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(54) **Vapor shield arrangement for vacuum switching tube**

(57) The invention relates to a vapor shield arrangement for vacuum switching tube, as for the use in medium voltage switchgears.
In order to result a shielding which has a high absorbance of thermal energy as well as a good protection against metal deposition on the inner ceramic surface caused by high energy light arc impact, it is proposed, that the

shielding consist of at least two concentric arranged cylindric shielding elements with a space or hollow space between the so arranged inner shielding (4) element and the at least one outer shielding (4') element, and that the inner shielding (4) element has openings (8) which corresponds with the hollow space between the shielding elements.

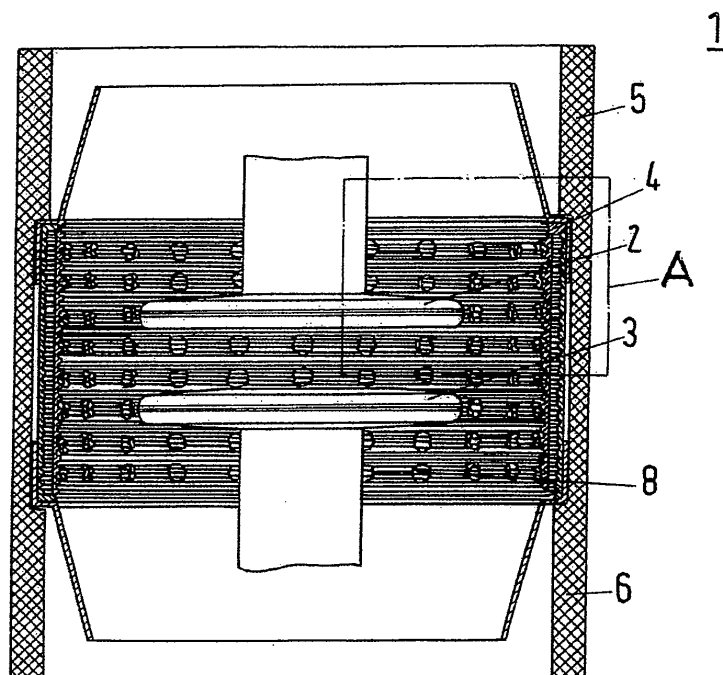


Fig.1

Description

[0001] The invention relates to a vapor shield arrangement for vacuum switching tube, as for the use in medium voltage switchgears.

[0002] Vacuum switching tubes are often applied with radial- or axial- magnetic field contact system with coaxial shielding. In use of that, a profiled shielding supports power increase of such vacuum switching tubes. During the contact opening process under loadcondition a light arc occurs between the contact pieces. In order to prevent a deposition of metal vapor on the inner surface of the ceramic part and to prevent the reduction of the dielectrical withstand of a vacuum switching tube, cylindrical shieldings are positioned around the contacts.

Such arrangements are known from the DE 195 03 347 A1.

[0003] It is the object of the invention to result a shielding which has a high absorbance of thermal energy as well as a good protection against metal deposition on the inner ceramic surface caused by high energy light arc impact.

[0004] So the basical idea of the invention is, that the shielding consist of at least two concentric arranged cylindric shielding elements with a space or hollow space between the so arranged inner shielding element and the at least one outer shielding element, and that the inner shielding element has openings, which corresponds with the hollow space between the shielding elements, and the surrounding outer shielding element is made of a porous material.

With this invention the effect of metal particle deposition on the inner ceramic vacuum chamber surface will be prevented not only by the use of a single shielding, but by the use of hollow space absorption of the light arc energy as well as the absorption of the metal particle evaporation. Furthermore the outer shielding made of porous material dissipates the energy which passes through the openings of the inner shielding into the hollow space in case of an occurring light arc in a perfect way.

[0005] In single layer shielding in the state of the art, a metal evaporation from the contact piece surfaces directly and a following deposition on the inner vacuum chamber is prevented, but the light arc can produce such a high energy, that the well known single layer shielding can evaporate itself metal particles towards the inner ceramic surface.

[0006] This effect can be exluded with the invention.

[0007] A further advantageous embodiment is, that the openings are arranged regular over the complete inner shielding element. With this an optimal energy distribution is given.

[0008] A further embodiment propose, that the concentric shielding arrangement consist of more than two concentric arranged shielding elements.

This furthermore increases the shielding performance.

[0009] In an advantageous way the openings are made by punching, machining, lasering or simply sintering of

particles out. This is easy in manufacture and physically very effective, because of the shape of such punched out openings, with the resulting bending of the borderline.

[0010] A futher advantageous possibility is, that the openings are made by materials drilling.

[0011] Furthermore, at least one of the shielding elements can consist of topographic structured regular surface structure. This supports the aforesaid energy distribution furthermore

[0012] According to advantageous material use for this invention is disclosed, that at least the inner shielding element consist of, or is surface coated on its inner surface with heat erosion resistant material such as copper-chromium or copper-tungsten or copper-chromium-tungsten or stainless steel.

[0013] Furthermore is proposed, that the outer, or the next to the inner shielding element arranged further shielding element is made of copper, or a copper a copper steel or iron alloy.

