(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 863 490 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.04.2015 Bulletin 2015/17

(51) Int Cl.:
H01R 13/629 *(2006.01)* ***H01R 13/641*** *(2006.01)*
H01R 13/639 *(2006.01)*

(21) Application number: **13189314.1**

(22) Date of filing: **18.10.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) Connector assembly with CPA member

(57) The present invention relates to an electrical connector assembly (10) comprising a connector housing (20) and a mate assist member (30) being movable arranged thereon from a preliminary mating position to a fully mated position to facilitate the mating process of the connector housing (20) with a corresponding counter connector (11). The assembly is further provided with a connector position assurance (CPA) member (40) arranged movable on the connector housing (20) between a first and a second position, whereby the CPA member (40) is fixed in the first position on the housing and is adapted to be automatically released from said position upon mating of the connector housing with a corresponding counter connector.

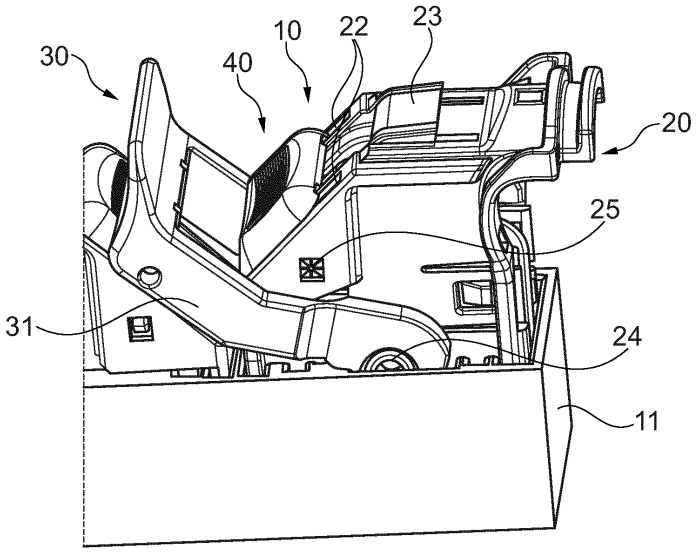

Fig. 2

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Description

I. Field of the Invention

[0001] The present invention relates to an electrical connector assembly comprising a mate assist member and a connector position assurance (CPA) member.

II. Technical Background

[0002] In many fields of application, as e.g. in the case of mass production assembly processes, it is important that electrical connectors can be connected easily, fast and fail-proof. In cases where connectors have a plurality of electrical contact terminals to be mated, as it is often the case in the field of automotive applications, it is therefore common that the connectors are provided with mate assist mechanisms in the form of mate assist levers or sliders to facilitate mating of connector and counter connector (mating connector).

[0003] Such mate assist mechanisms usually are provided linearly moveable or pivotably moveable on a connector housing. Upon pre-mating of the connector with the corresponding mating connector, the mate assist mechanism is actuated and moved from a first or preliminary mating position, to a second, fully mated position, thereby facilitating the mating process. Commonly, the mating movement is achieved by suitable cam elements provided on the mate assist mechanism that interacts with a suitable cam groove, so that the two connectors to be mated are pulled towards each other upon actuating of the mate assist mechanism. Another principle uses rack and pinion elements, whereby e.g. a pinion (gear wheel) is provided on a rotatable lever that is mounted to a connector housing and a corresponding tooth rack is provided on the counter connector. Upon engagement of rack and pinion a rotation of the lever will result in a mating movement of the two connector parts to be mated.

[0004] A typical example of a connector assembly with a mate assist mechanism in form of a rotatable lever is described in WO 2013/ 011345 A1. The mate assist lever disclosed in this document is provided rotatable on a connector housing and has generally a u-shaped form with two lever arms connected by a common web. Each lever arm comprises a cam groove that is adapted to interact with a corresponding cam pin or cam follower provided on the counter connector housing. Upon mating, the cam follower is introduced in the cam groove of the lever and upon rotating of the lever from a preliminary mating position to a fully mated position, the cam groove acts on the cam follower, whereby the two connectors to be mated are pulled towards each other. The connector housing further comprises a locking latch to hold or fix the lever in the fully mated position. Further, the connector is provided with a secondary locking device that is arranged moveable on the connector housing between an open position and a closed position. In the closed position, the secondary locking device prevents a release movement of the locking latch of the connector housing, so that an unintended movement of the lever out of the fully mated position is prevented. However, this construction does not comprise a connector position assurance member.

[0005] It is an object of the present invention to provide an electrical connector assembly with a mate assist member and an improved CPA member that allows an easy and secure verification of the mated condition of the connector with a corresponding counter connector. It is further an object of the invention, to provide such a CPA member that also allows the provision of a secondary locking function.

