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(11) Publication number:

0 564 949 A1

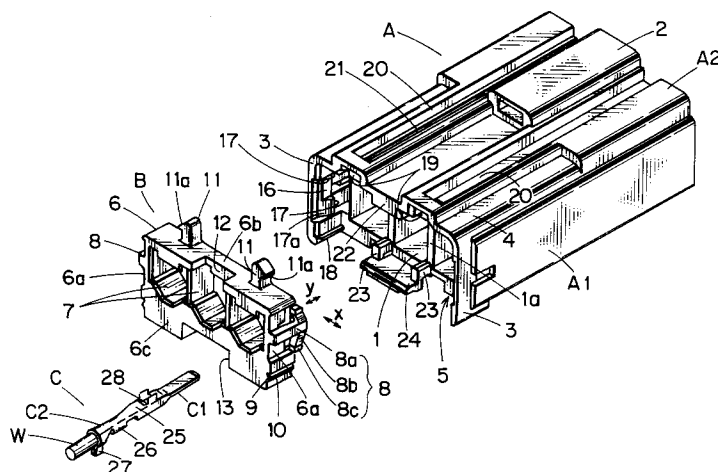
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EUROPEAN PATENT APPLICATION(21) Application number: **93105163.5**(51) Int. Cl.⁵: **H01R 13/436**(22) Date of filing: **29.03.93**(30) Priority: **08.04.92 JP 87316/92**(43) Date of publication of application:
13.10.93 Bulletin 93/41(84) Designated Contracting States:
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D-80504 München (DE)(54) **Electrical connector.**

(57) An improvement in an electrical connector having a terminal locking member for preventing terminals accommodated in terminal accommodating cavities from being slipped off. The electrical connector according to the present invention comprising: terminal accommodating cavities; a connector housing having the terminal accommodating cavities; a terminal locking member mounted to the rear portion of the connector housing in two steps of a preliminarily locked state and a completely locked state. Further, a bracket inserting portion having an opening may

be formed on an outer peripheral wall of the connector housing on the side that the terminal locking member is mounted, and the terminal locking member covers the opening of the bracket inserting portion to prevent the bracket inserting portion from being inserted into a bracket in the preliminarily locked state of the terminal locking member, and the opening of the bracket inserting portion is opened to allow the bracket inserting portion to be inserted into the bracket in the completely locked state.

F I G . 1

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical connector, and more particularly to an improvement in an electrical connector having a terminal locking member for preventing terminals accommodated in terminal accommodating cavities from being slipped off.

2. Description of the Prior Art

Generally, locking means called as a terminal lance or a case lance is provided between a terminal and a terminal accommodating cavity to prevent the terminal from being slipped off. The former is used for a method of forming a struck-out lance to the terminal and engaging the lance with a locking channel which is formed on an inner wall of the terminal accommodating cavity. Further, the latter is used for a method of engaging a resilient locking arm formed on the inner wall of the terminal accommodating cavity with a shoulder or a locking hole of the terminal.

However, since such connector has been designed to accommodate a plurality of terminals or such terminals have been miniaturized, the struck-out lance and the resilient arm described above are also miniaturized, which provides difficulty in maintaining sufficient strength and sustaining force. Then, recently, it has been used a method in which a terminal locking member (a rear holder), which is provided separately from a connector housing, is used in combination with the locking means described above, which increases the sustaining force and improves the reliability of the electrical connection. Figures 12A and 12B show an example of a conventional connector having the rear holder (Japanese patent application laid-open Kokoku Heisei 1-43986), in which 12A shows a preliminarily locked condition of the rear holder b to the housing a, and 12B shows a completely locked condition.

In the electrical connector illustrated in Fig. 12A and 12B, terminals c are inserted into terminal accommodating holes a1 in the preliminarily locked condition described above and the engagement between locking pieces c1 and terminal locking claws a2 achieve a first locking state, then the rear holder b is moved to the fully locked condition to engage the terminals c with an edge b1 as a portion of the holder.

In the connector having a known structure, when the rear holder b is preliminarily locked, it is necessary to provide a stopper (shoulder) to prevent unexpected proceeding of the rear holder to the completely locked state, which necessitates two steps in which the rear holder is depressed in

the direction indicated by the arrow p and is pushed in the direction of the arrow q to obtain the completely locked state, resulting in increased number of steps in assembling work.

Meanwhile, in manufacturing a wire harness and installing the wire harness to a vehicle body, when the electrical connector is connected a mated connector, the rear holder should be in the completely locked state. However, with the conventional structure, workers or inspectors should confirm whether or not the rear holder is in the completely locked state one by one through visual observation, which provides worrisome work and necessitates remarkable attention at the work.

SUMMARY OF THE INVENTION

It is therefore the object of the present invention to provide an electrical connector in which the terminal locking member can be moved from the preliminarily locked state to the completely locked state through one step and whether or not the terminal locking member is in the completely locked state can be judged from outside with ease.

To accomplish the above objective, the electrical connector according to the present invention comprises: terminal accommodating cavities; a connector housing having the terminal accommodating cavities; and a terminal locking member mounted to the rear portion of the connector housing in two steps of a preliminarily locked state and a completely locked state.

Further, another electrical connector according to the present invention further comprising a bracket inserting portion having an opening on an outer peripheral wall of the connector housing on the side that the terminal locking member is mounted, wherein the terminal locking member covers the opening of the bracket inserting portion to prevent the bracket inserting portion from being inserted into a bracket in the preliminarily locked state of the terminal locking member, and the opening of the bracket inserting portion is opened to allow the bracket inserting portion to be inserted into the bracket in the completely locked state.

In the electrical connector according to the present invention, the movement from the preliminarily locked state to the completely locked state can be carried out by slidably moving the terminal locking member to the rear portion of the connector housing in one direction, which improves workability. Further, when the terminal locking member is not in the completely locked state, the bracket inserting portion is covered so that the bracket can not be inserted. As a result, whether or not the terminal locking member is in the completely locked state is judged with ease.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more apparent from the ensuing description with reference to the accompanying drawing wherein:

Figure 1 is an exploded perspective view of an electrical connector according to one embodiment of the present invention;

Figure 2 is a perspective bottom view of the female connector housing A of Fig. 1;

Figure 3 is a cross-sectional side view of the connector shown in Fig. 1;

Figure 4 is a rear view of the female connector housing of Fig. 1.

