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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Radio connector block plate**

(57) An electrical connector is provided, which comprises a connector housing (1) having a plurality of contacts (2, 3, 4), said contacts (2, 3, 4) protruding out of a side of the connector housing (1), a plate (5) made of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts (2, 3, 4) protruding out of the connector housing (1),

and a printed circuit board (6) being arranged on the plate (5), said printed circuit board (6) having a plurality of holes for accommodating the extremities of the protruding contacts (2, 3, 4), wherein said plate (5) is sandwiched between the connector housing (1) and the printed circuit board (6), and the side of the connector housing (1), the plate (5) and the printed circuit board (6) all lie in a same plane.

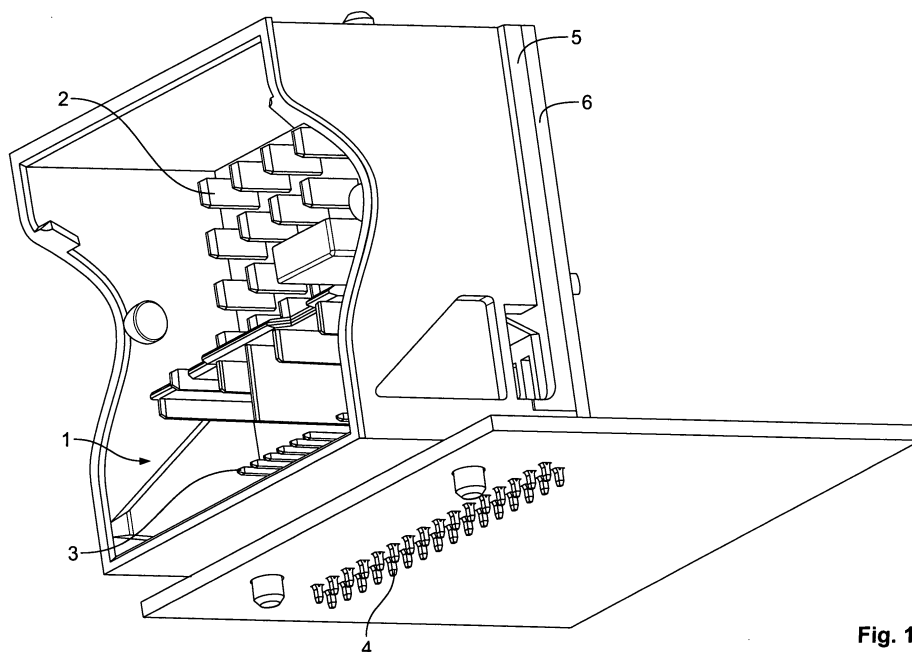


Fig. 11

Description

[0001] The present invention relates to an electrical connector and to a method for manufacturing same. In particular, the electrical connector is used as a car radio connector.

[0002] With the ongoing trend towards smaller, faster and higher performance electrical components, such as a processor used in computers, routers, switches, etc., it has become increasingly important for the electrical interfaces along the electrical path to also operate at higher frequencies and at higher densities with increased throughput.

[0003] In a traditional approach for interconnecting circuit boards, one circuit board serves as a backplane and the other as a daughter board. The backplane typically has a connector, commonly referred to as a header that includes a plurality of signal pins or contacts, which connect to conductive traces on the backplane. The daughter board connector, commonly referred to as a receptacle, also includes a plurality of contacts or pins. Typically, the receptacle is a right angle connector that interconnects the backplane with the daughter board so that signals can be routed between the two. The right angle connector typically includes a mating face that receives the plurality of signal pins from the header on the backplane and a mounting face that connect to the daughter board. Likewise, the header comprises a mating face adapted to mate with the mating face of the right angle connector and a mounting face that connects to the backplane board.

[0004] US 6,719,574 B2 discloses an angled electrical connector having first connector means extended in a first direction and second connector means extended in an angled direction with respect to the first connector means. The slanted connector comprises a first part comprising the first connector means and a second part comprising a second connector means. The second part comprises two plates being integrally, mechanically connected and angled to each other, the angle deciding how much the connector is slanted. One of the plates is intended to be connected to the incoming pins protruding out of the first part, while the other plate is provided with the outgoing pins on the side of the plate turned towards a printed circuit board, on which the connector is intended to be mounted.

[0005] The plate intended to be connected to the incoming pins comprises holes, which have a size just adapted to the size of the incoming pins in order to have a good grip together with good electrical contact. As far as the outgoing pins on the side of the plate turned towards the printed circuit board are concerned, they are mounted in metalized through-holes of the plate for electrical connection. When the connector is mounted, the outgoing pins from the plate could be adapted for wave soldering and should then rest on contact pads on the printed circuit boards to which the pins should be soldered. Alternatively, the pins could be adapted to be in-

serted in holes in the board to be soldered therein.

[0006] In the angled electrical connector according to US 6,719,574 B2, the incoming pins of the first part of the electrical connector undergo a large level of mechanical stress, which eventually leads to mechanical failure of the electrical connector. There is therefore a need for an electrical connector, in which no mechanical stress is induced on the contacts, thereby leading to a higher lifetime of the electrical connector.

[0007] An object of the invention is to provide an electrical connector whose connector housing can be connected to the printed circuit board without introducing mechanical stress on the contacts of the electrical connector. Further, a corresponding method for manufacturing same is to be provided.

[0008] This object is solved by the subject matter of the independent claims. Preferred embodiments are subject matter of the dependent claims.

[0009] An embodiment of the invention provides an electrical connector comprising a connector housing having a plurality of contacts, said contacts protruding out of a side of the connector housing, a plate made of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts protruding out of the connector housing, and a printed circuit board being arranged on the plate, said printed circuit board having a plurality of holes for accommodating the extremities of the protruding contacts, wherein said plate is sandwiched between the connector housing and the printed circuit board, and the side of the connector housing, the plate and the printed circuit board all lie in a same plane.

[0010] According to a preferred embodiment of the invention, a dimension of the through-holes in the plate is such that a clearance is left within the through-holes after the introduction of the protruding contacts into the through-holes.

[0011] The present invention will be described in detail in the following based on the figures enclosed with the application.

Figure 1 is a perspective view of a connector housing according to an embodiment of the invention;

Figure 2 is a perspective view of a connector housing, a plate and printed circuit board constituting an electrical connector according to an embodiment of the invention;

Figure 3 is a perspective view of a connector housing according to an embodiment of the invention;

Figure 4 is a perspective view of a connector housing according to an embodiment of the invention;

Figure 5 is a perspective view of a connector housing and a plate according to an embodiment of the invention before mounting of the plate onto the con-

connector housing;

Figure 6 is a perspective view of a connector housing and a plate according to an embodiment of the invention before mounting of the plate onto the connector housing;

Figure 7 is a perspective view of a connector housing and a plate according to an embodiment of the invention after mounting of the plate onto the connector housing;

Figure 8 is a perspective view of a connector housing, a plate and a printed circuit board according to an embodiment of the invention before mounting of the printed circuit board onto the plate mounted on the connector housing;

Figure 9 is a perspective view of a connector housing, a plate and a printed circuit board according to an embodiment of the invention after mounting of the printed circuit board onto the plate mounted on the connector housing;

Figure 10 is a perspective view of a mounted connector before mounting of the connector onto a second printed circuit board; and

Figure 11 is a perspective view of a mounted connector according to an embodiment of the invention after mounting of the mounted connector onto the second printed circuit board.

[0012] Figure 1 shows a perspective view of a connector housing according to an embodiment of the invention. The connector housing 1 is made out of an insulating material, preferentially plastic material. A first kind of contacts, the power tabs 2, are arranged within the connector housing 1. The power tabs 2 are preferentially arranged parallel to each other. The connector housing 1 further comprises a second kind of contacts, the so-called MQS contacts 3, which are preferentially arranged parallel to each other. MQS stands for "Micro Quadlock", which is a contact system adapted for high speed data transmission. Further, the MQS contacts 3 are preferentially arranged parallel to the power tabs 2. A fuse 8 is arranged in the connector housing 1. The connectors 2, 3 are shown as inserted within the connector housing 1 from one side of the connector housing 1.

