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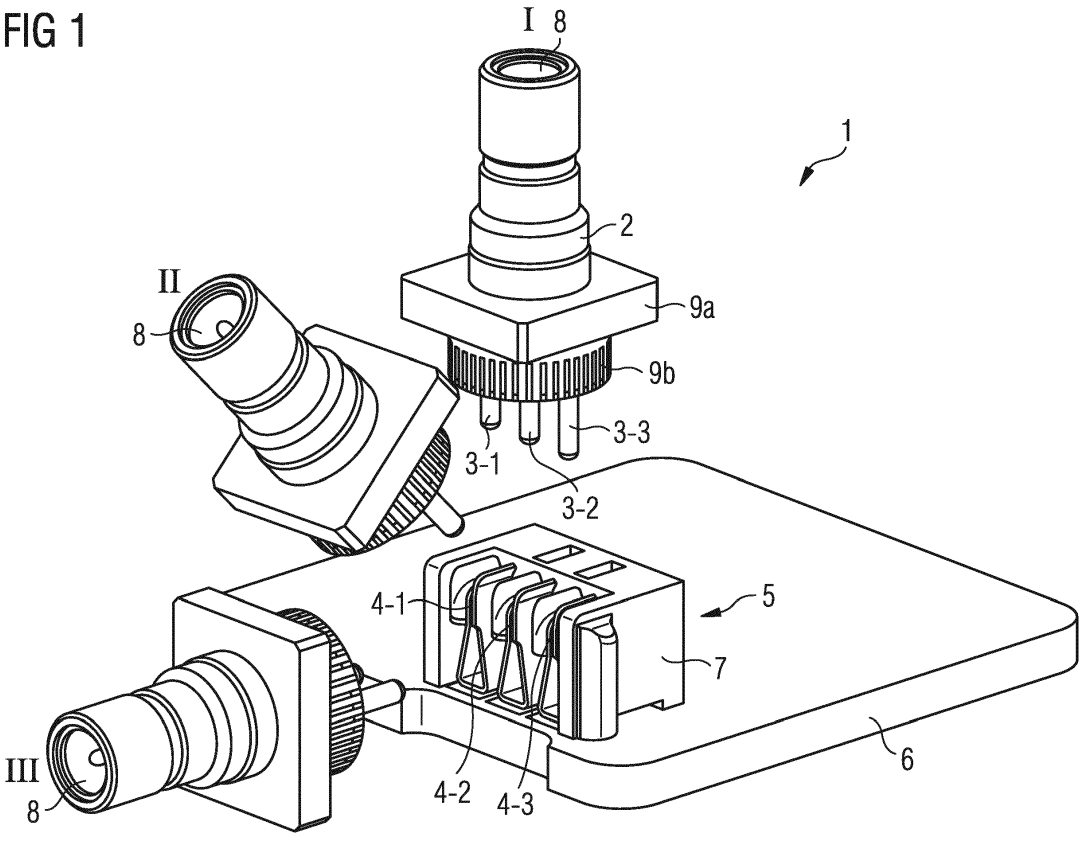
(54) CABLE HARNESS CONNECTION ASSEMBLY

(57) A cable harness connection assembly for connecting a cable harness to a printed circuit board of an electronic device at different mounting angles, said cable harness connection assembly comprising a cable harness connector attachable to said cable harness, wherein said cable harness connector comprises terminal pins adapted to be pushed into corresponding spring contacts of a spring connector mounted on said printed circuit board at a mounting angle between 0 and 90 degrees with respect to said printed circuit board.

FIG 1



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Description

[0001] The invention relates to a cable harness connection assembly for connecting a cable harness to an electronic device.