[0006] These and other objects which become apparent upon reading the following description are solved by an electrical connector assembly according to claim 1.

III. Summary of the Invention

[0007] According to the invention, an electrical connector assembly is provided comprising a connector housing and a mate assist member that is arranged moveable from a preliminary mating position to a fully mated position to facilitate the mating process of the connector housing with a corresponding counter connector. In the context of this application, the preliminary mating position of the mate assist member is the position, in which it is possible to initiate the mating process. Upon movement from that preliminary mating position to the fully mated position, the connector housing and the corresponding counter connector are pulled towards each other until they are fully mated. In order to verify, whether the fully mated state of the connectors is correctly achieved, the assembly further comprises a connector position assurance (CPA) member, that is likewise arranged moveable on the connector housing between a first and a second position. The CPA member comprises a latching member that engages a locking portion on the connector housing, whereby the CPA member is fixed in its first position on the housing. Upon sufficient mating of the connector housing with the corresponding counter connector, i.e. at the end of the mating process, the latching member is released from said locking portion due to preferably a contact with a part of the corresponding counter connector. In other words, at the end of the mating process of the two connectors, the latching arm is released, so that the CPA member can be moved into the second position. Thereby, it is easily possible to visually verify whether the fully mated condition is achieved, since the CPA can only be moved out of the first into the second position, when the mating process is sufficiently completed.

[0008] Preferably, the connector housing further comprises a second locking portion, onto which the latching member latches when the CPA member is in the second position. Thereby, the same latching member can be used for a fixation of the CPA member in the first as well as the second position.

[0009] Generally preferred, the CPA member further blocks a movement of the mate assist member when the

CPA member is in its second position and it allows a movement of the mate assist member, when the CPA member is in the first position. This has the particular advantage, that the CPA member has the additional function of a secondary lock. Thus, when the CPA member is moved into the second position, an operator has a reliable control means to check whether the connector housing is correctly mated with the corresponding counter connector, since only in that case is it possible to move the CPA member from the first to the second position. In the second position, at the same time the mate assist member is locked in its mated position by the CPA. Thus, a single working step achieves two important functions.

[0010] To allow a controlled movement of the CPA from the first to the second position, it is preferred that the connector housing is provided with at least one sliding groove and the CPA member with a corresponding sliding portion, which runs in the sliding groove similar to a key and keyway connection.

[0011] Preferably, the connector housing further comprises a locking latch to lock or latch the lever in the fully mated position thereof. This locking latch is preferably provided such that it automatically latches onto a suitable portion of the lever, when the lever is moved into the fully mated position. A release of the lever requires in that case a release of the locking latch, by for example using a suitable tool or by a manual release of the locking latch. Generally preferred, the CPA member is in this embodiment adapted to prevent the release movement of the locking latch, when the CPA member is in its second position. Most preferably, this is achieved by means of a blocking portion provided on or at the CPA member that engages respectively blocks the locking latch when the CPA is in its second position. Thereby, it is not possible to actuate the locking latch, i.e. to move it into a release orientation.

IV. Description of the preferred embodiments

[0012] In the following, the invention is described exemplarily with reference to the enclosed figures, in which

- Fig. 1 shows a connector assembly in a 3-dimensional view;
- Fig. 2 shows a 3-dimensional view of a connector housing with a mate assist member in its preliminary mating position;
- Fig. 3 shows a detail of the embodiment Fig. 2;
- Fig. 4 shows two 3-dimensional views of a CPA member from two different perspectives;
- Fig. 5 shows a 3-dimensional partially cut view of the connector of Fig. 2;
- Fig. 6 shows another detail of a CPA member;
- Fig. 7 shows a detail of a cut view showing the CPA member arranged on the connector housing; and
- Fig. 8 shows a 3-dimensional cut view of the connector housing in accordance with the invention.

[0013] In Fig. 1, a connector assembly 10 in accordance with the present invention is shown in a 3-dimensional schematic view. In Fig. 1, two plug connectors are shown, that have basically the same features, so that in the following only the right hand connector will be described in more detail. The connector assembly 10 comprises a connector housing 20 and a mate assist member in form of a rotatable lever 30 that is mounted on the connector housing 20. The rotatable lever 30 has a generally u-shaped form with two parallel lever arms 31 and 32 that are connected by a common web 33. The lever 30 is rotatably arranged on the housing 20 by means of pivot pins 24 that are formed on the side walls of connector housing 20. The lever arms 31, 32 comprise a pivot element or gear wheel 34 that is adapted to interact with a tooth bar or pinion (not shown) provided on the inner walls of counter connector 11. As the skilled person will recognize, upon rotating lever 30 clockwise in the orientation shown in Fig. 1, the gear wheel 34 can interact with the pinion or tooth bar provided in the counter connector 11, whereby connector housing 20 is pulled into the receiving opening of counter connector 11. Naturally, the connector housing 20 has to be first inserted further into the counter connector into a pre-mating orientation as shown in Fig. 2, so that the teeth of the gear wheel can engage the rack. These mechanisms are however generally known to the skilled person. Further, a connector position assurance member 40 is arranged moveable on the connector housing 20. The function of the CPA 40 will be explained in more detail below under reference to the further figures.

