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Remarks:
The references to the drawing(s) no 6 and 7 are deemed to be deleted (Rule 56(4) EPC).

(54) ELECTRICAL CONNECTOR

(57) Electrical connector (10), comprising a connector housing (100) having a first wall (110) arranged perpendicular to a mating axis (X), a second wall (120) extending from the first wall (110) along the mating axis (X) in a mating direction (M), defining a shroud (130), the shroud (130) surrounds, with a first distance (140), a terminal holder portion (150) that surrounds the mating axis (X), whereby the terminal holder portion (150) comprises at least one cavity (160) aligned along the mating axis (X) and adapted to receive an electrical terminal, whereby the terminal holder portion (150) comprises at least one tunnel (170), arranged perpendicular to the mating axis (X), along a bar axis (Y), providing access to the at least one cavity (160), wherein a bar (200) is at least partly inserted in the at least one tunnel (170), wherein the at least one tunnel (170) comprises a first bar locking means and whereby the bar (200) comprises a second bar locking means, whereby the a first bar locking means and the second bar locking means cooperate to lock the bar (200) releasable in a first position (A) or in a second position (B), whereby the shroud (130) comprises an shroud opening (132) surrounding the bar axis (Y), whereby a first end (202) of the bar (200) is hold in the shroud opening (132) when the bar (200) is in the first position (A).

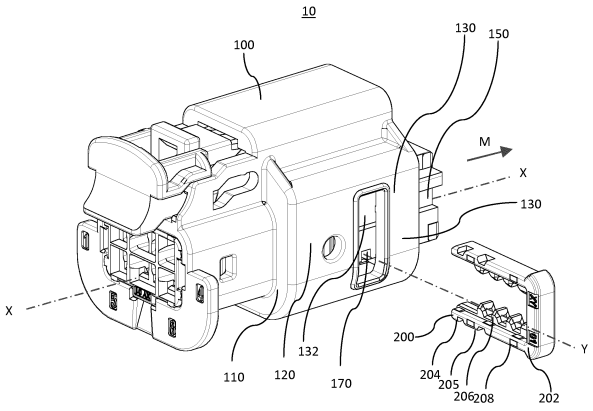

Fig. 1

EP 3 487 010 A1

Description

TECHNICAL FIELD OF INVENTION

[0001] The invention relates to an electrical connector with a terminal position assurance.

BACKGROUND OF INVENTION

[0002] In recent years, vehicles have been equipped with numerous on board electronics. These on board electronics provide a wide field of functionality, such as sensors, control functions and the like. The increased number of devices demand an increased number of electrical connections in the vehicles. To prevent growing space recruitments for connector housings and wires, miniaturization is a solution. On the other hand, miniaturization guides to mechanical weaker connectors and wires. Connector designs that worked well in the past can cause problems, when scaled down. A connector comprising a terminal position assurance device (TPA) that is scaled down works no longer in a proper way and needs to be redesigned. A new connector design causes often problems while assembly and further handling. To allow loading the terminals into the cavities, the TPA device has to be in an inactive position. In this position, the cavities are free accessible. The TPA device is moved for this reason in a direction, perpendicular to the mating axis, for a distance of half the wide of a cavity. In this position, the TPA device protrudes outside of the terminal holding housing portion. Because the miniaturization the protruding part can be easily moved back, towards the housing and blocking the cavities or even worse broke the TPA device by an accidently inserted counter connector shroud.

[0003] Thus, there is the need in the art to provide a robust miniaturized electrical connector that can be assembled in a fast and reliable assembly process.

[0004] Therefore, in one aspect, the present invention improves the state of the art by providing an electrical connector assembly that can be assembled in a fast and reliable assembly process.

[0005] An electrical connector according claim1 solves these and other objects, which become apparent upon reading the following description.

SUMMARY OF THE INVENTION

[0006] The present application relates to an electrical connector, comprising a connector housing having a first wall arranged perpendicular to a mating axis extending from the first wall along the mating axis in a mating direction, defining a shroud. The shroud surrounds, with a first distance, a terminal holder portion that surrounds the mating axis. The terminal holder portion comprises at least one cavity aligned along the mating axis and adapted to receive an electrical terminal. The terminal holder portion comprises at least one tunnel, arranged perpendicular to the mating axis, along a bar axis, providing access to the at least one cavity. A bar is, at least partly, inserted in the at least one tunnel. The at least one tunnel comprises a first bar locking means and the bar comprises a second bar locking means. The first bar locking means and the second bar locking means cooperate to lock the bar releasable in a first position or in a second position. The shroud comprises a shroud opening surrounding the bar axis, whereby a first end of the bar is hold in the shroud opening when the bar is in the first position.

[0007] The disclosed invention provides an electrical connector with a TPA device that holds the terminals in correct position in the cavities after the connector is equipped with all terminals (second position). In the open position (first position), the TPA device is hold at one end inside the terminal holding portion of the connector. The other end it is hold in an opening of the shroud of the connector. Because the TPA device is hold on both ends, it is robust against bending the end of the TPA device. Furthermore an accidently movement towards the terminal holding portion is prevented because the there is no free end accessible. The dimensions of the assembly are chosen in the way that the TPA device is moved out three times the usually displacement.

