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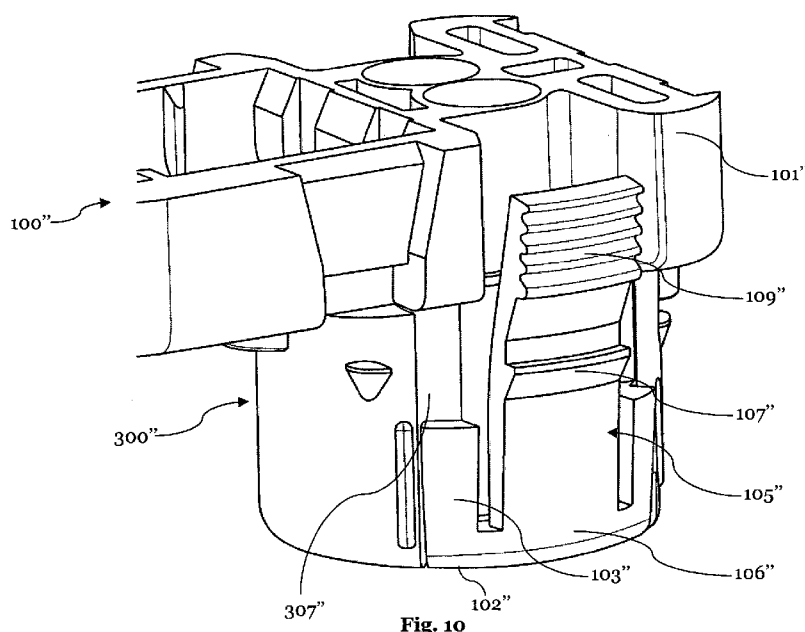
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(54) Title: AIRBAG CONNECTOR SYSTEM



(57) Abstract: The present invention provides an airbag connector system comprising an airbag squib connector (100') adapted to be mated with a corresponding airbag squib socket, whereby the airbag squib connector (100') comprises a connector or housing (101') with a connection tube (103'). The connection tube (103') is provided with at least one reversed locking arm (105') adapted to lock the airbag squib connector (100') to the airbag squib socket, whereby the reversed locking arm (105') extends from a flexible torsion element (106') provided at an insertion sided end (102; 102'; 102'') of the connection tube (103') in a direction essentially opposing the insertion direction of the airbag squib connector (100') into the socket (400). Thereby, the flexible torsion element (106') is adapted to deform and thereby enable a deflection of the reversed locking arm (105') upon insertion of the airbag squib connector (100') into the airbag squib socket.

AIRBAG CONNECTOR SYSTEM

1. Field of the invention

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The present invention relates to a scoop-proof electrical connector system, in particular for pyrotechnical safety restraint (SRS) systems, as e.g. airbag connector systems comprising an electrical connector adapted to be connected to a corresponding socket by means of reversed locking arms.

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2. Technical background

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To protect contact pins in particular of SRS connectors as for example airbag squib connectors upon mating to corresponding sockets, so called “scoop-proof” connector systems exist. Such systems typically consist of a squib connector with a connection tube being shaped as a closely fitting counterpart of a corresponding squib socket. Due to the corresponding closely fitting shapes of connection tube and socket, the squib connector can be inserted into the socket only at a correct angle and thus, damage of contact pins of the socket due to false insertion of the connector is prevented. To further protect the pins, the system can be provided with a retainer which is inserted into the socket before the connector is mated. The retainer usually is shaped to cover the contact pins of the socket, being essentially shaped as an inner counterpart of the connection tube and thereby further ensuring the correct mating of squib connector and squib socket.

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An example of a scoop-proof airbag connector is disclosed in document DE 202 16 337 U1. Therein, a squib connector is described which can be connected to a squib socket by means of reversed locking arms. Such reversed locking arms usually extend from an insertion sided end of a connection tube of the squib connector in a direction opposing the insertion direction of the squib connector into the socket. Upon mating

of the squib connector to the squib socket, these locking arms are deflected inwardly until locking steps provided thereon snap into a corresponding groove of the socket. According to DE'337, the connection tube and the reversed locking arms are made from a conductive material such as metal to prevent electrical discharges upon mating.

A further example of a scoop-proof electrical connector is disclosed in document EP 2 230 731 A1. The squib connector disclosed therein can be connected to a corresponding squib socket by means of locking arms which are pivotably mounted to flexible portions provided on a connection tube of the squib connector. Due to the flexibility of this portion, upon insertion of the squib connector into the socket, the locking arms pivot inwardly until locking projections provided thereon snap into corresponding recesses.

Document WO 2008/048541 A2 describes a further example of a squib connector which can be mounted to a corresponding socket by means of reversed locking arms. The reversed locking arms described therein are mounted to steps extending in rectangular direction outwards from side walls of a connection tube of the squib connector. Similar as in the cases described above, upon insertion of the squib connector into a corresponding socket, the locking arms bend inwardly until locking projections of the locking arms snap into a corresponding groove of the socket to fix the squib connector to the socket.

It is an object of the present invention to improve the state of the art by providing an electrical connector system, in particular for SRS systems, with a connector with improved reversed locking arms which can be fabricated from injection-molded plastic material. It is a further object of the present invention to provide a connector for an electrical connector system, in particular for SRS systems, which facilitates assembly of the connector with a corresponding socket.

These and other objects which become apparent upon reading the following description are solved by an electrical connector system according to claim 1.

5 3. Summary of the invention

According to the invention, an electrical connector system, in particular for pyrotechnical safety restraint systems such as airbag connector systems, is provided which comprises an electrical connector which is adapted to be mated with a corresponding socket, whereby the electrical connector comprises a connector housing with a connection tube. To lock the electrical connector to the socket, the connection tube is provided with at least one reversed locking arm.

15 Preferably, the reversed locking arm is integrally formed with the connector housing and preferably is not made from metal but most preferably from a non-conductive material as for example plastic. Thus, preferably the electrical connector can be produced as an inexpensive injection-molded plastic piece. The electrical connector can be connected indirectly to the socket, i.e. the reversed locking arm can interact with an intermediate component such as with an airbag squib retainer which is locked to the socket. However, most preferably the reversed locking arm is adapted to lock the electrical connector directly to the socket.

25 According to the invention, the reversed locking arm extends from a flexible deformable element which is provided at the insertion sided end of the connection tube, whereby the flexible deformable element is adapted to deform, thereby enabling a deflection of the reversed locking arm upon insertion of the electrical connector into the socket. In this document "deformable" means which is able to deform. Thus, as opposed to the case of a metal locking arm extending from a stiff, rigid metal tube, the inventive reversed locking arm extends from a flexible portion of the connection tube, i.e. from said flexible deformable element. Due to this inventive construction, the reversed locking arm is

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provided with advantageous flexibility, thereby preventing degrading effects based e.g. on material fatigue. Preferably, in fully mated condition, the reversed locking arm is not biased against any component of the system, whereby said prevention of effects based on material fatigue is further enhanced.

In a preferred embodiment, the reversed locking arm is provided with a locking protrusion extending outwardly from the reversed locking arm having a non-symmetric essentially trapezoidal cross section. Thereby a self-locking function of the electrical connector is enabled, i.e. the locking protrusion of the locking arm is designed such that when the connector is fully mated with the socket and a force is applied to the electrical connector in a direction opposing the insertion direction, the locking action of the locking protrusion intensifies, thereby acting against said force.

In a preferred embodiment, the electrical connector system further comprises an airbag squib retainer which is adapted to be inserted into the socket and which is adapted to receive the electrical connector whereby the airbag squib retainer is provided with at least one locking tongue to lock the airbag squib retainer to the socket. The squib retainer can for example be provided to enable a scoop-proof function to protect contact pins of the socket as described in the introduction.

