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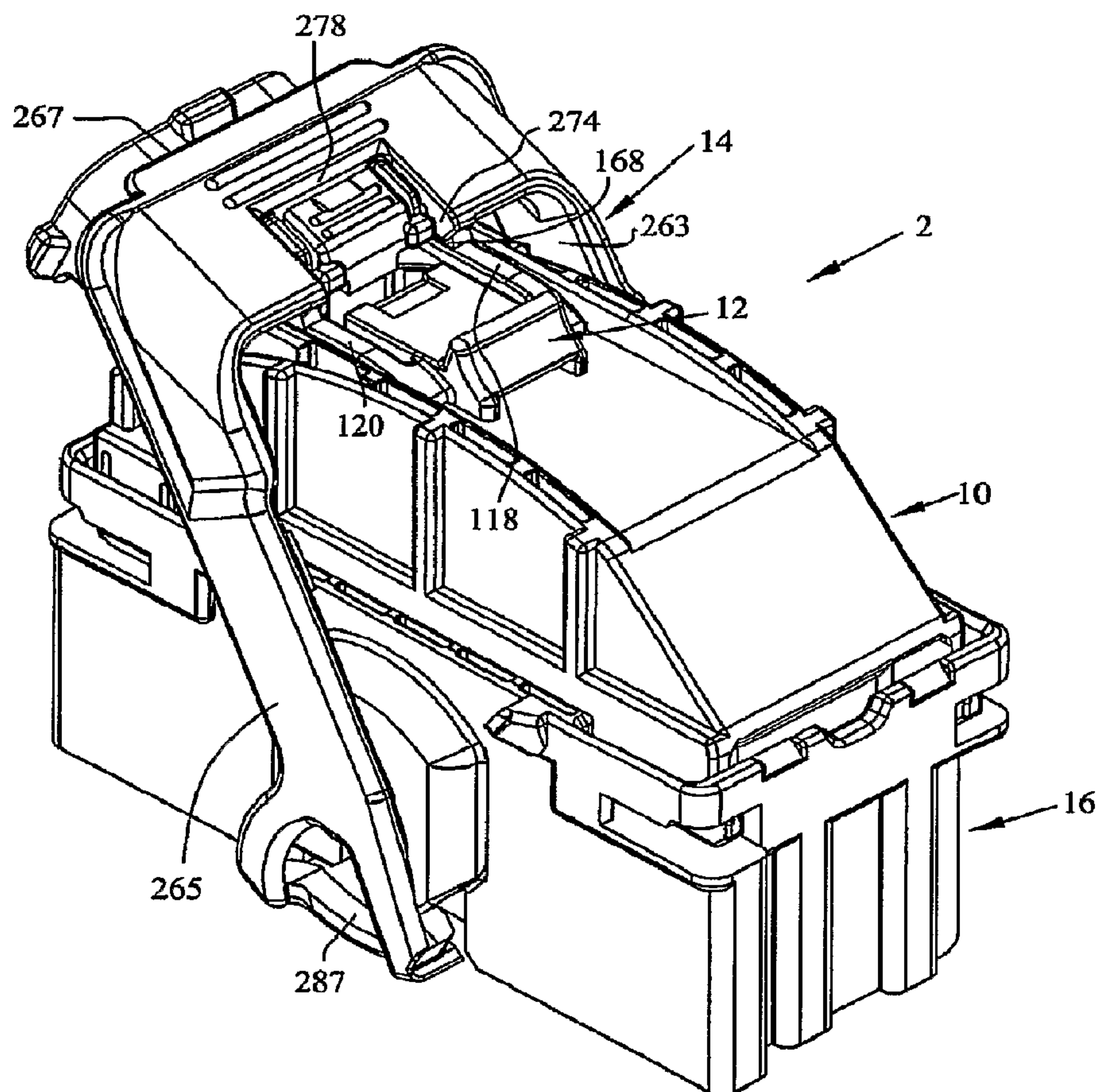
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(54) Title: LEVER MATED CONNECTOR ASSEMBLY



(57) Abrégé/Abstract:

A lever mated connector assembly including a housing (16) configured to mate with a header, a wire guide (10) mounted to the housing having a latch (86) with a retaining surface (96), and a lever (14) having a catch (278) with a retaining surface and being

(57) Abrégé(suite)/Abstract(continued):

coupled to the housing for rotational movement between an unlocked position and a locked position wherein the catch retaining surface engages the latch retaining surface to inhibit movement of the lever out of the locked position. A connector position assurance (CPA) member (12) has an interengaging locking assembly (67, 73; 131, 133) connecting to the CPA member to the wire guide in a low profile configuration for movement between a first position and a second position. The CPA is attached to the wire guide by way of a dovetail interlocking arrangement comprised of dovetail slot (67a, 73a) and dovetail flange (131a, 133a). The wire guide and latch are provided with an overstress mechanism (83a, 85a; 97) to prevent over extension of the latch to a position where the latch would be plastically deformed.

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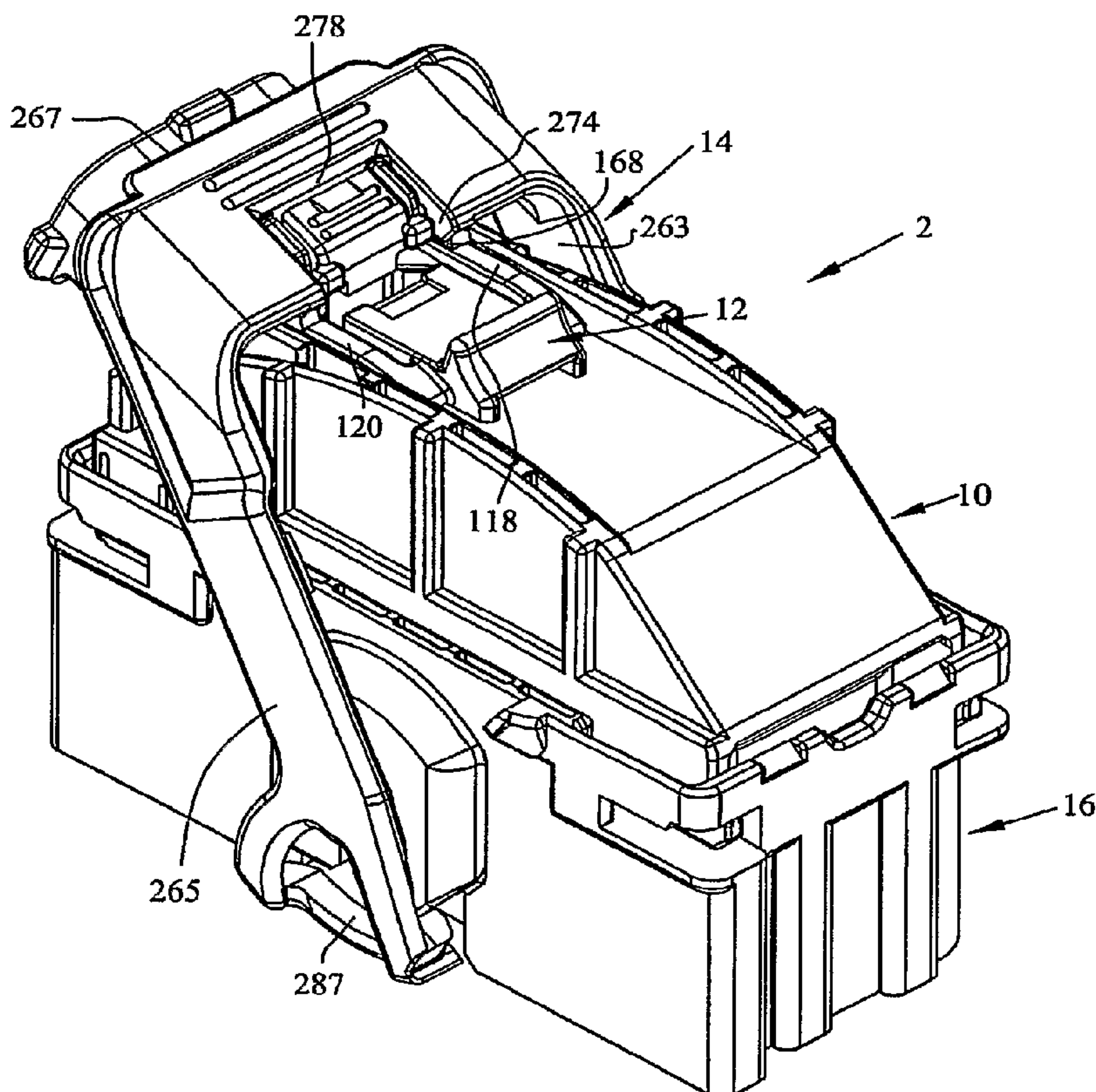
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LEVER MATED CONNECTOR ASSEMBLY

FIELD OF THE INVENTION

[0001] The present invention generally relates to connectors, and more particularly to a lever mated connector assembly.

