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(54) **Strain relief system for an electrical connector assembly**

(57) The present invention relates to a strain relief system (100) comprising a guide retainer (101) and at least one actuating jaw (104, 105) assigned to the guide retainer (101). The actuating jaw (104, 105) is arranged inside the guide retainer (101) to be moveable essentially along the longitudinal axis (601) of an inserted cable from a pre-locked position to a final locked position. Upon a movement from said prelocked position to said final locked position, the actuating jaw (104, 105) as a whole performs a movement to fix the inserted cable to provide a strain relief function.

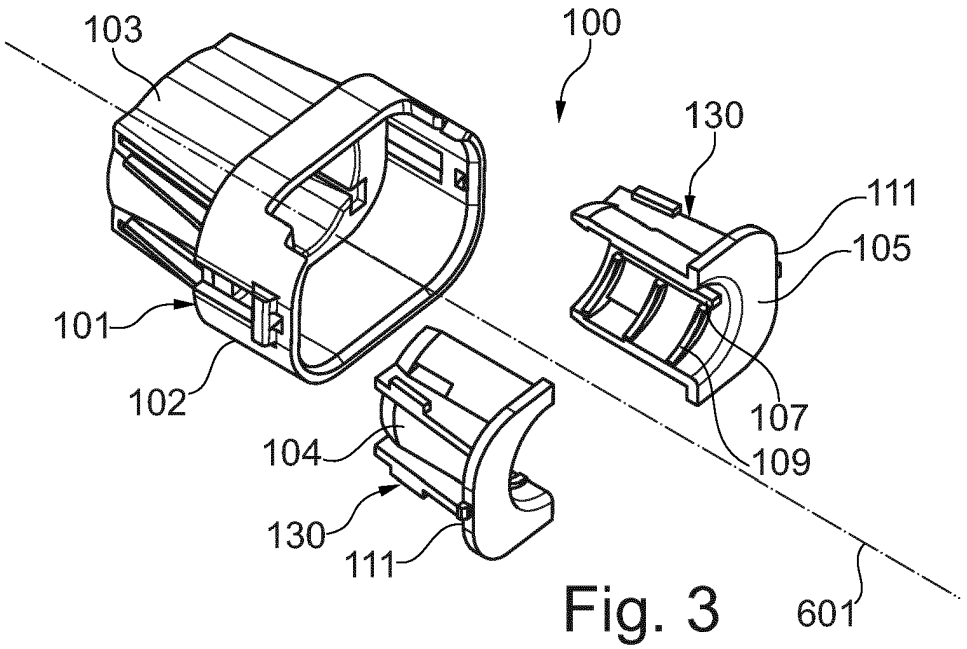

Fig. 3

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Description

Technical field of the invention

[0001] The present invention relates to a strain relief system for a connector assembly, the strain relief system comprising a guide retainer and actuating jaws assigned to the retainer.

Background of the invention

[0002] Strain relief systems are used to provide strain relief in particular between electrical connector assemblies and electrical cables. Even though strain relief systems are used in many fields of electric and electronic applications, in particular in the newly growing field of hybrid and electrical vehicles such strain relief systems are often necessary. In this field cables are often required to transmit high currents which go along with correspondingly high electrical powers. For this reason, often cables of large diameter including relatively large electrically conductive metal cores with core diameters on the order of several millimeters need to be used. The stiffness of such cables or of similarly stiff multi-core cables can result in large tensile, bending and torsional strains acting on connected electrical components when such cables are moved for example upon assembly or maintenance. Such strains can lead to disconnection or even damage of the cable and the respective electrical components.

[0003] In order to avoid such strains to be transmitted to components connected to the respective cable, various kinds of strain relief systems are known which can be mounted e.g. to electrical connector assemblies and which are provided with means for the reception of electrical cables. Strains resulting e.g. from cable movement are thus mainly absorbed by the strain relief system and therefore are not transmitted to electrical components within the connector assembly electrically connected to the electrical cable.

[0004] A typical prior art example of a strain relief system is disclosed in document WO 93/06637 A1. Therein, a strain relief system is described comprising a threaded coupling nut which receives a pair of bars which are used for clamping a cable therebetween. A corresponding clamp nut can be threaded to the corresponding threads of the coupling nut for closing the system. The bars are provided axially stationary relative to the clamp body in order to absorb strains resulting from cable movement.

[0005] A further prior art strain relief system is disclosed in document US 2012/0037416 A1. Therein, a packing member made of an elastic material such as rubber is described which acts as a strain relief device for securing a cable received therein to a flexible conduit. Upon screwing a cap onto a casing, respective portions of the packing member are deformed such that an annular retaining rib of the packing member is forced into engagement with a grooved periphery of the flexible conduit. Further, a tapered portion of the packing member is pressed onto the cable. Due to said compression of the flexible packing member, strain relief is provided between cable and conduit.

[0006] Document WO 2010/068291 A1 describes a strain relief system comprising a collet and a retainer. The collet is provided with an opening for the reception of a cable and corresponding fingers are provided around the opening of the collet along a longitudinal axis of the inserted cable. Upon mounting the retainer to the collet, the fingers of the collet are bent towards the cable to fix the cable to the collet. Due to this bending, serrated edges of the fingers are pressed onto an outer surface of the cable.

[0007] It turned out that in particular bending movements of fingers as used in prior art designs can be non-optimal since the resulting inhomogeneous compression of the cable, i.e. a compression of the cable only within relatively small portions of the corresponding fingers, often does not optimally secure or fix the inserted cable. Further, it turned out that in particular elastic components used in prior art strain relief systems often are susceptible to wearout in particular when used in automotive applications where electrical components can be subjected to the outside environment and to relatively large temperature changes.

[0008] In view of the above, it is an object of the present invention to provide a strain relief system to be used in connection with a connector assembly, in particular with a high power electrical connector assembly, which overcomes the above problems. It is in particular an object of the present invention to provide a strain relief system which can provide a homogeneous compression on an inserted cable to provide an improved fixing force fixing the cable e.g. to a corresponding retainer. It is still a further object of the present invention to provide a strain relief system comprising components which are less susceptible to wearout while at the same time they can provide an optimum strain relief function. These and other objects which will become apparent upon reading the following description are solved by a strain relief system according to claim 1 and by an electrical connector assembly according to claim 12.