[0013] Figure 2 shows a perspective view of a connector housing, a plate and a printed circuit board constituting a connector according to an embodiment of the invention.

[0014] Figure 2 shows the side of the connector housing 1 that is opposite the side shown in Figure 1. The fuse contact 7 of the fuse 8 can be seen as protruding out of the side of the connector housing 1 shown in Figure 2. Further, the extremities of the power tabs 2 can be seen as protruding out of the side of the connector hous-

ing 1. Likewise, the extremities of the MQS contacts 3 can be seen as protruding out of the side of the connector housing 1.

[0015] The connector housing 1 further comprises a plurality of multispring contacts 4, which are arranged at the bottom of the connector housing 1. The multispring contacts 4 have one contact side that is preferentially parallel to the axis of the power tabs 2 and the MQS contacts 3 and one other contact side that is essentially perpendicular to the axis of the power tabs 2 and the MQS contacts 3.

[0016] A plate 5 made out of electrically insulating material is arranged on the side of the connector housing 1, where the contacts 2, 3, 4 protrude out of the connector housing 1. According to an embodiment of the invention, the plate 5 is made of plastic material, for instance polyphenylene sulphide (PPS), which has good mechanical and electrical insulation properties.

[0017] The plate 5 comprises a plurality of through-holes for accommodating the protruding extremities of the power tabs 2 and the MQS contacts 3. Further, the plate 5 comprises a plurality of through-holes for accommodating the contact sides of the multispring contacts 4 that are parallel to the power contacts 2 and the MQS contacts 3. A printed circuit board 6 having holes for accommodating the extremities of the protruding contacts 2, 3, 4 can then be press-fitted onto the plate 5.

[0018] The contact stitching operation will be explained in the following with respect to the Figures 3 and 4.

[0019] Figure 3 shows a perspective view of the connector housing 1 according to an embodiment of the invention. The power tabs 2 are introduced into corresponding through holes within the connector housing 1. Likewise, the MQS contacts 3 are introduced into corresponding through-holes of the connector housing 1. Multispring contacts 4 are introduced into corresponding slits of the connector housing 1 situated at the bottom of the connector housing 1. Figure 4 shows the connector housing 1 upon completion of the contact stitching operation.

[0020] The plate assembly operation will now be described with respect to Figures 5 to 7.

[0021] Figure 5 shows a perspective view of the connector housing 1 according to an embodiment of the invention. The plate 5 made of insulating material, preferentially plastic material, which comprises a plurality of through-holes, is arranged on the side of the connector housing 1, where the contacts 2, 3, 4 protrude out of the connector housing 1. Upon arranging the plate 5 on the side of the connector housing 1, the protruding contacts 2, 3, 4 are introduced into the corresponding through-holes of plate 5. The plate 5 is thus fitted onto the side of the connector housing 1.

[0022] Figure 6 shows a different perspective view of the connector housing 1 and the plate 5, which shows supporting ribs 9 that are arranged on the side of the plate 5 to support the protruding contacts 2, 3, 4 upon insertion into the through holes of the plate 5. Since the

supporting ribs 9 facilitate the introduction of the contacts 2, 3, 4 into the through-holes of the plate 5, this facilitates the fitting operation of the plate 5 onto the connector housing 1. Figure 7 shows a perspective view of the connector housing 1 upon completion of the fitting operation of the plate 5 onto the side of the connector housing 1.

[0023] According to a preferred embodiment of the invention, a dimension of the through-holes in the plate 5 is chosen in such a way that, after an introduction of the corresponding contacts 2, 3, 4 into the through-holes of the plate 5, a clearance is left within the through-holes. This allows to suppress mechanical stress on the contacts 2, 3, 4.

[0024] The operation of assembling a printed circuit board 6 onto the connector housing 1 foreseen with the plate 5 will then be explained with respect to Figures 8 and 9.

[0025] Figure 8 shows a perspective view of the connector housing 1 having the plate 5 arranged on the side where the contacts 2, 3, 4 are arranged. It further shows a printed circuit board 6 that comprises holes for accommodating the extremities of the contact 2, 3, 4 protruding out of the plate 5.

[0026] Figure 9 shows a perspective view of the connector after arranging the printed circuit board 6 onto the plate 5. The printed circuit board 6 is soldered to the contacts 2 and 3, which protrude from the through-holes of the plate 5. Further, a clearance is foreseen between the connector housing 1 and the plate 5, on the one hand, and also between the printed circuit board 6 and the plate 5, on the other hand. Hence, the plate 5 is able to move freely within a predetermined range. The plate 5 is, for instance, able to move down upon pressing down the connector onto a second printed circuit board.

[0027] Figure 10 shows a perspective view of a connector according to an embodiment of the invention upon introduction of the multispring contacts 4 onto corresponding holes of a second printed circuit board. The multispring contacts 4 are press-fitted onto the plate 5 through holes of the second printed circuit board. Hence, a fully solder-less assembly process of the electrical connector onto the second printed circuit board can be guaranteed.

[0028] During the press-fit operation, the plate 5 is used as an intermediary element to avoid any mechanical stress from being applied on the soldered joints between the contacts 2 and 3 and the printed circuit board 6, to which they are soldered. The plate 5 is used as a means to push down the multispring contacts 4 onto the plate 5 through holes of the second printed circuit board.

[0029] According to a preferred embodiment of the invention, the plate 5 is designed for optimized structural mechanical behaviour and is able to support the press-down force required to insert the contacts onto the printed circuit board. During the press-fit operation, the plate 5 prevents any mechanical stress from being created in the connector housing 1, the contacts 2 and 3 as well as the printed circuit board 6. Hence, the electrical connec-

tor can be reliably connected to the second printed circuit board using a solder-less process.

[0030] Figure 11 shows a perspective view of the connector upon completion of the press-fit operation of the multispring contacts 4 onto the second printed circuit board.

[0031] An electrical connector according to an embodiment of the invention is such that the plate 5 made of electrically insulating electrical material is sandwiched between the connector housing 1 and the printed circuit board 6, wherein the side of the connector housing 1, the plate 5 and the printed circuit board 6 all lie in a same plane. This thus allows for press-fitting the electrical connector onto a second printed circuit board without introducing any mechanical stress on the soldered joints between the contacts 2 and 3 and the printed circuit board 6, the plate 5 supporting the press-down force required to insert the contacts onto the printed circuit board.

LIST OF REFERENCE SIGNS

[0032]

- 1 connector housing
- 2 power tab
- 3 MQS contact
- 4 multispring contact
- 5 plate
- 6 printed circuit board
- 7 fuse contact
- 8 fuse
- 9 supporting ribs

Claims

1. An electrical connector comprising:
 - a connector housing (1) having a plurality of contacts (2, 3, 4), said contacts (2, 3, 4) protruding out of a side of the connector housing (1),
 - a plate (5) made of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts (2, 3, 4) protruding out of the connector housing (1), and
 - a printed circuit board (6) being arranged on the plate (5), said printed circuit board (6) having a plurality of holes for accommodating the extremities of the protruding contacts (2, 3, 4),

wherein said plate (5) is sandwiched between the connector housing (1) and the printed circuit board (6), and the side of the connector housing (1), the plate (5) and the printed circuit board (6) all lie in a same plane.

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2. The electrical connector according to claim 1, wherein a dimension of the through-holes in the plate (5) is such that a clearance is left within the through-holes after the introduction of the protruding contacts (2, 3, 4) into the through-holes.

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3. The electrical connector according to claim 1 or 2, wherein the plate (5) is made of plastic material.

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4. The electrical connector according to one of claims 1 to 3, wherein the plate (5) comprises supporting ribs (9) for guiding and supporting the protruding extremities of the contacts (2, 3, 4).

