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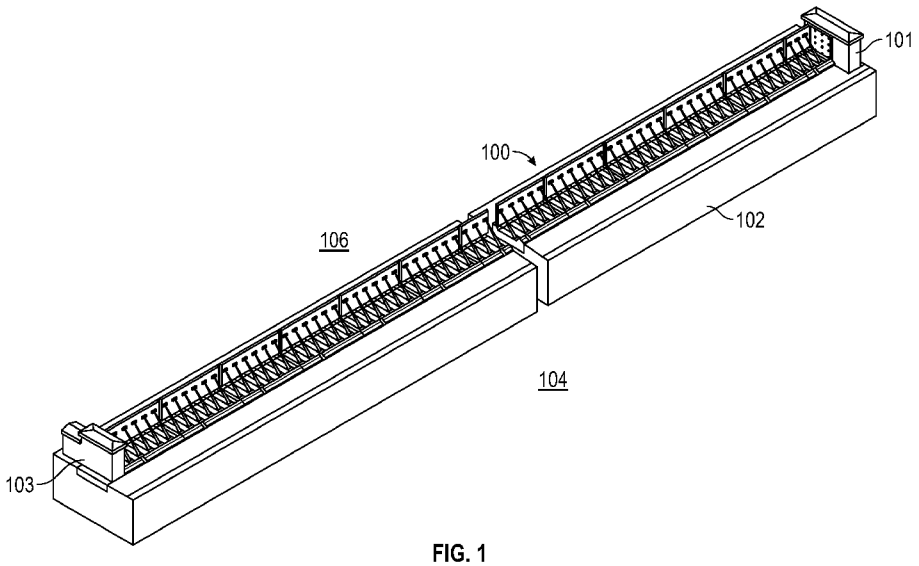


FIG. 1

(57) **Abstract:** A flexible and movable splice joint between edge aligned adjacent panels incorporates a flexible water sealing gasket and a flexible tensile member, which may be a strap or a cable or chain that allow the panels to move laterally and rotationally transversely relative to each other without damaging each other by such movements, and is particularly applicable to a plurality of assemblies of so joined panels that form raisable flood barriers to prevent flooding of land and improvements on the land by water rising from an adjacent body of water without permanently blocking a view of the waterscape.

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— *as to the identity of the inventor (Rule 4.17(i))*
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
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SPLICE JOINT

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application 63/282,479 filed 11/23/2021 and titled "SPLICE JOINT." U.S. Provisional Application 63/282,479 is hereby fully incorporated by reference as if set forth fully herein.

BACKGROUND OF THE INVENTION

[0002] U.S. Pat. 9,279,224 by one of the inventors of the present invention describes a passive self-erecting system involving buoyant metal panels extending over water and rotating upward between flanking permanent end walls to form a floodwater barrier. A more recent U.S. patent by such inventor is U.S. Pat. 10,619,317 respecting flood barrier panel assemblies in land near a water frontage shoreline that have panels actively erectable into a continuous barrier preventing flooding of the land.

[0003] Barrier panels are often constructed of a metal such as aluminum. Thermal heating of such panels can cause the panels to expand and move laterally toward each other. Thermal cooling has the opposite effect, causing the panels to contract and move way from each other. Individual panels rotationally erectable once erected can move transversely to each other under the influence of external forces. These movements have the potential to interfere with the water sealing function of gaskets lining the lateral sides of next adjacent panels.

BRIEF SUMMARY OF THE INVENTION

[0004] This invention relates to splice joints and more particularly to a flexible and movable splice joint between edge aligned adjacent panels to allow the panels to move laterally and transversely without damaging each other or gaskets lining the sides of next adjacent panels and is particularly applicable to a plurality of assemblies of so joined panels that form raisable flood barriers to prevent flooding of land and improvements on the land by water rising from an adjacent body of water without permanently blocking a view of the often attractive waterscape.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] In the following detailed description of exemplary embodiments, reference is made in some embodiments to the accompanying drawings, which form a part hereof and in which are shown by way of illustration non-limiting embodiments by which the invention may be practiced. Certain features of the invention are shown in exaggerated scale or in somewhat schematic form and in some drawing some details of elements shown in other drawings are omitted in the interest of clarity and conciseness. Referring to the drawings:

[0006] FIG. 1 depicts in isometric view a linear arrangement of exemplary embodiments of a flood barrier series of panels in accordance with this invention.

[0007] FIG. 2 depicts in isometric view an enlargement of end panels at the right end of the flood barrier of FIG. 1

[0008] FIG. 3 depicts in isometric view a pair of next adjacent edge aligned panels connected by a splice joint as depicted in FIGS. 5 and 6.

[0009] FIG. 4 is a top plan view of a splice joint connecting a pair of next adjacent edge aligned panels, indicating where cross sections FIG. 5 and FIG. 6 are taken.

[0010] FIG. 5 is a cross section of a splice joint of this invention taken along the lines 5-5 of FIG. 4 across fasteners 147, 148 visible at the exterior of the splice joint, and shows nominal spacing at the splice joint.

[0011] FIG. 6 is also a cross section of a splice joint of this invention taken along the lines 5-5 of FIG. 4 across fasteners 147, 148 visible at the exterior of the splice joint showing thermal contraction lateral movement of next adjacent panels relative to one another producing a taunt splice joint.

[0012] FIG. 7 is a cross section of the splice joint of this invention taken along the lines 6-6 of FIG. 4 where fasteners 145, 146 are not visible at the exterior of the splice joint.

[0013] FIG. 8 is another a cross section of a splice joint of this invention taken along the lines 5-5 of FIG. 4 across fasteners 147, 148 showing thermal expansion lateral movement of next adjacent panels relative to one another producing a slack splice joint.

[0014] FIG. 9 is a cross section of the splice joint along the same lines 5-5 of FIG. 4 showing structural loading across the splice joint from transverse movement of one said panel relative to the next adjacent panel.

[0015] FIG. 10 is a cross section of another embodiment of a splice joint of this invention in the same view as FIG. 5 in which a tensile member is incorporated in a gasket member of the splice joint.

[0016] FIG. 11 is a perspective partial view of next adjacent panels linked by the splice joint of FIG.5 in which the splice joint is in nominal spacing.

[0017] FIG. 12 is a cross section of a splice joint of this invention taken along the lines 5-5 of FIG. 4 in which the tensile member of the splice joint is a cable, showing nominal spacing at the spice joint.

[0018] FIG. 13 is a cross section of the splice joint of this invention taken along the lines 5-5 of FIG. 4 in which the tensile member of the splice joint is a cable, showing thermal contraction lateral movement of next adjacent panels relative to one another producing a taunt splice joint.

[0019] FIG. 14 is a cross section of the splice joint of this invention taken along the lines 5-5 of FIG. 4 in which the tensile member of the splice joint is a cable, showing thermal expansion lateral movement of next adjacent panels relative to one another producing a slack splice joint.

[0020] FIG. 15 is a cross section of the splice joint of this invention taken along the lines 5-5 of FIG. 4 in which the tensile member of the splice joint is a cable, showing structural loading across the splice joint from transverse movement of one said panel relative to the next adjacent panel.

[0021] FIG. 16 is a perspective partial view of next adjacent panels linked by the splice joint of FIG.12 in which the tensile member of the splice joint is a cable and in which the splice joint is in nominal spacing.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0022] In accordance with this invention, a splice joint moveably connected between edge aligned structural panels allows lateral and transverse movement between the panels, sealing the junction between adjacent panels from water penetration between the panels while providing tensile loading limiting the panels' ability to swing separately from each other. The splice joined panels are preferably in a series of next adjacent flood barrier panels arranged on land near a water frontage shoreline, providing a surface not

interfering with a view of the water while being erectable manually prior to a flooding vent or automatically by buoyancy in a flooding vent to provide a continuous vertical barrier, preventing flooding of land on the dry side of the barrier.

[0023] Specific details described herein, including what is stated in the Abstract, are in every case a non-limiting description and exemplification of embodiments representing concrete ways in which the concepts of the invention may be practiced. This serves to teach one skilled in the art to employ the present invention in virtually any appropriately detailed system, structure or manner consistent with those concepts. Reference throughout this specification to "an exemplary embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one exemplary embodiment of the present invention. Thus, the appearances of the phrase "in an exemplary embodiment" or similar expression in various places throughout this specification are not necessarily all referring to the same embodiment. Further, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments. Various changes and alternatives to the specific described embodiments and the details of those embodiments may be made within the scope of the invention. One or more of the elements depicted in the drawings can also be implemented in a more separated or integrated manner, or even removed or rendered as inoperable in certain cases, as is useful in accordance with a particular application. Because many varying and different embodiments may be made within the scope of the inventive concepts herein described and in the exemplary embodiments herein detailed, it is to be understood that the details herein are to be interpreted as illustrative and not as limiting the invention to that which is illustrated and described herein.

