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(71) Applicant: **Aptiv Technologies Limited**
St. Michael (BB)

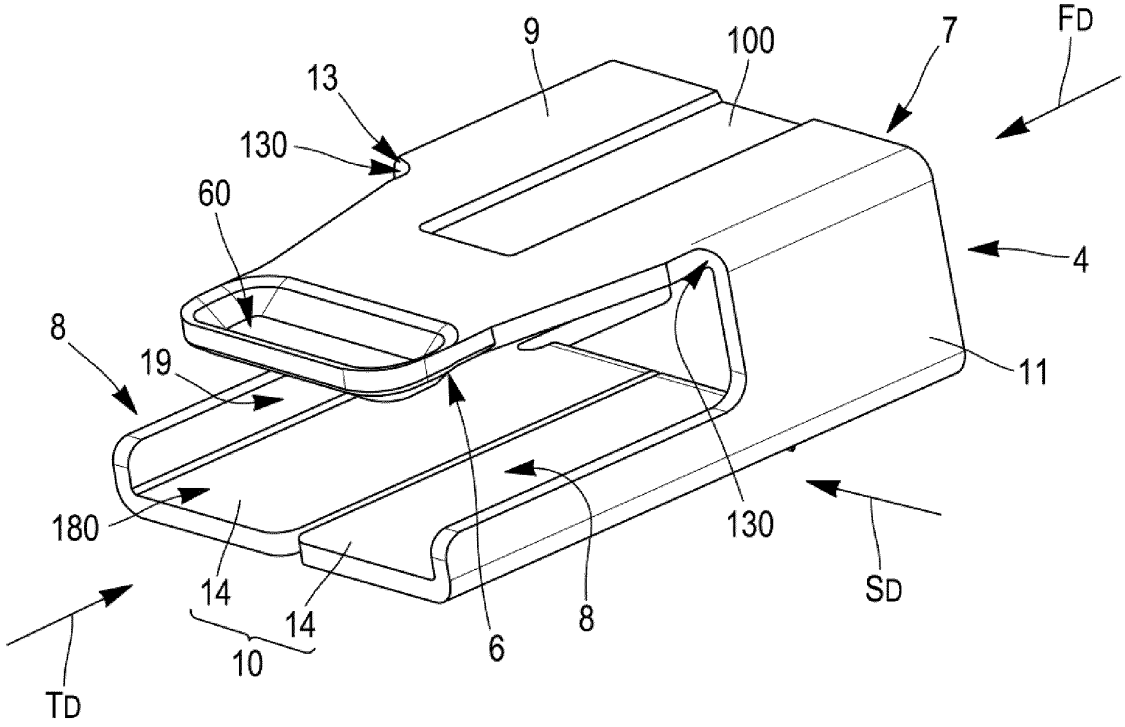
(72) Inventors:
- **BOSSUYT, Sylvain**
  28140 BOUTIGNY PROUAIS (FR)
- **DOMERGUE, Lionel**
  28300 MAINVILLIERS (FR)

(74) Representative: **INNOV-GROUP**
310, avenue Berthelot
69372 Lyon Cedex 08 (FR)

(54) POWER INTERCONNECTION SYSTEM

(57) Interconnection system (1) for interconnecting two flat portions (20, 30) of power conductors (2, 3), comprising a cage (4) made of a single piece cut and shaped in a sheet metal. The cage (4) comprises a support (5) forming a tunnel extending longitudinally parallel to a first direction (FD). The cage (4) further comprises a contact blade (6) configured for pressing a flat portion (30) of the second power conductor (3) against a flat portion (20) of the first power conductor (2). The contact blade (6) and a support beam define a contact region open on four sides, two sides being perpendicular to the first direction (FD) and two sides being perpendicular to a second direction (SD) essentially perpendicular to the first direction (FD).

[Fig. 6]



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Description

Technical Field

[0001] The invention relates to the field of electrical power interconnections in automotive vehicles. For example, the invention relates to interconnection systems between power terminals and/or busbars for interconnecting battery cells, converters, charge plugs, motors, etc. in electric or hybrid motor vehicles.

