

(19)



(11)

EP 3 591 769 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

08.01.2020 Bulletin 2020/02

(51) Int Cl.:

H01R 13/629 ^(2006.01)**H01R 13/641** ^(2006.01)**H01R 13/70** ^(2006.01)**H01R 13/707** ^(2006.01)**H01R 13/436** ^(2006.01)**H01R 13/52** ^(2006.01)(21) Application number: **19182816.9**(22) Date of filing: **27.06.2019**

(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:

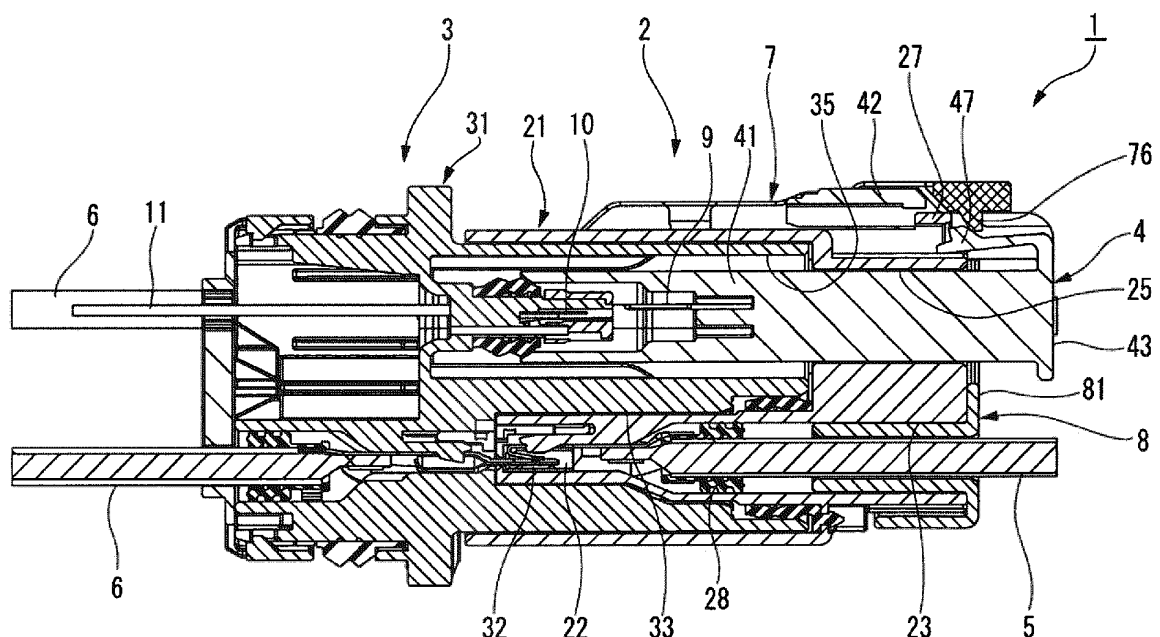
BA ME

Designated Validation States:

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80802 München (DE)**(30) Priority: **02.07.2018 JP 2018126278**(54) **CONNECTOR DEVICE**

(57) A connector device includes a first connector, a second connector, a movable arm provided on the first connector and holding the second connector in a fitted state with respect to the first connector, a connector fitting assurance mechanism that locks the movable arm by slidably engaging a slider with the movable arm that holds the second connector in the fitted state, a signal circuit that is possible to electrically connect electric wires to

each other, and an interlock terminal provided in the slider, the slider is disposed at a position where a rear end portion of the slider projects backward from a rear end of the first connector when the movable arm is not locked, and is disposed at a position where the rear end of the first connector and the rear end portion of the slider are substantially flush with each other when the movable arm is locked.

FIG.6**EP 3 591 769 A1**

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a connector device.

BACKGROUND ART

[0002] In related art, a lever fitting type connector used for electrical connection between a motor and an inverter mounted on a vehicle such as an electric vehicle or a plug-in hybrid vehicle is proposed as a connector device that mechanically detects a fitting between male and female connectors and electrically detects the fitting of their connectors in order to prevent arc discharge when the connectors are separated (see JP 2007-149420 A).

[0003] In such a lever fitting type connector, since an interlock terminal is integrated with a slider of a connector fitting assurance mechanism, the lever fitting type connector can be shortened and the number of components of the lever fitting type connector can be reduced.

[0004] In the lever fitting type connector in which the interlock terminal is integrated with the slider of the connector fitting assurance mechanism, since the slider is disposed inside a rotation track of the coupling lever, a direction of visual confirmation of an inspector for a fitting work is limited only to a coupling lever side. Therefore, depending on a vehicle mounting state of the lever fitting type connector, it is difficult for the inspector of the fitting work to visually confirm whether the slider is in a normal locked position, which may lead to a decrease in workability of inspection work.

SUMMARY OF INVENTION

[0005] An aspect of the present invention is to provide a connector device capable of shortening a connector by integrating an interlock terminal with a slider of a connector fitting assurance mechanism and facilitating visual confirmation of whether the slider is in a normal locked position.

[0006] According to an aspect of the present invention, the connector device can be provided in which the connector may be shortened by integrating the interlock terminal with the slider of the connector fitting assurance mechanism, and the visual confirmation of whether the slider is in the normal locked position may be facilitated.

[0007] Aspects of non-limiting embodiments of the present invention have been briefly described as above. Details of the aspects are further clarified by reading a mode (hereinafter, referred to as "embodiment") for carrying out the aspects described below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

Fig. 1 is an exploded perspective view of a connector device according to an embodiment of the invention. Fig. 2 is an exploded perspective view of a first connector illustrated in Fig. 1.

Fig. 3 is a perspective view illustrating a housing and a slider of the first connector illustrated in Fig. 2.

Fig. 4 is a perspective view illustrating a temporarily locked state of the connector device illustrated in Fig. 1.

Fig. 5 is a perspective view illustrating a fully locked state of the connector device illustrated in Fig. 1.

Fig. 6 is a longitudinal sectional view illustrating the fully locked state of the connector device illustrated in Fig. 1.

Fig. 7 is a perspective view illustrating h of the connector device illustrated in Fig. 1.

Fig. 8 is a longitudinal sectional view illustrating a completely fitted state of the connector device illustrated in Fig. 1.

Figs. 9A to 9C are a top view, a side view and a bottom view of the connector device illustrated in Fig. 1 in the fully locked state.

Fig. 10 is a horizontal sectional view illustrating a completely fitted state of the connector device illustrated in Fig. 1.

DESCRIPTION OF EMBODIMENTS

[0009] Hereinafter, embodiments according to the present invention will be described with reference to the drawings.

[0010] Fig. 1 is an exploded perspective view of a connector device 1 according to an embodiment of the present invention. Fig. 2 is an exploded perspective view of a first connector 2 illustrated in Fig. 1. Fig. 3 is a perspective view illustrating a housing 21 and a slider 4 of the first connector 2 illustrated in Fig. 2.

[0011] As illustrated in Figs. 1 and 2, the connector device 1 according to the embodiment is a lever fitting type connector including the first connector 2, a second connector 3, a coupling lever 7 serving as a movable arm, and a slider 4 forming a connector fitting assurance mechanism.

