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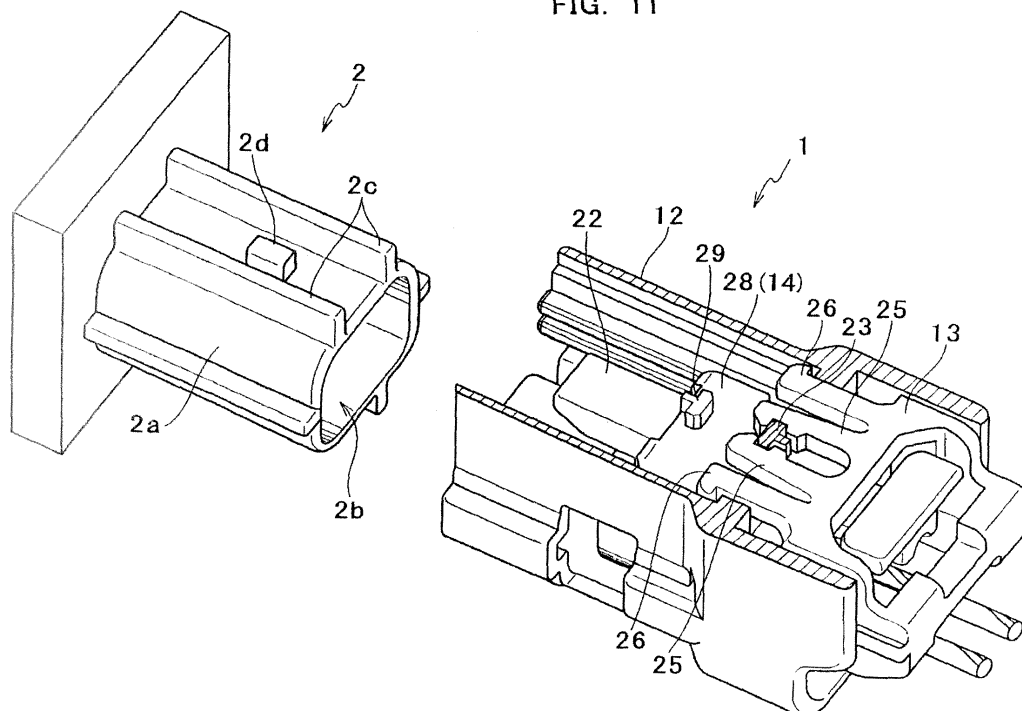
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(54) **Electrical connecting device**

(57) A connecting housing element 12 supports connection terminals and is connected to a to-be-connected housing element 2 by fitting. A hook element 13 is inserted into the connecting housing element 12, is locked and hooked to the connecting housing element 12 at a first position. A slider 14 is slidably supported by the connecting housing element 12, and is brought into contact with

a part of the to-be-connected housing element 2 and energized to be moved toward the hook element 13 during the fitting operation. The moved slider 14 comes into contact with the hook element 13 and releases the locking of the hook element 13 to the connecting housing element 12 at the first position to make the hook element 13 movable in relation to the connecting housing element 12.

FIG. 11



Description

[Technical Field]

[0001] The present invention relates to an electrical connecting device that is connected to a to-be-connected housing element that supports one or more to-be-connected terminal(s).

[Background Art]

[0002] As an electrical connecting device that is connected to a to-be-connected housing element supporting to-be-connected terminals, an electrical connecting device has been conventionally known that includes: a connecting housing element for supporting connection terminals which are electrically connected to the to-be-connected terminals and for being connected to the to-be-connected housing element by fitting; and a hook element for being hooked to the connecting housing element (see Japanese published unexamined patent applications Nos. H08-264229 and H11-144804). In the electrical connecting device, when the connecting housing element is fitted into the to-be-connected housing element, the hook element operates in cooperation with the to-be-connected housing element. Meanwhile, the hook element is relatively moved to the connecting housing element so that a hooked position is changed, and thus a fitting state can be confirmed. That is, an appropriate fitting state is ensured with the operation of the hook element and therefore it is possible to confirm whether mechanical and electrical connection states are completed can be confirmed.

[0003] However, in the conventional electrical connecting devices disclosed in Japanese published unexamined patent applications Nos. H08-264229 and H11-144804, since the hook element is made to operate in cooperation with the to-be-connected housing element when the connecting housing element is fitted into the to-be-connected housing element, the to-be-connected housing element is required to have an exclusive shape. That is, at least a part of the shape of the to-be-connected housing element is required to have a specific shape corresponding to the hook element so that the hook element can operate in cooperation with the to-be-connected housing element. Thus, the shape of the to-be-connected housing element becomes a structure exclusive for an electrical connecting device provided with a predetermined hook element, and it becomes difficult that an electrical connecting device provided with no hook element is connected to the to-be-connected housing element. In this case, for example, when the electrical connecting device provided with the hook element is required to be changed so as to be applicable under an environment that a connector unit configured by the to-be-connected housing element and the electrical connecting device provided with no hook element is used, not only the electrical connecting device but also the to-be-connected

housing element must be changed. Further, in the case where the electrical connecting device provided with the hook element is used in a mix with that without the hook element, a to-be-connected housing element in accordance with each shape of them is needed, and therefore there is a possibility of causing an increase in the kinds of components.

[Disclosure of the Invention]

[0004] In view of the above-described situation, it is an object of the present invention to provide an electrical connecting device capable of significantly reducing restrictions in shape of a to-be-connected housing element regarding operation of a hook element for confirmation of fitting, and to make the to-be-connected housing element common in both cases where the electrical connecting device for connection includes the hook element and where it includes no hook element.

[0005] The present invention relates to an electrical connecting device that is connected to a to-be-connected housing element supporting one or more to-be-connected terminal(s).

Further, the present invention has some features as described below in order to accomplish the above-described object. That is, the present invention includes only one of the features or in combination of any of the features as described below.

[0006] In to accomplish the above-described object, a first feature of the electrical connecting device according to the present invention is that the electrical connecting device includes: a connecting housing element for supporting one or more connection terminal(s) which is or are electrically connected to the to-be-connected terminal(s) and for being connected to the to-be-connected housing element by fitting; a hook element for being hooked to the connecting housing element in such a way of being inserted into the connecting housing element and locked thereto at a first position; and a slider as a member which is slidably supported in the connecting housing element and is brought into contact with a part of the to-be-connected housing element and energized to be moved toward the hook element hooked to the connecting housing element at the first position when the connecting housing element is fitted into the to-be-connected housing element, and is that the slider comes into contact with the hook element to release the locking at the first position when moved toward the hook element so that the hook element becomes movable in relation to the connecting housing element.

[0007] According to this configuration, the slider is brought into contact with a part of the to-be-connected housing element and energized to be moved to the hook element side when the connecting housing element is fitted into the to-be-connected housing element. Then, the moved slider comes into contact with the hook element so that the locking at the first position is released, and therefore the hook element becomes movable in re-

lation to the connecting housing element. Accordingly, workers can confirm a fitting state between the to-be-connected housing element and the connecting housing element by confirming the movable state of the hook element. Thus, the hook element can almost be made to operate by only a mechanism of the electrical connecting device side with almost no regard for the shape of the to-be-connected housing element during the connecting operation of the connecting housing element and the to-be-connected housing element. Therefore, the present invention can provide the electrical connecting device capable of significantly reducing restrictions in the shape of the to-be-connected housing element regarding operation of the hook element for confirmation of fitting, and can make the to-be-connected housing element common in both cases where the electrical connecting device for connection includes the hook element and where it includes no hook element.

[0008] A second feature of the electrical connecting device according to the present invention is that a sliding direction of the slider slidably supported coincides with a fitting direction in which the connecting housing element is fitted into the to-be-connected housing element.

[0009] According to this configuration, since the sliding direction coincides with the fitting direction, the slider brought into contact with a part of the to-be-connected housing element can smoothly be energized in the same direction as the fitting direction when the connecting housing element is fitted into the to-be-connected housing element. Therefore, the moving operation of the slider can smoothly be performed without interfering with the fitting operation.

[0010] A third feature of the electrical connecting device according to the present invention is that a moving direction of the hook element, of which the locking to the connecting housing element at the first position is released, coincides with the fitting direction in which the connecting housing element is fitted into the to-be-connected housing element.

[0011] According to this configuration, since the moving direction of the hook element at the time of release of the locking coincides with the fitting direction, the moving operation of the hook element after the release of the locking and the fitting operation can smoothly be performed without interference with each other. Further, the moving operation of the hook element after the release of the locking and the fitting operation can be realized as a series of operations and a continuous one operation.

[0012] A fourth feature of the electrical connecting device according to the present invention is that the hook element, of which the locking to the connecting housing element at the first position is released, can be hooked to the connecting housing element at a second position deviated from the first position in the fitting direction in which the connecting housing element is fitted into the to-be-connected housing element.

[0013] According to this configuration, it is possible to confirm that the fitting state is incomplete and mechanical

and electrical connections are not completed when the hook element is hooked to the connecting housing element at the first position, and to confirm that the fitting state is complete and mechanical and electrical connections are completed when the hook element is hooked to the connecting housing element at the second position. That is, the fitting state can easily be confirmed by visual observation on whether the hook element is hooked to the connecting housing element at the first position or second position.

[0014] A fifth feature of the electrical connecting device according to the present invention is that the hook element is formed so as to protrude from the connecting housing element when hooked to the connecting housing element at the first position and is formed so as not to protrude from the connecting housing element when hooked to the connecting housing element at the second position.

[0015] According to this configuration, it is possible to easily confirm by the visual observation that the hook element is hooked to the connecting housing element at the first position when it protrudes from the connecting housing element and similarly to easily confirm by the visual observation that the hook element is hooked to the connecting housing element at the second position when it does not protrude from the connecting housing element. Therefore, the fitting state can easily be confirmed by the visual observation.

[0016] A sixth feature of the electrical connecting device according to the present invention is that the hook element includes a pair of cantilever-shaped elastic clamp parts for clamping an erecting part formed in the connecting housing element so as to erect in a direction perpendicular to the direction in which the hook element is inserted into the connecting housing element; and the pair of elastic clamp parts of the hook element interferes with the erecting part to be elastically deformed and then is elastically recovered to be engaged with the erecting part when the hook element is inserted into the connecting housing element, and thus the hook element is hooked to the connecting housing element at the first position.

[0017] According to this configuration, a configuration in which the hook element is hooked to the connecting housing element at the first position can easily be realized with a simple mechanism by inserting the hook element into the connecting housing element.

[0018] A seventh feature of the electrical connecting device according to the present invention is that the slider includes a projection part protruded so as to come into contact with both front end parts of the pair of elastic clamp parts; and the projection part is energized in a direction in which the pair of elastic clamp parts are pressed and opened with the movement of the slider.

[0019] According to this configuration, a configuration in which the slider is brought into contact with the hook element to release the locking at the first position when moved toward the hook element during the fitting oper-

ation can easily be realized with the simple mechanism.

