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BUSHING INSULATOR WITH SHIELDING OF THE ELECTRICAL FIELD, PARTICULARLY FOR MEDIUM AND HIGH-VOLTAGE SWITCHBOARDS

Durchführungsisolator mit elektrische Feldabschirmung, insbesondere für Mittel- und Hochspannungsschaltanlagen
Traversée-isolateur avec blindage contre des champs électriques notamment pour dispositifs de commutation à moyenne et haute tension

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(56) References cited:
DE-A-19 547 120

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Description

[0001] The present invention relates to a bushing insulator with shielding of the electrical field. As is known, bushing insulators, such as those for medium-voltage switchboards, for example, generally comprise a moulding of electrical insulating material that separates the grounded metal structure of the electrical equipment from the live conductor and which encloses a metal insert for shielding the electrical field. Said insert has the function of limiting the electrical stresses acting on the distribution of the field lines.

[0002] An example of a bushing insulator according to the preamble of claim 1 can be found in DE-A-19 547 120.

[0003] The inserts are normally made using a metal mesh that must be able to withstand the mechanical stresses that occur during the phase for moulding the insulating material to avoid deformations that could impact its correct positioning.

[0004] Conversely, the solution of increasing the thickness of the metal mesh would impart the electrical characteristics, so that the usual solution is to resort to a compromise, using inserts that have a relatively low mass and are able to have good stability at the moment of moulding.

[0005] This makes it necessary to adopt a series of measures to maintain the correct position of the metal inserts that are normally shaped with a toroidal portion located in correspondence of the passage hole provided on a medium-voltage electrical switchboard.

[0006] The task of the invention is precisely to overcome the drawbacks set forth above by making a bushing insulator with shielding of the electrical field to be used, for example, in medium and high-voltage air-insulated switchboards (AIS), gas-insulated switchboards (GIS), medium and high-voltage power transformers and reactance, instrument transformers, capacitors, and medium and high-voltage gas insulated busbar in which it is possible to use metal inserts that, while having a relatively low mass are able to maintain a predetermined shape and position at the moment of moulding, thus achieving the best characteristics from an electrical standpoint.

[0007] Within the aforementioned task, one particular object of the invention is to develop a bushing insulator in which any deformations are eliminated with certainty at the moment of moulding, so that the metal insert has the optimal position and shape when the resin is polymerised.

[0008] A further object of the present invention is to develop a bushing having high reliability and safety in use due to its distinctive constructional characteristics.

[0009] Not the last object of the present invention is to develop a bushing insulator that can easily be obtained from commercially available parts and materials and that is, moreover, competitive from a purely economic standpoint.

[0010] The aforesaid task, together with the above-mentioned and other objects that will become more clear hereinafter, are achieved by a bushing insulator for shielding an electrical field, particularly for medium voltage switchboards, comprising a moulding of electrical insulating material to be located in a passage hole in an electrical switchboard and enclosing a metal insert for shielding the electrical field. The bushing insulator according to the invention is characterised in that said metal insert comprises a shape memory material capable to assume a predetermined shape upon thermal stress.

[0011] Further characteristics and benefits will become more clear from the description of a number of preferred but not exclusive embodiments, illustrated purely by way of example and without limitation with the aid of the attached drawings in which:

Figure 1 is a diagrammatic representation of the bushing insulator prior to moulding of the resin;
Figure 2 is a cross-sectional diagrammatic representation of the bushing insulator after moulding of the resin;
Figure 3 shows a metal insert made using a mesh;
Figure 4 shows a metal insert made using a foil;
Figure 5 shows the insert with portions of shape memory material positioned so that they are parallel to the axis;
Figure 6 shows the metal insert with portions of shape memory material positioned circumferentially;
Figure 7 shows the metal insert with portions of shape memory material positioned so that they cross each others; and
Figure 8 shows the metal insert with portions of a shape memory material that are positioned in a helical manner.

[0012] With reference to the said figures, the bushing insulator with shielding of the electrical field according to the invention, indicated by reference number 1, comprises a casting 2 of electrical insulating material, that it is preferably made of epoxy resin, which is located in a hole 3 provided in the metal wall of an electrical switchboard, generally indicated by reference number 4.

