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(54) **ELECTRICAL CONNECTOR FOR MOUNTING IN A PANEL CUTOUT**

ELEKTRISCHER VERBINDER ZUR ANBRINGUNG IN EINEM TAFELAUSSCHNITT

CONNECTEUR ÉLECTRIQUE POUR MONTAGE DANS UNE DÉCOUPE DE PANNEAU

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- **PATENT ABSTRACTS OF JAPAN vol. 2003, no. 03, 5 May 2003 (2003-05-05) -& JP 2002 343507 A (YAZAKI CORP), 29 November 2002 (2002-11-29)**

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Description

[0001] The present invention generally relates to the art of electrical connectors and, particularly, to an electrical connector for mounting to a panel.

[0002] Electrical connectors consisting of two mating plug ("male") and receptacle ("female") connectors which comprise mating electrical terminals are often mounted in or on a support structure, like a planar panel. Thereby it is necessary to secure one of the two mating connectors to the panel. This typically will be accomplished by fasteners such as bolts, screws, separate clips or the like.

[0003] From US 5 403 214 it is known to couple a connector, especially a grounding jack, to a cutout provided in an electrical element, especially a receiver hole of a ground conducting member. The connector includes an engaging region having knurled outside portion for engaging with the cutout. The engaging region of the connector, which has a diameter slightly larger than the diameter of the cutout, includes a longitudinal slot allowing the engaging region to be reduced in diameter when inserted into the cutout.

[0004] Another solution known from EP 1 059 696 B1 proposes a mating connector for mounting in a general circular cutout of a panel. The housing of the mating connector comprises a peripheral flange extending from an outer surface of the housing and engaging members projecting radially from said outer surface. At the periphery of the circular cutout, the panel has grooves corresponding in form to the engaging members of the housing. Once the engaging members have passed the panel on inserting the connector into the cutout, the connector may be rotated so as to engage the panel into U-shaped recesses defined by the engaging members and the flange.

[0005] The forms of the cutouts and the connectors are rather complex, and the mounting needs complicated steps. Further, those measures cannot be used where there is only little space.

[0006] EP-A-1271712 discloses a connector for mounting into a cutout of a panel comprising a housing, a flange, locking means, said housing having one internal cavity along a mating axis, said flange extending from an outer surface of said housing for engaging said panel, and said flange being inclined with respect to a plane perpendicular to said mating axis.

[0007] JP-A-2002-343507 discloses an electric connector for mounting into a cutout of a panel comprising a housing and a flange engaging the panel.

[0008] US-A-2460636 discloses an electric light socket for mounting into a cutout of a panel comprising a housing and a flange inclined with respect to the panel.

[0009] In view of the foregoing, it is an object of the present invention to provide for an improved electrical connector panel mounting mechanism.

[0010] This object is achieved by means of the features of the independent claims. Advantageous features are defined in the dependent claims. Further objects and advantages of the invention are apparent in the following detailed description.

[0011] The proposed solution is directed to a first (electrical) connector for mating with a second counter-part (electrical) connector. The first connector is adapted to be engaged with the cutout of the panel along a direction that is inclined with respect to a perpendicular to the mating direction. Accordingly, the connector is particularly suitable for engagement with panels offering little space for mounting such as panels in the vicinity of hinges between the body and the door of an automobile.

[0012] The invention further proposes to lock in place the first connector on the panel by means of a slider, which can be slideably assembled to the first connector so as to maintain and hold the panel between an external flange of the first connector and said slider. The slider furtheron comprises positioning elements ensuring that the second connector can only mate with the first connector if the slider is correctly assembled to the first connector, i.e. if the first connector is correctly mounted into the panel. The invention thus prevents the connectors from being not correctly installed.

[0013] The features, objects, and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments when taken in conjunction with the figures of the accompanying drawings, in which:

Fig. 1 is a perspective view of an electrical connector panel mounting system in accordance with the invention,

Fig. 2 is an exploded perspective view of a first connector of an electrical connector in accordance with the invention,

Fig. 3 is a perspective view of a first connector of the invention in a disassembled condition,

Fig. 4A is a view of a first connector of the invention according to opposite direction Y of Fig. 3,

Fig. 4B is a view of a first connector of the invention according to opposite mating direction X of Fig. 3,

Fig. 4C is a view of a first connector of the invention according to direction Y of Fig. 3,

Fig. 4D is a view of a first connector of the invention according to direction Z of Fig. 3,

Fig. 5 is a perspective view of a slider of a first connector in accordance with the invention,

Fig. 6 is a perspective view of a slider of a first connector in accordance with the invention,

Fig. 7A is a view of a slider of the invention according to direction Y of Fig. 5,

Fig. 7B is a view of a slider of the invention according to mating direction X of Fig. 5,

Fig. 7C is a view of a slider of the invention according to opposite direction Z of Fig. 5,

Fig. 8 is an exploded perspective view of a second connector of an electrical connector in accordance with the invention,

Fig. 9 is a part-sectional perspective view of a second connector of the invention in an assembled condition,

Fig. 10 is a cross-section of a second connector of the invention in an assembled condition,

Fig. 11 is a perspective view of a first connector according to the invention before mounting into a cutout of a panel,

Fig. 12 is a side view of a slider being engaged with a first connector mounted into a cutout of a panel in accordance with the invention,

Fig. 13A is a perspective view of an electrical connector of the invention during mating of a second connector with a first connector that is locked with respect to a panel,

Figs. 13B and 13C are enlarged views of the electrical connector shown n Fig. 13A,

Fig. 14 is a perspective view of a mated electrical connector mounted on a panel in accordance with the invention.

[0014] An electrical connector in accordance with the subject invention is identified generally by reference number 10 in Fig. 1. The electrical connector 10 of the shown embodiment is particularly adapted for being used in connection with an automobile, and particularly a door panel of an automobile.

[0015] The electrical connector 10 includes a first connector 12 and a corresponding second connector 14 which is mateable with the first connector 12. The first connector 12 is preferably of male type and the second mating connector 14 of female type. A mounting panel 16 consisting of a first or inner panel 18 and a second or outer panel 20, or any other support structure of general flat type, receives the electrical connector 10 and preferably the first connector 12 of the electrical connector 10. The first connector 12 is designed to be mounted on (or in) the mounting panel 16. In such a mounted condition the first connector 12 and the second connector 14 can be mated and electrical terminals (not shown) thereof can be connected.

[0016] In the following the structure of the first connector 12 according to the invention and its constituting elements will be described with reference to Figs. 2 to 4D.

[0017] The first connector 12 according to the invention comprises a housing 22, a slider 58, preferably a terminal position assurance member 60, and preferably a seal 62. Seal 62 can be a separate foam or rubber molded or stamped part. Preferably it is overmolded on the housing 22 using the bimaterial molding technology.

[0018] The housing 22, which is preferably molded as a one-piece body form a plastic material, comprises a first or front end 24 and a second or back end 26. An intermediate section 28 of the housing 22 extends along a mating direction X between the front end 24 and the back end 26. An outer surface 30 of the intermediate section 28 includes a top surface 32 in a direction Y perpendicular to direction X, a bottom surface 34, a left surface 36, and a right surface 38, which are connected to one another via more or less smooth or rounded transitions, as shown below.

[0019] The top surface 32 and the bottom surface 34 are preferably plane, parallel to each other, and contained in a plane defined by the directions X and Z, which direction Z is perpendicular to axes X and Y. According to further embodiments said top surface 32 and bottom surface 34 can have a round profile. The left surface 36 and the right surface 38 have a preferably plane central section 35 that is parallel to the directions X and Y, and preferably also a front section 37 and a rear section 39. Said front section 37 and rear section 39 are rounded or chamfered sections that link to the top surface 32 and the bottom surface 34 respectively.

[0020] The outer surface 30 of the intermediate section 28 has a front portion 40, which is insertable through a corresponding cutout 44 of the panel 16, and a back portion 42. The front portion 40 is mateable with the second electrical connector 14.

[0021] A flange 46, which is formed on the circumference of the intermediate section 28, separates the front portion 40 and the back portion 42 of the housing 22. The flange 46 extends from the outer surface 30 laterally of the housing 22 with an angle α with respect to mating direction X in a plane defined by axes Δ_F and Z. The axis Δ_F is contained in the plane XY and has the angle α_F with respect to mating direction X. Said angle α_F is an acute angle between more than 0 degree and up to 90 degrees. In a preferred embodiment said angle α_F is about 65 degrees.

[0022] The flange 46 is by its circumference dimensioned larger than the cutout 44 of the inner panel 18 of the mounting panel 16 to prevent passage of the flange 46 through the cutout 44. Preferably, the flange 46 is circumferentially continuous so as to completely surround the housing 22. Alternatively, the flange 46 may be discontinuous over the circumference of the housing 22, e.g. consisting of a plurality of separated flange elements extending laterally of the housing 22. The flange 46 has a front surface 48 and a back surface 50. The front surface 48 is adapted to come into abutment with

the inner panel 18 around said cutout 44 via the sealing ring 62. The sealing ring 62 is compressible, such that planarity imperfections as well as tolerances can be compensated.

[0023] Strengthening elements 52 support the back surface 50 of the flange 46 in order to resist deflection of the flange 46. Said strengthening elements 52 extend from the back portion 42 of the housing 22 to the edge of the flange 46 in a sloping manner.

[0024] The front portion 40 of the housing 22 comprises ribs 54, 56 serving as guide for the slider 58. Preferably at least two ribs 54, 56 are respectively formed on the left surface 36 and the right surface 38. As shown on Figs. 4A, 4B, and 4D, each rib 54, 56 is a ridge along a closing direction Δ_C, which is preferably perpendicular to the mating direction X, which ridge is projecting from the left surface 36 or the right surface 38 respectively, see Figs. 4A and 4B. Said ribs 54, 56 project preferably from the central section 35 and the back section 39 of the left surface 36 and the right surface 38 respectively. A preferably long narrow raised part of each rib 54, 56 has the purpose of supporting, guiding, and/or retaining the slider 58 on the housing 22.

[0025] The ribs 54, 56 have preferably a shape that enables coding as explained below, i.e. a transversal section thereof does not have any symmetry plane. Fig. 4A shows such a coding shape, wherein the ribs 54, 56 are essentially V-shaped with two raised lateral surfaces of different length.

[0026] It is possible to provide the ribs 54, 56 with recesses 57 preferably regularly spaced along the closing direction Δ_C in order to save material, see Figs. 4B and 4D.

[0027] Two shoulders 64, 66 are formed on the front portion 40 of the housing 22 adjacent to the front end 24 and longitudinally along the mating direction X. Said shoulders 64, 66 interact with corresponding grooves of the second connector 14 for guiding and/or coding purposes. This coding ensures that the second connector 14 is correctly oriented with respect to the first connector 12 when mating the electrical connector 10, thereby preventing an operator from damaging the electrical connector 10 in case said orientation of the second connector 14 is not correct.