[0020] An eighth feature of the electrical connecting device according to the present invention is that the projection part is formed so as to have inclined surfaces which are formed to be inclined toward the slide moving direction in which the slider is slidably supported, and are energizing the pair of elastic clamp parts in the pressing and opening direction with the movement of the slider.

[0021] According to this configuration, since the both end parts of a surface at the hook element side of the projection part are formed to have the inclined surfaces, a configuration in which the pair of elastic clamp parts are pressed and opened by the projection part with the movement of the slider can be realized with the simple mechanism.

[0022] A ninth feature of the electrical connecting device according to the present invention is that the pair of elastic clamp parts are engaged with the projection part so as to clamp both the projection part and the erecting part via the elastic recovery by further movement of the in relation to the hook element after being pressed and opened with the movement of the slider.

[0023] According to this configuration, the hook element, of which the locking to the connecting housing element at the first position is released with the slider, is engaged with the projection part so as to clamp both the projection part and the erecting part with the slider. That is, the hook element, of which the locking to the connecting housing element at the first position is released, is hooked to the connecting housing element via the slider. Thus, the hook element, of which the locking to the connecting housing element at the first position is released, can be reliably and strongly hooked to the connecting housing element at a position different from the first position.

Moreover, the above-described and the other objects, features and advantages of the present invention will become apparent by reading the following description with reference to the attached drawings.

[Brief Description of the Drawings]

[0024] Fig. 1 is a perspective view illustrating an electrical connecting device and a to-be-connected housing element according to the present invention;

Fig. 2 is a perspective view showing a state that the electrical connecting device and the to-be-connected housing element shown in Fig. 1 are connected to each other;

Fig. 3 is a perspective view of the electrical connecting device shown in Fig. 1;

Fig. 4 is an exploded perspective view of the electrical connecting device shown in Fig. 3;

Fig. 5 is a longitudinal sectional view of the electrical connecting device shown in Fig. 3;

Fig. 6 is a perspective view of a connecting housing element of the electrical connecting device shown in

Fig. 4;

Fig. 7 is a perspective view of a hook element of the electrical connecting device shown in Fig. 4;

Fig. 8 is a perspective view of a slider of the electrical connecting device shown in Fig. 4;

Fig. 9 is an enlarged perspective view of a projection part of the slider in Fig. 8;

Fig. 10 is a perspective view of a retainer of the electrical connecting device shown in Fig. 4;

Fig. 11 is a perspective view of the electrical connecting device and the to-be-connected housing element shown in Fig. 1 and shows a top surface of the connecting housing element as a notch cross section;

Fig. 12 is a cross sectional view of the electrical connecting device and the to-be-connected housing element shown in Fig. 11 in a fitting direction;

Fig. 13 is a perspective view explaining connecting operation of the electrical connecting device and the to-be-connected housing element shown in Fig. 11;

Fig. 14 is a cross sectional view of the electrical connecting device and the to-be-connected housing element shown in Fig. 13 in the fitting direction;

Fig. 15 is the perspective view explaining the connecting operation of the electrical connecting device and the to-be-connected housing element shown in Fig. 11;

Fig. 16 is a cross sectional view of the electrical connecting device and the to-be-connected housing element shown in Fig. 15 in the fitting direction;

Fig. 17 is the perspective view explaining the connecting operation of the electrical connecting device and the to-be-connected housing element shown in Fig. 11; and

Fig. 18 is a cross sectional view of the electrical connecting device and the to-be-connected housing element shown in Fig. 17 in the fitting direction.

[Best Mode for Carrying Out the Invention]

[0025] The best mode for carrying out the present invention will be hereinafter described with reference to the drawings. The present invention can widely be applied to an electrical connecting device that is connected to a to-be-connected housing element supporting to-be-connected terminals. For example, the present invention can be employed as various connectors used for cars, however, it is not limited to that use, and can be applied thereto, in many different environments and for various purposes.

[0026] Fig. 1 to Fig. 5 illustrate an electrical connecting device 1 according to an embodiment of the present invention. The electrical connecting device 1, for example, is employed as an electrical device for connecting connection terminals provided at front end parts of cables to the to-be-connected housing elements which support the to-be-connected terminals disposed at the device side. That is, as shown in a perspective view of Fig. 1, the

electrical connecting device 1 according to the present embodiment is connected to the to-be-connected housing element 2 disposed at the device side. Moreover, Fig. 2 is a perspective view showing a state that the electrical connecting device 1 is connected to the to-be-connected housing element 2.

[0027] Fig. 3 is a perspective view of the electrical connecting device 1, and Fig. 4 is an exploded perspective view of the electrical connecting device 1. As shown in Fig. 3 and Fig. 4, the electrical connecting device 1 includes: connection terminals 11; a connecting housing element 12; a hook element 13; a slider 14; a retainer 15; a seal rubber 16 or the like. Moreover, the connecting housing element 12, the hook element 13, the slider 14 and the retainer 15 are formed of a non-conductive plastic material.

[0028] The connection terminals 11 are configured as a pair of female connection terminals, and each of the connection terminals 11 are attached to ends of cables 3 respectively by crimping, etc. (see Fig. 4). The connection terminals 11 are electrically connected to male to-be-connected terminals 10 supported by the to-be-connected housing element 2 (see the cross sectional view of Fig. 12) respectively by connection of the electrical connecting device 1 and the to-be-connected housing element 2. The electrical connecting device 1 including two connection terminals is described in the present embodiment as an example, however, the present invention can be applied to an electrical connecting device including of one or three or more connection terminal(s).

[0029] The connecting housing element 12 supports the pair of connection terminals 11 and 11 and is connected to the to-be-connected housing element 2 by fitting. The connecting housing element 12 is configured as a female housing element and is fitted into the to-be-connected housing element 2 as a male housing element.

[0030] Fig. 5 shows a longitudinal sectional view of the electrical connecting device 1 (a cross sectional view of a cross section parallel with a disposed direction of the connection terminals 11), and Fig. 6 shows a perspective view of the connecting housing element 12. As shown in Fig. 5 and Fig. 6, a terminal supporting part 20, a fitting hole 21, a slider supporting part 22, an erecting part 23, a retainer insertion port 24 and so on are formed in the connecting housing element 12.

[0031] Terminal connecting holes 20a and terminal insertion ports 20b are provided in the terminal supporting part 20, wherein the terminal connecting holes 20a are formed at a fit side as a side where the connecting housing element 1 is fitted into the to-be-connected housing element 2 and the terminal insertion ports 20b are formed at a non-fit side that is opposite the fit side. The terminal connecting holes 20a and the terminal insertion ports 20b configure a hollow part while communicating with each other. The retainer insertion port 24 for the retainer 15 shown in a perspective view of Fig. 10 is opened and formed at the side of the connecting housing element 12,

and an opening for insertion of the retainer 15 is formed at a part of the terminal supporting part 20 facing the retainer insertion port 24.

[0032] When the connection terminals 11 are attached to the connecting housing element 12, the ring-shaped seal rubber 16 which serves as a waterproof seal is firstly extrapolated to the terminal supporting part 20 so as to be fitted into the outer circumference of the terminal supporting part 20 (see Fig. 5). The seal rubber 16 is disposed as this can prevent water, etc., from entering a connection part between the to-be-connected terminal 10 and the connection terminal 11 when the to-be-connected housing element 2 and the connecting housing element 12 are fitted and connection is completed. After the seal rubber 16 is pushed into a base part of the terminal supporting part 20 so as to be extrapolated, the retainer 15 is inserted into the retainer insertion port 24 of the connecting housing element 12. Two terminal supporting holes 15a for respective insertion of the connection terminals 11 are provided in the retainer 15 (see Fig. 15). The retainer 15 is inserted into the connecting housing element 12 so that the terminal supporting holes 15a are arranged to be positioned in the terminal supporting part 20 (see Fig. 5).

[0033] Then, the connection terminals 11 attached to the end parts of the cables 3 are inserted into the terminal insertion ports 20b with the seal rubber 16 and the retainer 15 attached to the connecting housing element (see Fig. 5). Thus, end parts for connection of the connection terminal 11 inserted into the terminal insertion port 20b are arranged in the terminal connecting hole 20a. Meanwhile, the connection terminals 11 are fitted into the terminal supporting holes 15a of the retainer 15. The connecting housing element 1 is fitted into the to-be-connected housing element 2 in this state, and thus the to-be-connected terminal 10 entering from the terminal connecting hole 20a is fitted into the female connection terminal 11 so that the electrical connection of the connection terminals 11 and the to-be-connected terminals 10 is established.

[0034] The fitting hole 21 of the connecting housing element 12 is formed as an opening part provided around the terminal supporting part 20. A fitting part 2a which is formed in a pipe-shape of the to-be connected housing element 2 is inserted into the fitting hole 21 during the connecting operation. Meanwhile, the terminal supporting part 20 of the connecting housing element 12 is inserted into an opening 2b of the fitting part 2a. The slider supporting part 22 is protruded in parallel with the terminal supporting part 20 in the connecting housing element 12 so as to slidably support the slider 14 in the protruding direction. The erecting part 23 is formed in the connecting housing element 12 so as to erect in a direction perpendicular to the direction in which the hook element 13 is inserted into the connecting housing element 12. The hook element 13 is locked to the erecting part 23 so that the hook element 13 can be hooked to the connecting housing element 12.

[0035] The hook element 13 is inserted into and hooked to the connecting housing element 12 as shown in Fig. 3 and Fig. 5. Fig. 5 shows a state that the hook element 13 is hooked to the connecting housing element 12 at a first position. The hook element 13, as described later, can be hooked to the connecting housing element 12 at a second position deviated from the first position in a fitting direction in which the connecting housing element 12 is fitted into the to-be-connected housing element 2 (see Fig. 17 and Fig. 18).

[0036] Fig. 7 shows a perspective view of the hook element 13. As shown in Fig. 7, the hook element 13 includes elastic clamp parts 25, elastic lock pieces 26, projection parts 27 or the like. The elastic clamp parts 25 as a pair respectively include lock claws 25a opposite each other and lock claws 25b opposite each other. The pair of elastic clamp parts 25 and 25 is formed in a pair of cantilever shapes so as to clamp the erecting part 23 when the hook element 13 is inserted into the connecting housing element 12. The pair of elastic clamp parts 25 and 25 thus interferes with the erecting part 23 to be elastically deformed and then is elastically recovered to be engaged with the erecting part 23 when the hook element 13 is inserted into the connecting housing element 12, and therefore the hook element 13 is hooked to the connecting housing element 12 at the first position.

