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(54) **Plug connector arrangement with latching actuation slide means**

(57) A plug connector arrangement (100) has a socket housing with receptacle contacts and a plug housing with pluggable contacts. To make an electrical connection between the receptacle contacts and the pluggable contacts, at least one of the housings is a moveable housing that moves toward the other housing that is a fixed housing. At least one actuation slide means (108, 110) is mounted on the moveable housing (104) and is displaceable in a direction (112) transverse to a direction (106) of movement of the moveable hous-

ing. The actuation slide means (108, 110) has at least one control element (114) that co-operates with at least one control means (116) arranged on the fixed housing (102) such that the movable housing (104) moves toward the fixed housing when the actuation slide means (108, 110) is displaced. The actuation slide means (108, 110) has at least one latching device (124) that co-operates with at least one corresponding latching element (116) on the fixed housing (102) to hold the moveable housing (104) in position relative to the fixed housing (106) before actuation.

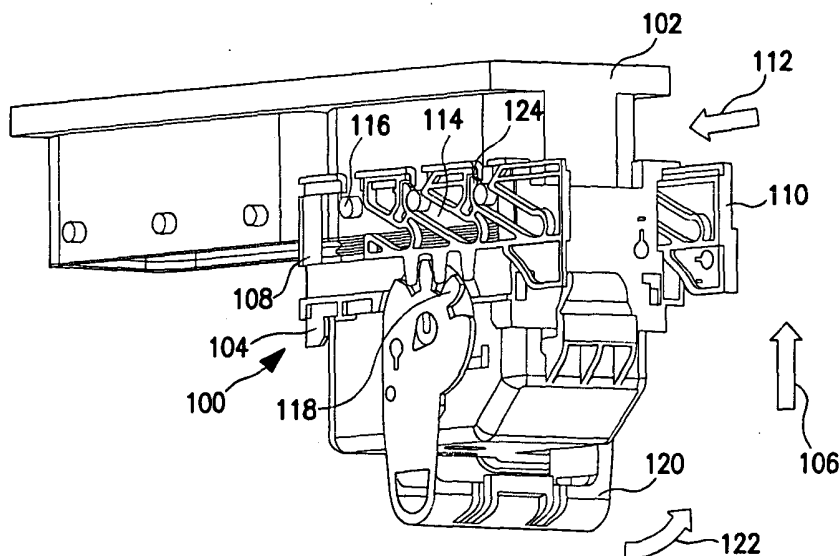


FIG. 1

Description

[0001] The invention relates to a plug connector arrangement that includes a moveable housing, a fixed housing, and an actuation means for moving the moveable housing into engagement with the fixed housing.

[0002] Plug connector arrangements typically have a plug housing, a socket housing, and an actuation means for moving one of the housings into engagement with the other housing such that receptacle contacts of the socket housing are electrically connected to pluggable contacts of the plug housing. These types of plug connector arrangements are primarily used in cases where one of the housings is fixed and accessibility to the plug connector arrangement is limited. These type of conditions typically exist, for example, in the automotive sector. In order to save space, the moveable housing is formed so that only a small portion of the moveable housing projects from the fixed housing when the housings are engaged. This configuration causes disengagement of the moveable housing from the fixed housing to be difficult. A problem also exists in that the plug connector arrangement has a large number of contact elements that exert a high normal contact force such that considerable force is required to plug-in and release the moveable housing from the fixed housing.

[0003] In order to resolve these problems, plug connector arrangements have been provided with actuation slide means. The actuation slide means is arranged on the movable housing and is displaceable in a direction transverse to a direction of engagement. For example, the moveable housing may be provided with sloping control grooves that engage with cam projections on the fixed housing. Movement of the movable housing toward the fixed housing can be performed by displacement of the actuation slide means transversely with respect to the direction of the movement of the moveable housing toward the fixed housing. In another example, an actuation slide means is constructed as a toothed rack wherein the displacement of the moveable housing is forced by rotary movement of a pivotal lever with a pinion region engaging in the toothed rack. Examples of such actuation slide means are taught by European Patent No. 0 273 999 B1 and United States Patent Nos. 5,618,194 and 5,660,556.