[0028] The front portion 40 of the housing 22 comprises pins 68 having preferably a circular shape. Said pins 68 are aligned perpendicularly to the mating direction X and are distributed regularly on the top surface 32 and the bottom surface 34. The pins 68 project externally from the housing 22 so as to cooperate with a mating slider 70 of the second connector 14 in order to complete the mating of the electrical connector 10 as shown below. According to further embodiments, the pins 68 project internally from the housing 22 in order to cooperate with said mating slider 70.

[0029] The housing 22 includes an arm 72 which is formed on the top surface 32 in the front portion 40, see Fig. 4C. The arm 72 consists of a base portion 74 and a free portion 76. The base portion 74 is rigidly fixed to the housing 22 and extends perpendicularly to the mating direction X. The free portion 76, which is linked to the base portion 74, extends essentially opposite to the mating direction X towards the flange 46 in parallel to the top surface 32, and is deflectable inwardly towards the housing 22 around base portion 74.

[0030] The free portion 76 of the arm 72 has a first surface 78 and a second surface 80 defining a free slot 82 between the arm 72 and the assembly defined by the flange 46 and the seal 62, such that the inner panel 18 is insertable into said free slot 82 on mounting the first connector 12 in the cutout 44. The first surface 78 of the free portion 76 faces the flange 46 and is preferably parallel with said flange 46 and with the axis Δ_F. Perpendicularly to said axis Δ_F, the distance d between said first surface 78 and the seal 62, which is fixed on the front surface 48 of the flange 46, is preferably equal or slightly superior to the thickness of the inner panel 18 in order to allow the inner panel 18 being inserted into the free slot 82 up to abutment against the second surface 80 that is preferably parallel to mating direction X or perpendicular to axis Δ_F.

[0031] As the seal 62 is compressible, the distance d can be in other embodiments slightly inferior to the thickness of the inner panel 18. Said inner panel 18 will then be inserted into the free slot 82 by compressing the seal 62, which compensates the tolerance on the thickness of the panel 18. The use of the seal 62 thus allows a mounting of the electrical connector 10 on panels having a thickness comprised within a given range.

[0032] The arm 72 further includes a shoulder 84 on top of the free portion 76. The shoulder 84 has a sloping front surface 84 in the mating direction X, such that on mounting the housing 22 into the cutout 44 of the panel 18, the panel 18 knocks against the shoulder 84. Consequently, the arm 72 deflects inwardly towards the housing 22. By pushing further the housing into the panel 18, said panel 18 passes the first surface 78 of the arm 72 and engages in the free slot 82 as the arm 71 finds its initial non-deflected position again. Thus, the first connector 12 'clicks' behind panel 18 in a pre-mounted position.

[0033] The first connector 12 has a plurality of cavities, not shown on the figures, extending from the back end 26 in the mating direction X. The cavities are configured and dimensioned to receive electrical terminals, not shown, and cables 63 attached thereto, shown in Fig. 14, in any per se known manner.

[0034] The terminal position assurance member 60, which can be inserted and locked into the housing 22, is provided in order to secure the electrical terminals within the housing 22. Said terminal position assurance member 60 is preferably pre-assembled to the housing 22 in a pre-position that allows insertion of the electrical terminals into the cavities of the first connector 12, see Fig. 3. In this pre-assembled condition, the terminal position assurance member 60 can be moved to its end-position, e.g. by an operator pushing it further into the housing 22

against the mating direction X.

[0035] In the following the structure of the slider 58 of the first connector 12 according to the invention will be described with reference to Figs. 5 to 7C.

[0036] The slider 58 is preferably a one-piece molded plastic element which is generally U-shaped. It has a middle portion 88 which corresponds to the base of the U-shaped slider 58, and a left portion 90 and a right portion 92 which are the free arms of the slider 58. The left portion 90 and the right portion 92 have an end surface 91, 93 at the respective free ends thereof. The slider 58 is defined by an external surface 94 and an internal surface 96 respectively corresponding to the convex and the concave parts of the slider 58.

[0037] The edges between said external surface 94 and said internal surface 96 are defined as a first or front surface 98 and a second or back surface 100. The front surface 98 is, when mounted, perpendicular to the mating direction X, whereas the rear surface 100 is parallel to the axis Δ_F, see Fig. 7C. Accordingly the rear surface 100 is fitted to the inclination of the assembly flange 46 and seal 62.

[0038] Grooves 102, 104 are formed on the internal surface 96 of the left portion 90 and right portion 92 of the slider 58. The grooves 102, 104 are cuts extending from the ending surfaces 91, 93 and the adjacent back surface 100 and when mounted preferably along direction Y towards the base portion 58. According to further embodiments, the grooves 102, 104 open only at the ending surfaces 91, 93 or at the adjacent back surface 100.

[0039] The grooves 102, 104 have a shape that correspond to the shape of the ribs 54, 56. An operator thus can mount the slider 58 on the first connector 12 by guiding the left and right grooves 102, 104 along the left and right ribs 54, 56, with the back surface 100 of the slider 58 facing the flange 46 and the seal 62. As the ribs 54, 56 include coding elements in their shape, corresponding coding elements are formed on the shape of the grooves 102, 104. This coding prevents the operator from inserting the left groove 102 into the right rib 56.

[0040] Guiding ribs 106, 108 are provided on the back surface 100 and are designed to counteract a possible bending out of the slider 58 during mounting on the housing 22. During said mounting, the guiding ribs 106, 108 slide along the left surface 36 and the right surface 38 of the housing 22 up to abutment against the front surface 48 of the flange 46 between the seal 62 and the housing 22. The cutout 44 of the panel 18 is dimensioned accordingly, i.e. it is dimensioned larger than the distance between the left surface 36 and the right surface 38 of the housing 22 so as to allow the guiding ribs 106, 108 to enter the cutout 44. The panel 18 surrounding the cutout 44 thereafter prevents the guiding ribs 106, 108 from being deflected outwardly, and the slider 58 from bending out and leaving the guiding ribs 54, 56.

[0041] The slider 58 includes noses 110, 112 and a first 114 and a second shoulder, 116. The noses 110, 112 are formed on the back surface 100 and preferably in the base portion 88. When assembling the slider 58 onto the housing 22 of the first connector 12 previously mounted on the panel 18, the noses 110, 112 are adapted to make a snap fit into the cutout 44 of the panel 18, in any per se known manner. The cutout 44 is dimensioned larger than the front portion 40 of the housing 22 in order to enable the noses 110, 112 to be inserted in the cutout 44 and to latch the panel 18. To release the locking of the noses 110, 112 with the panel 18, an operator preferably needs to slightly remove the base 88 of the slider 58 from the panel 18.

[0042] The first shoulder 114 and the second shoulder 116 project preferably in the mating direction X respectively from the front surface 98 of the left portion 90 and the right portion 92, or vice versa. Said first shoulder 114 comprises a first surface 115 extending along the mating direction X and preferably a second or sloping surface 117 which is inclined with respect to the mating direction X. Said second shoulder 116 has preferably a rectangular shape with chamfered edges.

[0043] In the following in accordance with the invention the second connector 14 of the electrical connector 10 which is mateable with the first connector 12 will be described with reference to Figs. 8 to 10.

[0044] The second connector 14 includes a housing 118, preferably a terminal position assurance member 122, the mating slider 70, and an inner seal 120 installed within the housing 118. Said housing 118 extends from a first or front end 124 to a second or back end 126, and comprises a front portion 125 adapted to mate with the first connector 12 and back portion 127.

[0045] Cavities 128 are formed in the housing 118 from the back end 126 to the front end 124 along the mating direction X. Leads in form of cables 130 attached to electrical terminals 132 are insertable into the cavities. Said electrical terminals 132 are mateable with the electrical terminals, not shown, of the first connector 12 such as an electrical connection can be achieved between said cables 130 and cables 63 of the first connector 12.

[0046] The electrical terminals 132 are locked in place in the housing 118 by means of locking means 140 of the terminal position assurance member 122. Said terminal position assurance member 122 further comprises openings 142 for enabling mating of the electrical terminals 132 of the first 12 and the second connector 14, and a first groove 134 and a second groove 136 formed perpendicularly to the mating direction X for interacting with a corresponding shoulder 138 of the housing 118.

[0047] The first groove 134 and the second groove 136 define two assembly positions of the terminal position assurance member 122 on the housing 118, which respectively are a pre-position and an end-position. The pre-position, which is adapted to allow insertion of the electrical terminals 132, is obtained on inserting the terminal position assurance member 122 into the front end 124 of the housing 118 by means of a snap fit of the shoulder 138 into the first groove 134.

[0048] A further insertion into the housing 118 of the terminal position assurance member 122 being in its pre-position causes the locking between the first groove 134 and the shoulder 138 to be released, and next the second groove 136 making a snap fit with said shoulder 138 of the housing 118, such that the terminal position assurance member 122 is locked into the end-position.

[0049] The housing 118 includes, with respect to the mating axis X, a longitudinal slot 144 and transversal openings 146 within the front portion 125. The slot 144 is dimensioned to receive the front portion 40 of the first connector 12

[0050] when mating the electrical connector 10. The openings 146 are adapted to receive the mating slider 70.

[0051] As shown in Fig. 8, the mating slider 70 of the second connector 14 includes a base wall 152 and lateral walls 148, 150, which are slidebly insertable into the openings 146 of the housing 118 in the direction Y. The two lateral walls 148, 150 are parallel to each other and linked by the base wall 152, such that the mating slider 70 is formed as a general U-shaped one-piece element. According to alternate embodiments, the mating slider 70 comprises only one lateral wall 148 instead of two, or comprises only two lateral walls 148, 150 being two separate pieces.

[0052] Each lateral wall 148, 150 comprises guide channels 154 for cooperating with the pins 68 of the first connector 12 in order to close the electrical connector 10. Each one of the preferably two guide channels 154 per lateral wall 148, 150 opens at a channel opening 156 located in a front section 158 of the lateral wall 148, 150. The guide channels 154 extend from the channel opening 156 in the front section 158 to an channel intermediate region 160 in a preferably straight manner along the mating direction X, and from said channel intermediate region 160 to a channel end 162 in a preferably straight manner along an axis Δ_G departing from said front section 158. The axis Δ_G has an angle α_G preferably inferior to 45 degrees with respect to the sliding axis Y of the mating slider 70, and preferably comprised between 15 and 30 degrees with respect to the axis Y.

[0053] The mating slider 70 comprises locking means 164, see Fig. 8, for locking the mating slider 70 in an open-position into the transversal openings 146 of the housing 122. In said open-position, the channel opening 156 of the lateral walls 148, 150 can be aligned with the pins 68 of the first connector 12 so as to enable the insertion of the second connector 14 in the first connector 12 until said pins 68 reach the channel intermediate region 160 of the guide channels 154.

[0054] On sliding further the mating slider 70 into the housing 118 the open-position is unlocked and the pins 68 move along the respective guide channels 154 until they reach the respective channel end 162. The arrangement in which the pins 68 are located in the channel ends 162 corresponds both to a fully mated state of the electrical connector 10 and to a closed-position of the mating slider 70. In this closed-position the base wall 152 of the mating slider 70 abuts against the housing 118, as illustrated on Figs. 9 and 10.