[0037] Fig. 11 is a perspective view of the electrical connecting device 1 and the to-be-connected housing element 2 and shows a top surface of the connecting housing element 12 as a notch cross section. Fig. 11 shows a state that the hook element 13 is hooked to the connecting housing element 12 at the first position. As shown in Fig. 11, the erecting part 23 is engaged with the lock claws 25a and lock claws 25b of the pair of elastic clamp parts 25 and 25 (see Fig. 7) so that the hook element 13 can be hooked to the connecting housing element 12.

[0038] Moreover, as shown in Fig. 11, the pair of elastic lock pieces 26 and 26 of the hook element 13 are also locked to the connecting housing element 12 at the first position. When the hook element 13 is inserted into the connecting housing element 12, the protrusions 27, which are formed at both sides of the hook element 13 in a width direction respectively, are slide-fitted into grooves (not shown) of the connecting housing element 12. The hook element 13 is straightly inserted into the connecting housing element 12 by the slide-fitting.

[0039] As shown in Fig. 5, the slider 14 is configured as a member slidably supported to the slider supporting part 22 of the connecting housing element 12. Fig. 8 shows a perspective view of the slider 14, the slider 14 includes a main body part 28 formed as a cross section of a shape such that one side of an approximate rectangle is lacking (a shape configured by three sides of the approximate rectangle), and the main body part 28 is slidably fitted into the slider supporting part 22 of the connecting housing element 12 (see Fig. 11). The slider 14 slidably supported by the slider supporting part 22 is

brought into contact with a part of the to-be-connected housing element 2 to be energized when the connecting housing element 12 is fitted into the to-be-connected housing element 2, and thereby being moved toward the hook element 13 hooked to the connecting housing element 12 at the first position. Moreover, end surfaces 28a of the main body part 28 of the slider 14 (see Fig. 8) are brought into contact with end surfaces of protrusions 2c formed in the to-be-connected housing element 2 (see Fig. 11) and parts of an end surface of the fitting part 2a continuing to the projection parts 2c respectively so as to be moved toward the hook element 13 in the electrical connecting device 1.

[0040] Further, as shown in Fig. 8, the slider 14 includes a projection part 29 protruded upward from a top surface 28b of the main body part 28. The geometry and arrangement of the protrusion 29 is formed so as to be able to come into contact with both front end parts of the pair of the elastic clamp parts 25 and 25 of the hook element 13 when the slider 14 is brought into contact with a part of the to-be-connected housing element 2 and energized to be moved toward the hook element 13.

[0041] Fig. 9 is an enlarged perspective view of the projection part 29. As shown in Fig. 9, a pair of inclined surfaces 29a and 29a obliquely formed to the slide direction of the slider slidably supported is provided for the projection part 29. The pair of inclined surfaces 29a and 29a allow the projection part 29 to be energized in a direction in which the pair of elastic clamp parts 25 and 25 of the hook element 13 is pressed and opened with the movement of the slider 14. When the pair of elastic clamp parts 25 and 25 is pressed and opened, engagement of the lock claws 25a and lock claws 25b thereof with the erecting part 23 of the connecting housing element 12 is released. Since the projection part 29 having such shape is provided, the slider 14 can make the hook element 13 movable in relation to the connecting housing element 12 by coming into contact with the hook element 13 and releasing the locking when brought into contact with a part of the to-be-connected housing element 2 and energized to be moved toward the hook element 13.

[0042] Moreover, the electrical connecting device 1 is formed in such a way that the slide direction in which the slider 14 is slidably supported coincides with the fitting direction in which the connecting housing element 12 is fitted into the to-be-connected housing element 2. Further, the electrical connecting device 1 is formed in such a way that a moving direction of the hook element 13 of which the locking to the connecting housing element 12 at the first position is released coincides with the above-described fitting direction.

[0043] Next, connecting operation of the electrical connecting device 1, that is, operation for connecting the electrical connecting device 1 to the to-be-connected housing element 2, will be described with reference to Fig. 11 to Fig. 18 as a description of operation of the above-described electrical connecting device 1.

[0044] Fig. 12 shows a cross section of the connecting

housing element 12 of which a part is notched and is a perspective view showing a state before connection of the electrical connecting device 1 and the to-be-connected housing element 2. On the other hand, Fig. 12 is a cross sectional view corresponding to Fig. 11 and shows a cross sectional view of the electrical connecting device 1 and the to-be-connected housing element 2 in the fitting direction. Moreover, a part of the cross sectional structure of the electrical connecting device 1 is omitted in Fig. 12. In Fig. 11 and Fig. 12, the state is shown that the hook element 13 is hooked to the connecting housing element 12 at the first position, and further the state is shown that the slider 14 is slidably held by the slider supporting part 22 of the connecting housing element 12. The connecting operation is started from the state shown in Fig. 11 and Fig. 12 by operation of the worker not shown and a relative movement in the fitting direction of the electrical connecting device 1 to the to-be-connected housing element 2 is started.

[0045] Fig. 13 and Fig. 14 are figures respectively corresponding to Fig. 11 and Fig. 12, and show a state under a connecting operation of the electrical connecting device 1 and the to-be-connected housing element 2. When the electrical connecting device 1 is relatively moved in the fitting direction to the to-be-connected housing element 2, the fitting part 2a of the to-be-connected housing element 2 is fitted into the fitting hole 21 of the connecting housing element 12 and the terminal supporting part 20 of the connecting housing element 12 is fitted into the opening 2b of the to-be-connected housing element 2 (see Fig. 12 and Fig. 14).

[0046] Moreover, an engagement convex part 2d is protruded on the fitting part 2a of the to-be-connected housing element 2, and an engagement convex part 22a is provided at a front end part of the cantilever-shaped slider supporting part 22 of the connecting housing element 12 (see Fig. 11 and Fig. 14). Thus, the engagement convex part 22a of the slider supporting part 22 interferes with the engagement convex part 2d of the fitting part 2a with the fitting operation of the to-be-connected housing element 2 and the connecting housing element 12 as shown in Fig. 13 and Fig. 14. Meanwhile, the engagement convex 2d of the fitting part 2a comes into contact with an inclined surface formed in the engagement convex part 22a of the slider supporting part 22. Then, the slider supporting part 22 is bent upward (opposite side to the engagement convex part 2d) while elastically deformed in such a way that the inclined surface of the engagement convex part 22a of the slider support 22 runs up onto the engagement convex part 2d of the fitting part 2a with the fitting operation. Meanwhile, the end surfaces 28a (see Fig. 8) of the slider 14 are brought into contact with a part of the to-be-connected housing element 2 so that the slider 14 is energized to the hook element 13.

[0047] Fig. 15 and Fig. 16 show a state that the connecting operation of the electrical connecting device 1 and the to-be-connected housing element 2 further proceeds from the state shown in Fig. 13 and Fig. 14. In the

state shown in Fig. 15 and Fig. 16, the bend of the slider supporting part 22 of the connecting housing element 12 is lost by elastic recovery and the engagement of the engagement convex part 22a of the slider supporting part 22 with the engagement part 2d of the fitting part 2a of the to-be-connected housing element 2 is almost completed. Further, the projection part 29 of the slider 14 brought into contact with the to-be-connected housing element 2 and energized comes into contact with the front end parts of the pair of elastic clamp parts 25 and 25 of the hook element 13 and is about to press and open the elastic clamp parts 25 and 25.

[0048] The fitting operation is completed through the state shown in Fig. 15 and Fig. 16, and thus, as shown in Fig. 17 and Fig. 18, the connecting housing element 12 is pushed into the depth in the fitting direction until the whole base part of the fitting part 2a of the to-be-connected housing element 2 is concealed. In the state shown in Fig. 17 and Fig. 18, an engagement relationship between the engagement convex part 22a of the slider supporting part 22 and the engagement convex part 2d of the fitting part 2a is completely established, and a mechanical connection of the electrical connecting device 1 and the to-be-connected housing element 2 is established. Further, the terminal supporting part 20 of the connecting housing element 12 is fitted into the depth of the opening 2b of the to-be-connected housing element 2 so that the pair of connection terminals 11 and 11 is fitted into the pair of to-be-connected terminals 10 and 10 respectively, and therefore an electrical connection is established.

[0049] In the state shown in Fig. 17 and Fig. 18, the projection part 29 of the slider 14 brought into contact with a part of the to-be-connected housing element 2 and energized comes into contact with the pair of elastic clamp parts 25 and 25 of the hook element 13 and presses and opens it to enter therebetween. Meanwhile, the pair of elastic clamp parts 25 and 25 is pressed and opened and thus the engagement of the lock claws 25a and lock claws 25b with the erecting part 23 of the connecting housing element 12 is released. The slider 14 is thus moved toward the hook element 13 after the pair of elastic clamp parts 25 and 25 is pressed and opened with the movement of the slider 14, and therefore the pair of elastic clamp parts 25 and 25 is elastically recovered to be engaged with the projection part 29 so as to clamp both the projection part 29 and the erecting part 23 of the connecting housing element 12. Moreover, when the pair of elastic clamp parts 25 and 25 is pressed and opened by the slider 14, the elastic lock pieces 26 of the hook element 13 are also energized to the fitting side at lock projection parts 30 formed in the connecting housing element 12 respectively (see Fig. 15 and Fig. 17).

[0050] When the fitting operation is thus completed, the locking of the hook element 13 to the connecting housing element 12 at the first position is released and the hook element 13 is hooked to the connecting housing element 12 at the second position (Fig. 17). In the elec-

trical connecting device 1, the shape and size of the connecting housing element 12, etc., are determined so that the hook element 13 protruded from the connecting housing element 12 when hooked to the connecting housing element 12 at the first position as shown in Fig. 1 and Fig. 11 is not protruded from the connecting housing element 12 when hooked to the connecting housing element 12 at the second position as shown in Fig. 2 and Fig. 17.

[0051] According to the above-described electrical connecting device 1, the slider 14 is brought into contact with a part of the to-be-connected housing element 2 and energized to be moved to the hook element 13 side when the connecting housing element 12 is fitted into the to-be-connected housing element 2. Then, the moved slider 14 is brought into contact with the hook element 13 so that the locking of the hook element 13 to the connecting housing element 12 at the first position is released, and therefore the hook element 13 becomes movable in relation to the connecting housing element 12. Accordingly, the workers can confirm the fitting state between the to-be-connected housing element 2 and the connecting housing element 12 by confirming the movable state. Thus, the hook element 13 can almost be made to operate by only a mechanism of the electrical connecting device side with almost no regard for the shape of the to-be-connected housing element 2 during the connecting operation of the connecting housing element 12 and the to-be-connected housing element 2. Therefore, the present invention can provide the electrical connecting device capable of significantly reducing restrictions in shape of the to-be-connected housing element regarding operation of the hook element for confirmation of fitting, and can make the to-be-connected housing element common in both cases where the electrical connecting device for connection includes the hook element and where it includes no hook element.

[0052] Additionally, according to the electrical connecting device 1, since the sliding direction coincides with the fitting direction, the slider 14 brought into contact with a part of the to-be-connected housing element 2 can smoothly be energized in the same direction as the fitting direction when the connecting housing element 12 is fitted into the to-be-connected housing element 2. Therefore, the moving operation of the slider 14 can smoothly be performed without interfering with the fitting operation.