Prior Art

[0002] For HV interconnect applications, power interconnection devices are used for interconnecting busbars and/or power terminals. More particularly, they can be used for interconnecting male portions of busbars and/or terminals. An example of interconnection system of the prior art is shown in Fig.1. This interconnection system comprises a first power conductor 2, a second power conductor 3 and an interconnection device, also called junction socket 4. The first power conductor 2 comprises a flat portion 20. The second power conductor 3 comprises a flat portion 30. The junction socket 4 is made of two separate elements, a support 5 and a contact blade 6 mounted in the support 5 (See also Figure 2). The flat portion 20 of the first power connector 2 is inserted in the junction socket 4, from a rear opening 7, in a first direction FD. The flat portion 30 of the second power connector 30 can be inserted in the junction socket 4, between the flat portion 20 of the first power connector 2 and the contact blade 6, either from a side opening 8, in a second direction SD which is 90° to the first direction FD, or from a front opening 9, in a third direction TD which is 180° to the first direction FD. The second direction SD and the third direction TD are the only two possible directions for inserting the plat portion 30 of the second power conductor 3, in this junction socket 4 of the prior art.

[0003] The contact blade 6 is configured for pressing the flat portion 30 of the second power conductor 3 against the flat portion 20 of the first power conductor 20. Therefore, the main function of the junction socket 4 is to apply a pressure between two flat male portions 20, 30 (respectively of two busbars, of two power terminals or of a busbar on one side and of a power terminal on another side).

[0004] The junction socket 4 of Figures 1 and 2 has several disadvantages including:

- manufacturing complexity due to the material thickness and the process for assembling the two parts 5, 6,
- only two coupling/insertion directions SD, TD are allowed (90 and 180°),
- dimensions of the junction socket 4 due to the material thickness which is necessary to have a sufficiently robust support 5.

[0005] A purpose of this disclosure is to provide an interconnection system for interconnecting two flat portions of power conductors, such as male ends of busbars and/or terminals that at least partially alleviates the aforementioned drawbacks.

Summary of the invention

[0006] For this purpose, it is disclosed an interconnection system according to claim 1.

[0007] Indeed, thanks to such an interconnection system not only the support and the contact blade of the cage are made as a single piece, but three coupling directions are possible: the contact region is open on four sides which can be used for the insertion of the flat portion of the first power conductor and the flat portion of the second power. Consequently, the first and second conductors can be oriented in the contact region at 90, 180 or 270 degrees to each other.

[0008] The interconnection system of claim 1 possibly comprises one and/or the other of the features listed in claims 2 to 10, each considered independently of each other or in combination with one or more others.

Brief description of the drawings

[0009] Other features, purposes and advantages of the invention will become apparent on reading the following detailed description given with reference to the appended drawings and by way of non-limiting examples and in which:

Figure 1 is a diagrammatic representation in perspective of an interconnection system of the prior art;
Figure 2 is a diagrammatic representation in perspective of the junction socket of the interconnection system shown in Figure 2;
Figure 3 is a diagrammatic representation in perspective of an example of an interconnection system;
Figure 4 is a diagrammatic lateral view of the junction socket of the interconnection system shown in Figure 3;
Figure 5 is a diagrammatic representation in perspective of the junction socket of the interconnection system shown in Figure 3;
Figure 6 is a diagrammatic representation in perspective of another example of junction socket for an interconnection system.

Detailed description

[0010] An example embodiment of interconnection system 1 is shown in Figure 3. According to this example, the interconnection system 1 comprises a first power conductor 2, a second power conductor 3 and a junction socket 4. The first power conductor 2 comprises a flat portion 20. The second power conductor 3 comprises a flat portion 30.

[0011] As shown in Figures 3 to 5, the junction socket 4 is made in one-piece comprising a support 5 and a contact blade 6 cut from a sheet metal and shaped from the blank cut out in the sheet metal. For example, the sheet metal is a made of an alloy of stainless steel 0.8 to 1 mm thick. (depending on the width of busbar).

[0012] The support 5 comprises a top wall 9, a bottom wall 10, two side walls 11. Each side wall 11 extends between the top wall 9 and the bottom wall 10, on opposite sides of the cage. The top wall 9, the bottom wall 10 and the two side walls 11 form a tunnel extending longitudinally parallel to the first direction FD. The tunnel has a rear opening 7 and a front opening 18.

[0013] The top wall 9 extends along the first direction FD between a rear edge 12 and a front edge 13.