Preferably, the airbag squib retainer has an essentially cylindrical shape and is provided with an essentially cylindrical base portion with at least one cut-out. Thereby, the overall height of the retainer and the height of the retainer cut-out are dimensioned to facilitate a deflection of the reverse locking arm during mating of the system. Preferably, the ratio $h_{\text{retainer}}/h_{\text{cut-out}}$ of the retainer height h_{retainer} with respect to the height of the cut-out $h_{\text{cut-out}}$ is less than 3, preferably less than 2, more preferably less than 1.75, and most preferably less than 1.1. The inventors found that by correctly choosing this ratio, optimal flexibility of the reversed locking arm is achieved. In a preferred embodiment, the ratio

$h_{\text{retainer}}/h_{\text{cut-out}}$ equals 1, i.e. the cut-out portion is cut out along the entire height of the retainer.

Even though due to the inventive reversed locking arms, the electrical connector can be firmly mated with the socket such that additional security members are not necessary, in a most preferred embodiment the electrical connector system further comprises a secondary locking device which is assigned to the connector housing and which is movable between an open and a closed position. The secondary locking device is provided with a locking surface which is adapted to abut a corresponding blocking surface of the reversed locking arm when the secondary locking device is placed in the closed position whereby an inward deflection of the reversed locking arm is prevented.

Thereby, the reversed locking arm is blocked in locking engagement with the socket such that in order to unmate the electrical connector from the socket, first the secondary locking device has to be removed. Further, the secondary locking device can only be placed into its closed position when the electrical connector is inserted into the socket. Thus, an operator can visually detect the mated state of electrical connector and socket.

In a preferred embodiment, the electrical connector system is not provided with electrical shorting members such as shorting bridges which short circuit for example electrical contact pins of the socket when the connectors are not fully mated.

Generally preferred, the connector housing is made from injection molded plastics. As material for the connector housing preferentially Polyamide (PA) is used, as e.g. PA 6 and/or PA 6,6 and even more preferentially Polyamide comprising glass fibers as reinforcement is used. PBT can also be used.

In a preferred embodiment, the connector housing comprises one or more ferrite choke(s) adapted to reduce electromagnetic interferences.

4. Description of the preferred embodiments

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

- Fig. 1 shows a schematic illustration of an electrical connector to be used in connection with an airbag connector system;
- 10 Fig. 2 shows a different embodiment of an electrical connector which is provided with a secondary locking device;
- Fig. 3 shows a schematic illustration of an airbag squib retainer;
- 15 Fig. 4 shows a detail illustration of part of the connection tube with the reversed locking arm;
- Fig. 5A illustrates a simulation of an inwardly directed bending of an embodiment of a reversed locking arm according to an intermediate development;
- 20 Fig. 5B illustrates a further simulation, whereby a further embodiment of a reversed locking arm is shown bent inwardly;
- 25 Fig. 6 shows a cross-sectional view of the electrical connector of Fig. 2, whereby the secondary locking device is placed in the open position;
- 30 Fig. 7 shows a cross-sectional view of the squib connector of Fig. 2 whereby the secondary locking device is placed in the closed position;

Fig. 8 shows a different cross-sectional view of the electrical connector of Fig. 2 with the secondary locking device being placed in the open position;

5 Fig. 9 shows the cross-sectional view of Fig. 8 whereby the secondary locking device is placed in the closed position,

Fig. 10 shows a different embodiment of an electrical connector, connected to a different embodiment of an airbag squib
10 retainer;

Fig. 11 shows the electrical connector and the airbag squib retainer of figure 10 from a different perspective;

15 Fig. 12A shows the electrical connector of figure 10;

Fig. 12B shows the electrical connector of Fig. 5A;

Fig. 13A shows a prior art example of an electrical connector; and

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Fig. 13B shows the electrical connector of figure 10.

Fig. 1 shows an electrical connector 100' to be used in connection with an airbag connector system. As one can see, the electrical connector 100' is
25 provided with a connector housing 101' which is closed by a lid 111'. The connector housing 101' is provided with a connection tube 103' which extends in essentially perpendicular orientation from the connector housing 101'. As it will be clear to the skilled person, likewise different orientations of the connection tube are possible.

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As one can see in Fig. 1, the connection tube 103' is provided with a reversed locking arm 105' which is formed integrally with the connection tube 103'. A similar reversed locking arm 105' is provided on the opposing side of the connection tube 103' which is not visible in the

figure due to the perspective. Two locking arms 105' are advantageous; however one or more than two locking arms 105' are possible. The reversed locking arm 105' extends from a flexible deformable element 106' which is provided within a lower half of the connection tube 103'. As
5 shown in the figures, and as it is generally preferred, the housing 100' comprises two cut-outs 110' adjacent the locking arms 105', which are arranged to facilitate the actuation of the arms. Preferably, the flexible deformable element is provided within a lower third, more preferably within a lower quarter and most preferably as shown at the insertion
10 sided end on the lower edge 104' of the connection tube. The reversed locking arm 105' is provided with a non-symmetric, essentially trapezoidal locking protrusion 107' which extends outwardly from the reversed locking arm away from the connection tube 103'. The locking protrusion 107' is adapted to snap for example into a locking recess of a
15 corresponding socket to lock the electrical connector 100' to the socket.

Due to the above described self-locking function provided by the reversed locking arms 105', the squib connector 100' can be firmly connected to a corresponding socket such that extra security
20 mechanisms such as secondary locking devices are not required. In order to release the electrical connector 100' from the mated state in the socket, an operator has to press grooved section 109' of the reversed locking arm 105' to bend the reversed locking arm 105' inwardly, thereby releasing the locking protrusion 107' from said groove.

25 Even though secondary locking devices are not strictly necessary, such devices can be provided for additional security. Fig. 2 shows a further embodiment of the electrical connector 100 which is provided with a secondary locking device 200 and is apart from that identical to the embodiment of Fig. 1 (identical components have the same number
30 differentiated by an apostrophe; i.e. 111' denotes the same part in the Fig. 1 embodiment as 111 in the Fig. 2 embodiment). As can be derived from the figure, the secondary locking device 200 is provided with a locking surface 206 which moves behind a blocking surface 117 of the reversed

locking arm 105 when the secondary locking device is moved into the electrical connector 100, i.e. into a closed position. As can be derived from this figure, when the secondary locking device 200 is placed in said closed position the locking surface 206 prevents a deflection of the reversed locking arm 105 inwardly, i.e. towards the connector housing 101. Thus, when the electrical connector 100 is mated with the socket and the secondary locking device is placed in the closed position, unmating of the squib connector with the socket is prevented.

Fig. 3 shows a schematic illustration of an airbag squib retainer 300. The airbag squib retainer 300 is adapted to be inserted into a socket and is provided with four locking tongues 301 to be fixed in corresponding recesses provided in the socket. As it will be clear to the skilled person, likewise, more or less locking tongues 301 are possible if desired. The airbag squib retainer 300 is further adapted to receive the electrical connector 100, i.e. the airbag squib retainer is provided with an essentially circular-shaped recess 313 which can receive the connection tube 103 of the electrical connector 100, 100'. The retainer is further provided with a scoop-proof protection dome 315 which in mounted condition surrounds contact pins of the socket. As can be derived from this figure, due to this scoop-proof connection dome, the connection tube 103 has a ring-shaped end, surrounding the dome when the connector and the retainer are mated. Thanks to the scoop-proof connection dome, it is not possible to insert the connection tube 103 of the electrical connector 100 at a false angle, whereby the electrical contact pins are protected against damage.

Fig. 4 shows a detail view of the connection tube 103 of the electrical connector 100. As one can see, the flexible deformable element 106 is formed as an integral part of a base ring 104 provided at the insertion sided end 102 of the connection tube 103. Likewise, the flexible deformable element can be formed as an integral portion of the connection tube 103. Upon deflection of the reversed locking arm 105, the flexible deformable element 106 performs a torsion movement

essentially around a circumferential line which is indicated by the dashed black line 601 in the figure. Further, as it will be clear to the skilled person, upon said deflection of the locking arm the flexible deformable element 106 itself may also be moved inwardly towards the center of the connection tube 103, thereby deforming the ring shape of the base ring 104.