[0002] In certain applications, electrical connectors must be securely mated to one another to prevent disconnection of the electrical signals routed through the connector conductors. For example, in automotive applications wherein electrical signals are routed to safety equipment such as air bag deployment systems or other systems relating to the operational or safety features of the vehicle, disconnection of the electrical signals as a result of accident, negligence, or operating conditions such as vibration, etc. may result in undesirable consequences. Thus, some electrical connectors are coupled to connector assemblies that mechanically lock the electrical connectors in mating engagement with one another.

[0003] Some conventional connector assemblies include a housing that houses an electrical connector, a wire guide attached to the housing which helps to organize cable of the electrical connector, and a lever that couples the housing to a header housing. When in a locked position, the lever prevents disconnection of the housing from the header, which prevents disconnection of the mated electrical connectors.

[0004] In certain applications, if excessive force is applied to the assembly, the levers may disengage from the wire guide and permit disconnection of the mated electrical connectors. For that reason, some levers are further configured to latch into engagement with the wire guide when the lever is in the locked position to ensure that the lever is not unintentionally moved out of the locked position. As this latch may be used multiple times over the course of its life, and as its life is the same as that of the device in which it operates (in the case of automotive use, multiple years) it is desirable to not overstress the latch while disconnecting it.

[0005] For example U.S. Patent 6,558,176 shows an electrical connector having a wire guide having a latch with a retaining surface, and a lever having a catch with a retaining surface. The lever is movable between an unlocked position and a locked position wherein

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the catch retaining surface engages the latch retaining surface to inhibit movement of the lever out of the locked position.

[0006] The problem to be solved is to provide a lever locking connector assembly whereby the useful life of the lever and the latch which retains it in the locked position are increased.

[0007] The solution to the problem is provided by a connector assembly comprising a wire guide having a latch with a retaining surface, and a lever having a catch with a retaining surface. The lever is movable between an unlocked position and a locked position wherein the catch retaining surface engages the latch retaining surface to inhibit movement of the lever out of the locked position. The latch further comprises an overstress mechanism to prevent overextending the latch.

[0008] In other applications, connector housings are often configured with locking members attached to them. For example, U.S. Patent 4,370,013 shows a member locked to a top surface of a housing.

[0009] However, in many applications the space in which these connectors occupy must be kept to a minimum. One of the problems to be solved then, is to provide a low profile connector assembly, having full locking functionality but operating in a decreased volume envelope.

[0010] The solution to the problem is provided by connector assembly comprising a connector housing first portion having a top wall and a locking member is profiled to lie proximate to the top wall and having an upper surface. An interengaging locking mechanism is provided between the connector housing first portion and the locking member, the interengaging locking mechanism being positioned below the upper surface of the locking member.

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In one broad aspect of the invention there is provided a connector assembly, comprising: a connector housing first portion, having a top wall; a locking mechanism, profiled to lie proximate to the top wall and having an upper and lower surface; an interengaging locking mechanism, allowing movement of
5 the locking mechanism parallel to the top wall and locking the locking mechanism to the top wall in a direction normal to the top wall and provided between the connector housing first portion and the locking mechanism, the interengaging locking mechanism having a first locking portion positioned on the top wall of the connector housing, and a second portion extending from the lower surface of the
10 locking mechanism, the first and second portions extending only between the top wall of the connector housing and the lower surface of the locking mechanism.

In another broad aspect of the invention there is provided a connector assembly, comprising: a wire guide having a latch with a retaining surface; a lever having a catch with a retaining surface, the lever being movable
15 between an unlocked position and a locked position wherein the catch retaining surface engages the latch retaining surface to inhibit movement of the lever out of the locked position; a connector position assurance member having a locking surface, the connector position assurance member being moveable between a first position and a second position wherein the locking surface inhibits movement
20 of the latch, thereby further inhibiting movement of the lever out of the locked position; and an interengaging locking mechanism locking the connector position assurance member to the wire guide and provided between a first locking element which extends downwardly from a lower surface of the connector position assurance member and a second locking element which extends upwardly from
25 an upper surface of the wire guide to allow slidable movement of the connector position assurance member, the interengagement between the first and second locking elements, extending only between the top wall of the connector housing and the lower surface of the connector position assurance member.

[0011] The above mentioned and other features of this invention, and the manner of attaining them, will become more apparent and the invention itself will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, where:

[0012] Figure 1 is a perspective view of one embodiment of a lever mated connector assembly according to the present invention depicting the lever in an unlocked position;

[0013] Figure 2 is a view similar to that of Figure 1 showing the lever in a position just prior to a fully locked position, but with the CPA retracted;

[0014] Figure 3 is a view similar to that of Figure 1 showing the lever in a locked position, but with the CPA retracted;

[0015] Figure 4 is a perspective view of the wire guide showing the CPA attached to the wire guide in an unlocked position;

[0016] Figure 5 is a perspective view similar to that of Figure 4 with the CPA removed;

[0017] Figure 6 is an enlarged view of the latch portion of the wire guide of Figures 4 and 5;

[0018] Figure 7 is a cross sectional view through lines 7-7 of Figure 6;

[0019] Figure 8 is an underside perspective view of the wire guide;

[0020] Figure 9 is a front, top-side perspective view of the CPA shown in Figure 6;

[0021] Figure 10 is a front, underside perspective view of the CPA of Figure 9;

[0022] Figure 11 is a front perspective view of the CPA shown in Figure 9;

[0023] Figure 12 is a front plan view of the wire guide with the CPA removed; and

[0024] Figure 13 is a view similar to that of Figure 12 with the CPA in place.

[0025] Referring first to Figure 1, an embodiment of the invention will be described. As shown first in Figure 1, a lever mated connector assembly is shown at 2 comprised of a wire guide 10, a locking member in the form of a connector position assurance member

(CPA) 12, a rotatable lever 14 and a housing 16. It should be appreciated that, lever 14 is rotatable between the position of Figure 1, to the position of Figure 3 where it would be locked in place. CPA 12 acts as stop assuring that the rotatable lever stays in place in the locked position, as more fully described herein. It should also be appreciated that housing 16 would mate with a pin header as is known in the art.

[0026] As shown in Figures 4 and 5, wire guide 10 includes sidewalls 18 and 20 and end walls 22, defining an interior space 26. Wire guide 10 includes tabs 30 and 42 (Figure 8) which retain wire guide 10 to housing 16. As shown in Figure 5, wire guide 10 defines a CPA receiving portion 48, a lever retaining portion 50 and a wire shroud 52.

[0027] As best shown in Figure 6, CPA receiving portion 48 includes a top flat wall 54 with a retaining wedge or latch 56, defined by cutouts 58 molded in the plastic wire guide 10, and surrounding the latch 56. As shown in Figure 6, retaining wedge 56 includes a camming surface 60 together with a retaining surface 64. CPA receiving portion 48 further includes inner edges 66 and 72, where edges 66, 72 flank dovetail flanges 67, 73. As shown best in Figures 6 and 7 dovetail flanges 67 and 73 include outwardly extending ridges 68 and 74, respectively, which define dovetail surfaces 67a, 73a as best shown in Figure 12. As also shown in Figure 6, ribs 75 flank dovetail flanges 67, 73 and define stop edges 77, as best shown in Figure 7.

[0028] With respect still to Figures 6 and 7, lever retaining portion 50 intersects with CPA receiving portion 48 to define an opening 80, through which a portion of CPA 12 will be received, as further described herein. Lever retaining portion 50 further includes flats 82 and 84 which define abutting surfaces 82a, 84a, respectively as best shown in Figure 6. As best shown in Figures 6 and 7, flat 82 has an upstanding wall 83 defining a forwardly directed engaging surface 83a, and flat 84 has an upstanding wall 85 defining a forwardly directed engaging surface 85a (Figure 7).

[0029] Again with respect to Figures 6 and 7, walls 83 and 85 flank cantilever latch 86 which is defined by cutouts 88 and 90 (Figure 7) through flats 82, 84. Cantilever latch 86 extends from wire guide 10 by way of cantilever arms 91 as shown in Figure 7. The front edge of cantilever latch 86 includes a cam surface 92 which continues upwardly to define an upper surface 94 having tactile ribs 95.

[0030] Cantilever latch 86 includes a retaining surface at 96 for locking with lever 14 as will be described herein. Cantilever latch 86 further includes two overstress wings 97 which extend to a width greater than front edges 83a, 85a, to define an overstress stop for cantilever latch 86 as will also be further described herein.

[0031] With respect now to Figure 8, recesses 98, 100 are shown which will receive a portion of CPA 12, as further described herein. Finally as shown in Figures 4 and 5, wire shroud 52 is defined by distal edge 102, shroud sidewalls 103, 104 together with upper wall 106 (Figure 4), to define shroud opening 108 (Figure 8). As shown in both Figures 7 and 8, cantilever latch 86 includes a lower edge 101, which will be used as a locking surface as described herein.

[0032] With reference now to Figure 9-11, CPA 12 will be described in greater detail. CPA 12 includes a body 116 having arms 118, 120 flanking body 116. Body 116 includes base portion 122, an extension 123 having an upper wall 124. Rails 131 and 133 extend downwardly from lower wall 132 of body 116. Rails 131 and 133 define dove tail slots having dove tail surfaces 131a, 133a as best shown in Figure 11. It should be appreciated that these cooperate with dove tail surfaces 67a, 73a described above.