[0012] As illustrated in Fig. 2, the first connector 2 includes the housing 21 molded from an electrically insulating synthetic resin. Five female terminals (first terminals) 22 are respectively accommodated in five terminal accommodation chambers 23 of the housing 21, and electric wires 5 are respectively connected to the female terminals 22. A rubber plug 28 serving as a sealing member is attached to each electric wire 5 behind the female terminal 22. A main body portion 41 of the slider 4 is accommodated in a slider accommodation chamber 25 of the housing 21.

[0013] A slider locking portion 27 is formed on an upper portion of the housing 21. A pair of pins 24 project from both side surfaces of the housing 21, and as illustrated in Fig. 1, the coupling lever 7 made of a synthetic resin

formed in a substantially U shape is rotatably attached to the pins 24 around the pins 24.

[0014] Guide grooves 71 are respectively formed in both leg portions of the coupling lever 7, and each guide groove 71 has a substantially arc shape so as to shorten a distance to the pin 24 as approaching from a tip portion having an opening to an end portion of the guide groove 71. A temporary locking release projection 76, a pair of first engagement holes 77 for a fitting detection member and a pair of second engagement holes for full locking 75 are formed in a grip portion of the coupling lever 7.

[0015] As illustrated in Fig. 1, the second connector 3 includes a housing 31 molded from an electrically insulating synthetic resin. Five male terminals (second terminals) 32 are respectively accommodated in five terminal accommodation chambers 33 of the housing 31, and electric wires 6 are respectively connected to the male terminals 32. An interlock female terminal 10 connected to an end of an electric wire 11 is accommodated in a terminal accommodation chamber 35 of the housing 31 facing the slider accommodation chamber 25 of the housing 21.

[0016] A pair of pins 34 project from both left and right side surfaces of the housing 31, and each pin 34 faces the tip portion having the opening of the guide groove 71 of the coupling lever 7.

[0017] The slider 4 is made of a synthetic resin and, as illustrated in Fig. 1, is attached so as to be movable back and forth with respect to the housing 21 of the first connector 2 in a front-rear direction thereof. As illustrated in Figs. 2 and 3, the slider 4 includes the cylindrical main body portion 41, and a temporary locking portion 47 is cantilevered at a rear side of the main body portion 41 so as to be elastically movable upward and downward.

[0018] A pair of U-shaped flexible arms 45 are integrally formed on the main body portion 41 so as to extend forward from a rear end portion 43 of the slider 4 and then a front side of the flexible arms 45 extends backward to the connector the rear end portion 43 of the slider 4 such that the front side of the flexible arms 45 is folded. A tip portion of each flexible arm 45 is integrally provided with an engaging claw 45a preventing from falling-off and projecting therefrom. Since the temporary locking portion 47 of the slider 4 is normally locked to the slider locking portion 27 of the housing 21, the slider 4 is prevented from moving forward from the slider locking portion 27.

[0019] An interlock male terminal (terminal for an interlock) 9 illustrated in Fig. 2 is built in the main body portion 41 of the slider 4, and an interlock female terminal 10 is built in the housing 31 of the second connector 3 so as to face the interlock male terminal 9.

[0020] The interlock male terminal 9 and the interlock female terminal 10 are connected to a signal circuit configured to be possible to electrically connect the electric wires 5 of the first connector 2 and the electric wires 6 of the second connector 3 (i.e., electrically connecting the electric wires 5 and 6 with each other, or electrically disconnecting the electric wires 5 and 6 with each other).

[0021] When the interlock male terminal 9 and the interlock female terminal 10 are connected with each other, the signal circuit is closed, so that the electric wires 5 and the electric wires 6 are in conduction. Conversely, when the interlock male terminal 9 and the interlock female terminal 10 are not connected with each other, the signal circuit is opened, so that conduction between the electric wires 5 and the electric wires 6 is cut off.

[0022] The wording "the signal circuit configured to be possible to be electrically connect the electric wires 5 and the electric wires 6" is intended to mean that the signal circuit is closed so that the electric wires 5 and the electric wires 6 are in conduction, or that the signal circuit is opened so that conduction between the electric wires 5 and the electric wires 6 is cut off.

[0023] Since the connector device 1 according to the embodiment has the above-described configuration, when the first connector 2 and the second connector 3 of the connector device 1 are coupled, the following procedure is performed.

[0024] First, as illustrated in Fig. 1, the second connector 3 is made to face the first connector 2. At this time, the coupling lever 7 is rotated forward to a front side of the first connector 2 and stands up. Since the slider 4 is pulled backward to a rear side of the first connector 2, the temporary locking portion 47 is engaged with the slider locking portion 27 of the housing 21 and locked at the rear side of the first connector 2, and the interlock male terminal 9 is not connected to the interlock female terminal 10.

[0025] Next, as illustrated in Fig. 4, the second connector 3 is inserted into the first connector 2 and temporarily locked thereto. Then, the pins 34 of the second connector 3 are respectively engaged with the tip portions having openings of the guide grooves 71 of the coupling lever 7. The female terminals 22 of the first connector 2 and the male terminals 32 of the second connector 3 are lightly fitted. However, at this time, since the interlock male terminal 9 and the interlock female terminal 10 are not connected, the electric wires 5 and the electric wires 6 may not be in conduction in a halfway fitted state (i.e., temporary locking). Therefore, operations such as inspection and repair of an electric system can be performed more safely.

[0026] Next, as illustrated in Figs. 5 and 6, the first connector 2 and the second connector 3 are fully locked. In this case, the coupling lever 7 is rotated backward by substantially 90° to the rear side of the first connector 2. Then, the guide grooves 71 rotate backward around the pins 24 to the rear side of the first connector 2 while keeping engagement with the pins 34, respectively. At this time, since the distance between the guide groove 71 and the pin 24 is shortened as approaching from the tip portion having opening to the end portion of the guide groove 71, a distance between the pin 24 and the pin 34, that is, a distance between the first connector 2 and the second connector 3 is shortened as the coupling lever 7 is rotated backward to the rear side of the first connector

2. As a result, the second connector 3 approaches to the first connector 2, and the female terminals 22 of the second connector 3 and the male terminals 32 of the second connector 3 are reliably fitted. In this way, the first connector 2 and the second connector 3 are fully locked. The slider 4 is pulled backward to the rear side of the first connector 2.

[0027] Due to a lever fitting type in which the second connector 3 is pulled backward to the first connector 2 by operating the coupling lever 7 for full locking, a force required for an insertion of the second connector 3 during the temporary locking may be small. However, the coupling lever 7 is not locked, that is, in a non-locked state.

[0028] When the coupling lever 7 is rotated by substantially 90° to the rear side of the first connector 2, the temporary locking release projection 76 pushes down the temporary locking portion 47 of the slider 4, so that the slider 4 is unlocked at the rear side of the first connector 2 and can be moved forward to the front side of the first connector 2.

[0029] Finally, as illustrated in Figs. 7 and 8, the coupling lever 7 is locked and the first connector 2 and the second connector 3 are completely fitted. In this case, the slider 4 is moved forward to the front side of the first connector 2 by pressing an operation portion 42. Then, the slider 4 is positioned at a normal locked position and the flexible arms 45 are respectively engaged with the first engagement holes 77 for the fitting detection member of the coupling lever 7, and the engaging claws 45a preventing from falling-off are respectively engaged with the second engagement holes 75 for the full locking of the coupling lever 7. At this time, since the tip portion of each flexible arm 45 of the slider 4 can be elastically bent upward and downward, engagement of the engaging claws 45a preventing from falling-off with respect to the second engagement holes 75 for the full locking is smoothly performed.