[0014] For example, the bottom wall 10 comprises two support beams 14. More particularly, in the example illustrated in Figures 3 to 5, the junction socket 4 is made by bending the blank cut out in the sheet metal symmetrically on both sides of a plane parallel to the first direction FD and perpendicular to the top wall 9. In other words, each one of the support beams 14 is bent from an opposite side wall 11 and the two support beams 14 meet in a middle region of the bottom wall 10, so as to form the tunnel mentioned above. In other words, the two support beams 14 approach each other along a junction line which is parallel to the first direction FD. Each support beam 14 has a rear edge 15 and a front edge 16, respectively offset in the first direction FD relatively to the rear edge 12 and the front edge 13 of the top wall 9. More particularly, each support beam 14 extends further in the first direction FD than the front edge 13 of the top wall 9. For example, each support beam 14 extends further in the first direction FD by a distance D (see Figure 4) at least equal to the width W of the flat portion 30 of the second power conductor 3 (see Figure 3).

[0015] For example, the junction socket 4 comprises two guiding rims 40, each one of which extending, parallel to a side wall 11, from a respective support beam 14. These guiding rims 40 help guiding and maintaining the flat portion 20 of the first power conductor 2 inserted in the junction socket 4 from the rear opening 7.

[0016] A stop portion 17 is formed by bending a rearward region of each support beam 14. Such stop portions 17 are used for blocking the junction socket 4 in a dielectric housing (not shown).

[0017] The bottom wall 10 is configured for supporting at least partially the flat portion 20 of the first power conductor 2 when this flat portion 20 is inserted in the cage (i.e. the tunnel) through the rear opening 7.

[0018] In the example illustrated by Figures 3 to 5, the contact blade 6 extends from the rear edge 12 of the top wall 9 and is bent so as to extend below the top wall 9 further in the first direction FD than the front edge 13 of the top wall 9. The contact blade 6 and the support beams 14 thus define a contact region 19 (between the support beams 14 and the contact blade 6). The contact region 19 is open on four sides: two sides being perpendicular to the first direction FD, respectively located on either side of the contact region 19, and two sides being perpendicular to the second direction SD, respectively located on either side of the contact region 19, the second direction SD being essentially perpendicular to the first direction FD.

[0019] For example, at least one bump 60 is formed in the portion of the contact blade 6 which extends in the contact region 19. In the example illustrated by Figures 3 to 5, there is one bump 60 formed in the contact blade 6, with a curvature directed towards the bottom wall 10. Such a bump 60 helps improving the electrical contact between the contact blade 6 and the flat portion 30 of the second power conductor 3.

[0020] For example, at least one bump 90 is formed in the top wall 9. In the example illustrated by Figures 3 to 5, there is one bump 90 formed in the top wall 9, with a curvature directed towards the contact blade 6. Such a bump 90 allows an adjustment of the pressure exerted by the contact blade 6 on the flat portion 30 of the second power conductor 3 and on said flat portion 20 of the first power conductor 2. Such a bump 90 also allows an adjustment of the contact force, and consequently the contact resistance between the contact blade 6 and the flat portion 30 of the second power conductor 3.

[0021] Another example embodiment of junction socket 4 is shown in Figure 6. According to this example, the contact blade 6 extends from the front edge 13 of the top wall 9, essentially parallel to the bottom wall 10. An embossment 100 can be formed in the top wall 9, which extends in the contact blade 6, beyond the front edge 13 of the top wall 9, in the first direction FD. Such an embossment 100 makes the contact blade 6 less flexible and helps increasing the contact force exerted by the contact blade 6 over the flat portion 30 of the second power conductor 3. In this second embodiment, the stress applied to the contact blade 6 when the flat portions 20, 30 of the first 2 and second 3 power conductors are inserted in the contact region 19, may be relatively important at the corners 130 between the contact blade 6 and the front edge 13 of the top wall 9. On the contrary, in the first embodiment example, the stress is better and more uniformly distributed.

[0022] The other features of the junction socket 4 according to this second embodiment are essentially the same as those of the first embodiment example. For the sake of conciseness, they are not repeated.