[0014] An embodiment of the invention is shown in figure 1 and 2.

[0015] Figure 1 shows partly a vacuum chamber in medium voltage use for so called vacuum circuit breakers 1. Such a vacuum chamber consist basically of a middle part made as a ceramic tube or connected ceramic tube segments. The ends are closed vacuum tight with metal caps. Inside are two contact pieces which can be moved relatively in order to close and open the contact pieces 2 and 3. In most cases one contact piece is fixed and one is movable, over a vacuumtight bellows. In case of opening the contact, a light arc occurs, which has to be eliminated quickly. A schielding, which is a cylindric tube 4 surrounds the contact area in order to prevent metal particle deposition on the inner surface of the ceramic parts 5 and 6.

In this invention the shielding is not a single layer tube, but an arrangement of at least two concentric shielding tubes 4 and 4' in that way, that the shielding is a tube-in-tube arrangement.

[0016] Figur 2 shows more detailed the shielding.

[0017] The inner shielding element or tube has regular arrangement of punched out openings with a spreaded irregular borderline of around this openings itself. This causes an optimal energy dissipation in case of occuring light arc.

Important is, that only the inner shielding element has such openings. The surrounding second shielding element has no openings in case there is a "only" a double shield arrangement. So both concentric shielding elements or tube include a inner hollow space, in which perfect energy dissipation takes place.

[0018] This is supported importantly by the feature of using an outer shielding made of porous material, in order to cause perfect energy dissipation of the occurring light arc.

[0019] Furthermore the surface of both shielding elements are structured regularly. In that shown embodiment, the surface structure is made by a kind of a folded

tube like a bellows. In that case, each surface, inner and outer surfaces are structured in that way. This prolongs the energy dissipation path furthermore and supports the intended effect additionally.

[0020] The axial fixation, that means the prevention of an axial displacement of the external shielding element 4' is realized by a rotation symmetric cavity in the inner surface of the ceramics, which is dimensioned equal of only slightly longer (in axial direction) than the outer axial extension of the outer shielding element or tube 4'. This gives a sure position of the outer shielding element 4' and prevents an unintended axial shifting.

Position numbers

[0021]

- 1 vacuum chamber
- 2 contact piece
- 3 contact piece
- 4 Absorber shielding element
4' Further Absorber shielding element
- 5 ceramic tube, upper part
- 6 ceramic tube, lower part
- 7 cavity in the inner surface of the ceramic tube
- 8 openings
- 9 hollow space between the shielding elements 4 and 4'

Claims

- 1. Vapor shield arrangement for vacuum switching tube, with cylindric shielding elements around the contact piece area,
characterized in that the shielding consist of at least two concentric arranged cylindric shielding elements with a space or hollow space between the so arranged inner shielding element and the at least one outer shielding element, and that the inner shielding element has openings, which corresponds with only the hollow or the space between the shielding elements, and the surrounding outer shielding element is made of a porous material
- 2. Vapor shield arrangement according to claim 1,
characterized in that the openings or hollows are arranged regular over the complete inner shielding element.

- 3. Vapor shield arrangement according to claim 1 or 2,
characterized in that the concentric shielding arrangement consist of more than two concentric arranged shielding elements.
- 4. Vapor shield arrangement according to claim 1,
characterized in that the openings are made by punching out.
- 5. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that the openings are made by materials drilling.
- 6. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that the openings are made by materials lasering.
- 7. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that at least one of the shielding elements consist of topographic structured regular surface structure.
- 8. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that at least one of the shielding elements consist of partly arranged hollows at the surface structure of the inner shield.
- 9. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that at least the inner shielding element consist of, or is surface coated on its inner surface with heat erosion resistant material such as copper-chromium or copper-tungsten or copper-chromium-tungsten or stainless steel.
- 10. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that the outer, or the next to the inner shielding element arranged further shielding element is made of copper, or a copper a copper steel or iron alloy.
- 11. Vapor shield arrangement according to one of the aforesaid claims,
characterized in that the outer shielding element is made of a porose sinter-material.