Figures 5A, 5B, and 5C are a perspective front view, a rear view, and a right side view of the terminal locking member of Fig. 1;

Figures 6A and 6B are rear views of the female connector housing in a preliminarily locked state and a fully locked state of the terminal locking member respectively;

Figure 7 is a cross-sectional view showing the condition in which the connector of Fig. 1 can not be locked to the bracket;

Figure 8 is a cross-sectional view showing the condition immediately before the locking between the connector and the bracket illustrated in Fig. 7;

Figure 9 is a cross-sectional view showing the condition in which the connector and the bracket of Fig. 7 are locked;

Figures 10A and 10B are partially enlarged cross-sectional views of the locking arm of Fig. 6;

Figure 11 is a partially enlarged view for explaining the preliminarily locked condition of the locking lever of Fig. 6A;

Figures 12A and 12B are cross-sectional views showing a preliminarily locked condition and a fully locked condition of a conventional electrical connector respectively.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In Figures 1 to 5, reference symbol A is a female connector housing (hereinafter merely called as "housing") made of synthetic resin and B a terminal locking member made of synthetic resin also, C a male terminal connected to an end of a wire W. The housing A comprises a housing main body A1 having a plurality of terminal accommodating cavities (three in this embodiment) for accommodating and locking the male terminals C, and a hood A2 for receiving a male connector housing not shown which is formed at a front portion of the housing main body A1. A locking chamber 2 for a locking arm not shown on the

male connector housing is formed on an upper outer wall. Further, locking piece cavities 5 having side walls 3 and an upper wall 4 for the terminal locking member B are formed on a rear face of the housing main body A1.

The terminal locking member B is provide with a frame-shaped main portion 6 having a plurality of openings 7 which oppose the terminal accommodating cavities of the housing A. The dimension of the openings 7 is sufficient when the male terminal C is able to be inserted through the opening 7 in the preliminarily locked state of the terminal locking member B described below. Therefore, the openings 7 may be formed smaller than a cross-sectional area of the openings. Further, tapered pushing locking faces 7a shown in Figure 5 for the male terminals C are formed at inner edges of the front face of the openings 7. The frame-shaped main portion 6 is provided with locking arms 8, locking channels 9, and locking projections 10 for the housing A at outer faces of the right and left sides of the frame-shaped body 6a. On an upper frame 6b of the frame-shaped body is provided a pair of locking levers 11 and a concave portion 12. The locking arms 8 comprise horizontally resilient arms 8a which extend from a rear portion of the frame-shaped body to a front portion thereof and axially resilient arms 8b which extend from tip portions of the horizontally resilient arms 8a to form a T-shape. The axially resilient arms 8b are formed as locking springs which bend backward and locking projections 8c are formed at free ends thereof. The horizontally resilient arms 8a deform resiliently in the direction indicated by the arrow y. Further, the locking levers 11 each has a shape of a hook and locking claws 11a each projects outward from a tip thereof. A lower portion 6c of the frame-shaped main body 6 has a concave portion 13 at the center thereof, a pair of channels 14 which are positioned at both sides of the concave portion 13 at a front face thereof, and a pair of rotation preventing pieces 15 extending forwardly from inner wall of the concave portion. The rotation preventing pieces 15 comprise L-shaped arms 15a and locking projections 15b formed at inner portion at tip portions thereof as illustrated in Fig. 5.

Locking portions 17 for the locking projections 8c are vertically arranged with the channels 16 for the horizontally resilient arms 8a of the locking arms 8 between at an inner central portion of the side wall 3 on a rear face side of the housing main body A1, that is, on the locking piece cavities 5 side of the housing main body A1. Further, locking projections 18 for the locking channels 9 are mounted on a lower portion of the side wall 3. Two rows of locking chambers 19 for the locking lever 11 are formed so as to project on an upper wall. The locking chambers 19 each is provided with a lock-

ing hole 20 and a full locking projection 21 as shown in Fig. 8. A locking portion 12 is provided between the locking chambers 19. Further, positioning projections 23 for engaging the pair of channels 14 are provided on a lower portion of the housing main body A1 on the rear face side of the housing main body A1. The positioning projections 23 are located at ends of the partitions 1a of the terminal accommodating cavities 1. A guide strips 24 having a L-shaped cross-section projects in such a manner as to connect lower ends of the both projections 23 with each other.

The male terminal C is provided with an electrical contact portion C1 at a main body 25 which is produced by bending a conductive metal plate into a rectangular tube, and a wire connecting portion C2 at a rear portion of the main body 25. The electrical contact portion C1 is formed as a folded double-plate structure and the wire connecting portion C2 comprises a pair of conductor holding pieces 26 and insulator holding pieces 27. The main body 25 is provided a locking hole 28 at a bottom plate portion thereof. Meanwhile, another terminal having a stabilizer not shown may be attached next to the insulator holding piece 27 as the male terminal C.

A bracket inserting portion 40 having a shape of a channel is formed on a lower outer peripheral wall of the housing main body A1. This bracket inserting portion 40 has a function of checking whether or not the housing A is connected to a vehicle body as well as the terminal locking member B is in the completely locked state. The bracket inserting portion 40 is provided with an opening 40a on the side that the terminal locking member B is inserted and a resilient locking piece 41 having a projection 41a is attached to the bottom wall.

Next, a method of using the terminal locking member B and the action thereof will be explained. First, the terminal locking member B is inserted into the rear face of the housing and is preliminarily locked therein. The male terminal C is inserted into the terminal accommodating cavity 1 under the condition described above and is locked therein. Finally, the terminal locking member B is slidably moved upward so as to be completely locked and prevented from being slipped off backward.

In Fig. 3, the terminal locking member B is inserted into the locking piece cavity of the housing A in the direction indicated by the arrow P. The terminal locking member B proceeds into the locking piece cavity while the locking channel 9 thereof being guided by the locking projection 18 on the side wall 3 of the housing A. In such a case, the concave portion 13 on the lower face of the terminal locking member B is supported by the guide strip 24, and the double locking levers 11 proceed into the locking chambers 19, and the positioning

projections 23 engage the channels 14 at the front face of the terminal locking member B.

Further, the locking arm 8 of the terminal locking member B bends inwardly at the proceeding thereof since the upper and lower locking projections 8c with respect to the locking arm 8 are slidably guided by the tapered faces 17a of the locking portion 17 on the inner side walls. Then, the locking arms 8 return to the original positions by their resiliency after the locking projections 8c cross over the tapered faces 17c. At this moment, the front face B0 of the terminal locking member B contacts the rear face A0 of the housing A and the rear faces of the locking projections 8c engage the locking portions 17 to achieve the preliminarily locked condition, which prevents the terminal locking member B from being slipped off backwardly. Further, the terminal locking member B is urged to the housing A by the spring force of the axially resilient arms 8b which are formed as locking springs.

