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(54) Embedded or assembled pole part with vacuum interrupter, and method of manufacture the same

(57) The invention relates to an embedded pole part and method of manufacture the same, with vacuum interrupter which is embedded or assembled in an epoxy resin or thermoplastic housing, with a fixed contact and a movable contact, wherein the fixed contact is electrically and mechanically fixed to an upper electrical terminal, according to the preamble of claim 1 and 8. In order to damp and/or reduce this bouncing at the upper terminal or at the terminal concerning to the fixed contact of the pole part, the upper terminal or the terminal according to the fixed contact is covered by a damping layer between the terminal surface and the embedding or surrounding housing.

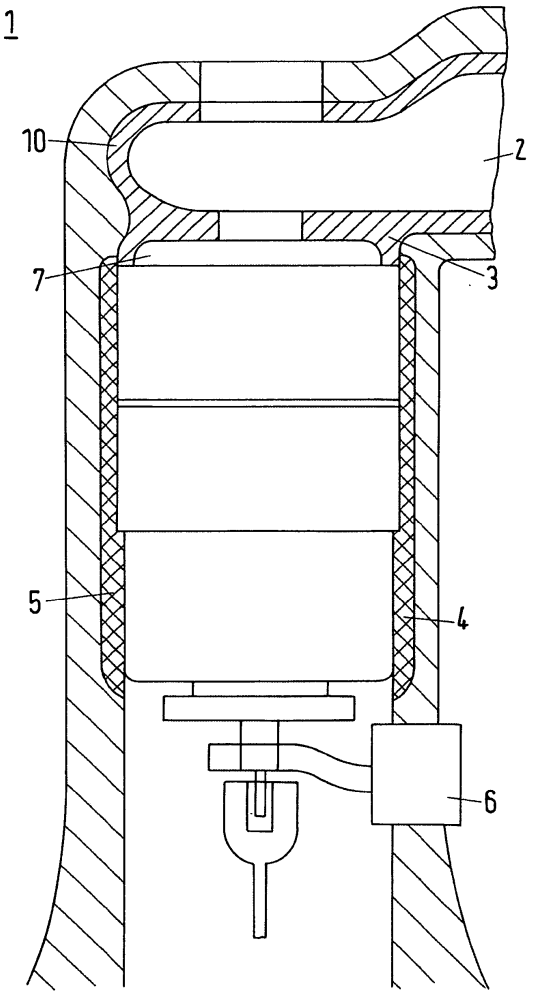

Fig.1

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Description

[0001] The invention relates to an embedded pole part and method of manufacture the same, with vacuum interrupter which is embedded or assembled in an expoxy resin or thermoplastic housing, with a fixed contact and a movable contact, wherein the fixed contact is electrically and mechnically fixed to an upper electrical terminal, according to the preamble of claim 1 and 8.

[0002] Basically the vacuum interrupter is embedded inside a pole housing and inside epoxy resin or a thermoplastic material. This can be done by a hot mould or injection process. Alternatively the vacuum interrupter can also be introduced in a ready premanufactured housing, which is then called assembled pole part. The vacuum interrupter inside the embedded housing is stiff embedded in the housing.

[0003] During the closing operation of the contacts the fixed contact has nearly no possible movement in case that the contacts are closed with the impulse

$$\underline{P} = m \times \underline{V}$$

which generates a high force and mechanical impact while the duration time dP/dt is less because the fixed contact is stiff embedded in the housing. This causes the so called bouncing, focussed normally to the upper contact, which is normally the fixed contact. The impact will then be caused by the shutting movement of the lower contact towards the upper contact.

[0004] It is also known, that the vacuum interrupter is covered with a damping layer between the interrupter surface and the epoxy housing.

[0005] Nevertheless, the damping layer on the interrupters surface cannot dampf the bouncing for on the upper terminal of the fixed contact.

[0006] So it is the object of the invention, to damp and/or reduce this bouncing at the upper terminal or at the terminal concerning to the fixed contact of the pole part.

[0007] This problem is solved with the invention, that the upper terminal or the terminal according to the fixed contact is covered by a damping layer between the terminal surface and the embedding or surrounding housing. This damping layer is therefore located closely between the terminals surface and the housing, so that the damping effect in case of shutting can most effectively to prevent or damp the bouncing.

[0008] The damping layer is made of elastic and/or at least compressible or at least partly compressible material.

[0009] Therefore several advantageous materials are proposed in the follwing.

[0010] The first is that the damping layer material of the terminal is polyurethane. This material is strong and with high mechanical and thermal resistance and can be treated in case of a following hot resin or thermoplastic process by remaining its mechnical characteristics.

[0011] A further material is that the damping layer material of the terminal is silicone. This material is strong and with high mechanical and thermal resistance and can be treated in case of a following hot resin or thermoplastic process by remaining its mechnical characteristics.