[0014] Fig. 2 shows the same connector assembly as Fig. 1, when connector housing 20 is in a preliminary mating position. Also the mate assist member (the lever) 30 is in its preliminary mating position, in which the teeth of the gear wheel 34 are ready to engage the corresponding teeth of the pinion or tooth bar of counter connector 11. The CPA member is shown in a first position in which it is held by a latching member in form of two latching arms 41, 43. This is more clearly shown in Figs. 3 and 4. The latching arm 41 engages a locking portion 21 of connector housing 20, so that the CPA is fixed in this first position as shown in Figs. 2 and 3. On the opposite side of the connector housing, an identical locking portion is provided that is engaged by the second latching arm 43, which arm is not visible in Fig. 3 due to the perspective of the figure. In the position shown in Fig. 2, it is not possible to move the CPA from the first position into the second position, since latching arms 41, 43 are in engagement with the corresponding locking portions of the housing. However, the latching arms 41, 43 are adapted to be released from the locking portions 21 upon (preferably full) mating of connector housing 20 with the corresponding counter connector 11. In other words, upon inserting connector housing 20 further into the receiving opening of counter connector 11, the latching arms 41, 43 will be deflected at the end of the mating process by the inner walls of counter connector 11 until the latching

arms 41, 43 are released from the respective locking portions. In the embodiment shown, this release of latching arms 41, 43 is only effected upon full mating or coupling of connector housing 20 into counter connector 11. This situation is shown in Fig. 5.

[0015] The connector housing 20 is further provided with an aperture 25, which serves as second locking portion. In the second position of CPA, the two latching arms 41, 42, respectively the L-shaped hooks arranged thereon, will latch into this aperture 25, so that the CPA 40 cannot unintentionally move out of the second position, once it is disposed therein. However, upon applying sufficient force onto the CPA, it is possible to manually release the same from the second position.

[0016] Now turning to Fig. 4, in which the CPA 40 is shown in two different perspective views. The CPA 40 comprises two latching arms 41 and 42. Both latching arms protrude from the CPA member in the mating direction of the connector housing. The free ends of latching arms 41, 42 are provided with L-shaped hooks 43, 44 for a secure fixation of the CPA 40 in the first and second positions. Further, the free ends of latching arms 41, 42 comprise an inclined release portion, which is adapted to come into contact with a portion or wall of the counter connector upon mating. This inclined release portion facilitates the release of the latching arms from locking portion 21. The CPA member 40 is further provided with two sliding portions 45 also extending in mating direction of connector housing 20. The sliding portions 45 are adapted to interact with two corresponding sliding grooves 22 provided in an outer wall of connector housing 20. Still further, a blocking portion 46 is integrally formed with CPA 40 that is adapted to engage a locking latch of the connector housing when the CPA is in its second position, in order to prevent the release movement of the locking latch. This will be explained in more detail below.

[0017] Fig. 5 shows a 3-dimensional partially cut view of the connector assembly. In Fig. 5 the connector housing is fully mated with the counter connector and the lever 30 is in the fully mated position. In this position the lever is locked by a locking latch 23 provided on the connector housing. The skilled person will recognize from Figs. 2 and 5, that the locking latch 23 will be depressed downwardly by the common web 33 of lever 30 when the lever is rotated into the fully mated position of Fig. 5 and the locking latch 23 will then automatically spring or latch back in the position shown in Fig. 5, when the lever reaches its fully mated position. To release the lever 30, an operator has to manually press the locking latch 23 downwardly in the orientation shown in Fig. 5. From Fig. 5 one can also see, that the inner walls of counter connector 11 are in contact with the free ends of latching arms 41, 42, whereby the latching arms are bent inwardly towards each other, such that the L-shaped hooks 43, 44 are released from the locking portion 21 of the connector housing. In the situation shown in Fig. 5, the CPA 40 is therefore released and can be pushed into the second position.

[0018] Fig. 6 and 7 show again details of the CPA 40 and in particular of the interaction of sliding grooves 22 and corresponding sliding portions 45. As one can take from Figs. 7, the two sliding grooves 22 are adapted to receive the sliding portions 45 therein. The sliding portions 45 comprise hooks 47 that engage behind a wall of the grooves so that the CPA 40 cannot become unintentionally loose.

