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

(11) EP 0 484 951 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
04.09.1996 Bulletin 1996/36

(51) Int Cl.[6]: **H01R 13/627**

(21) Application number: **91119016.3**

(22) Date of filing: **07.11.1991**

(54) Connector locking connection detection device

Vorrichtung zum Anzeigen der Verriegelungsstellung eines Verbinders

Dispositif de détection de verrouillage d'un connecteur

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **08.11.1990 JP 301097/90**
09.11.1990 JP 302786/90
29.11.1990 JP 125260/90

(43) Date of publication of application:
13.05.1992 Bulletin 1992/20

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- **PATENT ABSTRACTS OF JAPAN vol. 014, no. 457 (E-0986)2 October 1990 & JP-A-21 83 978 (NIPPON EE M P KK) 18 July 1990**

EP 0 484 951 B1

Description

This invention relates generally to a connector for connecting a wire harness for an automotive vehicle, and more particularly to a device for detecting a locking connection between a pair of connectors.

Figs. 1 and 2 show a conventional connector according to the precharacterizing part of claim 1.

In Fig. 1, a flexible lock arm c of the cantilever type is formed on a surface of a male connector housing a, and is extended forwardly. An engagement hole d for a retaining portion c1 of the flexible lock arm c is formed in a female connector housing b.

In the above construction, when the male and female connector housings a and b are to be connected together, the retaining portion c1 of the flexible lock arm c is abutted against a front end of an engagement frame portion d1 of the female connector housing b, and is displaced downward, and then the retaining portion c1 is received in the engagement hole d, and is restored to its initial form to thereby complete the locking connection, thus providing a completely locked condition.

In this condition, an unlock prevention piece e is fitted on the flexible lock arm c to partially fill in a gap f between the flexible lock arm c and the surface of the male connector housing a, thereby preventing a subsequent displacement of the flexible lock arm c to prevent the unlocking (Fig. 2).

In an incompletely locked condition in which the retaining portion c1 is not engaged in the engagement hole d, the flexible lock arm c is kept displaced downward with the gap f reduced, and therefore it is impossible to connect the unlock prevention piece e to the flexible lock arm c. With this arrangement, the incomplete connection between the pair of connector housings is detected (Japanese Utility Model Publication No. Sho. 59-29351 or US-A 4 950 179 respectively).

In the above conventional art, the unlock prevention piece e, having the function of detecting the incomplete connection, must be attached to the flexible-lock arm c when the pair of connector housings are connected together, and therefore extra labor is required for the detection, and besides this is cumbersome from the viewpoint of the management of the parts.

SUMMARY OF THE INVENTION

With this problem in view, it is an object of this invention to provide a construction by which a complete connection of a connector can be detected easily.

The above object has been achieved by a connector according to the features as claimed in claim 1.

The locking connection detection member is retained onto a rear portion of the first connector housing in advance of connecting the first and second connector housings.

It is preferable that the engagement means includes resilient retaining pieces for retaining the locking connection detection member to a rear portion of the first connector housing in such a manner that the locking connection detection member is extended rearwardly from the first connector housing.

It is preferable that releasing means includes engagement release projections for the resilient retaining pieces, provided on the second connector housing.

The resilient retaining pieces are provided on the locking connection detection member, or otherwise, may be provided in the first connector--housing.

In the former case, it is preferable that the engagement means further includes stopper projections formed on the locking connection detection member, first retaining projections respectively formed on the resilient retaining pieces at predetermined positions apart from the stopper projections, and second retaining projections formed on the first connector housing at the rear end thereof so that each of the second retaining projections is interposed between the stopper projections and the first retaining projection to retain the locking connection detection member to the rear portion of the first connector housing.

In the latter case, it is preferable that the resilient retaining pieces are provided within receiving chambers passing through the first connector housing from its front end to its rear end, and the engagement means includes forwardly-directed retaining pieces projected from the locking connection detection member. The forwardly-directed retaining pieces are engaged with the resilient retaining pieces within the receiving chambers for retaining the locking connection detection member to the rear portion of the first connector housing.

Terminal retaining chambers not retaining terminals and terminal retaining pieces in the terminal retaining chambers may be used as the receiving chambers and the resilient retaining pieces, respectively.

It is preferable that the first and second connector housing are male and female connector housings, respectively, and the first means includes a flexible lock arm provided on the male connector housing and an engagement portion formed on the female connector housing for the flexible lock arm.

The locking connection detection member may further include an incomplete connection detection retaining portion with which the flexible lock arm is engaged when the male and female connector housings are mated together but the lock arm is not engaged with the engagement portion.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is an exploded perspective view of the conventional art;

Fig. 2 is a cross-sectional view of the above conventional art.

Fig. 3 is an exploded perspective view of one em-

bodiment of the present invention;
Figs. 4A, 4B, 4C and 4D are side-elevational views showing the process of connection between male and female connector housings;
Figs. 5A and 5B are cross-sectional views of an important portion, showing the above connecting process;
Fig. 6 is an exploded perspective view of another embodiment;
Fig. 7 is an exploded perspective view of said another embodiment with an important portion thereof broken;
Fig. 8 is an enlarged perspective view of a flexible lock arm of said another embodiment;
Figs. 9A, 9B, 9C and 9D are cross-sectional views showing the process of connection of male and female connector housings of said another embodiment;
Fig. 10 is an exploded perspective view of yet another embodiment of the present invention;
Fig. 11 is an exploded perspective view of the above embodiment shown in Fig. 10 with an important portion thereof broken;
Figs. 12A, 12B and 12C are cross-sectional views showing the process of connection in the above embodiment shown in Fig. 10;
Figs. 13A, 13B, 13C and 13D are cross-sectional views showing the above connecting process;
Fig. 14 is an exploded, perspective view showing a connector having a connector locking connection detection device according to yet another embodiment of the present invention;
Figs. 15A and 15B show a fitted condition of the connector shown in Fig. 14, where Fig.15A is a vertical cross-sectional view showing a condition during the fitted operation, and Fig. 15B is a vertical cross-sectional view showing a condition of completion of the fitting;
Figs. 16A, 16B and 16C are vertical cross-sectional views of a modified one of the connector shown in Fig. 14, respectively showing a condition during the fitting operation, a completely fitted condition, and a condition in which a locking connection detection member is removed after confirming the complete fitting;
Figs. 17 and 18 are perspective views of important portions of modified retaining constructions for retaining a fitting confirmation member relative to a retaining hole, respectively;
Fig. 19 is a perspective view showing another modified one of the connector shown in Fig. 14;
Fig. 20A, 20B and 20C are cross sectional views of the connector shown in Fig. 19, respectively showing a condition before the fitting, a condition during the fitting, and a condition in which a locking connection detection member is sprung out after the fitting is finished;
Fig. 21 is an exploded, perspective view of a connector according to a still another embodiment of the present invention;
Fig. 22 is a partly-broken, side-elevational view of the connector in Fig.21, showing a condition in which a locking connection detection piece is attached;
Fig. 23A, 23B and 23C are partly-broken, side-elevational views of the connector in Fig. 21, showing the process of the fitting of a pair of connector housings;
Fig. 24 is a perspective view of a modified form of one connector housing of the connector shown in Fig. 21; and
Fig. 25 is a partly-broken, perspective view of a modified form of the other connector housing of the connector shown in Fig. 21.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 3 to 5B show a connector having a connector locking connection detection device according to an embodiment of the present invention.

In Fig. 3, reference character A denotes a male connector housing, reference character B a female connector housing, and reference character C a locking connection detection member. These are made of a synthetic resin.

The male connector housing A has a groove 1 formed in its upper surface thereof and extending from its front to its rear end, and a flexible lock arm 2 which is received in the groove 1 and is extended rearwardly via its upstanding proximal portion 2a. This flexible lock arm has a lock projection 2b intermediate the opposite ends thereof, and an operating portion 2c at the rear end thereof. Retaining projections 3 for the locking connection detection member C are formed respectively on the right and left side surfaces of the male connector housing A at the rear end thereof, and are directed right and left, respectively.

An engagement portion 5 for the lock projection 2b is notched in a sleeve portion 4 of the female connector housing B, and engagement release projections 6 are formed respectively on the right and left portions of the front end of the sleeve portion 4. The engagement release projections are directed forwardly, and have respective sharp tip edges 6a and respective tapered drive surfaces 6b directed right and left, respectively.

The locking connection detection member C is of a U-shape defined by a top plate portion 7 and a pair of side plate portions 8 and 8 extending from the opposite ends of the top plate portion 7. Each of the two side plate portions 8 has a resilient retaining piece 9 formed at the front end portion thereof as a result of the provision of slits 8a, the resilient retaining piece 9 having a retaining projection 9a. The retaining projection 9a has a tapered driven surface 9b at its inner side. Stoppers 10 are formed on the inner surface of each side plate portion 8

in spaced relation to the retaining projection 9a.

In the above construction, the locking connection detection member C is beforehand connected to the male connector housing A and is extended rearwardly therefrom in such a manner that the retaining projections 9a of the resilient retaining pieces 9 are engaged respectively with the retaining projections 3 (Fig. 4A).

In this condition, when the male connector housing A is fitted into the female connector housing B by holding the locking connection detection member C, the lock projection 2b is abutted against the front end of the sleeve portion 4, and the flexible lock arm 2 is displaced downward, and at the same time the engagement release projections 6 are abutted respectively against the retaining projections 9a of the resilient retaining pieces 9 (Figs. 4B and 5A). When the male connector housing A is completely fitted in the female connector housing B, the flexible lock arm 2 is restored to its initial form, so that the lock projection 2b is engaged in the engagement portion 5, and metal terminals (not shown) contained in the two connector housings are connected together. At the same time, the tapered drive surfaces 6b of the engagement release projections 6 respectively displace the resilient retaining pieces 9 outwardly through the tapered driven drive surfaces 9b in such a manner that the retaining projections 9a are disengaged from the retaining projections 3, respectively (Figs. 4C and 5B). In this condition, the locking connection detection member C is removed, thereby detecting the complete connection between the pair of connectors (Fig. 4D).

In an embodiment shown in Figs. 6 to 9D, in addition to the above construction, an engagement plate portion 11 for receiving the operating portion 2c of the flexible lock arm 2 of the male connector housing A in a manner to allow displacement thereof is provided on the inner side of a top plate portion 7 of a locking connection detection member C'. Incomplete connection detection retaining portions 12 for engagement with projections $2c_1$ provided respectively on the opposite sides of the operating portion 2c are formed on the engagement plate portion 11.

In this case, the locking connection detection member C' is connected to the male connector housing A as shown in Fig. 9A, and in this condition the operating portion 2c of the flexible lock arm 2 is not engaged with the incomplete connection detection retaining portions 12.

In the condition in which the male connector housing A is incompletely fitted in the female connector housing B, the flexible lock arm 2 is displaced downward, and therefore the projections $2c_1$ of the operating portion 2c are engaged with the incomplete connection detection retaining portions 12, thereby preventing the locking connection detection member C' from being disengaged from the male connector housing A (Fig. 9B).

When the male connector housing A and the female connector housing B are completely connected together, the flexible lock arm 2 is restored to its initial form, and the lock projection 2b is engaged in the engagement portion 5. As a result, the engagement between the operating portion 2c and the incomplete connection detection retaining portions 12 is released (Fig. 9C), and as described above, each engagement release projection 6 releases the engagement between the resilient retaining piece 9 and the retaining projection 3, and therefore the locking connection detection piece C' can be detached from the male connector housing A (Fig. 9D).

In an embodiment shown in Figs. 10 to 13D, a resilient retaining piece 13a is provided within each of receiving chambers 13. Terminal receiving chambers 13' for retaining terminals and the receiving chambers 13 for receiving retaining pieces (later described) of the locking connection detection member C", extend through the male connector housing from its front to its rear end. Engagement release projections 16 are provided within the sleeve portion 4 and are directed forwardly. Each of the engagement release projection 16 has a sharp edge 16a at its front end, and a tapered drive surface 16b directed downwardly. Forwardly-directed retaining pieces 19 each having an engagement hole 19a are formed respectively on the inner surfaces of the side plate portions 8.