[0002] A cable harness can comprise electric cables which are bound together, for instance by straps, cable ties, electrical tapes or cable lacings. Cable harnesses are widely used in vehicles and construction machinery. For example, many vehicles comprise a plurality of wires for different vehicle components. By binding the wires and cables into a cable harness, wires and cables can be better secured against vibrations, abrasions or moisture. Further, by binding cables into a cable harness usage of space is optimized. A cable harness is normally only slightly bendable. For connecting an electronic device within a vehicle to a cable harness, the housing of the respective electronic device normally comprises a single predetermined exit angle from the body of the enclosure. Consequently, different exit angles of cable harness connectors require different connector designs. A drawback with different harness angles is that different connectors and assembly architectures are needed for different vehicle installations. This leads to an increase of part development costs, an increase of part inventories and to a more complex manufacturing and assembly.

[0003] Accordingly, there is a need for a cable harness connection assembly allowing to connect a cable harness for a variety of electronic devices within a vehicle efficiently.

[0004] This object is achieved by a cable harness connection assembly comprising the features of claim 1.

[0005] The invention provides according to a first aspect a cable harness connection assembly for connecting a cable harness to an electronic device at different mounting angles, said cable harness connection assembly comprising a cable harness connector attachable to said cable harness, wherein said cable harness connector comprises terminal pins adapted to be pushed into corresponding spring contacts of a spring connector mounted on a printed circuit board at a mounting angle between 0 and 90 degrees with respect to the printed circuit board of the electronic device.

[0006] In a possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, each spring contact of the spring connector is V-shaped and comprises a chamfer for guiding a corresponding terminal pin of said cable harness connector.

[0007] In a further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the spring contacts are contained in an insulating carrier (7) of the spring connector mounted to the printed circuit board of the electronic device.

[0008] In a further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the terminal pins of the cable harness connector comprise a cylindrical shape with a chamfer tip portion.

[0009] In a further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the terminal pins of said cable harness connector are arranged in a row.

[0010] In a further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the terminal pins of the cable harness connector are inserted through an insertion opening within a housing of the electronic device to be pushed into the corresponding spring contacts of the spring connector.

[0011] In a further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, a position of an insertion opening within the housing of said electronic device defines the mounting angle between the cable harness and the electronic device.

[0012] In a still further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the cable harness comprises at least one cable connecting the electronic device with other electronic components of a vehicle.

[0013] In a still further possible embodiment of the cable harness connection assembly according to the first aspect of the present invention, the electronic device is a sensor device of a driver assistance system of a vehicle.

[0014] The invention further provides according to a further aspect an electronic sensor device of a driver assistance system of a vehicle comprising the features of claim 10.

[0015] The invention provides according to the second aspect an electronic sensor device of a driver assistance system of a vehicle,
said electronic sensor device comprising
a spring connector attached to a printed circuit board of the sensor device,
said spring connector having spring contacts adapted to receive terminal pins of a cable harness connector having terminal pins adapted to be pushed into the corresponding spring contacts at a mounting angle between 0 and 90 degrees.

[0016] In a possible embodiment of the electronic sensor device according to the second aspect of the present invention, the electronic sensor device comprises a housing having at least one insertion opening for inserting the terminal pins of the cable harness connector into the spring contacts of said spring connector,
wherein the position of said insertion opening defines the mounting angle between the cable harness and the electronic sensor device.

[0017] In a further possible embodiment of the electronic sensor device according to the second aspect of the present invention, the electronic sensor device comprises a camera, a radar sensor or a Lidar sensor.

[0018] In a possible embodiment of the electronic sensor device according to the second aspect of the present

invention, each spring contact of said spring connector is V-shaped and comprises a chamfer for guiding a corresponding terminal pin of the cable harness connector.

[0019] In a further possible embodiment of the electronic sensor device according to the second aspect of the present invention, the spring contacts are contained in an insulating carrier (7) of said spring connector mounted to the printed circuit board of said electronic sensor device.

[0020] In a still further possible embodiment of the electronic sensor device according to the second aspect of the present invention, the terminal pins of the cable harness connector comprise a cylindrical shape with a chamfer tip portion.

[0021] The invention further provides according to a third aspect a driver assistance system of a vehicle comprising the features of claim 15.