[0019] Fig. 8 shows the CPA 40 in the second position. The lever 30 is in the fully mated position, i.e. connector housing and counter connector are fully mated with each other. From the cut-view of Fig. 8 one can also see how the locking latch 23 is latched behind the common web 33 of lever 30, so that in the situation shown in Fig. 8 it is not possible to rotate the lever 30 in counter clockwise direction. Due to the kinematics of the lever, this means that it is not possible to unmate the two connectors. For unmating, an operator has to first deflect the locking latch 23 downwardly in the figure, such that the common web can move over the top surface of locking latch 23. However, in the position shown in Fig. 8, the blocking portion 46 of CPA 40 is arranged underneath the free, flexible end of locking latch 23. Therefore, it is not possible to press the locking latch 23 downwardly and therefore a release of lever 30 is not possible. The CPA 40 thus not only serves as an indicator for a successfully completed mating operation but at the same time as a secondary lock, that securely prevents any unintentional release movement of lever 30.

List of references:

[0020]

10	Electrical connector assembly
11	Counter connector
20	Connector housing
21	Locking portion
22	Sliding grooves
23	Locking latch
24	Pivot pins
25	Aperture (second locking portion)
30	Mate assist member (lever)
31, 32	Lever arm
33	Common web
34	Gear wheel
40	CPA
41, 42	Latching arms
43, 44	L-shaped hook
45	Sliding portions
46	Locking portion
47	Hook

Claims

1. An electrical connector assembly (10) comprising:

a connector housing (20);

a mate assist member (30) being movable from a preliminary mating position to a fully mated position to facilitate the mating process of the connector housing (20) with a corresponding counter connector (11); and
a connector position assurance (CPA) member (40) arranged movable on the connector housing (20) between a first and a second position, **characterized in that** the CPA member (40) comprises a latching member (41, 42) that engages a locking portion (21) on the connector housing (20) to fix the CPA member (40) in the first position on the housing and which latching member (41, 42) is adapted to be released from said locking portion (21) upon mating of the connector housing with a corresponding counter connector.

2. The electrical connector assembly (10) according to claim 1, **characterized in that** the mate assist member (30) is a rotatable lever that is mounted on the connector housing (20).

3. The electrical connector assembly (10) according to claim 1 or 2, **characterized in that** the latching member (41, 42) is a latching arm that protrudes from the CPA member (40).

4. The electrical connector assembly (10) according to claim 3, **characterized in that** the latching arm (41, 42) protrudes in mating direction of the connector housing (20).

5. The electrical connector assembly (10) according to claim 4, **characterized in that** the latching arm (41, 42) comprises an inclined release portion adapted to come into contact with a portion of the counter connector upon mating of the connector housing with a corresponding counter connector.

6. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the connector housing (20) further comprises a second locking portion (25) onto which the latching member (41, 42) latches when the CPA member (40) is in the second position.

7. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the CPA member (40) blocks a movement of the mate assist member (30) when in the second position and allows movement of the mate assist member (30) when in the first position.

8. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the CPA member (40) is adapted to be manually releasable from the second position.

9. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the connector housing (20) comprises at least one sliding groove (22) and the CPA member (40) comprises a corresponding sliding portion (45) arranged therein to allow a controlled movement of the CPA from the first to the second position.

10. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the latching member (41, 42) is formed by two latching arms.

11. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the mate assist member (30) comprises a rotatable lever that is mounted rotatable on the connector housing from the preliminary mating position to the fully mated position, and the connector housing (20) comprises a locking latch (23) to lock the lever in the fully mated position.

12. The electrical connector assembly (10) according to the preceding claim, **characterized in that** the CPA member (40) is adapted to prevent the release movement of the locking latch (23).

13. The electrical connector assembly (10) according to claim 11 or 12, **characterized in that** the CPA member (40) comprises a blocking portion (46) that engages the locking latch (23) when the CPA is in its second position to prevent the release movement of the locking latch (23).

14. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the latching member (41, 42) is formed by two latching arms wherein each latching arm comprises an inclined release portion adapted to come into contact with a portion of the counter connector upon mating of the connector housing with a corresponding counter connector.

15. The electrical connector assembly (10) according to any preceding claim, **characterized in that** the latching member (41, 42) comprises an L-shaped hook (43, 44) that engages the locking portion (21).

16. The electrical connector assembly (10) according to any preceding claim, further comprising a corresponding mating connector (11).