[0024] The various directions such as "upper," "lower," "back," "front," “vertical”, “upright”, “horizontal,” “length,” “laterally”, “proximal”, “distal” and so forth used in the detailed description of exemplary embodiments are made only for easier explanation in conjunction with the drawings. The components may be oriented differently while performing the same function and accomplishing the same result as the exemplary embodiments herein detailed embody the concepts of the invention, and such terminologies are not to be understood as limiting the concepts which the embodiments

exemplify. The terms “horizontal” or “horizontally” include but are not limited to literal horizontal and generally mean not out of level with respect to immediately adjacent land to a degree that will materially adversely affect the function of the element described as horizontal. Similarly, the terms “vertical” or “upright” include but are not limited to literal vertical and generally mean substantially up and down with respect to immediately adjacent land to a degree that will not materially adversely affect the function of the element described as vertical or upright.

[0025] As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, apparatus that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such apparatus. Further, unless expressly stated to the contrary, "or" refers to an inclusive or and not to an exclusive or. That is, unless otherwise indicated, the term "or" is generally intended to mean "and/or". For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

[0026] As used herein, the use of the word "a" or "an" when used in conjunction with the term "comprising" (or the synonymous "having" or “including”) in the claims and/or the specification may mean "one," but it is also consistent with the meaning of "one or more," "at least one," and "one or more than one." In addition, as used herein, the phrase “connection to” or "connected to" means joined to, either directly or through intermediate components.

[0027] Exemplary apparatus embodiments of the invention comprise a plurality of next adjacent structural panels moveably connected by a splice joint. More particularly, each panel has a top surface, a bottom surface, a front end, a back end, and lateral sides in edge alignment with the next adjacent panel. The panels have a gap between the lateral sides, and the next adjacent panels are moveably connected across that gap by a splice joint comprising (a) a flexible gasket having a segment spanning that gap and having portions distal to such segment, the distal portions of the gasket being secured to the panels proximate the lateral sides, and (b) a tensile member having end segments secured to the panels proximate the lateral sides and an intermediate flexible joint segment spanning the

gap, the flexible joint segment allowing thermal expansion and contraction lateral movement of the next adjacent panels relative to one another and allowing transverse rotational movement of one panel relative to the next adjacent panel, spreading a tension load over the flexible joint segment spanning the gap.

[0028] In an exemplary embodiment, the tensile member is a strap comprising a fiber reinforced material. The fiber may be a metal. In a particular exemplary embodiment, the tensile strap comprises an interwoven polyester fabric. In an exemplary embodiment, the tensile member of the apparatus is metal wiring incorporated in the flexible gasket. In an exemplary embodiment, the edge aligned panels have a height that runs from the back end to at least near the front end of the panels, and the tensile strap has a length that runs said height of said panels.

[0029] In an exemplary embodiment the lateral sides of the next adjacent edge aligned panels each have a flange attached to the panel lateral side adjacently below the panel top surface, and the flanges define the gap between the lateral sides of said panels. In an exemplary embodiment the panels have a height that runs from the back end to at least near the front end of the panels, and the flanges and the gasket have a length that runs said height of said panels.

[0030] In other exemplary embodiments, the tensile member is a cable or chain. The cable or chain is attached to projections from the panel lateral sides or from proximate the panel lateral sides in the direction of the gap separating the next adjacent edge aligned panels. In a particular, at least one set of projections are provided, one projection extending in the direction of said gap from one lateral side or from proximate one lateral side of the next adjacent edge aligned panels, and another projection extending in the direction of the gap from the other lateral side or from proximate the other lateral side of the next adjacent edge aligned panels. Terminal ends of the cable or chain are attached to the one projection and to the other projection of the at least one set of projections.

[0031] In an exemplary embodiment, the splice joint is employed in apparatus comprising a plurality of adjacent edge aligned panels in flood barrier assemblies arranged on land near a water frontage shoreline. The panels reside in at least one support pan situated in or on the land. The lateral sides of the panels have an imagined projected

intersecting angle to the shoreline. The panels have a height that runs from the back end to at least near the front end of the panels. The panels have a gap between the lateral sides, and the panels are moveably connected across that gap by a splice joint comprising (a) a flexible gasket having a segment spanning that gap and having portions distal to such segment, the distal portions of the gasket being secured to the panels proximate the lateral sides, and (b) a tensile member having end segments secured to the panels proximate the lateral sides and an intermediate flexible joint segment spanning the gap. The flexible gasket is impermeable to water. The panels residing in the support pan are hingedly rotatable on a substantially horizontal axis of rotation at the back end of the panels for the panels to be rotated upwardly to an upright position where water invading from the shoreline will be impounded behind the bottom surface of the panels, the gasket running the height of the panels to prevent water impounded at the bottom surface of the panels from penetrating between the next adjacent panels. In an embodiment the panels are buoyant and rotate upward buoyantly on invasion of water from the shoreline. In an embodiment, the tensile member is a strap comprising a fiber reinforced material. In another embodiment the tensile member is a cable or chain.

[0032] In an exemplary apparatus embodiment, a plurality of edge aligned next adjacent structural panels are moveably connected by a splice joint. Each panel has a top surface, a bottom surface, a front end, a back end, and lateral sides in edge alignment with the next adjacent panel. The panels have a height that runs from the back end to at least near the front end of the panels. The lateral sides of the next adjacent edge aligned panels each have a flange, suitably orthogonal, attached to the panel lateral side adjacently below the panel top surface. The flanges have upper and lower arms and define a first gap between the upper arms of the flanges. The next adjacent panels are moveably spliced together by a flexible gasket and a flexible tensile strap. The flexible gasket extends from adjacent the lateral side edges of the next adjacent panels and spans across the first gap. The gasket is supported by both flanges atop the upper arm of the flanges and is partially covered by separate first and second spaced apart gasket cover plates atop the gasket. The cover plates define between them a second gap. The flexible tensile strap extends from adjacent the flanges across the first gap and is held under the upper arms of the flanges by separate first and second spaced apart splice plates defining a third gap between them.

The first, second and third gaps separate the next adjacent panels. A first set of fasteners fastens the flexible tensile strap between the flanges and the first and second splice plates. A second set of fasteners spaced from the first set of fasteners fastens together the first and second gasket cover plates, the gasket, the flanges, the strap, and the first and second splice plates. The flexible tensile strap allows thermal expansion and contraction lateral movement of the next adjacent panels relative to one another and also allows structural loading across the splice joint from transverse rotational movement of one panel relative to the next adjacent panel. The third gap spreads a tension load over a section of the strap.

[0033] In exemplary embodiments, the flexible tensile straps comprise a fiber reinforced material or an interwoven polyester fabric. In another exemplary embedment, the flexible gasket and the flexible tensile strap are combined into a single component in which the component provides both sealing and structural loading.

[0034] Referring now to the drawings, in FIG. 1 reference numeral 100 depicts a plurality of flood barrier assemblies comprising a series of connected next adjacent panels raised from pans and arranged on an on-land levee 102 near a water frontage shoreline indicated by reference numeral 104, the dry side of the land guarded by the flood barrier being indicated by the reference numeral 106.

[0035] FIG. 2 is an enlargement of the panels at the right end of the flood barrier of FIG. 1. Next adjacent edge aligned panels 108, 110 are connected by a splice joint 112 and are held upright by tensioning members 114 connected to a support pan 116 and to the bottom surface 118 of each panel 108, 110. Tensioning members 114 when loaded by hydrostatic pressure of water contained on the bottom surface 118 of the raised panels 108, 110 prevent the panels from rotating past a predetermined raised position. A wiper wall 120 is located at the end of the flood barrier 100, wiped by a wiping gasket when the panels elevate, the wiping gasket preventing water from passing between the end panel 110 and the wiper wall 120. Reference numerals 101 and 103 (FIGS. 1 and 2) indicate a wiper wall support structure.

[0036] FIG. 3 is an enlargement of two next adjacent edge aligned panels 108, 110 connected by splice joint 112 and raised from support pan 116. Panels 108, 110 have a top surface 121 (better seen on FIGS. 5, 6 and 7), a bottom surface 118, a front end 123, a back end 124, and lateral sides 125 in edge alignment with the next adjacent panels 108,

110. When resident in pan 116, the sides 125 have an imagined projected intersecting angle to shoreline 104. Panels 108, 110 have a height 126 that runs from back end 124 to at least near front end 123 of panels 108, 110. The panels 108, 110 reside in support pan 116 hingedly rotatable on a substantially horizontal axis of rotation 127 at the back end 124 of the panels to be manually rotated to an upright position prior to invasion of water so invading water will be impounded behind bottom surface 118 of the panel, or in another exemplary embodiment in which the panels are buoyant, rotatable on the substantially horizontal axis of rotation on invasion of water into pan 116 under bottom surface 118 of the panels raising the panels to an upright position where invading water will be impounded behind bottom surface 118 of the panels.

