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

(11) EP 0 921 599 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.06.1999 Bulletin 1999/23

(51) Int Cl.[6]: **H01R 13/428**

(21) Application number: **98309815.3**

(22) Date of filing: **01.12.1998**

(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: **05.12.1997 JP 35242097**

(71) Applicant: **THE WHITAKER CORPORATION**
Wilmington, DE 19808 (US)

(72) Inventor: **Yamagami, Hidehisa**
Yokohama, Kanagawa 227-0064 (JP)

(74) Representative: **Johnstone, Douglas Ian et al**
Baron & Warren,
18 South End
Kensington, London W8 5BU (GB)

(54) Electrical connector and contacts used therein

(57) An electrical connector allows for easy removal of electrical contacts from a housing even if the contacts are arranged in multiple rows. Electrical connector (1) comprises a housing (10) having contact-receiving cavities (11) arranged in multiple rows and multiple electrical contacts (20) disposed in the contact-receiving cavities (11). Each contact (20) includes a contact section (21) intended to form electrical connection with a mating contact, a wire-connecting section (22) located behind the contact section (21) and a retention device (23) engaging with a retention lug (17) of the housing (10). The retention device (23) comprises two spring-loaded lances (24) that are arranged along an axis of the contact and they can be bent to left and right directions. The retention device (23) is located near a front end of the contact section (21), and the housing (10) has recesses (18) for the insertion of a retention-release tool extending from the front surface (14) of the housing (10) to the retention device (23).

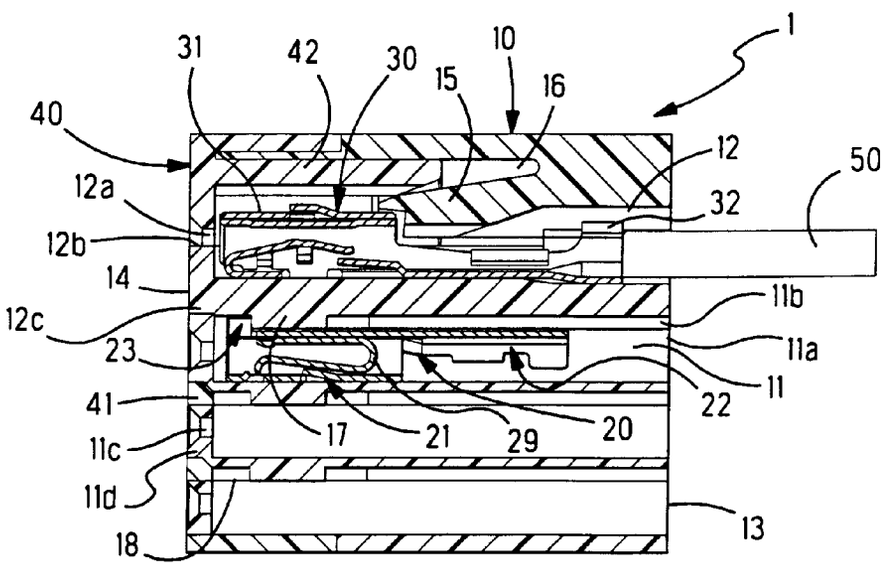

Fig. 2

EP 0 921 599 A2

Description

[0001] The present invention relates to electrical connectors whose purpose is to form electrical connections between electrical wires and mating electrical contacts and to electrical contacts used in such connectors.

[0002] Conventional electrical connectors of this type and electrical contacts used therein can be found in Japanese Patent Publication No. 59-164172 as shown in Figures 7a-7c. Electrical connector 100 comprises a housing 110 having contact-receiving cavities 111 extending forward from back surface 112 and electrical contacts 120 placed inside the contact-receiving cavities 111. Electrical contact 120 includes a contact section 121 intended to form electrical connection with a mating electrical contact (not shown), a wire-connecting section 122 located behind the contact section 121 and intended for electrical connection to an electrical wire 130. Middle section 123 has opposing side walls 124 extending vertically from a bottom wall with two spring-loaded retaining lances 125 located at the upper edges of the side walls 124. The ends of the spring-loaded lances 125 converge toward each other but are not engaged. When the contact 120 is inserted into the contact-receiving cavity 111 from the back surface 112 of the housing 110 toward the front surface 113, the retaining lances 125 become engaged with a retention lug 114 extending downwardly from an upper surface of the contact-receiving cavity of the housing 110. In the process of the retaining lances 125 engaging the retention lug 114, the ends of the retaining lances 125 are deflected by the lug 114 to the left and to the right relative to the axial direction (up and down directions as seen in Fig. 7c), and when the ends pass beyond the lug 114, they return to their original position due to their spring-loaded characteristics, thus preventing the contact 120 from being pulled out of the housing 110 in the back direction. Since for the retention of the contacts in the housing, it is sufficient to have spring-loaded action of retaining lances 125 only in the left and right direction relative to the axial direction without providing spring-loaded action in the up and down direction, the height of the contact-receiving cavities 111 can be made lower.

[0003] In order to remove contact 120 from the housing 110, a special opening 116 is provided in an upper wall 115 of the housing 110 that is linked to the contact-receiving cavity 111 at the location of the retaining lances 125. The contact 120 is removed by insertion of a special retention-releasing tool 140 into opening 116. When the retention-releasing tool 140 is inserted into the opening 116, it bends the spring-loaded lances to the left and to the right relative to the axial direction, thus making it possible to remove the contact 120 from the housing 110.

