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(54) **MEDIUM- OR HIGH VOLTAGE POLE PART WITH AT LEAST ONE HEAT SINK ELEMENT**

(57) The invention relates to a Medium- or high voltage pole part with at least one heat sink element around or on top of at least one of the electrical contact terminals of the pole part, according to the preamble of claim 1. In order to create a pole part with a heat sink construction, which effects a high heat transportation away from the electrical terminal, which are light and easy to attach, the invention is, that the heat sink element (2) is U-shaped or L-shaped in such, that it is mountable by shifting and clamping it on the pole part body, from the contact face side of the pole part (1).

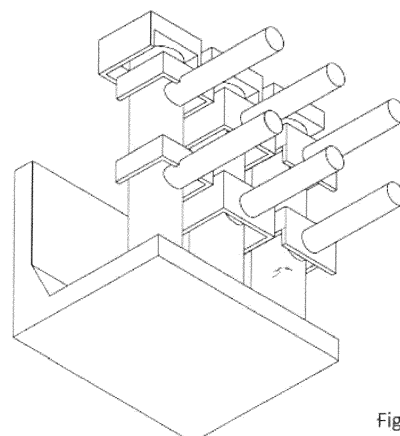
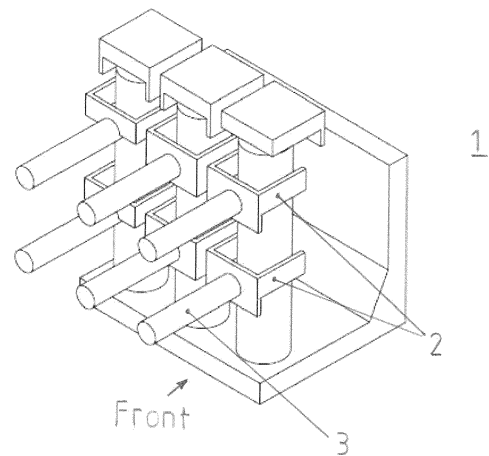


Fig. 1

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## Description

**[0001]** The invention relates to a medium- or high voltage pole part with at least one heat sink element, according to the preamble of claim 1.

**[0002]** For air insulated and gas insulated switchgears, the temperature rise especially in the region of the contact terminal has to be limited.

**[0003]** A pole part of a circuit breaker arrangement with a heat sink element arranged near the upper electrical contact terminals is disclosed in EP 2 720 244 A1. This heat sink element is additionally heavy and compact with a relatively high mass, in order to fulfill a double function, as a heat sink, and as a bouncing absorber for absorbing shock energy from the movement of the moving contact in the end position.

**[0004]** The function as heat sink near the upper contact terminal is advantageous, in order to dissipate away the heat, which occurs there by the effect of electrical power loss of electrical conducting part and transition resistance between electrical contacting parts.

**[0005]** The known heat sink element, which is very solid and heavy has its main function, in compensation of bouncing energy. Therefore, the installation is much more complex than necessary.

**[0006]** It is the object of the invention to create a pole part with a heat sink construction, which effects a high heat transportation away from the electrical terminal, which are light and easy to attach.

**[0007]** This problem has been overcome by the features of the invention.

**[0008]** The invention is, that the heat sink element is U-shaped in such, that it is mountable by shifting and clamping it on the pole part body, from the contact face side of the pole part.

**[0009]** Usually only a heat sink is used on top of the pole part, as shown in the aforesaid EP 2 720 244 A1. With the invention, heat will be dissipated in a much more effective way, by the contour structures, which are positioned closely at that point of the vacuum interrupter pole part, where heat occurs, for example by electrical transition resistance. Furthermore, the assembly of the heat sink elements on the pole part is much easier. Furthermore, the heat sink element can be retrofitted much easier.

**[0010]** A preferably thin U shaped heat sink is fixed to the contact arms of the terminals of the vacuum circuit breaker pole part. This heat sink will get the local power loss dissipated to the surrounding of the pole part of the vacuum circuit breaker.

