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(54) **SWITCHGEAR**

(57) A switchgear (1) at least one first contact (2) and one second contact (3) is proposed, the switchgear (1) comprises a first arc running electrode (4) and a second arc running electrode (5), an arc quenching device (6) of the switchgear (1) is arranged at least partially in a space between the first arc running electrode (4) and the second arc running electrode (5), the arc quenching device (6)

comprises an arc entrance (7) and at least one gas outlet (8), the arc quenching device (6) comprises at least one stationary non-conductive arc barrier (9), which arc barrier (9) is embodied and positioned to cross an arc traveling path (10) from the arc entrance (7) to the gas outlet (8)

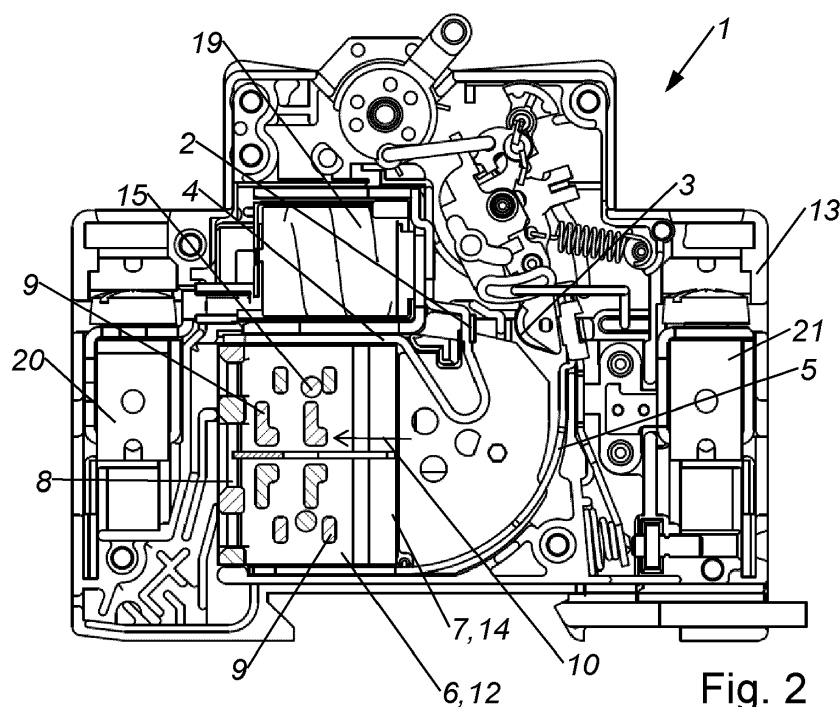


Fig. 2

Description

[0001] The present disclosure relates to a switchgear according to the generic part of claim 1.

[0002] Separating electrical contacts carrying an electric current always cause an electric arc between the contacts. Switchgears, especially circuit breakers, for interrupting high currents typically comprise a device for extinguishing an arc. A common embodiment of such a device is an arc quenching chamber.

[0003] Known arc quenching chambers comprise a plurality of metal plates, isolated from each other. The arc is divided and cooled at the metal plates and thus extinguished. The separate metal plates are held in an insulated body.

[0004] A drawback of these arc quenching chambers is the high number of individual parts and the high effort to assemble the complete arc quenching chamber. The used metal plates are expensive, and they cause the further problem of possible short circuits between some of them. Metal plates further store thermal energy. This might be a risk in case of a series of short circuit events. The delayed heat emission can further damage the surrounding plastic parts of the switchgear.

[0005] It is an object of the present invention to overcome the drawbacks of the state of the art by providing a switchgear with an arc quenching device, which comprises a low number of parts, which is easy to assemble, and which lowers the risk of an electric and/or thermic failure.

[0006] According to the invention, this object is solved by the features of claim 1.

[0007] The switchgear contains a low number of parts, and is easy to assemble. As no metal plates are necessary the risk of electric and/or thermal damage is decreased. The arc quenching device can be made complete out of plastic, in one or two pieces, without the need to place a plurality of metal plates.

[0008] Dependent claims describe further preferred embodiments of the invention.

[0009] The invention is described with reference to the drawings, showing only a preferred embodiment.