[0004] These plug connector arrangements, however, have the disadvantage that before being pushed together the two plug connector housings have to be manually held in position until the actuation slide means is displaced so that the pre-positioned fixed and moveable housings do not come apart in an uncontrolled manner. This is particularly disadvantageous if the movable housing is to be pushed into a fixed housing mounted overhead, for example, in a ceiling of a vehicle. Additionally, when the fixed housing is mounted overhead, the movable housing has to be manually prevented from falling when released from engagement with the fixed housing.

[0005] It is therefore desirable to develop a plug connector arrangement which can be pushed together and released in a simplified and secured manner while at the same time maintaining low manufacturing costs and saving space.

[0006] This and other objects are solved by a plug connector arrangement having a socket housing with receptacle contacts and a plug housing with pluggable contacts. To make an electrical connection between the receptacle contacts and the pluggable contacts, at least one of the housings is movable so that it can be pushed together with the other housing that is fixed. At least one actuation slide means is mounted on the movable housing and is displaceable in a direction transverse to a direction of pushing together. The actuation slide means has at least one control element that co-operates with at least one control means arranged on the fixed housing such that the movable housing moves parallel to the direction of pushing together when the actuation slide means is displaced. The actuation slide means has at least one latching device in the form of a latching hook that co-operates with at least one corresponding latching element in the form of a latching projection on the fixed housing to hold the moveable housing in position relative to the fixed housing before actuation.

[0007] The invention will now be described in greater detail with reference to the drawings, in which:

Figure 1 is a perspective view of a plug connector arrangement according to the invention with the plug connector arrangement partially opened-up; Figure 2 is a side view of the plug connector arrangement of Figure 1;

Figure 3 is an exploded view of the plug connector arrangement of Figure 1;

Figure 4 is a first side view of an actuation slide means;

Figure 5 is a sectional view taken along line B-B of Figure 4;

Figure 6 is a second side view of the actuation slide means of Figure 4;

Figure 7 is a sectional view taken along line A-A of Figure 4;

Figure 8 is an enlarged view of area X of Figure 7;

Figure 9 is an enlarged view of area W of Figure 4;

Figure 10 is an enlarged view of area Z of Figure 6;

Figure 11 is an enlarged view of area Y of Figure 6;

Figure 12 is a perspective view of the actuation slide means of Figure 4; and

Figure 13 is a perspective view of the actuation slide means of Figure 6.

[0008] Figure 1 shows an example of an embodiment of a plug connector arrangement 100 according to the invention. As best shown in Figure 3, the plug connector arrangement 100 has a fixed housing 102. In the embodiment illustrated, the fixed housing 102 is a plug housing, however, the fixed housing may alternatively

be moveable. The fixed housing 102 mounts the plug connector arrangement 100 overhead such as in a ceiling of a motor vehicle. The fixed housing 102 has an outside surface provided with cam projections 116 that also act as latching elements. A contact housing 126 provided with contact pins (not shown) is received in the fixed housing 102. A first seal 128 is positioned adjacent to the contact housing 126 for sealing the two housings when the plug connector arrangement 100 is fully engaged.

[0009] A movable housing 104 receives the contact housing 126. In the embodiment illustrated, the movable housing 104 is a socket-type plug, however, the socket-type plug may also be fixed. The movable housing 104 has two actuation slide means 108, 110 and toothed racks 126. The actuation slide means 110 is of a construction that has mirror symmetry with respect to the actuation slide means 108 illustrated herein. As best shown in Figures 4 through 13, the actuation slide means has a control element constructed as a ramp-like groove 114. A web integrally formed on a thin outer skin forms the ramp-like groove 114. Each of the ramp-like grooves 114 is arranged to correspond to the cam projections 116 of the fixed housing 102. Although the ramp-like grooves 114 ensure a high level of stability for the actuation slide means 108, 110, alternatively, the grooves 114 may be constructed as through apertures. As best shown in Figures 9 and 10, integrally formed in an introduction region of the ramp-like grooves 114 is a latching device in the form of a resilient latching hook 124. The latching hook 124 is integrally formed on a free end of a projecting cut-out spring arm. An abutment projection 140 is arranged adjacent to the latching hook 124 to prevent the latching hook 124 from resiling too far.