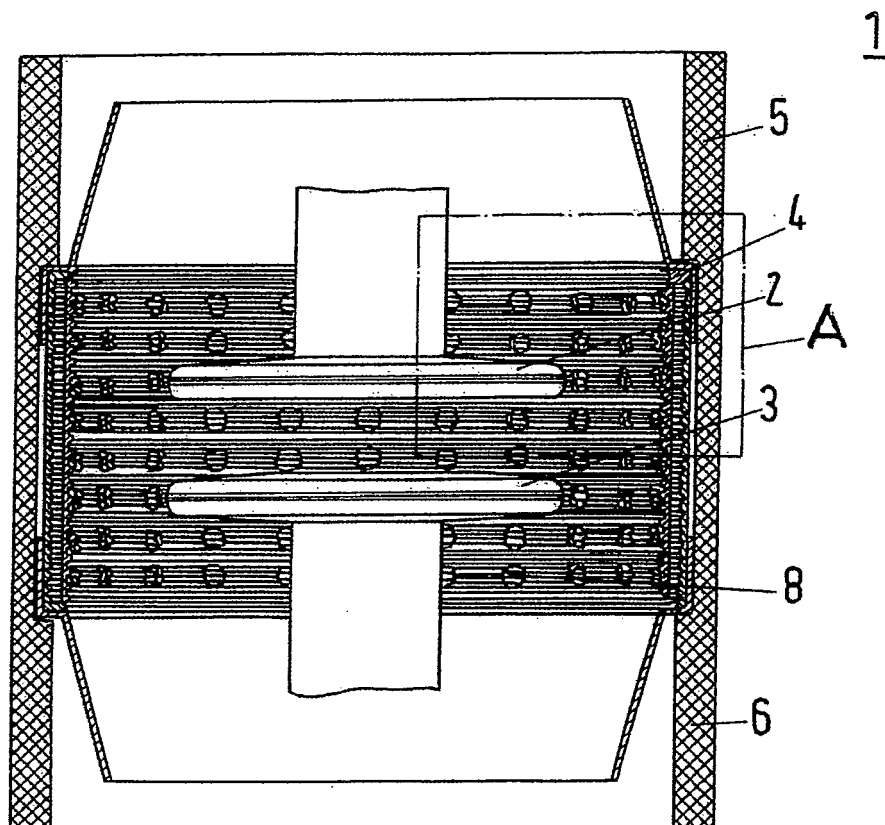


Fig.1

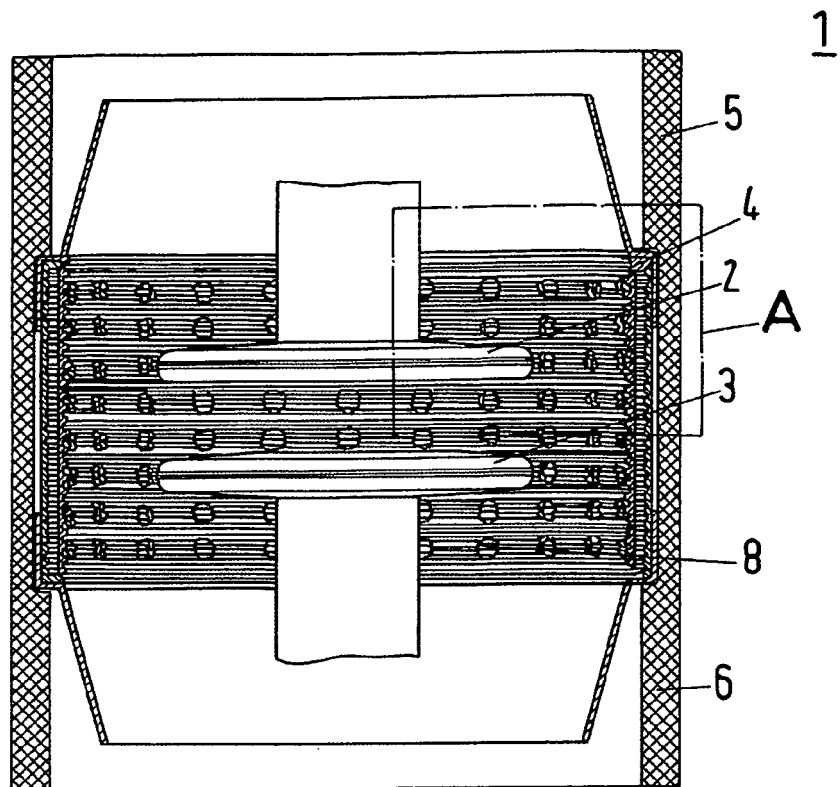


Fig.1

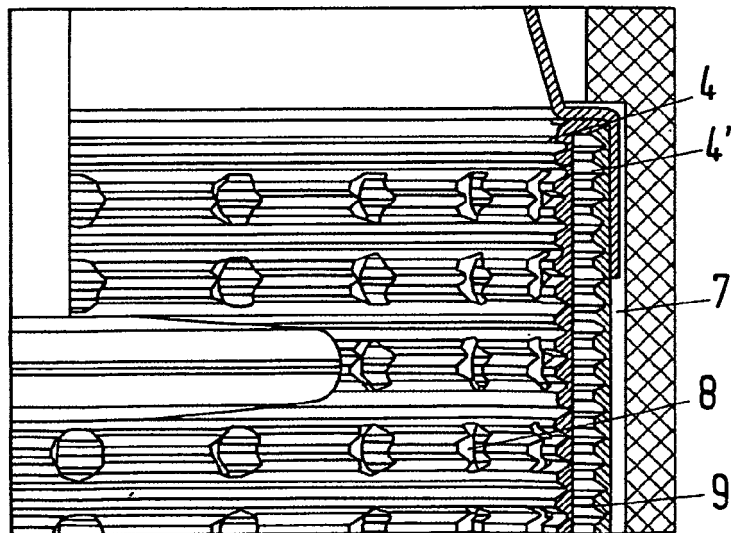


Fig.2
A



EUROPEAN SEARCH REPORT

Application Number
EP 12 00 0299

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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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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 May 2012	Examiner Glaman, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 00 0299

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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21-05-2012

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