In the preliminarily locked state described above, the locking channels 9 engage the locking projections 18 and the locking claws 11a of the locking levers 11 engage locking projections 21 for the complete locking of the locking chambers 19 as illustrated in Fig. 11. As a result, the terminal locking members B are prevented from its upward and downward play and the axes of the openings 7 of the terminal locking member B and the terminal accommodating cavity 1 coincide with each other as illustrated in Fig. 6A. Further, as shown in the figures, the provision of the guide strip 24 prevents the play, particularly downward play, of the terminal locking member B more securely.

In the preliminarily locked condition, as illustrated in Fig. 7, the male terminal C which is connected to the wire is inserted into the terminal accommodating cavity 1 from the opening 7 and the resilient locking arm 29 mounted in the cavity 1 is engaged with the locking hole 28 to prevent the terminal C from being slipped off (a first locking of the terminal). Then, the terminal locking member B is slidably moved in the direction indicated by the arrow Q. That is, on moving the terminal locking member B upward under the area contact condition described above, the engagement between the locking channels 9 and the locking projections 18 is released to move the terminal locking member B upwardly. As a result, the locking claws 11a of the locking levers 11 move in the locking holes 20 shown in Fig. 11 after crossing over the locking projections 21 for complete locking in the locking chamber 19 and the locking projections 10 each at the both sides of the terminal locking member B are independently supported by the locking projections 18 on the inner wall to achieve completely locked state.

Figures 6B, 8, and 9 show the completely locked state of the rear holder B. That is, the slipping off of the terminal locking member B is completely prevented by the engagement between the locking projections 15b of the rotation preventing pieces 15 and the rear face of the guiding strip 24 as well as the engagement between the locking claws 11a of the locking levers 11 and the locking holes 20, and the engagement between the locking projections 18 and the locking projections 10.

In the completely locked state, even if a tension force is applied to the terminal C by way of the wire W, the terminal locking member B works as a stopper for the rear portion (the insulator holding piece 27 shown in the figures) of the male terminal C, which prevents, together with the first locking described above, the male terminal C from being slipped off. In the movement from the preliminarily locked state to the completely locked state of the terminal locking member B, when some male terminals C are inserted incompletely, tapered pushing faces 7a of the openings 7 engage the above insulator holding piece 27 at the sliding movement of the terminal C to push the male terminal C to the front portion of the terminal accommodating cavity 1, which dissolves the incomplete insertion.

Further, in Figures 8 and 9, even if a rotation force, for instance, in the direction indicated by the arrow R, is applied to the terminal locking member B, the rotation preventing pieces 15 engage the guide strip 24 as stated above, which eliminates the fear that the completely locked state is dissolved.

Furthermore, in the completely inserted condition, a dimensional error or elongation at the pressure contact of the male terminal C may cause the rear end 17a of the insulator holding piece 27 projects from the rear face A0 of the housing A by the length $=\Delta 1$ as illustrated in Figures 8 and 10B. In this case, the terminal locking member B retreats against the resilience of the axially resilient arm 8b to maintain the completely locked condition as it is.

As clearly understood by the above explanation, the locking portions 17 on the inner side walls and the locking arms 8 work as the preliminarily locked means and the completely locked means of the terminal locking member B and the housing A. Then, in the preliminarily locked state, the locking channels 9 and the locking projections 18 or the concave portion 13 and the guiding strip 24 supports the terminal locking member B to prevent the locking member B from dropping from the housing A. Similarly, the locking claws 11a of the locking levers 11 and the projections 21 for the complete locking in the locking chambers 19 or the locking projections 10 and the locking projections 18 pre-

vent the dropping of the terminal locking member B in the completely locked state. Further, the concave portion 12 and the locking portion 22 or the rotation preventing pieces 15 and the guiding strip 24 are effective to maintain and strengthen the completely locked state.

Further, in Figs. 7 and 6A, if only the preliminarily locking of the terminal locking member B, that is, only the first engagement of the male terminal C is performed but the movement to the completely locked state is neglected, the terminal locking member B will cover the opening 40a of the bracket inserting portion 40. As a result, the connector can not be inserted in nor fixed to the bracket 42 of the vehicle body or the like, which makes it possible to easily check the condition in which the terminal locking member B is not completely locked.

Meanwhile, if the terminal locking member B is properly moved to the completely locked state, the opening 40a is opened as illustrated in Figs. 8 and 6B, the inserting of the bracket 42 permits the projection 41a of the resilient locking piece 41 to engage the locking hole 43, which causes the connector to be locked. As a result, besides the double locking of the terminal C by the terminal locking member B, the generation of the noise caused by the play of the connector can be prevented when the vehicle travels.

The above explanation is carried out when a structure of the housing A having horizontal one-story terminal accommodating cavity 1. When the terminal accommodating cavities are arranged in a plurality of stories, the opening 7 of the terminal locking member B may be arranged in accordance with the arrangement of the terminal accommodating cavities. Further, the terminal locking member B is independent from the locking means between the male terminal C and the terminal accommodating cavities 1, that is, the resilient locking arm 29 used for the conventional case lance method. Therefore, the terminal locking member B may be applied to the conventional case lance method. Similarly, the male connector housing accommodating the female terminal may be applied to the conventional method.

As explained above, with the present invention, the movement from the preliminarily locked state to the completely locked state of the terminal locking member to the housing is smoothly performed by one step in which the terminal locking member is slidably moved to the rear portion of the housing in one direction, resulting in improved workability. Furthermore, the housing is provided with the bracket inserting portion to which the bracket can be inserted in the completely locked state of the terminal locking member, which permits the judgment whether or not the terminal locking member

is in the completely locked state to be easily preformed by observing outside.

Claims

1. An electrical connector comprising:
 - terminal accommodating cavities;
 - a connector housing having said terminal accommodating cavities; and
 - a terminal locking member mounted to said rear portion of the connector housing in two steps of a preliminarily locked state and a completely locked state.

2. An electrical connector as claimed in claim 1 further comprising a bracket inserting portion having an opening on an outer peripheral wall of said connector housing on the side that the terminal locking member is mounted, wherein said terminal locking member covers said opening of the bracket inserting portion to prevent said bracket inserting portion from being inserted into a bracket in the preliminarily locked state of the terminal locking member, and said opening of the bracket inserting portion is opened to allow said bracket inserting portion to be inserted into the bracket in the completely locked state.

3. An electrical connector as claimed in claim 1 or 2, wherein said terminal locking member comprising:
 - a frame-shaped main body having openings opposing said terminal accommodating cavities of the connector housing;
 - first locking means for engaging said connector housing, said first locking means mounted on right and left sides of said frame-shaped main body; and
 - second locking means for engaging said connector housing, said second means attached to an upper wall of the frame-shaped main body,
 - wherein said terminal locking member is axially moved to achieve the preliminarily locked state with the connector housing through the first locking means, and then said terminal locking member is moved upwardly to obtain the completely locked state with the connector housing through the second locking means.