[0010] As shown in Figure 3, the moveable housing 104 has a cover 134 provided with a pivotal lever 120. The pivotal lever 120 has pinion means 118 corresponding to the toothed racks 136 for moving the actuation slide means 108, 110. A second seal 130 and associated cover 132 for the second seal 130 are provided between the cover 132 and the movable housing 104.

[0011] The operation of the plug connector arrangement 100 will now be described in greater detail with reference to Figures 1 and 2. Figures 1 and 2 shows the position of the plug connector arrangement 100 before the moveable housing 104 is engaged with the fixed housing 102. To push the moveable housing 104 into engagement with the fixed housing 102 to create an electrical connection, the pivotal lever 120 is rotated in a direction 122, as shown in Figure 1. As a result of the transmission of forces between the pinion region 118 and the toothed rack 136, displacement of the actuation slide means 108, 110 occurs in a direction 112, which is transverse to a direction 106 of movement of the moveable housing 104. The movable housing 104 is securely guided in the direction 106 as the actuation slide means 108, 110 is displaced in the direction 112 via the grooves 114 by the cam projections 116.

[0012] So that the movable housing 104 is held in a prelatched position before the actuation slide means 108, 110 is displaced, the latching hooks 124 latch onto the cam projections 116 that are positioned in the respective grooves 114, as best shown in Figure 2. The latching hooks 124 hold the movable housing 104 both before engagement with the fixed housing 102 and after engagement with the fixed housing 201 so that the moveable housing 104 does not need to be manually held to prevent the moveable housing 104 falling-out in an uncontrolled manner.

[0013] The invention described herein has the latching hooks 124 integrally formed on the actuation slide means 108, 110 such that the movable housing 104 is secured to the fixed housing 102 before the actuation slide means 108, 110 is actuated. Thus, when the fixed housing 102 is mounted overhead, it is possible to prevent the separation of the movable housing 104 from the fixed housing 102 in an uncontrolled manner during either mounting or dismounting of the plug connector arrangement 100. Because the latching hooks 124 are integrally formed on the actuation slide means 108, 110, which may be manufactured separately from the other elements of the plug connector arrangement 100, and the latching hooks 124 engage cam projections 116 already needed to guide the movable housing 104, any plug connector arrangement may be retro-fit with a latching mechanism according to the invention simply by replacing the actuation slide means 108, 110. Thus, considerable manufacturing costs can be saved and a high level of flexibility attained. The latching hooks 124 are also structurally simple to form and inexpensive to make.

[0014] The force required to engage and release the moveable housing 104 with the fixed housing 102 is kept small while providing secure latching, because the latching hook 124 is movable substantially parallel to a direction of displacement of the actuation slide means 108, 110. Further, displaceability may be attained for the latching hook 124 by structural means, in that the latching hook 124 is integrally formed on the resilient cut-out spring arm. Because the latching hook 124 is arranged in an introduction region of the grooves 114, no additional introduction openings for the latching hooks 124 have to be provided.

[0015] The arrangement of the cam projections 116 and the grooves 114 offers the advantage that there is precise relative guidance between the fixed housing 102 and the moveable housing 104 when pushed together. Thus, the possibility that contact pins or sleeves are damaged when the connection is pushed together or released is largely eliminated. Further, if the control device of the actuation slide means 108, 110 is made as ramp-like grooves 114, a higher level of mechanical stability of the actuation slide means 108, 110 can be achieved. If, on the other hand, the grooves 114 are formed as continuous openings in the wall of the actuation slide means 108, 110, this arrangement offers the advantage

that simplified manufacture of the actuation slide means 108, 110, typically made as an injection moulded part of synthetic material, is possible.

[0016] A particularly convenient and secure way of moving the actuation slide means 108, 110 is for the actuation slide means 108, 110 to be constructed as the toothed rack 136 such that the pinion region 118 of the pivotal lever 120 engages the tooth rack 136 to displace the actuation slide means 108, 110. Further, the moveable and fixed housings 102, 104 can be prevented from twisting when actuation is performed if the actuation slide means 108, 110 is formed by two elements of mirror-symmetrical construction which are separated from one another.