[0037] FIG. 4 is a top plan view of edge aligned next adjacent panels 108, 110 connected by splice joint 112 and resident in support pan 116.

[0038] FIGS. 5 and 6 are cross sections of splice joint 112 taken along lines 5-5 of FIG. 4 across fasteners 147, 148 visible at the exterior of the splice joint. FIG 7 is a cross section of the splice joint of this invention taken along the lines 6-6 of FIG. 4 where fasteners 145, 146 are not visible at the exterior of the splice joint.

[0039] In FIGS 5-9, similar structures are numbered the same. Flanges 128, 129 are attached to the lateral side 125 of each of panels 108, 110 adjacently below the panel top surfaces 121. Suitably the flanges 128, 129 are a right-angle flange as illustrated. A first gap 130 is defined between the upper arms 131, 132 of the two flanges 128, 129. A flexible gasket 134 extends from adjacent the lateral side edges 125 of next adjacent panels 108, 110 and spans across first gap 130, supported by the upper arms 131, 132 of the two flanges 128, 129. Gasket 134 serves as a water seal between next adjacent panels 108, 110. Gasket 134 is partially covered by separate first and second spaced apart gasket cover plates 136, 137 atop gasket 134. Cover plates 136, 137 define between them a second gap 138. A flexible tensile strap 140 extends from adjacent flanges 128, 129 across first gap 130, held under the upper arms 131, 132 of the two flanges 128, 129 by separate first and second spaced apart splice plates 142, 143 defining a third gap 144 between them.

[0040] Referring to FIG.7, a first set of fasteners 145, 146 fastens strap 140 between upper arms 131, 132 of flanges 128, 129 and first and second splice plates 142, 143.

Referring back to FIGS. 5 and 6, a second set of fasteners 147, 148 spaced from the first set of fasteners 145, 146 fastens together first and second gasket cover plates 136, 137, gasket 134, upper arms 131, 132 of flanges 128, 129, strap 140, and splice plates 142, 143.

[0041] As seen from FIGS. 5, 6, 8 and 9 the first, second and third gaps, respectively 130, 138 and 144 separate next adjacent panels 108, 110 and are spanned by the splice joint comprising flexible gasket 134 and a tensile member 140. FIG. 5 shows nominal spacing at the splice joint. FIG. 6 shows thermal contraction lateral movement of next adjacent panels 108, 110 producing a taunt splice joint. Fig. 8 is the same cross-sectional view as FIGS. 5 and 6 and shows thermal expansion lateral movement of next adjacent panels 108, 110 producing a slack splice joint. FIG. 9 is the same cross-sectional view as FIGS. 5 and 6. In FIG. 9, panels 108, 110 are depicted with flexible tensile strap 140 providing structural loading across splice joint 112 from transverse rotational movement of panel 110 relative to next adjacent panel 108, third gap 144 spreading a tension load over an intermediate section of strap 140.

[0042] Referring to FIG. 10, the functions of flexible gasket 134 and flexible tensile strap 140 are combined into a single component 150 in which the component provides both sealing and structural loading. Component 150 is a wire-reinforced rubber strip (wires indicated by reference numeral 151) between the next adjacent panels 108, 110, which provides good tensile loading (e.g., limits the panels' ability to swing separately from each other) but also permits the panels to thermally contract or expand.

[0043] FIG. 11 is a partial perspective view of the next adjacent panels linked by the splice joint of FIG.5 in which the splice joint is in nominal spacing.

[0044] FIGS. 12-15 are cross section of the splice joint of this invention taken along the lines 5-5 of FIG. 4 in which the tensile member of the splice joint is a cable 154. A first gap 161 is defined between the upper arms 131, 132 of the two flanges 128, 129. Gasket 134 is partially covered by separate first and second spaced apart gasket cover plates 136, 137 atop gasket 134. Cover plates 136, 137 define between them a second gap 138. Fasteners 152, 153 fasten flexible gasket 134 between gasket cover plates 136, 136 and upper arms 131, 132 of flanges 128, 129. Gasket 134 serves as a water seal between next adjacent panels 108, 110 (not numbered in FIGS. 12-15 but understood from FIGS. 2-11

and FIG. 16). A projection 155 extends in the direction of gap 161from lateral side 125 or from flange 128 proximate lateral side 125 of next adjacent edge aligned panel 110, and another projection 156 extends in the direction of gap 161 from lateral side125 or from flange 129 proximate the other said lateral side 125 of next adjacent edge aligned panel 108. The terminal ends of cable 154 formed into loops are connected at 159, 160 and are attached to projections 155, 156 by fasteners 157, 158

[0045] FIG. 12 shows nominal spacing at the spice joint. FIG. 13 shows thermal contraction lateral movement of next adjacent panels 108, 110 relative to one another producing a taunt splice joint. FIG. 14 shows thermal expansion lateral movement of next adjacent panels 108, 110 relative to one another producing a slack splice joint. FIG. 15 shows structural loading across the splice joint from transverse movement of one panel 110 relative to the next adjacent panel 108.

[0046] FIG. 16 is a partial perspective view of the next adjacent panels 108, 110 linked by the splice joint of FIG. 12 in which the tensile member of the splice joint is cable 1554 and in which the splice joint is in nominal spacing.

[0047] The disclosed subject matter is to be considered illustrative, and not restrictive, and the appended claims are intended to cover all modifications, enhancements, and other embodiments that fall within the true scope of the present invention, which to the maximum extent allowed by law, is to be determined by the broadest permissible interpretation of the following claims and their equivalents, unrestricted or limited by the foregoing detailed descriptions of exemplary embodiments of the invention.

CLAIMS

1. Apparatus comprising a plurality of next adjacent structural panels, each panel having a top surface, a bottom surface, a front end, a back end, and lateral sides in edge alignment with the next adjacent panel, said panels having a gap between said lateral sides, said next adjacent panels being moveably connected across said gap by

(a) a flexible gasket having a segment spanning said gap and portions distal to said segment secured to said panels proximate said lateral sides and,

(b) a tensile member having end segments secured to said panels proximate said lateral sides and an intermediate flexible joint segment spanning said gap, said flexible joint segment allowing thermal expansion and contraction lateral movement of said next adjacent panels relative to one another and allowing transverse rotational movement of one said panel relative to the next adjacent panel, spreading a tension load over said flexible joint segment spanning said gap.

2. The apparatus of claim 1 wherein said tensile member is a strap comprising a fiber reinforced material.

3. The apparatus of claim 2 in which said fiber is a metal.

4. The apparatus of claim 2 in which said tensile strap comprises an interwoven polyester fabric.

5. The apparatus of claim 2 in which said panels have a height that runs from said back end to at least near the front end of the panels, and in which said tensile strap has a length that runs said height of said panels.

6. The apparatus of claim 1 in which said tensile member is metal wiring incorporated in said gasket.

7. The apparatus of claim 1 in which said lateral sides of said next adjacent edge aligned panels each have a flange attached to said panel lateral side adjacently below said panel top surface, said flanges defining said gap between the lateral sides of said panels.

8. The apparatus of claim 7 in which said panels have a height that runs from said back end to at least near the front end of the panels, and in which said flanges and said gasket have a length that runs said height of said panels.

9. The apparatus of claim 1 in which said tensile member is a cable or chain.

10. The apparatus of claim 9 comprising at least one set of projections, one projection extending in the direction of said gap from one said lateral side or from proximate one said lateral side of said next adjacent edge aligned panels, and another projection extending in the direction of said gap from the other said lateral side or from proximate the other said lateral side of said next adjacent edge aligned panels, terminal ends of said cable or chain being attached to said one projection and to said another projection of said at least one set of projections.

11. The apparatus of claim 1 in which said panels comprise flood barriers arranged on land near a water frontage shoreline resident in at least one support pan situated in or on said land, said lateral sides of said panels have an imagined projected intersecting angle to said shoreline, said panels having a height that runs from said back end to at least near the front end of the panels, said flexible gasket being impermeable to water, said panels residing in said support pan hingedly rotatable on a substantially horizontal axis of rotation at said back end of the panels for said panels to be rotated upwardly to an upright position where water invading from said shoreline will be impounded behind said bottom surface of the panels, said gasket running said height of the panels to prevent water impounded at said bottom surface of the panels from penetrating between said next adjacent panels.

12. The apparatus of claim 11 in which said panels are buoyant and rotate upward buoyantly on invasion of water from said shoreline.