[0033] CPA 12 further includes a push ridge 135 for longitudinal movement of CPA 12. With respect to Figure 10, CPA 12 includes stop edges 140, 141, as well as includes a retaining wall 150 which cooperates with cam surface 156 in order to lock CPA to wire guide 10 as described herein. With respect to Figure 9, arm 118 includes a retaining wedge 162, having cam surface 164 and forward surface 166. In a like manner retaining wedge 168 is positioned at a distal end of arm 120, having a cam surface 170 and a forward surface 172.

[0034] With reference again to Figures 1 and 2, lever 14 includes handle 261 having support arms 263 and 265, where handle 261 has forward edge 267 and upper surface 271. Cams 274 (Figure 2) flank arms 118, 120 and are profiled to contact retaining wedges 162, 168, as best shown in Figure 1, upon rotation. Lever handle 261 further includes catch 278 having a retaining surface profiled for engagement against retaining surface 96 of cantilever latch 86 as will also be described herein.

[0035] With the items as described above, the assembly and operation of assembly 2 will now be discussed in further detail. With respect first to Figures 4 and 13, CPA 12 is shown positioned in the CPA receiving portion 48 and retaining wedge 56 would be positioned adjacent to retaining wall 150 (Figure 10) to retain CPA 12 to wire guide 10. As shown in Figure 12 and 13, due to the dovetail surfaces 67a, 131a, 73a, 133a, the CPA 12 is held fixedly mounted to the wire guide 10. The dovetail configuration also provides a low profile mounting arrangement. The CPA 12 is movable between the extreme positions where interaction of retaining surface 64 and retaining wall 150 define the fully retracted position, and where interaction of stop edges 77 and stop edges 140, 141 define the fully forward position.

[0036] When the connector is in the position of Figure 1, CPA 12 cannot move forwardly, as forward surfaces 166 and 172 (Figure 9) abut corresponding surfaces 82a, 84a (Figure 6). However when the lever 14 is rotated to the position of Figure 2, cam surfaces 274 of lever 14 (Figure 2) interact with cam surfaces 164, 170 (Figure 9) to deflect arms 118, 120 downwardly. However, the lever 14 must be mated and latched to retaining surface 96, as shown in Figure 3, before the CPA 12 can be slid forward to the fully locked position. CPA 12 is slid forwardly such that recess 158 (Figure 9) is received under lower edge 101 (Figure 7) of cantilever latch 86. When in this position, retaining wedges 162 and 168 are received in corresponding recesses 98, 100, holding the CPA 12 in the latched position. When CPA 12 is slid forward, it acts as a stop for the wire guide latch 86, preventing deactivation of the latching feature by preventing rotation of the latch 86.

[0037] To disengage the lever, CPA 12 is moved back to the position of Figure 3 and the upper surface 94 and tactile ribs 95 are depressed disengaging retaining surface 96 from catch 278. It should be appreciated that overstress wings 97 prevent breaking cantilever latch 86, or overstressing cantilever arms 91 as the overstress wings 97 will engage respective surfaces 83a, 85a preventing any overstress.

[0038] As described, CPA 12 and wire guide 10 are provided with an interengaging locking mechanism by way of dovetail flanges 67, 73 and dovetail slots defined by surfaces 131a and 133a. This interengagement is provided between lower wall 132 of CPA 12, and flat wall 54 of the wire guide 10. As shown in Figure 13, all of this interengagement is

provided below upper wall of 124 of the CPA 12. This places the CPA 12 in close proximity to the wire guide 10, which reduces the "overhead room" required and allows the lever to have a shallow swing radius. This provides for a reduced volume environment for the installation and operation of the entire assembly.

[0039] As described, latch 86 is protected along its sides by walls 83, 85. These walls also upstand to the same vertical dimension as the latch, preventing inadvertent actuation of the latch. The overstress wings 97 flank the edges 83a, 85a (Figure 7) and will contact them to prevent an overstress situation.

[0040] It should also be appreciated that the assembly provides for an ergonomic design, for example a user may place an index finger beneath forward edge 267 of lever 14, while at the same time placing a thumb on top of upper surface 94 and tactile ribs 95, whereby cantilever latch 86 may be depressed by the thumb for release.

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CLAIMS:

1. A connector assembly, comprising:
 a connector housing first portion, having a top wall;
 a locking mechanism, profiled to lie proximate to the top wall and
 5 having an upper and lower surface;
 an interengaging locking mechanism, allowing movement of the
 locking mechanism parallel to the top wall and locking the locking mechanism to
 the top wall in a direction normal to the top wall and provided between the
 connector housing first portion and the locking mechanism, the interengaging
 10 locking mechanism having a first locking portion positioned on the top wall of the
 connector housing, and a second portion extending from the lower surface of the
 locking mechanism, the first and second portions extending only between the top
 wall of the connector housing and the lower surface of the locking mechanism.
2. The connector assembly of claim 1, wherein the connector housing
 15 first portion is defined as a wire guide.
3. The connector assembly of claim 2, further comprising a connector
 housing second portion, for retaining a plurality of electrical terminals.
4. The connector assembly of claim 3, wherein the wire guide is
 attached to a rear face of the connector housing second portion, and is profiled to
 20 guide wires therethrough.
5. The connector assembly of claim 4, wherein a lever is attached to
 sidewalls of the connector housing second portion, and rotates over the locking
 mechanism.
6. The connector assembly of claim 5, wherein the wire guide includes
 25 a latch which latches the lever to the wire guide.

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7. The connector assembly of claim 6, wherein the locking mechanism is profiled as a connector position assurance member and is slidably receivable under the latch, to prevent disconnection of the lever.
8. The connector assembly of claim 7, wherein the interengaging locking mechanism is provided as a dovetail slot and dovetail flange configuration.
9. The connector assembly of claim 1, wherein the interengaging locking mechanism is provided as a dovetail slot and dovetail flange configuration.
10. The connector assembly of claim 9, wherein the upper surface is provided with dovetail flanges therealong, which interengage with complementary dovetail surfaces on a lower surface of the locking mechanism.
11. The connector of claim 10, wherein a latching assembly is provided between the upper surface and the locking mechanism.
12. The connector of claim 11, wherein the latching assembly is provided between the dovetail slot and dovetail flange configuration.
13. The connector assembly of claim 1, further comprising a stop mechanism provided between the connector housing first portion and the locking mechanism, the stop mechanism being provided by complementary stop surfaces to define extreme positions of the locking mechanism.
14. A connector assembly, comprising:
 - a wire guide having a latch with a retaining surface;
 - a lever having a catch with a retaining surface, the lever being movable between an unlocked position and a locked position wherein the catch retaining surface engages the latch retaining surface to inhibit movement of the lever out of the locked position;
 - a connector position assurance member having a locking surface, the connector position assurance member being moveable between a first position

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and a second position wherein the locking surface inhibits movement of the latch, thereby further inhibiting movement of the lever out of the locked position; and

an interengaging locking mechanism locking the connector position assurance member to the wire guide and provided between a first locking element
5 which extends downwardly from a lower surface of the connector position assurance member and a second locking element which extends upwardly from an upper surface of the wire guide to allow slidable movement of the connector position assurance member, the interengagement between the first and second locking elements, extending only between the top wall of the connector housing
10 and the lower surface of the connector position assurance member.

15. The connector assembly of claim 10, wherein the second locking element on the wire guide includes dovetail flanges for guiding movement of the connector position assurance member between the first position and the second position.

15 16. The connector assembly of claim 11, wherein the first locking element on the connector position assurance member includes dovetail slots that move within the pair of dovetail flanges as the connector position assurance member moves between the first position and the second position.

17. The connector assembly of claim 10, wherein the wire guide
20 includes a retaining wedge having a retaining surface that engages a retaining surface formed on the connector position assurance member to prevent the connector position assurance member from moving in a first direction out of the first position.

