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(54) **Electrical contact arrangement with annulus unit consisting of contact fingers**

(57) The invention relates to an electrical contact arrangement for medium to high voltage applications with an annulus unit consisting of circular arranged and axially

directed contact fingers (2), which are attached to a distal end of a contact arm (1), wherein the single contact fingers (2) are fixed one to another on the outer side or the inner side (4) of a common support ring (5).

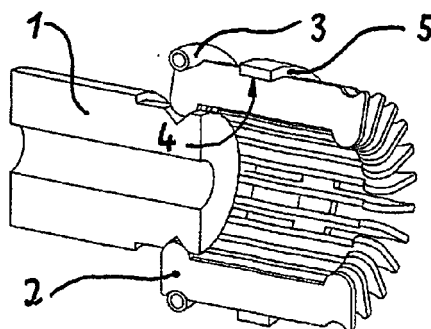


Fig. 1

Description

Field of the Invention

[0001] The present invention relates to an electrical contact arrangement for medium to high voltage applications with an annulus unit consisting of circular arranged and axially directed contact fingers, which are attached to the distal end section of the contact arm.

Background of the Invention

[0002] Medium voltage circuit breakers interrupt the current by creating and extinguishing the arc in a vacuum container. Modern vacuum circuit breakers tend to have longer life expectancy than air or SF6 circuit breakers. Vacuum circuit breakers replace air and SF6 circuit breakers at least for indoor applications. However, the present invention is mostly directed to air circuit breakers in the range of medium voltage to high voltage applications, especially for electrical connectors in air insulated medium voltage switchgear panels. Such switchgear panels require means or contact systems to connect and disconnect the electrical circuit to busbar terminals cables and terminal cables of the panel when they are being inserted and removed, respectively. Therefore, special electrical contact arrangements are provided having several contact fingers forming a circular crown shaped arrangement for electrically connecting the distal end section of a contact arm to the busbar terminal in the panel or the like.

[0003] The document DE 196 48 633 A1 discloses an electrical contact arrangement for high voltage applications comprising an annulus arrangement consisting of several axially and parallel directed contact fingers which are separated one to another by intermediate slits. The contact fingers are designed as respective sections of a one piece sleeve part, which is mechanically and electrically connected to the distal end of the contact arm.

[0004] According to another known embodiment of electrical contact arrangements the contact fingers are designed as single pieces. For an electro-mechanical contact to the contact arm, these single fingers are pressed with a surrounding spring ring onto a ring shaped surface on the distal end section of the contact arm. The contact fingers are supported by a structure to avoid twisting in order to ensure the parallel orientation of the contact fingers one to another. However, the number of contact fingers is relatively low usually, resulting in a relatively low number of electrical contact points and in a relatively high current that each contact point has to carry. Furthermore, the assembly of each contact finger onto the contact arm causes a high manual work effort.

[0005] Therefore, it is an object of the present invention to provide an electrical contact arrangement using a circular shaped annulus arrangement consisting of several axial and parallel directed contact fingers which are easy to assemble and which provide a resilient electrical con-

tact.

Summary of the Invention

[0006] According to the invention the single contact fingers are fixed one to another on the outer side or the inner side of the common supporting ring. As a result, the present invention proposes to use more and thinner contact fingers which are pre-mounted onto the special supporting ring and not on the contact arm.

[0007] The advantage of this special technical solution is reduced ohmic resistance and reduced contact resistance as many contact fingers form the pre-mounted annulus unit. Furthermore, there is an advantage under certain conditions due to the high number of single contact points. It is possible to connect the single contact fingers automatically to the supporting ring after punching. The special supporting ring is preferably formed by a bended sheet metal band, which is glued or welded together on its end sides.

[0008] The fixation of the single contact fingers with the supporting ring or the band can be done in several ways, preferably by gluing the band to the contact fingers. This can also be done by using hot melt glue that is poured on a roll of correctly spaced contact fingers. The contact fingers can have means to increase their glued surface, like holes, grooves, rivet or sandblasted surfaces. Another way - a second embodiment - is to use a supporting ring with snap-on connection means that latch with holes or another recess in the contact fingers. The snap-on connection means for the contact fingers preferably consist of a pair of corresponding clamps radially moulded on the supporting ring.

[0009] A metal band for forming the supporting ring of the contact fingers can be cut to the required length and bended around the contact arm. After forming the arrangement can be fixed with one or more spring rings which are peripherally arranged around the contact fingers. At least one spring ring should be a spiral ring or the like.