[0022] The invention provides according to the third aspect a driver assistance system of a vehicle,
said driver assistance system comprising
electronic sensor devices each comprising
a spring connector attached to a printed circuit board of the respective electronic sensor device,
said spring connector having spring contacts adapted to receive terminal pins of a cable harness connector having terminal pins adapted to be pushed into the corresponding spring contacts at a mounting angle between 0 and 90 degrees, wherein the electronic sensor devices are connected to at least one cable harness of said driver assistance system.

[0023] In the following, possible embodiments of the different aspects of the present invention are described with reference to the enclosed figures in more detail.

Figure 1 shows a perspective view on a possible embodiment of a cable harness connection assembly according to the first aspect of the present invention;

Figure 2 shows a section view through an exemplary embodiment of an electronic sensor device according to the second aspect of the present invention connected to a cable harness using a cable harness connection assembly according to the first aspect of the present invention;

Figures 3, 4 illustrate a possible embodiment of an electronic sensor device according to the second aspect of the present invention;

Figures 5, 6 show further possible exemplary insertion openings which can be used in a cable harness connection assembly according to the first aspect of the present invention.

[0024] Figure 1 shows a perspective view of a cable harness connection assembly 1 according to the first aspect of the present invention. The cable harness connection assembly 1 is provided in the illustrated exemplary embodiment for connecting a cable harness to an electronic device. The electronic device can be in a possible embodiment an electronic sensor device of a driver assistance system of a vehicle. The cable harness connection assembly 1 as illustrated in Figure 1 comprises a cable harness connector 2 comprising protruding terminal pins 3-1, 3-2, 3-3 adapted to be pushed into corresponding spring contacts 4-1, 4-2, 4-3 of a spring connector 5 mounted on a printed circuit board 6 at a mounting angle between 0 and about 90 degrees with respect to the printed circuit board 6. Figure 1 shows the cable harness connector 2 at three different relative positions with respect to the printed circuit board 6, i.e. at a mounting angle of 90 degrees in a position I, at a mounting angle of 45 degrees in a position II and at a mounting angle of 0 degrees in a position III. The cable harness connector 2 is attachable to a cable harness which is not illustrated in Figure 1. The cable harness can comprise several cables and/or wires adapted to connect the respective electronic device and other electronic components of a vehicle. The vehicle can be a land vehicle such as a car or a truck. The vehicle can be also another kind of vehicle such as an aircraft or a ship. The cable harness connector 2 comprises terminal pins 3-i which can be pushed into the spring contacts 4-i of the spring connector 5. The terminal pins 3-i of the cable harness connector 2 comprise in the illustrated embodiment a cylindrical shape with a chamfer tip portion for inserting the terminal pins 3-i into the corresponding spring connectors 4-i. In an alternative embodiment, the terminal pins 3-i of the cable harness connector 2 can also comprise a rectangular shape. The terminal pins 3-i of the cable harness connector 2 are arranged in a preferred embodiment in a row as illustrated in Figure 1. The number of the terminal pins 3-i of the cable harness connector 2 can vary depending on the respective application or electronic device. In the exemplary embodiment illustrated in Figure 1, the cable harness connector 2 comprises three terminal pins 3-1, 3-2, 3-3 which can be used for carrying signal data a reference potential such as ground GND or a power supply voltage. The spring contacts 4-i of the spring connector 5 are contained in a preferred embodiment in an insulating carrier 7 mounted to the printed circuit board 6 of the electronic device. Accordingly, in a preferred embodiment, the spring connector 5 is fixed to the printed circuit board 6 of the electronic device. In a preferred embodiment, the spring contacts 4-i of the spring connector 5 are V-shaped and comprise a chamfer for guiding a corresponding terminal pin 3-i of the cable harness connector 2. Each spring contact 4-i comprises a lead-in chamfer to guide a corresponding terminal pin 3-i into the spring connector 5. The lead-in forms a curve from horizontal to vertical planes for entry or insertion. As illustrated in the embodiment of Figure 1, the cable harness connector 2 can comprise a standard interface 8