13. The apparatus of claim 11 wherein said tensile member is a strap comprising a fiber reinforced material.

14. The apparatus of claim 13 in which said tensile strap comprises an interwoven polyester fabric.

15. The apparatus of claim 11 in which said tensile member is a cable or chain.

16. Apparatus comprising a plurality of next adjacent structural panels, each panel having a top surface, a bottom surface, a front end, a back end, and lateral sides in edge alignment with the next adjacent panel, said lateral sides of said next adjacent edge aligned panels each having an orthogonal flange with upper and lower arms, said lower arms being attached to said panel lateral side adjacently below said panel top surface, said upper arms of said flanges defining a first gap between them, said next adjacent panels being moveably connected across said first gap by a splice joint comprising:

(a) a flexible gasket extending from adjacent said lateral side edges of said next adjacent panels spanning across said first gap, supported by said upper arms of both said flanges, and partially covered by separate first and second spaced apart gasket cover plates atop said gasket, said cover plates defining between them a second gap, and

(b) a flexible tensile strap extending from adjacent said flanges across said first gap and held under said upper arms of said flanges by separate first and second spaced apart splice plates defining a third gap between them, said first, second and third gaps separating the next adjacent panels, a first set of fasteners fastening said flexible tensile strap between said flanges and said first and second splice plates, and a second set of fasteners spaced from said first set of fasteners fastening together said first and second gasket cover plates, said gasket, said flanges, said flexible tensile strap, and said splice plates, said flexible tensile strap allowing thermal expansion and contraction lateral movement of said next adjacent panels relative to one another and structural loading across said strap from transverse rotational movement of one said panel relative to the next adjacent panel, said third gap spreading a tension load over a section of said flexible tensile member.

17. The apparatus of claim 16 wherein said flexible tensile strap comprises a fiber reinforced material.

18. The apparatus of claim 17 in which said flexible tensile strap comprises an interwoven polyester fabric.

19. The apparatus of Claim 16 in which said panels comprise flood barriers arranged on land near a water frontage shoreline resident in at least one support pan situated in or on said land, said lateral sides of said panels have an imagined projected intersecting angle to said shoreline,

said panels having a height that runs from said back end to at least near the front end of the panels, said flexible gasket being impermeable to water, said panels residing in said support pan hingedly rotatable on a substantially horizontal axis of rotation at said back end of the panels for said panels to be rotated upwardly to an upright position where water invading from said shoreline will be impounded behind said bottom surface of the panels, said gasket running said height of the panels to prevent water impounded at said bottom surface of the panels from penetrating between said next adjacent panels.

20. The apparatus of claim 19 in which said panels are buoyant and rotate upward buoyantly on invasion of water from said shoreline.