**[0011]** As further embodiment, multiple plate, that means multiple layered structure can be used in order to increase the heat dissipation, like described in the following text.

**[0012]** Furthermore the U-shaped heat pipe can also be used.

**[0013]** In order to increase the heat dissipation, slots, holes, ribs, cubic, cylinder, radius ribs features could be

added into this U shaped part in order to enforce the heat dissipation of this part.

**[0014]** A further advantageous embodiment is given by that the U-shaped heat sink element consist of two opposing flanks which are both fixed at a bottom element, so that the so structured heat sink element is a one piece element. So it surrounds the pole part closely for good heat transition.

**[0015]** According to the above already given feature, an further embodiment ist, that each of the opposing flanks of the U-shaped heat sink element consist of at least two layers arranged spaced apart, and that the at least two layers per flank are fixed at the common bottom element.

**[0016]** A final advantageous embodiment is, that the bottom element is provided with a c-formed recess in such, that the c-conture of this recess is arrangend partly around the external wall of the electrical contact terminal.

**[0017]** The Invention is used in vacuum interrupter arrangements in such, that the vacuum interrupter is mounted on a frame, with medium- or high voltage pole parts according to one of the aforesaid claims, wherein the heat sink elements are U-shaped.

**[0018]** In an alternative embodiment the heat sink elements are provided furthermore with a bridge element at the open side of the U-shape contour, in order to form the heat sink element finally into a O-shaped contour, surrounding the pole part around the main axis. As alternative two U- or L-shaped contour could be fixed together around the contact arm, to form this O-shaped contour.

**[0019]** In a further advantageous embodiment, the pole part is provided with such heat sink element at both contact terminals, the upper contact terminal and the lower contact terminal.

**[0020]** An embodiment of the invention is shown in the drawings.

Figure 1: Perspective view on a three phase circuit breaker arrangement from top and bottom view, showing the position of the heat sink elements in different designs.

Figure 2: Perspective view to a circuit breaker arrangement with view on heat sink elements in detail

Figure 3: Detailed perspective view on a heat sink element with slots.

Figure 4: Detailed persepective view on a heat sink element.

**[0021]** Like shown in figure 1, a three phase arrangement 1 of three pole parts on a circuit breaker are provided with an U-shaped heat sink element 2 at each electrical contact or terminal arm 3. The U-shape is created as such, that the heat sink element can be inserted from the front side, that means from the contact face side of the pole parts of the circuit breaker.

**[0022]** The U-shaped heat sink element can be fixed to the contact arm of a vacuum circuit breaker pole part. This heat sink will get the local power loss dissipated to the surrounding of the pole part of the vacuum circuit breaker.

**[0023]** Figure 2 shows a further detailed heat sink element 2, like defined by the further depending claims in a special advantageous embodiment. So the heat sink element 2 will be inserted on the terminals of the pole part in the same way, like mentioned above. Here is shown, that the flanks of the heat sink element are splitted into two layers 2' and 2'' each. This multiplies the active heat emitting or dissipating surface. The fact that the layers are arranged as such, that in the mounted position, a vertically oriented slot will be between the layers, this will support cooling convection between them by normally vertically upstreaming convection of the air.

**[0024]** An alternative, or a combinable further embodiment of the heat sink is shown in figure 3. The flanks are provided with a number of parallel cooling slots 4, which are arranged here in a L-shape. This also supports cooling by convection. This slot arrangement can also be combined with the double or multilayered flanks of the heat sink element, as shown in figure 2.

**[0025]** As a further step, U-shaped heat pipe can also be used.

**[0026]** In order to increase the heat dissipation, further slots, holes, ribs, cubic, cylinder, radius ribs features could be added into this U shaped heat sink element.

**[0027]** In order to have a good heat transfer between the contact arm and the heatsink, the contact surface between them should be machined properly with good mechanical fit to each other, which results in low transit thermal resistance. Possible heat conductive paste could be also used to have a low thermal resistance in between. The surface area should be also dimensioned so, that the heat could be transferred properly.