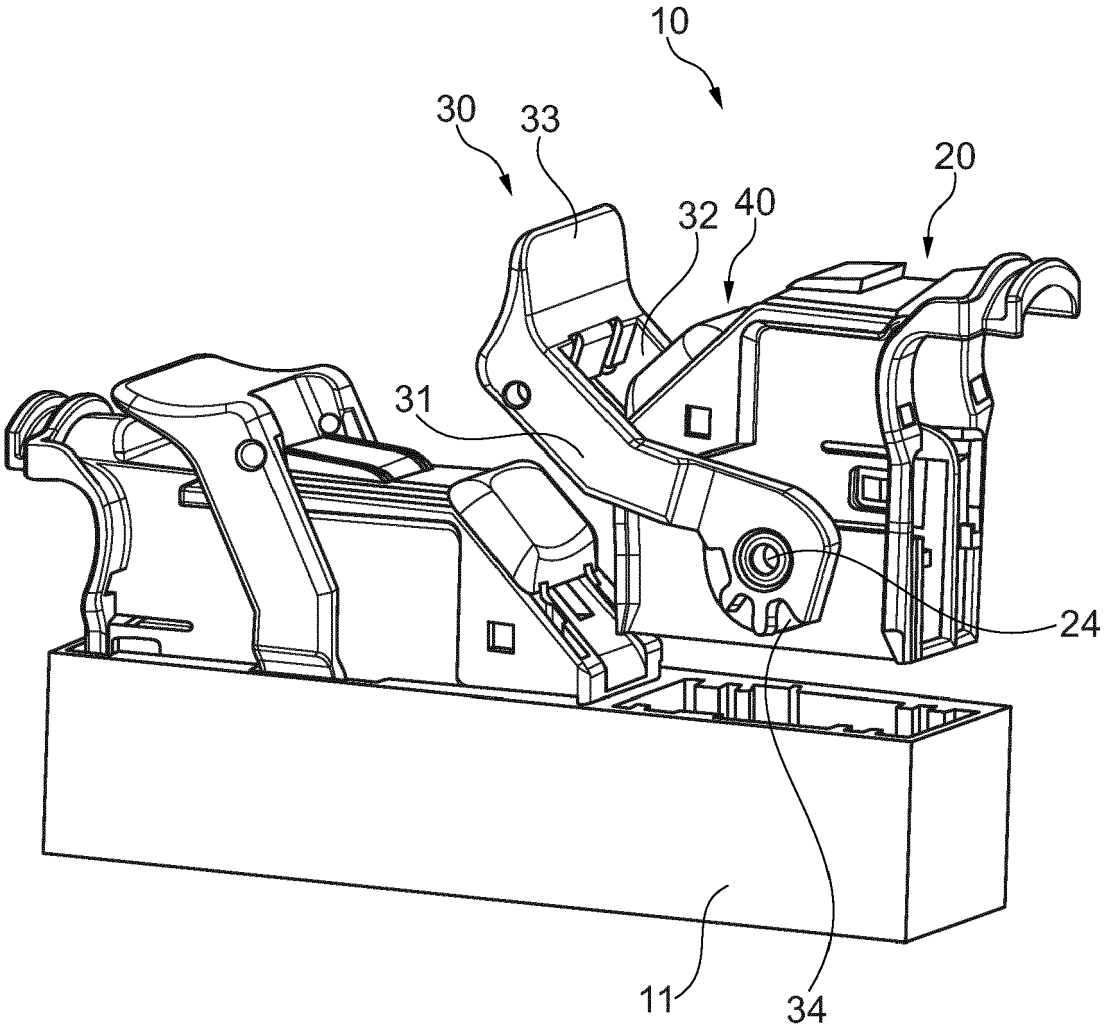

Fig. 1

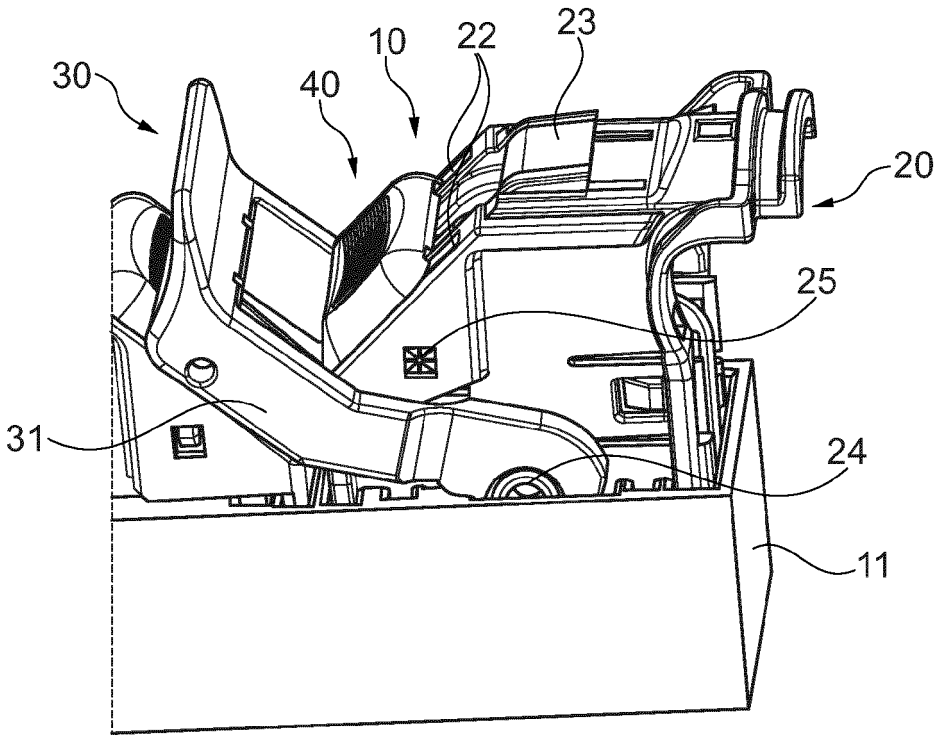

Fig. 2

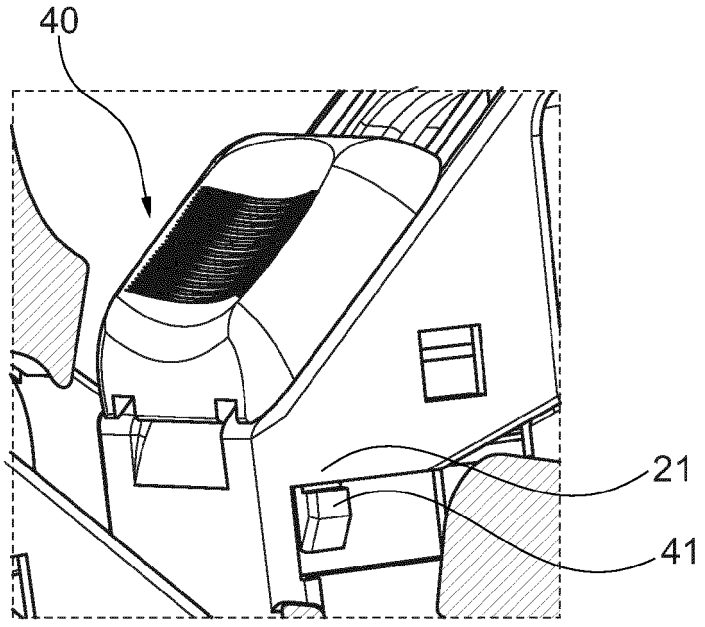

Fig. 3