[0055] A positioning shoulder 168 and a positioning opening 166 are formed on the front portion 125 of the second connector 14, and preferably on the front end 124 of said second connector 14, for interacting with the first shoulder 114 and the second shoulder 116, respectively, of the first connector 12 during mating.

[0056] The positioning shoulder 168 has a positioning surface 170 extending along the mating direction X, see Fig. 13C. The slider 58 being fully engaged with the housing 22, the positioning surface 170 will slide along the first surface 115 of the first shoulder 114 of said slider 58 on inserting the second connector 14 in the first connector 12.

[0057] On the one hand in the engaged condition of the slider 58, the first surface 115 of the slider 58 is directed toward the opposite closing direction Δ_C, see Fig. 14. On the other hand the positioning surface 170 is directed toward the closing direction Δ_C during insertion of the second connector 14 to the first connector 12. Accordingly, the positioning surface 170 can slide along said first surface 115 only in case the slider 58 is fully engaged with the housing 22.

[0058] In further embodiments, the first shoulder 114 may contain the additional second sloping surface 117. In case the slider 58 is not totally engaged with the housing 22, the positioning shoulder 168 can abut against the sloping surface 117 during insertion of the second connector 14. On inserting further the second connector 14 along mating direction X, the positioning shoulder 168 strikes at the sloping surface 117 and causes the slider 58 being moved into the closing direction Δ_C with respect to the housing 22.

[0059] The positioning opening 166 is defined by the space between positioning surfaces 172, 174, which are two opposed surfaces extending along the mating direction X. Said positioning opening 166 is dimensioned and located on the second connector 14 so as to receive the second shoulder 116 only if the slider 58 is fully engaged with the housing 22, see Fig. 13B.

[0060] According to further embodiments, the positioning shoulder 168, the positioning opening 166 and/or the second shoulder 116 comprise elements equivalent to the sloping surface 117 of the first shoulder 114 for sliding the slider 58 to its fully engaged position with respect to the housing 22.

[0061] In the following the steps of mounting the electrical connector 10 of the invention into the cutout 44 of the panel 18, and the steps of mating said electrical connector 10 will be described with reference to Figs. 1 and 11 to 14.

[0062] With reference to Fig. 11, prior to mating the first connector 12 has to be mounted into the cutout 44 of the panel 18. The size of the cutout 44 is adapted to enable the insertion of the front portion 40 of the first connector 12, and particularly to enable the passage through the cutout 44 of the elements projecting from the

front portion 40 that are the ribs 54, 56, the shoulders 64, 66, the pins 68, and the arm 72.

[0063] The cutout 44 and/or the first connector 12 can comprise guiding and/or coding elements. Said guiding elements are formed in any per se known manner and are adapted to guide the first connector 12 into the cutout 44 of the panel 18 during the phase of mounting said first connector 12 in said cutout 44.

[0064] Said coding elements can e.g. consist in recesses in the cutout 44 designed to interact with corresponding shoulders of the first connector 12, or vice versa. The aim of said coding elements is to classify the cutouts and the first connectors into respective categories so as to ensure that only first connectors of a given category can be mounted to a cutout of a given category.

[0065] On inserting the front portion 40 of the first connector 12 into the cutout 44, the free portion 76 of the arm 72 is first deflected inwardly by the edge of the panel 18 around the cutout 44. Then as the panel 18 reaches the free slot 82, the arm 72 comes back to its non-deflected position, such that the panel 18 is locked in place between the first surface 78 of the arm 72 and the seal 62, see Fig. 12.

[0066] As shown in Fig. 12, the slider 58 will thereafter be engaged with the front portion 40 of the housing 22 according to the closing direction Δ_C. This closing direction Δ_C is not parallel to the plane of the panel 18, such that the slider 58 can abut against said panel 18 in order to chock or jam the panel 18 and hold it against the seal 62.

[0067] The slider 58 is preferably engaged from the top surface 32 of the housing 22, which is the part of the circumference of the outer surface 30 of housing 22 that offers the widest range for the engaging angle α_C that is the angle between mating axis X and closing axis Δ_C. This range extends from 0 to (180-α_F) for said top surface 32. For an operator engaging the slider 58 with the housing 22 to lock the connector 10, an insertion of the slider 58 from said top surface 32 is therefore the most convenient.

[0068] After sliding along the ribs 54, 56 the noses 110, 112 snap in the cutout 44 of the panel 18. As a result, the slider 58 is in its close-position and fully engaged with the housing 22, see Fig. 1.

[0069] As shown in Fig. 13A, the second connector 14 will then be positioned on the first connector 12 so as to introduce the pins 68 of the first connector 12 into the guide channels 154 of the mating slider 70.

[0070] However, only when the slider 58 is in the closed-position, i.e. only when the first connector is fully mounted into the panel 18, the second connector 14 can be mated with the first connector 12. In fact, only in this condition the first shoulder 114 and the second shoulder 116 have the correct positioning with respect to the closing direction Δ_C that enables them to interact with the corresponding positioning shoulder 168 and opening 166 so as to allow a fully mating of the electrical connector 10 by then operating the mating slider 70, see Figs. 13B, 13C and 14.

[0071] The steps of disconnecting the electrical connector 10 and dismounting the first connector 12 from the panel 18 correspond to the reversed steps of mounting the first connector 12 to the panel 18 and mating the electrical connector 10 that are described above.

Claims

1. An electrical connector (12) for mounting into a cutout (44) of a panel (18) and for mating with a counterpart second electrical connector (14), comprising

   - a housing (22) having internal cavities along a mating axis (X) for receiving electrical terminals, a front portion (40) thereof being insertable in said cutout (44),
   - a flange (46) extending from an outer surface (30) of housing (22) for engaging the panel (18) around said cutout (44), and
   - locking means for maintaining said electrical connector (12) into said cutout (44),

   wherein
   said flange (46) is inclined with respect to a plane perpendicular to mating axis (X),
   characterized in that said locking means is a slider (58) being slideably engageable with front portion (40) of housing (22) according to a closing direction (Δ_C) secant to the plane of flange (46).

2. The electrical connector (12) according to claim 1, wherein
   said slider (58) comprises means (100) for maintaining the panel (18) between flange (46) and slider (58) when said slider (58) is fully engaged.

3. The electrical connector (12) according to anyone of the preceding claims,
   wherein
   said front portion (40) of housing (22) comprises sliding means (54, 56) for interacting with corresponding sliding means (102, 104) of said slider (58).

4. The electrical connector (12) according to anyone of the preceding claims,
   wherein
   said slider (58) comprises positioning means (114, 116) adapted to interact with corresponding positioning means (166, 168) of said counter-part second electrical connector (14) only if said slider (58) is fully engaged for allowing mating with said counter-part second electrical connector (14).

5. The electrical connector (12) according to anyone of the preceding claims,
   wherein

said slider (58) comprises means (117) adapted to interact with corresponding means (168) of said counter-part second electrical connector (14) for fully engaging said slider (58) with the front portion (40) of the housing (22).

6. The electrical connector (12) according to anyone of the preceding claims,
wherein
said slider (58) comprises noses (110, 112) adapted to make a snap fit into the cutout (44) of panel (18) when said slider (58) is fully engaged.

7. The electrical connector (12) according to anyone of the preceding claims,
wherein
said slider (58) comprises ribs (106,108) adapted to be inserted in the cutout (44) during engagement of said slider (58) in order to counteract a bending out of said slider (58).

8. The electrical connector (12) according to anyone of the preceding claims,
wherein
said flange (46) is provided continuously over the circumference of the outer surface (30).

9. The electrical connector (12) according to anyone of the preceding claims,
wherein
said front portion (40) comprises an arm (72) adapted to make a snap fit into said cutout (44).

10. The electrical connector (12) according to claim 9,
wherein
the arm (72) comprises a free portion (76) extending toward the flange (46) and deflectable inwardly during insertion of the front portion (40) in said cutout (44) of the panel (18), the panel (18) being locked in place between the free portion (40) and the flange (46).

11. The electrical connector (12) according to anyone of the preceding claims,
comprising
compressible means (62) on the surface (48) of the flange (46) abutting against said panel (18).

Patentansprüche

1. Ein elektrischer Verbinder (12) zur Montage in einem Ausschnitt (44) eines Paneels (18) und zum Verbinden mit einem passenden zweiten elektrischen Verbinder (14), umfassend
ein Gehäuse (22) mit internen Hohlräumen entlang einer Einsetzachse (X) zur Aufnahme von elektrischen Kontakten, wobei ein Frontabschnitt (44) davon in diesen Ausschnitt (44) einsetzbar ist,
einen Flansch (46), der sich von einer äußeren Oberfläche (30) des Gehäuses (22) erstreckt um das Paneel (18), um diesen Ausschnitt (44) herum anzugreifen, und
Verriegelungsmittel, um den elektrischen Verbinder (12) in diesem Ausschnitt (44) zu halten, wobei dieser Flansch (46) hinsichtlich einer Ebene senkrecht zur Einsetzachse (X) geneigt ist, **dadurch gekennzeichnet, dass** das Verriegelungsmittel ein Schieber (58) ist, der mit dem Frontabschnitt (40) des Gehäuses (22) verschiebbar im Eingriff ist, entlang einer Schließrichtung (Δ_C), welche sekant zur Ebene des Flansches (46) ist.

2. Der elektrische Verbinder (12) gemäß Anspruch 1, wobei der Schieber (58) Mittel (100) umfasst, um das Paneel (18) zwischen Flansch (46) und Schieber (58) zu halten, wenn der Schieber (58) in vollem Eingriff ist.

3. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Frontabschnitt (40) des Gehäuses (22) Schiebemittel (54, 56) zur Interaktion mit den entsprechenden Schiebemitteln (102, 104) des Schiebers (58) umfasst.

4. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Schieber (58) Positionierungsmittel (114, 116) umfasst, die eingerichtet sind, um mit entsprechenden Positionierungsmitteln (166, 168) des passenden zweiten elektrischen Verbinders (14) zusammenwirken, erst wenn der Schieber (58) in vollem Eingriff ist, um ein Verbinden mit dem passenden zweiten elektrischen Verbinder (14) zu erlauben.

5. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Schieber (58) Mittel (117) umfasst, die eingerichtet sind, um mit entsprechenden Mitteln (168) des passenden zweiten elektrischen Verbinders (14) zusammen zu wirken, um den Schieber (58) mit dem Frontabschnitt (40) des Gehäuses (22) voll in Eingriff zu bringen.

6. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Schieber (58) Nasen (110, 112) umfasst, die eingerichtet sind, um eine Schnappverbindung in dem Ausschnitt (44) von Paneel (18) herzustellen, wenn der Schieber (58) in vollem Eingriff ist.

7. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Schieber (58) Rippen (106, 108) umfasst, die eingerichtet sind, um in den Ausschnitt (44) während des Eingriffs des Schiebers (58) eingesetzt zu werden, um ein Biegen aus dem Schieber (58) heraus entgegen zu wirken.

8. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Flansch (46) kontinuierlich über den Unfang der äußeren Oberfläche (30) bereitgestellt ist.

9. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, wobei der Frontabschnitt (40) einen Arm (72) umfasst, der eingerichtet ist, um eine Schnappverbindung in dem Ausschnitt (44) herzustellen.