In the above construction, the locking connection detection member C" is beforehand connected to the male connector housing A' and is extended rearwardly therefrom in such a manner that the retaining pieces 19 are received respectively in the receiving chambers 13 of the male connector housing A', with retaining projections $13a_1$ of the resilient retaining pieces 13a received respectively in the engagement holes 19a (Figs. 12A and 13A).

In this condition, when the male connector housing A' is fitted into the female connector housing B' by holding the locking connection detection member C", the lock projection 2b is abutted against the front end of the sleeve portion 4, and the flexible lock arm 2 is displaced downward. At the same time the projections $2c_1$ of the operating portion 2c are engaged respectively with the incomplete connection detection retaining portions 12, and also the tapered drive surfaces 16b of the engagement release projections 16 are abutted respectively against tapered driven surfaces $13a_2$ of the resilient retaining pieces 13a (Figs. 12B and 13B). When the male connector housing A' is completely fitted in the female connector housing B', the flexible lock arm 2 is restored to its initial form, and as a result the engagement between the operating portion 2c and the incomplete connection detection retaining portions 12 is released, and also the lock projection 2b is engaged in the engagement portion 5. At this time, the tapered drive surfaces 16b of the engagement release projections 16 respectively displace the resilient retaining pieces 13a through the tapered driven drive surfaces $13a_2$ in such a manner that the retaining projections $13a_1$ are disengaged from the retaining holes 19a of the retaining pieces 19, respectively (Figs. 12C and 13C). In this condition, the locking connection detection member C" is removed,

thereby detecting the complete connection between the pair of connectors (Fig. 13D).

As described above, the present invention provides the connector locking connection detection device comprising the male connector housing having the flexible lock arm, and the female connector housing having the retaining portion for the flexible lock arm; wherein the locking connection detection member is beforehand attached to the rear portion of the male connector housing and is retained thereto by the resilient retaining means in such a manner that the locking connection detection member is extended rearwardly from the male connector housing; the engagement release projections for the resilient retaining means are provided on the female connector housing; and when the male and female connector housing are completely connected together with the lock arm engaged with the engagement portion, the engagement release projections release the retaining of the resilient retaining means, thereby enabling the removal of the locking connection detection member. Therefore, by removing the locking connection detection member, the complete connection of the connector can be confirmed easily and rapidly, and the removed locking connection detection member can be again used for attachment to another connector housing.

Further, since the locking connection detection member is attached to the male connector housing in such a manner that the former is extended rearwardly from the latter, the male connector housing can be fitted into the female connector housing while holding the locking connection detection member with an operator's hand when the male and female connector housings are to be connected together, and therefore the connecting operation is facilitated.

Figs. 14, 15A and 15B show a connector having a connector locking connection detection device according to yet another embodiment of the present invention. In Figs. 14 and 15, a male housing M has a lock arm 103 having a fulcrum portion 102 at its proximal portion. An operating portion 103a bent into an L-shape is formed on the distal end of the lock arm 103, and a lock pawl 104 is formed on the lock arm 103 intermediate the opposite ends thereof, the lock pawl 104 having a slanting guide surface directed toward the fulcrum portion 102.

A female housing F has a sleeve portion 106 for receiving the male housing M which sleeve portion is defined by a front half portion of the female housing. A retaining hole 108 is formed through an upper wall 106a of the female housing. Projections 110 and 110, which are elongated in an upward-downward direction in the drawings, are formed respectively on opposed upstanding portions of an inner peripheral surface 106b of the retaining hole 108. A retaining portion 111 in the form of a hole is formed in that portion of the inner peripheral surface 106b close to the male housing M.

A locking connection detection member 112 is retainably provided in the retaining hole 108, and has an L-shape as viewed from the side thereof, like the inner peripheral surface 106b. Circular hinge holes 113 are formed respectively in the opposite sides of the shorter leg of the L-shaped member 112. The projections 110 are fitted respectively in the hinge holes 113 for allowing a pivotal movement of the member 112, and therefore the diameter of the hinge hole 113 is slightly greater than the length of the projection 110. Further, a guide groove 114 is obliquely formed to extend to the hinge hole 113 so as to guide the projection 110 into the hinge hole 113. The width of the guide groove 114 is smaller than the length of the projection 110. A retaining portion 115 in the form of a projection is formed on the distal end of the longer leg of the L-shaped member 112, and is engageable in the retaining portion 111 of the housing. As shown in Fig. 15A, the fitting confirmation member 112 of the above construction is retained in the retaining hole 108 before the female and male housings F and M are fitted together.

When the female and male housings F and M are to be fitted together, first, as shown in Fig. 15A, the lock pawl 104 is abutted against an outer wall portion 106a' disposed forwardly of the retaining hole 108, so that the lock arm 103 is flexed and passes below the outer wall portion 106a'. Then, in the completely fitted position as shown in Fig. 15B, the lock arm 103 is resiliently restored, so that the lock pawl 104 on the upper surface thereof is engaged in the locking hole 108, thereby locking the female and male housings F and M together. At the same time, as shown in Fig 15B, the right end of the fitting confirmation member 112 is urged upward by the lock pawl 104, so that the retaining portion 115 is disengaged from the retaining portion 111 of the retaining hole 118, and as a result the locking connection detection member 112 is projected outwardly. Therefore, the operator can easily confirm the complete fitting. When part of the locking connection detection member 112 is thus projected outwardly from the female housing F, the guide groove 114 is disposed parallel to the projection 110, and therefore the fitting confirmation member 112 can be easily removed by pulling it up in a direction of an arrow.

Figs. 16A, 16B and 16C show a modified one of the connector shown in Figs. 14 to 15C, in which a lock arm 103 is provided in a direction reverse to the direction of provision of the lock arm in the connector shown in Fig. 14. In this connector, a lock pawl 104 is formed on the distal end of the lock arm 103, and the operation portion 103a is not provided. Hinge holes 113 and guide holes 114 in a locking connection detection member 112 are provided close to the front end of the housing. An engaging piece 116 for engagement with the lock pawl 104 extends from the front end portion of the female housing F into a retaining hole 108. Projections 110 are fitted respectively in the hinge holes 113 formed in the right end (Figs. 16A, 16B and 16C) of the locking connection detection member 112, and the locking connection detection member 112 is placed on the engaging piece 116

so as to be pivotally moved about the projections 110, and a distal end surface 112a of the locking connection detection member 112 is disposed adjacent to the distal end of the engaging piece 116, and is directed toward the interior of a sleeve portion 106. As in the preceding connector, a retaining portion 115 is formed on the left end of the locking connection detection member 112, and is engaged in a hole-like retaining portion 111 formed in the peripheral edge of the retaining hole 108.

When the female and male housings F and M are to be fitted together, the lock arm 103 is flexed downward and is introduced into the sleeve portion 106 by urging the two housings in the fitting direction. During the fitting operation, the lock pawl 104 on the distal end of the lock arm 103 is held by the engaging piece 116, and moves along the lower surface thereof, as shown in Fig. 16A.

When the female and male housings F and M are completely fitted together, the lock arm 103 is restored to its initial condition, and the lock pawl 104 is engaged with the distal end of the engaging piece 116 in the retaining hole 108 to provide a lock condition, as shown in Fig. 16B. The upper end of the lock pawl 104 is abutted against the lower end surface 112a of the locking connection detection member 112, and the engagement between the retaining portions 111 and 115 is released by the restoring force of the lock arm 103, so that the lower end surface 112a is raised. As a result, part of the locking connection detection member 112 is projected outwardly from the female housing F, thereby telling that the complete fitting has been made. At this time, each guide groove 114 is disposed in alignment with the corresponding projection 110, and the locking connection detection member 112 can be removed by pulling it upward in a direction of an arrow in Fig. 16C.

Figs. 17 and 18 show modified retaining constructions for retaining a locking connection detection member 112 relative to a retaining hole 108.

In Fig. 17, two flexible wires extends from the locking connection detection member 112, and the distal end portion of each of these wires is formed into a circular loop to provide a retaining portion 118. Pivot pins 119 for fitting respectively in the retaining portions 118 are formed respectively on opposed portions of a peripheral surface 106b of the retaining hole 108.

In Fig. 18, retaining projections 115 are formed respectively on three sides of the locking connection detection member 112, and retaining recesses 111 corresponding respectively to the retaining projections 115 are formed in a peripheral surface 106b of the retaining hole 108.

In this connector, when the lock pawl 104 enters the retaining hole 108, the engagement of the locking connection detection member 112 is automatically released, so that it is removed from the retaining hole 108. Therefore, no manual removal is needed.

Figs. 19, 20A, 20B and 20C show another modified one of the connector according to the present invention. A male housing M in these Figures is the same as that in the embodiment of Fig. 14. With respect to a female housing F, a retaining hole 108 not only is formed in a sleeve portion 106, but also extends in a grooved manner up to the left end of the housing. Projection-like retaining portions 111' are formed respectively on opposite sides of a peripheral surface 106b of the retaining hole 108, and guide projections 121 each having a rounded front end are formed respectively on the opposite sides of the peripheral surface 106b intermediate the opposite ends of the retaining hole 108, and shaft receiving recesses 122 are provided respectively at the opposite sides of the peripheral surface 106b rearwardly adjacent to the respective guide projections 121, and further a shaft retaining portion 123 is formed on a central portion of the rear end of the peripheral surface 106b.

A locking connection detection member 124 is generally elongated, and projections 125 for engagement with a peripheral wall 106a' of the retaining hole 108 are formed respectively on the opposite side portions of the longitudinal front end of the locking connection detection member 124. Retaining portions or recesses 115' for receiving the respective retaining portions 111' are formed respectively in the opposite sides of the locking connection detection member 124, and are disposed slightly rearwardly of the projections 125. Disposed rearwardly of the retaining portions 115' is a projection-like push portion 126 of a triangular cross-section which is adapted to be projected into the interior of the sleeve portion 106. The push portion 126 has a generally vertical front surface 126a, and an inclined rear surface 127 for abutment against the guide projections 121. A shaft 128 is formed at the rear end of the locking connection detection member 124, and extends perpendicularly to the longitudinal axis thereof.

As shown in Fig. 20A, the locking connection detection member 124 is attached to the female housing F. More specifically, first, the fitting confirmation member 124 is vertically oriented with the projections 125 directed upward and with the shaft 128 directed downward, and then the shaft 128 is introduced between the shaft receiving recesses 122 and the shaft retaining portion 123 (see Fig. 20C). Then, the front end of the locking connection detection member is urged in a clockwise direction to thereby engage the projections 125 with a distal end portion 106a'' of the peripheral wall 106a', thus completing the attachment.

In this condition, the shaft 128 is prevented by the shaft receiving recesses 122 from rightward and upward movements, and is also prevented by the shaft retaining portion 123 from leftward withdrawal. Therefore, the locking connection detection member 124 can not be removed from the female housing F. The vertical front surface 126a of the push portion 126 is slightly projected forwardly beyond a rear surface 106c of the sleeve portion, and the inclined rear surface 127 of the push portion 126 is held against the guide projections 121.

When the male housing M is inserted into the sleeve

portion 106 of the female housing F with the lock arm 103 being flexed, a front end surface 102a of the male housing is abutted against the vertical surface 126a of the push portion 126. When the male housing is further inserted, the inclined surface 127 moves upward along the guide projections 121, so that the whole of the locking connection detection member 124 is warped upward because of its own flexibility, as shown in Fig. 20B. As the housings approach to the completely-fitted position, the amount of engagement between the projections 125 of the locking connection detection member 124 and the distal end portion 106a'' of the peripheral wall 106a' decreases gradually, and a lock pawl 104 of the lock arm 103 is abutted against the reverse surface of that portion of the locking connection detection member 124 lying between the opposed projections 125.

Then, when the female and male housings F and M are brought into the completely fitted condition as shown in Fig. 20C, the front end surface 102a of the male housing M is held against the rear end surface 106c of the sleeve portion, and the lock pawl 104 urges the reverse surface of the fitting confirmation member 124 upward to thereby release the engagement between the projections 125 and the distal end portion 106a'', so that the locking connection detection member 124 is vigorously sprung out in a direction of an arrow by a repulsive force resulting from the restoration of the warping.