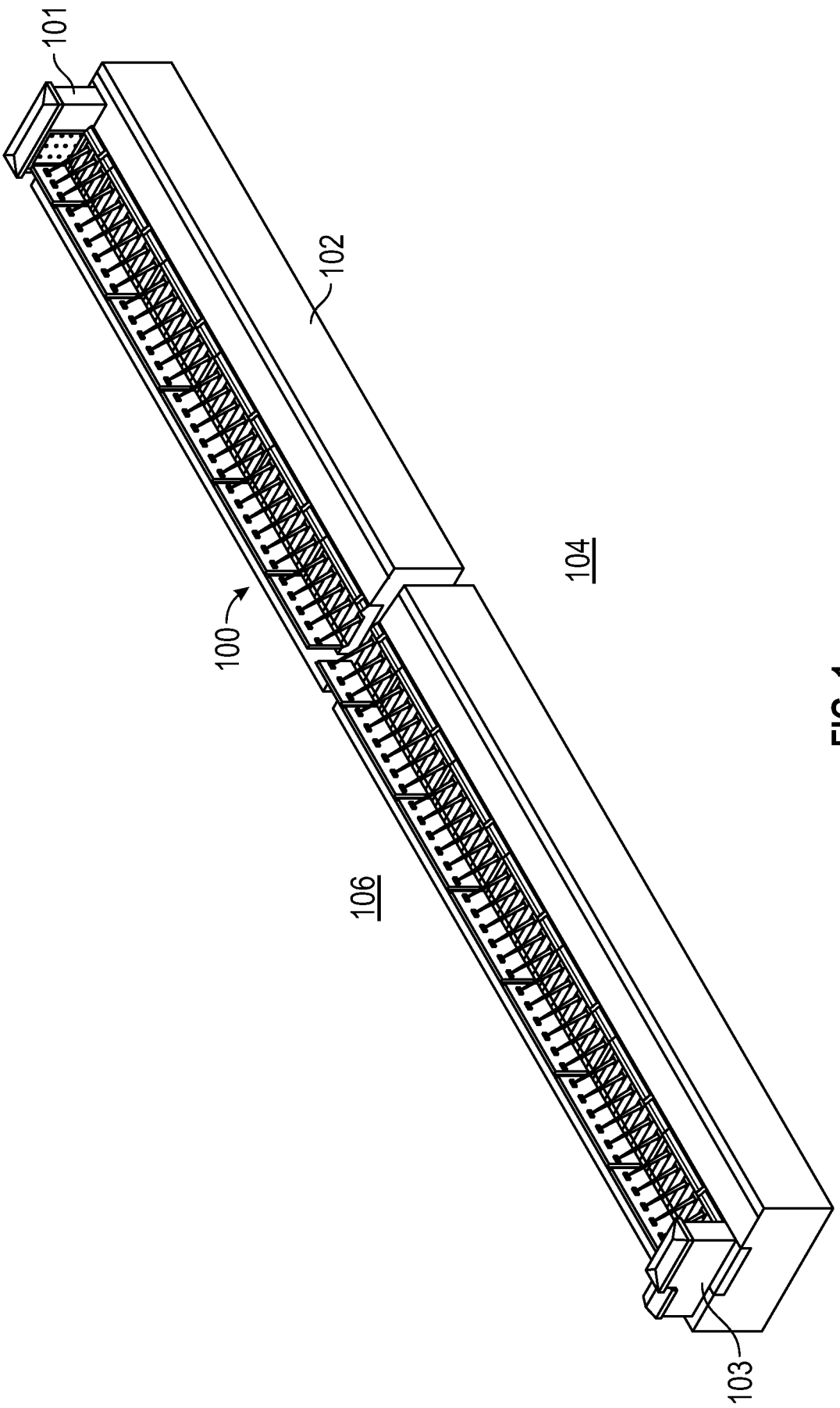


FIG. 1

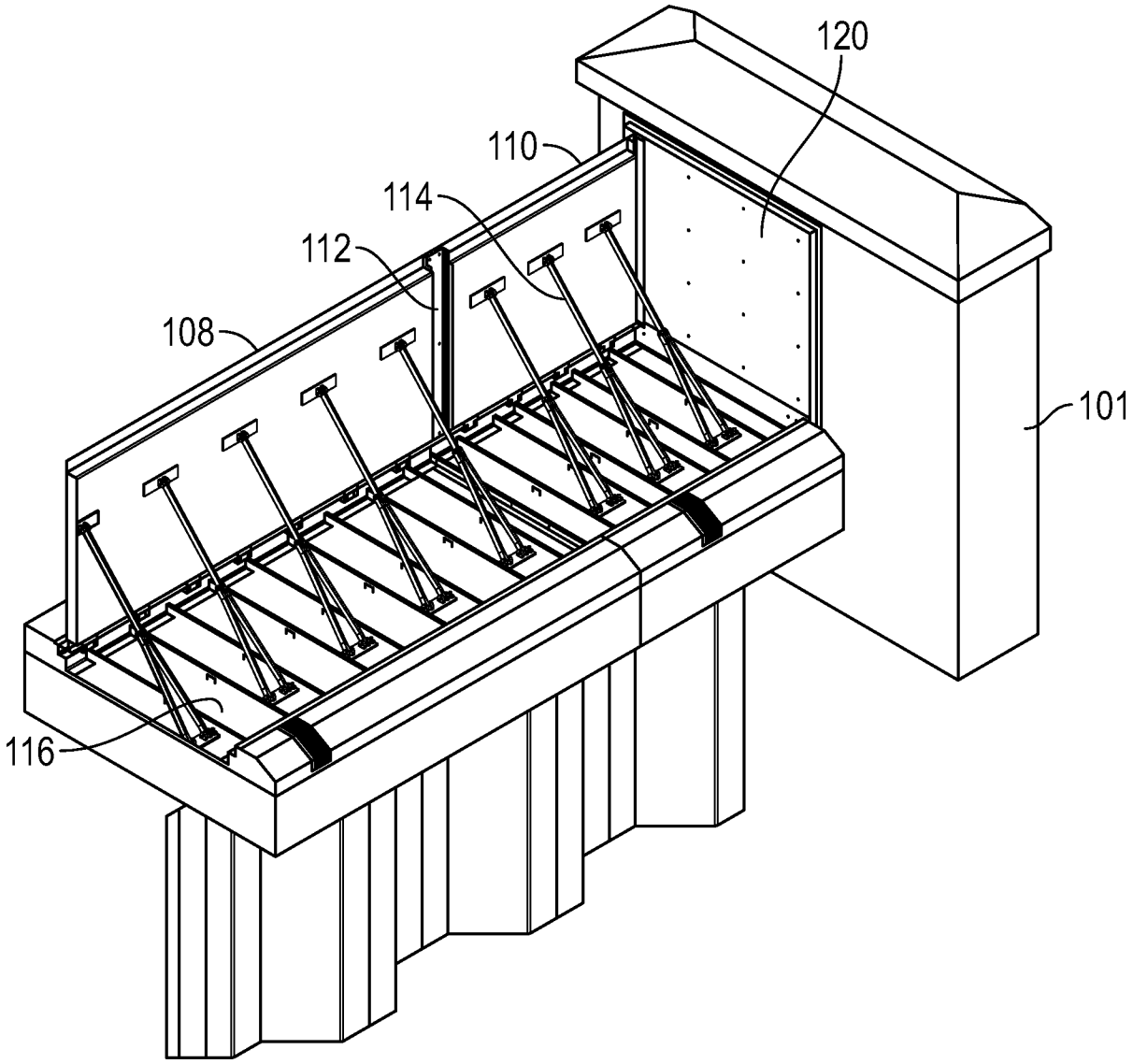


FIG. 2

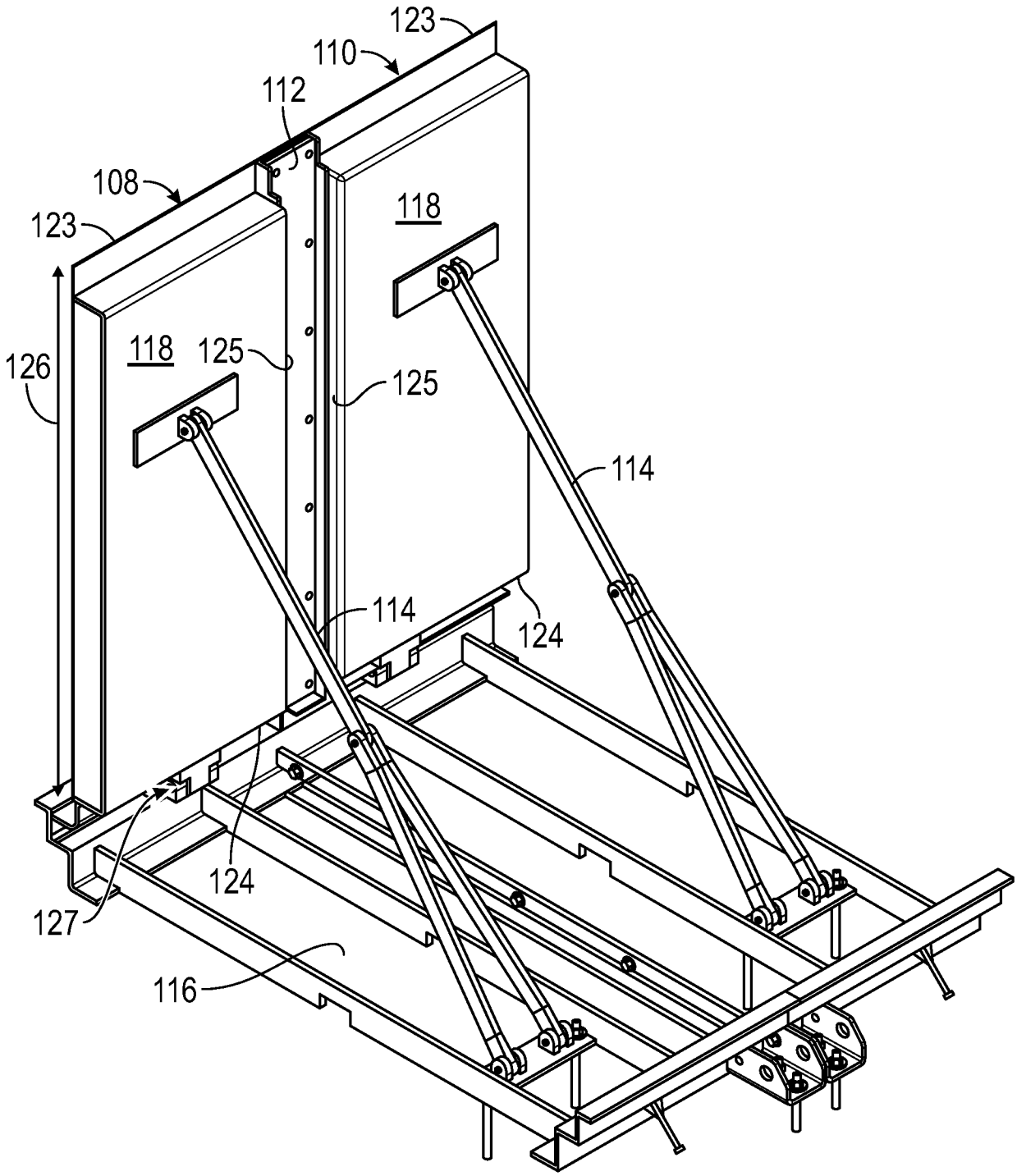


FIG. 3

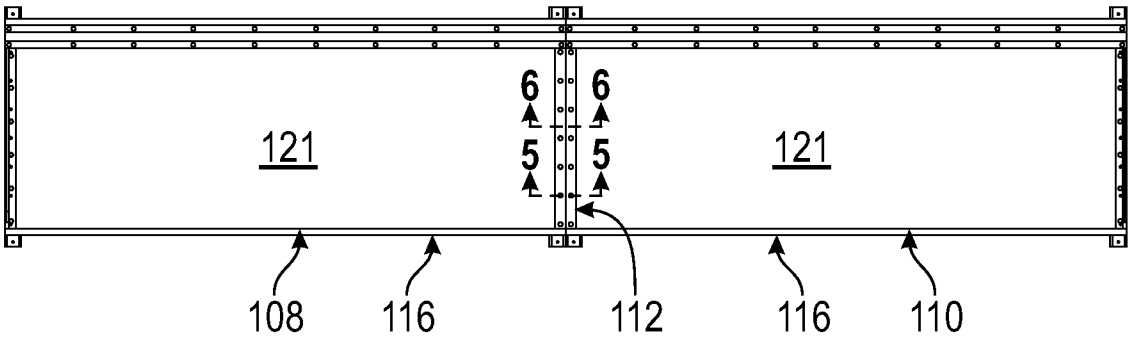


FIG. 4

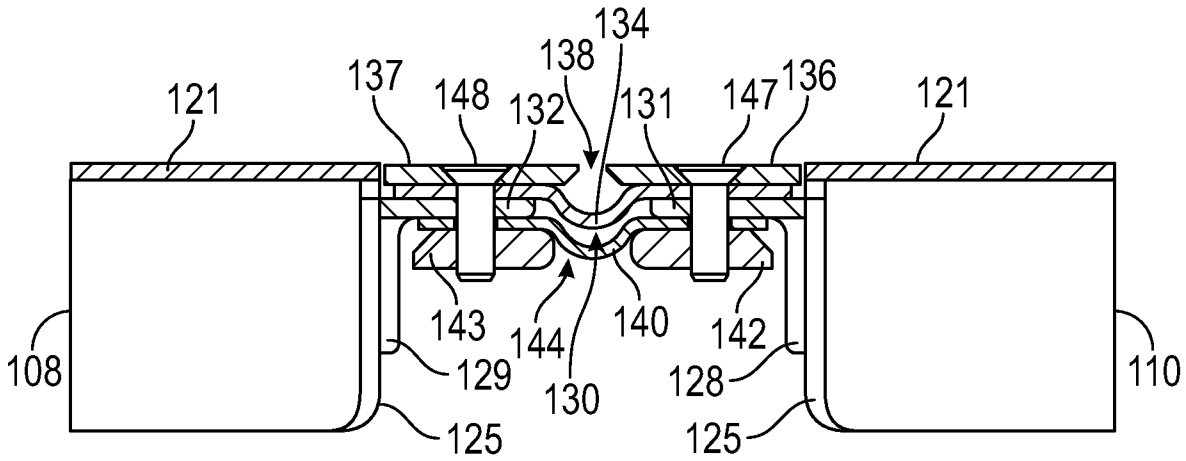


FIG. 5

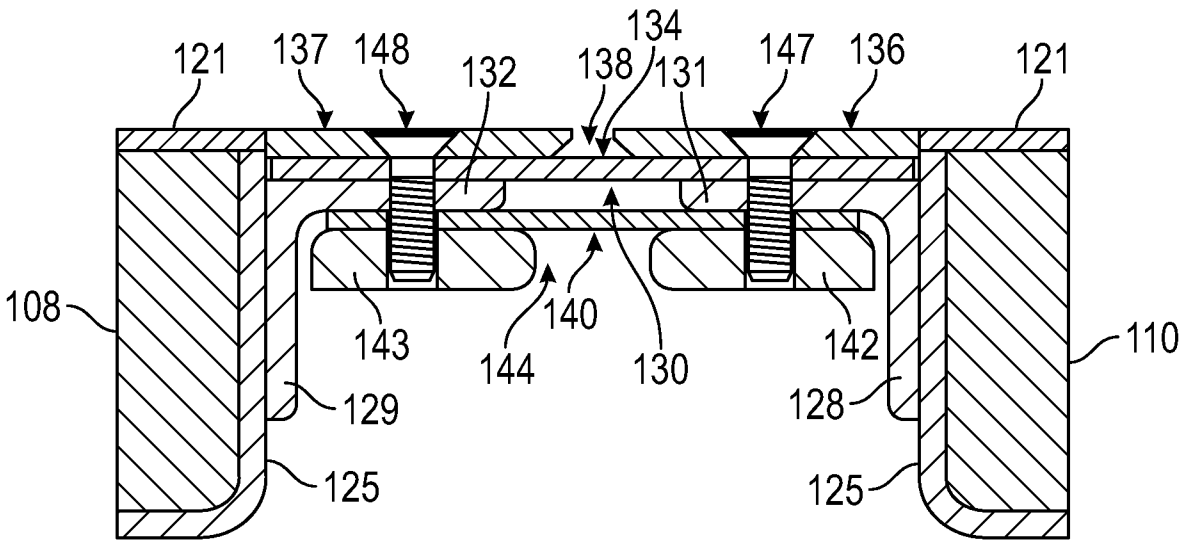


FIG. 6

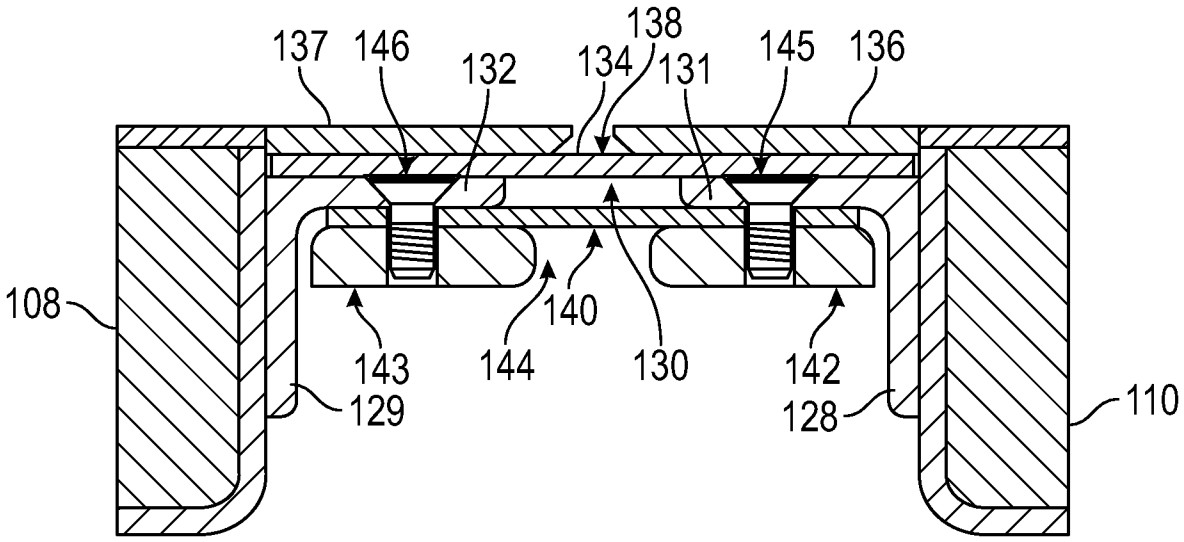


FIG. 7

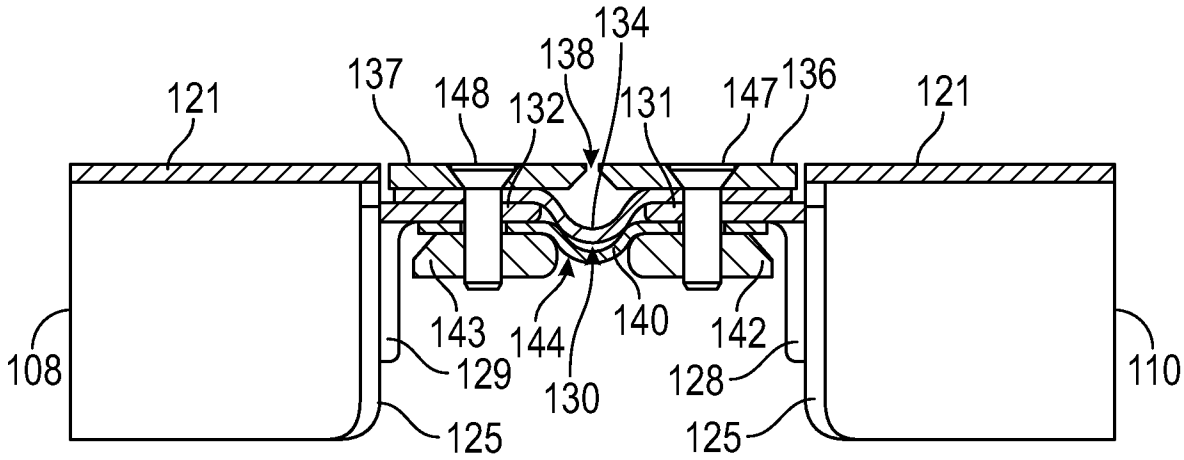


FIG. 8

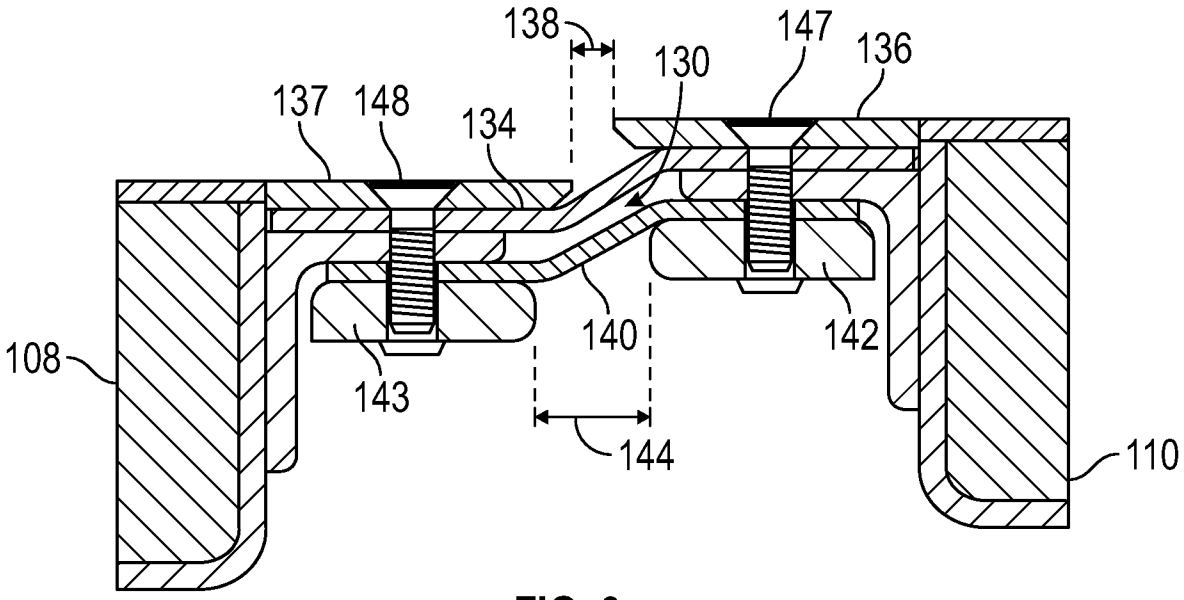


FIG. 9