[0008] According to a preferred embodiment, the first end of the bar is flush with the outer surface of the shroud, when the bar is in the first position. The first end of the bar is hold in the opening of the shroud because it does not protrude outside of the connector it cannot cause problems while assembly of a wiring harness by hooking behind wires. Because the bar is flush with the shroud, the fully wall thickness of the shroud is used for support the first end.

[0009] Preferably, the groove, adapted to receive a counter shroud of a counter connector housing, surrounds the terminal holder portion. This design provides a very compact connector assembly. The counter connector is adapted to cooperate with the bar. The counter connector provide a shroud that is blocked by the bar, when the bar is in the first position.

[0010] Advantageously, the bar comprises a blocking portion that is present in the groove when the bar is in the first position and wherein the blocking portion is not present in the groove when the bar is in the second position. This allows an easy control about when the counter connector is allowed to be connected to the electrical connector or is not allowed to be connected to the electrical connector. The counter connector can be connected, when the bar it is in the second position and locking the terminals in the cavities.

[0011] Preferably, the blocking portion is at least partly located in the tunnel, when the bar is in the second position. In the second position, a main part of the bar is received in the tunnel. A counter shroud can move inside the groove while mating.

[0012] Advantageously, the first bar locking means comprise a protrusion that protrude inwards the at least

one tunnel and wherein the second bar locking means comprise a first recess and a second recess, wherein the first recess and the second recess are inserted in the bar, spaced from each other along the bar axis. The two recess and the protrusion cooperate in the way that the bar is movable between the two positions. To move the bar out of the first position or the second position a bigger force is necessary. That prevents the bar from accidentally movement.

[0013] Preferably, the protrusion cooperates with the first recess in the first position and wherein the protrusion cooperates with the second recess in the second position. Because only one protrusion is necessary to define estoppel for the two position, the tool for making the connector housing can be designed simpler.

[0014] Preferably the bar comprises a terminal blocking protrusion and the at least one cavity is free of the terminal blocking protrusions, when the bar is in the first position and wherein the terminal blocking protrusions protrude into the least one cavity when the bar is in the second position. The terminal blocking protrusion holds the terminal, after insertion, in position. Furthermore and not correct inserted terminal is recognized because the bar is blocked by the terminal.

[0015] In a preferred embodiment, the terminal holder portion comprises a row of cavities and the row of cavities is aligned along the bar axis. If an electrical connector has more than one cavity, an arrangement of the cavities in a row, has the advantage that a TPA device for all cavities can be provided by using only one bar.

[0016] Preferably, the bar is U-shaped and the terminal blocking protrusions protrude from the legs of the U inwards. If the electrical connector comprises a plurality of cavities and terminals, more than one bar may be necessary. If two bars are necessary, the bars can be connected at one end, defining a U-shaped. That makes assembly easier, because the two bars are provided as one part.

[0017] Advantageously, an electrical connector assembly comprises an electrical connector and a counter connector. The counter connector comprises a counter connector housing with a counter shroud. The counter shroud it is adapted to be received in the groove of the electrical connector. The electrical connector is not connectable to the counter connector when the first bar locking means and the second bar locking means are in a first position The electrical connector is connectable to the counter connector when the first bar locking means and the second bar locking means are in a second position. The blocking portion is present in the groove and limits movement of the counter shroud along the mating axis when the bar is in the first position. The blocking portion is not present in the groove and allows movement to a fully mated position of the counter shroud along the mating axis, when the bar is in the second position.

Description of the preferred embodiments

[0018] In the following, the invention is described exemplarily with reference to the enclosed figures, in which

Fig. 1 shows a perspective, view of an electrical connector;

Fig. 2 shows a perspective and cut, view towards the mating face, of an electrical connector;

Fig. 3 shows in enlarged view of a portion of the electrical connector shown in figure 2;

Fig. 4 shows a cut, view (cut carried out along the mating axis) of the electrical connector with the TPA device in a not activated position;

Fig. 5 shows a cut, view (cut carried out along the mating axis) of the electrical connector with the TPA device in an activated position;

Fig. 6 shows a cut, view (cut carried out along the bar axis) of the electrical connector with the TPA device in a not activated position;

Fig. 7 shows a cut, view (cut carried out along the bar axis) of the electrical connector with the TPA device in an activated position;

Fig. 8 shows a cut, view of the electrical connector and a counter connector, with the TPA device in a not activated position;

[0019] Figure 1 shows a perspective view of an electrical connector 10. A connector housing 100 is having a first wall 110 arranged perpendicular to a mating axis X. A second wall 120 extending from the first wall 110 along the mating axis X in a mating direction M, defines a shroud 130. The terminal holder portion 150 comprises at least one tunnel 170, arranged perpendicular to the mating axis X, along a bar axis Y, providing access to the at least one cavity 160. The shroud 130 comprises a shroud opening 132 surrounding the bar axis Y. The bar 200 comprises a first end 202, a first recess 204 and a second recess 205, a terminal blocking protrusion 206 and a blocking portion 208.