[0030] As a result, the coupling lever 7 is locked to the housing 21 of the first connector 2 by the slider 4. The slider 4 is locked such that the first connector 2 is prevented from pulling backward to the rear side of the first connector 2 by engaging the engaging claws 45a preventing from falling-off with the full locking lock engagement holes 75.

[0031] When the slider 4 is moved forward to the front side of the first connector 2, the interlock male terminal 9 is connected to the interlock female terminal 10, and the electric wires 5 and the electric wires 6 are in conduction.

[0032] Here, coupling operation between the first connector 2 and the second connector 3 is completed.

[0033] According to the connector device 1 of the embodiment, as illustrated in Figs. 9A to 9C, the slider 4 of the connector fitting assurance mechanism provided with the interlock male terminal 9 is disposed at a position where a rear end portion 43 of the slider 4 projects backward from a rear end of the first connector 2 when the coupling lever 7 in the connector device 1 serving as the

lever fitting type connector is not locked. Therefore, the rear end portion 43 of the slider 4 that projects backward from the rear end of the first connector 2 can be visualized not only from a coupling lever 7 side, but also from an opposite side of the coupling lever 7 and a left-right width direction of the coupling lever 7.

[0034] Accordingly, in the connector device 1 of the embodiment, visual confirmation of whether the slider 4 is in the normal locked position is facilitated regardless of a vehicle mounting state, so that workability of inspection work is improved. According to the connector device 1 of the embodiment, it is possible to easily determine whether the coupling lever 7 is locked even in the lever fitting type connector.

[0035] According to the connector device 1 of the embodiment, a rear holder 8 is attached to the rear end of the first connector 2 to restrict the rubber plugs 28 from separation, the rubber plugs 28 being attached to openings leading out the electric wires 5 of the terminal accommodation chamber 23s in which the female terminals 22 are accommodated, and the rear end portion 43 of the slider 4 is disposed at a position substantially flush with a rear end surface 81 of the rear holder 8 when the coupling lever 7 is locked. In the rear holder 8, a pair of locking pieces 85 are locked and attached to a pair of locking portions 26 projecting from both side surfaces of the housing 21.

[0036] The wording "the position substantially flush with the rear end surface 81 of the rear holder 8" is intended to mean a position where the slider 4 moves forward to the front side of the first connector 2 as compared with a position where the slider 4 is pulled backward to the rear side of the first connector 2 (i.e., a surface formed by the rear end portion 43 and the rear end surface 81 is flat or has a bit of a step).

[0037] As illustrated in Fig. 2, the rear end surface 81 of the rear holder 8 is provided with a notch 83 that is cut out such that the rear end portion 43 of the slider 4 can be inserted. Therefore, the visual confirmation is simplified since it may be visualized whether the rear end portion 43 of the slider 4 projects backward from the rear end surface 81 of the rear holder 8 around the notch 83.

[0038] The aspect of the present invention is not limited to the above-described embodiment, and may be appropriately modified, improved and the like. In addition, the material, shape, size, number, arrangement position and the like of each component in the above-described embodiment are selectable and are not limited as long as the aspect of the present invention can be achieved.

[0039] For example, although the coupling lever 7 of the lever fitting type connector has been described as an example of the movable arm in the above embodiment, the aspect of the present invention is not limited thereto. For example, the movable arm according to the aspect of the present invention that holds the second connector in a fitted state with respect to the first connector may be a lock arm provided in the first connector for locking a lock projection portion provided in the second connector.

[0040] In the above embodiment, the rear end surface 81 of the rear holder 8 is used as the rear end of the first connector for visualizing the rear end portion 43 of the slider 4, but the aspect of the present invention is not limited thereto. For example, a rear end surface of the coupling lever 7 in a completely fitted state may be the rear end of the first connector, or a rear end of a housing may directly be the rear end of the first connector.

[0041] According to an aspect of the present invention, a connector device (1) including: a first connector (2) that includes a first terminal, that is, female terminal (22); a second connector (3) that includes a second terminal, that is, male terminal (32) to which the first terminal (22) is electrically connected; a movable arm, that is, coupling lever (7) that is provided on the first connector (2) and configured to hold the second connector (3) in a fitted state with respect to the first connector (2); a connector fitting assurance mechanism that locks the movable arm by slidably engaging a slider (4) with the movable arm that holds the second connector (2) in the fitted state; a signal circuit that is configured to be possible to electrically connect a first electric (5) wire connected to the first terminal (22) and a second electric wire (6) connected to the second terminal (32) to each other; and an interlock terminal, that is, a terminal for an interlock that is provided in the slider (4) and configured to close the signal circuit when the movable arm is locked and to open the signal circuit when the movable arm is not locked, in which the slider (4) is disposed at a position where a rear end portion of the slider (4) projects backward from a rear end of the first connector (2), that is, a rear end surface (81) of a rear holder (8) when the movable arm is not locked, and is disposed at a position where the rear end of the first connector (2) and the rear end portion (43) of the slider (4) are substantially flush with each other when the movable arm is locked.

[0042] According to an aspect of the present invention, the movable arm is a coupling lever (7) of a lever fitting type connector that applies fitting force and separation force to the first connector (2) and the second connector (3) by rotation operation.

[0043] According to an aspect of the present invention, the rear holder (8) is attached to the rear end of the first connector (2) to restrict a seal member, that is, rubber plug (28) from a separation, the sealing member being attached to an opening leading out the first electric wire of a terminal accommodation chamber (23) in which the first terminal (22) is accommodated, and the rear end portion (43) of the slider (4) is disposed at a position substantially flush with a rear end surface (81) of the rear holder (8) when the movable arm is locked.

[0044] According to another aspect of the present invention, the rear end surface (81) of the rear holder (8) is provided with a notch (83) that is cut out such that the rear end portion (43) of the slider (4) is inserted.

[0045] According to the aspects of the present invention, the slider of the connector fitting assurance mechanism provided with the interlock male terminal is dis-

posed at a position where a rear end portion of the slider projects backward from a rear end of the first connector when the movable arm is not locked. Therefore, the rear end portion of the slider that projects backward from the rear end of the first connector can be visualized not only from a movable arm side, but also from an opposite side of the movable arm and a left-right width direction of the movable arm. Accordingly, visual confirmation of whether the slider is in the normal locked position is facilitated regardless of a vehicle mounting state, so that workability of inspection work is improved.

[0046] The slider of the connector fitting assurance mechanism provided with the interlock male terminal is disposed at a position where a rear end portion of the slider projects backward from a rear end of the first connector when the coupling lever in the connector device serving as the lever fitting type connector is not locked. Therefore, the rear end portion of the slider that projects backward from the rear end of the first connector can be visualized not only from a coupling lever side, but also from an opposite side of the coupling lever and a left-right width direction of the coupling lever. Accordingly, it is possible to easily determine whether the coupling lever is locked even in the lever fitting type connector.

[0047] Visual confirmation is simplified since it may be visualized whether the rear end surface of the slider projects backward from the rear end surface which is substantially flush at the rear holder attached to the rear end of the first connector.