10. Der elektrische Verbinder (12) gemäß Anspruch 9, wobei der Arm (72) einen freien Abschnitt (76) umfasst, der sich zu dem Flansch (46) erstreckt und während des Einsetzens des Frontabschnitts (40) in den Ausschnitt (44) des Paneels (18) nach innen ablenkbar ist, währenddessen das Paneel (18) zwischen dem freien Abschnitt (44) und dem Flansch (46) verriegelt ist.

11. Der elektrische Verbinder (12) gemäß einem der vorhergehenden Ansprüche, umfassend kompressible Mittel (62) an der Oberfläche (48) des Flansches (46), die gegen das Paneel (18) anliegen.

Revendications

1. Connecteur électrique (12) pour montage dans une découpe (44) d'un panneau (18) et pour accouplement avec un second connecteur électrique complémentaire (14), comprenant

- un boîtier (22) ayant des cavités internes le long d'un axe d'accouplement (X) destiné à recevoir des bornes électriques, une partie avant (40) de celui-ci pouvant être insérée dans ladite découpe (44),
- un rebord (46) s'étendant à partir d'une surface externe (30) du boîtier (22) pour se mettre en prise avec le panneau (18) autour de ladite découpe (44) et
- un moyen de blocage destiné à maintenir ledit connecteur électrique (12) dans ladite découpe (44),

dans lequel
ledit rebord (46) est incliné par rapport à un plan perpendiculaire à l'axe d'accouplement (X),
caractérisé en ce que ledit moyen de blocage est un coulisseau (58) pouvant être mis en prise de manière coulissante avec la partie avant (40) du boîtier (22) selon une direction de fermeture (Δc) sécante par rapport au plan du rebord (46).

2. Connecteur électrique (12) selon la revendication 1, dans lequel
ledit coulisseau (58) comprend un moyen (100) pour maintenir le panneau (18) entre le rebord (46) et le coulisseau (58) lorsque ledit coulisseau (58) est complètement en prise.

3. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ladite partie avant (40) du boîtier (22) comprend des moyens coulissants (54, 56) pour interagir avec les moyens coulissants correspondants (102, 104) dudit coulisseau (58).

4. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ledit coulisseau (58) comprend des moyens de positionnement (114, 116) conçus pour interagir avec des moyens de positionnement correspondants (166, 168) dudit second connecteur électrique complémentaire (14) uniquement si ledit coulisseau (58) est complètement en prise pour permettre l'accouplement avec ledit second connecteur électrique complémentaire (14).

5. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ledit coulisseau (58) comprend des moyens (117) conçus pour interagir avec les moyens correspondants (168) dudit second connecteur électrique complémentaire (14) pour mettre en prise complètement ledit coulisseau (58) avec la partie avant (40) du boîtier (22).

6. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ledit coulisseau (58) comprend des nez (110, 112) conçus pour s'emboîter par pression dans la découpe (44) du panneau (18) lorsque ledit coulisseau (58) est complètement en prise.

7. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ledit coulisseau (58) comprend des nervures (106, 108) conçues pour être insérées dans la découpe (44) lors de la mise en prise dudit coulisseau (58) afin de contrebalancer une flexion dudit coulisseau (58).

8. Connecteur électrique (12) selon l'une quelconque des revendications précédentes,
dans lequel
ledit rebord (46) est disposé en continu sur la circonférence de la surface externe (30).

9. Connecteur électrique (12) selon l'une quelconque

des revendications précédentes,
dans lequel
ladite partie avant (40) comprend un bras (72) conçu pour s'emboîter par pression dans ladite découpe (44).

10. Connecteur électrique (12) selon la revendication 9, dans lequel
le bras (72) comprend une partie libre (76) s'étendant vers le rebord (46) et pouvant être déviée vers l'intérieur lors de l'insertion de la partie avant (40) dans ladite découpe (44) du panneau (18), le panneau (18) étant bloqué en position entre la partie libre (40) et le rebord (46).

11. Connecteur électrique (12) selon l'une quelconque des revendications précédentes, comprenant
des moyens compressibles (62) sur la surface (48) du rebord (46) venant en butée contre ledit panneau (18).

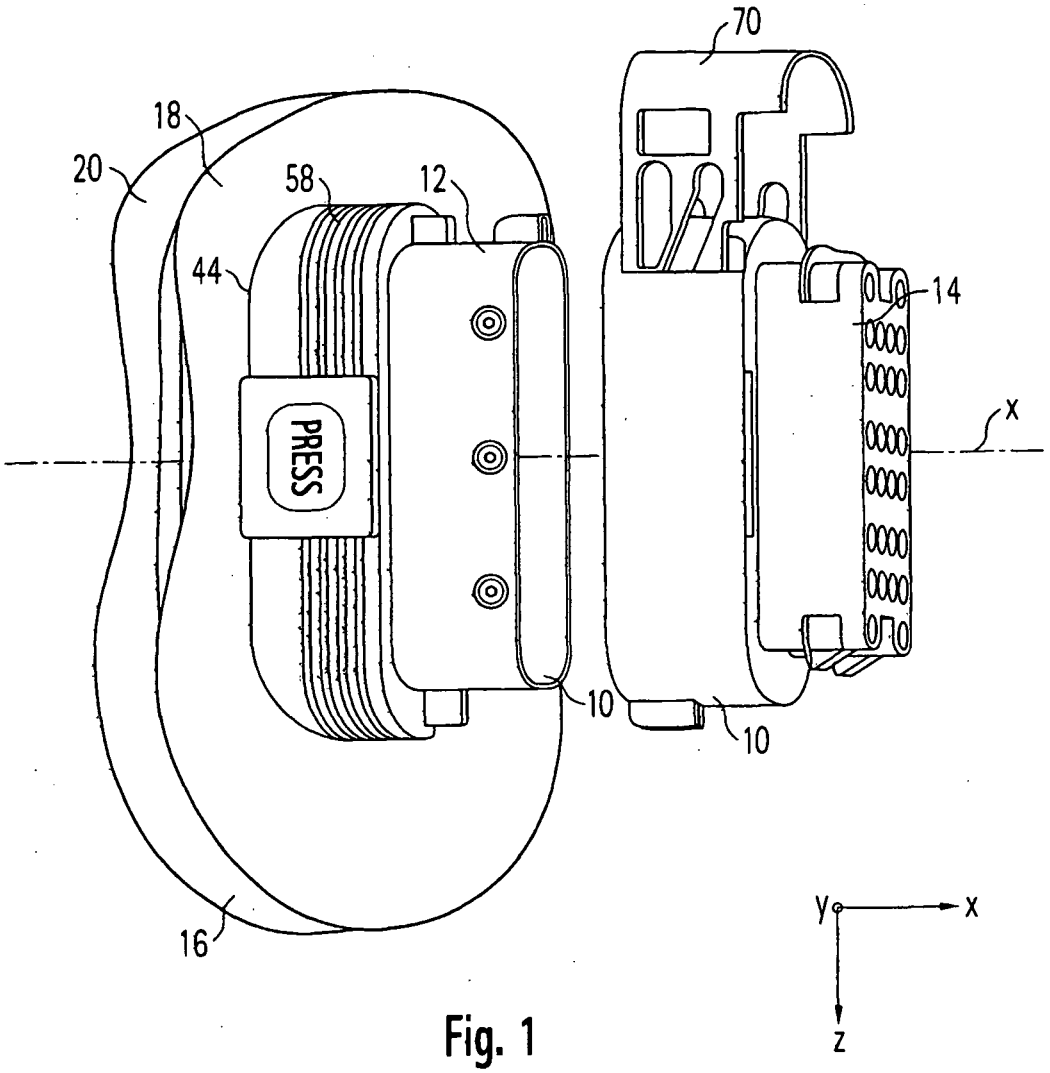


Fig. 1

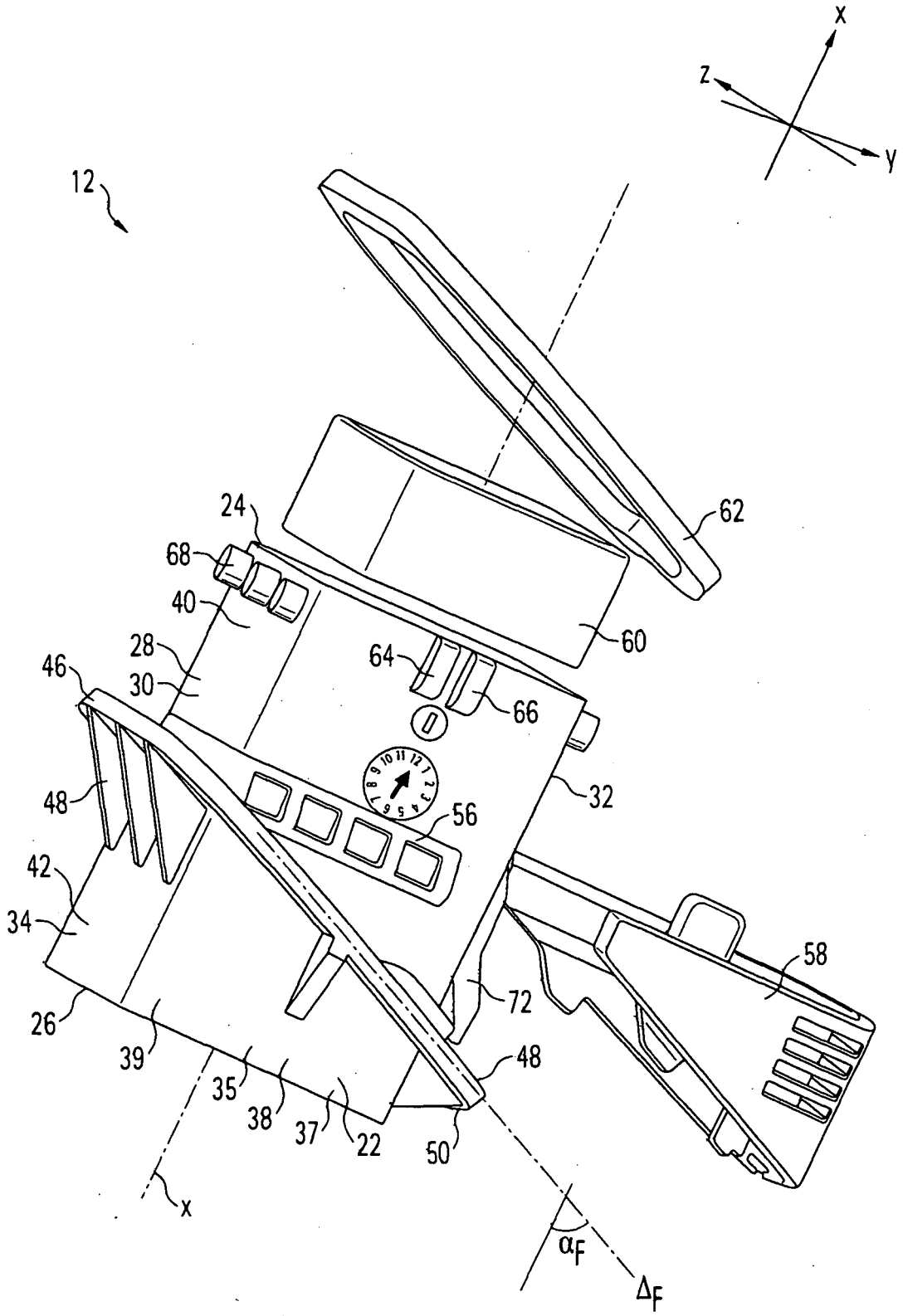

x
z
y
12
24
68
40
28
30
46
62
60
64
66
32
48
56
42
34
58
72
26
39
35
38
37
22
50
48
x
α_F
Δ_F

