of a great variety of insulating core bodies for each type of high voltage resistant device.

[0005] This object is achieved in that at least a part of the mould is formed by an adhesive, flexible tape which is wound externally onto the wound web material so as to form a mould shell and which is resistant and impermeable to the resin. The tape will form at least one tight layer which encloses the insulating core body so as to function as a mould shell when the core body is impregnated with a curable resin. Of course, the dimensions and the geometrical configuration of such a mould formed by a flexible tape can be adjusted at will in accordance with the specific conditions and requirements. The mould shell can be combined with other mould parts, e.g. in combination with an external tubular member which is to form an integral part of the finished device.

[0006] According to a further aspect of the invention, two kinds of material can be used to form the mould shell or a part thereof. For example, a first kind of tape may be wound directly onto the insulating core body to form an inner tight layer and a second kind, to be used several times in the production, is then wound externally to form a strong and rigid outer layer of the mould shell. As a modification, the inner layer may be formed by a flexible hose which is slipped onto the core body, the outer layer being formed by a tape which is wound onto the hose.

[0007] Upon curing of the resin, the mould shell is preferably removed mechanically, e.g. by a machining operation, such as by turning.

[0008] These and other advantageous features are stated in the dependant claims.

[0009] The invention will now be described more fully with reference to the appended drawings illustrating three embodiments.

Figure 1 shows, in a side view, a bushing with a straight insulating core body;

Figure 2 shows, in a longitudinal sectional view, the bushing of figure 1 with a mould tape and apparatus for impregnating the core body with a curable resin;

Figure 3 shows, in a side view, a bushing with an external tubular member of silicone rubber and an insulating core body extending downwardly from the tubular member;

Figure 4 shows, in longitudinal section, the bushing of figure 3 while being impregnated with a curable resin.

Figure 5 shows, in a longitudinal sectional view, a measurement transformer having an insulating core body according to the present invention.

[0010] The bushing shown in figure 1 comprises an insulating, hollow core body 1 and a central conductor 2 extending along the axis of the bushing. At the axial end portions, there are top and bottom end walls 3 and 4, respectively, serving as parts of a mould during production of the bushing.

[0011] The insulating core body 1 is produced by winding a strip of paper onto a mandrel, formed by the central conductor 2 in the illustrated embodiment, and impregnating the wound paper with a curable resin in a mould. In accordance with the invention, the mould is partly formed by an adhesive, flexible tape 5 which is wound externally onto the core body 1 and which is resistant and impermeable to the resin. Preferably, the tape has a large width, e.g. 20 cm or even wider, and is wound with overlap in a helical configuration so as to form at least one tight layer. The tape may alternatively be as wide as the length of the core body. Then, it is sufficient to wind it around the core body in one lap.

[0012] Generally, the tape comprises a flexible foil material and an adhesive coating on at least one side thereof. The foil material may be paper or a thermoplastic material, such as polypropylene or polyester, whereas the adhesive coating may be a silicone-based or acrylic-based glue or natural rubber.

[0013] In order to achieve sufficient strength and rigidity of the mould shell, it is possible to apply an outer flexible strip externally onto the adhesive tape 5. Such a strip 5a may be constituted by a stronger and more expensive adhesive tape or a foil material without adhesive properties, such as a thermoplastic foil material, possibly reinforced by fibers to make it stronger and less elastic but yet flexible. The outer flexible strip 5a is wound externally with overlap and can be removed and

used over again several times in the production.

[0014] Upon forming the mould shell constituted by the adhesive tape 5 and possibly the external layer 5a, a curable resin, such as an epoxy resin with a curing agent, is fed through a flexible hose 6 from a funnel 7 to a nozzle 8 in the lower mould part 4, whereby the paper core 1 is slowly impregnated in its entirety. Excess resin will flow out through an outlet channel 9 in the upper mould part 3 to an outlet collecting funnel 10. When the epoxy resin has cured, typically in about ten hours, the mould parts 3, 4 and 5a are removed upon detaching upper and lower hose clamps (not shown) having being used to securely fix the upper and lower ends of the mould shell 5, 5a.

[0015] The adhesive tape 5, which is firmly bound to the insulating core 1, is preferably removed by a machining operation, such as by turning.