Fig. 1 shows a preferred embodiment of an actual switchgear with open housing;

Fig. 2 shows the switchgear according Fig. 1 with an opened arc quenching device;

Fig. 3 shows one part of the open arc quenching device according Fig. 2;

Fig. 4 shows the parts of the arc quenching device according Fig. 2 in a three dimensional exploded view; and

Fig. 5 shows the arc quenching device according Fig. 2 in a three dimensional view.

[0010] Fig. 1 and 2 showing a preferred embodiment of a switchgear 1 comprising at least one first contact 2 and one second contact 3 to form an electrical conducting path through the switchgear 1, the switchgear 1 comprises a first arc running electrode 4, which first arc running electrode 4 is connected to the first contact 2 at least when the contacts 2, 3 are positioned in a separated state, the switchgear 1 comprises a second arc running electrode 5, which second arc running electrode 5 is connected to the second contact 3 at least when the contacts 2, 3 are positioned in the separated state, an arc quenching device 6 of the switchgear 1 is arranged at least partially in a space between the first arc running electrode 4 and the second arc running electrode 5, the arc quenching device 6 comprises an arc entrance 7 and at least one gas outlet 8. The arc quenching device 6 comprises at least one stationary non-conductive arc barrier 9, which arc barrier 9 is embodied and positioned to cross an arc traveling path 10 from the arc entrance 7 to the gas outlet 8.

[0011] The switchgear 1 contains a low number of parts, and is easy to assemble. As no metal plates are necessary the risk of electric and/or thermal damage is decreased. The arc quenching device 6 can be made complete out of plastic, even in one or two pieces, without the need to place a plurality of metal plates.

[0012] The switchgear 1 is preferably embodied as circuit breaker, as shown in Fig. 1 and 2. As a circuit breaker the switchgear 1 comprises at least one trigger 19. The switchgear according Fig. 1 and 2 comprises a first trigger comprising a bimetal element and a second trigger 19 in form of an electromagnetic-trigger.

[0013] The switchgear 1 comprises at least a first mechanical electrical contact 2 and a second mechanical electrical contact 3. The first and second contacts 2, 3 form an electrical conducting path from a first clamping device 20 of the switchgear 1 to a second clamping device 21 of the switchgear 1.

[0014] The switchgear 1 comprises a first arc running electrode 4 and a second arc running electrode 5. According the preferred embodiment, the first contact 2 is a stationary contact, which is positioned directly on the first arc running electrode 4. According the preferred embodiment, the second contact 3 is a movable contact. When the contacts 2, 3 are positioned in a separated state, as shown in Fig. 1 and 2, the second arc running electrode 5 is connected to the second contact 3. When the second contact 3 is connected to the first contact 2, the second arc running electrode 5 is not connected to the second contact 3.

[0015] The switchgear 1 comprises an arc quenching device 6. Typical other terms for the arc quenching device 6 are arc extinguishing device, arc quenching chamber or arc extinguishing chamber.

[0016] In case of a switch off operation, an arc 22 will be established between the first contact and the second contact 2, 3. The arc 22 moves from the contacts 2, 3 to the first and second arc running electrode 4, 5, and moves

along them to the arc quenching device 6. The arc quenching device 6 is arranged at least partially in a space between the first arc running electrode 4 and the second arc running electrode 5.

[0017] The arc quenching device 6 comprises an arc entrance 7 and at least one gas outlet 8. Preferably the arc quenching device 6 is embodied as chamber, further comprising at least a first side wall 11 or first lateral surface and a second side wall 12 or second lateral surface. Especially the chamber has substantially the form of a cuboid, with the first and the second side walls 11, 12 each extending from the first arc running electrode 4 to the second arc running electrode 5, as shown in Fig. 1 and 2.

[0018] The arc entrance 7 is an opening directed to the contacts 2, 3 of the switchgear 1. Preferably the arc entrance 7 is - at least partially - formed as a nozzle 14, to compress the arc plasma.

[0019] The arc quenching device 6 comprises at least one stationary non-conductive arc barrier 9, which arc barrier 9 is embodied and positioned to cross an arc traveling path 10 from the arc entrance 7 to the gas outlet 8, which arc 22 is established between the first and the second arc running electrode 4, 5. The arc barrier 9 extends the length of an arc 22 from the first arc running electrode 4 to the second arc running electrode 5 by crossing its way. This makes it necessary for the arc 22 to bend over the arc barrier 9. Another term for the arc barrier 9 is non-conductive obstacle. "Non-conductive" means that the arc barrier 9 comprises at least an insulating surface.