Fig. 5A illustrates the result of a simulation of an inwardly directed bending of a reversed locking arm 105^{id} according to an embodiment of the invention corresponding to an intermediate development. This intermediate development was achieved by the inventors of the present invention by providing improved reversed locking arms to a base ring of a standard connector. As one may derive from the illustration, the lines around the base ring 104^{id} show different regions of different strain or total deformation of the material, whereby the density of the lines indicates the magnitude of the total deformation. The grey shaded areas indicate the zones of maximum total deformation and strain. As can be derived from this figure, even though this design allows for satisfactory results, upon bending said locking arm, areas of a corresponding base ring 104^{id} adjacent to the reversed locking arm 105' are subjected to a relatively large strain which in certain cases may exceed a maximum strain allowed by the material.

Fig. 5B shows the result of a simulation of an inward bending action of an inventive reversed locking arm 105, illustrating the total deformation of the flexible deformable element 106. As can be derived from the scale provided in Fig. 5B, the differently shaded sections 1 to 9 are sections of different magnitude of total deformation. Thereby, section 1 corresponding essentially to the main part of the connection tube 103 is not deformed at all. The upper part of the groove portion 109 corresponds to the area of maximum deformation denoted as section 9. As can be derived from the scale provided in the figure, this area is moved inwardly by about 2.3 mm. In this figure the flexible deformable element 106 corresponds essentially to section 3.

As can be further derived from the figure, the deflection gradually decreases from zone 9 towards zone 2 whereby zone 2 corresponds to two portions of the base ring 104 which are only deformed by about 0.01 mm. In other words, in contrast to the intermediate development shown in Fig. 5A, the base ring zones adjacent to the inventive flexible deformable element 106 are barely subject to any deformation.

This is due to a deformation of the flexible deformable element 106, corresponding to area 3 which is deformed by up to about 0.2 mm, i.e. an upper portion of the flexible deformable element is moved inwardly while a lower portion may be moved slightly outwardly. Thereby, the flexible deformable element provides advantageous flexibility to the reversed locking arm 105. Due to this advantageous flexibility provided by the inventive combination of reversed locking arm 105 with the flexible deformable element 106 it becomes possible to provide a reliable reversed locking arm which is producible by inexpensive plastic material. Further due to this construction damages based on material fatigue are diminished as compared to prior art plastic constructions.

Fig. 6 shows a cross-sectional view of the electrical connector 100 of Fig. 2 whereby the secondary locking device 200 is placed in an open position. As can be seen in this figure, upon moving the secondary locking device 200 into the connector housing 101, the secondary locking device is guided by guide walls 115 which are moved into guiding slots 211 of the secondary locking device 200. In Fig. 6, the secondary locking device 200 is placed in its open position wherein it is held by an interaction of holding arms 205 with a support structure 123 of the connector housing 101. In the open position stop projections 209 of the holding arms 205 rest on stop protrusions 113 of the support structure 123, whereby a downward movement of the secondary locking device 200 into the connector housing 101 is prevented.

To release the secondary locking device 200 from its open position, an interaction of the holding arms 205 with release surfaces 302 of the airbag squib retainer (cf. Fig. 3) is necessary. Upon insertion of the electrical connector 100 into the airbag squib retainer 300, a deflection surface 208 at the lower end of the holding arm 205 engages a release surface 302 of the retainer 300 (cf. Fig. 3). Due to the interaction of the deflection surface 208 with the release surface 302, the holding arms 205 are deflected outwardly and the stop projections 209 are released from the stop protrusions of the connector housing 101. Thus, the secondary locking device 200 is released and can be moved in insertion direction, i.e. along arrow 600, into the fully mated condition as shown in Fig. 7.

Fig. 7 shows the fully mated condition of the electrical connector 100 with a corresponding socket 400. As can be seen in this figure, the airbag squib retainer is placed inside the socket 400 and locking tongues 301 are placed in a locking groove 401 of the socket to fix the airbag squib retainer inside the socket. Similarly, the locking protrusions 107 of the reversed locking arms 105 are placed inside the same locking groove 401 (not visible due to the perspective of the figure) to lock the electrical connector 100 directly to the socket 400.

Fig. 8 shows a different cross section of the airbag connector system with the secondary locking device 200 placed in the open position. As can be seen in Fig. 8, the electrical connector 100 is already fully mounted with the socket 400 and the locking protrusions 107 of the reversed locking arms 105 are placed in the locking groove 401 of the socket.

Fig. 9 shows the secondary locking device 200 placed in the closed position in which locking surfaces 206 are moved behind corresponding surfaces of the reversed locking arms 105, thereby blocking the reversed locking arms 105 in locking engagement with the socket 400. In order to release the locking protrusions 107 out of the locking groove 401, i.e. to

bend the reversed locking arms 105 inwardly, an operator first has to remove the secondary locking device from its closed position.

Figure 10 shows a further embodiment of an electrical connector 100" connected to a further embodiment of an airbag squib retainer 300". As one can see, the electrical connector 100" is provided with a connector housing 101" and a reversed locking arm 105" formed as an integral part of a connection tube 103". As can be taken from this figure, the cutout 307" is formed along the entire length of retainer 300" such that the connection tube 103" is not provided with a base ring as in the case of the embodiment shown in figure 1.

Figure 11 shows the electrical connector 100" and the airbag squib retainer 300" of figure 10 from a different perspective. As can be derived from this figure, the electrical connector 100" is provided with two locking arms 105" each on one side of the connection tube 103". As may be derived from figure 11, to allow for the inventive construction, and in particular to provide sufficient robustness to the retainer 300" and the connection tube 103", the retainer 300" is provided with a thin wall portion 309" while the connection tube 103" is provided with a corresponding thin wall section 108". Thereby, it becomes possible to increase the length of the inventive reversed locking arms and still fulfill required space and dimension limitations.

Figures 12A and 12B illustrate the inventive electrical connector of figure 10 (figure 12A) compared to the intermediate development as shown in figure 5A above (figure 12B). As may be derived from these figures, due to the inventive construction of retainer 300" and connection tube 103" as illustrated in figures 10 and 11 above, it becomes possible to construct connection tubes of longer dimension. This is indicated in the figures by heights x1 and x2. Even though the intermediate development already provided satisfactory results, due to the larger height x1 as compared to the height x2 a free length of the reversed locking arm 105" of the

inventive example is increased. Thereby, the inventive reversed locking arm 105" could be provided with additional, suitable flexibility.

5 Figure 13 illustrates typical prior art reversed locking arms (figure 13A) as compared to the inventive locking arms (figure 13B). The cut-out shown in figure 13B corresponds to the embodiment described in the context of figure 11 above. As can be taken from figure 13A, in order to provide the prior art reversed locking arms 105^{pa} with the required
10 flexibility, the same are mounted to rectangular step portions 151^{pa} which are provided on a connection nose 103^{pa}. In contrast, as compared to this rectangular step portions, the reversed locking arms 105" according to the present invention are provided with an intrinsic advantageous flexibility due to their mounting to the inventive flexible deformable
15 element 106". Thereby, protruding elements such as the shown rectangular step portions can be avoided, which can lead to difficulties upon assembly.

Claims

1. Electrical connector system comprising an electrical connector (100; 100'; 100'') adapted to be mated with a corresponding socket (400), the electrical connector (100; 100'; 100'') comprising a connector housing (101; 101'; 101'') with a connection tube (103; 103'; 103'') which is provided with at least one reversed locking arm (105; 105'; 105'') adapted to lock the electrical connector (100; 100'; 100'') to the socket (400),
characterized in that
the reversed locking arm (105; 105'; 105'') extends from a flexible deformable element (106; 106'; 106'') provided at an insertion sided end (102; 102'; 102'') of the connection tube (103; 103'; 103'') in a direction essentially opposing the insertion direction (600) of the electrical connector (100; 100'; 100'') into the socket (400), whereby the flexible deformable element (106; 106'; 106'') is adapted to deform and thereby enable a deflection of the reversed locking arm (105; 105'; 105'') upon insertion of the electrical connector (100; 100'; 100'') into the socket (400).
2. Electrical connector system according to claim 1, characterized in that said deflection of the reversed locking arm (105; 105'; 105'') causes the flexible deformable element (106; 106'; 106'') to deform inwardly towards a center of the connection tube (103; 103'; 103'').
3. Electrical connector system according to any one of the preceding claims, characterized in that the flexible deformable element (106; 106'; 106'') is formed as an integral part of a base ring (104; 104') at the insertion sided end (102; 102'; 102'') of the connection tube (103; 103'; 103''), whereby upon said deflection of the reversed locking arm (105; 105'; 105'') the flexible deformable element (106; 106'; 106'') is adapted to perform a

torsion movement essentially around a circumferential line (601) of the base ring (104; 104').