[0013] A metal insert, indicated by reference number 10, is provided around the conductor 5 to be shielded, said metal insert being embedded in the moulding of electrical insulating material.

[0014] The distinctive feature of the invention is constituted by the fact that said metal insert, which has the function of limiting the electrical stress acting on the distribution of the field lines, is made using shape memory alloys that, when subjected to thermal stress, restore the correct geometry within the material.

[0015] The shape memory alloys, for example alloys such as NiTi, CuAl, CuAlX, where X is Ni, Be, Zn or Mn, and CuZnY, where Y is Al, Si, Sn, Ga or Mn, are char-
characterised by the possibility of restoring their original configuration determined in the design phase when they are subjected to an increase in temperature above a critical transition temperature; these shape memory alloys thus ensure the correct position and shape is restored within the insulator at the moment of moulding the plastic in liquid phase at high temperature.

[0016] The shape memory metal component in martensite phase is positioned in the moulding simply taking care to fix the insert correctly in the various fixing points, without having to pay any particular attention to the overall position of the insert.

[0017] At the moment of moulding the liquid resin, at high temperature, the insert begins responding to the thermal stress, actuating the transformation from martensite to austenite phase and thus regaining the original design shape and assuming the predetermined shape that corresponds to the optimal positioning of the metal insert.

[0018] The response of the shape memory material to the thermal stress, which is defined as the time required for the predetermined shape to be restored, is in the order of fractions of a second. The polymerisation time of the resin consequently does not cause any limitation on this restoration of shape.

[0019] It is advantageously possible to use so-called "single shot" shape memory alloys, defined as alloys that guarantee perfect functioning for a single operation or for a few operations. Indeed for this type of application it is not necessary for the alloy to be able to execute the restoration of shape more than once, given that the correct position is subsequently held due to the fact that the metal insert remains embedded in the resin moulding.

[0020] With reference to Figure 3, a metal insert is illustrated, indicated by 10a, which is shaped with a toroidal portion and is made using a mesh of shape memory material that enables easier passage of the resin during moulding.

[0021] Figure 4 illustrates a metal insert, indicated by 10b that is obtained using a foil that is also made of shape memory material.

[0022] The shape memory material may simply form a part of the metal insert and not necessarily the entire metal insert, provided that the portions used are able to restore the entire metal insert to its predetermined shape.

[0023] As illustrated in Figure 5, the insert 10 comprises inserts 10c of shape memory material that are positioned parallel to the axis and extend over the entire circumferential development of the insert.

[0024] As illustrated in Figure 6, it is also possible to use inserts of shape memory alloy indicated by 10d that have an annular configuration and are uniformly distributed.

[0025] In figure 7, the inserts 10e are positioned so that they cross over one another and are made of shape memory alloy applied to an insert 10 that can have different shapes.

[0026] In Figure 8, the shape memory alloy insert 10f assumes a helical position within a metal insert that can be made in a variety of ways.

[0027] From what has been illustrated above, it is easy to see how the invention achieves the objectives set. It should in particular be emphasised that in the bushing insulator according to the invention, the thermomechanical stress that is applied by the liquid resin, has a positive effect, since it causes the automatic restoration of the designed shape and consequently of the optimal characteristics of the insert that is always positioned perfectly. Conversely, in the prior art bushing insulator, traditional shielding undergoes a distortion in the designed shape and consequently has a negative effect.

Claims

1. Bushing insulator (1) for shielding an electrical field, comprising a moulding (2) of electrical insulating material to be located in a passage hole (3) in an electrical switchboard (4) and enclosing a metal insert (10) comprising a foil (10b) of said shape memory material, characterised in that said metal insert comprises a shape memory material capable to assume a predetermined shape upon thermal stress.

2. Bushing insulator according to claim 1, characterised in that said metal insert comprises a mesh (10a) of said shape memory material.

3. Bushing insulator according to claim 1, characterised in that said metal insert comprises a foil (10b) of said shape memory material.