for connecting a cable harness to the cable harness connector 2. In the illustrated embodiment, a cable harness or cable can be plugged into a standard socket or interface 8 of the cable harness connector 2. The terminal pins 3-i of the cable harness connector 2 are inserted in a preferred embodiment through a corresponding insertion opening within a housing or enclosure of the electronic device to be pushed into the corresponding spring contacts 4-i of the spring connector 5. In Figure 1, the housing and the corresponding insertion opening are not illustrated. The position of the insertion opening within the enclosure or housing of the electronic device defines the final mounting angle between the cable harness and the electronic device. The electronic device having the printed circuit board 6 as illustrated in Figure 1 can be for instance an electronic sensor device, in particular a camera, a radar sensor or a Lidar sensor of a driver assistance system DAS. The cable harness connected to the front end of the cable harness connector 2 can comprise for instance at least one coaxial cable having low mechanical flexibility.

[0025] In the illustrated embodiment of Figure 1, the cable harness connector 2 comprises a plane section 9a and a serrated circular section 9b. The section 9b can be plugged into a corresponding opening of the enclosure of the respective electronic device.

[0026] Figure 2 shows a cross-section view through an exemplary embodiment of an electronic device 10 having at least one printed circuit board 6 contained within a housing 11 of the electronic device 10. In the exemplary embodiment shown in Figure 2, the printed circuit board 6 can comprise several electronic components 12-1, 12-2-, 12-3, such as microprocessors or capacitors of the electronic sensor device 10. The spring connector 5 is fixed to the printed circuit board 6 as shown in Figure 2. The housing 11 of the electronic device 10 comprises in the illustrated embodiment an opening 13 for the cable harness connection assembly 1. In the illustrated embodiment, terminal pins 3-i of the cable harness connector 2 are inserted through the insertion opening 13 of the housing 11 of the electronic device 10 and pushed into corresponding spring contacts 4-i of the spring connector 5 fixed to the printed circuit board 6 of the electronic device 10. Figure 2 shows further a cable harness 14 connected to a standard interface of the cable harness connector 2. As can be seen in Figure 2, the position of the insertion opening 13 within the housing or enclosure of the sensor device 10 defines the final mounting angle α between the cable harness 14 and the electronic device 10. The cable harness 14 can comprise in a possible embodiment at least one coaxial cable with low flexibility.

[0027] Figures 3, 4 show a further possible embodiment of a cable harness connection assembly 1 according to the present invention. In the illustrated embodiment, the cable harness connector 2 is slightly movable within a longitudinal insertion opening 13 of the housing 11 to perform an adjustment of the mounting angle α within a range from angle $\beta 1$ and angle $\beta 2$ defined by the lower and upper end of the longitudinal insertion opening 13.

[0028] Figures 5, 6 illustrate possible insertion openings 13 within a housing 11 of an electronic device 10. Figure 5 shows a circular opening for inserting a cable harness connector 2 into the housing 11 of the electronic device. Figure 6 shows a serrated opening 13. In a possible embodiment, the serrated circular section 9b of the cable harness connector 2 is pushed into the corresponding serrated opening 13 as illustrated in Figure 6 and the terminal pins 2 of the cable harness connector 2 are pushed in the corresponding spring contacts 4-i of the spring connector 5 mounted on the printed circuit board 6 within the housing 11. The cable harness connection assembly 1 according to the present invention provides a standard external fitting to the cable harness 14 which can be fitted to a housing of a sensor device of a driver assistance system DAS. The terminal pins 3-i of the cable harness connector 2 are pushed into corresponding spring contacts 4-i of a spring connector 5 within the housing 11 of the electronic device 10. The spring contacts 4-i are shaped in a preferred embodiment to accept entry of the cable harness connector 2 at any angle from 0 to about 90 degrees. The insertion load can be reacted by the geometry of both the springs and the housing containing the spring contacts, hence to the PCB 6 without overstressing the electrical contacts or the mounts. The cable harness connection assembly 1 according to present invention allows different variants of electronic device design using common parts for common assembly processes and tooling with reduced part costs due to higher manufacturing volumes and consequently a reduced inventory of different connectors for slightly differing products. The cable harness connection assembly 1 according to the present invention allows to tailor product variants to an available package space. The cable harness connection assembly 1 according to the present invention can be used for a wide range of applications, in particular for sensor devices connected to a cable harness of a driver assistance system DAS within a vehicle.