4. Electrical connector system according to any one of the preceding claims, characterized in that upon insertion of the electrical connector (100; 100'; 100'') into the socket (400) the base ring (104; 104') deforms such that the flexible deformable element (106; 106'; 106'') is moved inwardly towards the center of the connection tube (103; 103'; 103'').
5. Electrical connector system according to any one of the preceding claims, characterized in that upon insertion of the electrical connector (100; 100'; 100'') into the socket (400) the flexible deformable element (106; 106'; 106'') is subject to a total deformation of at least 0.01 mm, preferably by at least 0.02 mm, more preferably by at least 0.03 mm, even more preferably by at least 0.04 mm, yet even more preferably by at least 0.05 mm, and most preferably by at least 0.06 mm.
6. Electrical connector system according to any one of the preceding claims, characterized in that the reversed locking arm (105; 105'; 105'') is integrally formed with the connector housing (101; 101'; 101'').
7. Electrical connector system according to any one of the preceding claims, characterized in that the reversed locking arm (105; 105'; 105'') is not made from metal and preferably made from non-conductive material.
8. Electrical connector system according to any one of the preceding claims, characterized in that the flexible deformable element (106; 106'; 106'') is provided at the insertion sided end (102; 102'; 102'') within a lower half of the connection tube (103; 103'; 103''), preferably within a lower third of the connection tube (103; 103';

103”), more preferably within a lower quarter of the connection tube (103; 103’; 103”) and most preferably on the lower edge of the connection tube (103; 103’; 103”).

- 5 9. Electrical connector system according to any one of the preceding claims, characterized in that the reversed locking arm (105; 105’; 105”) is provided with a locking protrusion (107; 107’; 107”) which extends outwardly from the reversed locking arm (105; 105’; 105”) and which has a non-symmetric essentially

10 trapezoidal cross-section and which is adapted to enable a self-locking function of the electrical connector (100; 100’; 100”).
- 15 10. Electrical connector system according to any one of the preceding claims, further comprising an airbag squib retainer (300; 300”) adapted to be inserted into the socket (400) and adapted to receive the electrical connector (100; 100’; 100”), whereby the airbag squib retainer (300; 300”) is provided with at least one locking tongue (301) to lock the airbag squib retainer (300; 300”) to the socket (400).

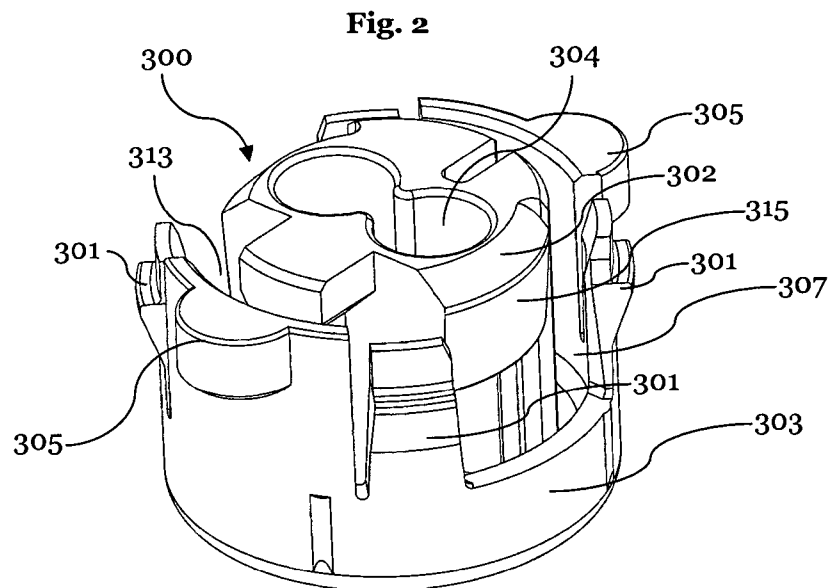
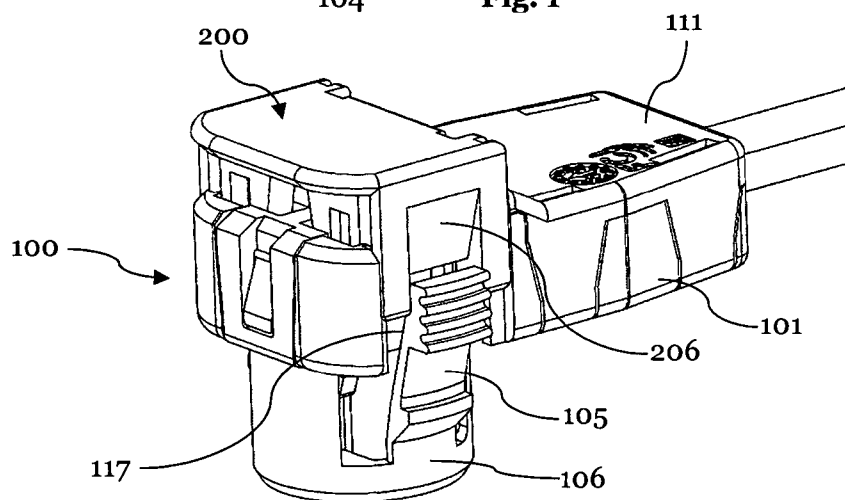
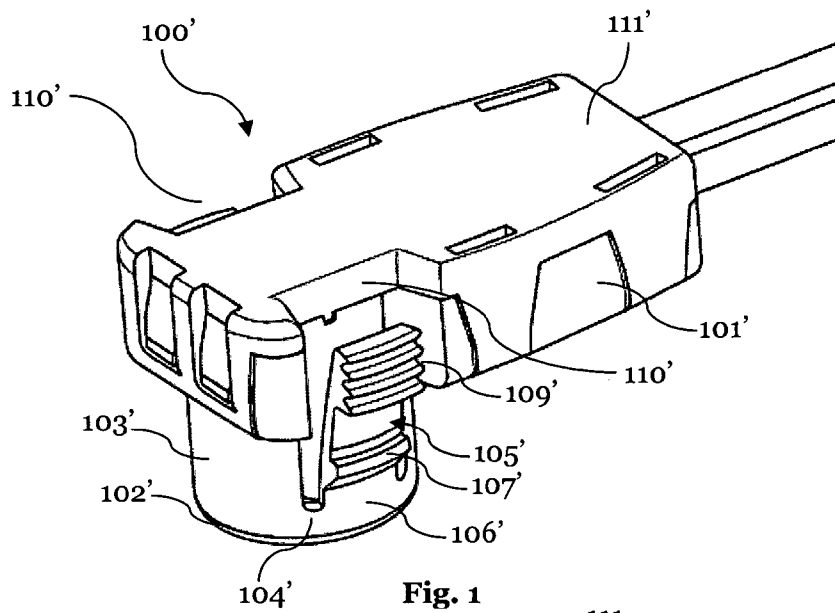
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- 25 11. Electrical connector system according claim 10, characterized in that the airbag squib retainer has an essentially cylindrical shape and is provided with an essentially cylindrical base portion (303) and has at least one cutout (307; 307”), whereby an overall height of the retainer h_{retainer} and a height of the retainer cutout (301) h_{cutout} are dimensioned to facilitate said deflection of the reversed locking arm (105; 105’; 105”) when the electrical connector (100; 100’; 100”) is mated with the socket (400), and whereby the ratio $h_{\text{retainer}}/h_{\text{cutout}}$ is less than 3, preferably less than 2, more

