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(54) **ELECTRICAL POWER CONNECTOR AND METHOD FOR UNMATING THE SAME**

(57) Electrical connector (2) comprising
- a housing (4, 5) for accommodating at least two electrical power terminals (7), each power terminal (7) having a mating portion extending longitudinally in a mating direction (MD),
- a mate assist slider (11) slidably mounted on the housing (4, 5) so as to slide in a sliding direction (SD), between an unlocking position and a locking position,
- locking means (17) comprising a first locking element (18) integral with the housing (4, 5) and a second locking

element (19) integral with the slider (11), the first (18) and second (19) locking elements engaging each other in the locking position of the slider (11) so as to lock the slider (11) in the locking position.

The first (18) and second (19) locking elements are both located inside the slider (11), behind a protecting wall. An aperture (24) is made through said protecting wall, so that a tool (100) inserted, through said aperture (24), allows to release the first (18) and second (19) locking elements, from each other.

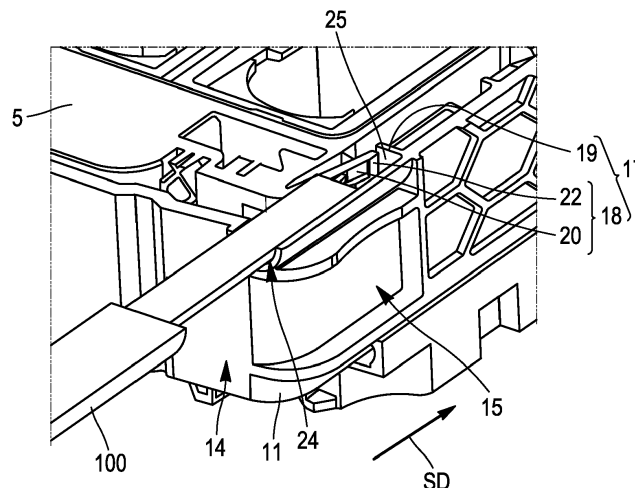


FIG. 3

Description

[0001] The disclosure relates to the field of power connection systems for motor vehicles. For example, the disclosure can find an application in power connectors, such as those used to charge a rechargeable electric or hybrid vehicle battery or as those used in interconnect power circuits connecting batteries, converters, electrical motors, and any other power device of a vehicle.

[0002] In the field of power connection systems for motor vehicles, electrical connector assembly may comprise a connector (for example a female connector), a counter-connector (for example a male connector) and a mate assist system that helps mating the connector and the counter-connector with each other. The mate assist system comprises a slider that is movable between an unlocking position and a locking position. When the slider is moved from the unlocking position to the locking position, the connector and counter-connector are brought together and progressively mated with each other. When the slider is moved from the locking position to the unlocking position, the connector and counter-connector are progressively separated from each other and unmated. However, in the locking position, the slider is locked by locking means configured so as to prevent the connector and counter-connector from being separated and unmated. For example, a connector assembly of this type is disclosed by the prior art document WO2012/156486 A1.

[0003] As illustrated by Figure 7, in the prior art connector assembly 1, the locking means that locks the slider 11 in its locking position comprise a first locking element 18 integral with the housing 5 and a second locking element 19 integral with the slider 11. In this illustrated example, the first locking element 18 is a flexible lance and the second locking element 19 is an abutment surface 25. The slider 11 further comprises a button 30 that is configured to be pressed by a user. When pressed, the button 30 pushes the flexible lance away from the abutment surface 25.

[0004] Such a prior art configuration presents several drawbacks. For instance, an unauthorized user may press the button while the connector assembly is still under high voltage. Another drawback is that the button, which is not protected, can be unintentionally broken.

[0005] The below disclosure provides a solution for at least partially mitigate these drawbacks.

[0006] Indeed, it is disclosed below an electrical connector according to any of claims 1 to 8, a connector assembly according to claim 9 and a method for unmating an electrical connector and a counter-connector according to claim 10.