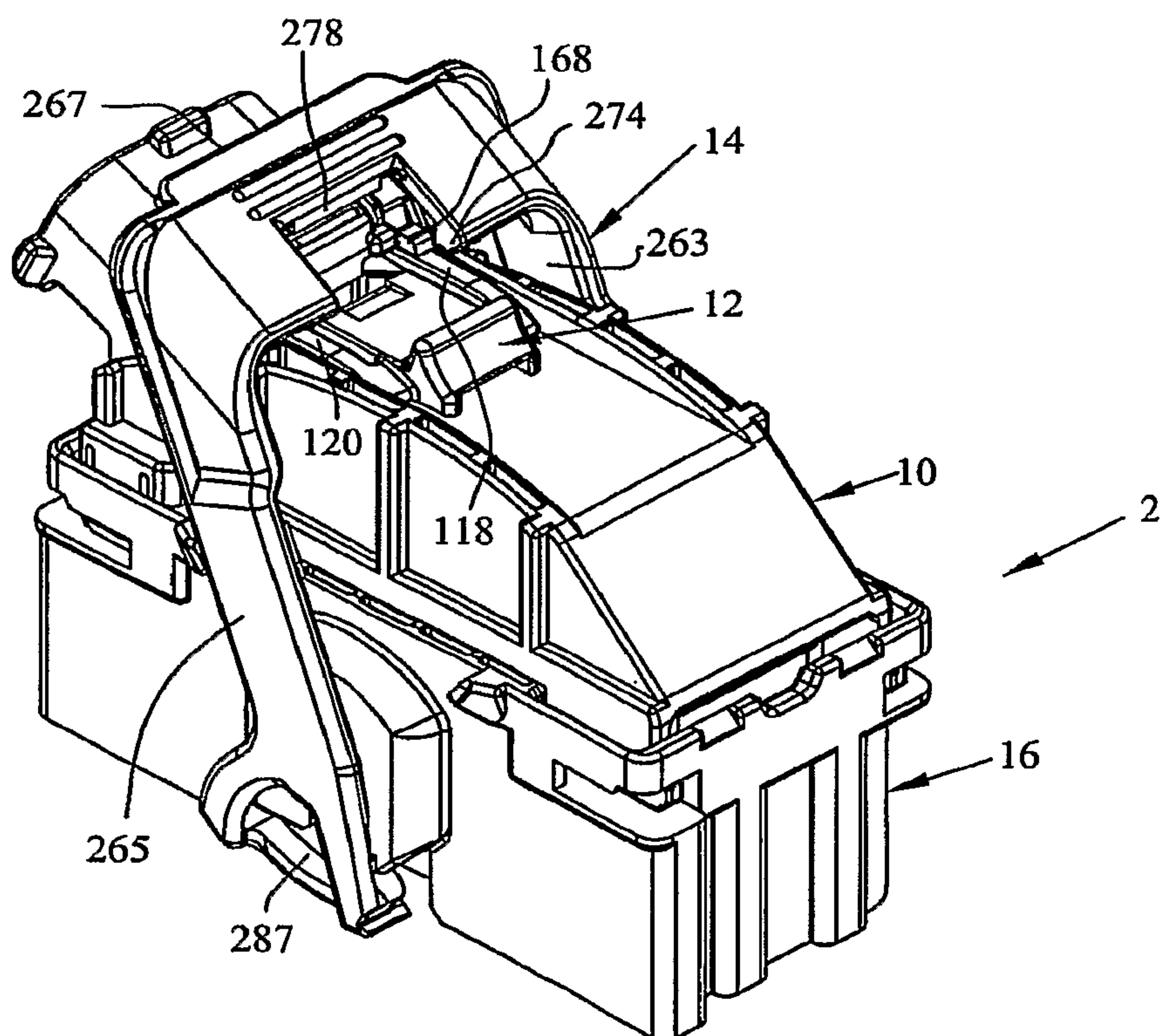
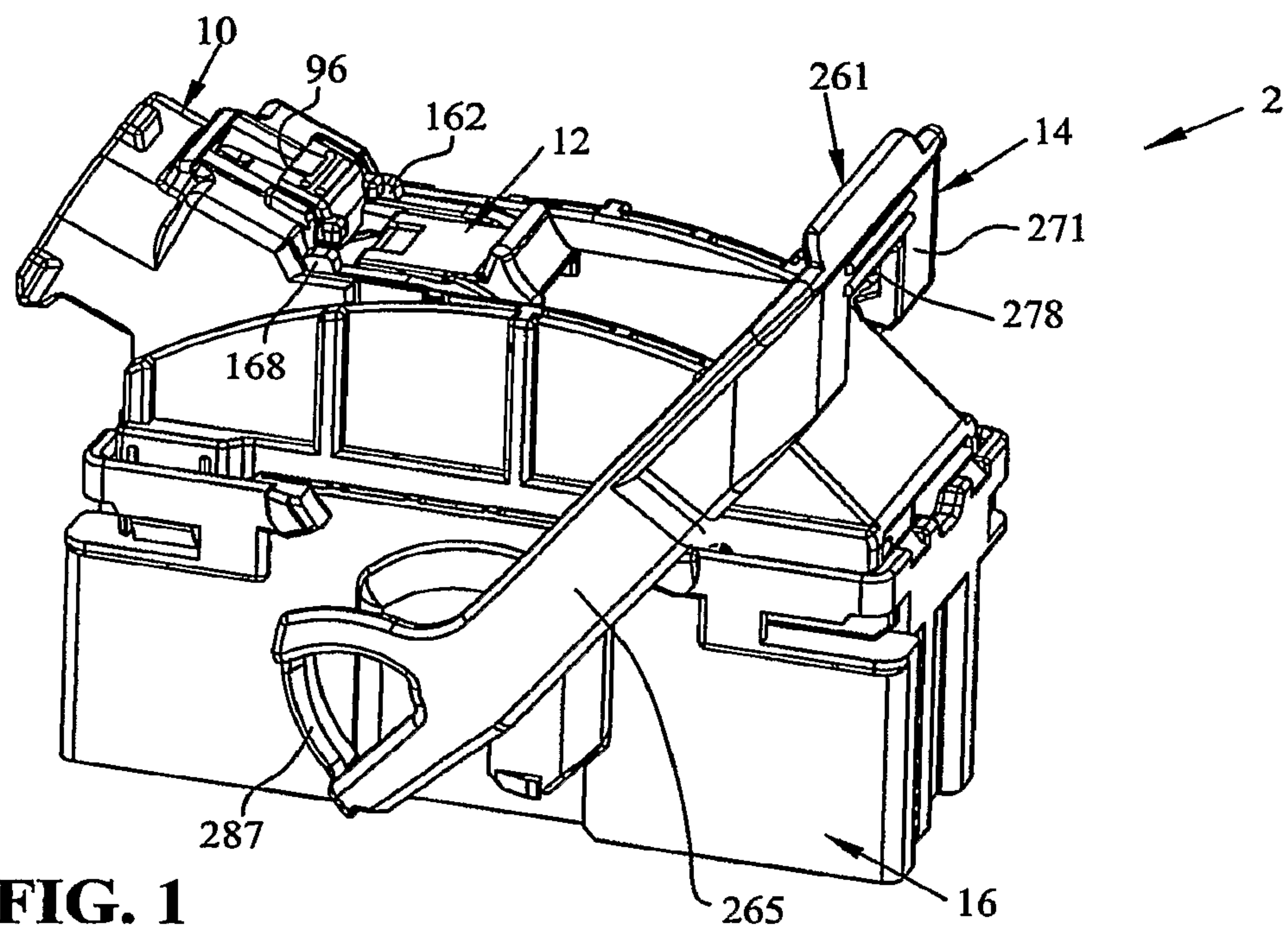
18. The connector assembly of claim 14, wherein the connector position
25 assurance member includes a push ridge for use in moving the connector position assurance member between the first position and the second position.

19. The connector assembly of claim 14, further including a housing having one end for receiving the wire guide and another end configured to mate with a header.

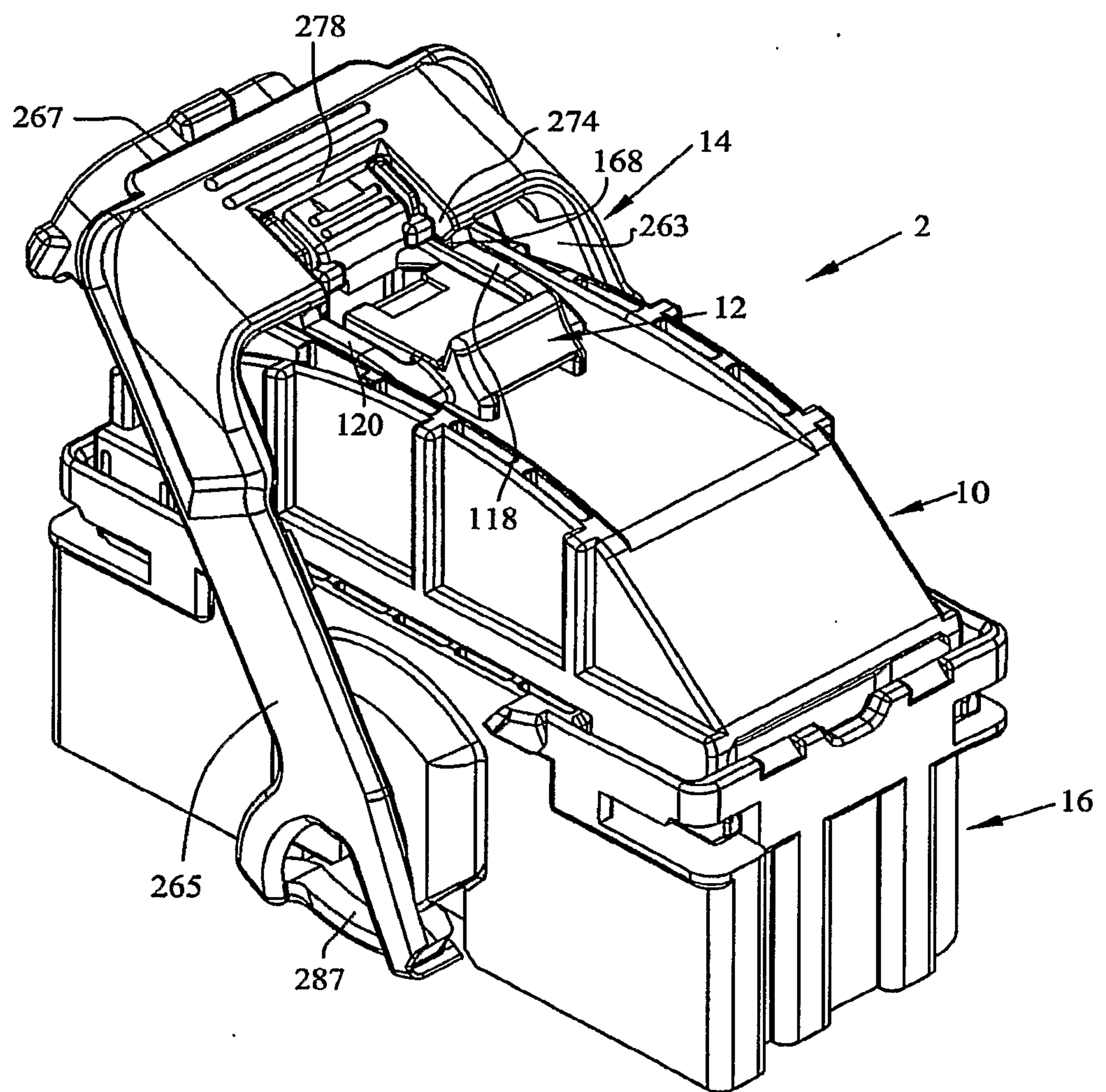
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20. The connector assembly of claim 19, wherein the lever includes a pair of gears that engage a corresponding pair of grooves formed on the housing as the lever is moved from the unlocked position to the locked position, thereby drawing the housing toward the header.