Fig. 2

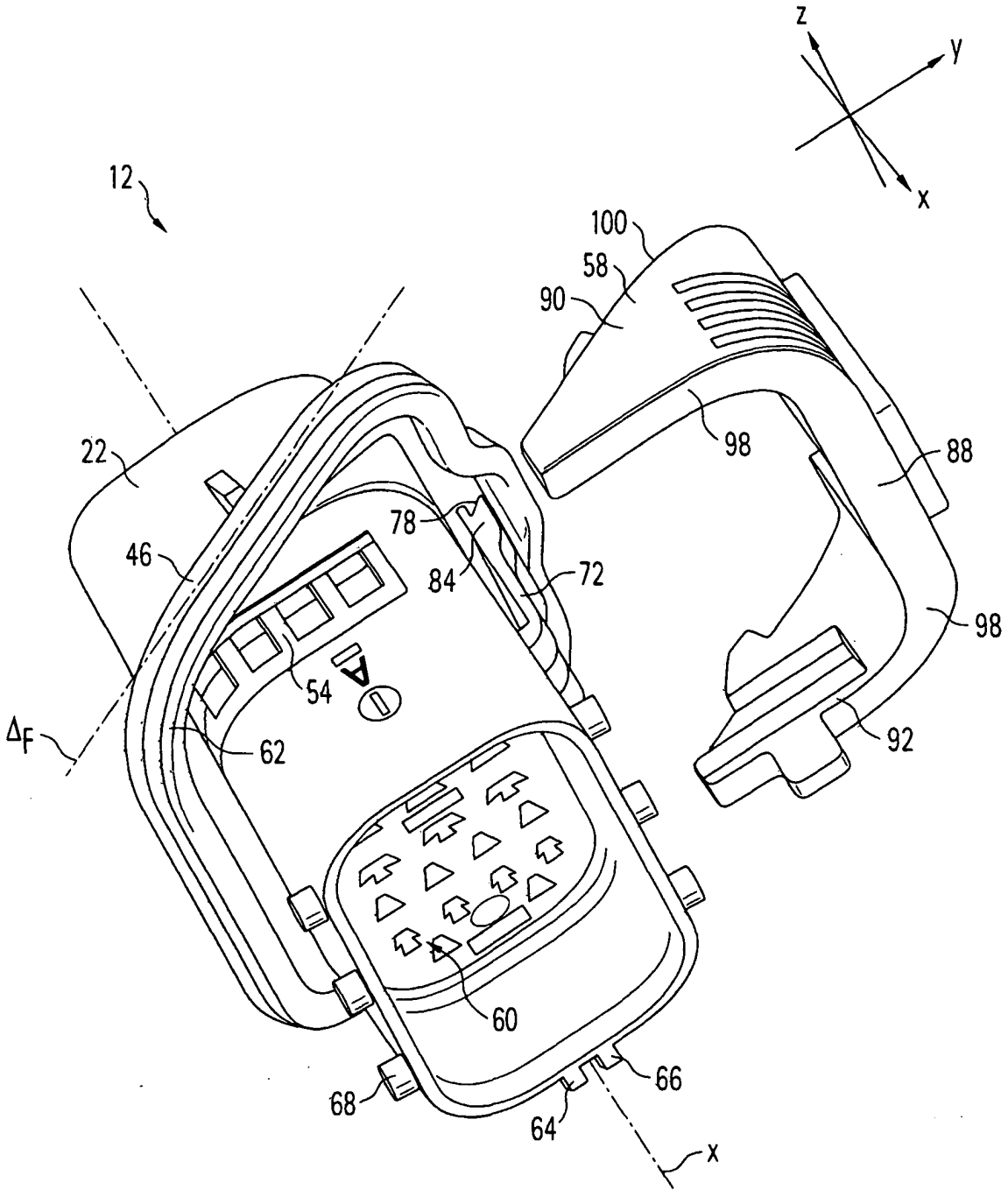

z
y
x
12
100
58
90
98
88
22
78
84
72
46
54
A
A
98
Δ_F
62
92
60
66
68
64
x

Fig. 3

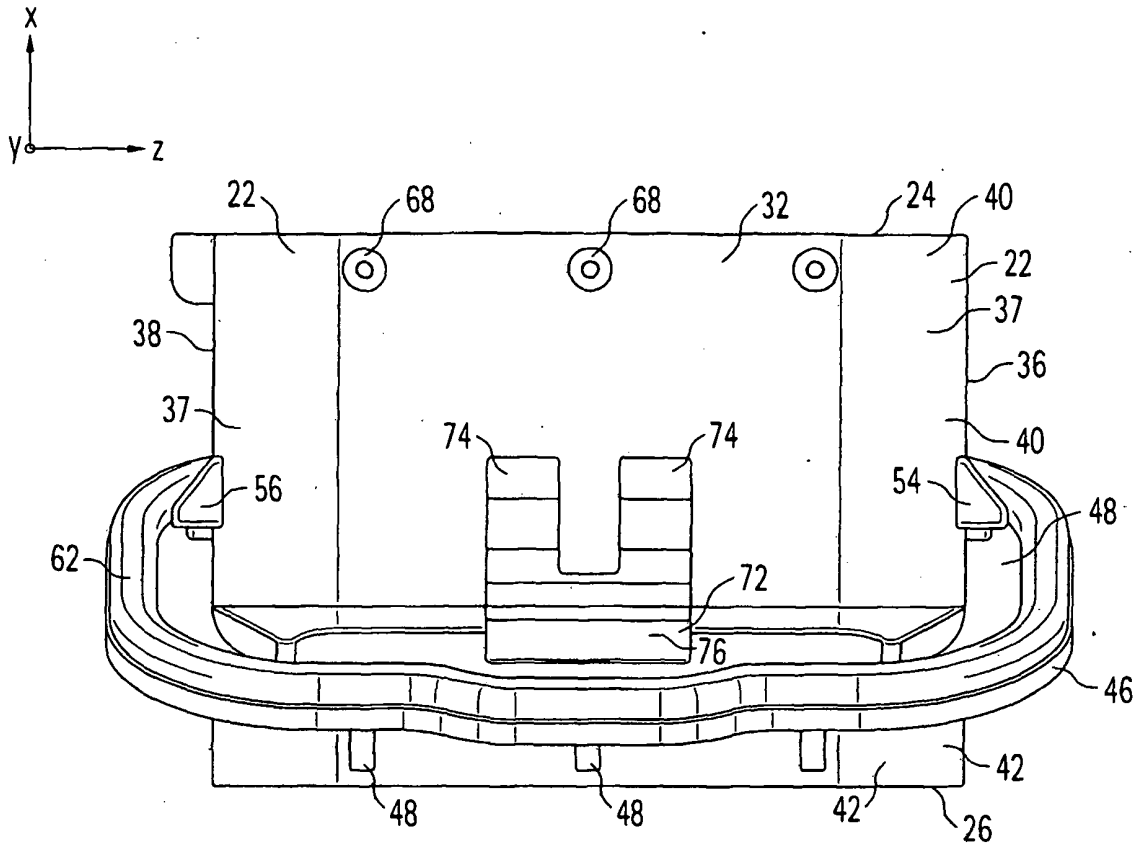

x
y
z
22
68
68
32
24
40
22
37
38
36
37
74
74
40
56
54
48
62
72
76
46
42
48
48
42
26

