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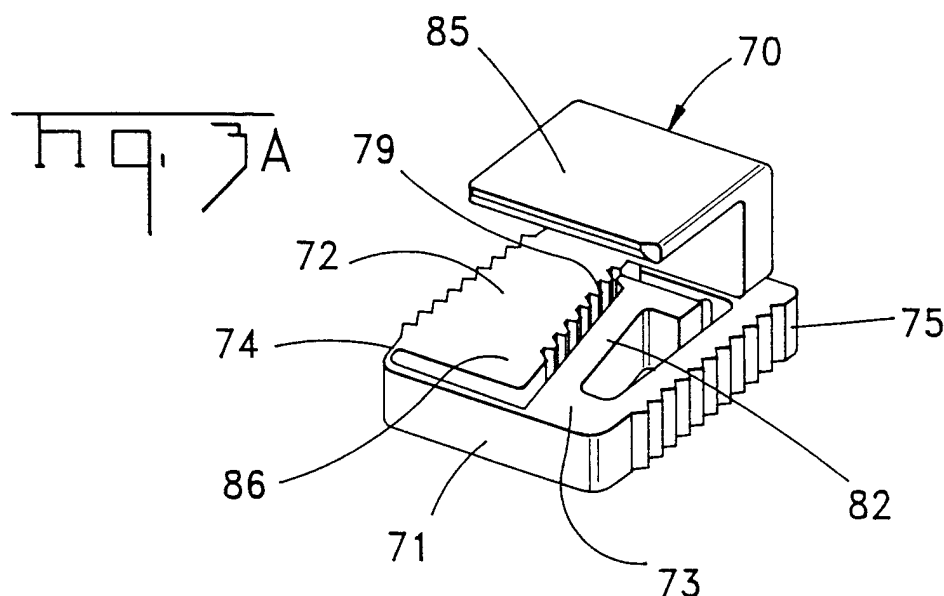
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(54) **Connector-latching device**

(57) A connector-latching device (70) is described which can be applied even to relatively small connectors and has enough holding force effectively to prevent uncoupling of engaged connectors. It comprises a first member (72) and a second member (73) which are generally wedge-shaped. The first member (72) has an outer surface (74) for engaging a connector (30) and an inner surface (78) which serves as the latching surface and which engages with the second member (73). The latter has an outer surface (75) for engaging the con-

connector and a latching surface (81) which engages with the inner surface (78) of the first member (72). In use, the first member (72) of the device is placed under the locking arm (34) of the connector, after which the second member (73) is pushed in to an adjacent position which results in the first and second members being wedged between opposing walls of the connector housing located on opposite sides of the locking arm. Displacement of the locking arm is thereby prevented. A cover (85) for protecting the locking arm is located on the first member (72).



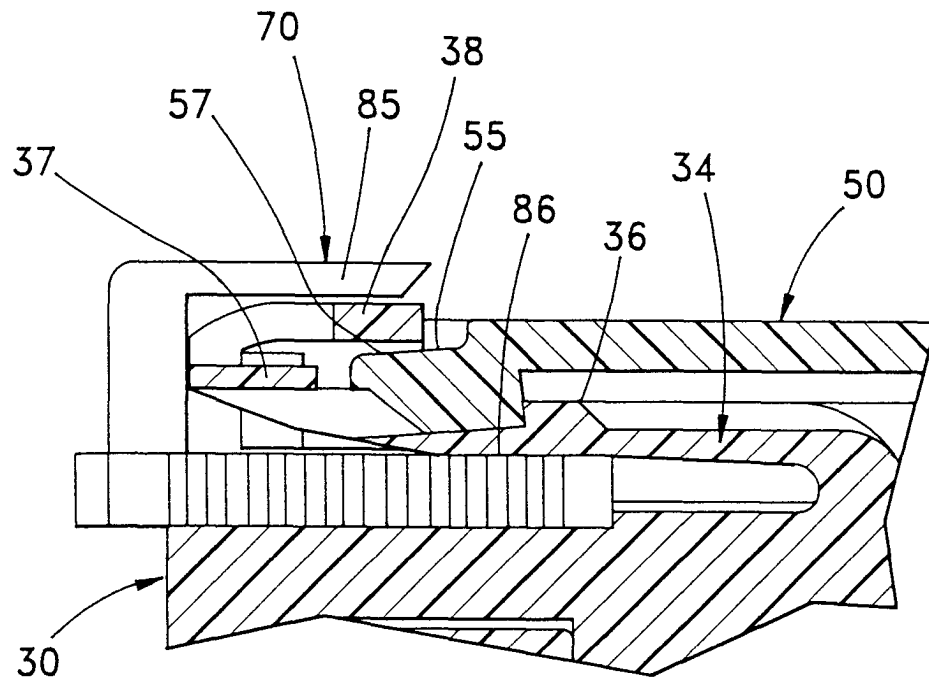


Fig. 5

Description

[0001] The present invention relates to a connector-latching device that provides a means or structure for preventing the uncoupling or disconnecting of a pair of connectors that have been coupled or connected together.

[0002] An example of this type of connector-latching device is disclosed in Japanese Utility Model Publication No. 5-17949. The disclosed connector-latching device prevents uncoupling by being inserted under a locking arm so as to prevent the bending deformation thereof. This connector-latching device requires a latching protrusion that is latched by the locking arm in order to maintain engagement or prevent disengagement, and it can therefore only be applied to connectors having a specially-shaped locking arm.