[0020] Figure 2 shows a perspective and cut, view towards the mating face, of an electrical connector 10. The terminal holder portion 150 comprises at least one cavity 160, aligned along the mating axis X and adapted to receive an electrical terminal. The shroud 130 surrounds, the terminal holder portion 150, that surrounds the mating axis X. A groove 142, adapted to receive a counter shroud 504 of a counter connector housing 502 (see figure 7), surrounds the terminal holder portion 150.

A bar 200 is at least partly inserted in the at least one tunnel 170. The at least one tunnel 170 comprises a first

bar locking means. The bar 200 comprises a second bar locking means. The first bar locking means and the second bar locking means cooperate to lock the bar 200 releasable in a first position A or in a second position B (not shown). The first end 202 of the bar 200 is hold in the shroud opening 132 when the bar 200 is in the first position A. The first end 202 of the bar 200 is flush with the outer surface of the shroud 130 when the bar 200 is in the first position A. The blocking portion 208 is not located in the tunnel 170, when the bar 200 is in the first position A. The terminal holder portion 150 comprises a row of cavities 160. The row of cavities 160 is aligned along the bar axis Y. The bar 200 is U-shaped and wherein the terminal blocking protrusions 206 protrude from the legs of the U inwards.

[0021] Figure 3 shows in enlarged view of a portion of the electrical connector 10 shown in figure 2. The first bar locking means comprise a protrusion 172 that protrude inwards the at least one tunnel 170 and wherein the second bar locking means comprise a first recess 204 and a second recess 205. The first recess 204 and the second recess 205 are inserted in the bar 200, spaced from each other along the bar axis Y. The protrusion 172 cooperates with the first recess 204 in the first position A. The protrusion 172 cooperates with the second recess 205 in the second position B (not shown).

[0022] Figure 4 shows a cut, view (cut carried out along the mating axis) of the electrical connector with the TPA device in a not activated position (first position A). The shroud 130 surrounds, with a first distance 140, the terminal holder portion 150 that surrounds the mating axis X. The bar 200 comprises a blocking portion 208 that is present in the groove 142 when the bar 200 is in the first position A.

[0023] Figure 5 shows a cut, view (cut carried out along the mating axis) of the electrical connector with the TPA device in an activated position (second position B). The bar 200 comprises a blocking portion 208 that is not present in the groove 142 when the bar 200 is in the second position B.

[0024] Figure 6 shows a cut, view (cut carried out along the bar axis) of the electrical connector with the TPA device in a not activated position (first position A). The bar 200 comprises a terminal blocking protrusion 206. The at least one cavity 160 is free of the terminal blocking protrusion 206, when the bar 200 is in the first position A.

[0025] Figure 7 shows a cut, view (cut carried out along the bar axis) of the electrical connector with the TPA device in an activated position (second position B). The terminal blocking protrusion 206 protrude into the at least one cavity 160 when the bar 200 is in the second position B.

[0026] Figure 8 shows a cut, view of the electrical connector 10 and a counter connector 500, with the TPA device in a not activated position (first position A). An Electrical connector assembly comprising an electrical connector 10 and a counter connector 500. The counter connector 500 comprises a counter connector housing 502 with a counter shroud 504 adapted to be received in the groove 142 of the electrical connector 10. The electrical connector 10 is not connectable to the counter connector 500 when the first bar locking means and the second bar locking means are in a first position A. The electrical connector 10 is connectable to the counter connector 500 when the first bar locking means and the second bar locking means are in a second position B. The blocking portion 208 is present in the groove 142 and limits movement of the counter shroud 504 along the mating axis X when the bar 200 is in the first position A.

Claims

1. Electrical connector (10), comprising a connector housing (100) having a first wall (110) arranged perpendicular to a mating axis (X), a second wall (120) extending from the first wall (110) along the mating axis (X) in a mating direction (M), defining a shroud (130), the shroud (130) surrounds, with a first distance (140), a terminal holder portion (150) that surrounds the mating axis (X), whereby the terminal holder portion (150) comprises at least one cavity (160) aligned along the mating axis (X) and adapted to receive an electrical terminal, whereby the terminal holder portion (150) comprises at least one tunnel (170), arranged perpendicular to the mating axis (X), along a bar axis (Y), providing access to the at least one cavity (160), wherein a bar (200) is at least partly inserted in the at least one tunnel (170), wherein the at least one tunnel (170) comprises a first bar locking means and whereby the bar (200) comprises a second bar locking means, whereby the a first bar locking means and the second bar locking means cooperate to lock the bar (200) releasable in a first position (A) or in a second position (B), whereby the shroud (130) comprises an shroud opening (132) surrounding the bar axis (Y), whereby a first end (202) of the bar (200) is hold in the shroud opening (132) when the bar (200) is in the first position (A).