[0010] As an alternative solution -this is the third embodiment- for twist protection of the contact fingers, each contact finger can have one or more embossments that can be made within the punching process, that control the distance and angle to the adjacent contact finger. Furthermore, it is also possible - in a fourth embodiment - to use at least one circular fibre running through each contact finger with support spacers for defining the distance between the contact fingers. There should be at least one fibre or wire going through holes and each contact finger in order to realise the circular shape. It is possible to produce such an electrical contact arrangement automatically and directly after the punching process of the contact fingers. In that case the circular fibre or wire represents the supporting ring.

[0011] According to a fifth embodiment of the invention the single contact fingers are formed by parallel slittings of a sheet metal which is bended to form the circular ring.

The solution avoids pre-production of single contact fingers which have to be mounted to the annulus unit according to the foregoing described first embodiment.

[0012] According to another aspect of the fifth embodiment the circular ring is preferably attached to the distal end of the contact rod via several holes by screwing or the like. The circular ring itself is preferably produced by punching sheet metal in order to form the parallel slits between the contact fingers as well as the holes or other fastening means to the contact arm. After punching the part can be rolled to form the annulus unit of the electrical contact arrangement.

[0013] In order to increase the contact pressure the contact fingers are preferably surrounded by a spring element, which is disposed on the distal ends of the contact fingers the width of the contact fingers, the width of the gap between the contact fingers and the force generated by the spring ring can be chosen in a way that the spring ring compresses the annulus unit to a certain diameter, if the contact fingers are not engaged with the corresponding terminal of the panel or the like.

[0014] According to the sith embodiment of the invention the sheet metal is provided with a bended bottom section in order to form a pot shaped annulus unit. The bottom section is preferably provided with a central hole for a screw element or another connecting element for attaching the pot shaped annulus unit onto the front side of the contact arm. That special attachment solution provides a stable mechanical connection as well as a reliable electrical connection. It is proposed to add cut-offs in the region of the central hole that is to be bended and rolled on the edge in order to make the process of bending easier.

[0015] The foregoing and other aspects of the invention will become apparent following the detailed description of the invention when considered in conjunction with the enclosed drawing.

Brief description of the drawings

[0016]

- Figure 1 is a perspective cross section view of the first embodiment of the electrical contact arrangement,
- Figure 2 is a perspective view of a pre-mounted contact finger unit according to the first embodiment,
- Figure 3 is a perspective view of a pre-mounted contact finger unit according to the second embodiment,
- Figure 4 is a perspective view of the third embodiment of the electrical contact arrangement,
- Figure 5 is a perspective view of the fourth embodi-

ment of an electrical contact arrangement,

Figure 6 is a perspective view of the fifth embodiment of an electrical contact arrangement,

Figure 7 is a perspective view of pre-produced contact finger unit for the electrical contact arrangement according to Figure 6,

Figure 8 is a perspective view of the sixth embodiment of an electrical contact arrangement, and

Figure 9 is a perspective view of a preferred embodiment of a double bended annulus unit for an embodiment according to Figure 8.

Detailed description of the drawings

[0017] The electrical contact arrangement as shown in Figure 1 principally consists of a contact arm 1, which is designed as a hollow cylinder made of copper material. On its left side the contact arm 1 is mechanically connected to a - not shown - medium voltage circuit breaker pole part. On its right side the contact arm 1 is provided with a circular shaped annulus arrangement. The special annulus arrangement consists of several axial and parallel directed contact fingers 2. Each contact finger 2 is pressed onto the distal end section of the contact arm 1 by a spring ring 5 which peripherally surrounds the circular arranged contact fingers 2 in order to form the kind of annulus unit.

[0018] All contact fingers 2 are fixed one to another on an inner side 4 of a common supporting ring 5. Each contact finger 2 is attached to the supporting ring 5 by gluing in the present sample.

[0019] As shown in Figure 2, the annulus unit consists of a pre-assembled flat strip which has to be bended to an annular form in order to reach the circular arrangement of single contacts fingers 2. During that production stadium the supporting ring 5 is a flat band.

[0020] According to Figure 3 the single contact fingers 2 are attached to the supporting ring by snap-on connection means. The snap-on connection means for the contact fingers 2 consists of a pair of corresponding clamps 6a and 6b which are directly moulded onto supporting ring 5. The pair of corresponding clamps 6a and 6b engages in a respective recess or hole 7 in each contact finger 2.

[0021] In view of Figure 4 each contact finger 2 comprises several embossed sections 8 for defining distance between adjacent contact fingers 2, the embossed section 8 is made within the punching process of contact fingers 2 and controls the distance and angle to the adjacent contact finger 2.

[0022] Another embodiment of the annulus unit is shown in Figure 5. Two circular fibres 9a and 9b run through each contact finger 2 and support spacer 10 for defining the distance between the contact fingers 2.