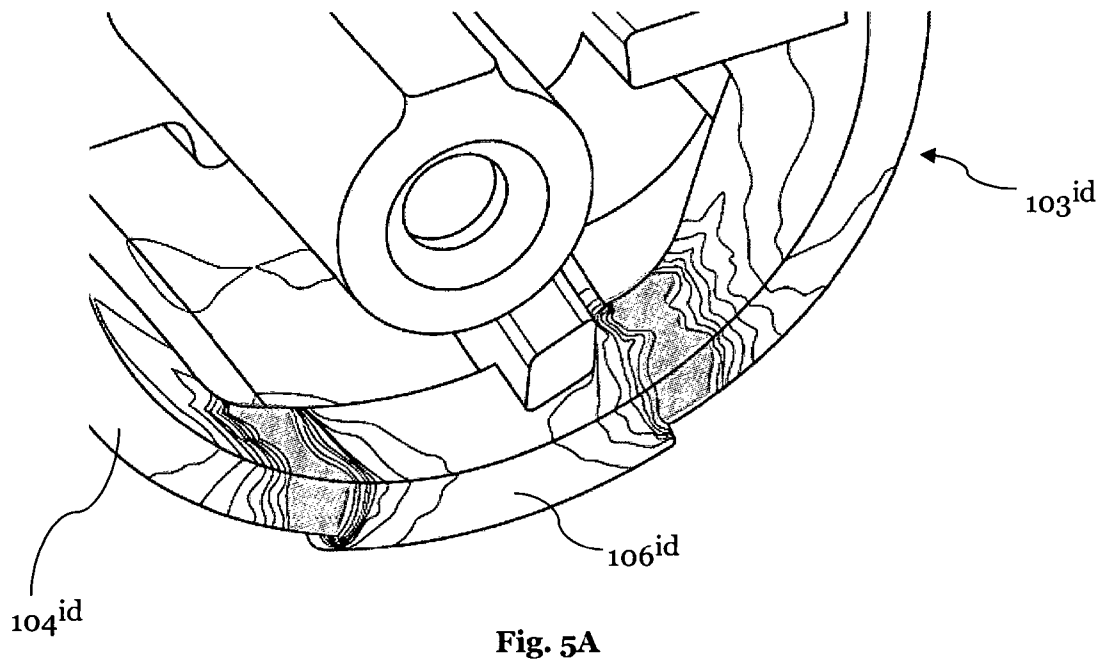
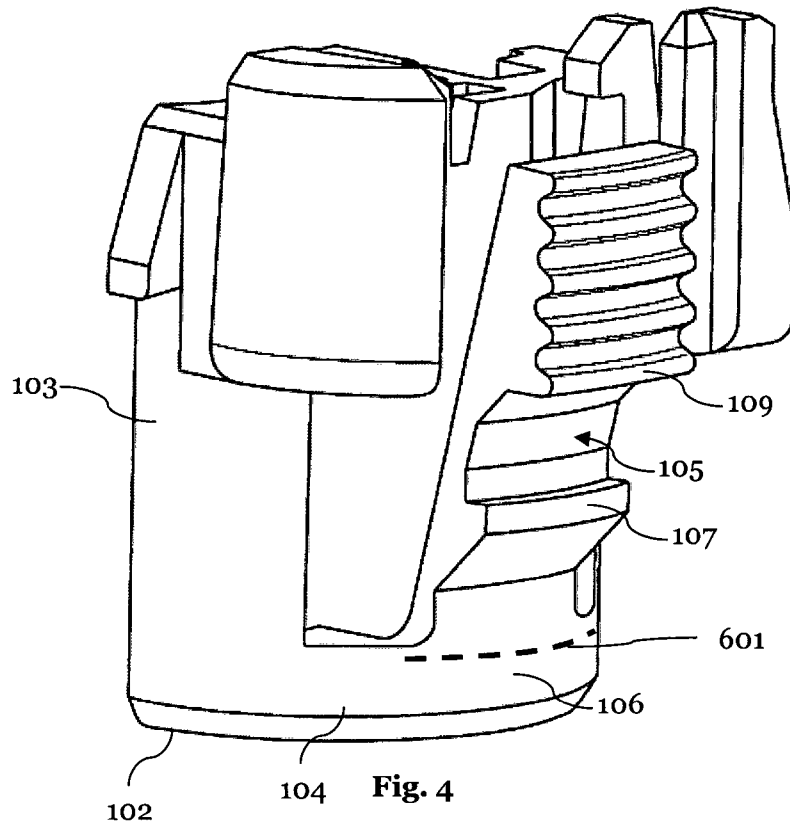
30 preferably less than 1.75 and most preferably less than 1.1.
12. Electrical connector system according claim 11, characterized in that the ratio $h_{\text{retainer}}/h_{\text{cutout}}$ equals 1, i.e. the cutout (307”) is cut along the entire height of the retainer.

13. Electrical connector system according to any one of the preceding claims, further comprising a secondary locking device (200) assigned to the connector housing (100; 100'; 100'') being
5 movable between an open and a closed position, whereby the secondary locking device (200) is provided with a locking surface (206) which is adapted to abut a corresponding blocking surface (117) of the reversed locking arm (105; 105'; 105'') to prevent an inward deflection of the reversed locking arm (105; 105'; 105'')
10 when the secondary locking device (200) is placed in the closed position and whereby the secondary locking device (200) can only be moved into the closed position when the electrical connector (100; 100'; 100'') is inserted into the socket (400).
14. Electrical connector system according claim 12, characterized in that the secondary locking device (200) is provided with at least one holding arm (205) with at least one stop projection (209) and the connector housing (101) is provided with at least one stop protrusion (113), whereby the stop projection (209) engages the
20 stop protrusion (113) when the secondary locking device (200) is placed in the open position, thereby preventing a movement of the secondary locking device (200) towards the closed position as long as the electrical connector (100; 100'; 100'') is not mated with the socket (400).
15. Electrical connector system according any one of claims 12 or 13, characterized in that the airbag squib retainer (300; 300'') is provided with at least one release surface (302) and the holding arm (205) of the secondary locking device (200) is provided with
30 at least one deflection surface (208) which is adapted to engage the release surface (302) upon mounting the electrical connector (100; 100'; 100'') to the airbag squib retainer (300; 300''), thereby causing a deflection of the holding arm (205) to release

said engagement between the stop projection (209 and the stop protrusion (113).

- 5 16. Electrical connector system according to any one of the preceding claims, whereby the airbag connector system is not provided with electrical shorting members.
- 10 17. Electrical connector system according to any one of the preceding claims, whereby the reversed locking arm (105; 105'; 105'') is adapted to lock the electrical connector (100; 100'; 100'') directly to the socket (400).
- 15 18. Electrical connector system according to any one of the preceding claims, characterized in that the electrical connector (100; 100'; 100'') does not comprise a rectangular step portion (151^{pa}) onto which the reversed locking arm (105; 105'; 105'') is mounted.
- 20 19. Electrical connector system according to any one of the preceding claims, characterized in that the connector housing is made from injection molded plastics.
- 25 20. Electrical connector system according to any one of the preceding claims, characterized in that as material for the connector housing Polyamide (PA) is used, in particular Polyamide comprising glass fibres.
- 30 21. Electrical connector system according to any one of the preceding claims, characterized in that the connector housing comprises one or more ferrite choke(s) adapted to reduce electromagnetic inferences.
22. Electrical connector system according to any one of the preceding claims comprising the socket (400).