2. Electrical connector (10) according to claim 1, wherein the first end (202) of the bar (200) is flush with the outer surface of the shroud (130) when the bar (200) is in the first position (A).

3. Electrical connector (10) according to any preceding claim, wherein a groove (142), adapted to receive a counter shroud (504) of a counter connector housing (502), surrounds the terminal holder portion (150).

4. Electrical connector (10) according to the preceding claim, wherein the bar (200) comprises a blocking portion (208) that is present in the groove (142) when the bar (200) is in the first position (A) and wherein the blocking portion (208) is not present in the groove (142) when the bar (200) is in the second position (B).

5. Electrical connector (10) according to the preceding claim, wherein the blocking portion (208) is at least partly located in the tunnel (170), when the bar (200) is in the second position (B).

6. Electrical connector (10) according to any preceding claim, wherein the first bar locking means comprise a protrusion (172) that protrude inwards the at least one tunnel (170) and wherein the second bar locking means comprise a first recess (204) and a second recess (205), wherein the first recess (204) and the second recess (205) are inserted in the bar (200), spaced from each other along the bar axis (Y).

7. Electrical connector (10) according to the preceding claim, wherein the protrusion (172) cooperates with the first recess (204) in the first position (A) and wherein the protrusion (172) cooperates with the second recess (205) in the second position (B).

8. Electrical connector (10) according to any preceding claim, wherein the bar (200) comprises a terminal blocking protrusion (206) and whereby the at least one cavity (160) is free of the terminal blocking protrusions (206), when the bar (200) is in the first position (A) and wherein the terminal blocking protrusions (206) protrude into the least one cavity (160) when the bar (200) is in the second position (B).

9. Electrical connector (10) according to any preceding claim, wherein the terminal holder portion (150) comprises a row of cavities (160) and wherein the row of cavities (160) is aligned along the bar axis (Y).

10. Electrical connector (10) according to the preceding claim, wherein the bar (200) is U-shaped and wherein the terminal blocking protrusions (206) protrude from the legs of the U inwards.

11. Electrical connector assembly comprising an electrical connector (10) according to any preceding claim and a counter connector (500) comprising a counter connector housing (502) with a counter shroud (504) adapted to be received in the groove (142) of the electrical connector (10),
whereby the electrical connector (10) is not connectable to the counter connector (500) when the first bar locking means and the second bar locking means are in a first position (A) and whereby the electrical connector (10) is connectable to the counter connector (500) when the first bar locking means and the second bar locking means are in a second position (B).

12. Electrical connector assembly according to the preceding claim, wherein the blocking portion (208) is present in the groove (142) and limits movement of the counter shroud (504) along the mating axis (X) when the bar (200) is in the first position (A) and wherein the blocking portion (208) is not present in the groove (142) and allows movement to a fully mated position of the counter shroud (504) along the mating axis (X), when the bar (200) is in the second position (B).