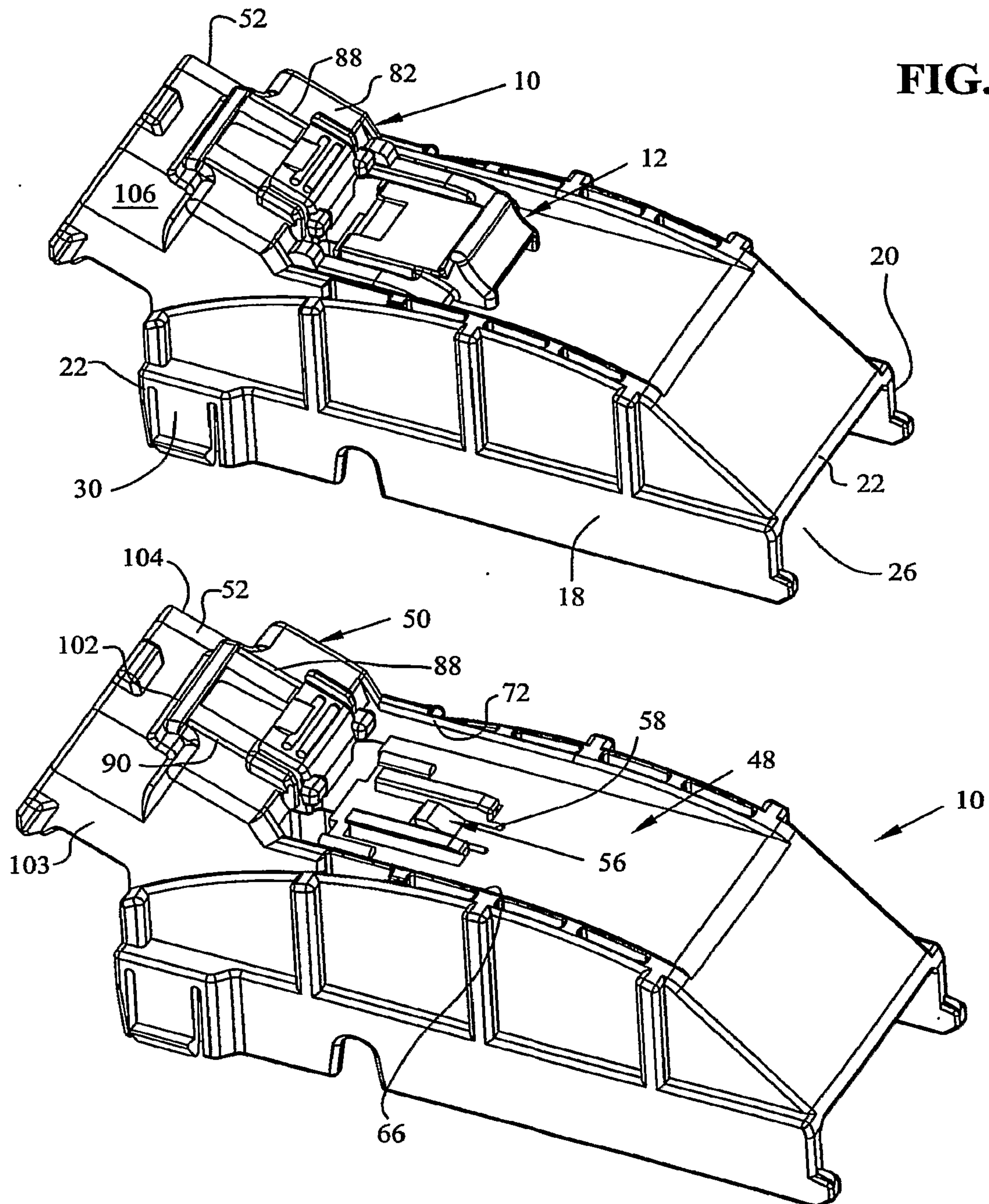
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**FIG. 3**