Fig. 4A

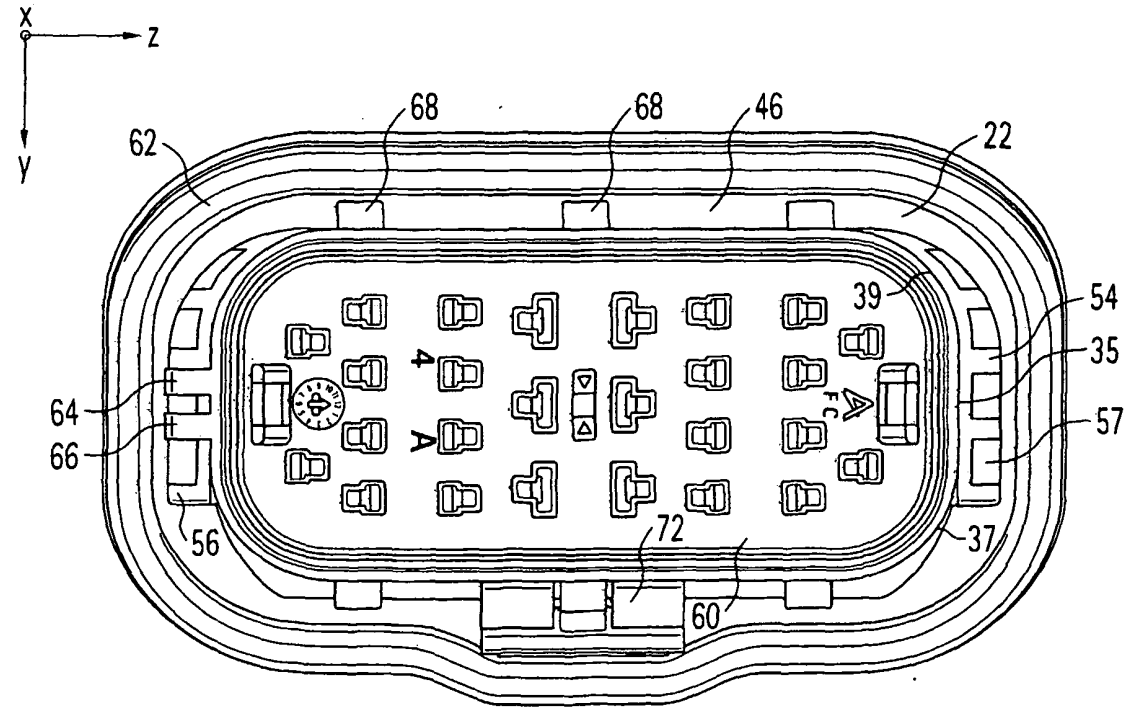

x
z
y
68
68
46
22
62
39
54
35
64
66
57
56
72
37
60

Fig. 4B

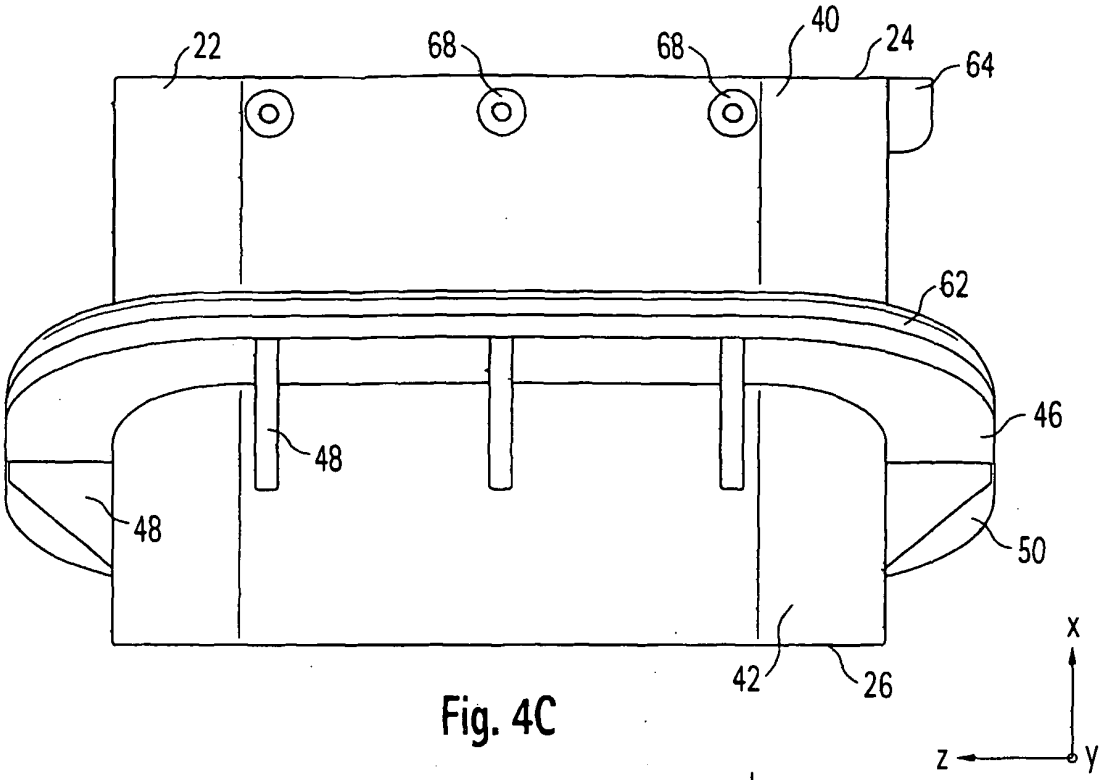

22
68
68
40
24
64
62
46
48
48
50
42
26
x
z
y

Fig. 4C

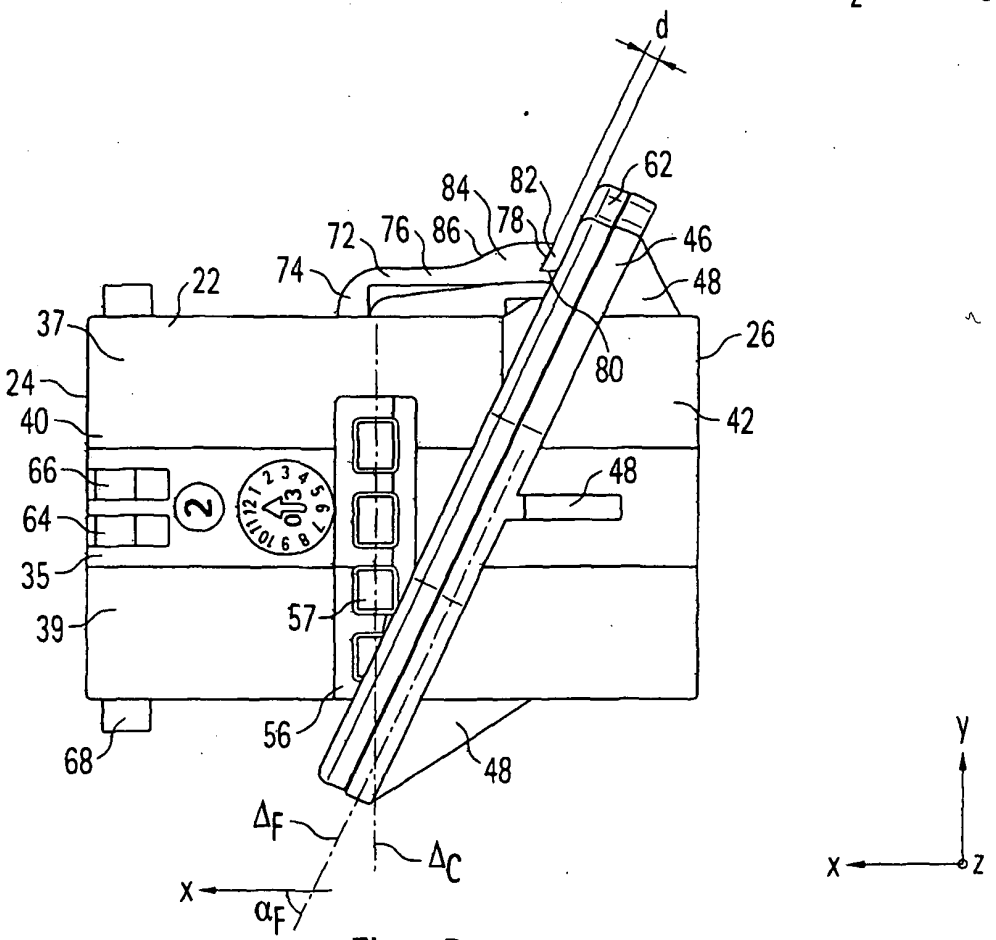

d
62
84
82
72
76
86
78
46
74
48
22
37
80
26
24
40
42
66
64
35
39
57
48
68
56
48
Δ_F
Δ_C
x
α_F
y
x
z