Thereafter, the locking connection detection member 124 is pulled upward to be removed from the female housing F.

According to the connectors shown in Figs. 14 to 20C, the locking connection detection member 112, 124 is beforehand engaged in the retaining hole 108 before the fitting operation, and by doing so, the operator is positively prevented from forgetting the confirmation of the fitting. Further, after confirming the complete fitting, the fitting confirmation member is removed, and can be used again for another housing, and therefore the number of the component parts can be reduced.

As described above, in the present invention, if the female and male housings are incompletely fitted together, the fitting confirmation member is not projected, and this member is projected only in the completely fitted condition. Therefore, the incomplete fitting and/or incompletely locking can be positively prevented. Further, if the fitting confirmation member is merely engaged in the retaining hole, this positively prevents the operator from forgetting the confirmation of the fitting, and troubles resulting from the incomplete fitting can be prevented. Further, after confirming the complete fitting, the fitting confirmation member is removed and can be used again and again for other housings, and therefore the number of the component parts can be reduced, which is economical.

Figs. 21, 22, 23A, 23B and 23C show a connector having a connector locking connection detection device according to still another embodiment of the present invention. Referring to Fig. 21, a male connector housing A, a female connector housing B and a locking connection detection piece C are all made of a synthetic resin.

The male connector housing A has a flexible lock arm 131 extending rearwardly from an upstanding proximal portion 131a at a front end thereof. A locking projection 131b and an operating portion 131c are also formed on this male connector housing.

An engaging portion 133 for receiving the locking projection 131c is notched in a sleeve portion 132 of the female connector housing B.

A flexible retaining arm 135 of the cantilever type is formed on a side wall 134 of the sleeve portion 132 of the female connector housing B, and extends rearwardly. A driven projection 135a and a retaining projection 135b are formed respectively on the opposite sides of the free end of the flexible retaining arm 135, and thanks to the provision of a slit 136, the free end portion is displaceable upward and downward. A container case portion 137 is formed on the outer surface of the side wall 134, and has an opening 137a at its front end.

The locking connection detection piece C comprises a small piece of plate 138, and has a tapered drive portion 138a at its front end, and a retaining recess 138b in its upper surface, and an operating portion 138c at its rear end.

A projected portion 139 is formed on a side wall of the male connector housing A, and a tapered drive surface 139a is formed on the projected portion 139.

In the above construction, the locking connection detection piece C is beforehand inserted in the container case portion 137 of the female connector housing B, and at this time the retaining projection 135b on the free end of the flexible retaining arm 135 is displaced upward by the tapered drive portion 138a, and then is engaged in the retaining recess 138b to thereby prevent withdrawal of the locking connection detection piece C (Fig. 22).

In this condition, when the connector housing A is to be fitted, the locking projection 131b of the flexible lock arm 131 is abutted against the front end of the sleeve portion 132, and then moves beneath the upper wall of the sleeve portion 132, so that the flexible lock arm 131 is displaced downward to thereby achieve an incompletely-connected condition (Fig. 23A). When this fitting further proceeds, the locking projection 131b is engaged in the engaging portion 133, so that the flexible lock arm 131 is fully restored to its initial condition to thereby achieve a completely-connected condition. At this time, the tapered drive surface 139a flexibly displaces the free end of the flexible retaining arm 135 upward through the driven projection 135a, so that the retaining projection 135b is disengaged from the retaining recess 138b of the locking connection detection piece C (Fig. 23B). Therefore, in this condition, the locking connection detection piece C can be withdrawn (Fig. 23C).

Fig. 24 shows a modified one of the connector shown in Figs. 21 to 23C. In the connector shown in Fig. 24, instead of the tapered drive surface 139a, a tapered drive groove 139a' is formed in a side wall of a male

connector housing A'.

Fig. 25 shows another modified one of the connector shown in Figs. 21 to 23C. In the connector shown in Fig. 25, a resilient push piece 140 is provided at the inner end of a container case portion 137, and in the completely-connected condition, the resilient push piece 140 pushes a locking connection detection piece C outwardly.

Claims

1. A connector comprising:

a pair of first and second connector housings (A,B;A',B';F,M;B,A) to be connected to each other;

a flexible lock arm (2;103;131) provided to one (A;A';M;A) of said first and second connector housings (A,B;A',B';F,M;B,A) ;

an engagement portion (5;108;133) provided to the other (B;B';F;B) of said first and second connector housings (A,B;A',B';F,M;B,A), said flexible lock arm (2;103;131) and said engagement portion (5;108;133) being provided for locking a complete connection between the first and second connector housings (A,B;A',B';F,M;B,A); and

a locking connection detection member (C;C';C";112;124;C)

characterized in that

said locking connection detection member (C;C';C";112;124;C) and said first connection housing (A,A';F;B) have engagement means (3,9;19a,16a;11,115; 111',115';135b,138b) for attaching said locking connection detection member (C;C';C";112;124;C) to the first connector housing (A,A',F,B) beforehand a connection between the first and second connector housings (A,B;A',B';F,M;B,A); and

the second housing (B,B',A) has a drive means (6;16;104;139) for disengaging the engagement means (3,9;19a,16a;111,115;111',115';135b,138b) of the locking connection detection member (C;C';C";112;124;C) and the first connector housing (A,A',F,B) due to a mutual advance of the first and second connector housings (A,B;A',B";F,M;A) as a consequence of the complete connection, to thereby enable the removal of the locking connection detection member (C;C';C";112;124;C) to indicate the locking connection of the flexible arm (2;103;131) with the engagement portion (5;108;133).

2. The connector according to claim 1, wherein said locking connection detection member (C;C',C") is retained onto a rear portion of said first connector housing (A;A') in advance of connecting said first and second connector housings (A,B;A',B')

3. The connector according to claim 1 or 2, wherein said engagement means includes resilient retaining pieces (9;13a) for retaining said locking connection detection member (C;C';C") to a rear portion of said first connector housing (A;A') in such a manner that said locking connection detection member (C;C';C") is extended rearwardly from said first connector housing (A;A').

4. The connector according to claim 3, wherein said drive means includes engagement release projections (6;16) for said resilient retaining pieces (9;13a) provided on said second connector housing (B;B').

5. The connector according to claim 3 or 4, wherein said resilient retaining pieces (9;13a) are provided on said locking connection detection member (C;C';C").

6. The connector according to claim 5, wherein said engagement means further includes stopper projections (10) formed on said locking connection detection means (C,C'), and first retaining projections (9a;13a) respectively formed on said resilient retaining pieces (9;13a) at predetermined positions apart from said stopper projections (10).

7. The connector device according to claim 6, wherein said engagement means further includes second retaining projections (3) formed on said first connector housing (A) at the rear end thereof, each of said second retaining projections (3) being interposed between said stopper projections (10) and said first retaining projections (9a) to retain said locking connection detection member (C) to the rear portion of said first connector housing (A).

8. The connector according to claim 3 or 4, wherein said resilient retaining pieces (13a) are provided in said first connector housing (A').

9. The connector according to claim 8, wherein said first connector housing (A') is formed with receiving chambers (13) passing through said first connector housing (A') from its front end to its rear end, said resilient retaining pieces (13a) being provided within said receiving chambers (13).

10. The connector according to claim 8, wherein said first connector housing is formed with terminal re-

ceiving chambers (13') for retaining terminals within said terminal retaining chambers (13'), and terminal retaining pieces (13a) in terminal retaining chambers (13') not retaining terminals serves for said resilient retaining pieces (13a).

11. The connector according to claim 9 or 10, wherein said engagement means includes forwardly-directed retaining pieces (19) projected from said locking connection detection member (C"), and engaged with said resilient retaining pieces (13a) within said receiving chambers (13) for retaining said locking connection detection member (C") to the rear portion of said first connector housing (A').

12. The connector according to one of claims 4 to 11, wherein said drive means (16;16) are formed with tapered drive surfaces (6b;16b) for resiliently displacing said resilient retaining pieces (9;13a) when the connection between said first and second connector housings (A,B;A',B') are locked.

13. The connector according to one of claims 1 to 12, wherein said first and second connector housings (A,B;A',B';F,M) are male and female connector housings, respectively.

14. The connector according to claim 12, wherein said flexible lock arms (2;103;131) are provided on said male connector housing (A;A';M) and said engagement portion (5;108;133) is formed on said female connector housing (B;B';F) for said flexible lock arm (2;103;131).

15. The connector according to claim 14, wherein said locking connection detection member (C';C") further includes an incomplete connection detection retaining portion (12) with which said flexible lock arm (2) is engaged when said male and female connector housings (A,B;A',B') are mated together but said lock arm (2) is not engaged with said engagement portion.

Patentansprüche

1. Steckverbinder, mit:

ein Paar ersten und zweiten Verbindergehäusen (A, B; A', B'; F, M; B, A), die miteinander zu verbinden sind;

einem elastischen Verriegelungsarm (2; 103; 131), der auf einem (A; A'; M; A) des ersten und zweiten Verbindergehäuses (A, B; A'; B'; F, M; B, A) vorgesehen ist;

einem Eingriffsbereich (5; 108; 133), der auf dem anderen (B; B'; F; B) des ersten und zweiten Verbindergehäuses (A, B; A'; B'; F, M; B, A) vorgesehen ist, wobei der elastische Verriegelungsarm (2; 103; 131) und der Eingriffsbereich (5; 108; 133) zum Verriegeln einer vollständigen Verbindung zwischen dem ersten und zweiten Verbindergehäuse (A, B; A', B'; F, M; B, A) vorgesehen ist; und

einem Verriegelungsverbindungs-Nachweiselement (C; C'; C"; 112; 124; C)

dadurch gekennzeichnet, daß

das verriegelungsverbindungs-Nachweiselement (C; C'; C"; 112; 124; C) und das erste Verbindergehäuse (A, A'; F; B) eine Eingriffseinrichtung (3, 9; 19a, 16a; 11, 115; 111', 115'; 135b, 138b) zum Anbringen des Verriegelungsverbindungs-Nachweiselementes (C; C'; C''; 112; 124; C) an dem ersten Verbindergehäuse (A, A', F, B) vor einer Verbindung zwischen dem ersten und zweiten Verbindergehäuse (A, B; A', B'; F, M; B, A) aufweist; und

das zweite Gehäuse (B, B', A) eine Antriebseinrichtung (6; 16; 104; 139) zum Außereingriffbringen der Eingriffseinrichtung (3, 9; 19a, 16a; 111, 115; 111', 115'; 135b, 138b) des Verriegelungsverbindungs-Nachweiselementes (C; C'; C"; 112; 124; C) von dem ersten Verbindergehäuse (A, A', F, B) bezüglich eines Vorrückens des ersten und zweiten Verbindergehäuses (A, B; A'; B"; F, M; A) zueinander als eine Folge der vollständigen Verbindung aufweist, um dadurch die Entnahme des Verriegelungsverbindungs-Nachweiselementes (C; C'; C"; 112; 124; C) zu ermöglichen, um den Verriegelungszustand des elastischen Arms (2; 103; 131) mit dem Eingriffsbereich (5; 108; 133) anzuzeigen.

2. Steckverbinder nach Anspruch 1, wobei das Verriegelungsverbindungs-Nachweiselement (C; C'; C'') auf einem hinteren Bereich des ersten Verbindergehäuses (A; A') beim Fortschreiten des Verbindens des ersten und zweiten Verbindergehäuses (A, B; A', B') zurückgehalten wird.

3. Steckverbinder nach Anspruch 1 oder 2, wobei die Eingriffseinrichtung elastische Rückhalteteile (9; 13a) einschließt zum Zurückhalten des Verriegelungsverbindungs-Nachweiselementes (C; C'; C") auf einem hinteren Bereich des ersten Verbindergehäuses (A; A') in einer solchen Weise, daß das verriegelungsverbindungs-Nachweiselement (C; C'; C") sich rückwärts von dem ersten Verbindergehäuse (A; A') erstreckt.

4. Steckverbinder nach Anspruch 3, wobei die Antriebseinrichtung Eingriffslösevorsprünge (6; 16) für die elastischen Rückhalteteile (9; 13a) einschließt, die auf dem zweiten Verbindergehäuse (B; B') vorgesehen sind.