**[0028]** As alternative a L-shaped heatsink by using half of the U-shaped heat sink could be also connected to the contact arm.

**[0029]** Last but not least, painting or coating with an insulating material on the surface of the heat sink elements can be also used for increase the thermal radiation and improve the dielectric performance.

**[0030]** Figure 4 shows once more in detail an embodiment of the heat sink element 2. In the area in front is shown a half round or better a C-formed recess 5, which is placed over the contact arms 3, like shown in figure 1.

#### Numbering:

#### [0031]

- 1 three phase arrangement
- 2 heat sink element
- 2' layer of the flanks of the heat sink element
- 2'' further layer of the flanks of the heat sink element
- 3 contact arm(s)

- 4 cooling ribs, or slots
- 5 C-formed recess

#### 5 Claims

1. Medium- or high voltage pole part with at least one heat sink element around or on top of at least one of the electrical contact terminals of the pole part, **characterized in that** the heat sink element (2) is U-shaped or L-shaped in such, that it is mountable by shifting and clamping it on the pole part body, from the contact face side of the pole part (1).
2. Medium- or high voltage pole part according to claim 1, **characterized in that** the U-shaped or L-shaped heat sink element (2) consist one or two opposing flanks which are both fixed at a middle element, so that the so structured heat sink element is a one piece element.
3. Medium- or high voltage pole part according to claim 1 or 2, **characterized in that** each of the opposing flanks of the U-shaped heat sink element (2) consist of at least two layers (2', 2'') arranged spaced apart, and that the at least two layers per flank are fixed at the common middle element.
4. Medium- or high voltage pole part according to claim 1 or 2, **characterized in that** the middle element is provided with a C-formed recess (5) in such, that the C-contour of this recess is arranged partly around the external wall of the electrical contact terminal.
5. Medium or high voltage pole part according to claim 1 or 2, **characterized in** one or two U- and L-shaped parts are fixed together.
6. Vacuum interrupter pole part, mounted on a frame, with medium- or high voltage pole part according to one of the aforesaid claims 1 to 5, wherein the heat sink elements are U-shaped and/or L-shaped.
7. Vacuum interrupter arrangement mounted on a frame, with medium- or high voltage pole part according to one of the aforesaid claims 1 to 5, wherein the heat sink element is provided furthermore with a bridge element at the open side of the U-shape contour, in order to form the heat sink element finally into a O-shaped contour, surrounding the pole part around the main axis.
8. Vacuum interrupter arrangement, mounted on a

frame, with medium- or high voltage pole part according to one of the aforesaid claims 1 to 5, wherein the heat sink element is provided with two U-shaped and/or L-shaped contours, fixed together in such, that they form an O-shaped contour.

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9. Vacuum interrupter arrangement according to one of the claims 1 to 8, **characterized in that** the pole part is provided with such heat sink element at both contact terminals, the upper contact terminal and the lower contact terminal.

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10. Vacuum interrupter arrangement according to one of the claims 1 to 9, **characterized in that** the heat sink element is coated or painted with an insulating material on the surface in order to cause a better heat radiation and a better dielectric performance.