[0020] The at least one arc barrier 9 can have different forms and different embodiments regarding the actual design of the complete arc quenching device 6. Preferably the arc quenching device 6 contains a plurality of arc barriers 9. Preferably the arc barriers 9 have substantially rectangular and/or L-shaped cross-sections, as shown in Fig. 3. Especially the cross-section of the arc barrier 9 is not circular. This would increase the surface of the arc barrier 9 as well as the effect of cooling the arc 22.

[0021] Preferably the at least one arc barrier 9 extends from the first side wall 11 to the second side wall 12 of the arc quenching device 6. According a highly preferred embodiment, the at least one arc barrier 9 is arranged substantially perpendicular to the first side wall 11 and/or the second side wall 12, what supports the manufacture of the arc quenching device 6 by injection molding. Especially the at least one arc barrier 9 is formed in one piece or integrally with the first side wall 11 and/or the second side wall 12.

[0022] In case of a plurality of arc barriers 9, all of them are preferably substantially parallel.

[0023] The at least one arc barrier 9 is further preferably arranged substantially parallel to the first arc running electrode 4 and/or the second arc running electrode 5.

[0024] The arc quenching device 6 is preferably made of plastic material, which may be partially vaporized by

an arc. Such plastic materials as well as the effect of vaporization are well known in the field of arc quenching devices 6.

[0025] According a further preferred but not shown embodiment, the arc quenching device 6 comprises only non-conductive parts, preferably made of plastic material. This causes a very simple and cost effective arc quenching device 6.

[0026] The switchgear 1 typically comprises a molded housing 13 made of an insulating plastic material. The arc quenching device 6 can be embodied as separate part, which is inserted into the switchgear 1. According a not shown embodiment, the arc quenching device 6 is an integral part of the switchgear 1, and the at least one arc barrier 9 is formed integrally with at least a part of the molded housing 13.

[0027] The at least one arc barrier 9 is embodied and arranged to cross the way of the arc 22 from the arc entrance 7 to the gas outlet 8. Preferably the at least one arc barrier 9 is arranged in front of the at least one gas outlet 8. This means the arc barrier 9 is positioned in a sight line from the arc entrance 7 to the gas outlet 8 in such a way, that an arc has to pass the arc barrier 9 on its way to the gas outlet 8.

[0028] According the preferred embodiment the arc quenching device 6 comprises a plurality of arc barriers 9. The plurality of non-conductive arc barriers 9 is embodied and arranged in the arc quenching device 6 in such a way, that - in a view from the arc entrance 7 - at least 70% of the opening area of the at least one gas outlet 8 or the area of the sum of all areas of all gas outlets 8 is covered by the arc barriers 9.

[0029] The arc quenching device 6 according the embodiments shown in Fig. 1 to 3 comprises at least one conducting element 15. This conduction element 15 is preferably not electrical connected to another part or a special electric potential.

[0030] According a first embodiment of the conducting element 15, it is embodied as arc splitting plate 16, which is preferably arranged substantially parallel to the first arc running electrode 4 and/or second arc running electrode 5. The arc 22 will be divided and cooled at the splitting plate 16.

[0031] According a second embodiment of the conducting element 15, it is embodied as conducting obstacle 17, which is embodied and positioned to cross the arc traveling path 10 from the arc entrance 7 to the gas outlet 8. Preferably the at least one conducting obstacle 17 is arranged substantially parallel to the at least one non-conductive arc barrier 9.

[0032] Conducting obstacles 17 are helping to define a preferred arc path 10 through the arc quenching device 6. Fig. 2 and 3 showing an arc quenching device 6 with conducting elements 15 according the first and the second embodiment.

[0033] Fig. 4 and 5 showing three dimensional views of the preferred embodiment of the actual arc quenching device 6. As best can be seen in Fig. 4 the basic structure

of the arc quenching device 6 is made of only two identical plastic parts 23, which also could be named as first half shell and second half shell. Both plastic parts 23 can be made with the same mold, and it is not necessary to hold different parts on stock.

[0034] The preferred arc quenching device 6 further comprises the conductive arc splitting plate 16, which is arranged in a slot 18 of the two half shells. Further conductive obstacles 17 are arranged in receptacles of the half shells. Although the conductive obstacles 17 are shown in Fig. 4 arranged at the first side wall 11 the receptacles for them in the second side wall 12 are not shown in the figures.