Fig. 4D

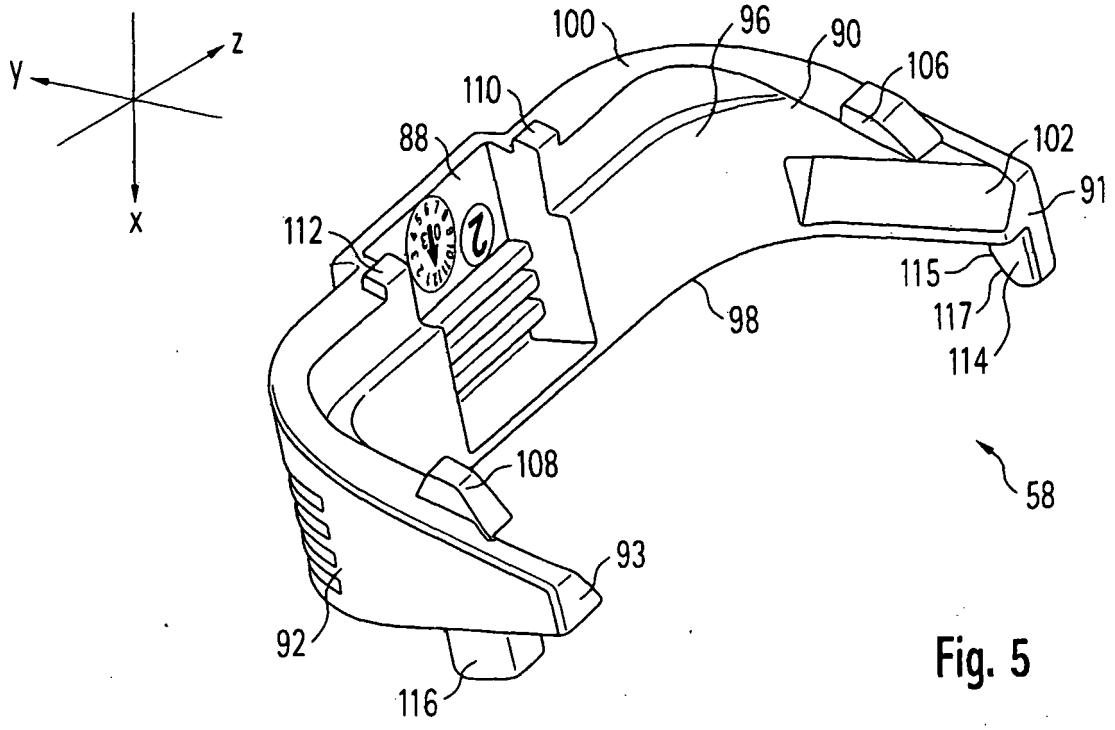

y
z
x
100
96
90
106
110
88
102
91
112
115
117
114
98
108
58
93
92
116

Fig. 5

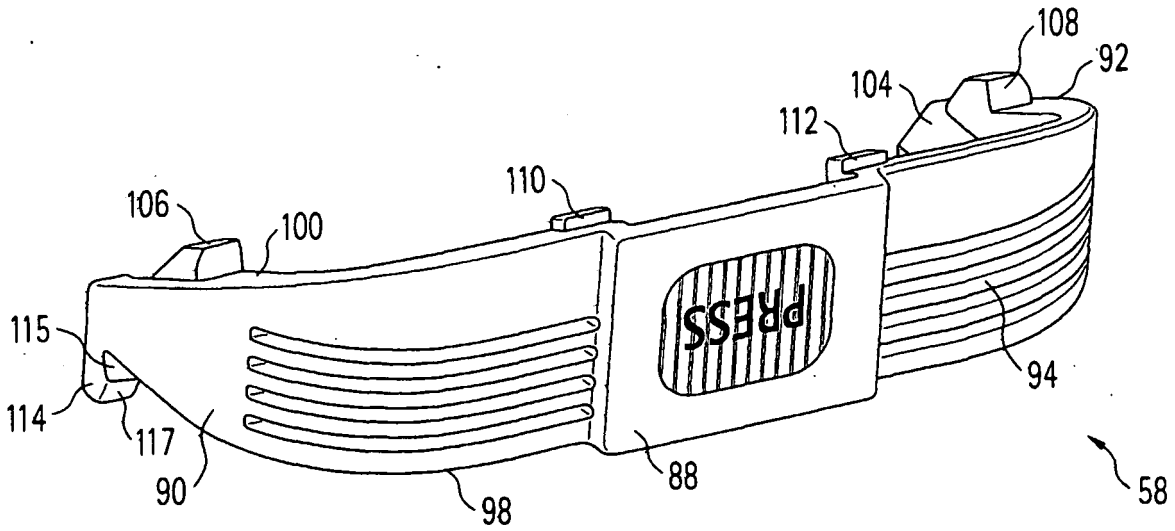

108
92
104
112
110
106
100
PRESS
115
94
114
117
90
88
98
58

Fig. 6

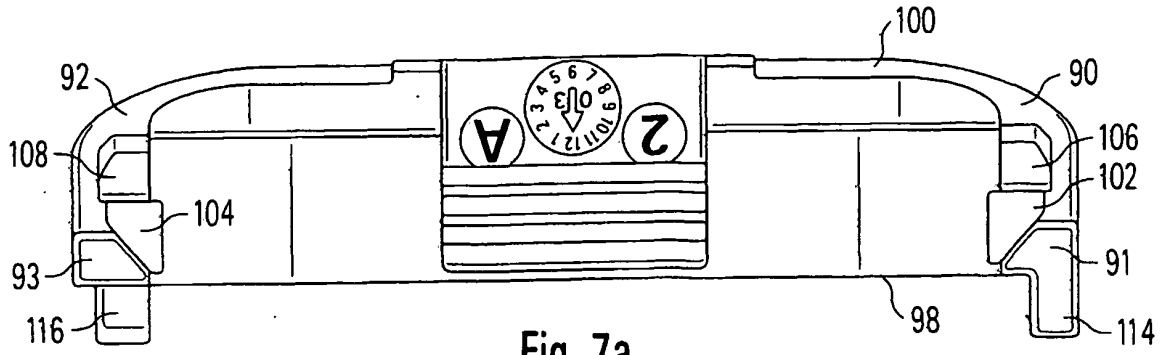


Fig. 7a

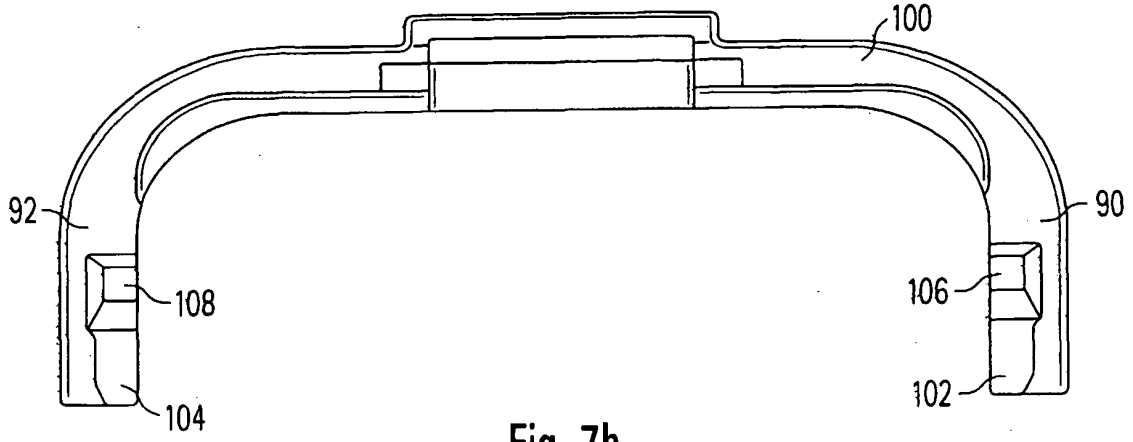


Fig. 7b

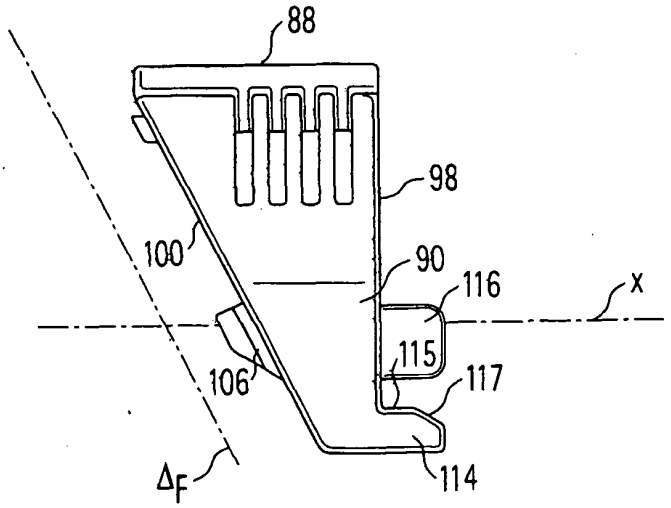


Fig. 7c

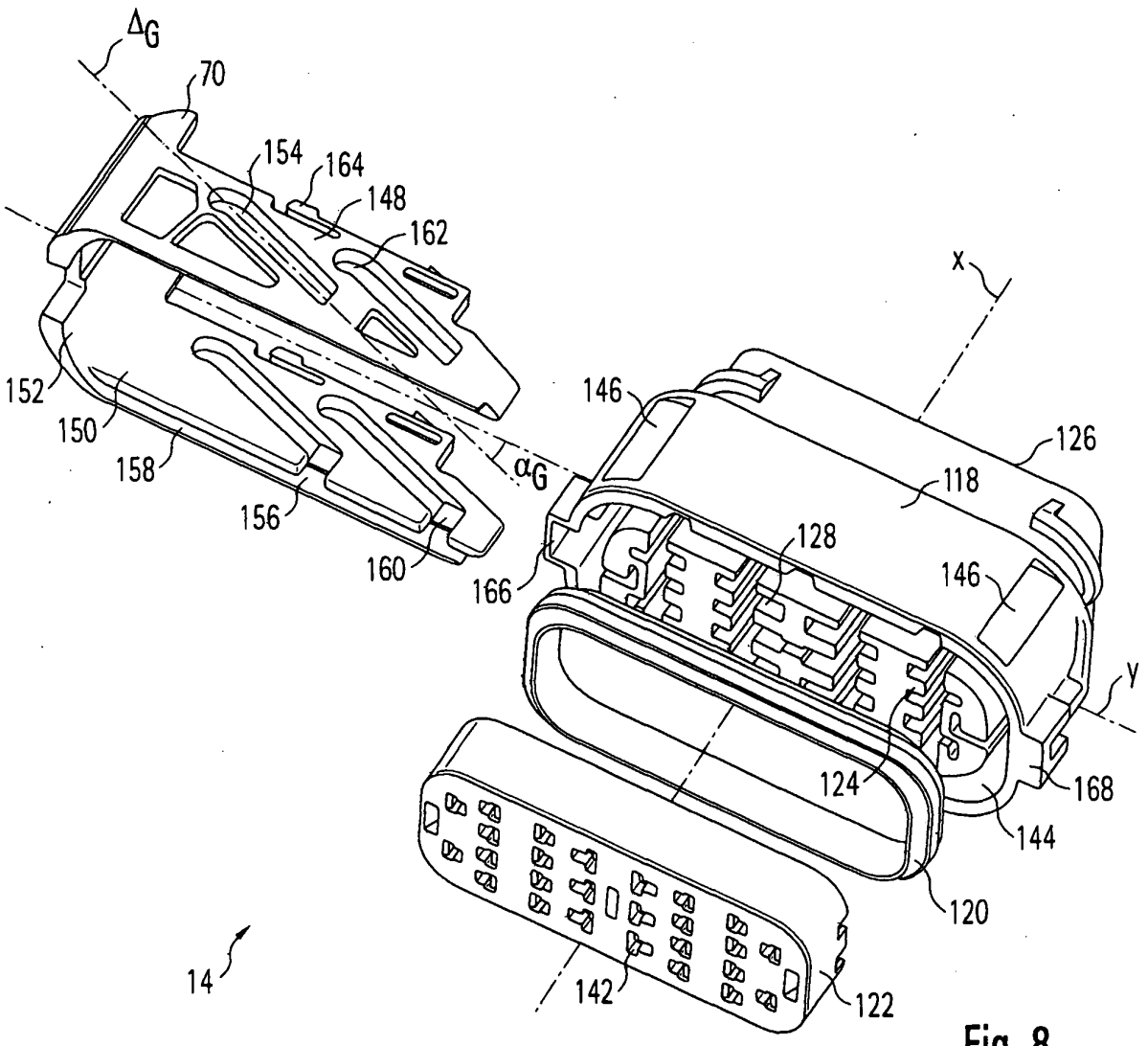

Δ_G
70
154
164
148
162
152
150
158
156
160
α_G
146
x
126
118
128
166
146
y
124
168
144
120
14
142
122

Fig. 8

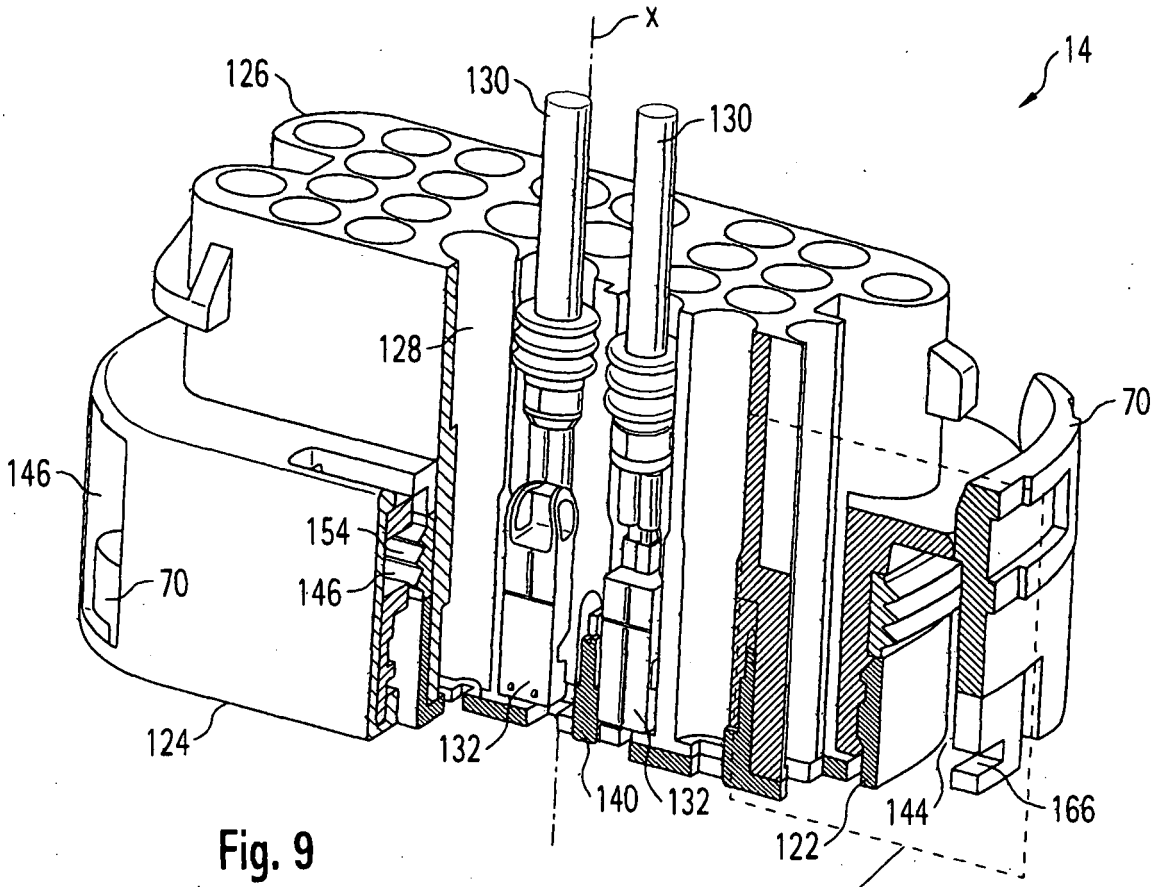

X
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130
130
128
70
146
154
146
70
124
132
140
132
144
166
122