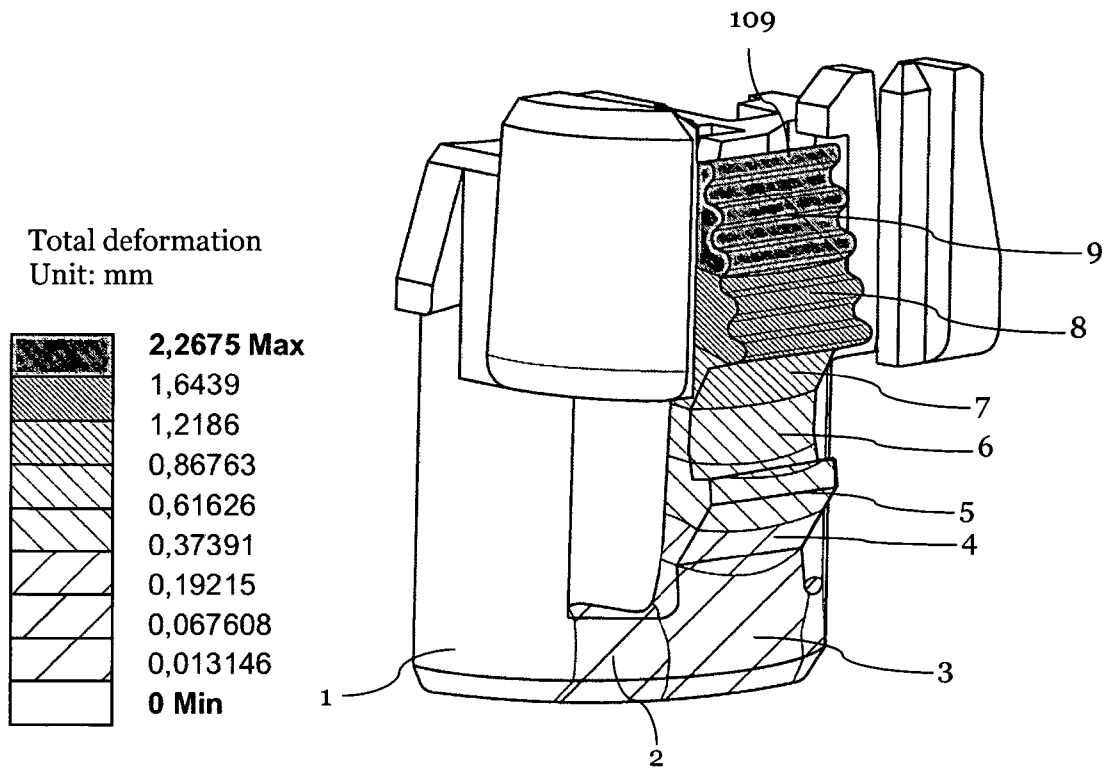


Fig. 5B

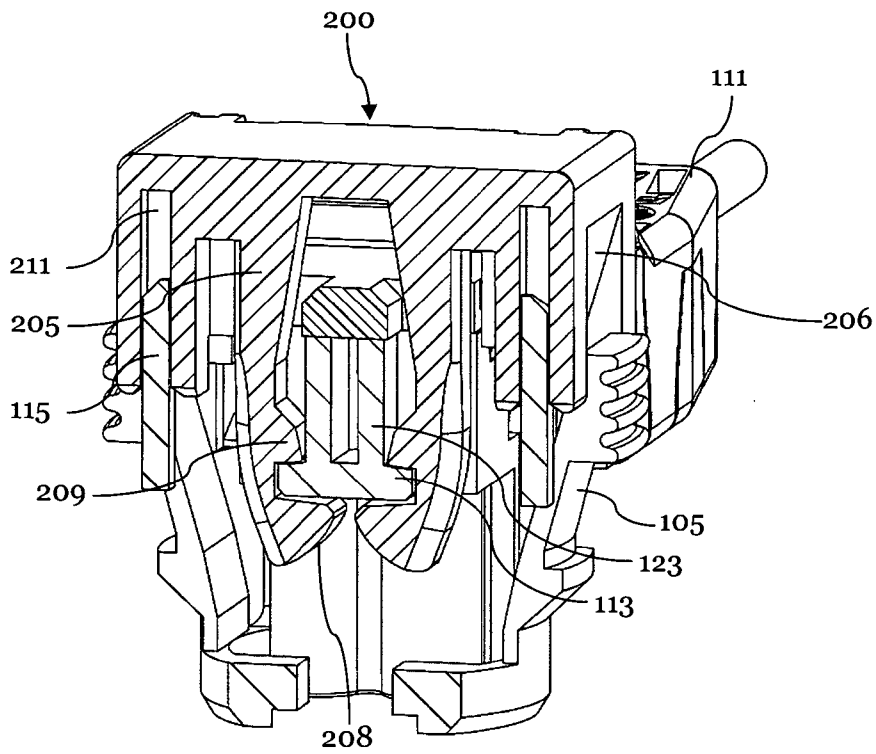


Fig. 6

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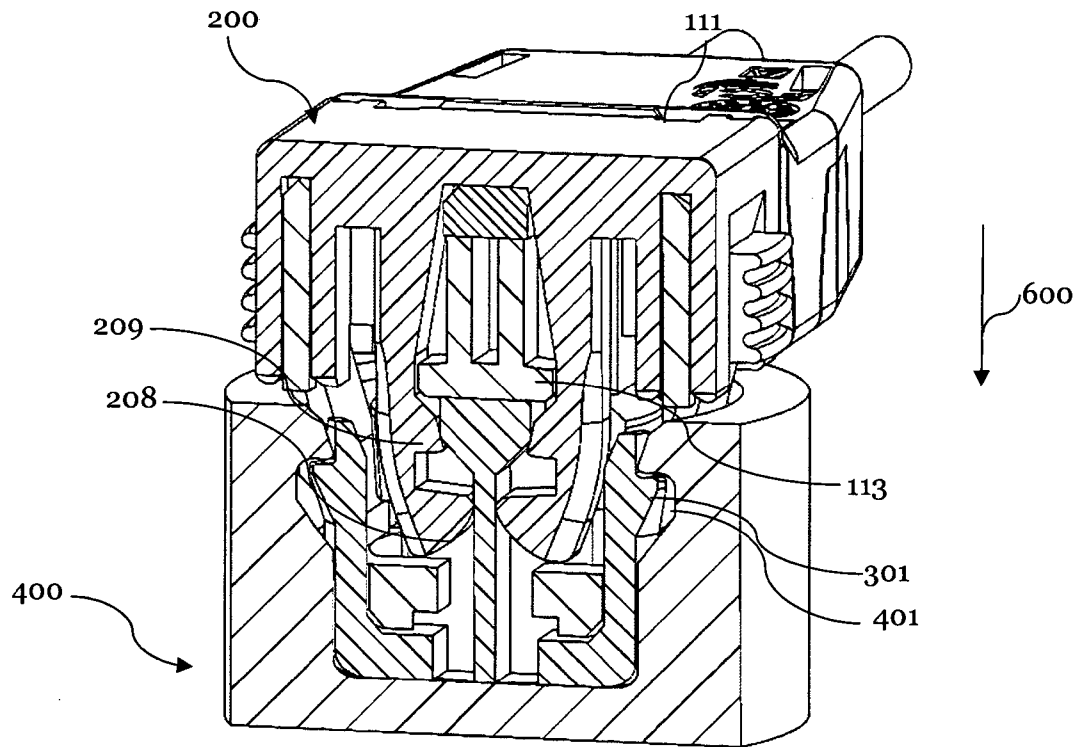