Claims

1. A plug connector arrangement (100) having a socket housing with receptacle contacts and a plug housing with pluggable contacts, in which, to make an electrical connection between the receptacle contacts and the pluggable contacts, at least one of the housings is a moveable housing that moves toward the other housing that is a fixed housing, at least one actuation slide means (108, 110) is mounted on the movable housing (104) and is displaceable in a direction (112) transverse to a direction (106) of movement of the moveable housing, the actuation slide means (108, 110) has at least one control element (114) that co-operates with at least one control means (116) arranged on the fixed housing (102) such that the movable housing (104) moves toward the fixed housing when the actuation slide means (108, 110) is displaced, **characterised in that:**

the actuation slide means (108, 110) has at least one latching device (124) which co-operates with at least one corresponding latching element (116) on the fixed housing (102) to hold the moveable housing (104) in position relative to the fixed housing (106) before actuation.

2. The plug connector arrangement according to Claim 1, **characterised in that** the latching device is a latching hook (124) and the latching element is a corresponding latching projection (116).
3. The plug connector arrangement according to Claim 2, **characterised in that** the latching hook (124) is movable substantially parallel to the direction (112) of displacement of the actuation slide means (108, 110).
4. The plug connector arrangement according to Claim 2 or 3, **characterised in that** the latching hook (124) is integrally formed on the actuation con-

trol means (108, 110) on a distal end of a cut-out spring arm.

5. The plug connector arrangement according to any one of Claims 1 through 4, **characterised in that** the control element is a groove (114) and the control means is a cam projection (116) which engages in the groove (114).
6. The plug connector arrangement according to Claim 5, **characterised in that** the groove (114) extends at an inclination with respect to the direction (106) of pushing together.
7. The plug connector arrangement according to Claim 5 or 6, **characterised in that** the groove (114) is a web integrally formed on a surface of the actuation slide means (108, 110).
8. The plug connector arrangement according to Claim 5 or 6, **characterised in that** the groove (114) is formed as an opening in a wall of the actuation slide means (108, 110).
9. The plug connector arrangement according to any one of Claims 5 through 8, **characterised in that** the latching element (124) is arranged in an introduction region of the control groove (114).
10. The plug connector arrangement according to any one of Claims 5 through 9, **characterised in that** the latching projection is formed by the cam projection (116).
11. The plug connector arrangement according to any one of Claims 1 through 10, **characterised in that** the actuation slide means (108, 110) has a toothed rack with which a pinion region (118) of a pivotal lever (120) engages in order to displace the actuation slide means (108, 110).
12. The plug connector arrangement according to any one of Claims 1 through 11, **characterised in that** the actuation slide means (108, 110) is formed by two actuation slide elements of mirror-symmetrical construction which are separated from one another.
13. The plug connector arrangement according to any one of Claims 5 through 12, **characterised in that** the latching device (124) projects into the groove (114).