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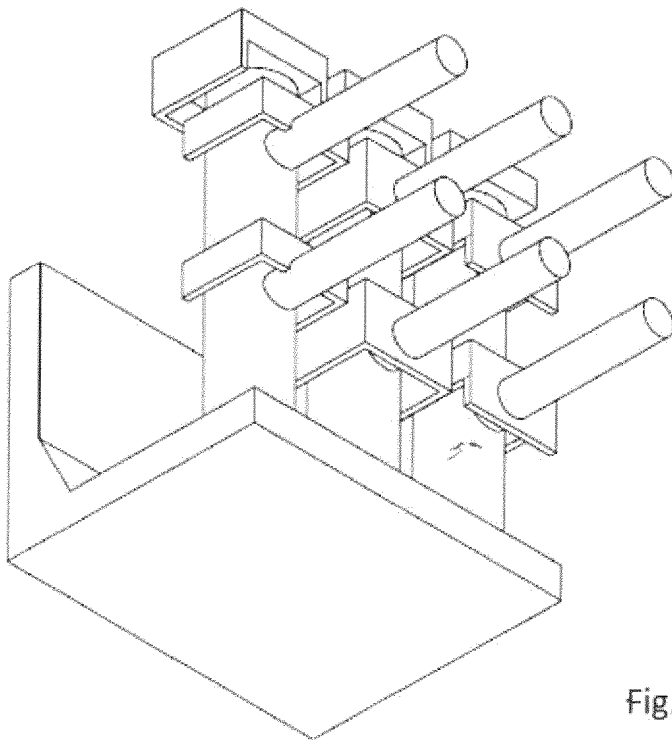
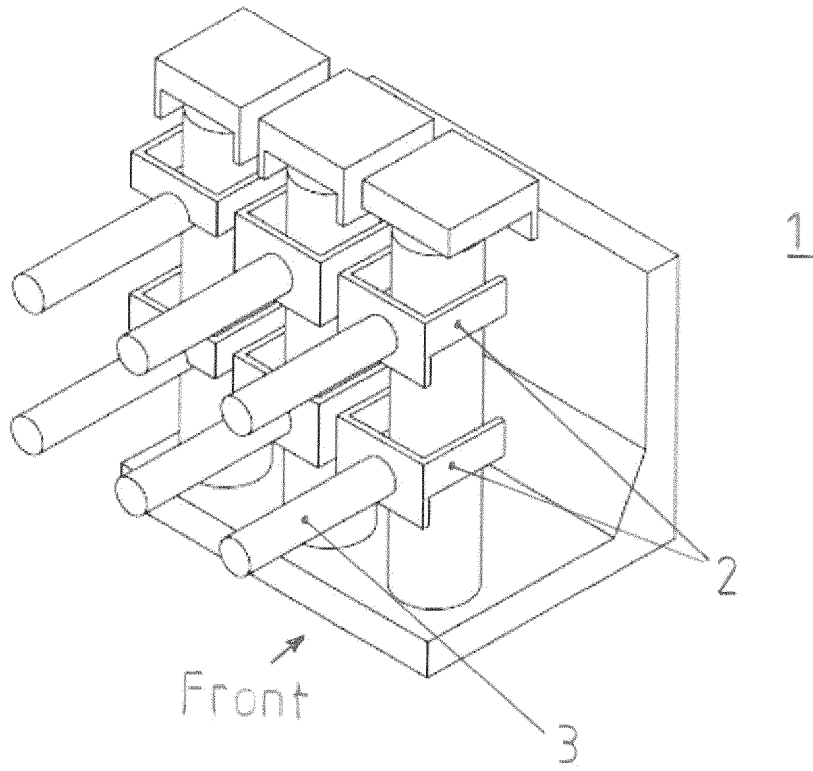


