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

(11) EP 3 525 291 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.08.2019 Bulletin 2019/33

(51) Int Cl.:
H01R 13/11 *(2006.01)*

(21) Application number: **18155754.7**

(22) Date of filing: **08.02.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(71) Applicant: **Aptiv Technologies Limited**
St. Michael (BB)

(72) Inventors:
- **PALUCH, Dariuz**
  32-061 Rybna (PL)
- **KLOCH, Konrad, T**
  33-100 Tarnow (PL)
- **CIEPKA, Przemyslaw**
  32353 Trzyciaz (PL)
- **KAWALEC, Dominik**
  32-084 Morawica (PL)

(74) Representative: **Manitz Finsterwald**
Patent- und Rechtsanwaltspartnerschaft mbB
Postfach 31 02 20
80102 München (DE)

(54) ELECTRICAL TERMINAL ASSEMBLY

(57) An electrical terminal assembly (100) comprising an fork shaped electrical contact (120) having a first prong (130) and a second prong (160), extending along a mating axis (X), from a base (122) of the fork shaped electrical contact (120), spaced apart by a gap (124) disposed there between, the gap (124) is configured to receive a blade shaped mating electrical contact (200) that mechanically and electrically communicates with the first prong (130) and the second prong (160), when the blade shaped mating electrical contact (200) is fully mated, wherein the blade shaped mating electrical contact (200) comprises a first flat mating contact surface (220),.arranged along the mating axis (X) and a second flat mating contact surface (230) arranged, parallel to the first flat mating contact surface (220), wherein the first prong (130) comprises a flat main contact surface (132) extending along the mating axis (X) and arranged opposite to the second prong (160) and wherein the second prong (160) comprises a flat first support surface (162) and a flat second support surface (164) arranged opposite to the first prong (130), wherein the blade shaped mating electrical contact (200) is clamped between the flat main contact surface (132) and the flat first support surface (162) and the flat second support surface (164)), when fully mated thereby providing electrical connection.

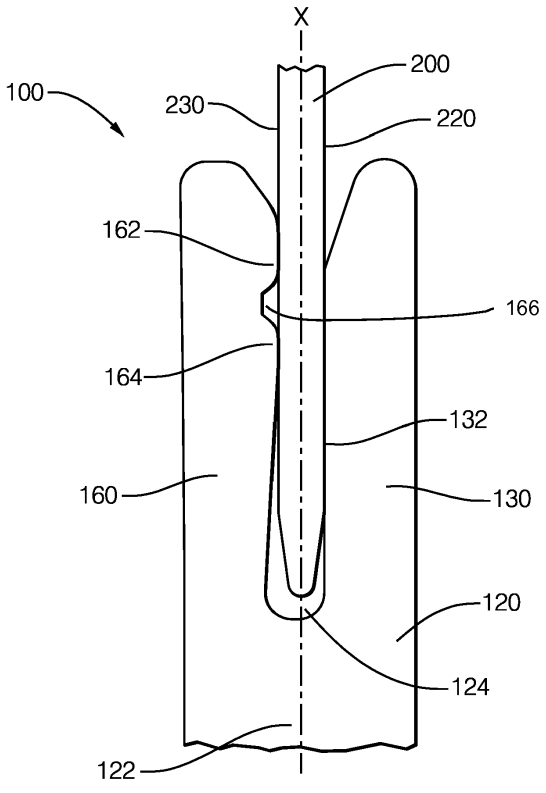


FIG. 2

EP 3 525 291 A1

Description

TECHNICAL FIELD OF INVENTION

[0001] The invention relates to an electrical terminal assembly for use in electrical junction boxes distributing high currents in vehicles.