4. An electrical connector as claimed in claim 3, wherein said first locking means includes a T-shaped locking arm comprising:
 - a horizontally resilient arm extending from a rear portion of the frame-shaped body to a front portion thereof;

axially resilient arms extending from a tip portion of said horizontally resilient arm; and

locking projections attached to said free ends of said axially resilient arms, said locking projections engaging locking portions on inner side walls of the connector housing.

5. An electrical connector as claimed in claim 3, wherein said second locking means includes a locking lever having a shape of a hook, said locking lever having a locking claw at the tip thereof to engage a locking projection for complete locking of the connector housing.

6. An electrical connector as claimed in claim 3, wherein said terminal locking member further comprising tapered pushing locking faces at a front portion thereof for allowing the terminals to move the completely locked state.

FIG. 1

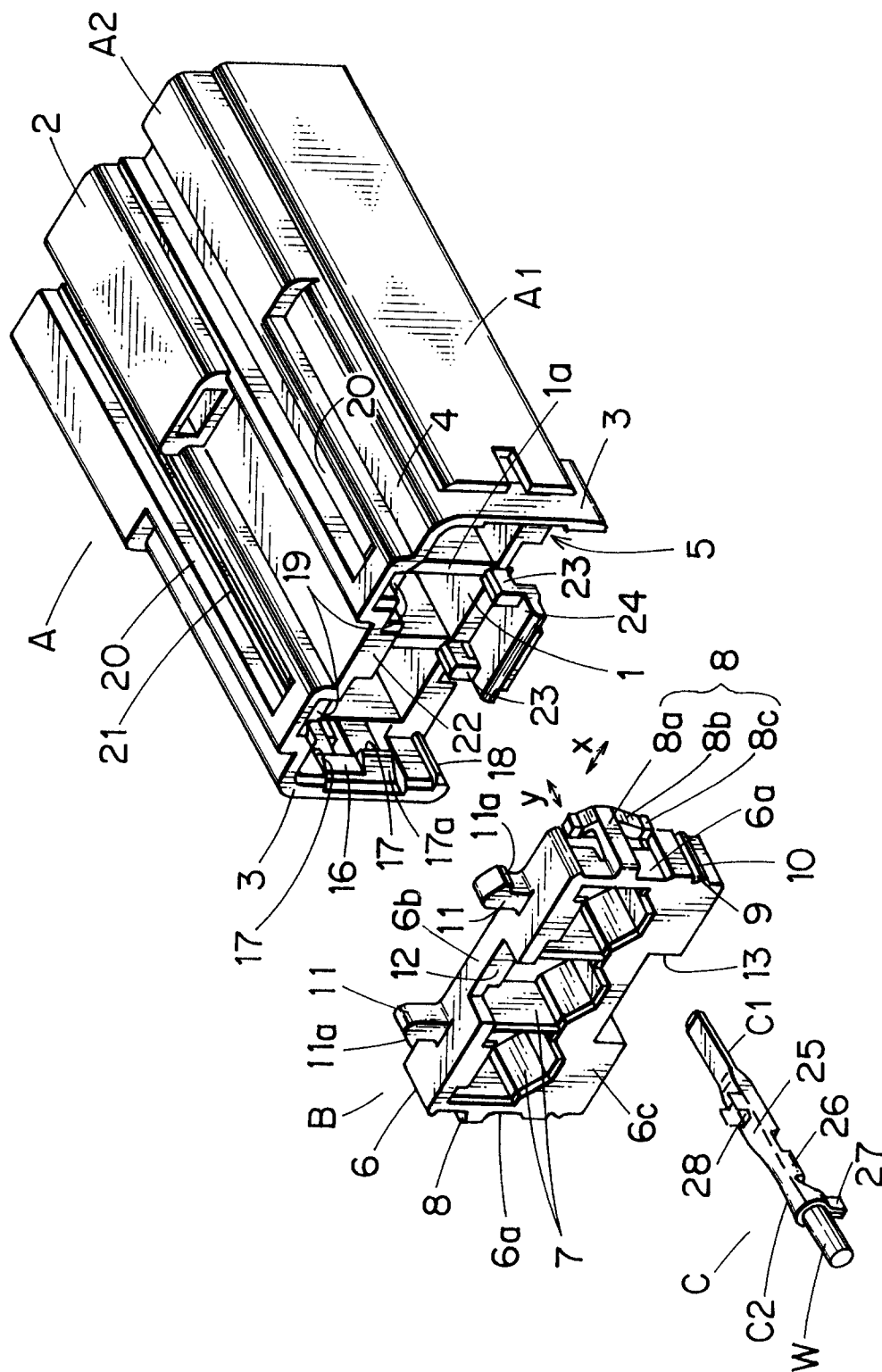
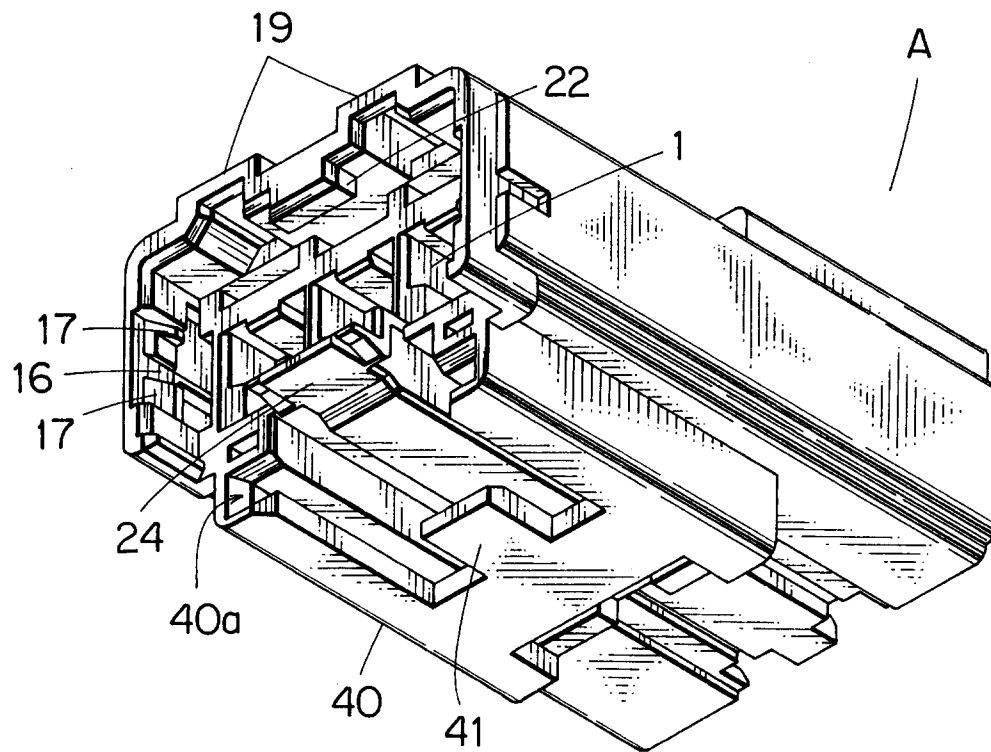
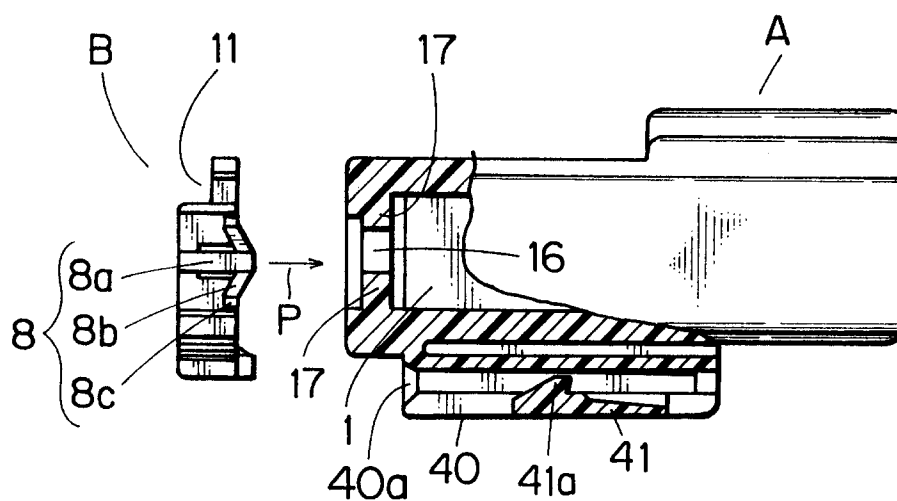


