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(54) **Creepage current reducing arrangements for an electric switching device**

(57) The invention relates to an arrangement (1) for an electric switching device such as a relay or a contactor, comprising two opposing contacts (3, 3') for performing the switching operation. In order to provide an arrangement for an electric switching device which effectively

reduces or prevents the formation of conductive way paths for creepage currents and which is compact and easy to produce, it is intended according to the invention, that at least one of the contacts (3, 3') is surrounded laterally at least in parts by a barrier wall (7, 7').

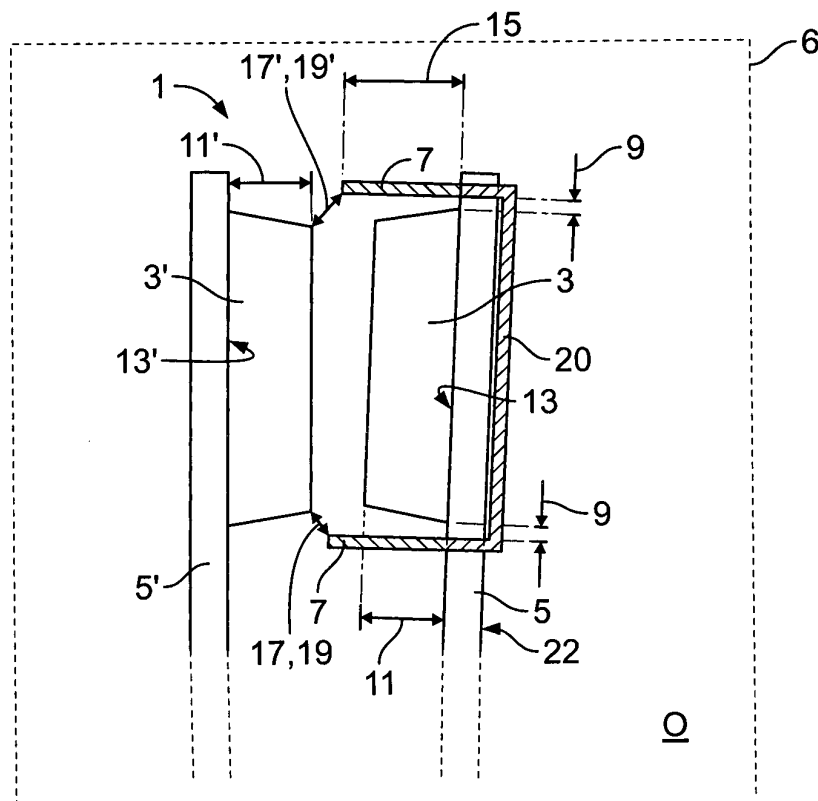


Fig. 1

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Description

[0001] The invention relates to an arrangement for an electric switching device such as a relay or a contactor, comprising two opposing contacts for performing the switching operation. The invention further relates to an electric switching device comprising an arrangement according to the invention.

[0002] Electric switching devices such as relays or contactors are widely used in electronics. In every switching operation, electric arcs between the opposing contacts can be created. The strength and the lifetime of the electric arcs depend on parameters such as the electric current amongst others. The electric arcs can lead to evaporation of the contact material. After cooling down, the evaporated contact material may deposit in a switching chamber which surrounds the contacts and on other components inside the chamber. This deposited contact material may lead to creepage currents between opened contacts. This conduction of the deposited contact material leads to a dysfunction of the switching device, especially when high voltages are applied to the contacts. The deposition of evaporated contact material therefore limits the lifetime of an electric switching device.

[0003] It is therefore an object of the invention to provide an arrangement for an electric switching device which limits or prevents the formation of creepage currents between opened contacts.

[0004] The object is reached according to the invention for an arrangement for an electric switching device as mentioned in the beginning in that at least one of the contacts is surrounded laterally at least in parts by a barrier wall. For the electric switching device as mentioned in the beginning, the object is reached in that the electric switching device comprises a switching chamber, in which opposing contacts are located on terminals, the opposing contacts being each surrounded by a barrier wall, the barrier walls being shaped as ring walls, the barrier walls of opposing contacts forming a chamber, which separates the contacts from the surrounding switching chamber at least in the closed position.