[0004] However, as was mentioned, an opening 116 for the retention-release tool passes through the upper wall 115 of the housing 110 to the contact-receiving cavity 111 at the location of the retaining lances 125. Therefore, contacts 120 cannot be arrayed in two or more horizontal rows in the housing 110, because it is impossible to make openings 116 through which the contacts other than those in the upper row can be accessed from the upper wall by the retention-release tool. In order to solve this problem, it was suggested to make the opening 116 for the retention-release tool in the front surface 113 of the housing 110. However, in such a case, since the retaining lances 125 are located between the contact section 121 and the wire-connecting section 122, it would be necessary to make the opening 116 very deep and the retention-release tool 140 very long, thereby making the contact removal rather complicated.

[0005] On the other hand, in the insertion of contacts in the housing, some contacts can be inadvertently inserted upside down. In a conventional electrical connector 100, such an occurrence is prevented from happening by the front edge of the retaining lances 125 of the contact 120 being pressed against the back surface 112 of the housing 110, thus drawing attention to the fact that a contact is upside down.

[0006] Nevertheless, since in the conventional electrical connector 100, the retaining lances 125 of the contact 120 are located between the back edge of the contact section 121 and the front edge of the wire-connecting section 122, the contact can be inserted even when it is upside down.

[0007] Therefore, the purpose of the present invention is to offer an electrical connector allowing for easy removal of contacts from the housing.

[0008] Another purpose of the present invention is to offer an electrical connector making it possible to immediately identify a contact that is being inserted in an upside down position, and contacts used therein.

[0009] An electrical connector according to the present invention comprises a housing having contact-receiving cavities extending forward from the back surface and arrayed in several rows, and multiple electrical contacts accommodated in the contact-receiving cavities of the housing, with the contacts having a contact section intended to form electrical connections with mating electrical contacts, a wire-connecting section located behind the contact section and intended for electrical connection to an electrical wire, and a retaining section engaging with a retention lug provided in the housing that is configured as a pair of spring-loaded retaining lances extending from the front to the back and bending to the left and the right with respect to an axial direction of the contact, and the retaining section of the contacts is located near a front end the contact section and the contact-receiving cavities are provided in the housing with recesses running from a front surface of the housing to the front end of the contacts for the insertion of a tool for the purpose of releasing the retention of the spring-loaded retaining lances from the retention lugs.

[0010] The contact-receiving cavities include a first cavity section whose width corresponds to the width of the contact section of the contacts and a second cavity

section that is linked to the first cavity section and is of a different width than the first cavity section, i.e., whose width corresponds to the width of the retaining section of the contacts.

[0011] An electrical contact according to the present invention comprises a contact section, a wire-connecting section behind the contact section and intended for electrical connection to an electrical wire, and a retaining section engaging with a retention lug provided in the housing that is configured as a pair of spring-loaded retaining lances extending from a front end toward a back end of the contact and bending to the left and the right with respect to an axial direction of the contact, and the retaining section is located adjacent the front end of the contact.

[0012] Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:

[0013] Figure 1 is a front view of an electrical connector according to the present invention.

[0014] Figure 2 is a cross-sectional view taken along line 2-2 in Fig. 1.

[0015] Figure 3 is a cross-sectional view taken along line 3-3 in Fig. 1.

[0016] Figure 4 is a rear view of the electrical connector shown in Fig. 1.

[0017] Figure 5 is a perspective view of an electrical contact according to the present invention, constituting a part of the electrical connector shown in Fig. 1.

[0018] Figure 6 is an exploded perspective view of the electrical connector depicted in Fig. 1 with the secondary retention member being spaced from the housing before its coupling with the housing.

[0019] Figures 7a-7c show a conventional electrical connector and electrical contact used therein with Figure 7a being a perspective view of the contact; Figure 7b a part cross-sectional view of the electrical connector; and Figure 7c a cross-sectional view taken along line 7c-7c in Figure 7b.

[0020] Figures 1 through 4 show electrical connector 1 comprising a dielectric housing 10 having contact-receiving cavities 11, 12 extending from rear surface 13 to front surface 14, arrayed in several rows, and of multiple electrical contacts 20, 30 inserted in the contact-receiving cavities 11, 12 of the housing 10. From among the contact-receiving cavities 11, 12, the cavities 12 comprising the upper row accommodate contacts 30 including contact section 31 intended to form electrical connection with mating contacts (not shown) and wire-connecting section 32 electrically connected to electrical wire 50. The rear end of the contact section 31 of contact 30 engages against housing lance 15 extending inside the contact-receiving cavity 12, thus providing for primary retention in the back direction. In addition, at the front surface 14 of the housing 10, a dielectric secondary-retention member 40 is mounted whose extension 42 enters space 16 located above the housing lance 15 and blocks it from being displaced upward, thereby providing for the secondary retention for the contact 30 within contact-receiving cavity 12.

[0021] The contact-receiving cavities 11 of the second and lower rows of the contact-receiving cavities 11, 12 of the housing 10 accommodate multiple electrical contacts 20 that are different from contacts 30. Contacts 20 are stamped and formed from brass or other sheet metal material. Contacts 20 include contact section 21 intended to form electrical connection with mating contacts (not shown) and wire-connecting section 22 intended for electrical connection to an electrical wire (not shown) that is located behind the contact section 21. Near a front end of the contact section 21, an upward extending retention device 23 is located that engages with a retention lug 17 in the contact-receiving cavity 11 of the housing 10.

