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(11) **EP 1 085 612 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.03.2001 Bulletin 2001/12

(51) Int. Cl.⁷: **H01R 13/52, H01R 13/436**

(21) Application number: **00119352.3**

(22) Date of filing: **08.09.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **16.09.1999 JP 26216799**

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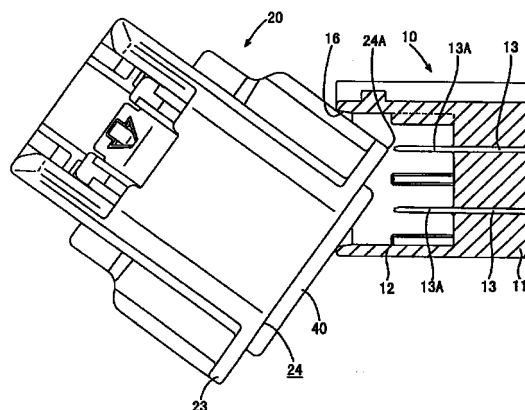
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(54) **A connector**

(57) [Object]

To prevent male terminal fittings from being deformed due to an attempt to connect misaligned male and female housings, a larger receptacle (23) is provided around a female terminal accommodating portion (22) in a female housing (20), and a smaller receptacle (12) of a male housing (10) is fittable into the larger receptacle (23). A retainer (40) for doubly locking female terminal fittings is mounted on the front surface of the female terminal accommodating portion (22), and projects more forward than an opening edge (24) of the larger receptacle (23). When an attempt is made to connect misaligned housings (10,20), an opening edge (24A) at one shorter side of the larger receptacle (23) may, for example, deeply enter the smaller receptacle (12). Since the retainer (40) projects more forward than the opening edge (24) of the larger receptacle (23) and is in contact with an opening edge (16) of the smaller receptacle (12), the entered opening edge (24A) stays in a position closer to the opening edge (16) of the smaller receptacle (12), and is prevented from interfering tabs (13A) of male terminal fittings (13) even if the female housing (20) is rotated.

FIG. 7



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Description

[0001] The present invention relates to a connector improved to prevent terminals from being deformed by an attempt to connect first or female and second or male housings misaligned with respect to each other. 5

[0002] A watertight connector is, as shown in FIG. 9, generally constructed such that a female housing 3 is provided with a larger receptacle 2 around a terminal accommodating portion 1 for accommodating female terminals, a male housing 6 is provided with a smaller receptacle 4 and male terminal fittings 5 which are accommodate in the male housing 6 while tabs 5A thereof project into the smaller receptacle 4, and sealing is provided between the housings 3, 6 by fitting the smaller receptacle 4 of the male housing 6 into the larger receptacle 2 of the female housing 3 and squeezing a seal ring 7 between the smaller receptacle 4 and the terminal accommodating portion 1. Such a construction is disclosed, for example, in Japanese Unexamined Utility Model Publication No. 63-96783. 10 15 20

[0003] There has been a gradual demand for making the size of connectors of this type smaller. For example, it has been proposed to shorten a projecting distance „a“ of the smaller receptacle 4 of the male housing 6. This causes the leading ends of the tabs 5A of the male terminal fittings 5 to be located back from the opening edge of the smaller receptacle 4 by a shorter distance. 25

[0004] On the other hand, when the male and female housings 3, 6 as above are to be connected, they may be fitted while being misaligned, for example, if they try to be connected by touch without being looked at. Particularly, in the case that the housings 3, 6 have substantially rectangular cross sections and an attempt is made to connect them while they are displaced by about 90° about their longitudinal axes with respect to each other and their longitudinal axes are inclined with respect to each other, the opening edge at one shorter side of the larger receptacle 2 of the male housing 3 may deeply enter the smaller receptacle 4 of the male housing 6 as shown in FIG. 10. If the projecting distance of the smaller receptacle 4 is made shorter as described, the entered opening edge of the larger receptacle 2 may interfere the leading ends of the tabs 5A as indicated by phantom line in FIG. 10 to deform them when the male housing 3 is rotated while being held in sliding contact with the opening edge of the smaller receptacle 4. 30 35 40 45

[0005] The present invention was developed in view of the above problem, and an object thereof is to prevent terminal fittings from being deformed due to an attempt to connect misaligned housings. 50

[0006] This object is solved according to the invention by a connector according to claim 1. Preferred embodiments of the invention are subject of the dependent claims. 55

[0007] According to the invention, there is provided

a connector, comprising:

a first housing comprising a first terminal accommodating portion for accommodating one or more first or female terminal fittings and a first receptacle provided substantially around the first terminal accommodating portion, and

a second housing comprising a second receptacle fittable or insertable between the first terminal accommodating portion and the first receptacle and accommodating one or more second or male terminal fittings,

wherein an opening edge of the first receptacle of the first housing is positioned more backward than a connecting end surface of the first terminal accommodating portion or in a position retracted or at a distance from the connecting end surface along the connection direction of the two housings lest it should interfere the second terminal fittings even if the first housing is rotated with the connecting end surface of the first terminal accommodating portion held in contact with an opening edge of the second receptacle.

[0008] According to a preferred embodiment of the invention, the second housing accommodates the one or more second terminal fittings such that tabs thereof project into the second receptacle.

[0009] Preferably, the first receptacle is a larger receptacle and the second receptacle is a smaller receptacle.

[0010] According to a further preferred embodiment, there is provided a connector, comprising:

a female housing comprising a female terminal accommodating portion for accommodating female terminal fitting(s) and a larger receptacle provided around the female terminal accommodating portion, and

a male housing comprising a smaller receptacle fittable between the female terminal accommodating portion and the larger receptacle and accommodating male terminal fittings such that tabs thereof project into the smaller receptacle,

wherein an opening edge of the larger receptacle of the female housing is positioned more backward than a connecting end surface of the female terminal accommodating portion lest it should interfere the tabs even if the female housing is rotated with the connecting end surface of the female terminal accommodating portion held in contact with an opening edge of the smaller receptacle.

[0011] The tabs of the male terminal fittings are likely to be deformed when the housings misaligned with respect to each other are fitted to each other such that a part of the opening edge of the larger receptacle of the female housing enters the small receptacle of the

male housing. In the present invention, upon an occurrence of such a state, the connecting end surface of the female terminal accommodating portion comes into contact with the opening edge of the smaller receptacle. Even if the female housing is rotated in this state, the opening edge of the larger receptacle does not interfere the tabs of the male terminal fittings since being located more backward than the connecting end surface. This prevents the tabs from being deformed.