5. Steckverbinder nach Anspruch 3 oder 4, wobei die elastischen Rückhalteteile (9; 13a) auf dem Verriegelungsverbindungs-Nachweiselement (C; C'; C") vorgesehen sind.

6. Steckverbinder nach Anspruch 5, wobei die Eingriffseinrichtung ferner Anschlagvorsprünge (10) einschließt, die auf der Verriegelungsverbindungs-Nachweiseinrichtung (C; C') ausgebildet sind, und erste Rückhaltevorsprünge (9a; 13a) einschließt, die jeweils auf den elastischen Rückhalteteilen (9; 13a) an vorbestimmten Positionen abseits von den Anschlagvorsprüngen (10) ausgebildet sind.

7. Steckverbinder nach Anspruch 6, wobei die Eingriffseinrichtung ferner zweite Rückhaltevorsprünge (3) einschließt, die auf dem ersten Verbindergehäuse (A) an dessen hinterem Ende ausgebildet sind, wobei jeder der zweiten Rückhaltevorsprünge (3) zwischen den Anschlagvorsprüngen (10) und den ersten Rückhaltevorsprüngen (9a) zwischenliegend angeordnet sind, um das Verriegelungsverbindungs-Nachweiselement (C) auf dem hinteren Bereich des ersten Verbindergehäuses (A) zurückzuhalten.

8. Steckverbinder nach Anspruch 3 oder 4, wobei die elastischen Rückhalteteile (13a) auf dem ersten Verbindergehäuse (A') vorgesehen sind.

9. Steckverbinder nach Anspruch 8, wobei das erste Verbindergehäuse (A') mit Aufnahmekammern (13) ausgebildet ist, die durch das ersten Verbindergehäuse (A') von dessen vorderem Ende zu dessen hinterem Ende hindurchtreten, wobei die elastischen Rückhalteteile (13a) innerhalb der Aufnahmekammern (13) vorgesehen sind.

10. Steckverbinder nach Anspruch 8, wobei das erste Verbindergehäuse mit Anschlußklemmen-Aufnahmekammern (13') ausgebildet ist zum Zurückhalten von Anschlußklemmen innerhalb der Anschlußklemmen-Rückhaltekammern (13'), und mit Anschlußklemmen-Rückhalteteilen (13a) in den Anschlußklemmen-Rückhaltekammern (13') ausgebildet ist, die nicht die Anschlußklemmen zurückhalten und die für die elastischen Rückhalteteile (13a) dienen.

11. Steckverbinder nach Anspruch 9 oder 10, wobei die Eingriffseinrichtung vorwärtsgerichtete Rückhalteteile (19) einschließt, die von dem Verriegelungsverbindungs-Nachweiselement (C") hervorstehen und die mit den elastischen Rückhalteteile (13a) innerhalb der Aufnahmekammern (13) in Eingriff sind zum Zurückhalten des Verriegelungsverbindungs-Nachweiselementes (C") auf dem hinteren Bereich des ersten Verbindergehäuses (A').

12. Steckverbinder nach einem der Ansprüche 4 bis 11, wobei die Antriebseinrichtung (16; 16) mit abgeschrägten Antriebsflächen (6b; 16b) zum elastischen Versetzen der elastischen Rückhalteteile (9; 13a) ausgebildet ist, wenn die Verbindung zwischen dem ersten und zweiten Steckverbindergehäuse (A, B; A,'; B') verriegelt ist.

13. Steckverbinder nach einem der Ansprüche 1 bis 12, wobei das erste und zweite Verbindergehäuse (A, B; A', B'; F, M) jeweils Stecker- und Buchsen-Verbindergehäuse sind.

14. Steckverbinder nach Anspruch 12, wobei die elastischen Verriegelungsarme (2; 103; 131) auf dem Stecker-Verbindergehäuse (A; A'; M) vorgesehen sind, und wobei der Eingriffsbereich (5; 108; 133) auf dem Buchsen-Verbindergehäuse (B; B'; F) für den elastischen Verriegelungsarm (2; 103; 131) ausgebildet ist.

15. Steckverbinder nach Anspruch 14, wobei das Verriegelungsverbindungs-Nachweiselement (C'; C") ferner einen Rückhaltebereich (12) für einen Nachweis einer unvollständigen Verbindung einschließt, wobei der elastische Verriegelungsarm (2) in Eingriff befindlich ist, wenn das Stecker- und Buchsen-Verbindergehäuse (A, B; A', B') zusammengepaßt sind, aber der Verriegelungsarm (2) nicht mit dem Eingriffsbereich in Eingriff befindlich ist.

Revendications

1. Connecteur comprenant :

   - une paire d'un premier et d'un second boîtier de connecteur (A, B ; A', B'; F, M ; B, A) destinés à être connectés l'un à l'autre ;
   - un bras de blocage flexible (2 ; 103 ; 131) prévu sur l'un (A ; A' ; M; A) desdits premier et second boîtiers de connecteur (A, B; A', B' F, M ; B, A) ;
   - une partie d'engagement (5 ; 108; 133) prévue sur l'autre (B ; B' ; F ; B) desdits premier et second boîtiers de connecteur (A, B ; A', B' ; F, M ; B, A), ledit bras de blocage flexible (2 ; 103 ; 131) et ladite partie d'engagement (5 ; 108 ; 133) étant prévus pour verrouiller une connexion complète entre le premier et le second boîtier de connecteur (A, B ; A', B' ; F,M ; B, A) ; et

- un élément de détection (C ; C'; C" ; 112 ; 124 ; C) de la connexion verrouillée ;

caractérisé en ce que

ledit élément de détection de la connexion verrouillée (C ; C' ; C" ; 112 ; 124 ; C) et ledit premier boîtier de connecteur (A, A' ; F ; B) comportent des moyens d'engagement (3, 9 ; 19a, 16a ; 11, 115 ; 111', 115'; 135b, 138b) pour attacher ledit élément de détection de la connexion verrouillée (C ; C' ; C" ; 112 ; 124 ; C) sur le premier boîtier de connecteur (A, A', F, B) antérieurement à la connexion entre le premier et le second boîtier de connecteur (A, B ; A', B' ; F, M ; B, A) ; et en ce que
le second boîtier (B, B', A) comporte des moyens d'entraînement (6 ; 16 ; 104 ; 139) pour dégager les moyens d'engagement (3, 9 ; 19a, 16a ; 11, 115 ; 111', 115'; 135b, 138b) de l'élément de détection de la connexion verrouillée (C ; C' ; C" ; 112 ; 124 ; C) et le premier boîtier de connecteur (A, A', F, B) en raison d'une avance mutuelle du premier et du second boîtier de connecteur (A, B ; A', B" ; F, M ; A) à titre de conséquence de la connexion complète, pour permettre ainsi l'enlèvement de l'élément de détection de la connexion verrouillée (C ; C'; C" ; 112 ; 124 ; C) pour indiquer la connexion verrouillée du bras flexible (2 ; 103 ; 131) avec la partie d'engagement (5 ; 108 ; 133).

2. Connecteur selon la revendication 1, dans lequel ledit élément de détection de la connexion verrouillée (C ; C', C") est retenu sur une partie arrière dudit premier boîtier de connecteur (A ; A') en avance de la connexion dudit premier et dudit second boîtier de connecteur (A, B ; A', B').

3. Connecteur selon l'une quelconque des revendications 1 et 2, dans lequel les moyens d'engagement incluent des pièces de retenue élastiques (9 ; 13a) pour retenir ledit élément de détection de la connexion verrouillée (C ; C' ; C") sur une partie arrière dudit premier boîtier de connecteur (A ; A') d'une manière telle que ledit élément de détection de la connexion verrouillée (C ; C' ; C") s'étend vers l'arrière depuis ledit premier boîtier de connecteur (A ; A').

4. Connecteur selon la revendication 3, dans lequel lesdits moyens d'entraînement incluent des projections de libération d'engagement (6 ; 16) pour lesdites pièces de retenue élastiques (9 ; 13a), prévues sur ledit second boîtier de connecteur (B ; B').

5. Connecteur selon l'une ou l'autre des revendications 3 et 4, dans lequel lesdites pièces de retenue élastiques (9 ; 13a) sont prévues sur ledit élément de détection de la connexion verrouillée (C ; C' ; C").

6. Connecteur selon la revendication 5, dans lequel lesdits moyens d'engagement incluent en outre des projections d'arrêt (10) formées sur lesdits moyens de détection (C, C') et des premières projections de retenue (9a ; 13a) formées respectivement sur lesdites pièces de retenue élastiques (9 ; 13a) à des positions prédéterminées en écartement desdites projections d'arrêt (10).

7. Connecteur selon la revendication 6, dans lequel lesdits moyens d'engagement incluent en outre des secondes projections de retenue (3) formées sur ledit premier boîtier de connecteur (A) à l'extrémité arrière de celui-ci, chacune desdites secondes projections de retenue (3) étant interposée entre lesdites projections d'arrêt (10) et lesdites premières projections de retenue (9a) pour retenir ledit élément de détection (C) à la partie arrière dudit premier boîtier de connecteur (A).

8. Connecteur selon l'une ou l'autre des revendications 3 et 4, dans lequel lesdites pièces de retenue élastiques (13a) sont prévues dans ledit premier boîtier de connecteur (A').

9. Connecteur selon la revendication 8, dans lequel ledit premier boîtier de connecteur (A') est formé avec des chambres de réception (13) qui traversent ledit premier boîtier de connecteur (A') depuis son extrémité avant jusqu'à son extrémité arrière, lesdites pièces de retenue élastiques (13a) étant prévues dans lesdites chambres de réception (13).

10. Connecteur selon la revendication 8, dans lequel ledit premier boîtier de connecteur est formé avec des chambres de réception de bornes (13') pour retenir des bornes à l'intérieur desdites chambres de retenue de bornes (13'), et des pièces de retenue de borne (13a) dans des chambres de retenue de bornes (13') qui ne retiennent pas de bornes servent pour lesdites pièces de retenue élastiques (13a).

11. Connecteur selon l'une ou l'autre des revendications 9 et 10, dans lequel lesdits moyens d'engagement incluent des pièces de retenue dirigées vers l'avant (19) qui se projettent depuis ledit élément de détection de la connexion verrouillée (C") et engagées avec lesdites pièces de retenue élastiques (13a) à l'intérieur desdites chambres de réception (13) pour retenir ledit élément de détection (C") à la partie arrière dudit premier boîtier de connecteur (A').

12. Connecteur selon l'une quelconque des revendications 4 à 11, dans lequel lesdits moyens d'entraînement (16 ; 16) sont formés avec des surfaces d'entraînement inclinées (6b ; 16b) pour déplacer élastiquement lesdites pièces de retenue élastiques (9 ; 13a) lorsque la connexion entre lesdits premier et second boîtiers de connecteur (A, B; A', B') est verrouillée.

13. Connecteur selon l'une quelconque des revendications 1 à 12, dans lequel lesdits premier et second boîtiers de connecteur (A, B ; A', B' ; F, M) sont respectivement des boîtiers de connecteur mâle et femelle.

14. Connecteur selon la revendication 12, dans lequel lesdits bras de blocage flexibles (2 ; 103 ; 131) sont prévus sur ledit boîtier de connecteur mâle (A ; A'; M) et ladite partie d'engagement (5 ; 108 ; 133) est formée sur ledit boîtier de connecteur femelle (B ; B'; F) pour ledit bras de blocage flexible (2 ; 103 ; 131).

15. Connecteur selon la revendication 14, dans lequel ledit élément de détection de la connexion verrouillée (C' C") inclut en outre une partie de retenue et de détection d'une connexion incomplète (12), avec laquelle ledit bras de blocage flexible (2) est engagé lorsque lesdits boîtiers de connecteur mâle et femelle (A, B ; A', B') sont accouplés ensemble mais que ledit bras de blocage (2) n'est pas engagé avec ladite partie d'engagement.