[0048] Visual confirmation is simplified since it may be visualized whether the rear end portion of the slider projects backward from the rear end surface of the rear holder around the notch.

REFERENCE SIGNS LIST

[0049]

1	connector device
2	first connector
3	second connector
4	slider
5	electric wire
6	electric wire
7	coupling lever (movable arm)
22	female terminal (first terminal)
32	male terminal (second terminal)
43	rear end portion
81	rear end surface (rear end of first connector)

Claims

1. A connector device comprising:

a first connector that includes a first terminal;
a second connector that includes a second terminal to which the first terminal is electrically

connected;
 a movable arm that is provided on the first connector and configured to hold the second connector in a fitted state with respect to the first connector; 5
 a connector fitting assurance mechanism that locks the movable arm by slidably engaging a slider with the movable arm that holds the second connector in the fitted state;
 a signal circuit that is configured to be possible to electrically connect a first electric wire connected to the first terminal and a second electric wire connected to the second terminal to each other; and 10
 an interlock terminal that is provided in the slider and configured to close the signal circuit when the movable arm is locked and to open the signal circuit when the movable arm is not locked, wherein the slider is disposed at a position where a rear end portion of the slider projects backward from a rear end of the first connector when the movable arm is not locked, and is disposed at a position where the rear end of the first connector and the rear end portion of the slider are substantially flush with each other 20
 when the movable arm is locked. 25

2. The connector device according to claim 1, wherein the movable arm is a coupling lever of a lever fitting type connector that applies fitting force and separation force to the first connector and the second connector by rotation operation. 30
3. The connector device according to claim 1 or 2, wherein a rear holder is attached to the rear end of the first connector to restrict a seal member from a separation, the sealing member being attached to an opening leading out the first electric wire of a terminal accommodation chamber in which the first terminal is accommodated, and 35
 the rear end portion of the slider is disposed at a position substantially flush with a rear end surface of the rear holder when the movable arm is locked. 40
4. The connector device according to claim 3, wherein the rear end surface of the rear holder is provided with a notch that is cut out such that the rear end portion of the slider is inserted. 45