[0053] Additionally, according to the electrical connecting device 1, since the moving direction of the hook element 13 at the time of release of the locking coincides with the fitting direction, the moving operation of the hook element 13 after the release of the locking and the fitting operation can smoothly be performed without interference with each other. Further, the moving operation of the hook element 13 after the release of the locking and the fitting operation can be realized as a series of operations and a continuous one operation.

[0054] Additionally, according to the electrical connecting device 1, it is possible to confirm that the fitting

state is incomplete and mechanical and electrical connections are not completed when the hook element is hooked to the connecting housing element at the first position, and further to confirm that the fitting state is complete and mechanical and electrical connections are completed when the hook element is hooked to the connecting housing element at the second position. That is, the fitting state can easily be confirmed by visual observation on whether the hook element 13 is hooked to the connecting housing element at the first position or second position.

[0055] Additionally, according to the electrical connecting device 1, it is possible to easily confirm by the visual observation that the hook element 13 is hooked to the connecting housing element 12 at the first position when protruded from the connecting housing element 12 and similarly to easily confirm by the visual observation that the hook element 13 is hooked to the connecting housing element 12 at the second position when not protruded from the connecting housing element 12. Therefore, the fitting state can easily be confirmed by the visual observation.

[0056] Additionally, according to the electrical connecting device 1, the pair of elastic clamp parts 25 and 25 is provided in the hook element 13, the erecting part 23 is provided in the connecting housing element 12 and the hook element 13 is inserted into the connecting housing element 12, so that a configuration in which the hook element is hooked to the connecting housing element at the first position can easily be realized with a simple mechanism. Further, the protrusion 29, of which the inclined surfaces 29a are formed, is formed on the slider 14, and thus a configuration, in which the pair of elastic clamp parts 25 and 25 are pressed and opened so that the slider 14 is brought into contact with the hook element 13 to release the locking at the first position when moved toward the hook element 13 with the fitting operation, can easily be realized with the simple mechanism.

[0057] Additionally, according to the electrical connecting device 1, the hook element 13, of which the locking to the connecting housing element 12 at the first position is released with the slider 14, is engaged with the projection part 29 so as to clamp both the projection part 29 and the erecting part 23. That is, the hook element 13, of which the locking to the connecting housing element 12 at the first position is released, is hooked to the connecting housing element 12 via the slider 14. Thus, the hook element 13, of which the locking to the connecting housing element 12 at the first position is released, can be reliably and strongly hooked to the connecting housing element 12 at the second position different from the first position.

[0058] The embodiment of the present invention has been described as above. However, as a matter of course, the present invention is intended to embrace all modifications, variations, and their equivalents that fall within the spirit and scope of the appended claims, and such modifications and variations will be become appar-

ent by reading and understanding this specification.

For example, the following modifications may be carried out.

[0059] (1) Each shape and position of the elastic clamp part of the hook element, the erecting part of the connecting housing element, the projection part of the slider or the like are not limited to the present embodiment, and modification thereof may be widely performed within the appended claims.

[0060] (2) The case has been described where the electrical connecting device 1 is mechanically connected to the to-be-connected housing element 2 by the engagement of the elastic cantilever-shaped engagement convex part provided at the front end part of the slider supporting part of the connecting housing element with the engagement convex part provided on the fitting part of the to-be-connected housing element, as an example. However, the present invention is not limited to this case.

[Industrial Applicability]

[0061] An electrical connecting device of the present invention can widely be applied to an electrical connecting device that is connected to a to-be-connected housing element that supports to-be-connected terminals. For example, the present invention can be employed as various connectors used for cars, however, it is not limited to that use thereto, and can be applied to a wider use, in many different environments and for various purposes.

Claims

1. An electrical connecting device (1) that is connected to a to-be-connected housing element (2) that supports one or more to-be-connected terminal(s) (10), comprising:

a connecting housing element (12) for supporting one or more connection terminal(s) (11) which is or are electrically connected to the to-be-connected terminal(s) (10) and for being connected to the to-be-connected housing element (2) by fitting;

a hook element (13) for being hooked to the connecting housing element (12) in such a way of being inserted into the connecting housing element and locked thereto at a first position; and a slider (14) as a member which is slidably supported in the connecting housing element (12) and is brought into contact with a part of the to-be-connected housing element (2) and energized to be moved toward the hook element (13) locked to the connecting housing (12) element at the first position when the connecting housing element is fitted into the to-be-connected housing element,

wherein the slider (14) comes into contact with the hook element (13) to release a locking at the first position when moved toward the hook element (13), so that the hook element becomes movable in relation to the connecting housing element (12).

2. An electrical connecting device according to claim 1, wherein a sliding direction in which the slider (14) is slidably supported coincides with a fitting direction in which the connecting housing element (12) is fitted into the to-be-connected housing element (2).
3. An electrical connecting device according to claim 1 or claim 2, wherein a moving direction of the hook element (13), of which the locking to the connecting housing element at the first position is released, coincides with the fitting direction in which the connecting housing element (12) is fitted into the to-be-connected housing element (2).
4. An electrical connecting device according to any one of claim 1 to claim 3, wherein the hook element (13), of which the locking to the connecting housing element (12) at the first position is released, can be hooked to the connecting housing element at a second position deviated from the first position in the fitting direction in which the connecting housing element (12) is fitted into the to-be-connected housing element (2).
5. An electrical connecting device according to claim 4, wherein the hook element (13) is formed so as to protrude from the connecting housing element (12) when hooked to the connecting housing element at the first position and formed so as not to protrude from the connecting housing element when hooked to the connecting housing element at the second position.
6. An electrical connecting device according to any one of claim 1 to claim 5, wherein the hook element (13) comprises a pair of cantilever-shaped elastic clamp parts (25) for clamping an erecting (23) part formed in the connecting housing element (12) so as to erect in a direction perpendicular to a direction in which the hook element (13) is inserted into the connecting housing element; and the pair of elastic clamp parts (25) of the hook element interferes with the erecting part (23) to be elastically deformed and then is elastically recovered to be engaged with the erecting part when the hook element (13) is inserted into the connecting housing element (12), and thus the hook element is hooked to the connecting housing element at the first position.

7. An electrical connecting device according to claim 6, wherein the slider (14) includes a projection part (29) protruded so as to come into contact with both front end parts of the pair of elastic clamp parts (25), and the projection part (29) is energized in a direction in which the pair of elastic clamp parts (25) are pressed and opened with a movement of the slider. 5
8. An electrical connecting device according to claim 7, wherein the projection part (29) is formed so as to have inclined surfaces (29a) which are formed to be inclined toward the slide moving direction in which the slider (14) is slidably supported and are energizing the pair of elastic clamp parts (25) in the pressing and opening direction with the movement of the slider. 10 15
9. An electrical connecting device according to claim 8, wherein the pair of elastic clamp parts (25) are engaged with the projection part (29) so as to clamp both the projection part and the erecting part (23) via the elastic recovery by further movement of the slider (14) in relation to the hook element (13) after pressed and opened with the movement of the slider. 20 25

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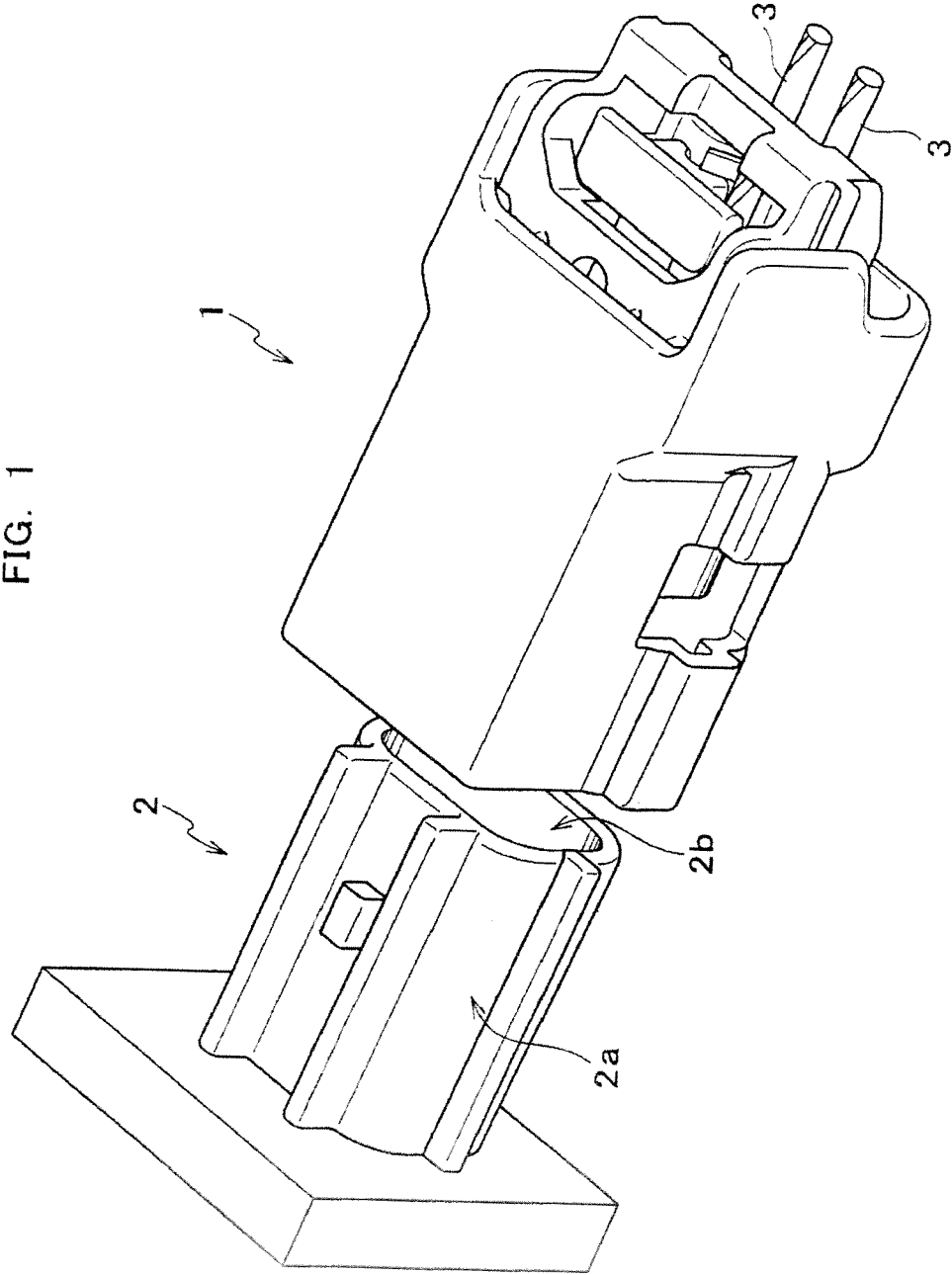