BACKGROUND OF INVENTION

[0002] The number of Advanced Driver Assistance Systems used in vehicles increases continuously. This ADAS require support devices that use high currents while perform their functions controlled by the ADAS controller. The high current is distributed injunction boxes. The junction boxes comprise also high current fuses to protect the wire harness and the electrical devices in case of malfunction. The fuses have blade shaped contacts adapted to be connected to fork shaped electrical contacts. In the past the junction boxes have been equipped with bus bars that had electrical terminals made of a part of and protruding from the bus bar. This design works fine for currents up to 18 Ampere. For higher currents up to 32 Ampere, the contact resistance limits the usability. To overcome this problem the bus bar and the electrical terminals are oversized in known junction boxes. To provide a second electrical terminal parallel to a first one, that additional contacts the blade shaped contact of the fuse is a further solution. But this solutions increase costs, weight and size of the junction boxes.

[0003] Thus, there is the need in the art to provide an electrical terminal assembly for a junction box that provides low electrical resistance as well as good thermal conductivity, thereby only requiring usual insertion forces while connecting the terminal assembly.

[0004] An electrical terminal assembly according claim1 solve these and other objects, which become apparent upon reading the following description.

SUMMARY OF THE INVENTION

[0005] The present application relates to an electrical terminal assembly comprising a fork shaped electrical contact having a first prong and a second prong, extending along a mating axis, from a base of the fork shaped electrical contact. The first prong and a second prong are spaced apart by a gap disposed there between. The gap is configured to receive a blade shaped mating electrical contact that mechanically and electrically communicates with the first prong and the second prong, when the blade shaped mating electrical contact is fully mated. The blade shaped mating electrical contact comprises a first flat mating contact surface arranged along the mating axis and a second flat mating contact surface arranged parallel to the first flat mating contact surface. The first prong comprises a flat main contact surface extending along the mating axis and arranged opposite to the second prong and wherein the second prong comprises a flat first support surface and a flat second support surface arranged opposite to the first prong. The blade shaped mating electrical contact is clamped between the flat main contact surface and the flat first support surface and the flat second support surface, when fully mated thereby providing electrical connection.

[0006] The disclosed invention provides an electrical terminal assembly having a fork shaped electrical contact. The fork shaped electrical contact has three flat surfaces for making contact to a blade shaped mating electrical contact that is hold in between the prongs. The flat main contact surface, the flat first support surface and the flat second support surface contact the surfaces of the blade shaped mating electrical contact at the opposite corresponding surfaces. The surfaces are arranged flat on the surface of the blade shaped mating electrical contact, proving a large contact surface. The large contact surface provides low electrical resistance as well as good thermal conductivity, thereby not increasing the insertion force of the electrical terminal assembly.

[0007] According to a preferred embodiment, the first flat mating contact surface is in contact with the flat main contact surface and the second flat mating contact surface is in contact with the flat first support surface and the flat second support surface, when fully mated. The surfaces are arranged and formed to provide as much contact surface as possible, while not increasing insertion force of the electrical terminal assembly.

[0008] Preferably, the flat main contact surface extents a longer distance, along the first prong, than the total distance the flat first support surface and second flat support surface extend along the second prong. This provides a huge, flat contact surface, contacting the flat blade shaped mating electrical contact, while not increasing insertion force of the electrical terminal assembly.

[0009] Advantageously, the flat main contact surface extents at least half the length of the first prong this provides a huge, flat contact surface, contacting the flat blade shaped mating electrical contact.

[0010] Preferably, the wide of the first prong is constant along the extension of the flat main contact surface. This design provides constant electrical resistance along the first prong. That prevents hot spots caused by portions with higher electrical resistance.

[0011] Advantageously, the second prong comprises a narrowing defined by a cut out located in between the flat first support surface and the flat second support surface, narrowing the width of the second prong perpendicular to the mating axis. The narrowing weakens the second prong on the position. This makes the second prong more flexible using the weaker portion as a flexible hinge, thereby decreasing insertion force of the electrical terminal assembly.