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FIG.1

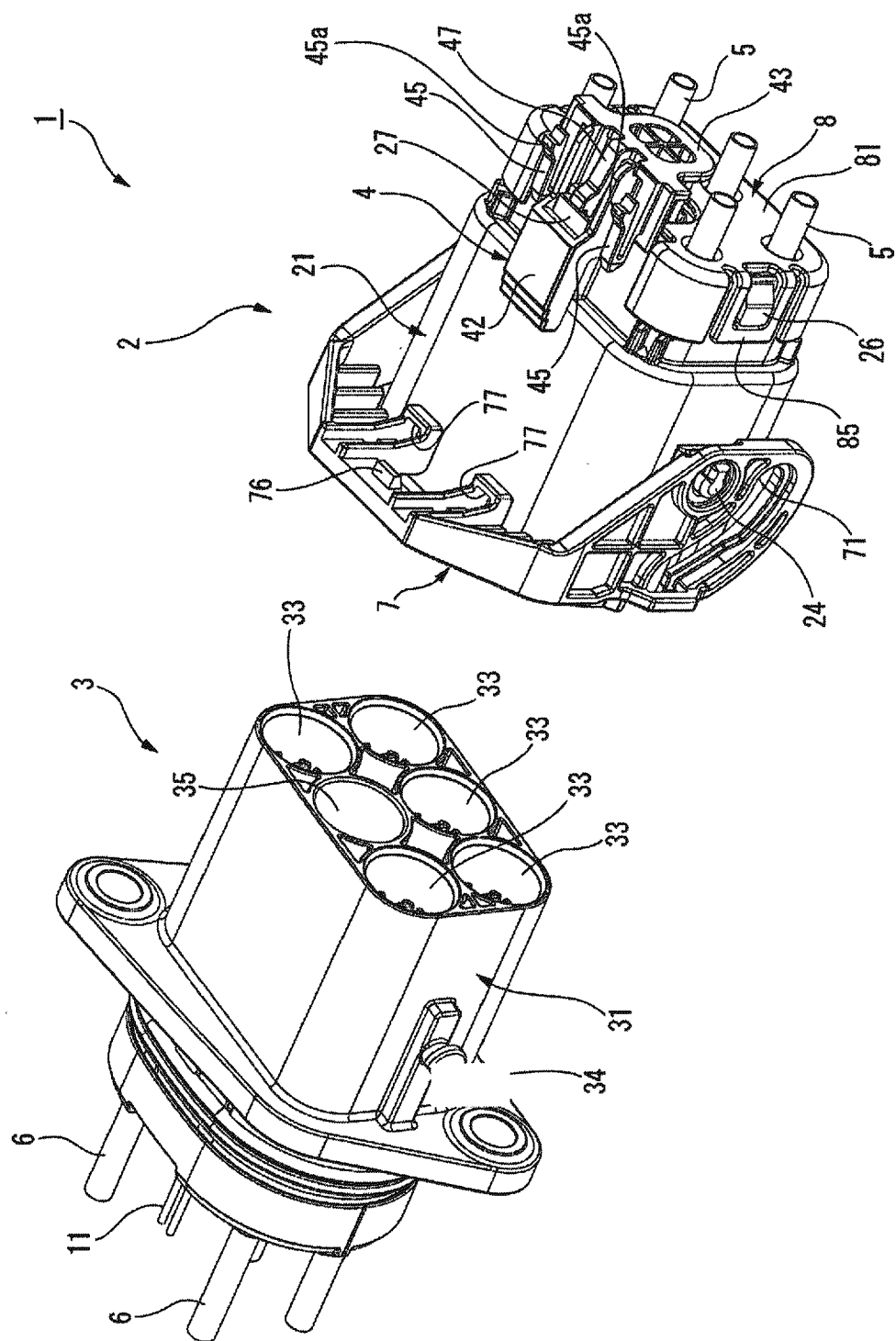


FIG.2

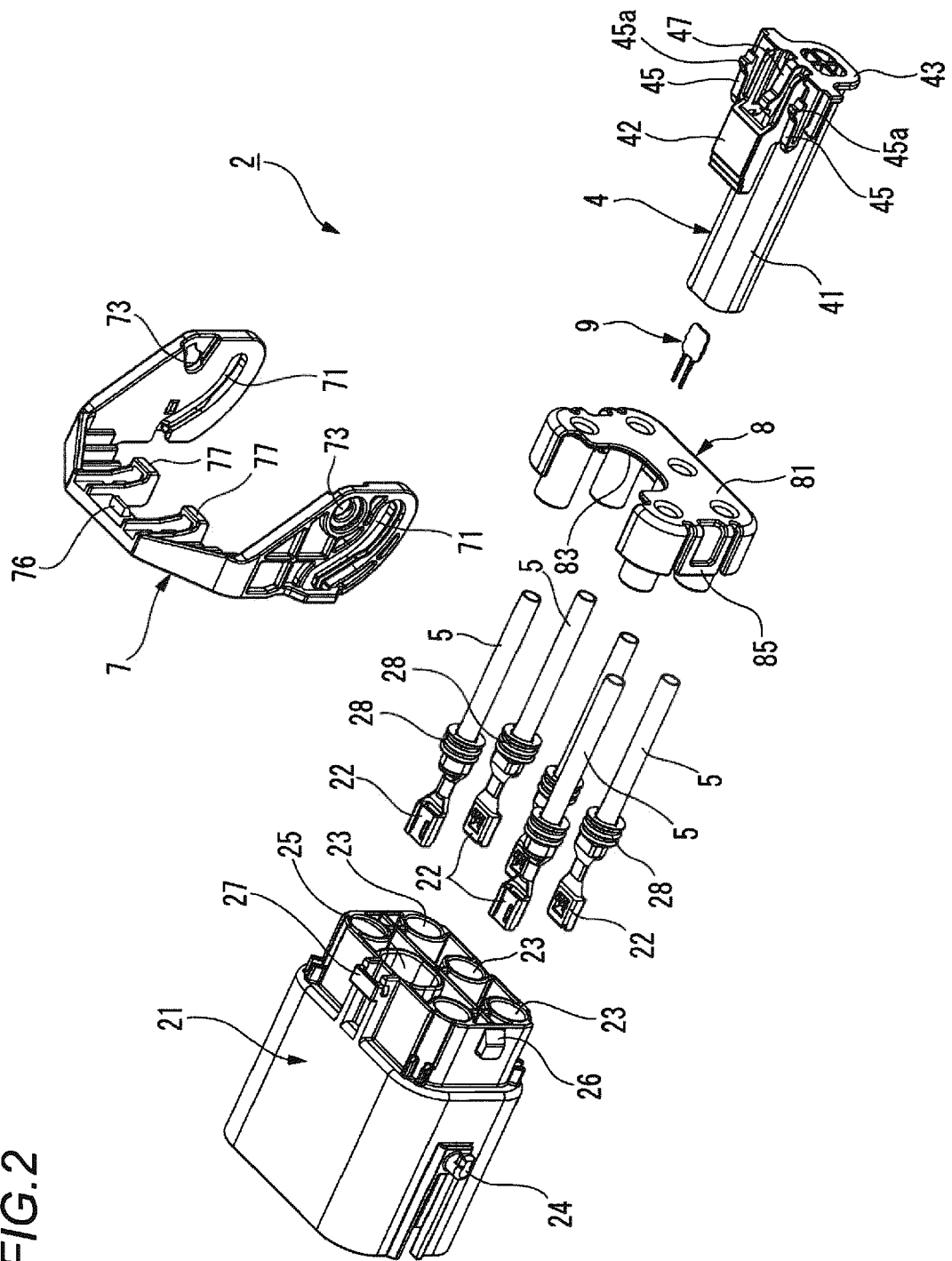