[0007] In the connector and connector assembly disclosed below, the locking means that lock the slider in its locking position are protected by a slider wall and are only accessible, when the slider is its locking position on the connector housing, with a tool through an aperture made in that slider wall. Then, there is no longer any

button that can be unintentionally pressed or broken.

[0008] Other features and advantages of the invention will become apparent on reading the following detailed description and from the attached drawings. In these drawings:

- Figure 1 represents, schematically and in perspective, an exploded view of the main parts of a first embodiment of a connector assembly;
- Figure 2 represents, schematically and in perspective, the connector assembly of figure 1, the connector and counter-connector of this connector assembly being mated;
- Figure 3 represents, schematically in perspective, a cross-section of the slider locking means of the connector assembly of figures 1 and 2, with a first type of tool inserted through an aperture in the slider wall;
- Figure 4 represents, schematically in perspective, a cross-section of the slider locking means of the connector assembly of figures 1 and 2, with a second type of tool inserted through an aperture in the slider wall;
- Figure 5 represents, schematically and in perspective, a second embodiment of a connector assembly;
- Figure 6 represents, schematically and in perspective, a third embodiment of a connector assembly;
- Figure 7 represents, schematically and in perspective, a connector assembly of the prior art, with a cross section of the locking means of the slider.

[0009] A first example of a connector assembly 1 is shown in Figures 1 to 4. This connector assembly 1 comprises a connector 2 and a counter-connector 3. For example, the connector 2 is a right-angle connector. For example, the connector 2 is a female connector. For example, the connector 2 comprises an inner housing 4, an outer housing 5, shielding elements 6 inserted between the inner 4 and outer 5 housings. For example, the inner housing 4 has two cavities, each one of which accommodating a female power terminal 7, as well as sealing means 8 and retaining means 9 (that in particular retains the sealing means 8 in their respective cavity). Each female power terminal 7 is for example crimped at a free end of a power cable 10. Each female power terminal 7 has a mating portion extending longitudinally in a mating direction MD and a crimping portion extending longitudinally essentially perpendicular to the mating direction.

[0010] Further, a mate assist slider 11, is slidably mounted on the outer housing 5. For example, the slider 11 is mounted on the outer housing 5 in a way identical or similar to the one disclosed in the prior art document WO2012/156486 A1 which is incorporated by reference. The slider 11 is slidably mounted on the outer housing 5 so as to slide in a sliding direction SD, between an unlocking position and a locking position, and vice-versa. For example, the sliding direction SD corresponds to the longitudinal direction of the cavities accommodating the

crimping portion female power terminals 7.

[0011] A locking button 12 is slidably mounted on the outer housing 5. The function of this locking button is similar to the one disclosed in the prior art document WO2012/156486 A1.

[0012] The inner housing 4, the outer housing 5, the retainer means 9, the slider 11, and the locking button 12 are molded parts made of dielectric materials. The shielding elements 6 and the terminals 7 are made of electrically conductive materials.

[0013] The counter-connector 3 is identical or similar to the one disclosed in the prior art document WO2012/156486 A1.

[0014] In Figure 2, a shielding braid 26 is maintained on the connector 2 with a strap 27.

[0015] As shown, in particular, in Figures 1 and 2, the slider 11 comprises a top wall 13, a front wall 14 and two lateral walls 15. The top wall 13 essentially faces a mating face through which the female power terminals 7 are mated to male power terminals of the counter-connector 3. In other words, the top wall 13 extends essentially perpendicularly to the mating direction MD. The front wall 14 is essentially parallel to the mating direction MD and perpendicular to a sliding direction SD. The lateral walls 15 are essentially perpendicular to both the top wall 13 and the front wall 14. In other words, the lateral walls 15 extend respectively in a plane which is essentially parallel to the sliding direction SD.