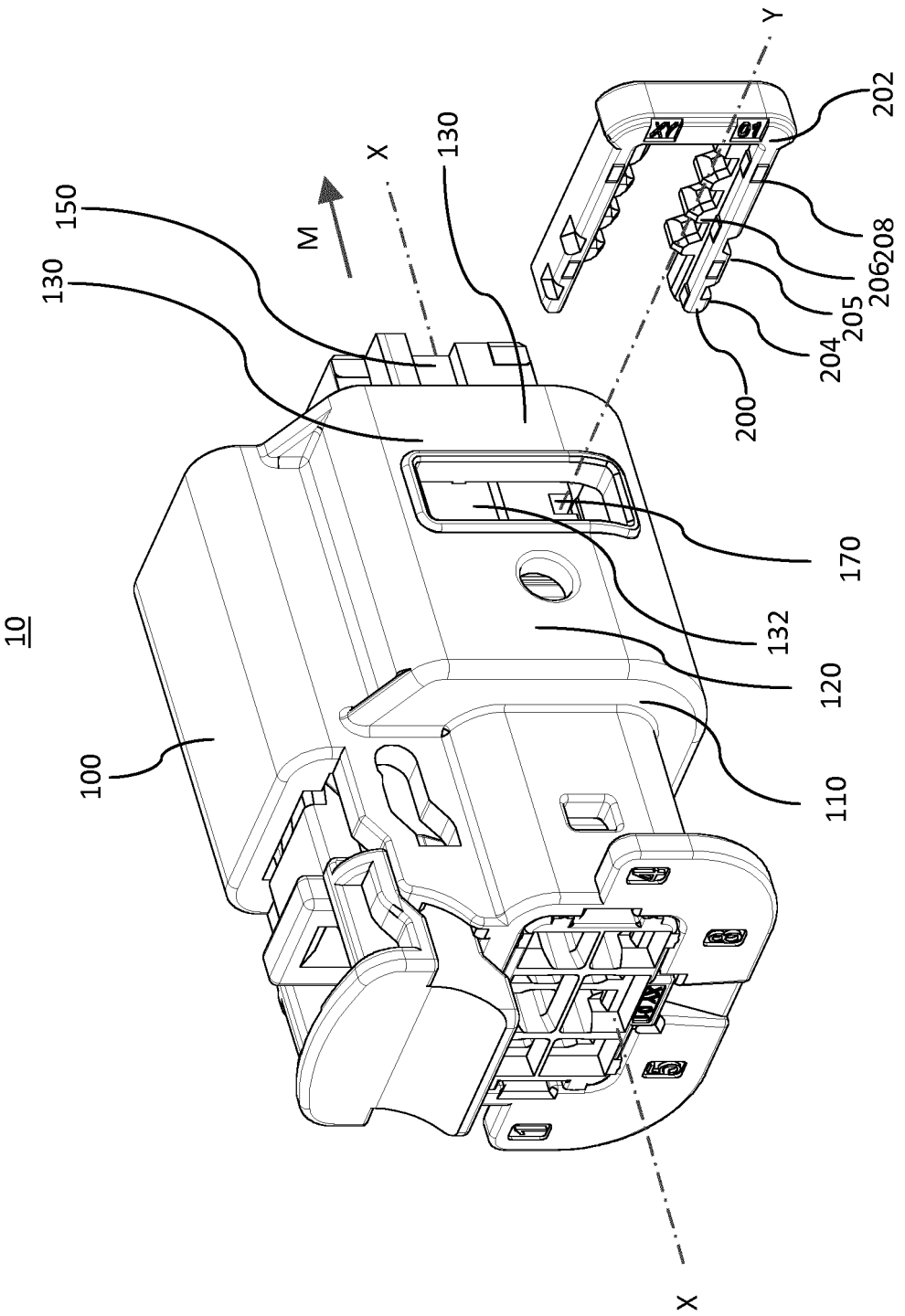

Fig. 1

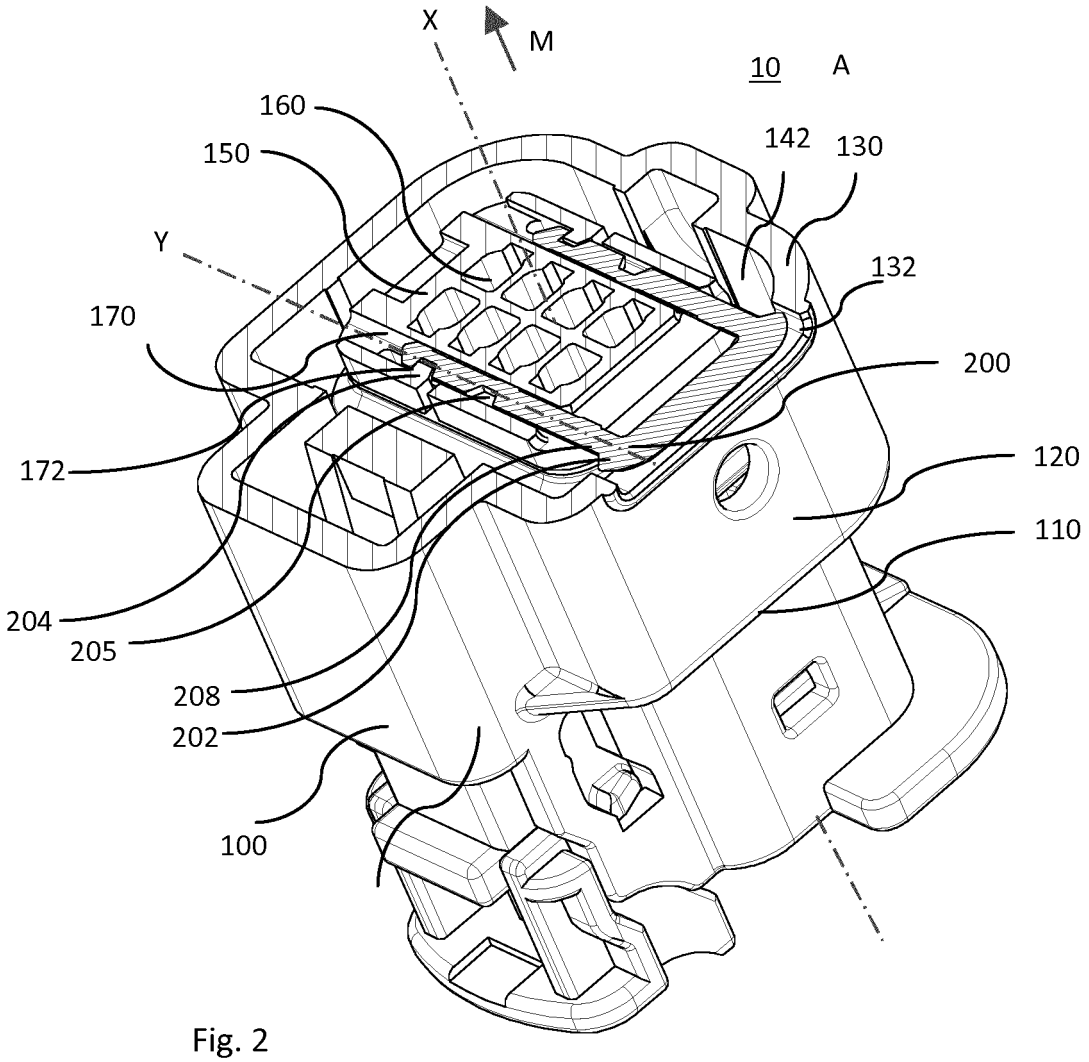
X
M
10
A
160
150
142
130
Y
132
170
200
172
120
110
204
205
208
202
100