Fig. 7

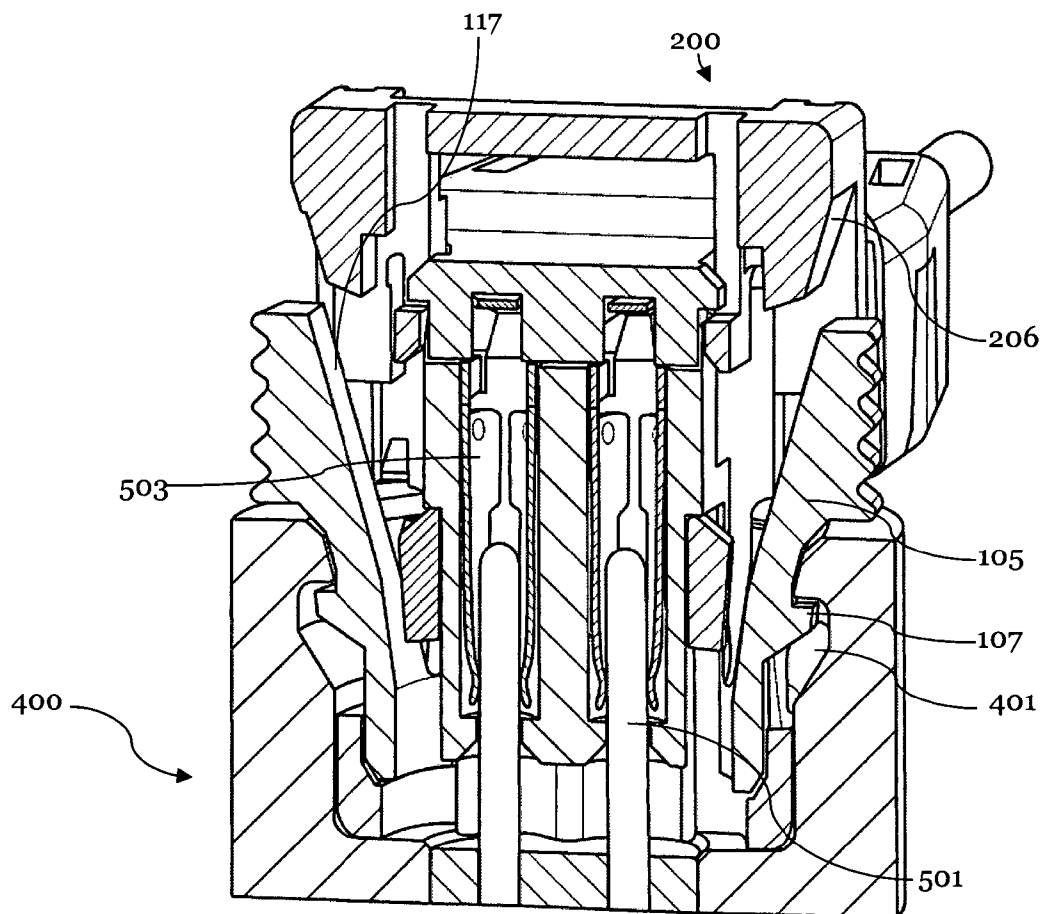


Fig8

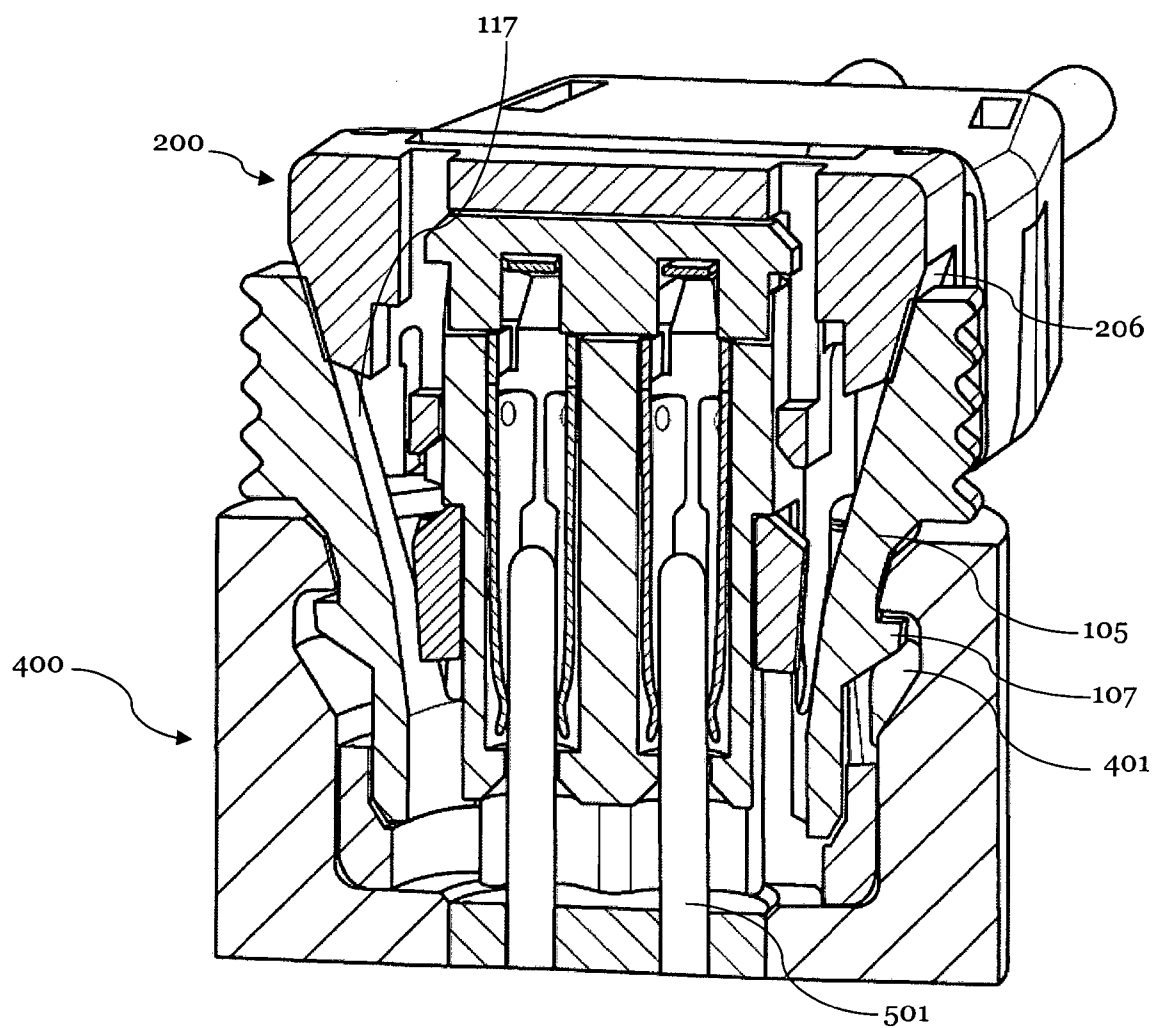


Fig. 9

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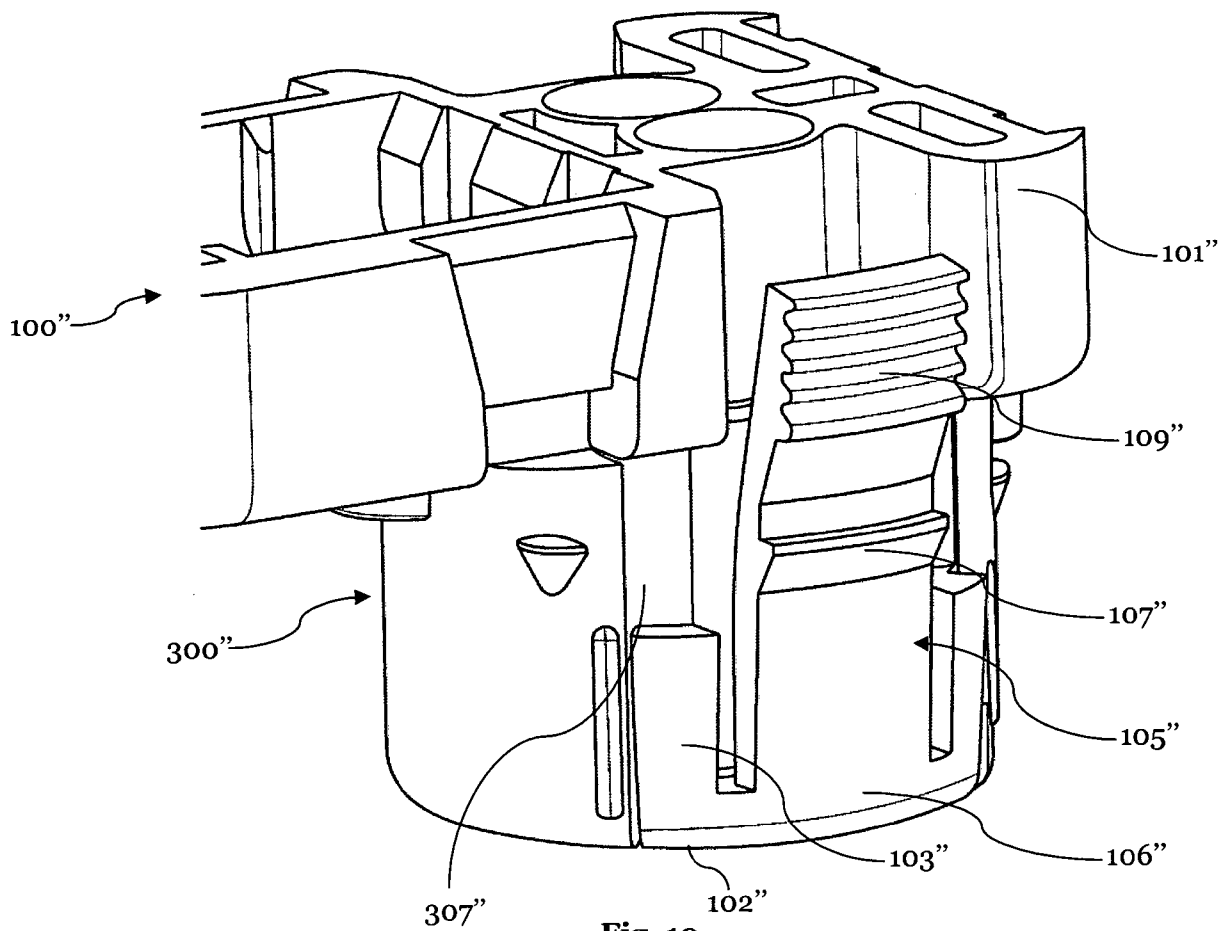