[0022] As can be seen in Figure 5, the retention device 23 includes two spring-loaded retaining lances 24 oriented in the longitudinal direction that can bend to the right and to the left or away from each other relative to a centerline or axis of the contact 20. The contact section 21 includes a bottom wall 25 and two side walls 26 extending upward from both sides of the bottom wall 25. One of the two side walls 26 is bent to form upper wall 27 thereby forming a box-shaped receptacle 28 having inside it a spring-loaded U-shaped contact 29 that establishes electrical connection with a mating contact. One of the two spring-loaded lances 24 forming the retention device 23 is made by being cut from the upper wall 27 of the receptacle 28 by a cut in the direction of the contact centerline, and the other lance 24 extends from the side wall 26. The spring-loaded retaining lances 24 extend parallel to one another and to the contact centerline.

[0023] The contact-receiving cavities 11 accommodating contacts 20 include a cavity section 11a, whose width corresponds to the width of the contact section 21 and a second cavity section IIb of lesser width corresponding to the width of the retention device 23 that is linked to the first cavity section 11a. The width of the second cavity section 11b may also be greater than that of the first cavity section 11a.

[0024] The contact section 21 and the wire-connecting section 22 of all contacts 20 are inserted from the rear surface 13 of the housing 10 in the first cavity section 11a. At this time, the retention devices 23 of the contacts 20 are inserted in the second cavity section 11b also from the rear surface 13 of the housing 10. If a contact 20 is upside down during the insertion, it will engage against the rear surface 13 of the housing 10, thus making insertion impossible and indicating that the contact is in the wrong position. In such a situation, due to the fact that the retention device 23 of the contact 20 is located near the front end of the contact section 21, it blocks the insertion of the contact in the wrong position and makes it possible to easily identify the problem. Eventually, in the process of insertion, the retention device 23 engages with the retaining lug 17 of the housing

10.

[0025] The retaining lugs 17 of the housing 10 are arranged at a front end of an upper wall of the contact-receiving cavities 11 extending inside the cavities. When the retention device 23 is inserted into the contact-receiving cavity 11, the spring-loaded lances 24 comprising the retention device 23 move along cam surfaces 17a located on both sides of the retention lug 17 and are bent aside to the right and left from the center line, and after they pass the lug 17, they return to their original position at a front end of the retention lug, thus securing the contact 20 in the housing 10. Since in such a configuration the spring-loaded lances 24 of the retention device 23 are deflected to the left and right sides of the centerline, there is no need in bending them up and down, thus making it possible to reduce the height of the contact-receiving cavities.

[0026] At the front end 14 of the housing 10, a recessed surface 14a (Figure 6) is located to accommodate secondary retention member 40. The recessed surface 14a has guiding openings 11c for the reception of mating contacts that correspond to the contact-receiving cavities 11. The guiding openings 11c are surrounded by projections 11d. In addition, in the recessed surface 14a, above each contact-receiving cavity 11 surrounded by the projections 11d, recesses 18 for insertion of a retention-release tool are provided that are linked to the contact-receiving cavities 11 and extend to the retention lugs 17. In addition, projections 12c surrounding slanted contact-guiding surfaces 12b located at the lower side of the guiding openings 12a for mating contacts are provided on the recessed surface 14a at areas corresponding to the contact-receiving cavities 12. In the front wall 41 of the secondary retention member 40 that fits over the recessed surface 14a, multiple openings 43 are located that receive the projections 11d of the housing 10 when the secondary retention member 40 is secured on the recessed surface 14a. In addition, the front wall 41 of the secondary retention member 40 has multiple secondary openings 44 that couple with the projections 12c and together with the slanted contact guiding surfaces 12b of the projections 12c form contact-guiding openings 12a when the secondary retention member 40 is secured on the recessed surface 14a.

[0027] The secondary retention member 40 can be shifted between the temporary retention position of the contacts 30 in the contact-receiving cavities 12 and the secondary or final retention position of the contacts 30. In order to perform the temporary and final retention by the secondary retention member 40, temporary-latching lugs 19a and final-latching lugs 19b are located on the side walls of the housing 10, and latching slots 46 having latches 47 are located on both side walls 45 of the secondary retention member 40. In the temporary retention position, the latches 47 of the secondary retention member 40 engage latching lugs 19a and final-latching lugs 19b of the housing 10, and the motion of the secondary retention member 40 is temporarily blocked in both coupling and removing directions. In the final retention position of the secondary retention member 40, the front edges of the latches 47 of the secondary retention member 40 engage with the ledges 19c located on the side walls of the housing 10 and the back edges of the latches 47 engage with the final-latching lugs 19b, thus blocking the motion of the secondary retention member 40 both in the coupling and removing direction.

[0028] Next the process of the removal of contacts 20 arranged in multiple rows in the contact-receiving cavities 11 of the housing 10 is explained.

[0029] In order to remove contacts 20 arranged in multiple rows from the housing 10, it is necessary first to disengage the secondary retention member 40 from the housing 10 by bending both side walls 45 of the secondary retention member 40 outwardly, after which the secondary retention member 40 can be removed from the housing 10. After that, the retention-release tool (not shown) is inserted from the front side of the housing 10 in the recesses 18 provided for this purpose. The retention-release tool separates the spring-loaded lances 24 of the retention device 23 of the contact 20, thus resulting in the disengagement of the retention device 23 from the retention lug 17. After that, contact 20 can be removed through the back surface of the housing 10.