[0016] Each lateral wall 15 has an inner surface onto which are formed at least one groove, as disclosed in the prior art document WO2012/156486 A1. Each groove is inclined with respect to the sliding direction SD and is configured to engage a peg protruding from the counter-connector 3 so as to draw the connector 2 and counter-connector 3 in each other and progressively mate them with each other, when the slider 11 is moved, along the sliding direction SD, from its unlocking position to its locking position.

[0017] Each lateral wall 15 has an outer surface 23. The outer surfaces 23 are configured so as to form gripping surfaces for an operator to move the slider 11 along the sliding direction SD, from its unlocking position to its locking position.

[0018] The top wall 13, front wall 14 and lateral walls 15 form a protecting wall.

[0019] The connector 2 comprises locking means 17. These locking means 17 comprise a first locking element 18 and a second locking element 19. For example, the first 18 and second 19 locking elements are the same or are similar to the ones disclosed in the prior art document WO2012/156486 A1. For example, the first locking element 18 forms a single piece with the inner housing 4 and the second locking element 19 forms a single piece with the slider 11. For example, the first locking element 18 comprises a locking lance 20 extending longitudinally from a joint 21, where the locking lance 20 is resiliently attached to the inner housing 4, to a locking portion 22 configured to engage an abutment surface 25 supported

by the second locking element 19 (See Figure 4). The joint 21 is closer to the front wall 14 than the locking portion 22. For example, the abutment surface 25 is formed on a lateral wall 15. For example, the abutment surface 25 forms a step, essentially perpendicular to the sliding direction SD, on the inner surface of a lateral wall 15.

[0020] The first locking element 18 and second locking element 19 are both located inside the slider 11, behind the protecting wall. In other words, the first locking element 18 and second locking element 19 are essentially hidden by the protecting wall (however, the first locking element 18 and second locking element 19 can possibly be seen through at least one aperture 24 that will be disclosed below in more detail). In other words again, the first locking element 18 and second locking element 19 are not directly accessible. They are only accessible through said aperture 24.

[0021] Said aperture 24 is provided through the protecting wall. For example, as shown in Figures 1 to 4, the aperture 24 is made through the front wall 14. The aperture 24 is configured so as to face the locking means 17. For example, the shape and the position of the aperture 24 are configured so that a tool 100 can be introduced into the aperture 24 to reach the locking means 17 that are behind the protecting wall. For example, as illustrated by Figures 3 and 4, the shape of the aperture 24 is configured so that tools 100 of various shapes can be inserted into it parallel to an insertion direction ID.

[0022] The locking lance 20 forms essentially an acute angle with the insertion direction ID, so that when a tool 100 is inserted in the aperture 24 and pushed against the locking lance 20, the locking lance 20 elastically deforms so as to free the locking portion 22 from the abutment surface 25. In this first embodiment, the insertion direction ID of the tool 100 through the aperture 24 is essentially parallel to the sliding direction SD and perpendicular to the mating direction MD.

[0023] According to a second embodiment illustrated by Figure 5, the aperture 24 is formed through the top wall 13. In this configuration, if the locking means 17 are essentially the same or similar to the ones disclosed with respect to the first embodiment, the tool 100 can be tilted essentially around a rotation axis perpendicular to the lateral wall 15 so as to push the locking lance 20 away from the abutment surface 25. In this second embodiment, the insertion direction ID of the tool 100 through the aperture 24 is essentially perpendicular to the sliding direction SD and parallel to the mating direction MD.

[0024] According to a third embodiment illustrated by Figure 6, the aperture 24 is formed through a lateral wall 15. In this configuration, if the locking means 17 are essentially the same or similar to the ones disclosed with respect to the first embodiment, the aperture 24 can face the locking lance 20 (for example in front of the locking portion 22) and the tool 100 can push the locking lance 20 away from the abutment surface 25. In this second embodiment, the insertion direction ID of the tool 100 through the aperture 24 is essentially perpendicular to

the sliding direction SD and the perpendicular to the mating direction MD.

