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

Dampfabschirmungsanordnung für Vakuumschaltröhre

Agencement de protection de vapeur pour tube de commutation sous vide

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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. FR 1 349 552 A discloses a vapor shield arrangement for vacuum switching tube, with cylindric shielding elements around the contact piece area. Furthermore this document discloses, that the shielding consists of at least two concentric arranged cylindric shielding elements with a space of 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. 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. 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.

[0003] 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.

[0004] This effect can be excluded with the invention, which provides a vapor shield arrangement as defined by claim 1.

[0005] A further advantageous embodiment is, that the openings are arranged regularly over the complete inner shielding element. With this an optimal energy distribution is given.

[0006] A further embodiment proposes that the concentric shielding arrangement consists of more than two concentric arranged shielding elements.

[0007] This furthermore increases the shielding performance. According to the invention, the openings the inner shielding element are made by punching. This is easy in manufacture and physically very effective, because of the shape of such punched out openings, with the resulting bending of the border line.

[0008] Furthermore, at least one of the shielding elements can have a topographic structured regular surface structure. This supports the aforesaid energy distribution further.

[0009] Advantageous material use for this invention is disclosed, in that at least the inner shielding element consists of, or is surface coated on its inner surface with, heat erosion resistant material such as copper-cromium or copper-tungsten or copper-chromium-tungsten or stainless steel.

[0010] 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.

[0011] An embodiment of the invention is shown in figure 1 and 2.

[0012] 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 shielding, 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.

[0013] 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.

[0014] Figur 2 shows more detailed the shielding.

[0015] The inner shielding element or tube 4 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.

[0016] 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.

[0017] This is supported importantly by the feature of using an outer shielding 4' made of porous material, in order to cause perfect energy dissipation of the occurring light arc.

[0018] Furthermore the surface of both shielding elements are structured regularely. 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.

[0019] 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) then the outer axial extension of the outer shielding element or tube 4'.

[0020] 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 cavitiy 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 a vacuum switching tube, with cylindrical shielding elements around a contact piece area, wherein the shielding elements consist of at least two concentric arranged cylindrical shielding elements (4, 4') with a space or hollow space (9) therebetween, the so arranged shielding elements comprising an inner shielding element (4) and at least one outer shielding element (4'), and wherein the inner shielding element (4) has openings (8) which correspond with only the hollow space (9) or the space between the shielding elements (4, 4'), **characterized in that** the surrounding outer shielding element (4') is made of a porous material, and **in that** the openings (8) are punched out openings (8) having a spread, irregular borderline around the openings.

2. Vapor shield arrangement according to claim 1, **characterized in that** the openings (8) are arranged regularly over the complete inner shielding element (4).

3. Vapor shield arrangement according to claim 1 or 2, **characterized in that** the concentric shielding arrangement consists of more than two concentric arranged shielding elements.

4. Vapor shield arrangement according to one of the aforesaid claims, **characterized in that** at least one of the shielding elements has a topographic structured regular surface structure.

5. Vapor shield arrangement according to one of the aforesaid claims, **characterized in that** at least one of the shielding elements (4, 4') comprises a bellowed inner surface structure.

6. Vapor shield arrangement according to one of the aforesaid claims, **characterized in that** at least the inner shielding element (4) consists 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.

7. Vapor shield arrangement according to one of the aforesaid claims, **characterized in that** the outer shielding element (4'), or a further said shielding element arranged next to the inner shielding element (4), is made of copper, or a coppersteel or iron alloy.

8. Vapor shield arrangement according to one of the aforesaid claims, **characterized in that** the outer shielding element (4') is made of a porous sintermaterial.

Patentansprüche

1. Dampfabschirmungsanordnung für eine Vakuumschaltröhre mit zylindrischen Abschirmungselementen um einen Kontaktstückbereich herum, wobei die Abschirmungselemente aus mindestens zwei konzentrisch angeordneten zylindrischen Abschirmungselementen (4, 4') mit einem Raum oder einem Hohlraum (9) dazwischen bestehen, wobei die so angeordneten Abschirmungselemente ein inneres Abschirmungselement (4) und mindestens ein äußeres Abschirmungselement (4') umfassen und wobei das innere Abschirmungselement (4) Öffnungen (8) aufweist, die nur dem Hohlraum (9) oder dem Raum zwischen den Abschirmungselementen (4, 4') entsprechen, **dadurch gekennzeichnet, dass** das umgebende äußere Abschirmungselement (4') aus einem porösen Material angefertigt ist, und dadurch, dass die Öffnungen (8) ausgestanzte Öffnungen (8) sind, die eine ausgebreitete unregelmäßige Grenz-

linie um die Öffnungen herum aufweisen.

2. Dampfabschirmungsanordnung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Öffnungen (8) regelmäßig über das ganze innere Abschirmungselement (4) angeordnet sind.

3. Dampfabschirmungsanordnung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die konzentrische Abschirmungsanordnung aus mehr als zwei konzentrisch angeordneten Abschirmungselementen besteht.