[0030] The same procedure is then applied to each contact 20. In this manner, all contacts 20 can be removed from the housing 10. Since the retention device 23 is located near the front end of the contact section 21 and since the recesses 18 for the retention-release tool are located at the front end 14 of the housing 10 in proximity of the retention devices 23, the retention devices 23 can be easily disengaged by the retention-release tool even if the contacts 20 are arranged in the housing 10 in multiple rows.

[0031] Due to the fact that in the electrical connector according to the present invention, the contact-retaining section is located near the front end of the contact section and since recesses for the insertion of the retention-release tool extending from the front surface of the housing to the retention device are provided, the retention device can be easily disengaged when a contact must be removed from the housing. Contacts can be easily removed from the housing even if they are arranged in multiple rows.

[0032] Since the contact-receiving cavities consist of two sections with the first section of the cavity having the same width as the contact section of the contact, and the second section of the cavity, which is linked to the first section but whose width is different from that of the first section and corresponds to the retention device width, the contacts cannot be inserted in the contact-receiving cavity in an upside down position because the retention device engages against the back surface of the housing, thereby preventing farther insertion and indicating that the contact is in the wrong position. Therefore, due to the fact that the retention device is located near the front end of the contact, the insertion of con-

tacts in an upside down position into the contact-receiving cavities can be easily prevented.

[0033] Since the retention device of the contact is configured as two spring-loaded lances that can bend to the left and right relative to the axis of the contact and since the retention device is located near the front end of the contact section, it is possible to reduce the vertical dimensions of the contact-receiving cavities. In addition, since the retention device can be easily disengaged from the retention lug by using a retention-release tool, the contacts can be easily removed from the housing, thus making it possible to arrange contacts in the housing in several rows. Positioning of the retention device near the front end of the contact section makes it possible to immediately recognize that the contact is in a wrong position during its insertion in the contact-receiving cavity.

Claims

1. An electrical connector comprising a housing (10) having contact-receiving cavities (11) extending through the housing from a back end to a front end and arranged in rows, electrical contacts (20) disposed in the contact-receiving cavities with the contacts having a contact section (21) for electrical connection with mating electrical contacts, a wire-connecting section (22) for electrical connection to an electrical wire, and a retaining section (23) engaging with retention lugs (17) provided in the contact-receiving cavities thereby retaining the contacts in the contact-receiving cavities, wherein

   the retaining section (23) is located adjacent a front end of the contact section (21), and the contact-receiving cavities are provided with recesses (18) extending from the front end of the housing to the front end of the contacts for the insertion of a tool to release the retaining sections (23) from the retention lugs (17) so that the contacts can be removed from the contact-receiving cavities.

2. An electrical connector as claimed in claim 1, wherein the retaining section (23) is in the form of a pair of spring-loaded lances (24) extending upwardly from the contact section and they can be bent away from each other.

3. An electrical connector as claimed in claim 1 or 2 wherein the contact-receiving cavities (11) comprise a first section (11a) having a width corresponding to the width of the contact section (21) and a second section (llb) linked to said first section and is of a different width than the first section so as to accommodate the retaining section (23).

4. An electrical connector as claimed in claim 1, 2 or 3 wherein the retention lugs (17) have cam surfaces (17a) at inner ends thereof.

5. An electrical connector as claimed in any preceding claim wherein other contact-receiving cavities (12) are provided in said housing (10) in which other electrical contacts (30) are disposed, housing lances (15) are located in the other contact-receiving cavities engaging the other electrical contacts, and a secondary retention member (40) is latchably mounted onto said housing and includes an extension (42) engaging the housing lances and blocks them from being displaced from the other electrical contacts.

6. An electrical contact comprising a contact section (21) for electrical connection to a mating contact, a wire-connecting section (22) located adjacent the contact section for electrical connection to an electrical wire, and a retaining section (23) for engagement with a retention lug in a contact-receiving cavity of a housing to retain the contact therein, wherein

   the retaining section is located adjacent a front end of the contact section.

7. An electrical contact as claimed in claim 6, wherein the retaining section (23) is in the form of a pair of spring-loaded lances (24) extending outwardly from the contact section (21) and they can be bent away from each other.