[0012] Preferably, the width of the second prong decreases starting from the second flat support surface along the mating axis, towards the base. The decreasing of the width of the second prong goes along with increasing of flexibility of the second prong. This provides de-

creasing of insertion force of the electrical terminal assembly and flexible support for the flat first support surface and the flat second support surface towards the blade shaped mating electrical contact.

[0013] Preferably, the flat main contact surface is parallel to the flat first support surface and is parallel to the flat second support surface, when fully mated to the blade shaped mating electrical contact. The contact surface is at its maximum and the electrical resistance is at its minimum, when the contact surface is parallel to the flat first support surface and is parallel to the flat second support surface, thereby contacting the parallel surfaces of the blade shaped mating electrical contact.

[0014] In a preferred embodiment, the flat main contact surface is not parallel to the flat first support surface or/and not parallel to the flat second support surface, when not mated to the blade shaped mating electrical contact. Preferably, the flat first support surface or/and the flat second support surface are sloped towards the first prong, when not mated to the blade shaped mating electrical contact. At least one of the first prong and a second prong is formed inwards the gap, thereby limiting the space between the flat main contact surface and the flat first support surface and the flat second support surface to an amount les the width of the blade shaped mating electrical contact. That enables to provide a pre tension to the flat main contact surface and the flat first support surface and the flat second support surface that pushes the surfaces toward the blade shaped mating electrical contact when mated, thereby having the surfaces parallel.

[0015] Advantageously, the blade shaped mating electrical contact comprises a rectangular cross-section. The rectangular cross-section of the blade shaped mating electrical contact provides straight, flat and parallel surfaces to make with the flat main contact surface and the flat first support surface and the flat second support surface.

[0016] Preferably, the blade shaped mating electrical contact and the fork shaped electrical contact are made of sheet metal. The blade shaped mating electrical contact and the fork shaped electrical contact can be easy stamped out of a sheet metal that keeps production costs low. The fork shaped electrical contact can be made of the same sheet metal as the bus bar. The bus bar and the fork shaped electrical contact can be made as one part out of a sheet metal. Alternatively, the base of the fork shaped electrical contact can be adapted to be attached to a printed circuit board or to the end of an electrical wire.

[0017] In a preferred embodiment, the total area of the main contact surface is at least double the size than the total area of the flat first support surface and the second flat support surface in total. The sizes of the main contact surface and the size of the flat first support surface and size of the second flat support surface are balanced to reach a combination of required electrical resistance and required insertion force.

[0018] Advantageously, the first prong is more rigid than the second prong. A more rigid first prong provides a robust support for the main contact surface.

[0019] Preferred is an electrical junction box comprising the inventive electrical terminal assembly, wherein the fork shaped electrical contact is defined of a part of an electrical bus bar and wherein the blade shaped mating electrical contact is defined by a contact of a high current fuse. In state of the art, electrical junction boxes electrical contacts defined of a part of an electrical bus bar are widely used. The new designed fork shaped electrical contact can replace the currently used electrical contacts without changes on the housings of the electrical junction boxes.

Description of the preferred embodiments

[0020] In the following, the invention is described exemplarily with reference to the enclosed figures, in which

- Fig. 1 shows a plane, view to an electrical terminal assembly known in prior art;
- Fig. 2 shows a plane, view to an electrical terminal assembly;
- Fig. 3 shows a plane, view to a fork shaped electrical contact;
- Fig. 4 shows a perspective, view to a fork shaped electrical contact;

[0021] Figure 1 shows a plane, view to an electrical terminal assembly 10 known in prior art. The electrical terminal assembly 10 comprises a fork shaped electrical contact 12 having a base 22. A first prong 13 and a second prong 16 extend from a base 22 along a mating axis X. A blade shaped mating electrical contact 20 is arranged in a gap 24 between the first prong 13 and a second prong 16. A first contacting nub 17a and a second contacting nub 17b, spaced from the first contacting nub 17a along the mating axis, protrude from the first prong 13 towards the blade shaped mating electrical contact 20. A third contacting nub 17c protrudes from the second prong 16 towards the blade shaped mating electrical contact 20. The three contacting nubs 17a,b,c contact the blade shaped mating electrical contact 20 with a the ends of the contacting nubs what result in a small contact surface between the blade shaped mating electrical contact 20 and the fork shaped electrical contact 12.