4. Dampfabschirmungsanordnung nach einem der obenstehend genannten Ansprüche, **dadurch gekennzeichnet, dass** mindestens eines der Abschirmungselemente eine topographisch strukturierte regelmäßige Oberflächenstruktur aufweist.

5. Dampfabschirmungsanordnung nach einem der obenstehend genannten Ansprüche, **dadurch gekennzeichnet, dass** mindestens eines der Abschirmungselemente (4, 4') eine gefaltete Innenflächenstruktur umfasst.

6. Dampfabschirmungsanordnung nach einem der obenstehend genannten Ansprüche, **dadurch gekennzeichnet, dass** mindestens das innere Abschirmungselement (4) aus hitzeerosionsbeständigem Material, wie beispielsweise Kupfer-Chrom oder Kupfer-Wolfram oder Kupfer-Chrom-Wolfram oder Edelstahl, besteht oder damit auf seiner Innenfläche oberflächenbeschichtet ist.

7. Dampfabschirmungsanordnung nach einem der obenstehend genannten Ansprüche, **dadurch gekennzeichnet, dass** das äußere Abschirmungselement (4') oder ein weiteres besagtes Abschirmungselement, das neben dem inneren Abschirmungselement (4) angeordnet ist, aus Kupfer oder einer Kupfer-Stahl- oder -Eisenlegierung angefertigt ist.

8. Dampfabschirmungsanordnung nach einem der obenstehend genannten Ansprüche, **dadurch gekennzeichnet, dass** das äußere Abschirmungselement (4') aus einem porösen Sintermaterial angefertigt ist.

Revendications

1. Agencement de protection contre la vapeur pour un tube de commutation à vide, avec des éléments de protection cylindriques autour d'une zone de pièce de contact, les éléments de protection étant constitués d'au moins deux éléments de protection cylindriques (4, 4') agencés concentriquement avec un espace ou un espace creux (9) entre eux, les éléments de protection ainsi agencés comprenant un élément de protection intérieur (4) et au moins un élément de protection extérieur (4'), et l'élément de protection intérieur (4) comportant des ouvertures (8) qui correspondent uniquement à l'espace creux (9) ou à l'espace entre les éléments de protection (4, 4'), **caractérisé en ce que** l'élément de protection extérieur (4') qui l'entoure est constitué d'un matériau poreux, et **en ce que** les ouvertures (8) sont des ouvertures perforées (8) ayant un contour étalé et irrégulier autour des ouvertures.

2. Agencement de protection contre la vapeur selon la revendication 1,
caractérisé en ce que les ouvertures (8) sont agencées régulièrement sur l'ensemble de l'élément de protection intérieur (4).

3. Agencement de protection contre la vapeur selon la revendication 1 ou 2,
caractérisé en ce que l'agencement de protection concentrique consiste en plus de deux éléments de protection agencés concentriquement.

4. Agencement de protection contre la vapeur selon l'une des revendications précédentes,
caractérisé en ce qu'au moins un des éléments de protection présente une structure de surface régulière à structure topographique.

5. Agencement de protection contre la vapeur selon l'une des revendications précédentes,
caractérisé en ce qu'au moins un des éléments de protection (4, 4') comprend une structure de surface intérieure à soufflet.

6. Agencement de protection contre la vapeur selon l'une des revendications précédentes,
caractérisé en ce qu'au moins l'élément de protection intérieur (4) consiste en, ou est revêtu en surface sur sa surface intérieure avec, un matériau résistant à l'érosion thermique tel que le cuivre-chrome ou le cuivre-tungstène ou le cuivre-chrome-tungstène ou l'acier inoxydable.

7. Agencement de protection contre la vapeur selon l'une des revendications précédentes,
caractérisé en ce que l'élément de protection extérieur (4'), ou un élément de protection supplémentaire desdits éléments de protections, agencé à côté de l'élément de protection intérieur (4), est constitué de cuivre, ou d'un acier au cuivre ou d'alliages de fer.

8. Agencement de protection contre la vapeur selon l'une des revendications précédentes,
caractérisé en ce que l'élément de protection extérieur (4') est constitué d'un matériau fritté poreux.