[0023] The embodiment of Figure 6 shows contact fingers 2 which are formed by parallel slittings 11 of a sheet metal 12 which is bended to the form of a circular ring 3. The circular ring 3 is attached to the distal end of the contact rod 1 via several holes 13 by screwing. All fingers 2 of the annulus unit are surrounded by a spring ring 14 disposed on the distal ends of the contact fingers 2.

[0024] Figure 7 shows the slitted sheet metal 12 before bending to the ring shape.

[0025] According to Figure 8 an annulus unit with circular arranged contact fingers 2 is formed by a sheet metal 12 having a bended bottom section 15. A pot shaped annulus comprises a central hole 16 for a screw element 17 for attaching the pot shaped annulus unit onto the front side of the contact arm 1.

[0026] As shown in Figure 9 the bottom section 15 of the pot shaped annulus unit comprises several cut-outs 18 forming a star shaped recess on the periphery of the central hole 16 in order to get an even bottom section 15.

Reference signs

[0027]

- 1 Contact Arm
- 2 Contact Fingers
- 3 Circular Ring
- 4 Inner Side of Support Ring
- 5 Support Ring
- 6 Clamp
- 7 Hole
- 8 Embossed Section
- 9 Fibre
- 10 Spacer
- 11 Slitting
- 12 Sheet Metal
- 13 Hole
- 14 Spring Ring
- 15 Bottom Section
- 16 Central Hole
- 17 Central Screw Element

18 Cut-out

Claims

- 5 1. Electrical contact arrangement for medium to high voltage applications with an annulus unit consisting of circular arranged and axially directed contact fingers (2), which are attached to a distal end of a contact arm (1),
characterized in that the single contact fingers (2) are fixed one to another on the outer side or the inner side (4) of a common support ring (5).
- 10 2. Electrical contact arrangement according to Claim 1,
characterized in that each contact finger (2) is attached to the support ring (5) by gluing or welding.
- 15 3. Electrical contact arrangement according to Claim 2,
characterized in that each contact finger (2) comprises means for increasing the contact surface or structure to the support ring (5).
- 20 4. Electrical contact arrangement according to Claim 1,
characterized in that each contact finger (2) is attached to the support ring (5) by snap-on connection means.
- 25 5. Electrical contact arrangement according to Claim 4,
characterized in that the snap-on connection means for the contact finger (2) consist of a pair of corresponding clamps (6a, 6b) radially molded on the support ring (5) for engaging in a respective recess or hole (7) in the contact finger (2).
- 30 6. Electrical contact arrangement according to Claim 1,
characterized in that the support ring (5) consists of a metal band material which is bended to form a circular ring.
- 35 7. Electrical contact arrangement according to Claim 1,
characterized in that the contact fingers (2) are attached to the contact arm (1) by at least one spring ring (3) peripherally arranged around the contact fingers (2).
- 40 8. Electrical contact arrangement according to Claim 1,
characterized in that each contact finger (2) comprises at least one embossed section (8) for defining a distance to the adjacent contact finger (2).
- 45 9. Electrical contact arrangement according to Claim 1,
characterized in that at least one circular fibre (9a, 9b) runs through each contact finger (2) which and each support spacer (10) for defining a distance and an angle between the contact fingers (2).
- 50 10. Electrical contact arrangement according to Claim 1,
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characterized in that each contact finger (2) comprises at least two embossed sections for defining a distance and an angle to the adjacent contact finger (2).

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11. Electrical contact arrangement for medium to high voltage applications with an annulus unit consisting of circular arranged and axially directed contact fingers (2), which are attached to a distal end of a contact arm (1),

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characterized in that the single contact fingers (2) are formed by parallel slittings (11) of a sheet metal (12) which is bended to form a circular ring (3).

12. Electrical contact arrangement according to Claim 11,

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characterized in that the circular ring (3) is attached to the distal end of the contact arm (1) via several holes (13) by screwing.

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13. Electrical contact arrangement according to Claim 11,

characterized in that the contact fingers (2) are surrounded by a spring ring (14) disposed on the distal ends of the contact fingers (2).

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14. Electrical contact arrangement according to Claim 11,

characterized in that the sheet metal (12) is provided with a bended bottom section (15) in order to form a pot-shaped annulus unit.

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15. Electrical contact arrangement according to Claim 11,

characterized in that a central hole (16) for a screw element (17) is arranged in the bottom section (15) of the pot-shaped annulus unit for screwing pot-shaped annulus unit onto the front side of the contact arm (1).

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16. Electrical contact arrangement according to Claim 11,

characterized in that the central hole (16) comprises several cut-outs (18) forming a star-shaped recess on the bottom section (15).