[0022] Figure 2 shows a plane, view to an electrical terminal assembly 100. The electrical terminal assembly 100 comprising a fork shaped electrical contact 120 having a first prong 130 and a second prong 160, extending along a mating axis X, from a base 122 of the fork shaped electrical contact 120. The first prong 130 and a second prong 160 are spaced apart by a gap 124 disposed there between. The gap 124 is configured to receive a blade shaped mating electrical contact 200 that mechanically and electrically communicates with the first prong 130 and the second prong 160. The blade shaped mating

electrical contact 200 comprises a first flat mating contact surface 220,.arranged along the mating axis X and a second flat mating contact surface 230 arranged, parallel to the first flat mating contact surface 220. The first prong 130 comprises a flat main contact surface 132 extending along the mating axis X and arranged opposite to the second prong 160 and wherein the second prong 160 comprises a flat first support surface 162 and a flat second support surface 164 arranged opposite to the first prong 130. The blade shaped mating electrical contact 200 is clamped between the flat main contact surface 132 and the flat first support surface 162 and the flat second support surface 164. The first flat mating contact surface 220 is in contact with the flat main contact surface 132 and the second flat mating contact surface 230 is in contact with the flat first support surface 162 and the flat second support surface 164. The flat main contact surface 132 is parallel to the flat first support surface 162 and is also parallel to the flat second support surface 164.

[0023] Figure 3 shows a plane, view to a fork shaped electrical contact 120. The flat main contact surface 132 extents a longer distance, along the first prong 130, than the total distance, the flat first support surface 162 and second flat support surface 164 extend along the second prong 160. The flat main contact surface 132 extents at least half the length of the first prong 130. The wide of the first prong 160 is constant along the extension of the flat main contact surface 132. The second prong 160 comprises a narrowing defined by a cut out 166 located in between the flat first support surface 162 and flat second support surface 164, narrowing the width of the second prong 160 perpendicular to the mating axis X. The width of the second prong 160 decreases starting from the second flat support surface 164 along the mating axis, towards the base 122. The flat main contact surface 132 is not parallel to the flat first support surface 162 and also not parallel to the flat second support surface 164. The flat first support surface 162 and the flat second support surface 164 are sloped towards the first prong 130.

[0024] Figure 4 shows a perspective, view to a fork shaped electrical contact 120. The total area of the main contact surface 132 is at least double the size than the total area of the flat first support surface 162 and the second flat support surface 164 in total.

Claims

1. An electrical terminal assembly (100) comprising an fork shaped electrical contact (120) having a first prong (130) and a second prong (160), extending along a mating axis (X), from a base (122) of the fork shaped electrical contact (120), spaced apart by a gap (124) disposed there between, the gap (124) is configured to receive a blade shaped mating electrical contact (200) that mechanically and electrically communicates with the first prong (130) and the second prong (160), when the blade shaped mating electrical contact (200) is fully mated, wherein the blade shaped mating electrical contact (200) comprises a first flat mating contact surface (220),.arranged along the mating axis (X) and a second flat mating contact surface (230) arranged, parallel to the first flat mating contact surface (220), wherein the first prong (130) comprises a flat main contact surface (132) extending along the mating axis (X) and arranged opposite to the second prong (160) and wherein the second prong (160) comprises a flat first support surface (162) and a flat second support surface (164) arranged opposite to the first prong (130), wherein the blade shaped mating electrical contact (200) is clamped between the flat main contact surface (132) and the flat first support surface (162) and the flat second support surface (164)), when fully mated thereby providing electrical connection.