[0003] Another conventional example is disclosed in Japanese Patent Publication No. 8-7982. The disclosed connector-latching device is inserted under a locking arm positioned between a pair of opposing housing walls, and the connector-latching device is held engaged with the pair of opposing walls. This connector-latching device is compatible with locking arms of a variety of shapes and it keeps the connector from being disconnected. The latching device has a pair of resilient engaging tabs in order to engage with the walls. However, the disclosed structure does not necessarily meet the need to prevent even more effectively the uncoupling or disconnection of connectors; and, particularly when the connector is relatively small, the resilient engaging tabs also have to be small, which means that the holding force of the connector-latching device is weak. It is therefore an object and an important feature of the present invention to provide a connector-latching device which can be applied even to relatively small connectors and has enough holding force to effectively prevent the uncoupling of the connector.

[0004] The present invention is directed to a connector-latching device which is placed under a resiliently bendable locking arm that is integrally provided between opposing walls as part of a housing of a connector, the connector-latching device engages with the opposing walls when the connector is latchably coupled with a mating connector, thereby preventing the bending of the locking arm, the connector-latching device including generally wedge-shaped first and second members, having housing-engagement surfaces that each engages with one or the other of the opposing walls, and latching surfaces positioned on the opposite sides of the first and second members, the first and second members being constructed such that they are placed under the locking arm and facing away from each other, and when the members undergo relative displacement, the latching surfaces latch with each other and they are held in engagement while being sandwiched between the opposing walls

[0005] The first and second members are formed as

an integral member linked by a hinge.

[0006] A plurality of engaging barbs or engaging protrusions are located on the housing-engagement surfaces.

[0007] A plurality of engaging steps are located on one of the latching surfaces of the first and second members, and a resilient latching arm that engages the engaging steps is provided as part of the other latching surface.

[0008] The first member is placed under the locking arm, the second member is also inserted under the locking arm so as to line up with the first member, and a cover that covers at least the operation member of the locking arm is located on the first member.

[0009] The engaging steps are preferably located on the first member, and the resilient latching arm is located on the second member.

[0010] Further, the present invention is directed to a connector-latching device which is placed under a resiliently bendable locking arm that is formed as part of a housing of a connector which is coupled with a mating connector and prevents the bending of the locking arm, the connector-latching device including a rigid base and an elastic member that is fitted into and supported in part of the base, the elastic member being elastically deformed by part of the housing so that the connector-latching device is sandwiched and held in engagement with opposing walls of the connector when inserted under the locking arm.

[0011] The elastic member constitutes two elastic members that are disposed along both sides of the base, and when the connector-latching device is inserted under the locking arm, the elastic members engage with the opposing walls provided on both sides of the locking arm of the housing and they are thereby elastically deformed.

[0012] The elastic members are held with a space between them and the base before the connector-latching device is mounted under the locking arm.

[0013] The elastic member is placed in a holding chamber provided in an approximate center of the base.

[0014] The holding chamber is structured so that it passes through the base from the top to the bottom thereof, and just one elastic member is disposed in the holding chamber.

[0015] The elastic members include a generally arcuate surface.

[0016] Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

[0017] Figures 1a-1c show a plug connector in which a connector-latching device of the present invention is to be located; Figure 1a is a plan view of the plug connector, Figure 1b is a side view thereof, and Figure 1c is a front view thereof.

[0018] Figures 2a-2c show a cap or receptacle connector to be latchably coupled with the plug connector in Figure 1; Figure 2a is a perspective view of the cap

connector, Figure 2b is a front view thereof, and Figures 2c is a cross-sectional view taken along line 2c-2c in Figure 2b.

[0019] Figures 3a-3c show a first embodiment of the invention which is fitted after the plug connector and cap connector shown in Figures 1 and 2, respectively, have been latchably coupled together; Figure 3a is a perspective view of the connector-latching device, Figure 3b is a bottom view thereof, and Figure 3c is a rear view thereof.

[0020] Figures 4a-4c show the plug connector and cap connector in a latched state, in which the connector-latching device has been mounted; Figure 4a is a plan view, Figure 4b is a front view, and Figure 4c is a side view.

[0021] Figure 5 is a part cross-sectional view from a side of the connector-latching device illustrating the action of the connector-latching device in maintaining a coupling state of the plug connector and the cap connector shown in Figure 4.

[0022] Figure 6 is a perspective view of an alternative embodiment of the connector-latching device, which can be used on the plug connector and cap connector shown in Figures 1 and 2.

[0023] Figures 7a and 7b is a further embodiment of the connector-latching device; Figure 7a is a perspective view, and Figure 7b is a side view thereof.

[0024] Figures 1 and 2 show a plug connector 30 and a cap connector 50 that are similar in shape to conventional plug and cap connectors. In Figure 1, the plug connector 30 includes a housing 31 having a plurality of cavities 32 that hold electrical contacts (not shown). A locking arm 34 for maintaining the coupling of the plug connector 30 with its mating connector, namely, the cap connector 50, is located on a side wall or an upper wall of the housing 31. It is particularly noteworthy that the locking arm 34 is located between opposing walls 41 of the housing 31. A protrusion 36 including an engaging shoulder 35 is located at a midway position in the lengthwise direction of the locking arm 34. An operation member 37 of the locking arm 34 is located at a rear end of the locking arm 34. An arch 38 extending so as to surround the operation member 37 at its periphery is provided by the housing 31 in order to protect the locking arm 34. A double-lock member 39 is located on a bottom wall of the housing 31. In Figure 1, the double-lock member 39 is shown as being in a non-latch position and protrudes outside of the housing 31; however, the double-lock member 39 is moved to its full latch position, in which it does not protrude beyond the outside, when an electrical contact (not shown) is at a specific position, i. e., a fully-inserted position.