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5. The electrical connector according to one of claims 1 to 4, wherein the protruding extremities of the contacts (2, 3, 4) are welded in the holes of the printed circuit board (6).

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6. The electrical connector according to one of claims 1 to 5, wherein the plurality of contacts (2, 3, 4) comprises multispring contacts (4), whose extremities are essentially perpendicular to the extremities of the other protruding contacts (2, 3, 4) and are adapted to be inserted into corresponding holes of a second printed circuit board, whose plane lies perpendicular to the plane of the printed circuit board (6).

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7. The electrical connector according to one of claims 1 to 6, further comprising a fuse (8), whose fuse contact (7) protrudes out of the connector housing (1).

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8. The electrical connector according to one of claims 1 to 7, wherein the electrical connector is a car radio connector.

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9. A method for manufacturing an electrical connector, said method comprising the following steps:

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forming a connector housing (1) having a plurality of contacts (2, 3, 4), said contacts (2, 3, 4) protruding out of a side of the connector housing (1),

forming a plate (5) out of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts (2, 3, 4) protruding out of the connector housing (1),

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arranging a printed circuit board (6) on the plate (5), said printed circuit board (6) having a plurality of holes for accommodating the extremities of the protruding contacts (2, 3, 4), and

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sandwiching said plate (5) between the connector housing (1) and the printed circuit board (6), wherein the side of the connector housing (1), the plate (5) and the printed circuit board (6) all lie in a same plane.

Amended claims in accordance with Rule 137(2) EPC.

1. An electrical connector comprising:

a connector housing (1) having a plurality of contacts (2, 3, 4), said contacts (2, 3, 4) protruding out of a side of the connector housing (1), a plate (5) made of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts (2, 3, 4) protruding out of the connector housing (1), and

a printed circuit board (6) having a plurality of holes for accommodating the extremities of the protruding contacts (2, 3, 4),

characterized in that

said plate (5) is sandwiched between the connector housing (1) and the printed circuit board (6), said printed circuit board (6) being arranged on the plate (5), wherein the side of the connector housing (1), the plate (5) and the printed circuit board (6) all lie in a same plane.

2. The electrical connector according to claim 1, wherein a dimension of the through-holes in the plate (5) is such that a clearance is left within the through-holes after the introduction of the protruding contacts (2, 3, 4) into the through-holes.

3. The electrical connector according to claim 1 or 2, wherein the plate (5) is made of plastic material.

4. The electrical connector according to one of claims 1 to 3, wherein the plate (5) comprises supporting ribs (9) for guiding and supporting the protruding extremities of the contacts (2, 3, 4).

5. The electrical connector according to one of claims 1 to 4, wherein the protruding extremities of the contacts (2, 3, 4) are welded in the holes of the printed circuit board (6).

6. The electrical connector according to one of claims 1 to 5, wherein the plurality of contacts (2, 3, 4) comprises multispring contacts (4), whose extremities are essentially perpendicular to the extremities of the other protruding contacts (2, 3, 4) and are adapted to be inserted into corresponding holes of a second printed circuit board, whose plane lies perpendicular to the plane of the printed circuit board (6).

7. The electrical connector according to one of claims 1 to 6, further comprising a fuse (8), whose fuse contact (7) protrudes out of the connector housing (1).

8. The electrical connector according to one of claims 1 to 7, wherein the electrical connector is a car radio connector. 5

9. A method for manufacturing an electrical connector, said method comprising the following steps: 10

forming a connector housing (1) having a plurality of contacts (2, 3, 4), said contacts (2, 3, 4) protruding out of a side of the connector housing (1), 15

forming a plate (5) out of electrically insulating material and comprising a plurality of through-holes for accommodating the plurality of contacts (2, 3, 4) protruding out of the connector housing (1), 20

forming a printed circuit board (6) having a plurality of holes for accommodating the extremities of the protruding contacts (2, 3, 4),

characterised by

sandwiching said plate (5) between the connector housing (1) and the printed circuit board (6), 25
said printed circuit board (6) being arranged on the plate (5), wherein the side of the connector housing (1), the plate (5) and the printed circuit board (6) all lie in a same plane. 30

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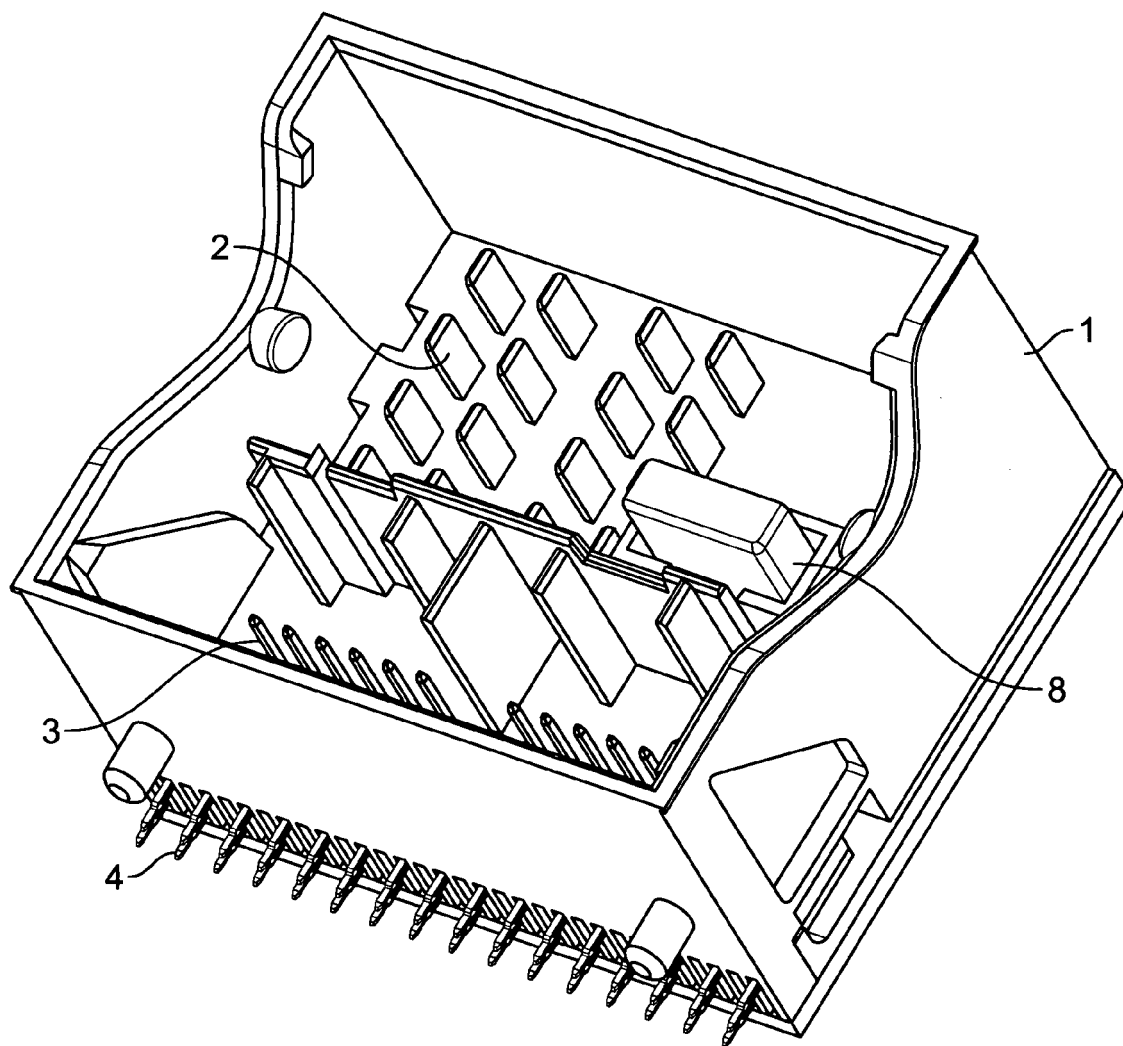