[0025] When the connector 2 and counter-connector 3 are fully mated, the slider 11 is locked in its locking position, with the locking means 17 are locked (i.e., the first 18 and second 19 locking elements are locked together). For unmating the connector 2 and counter-connector 3, the locking button 12 is pushed to its "unlock" position. Then, a tool 100 is inserted in the aperture 24 so as to engage and push the first locking element 18 (i.e., the locking lance 20). The first locking element 18 deflects and the locking portion 22 is released from the second element 19. The slider 11 is free to move and a user can pull the slider away from the outer housing 5, parallel to the sliding direction SD, from its locking position to its unlocking position. During this movement, the inclined grooves on the inner surface of the lateral wall 15 engage the peg protruding from the counter-connector 3 so as to spread the connector 2 and counter-connector 3 apart, and to finally unmate them.

Claims

1. Electrical connector (2) comprising
 - a housing (4, 5) made of dielectric material and accommodating at least two electrical power terminals (7), each power terminal (7) having a mating portion extending longitudinally in a mating direction (MD),
 - a mate assist slider (11) slidably mounted on the housing (4, 5) so as to slide in a sliding direction (SD), between an unlocking position and a locking position,
 - locking means (17) comprising a first locking element (18) integral with the housing (4, 5) and a second locking element (19) integral with the slider (11), the first (18) and second (19) locking elements engaging each other in the locking position of the slider (11) so as to lock the slider (11) in the locking position,

characterized in that the first (18) and second (19) locking elements are both located inside the slider (11), behind a protecting wall attached to the slider (11), an aperture (24) being made through said protecting wall, and **in that** at least one of the first (18) and second (19) locking elements is configured so as to be only accessible and actuatable with a tool (100) inserted, essentially parallel to an insertion direction (ID), through said aperture (24).
2. Electrical connector (2) according to claim 1, wherein the first locking element (18) forms a single piece with the housing (4, 5) and the second locking element (19) forms a single piece with the slider (11).
3. Electrical connector (2) according to claim 1 or 2, wherein said insertion direction (ID) is essentially perpendicular to the sliding direction (SD).
4. Electrical connector (2) according to any one of the preceding claims, wherein said insertion direction (ID) is essentially perpendicular to the mating direction (MD).
5. Electrical connector (2) according to claim 1 or 2, wherein said insertion direction (ID) is essentially parallel to the sliding direction (SD).
6. Electrical connector (2) according to any one of the preceding claims, wherein the first locking element (18) comprises a locking lance (20) extending longitudinally from a joint (21) where the locking lance (20) is resiliently attached to the housing (4, 5) to a locking portion (22) configured to engage the second locking element (19), the joint (21) being closer to the aperture (24) than the locking portion (22) and the locking lance (20) forming essentially an acute angle with said sliding direction (SD).
7. Electrical connector (2) according to claim 6, wherein the locking lance (20) forms essentially an acute angle with said insertion direction (ID).
8. Electrical connector (2) according to any one of the preceding claims, wherein the sliding direction (SD) is essentially perpendicular to the mating direction (MD).
9. Electrical connector assembly (1), comprising an electrical connector (2) according to any preceding claim and a counter-connector (3), the electrical connector (2) and counter-connector (3) being mated in said mating direction (MD), and the electrical connector (2) and counter-connector (3) being locked when they are fully mated, with the slider (11) is in said locking position.
10. Method for unmating an electrical connector (2) according to any preceding claim and a counter-connector (3), comprising
 - inserting a tool (100) parallel to the insertion direction (ID), through the aperture (24) made through said protecting wall,
 - actuating with the tool (100) inserted in the aperture (24), at least one of the first locking element (18) and second locking element (19), so as to disengage the first locking element (18) and second locking element (19) from each other,
 - once the first locking element (18) and second locking element (19) disengaged from each other, pulling the slider (11) parallel to the sliding

direction (SD), from its locking position to its un-locking position.