[0005] The barrier wall reduces the expansion of evaporated contact material and interrupts conductive way paths which may be formed by deposited contact material.

[0006] In the following, further improvements of the arrangement for an electric switching device according to the invention are described. These additional improvements may be combined independently of each other, depending on whether a particular advantage of a particular improvement is needed in a specific application.

[0007] According to a first embodiment, a distance between the at least one contact and its surrounding barrier wall is always smaller than a height of the contact. This leads to a compact structure.

[0008] A compact structure can also be reached in that the distance between the at least one contact and its surrounding barrier wall is always smaller than the half

of a contact diameter.

[0009] To effectively interrupt conductive way paths, the at least one barrier wall may project into the direction of the opposing contact.

5 **[0010]** According to another embodiment, at least one of the contacts and its surrounding barrier wall may be located on a terminal. At least one terminal may be moveable to perform the switching operation. The arrangement of the contact and the barrier wall allows for a compact structure and also a fixation of the barrier wall relative to the contact.

10 **[0011]** To reduce the expansion of evaporated contact material, the at least one contact may project from a base to a contact height, the barrier wall projecting from the base at least to the contact height.

15 **[0012]** To achieve a compact structure and a continuous surrounding of the contact, the at least one barrier wall may be shaped as a ringwall. Said ringwall preferably surrounds the entire contact laterally.

20 **[0013]** To effectively reduce the expansion of evaporated contact material in a surrounding switching chamber, at least in a closed position, the at least one barrier wall may form a chamber, which separates the two contacts from a surrounding switching chamber. The chamber may enclose the evaporated material and reduce or even prevent the expansion of this material into the surrounding switching chamber.

25 **[0014]** In order to achieve an effective reduction of the expansion of evaporated contact material and interruption of conductive way paths, the contacts may each comprise at least one barrier wall, the barrier walls opposing each other.

30 **[0015]** According to another embodiment, in the closed position, one of the barrier walls may protrude into an opening of the opposing barrier wall. According to this improvement, both barrier walls together may form a chamber in the closed position, which reduces or prevents the expansion of evaporated contact material.

35 **[0016]** To keep a simple design and to achieve a compact structure, in the closed position, the opposing barrier walls may overlap.

40 **[0017]** To prevent sticking of the barrier walls in the closed position, a moving space may extend between overlapping barrier walls in the closed position.

45 **[0018]** To achieve a simple design and to prevent sticking of the barrier walls, the opposing walls may abut on each other in the closed position. To improve the closing of a chamber which may be formed by the abutting barrier walls, at least one barrier wall may be formed from an elastic material, or may be provided with an elastic sealing element at its free end facing towards the opposing barrier wall.

50 **[0019]** To improve the interruption of conductive way paths, at least one barrier wall may be made from an insulating material. To reduce the production costs, at least one barrier wall may be made from a plastic material.

[0020] To achieve a compact and stable structure, at

least one barrier wall may comprise a holding structure, the holding structure extending at least in parts around a backside of the terminal opposite to the contact.

[0021] To reduce the risk of sparkovers between a contact and its opposite barrier wall, an insulating gap may extend between one contact and the barrier wall of the opposing contact, at least in an open position.

[0022] To reduce the risk of sparkovers between two opposing barrier walls, an insulating gap may extend between the barrier wall of one contact and the opposing barrier wall of the opposing contact, at least in the open position.

[0023] In the following, the invention and its improvements are described in more detail and in an exemplary manner using advantageous embodiments and with reference to the drawings. The described embodiments are only possible configurations, in which, however, the individual features as described above can be provided independent of one another and can be omitted in the drawings:

Fig. 1 is a schematic cross-sectional view of an exemplary embodiment of an arrangement for an electric switching device in an open position;

Fig. 2 shows a schematic cross-sectional view of the same embodiment as shown in Fig. 1 in a closed position;

Fig. 3 shows a schematic cross-sectional view of another embodiment of the arrangement for an electric switching device in an open position;

Fig. 4 shows a schematic cross-sectional view of the same embodiment as shown in Fig. 3 in a closed position.