Summary of the invention

[0009] According to the invention a strain relief system is provided comprising a guide retainer and at least one actuating jaw arranged movably inside the retainer. The system is assigned to an electrical connector assembly and adapted to

receive an electrical cable within an opening provided in the guide retainer of the strain relief system. Even though the inventive strain relief system can be used in connection with any electric or electronic application, preferably, the electrical connector assembly is adapted to transmit a high electrical power of at least 10 kW, preferably of at least 50 kW, even more preferably of at least 100 kW, and most preferably of at least 150 kW. Thus, e.g. due to suitable dimensions of the electrically conductive components, the electrical connector assembly is e.g. adapted to transmit a current of 40 A at a voltage of 850 V and thus a high electrical power of 34 kW.

[0010] The guide retainer can e.g. have a cylindrical basic structure or similar. A longitudinal axis of the strain relief system is defined by an inserted cable, i.e. a cable received in the opening. According to the invention, the strain relief system comprises at least one actuating jaw, preferably two actuating jaws, assigned to the guide retainer, which actuating jaws are arranged at least partially inside the guide retainer to be movable essentially along the longitudinal axis of the inserted cable from a pre-locked position to a final locked position.

[0011] Thus, advantageously, in particular as opposed to prior art solutions, the strain relief system according to the present invention allows for the actuating jaws to be placeable in said pre-locked position, i.e. it allows for a pre-position stage, such that the strain relief system can e.g. be shipped to customers already preassembled as one part.

[0012] Further, according to the invention, upon movement from said pre-locked position to said final locked position along the longitudinal axis of the inserted cable, the at least one actuating jaw as a whole performs also a movement in a direction essentially perpendicular to the longitudinal axis of the inserted cable to fix the inserted cable to the guide retainer. In other words, as for example opposed to a bending movement of fingers or tongues as known from the prior art, the actuating jaw moves as a whole towards the inserted cable and presses against the same to provide the desired strain relief function.

[0013] Preferably, the strain relief system comprises at least two actuating jaws, which enclose the inserted cable and which upon movement from the pre-locked position towards the final locked position, each as a whole, moves towards each other. Upon said movement, an inserted cable is pressed and thus fixed in between the two actuating jaws.

[0014] Since the jaw(s) move as a whole parallel as well as perpendicular to the longitudinal axis of the inserted cable, each point of the at least one actuating jaw exerts essentially the same force onto the inserted cable. Thus, a compression of the cable is achieved which is essentially homogeneous along the entire length of the jaw(s). This homogeneous compression results in an improved cable fixing or engagement force. Further, according to the invention, an electrical connector assembly is provided which comprises the inventive strain relief system.

[0015] In a preferred embodiment, the components of the strain relief system are injection molded plastic components which are less susceptible to wearout as for example typical elastic components such as rubber components. These can more easily be used in environments as they occur for example in automotive high power electrical applications.

Description of the preferred embodiment

[0016] In the following, the invention is described exemplarily with reference to the enclosed figures, in which:

Figs. 1 and 2 show the strain relief system within an exploded view and in assembled condition mounted to a connector housing, respectively;

Figs. 3 to 7 illustrate a guide retainer and two actuating jaws of the strain relief system in different views;

Figs, 8 and 9 illustrate cross sectional views of the strain relief system with a cable received therein;

Figs. 10, 11 and 12 illustrate further embodiments of actuating jaws and a guide retainer; and

Fig. 13 shows a further embodiment of a connector housing mounted to the components illustrated in Figs. 10 to 12.

[0017] Fig. 1 shows an exploded and Fig. 2 a respectively assembled view of a connector assembly 200 and a strain relief system 100. In order to seal the interior components against e.g. dust or humidity, the connector assembly 200 is provided with sealing components, i.e. with a housing seal 209, a seal retainer 211 and cable seal 207. Further, inside of the connector housing 201, shielding parts 205 are arranged around an inner housing 203 which serve to electromagnetically shield contact terminals 400. In order to secure the assembly of the shown components, a CPA device 213 is used which upon assembly is inserted into a corresponding channel of the connector housing 201. All these components are generally known to the skilled person and are not essential for the present invention, so that it is refrained from giving a detailed explanation thereof.

[0018] The strain relief system 100 shown comprises two actuating jaws 104, 105 which can be inserted into a guide retainer 101 of the strain relief system 100. In the shown embodiment, the two jaws are identical, which is advantageous for manufacturing reasons, although it is not strictly necessary. Details thereof will be explained with reference to Figs.

3 to 7. As it will be clear for the person skilled in the art when taking into account the present disclosure, instead of two actuating jaws 104, 105 as described exemplarily, the inventive function of the strain relief system can be accomplished similarly using only one actuating jaw, while the function of the other jaw is substituted by e.g. a corresponding inner surface of the guide retainer 101. Similarly, more than two actuating jaws can be provided.

[0019] Now referring to Fig. 3, the strain relief system 100 comprises a guide retainer 101 and actuating jaws 104, 105 which can be inserted into the guide retainer 101 in a pre-assembly or pre-locked position within the guide retainer 101 (see Figs. 5 and 6). To this end, preferably each of the actuating jaws 104, 105 is provided with at least one locking tongue 111, each locking tongue being adapted to be inserted into a pre-lock recess 117 (see Figs. 5 to 7) provided within respective opposing faces of the guide retainer 101 to hold the actuating jaws 104, 105 in the pre-lock position. Thus, when the components of the strain relief system 100 are assembled in said pre-locked position, the strain relief system can be delivered e.g. to customers already pre-assembled which simplifies further assembly processes carrier out by the customers.

[0020] The strain relief system 100 is adapted to receive an electrical cable 300 through an opening 108 (see Figs. 1 and 5). A such inserted cable defines a longitudinal axis 601 of the strain relief system along which the actuating jaws 104, 105 can be further inserted into the guide retainer from said pre-locked position towards a final locked position. Upon said movement, the actuating jaws 104, 105 are moved essentially from a main portion 102 of the guide retainer towards a compression portion 103 of the guide retainer, thus being evenly moved towards each other and thus being homogeneously pressed against outer surfaces of an inserted cable to fix said cable 300 to the guide retainer 101.