[0023] In both embodiments, the flat portion 20 of the first power connector 2 is inserted in the junction socket 4, from a rear opening 7, in a first direction FD. The flat portion 30 of the second power connector 30 can be inserted in the junction socket 4, between the flat portion 20 of the first power connector 2 and the contact blade 6, either from one of the side openings 8, in a second direction SD which is 90° or 270° to the first direction FD, or from a front opening 180, in a third direction TD which is 180° to the first direction FD. That is there are three possible insertion directions in the contact region 19, re-

spectively 90°, 180° and 270° to the first direction FD.

[0024] In other words, thanks to the interconnection systems disclosed above, it becomes possible to interconnect busbars and/or power terminals as follows:

- providing a first power conductor 2 having a flat portion 20, a second power conductor 3 having a flat portion 30 and a junction socket 4 made of a single piece cut and shaped in a sheet metal, the junction socket 4 comprising a contact blade 6 and at least one support beam 14, the junction socket 4 thus having a contact region 19 between the contact blade 6 and said at least one support beam 14,
- inserting the flat portion 20 of the first power conductor 2 in the contact region 19 from a first opening 7, in a first direction FD, and
- inserting the flat portion 30 of the second power conductor 3 in the contact region 19, from an another opening different from the first opening 7, in a direction SD, TD which makes an angle with the first direction FD chosen between at least 90°, 180° and 270°.

[0025] Of course, other angles of insertion than 90°, 180° and 270° are possible. In particular, variations of several degrees respectively around 90°, 180° and 270° can accommodate various orientations of the first 2 and second 3 power conductors relative to each other.

Claims

1. Interconnection system (1) for interconnecting two flat portions (20, 30) of power conductors (2, 3), comprising a first power conductor (2), a second power conductor (3) and a cage (4) made of a single piece cut and shaped in a sheet metal, the cage (4) comprising a support (5) comprising a top wall (9), a bottom wall (10), at least one side wall (11) joining the top (9) and bottom (10) walls, the top wall (9), the bottom wall (10) and said at least one side wall (11) forming a tunnel extending longitudinally parallel to a first direction (FD), the top wall (9) extending along the first direction (FD) between a rear edge (12) and a front edge (13) , at each of which the tunnel has respectively a rear opening (7) and a front opening (18), the bottom wall (10) being formed by at least one support (5) beam configured for supporting at least partially a flat portion (20) of the first power conductor (2) passing through the rear opening (7), the cage (4) further comprising a contact blade (6) configured for pressing a flat portion (30) of the second power conductor (3) against the flat portion (20) of the first power conductor (2),
   characterized

   - **in that** said at least one support (5) beam extends further in the first direction (FD) than the front edge (13),
   - **in that** the contact blade (6) is made in one piece with the cage (4) and extends further in the first direction (FD) than the front edge (13), so as to define a contact region (19) between said at least one support beam (14) and the contact blade (6), the flat portion (20) of the first power conductor (2) and the flat portion (30) of the second power conductor (3) being at least partially inserted in the contact region (19), and
   - **in that** the contact region (19) is open on four sides, two sides being perpendicular to the first direction (FD), respectively located on either side of the contact region (19), and two sides being perpendicular to a second direction (SD), respectively located on either side of the contact region (19), the second direction (SD) being essentially perpendicular to the first direction (FD).

2. Interconnection system (1) according to claim 1, comprising two support beams (14) approaching each other along a junction line which is parallel to the first direction (FD).

3. Interconnection system (1) according to claim 2, comprising two side walls (11), each one of which joining the top wall (9) to one of the support beams (14).

4. Interconnection system (1) according to claim 2 or 3, comprising two guiding rims (40), each one of which extending, parallel to a side wall (11), from a respective support beam (14).

5. Interconnection system (1) according to any one of the preceding claims, wherein a bump (60) is formed in the contact blade (6) with a curvature directed towards the bottom wall (10).

6. Interconnection system (1) according to any one of the preceding claims, wherein the contact blade (6) extends from a rear edge (12) of the top wall (9) and is bent so as to extend below the top wall (9).