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FIG. 4**FIG. 5**

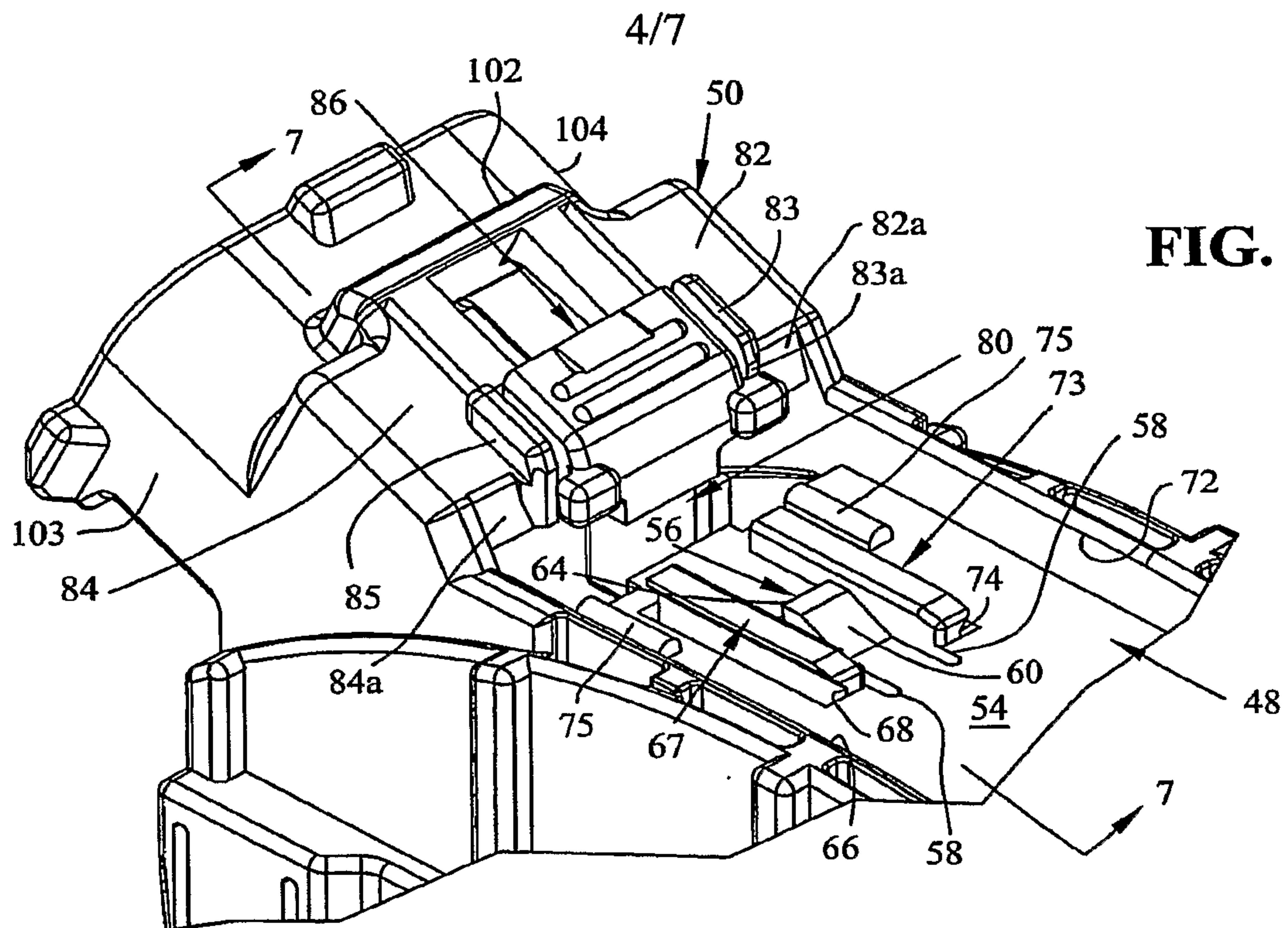


FIG. 6

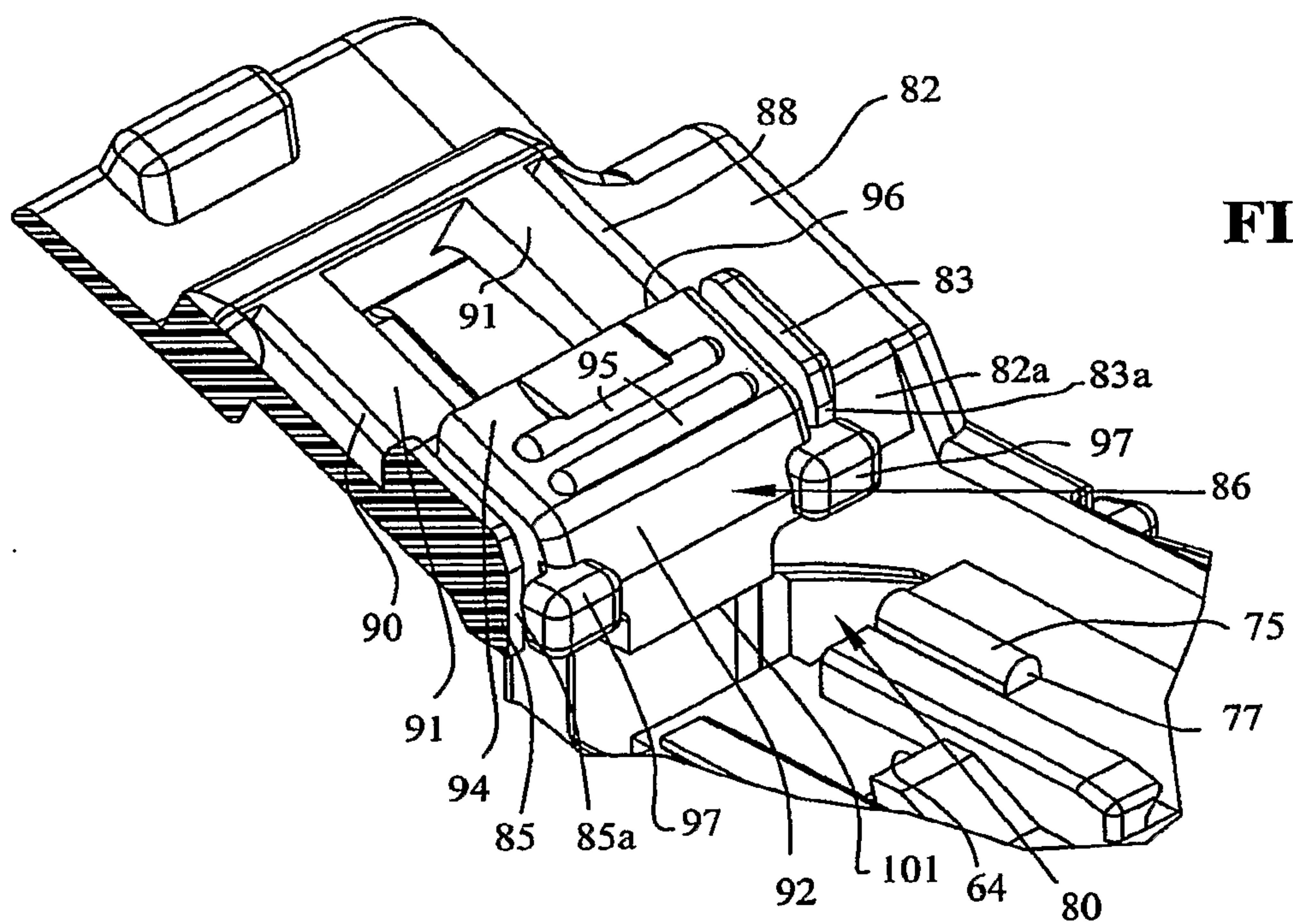
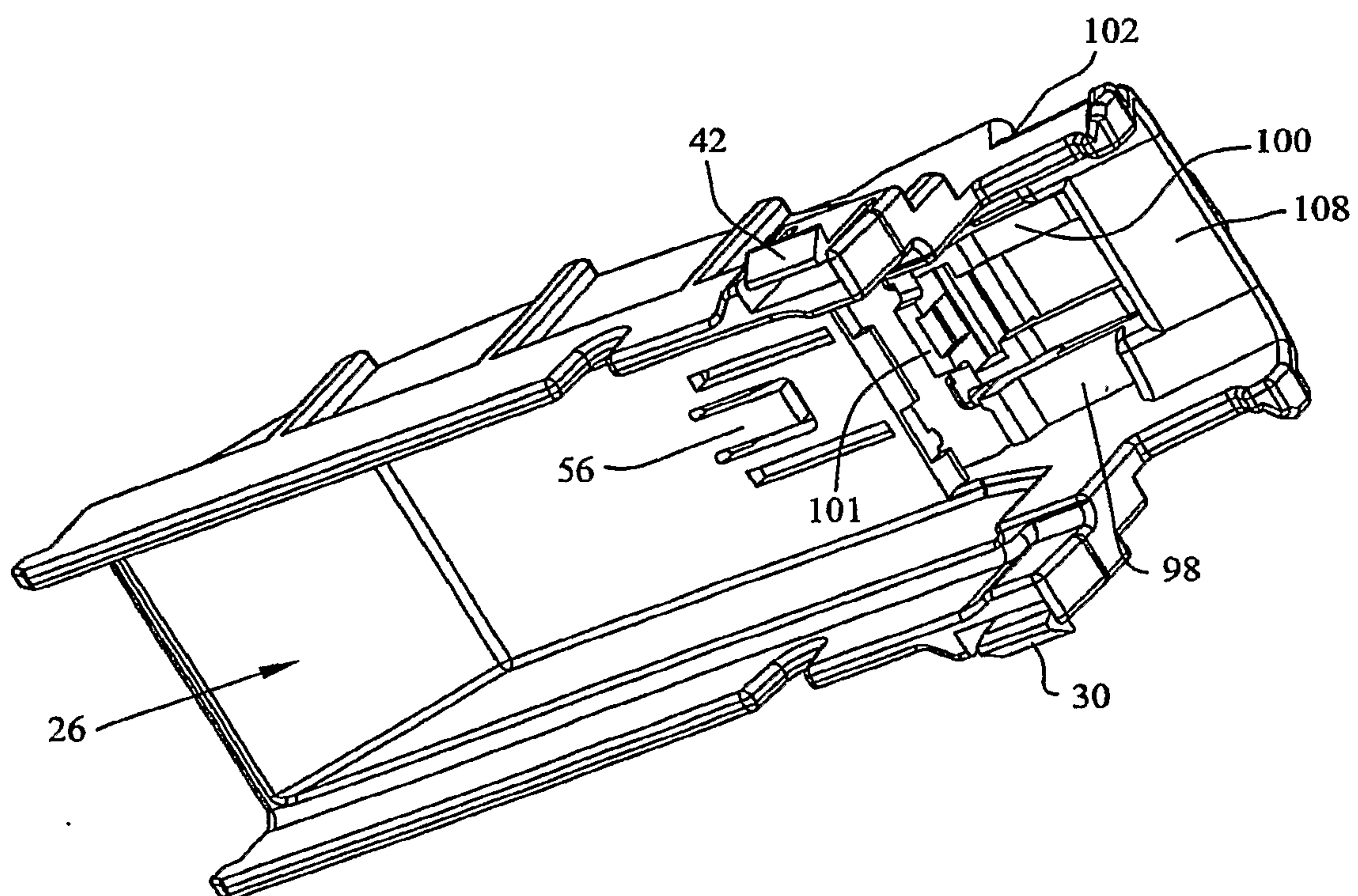