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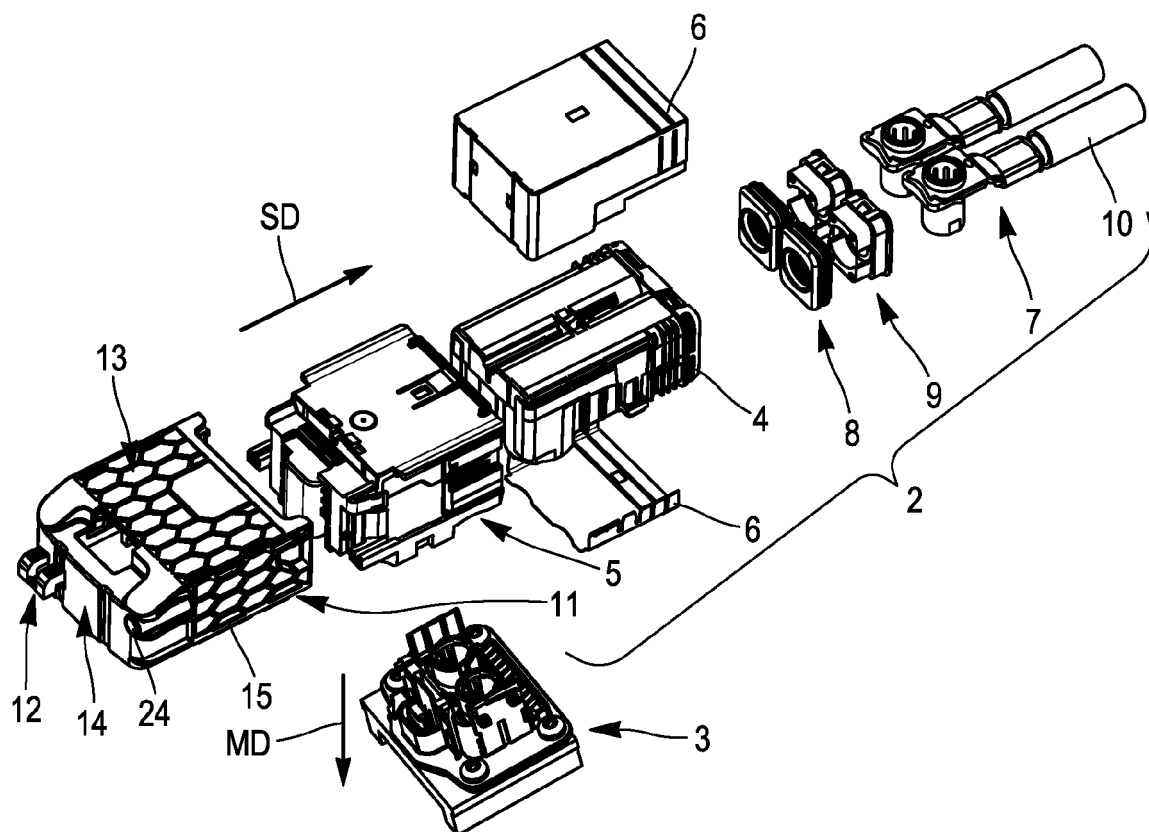