[0025] In Figure 2, the cap connector 50 has an approximately box-shaped housing 53 which is conventional in design. The housing 53 has a coupling cavity 51 that receives the plug connector 30 shown in Figure 1. A plurality of male electrical contacts 52 are disposed in a specific arrangement within the coupling cavity 51.

The male contacts 52 are coupled with female electrical contacts (not shown) in the cavities 32 of plug connector 30. In particular, as shown in Figure 2c, an engaging protrusion 55 that engages with the engaging shoulder 35 of the locking arm 34 upon receipt of the plug connector 30 is located at an upper wall 54 of the housing 53. The engaging protrusion 55 includes an engaging shoulder 56 facing toward the inside of the coupling cavity 51. As shown in Figure 2c, a cavity 57 is located in an upper surface of the engaging protrusion 55, and a through hole 59 is located in a rear wall 58 of the housing 53 to allow the entry of a mold pin in order to form the engaging shoulder 56. Furthermore, spaced protrusions 61, 62 extend in the coupling direction and they are located on both sides of the engaging protrusion 55 inside the coupling cavity 51. The protrusions 61, 62 form recesses for receiving ribs 44, 45 on the upper wall 33 of the plug connector 30, thereby constituting a means for preventing damage to the electrical contacts during coupling and for preventing coupling in an opposite direction.

[0026] As discussed above, the plug connector 30 and cap connector 50 of Figures 1 and 2 are designed so that they couple together forming an electrical connection therebetween, and the coupled state is maintained by the engaging shoulder 35 of the locking arm 34 of the plug connector 30 being engaged with the engaging protrusion 55 of the cap connector 50.

[0027] Connector-latching device 70 shown in Figure 3 is placed under the locking arm 34 after the connectors have been coupled, thereby preventing any bending deformation thereof as well as preventing any decoupling of the coupled connectors.

[0028] In Figures 3a-3c, the connector-latching device 70 comprises a first member 72 and a second member 73 that are linked by a hinge 71. As will be understood from Figure 3b in particular, the external shapes of the first member 72 and second member 73 are both approximately or generally wedge-shaped, and the hinge 71 links the two at their distal ends. The first member 72 and second member 73 have engaging barbs or engaging protrusions 76 and 77 along their outer surfaces 74, 75, respectively; engaging steps 79 are located on an inner surface 78 of the first member 72, and a resilient latching arm 82 is located along an inner surface 81 of the second member 73. The latching arm 82 extends at an angle from a distal end along the inner surface 81. A pawl 83 that protrudes generally laterally is located at a free end of the latching arm 82, and a generally rectangular protrusion 84 is located on a rear surface thereof. As seen in Figure 3a, the first member 72 is equipped with a cover 85 having an approximately L-shape cross section and extending upwardly. The action of cover 85 will be discussed below. An approximately or generally triangular hole 87 shown in Figure 3c is used for the insertion of a special tool in order to disengage the latching arm 82 and the engaging steps 79 from their latched state, which is discussed below.

The hole 87 is not necessarily required.

[0029] The connector-latching device 70 is inserted into a space 5 (see Figure 1c) under the locking arm 34 from the distal end side on which the hinge 71 is located. Because the first member 72 and second member 73 are linked by the hinge 71, they are free to move with respect to one another, and the first member 72 is inserted into the space 5 ahead of the second member 73 as a first step, after which the second member 73 is inserted as a second step. In the first step, the first member 72 can be inserted smoothly, but the insertion of the second member 73 requires considerable pressing force. This is because the width W of the connector-latching device 70 shown in Figure 3b is set to be sufficiently greater than the width of the space 5. As a result, when the second member 73 is inserted into the space 5, the first member 72 and the second member 73 are subjected to a force from the opposing walls 41 of the housing 31 that delineates the space 5, and they are thereby squeezed or forced together. The latching arm 82 of the second member 73 at this point creates a ratcheting action with the engaging steps 79, and this prevents the second member 73 from moving backward. Therefore, the first member 72 and second member 73 that make up the connector-latching device 70 are firmly pressed together by the opposing walls 41, and they are prevented from relative motion in the uncoupling direction by the ratcheting action produced by the latching arm 82 and the engaging steps 79, so they are securely fixed by being squeezed into the space 5.

[0030] It is noteworthy that bending or downward moving of the locking arm 34 is effectively prevented when the connector-latching device 70 is thus held inside the space 5. It can be understood from Figure 5 that the connector-latching device 70 is placed such that it overlaps with the locking arm 34, that an upper surface 86 thereof inhibits the bending of the locking arm 34. Furthermore, it can be understood from Figure 4c and Figure 5 that the cover 85 as part of the first member 72 is placed so as to overlap with the locking arm 34 and the arch 38. In Figure 5, when the plug connector 30 and the cap connector 50 are coupled, the locking arm 34 engages with the engaging protrusion 55, and the arch 38 is received into the cavity 57 located on the upper surface of the engaging protrusion 55. It will be understood that the cover 85 acts to prevent access to the operation member 37 from the outside and to protect the arch 38 as well as the locking arm 34 by covering the outside thereof.