FIG.3

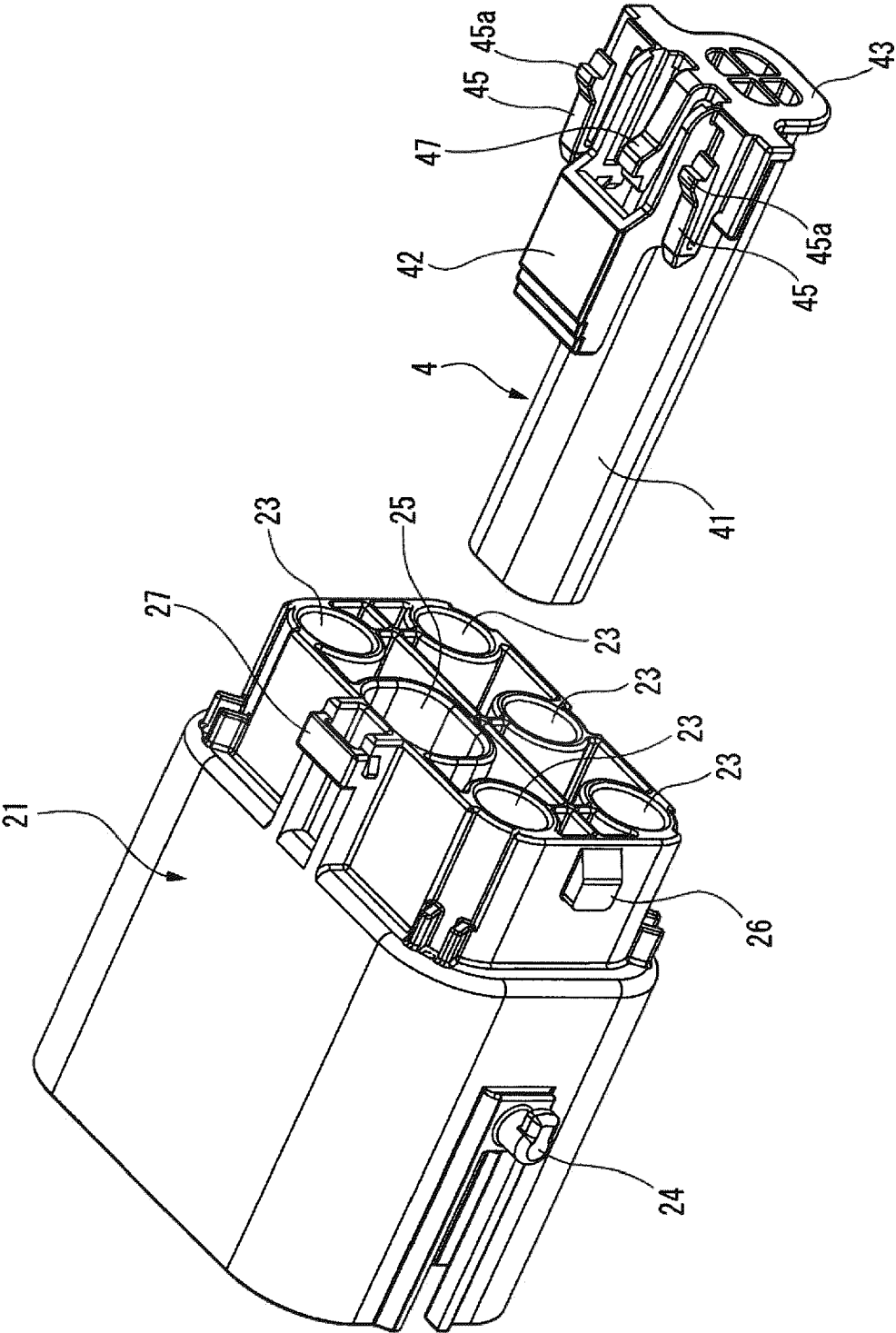


FIG.4

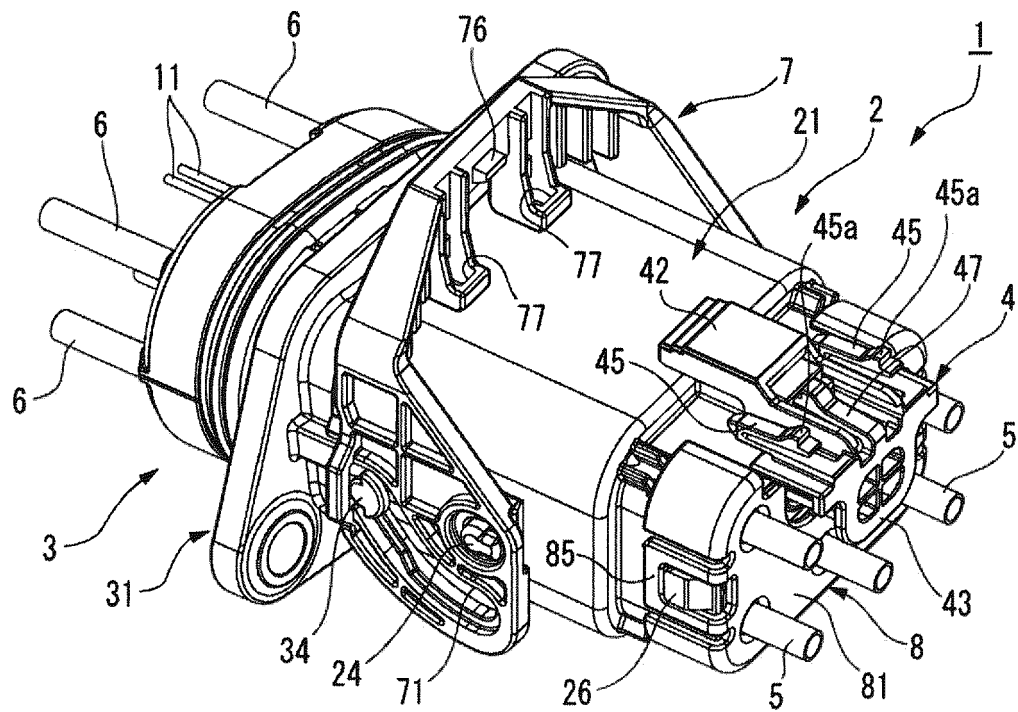


FIG.5