Claims

1. Switchgear (1) comprising at least one first contact (2) and one second contact (3) to form an electrical conducting path through the switchgear (1), the switchgear (1) comprises a first arc running electrode (4), which first arc running electrode (4) is connected to the first contact (2) at least when the contacts (2, 3) are positioned in a separated state, the switchgear (1) comprises a second arc running electrode (5), which second arc running electrode (5) is connected to the second contact (3) at least when the contacts (2, 3) are positioned in the separated state, an arc quenching device (6) of the switchgear (1) is arranged at least partially in a space between the first arc running electrode (4) and the second arc running electrode (5), the arc quenching device (6) comprises an arc entrance (7) and at least one gas outlet (8), **characterized in that** the arc quenching device (6) comprises at least one stationary non-conductive arc barrier (9), which arc barrier (9) is embodied and positioned to cross an arc traveling path (10) from the arc entrance (7) to the gas outlet (8).
2. Switchgear (1) according to claim 1, **characterized in that** the arc quenching device (6) comprises at least a first side wall (11) and a second side wall (12), and that the at least one arc barrier (9) extends from the first side wall (11) to the second side wall (12).
3. Switchgear (1) according to claim 1 or 2, **characterized in, that** the at least one arc barrier (9) is arranged substantially perpendicular to the first side wall (11) and/or the second side wall (12).
4. Switchgear (1) according to one of the claims 1 to 3, **characterized in, that** the at least one arc barrier (9) is arranged substantially parallel to the first arc running electrode (4) and/or the second arc running electrode (5).
5. Switchgear (1) according to one of the claims 1 to 4, **characterized in, that** the switchgear (1) comprises a molded housing (13), and that the at least one arc barrier (9) is formed integrally with at least a part of the molded housing (13).
6. Switchgear (1) according to one of the claims 1 to 5, **characterized in, that** the at least one arc barrier (9) is arranged in front of the at least one gas outlet (8).
7. Switchgear (1) according to one of the claims 1 to 6, **characterized in, that** a plurality of non-conductive arc barriers (9) is embodied and arranged in the arc quenching device (6) in such a way, that - in a view from the arc entrance (7) - at least 70% of the opening area of the at least one gas outlet (8) is covered by the arc barriers (9).
8. Switchgear (1) according to one of the claims 1 to 7, **characterized in, that** the arc entrance (7) is - at least partially - formed as a nozzle (14).
9. Switchgear (1) according to one of the claims 1 to 8, **characterized in, that** the arc quenching device (6) comprises only non-conductive parts, preferably made of plastic material, especially a plastic material that may be partially vaporized by an arc.
10. Switchgear (1) according to one of the claims 1 to 8, **characterized in, that** the arc quenching device (6) comprises at least one conducting element (15).
11. Switchgear (1) according to claim 10, **characterized in, that** the at least one conducting element (15) is embodied as arc splitting plate (16), which is preferably arranged substantially parallel to the first arc running electrode (4) and/or second arc running electrode (5).
12. Switchgear (1) according to claim 10 or 11, **characterized in, that** the at least one conducting element (15) is embodied as conducting obstacle (17), which is embodied and positioned to cross the arc traveling path (10) from the arc entrance (7) to the gas outlet (8).
13. Switchgear (1) according to claim 12, **characterized in, that** the at least one conducting obstacle (17) is arranged substantially parallel to the at least one non-conductive arc barrier (9).