[0031] Thus, the connector-latching device 70 has a relatively simple structure, but it is nevertheless held by a strong force inside the space 5 under the locking arm 34, so the latching reliability is better. Furthermore, even if there is a certain amount of dimensional discrepancy due to differences in the types of connector, or if there is a large amount of manufacturing tolerance in the connectors, this can still be accommodated by a single type of connector-latching device 70, which makes it more

universal. In addition, the first member 72 and second member 73 can be formed simultaneously in linked form by a linking means such as the hinge 71, so another advantage is that this device can be provided relatively inexpensively.

[0032] The connector-latching device 170 illustrated in Figure 6 is also fixed by being sandwiched between the opposing walls 41 within space 5 of the plug connector 30, and it has a base 171 composed of a rigid plastic, metal, or the like, and elastic or resilient members 172 disposed on both sides thereof. The base 171 has a generally triangular cavity 174 along both sides 173 thereof, and the generally cylindrical elastic members 172 are held within the cavities 174. The elastic members 172 may be retained within the cavities 174 by their own elastic force, or they may be held by another holding means. The elastic members 172 need not be cylindrical in shape, but it is necessary for at least outer surfaces 176 to be curved surfaces in the form of an arc. The dimensions of the base 171 and the elastic members 172 are selected according to the spacing of the opposing walls 41. Specifically, the width of the base 171 is slightly narrower than the spacing of the opposing walls 41, and the elastic members 172 are sized to protrude from the surfaces of the sides of the base 171. Therefore, when the connector-latching device 170 is inserted into the space 5, the elastic members 172 will undergo considerable elastic deformation by engagement with the opposing walls 41, thus the connector-latching device 170 will be securely held in place. As a result, the connector-latching device 170 is effectively maintained under the locking arm 34, so that the upper surface thereof can prevent the locking arm 34 from bending or moving downward. Specifically, although the structure is relatively simple, uncoupling is still effectively prevented. Recesses 175 provided adjacent outer ends of the sides 173 of the base 171 are used for engagement by a special tool or the like when such a tool is required to pull out the connector-latching device 170 from the space 5.

[0033] Whereas, two elastic members 172 are used in respective sides of base 171, a simple elastic member in one side will also work.

[0034] Connector-latching device 270 shown in Figure 7 also includes a base 271 composed of a rigid plastic, metal, or the like, and an elastic or resilient member 272. The elastic member 272 is disposed inside a through hole 273 located in the center of the base 271. The elastic member 272 has a spherical or distorted spherical shape, and its upper and bottom surfaces are curved surfaces 276, 277. Connector-latching device 270 is placed under the locking arm 34 when inserted into the space 5, and held in place by being sandwiched between upper wall 43 of the housing 31 and the locking arm 34 (see Figure 1c). Specifically, when the connector-latching device 270 is inserted in space 5, the elastic member 272 is deformed, and the elastic force thereof causes the connector-latching device 270 to be securely

held within the space 5. Therefore, the locking arm 34 is directly prevented from bending by the connector-latching device 270, thereby allowing the connectors to be securely latched together. It is particularly worth noting that as long as the rear surface of the locking arm 34 is flat, the connector-latching device 270 can accommodate connectors having locking arms of various shapes and sizes. The recesses 275 provided adjacent outer ends of the sides 274 of the base 271 can be used for the engagement of a tool for the same purpose as the recesses 175 shown in Figure 6.

[0035] Connector-latching devices representing preferred embodiments of the present invention were described in detail above, but these are nothing more than examples, and they do not limit the scope of the present invention, and various modifications and variations will be possible by a person skilled in the art.

[0036] The connector-latching device of the present invention includes generally wedge-shaped first and second members, each of which has a housing-engagement side that engages with one or the other of opposing walls of a housing, and a latching side positioned on the opposite side, with the first and second members being constituted such that they are placed behind a locking arm and facing away from each other, and when the members undergo relative displacement, the latching sides latch with each other and are held in engagement sandwiched between the opposing walls. Therefore, although the structure is relatively simple, the connector-latching device is securely fixed in the housing, and the connectors can be effectively kept coupled. Also, dimensional discrepancy due to differences in the types of connector or manufacturing tolerance in the connectors can be compensated for, so the device is more universal and its action is more reliable. Furthermore, since the structure is relatively simple, the reliability of this action will still be sufficiently high if the device is formed in a compact size.

[0037] The connector-latching device of the present invention has a rigid base and elastic members that are held in place by being fitted into part of the base, with the elastic members being elastically deformed by part of the housing so that the connector-latching device is sandwiched and held in engagement when inserted under a locking arm of the housing. Therefore, although the structure is relatively simple, the device is securely fixed in the housing, and the connectors can be effectively kept coupled. Also, manufacturing and assembly are easy, allowing the device to be provided at low cost. Furthermore, since the structure is relatively simple, the reliability of the action will still be sufficiently high if the device is formed in a compact size.

Claims

1. A connector-latching device (70) for positioning under a resiliently displaceable locking arm (34) dis-

posed between opposing walls (41) of a housing (31) of a connector (30) when the latter is coupled with a mating connector (50) and for preventing displacement of the locking arm, characterized by generally wedge-shaped first and second members (72,73) having housing-engagement surfaces (74,75) for engaging respective opposing walls (41), and opposing latching surfaces (78,81) for latchable engagement with each other when the housing-engagement surfaces are engaged with the opposing walls.