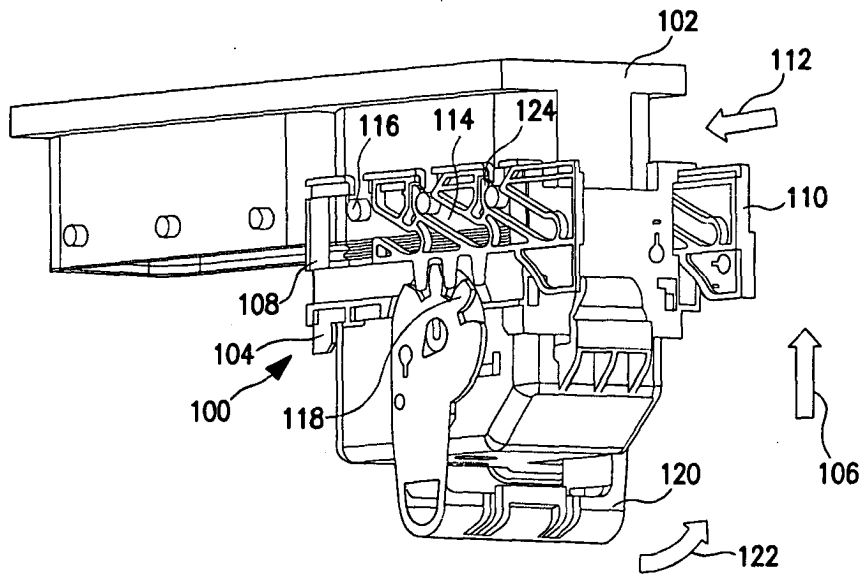


FIG. 1

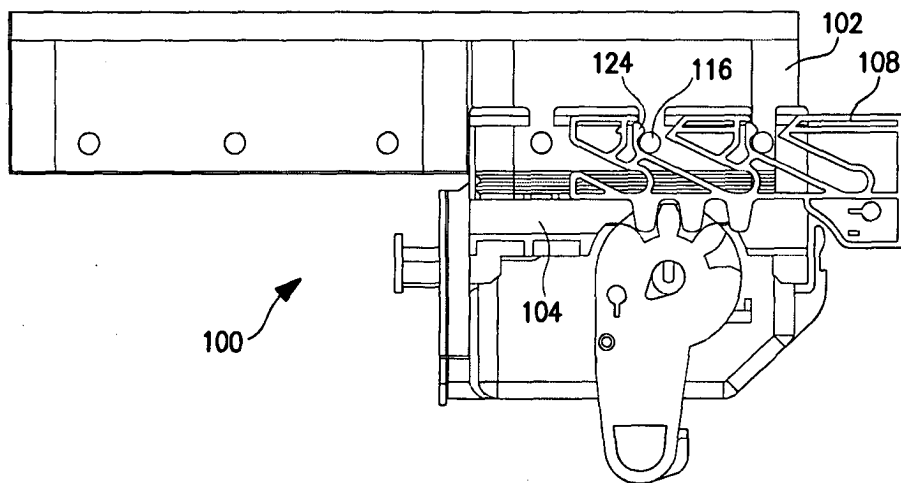


FIG. 2

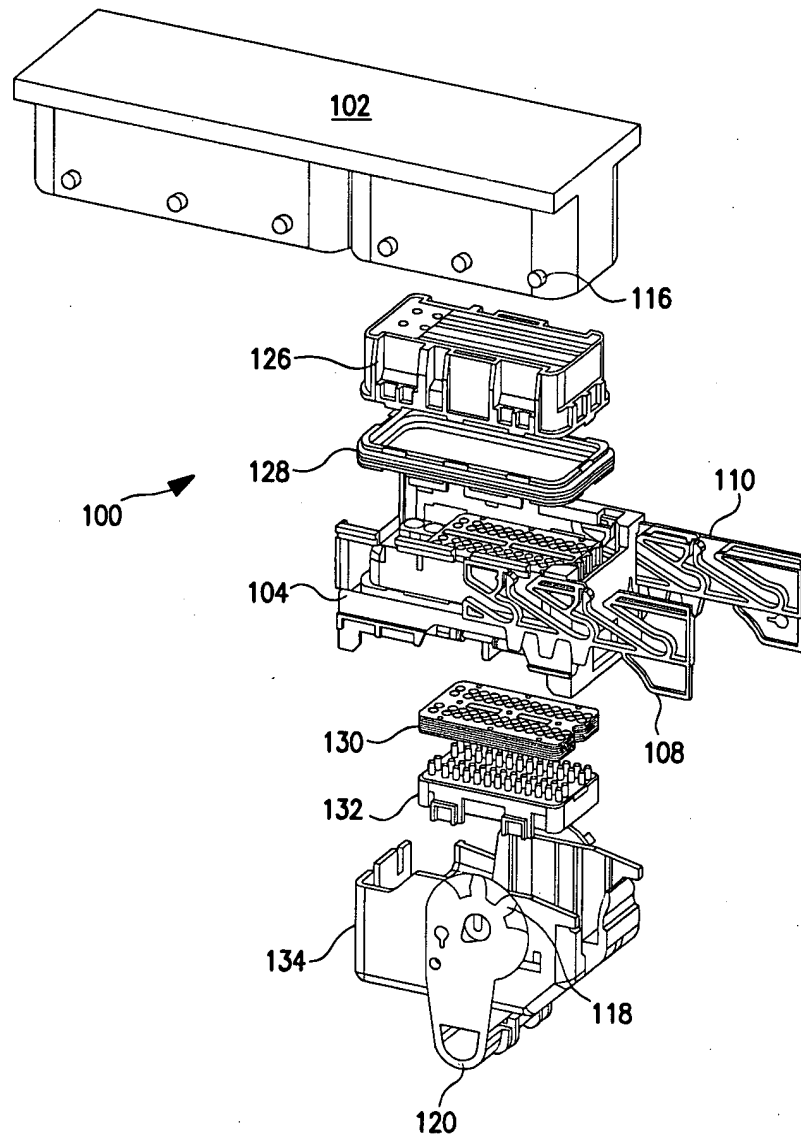


FIG. 3

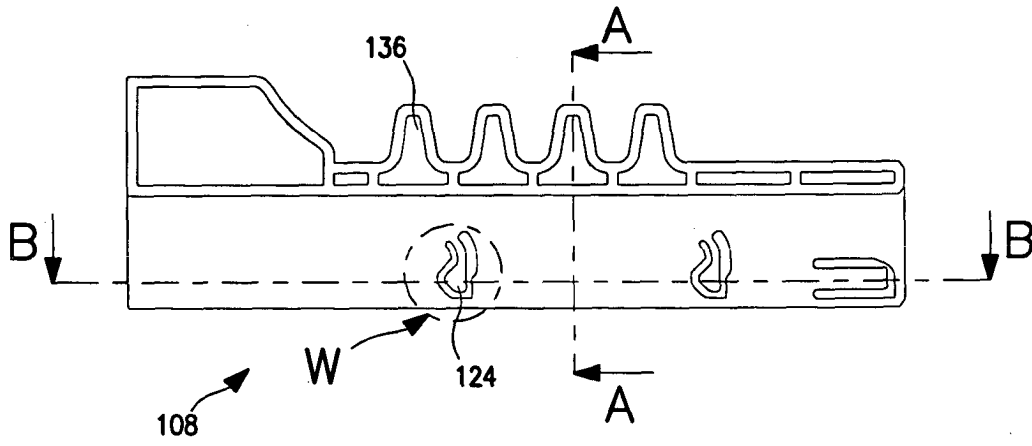


FIG. 4

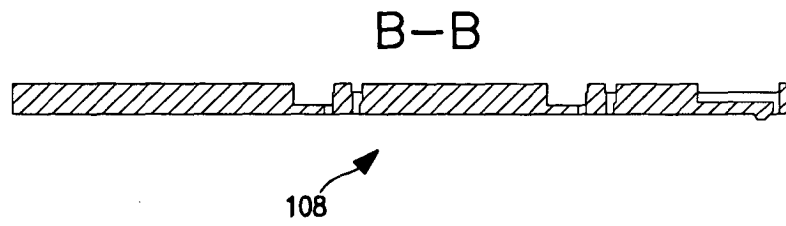


FIG. 5

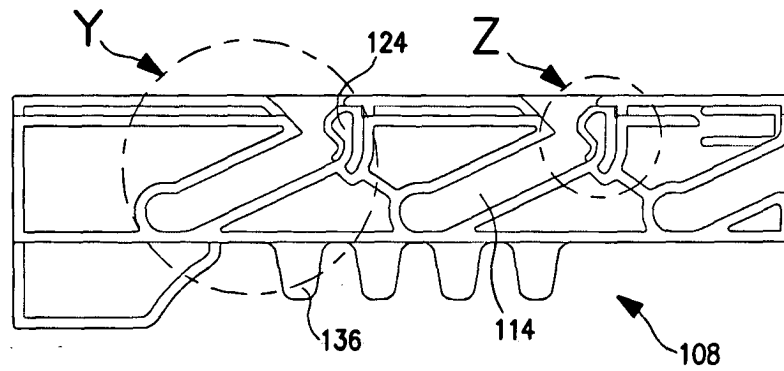