Fig. 1

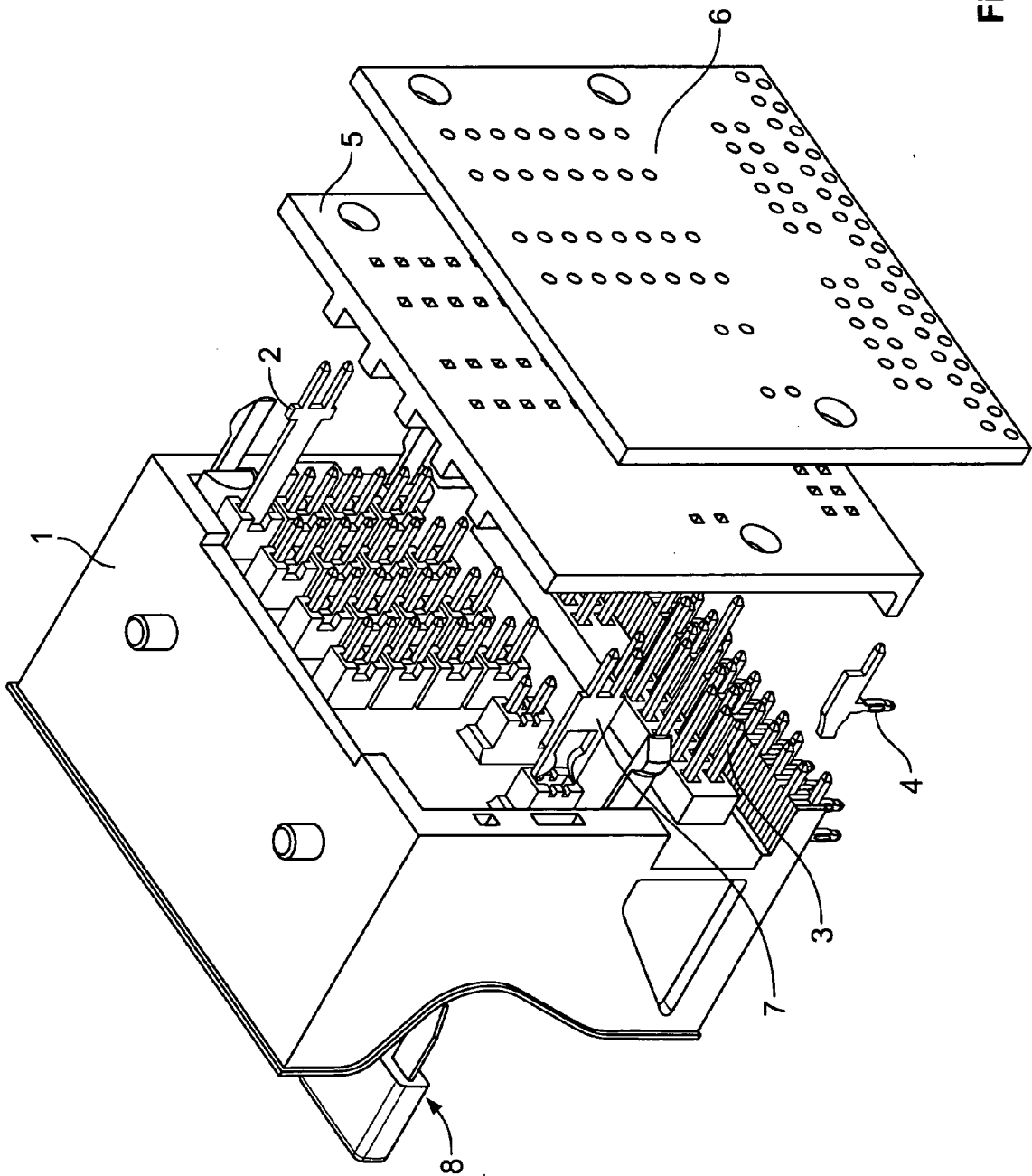


Fig. 2

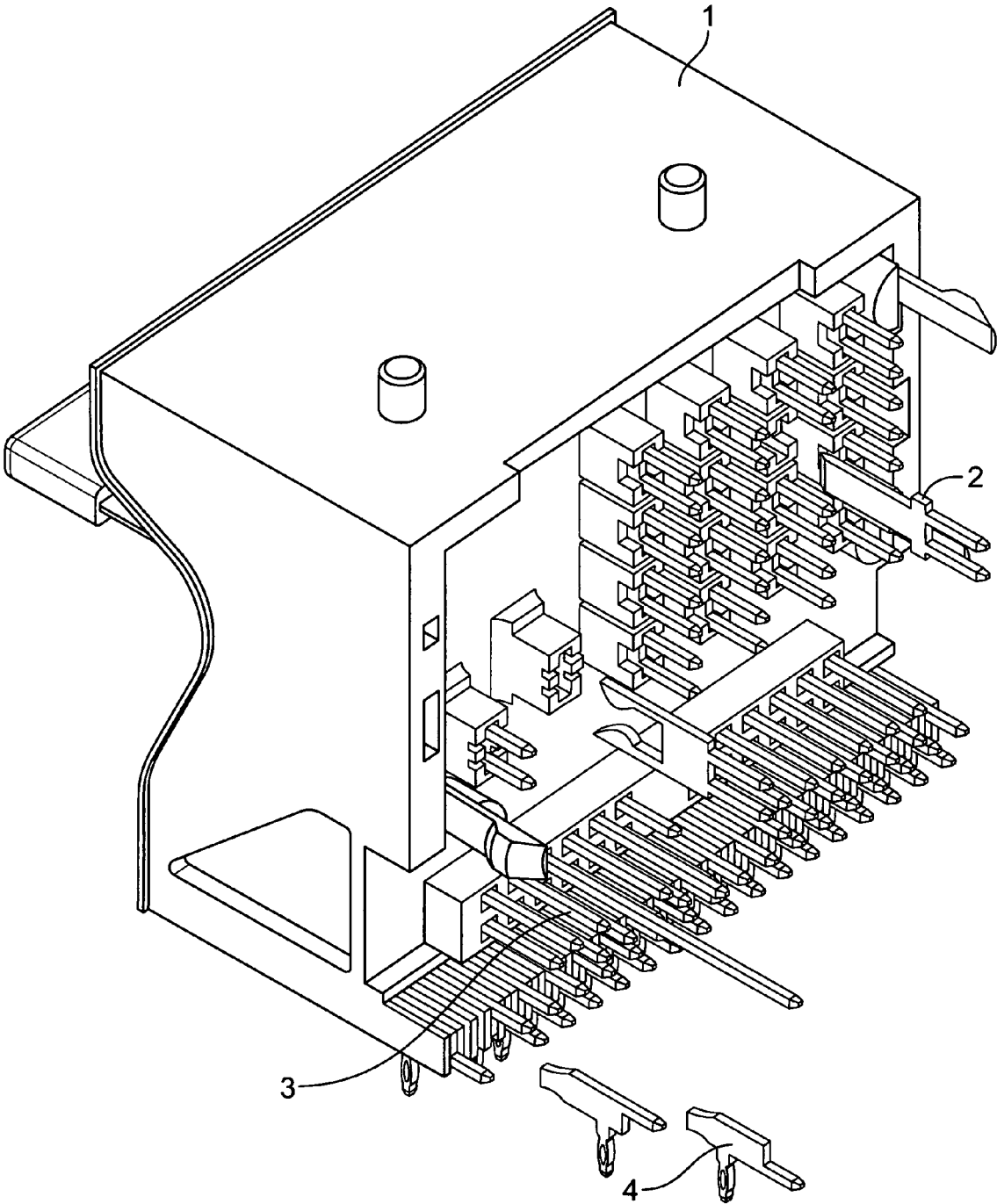


Fig. 3

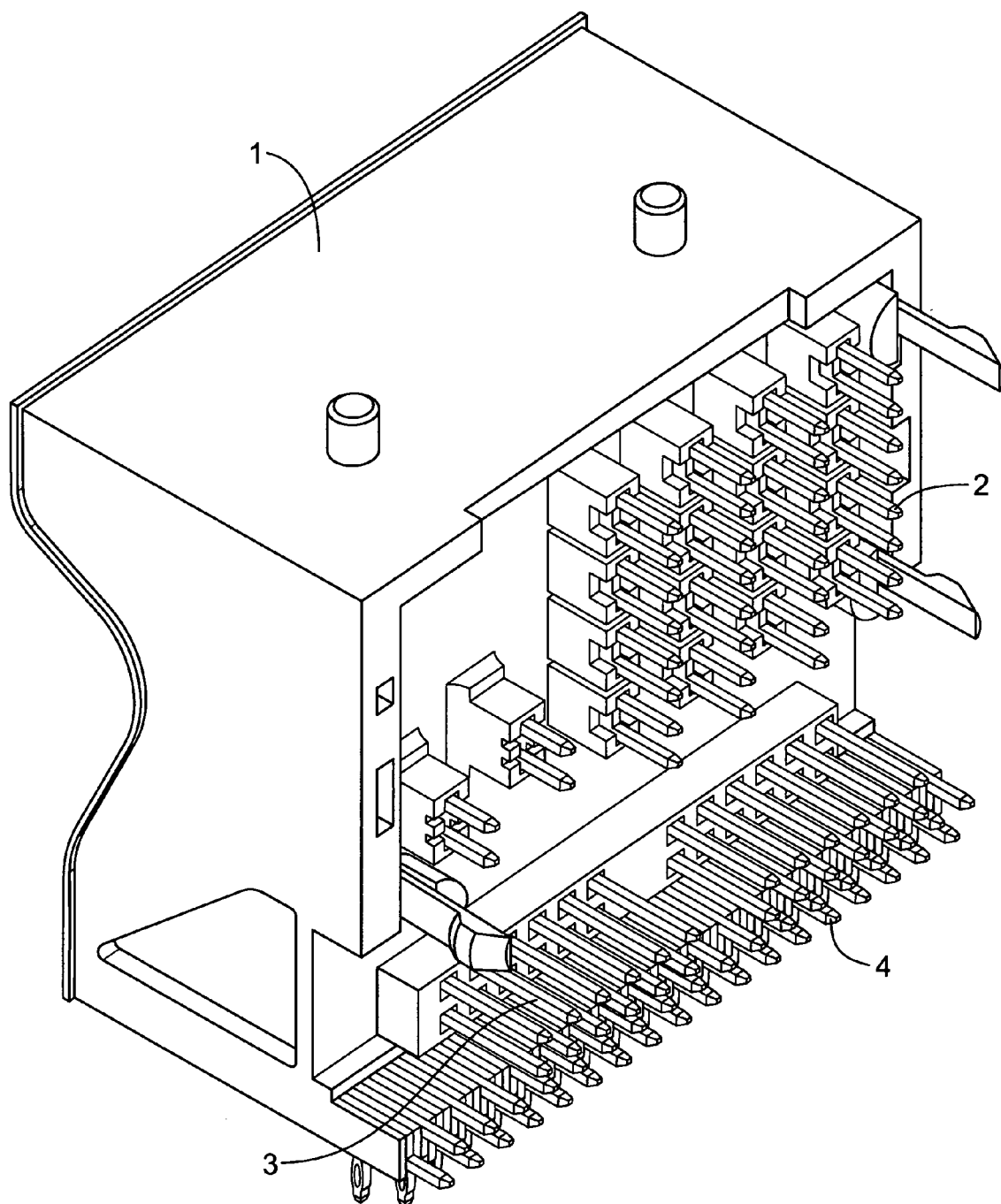


Fig. 4

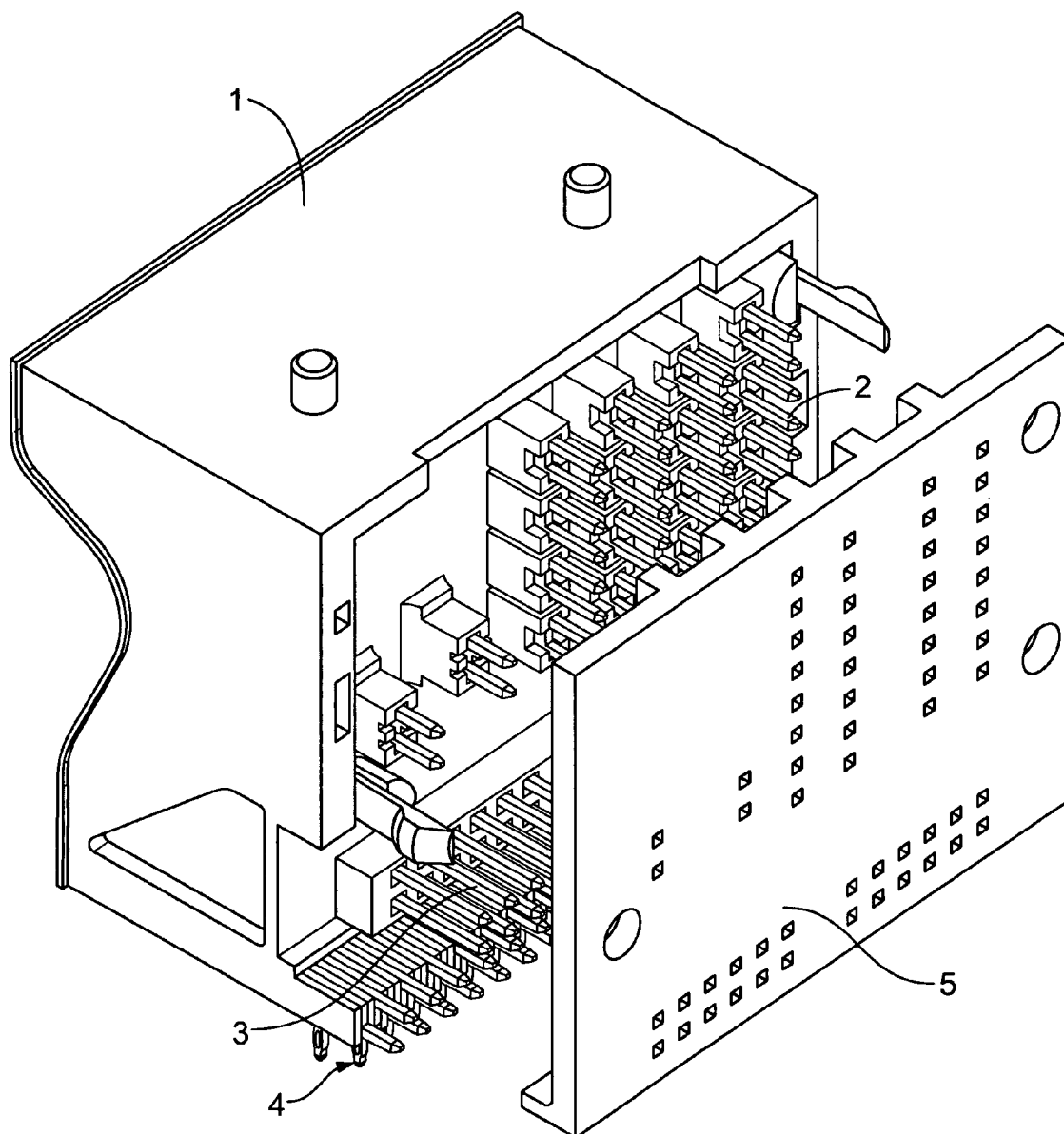


Fig. 5

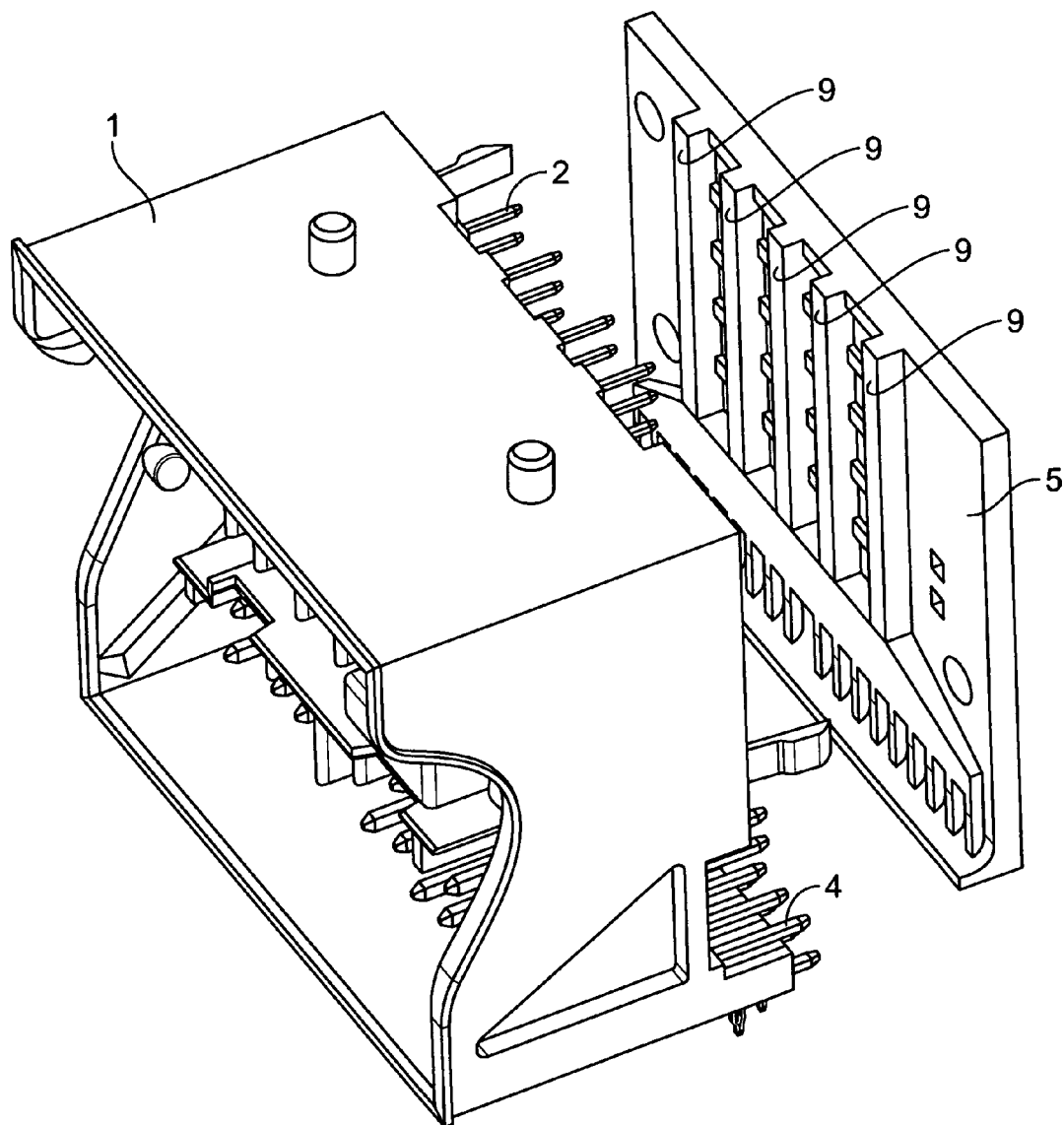


Fig. 6