FIG. 2

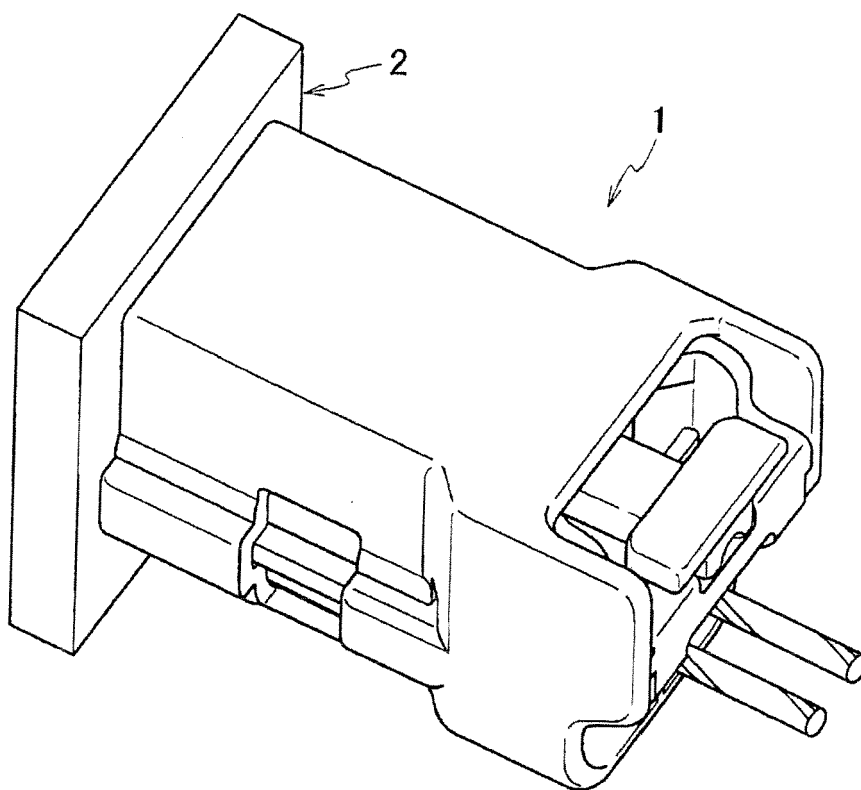


FIG. 3

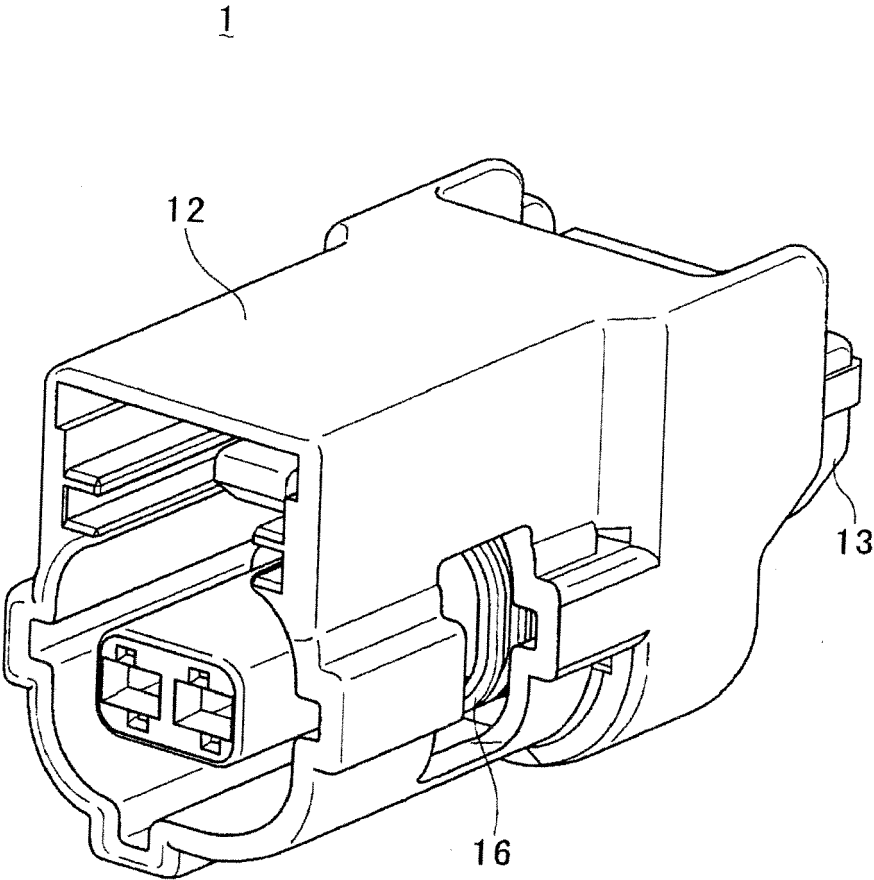


FIG. 4

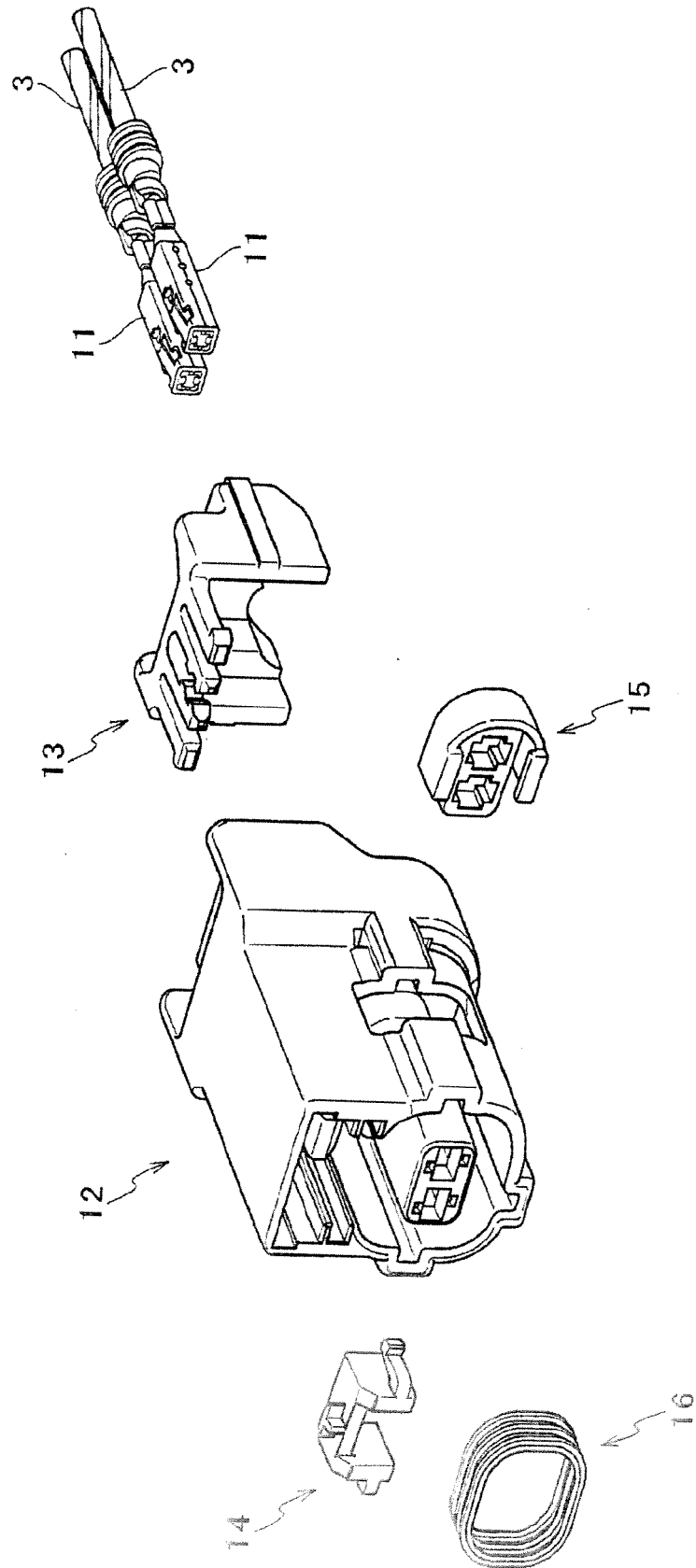


FIG. 5

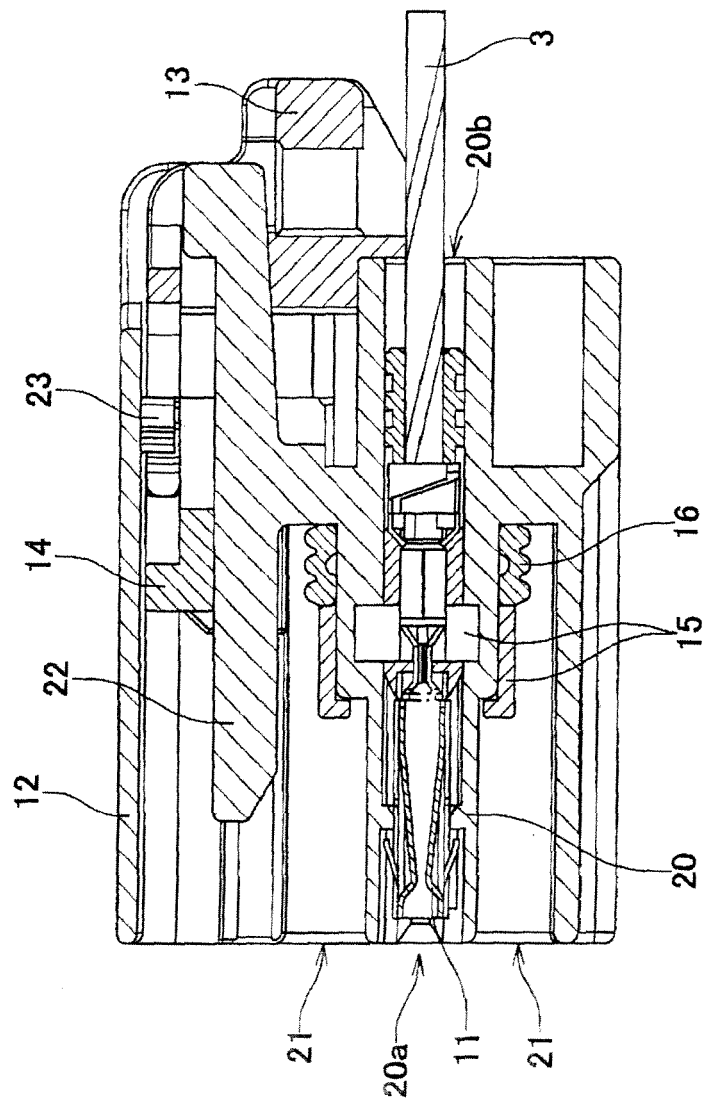


FIG. 6

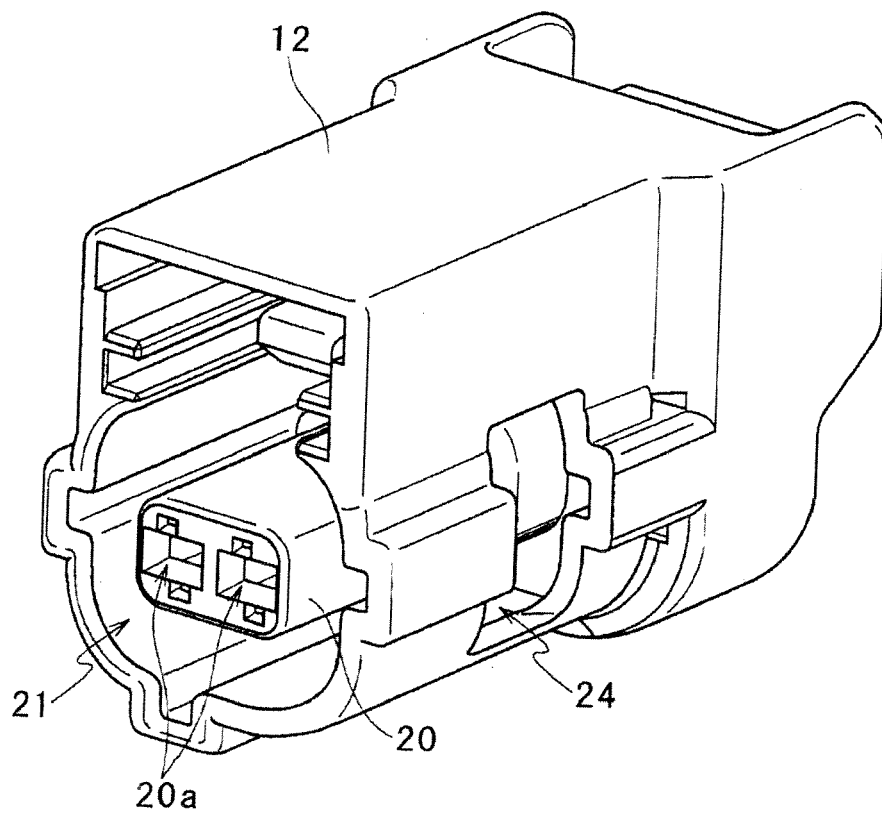


FIG. 7