FIG. 6

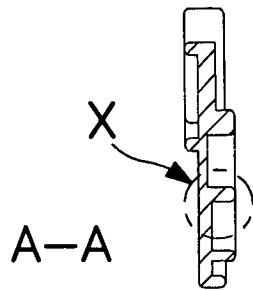


FIG. 7

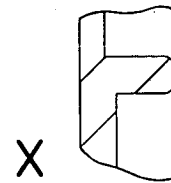


FIG. 8

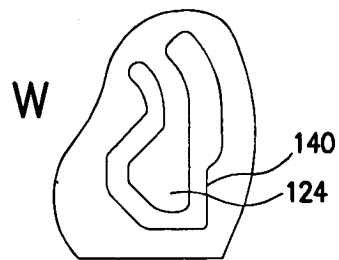


FIG. 9

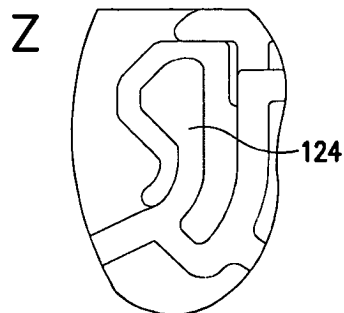


FIG. 10

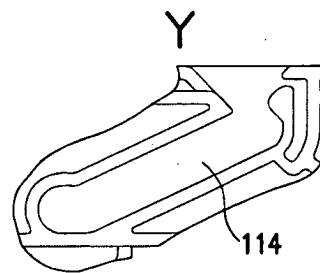