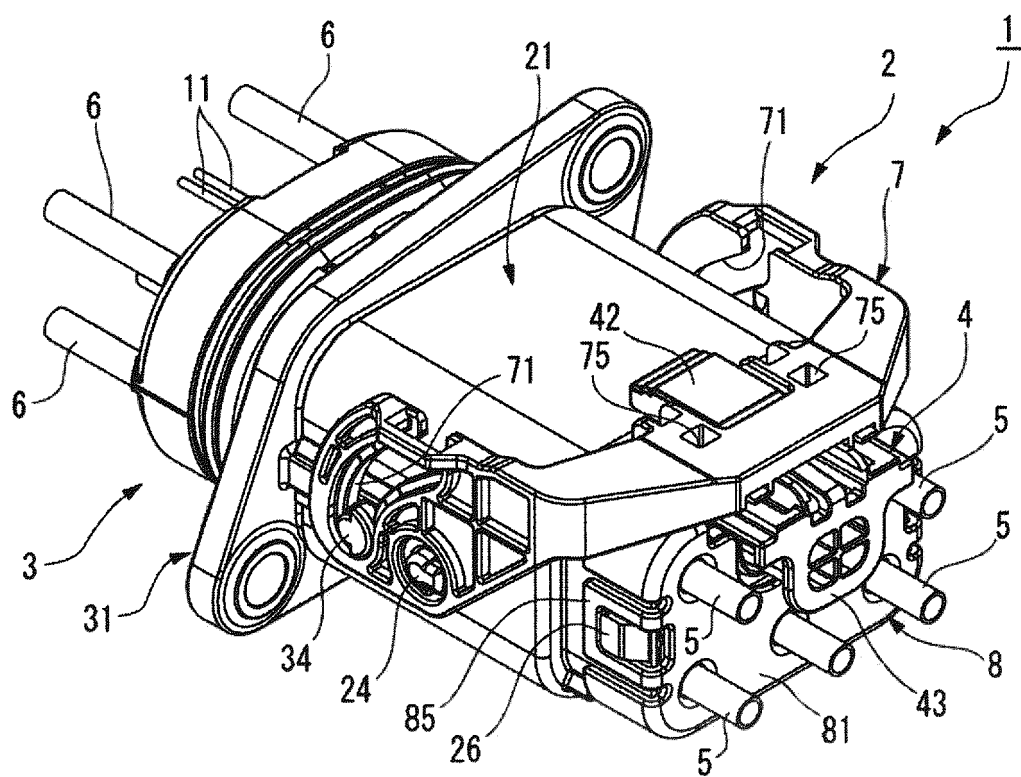


FIG.6

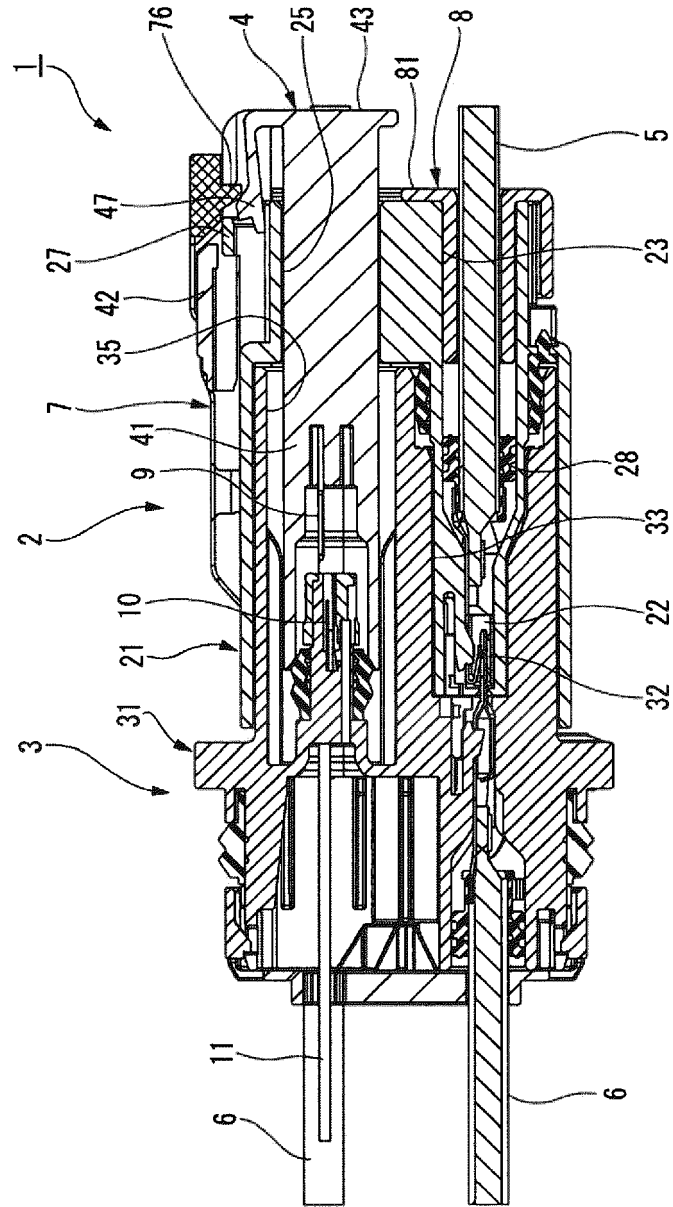
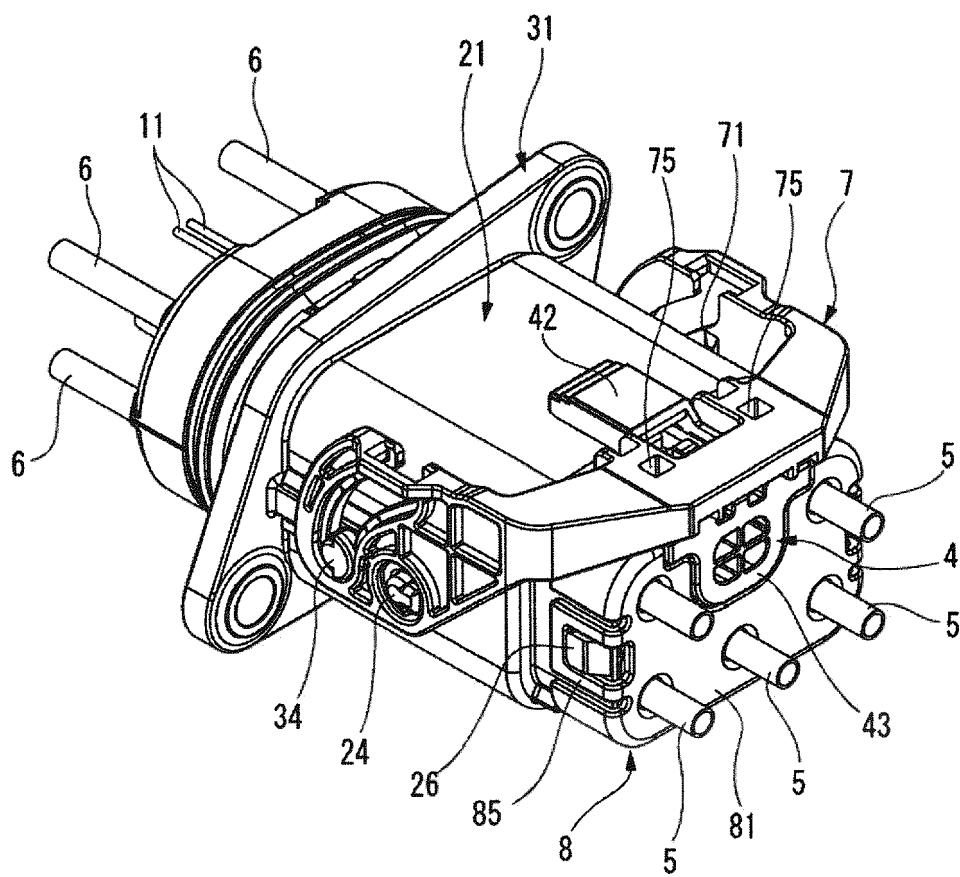