[0012] Preferably, a retainer for locking the first terminal fittings so as not to come out of the first terminal accommodating portion is mounted on the connecting end surface of the first terminal accommodating portion.

[0013] Further preferably, the connecting end portion of the first housing is at least partly formed by the retainer so that the opening edge of the first receptacle is positioned in the backward located position where it does not interfere the second terminal fittings by mounting the retainer on the first housing.

[0014] Still further preferably, a retainer for locking the female terminal fittings so as not to come out of the female terminal accommodating portion is mounted on the connecting end surface of the female terminal accommodating portion, and the opening edge of the larger receptacle is positioned in the backward located position where it does not interfere the tabs by mounting the retainer.

[0015] If a so-called front type retainer is mounted on the connecting end surface of the female terminal accommodating portion, the opening edge of the larger receptacle is located relatively backward if the retainer is so mounted as to project more forward than the opening edge of the larger receptacle. Therefore, the opening edge of the larger receptacle do not interfere the tabs even if an attempt is made to connect the housings misaligned with respect to each other.

[0016] Still further preferably, the first housing is provided with one or more locking portions for locking the first terminal fitting(s) in the first housing.

[0017] Most preferably, the locking portions are hindered from being disengaged from first terminal fittings by the retainer being at least partly inserted into deformation permitting spaces provided for a deformation of the locking portions.

[0018] These and other objects, features and advantages of the present invention will become apparent upon reading of the following detailed description of preferred embodiments and accompanying drawings in which:

FIG. 1 is a side view in section of male and female housings according to one embodiment of the invention before being connected,
 FIG. 2 is a front view of the male housing,
 FIG. 3 is a front view of the female housing,
 FIG. 4 is a side view in section of the female housing having a retainer mounted thereon,
 FIG. 5 is a plan view of the retainer,

FIG. 6 is a side view partly in section showing the misaligned male and female housings before being connected,

FIG. 7 is a side view partly in section showing the misaligned male and female housings while being connected,

FIG. 8 is a side view partly in section showing a state where the misaligned female housing is rotated,

FIG. 9 is a side view in section of a prior art connector, and

FIG. 10 is a side view in section of the prior art connector when an attempt is made to connect male and female housings in misaligned states.

[0019] Hereinafter, one embodiment of the invention is described with reference to FIGS. 1 to 8.

[0020] A watertight connector is shown in this embodiment. As shown in FIG. 1, this connector is comprised of a male connector housing 10 (hereinafter, „male housing“) 10 and a female connector housing (hereinafter, „female housing“) 20 being at least partially connectable with each other or insertable into each other.

[0021] In the following description, connecting or mating sides of the housings 10, 20 are referred to as front sides.

[0022] The male housing 10 shown at the right side of FIG. 1 preferably directly projects from an unillustrated equipment and is constructed such that a preferably smaller receptacle 12 (second receptacle) is formed on the front surface of a main body 11. The smaller receptacle 12 is in the form of a laterally long substantially rectangular tube as shown in FIG. 2, and tabs 13A of e.g. eight male terminal fittings 13 project preferably in two-stage arrangement from the back surface of the smaller receptacle 12.

[0023] A locking projection 15 is formed in the substantially middle of the upper surface of the smaller receptacle 12 with respect to widthwise direction.

[0024] The female housing 20 is provided with a female terminal accommodating portion 22 formed with e.g. eight cavities 21 arranged preferably in two stages so as to substantially correspond to the male terminal fittings 13 as shown in FIG. 3, and a preferably larger receptacle 23 is formed substantially around the front end of the female terminal accommodating portion 22. The larger receptacle 23 is in the form of a laterally long substantially rectangular tube which is a size larger than the smaller receptacle 12, so that the smaller receptacle 12 is substantially closely fittable or insertable into the larger receptacle 23. The front surface of the female terminal accommodating portion 22 projects more forward than an opening edge 24 of the larger receptacle 23 by a specified distance.

[0025] A seal ring 25 is mounted on the female terminal accommodating portion 22 in a position near the back end of the larger receptacle 23.

[0026] Terminal insertion openings 27 through which the tabs 13A of the mating male terminal fittings 13 are insertable are formed at the front surfaces of the respective cavities 21, and locking portions 28 at the upper and lower stages are formed behind the terminal insertion openings 27 while facing or being oriented in different directions. When female terminal fittings (not shown) preferably secured to ends of wires are inserted into the cavities 21 preferably from behind, they are elastically locked by the locking portions 28 so as not to come out of the cavities 21.

[0027] A waterproof rubber plug is secured at the rear end of each female terminal fitting to watertightly seal the entrance of the corresponding cavity 21.

[0028] A roof portion 30 is formed to project in the substantially middle of the upper surface of the larger receptacle 23. In the roof portion 30 is provided a lock arm 31 to elastically engage the locking projection 15 to lock the housings 10, 20 at least partly into each other when the housings 10, 20 are properly connected with each other. The roof portion 30 is also provided with a partial connection detecting mechanism 33 including coil springs 32 and function to separate the housings 10, 20 by spring forces of the coil springs 32 when the housings 10, 20 are left partly connected. No detailed description is given on the partial connection detecting mechanism 33 here.

[0029] A retainer 40 is mountable preferably on the front surface of the female terminal accommodating portion 22 of the female housing 20. The retainer 40 has a main body 41 fittable on the front surface of the female terminal accommodating portion 22. The main body 41 is formed with insertion holes 42, through which the tabs 13A of the male terminal fittings 13 are insertable, substantially in alignment with the terminal insertion openings 27 at the front ends of the cavities 21. Restricting pieces 43 which are at least partly insertable into deformation permitting spaces 29 between the corresponding pairs of the upper and lower locking portions 28 as shown in FIG. 5 project from the rear surface of the main body 41. In other words, when the retainer 40 is mounted after the female terminal fittings are inserted into the cavities 21 and partly locked by the locking portions 28, the restricting pieces 43 enter the deformation permitting spaces 29, thereby doubly locking the female terminal fittings. The retainer 40 is mounted in a specified position by locking members 44.