[0024] Fig. 1 shows an arrangement 1 for an electric switching device. The arrangement 1 comprises two opposing contacts 3, 3'. The contacts 3, 3' are located on terminals 5, 5'. The arrangement 1 may be situated in a surrounding switching chamber 6. In the open position O, the contacts 3, 3' are spaced apart from each other. The contacts 3', 3' may have the shape of a disc. In the cross-sectional view, the contacts 3, 3' may taper towards the opposing contacts 3', 3. The contacts 3, 3' are made by contact material at least in part. The contact 3 is surrounded by a barrier wall 7. The barrier wall 7 may be shaped as a ringwall. The barrier wall 7 protrudes into the direction of the opposing contact 3'.

[0025] The distance 9 between the barrier wall 7 and the contact 3 is smaller than the height 11 of the contact 3. The contacts 3, 3' project from bases 13, 13' to the contact heights 11, 11'. The contact heights 11 and 11' are not necessarily identical. The barrier wall 7 extends to the wall height 15. The wall height 15 is greater than the height 11 of the contact 3.

[0026] Insulating gaps 17, 17' extend between the barrier wall 7 and the opposing contact 3'. The insulating gap lengths 19 and 19' are adapted to prevent electric sparkovers between the barrier wall 7 and the opposing contact 3'. The insulating gaps 17, 17' are necessary to avoid sparkovers in the case that the barrier wall 7 has conducting properties, for example from deposited contact material.

[0027] The barrier wall 7 may comprise a holding structure 20 which extends at least partially around a backside 22 of the terminal 5.

[0028] Fig. 2 shows the arrangement 1 as shown in Fig. 1 in the closed position C. In the closed position C, the contacts 3, 3' contact each other. The barrier wall 7, which projects into the direction of the opposing contact 3', surrounds the opposing contact 3' partially in the closed position C. The barrier wall 7 extends from the terminal 5 further than a contact plane 21 of the contacts 3, 3' in the closed position C.

[0029] The barrier wall 7 forms an open chamber 23 around the contacts 3, 3'. The open chamber 23 reduces the expansion of evaporated contact material. However, the open chamber 23 cannot totally prevent the expansion of evaporated contact material into the switching chamber 6. If contact material is deposited on elements outside of the open chamber 23, the barrier wall 7 may interrupt conductive way paths or, if the barrier wall 7 itself is covered with contact material, it may extend the conductive way paths to an extent which still allows the full function of the switching device.

[0030] Fig. 3 shows another embodiment of an arrangement 1 according to the invention in an open position O. For the sake of clarity, only differences to the previously described embodiment will be described hereinafter. Both contacts 3, 3' are surrounded by barrier walls 7, 7'. The barrier walls 7, 7' project towards each other. In the open position O, insulating gaps 17a, 17'a extend not only between a barrier wall 7, 7' and its corresponding opposing contact 3, 3', respectively, but also between the barrier walls 7 and 7'. The lengths 19, 19' are adapted to prevent electric sparkovers between the barrier walls 7, 7' in the case that the barrier walls 7, 7' have conducting properties. The distance 9 between the barrier wall 7 and the contact 3 is greater than the distance 9' between the opposing barrier wall 7' and the contact 3'.

[0031] Fig. 4 shows the embodiment as described with respect to Fig. 3 in the closed position C. In the closed position C, both barrier walls 7, 7' extend beyond the contact plane 21. In the closed position C, the barrier walls 7 and 7' overlap. The overlapping barrier walls 7, 7' form a chamber 27 which surrounds the contacts 3, 3'. The chamber 27 effectively reduces or even prevents the expansion of evaporated contact material into the switching chamber 6. Therefore, the risk of the formation of conductive way paths between the contacts 3, 3' is reduced or prevented.

[0032] Between the barrier walls 7, 7' a moving space 29 may be formed, which is adapted to prevent sticking

of the barrier walls in the closed position C. The moving space 29 may be dimensioned in a way that it allows the movement of the barrier walls 7, 7' - but at the same time, prevents the expansion of evaporated contact material into the switching chamber 6 at least to a noncritical extent.

[0033] In an alternative embodiment, the barrier walls 7, 7' may abut on each other. In that case, both barrier walls 7, 7' extend preferably to the contact plane 21 and accordingly the contact height 11 equals the height 15 of the barrier walls 7, 7'.