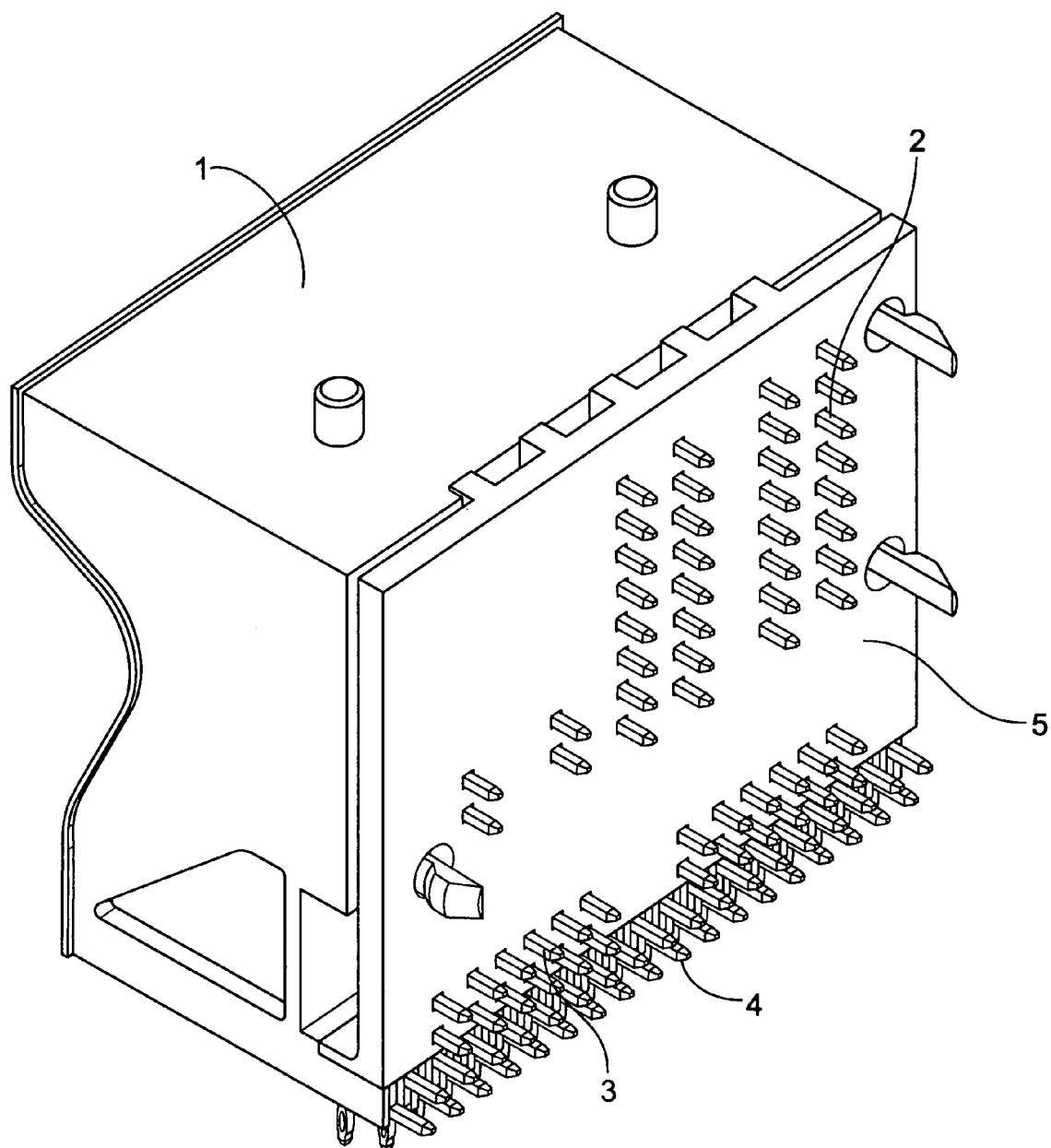


Fig. 7

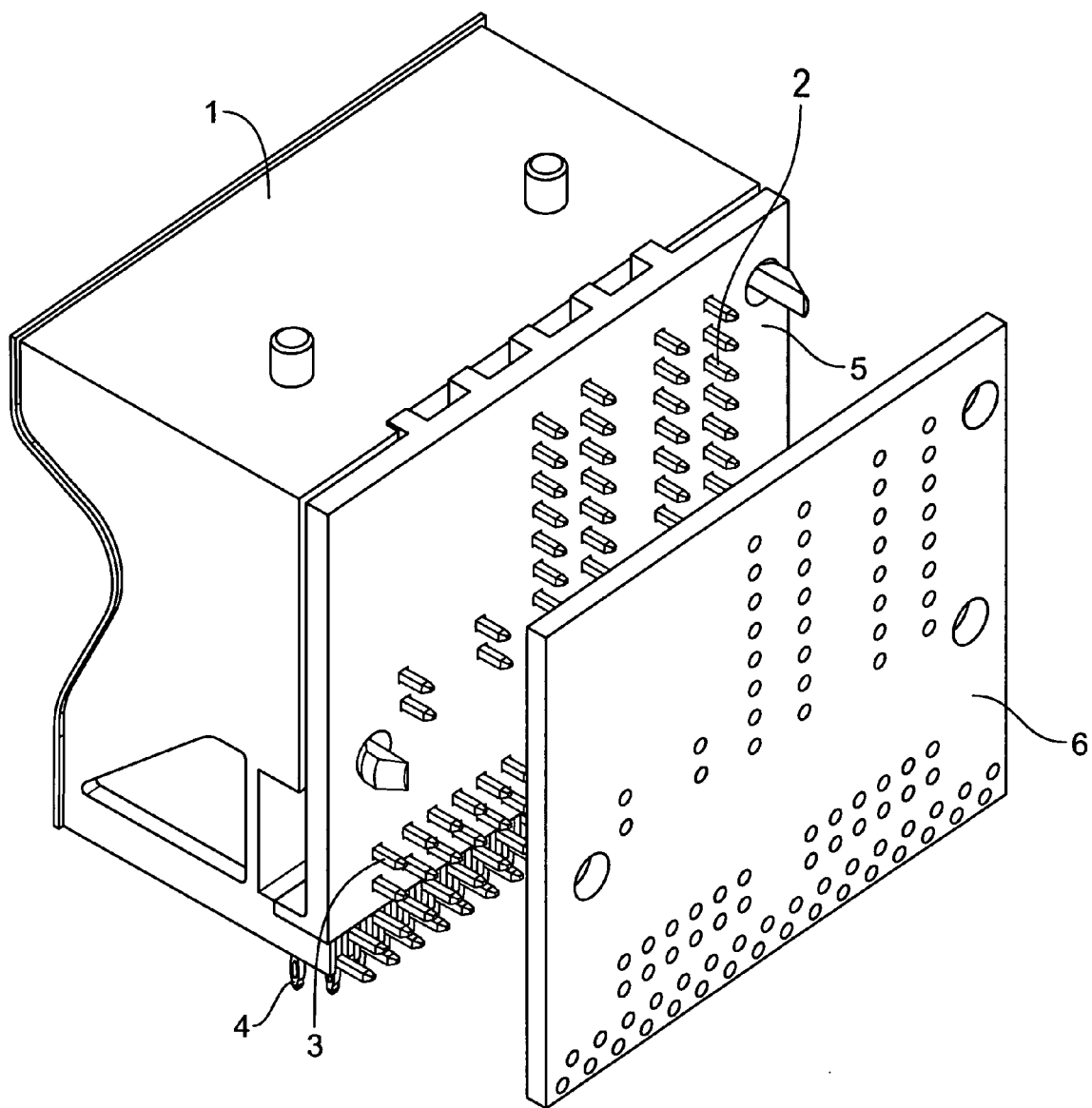


Fig. 8

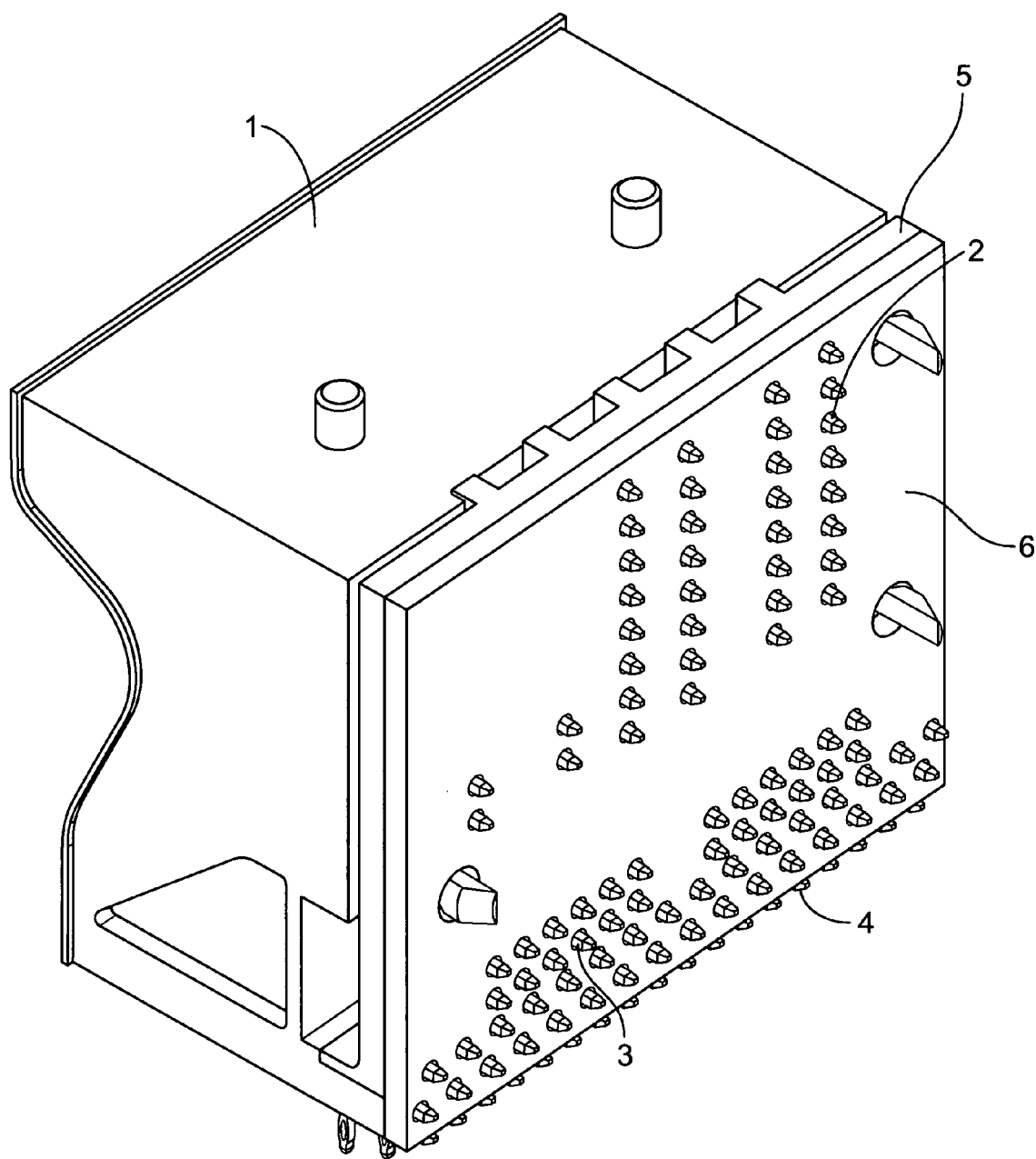


Fig. 9

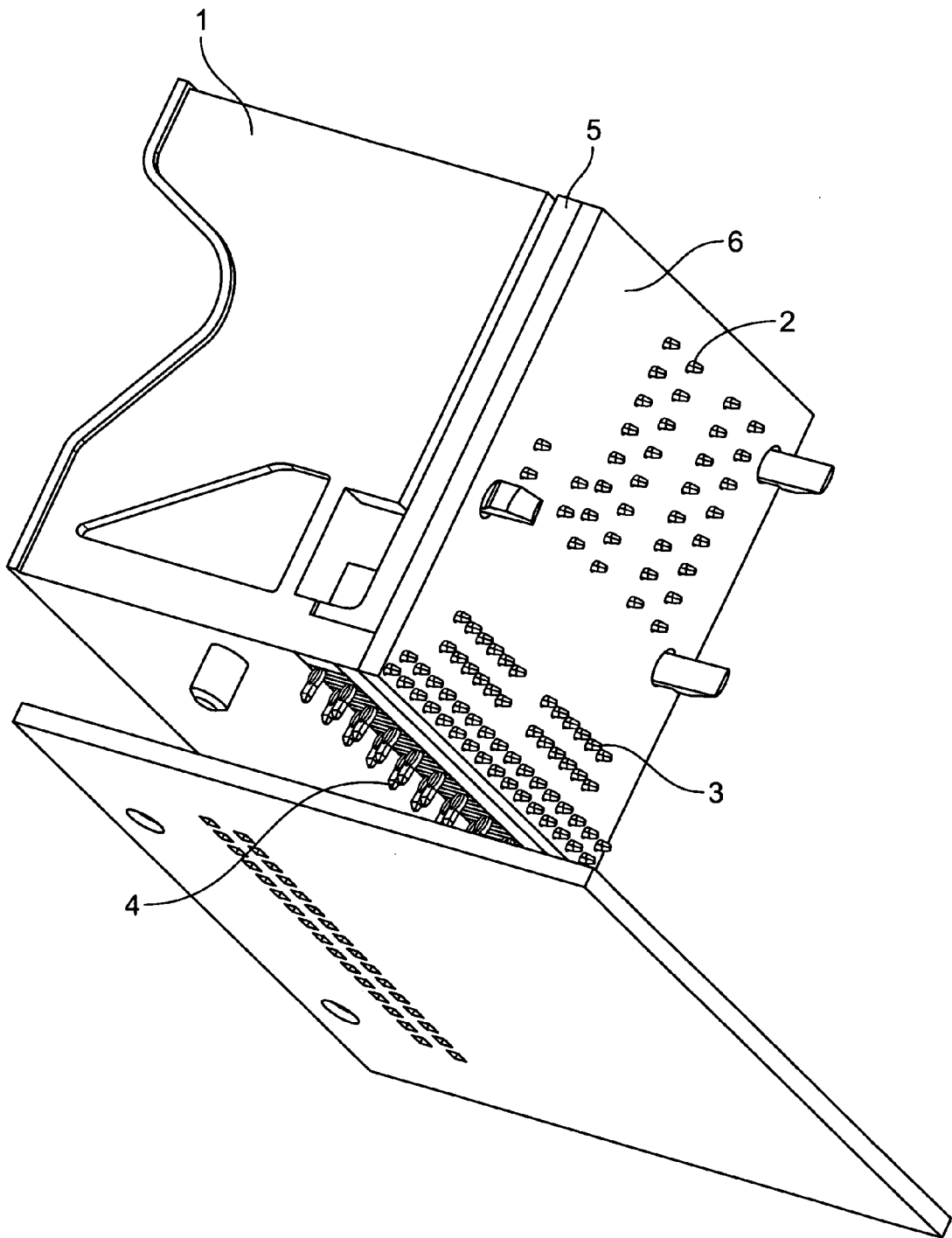


Fig. 10

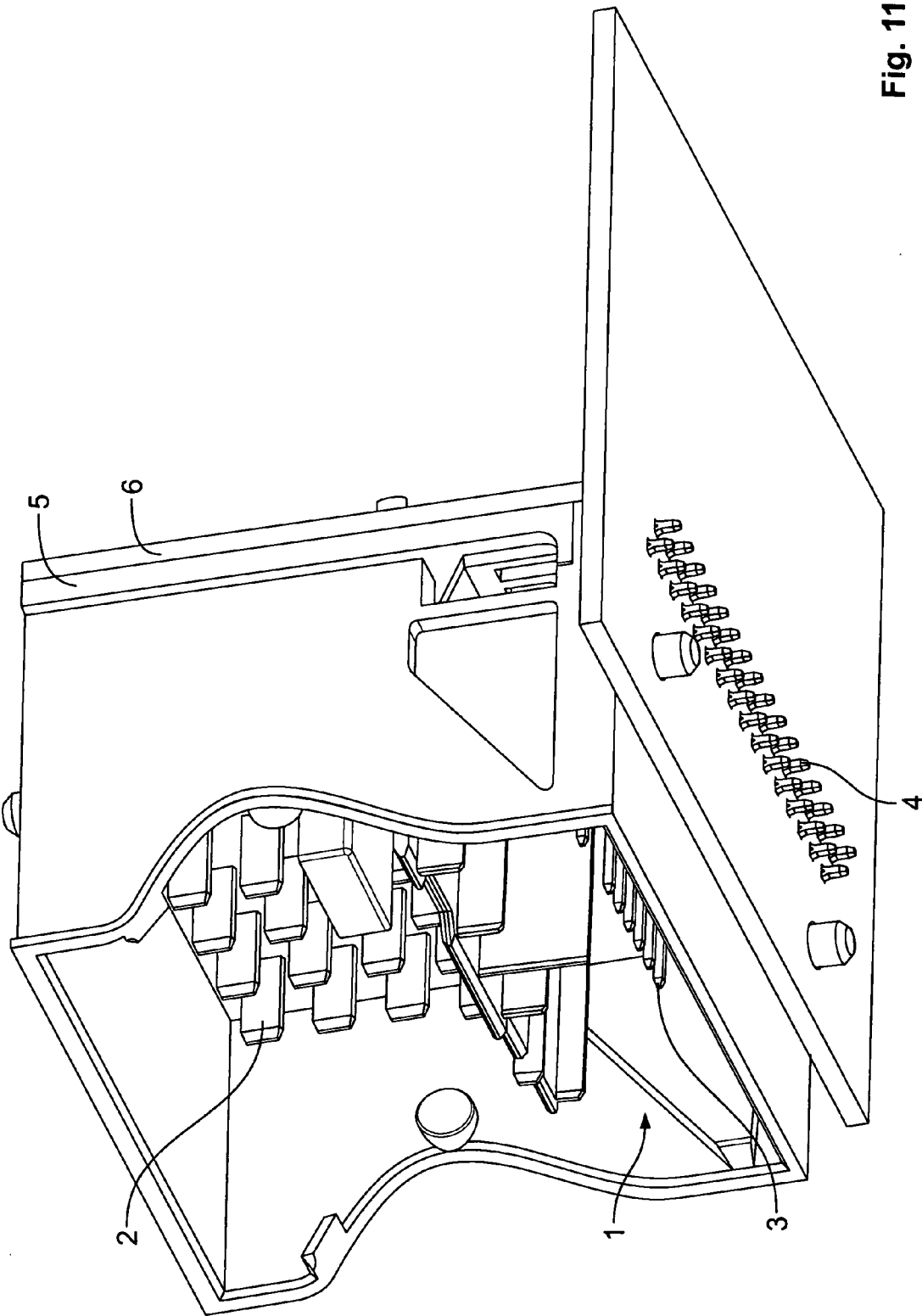


Fig. 11



EUROPEAN SEARCH REPORT

Application Number
EP 09 29 0210

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 02/082584 A (MOLEX INC [US]; KODAMA TAKAO [JP]; SAKANO MASAHIRO [JP]; ITO TAKAO [JP] 17 October 2002 (2002-10-17) * the whole document *	1-5,9	INV. H01R12/20
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			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 June 2009	Examiner VAUTRIN, Florent
CATEGORY OF CITED DOCUMENTS 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 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			

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

EP 09 29 0210

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16-06-2009

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REFERENCES CITED IN THE DESCRIPTION

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