[0021] As shown in Fig. 3, to this end, in a preferred embodiment the at least one actuating jaw 104, 105 is provided with at least one longitudinal compression rib 107 oriented essentially parallel to the longitudinal axis 601 of the inserted cable 300. Preferably the at least one actuating jaw 104, 105 is further or alternatively provided with at least one, preferably at least two, lateral compression ribs 109 (see also Fig. 6) oriented in a direction essentially perpendicular to the longitudinal axis 601 of an inserted cable. Thereby, the ribs 107, 109 are arranged on respective interior surfaces of the respective actuating jaw 104, 105 facing towards the inserted cable 300. Thus, when the actuating jaws 104, 105 are placed in the final locked position said ribs 107, 109 are essentially evenly pressed onto an outer surface of the inserted cable 300. The provision of said compression ribs 107, 109 allows advantageously to evenly distribute the fixing force resulting from said homogeneous pressing forces along outer surfaces of an inserted cable 300 and thus to fix and secure an inserted cable 300 inside the guide retainer 101. Further, by a suitable choice of the respective heights of the compression ribs 107, 109, the final pressing force can be controlled in an easily determinable manner. Further, due to the particular arrangement of the ribs, the rib 107 is particularly adapted to prevent a cable rotation, whereas the rib 109 effectively prevents a movement of the cable in longitudinal direction.

[0022] As illustrated in Figs. 4 and 5, in order to assure the homogeneous pressing, i.e. in order to assure that the actuating jaws 104, 105 are evenly pressed towards each other and against the inserted cable, a bending or tilting movement as it is known from prior art designs is avoided. This is achieved in the shown preferred embodiment in that each of the actuating jaws 104, 105 comprises a first guide structure, namely a guide rib 113. The retainer in turn has a second guide structure, namely a guide groove 115. Thus, upon movement of the actuating jaws 104, 105 from the pre-locked position as illustrated in Fig. 5, towards the final locked position as illustrated in Fig. 9, the first guide structure interacts with the corresponding second guide structure of the guide retainer 101 such that upon said movement, the actuating jaws 104, 105 as a whole perform a movement in a direction 603 (see Fig. 6) essentially perpendicular to the longitudinal axis 601 of the inserted cable 300. In the shown example, for this interaction, the guide ribs 113 move along a corresponding guiding groove 115. To yield the movement of the at least one actuating jaw in a direction essentially perpendicular to the longitudinal axis of an inserted cable, preferably, at least one of the guide strictures is inwardly inclined towards the inserted cable 300, preferably, by an angle with respect to the longitudinal axis 601 of an inserted cable 300 within 1° to 45°, more preferably within 2° to 30°, and most preferably within 3° to 20°. In the shown case, the guiding grooves 115 are inclined towards an inserted cable. However, as it will be clear for the person skilled in the art, similarly an inclined structure can be provided at the at least one actuating jaw to accomplish a similar movement. The choice of the appropriate angle allows for example to determine a suitable compression force for fixing an inserted cable 300 to the guide retainer 101 and it also allows to adapt the closing force. Similarly, it is also possible to provide the jaws with a guide groove and the retainer with a corresponding guide rib or ribs.

[0023] As can be derived e.g. from Fig. 4, in a preferred embodiment, at least one, preferably each, of the actuating jaws 104, 105 comprises a support rib 129 which extends from an outer surface of the actuating jaw 104, 105. The guide ribs 113 extend from said support ribs which allows to place said guide ribs 113 in appropriate positions thus allowing for an optimal guiding of the actuating jaws 104, 105 inside of the retainer. Further, in particular the provision of the elongated guide member 130 allows that in a preferred embodiment, upon movement of the actuating jaws 104, 105 from the pre-locked position towards the final locked position, outer faces of the guide member 130 interact with an interior guide structure, e.g. an interior surface of the guide retainer 101, said interaction additionally forcing the actuating jaws 104, 105 towards each other.

[0024] Thus, as also shown in Fig. 6, in a preferred embodiment, the guide retainer 101 comprises a compression (i.

e. pressing) portion 103 and a main portion 102, the main portion 102 being provided with a larger inner diameter as the compression portion 103. Thereby, the pre-lock recess 117 is provided within a surface of the main portion 102 and each locking tongue 111 extends at least partially in a direction essentially perpendicular to the main longitudinal axis 601 of an inserted cable 300 into the pre-lock recess 117 when the actuating jaws 104 are placed in the pre-locked position. Due to the reduced diameter of the compression portion 103, upon movement of the actuating jaws 104, 105 from the main portion towards the compression portion, the actuating jaws are moved towards each other for optimally fixing an inserted cable 300.

[0025] As one may derive from Fig. 7, upon movement of the actuating jaws 104, 105 out of the pre-locked position, each locking tongue is moved out of the pre-lock recess 117, moves beneath a separation bar 120 into a final lock recess 119 and upon completion of said movement, in a preferred embodiment, each locking tongue 111 abuts a corresponding stop surface 122 (see Fig. 6) of the guide retainer 101 when the actuating jaws 104, 105 are placed in the final locked position. In order to provide a stable positioning within the final locked position, in a preferred embodiment, each of the actuating jaws 104, 105 is provided with a collar 121, 123 extending within a plane oriented essentially perpendicular to the longitudinal axis 601 of the inserted cable. Thereby, each locking tongue 111 extends from a respective collar 121, 123 within said plane.

[0026] Fig. 8 illustrates a cable 300 being received by the strain relief system 100 with the actuating jaws 104, 105 being placed in the pre-locked position. In this configuration, in particular, the longitudinal compression ribs 107 abut an outer surface of the inserted cable 300 but do not yet exert any pressure on said cable.

[0027] Fig. 9 illustrates the situation when the actuating jaws 104, 105 are moved into the final locked position. Now, the longitudinal compression ribs 107 of the two jaws are pressed from opposite sides onto the outer surfaces of the inserted cable thus exerting an essentially homogeneous compression along the longitudinal axis of the inserted cable for fixing the inserted cable 300 to the guide retainer 101.

[0028] In Fig. 9, a connector housing 201 is shown mounted or coupled to the strain relief system 100, i.e. to the guide retainer 101. In order to assure said mounting, in a preferred embodiment when the strain relief system 100 is mounted to a connector housing of an electrical connector assembly 200, a locking latch 215 (see also Fig. 2) of the connector housing 201 is inserted into a final lock recess 119 of the guide retainer 101 to lock the connector housing 201 to the guide retainer 101. Thereby, the locking latch 215 is provided with a stop edge 216 which rests on a corresponding section 124 of a collar 121, 123 provided on each actuating jaw 104, 105 to hold the actuating jaws 104, 105 in the final locked position. Thus, the mounting of the connector housing 201 to the strain relief system 100 allows for an automatic movement of the actuating jaws 104, 105. That is, upon mounting the connector housing 201 to the strain relief system 100, said stop edges 216 engage the collar 121, 123 thus pressing the actuating jaws 104, 105 from the pre-locked position towards the final lock position and when the locking latches 215 are placed within the final lock recess 119, the actuating jaws 204, 205 are secured in the final locked position due to the interaction of stop edges 216 with the corresponding section 124 of each actuating jaw. Due to this interaction also the fixation of the inserted cable 300 to the guide retainer 101 is additionally secured. In other words, the present invention allows for an automatic activation of the strain relief function upon assembly of the connector system.