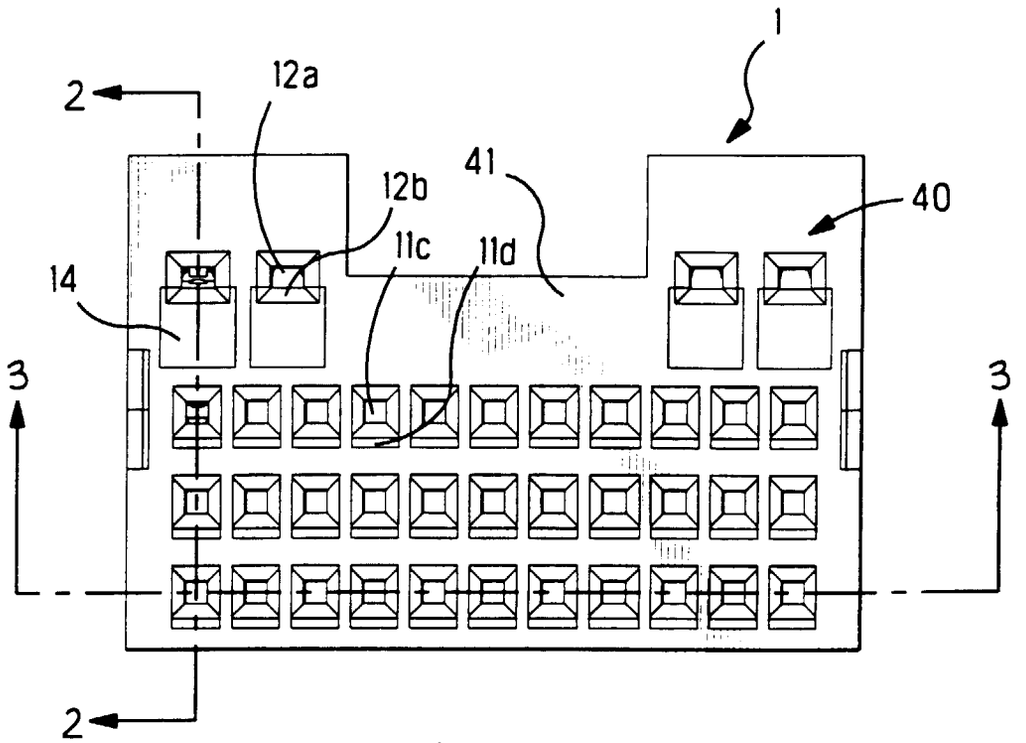
1
2
12a
12b
41
40
11c
11d
14
3
3
2

Fig. 1

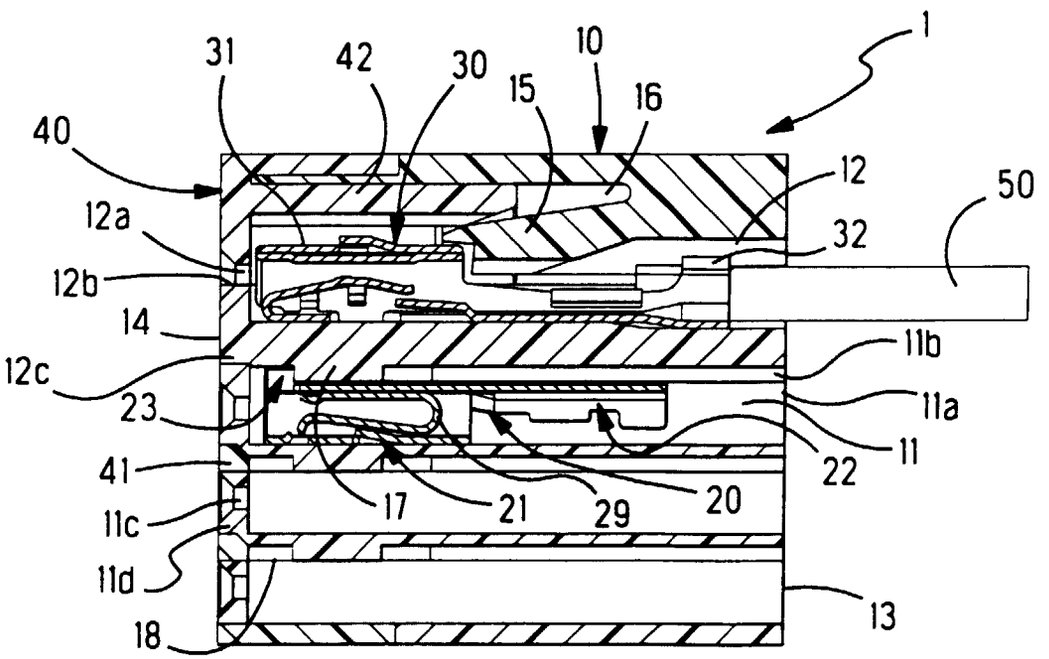
1
31
42
30
15
10
16
40
12
50
12a
32
12b
14
11b
12c
23
11a
11
22
41
17
21
29
20
11c
11d
13
18