2. An electrical terminal assembly (100) according to claim 1, wherein the first flat mating contact surface (220) is in contact with the flat main contact surface (132) and the second flat mating contact surface (230) is in contact with the flat first support surface (162) and the flat second support surface (164)), when fully mated.

3. An electrical terminal assembly (100) according to any preceding claim, wherein the flat main contact surface (132) extents a longer distance, along the first prong (130), than the total distance the flat first support surface (162) and second flat support surface (164) extend along the second prong (160).

4. An electrical terminal assembly (100) according to any preceding claim, wherein the flat main contact surface (132) extents at least half the length of the first prong (130).

5. An electrical terminal assembly (100) according to any preceding claim, wherein the wide of the first prong (160) is constant along the extension of the flat main contact surface (132).

6. An electrical terminal assembly (100) according to any preceding claim, wherein the second prong (160) comprises a narrowing defined by a cut out (166) located in between the flat first support surface (162) and the flat second support surface (164), narrowing the width of the second prong (160) perpendicular to the mating axis (X).

7. An electrical terminal assembly (100) according to any preceding claim, wherein the width of the second prong (160) decreases starting from the second flat support surface (164) along the mating axis, towards the base (122).

8. An electrical terminal assembly (100) according to any preceding claim, wherein the flat main contact surface (132) is parallel to the flat first support surface (162) and is parallel to the flat second support surface (164), when fully mated to the blade shaped mating electrical contact (200).

9. An electrical terminal assembly (100) according to any preceding claim, wherein the flat main contact surface (132) is not parallel to the flat first support surface (162) or/and not parallel to the flat second support surface (164), when not mated to the blade shaped mating electrical contact (200).

10. An electrical terminal assembly (100) according to the preceding claim, wherein the flat first support surface (162) or/and the flat second support surface (164) are sloped towards the first prong (130), when not mated to the blade shaped mating electrical contact (200).

11. An electrical terminal assembly (100) according to any preceding claim, wherein the blade shaped mating electrical contact (200) comprises a rectangular cross-section.

12. An electrical terminal assembly (100) according to any preceding claim, wherein the blade shaped mating electrical contact (200) and the fork shaped electrical contact (120) are made of sheet metal.

13. An electrical terminal assembly (100) according to any preceding claim, wherein the total area of the main contact surface (132) is at least double the size than the total area of the flat first support surface (162) and the second flat support surface (164) in total.

14. An electrical terminal assembly (100) according to any preceding claim, wherein the first prong (130) is more rigid than the second prong (160).

15. An electrical junction box comprising an electrical terminal assembly (100) according to any preceding claim, wherein the fork shaped electrical contact (120) is defined of a part of an electrical bus bar and wherein the blade shaped mating electrical contact (200) is defined by a contact of a high current fuse.