FIG. 1

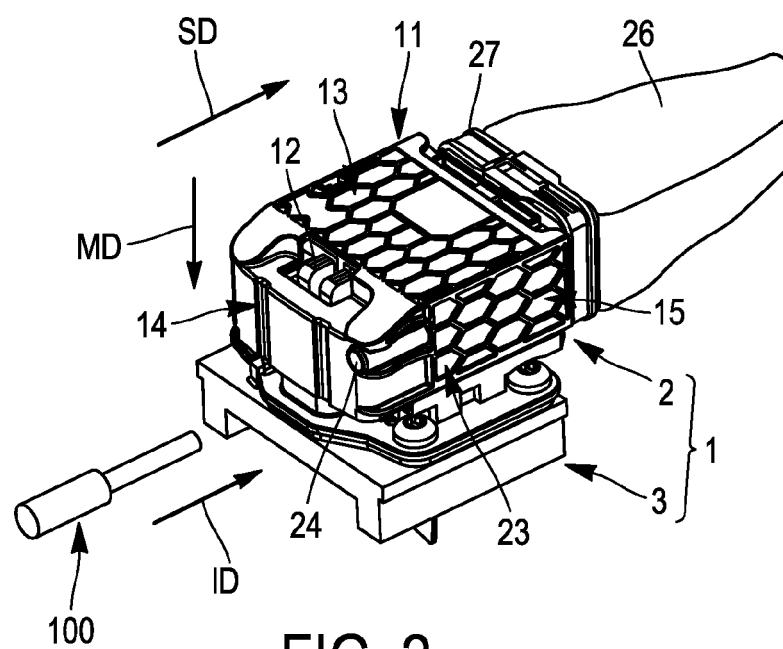


FIG. 2

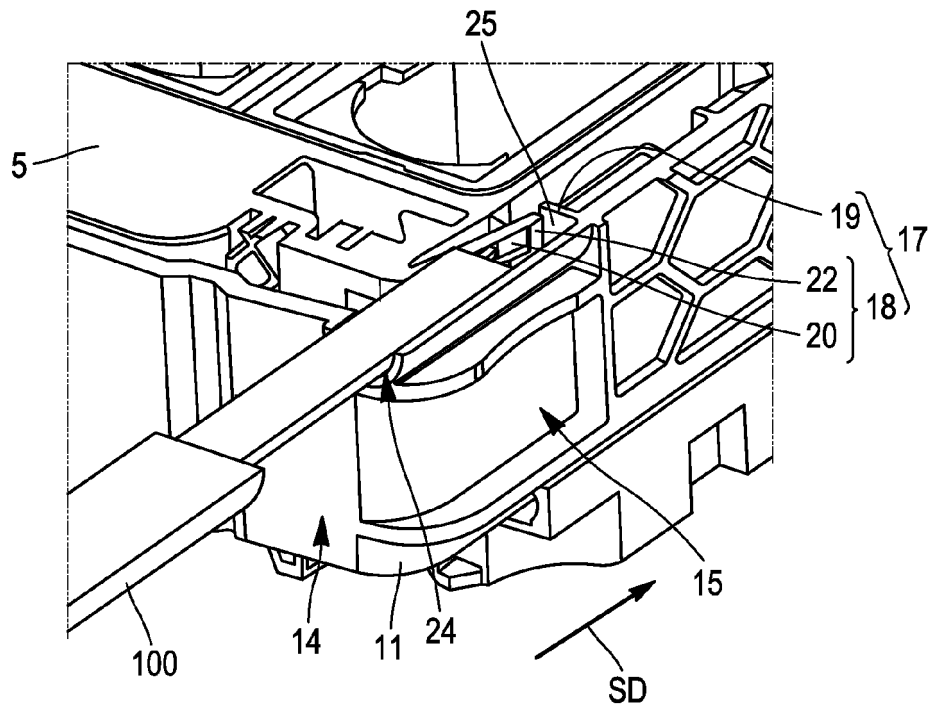


FIG. 3

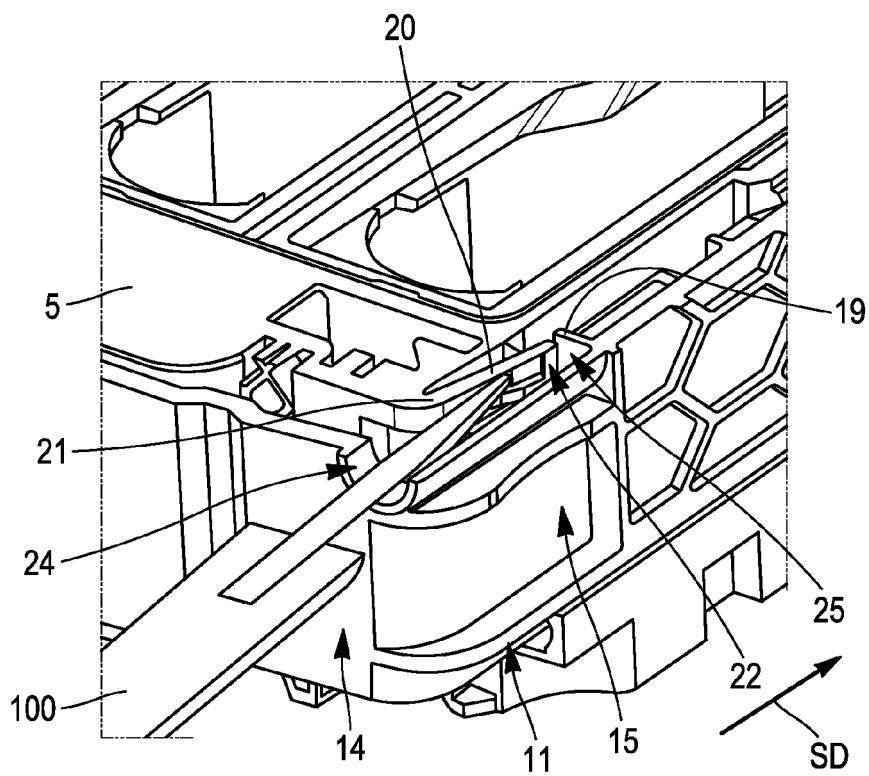


FIG. 4

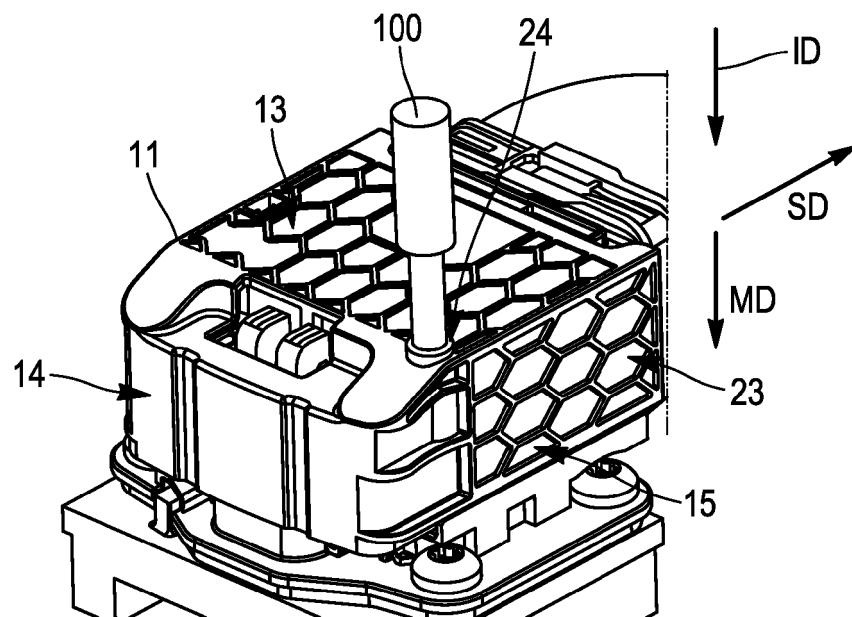


FIG. 5

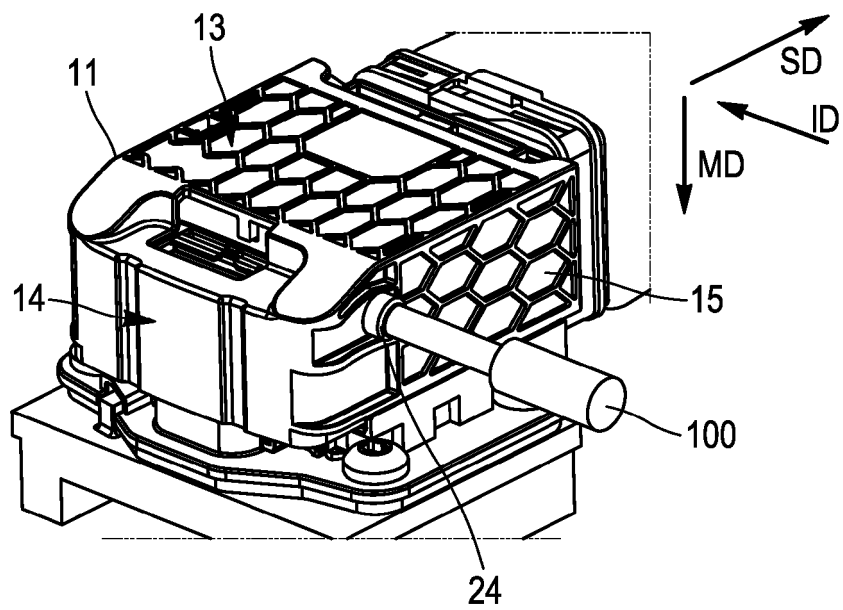