Fig. 9

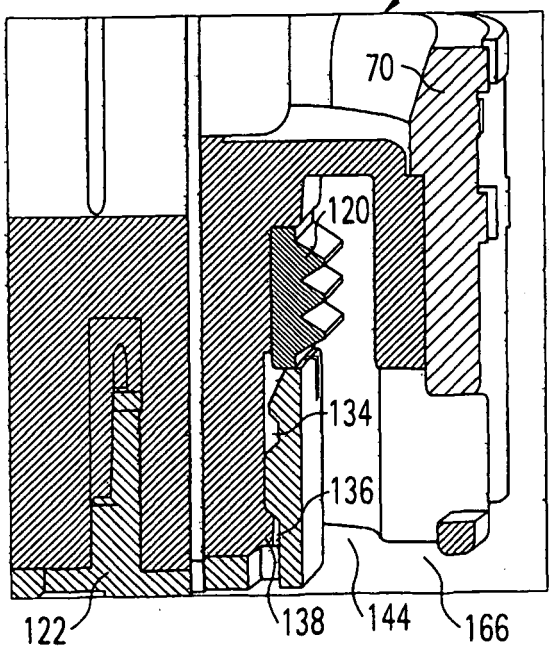

70
120
134
136
122
138
144
166

Fig. 10

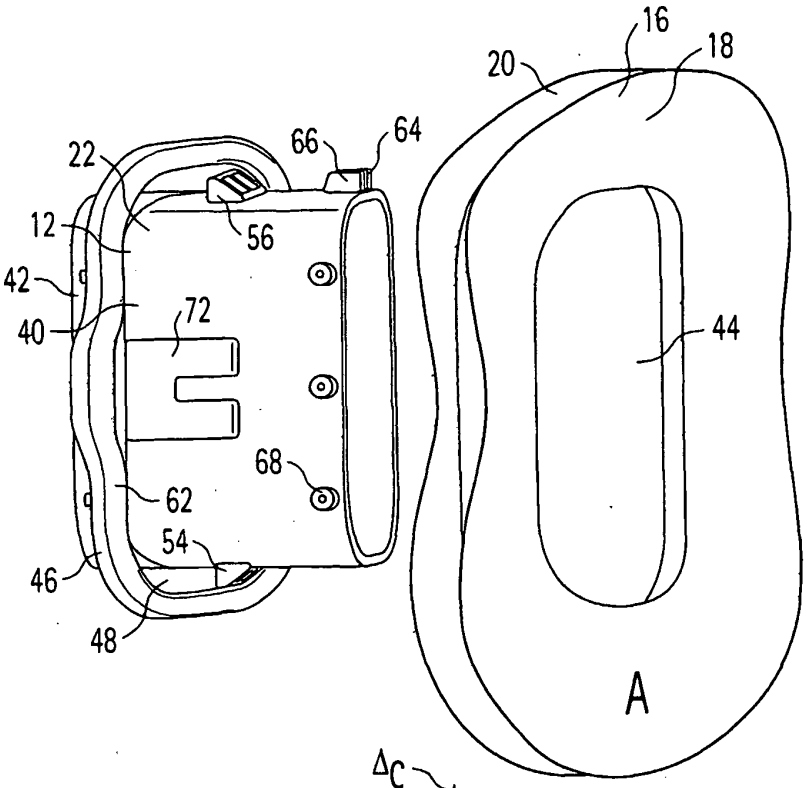

16
18
20
22
66
64
12
56
42
40
72
44
68
62
54
46
48
A

Fig. 11

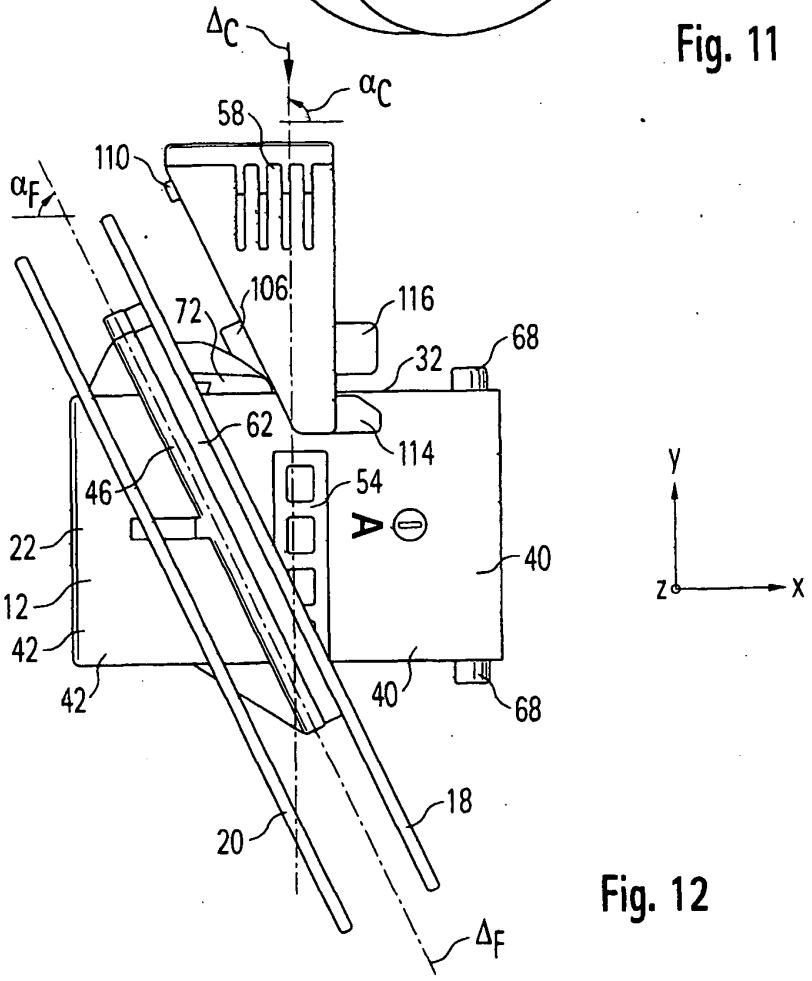

Δ_C
α_C
58
110
α_F
106
116
72
68
32
62
114
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A
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40
12
42
42
40
68
18
20
Δ_F
y
z
x

Fig. 12

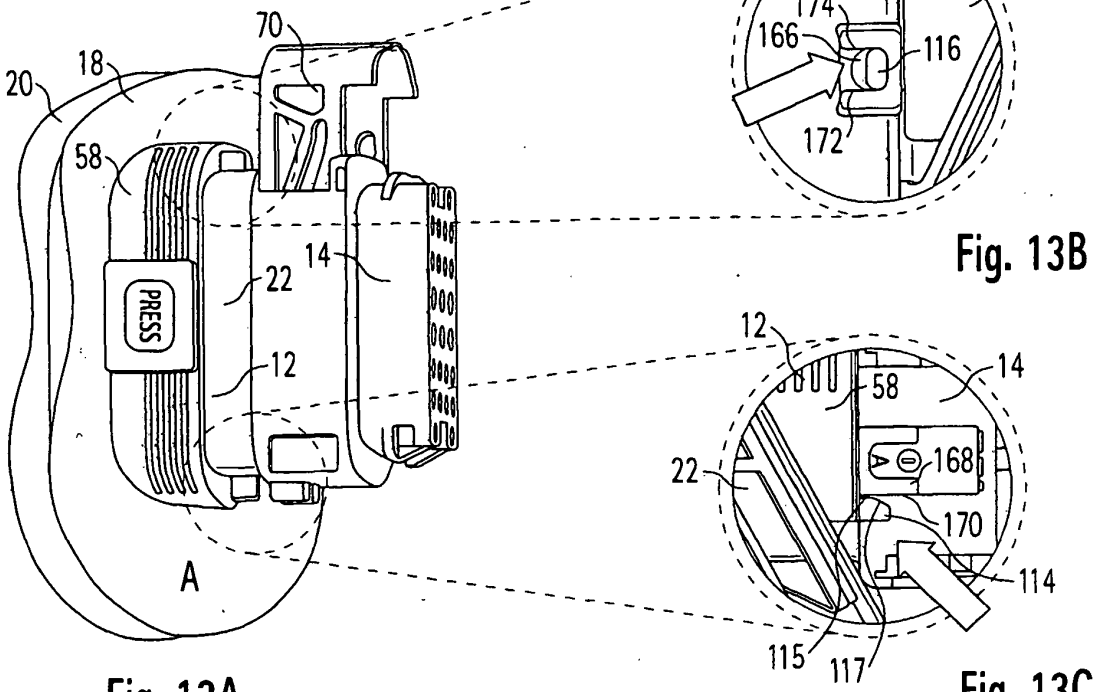


Fig. 13B

Fig. 13A

Fig. 13C

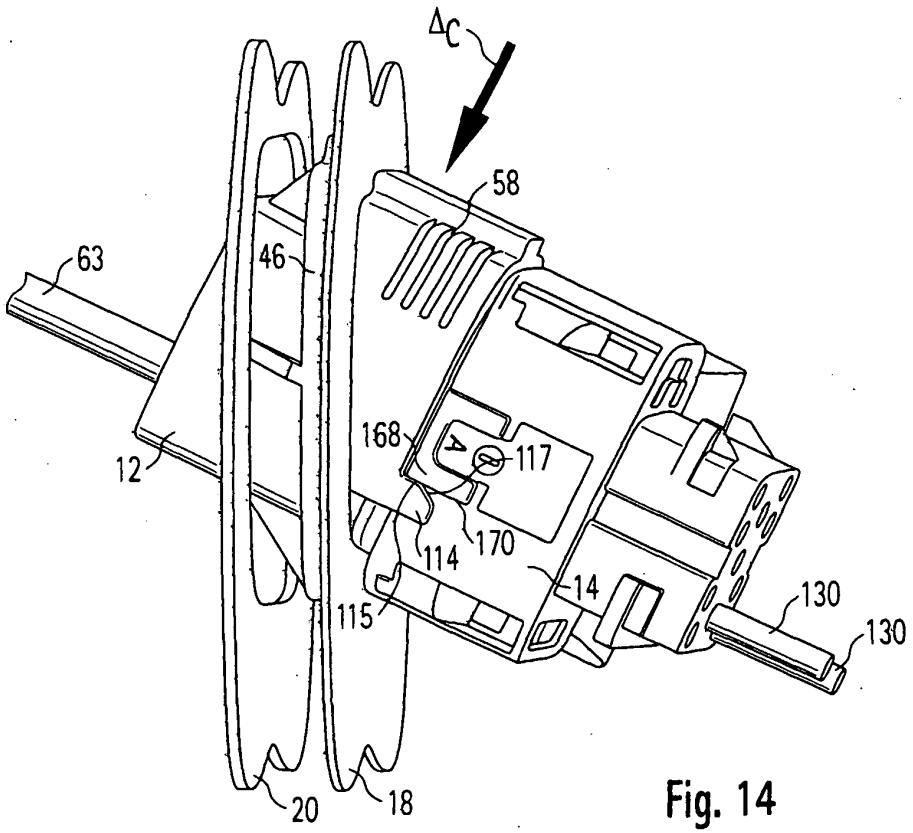


Fig. 14

REFERENCES CITED IN THE DESCRIPTION

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