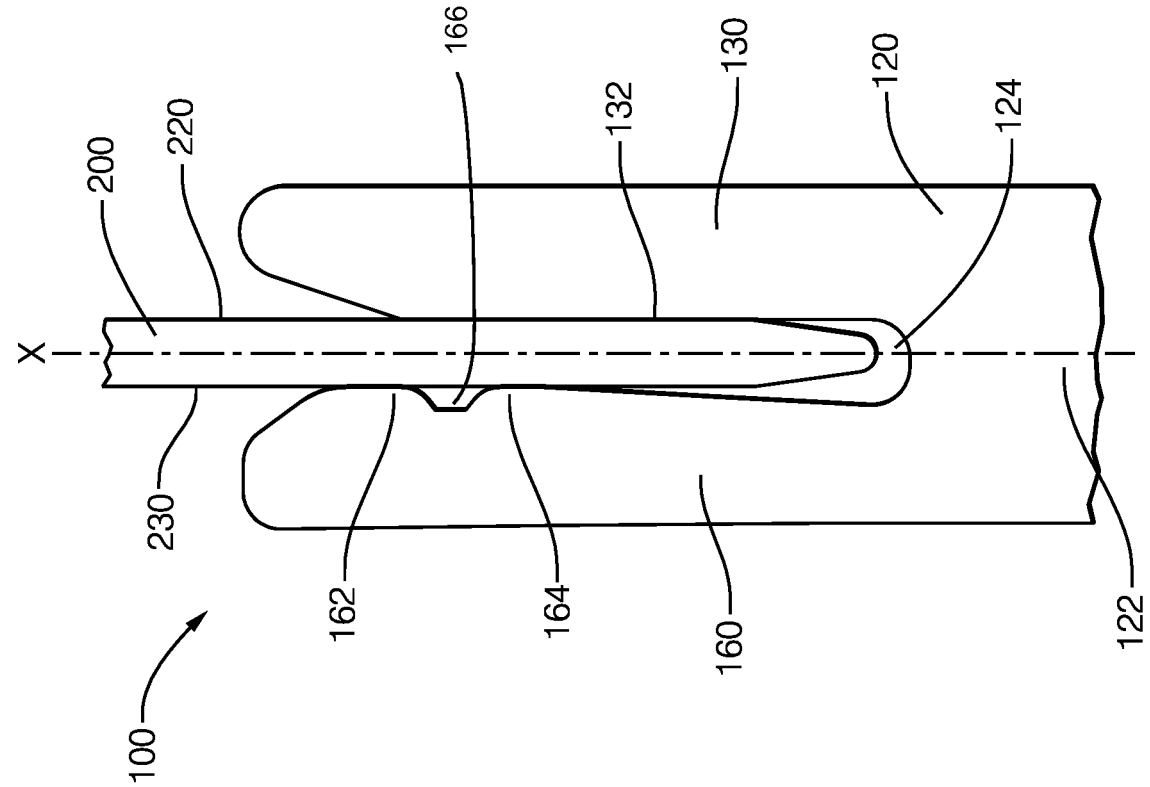
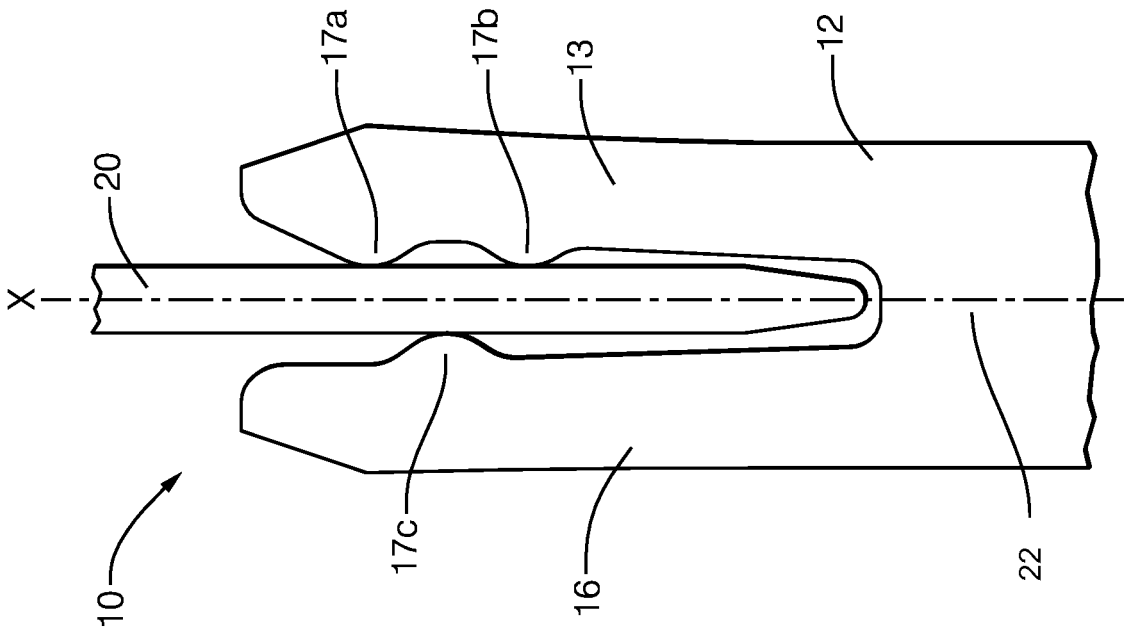