REFERENCE SIGNS

[0029]

1	Cable harness connection assembly
2	Cable harness connector
3	Terminal pin
4	Spring contact
5	Spring connector
6	Printed circuit board
7	Insulating carrier
8	Interface
9a	Planar section
9b	Circular serrated section
10	Electronic device
11	Housing
12	Electronic component

13 Insertion opening
14 Cable harness

Claims

1. A cable harness connection assembly (1) for connecting a cable harness (14) to a printed circuit board (6) of an electronic device (10) at different mounting angles, said cable harness connection assembly (1) comprising a cable harness connector (2) attachable to said cable harness (14), wherein said cable harness connector (2) comprises terminal pins (3) adapted to be pushed into corresponding spring contacts (4) of a spring connector (5) mounted on said printed circuit board (6) at a mounting angle between 0 and 90 degrees with respect to said printed circuit board (6).

2. The cable harness connection assembly according to claim 1, wherein each spring contact (4) of said spring connector (5) is V-shaped and comprises a chamfer for guiding a corresponding terminal pin (3) of said cable harness connector (2).

3. The cable harness connection assembly according to claim 1 or 2, wherein the spring contacts (4) are contained in an insulating carrier (7) of said spring connector (5) mounted to said printed circuit board (6).

4. The cable harness connection assembly according to one of the preceding claims 1 to 3, wherein the terminal pins (3) of said cable harness connector (2) comprise a cylindrical shape with a chamfer tip portion.

5. The cable harness connection assembly according to one of the preceding claims 1 to 4, wherein the terminal pins (3) of said cable harness connector (2) are arranged in a row.

6. The cable harness connection assembly according to one of the preceding claims 1 to 6, wherein the terminal pins (3) of said cable harness connector (2) are inserted through an insertion opening (13) within a housing (11) of said electronic device (10) to be pushed into the corresponding spring contacts (4) of said spring connector (5) .

7. The cable harness (14) connection assembly according to one of the preceding claims 1 to 6, wherein a position of an insertion opening (13) within the housing (11) of said electronic device (10) defines the mounting angle between the cable harness (14) and the electronic device (10).

8. The cable harness connection assembly according to one of the preceding claims 1 to 7, wherein the cable harness (14) comprises at least one cable connecting the electronic device (10) with other electronic components (12) of a vehicle.

9. The cable harness connection assembly according to one of the preceding claims 1 to 8, wherein the electronic device (10) is a sensor device of a driver assistance system of a vehicle.

10. An electronic sensor device (10) of a driver assistance system of a vehicle,
said electronic sensor device (10) comprising
a spring connector (5) attached to a printed circuit board (6) of the sensor device (10),
said spring connector (5) having spring contacts (4) adapted to receive terminal pins (3) of a cable harness connector (2) having terminal pins (3) adapted to be pushed into the corresponding spring contacts (4) at a mounting angle between 0 and 90 degrees.

11. The electronic sensor device according to claim 10, wherein the electronic sensor device (10) comprises a housing (11) having an insertion opening (13) for inserting the terminal pins (3) of said cable harness connector (2) into the spring contacts (4) of said spring connector (5),
wherein the position of said insertion opening (13) defines the mounting angle between the cable harness (14) and the electronic sensor device (10).

12. The electronic sensor device according to claim 10 or 11, wherein the electronic sensor device (10) comprises a camera, a radar sensor or a Lidar sensor.

13. The electronic sensor device according to one of the preceding claims 10 to 12, wherein each spring contact (4) of said spring connector (5) is V-shaped and comprises a chamfer for guiding a corresponding terminal pin (3) of said cable harness connector (2),
wherein the spring contacts (4) are contained in an insulating carrier (7) of said spring connector (5) mounted to said printed circuit board (6) of said electronic sensor device (10).