[0030] The retainer 40 is mounted on the female terminal accommodating portion 22 preferably such that the front surface thereof is substantially in flush with the front surface of the female terminal accommodating portion 22. Accordingly, the front surface of the retainer 40 is located more forward than the opening edge 24 of the larger receptacle 23 by the specified (predetermined or predeterminable) distance D along a mating or connection direction of the housings 10 and 20, as shown in FIG. 4.

[0031] Hereinafter, the meaning of projection of the

retainer 40 and a specified projecting distance thereof are described.

[0032] The male and female housings 10, 20 are connected as follows. After the female terminal fittings are at least partly accommodated in the female terminal accommodating portion 22 of the female housing 20, the retainer 40 is mounted preferably on the front end surface of the female terminal accommodating portion 22 to doubly lock the female terminal fittings. In this state, the female housing 20 is fitted to the mating male housing 10.

[0033] The housings 10, 20 may be fitted in relatively misaligned states if the housings 10, 20 are connected by touch because connecting portions thereof cannot be looked at. Particularly as shown in FIG. 6, if the female housing 20 is displaced by about 90° about its longitudinal axis from its proper orientation with respect to the male housing 10 and the longitudinal axis thereof is substantially inclined or arranged at an angle different from 0° or 180° with respect to that of the male housing 10, an opening edge 24A at one shorter side of the larger receptacle 23 of the female housing 20 may deeply enter the smaller receptacle 12 of the male housing 10.

[0034] If the housings 10, 20 are fitted to each other in the above state, the following occurs. Since the retainer 40 projects more forward than the opening edge 24 of the larger receptacle 23 in this embodiment, the front surface of the retainer 40 comes into contact with one longer side (lower longer side in FIG. 7) of an opening edge 16 of the smaller receptacle 12 and one shorter side surface of the larger receptacle 23 comes into contact with the other longer side of the opening edge 16 of the smaller receptacle 12 as shown in FIG. 7. Accordingly, even if the opening edge 24A at the one shorter side of the larger receptacle 23 should enter the smaller receptacle 12 of the male housing 10, the entered opening edge 24A stays in a position closer to the opening edge 16 of the smaller receptacle 12 since the retainer 40 is in contact.

[0035] During the connecting operation of the housings 10, 20, the female housing 20 may be rotated while the retainer 40 and the shorter side surface of the larger receptacle 23 are being held in sliding contact with the opening edge 16 of the smaller receptacle 12 as shown in FIG. 8. However, since the opening edge 24A of the larger receptacle 23 having entered the smaller receptacle 12 stays away from the tabs 13A, it prevents the opening edge 24A from interfering the male terminal fittings 13A of the male terminal fittings 13 projecting into the smaller receptacle 12. Thus, by setting the aperture of the smaller receptacle 12 and the outside dimensions of the larger receptacle 23 in an appropriate interdependent way, it can be avoided that the tabs 13A are damaged by mistake, when the larger receptacle 23 is rotated away from its connection orientation.

[0036] In other words, the projecting distance of the retainer 40 may be set such that the opening edge 24A

of the larger receptacle 23 having entered the smaller receptacle 12 is moved backward without interfering the tabs 13A when the female housing 20 is rotated with the retainer 40 held in contact with the opening edge 16 of the smaller receptacle 12 of the male housing 10.

[0037] As described above, according to this embodiment, by adopting a simple construction that the retainer 40 of the female housing 20 projects more forward than the opening edge 24 of the larger receptacle 23, an entering degree of the larger receptacle 23 can be suppressed even if the misaligned larger receptacle 23 is fitted into the smaller receptacle 12. This prevents an occurrence of an undesirable event where the opening edge 24A of the larger receptacle 23 deforms the male terminal fittings 13A of the male terminal fittings 13 upon striking on them.

[0038] The present invention is not limited to the above embodiment. For example, following embodiments are also embraced by the technical scope of the invention as defined in the claims. Besides these embodiments, various changes can be made without departing from the scope and spirit of the invention as defined in the claims.

(1) If the female terminal accommodating portion 22 itself is constructed to project more forward than the opening edge 24 of the larger receptacle 23 by a specified (predetermined or predeterminable) distance along a connection direction of the housing 10, 20, the entering degree of the opening edge 24 of the larger receptacle 23 can be similarly restricted even if the retainer 40 is not mounted on the female housing 20.

(2) The present invention is similarly applicable to connectors whose receptacles are in the form of tubes having substantially square and circular cross sections.

(3) The present invention is similarly applicable to connectors whose male housings are not directly connected with equipments, but are of the types which are used for usual wire-to-wire connection.

(4) The present invention is similarly applicable to nonwatertight connectors provided that they have female housings formed with larger receptacles fitable to the outer surface of smaller receptacles of male housings.

LIST OF REFERENCE NUMERALS

[0039]

10 male housing
12 smaller receptacle
13 male terminal fitting
13A tab
16 opening edge of (the smaller receptacle 12)
20 female housing
22 female terminal accommodating portion

23 larger receptacle
24 opening edge of (the larger receptacle 23)
24A opening edge (at a shorter side)
40 retainer

Claims

1. A connector, comprising:

a first housing (20) comprising a first terminal accommodating portion (22) for accommodating one or more first terminal fittings and a first receptacle (23) provided substantially around the first terminal accommodating portion (22), and

a second housing (10) comprising a second receptacle (12) fittable between the first terminal accommodating portion (22) and the first receptacle (23) and accommodating one or more second terminal fittings (13), wherein an opening edge (24) of the first receptacle (23) of the first housing (20) is positioned more backward than a connecting end surface of the first terminal accommodating portion (22) lest it should interfere the second terminal fittings (13) even if the first housing (20) is rotated with the connecting end surface of the first terminal accommodating portion (22) held in contact with an opening edge (16) of the second receptacle (12).

2. A connector according to claim 1, wherein the second housing (10) accommodates the one or more second terminal fittings (13) such that tabs (13A) thereof project into the second receptacle (12).

3. A connector according to one or more of the preceding claims, wherein the first receptacle (23) is a larger receptacle (23) and the second receptacle (12) is a smaller receptacle (12).

4. A connector according to one or more of the preceding claims, wherein a retainer (40) for locking the first terminal fittings so as not to come out of the first terminal accommodating portion (22) is mounted on the connecting end surface of the first terminal accommodating portion (22).