[0029] Figs. 10 to 13 illustrate a further embodiment of a strain relief system 100'. As shown in Fig. 10, at least one actuating jaw 104' is provided with a locking tongue 111' not provided on a collar but preferably being shaped as an essentially s-shaped tongue. As shown in Figs. 11 and 12, when the actuating jaws 104', 105' are placed in the pre-locked position within the guide retainer 101', locking tongues 111' of each actuating jaw 104', 105' are placed in corresponding pre-lock recesses 117' provided in corresponding faces of the guide retainer 101'. Thereby, there is no possibility to accidentally close the strain relief to the final locked position when no corresponding connector with corresponding release members is present. As can be derived from Figs. 10 and 11, in a preferred embodiment each actuating jaw 104', 105' is provided with at least one guiding tongue 112', which extend from a respective collar 121' provided on each actuating jaw 104', 105'. Upon movement of the actuating jaws 104', 105' the same move along respective guide channels 114' provided within respective faces of the guide retainer 101'. Due to said guiding tongues 112', the movement of each actuating jaw 104', 105' is further guided and secured within the guide retainer 101'.

[0030] The shape of locking tongue 111' allows for a beneficial automatic unlocking of the actuating jaws 104', 105' from the pre-locked position through interaction with a connector housing 201'. As shown in Fig. 13, preferably, upon mounting the strain relief system 100' to the connector housing 201' of the electrical connector assembly 200', a release tongue 217' of the connector housing 201' presses each locking tongue 111' out of the pre-lock recess 117', thereby releasing each of the actuating jaws 104', 105' to be moveable from the pre-locked position towards the final lock position as shown in Fig. 13. When the connector housing 201' is fully mounted to the strain relief system 100', a locking latch 215' is placed in the pre-lock recess 117' thereby for securing the mating of the connector housing 201' to the strain relief system 100.

List of reference numerals

[0031]

Strain relief system	100
Guide retainer	101
Main portion	102
Compression portion	103
First actuating jaw	104
Second actuating jaw	105
Longitudinal compression rib	107
Opening	108
Lateral compression rib	109
Locking tongue	111; 111’
Guiding tongue	112’
Guide rib	113
Guide channel	114’
Guiding groove	115
Pre-lock recess	117; 117’
Final lock recess	119
Separation bar	120
First collar	121
Stop surface	122
Second collar	123
Collar section	124
First half cone section	125
Second half cone section	127
Support rib	129
Elongated guide member	130
Guide face	131
Connector assembly	200
Connector housing	201

Inner housing	203
Shielding parts	205
Cable seal	207
Housing seal	209
Seal retainer	211
CPA	213
Locking latch	215
Stop edge	216
Release tongue	217'
Cable	300
Contact terminals	400
Longitudinal axis of inserted cable	601
Direction perpendicular to longitudinal axis	603

Claims

1. Strain relief system (100; 100') comprising a guide retainer (101);
the system being assigned to an electrical connector assembly (200) and adapted to receive an electrical cable (300) within an opening (108) provided in the guide retainer (101) of the strain relief system (100; 100');
characterized in that
the strain relief system comprises at least one actuating jaw (104, 105) assigned to the guide retainer (101), which actuating jaw (104, 105) is arranged at least partially inside the guide retainer (101) to be moveable essentially along the longitudinal axis (601) of an inserted cable (300) from a pre-locked position to a final locked position; and
in that
upon said movement along the longitudinal axis (601) from said pre-locked position to said final locked position, the actuating jaw (104, 105) as a whole performs a movement in a direction (603) essentially perpendicular to the longitudinal axis (601) of the inserted cable (300), to fix the inserted cable (300) to the retainer.

2. Strain relief system (100; 100') according to claim 1, **characterized in that** the at least one actuating jaw (104, 105) comprises a first guide structure, which upon movement of the actuating jaw (104, 105) from the pre-locked position towards the final locked position interacts with a corresponding second guide structure of the guide retainer (101).

3. Strain relief system (100; 100') according to claim 2, **characterized in that** the first and second guide structures are guide ribs (113) and corresponding guide grooves (115) interacting with the ribs.

4. Strain relief system (100; 100') according to any of the preceding claims, **characterized in that** at least one of the guide structures, preferably the second structure, is inwardly inclined towards the inserted cable (300), preferably by an angle with respect to the longitudinal axis (601) of an inserted cable (300) within 1° to 45°, more preferably within 2° to 30°, and most preferably within 3° to 20°.

5. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the at least one actuating jaw (104, 105) is provided with at least one longitudinal compression rib (107) oriented essentially parallel to the longitudinal axis (601) of the inserted cable (300), and being arranged on an interior surface of the at least one actuating jaw (104, 105) facing towards the inserted cable (300), such that said longitudinal compression rib(s) is essentially evenly pressed onto an outer surface of the inserted cable (300), when the at least one actuating jaw (104, 105) is placed in the final locked position.

6. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the at least one actuating jaw (104, 105) is provided with at least one lateral compression rib (109) oriented essentially perpendicular to the longitudinal axis (601) of the inserted cable, the at least one lateral compression rib (109) being arranged on an interior surface of the at least one actuating jaw (104, 105) facing towards the inserted cable (300), such that said lateral compression rib is essentially evenly pressed onto an outer surface of the inserted cable (300), when the at least one actuating jaw (104, 105) is placed in the final locked position.

7. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the at least one

actuating jaw (104, 105) is provided with at least one locking tongue (111; 111'), the locking tongue (111; 111') being adapted to be inserted into a pre-lock recess (117; 117') provided within a respective face of the guide retainer (101) to hold the actuating jaw (104, 105) in the pre-locked position.

8. Strain relief system (100; 100') according to claim 7, **characterized in that** the guide retainer (101) comprises a compression portion (103) and a main portion (102; 102'), the main portion (102; 102') being provided with a larger inner diameter as the compression portion (103), and **in that** the pre-lock recess (117; 117') is provided within a surface of the main portion (102; 102'), and **in that** said locking tongue (111; 111') extends at least partially in a direction essentially perpendicular to the longitudinal axis (601) of an inserted cable (300) into the pre-lock recess (117; 117'), when the at least one actuating jaw (104, 105) is placed in the pre-locked position.

9. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the at least one actuating jaw (104, 105) comprises a locking tongue (111), which abuts a corresponding stop surface (122) of the guide retainer (101) when the at least one actuating jaw (104, 105) is placed in the final locked position.

10. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the at least one actuating jaw (104, 105) is provided with a collar (121, 123) extending within a plane oriented essentially perpendicular to the longitudinal axis (601) of the inserted cable.

11. Strain relief system (100; 100') according to any one of the preceding claims, **characterized in that** the strain relief system (100; 100') is provided with at least two actuating jaws (104, 105) which upon said movement from said pre-locked position to said final locked position move towards each other.

12. Electrical connector assembly (200) comprising the strain relief system (100; 100') according to any one of claims 1 to 11, further comprising the electrical cable.

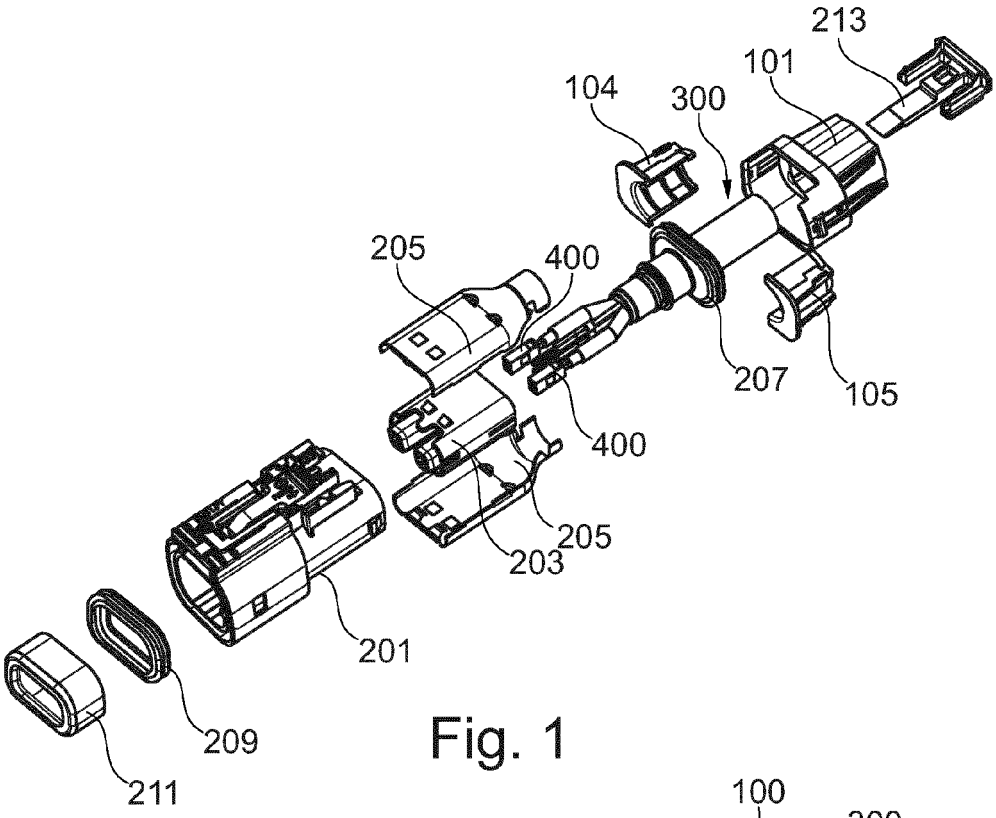
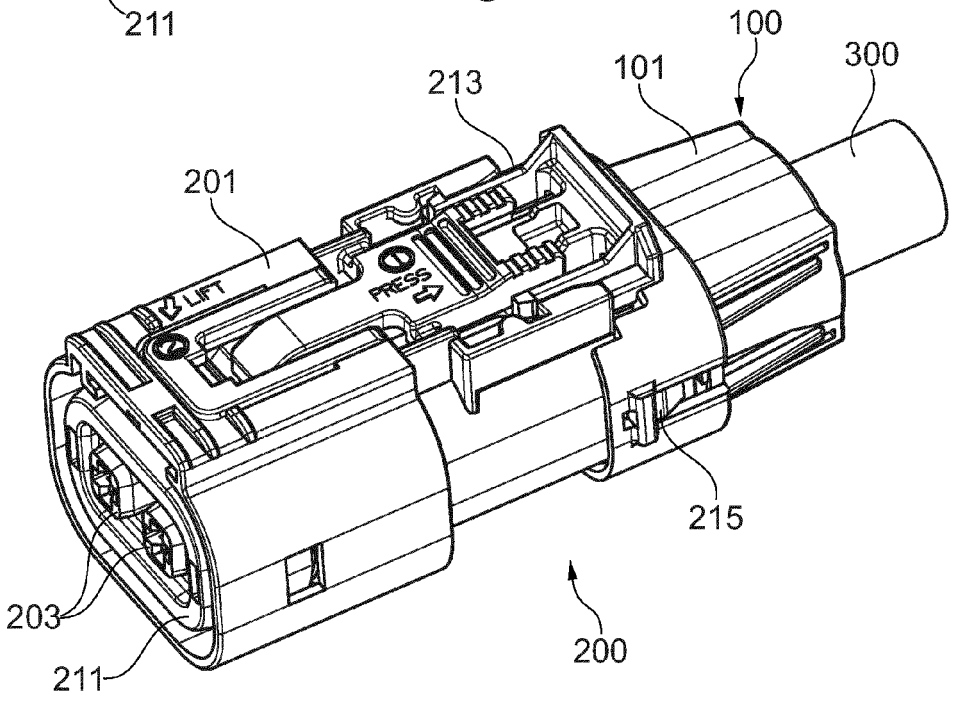

213
101
104
300
205
400
207
105
400
205
203
201
209
211

Fig. 1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LIFT
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203
211
200