14. The electronic sensor device according to one of the preceding claims 10 to 13,
wherein the terminal pins (3) of said cable harness connector (2) comprise a cylindrical or rectangular shape with a chamfer tip portion and wherein the terminal pins (3) of said cable harness connector (2) are arranged in a row.

15. A driver assistance system of a vehicle,
said driver assistance system comprising electronic sensor devices (10) according to one of the preceding claims 10 to 14 connected to at least one cable harness (14) of said driver assistance system.

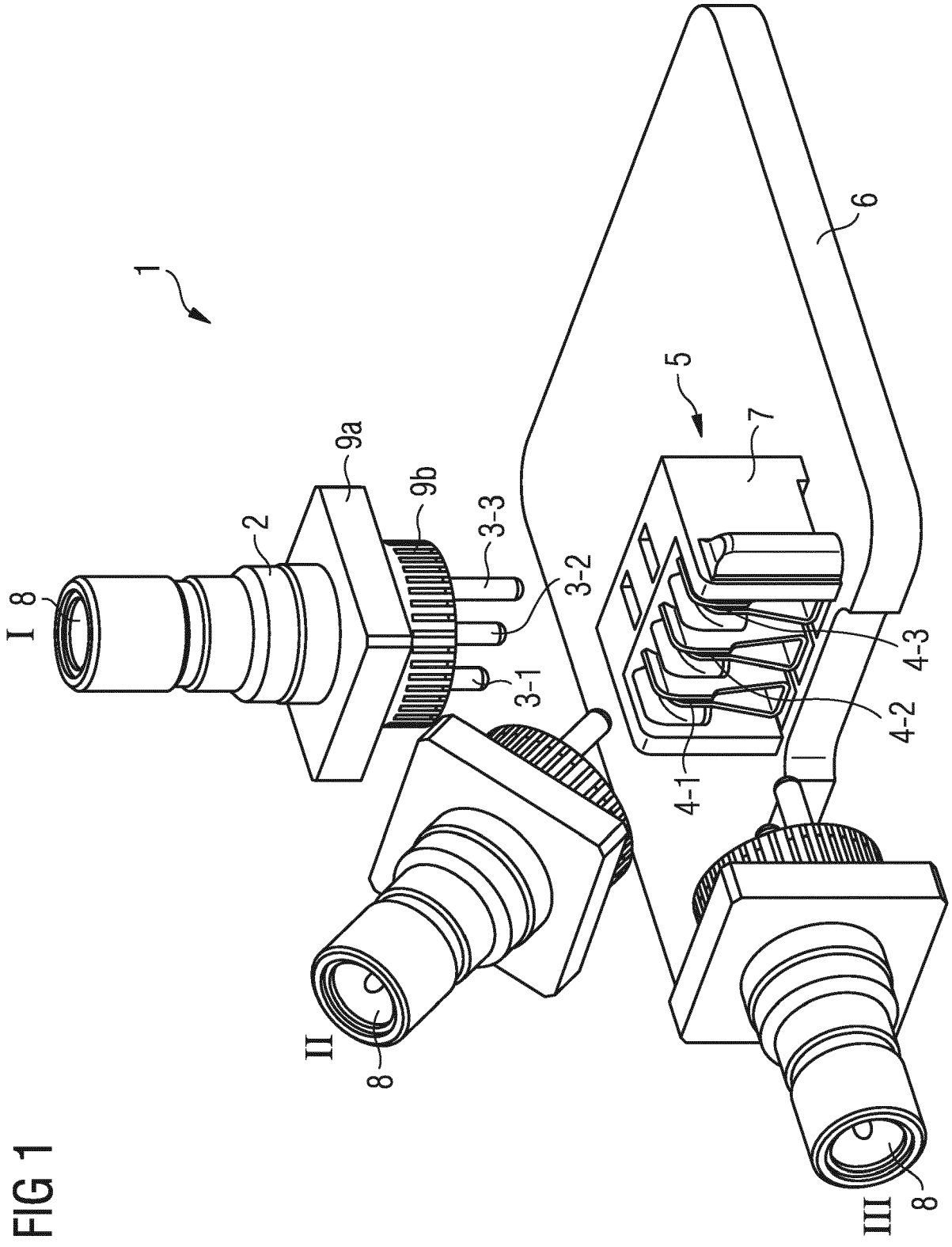


FIG 1

FIG 2

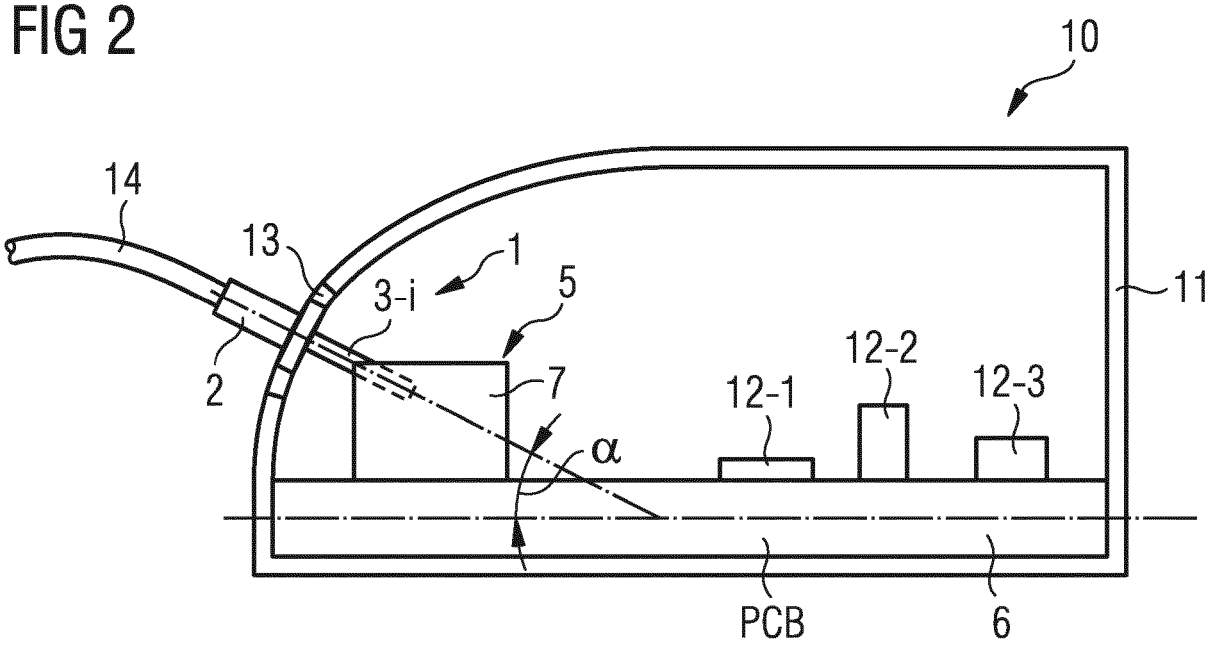


FIG 3

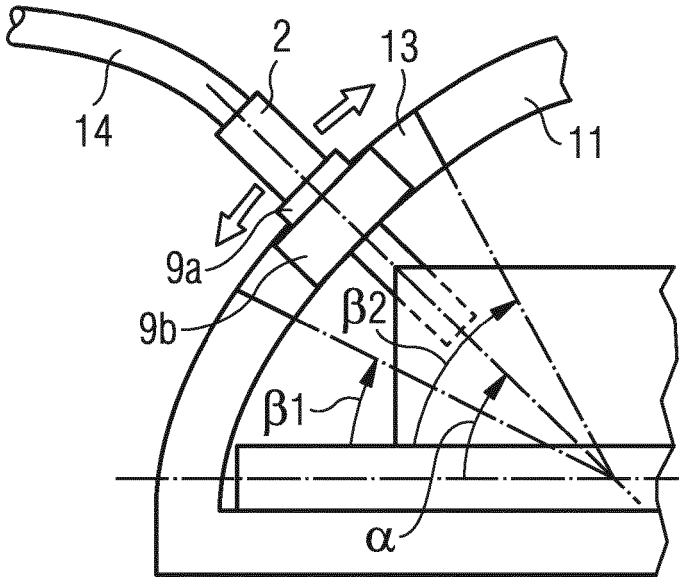


FIG 4

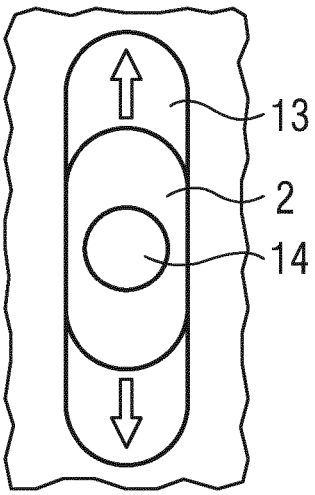


FIG 5

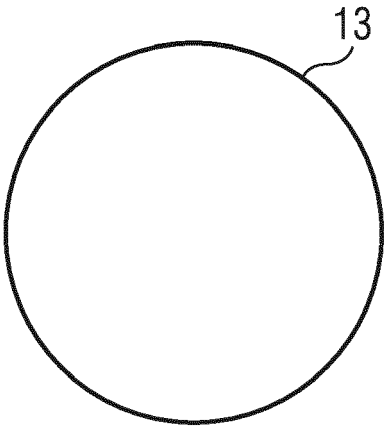
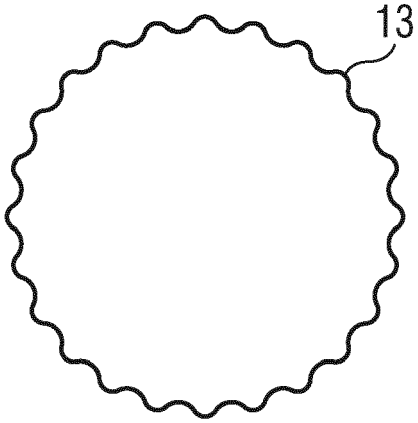


FIG 6



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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 9484