FIG. 2



F I G. 3



F I G. 4

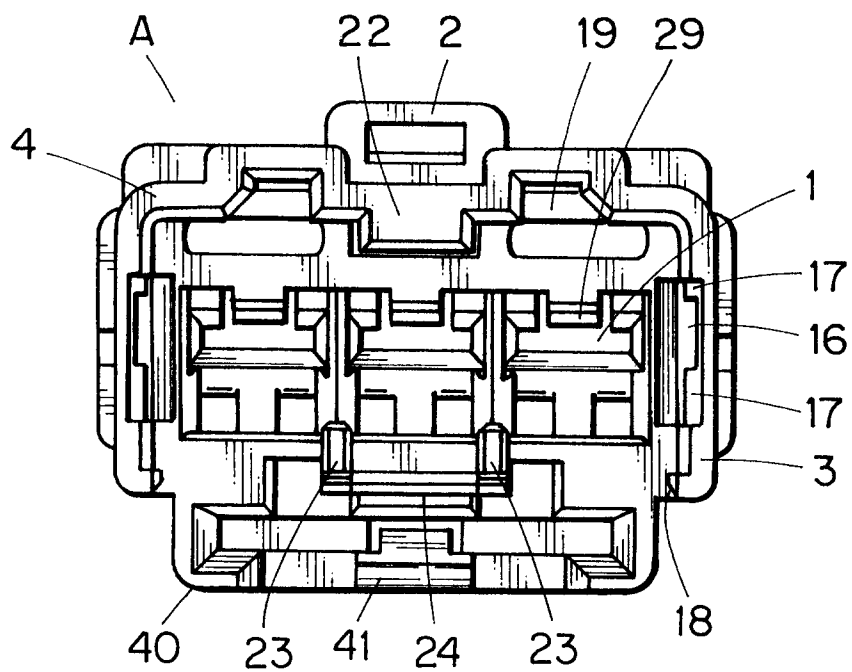


FIG. 5 A

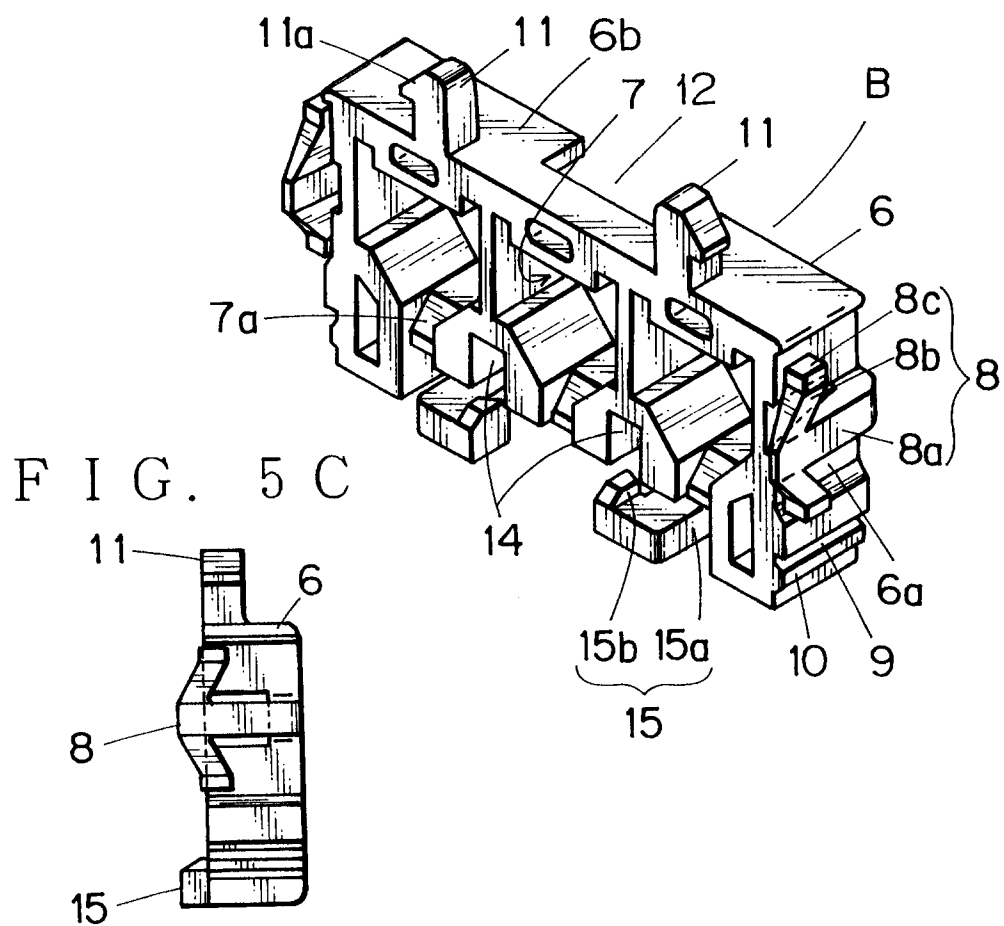


FIG. 5 C

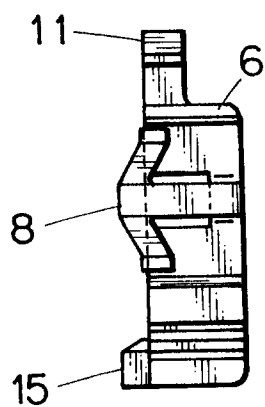