FIG. 11

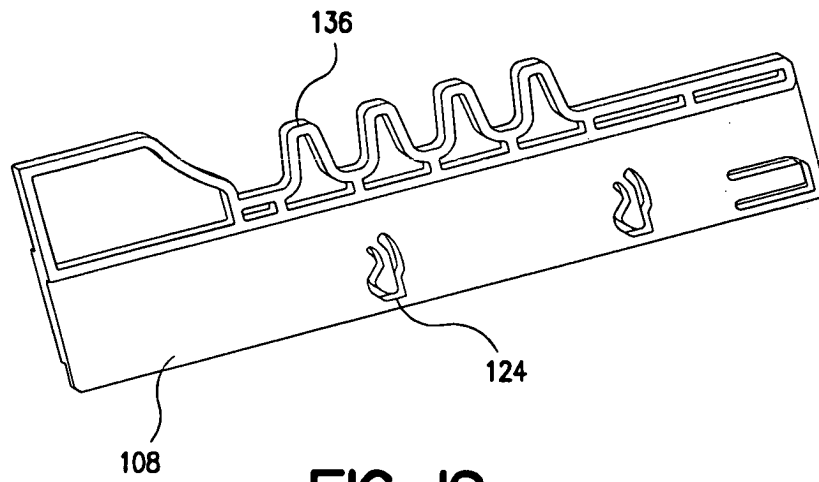


FIG. 12

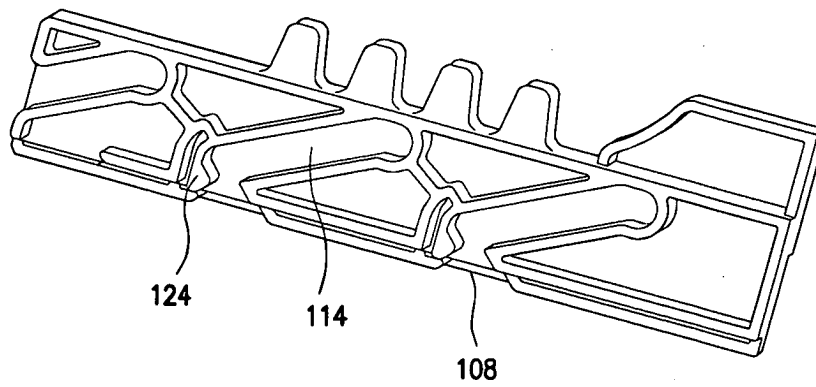


FIG. 13

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 01 6264

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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