Fig. 2

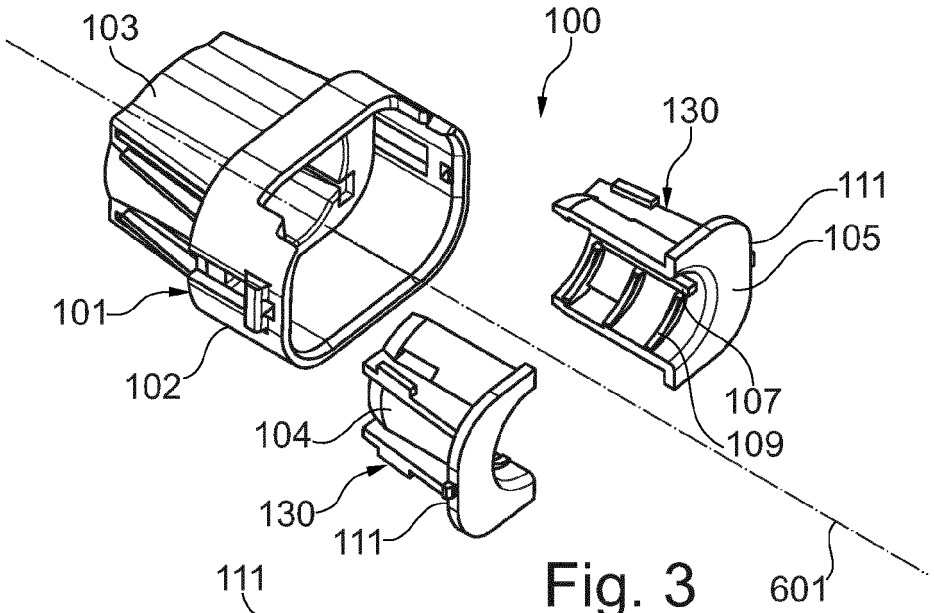


Fig. 3

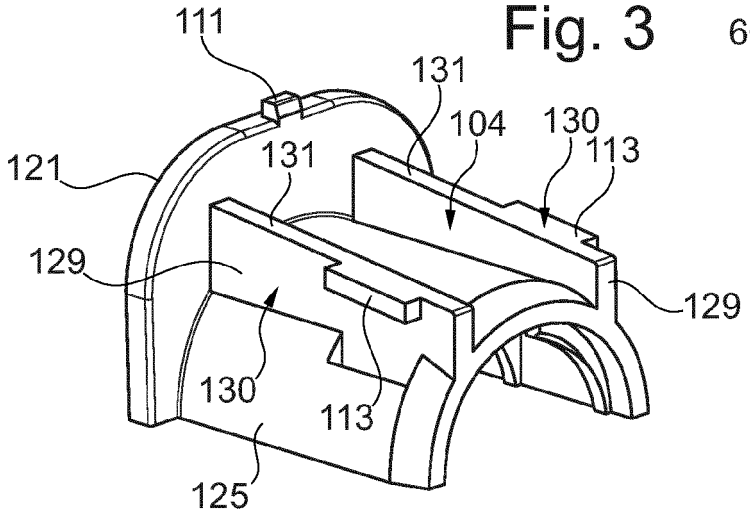


Fig. 4

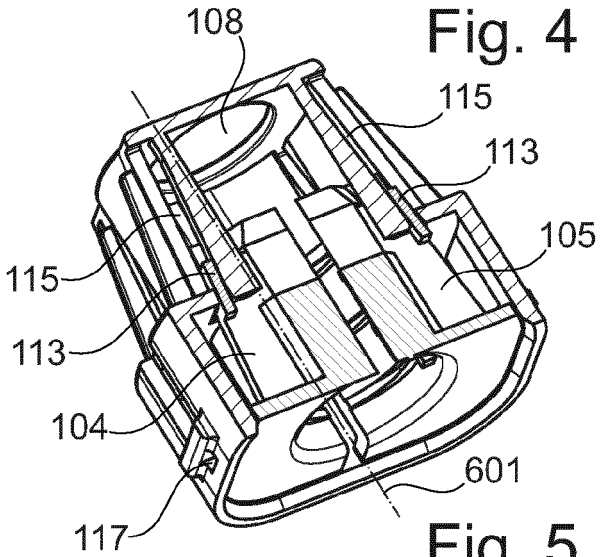
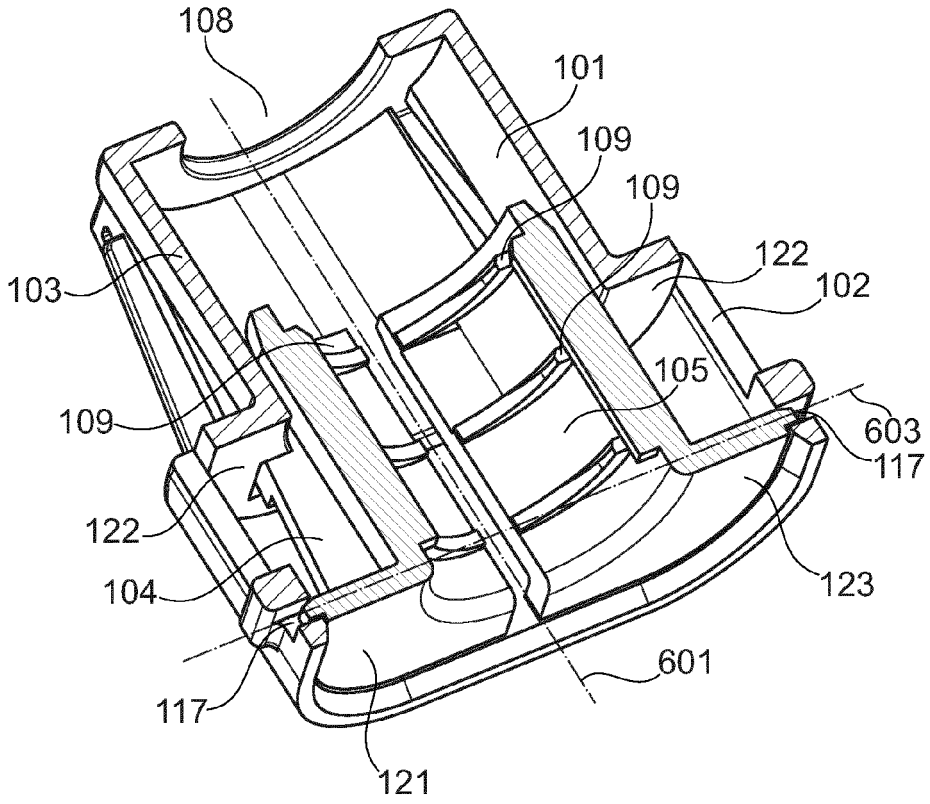