FIG. 5 B

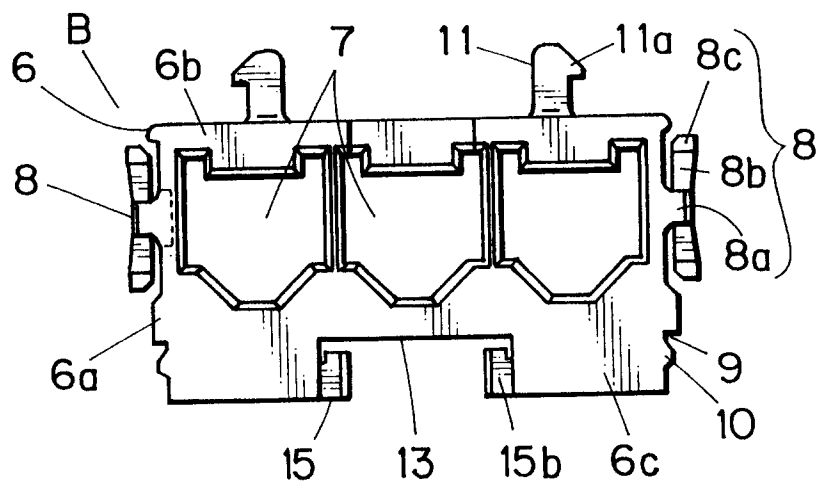


FIG. 6A

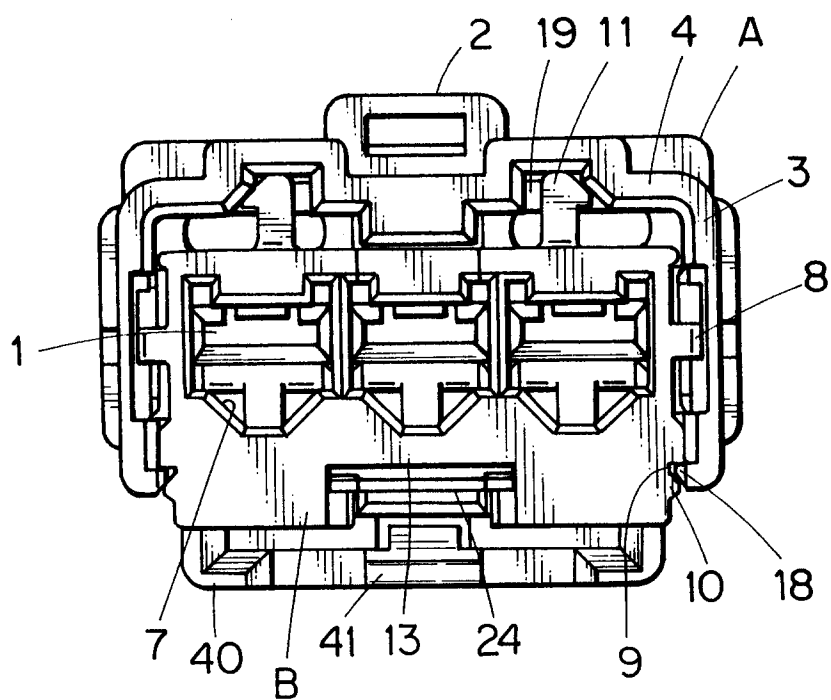


FIG. 6B

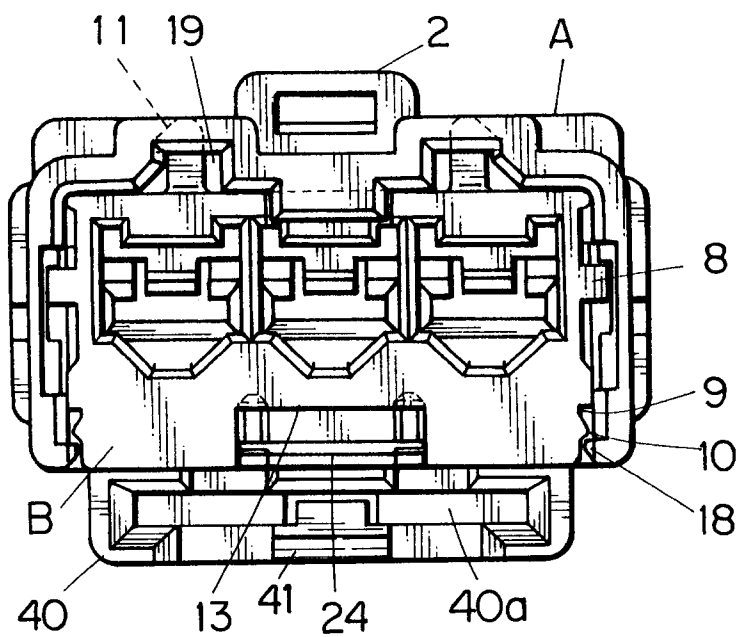


FIG. 7