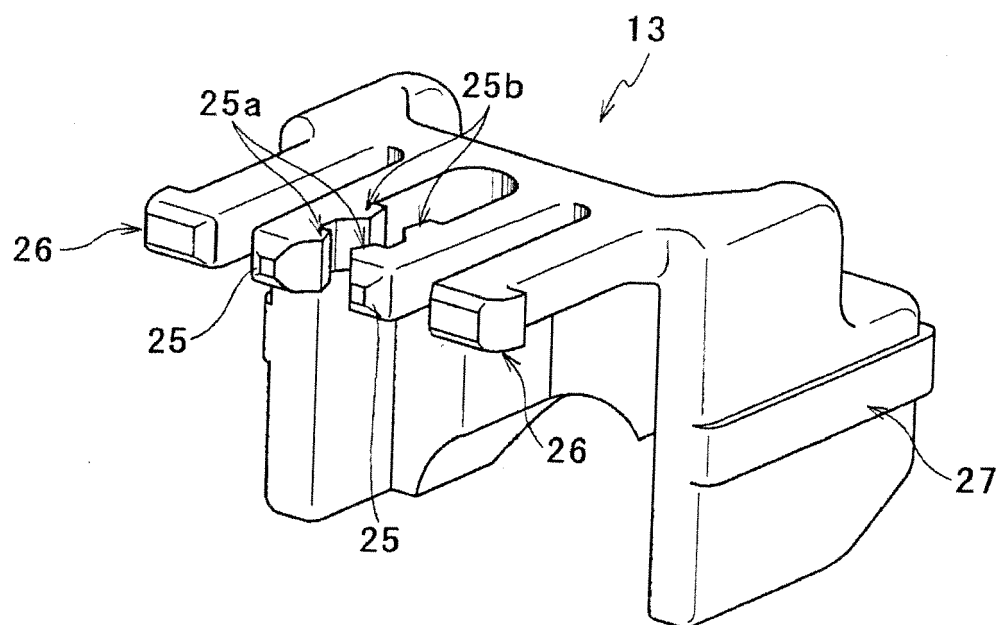


FIG. 8

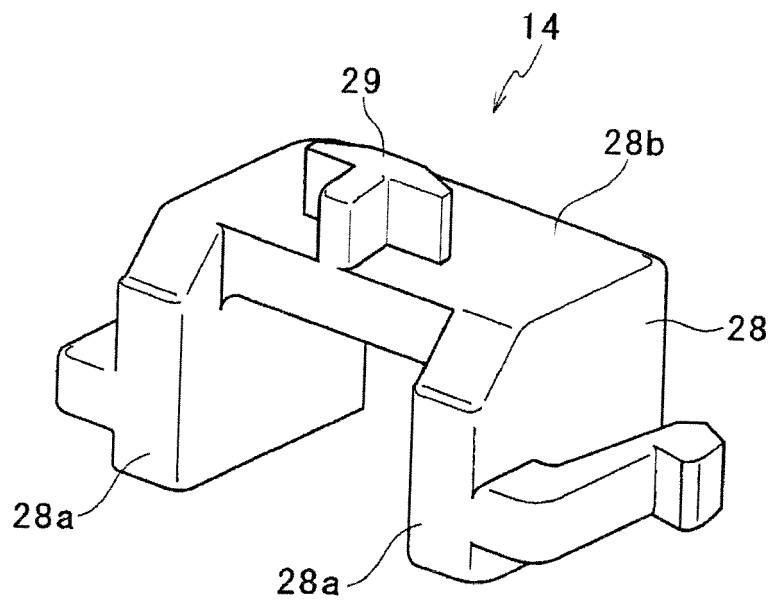


FIG. 9

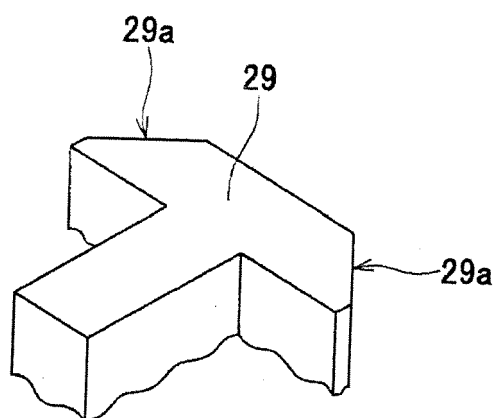


FIG. 10

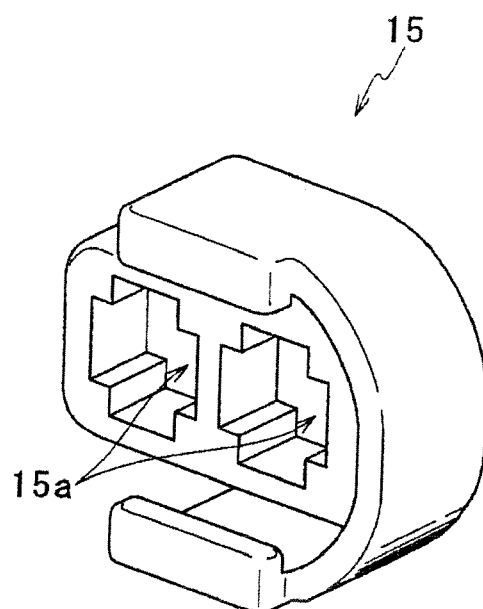


FIG. 11

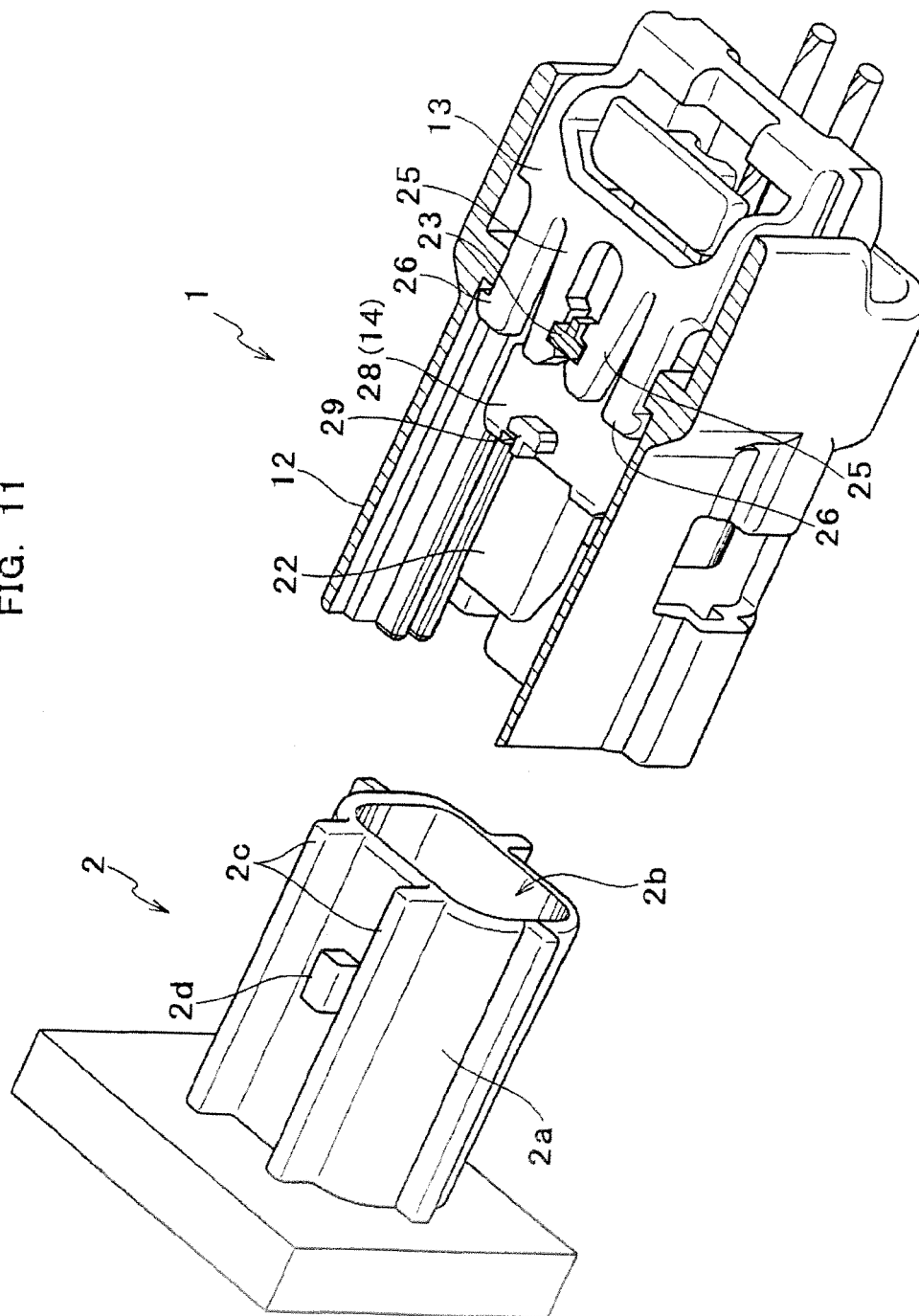


FIG. 12

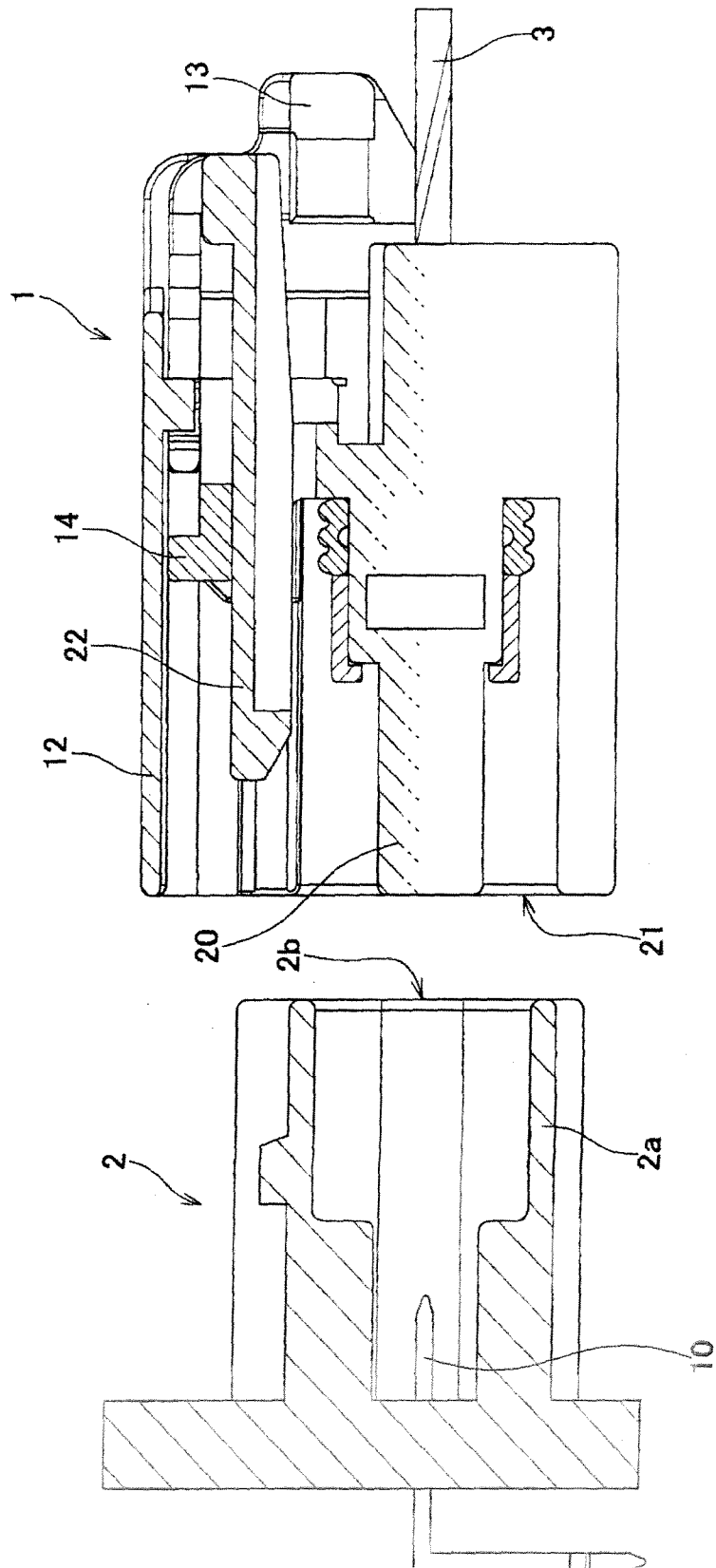