5. A connector according to claim 4, wherein the connecting end portion of the first housing (20) is at least partly formed by the retainer (40) so that the opening edge (24) of the first receptacle (23) is positioned in the backward located position where it does not interfere the second terminal fittings (13) by mounting the retainer (40) on the first housing (20).

6. A connector according to one or more of the pre-

ceding claims, wherein the first housing (20) is provided with one or more locking portions (28) for locking the first terminal fitting(s) in the first housing (20).

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7. A connector according to claim 6 and claim 4 or 5, wherein the locking portions (28) are hindered from being disengaged from first terminal fittings by the retainer (40) being at least partly inserted into deformation permitting spaces (29) provided for a deformation of the locking portions (28).

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FIG. 1

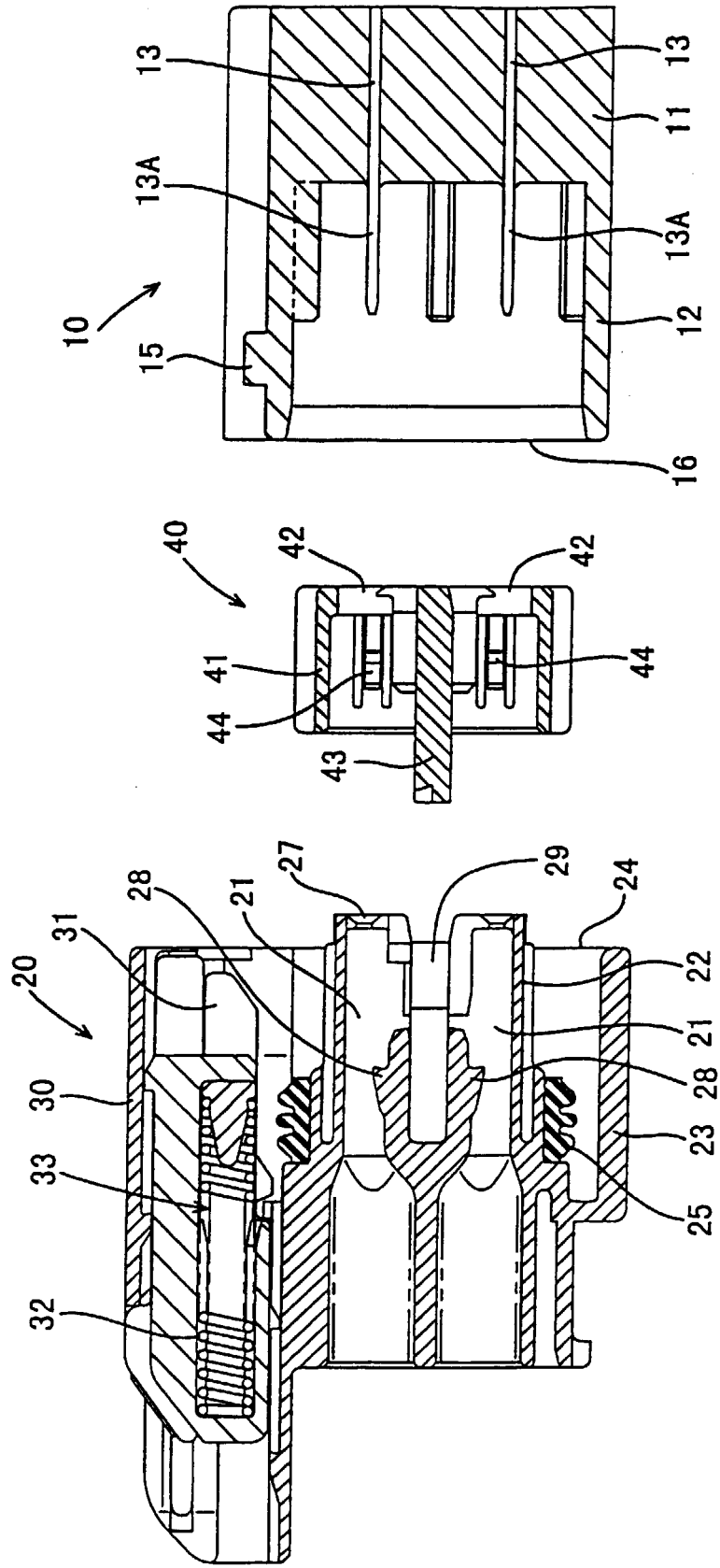


FIG. 2

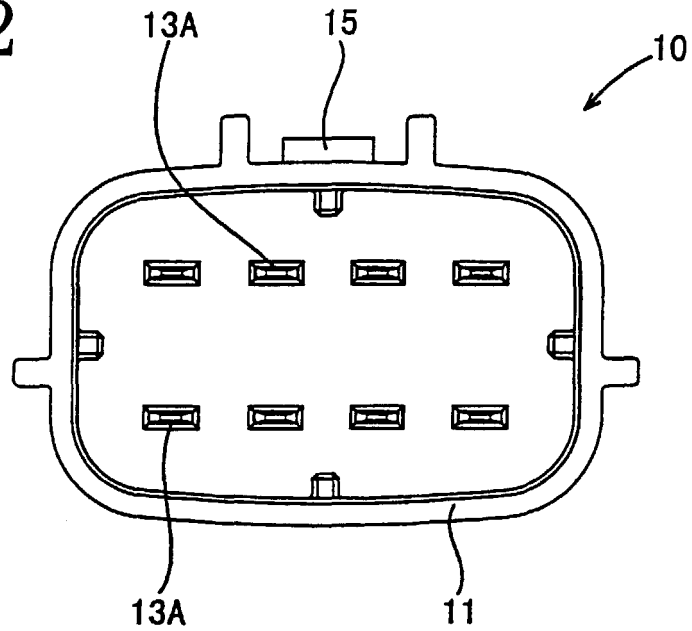


FIG. 3

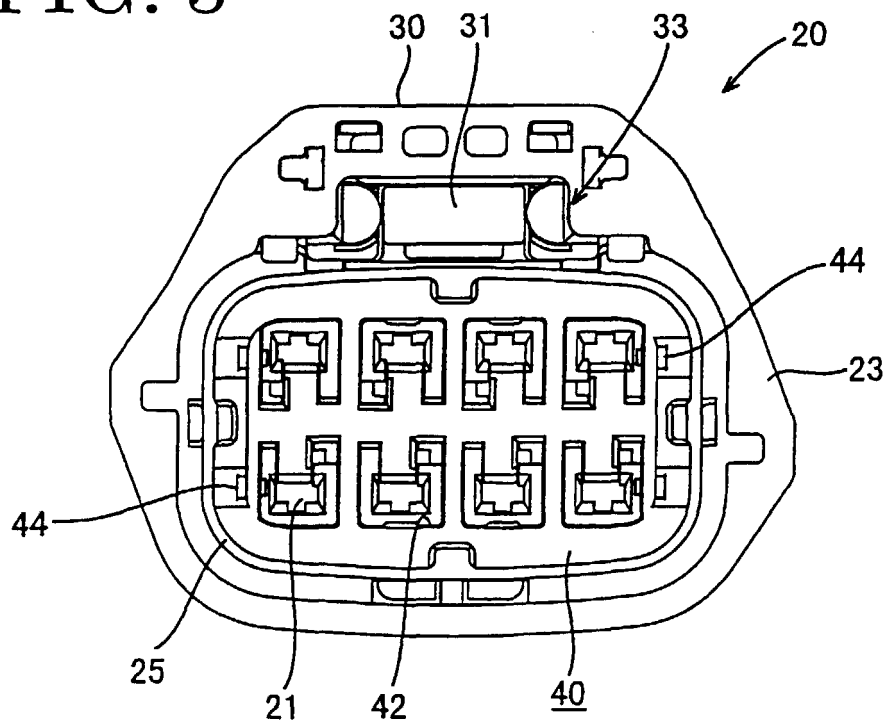


FIG. 4

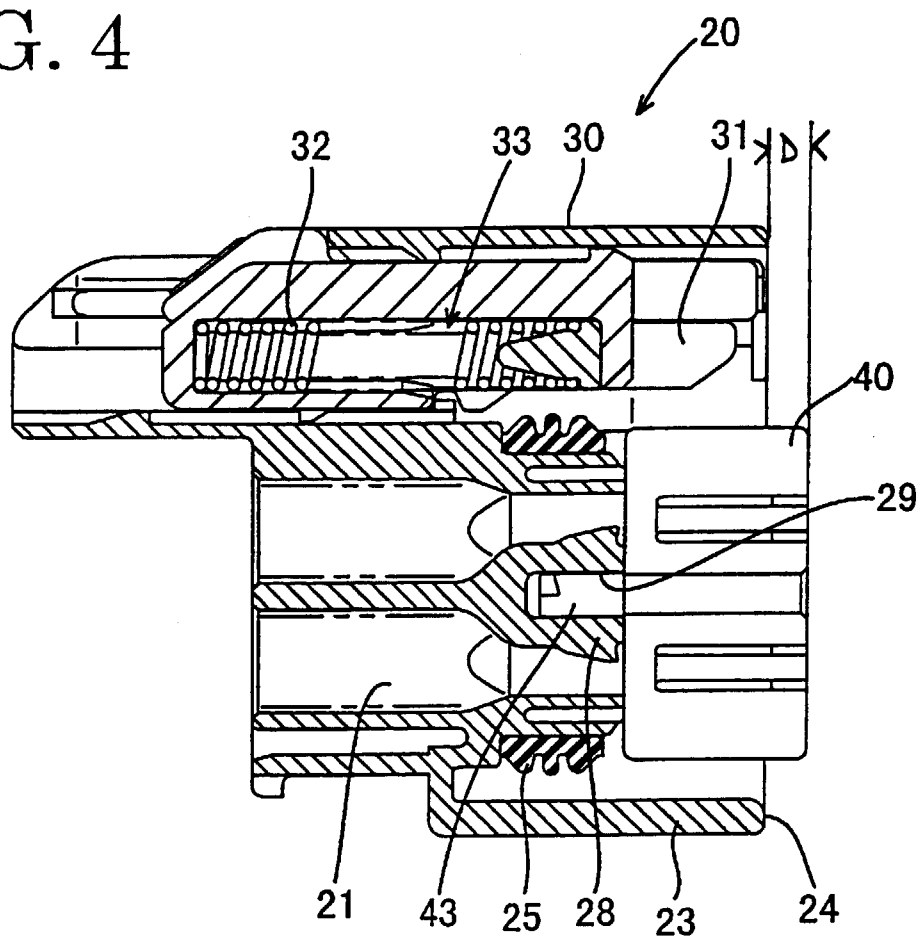


FIG. 5

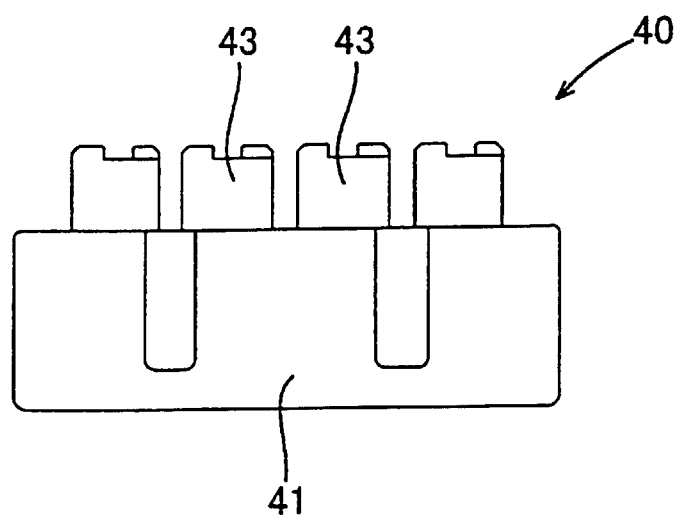


FIG. 6

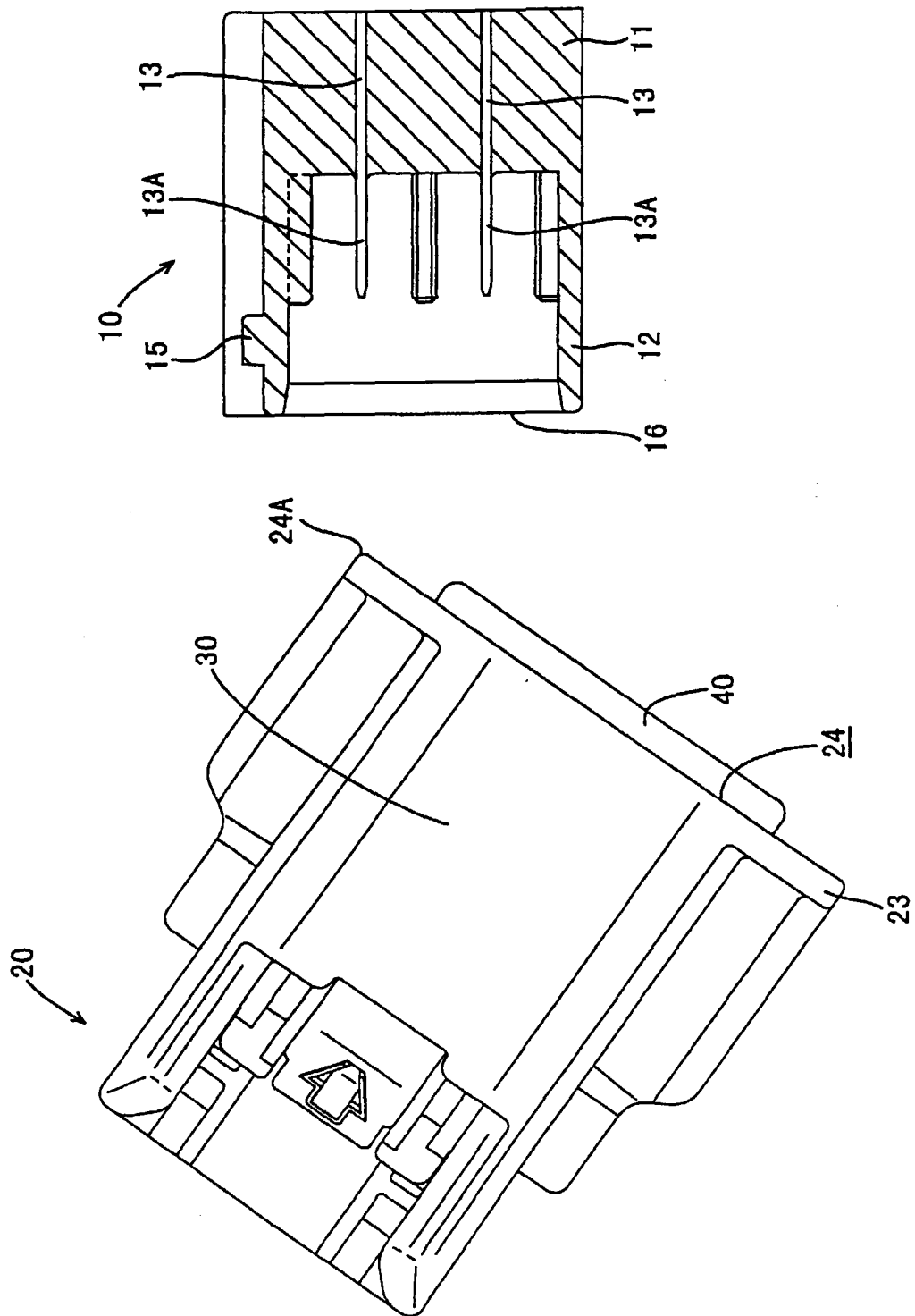


FIG. 7