Fig. 1

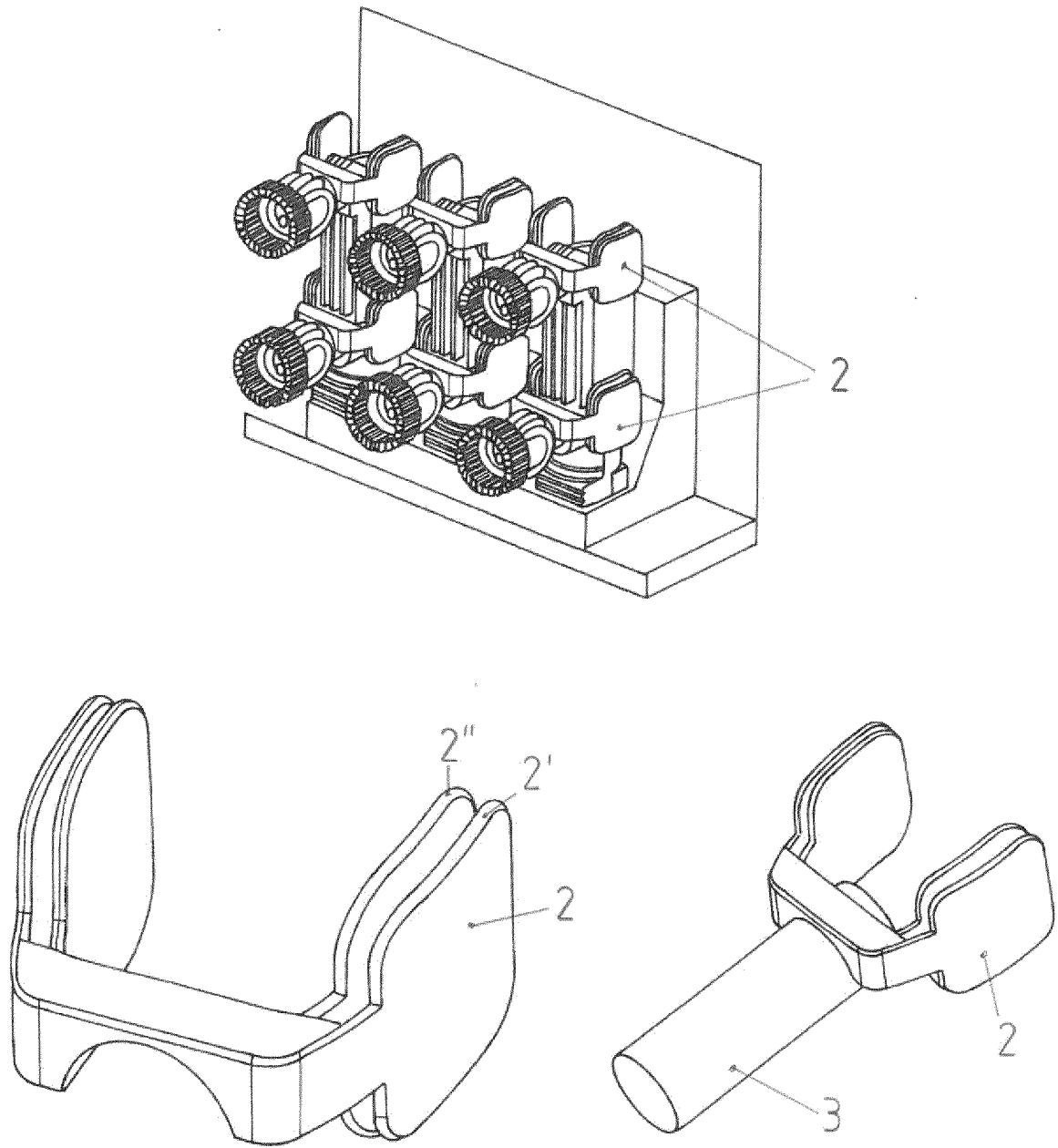


Fig.2

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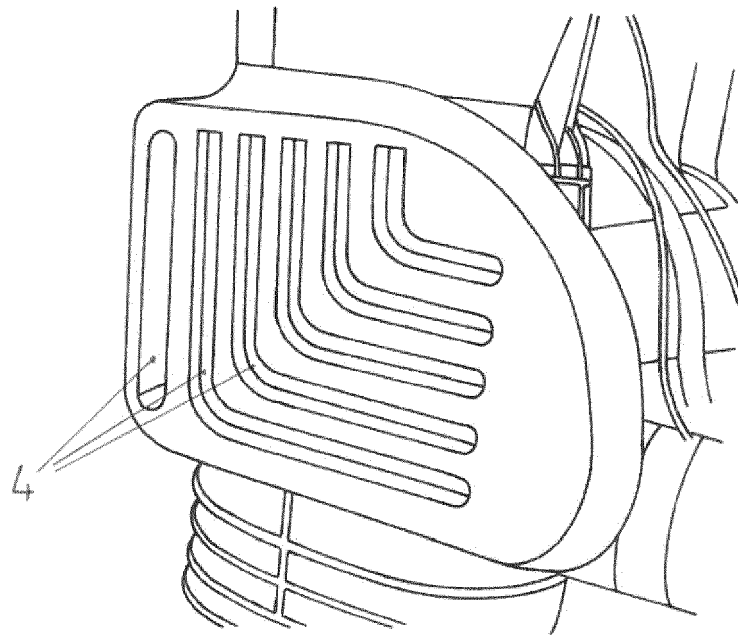