Fig. 2

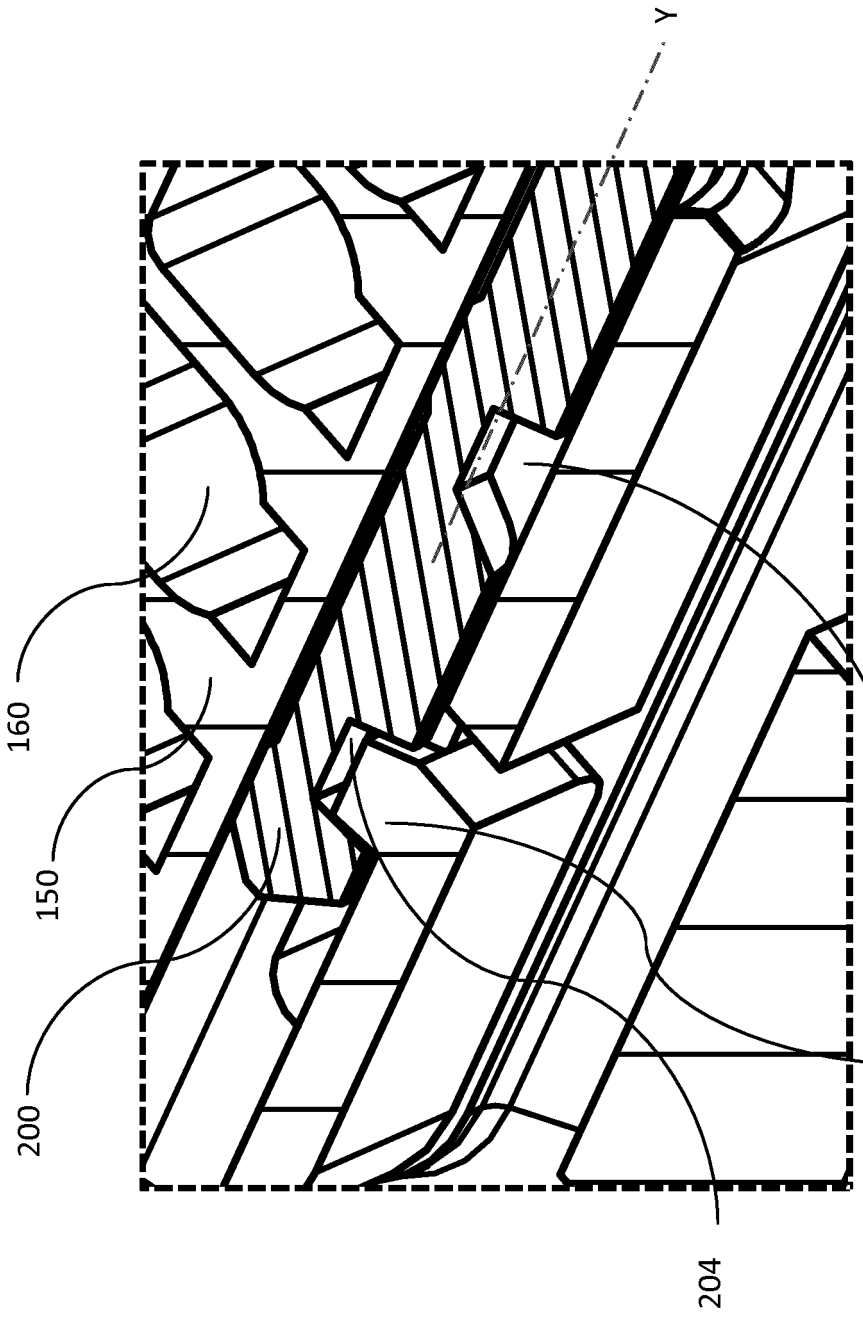

Fig. 3

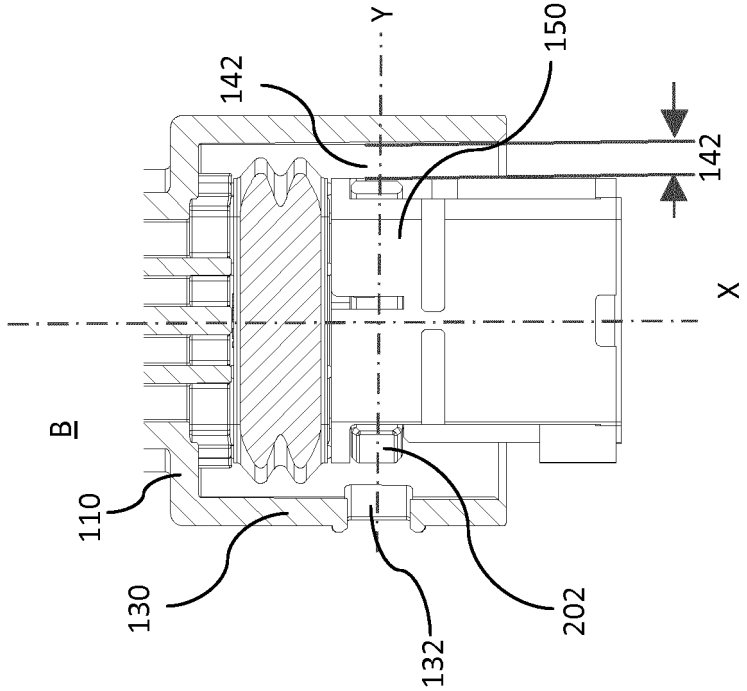
Y
150
142
142
X
B
110
130
132
202

Fig. 5