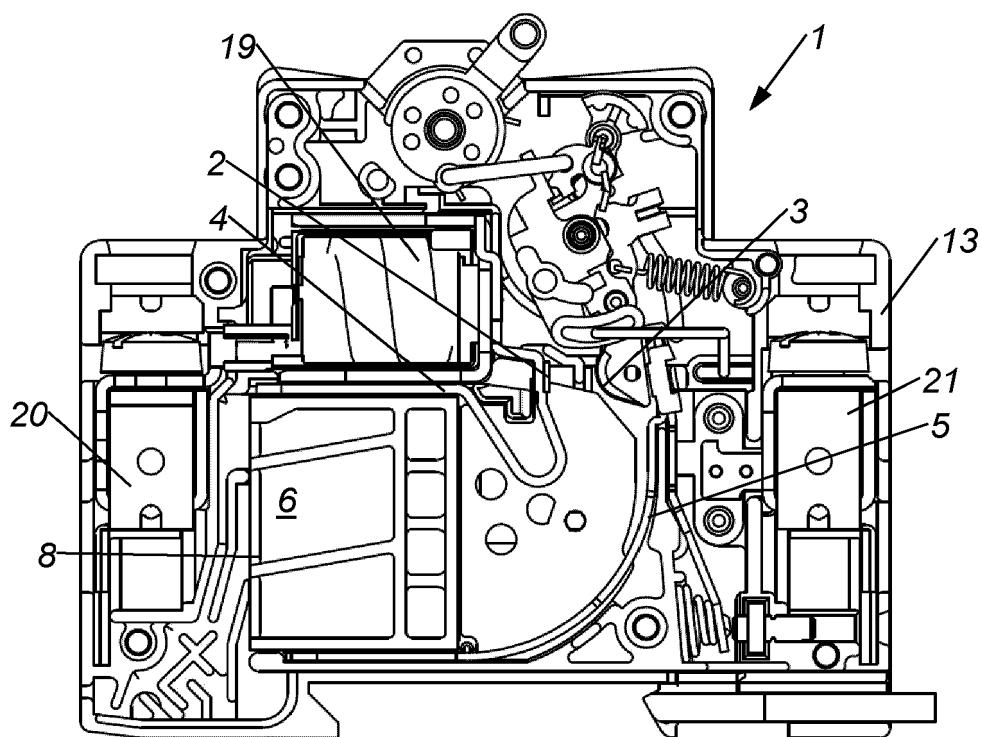


Fig. 1

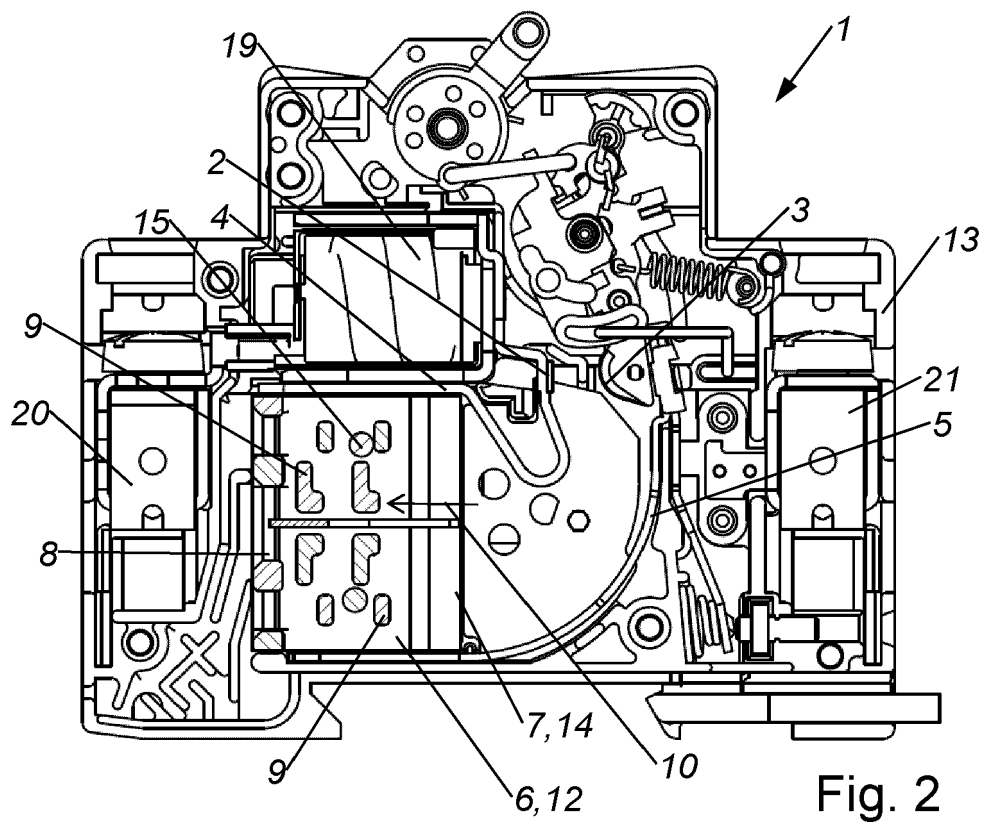


Fig. 2

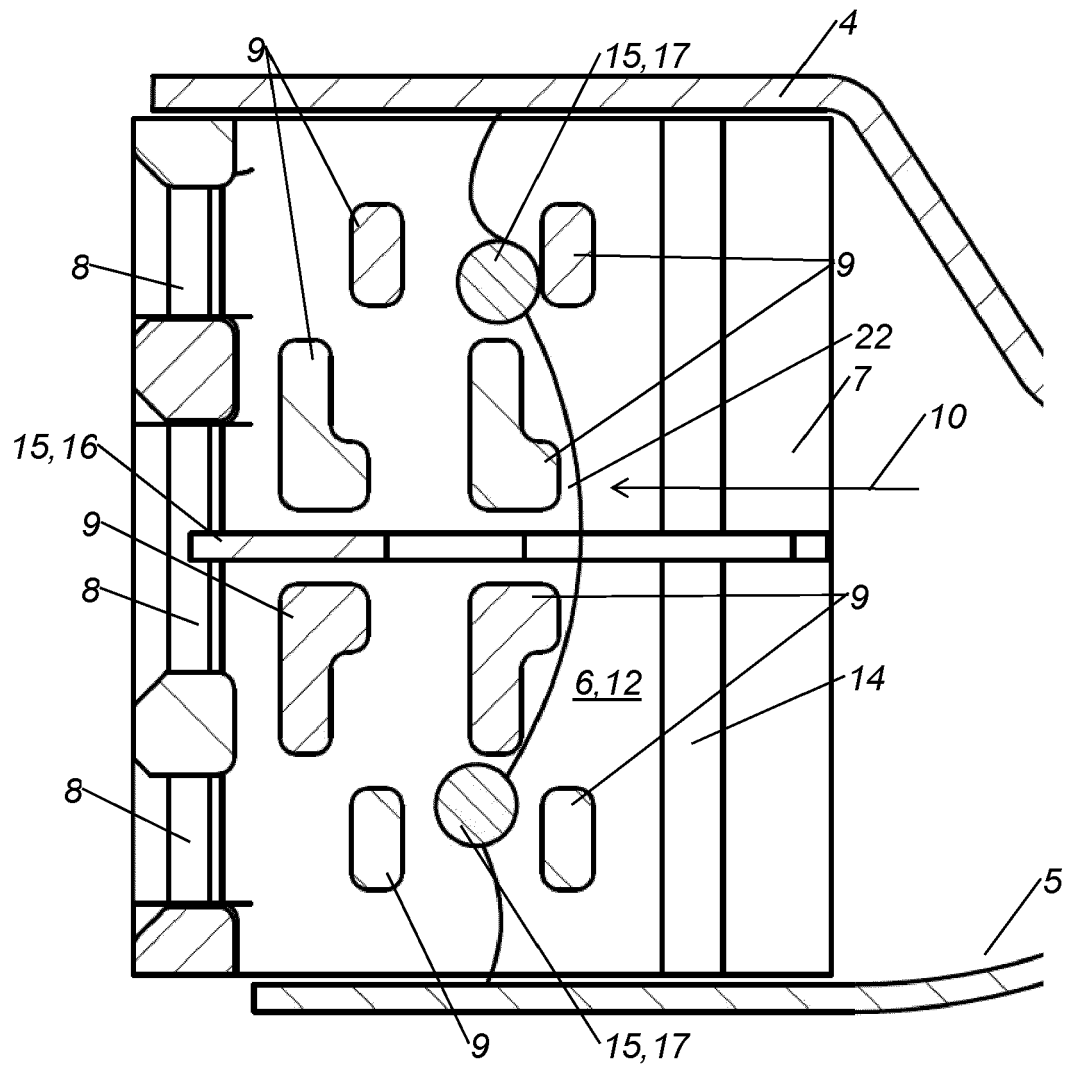
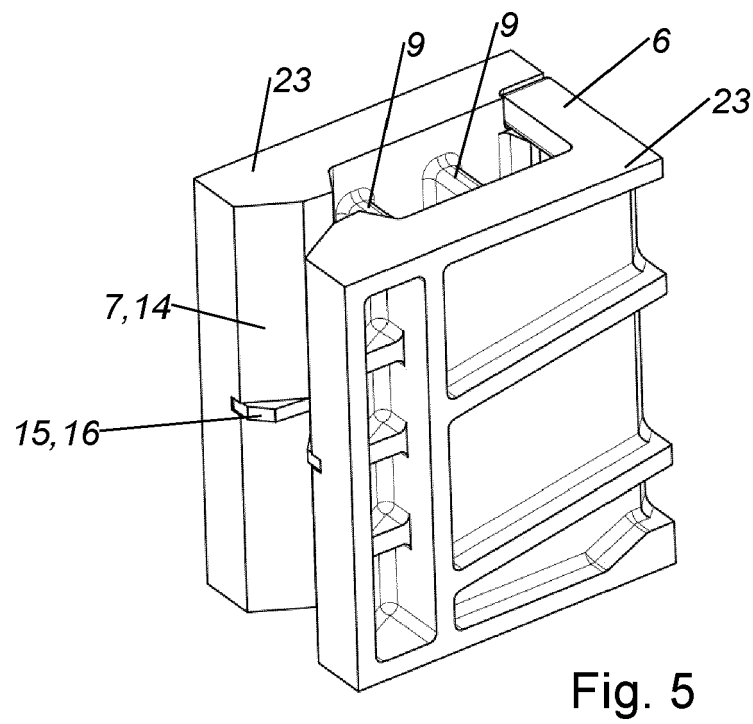
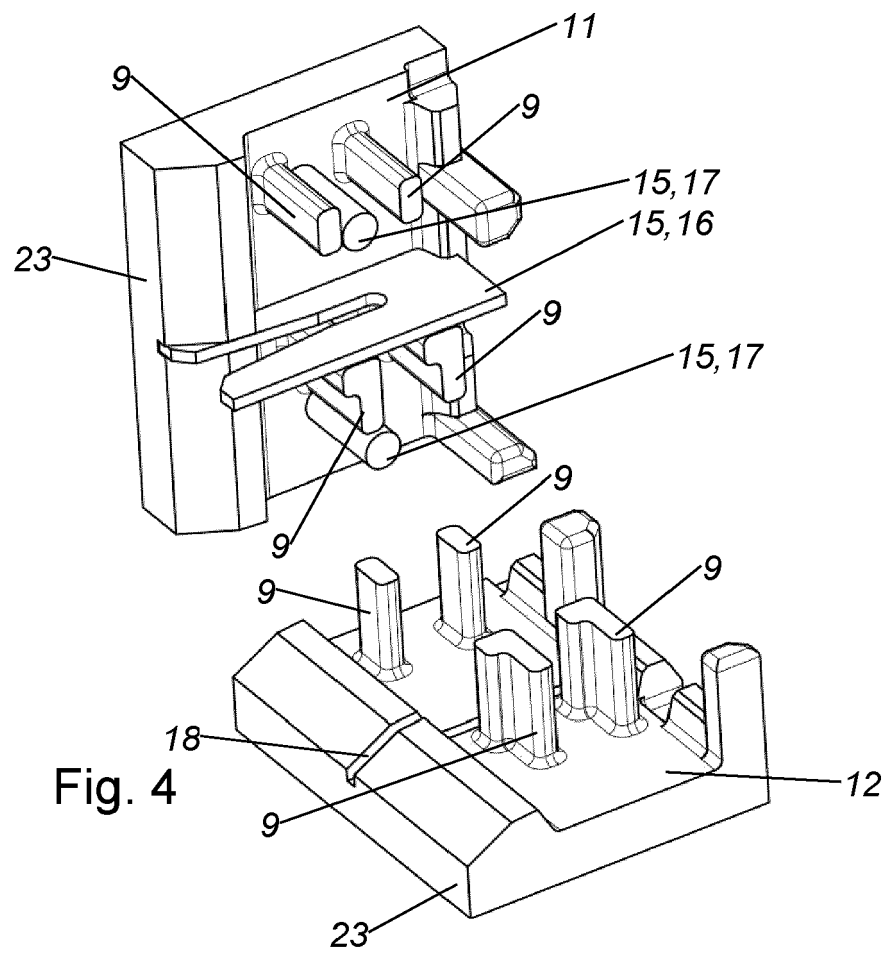


Fig. 3





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Application Number
EP 20 15 3668

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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 11 May 2020	Examiner Simonini, Stefano
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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.
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