Fig. 2

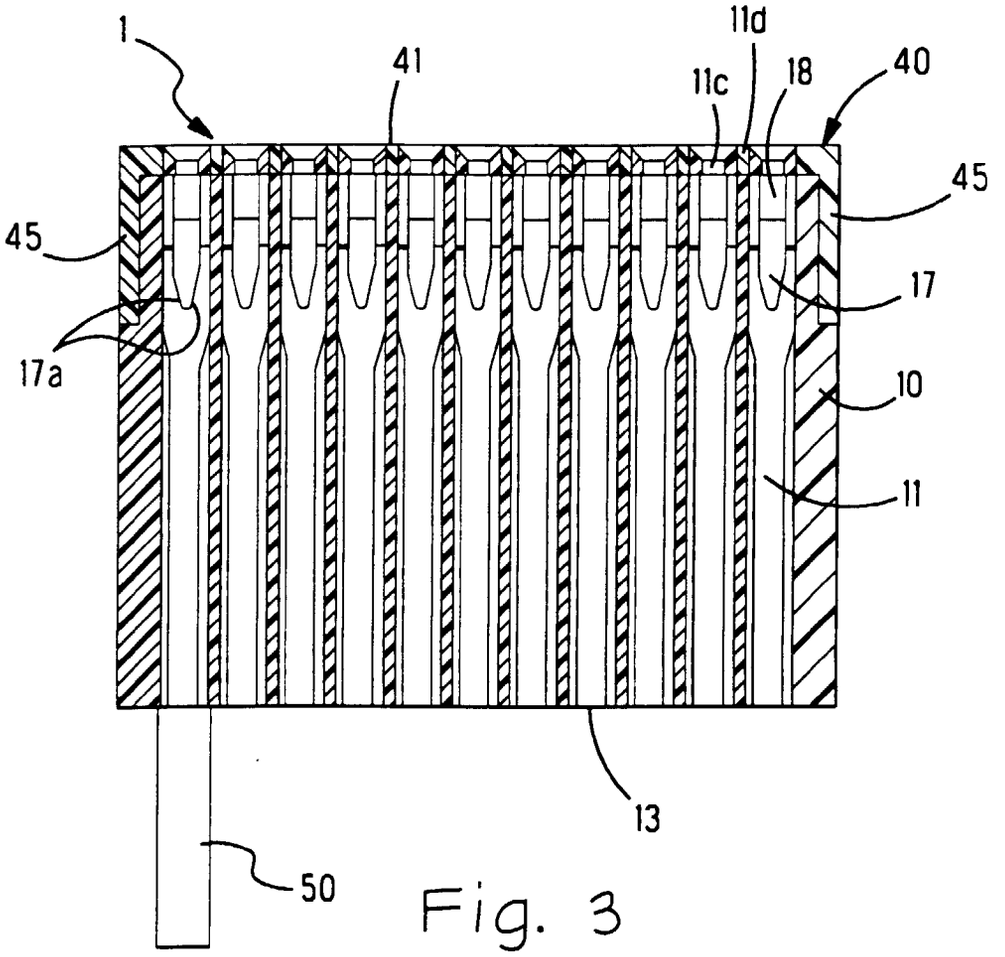

Fig. 3

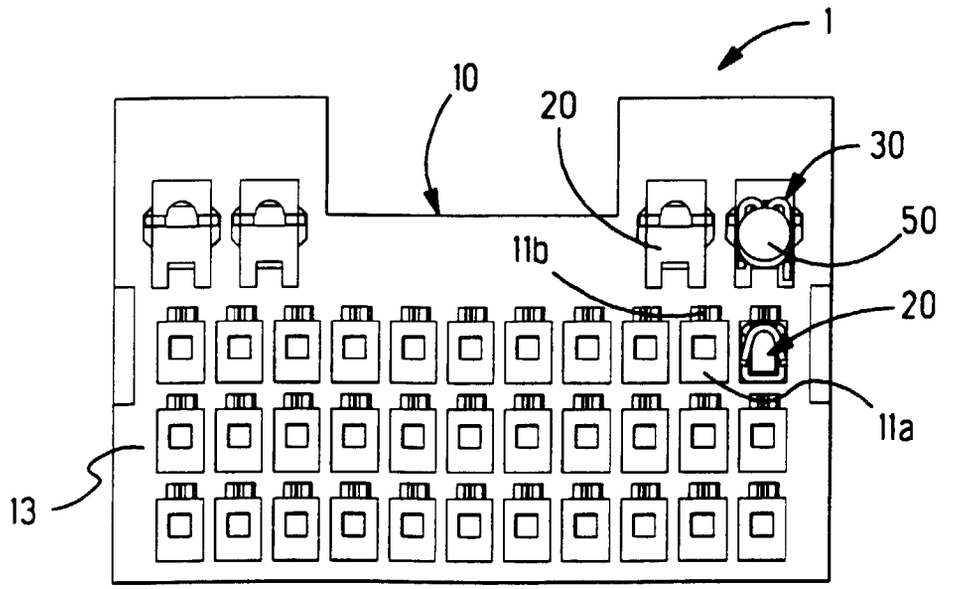

Fig. 4

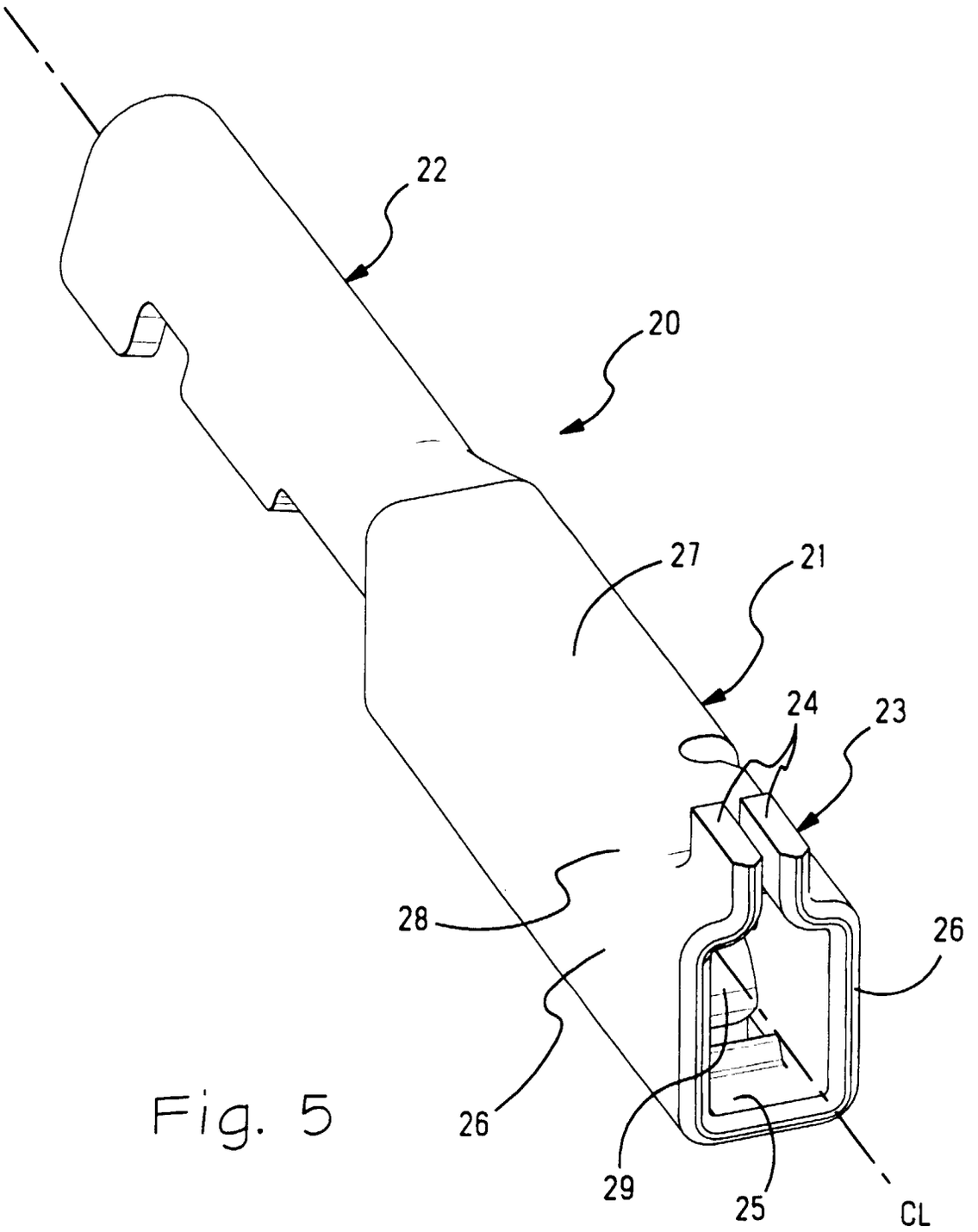