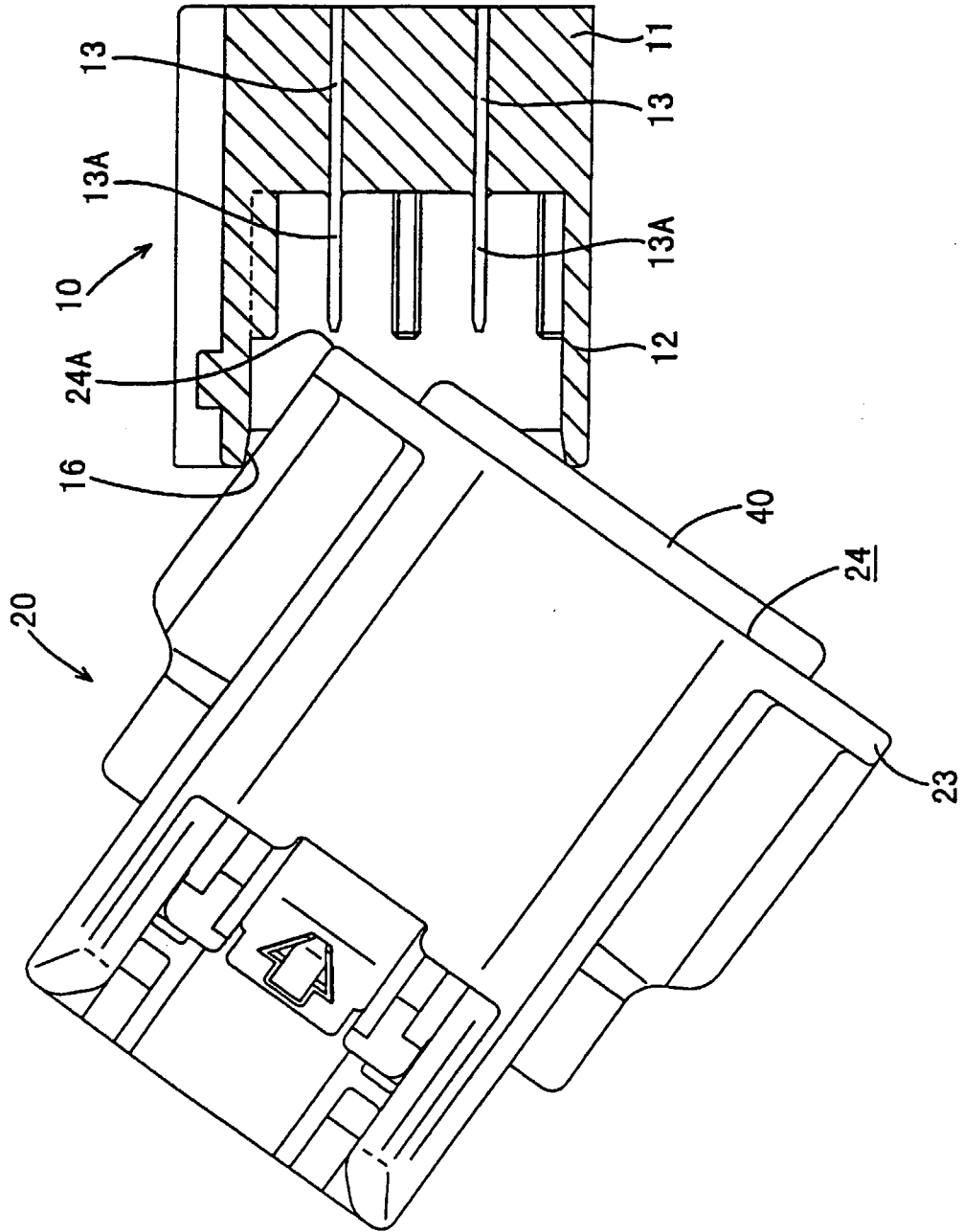


FIG. 8

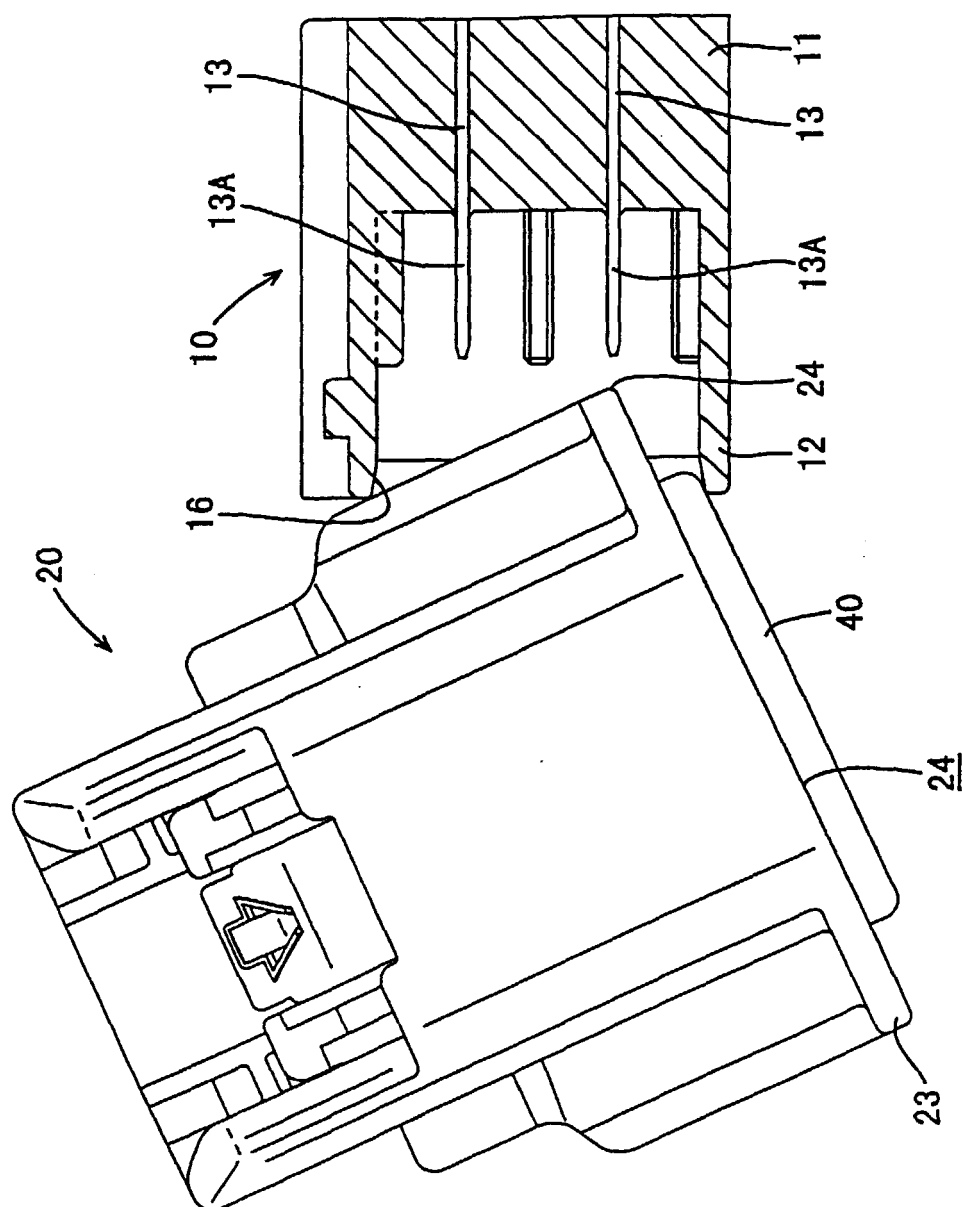


FIG. 9
PRIOR ART

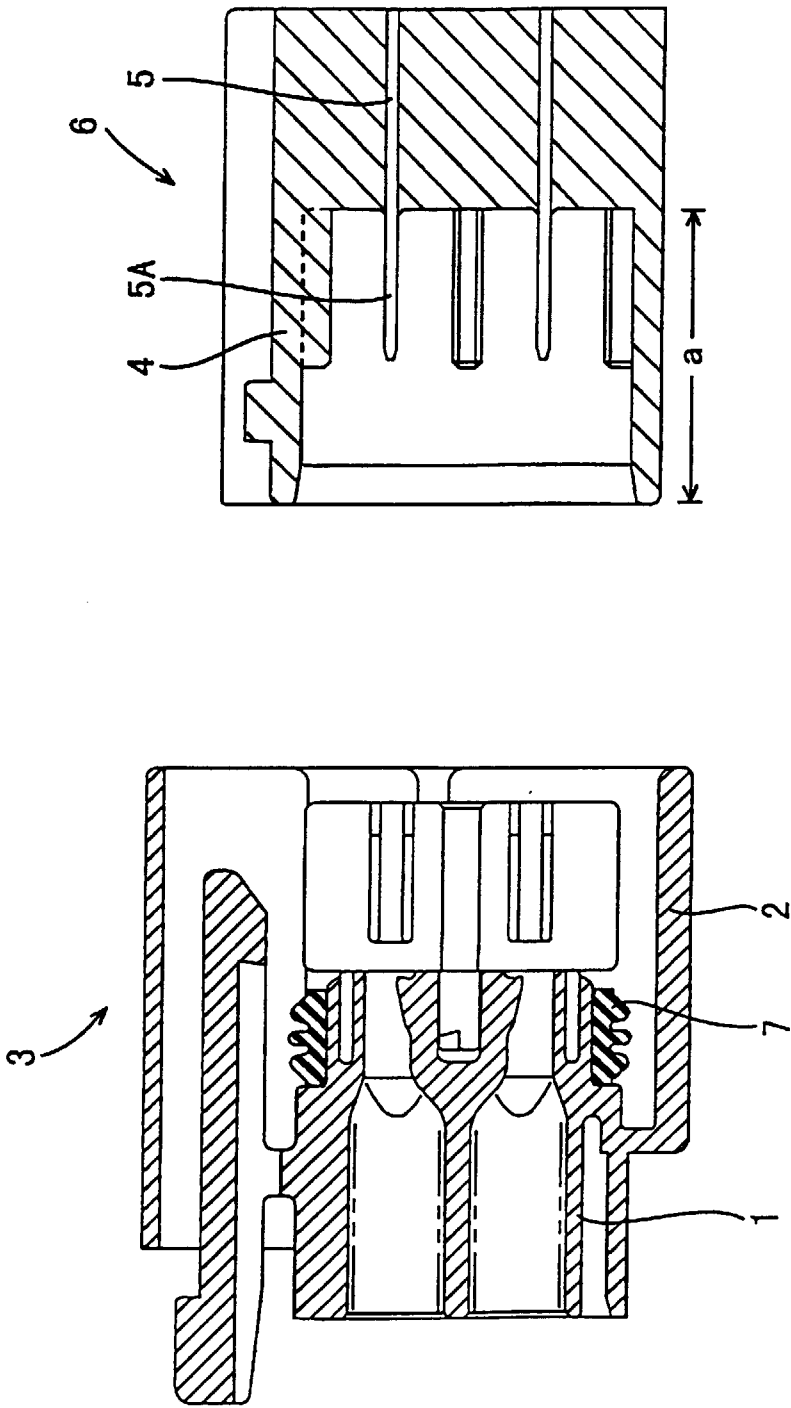
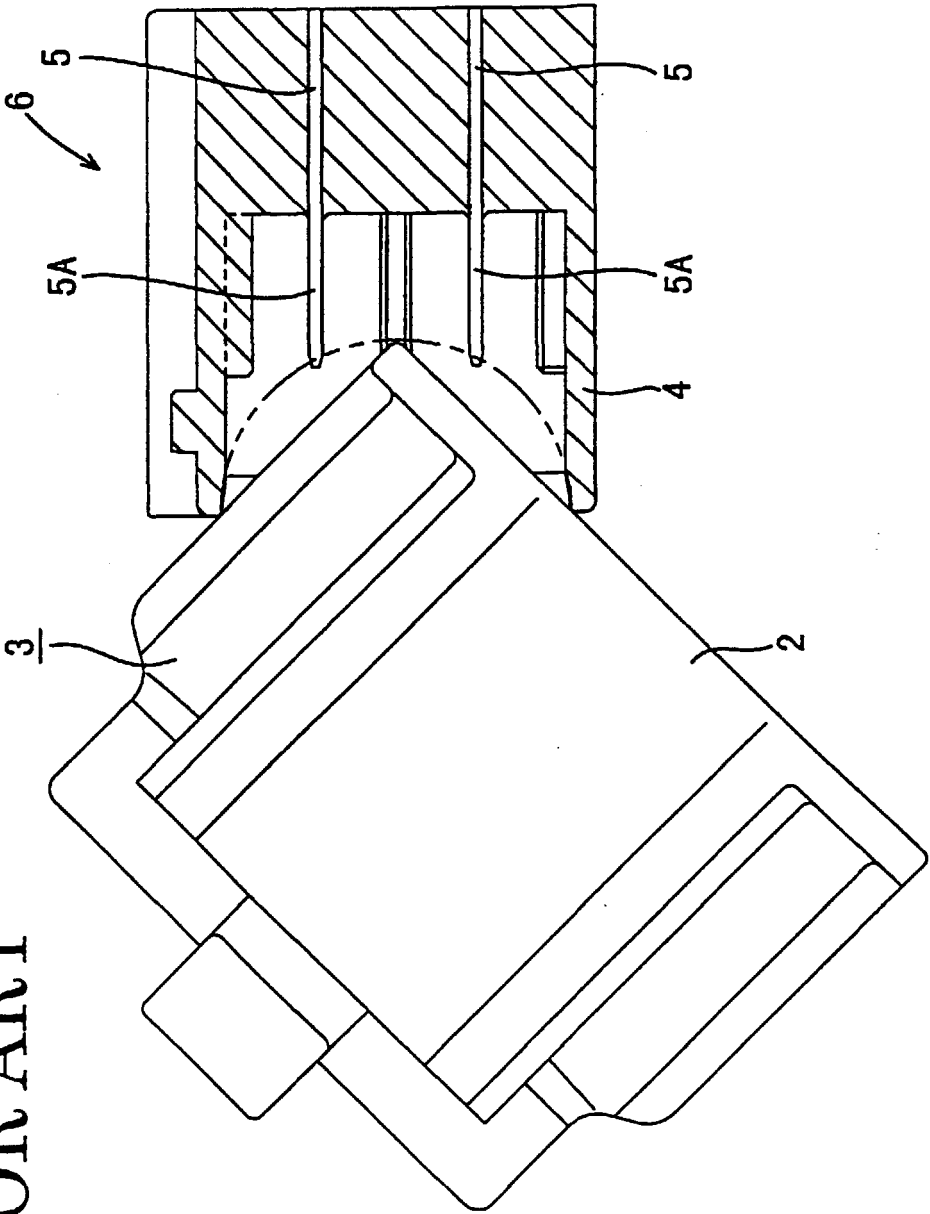


FIG. 10
PRIOR ART





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 11 9352

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
X	US 5 252 092 A (REIDER CHRISTOPHER G ET AL) 12 October 1993 (1993-10-12) * column 4, line 31 - column 10, line 30; figures 1-8 * -----	1-7	H01R13/52 H01R13/436
			TECHNICAL FIELDS SEARCHED (Int.CI.7)
			H01R
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 3 November 2000	Examiner Langbroek, A
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 9352

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-11-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5252092	A	12-10-1993	NONE

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82