[0016] The embodiment shown in figures 3 and 4 is quite similar to the one shown in figures 1 and 2, the only difference being that the upper part of the insulating core 1 is enclosed by a prefabricated tube member 11 of elastomeric material, which forms a permanent integral part of the finished bushing. The tube member 11 is used as a part of the external mould during the impregnating and curing operation. Thus, the mould shell formed by the adhesive tape 5 and a possible outer layer 5a is only applied onto the lower part of the insulating core 1.

[0017] In fig. 5 there is shown another embodiment, viz a measurement transformer for measuring a current flowing therethrough. The transformer includes a central conductive rod 2', having terminal end portions 2'a, 2'b for external connection, and a tubular insulating core body 1' which has been produced substantially in the same way as the bushing shown in figs. 1 and 2. The outside surface 5' has been machined so as to remove the mould shell. A transformer ring core 20, with inductive coils (not shown) and an annular insulating casing 21, is arranged so as to enclose the core body 1'.

[0018] The method and the bushing described above may be modified by those skilled in the art within the scope of the appended claims. For example, the insulating core body may be formed by a different material than paper, such as a plastic foil, preferably treated so as to form voids or channels upon being wound onto a mandrel. The resin may be fed into the core body directly from a moulding apparatus, if desired under pressure so as to accelerate the impregnating process. The mould shell may include two or more flexible layers applied to the core body, at least one such layer being formed by the flexible tape. Also, one of the layers, in particular an inner layer, may be formed by a flexible tube or hose of a thin thermoplastic material, the tube or hose being slipped onto the core body.

Claims

1. A method of producing an insulating core body (1, 1') of a high voltage resistant device, said insulating core body being produced by winding a web of insulating material onto a mandrel (2, 2') and impregnating the wound web material with a curable resin in a mould, **characterized in that** at least a part of the mould is formed by an adhesive, flexible tape (5) which is wound externally onto said core body so as to form a mould shell and which is resistant and impermeable to said resin.

2. A method as defined in claim 1, wherein at least two flexible layers are applied onto said core body so as to form said mould shell, at least one of the flexible layers being formed by said flexible tape (5, 5a).

3. A method as defined in claim 2, wherein said flexible tape (5) is wound directly onto said insulating core body to form an inner tight layer of said mould shell, whereupon an outer flexible strip (5a) is wound externally onto said tape (5) to form a strong and rigid outer layer of said mould shell.

4. A method as defined in claim 2 or 3, wherein one of said flexible layers (5a) comprises a foil material.

5. A method as defined in claim 2 or 3, wherein an inner one of said flexible layers comprises a flexible hose, which is slipped onto said core body.

6. A method as defined in any one of claims 1-5, wherein said mould shell is reinforced by fibres.

7. A method as defined in any one of claims 1-6, wherein a first part of said mould is constituted by an external tubular member (11) forming an integral part of said high voltage resistant device, whereas a second part of said mould is formed by said mould shell (5, 5a).

8. A method as defined in any one of the preceding claims, wherein said mould shell (5, 5a) is removed upon the curing of said resin.

9. A method as defined in any one of the preceding claims, wherein said tape (5) has a width of 5-20 cm and is wound onto said insulating core body (1) in a helical configuration so as to form at least one tight layer which encloses said insulating core body, possibly in combination with other mould parts (3, 4, 11).

10. A method as defined in any one of the preceding claims, wherein said tape (5) comprises a flexible foil material, such as polypropylene, polyester or paper, and an adhesive coating on at least one side

of said foil material, such as a silicon-based or acrylic-based glue or natural rubber.

Patentansprüche

1. Verfahren zur Herstellung eines isolierenden Kemkörpers (1, 1') einer hochspannungsbeständigen Vorrichtung, wobei der isolierende Kernkörper hergestellt wird, indem ein Gewebe isolierenden Materials auf eine Spindel (2, 2') gewickelt wird, und indem das gewickelte Gewebematerial mit einem aushärtbaren Harz in einer Form imprägniert wird, **dadurch gekennzeichnet, dass** mindestens ein Teil der Form von einem haftenden, flexiblen Band (5) gebildet wird, das außen auf den Kernkörper gewickelt ist, um eine Formschale zu bilden, und welches beständig gegenüber dem und undurchdringlich für das Harz ist.