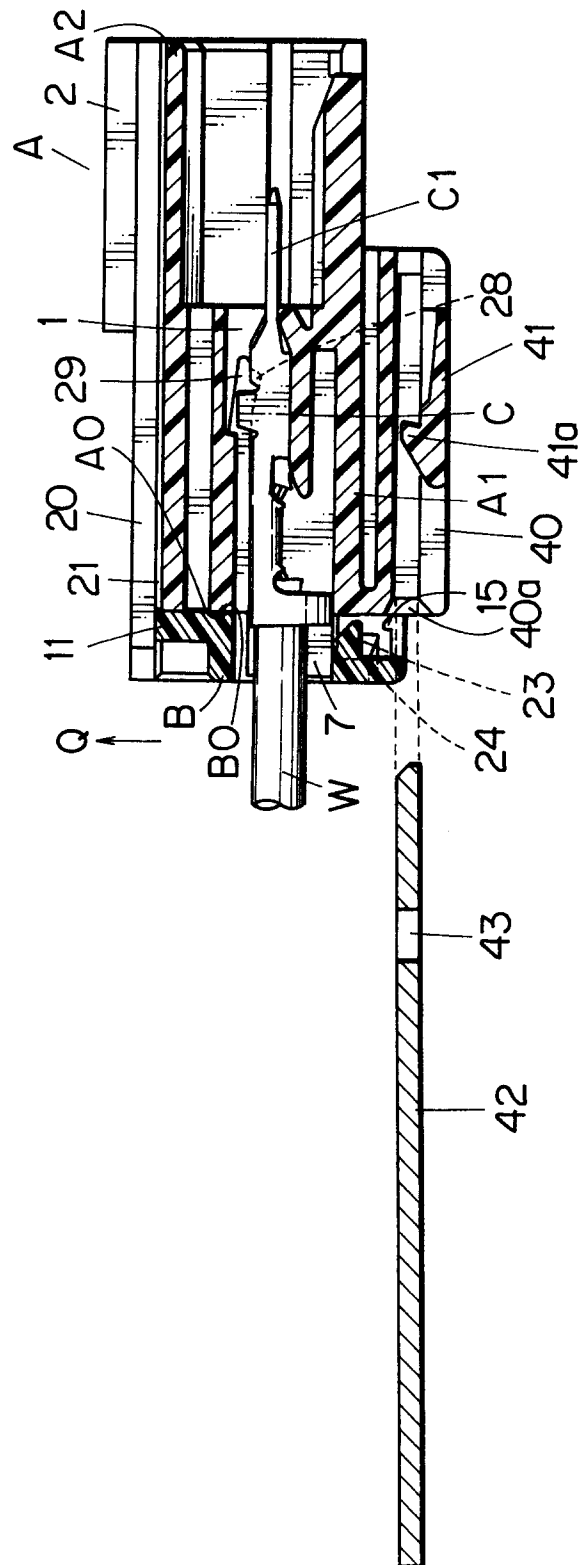


FIG. 8

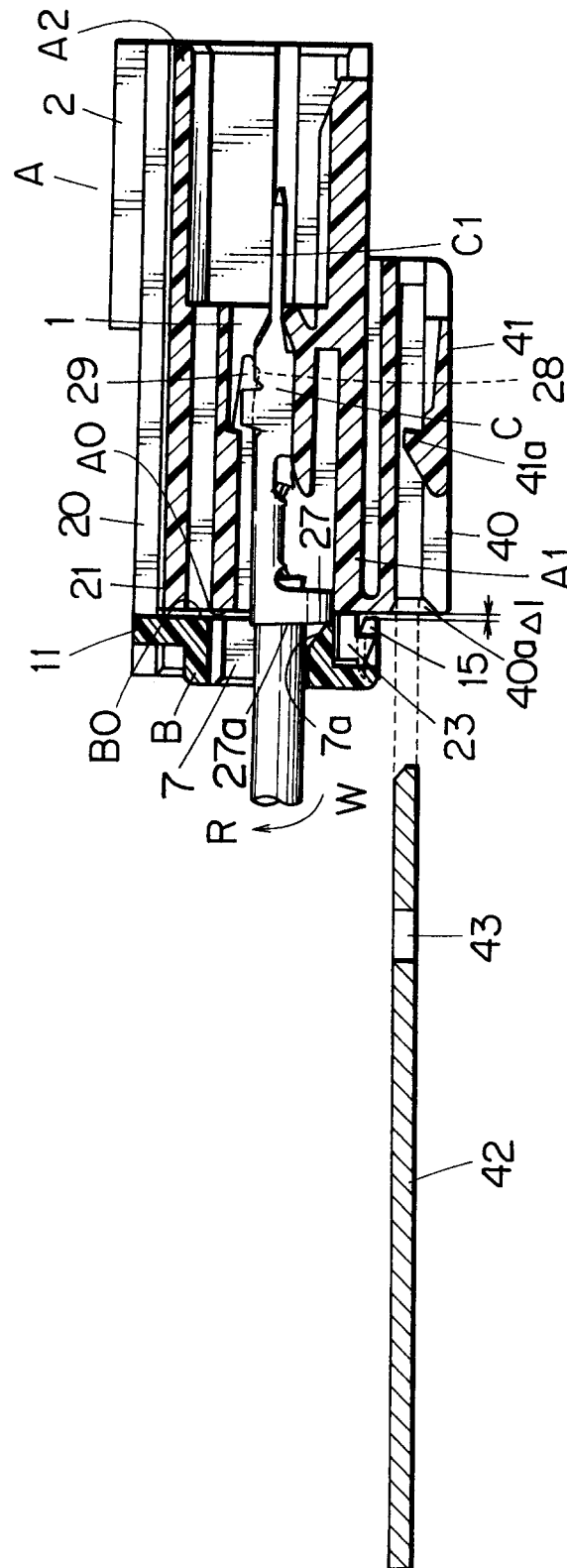
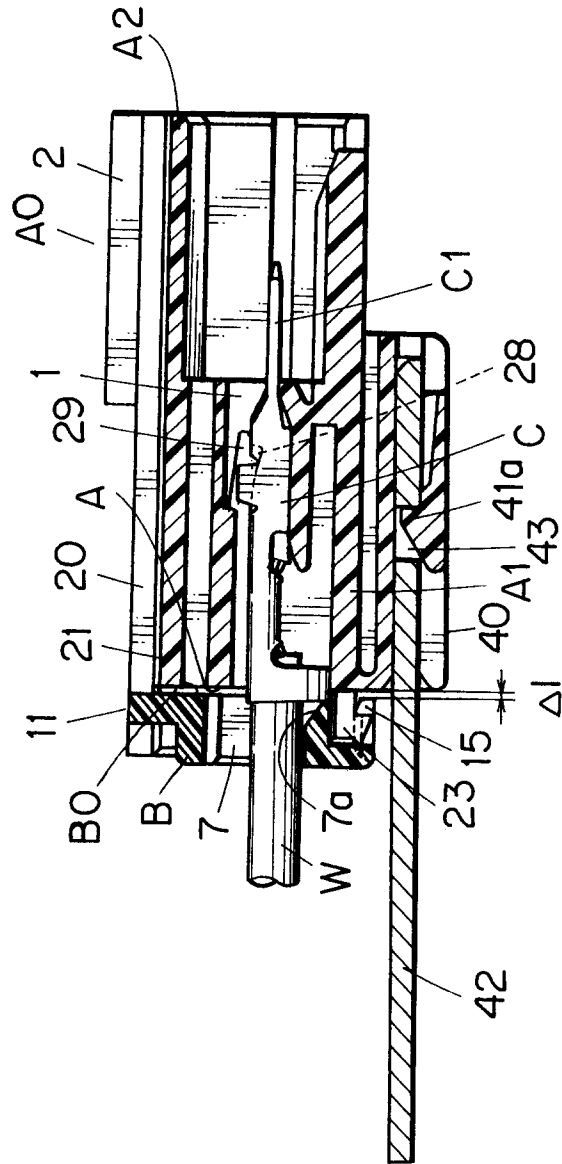
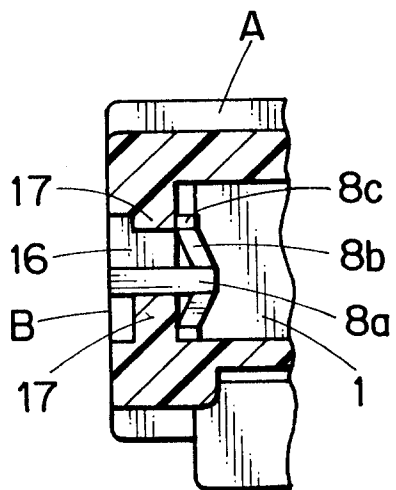