2. A connector-latching device as claimed in claim 1, wherein a hinge (71) links the first and second members (72,73) together.

3. A connector-latching device as claimed in claim 1 or 2, wherein the housing-engagement surfaces have engaging barbs (76,77).

4. A connector-latching device as claimed in claim 1, 2 or 3, wherein one (78) of the latching surfaces has engaging steps (79) and the other (81) of the latching surfaces is defined by a resilient latching arm (82) engageable with the steps.

5. A connector-latching device as claimed in claim 1, 2, 3 or 4, wherein a cover (85) is located on the first member (72) and covers an operating member (37) of the locking arm (34).

6. A connector-latching device (170,270) for positioning under a resiliently displaceable locking arm (34) disposed between opposing walls (41) of a housing (31) of a connector (30) when the latter is coupled with a mating connector (50) and for preventing displacement of the locking arm, characterized by a rigid base (171,271) and at least one elastic member (172,272) fitted into and supported in the base, the elastic member being deformable by the housing so that the connector-latching device is held in engagement with the opposing walls (41) of the connector when inserted under the locking arm.

7. A connector-latching device as claimed in claim 6, including two elastic members (172) disposed along opposite sides of the base (171) and engageable with respective opposing side walls (41) when the connector-latching device is inserted under the locking arm (34).

8. A connector-latching device as claimed in claim 7, wherein the elastic members (172) are disposed in generally triangular-shaped cavities (174) along opposite sides of the base (171), each elastic member including a generally arcuate surface (176).

9. A connector-latching device as claimed in claim 6,

wherein the elastic member (272) is located in a holding chamber (273) disposed approximately centrally of the base (271).