FIG. 1

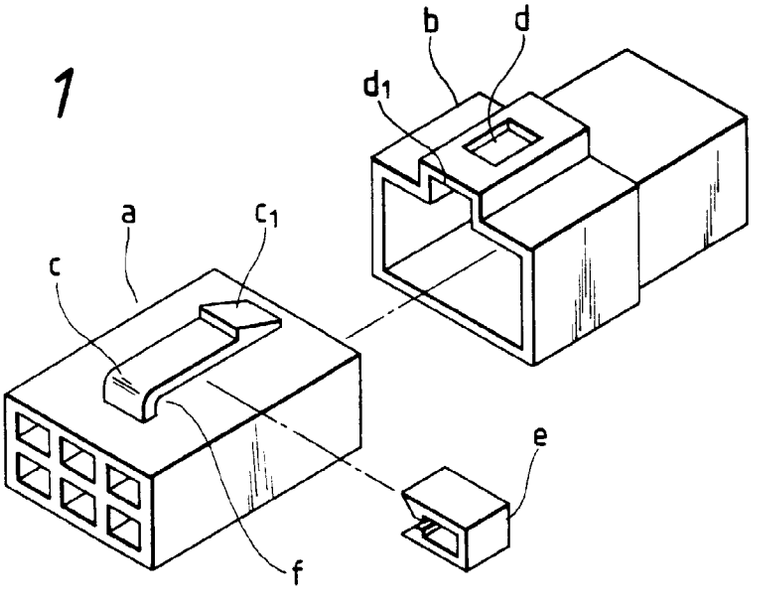

FIG. 2

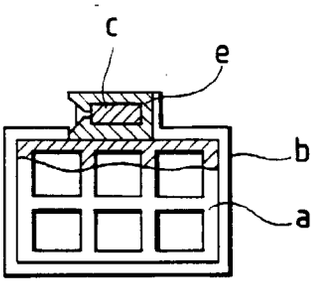

FIG. 3

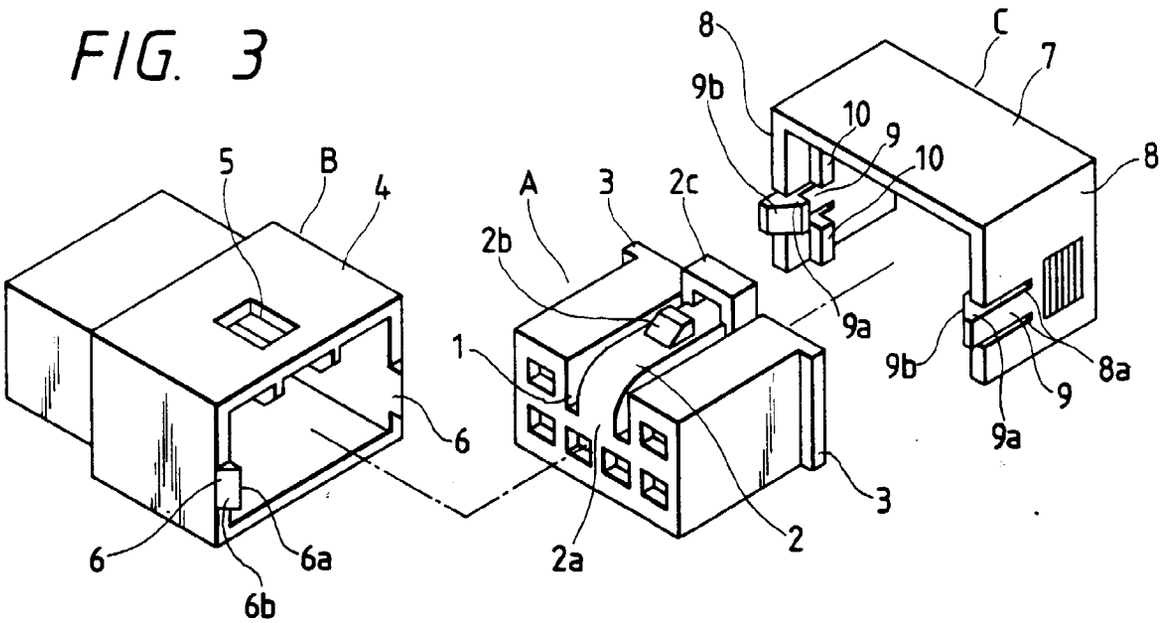

FIG. 4A

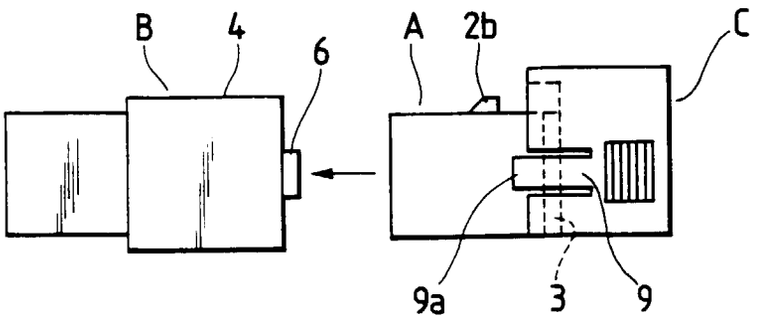

FIG. 4B

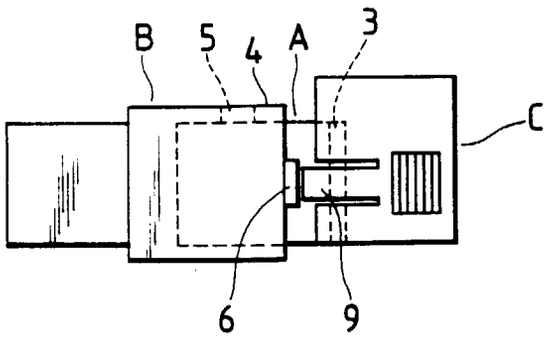

FIG. 4C

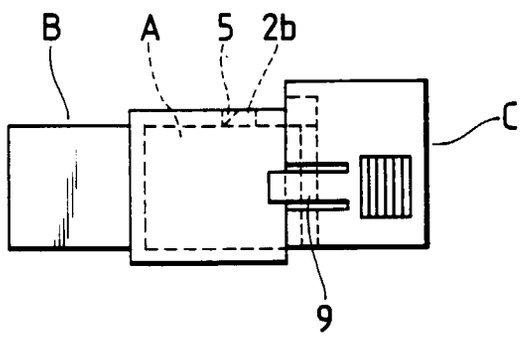

FIG. 4D

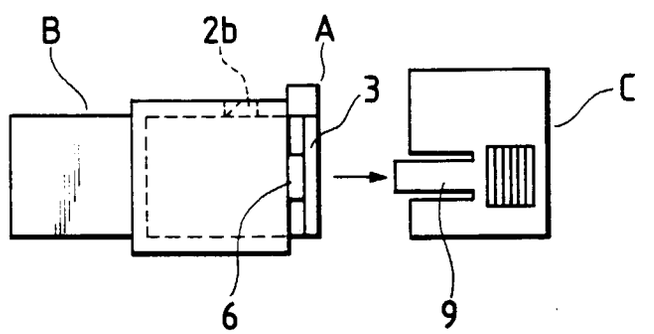

FIG. 5A

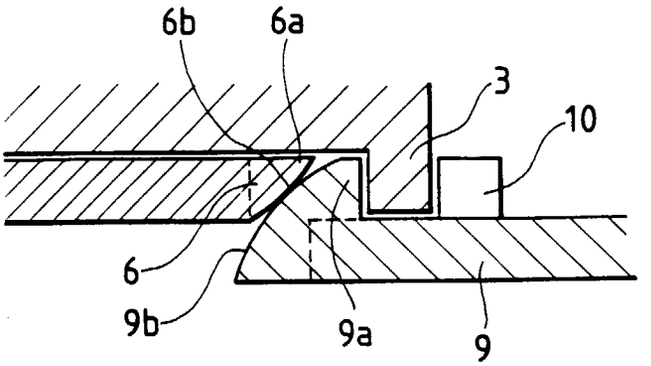

FIG. 5B

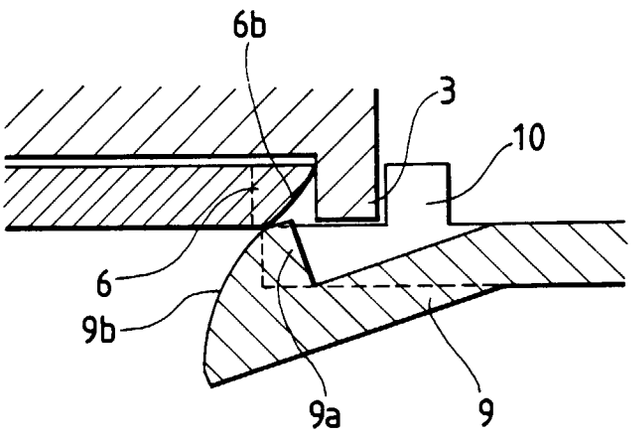

FIG. 6

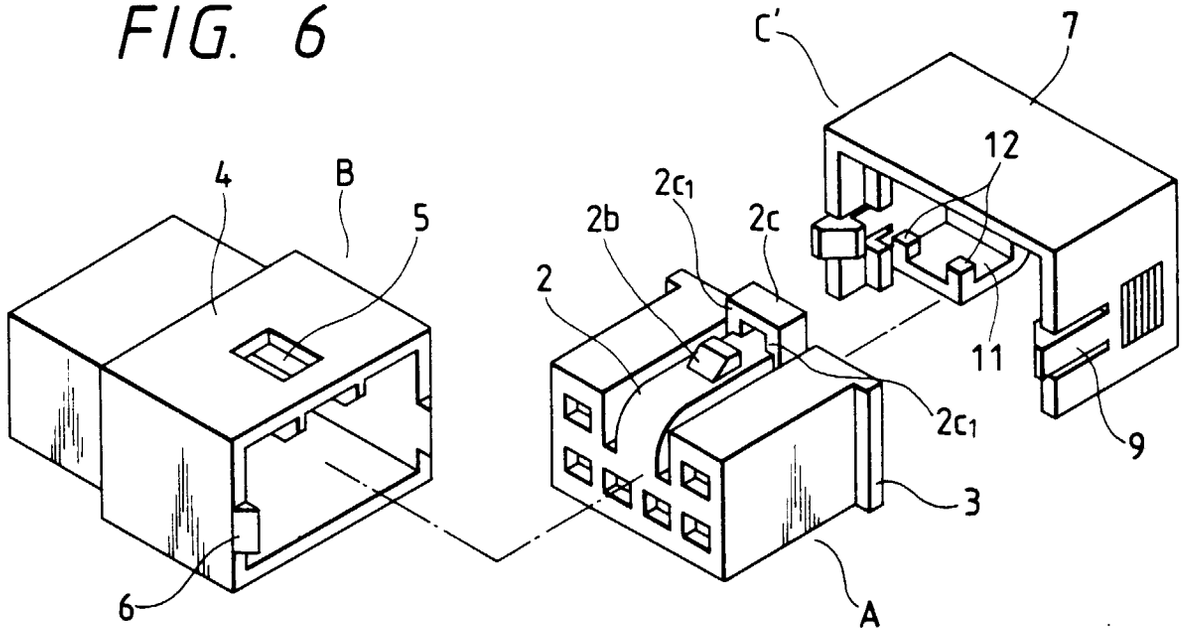

FIG. 7