[0012] Nevertheless each kind or elastomeres can be used.

[0013] A further alternative is, that the damping layer material of the terminal is rubber.

[0014] A further alternative is, that the damping layer material of the terminal is polysiloxane.

[0015] Furthermore also advantageous can be, that the damping layer material of the terminal is a mixture of polyurethane and/or rubber and/or polysiloxane, and/or a multilayercompound with at least two of the aforesaid materials or material combinations.

[0016] That means that the damping layer material can itself be a material mixture, or a layerwise compound construction itself. In case the material layer has a bubble structure, and/or particals inside like hollow glass bubbles, and/or hard particles inside which provides a nonlinear characteristic the damping effect is adjustable.

[0017] An advantageous embodiment is that the damping layer extends in the upper region in direct contact with the inner surface of the housing, and extends in the region towards the vacuum interrupter closely to next positioned cap or the metal cap of the vacuum interrupter. That means, that the damping layer is in direct contact with the vacuum interrupter at one side and with the inner wall of the housing around this terminal at the other sides.

[0018] According to a method, the basical idea of the invention is, that additionally the upper terminal or the terminal according to the fixed contact will be covered by an elastic and/or at least partly compressible damping layer, before the predesigned assembly group will be introduced into the housing or covered by the housing by hot epoxy or thermoplastic process.

[0019] So in result, the positioning of this additional special damping layer localized at the fixed contact terminal can be easily integrated into the manufacture process of the pole part and result in a final high performance pole part with bouncing reduction.

[0020] Figure 1 shows in a cross sectional view through the pole part. Optionally the vacuum interrupter can optionally be introduced into the housing also with a damping layer between the vacuum interupter surface and the housing inside wall.

[0021] The fixed contact of the vacuum interrupter is located in the upper region. The upper contact is mechanically and electrically connected with the upper terminal. The upper terminal is covered at least on its surface region which is located inside the housing with the

aforesaid damping layer between the terminal surface and the housing.

[0022] In case of closing operation of the contacts. The not visible lower contact will be moved quickly and will introduce a bouncing to the upper fixed contact in the moment when the contacts close. This bouncing will then be reduced effectively by this additional damping layer on the terminal. So this terminal is at the surfaces inside the housing perfectly surrounded by this damping layer. Furthermore, also the space between this upper terminal an the next positioned cap of the vacuum interrupter is is filled with this damping layer material, so that no shock waves by bouncing can be transmitted undamped towards this terminal.

[0023] As shown in the figure there exists the possibility to decrease the stiffness of the fixed contact side by introducing a damping material above the fixed contact to get a micromovement in the damping material. The damping material can be taken from polyurethane or silicone. The damping material has to be applied in the way that the micromovement can be achieved e.g. by the use of the layer on top of the vacuum interrupter lid and the upper contact terminal. The application can also be applied on defined areas where the movement can be achieved as well. This leads to a reduced force generated out of the Impulse be applying the equation dI / dt and reduced in addition the bouncing duration between the both contacts. The vacuum interrupter can be embedded in epoxy material with and without a compensation layer. The insulation material for the pole part can be epoxy, thermoplastic, BMC or other insulation material.

[0024] The effect is the reduction of bounce duration at the pole part.

Position numbers

[0025]

1	pole part
2	upper terminal
3	damping layer on terminal
4	vacuum interrupter
5	compensation layer on vacuum interrupter outer surface
6	lower terminal
7	cap or metal cap of the vacuum interrupter
10	housing

Claims

1. Embedded or assembled pole part with vacuum interrupter which is embedded or assembled in an expoxy resin or thermoplastic housing, with a fixed contact and a movable contact, wherein the fixed contact is electrically and mechnically fixed to an upper electrical terminal,
characterized in that the upper terminal or the terminal according to the fixed contact is covered by a damping layer between the terminal surface and the embedding or surrounding housing.

2. Embedded pole part according to claim 1,
characterized in that the damping layer material of the terminal is polyurethane.

3. Embedded pole part according to claim 1,
characterized in that the damping layer material of the terminal is rubber.

4. Embedded pole part according to claim 1,
characterized in that the damping layer material of the terminal is polysiloxane.

5. Embedded pole part according to claim 1,
characterized in that the damping layer material of the terminal is a mixture of polyurethane and/or rubber and/or polysiloxane, and/or a multilayercompound with at least two of the aforesaid materials or material combinations.

6. Embedded pole part according to claim 1 and 5,
characterized in that the damping layer material of the terminal has a bubble structure, and/or particals inside like hollow glass bubbles, and/or hard particles inside.

7. Embedded pole part according to one of the aforesaid claims, **characterized in that** the damping layer extends in the upper region in direct contact with the inner surface of the housing, and extends in the region towards the vacuum interrupter closely to next positioned cap or the metal cap of the vacuum interrupter.