4. Bushing insulator according to claim 1, characterised in that said metal insert comprises inserts (10c) made of said shape memory material.

5. Bushing insulator according to claim 4, characterised in that said inserts of shape memory material extend in directions that are substantially parallel to the axis of the said metal insert.

6. Bushing insulator according to claim 4, characterised in that said inserts of shape memory material have an annular configuration (10d) around the conductor to be insulated.

7. Bushing insulator according to claim 4, characterised in that said inserts of shape memory material are positioned so that they cross over one another.

8. Bushing insulator according to claim 4, as in one or more of the previous claims, characterised in that said inserts of shape memory material have a helical development (10f).
Patentansprüche

1. Buchsenisolator (1) zum Abschirmen eines elektrischen Feldes, umfassend ein Formteil (2) aus elektrisch isolierendem Material, das in einem Durchgangsloch (3) in einer elektrischen Schalttafel (4) anzuordnen ist und eine Metalleinlage zum Abschirmen des elektrischen Feldes einschließt, dadurch gekennzeichnet, daß die Metalleinlage (10) ein Formgedächtnismaterial enthält, das in der Lage ist, bei thermischer Beanspruchung eine vorbestimmte Form einzunehmen.

2. Buchsenisolator nach Anspruch 1, dadurch gekennzeichnet, daß die Metalleinlage ein Gewebe (10a) aus dem genannten Formgedächtnismaterial enthält:

3. Buchsenisolator nach Anspruch 1, dadurch gekennzeichnet, daß die Metalleinlage eine Folie (10b) aus dem genannten Formgedächtnismaterial enthält.

4. Buchsenisolator nach Anspruch 1, dadurch gekennzeichnet, daß die Metalleinlage Einlagen (10c) aus dem genannten Formgedächtnismaterial enthält.

5. Buchsenisolator nach Anspruch 4, dadurch gekennzeichnet, daß die genannten Einlagen aus Formgedächtnismaterial in Richtungen verlaufen, die im wesentlichen parallel zur Achse der Metalleinlage sind.

6. Buchsenisolator nach Anspruch 4, dadurch gekennzeichnet, daß die genannten Einlagen aus Formgedächtnismaterial um den zu isolierenden Leiter herum eine ringförmige Gestalt (10d) haben.


8. Buchsenisolator nach Anspruch 4, wie in einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die genannten Einlagen aus Formgedächtnismaterial eine schraubenförmige Abwicklung (10f) haben.

Revendications

1. Traversée-isolateur (1) pour former un blindage contre le champ électrique, caractérisée en ce que ledit élément métallique rapporté (10) est constitué d'un matériau à mémoire de forme apte à prendre une forme prédéterminée sous l'effet de contraintes thermiques.

2. Traversée-isolateur selon la revendication 1, caractérisée en ce que ledit élément métallique rapporté comprend un grillage métallique (10a) constitué dudit matériau à mémoire de forme.

3. Traversée-isolateur selon la revendication 1, caractérisée en ce que ledit élément métallique rapporté comprend une feuille métallique (10b) constituée dudit matériau à mémoire de forme.

4. Traversée-isolateur selon la revendication 1, caractérisée en ce que ledit élément métallique rapporté comprend des éléments rapportés (10c) constitués dudit matériau à mémoire de forme.

5. Traversée-isolateur selon la revendication 4, caractérisée en ce que lesdits éléments rapportés en matériau à mémoire de forme s'étendent dans des directions sensiblement parallèles à l'axe dudit élément métallique rapporté.

6. Traversée-isolateur selon la revendication 4, caractérisée en ce que lesdits éléments rapportés en matériau à mémoire de forme ont une configuration annulaire (10d) autour du conducteur à isoler.

7. Traversée-isolateur selon la revendication 4, caractérisée en ce que lesdits éléments rapportés en matériau à mémoire de forme sont placés de façon à s'entrecroiser.

8. Traversée-isolateur selon la revendication 4, comme dans une ou plusieurs des revendications précédentes, caractérisée en ce que lesdits élémens rapportés en matériau à mémoire de forme ont un développement hélicoïdal (10f).