Fig. 5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121

Fig. 6

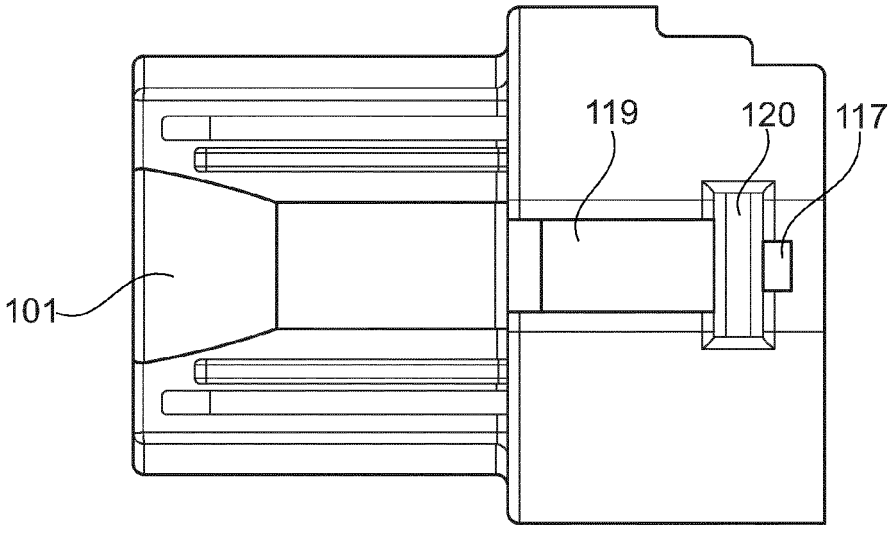
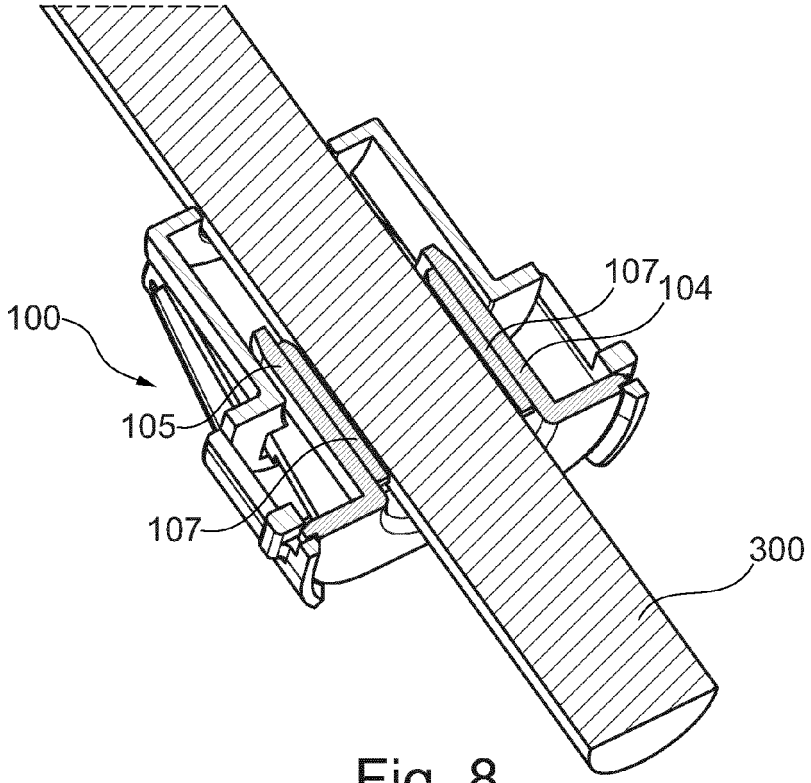

119
120
117
101

Fig. 7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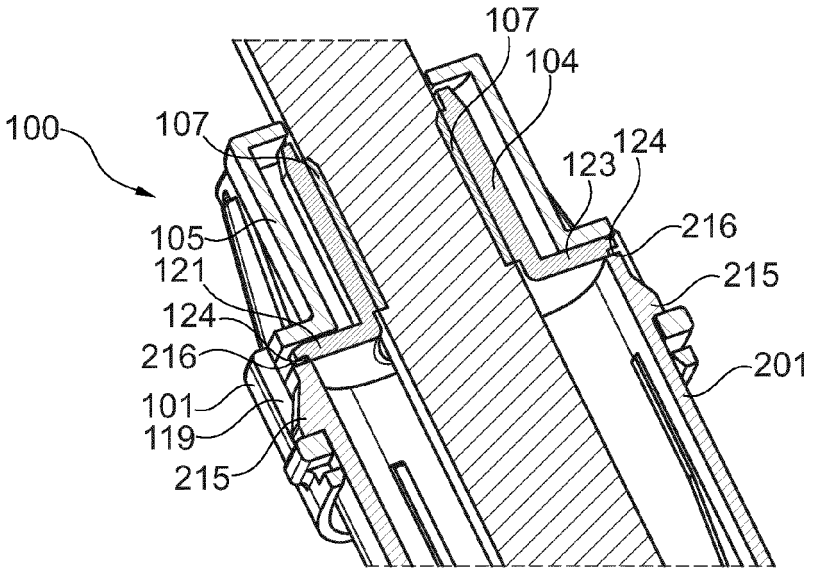
107
104
300