Fig. 10

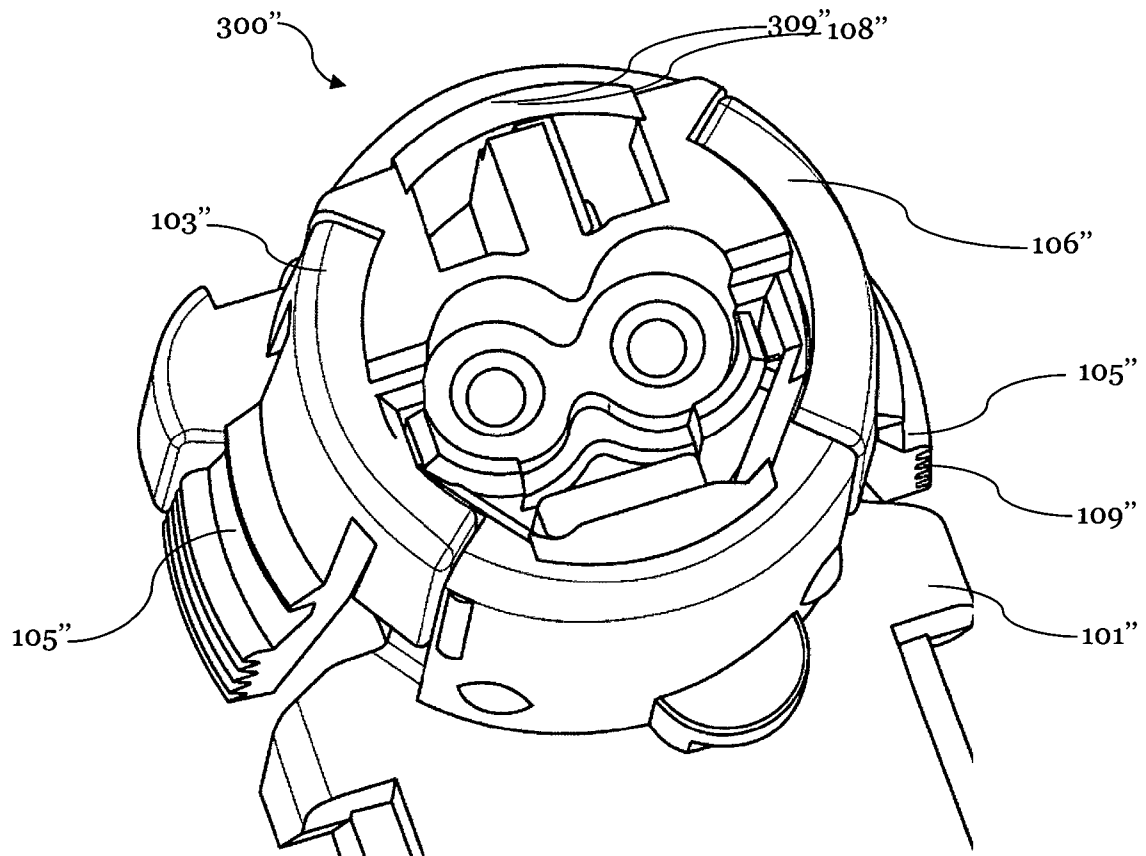


Fig. 11

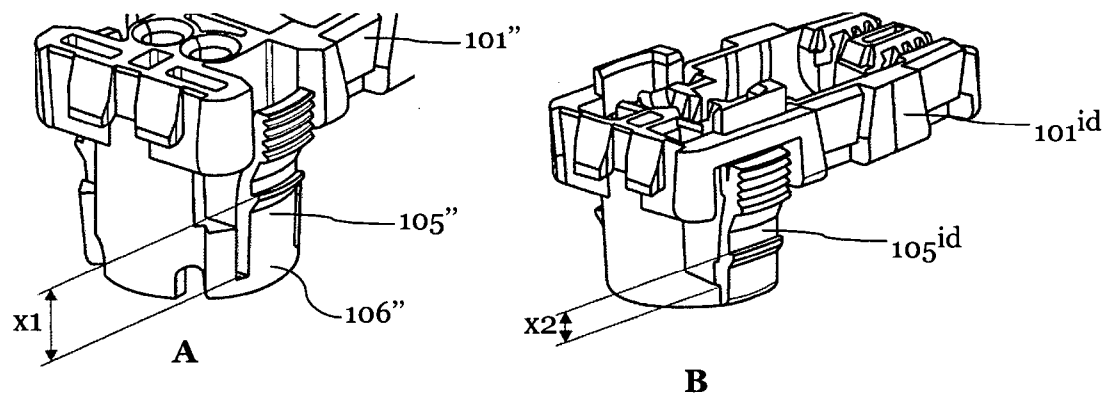


Fig. 12

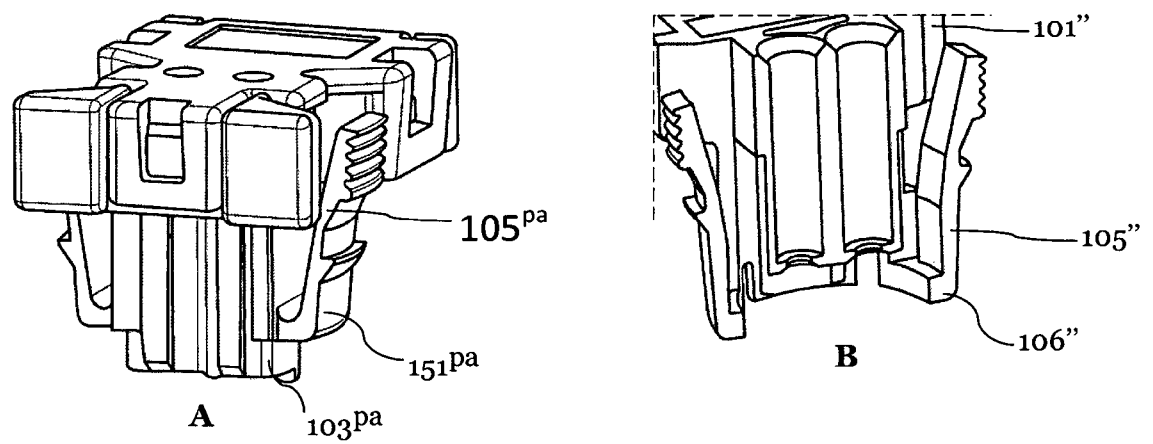


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/070093

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R13/627

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2009 009930 A1 (TYCO ELECTRONICS AMP KK [JP]) 27 August 2009 (2009-08-27) paragraph [0057]; figures 1-3 -----	1
A	US 5 924 885 A (PACHER FRANZ [DE]) 20 July 1999 (1999-07-20) the whole document -----	1
A	EP 2 230 731 A1 (AMPHENOL TUCHEL ELECT [DE]) 22 September 2010 (2010-09-22) cited in the application figure 1 -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search

18 January 2013

Date of mailing of the international search report

28/01/2013

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Authorized officer

Corrales, Daniel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/070093

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