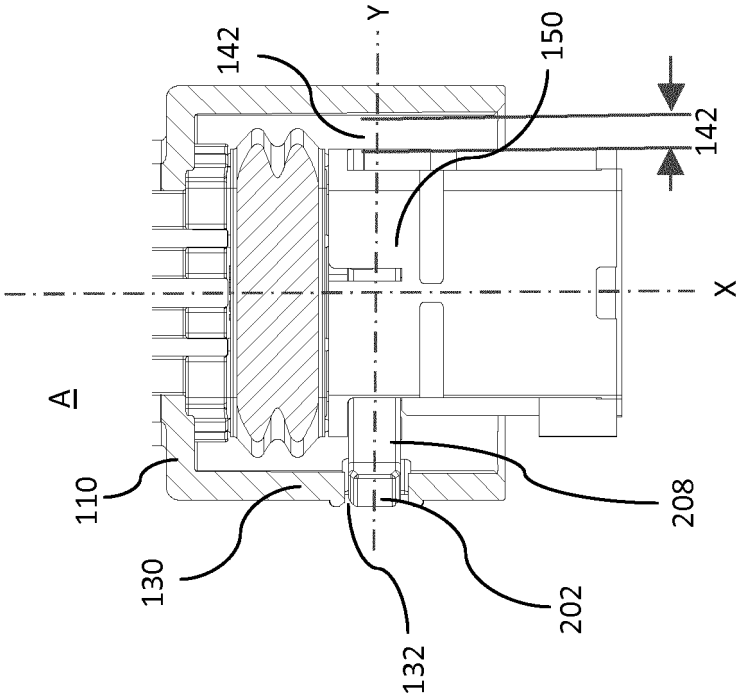
Y
142
150
142
X
A
110
130
132
202
208

Fig. 4

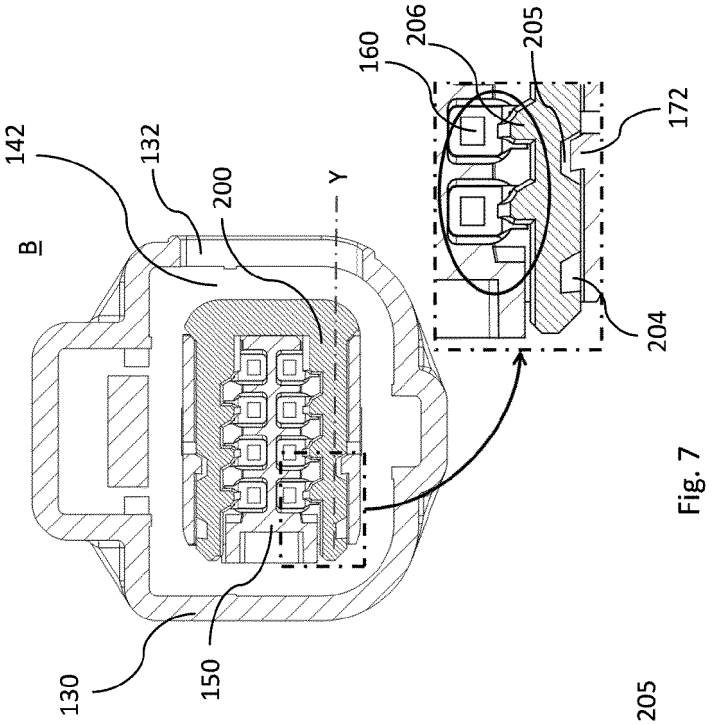
B
142
132
200
Y
160
206
205
172
204
130
150