Fig. 5

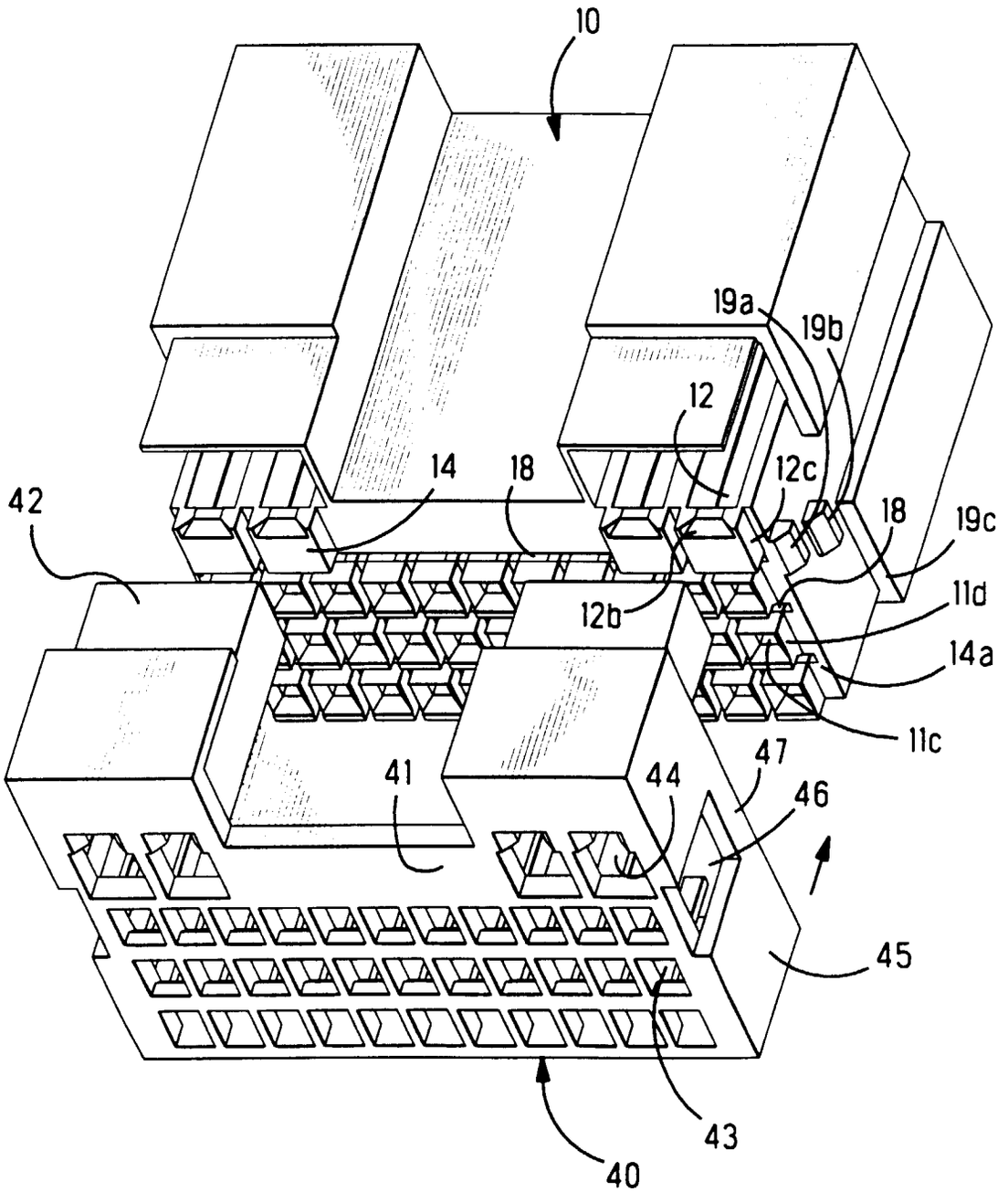
10
19a
19b
12
14
18
12c
18
19c
42
12b
11d
14a
11c
47
41
44
46
45
43
40