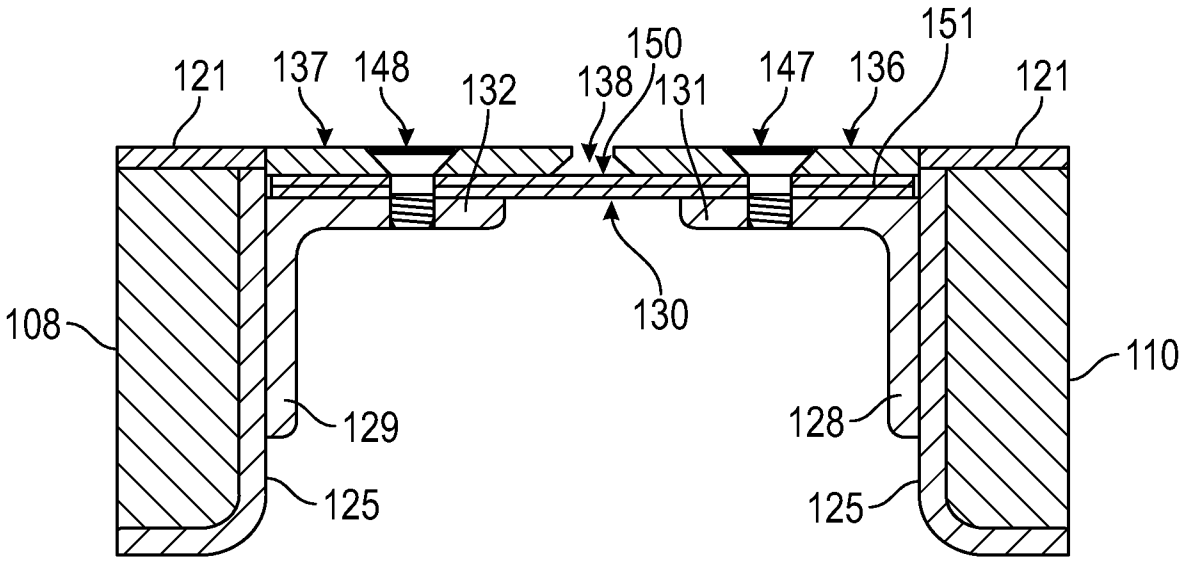

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FIG. 10

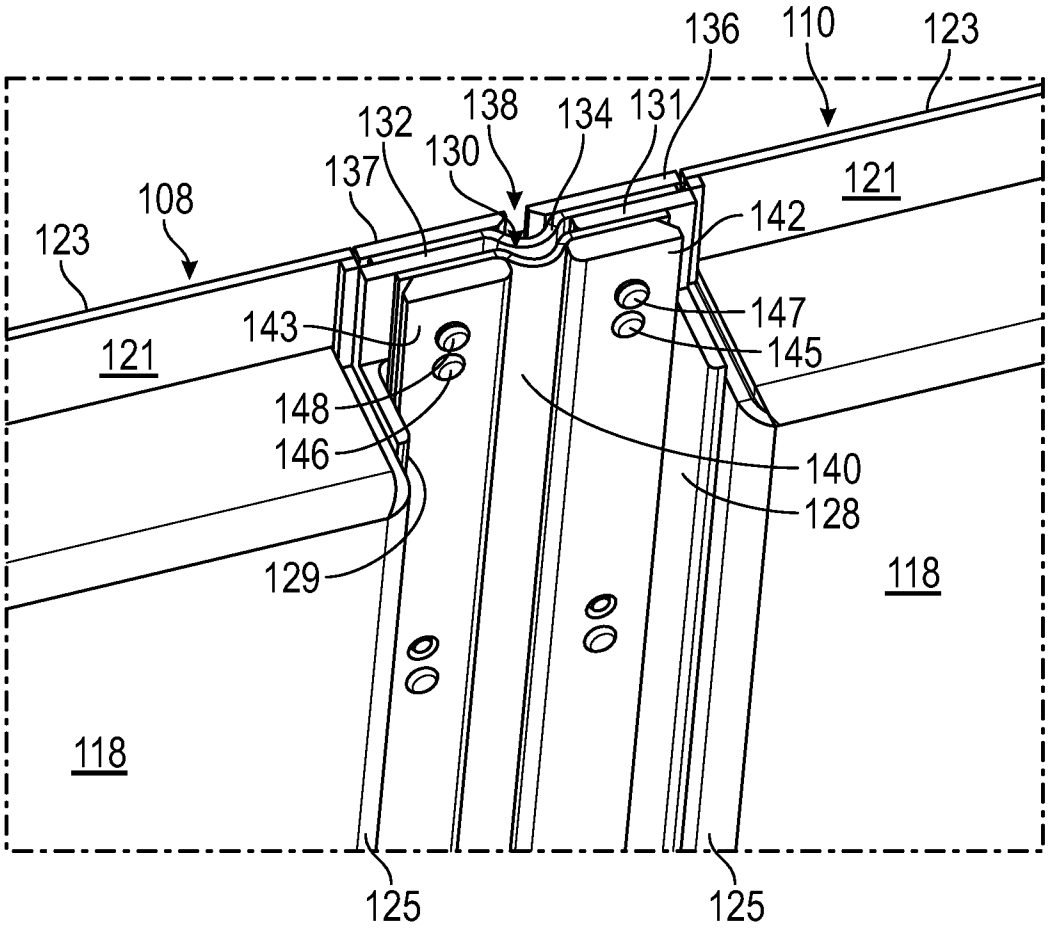

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FIG. 11

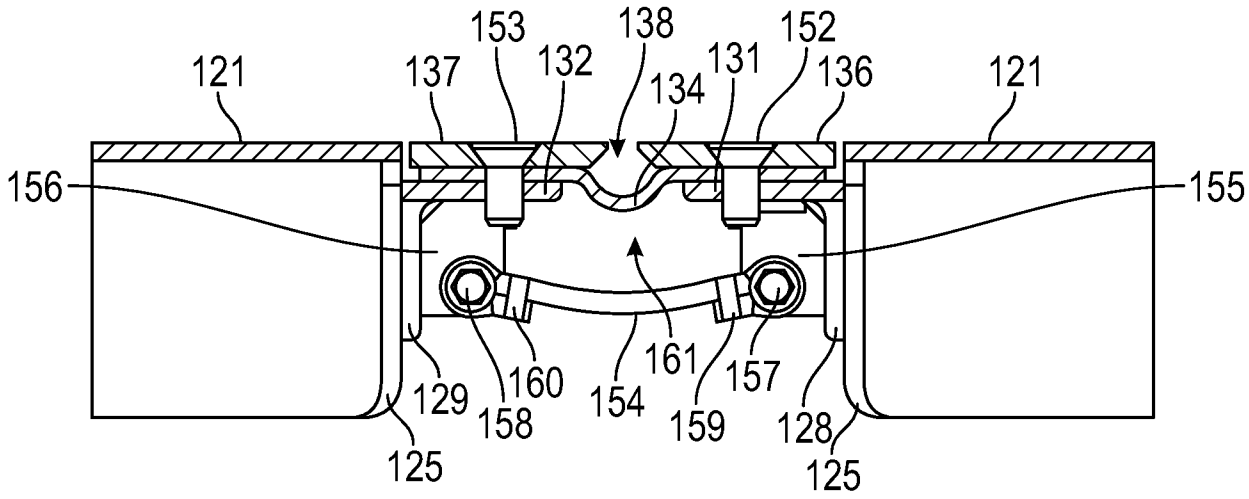


FIG. 12

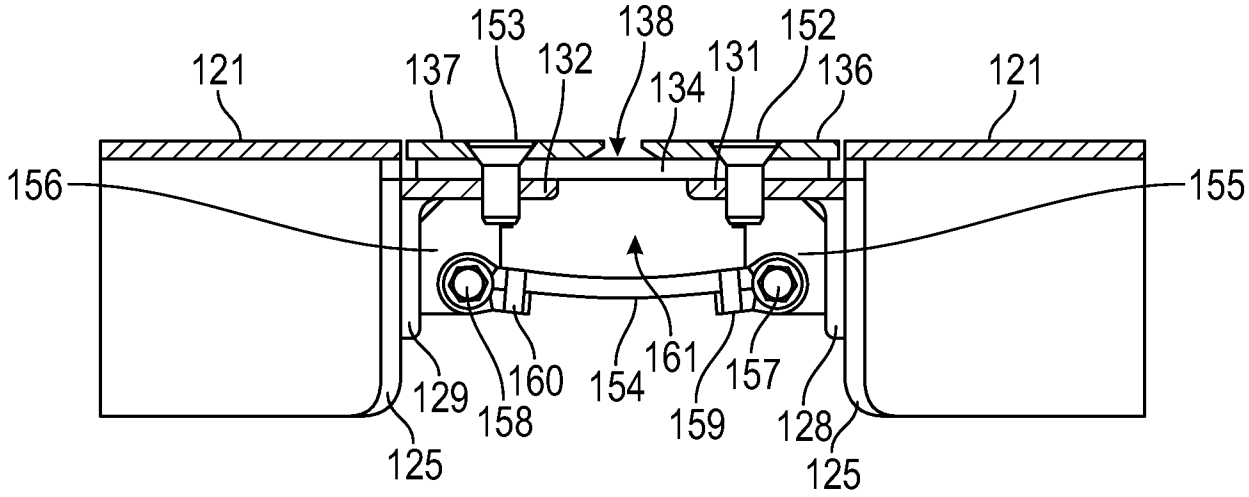


FIG. 13

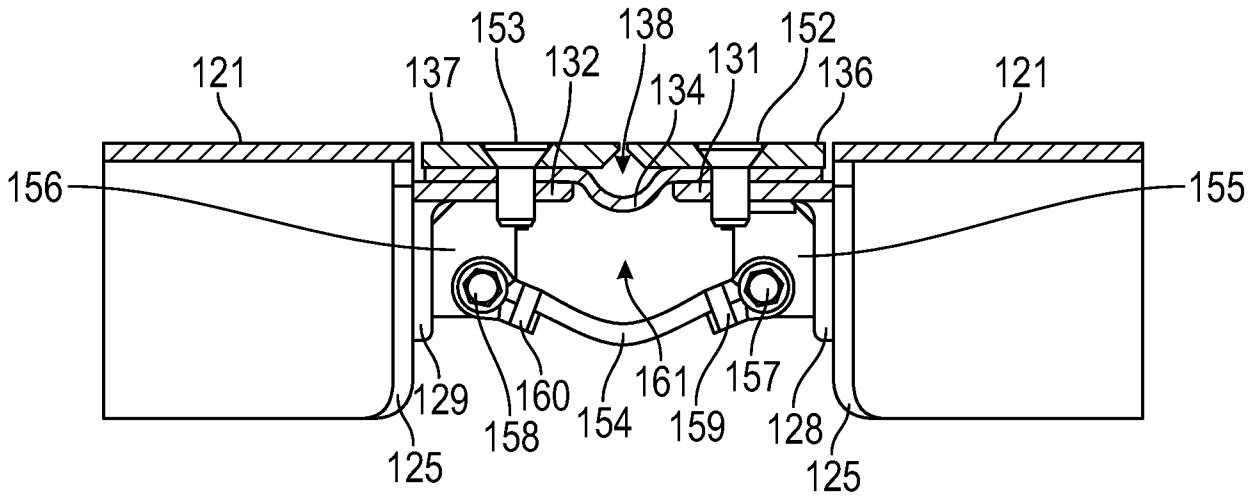


FIG. 14

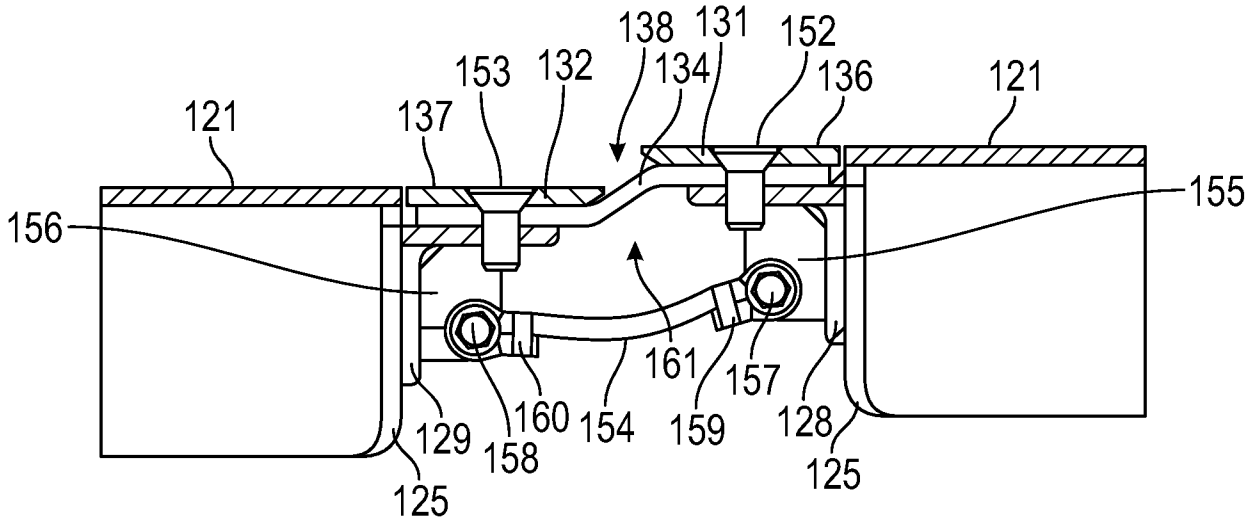

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FIG. 15

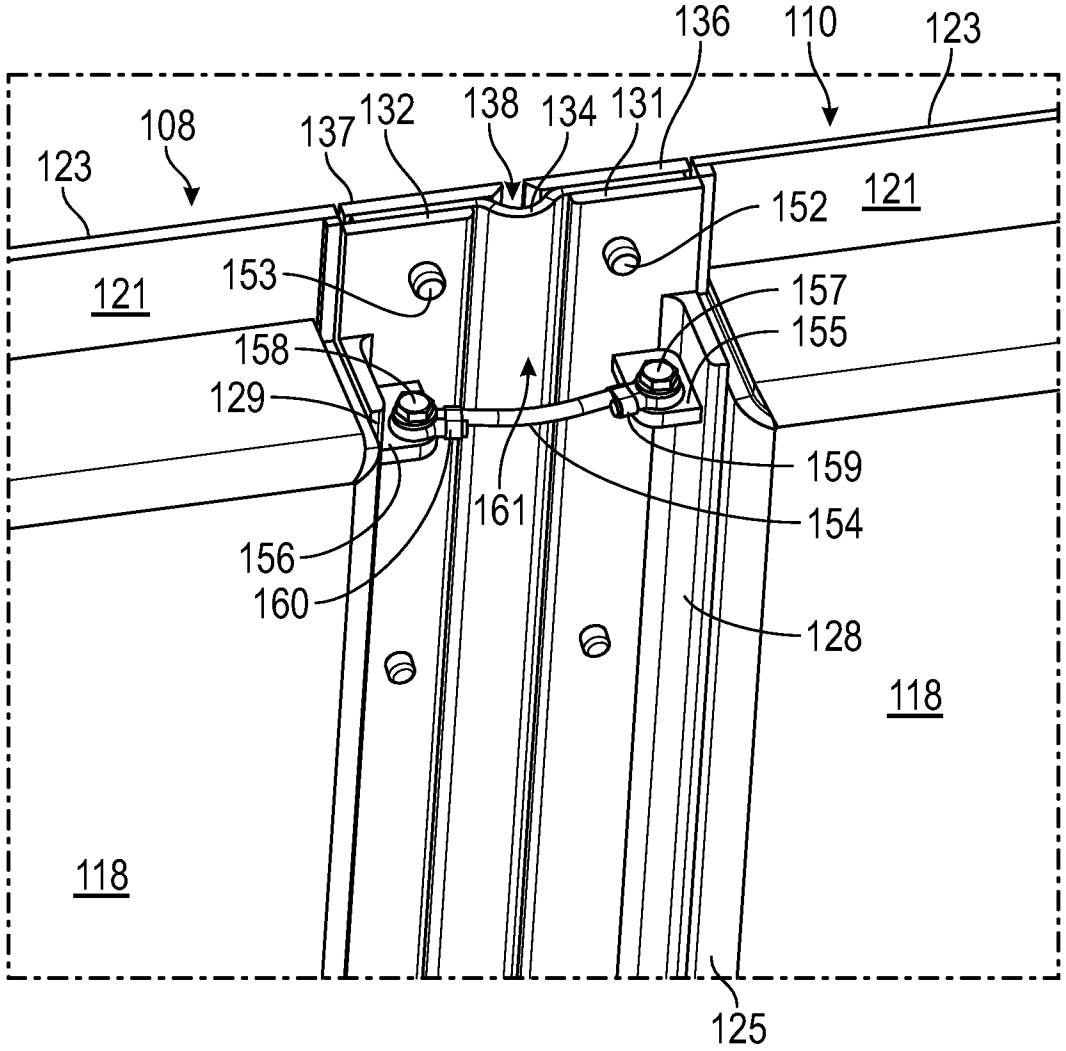

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FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2022/050748

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - INV. - E02B 7/54; E02B 7/44 (2023.01)
ADD.

CPC - INV. - E02B 7/54; E02B 7/44 (2023.02)

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2012/0163916 A1 (WATERS) 28 June 2012 (28.06.2012) entire document	1, 7, 8, 11, 12 --- 9, 10, 13-15
X --- Y	US 2,040,722 A (ZIMMERMANN) 12 May 1936 (12.05.1936) entire document	1 --- 2-6
Y	US 4,732,413 A (BACHMANN et al) 22 March 1988 (22.03.1988) entire document	2-6, 13, 14
Y	US 3,527,481 A (LEWIS) 08 September 1970 (08.09.1970) entire document	9, 10, 15
A	US 4,204,707 A (LINCICOME et al) 27 May 1980 (27.05.1980) entire document	1-20
A	US 2013/0209173 A1 (QUEK) 15 August 2013 (15.08.2013) entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 March 2023	APR 13 2023
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