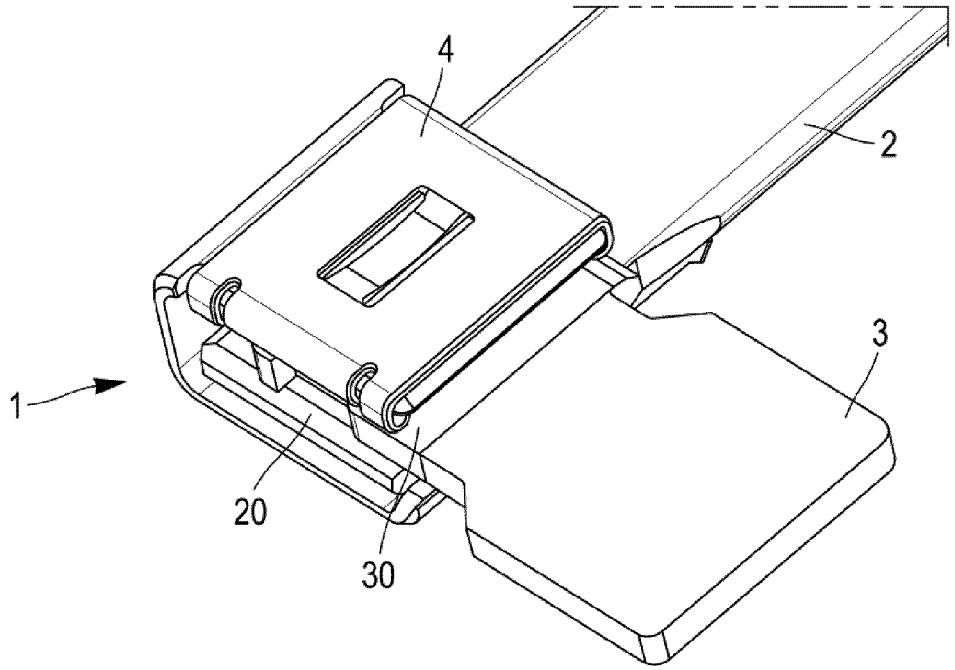
7. Interconnection system (1) according to claim 6, wherein a bump (90) is formed in the top wall (9) with a curvature directed towards the contact blade (6).

8. Interconnection system (1) according to any one of claim 1 to 6, wherein the contact blade (6) extends from a front edge (13) of the top wall (9), essentially parallel to the bottom wall (10).

9. Interconnection system (1) according to any one of the preceding claims, wherein at least one stop portion (17) extends outwardly of the cage (4), from at least one support beam (14).

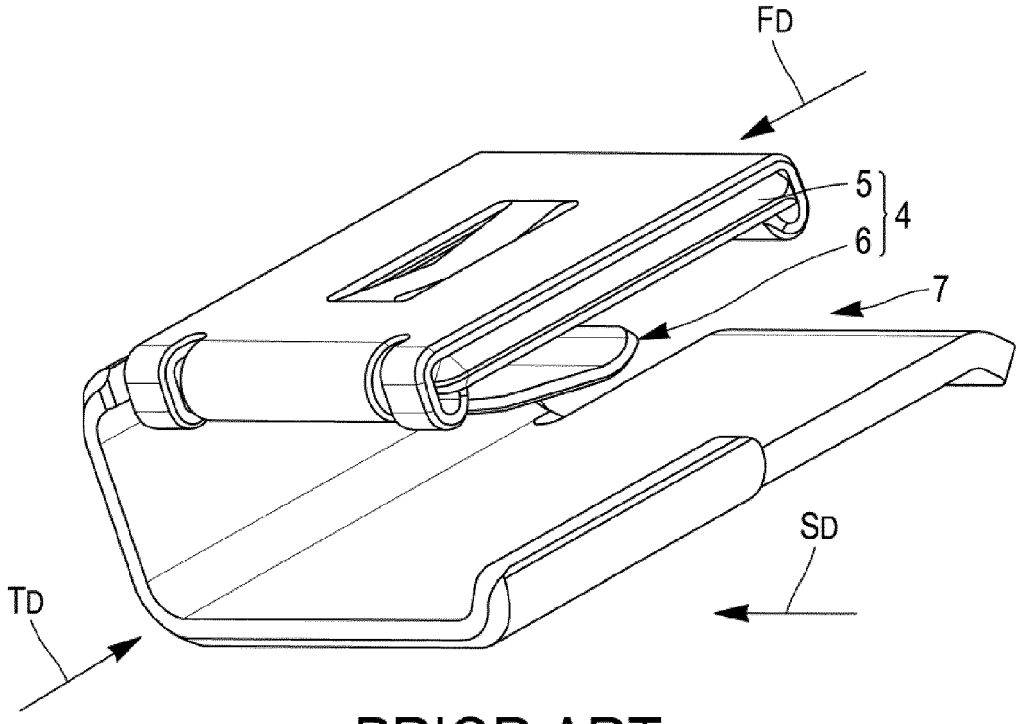
10. Interconnection system (1) according to any one of the preceding claims, wherein the flat portion (20) of the first power conductor (2) extends longitudinally in the contact region (19) in the first direction (FD), and wherein the contact blade (6) and said at least one support beam (14) are configured so that the flat portion (30) of the second power conductor (3) can be inserted in the contact region (19), in a direction (SD, TD) which makes an angle to the first direction (FD) that can be at least 90°, 180° or 270°.