2. Verfahren nach Anspruch 1, wobei mindestens zwei flexible Schichten auf den Kernkörper aufgebracht werden, um die Formschale zu bilden, und wobei mindestens eine der flexiblen Schichten von dem flexiblen Band (5, 5a) gebildet wird.

3. Verfahren nach Anspruch 2, wobei das flexible Band (5) direkt auf den isolierenden Kernkörper gewickelt wird, um eine innere dichte Schicht der Formschale zu bilden, woraufhin ein äußerer flexibler Streifen (5a) außen auf das Band (5) gewickelt wird, um eine feste und steife äußere Schicht der Formschale zu bilden.

4. Verfahren nach Anspruch 2 oder 3, wobei eine der flexiblen Schichten (5a) ein Folienmaterial aufweist.

5. Verfahren nach Anspruch 2 oder 3, wobei eine innere der flexiblen Schichten einen flexiblen Schlauch aufweist, der auf den Kernkörper geschoben wird.

6. Verfahren nach irgendeinem der Ansprüche 1 bis 5, wobei die Formschale durch Fasern verstärkt wird.

7. Verfahren nach irgendeinem der Ansprüche 1 bis 6, wobei ein erster Teil der Form durch ein röhrenförmiges Außen-Element (11) gebildet wird, das einen integralen Teil der hochspannungsbeständigen Vorrichtung bildet, wohingegen ein zweiter Teil der Form durch die Formschale (5, 5a) gebildet wird.

8. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei die Formschale (5, 5a) nach dem Aushärten des Harzes entfernt wird.

9. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei das Band (5) eine Breite von 5-20 cm aufweist, und in einer wendelförmigen Anordnung auf den isolierenden Kernkörper (1) gewikkelt wird, um mindestens eine dichte Schicht zu bilden, die den isolierenden Kernkörper, möglicherweise in Kombination mit anderen Teilen der Form (3, 4, 11), einschließt.

10. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei das Band (5) ein flexibles Folienmaterial, so wie Polypropylen, Polyester oder Papier, und eine Haft-Beschichtung auf mindestens einer Seite des Folienmaterials aufweist, so wie ein Silikonbasierter oder Acryl-basierter Kleber oder Naturkautschuk.

Revendications

1. Procédé de production d'un corps (1, 1') formant âme isolante d'un dispositif résistant aux hautes tensions, le corps formant âme isolante étant produit en enroulant un ruban de matériau isolant sur un mandrin (2, 2') et en imprégnant le matériau de ruban enroulé d'une résine pouvant durcir dans un moule, **caractérisé en ce qu'**au moins une partie du moule est formée par une bande (5) adhésive souple, qui est enroulée extérieurement sur le corps formant âme de manière à former une coquille de moule et qui est résistante et imperméable à la résine.

2. Procédé suivant la revendication 1, dans lequel au moins deux couches souples sont appliquées sur le corps formant âme de manière à former la coquille de moule, au moins l'une des couches souples étant formée par la bande (5, 5a) souple.

3. Procédé suivant la revendication 2, dans lequel la bande (5) souple est enroulée directement sur le corps formant âme isolante pour former une couche intérieure étanche de la coquille de moule, une bande (5a) extérieure souple étant alors enroulée extérieurement sur la bande (5) pour former une couche extérieure rigide et résistante de la coquille de moule.

4. Procédé suivant la revendication 2 ou 3, dans lequel l'une des couches (5a) souples comporte un matériau en feuille.

5. Procédé suivant la revendication 2 ou 3, dans lequel une couche intérieure des couches souples comporte un tuyau souple qui est glissé sur le corps formant âme.

6. Procédé suivant l'une quelconque des revendications 1 à 5, dans lequel la coquille de moule est ren-

forcée par des fibres.

7. Procédé suivant l'une quelconque des revendications 1 à 6, dans lequel une première partie du moule est constituée par un élément (11) extérieur tubulaire formant une partie d'une pièce du dispositif résistant aux hautes tensions, tandis qu'une deuxième partie du moule est formée par la coquille (5, 5a) de moule.

8. Procédé suivant l'une quelconque des revendications précédentes, dans lequel la coquille (5, 5a) de moule est retirée lors du durcissement de la résine.