FIG. 13

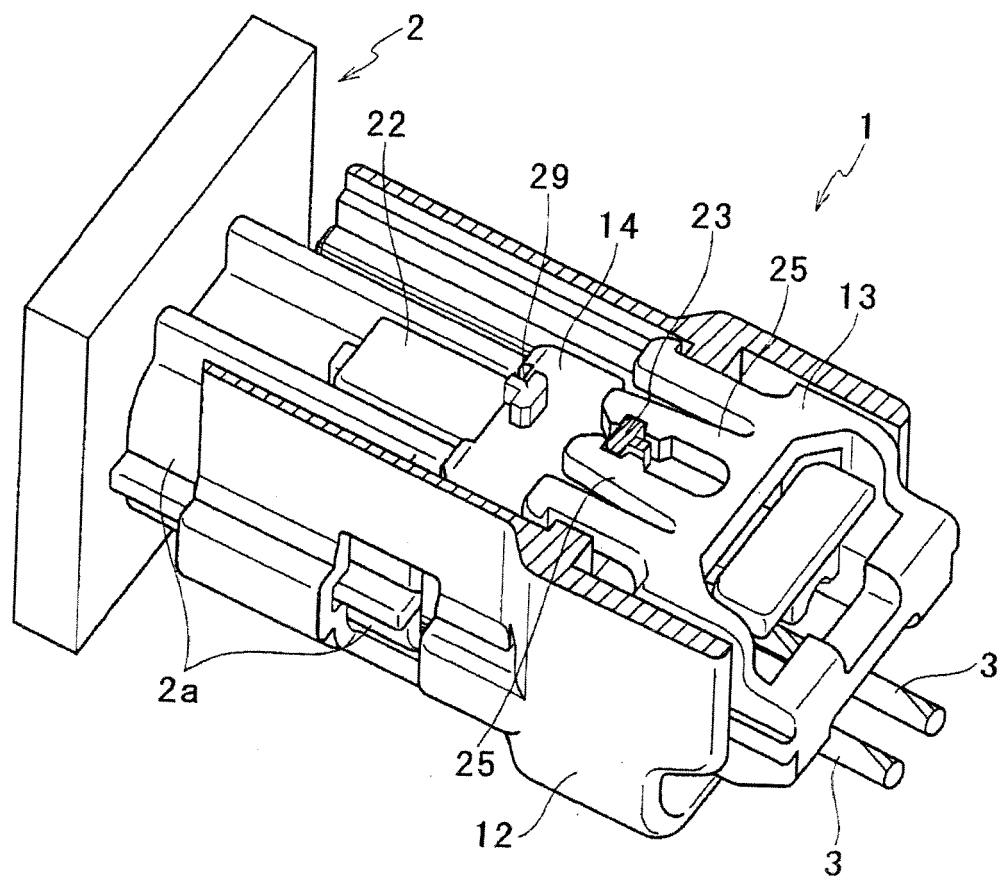


FIG. 14

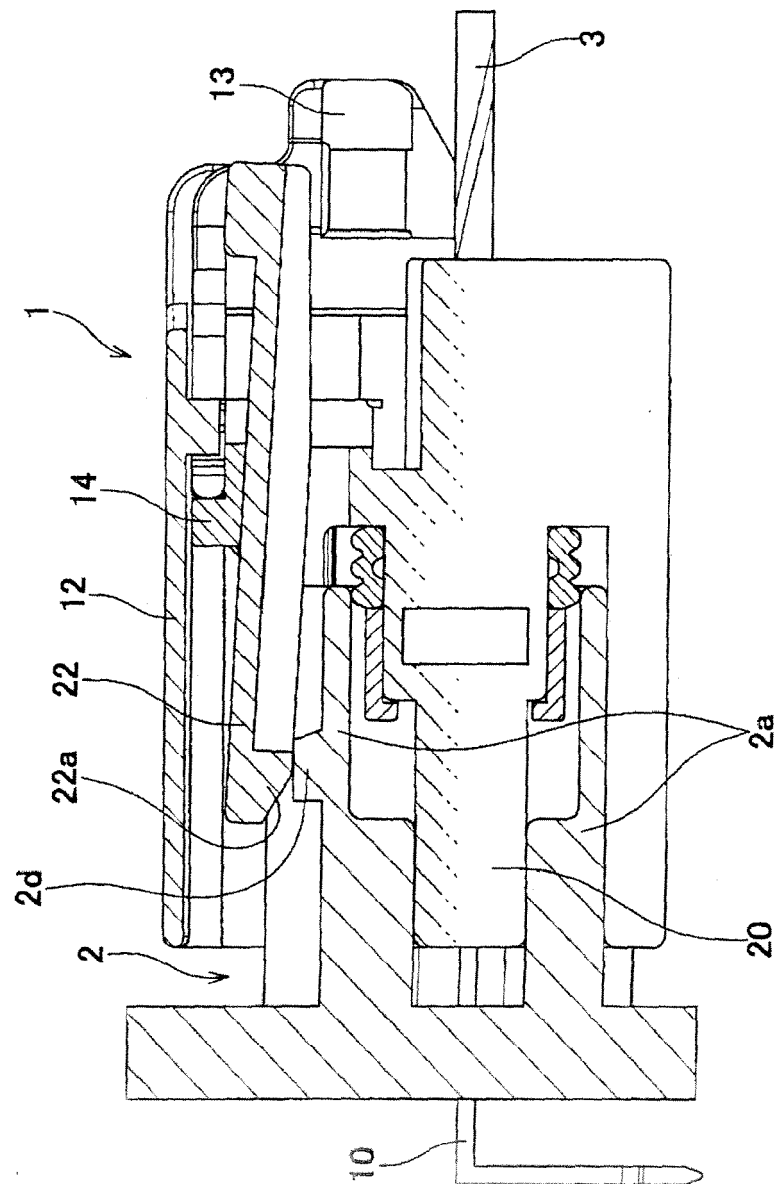


FIG. 15

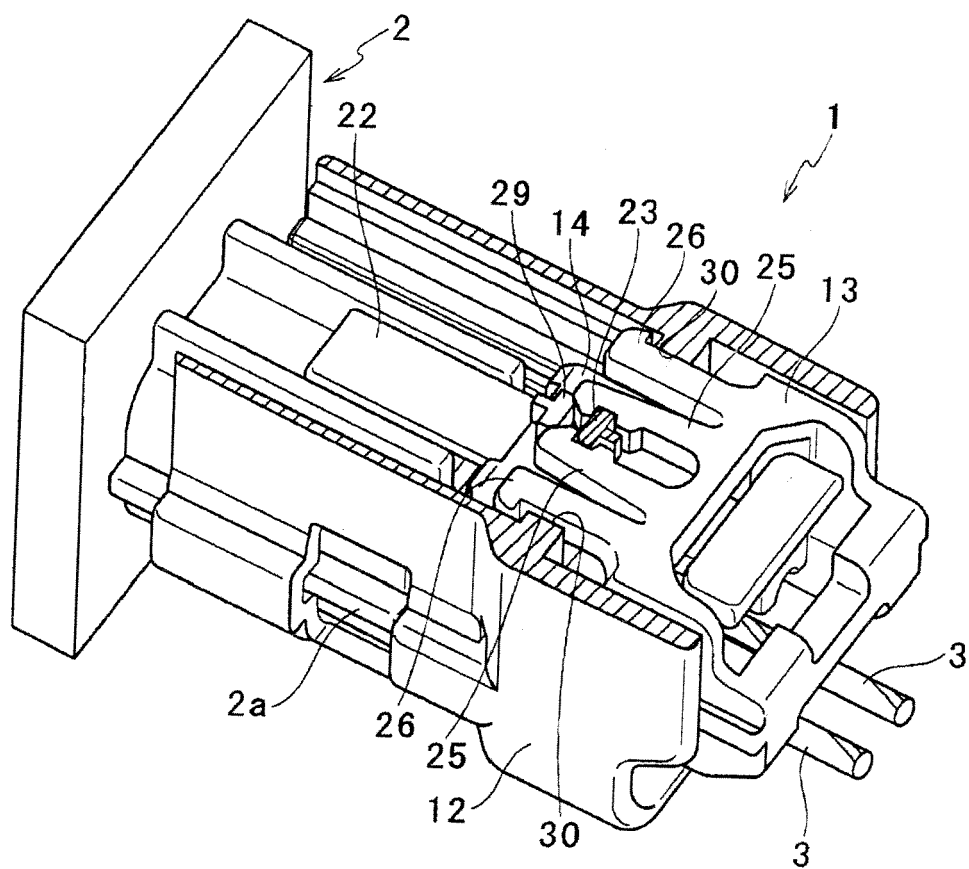


FIG. 16

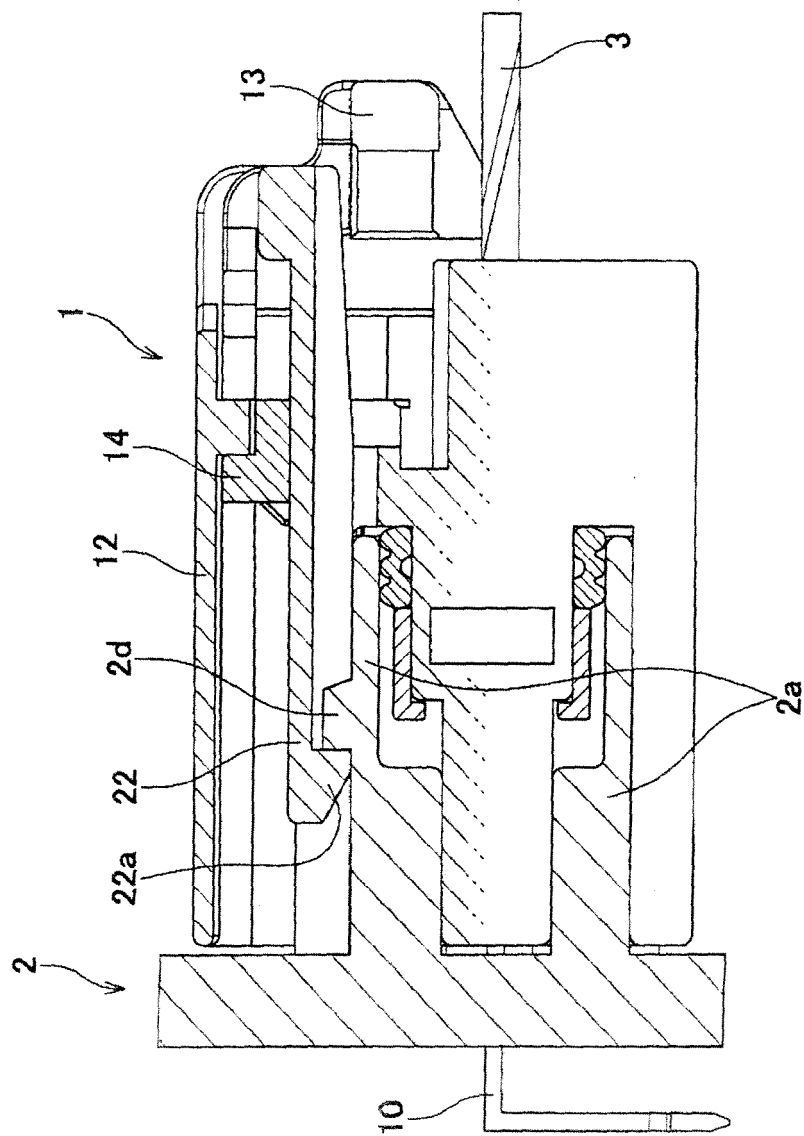


FIG. 17

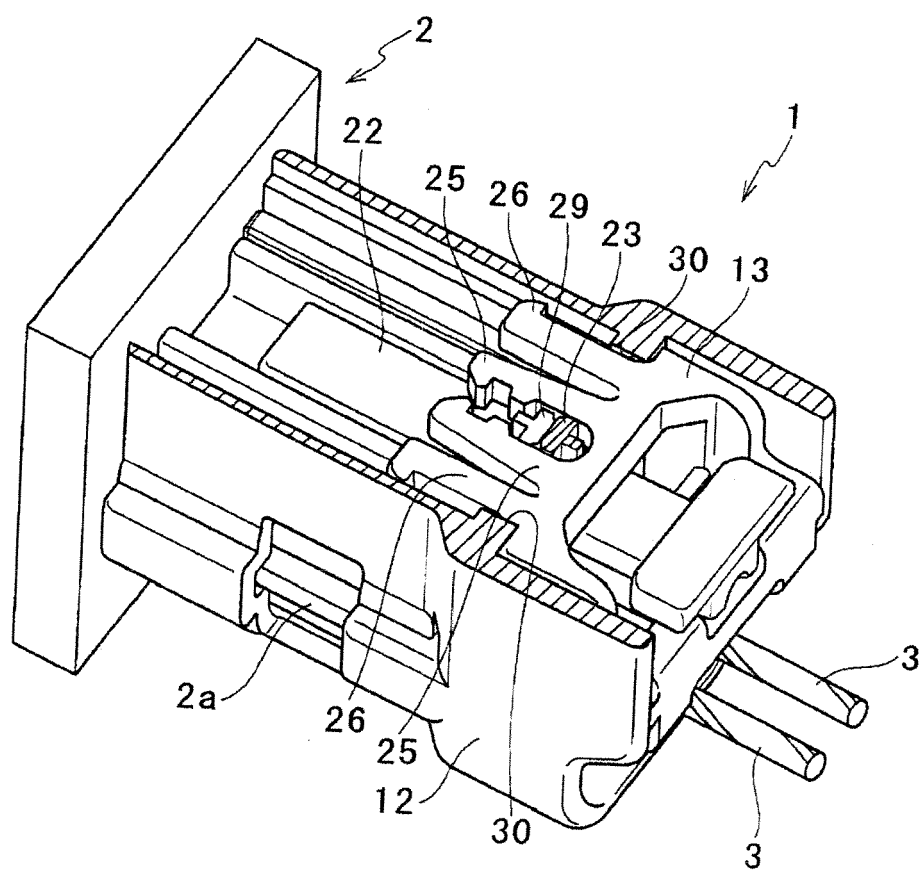
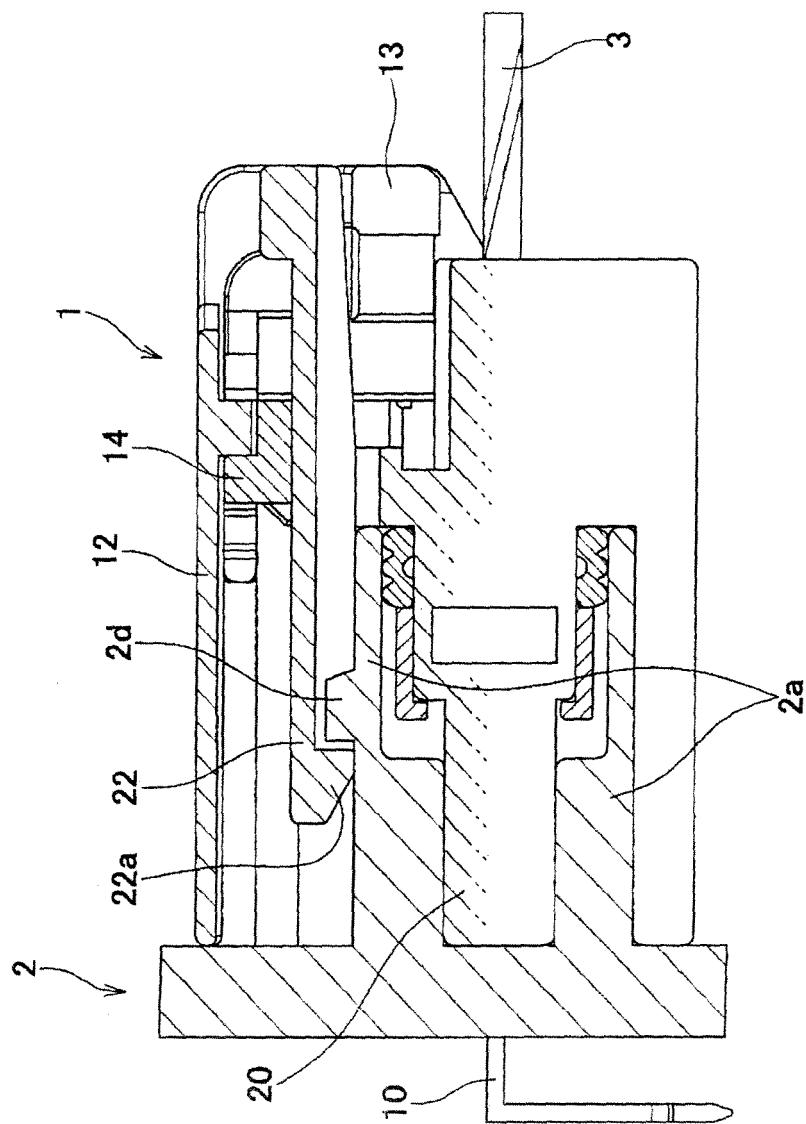


FIG. 18





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
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Place of search		Date of completion of the search	Examiner
Munich		7 August 2006	Serrano Funcia, J
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