FIG. 7

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**FIG. 8**

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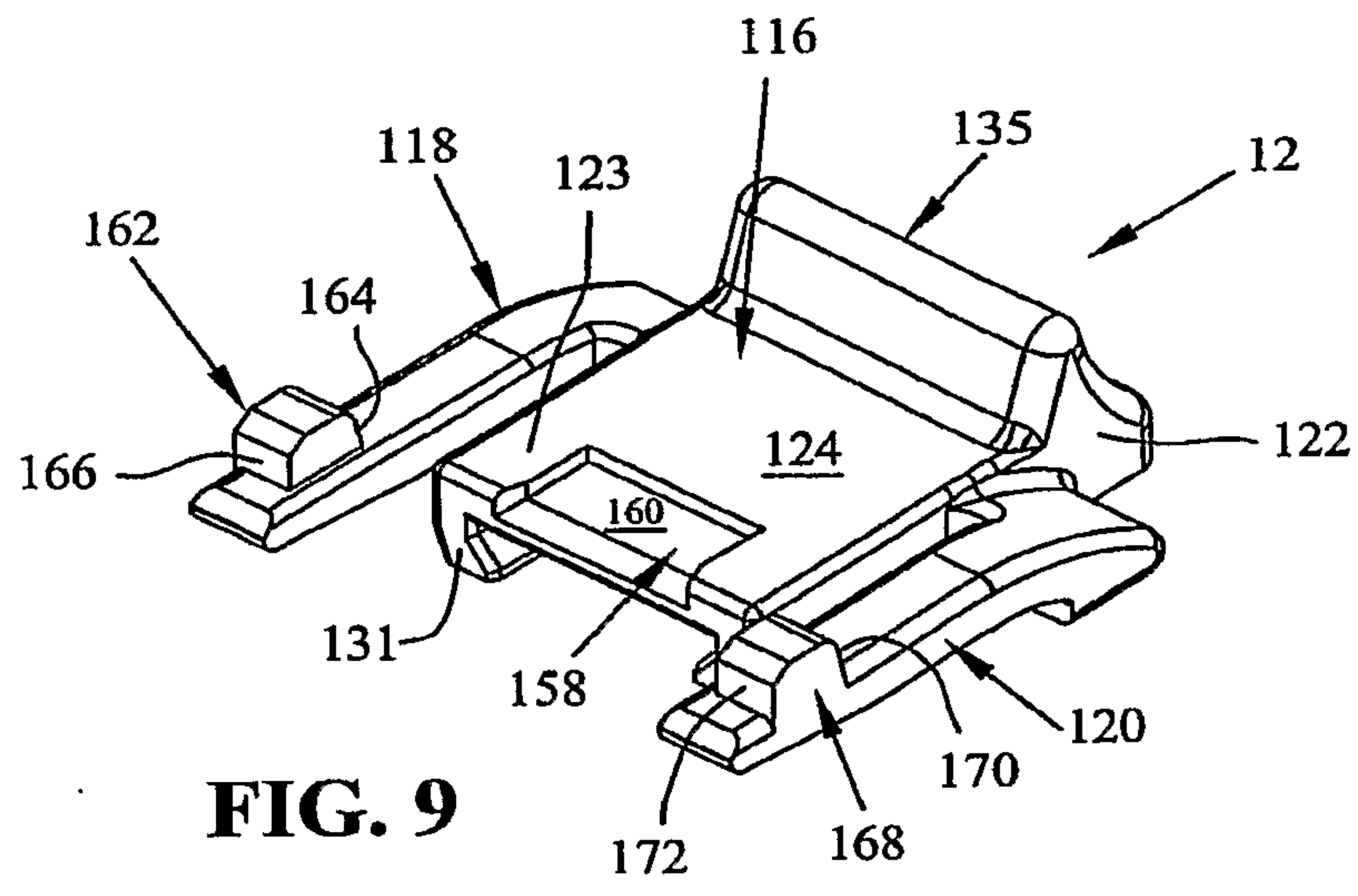