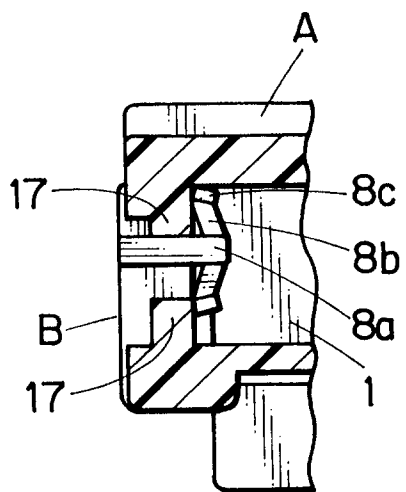
FIG. 9



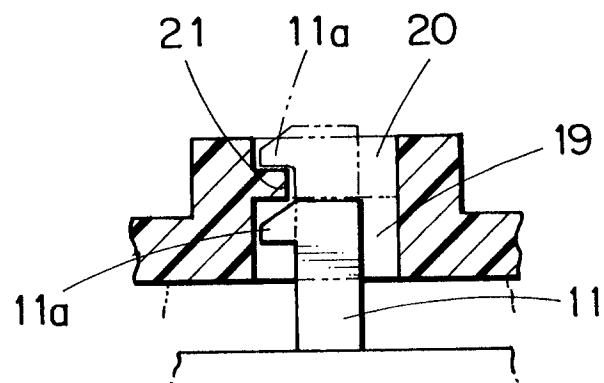
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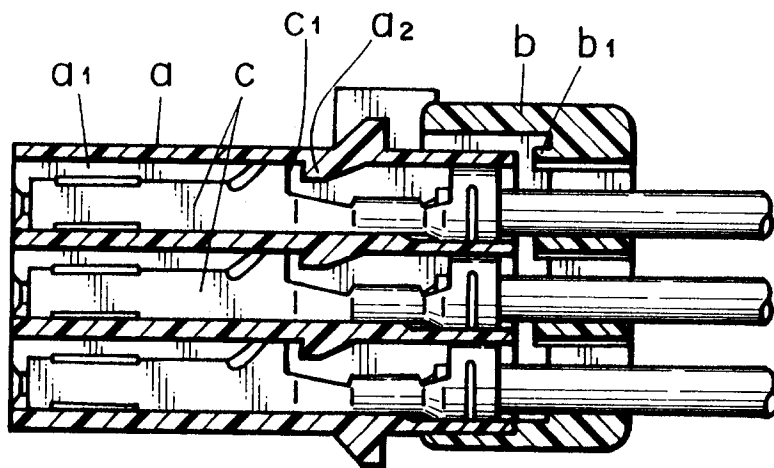
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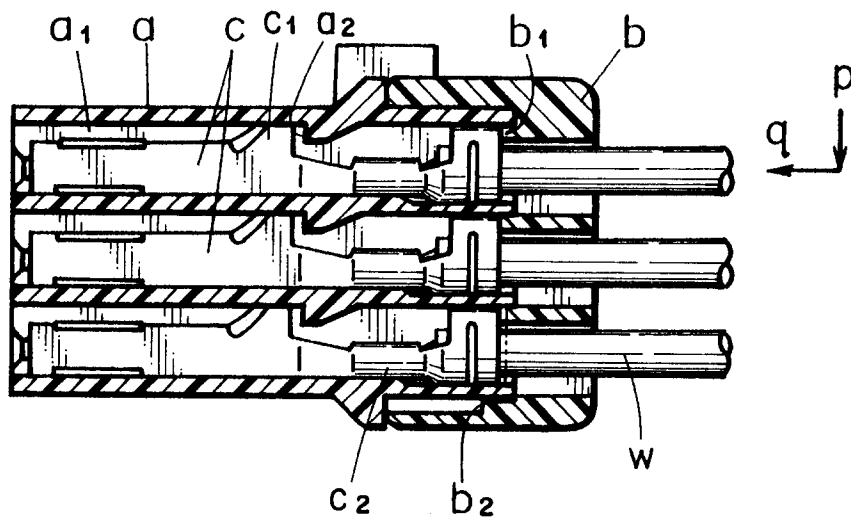
F I G . 11



F I G . 12A



F I G . 12B





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EUROPEAN SEARCH REPORT

Application Number

EP 93 10 5163

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	GB-A-2 237 457 (YAZAKI CORPORATION) * page 4, line 13 - page 7; figures 1-5 * ---	1 2,3,5	H01R13/436
X A	US-A-4 946 398 (TAKENOUCI ET AL.) * column 3, line 7 - column 4, line 22; figures 1-8 * ---	1 6	
X	DE-C-4 010 440 (LEOPOLD KOSTAL GMBH & CO KG) * column 2, line 14 - column 4, line 14; figure 1 * ---	1	
X	GB-A-2 245 777 (AMP) * page 4, line 5 - page 7; figures 1-4 * ---	1	
X	US-A-4 758 182 (ANBO ET AL.) * column 2, line 57 - column 7, line 5; figures 1-17 * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01R
Place of search THE HAGUE		Date of completion of the search 08 JULY 1993	Examiner TAPPEINER R.
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