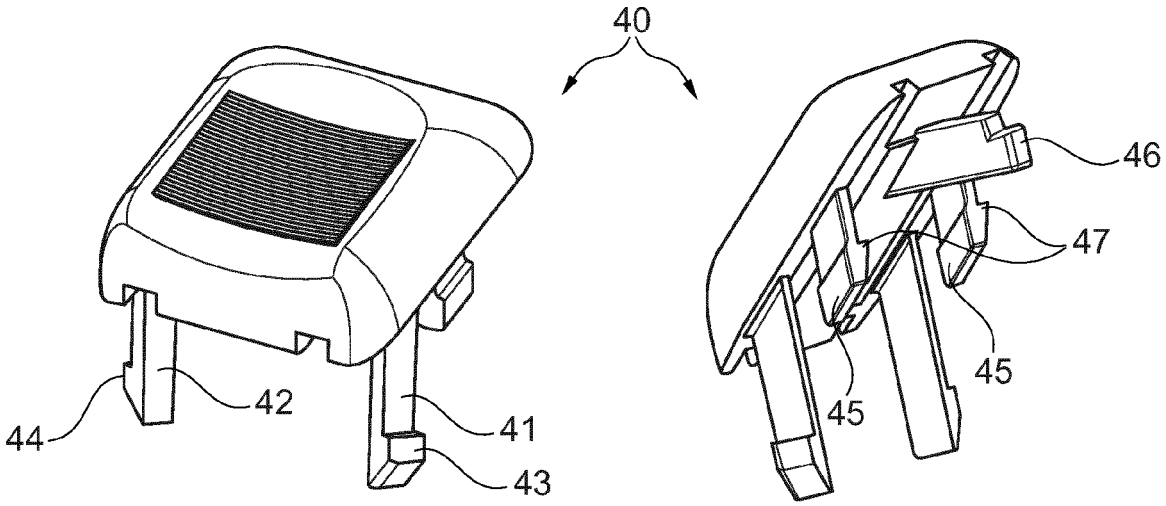

Fig. 4

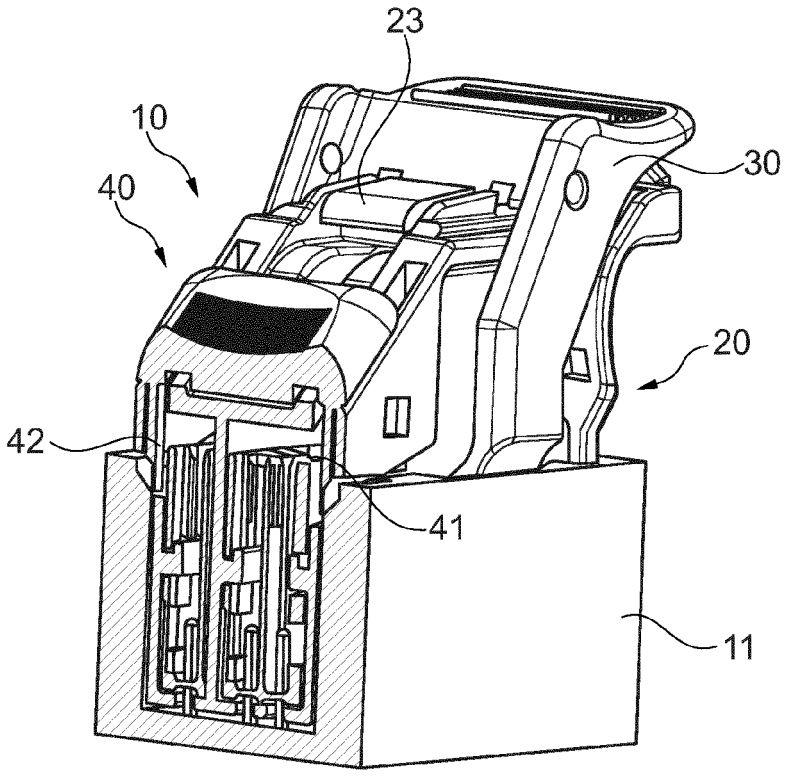

Fig. 5

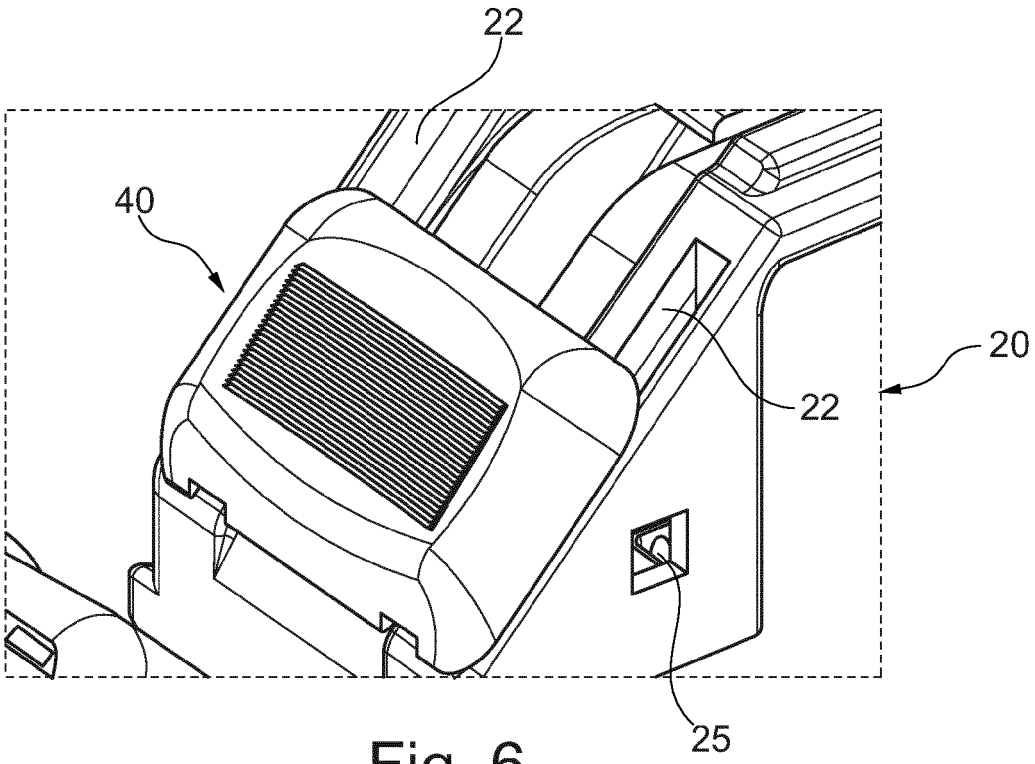

Fig. 6

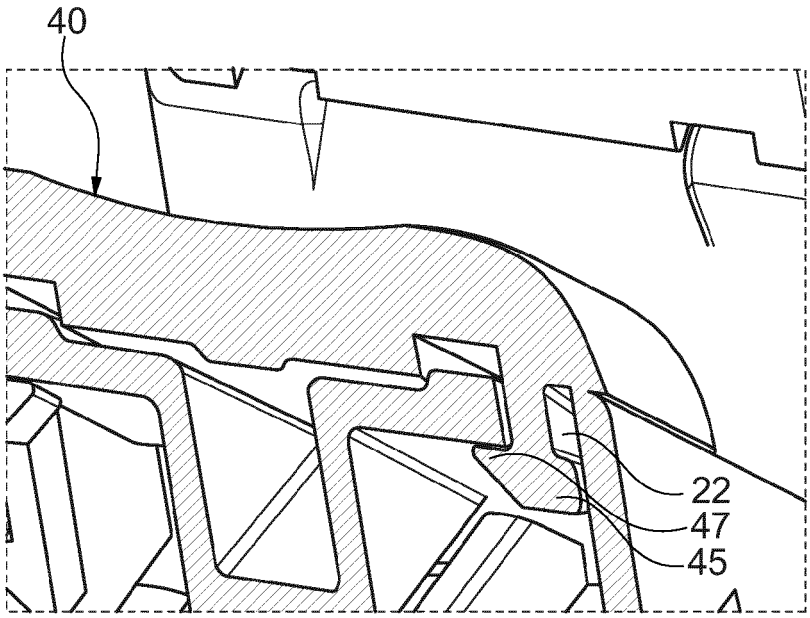