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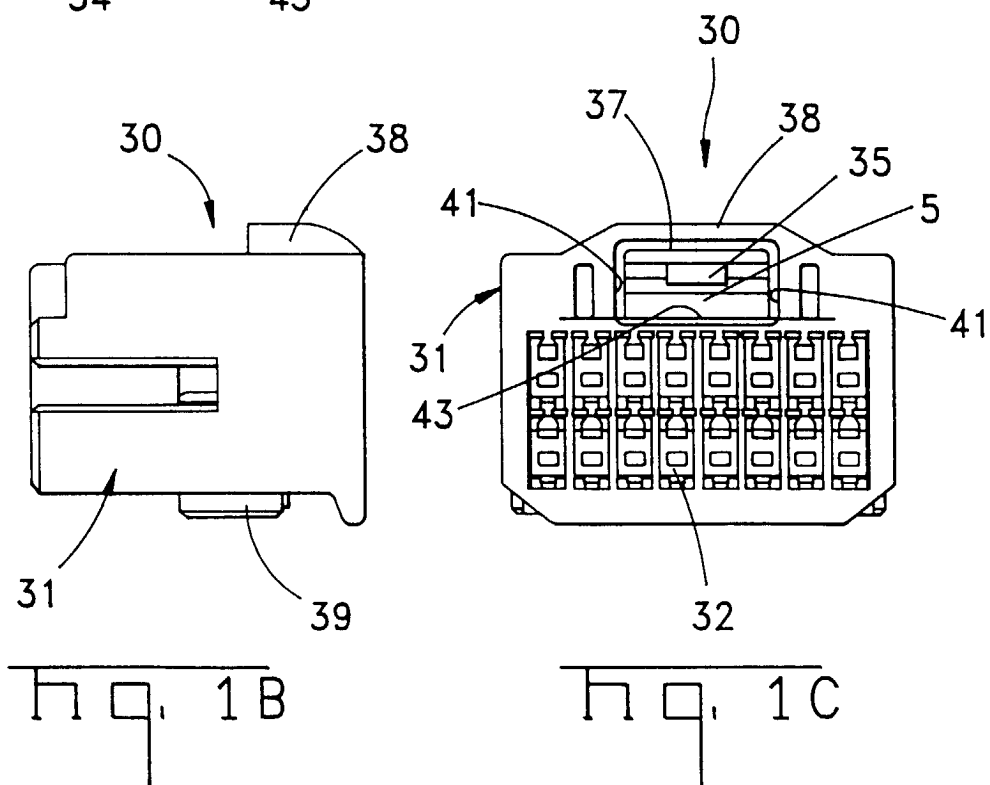
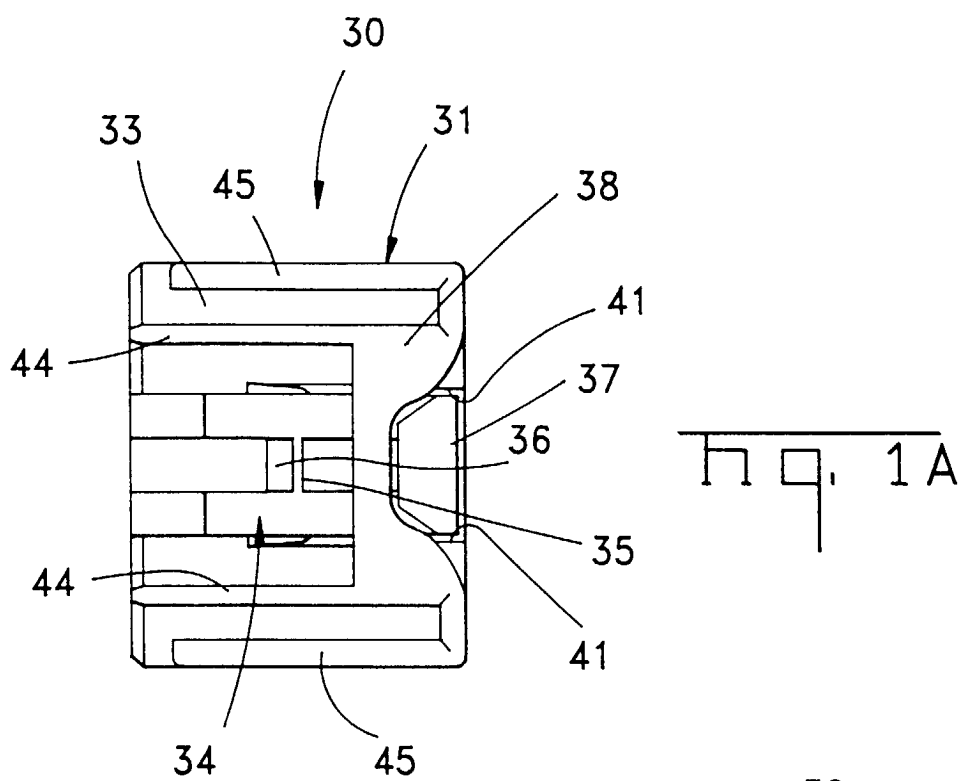
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