FIG. 2



PRIOR ART

FIG. 1

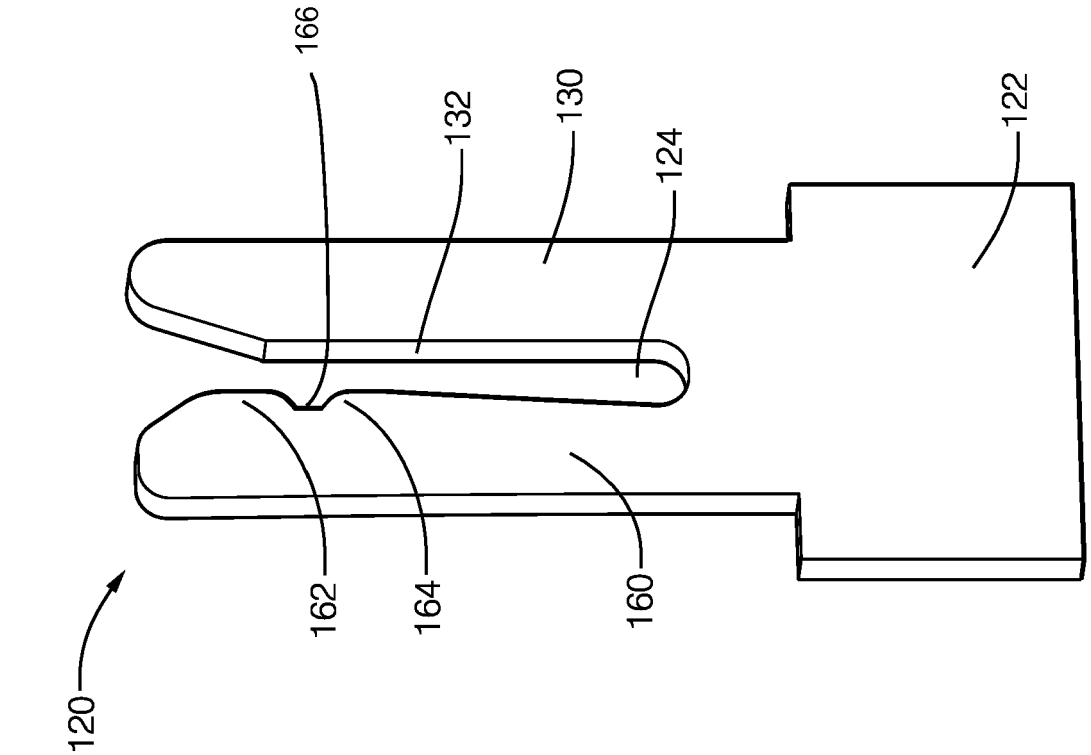

166
132
130
124
122
120
162
164
160

FIG. 4

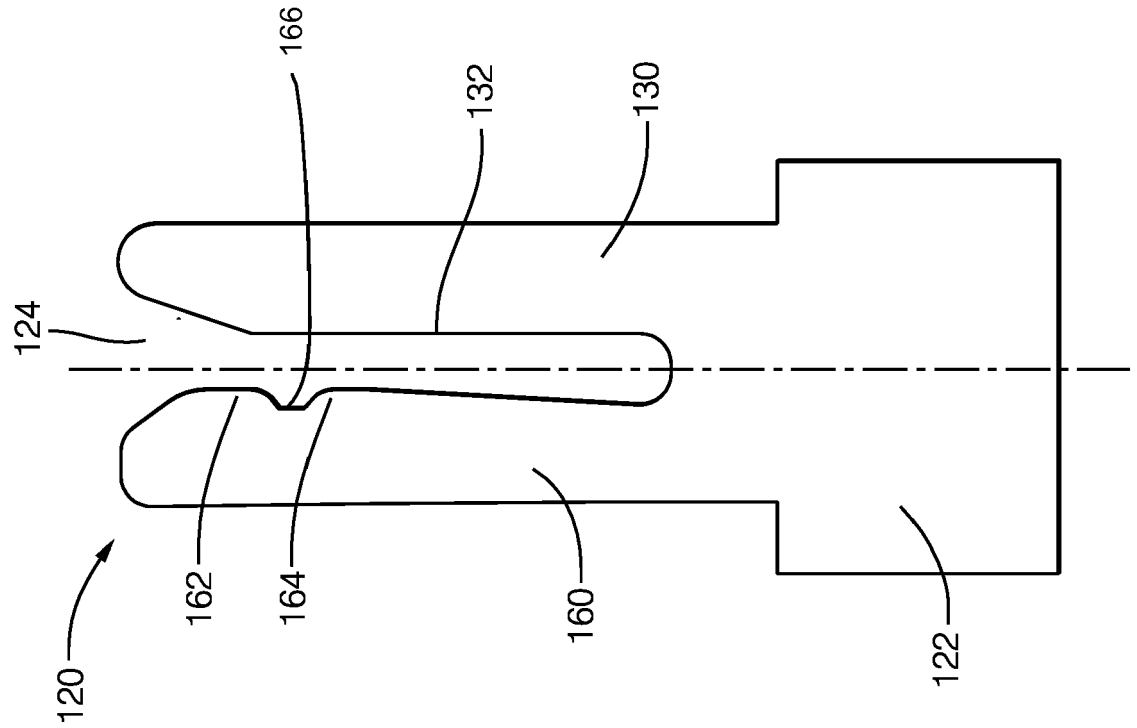

166
132
130
124
120
162
164
160
122

FIG. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 15 5754

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	US 3 748 633 A (LUNDERGAN R) 24 July 1973 (1973-07-24) * column 2, lines 4-57; figure 3 * -----	1,2,5,6, 8,11,12, 14,15	INV. H01R13/11
X	JP S50 49682 U (UNKNOWN) 15 May 1975 (1975-05-15) * the whole document * -----	1,2,5,6, 8,11,12, 14,15	
X	JP H04 46369 U (UNKNOWN) 20 April 1992 (1992-04-20) * the whole document * -----	1,2,5,6, 8,11,12, 14,15	
X	FR 1 310 684 A (UNKNOWN) 30 November 1962 (1962-11-30) * page 2, left column, page 3, right column; figure 10 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
A	US 2010/219930 A1 (OH SEIBANG [US] ET AL) 2 September 2010 (2010-09-02) * the whole document * -----	1-15	H01R H01H
A	JP 4 071311 B2 (HARNESS SOGO GIJUTSU KENKYUSHO; SUMITOMO WIRING SYSTEMS; SUMITOMO ELEC) 2 April 2008 (2008-04-02) * the whole document * -----	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 April 2018	López García, Raquel

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 5754

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-04-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3748633 A	24-07-1973	NONE	
JP S5049682 U	15-05-1975	JP S5049682 U	15-05-1975
		JP S5240394 Y2	12-09-1977
JP H0446369 U	20-04-1992	NONE	
FR 1310684 A	30-11-1962	NONE	
US 2010219930 A1	02-09-2010	CN 102365701 A	29-02-2012
		EP 2401755 A1	04-01-2012
		KR 20110126157 A	22-11-2011
		KR 20170117206 A	20-10-2017
		US 2010219930 A1	02-09-2010
		WO 2010099298 A1	02-09-2010
JP 4071311 B2	02-04-2008	JP 4071311 B2	02-04-2008
		JP H10189107 A	21-07-1998

EPO FORM P0459

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