Fig. 7

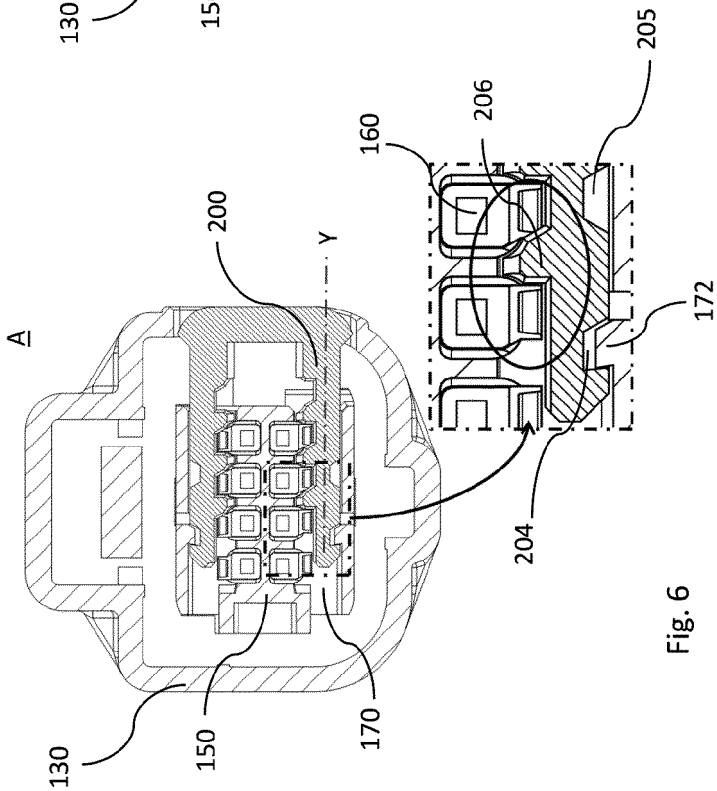
A
200
Y
160
206
205
172
204
130
150
170

Fig. 6

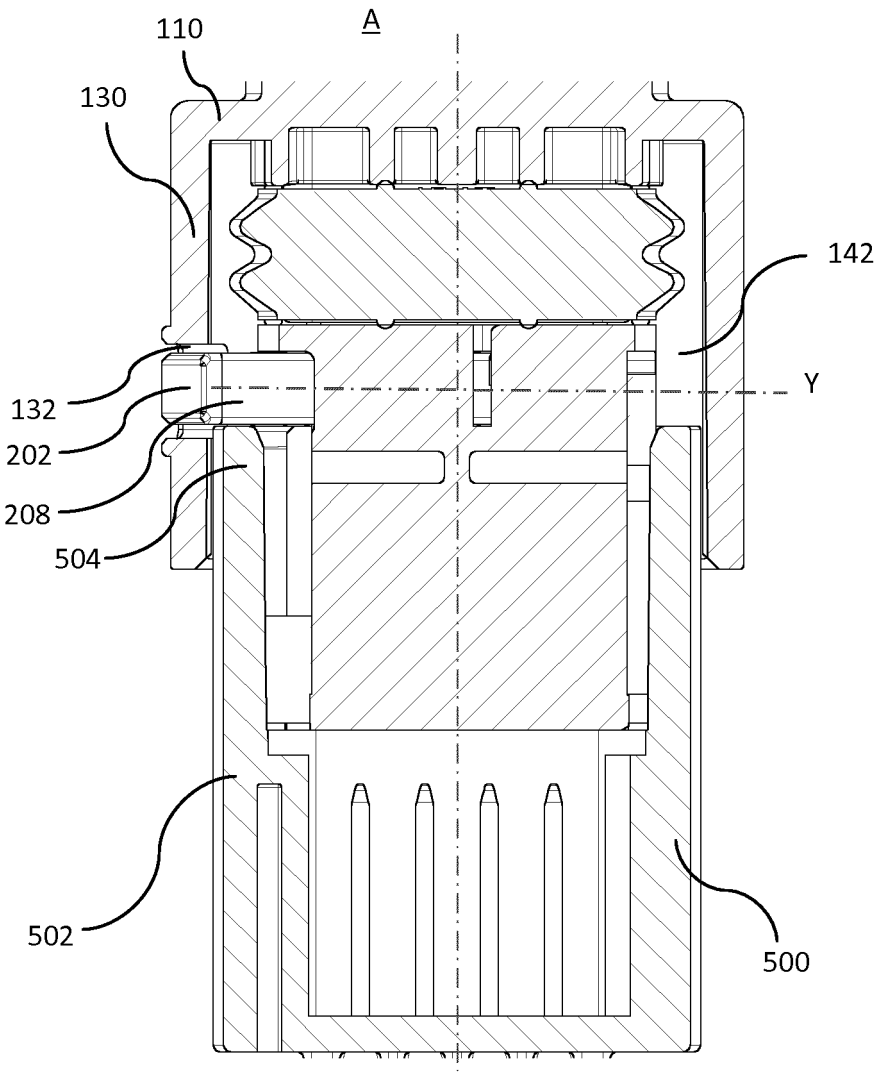

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 2834

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 July 2018	Ferreira, João

CATEGORY OF CITED DOCUMENTS

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