FIG. 9

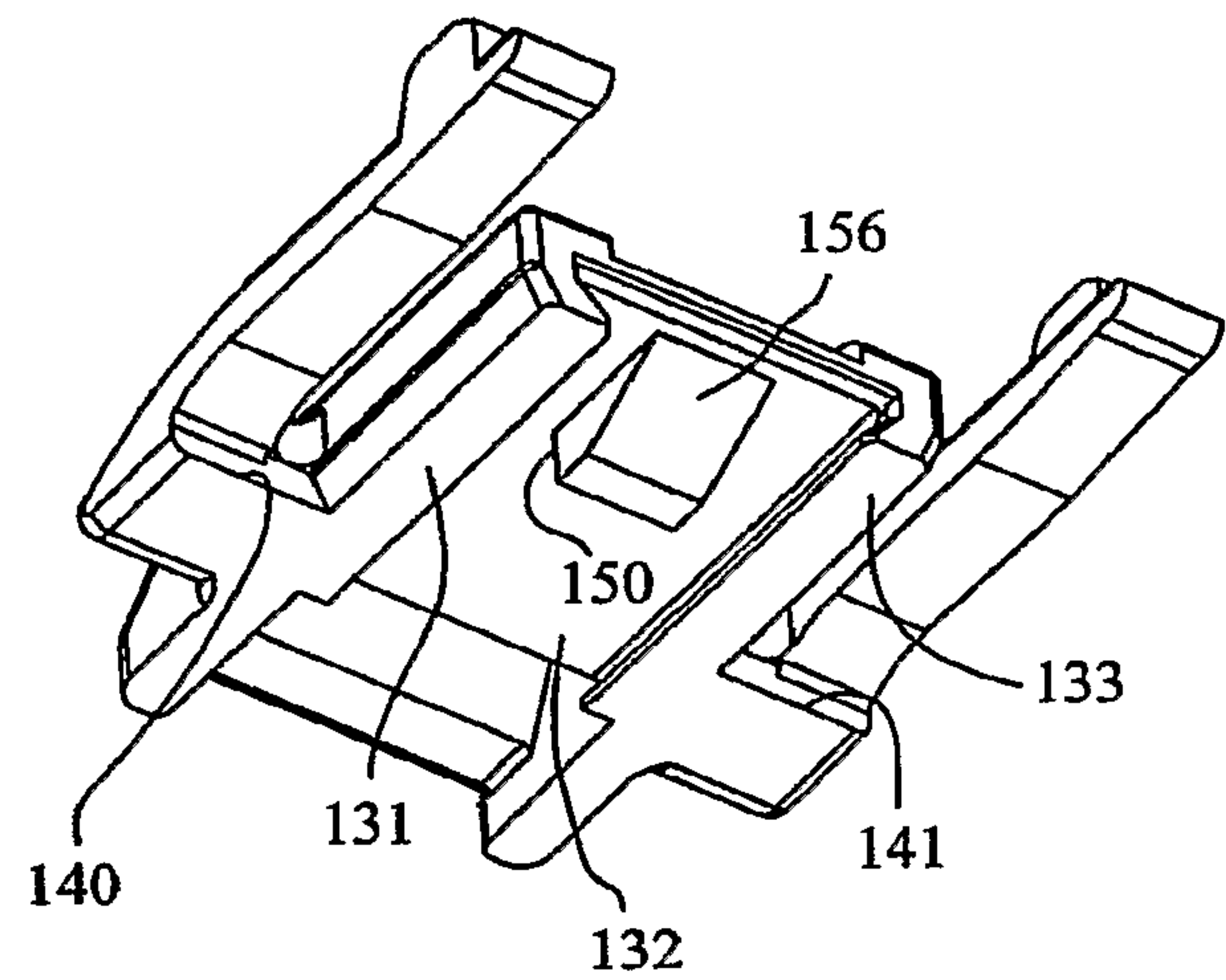


FIG. 10

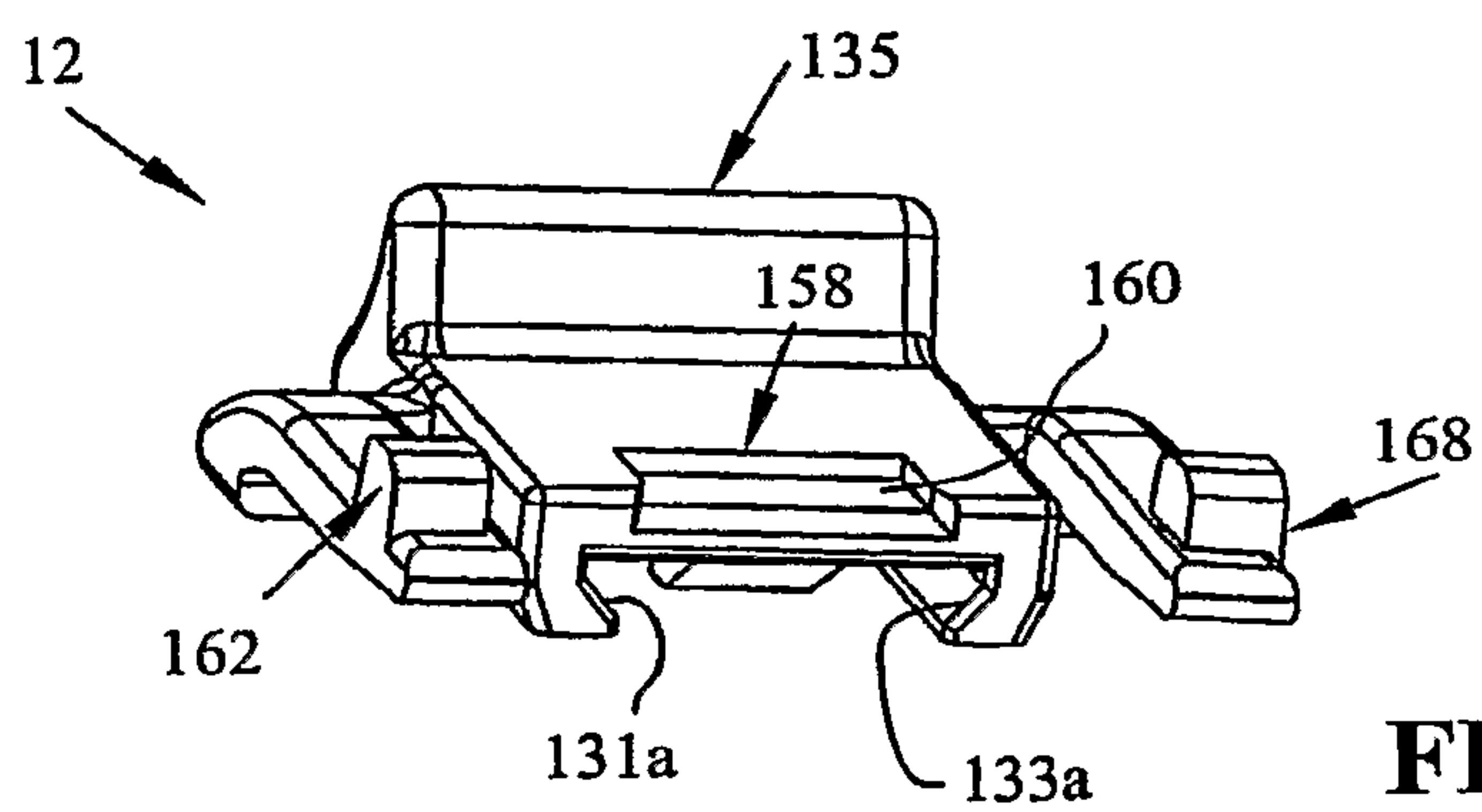
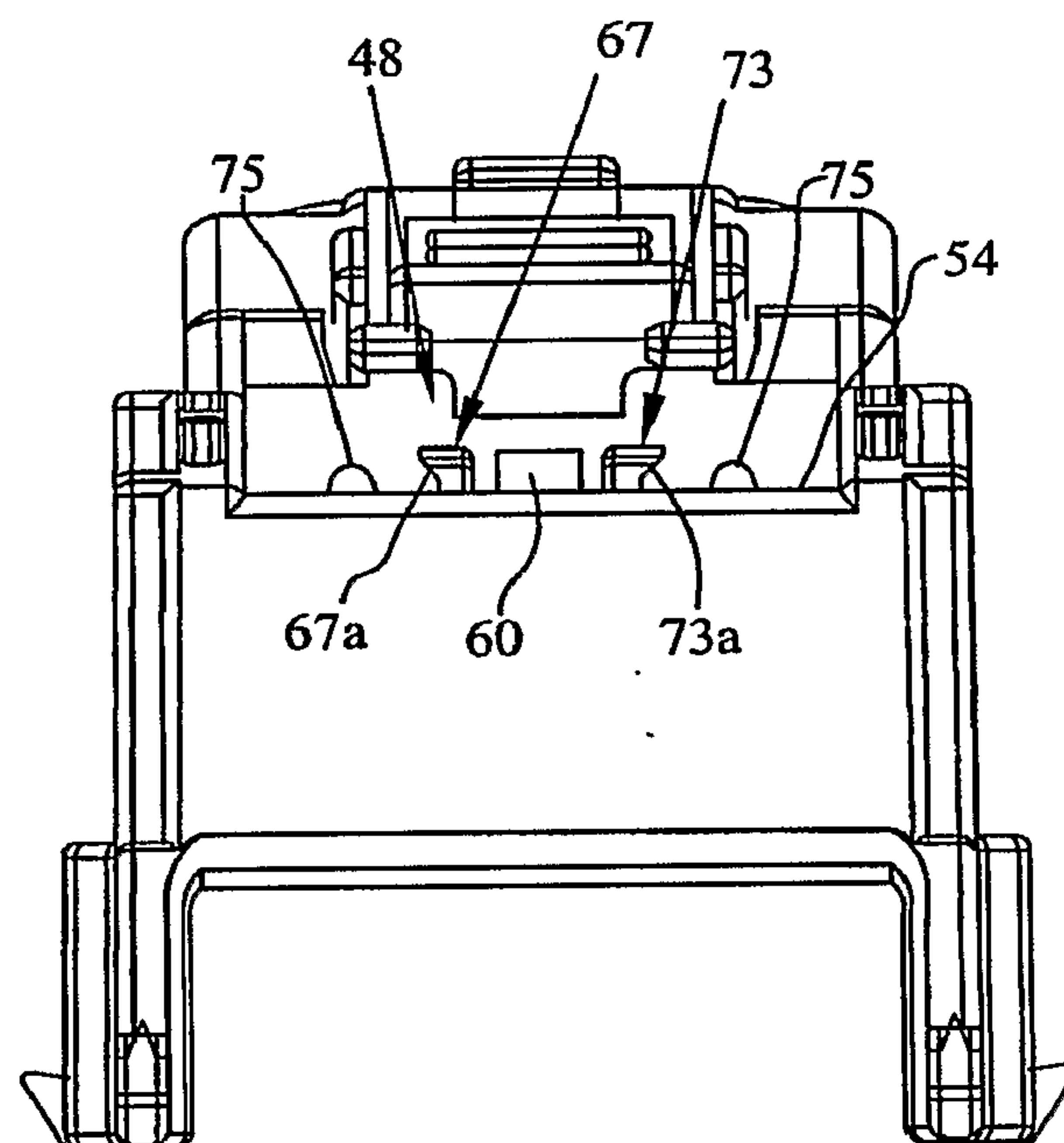
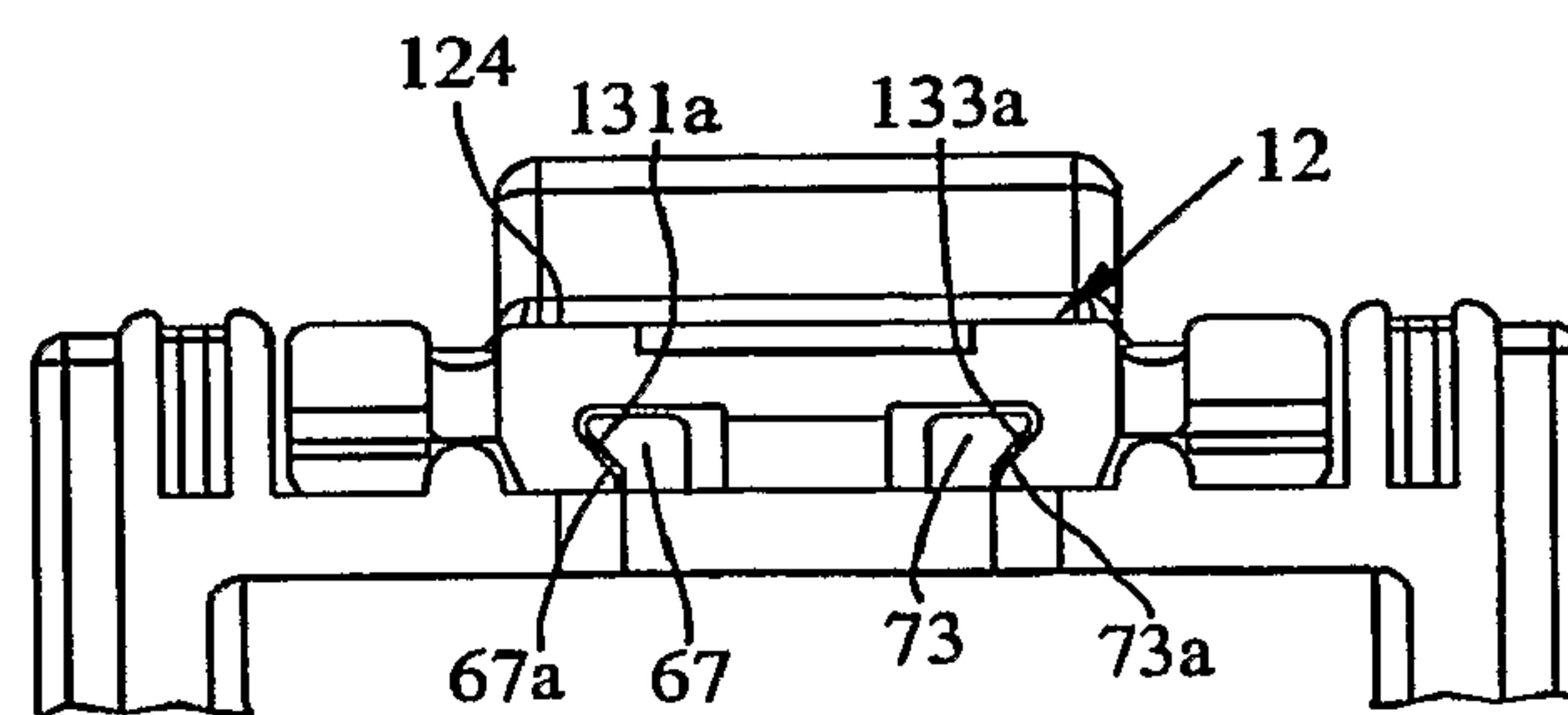


FIG. 11

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**FIG. 12****FIG. 13**