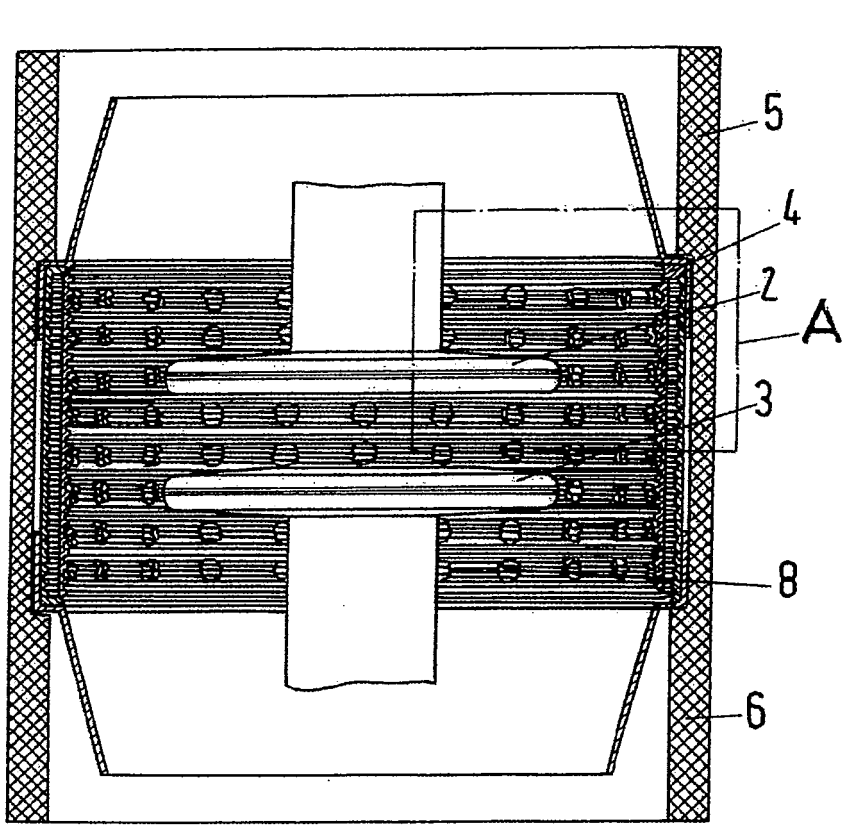

Fig.1

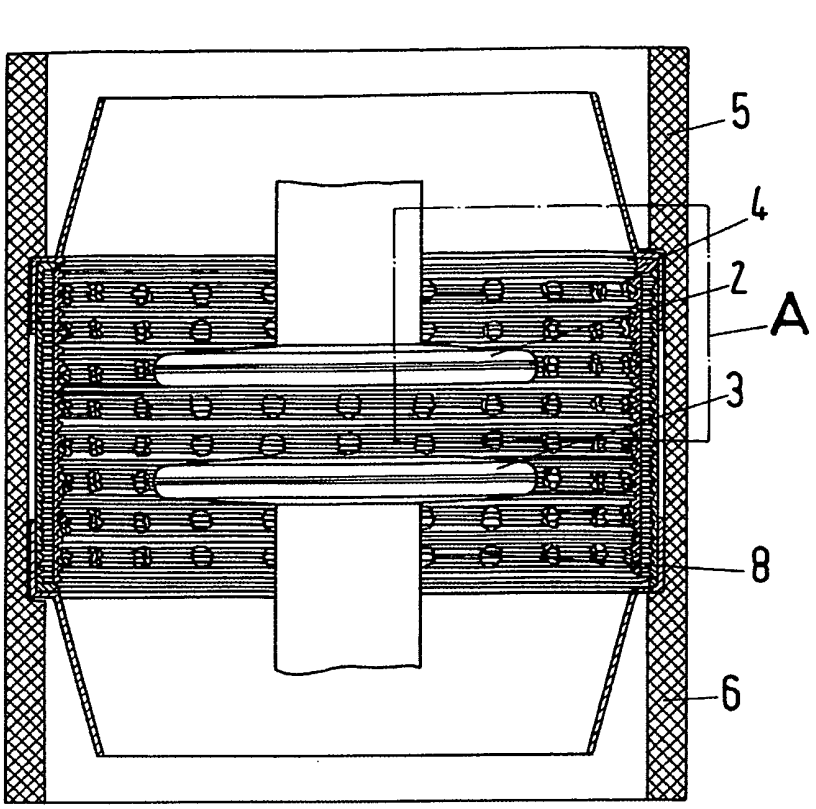

Fig.1

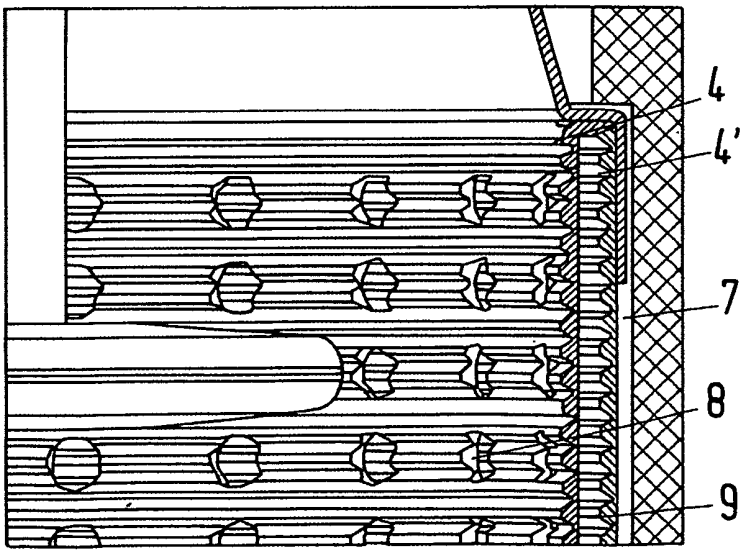

Fig.2
A

REFERENCES CITED IN THE DESCRIPTION

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