FIG. 6

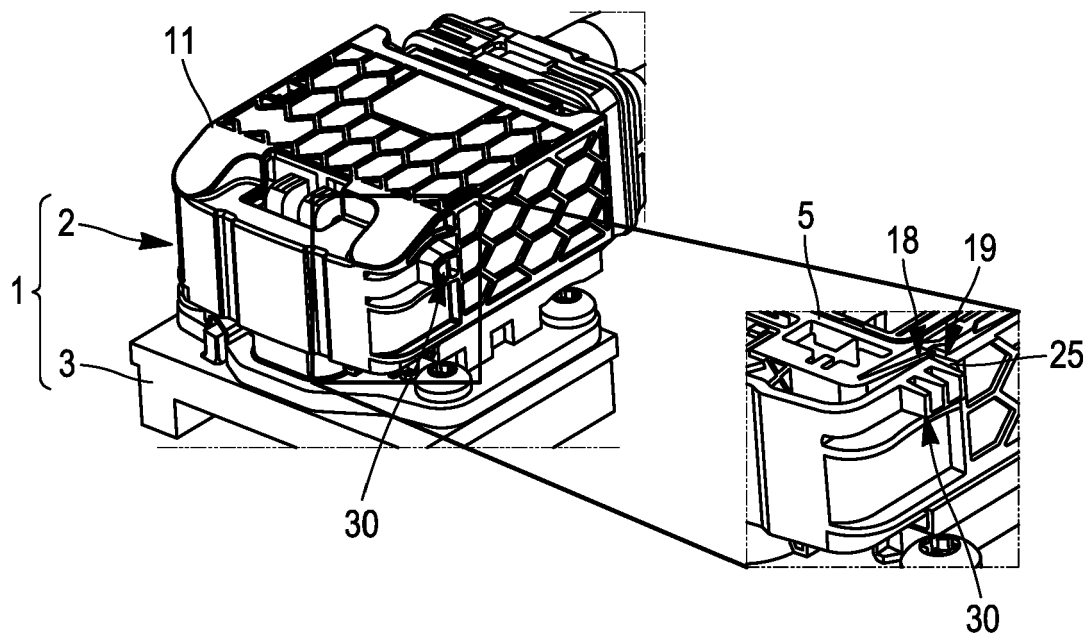


FIG. 7



EUROPEAN SEARCH REPORT

Application Number

EP 23 17 2649

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EPO FORM 1503 03.82 (P04C01)

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 October 2023	Examiner Pugliese, Sandro
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	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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[0016] [0019]