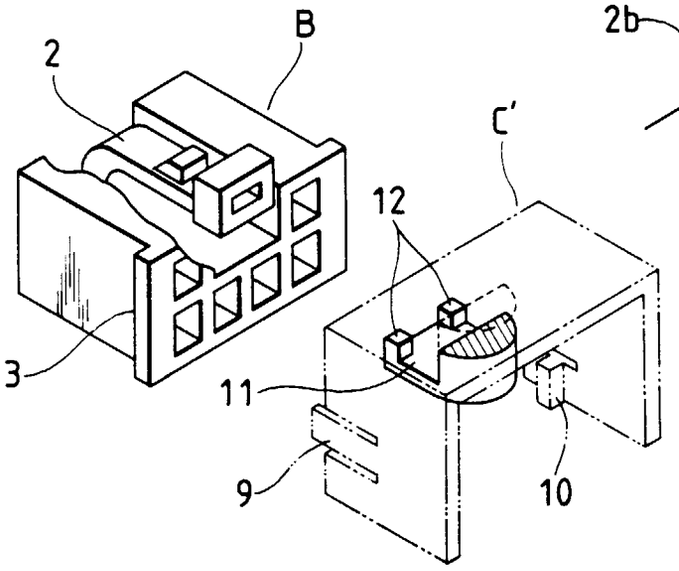

FIG. 8

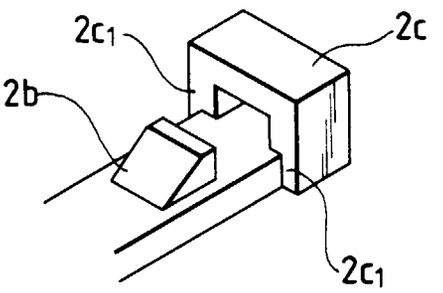

FIG. 9A

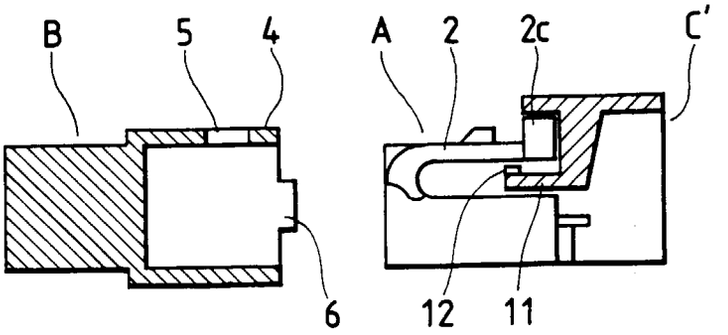

FIG. 9B

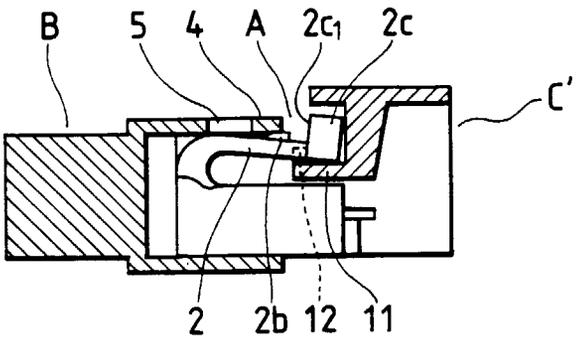

FIG. 9C

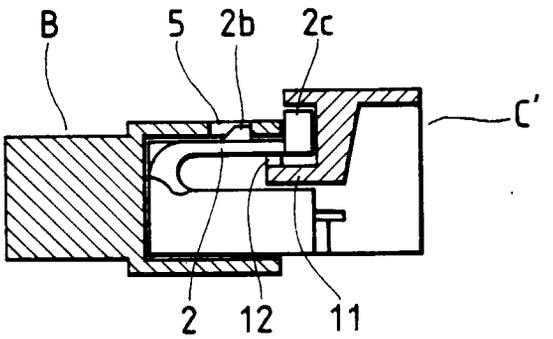

FIG. 9D

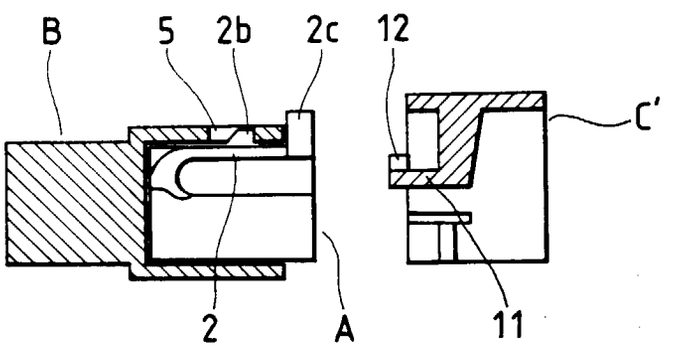

FIG. 10

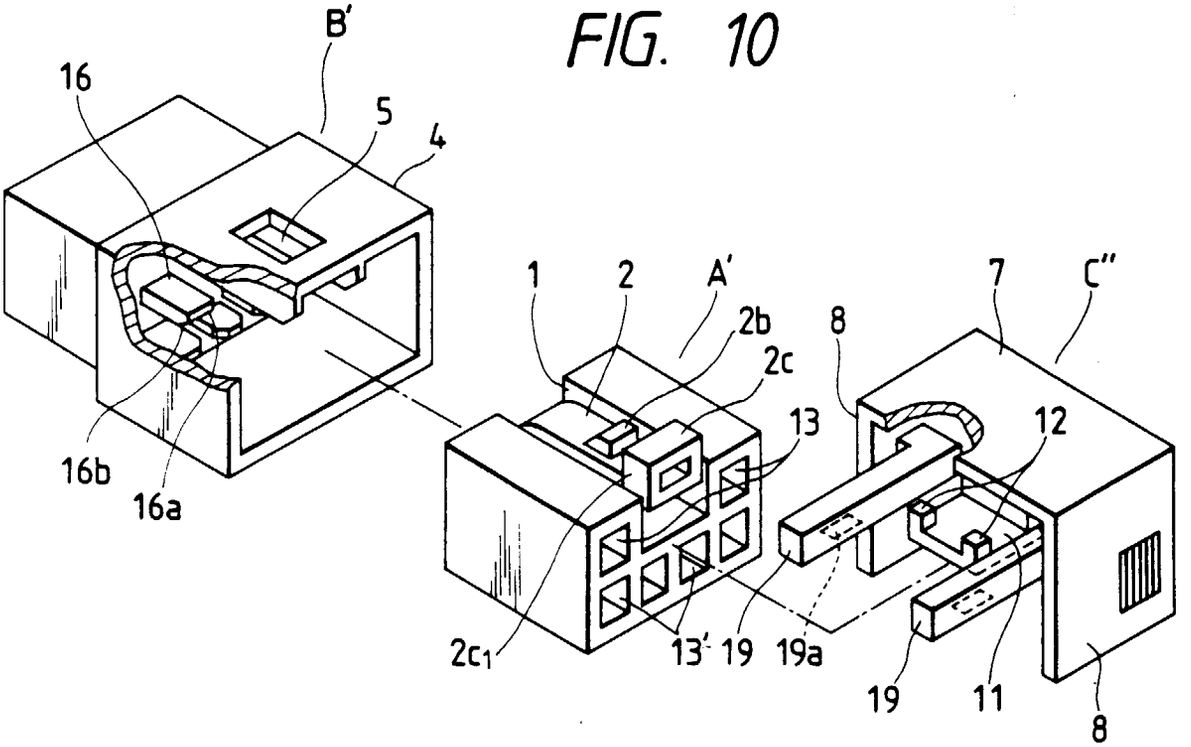
B'
16
5
4
16b
16a
1
2
A'
2b
2c
13
2c1
13'
19
19a
7
C''
8
12
19
11
8

FIG. 11

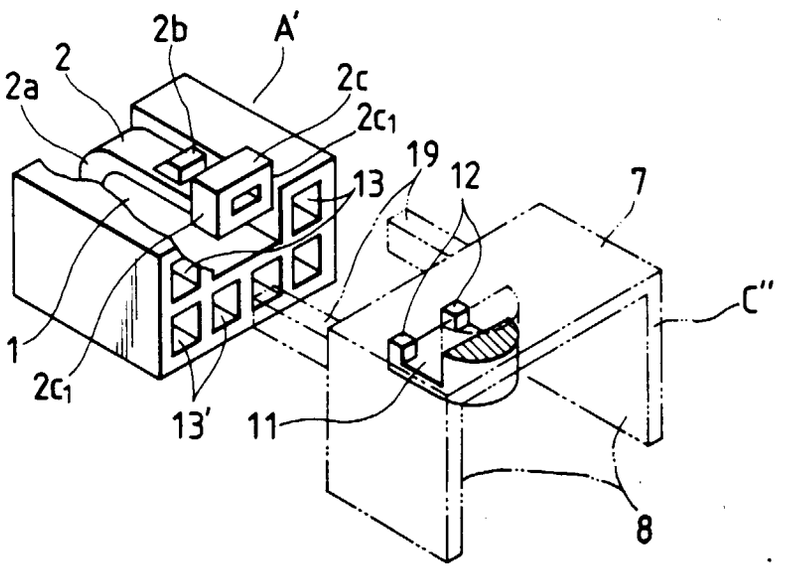
2b
A'
2
2a
2c
2c1
19
12
13
7
C''
1
2c1
13'
11
8