[Fig. 1]



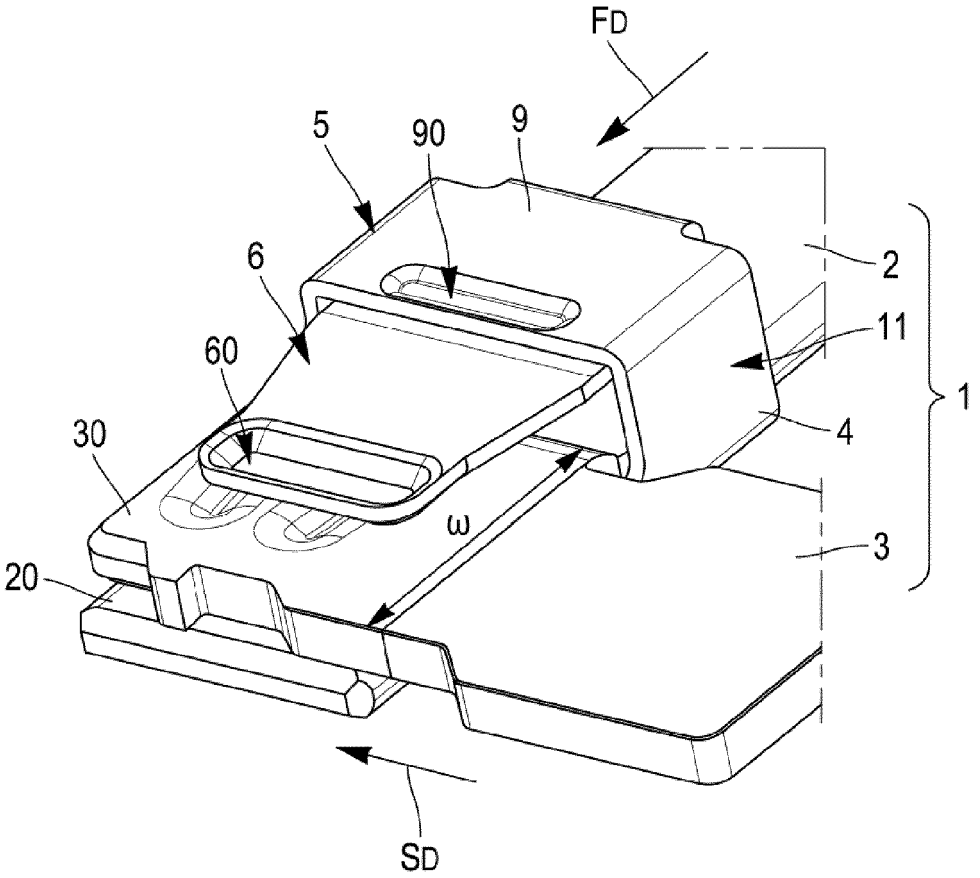
PRIOR ART

[Fig. 2]