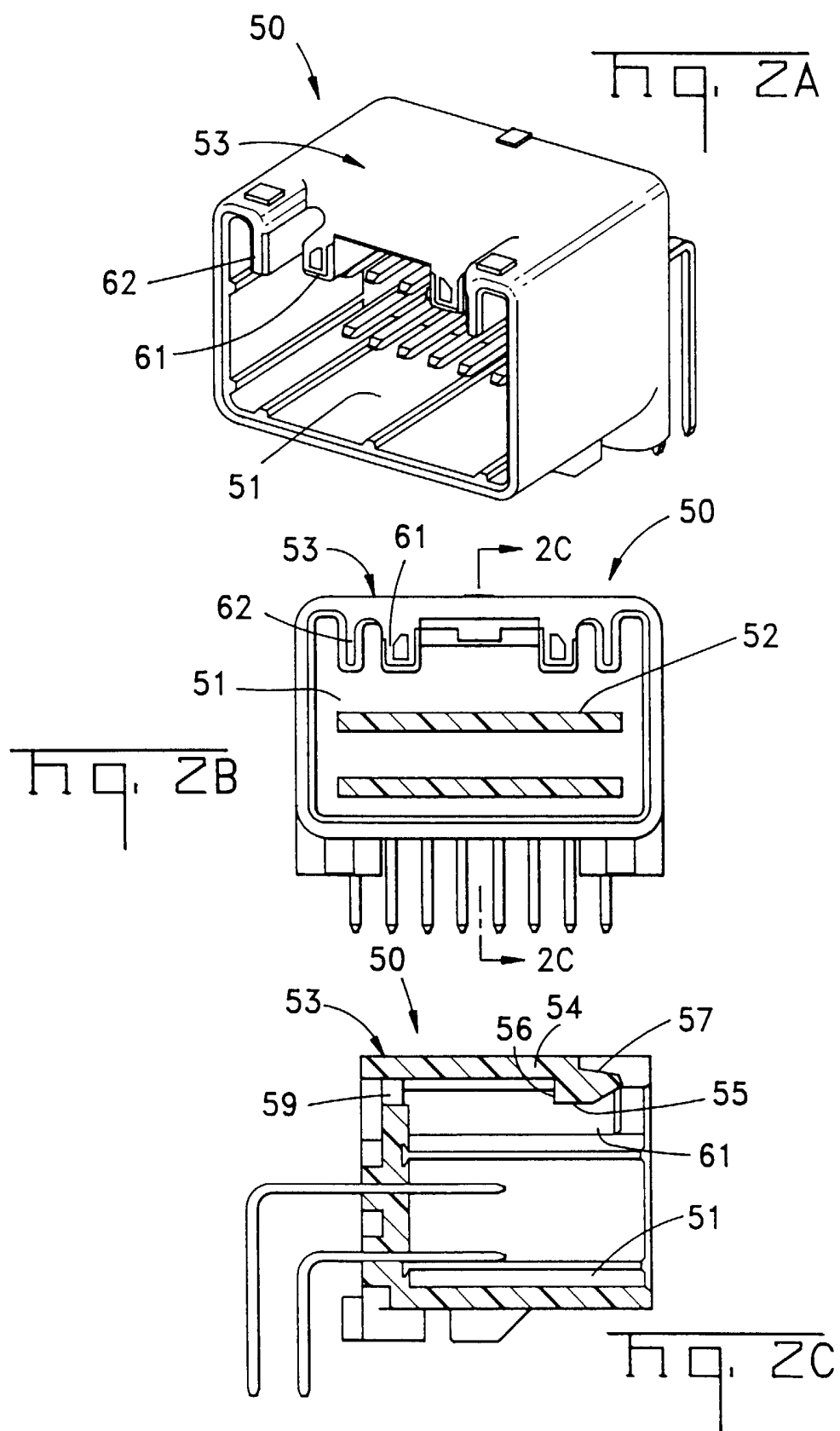
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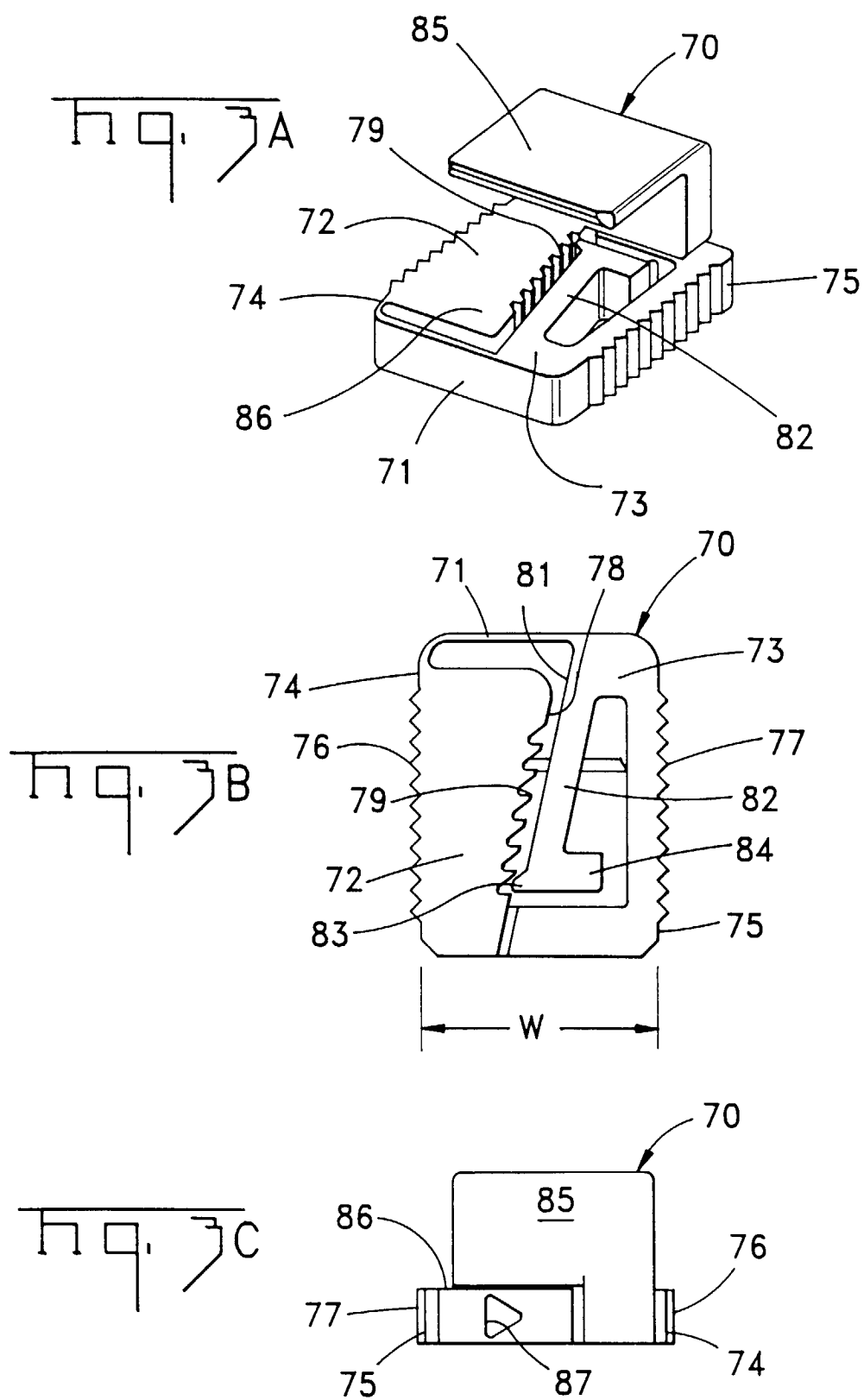
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