8. Method to manufacture an embedded pole part with vacuum interrupter which is embedded in an expoxy resin or thermoplastic housing, with a fixed contact and a movable contact, wherein the fixed contact is electrically and mechnically fixed to an upper electrical terminal, and wherein the components vacuum interrupter and terminals will be assembled to a predesigned assembly group which will be introduced in the following step into a housing or covered by the housing by hot epoxy, or BMC, or thermoplastic process,
characterized in that additionally the upper terminal or the terminal according to the fixed contact will be covered by an elastic and/or at least partly compressible damping layer, before the predesigned assembly group will be introduced into the housing or covered by the housing by hot epoxy or thermoplastic process.

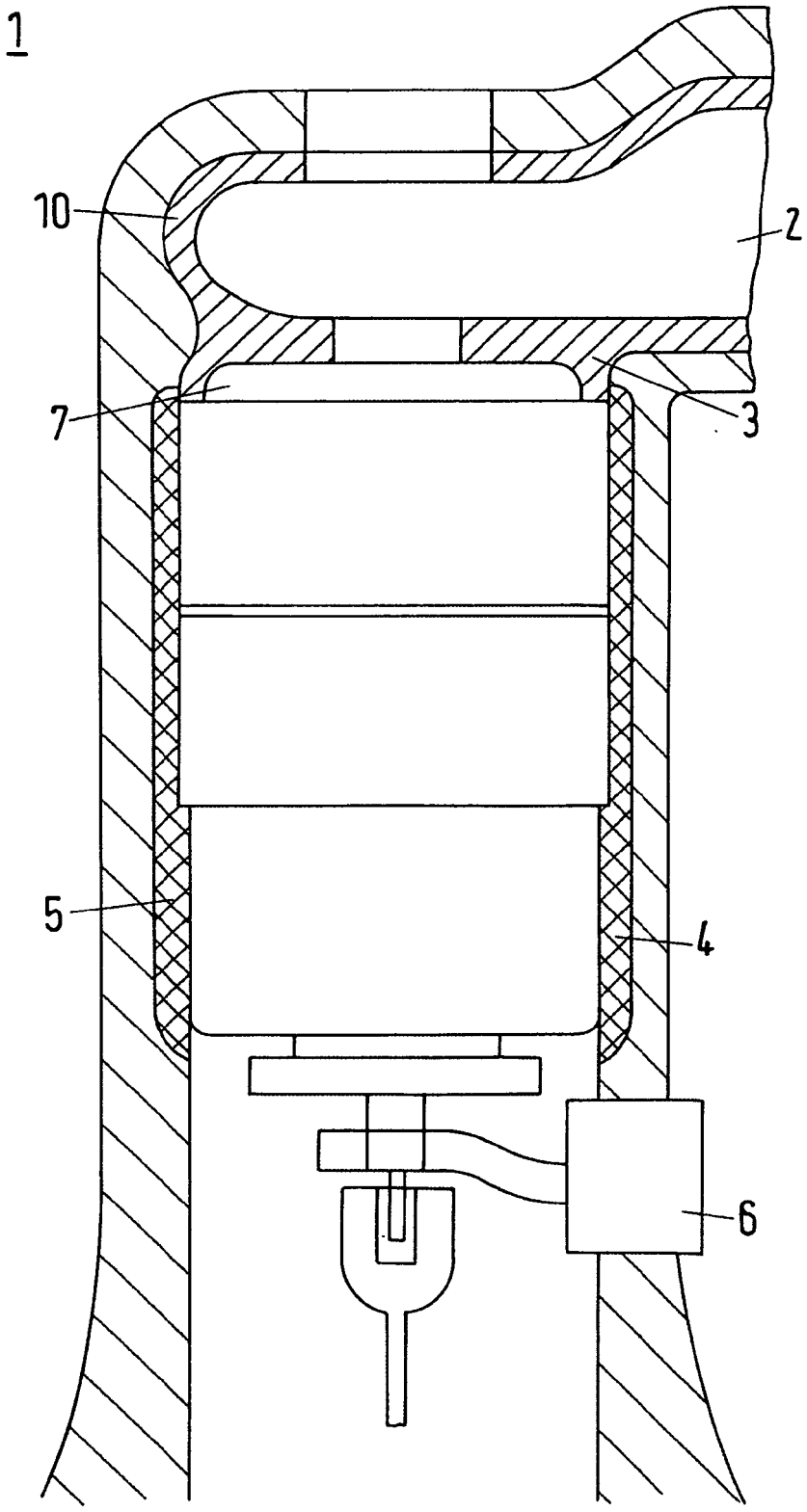

Fig.1

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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 0028

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC) H01H

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 May 2012	Fribert, Jan

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82