PRIOR ART

[Fig. 3]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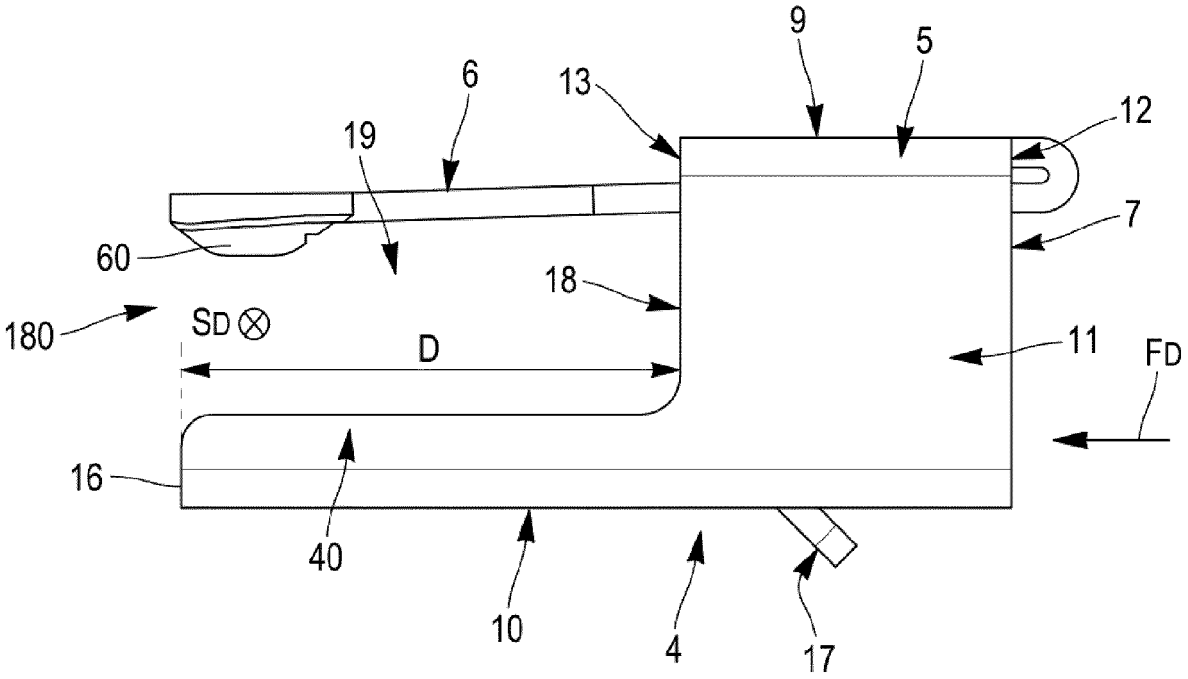
[Fig. 4]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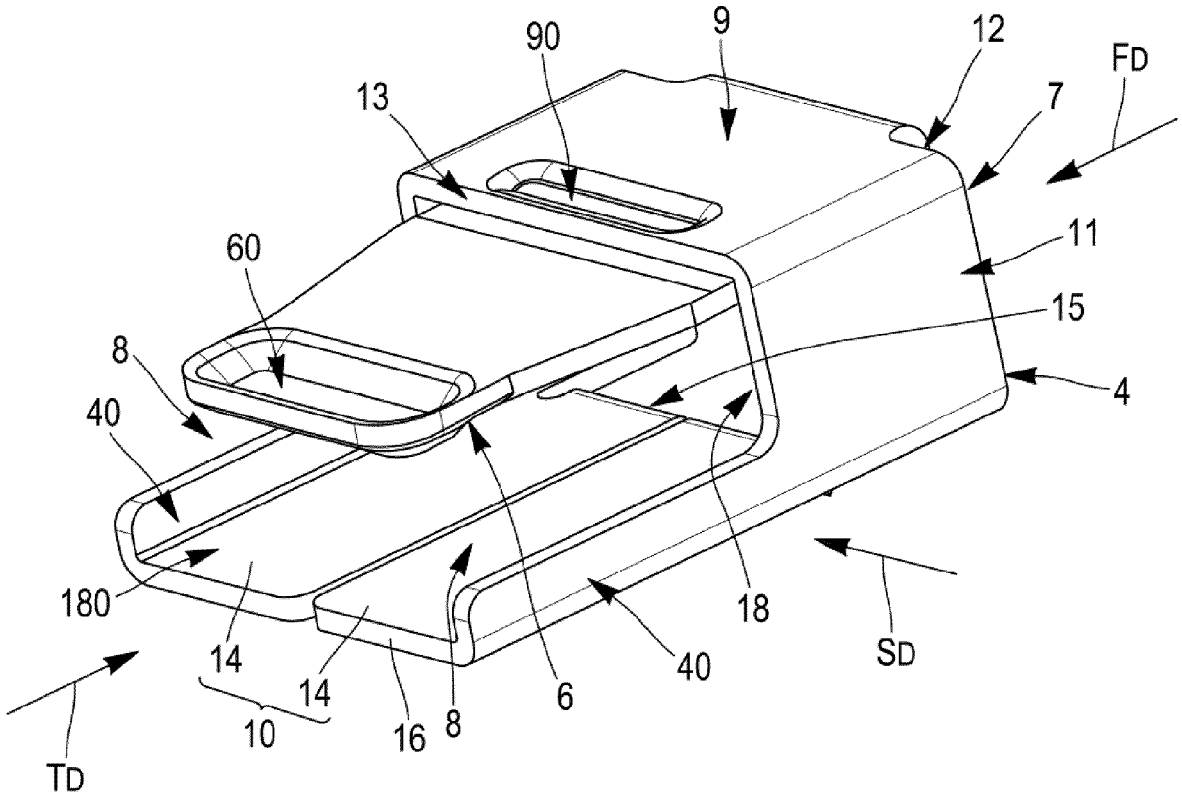
[Fig. 5]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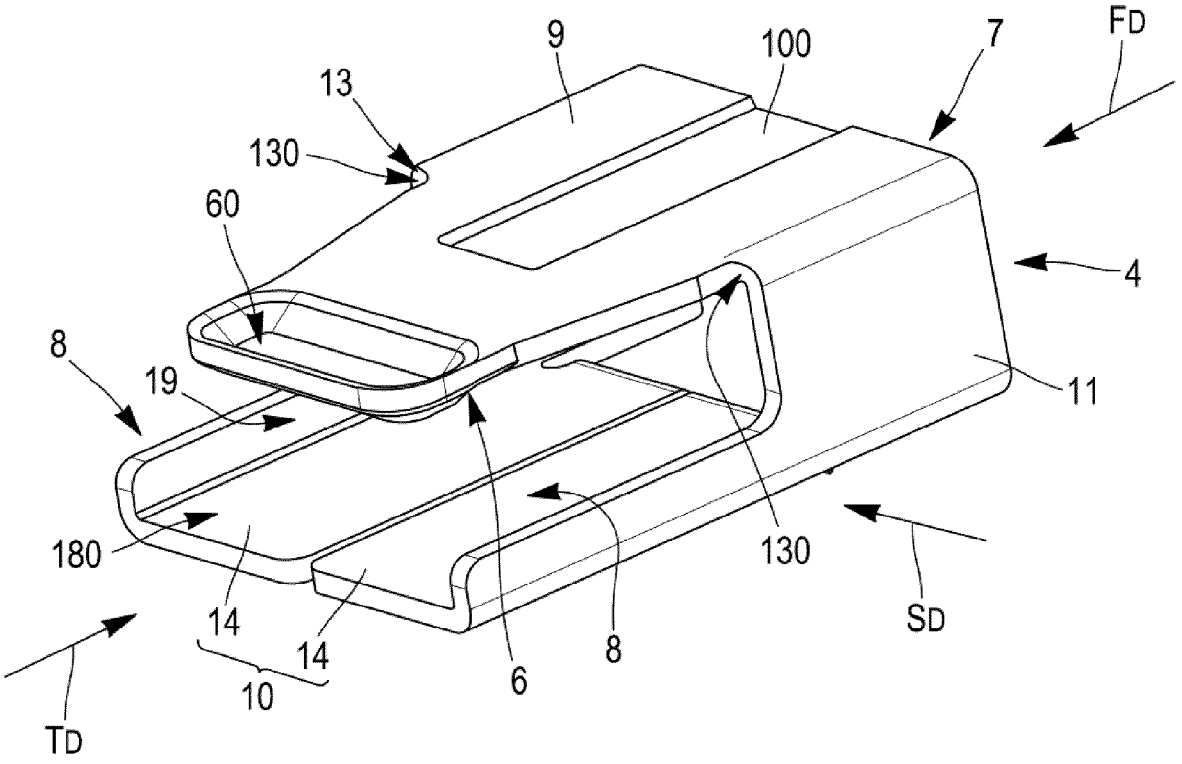
[Fig. 6]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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 7597

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

H01R
H01M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 March 2023	Gomes Sirenkov E M.

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07-03-2023

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