Fig. 7

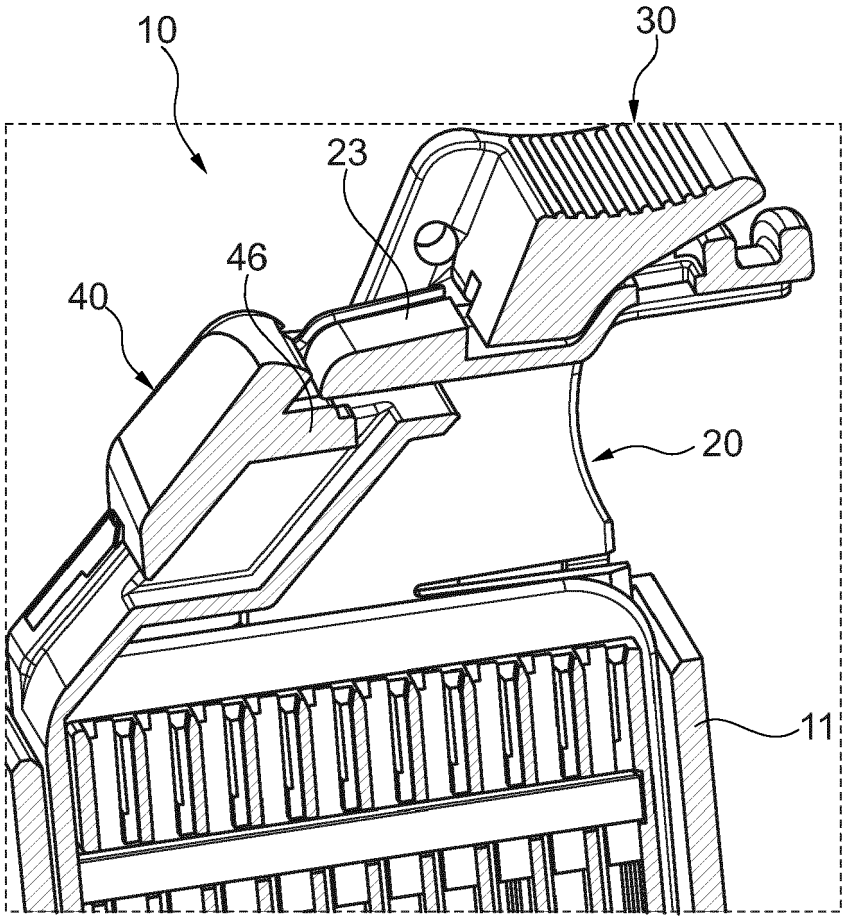

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 9314

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TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 February 2014	Vautrin, Florent

CATEGORY OF CITED DOCUMENTS

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