9. Procédé suivant l'une quelconque des revendications précédentes, dans lequel la bande (5) a une largeur de 5 à 20 cm et est enroulée sur le corps (1) formant âme isolante suivant une configuration hélicoïdale de manière à former au moins une couche étanche qui enferme le corps formant âme isolante, éventuellement en combinaison avec d'autres parties (3, 4, 11) de moule.

10. Procédé suivant l'une quelconque des revendications précédentes, dans lequel la bande (5) comporte un matériau de feuille souple, telles que du polypropylène, du polyester ou du papier, et un revêtement adhésif sur au moins un côté du matériau de feuille, telle qu'une colle à base d'acrylique ou à base de silicone ou un caoutchouc naturel.

Fig. 1

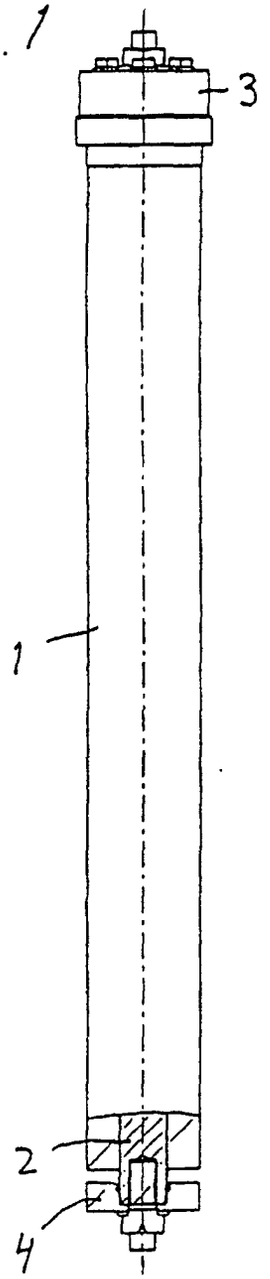

Fig. 2

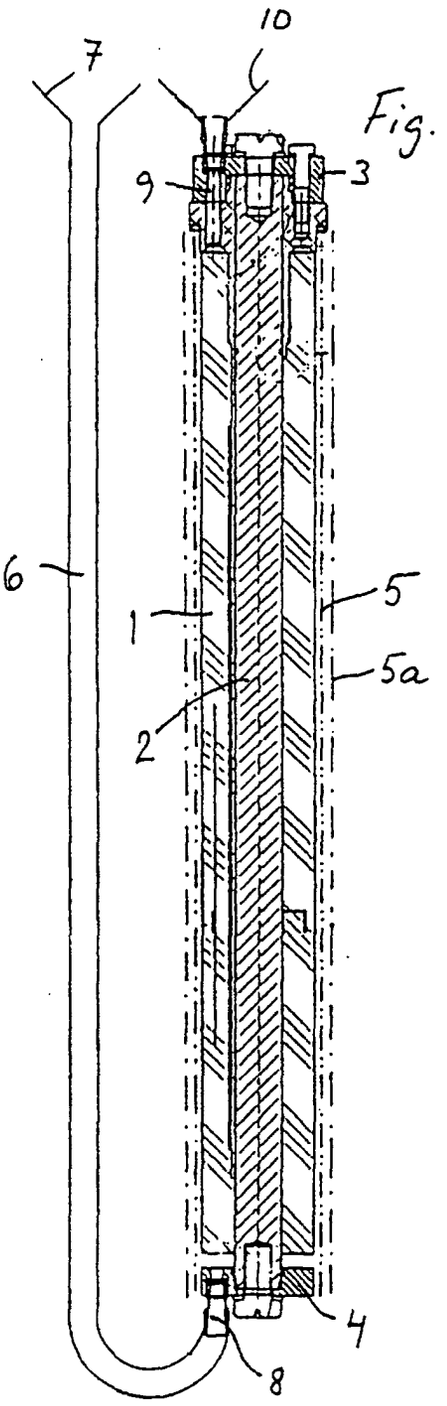

Fig. 5

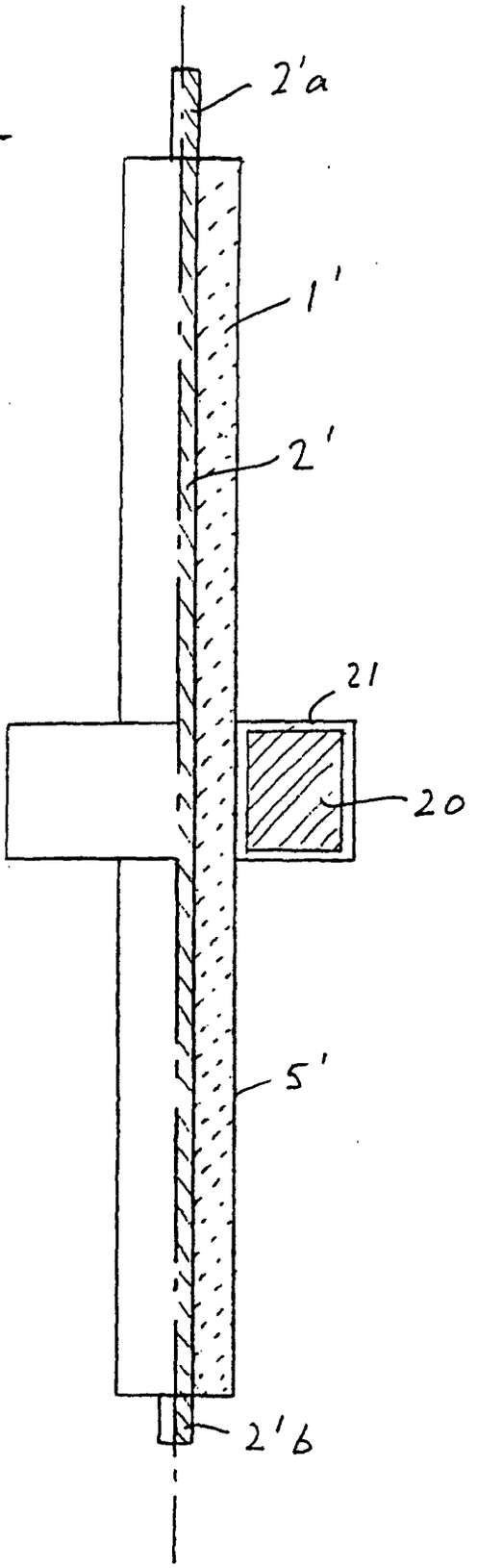

Fig. 3

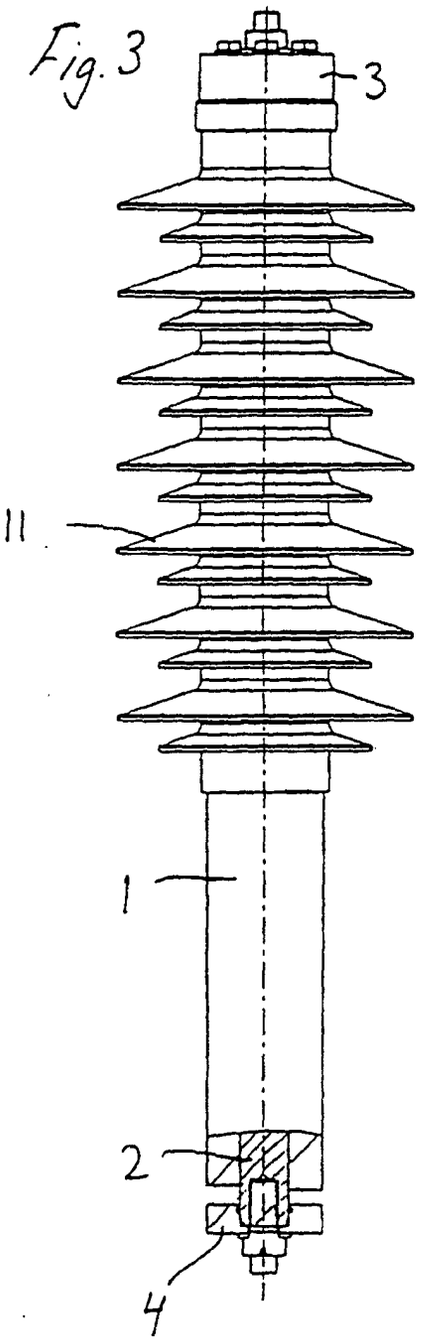

Fig. 4