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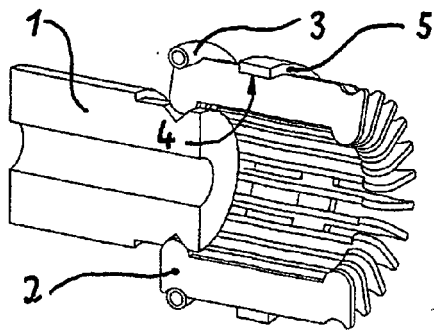


Fig. 1

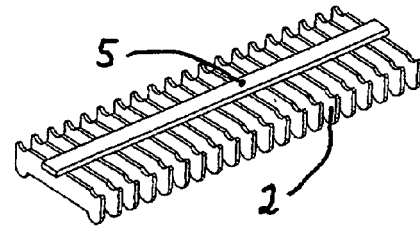


Fig. 2

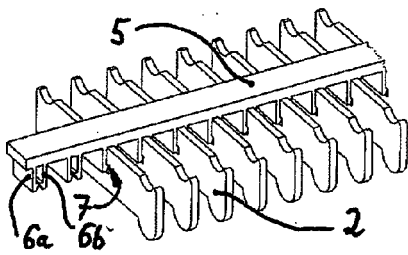


Fig. 3

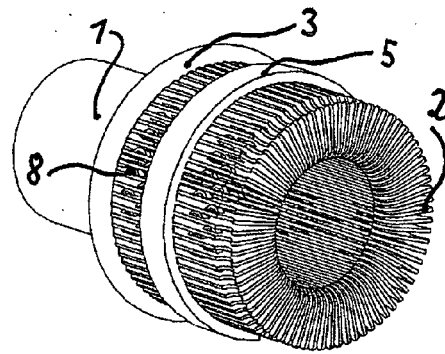


Fig. 4

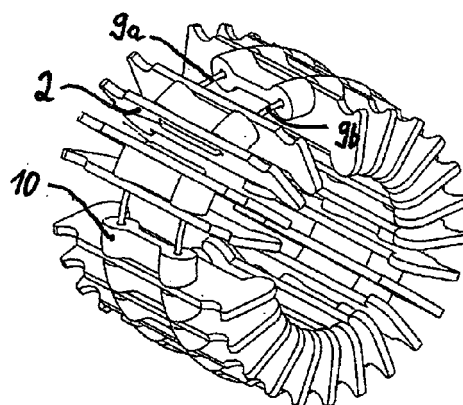


Fig. 5

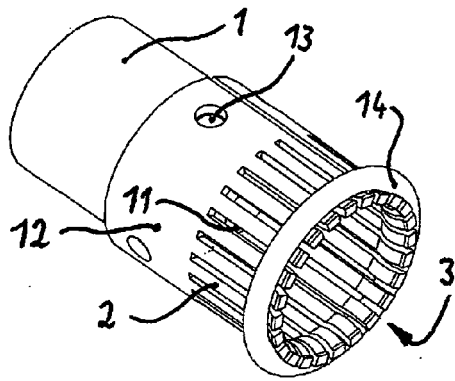


Fig.6

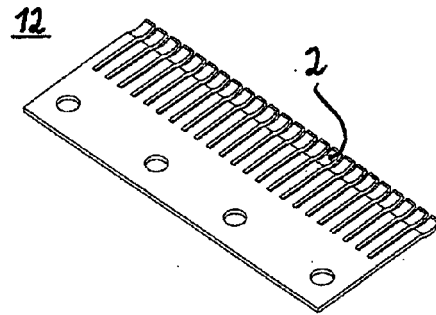


Fig.7

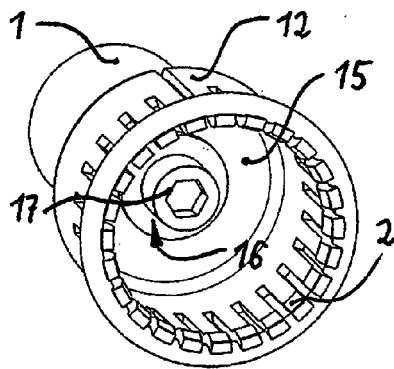


Fig.8

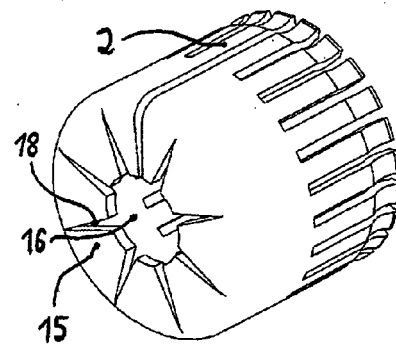


Fig.9



EUROPEAN SEARCH REPORT

Application Number
EP 10 01 0461

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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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			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 February 2011	Examiner Findeli, Luc
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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 01 0461

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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18-02-2011

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