FIG. 7



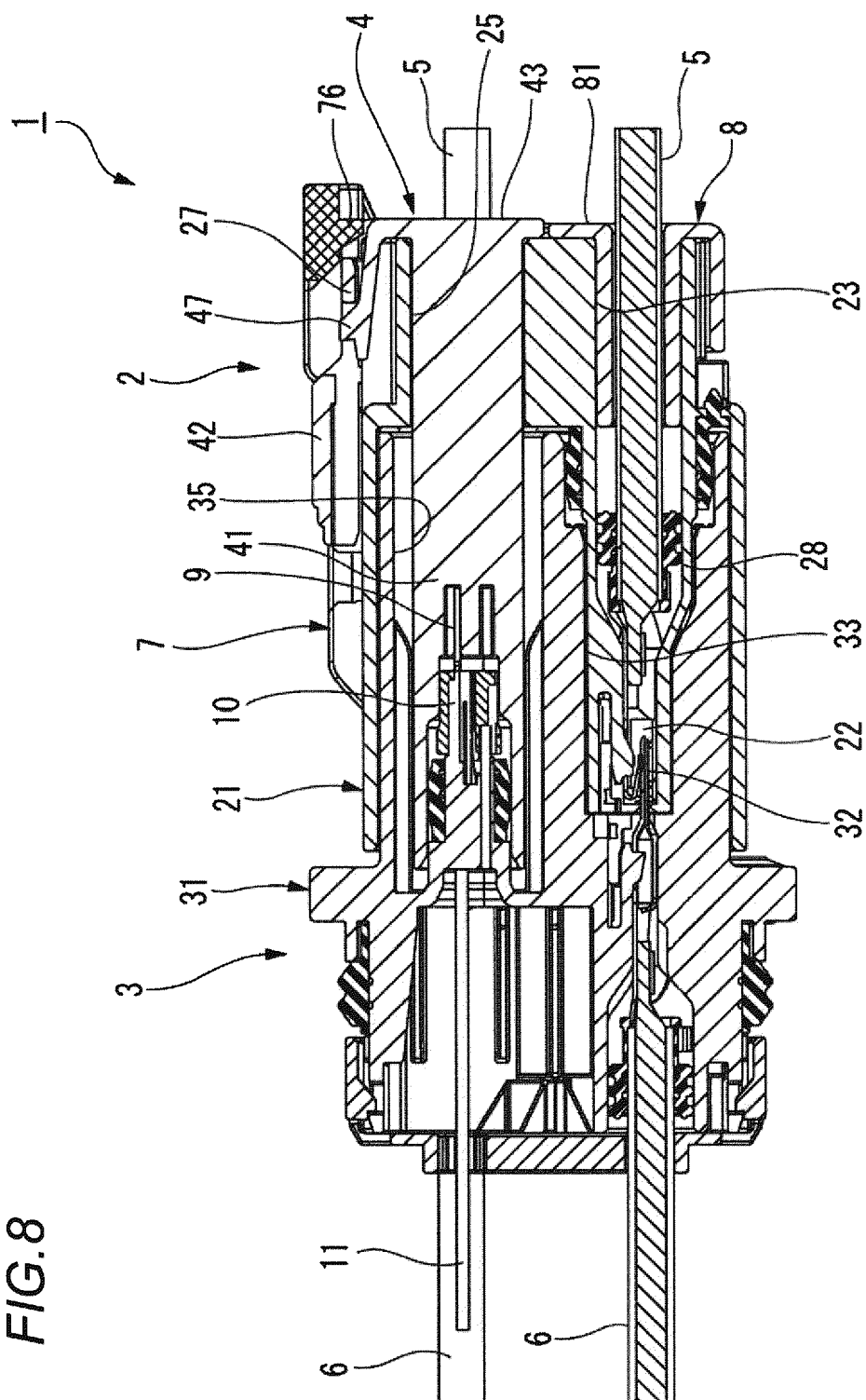


FIG.9A

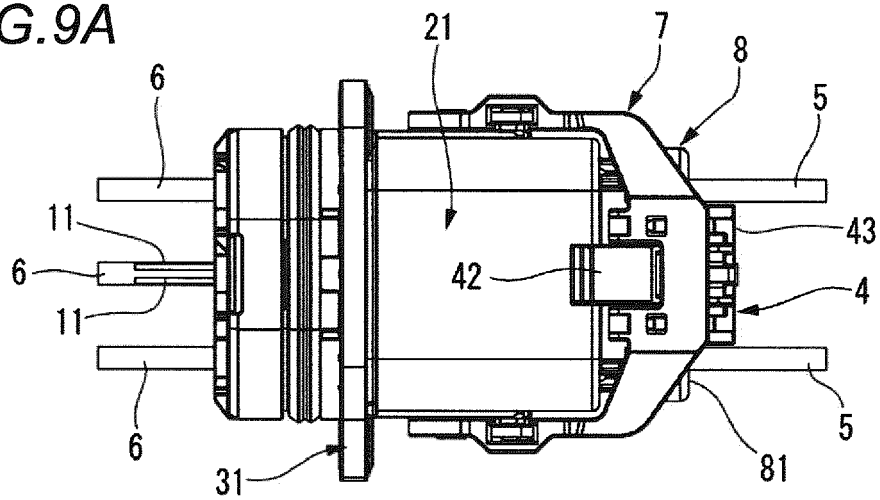


FIG.9B

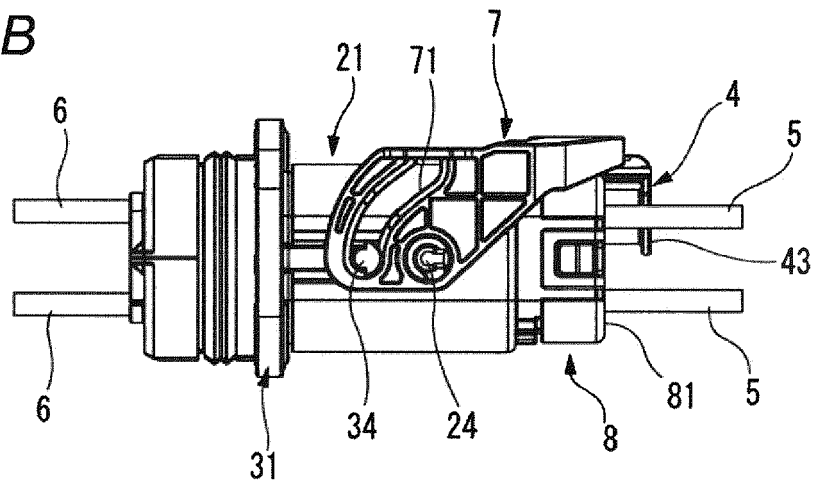
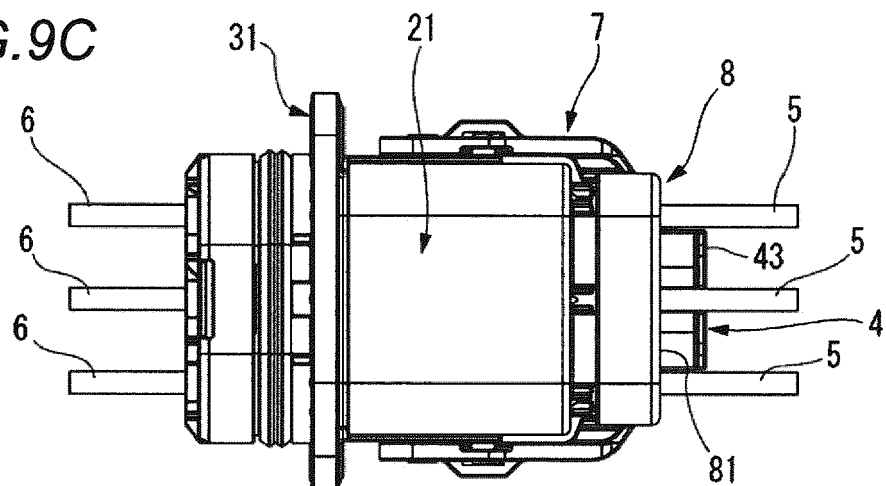
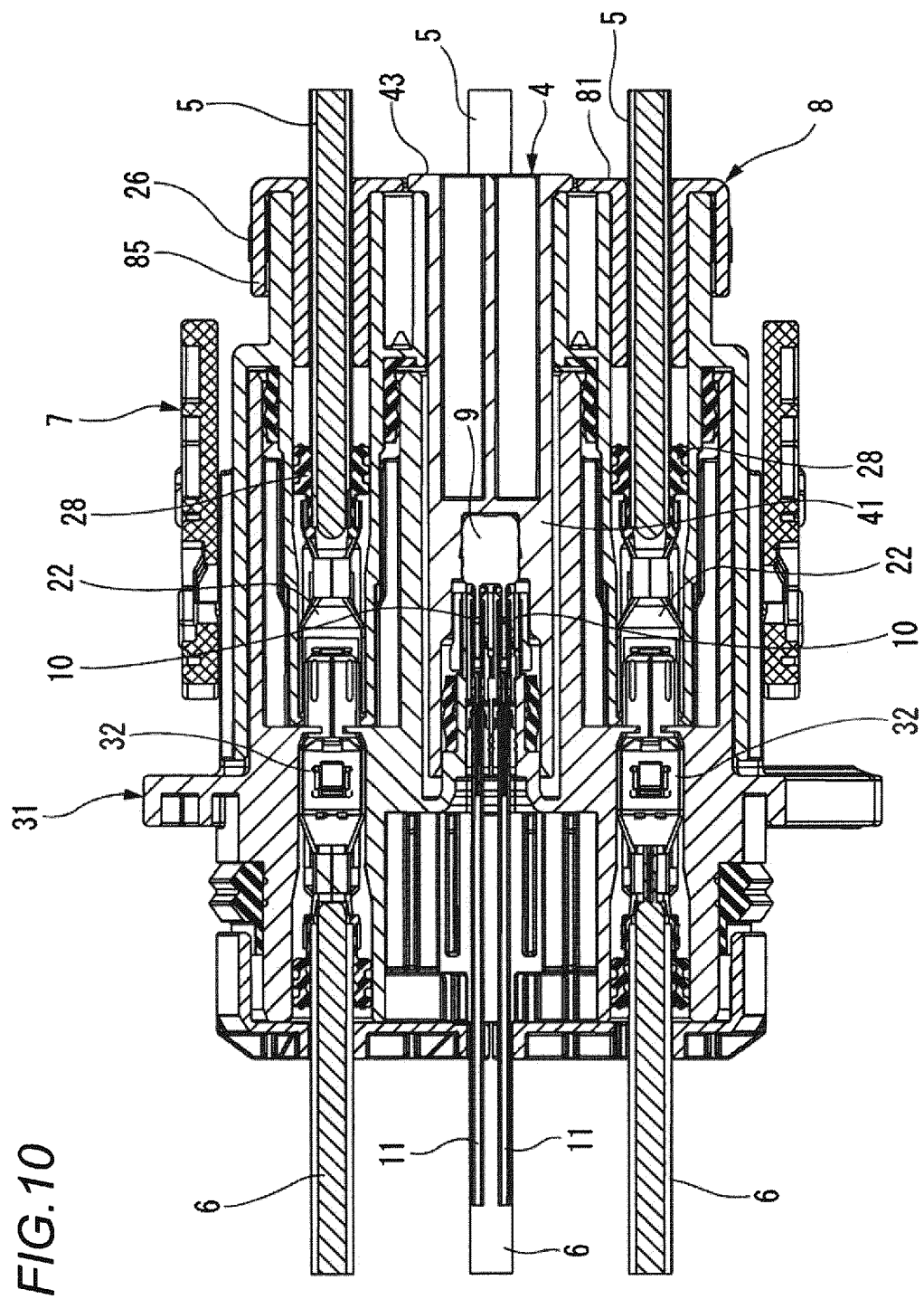


FIG.9C







EUROPEAN SEARCH REPORT

Application Number
EP 19 18 2816

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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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			H01R
Place of search		Date of completion of the search	Examiner
The Hague		10 October 2019	Mateo Segura, C
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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