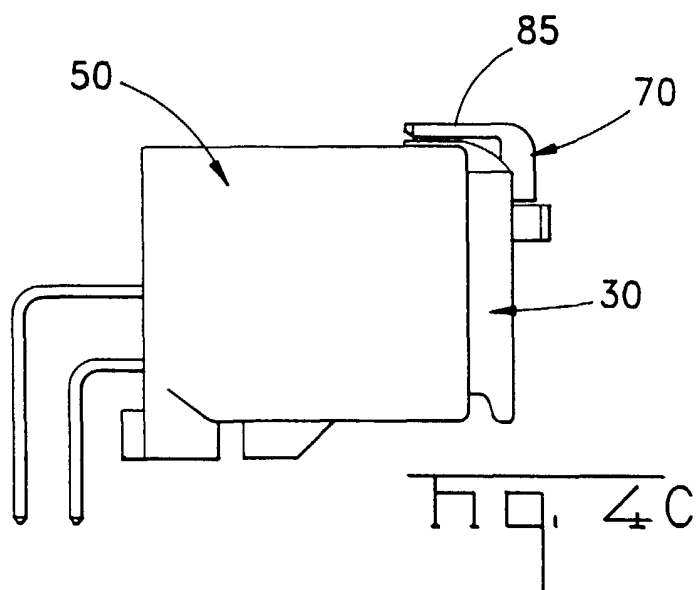
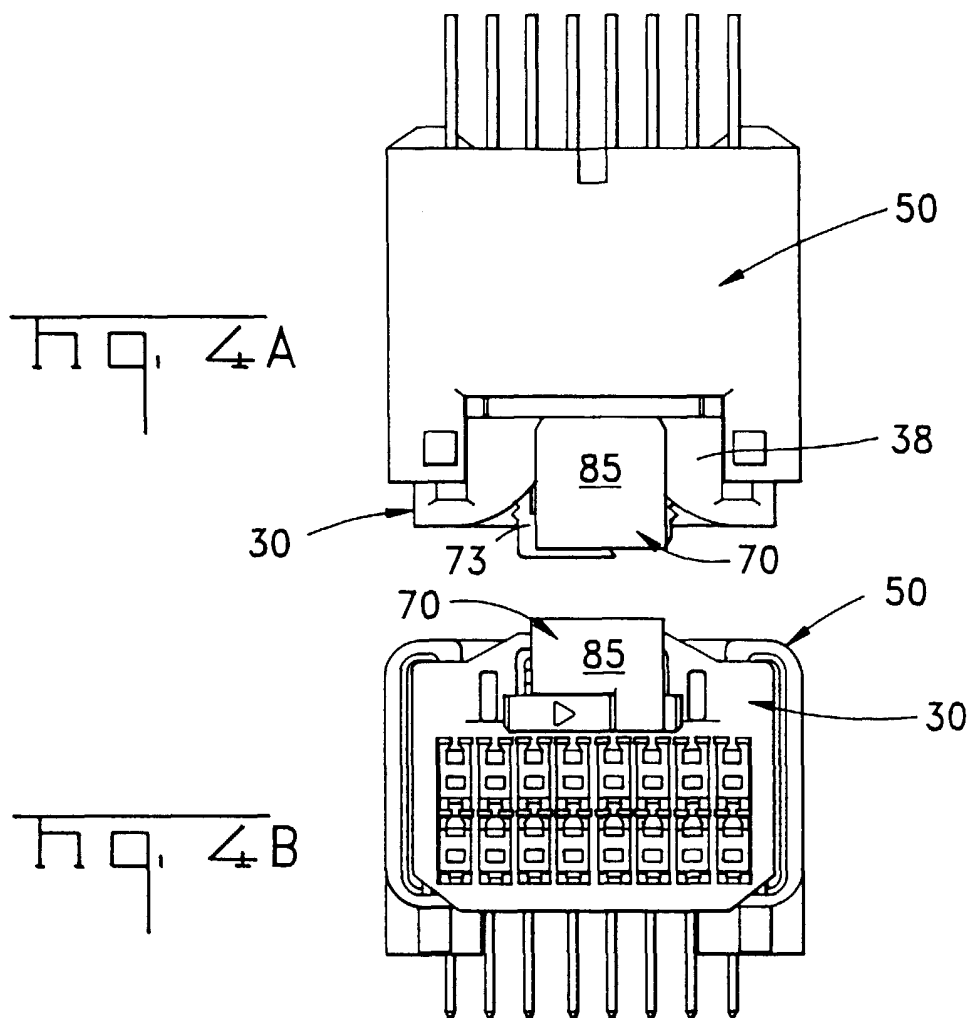
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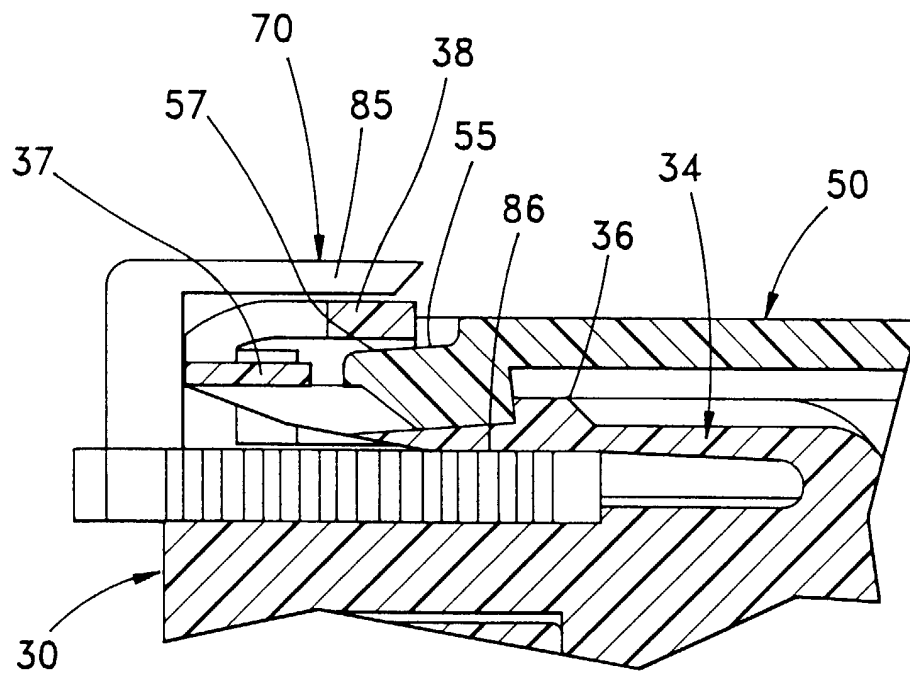


Fig. 5