Fig. 8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101
119
215
201

Fig. 9

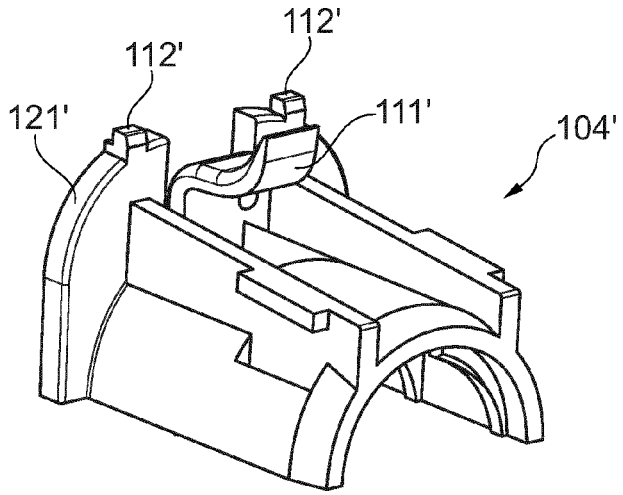

Fig. 10

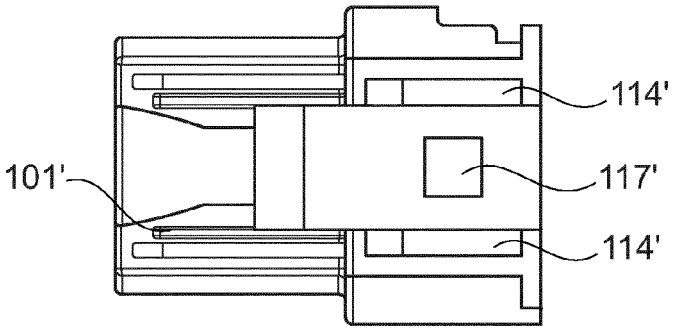

Fig. 11

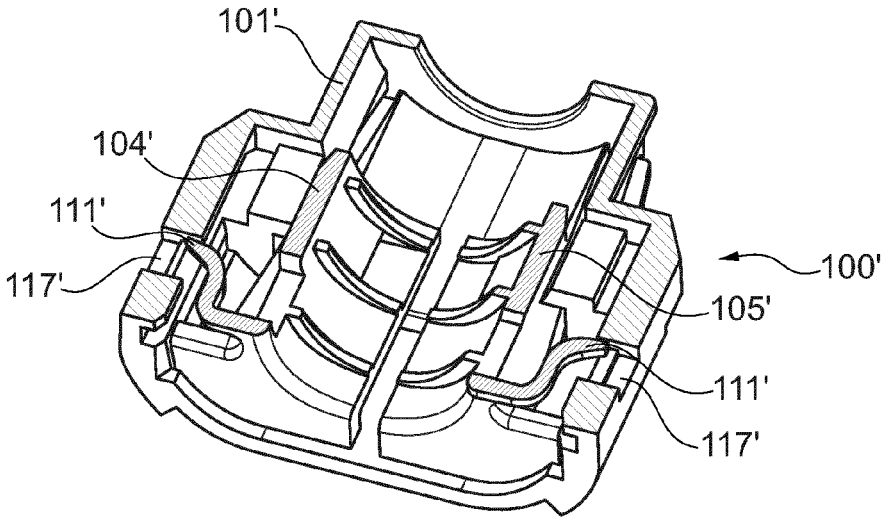

Fig. 12

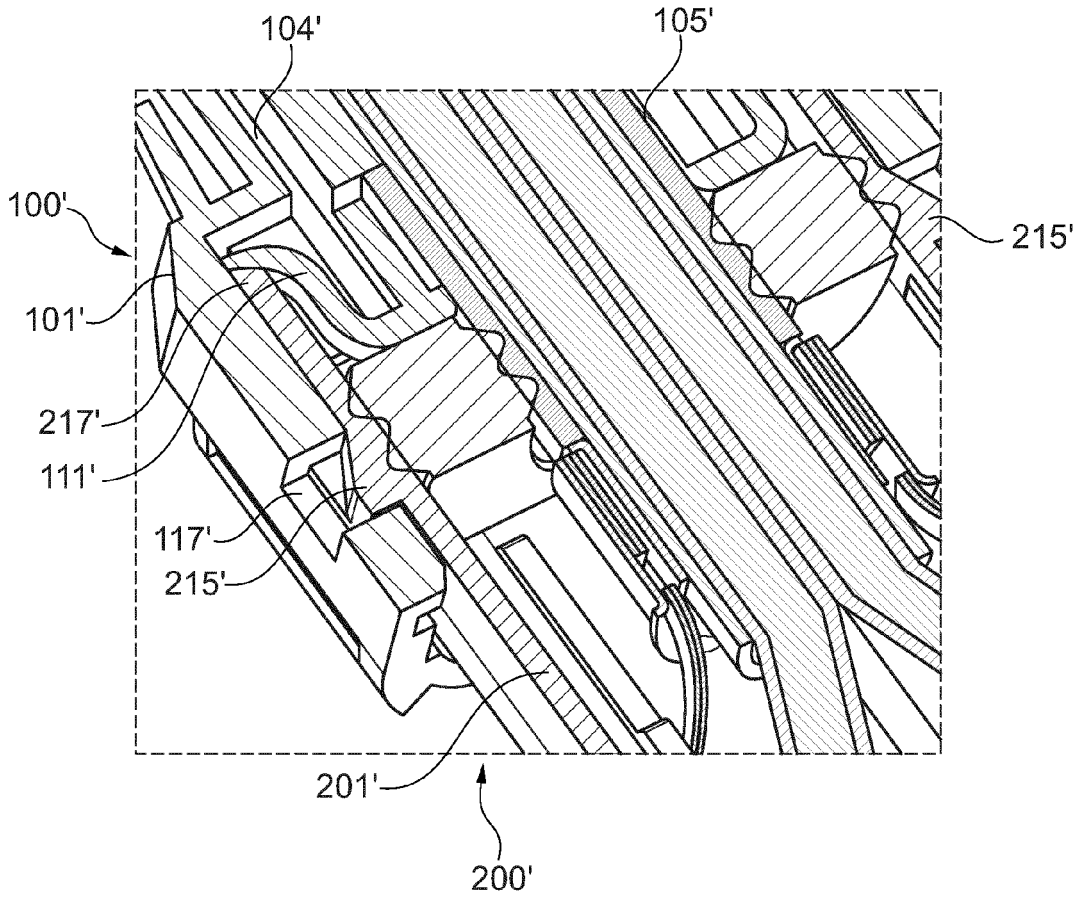

Fig. 13

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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 3136

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 A	US 2011/312211 A1 (NATOLI CHRISTOPHER PHILIP [US]) 22 December 2011 (2011-12-22) * claims 1, 2 , 15, 19 * * paragraphs [0047], [0052], [0053], [0056], [0057], [0059] * * figures 2B,2D,2E,3A,3B,3C,4A,4B,4C *	1-5,7, 9-12 6 8	INV. H01R13/58 ADD. H01R13/59
Y A	US 2010/248530 A1 (CLARK GORDON [US] ET AL) 30 September 2010 (2010-09-30) * paragraph [0044] * * figures 8, 10 *	6 1	
X A	US 2009/111323 A1 (BURRIS DONALD ANDREW [US] ET AL) 30 April 2009 (2009-04-30) * paragraphs [0054], [0055] * * figures 5-7 , 10 , 11 *	1,2,4, 10,12 7,8	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 November 2013	Stichauer, Libor

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13-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011312211 A1	22-12-2011	NONE	
US 2010248530 A1	30-09-2010	EP 2057716 A1	13-05-2009
		RU 2009111255 A	10-10-2010
		US 2008057778 A1	06-03-2008
		US 2008233794 A1	25-09-2008
		US 2010248530 A1	30-09-2010
		WO 2008027245 A1	06-03-2008
		ZA 200902077 A	28-04-2010
US 2009111323 A1	30-04-2009	CN 101919121 A	15-12-2010
		EP 2220725 A2	25-08-2010
		TW 200945709 A	01-11-2009
		US 2009111323 A1	30-04-2009
		WO 2009058270 A2	07-05-2009

EPO FORM P0459

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Patent documents cited in the description

- WO 9306637 A1 **[0004]**
- US 20120037416 A1 **[0005]**
- WO 2010068291 A1 **[0006]**