[0034] In a second alternative embodiment, one of the barrier walls 7, 7' may have a greater wall thickness 31, 31' than the opposing barrier wall 7, 7' and a ring-like opening in the barrier wall 7, 7'. The ring-like opening may extend into the direction of the opposing barrier wall 7, 7' and the opposing barrier wall 7, 7' may protrude into the ring-like opening in the closed position C.

Reference Signs List

[0035]

No.	Part
1	Arrangement
3, 3'	Contacts
5	Terminal
6	Switching chamber
7, 7'	Barrier wall
9, 9'	Distance
11	Height of contact
13, 13'	Bases
15	Wall height
17, 17', 17a, 17'a	Insulating gap
19, 19'	Insulating gap lengths
20	Holding structure
21	Contact plane
22	Backside
23	Open chamber
27	Chamber
29	Moving space
31, 31'	Wall thickness
O	Open position
C	Closed position

(continued)

No.	Part

Claims

- Arrangement (1) for an electric switching device such as a relay or a contactor, comprising two opposing contacts (3, 3') for performing the switching operation, **characterised in that** at least one of the contacts (3, 3') is surrounded laterally at least in parts by a barrier wall (7, 7').
- Arrangement (1) for an electric switching device according to claim 1, **characterised in that** a distance (9, 9') between the at least one contact (3, 3') and its surrounding barrier wall (7, 7') is always smaller than a height (11) of the contact (3, 3').
- Arrangement (1) for an electric switching device according to claim 1 or 2, **characterised in that** the at least one barrier wall (7, 7') projects into the direction of the opposing contact (3', 3).
- Arrangement (1) for an electric switching device according to one of the claims 1 to 3, **characterised in that** at least one of the contacts (3, 3') and its surrounding barrier wall (7, 7') are both located on a terminal (5, 5').
- Arrangement (1) for an electric switching device according to one of the claims 1 to 4, **characterised in that** the at least one contact (3, 3') projects from a base (13, 13') to a contact height (11), the barrier wall (7, 7') projecting from the base (13, 13') at least to the contact height (11).
- Arrangement (1) for an electric switching device according to one of the claims 1 to 5, **characterised in that** the at least one barrier wall (7, 7') is shaped as a ring wall.

7. Arrangement (1) for an electric switching device according to one of the claims 1 to 6, **characterised in that**, at least in a closed position (C), the at least one barrier wall (7, 7') forms a chamber (23, 27), which separates the two contacts (3, 3') from a surrounding switching chamber (6). 5
8. Arrangement (1) for an electric switching device according to one of the claims 1 to 7, **characterised in that** the contacts (3, 3') each comprise at least one barrier wall (7, 7'), the barrier walls (7, 7') opposing each other. 10
9. Arrangement (1) for an electric switching device according to claim 8, **characterised in that**, in the closed position (C), one of the barrier walls (7, 7') protrudes into an opening of the opposing barrier wall (7', 7). 15
10. Arrangement (1) for an electric switching device according to claim 8 or 9, **characterised in that**, in the closed position (C), the opposing barrier walls (7, 7') overlap. 20
11. Arrangement (1) for an electric switching device according to one of the claims 1 to 10, **characterised in that** at least one barrier wall (7, 7') is made from an insulating material. 25
12. Arrangement (1) for an electric switching device according to one of the claims 1 to 11, **characterised in that** at least one barrier wall (7, 7') comprises a holding structure (20), the holding structure extending at least in parts around a backside (22) of the terminal (5) opposite to the contacts (3, 3'). 30 35
13. Arrangement (1) for an electric switching device according to one of the claims 1 to 12, **characterised in that** an insulating gap (17, 17') extends between one contact (3, 3') and the barrier wall (7', 7) of the opposing contact (3', 3), at least in an open position (O). 40
14. Arrangement (1) for an electric switching device according to one of the claims 8 to 13, **characterised in that** an insulating gap (17a, 17'a) extends between the barrier wall (7, 7') of one contact (3, 3') and the opposing barrier wall (7', 7) of the opposing contact (3', 3), at least in the open position (O). 45 50
15. Electric switching device comprising an arrangement (1) according to one of the claims 1 to 14, **characterised in that** the electric switching device comprises a switching chamber (6), in which opposing contacts (3, 3') are located on terminals (5, 5'), the opposing contacts (3, 3') being each surrounded by a barrier wall (7, 7'), the barrier walls (7, 7') being shaped as ring walls, the barrier walls (7, 7') of opposing contacts (3, 3') forming a chamber (27), which separates the contacts (3, 3') from the surrounding switching chamber at least in the closed position (C). 55