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 Y	JP 2014 078327 A (HIROSE ELECTRIC CO LTD) 1 May 2014 (2014-05-01) * abstract * * figures 1-11 * -----	1-9 10-15	INV. H01R12/51 H01R12/75 H01R13/11 H01R13/631 H01R35/04
A	WO 2014/203999 A1 (YAZAKI CORP [JP]) 24 December 2014 (2014-12-24) * figures 1, 2 * -----	4	
A	WO 2013/037966 A1 (FRAMATOME CONNECTORS INT [FR]; DE BRUIJN JEROEN JOZEF MARIA [NL]) 21 March 2013 (2013-03-21) * page 10, line 3 - page 11, line 33 * * figures 17-20 * -----	3	
Y	DE 44 12 770 A1 (SIEMENS AG [DE]) 19 October 1995 (1995-10-19) * column 6, line 46 - column 7, line 17 * * figures 7, 8 * -----	10-15	

TECHNICAL FIELDS SEARCHED (IPC)

H01R
B60W
G01S
H01Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 October 2016	Henrich, Jean-Pascal

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

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 15 19 9484

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 15 19 9484

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-9

Group I, claim 1 is independent.
Cable harness connection assembly comprising a connector presenting pins adapted to be pushed into spring contacts, fixed to a printed circuit board, at a mounting angle between 0 and 90 degrees with respect to said printed circuit board.

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2. claims: 10-15

Group II, claim 10 is independent.
Electronic sensor device of a driver assistance system of a vehicle presenting a spring connector, attached to a printed circuit board, adapted to receive terminal pins at a mounting angle between 0 and 90 degrees.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 9484

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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17-10-2016

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