Fig. 6

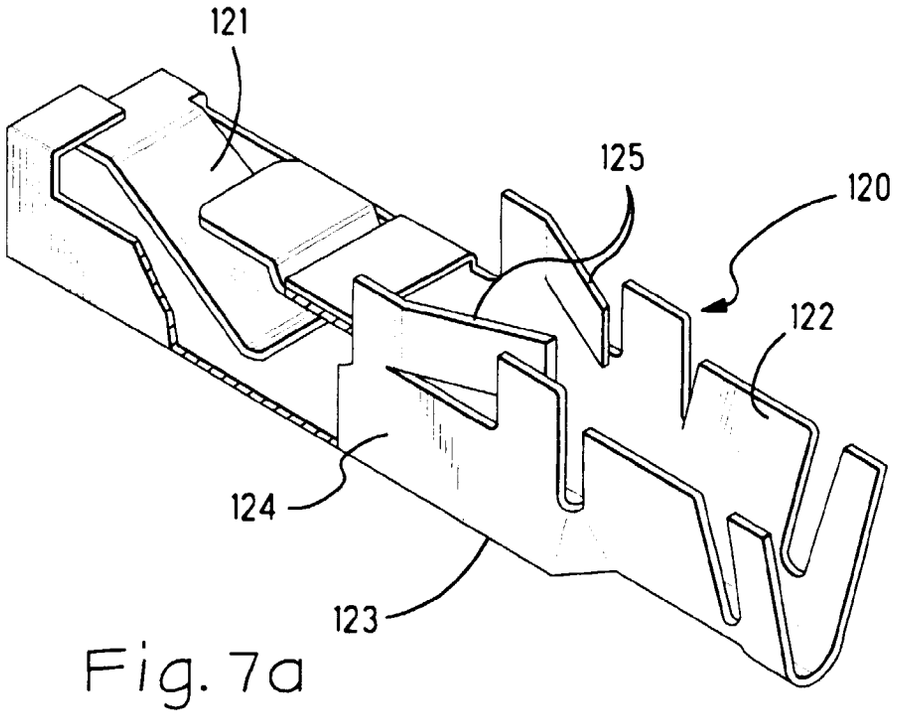

Fig. 7a

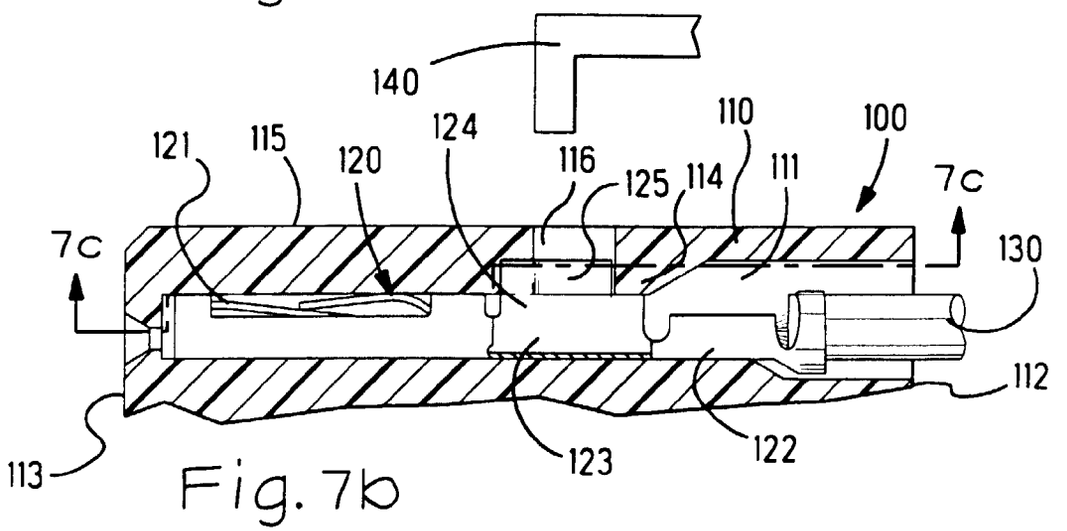

Fig. 7b

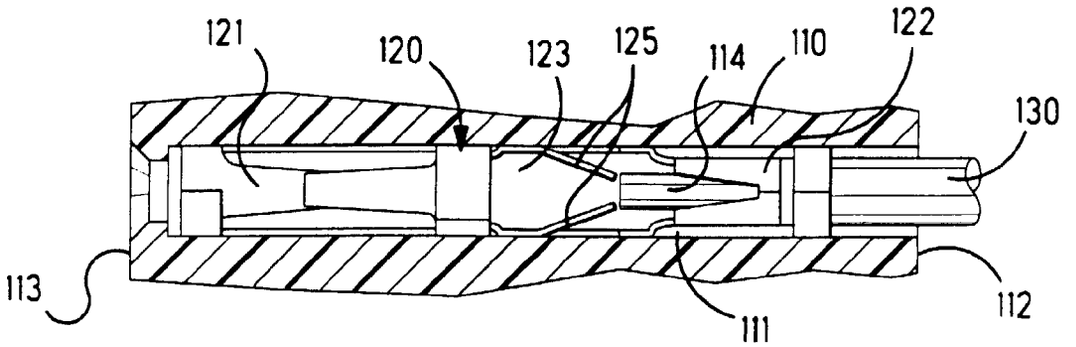

Fig. 7c