FIG. 12A

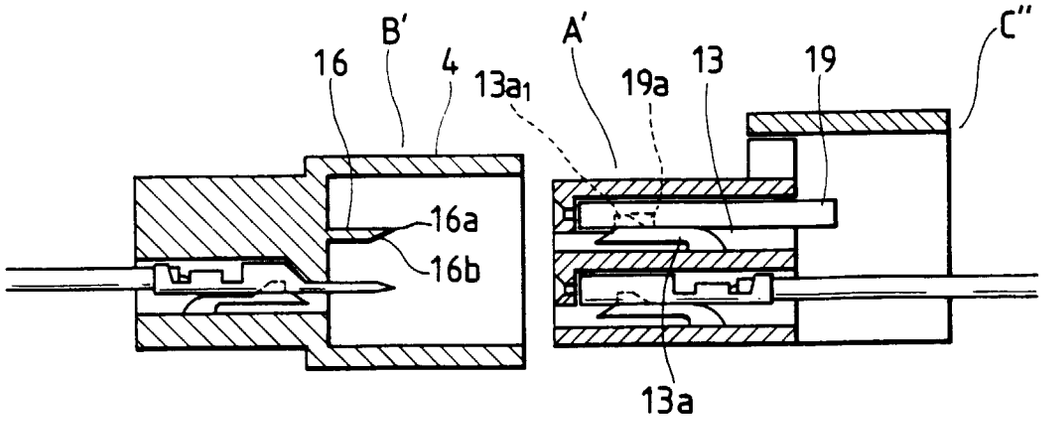

FIG. 12B

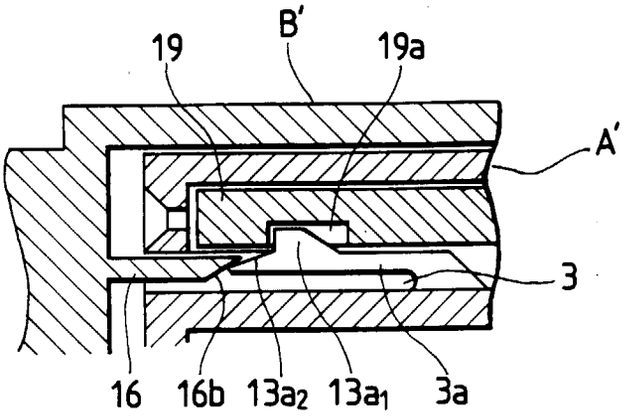

FIG. 12C

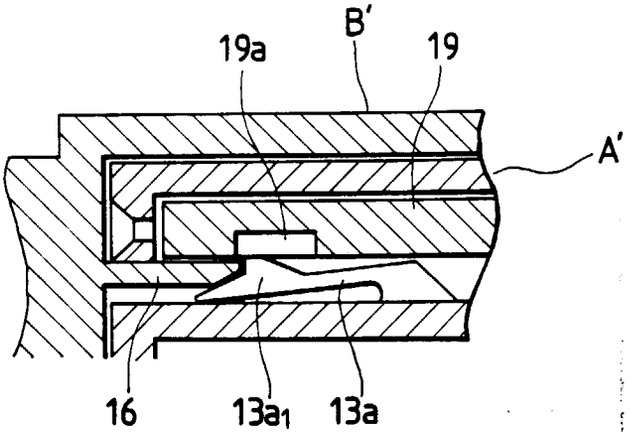

FIG. 13A

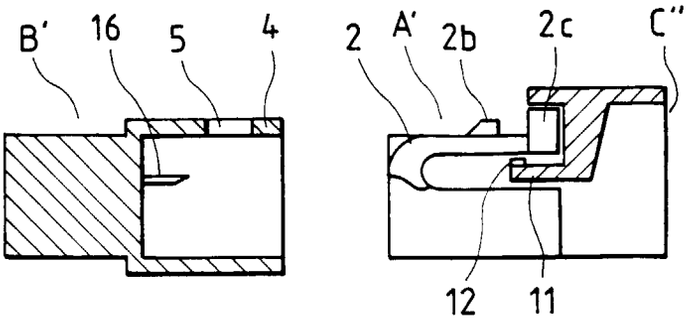

FIG. 13B

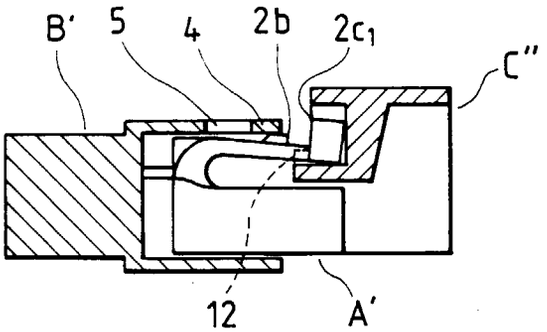

FIG. 13C

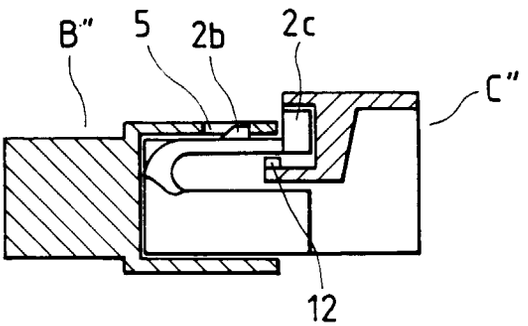

FIG. 13D

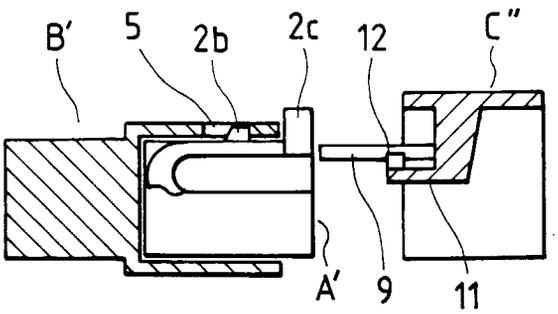

FIG. 14

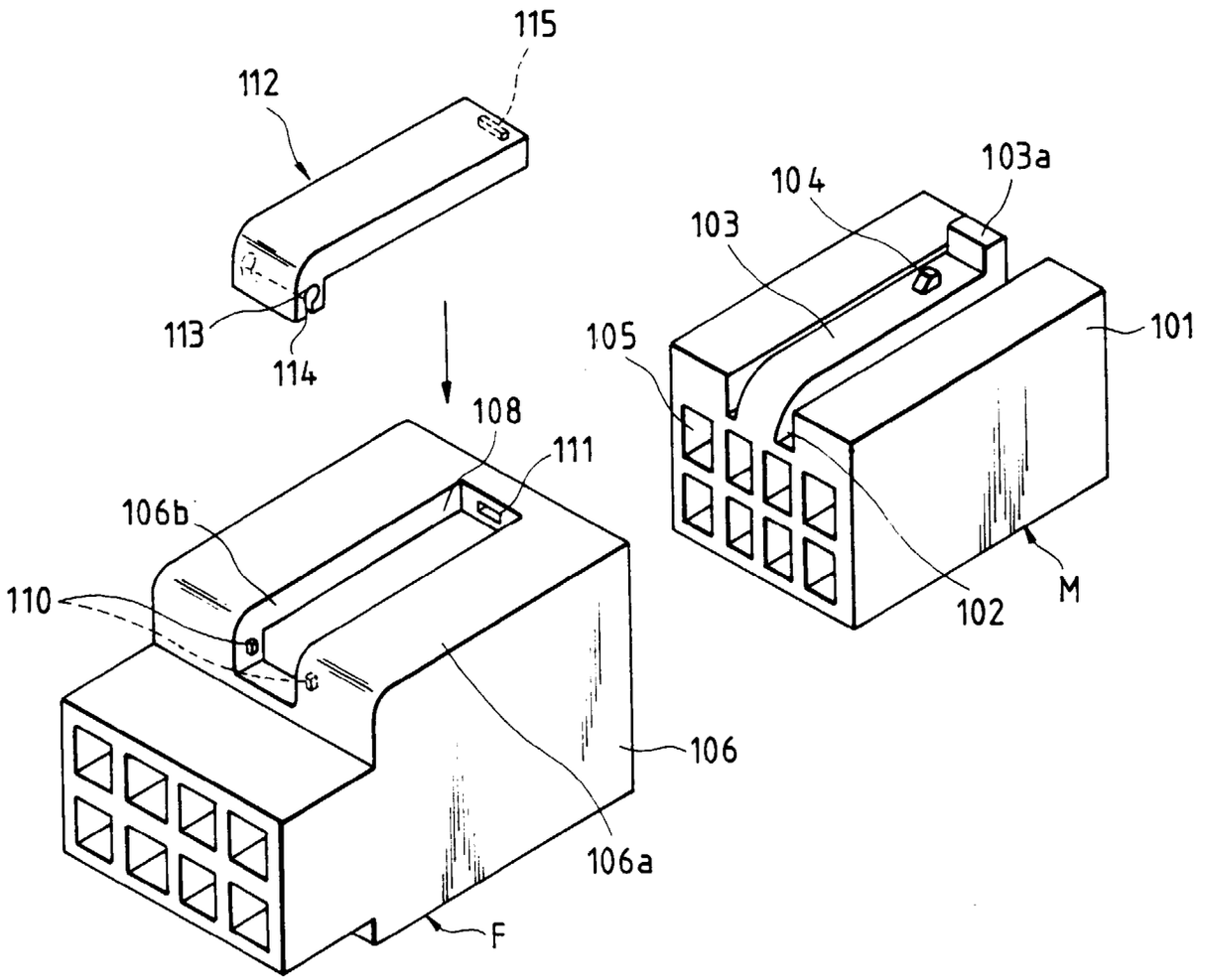
115
112
113
114
108
111
106b
110
106
106a
F
103a
104
103
105
101
102
M