Fig.3

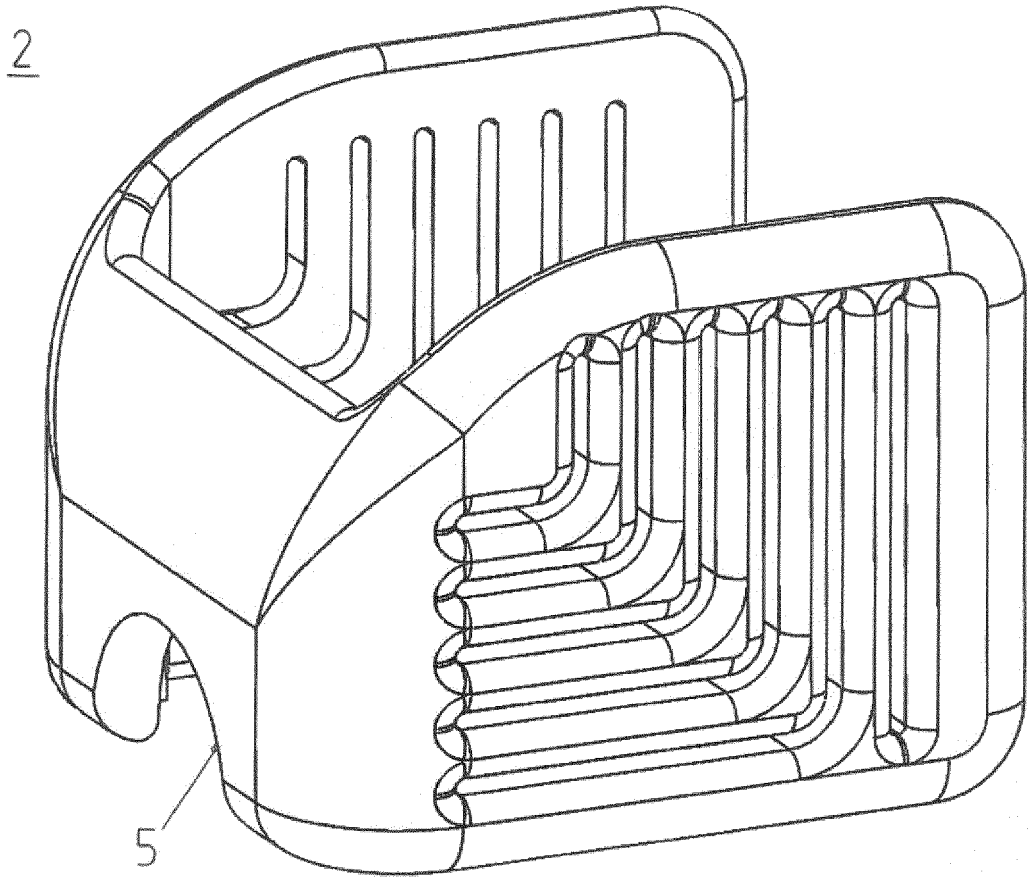


Fig.4



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Application Number  
EP 15 17 3142

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The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>1 December 2015</b>	Examiner <b>Nieto, José Miguel</b>
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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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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