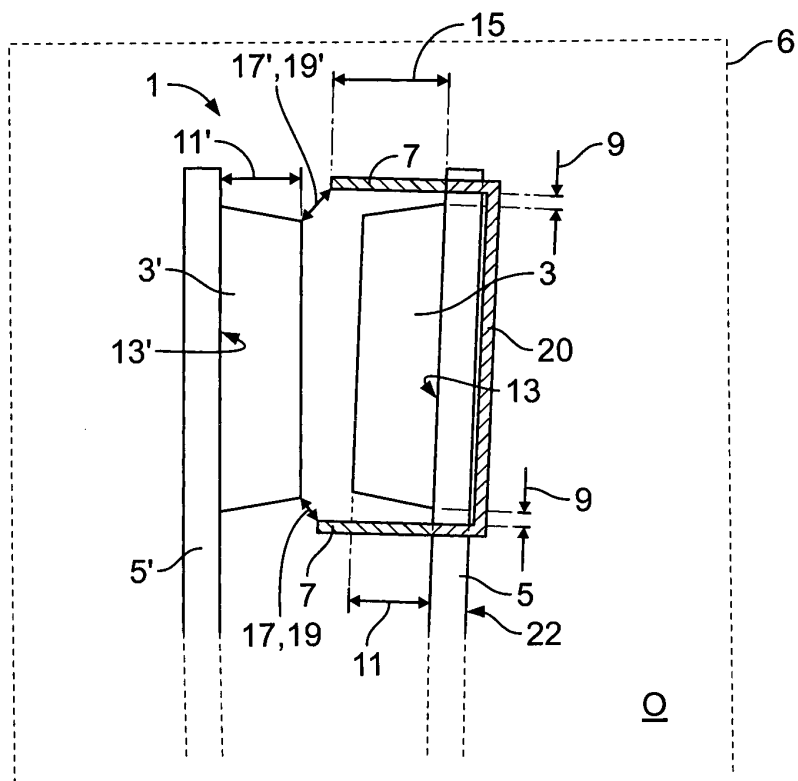


Fig. 1

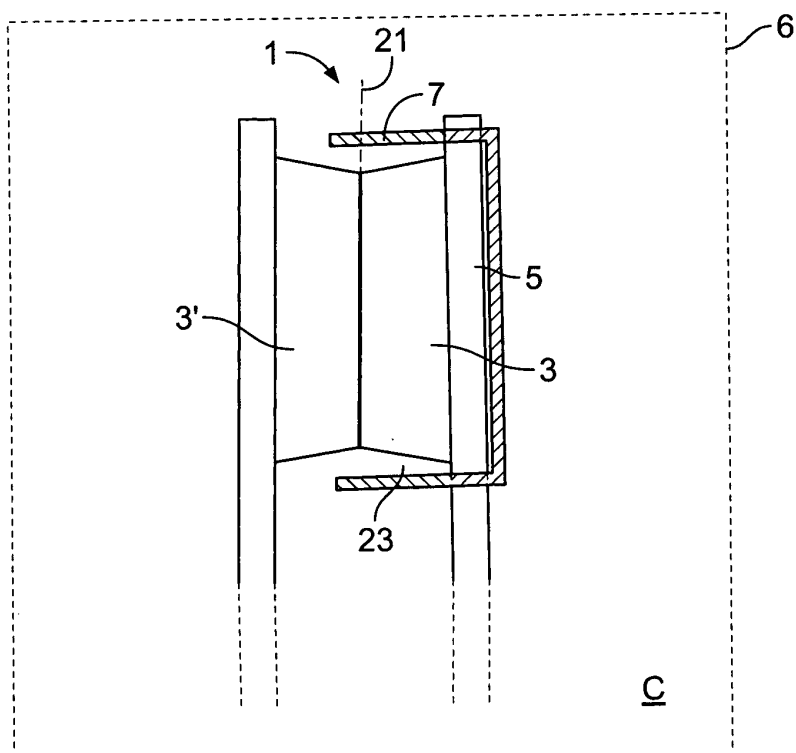


Fig. 2

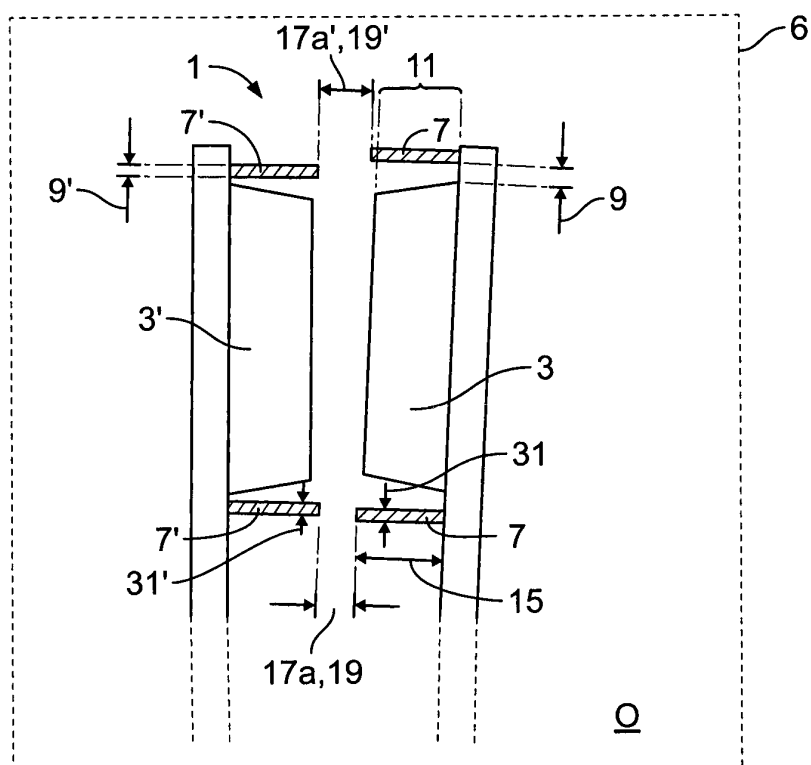


Fig. 3

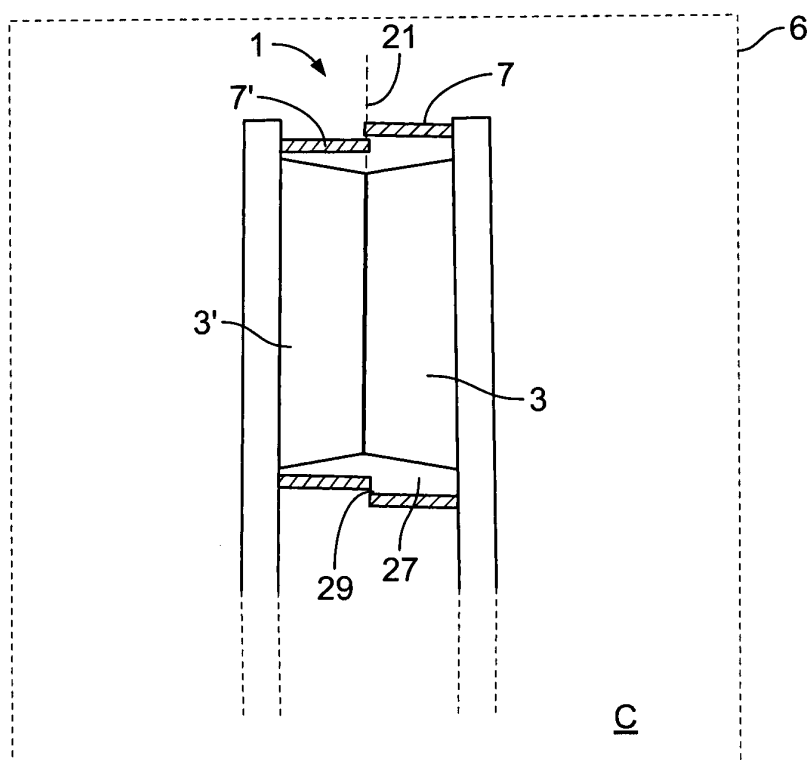


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 0084

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			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 September 2013	Examiner Nieto, José Miguel
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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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