FIG. 15A

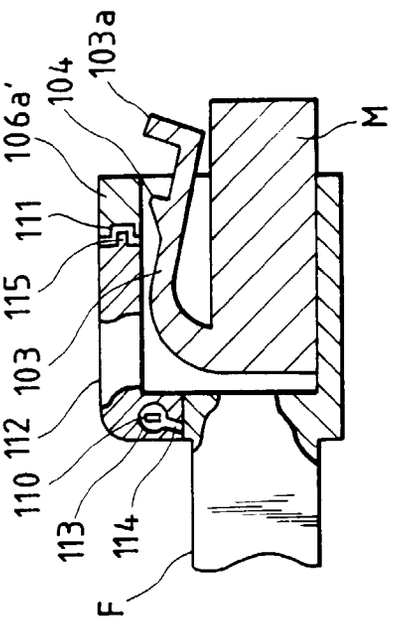

FIG. 15B

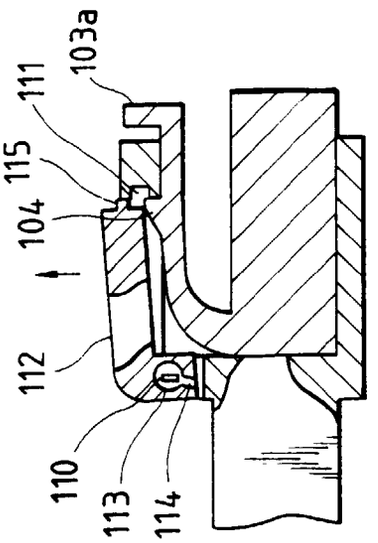

FIG. 16A

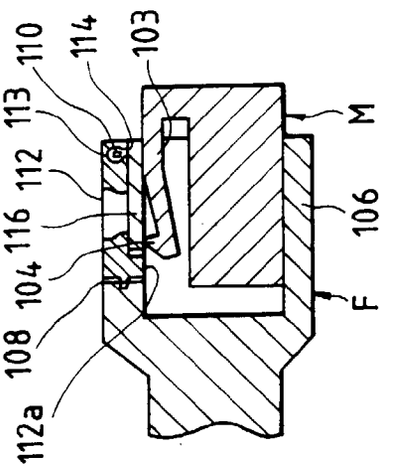

FIG. 16B

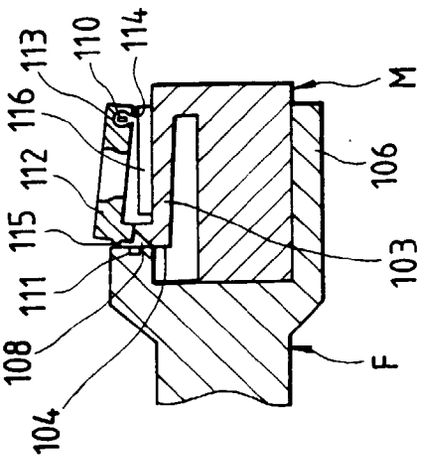

FIG. 16C

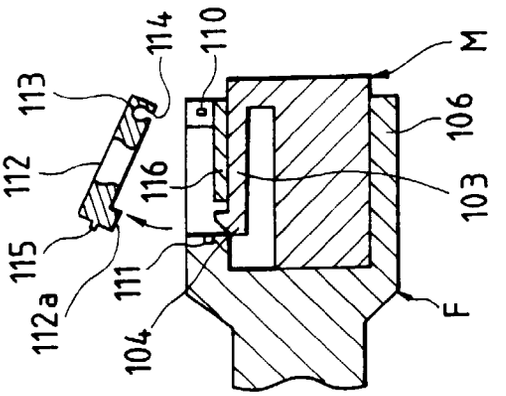

FIG. 17

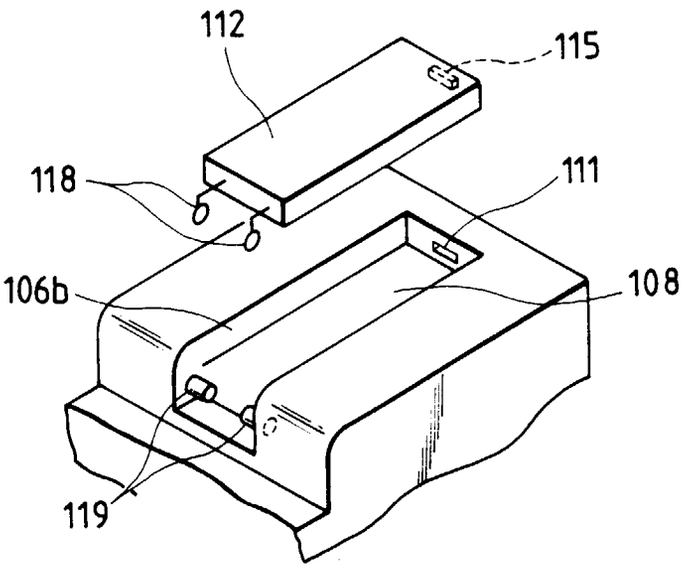

FIG. 18

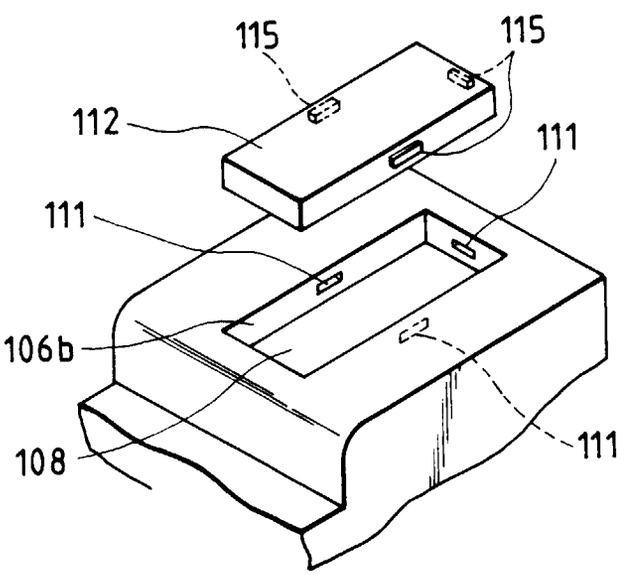

FIG. 19

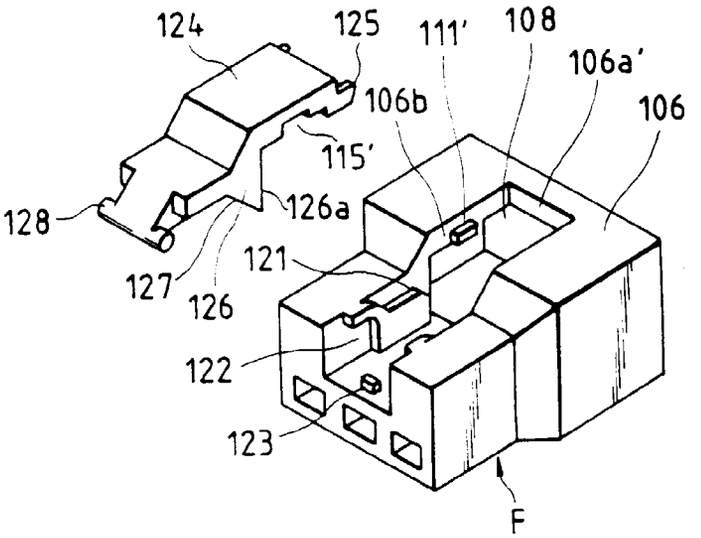

FIG. 20A

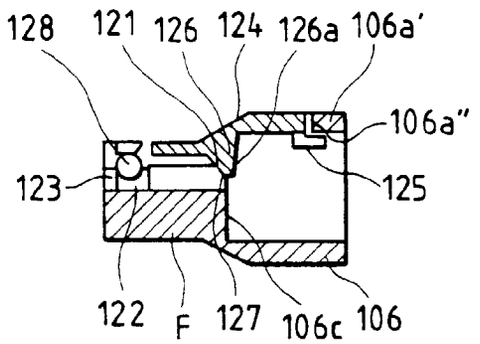

FIG. 20B

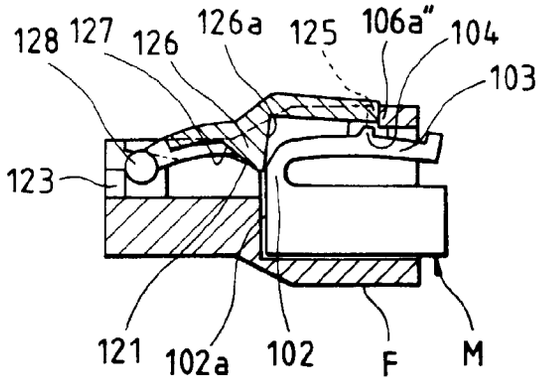

FIG. 20C

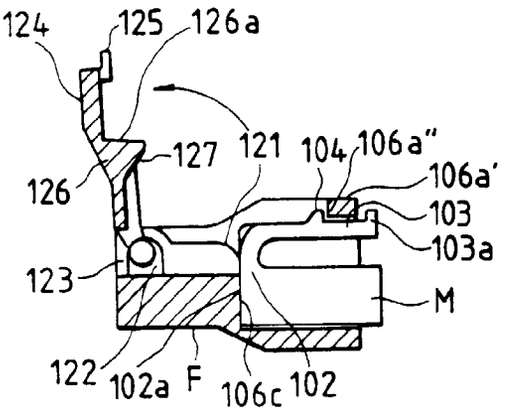

FIG. 21

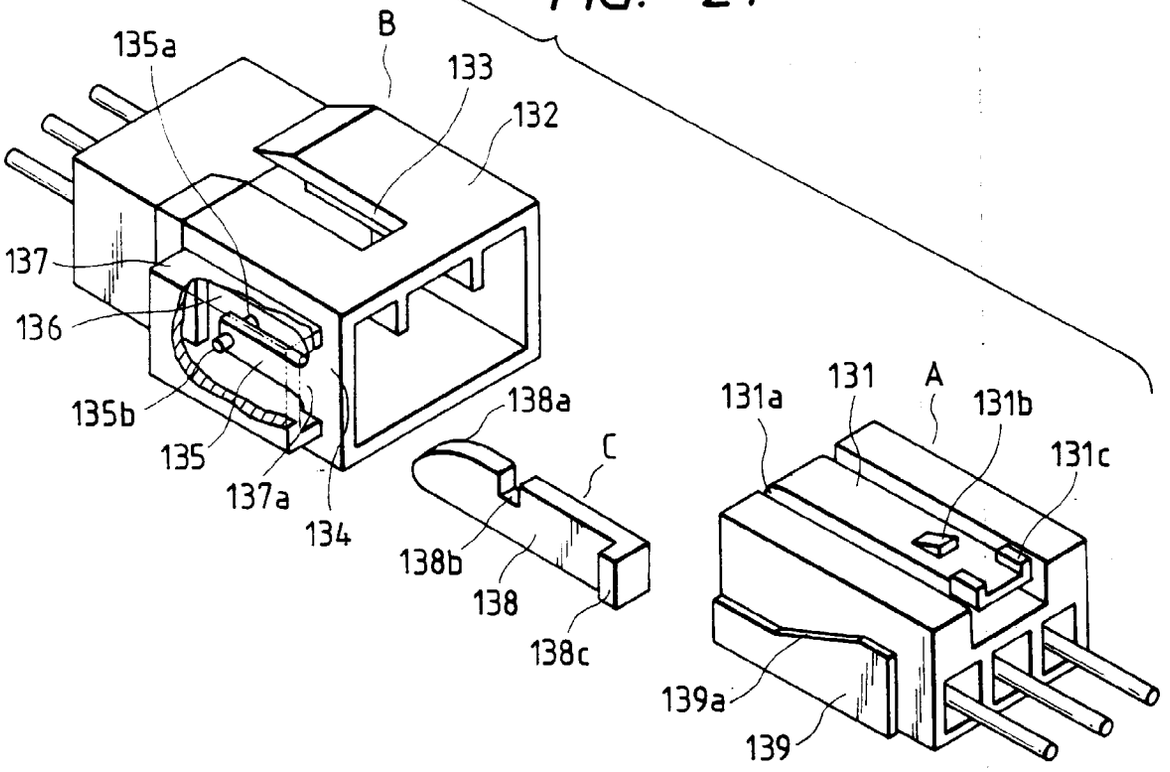
135a
B
133
132
137
136
135b
135
137a
134
138a
C
138b
138
138c
131a
131
A
131b
131c
139a
139

FIG. 22

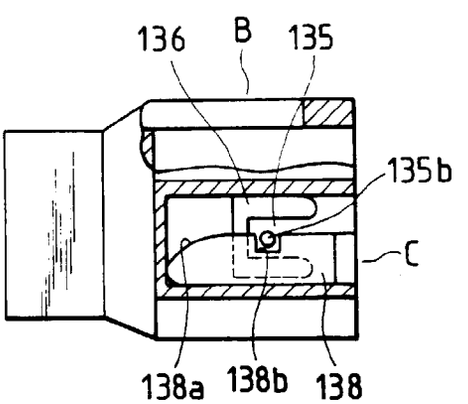
136
B
135
135b
C
138a
138b
138

FIG. 23A

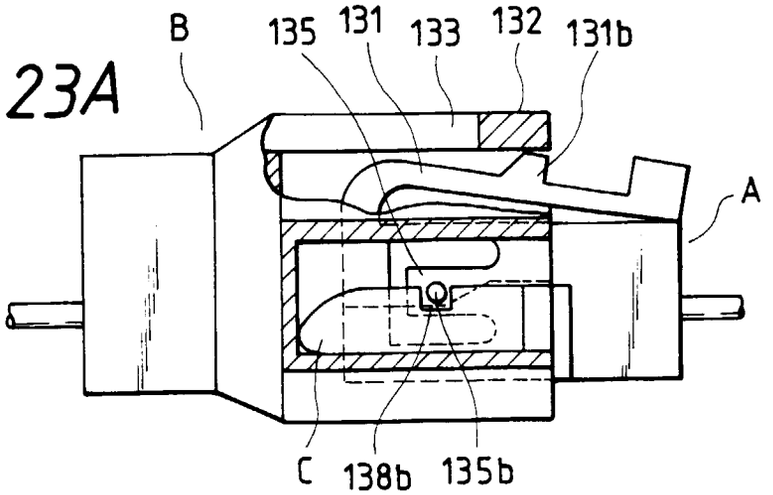

FIG. 23B

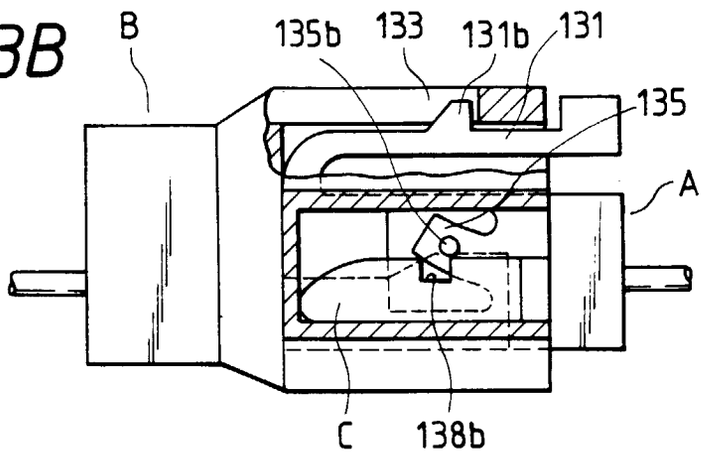

FIG. 23C

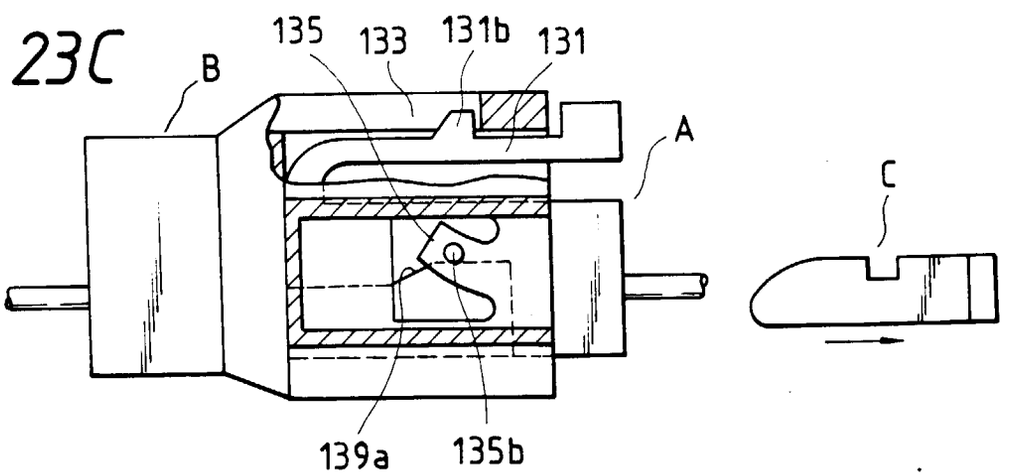

FIG. 24

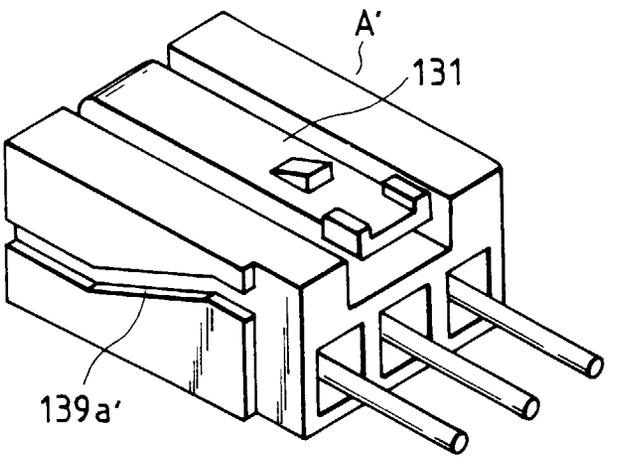

FIG. 25