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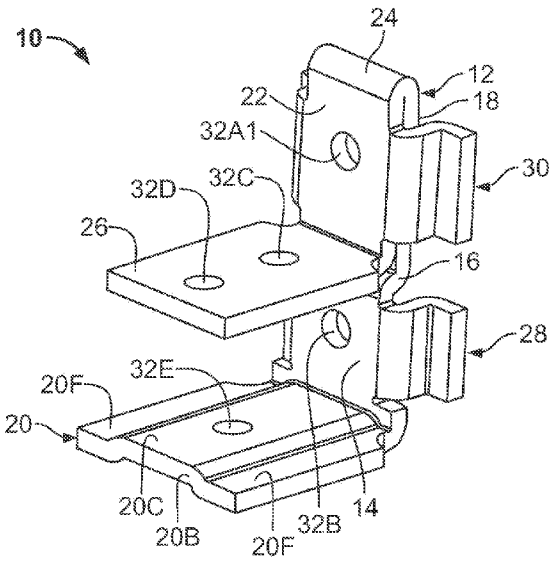


FIG. 1

(57) Abstract: A clip for assembling corners of hollow members such as the rails and stiles of an extruded aluminum door. The clip has an L shape and may feature a double L shape. A portion inserts into the hollow of a first member and is attached thereto. Another portion extends into the other hollow member for attachment thereto to form a sturdy joint without welding. Pairs of clips may be used at each corner.

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Manufacture and Method for Forming Structures and the Structures Resulting Therefrom

Field

The present invention relates to joinery methods and manufactures for assembling structures and more particularly, to such methods and manufactures applied to the task of assembling structures, such as doors, windows and frames, from members conjoined at an angle, e.g., perpendicular to one another.

Background

Various manufactures and methods are known for joining adjacent members, such as welding, mortise and tenon joints, the use of threaded fasteners extending through the adjacent ends of the members, etc. As applied to metal structures, such as metal doors, traditional welding methods of the stiles to the rails is labor and skill intensive, costly, and often causes discoloration and distortion of pre-finished members. The use of full-width tie rods in conjunction with corner fittings requires multiple fittings and assembly is time consuming and costly. Improved and /or alternative methods and devices for joinery therefore remain desirable.

Summary

The disclosed subject matter relates to a clip for attaching a first member to a second member, including a first leg, a second leg, the second leg attached to the first leg at a first angle,

the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of being received within an interior of the second member, contacting the interior of the second member and being fastened to the second member.

In another embodiment, the first leg and the second leg are each capable of being fastened to the first member and the second member, respectively at a plurality of locations.

In another embodiment, a third leg is attached to and extending from at least one of the first leg and the second leg in a direction of extension of the second leg, the third leg being spaced from the second leg and being capable of being fastened to the second member.

In another embodiment, a stabilizer member that extends from the first leg contacts an interior surface of the first member when the clip is fastened thereto limiting the motion of the clip relative to the first member.

In another embodiment, the clip is formed from a continuous ribbon of metal that is bent to form the clip with first, second and third legs.

In another embodiment, the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member.

In another embodiment, the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from an

interior hollow of the first member to a position exterior to the first member with the first leg being retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member.

In another embodiment, the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member.

In another embodiment, the first member has another slot therein for accommodating the stabilizer of the clip when the clip is fastened to the first member.

In another embodiment, a U shaped member is attached on one side to an end of the second leg with opposing sides of the U-shaped member parallel to the second leg, a bottom portion of the U shape being parallel to the first leg.

In another embodiment, the bottom portion of the U shape is spaced from the first leg to accommodate a wall of the first member there between.

In another embodiment, the first member has a slot in a wall thereof accommodating the clip.

In another embodiment, the first leg has first and second parallel walls conjoined at a U-shaped curve.

In another embodiment, the first wall of the first leg has a stub wall extending at an angle therefrom and is formed from a continuous length of metal ribbon that is bent into a form

defining the first leg and second leg, the bend at the U-shaped curve and the conjunction of the stub wall to the first wall being relieved at opposing edges thereof.

In another embodiment, a pair of retainer tabs extend from opposing sides of the clip proximate the first leg, the retainer tabs capable of preventing the clip from passing through a slot that is dimensioned to approximate the width of the first leg.

In another embodiment, a structure includes a first member, a second member,

a clip for attaching the first member to the second member, the clip having a first leg and a second leg, the second leg attached to the first leg at a first angle, the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior hollow of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of being received within an interior of the second member, contacting the interior of the second member and being fastened to the second member.

In another embodiment, the clip has a third leg attached to and extending from at least one of the first leg and the second leg in a direction of extension of the second leg, the third leg being spaced from the second leg and being capable of being fastened to the second member.

In another embodiment, the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member and wherein the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from the interior of the

first member to a position exterior to the first member with the first leg being retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member.

In another embodiment, the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member and wherein the first member has another slot therein for accommodating the stabilizer of the clip when the clip is fastened to the first member.

In another embodiment, a U shaped member is attached on one side to an end of the second leg with the one side and an opposing side of the U-shaped member parallel to the second leg, the opposing side forming the third leg, a bottom portion of the U shape being parallel to the first leg and spaced from the first leg to accommodate a wall of the first member there between and wherein the first member has a slot in a wall thereof accommodating the clip.

In another embodiment, the first and second members are a stile and a rail of an extruded aluminum alloy door frame.

In another embodiment, the first leg has first and second parallel walls conjoined at a U-shaped curve and the first wall of the first leg has a stub wall extending at an angle therefrom and is formed from a continuous length of metal ribbon that is bent into a form defining the first leg and second leg, the bend at the U-shaped curve and the conjunction of the stub wall to the first wall being relieved at opposing edges thereof and further comprising a pair of retainer tabs

extending from opposing sides of the clip proximate the first leg, the retainer tabs capable of preventing the clip from passing through a slot in the first member that is dimensioned to approximate the width of the first leg.

In another embodiment, a method for joining a first member to a second member, includes the steps of providing a clip for attaching the first member to the second member, the clip having a first leg and a second leg, the second leg attached to the first leg at a first angle, the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior hollow of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of extending from the interior of the first member to an exterior thereof and being received within an interior hollow of the second member, contacting the interior of the second member and being fastened to the second member; inserting the portion of the clip receivable in the first member into the hollow of the first member, with the second leg extending from the first member; fastening the clip to the first member; inserting the second leg into the hollow of the second member; and fastening the second member to the second leg.

In another embodiment, the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member and wherein the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from the interior hollow of the first member to a position exterior to the first member with the first leg being

retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member and further including the steps of extending the second leg and the third leg through corresponding ones of the plurality of slots in the first member after the step of inserting and prior to the step of fastening the clip to the first member.

In another embodiment, the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member and wherein the first member has another slot therein for accommodating a stabilizer of the clip when the clip is fastened to the first member and wherein the step of inserting includes inserting the portion of the clip extendable into the slot in the first member into the slot; and further including the step of rotating the clip until the upper portion of the upper L shape abuts an interior surface of the first member, after the step of inserting and prior to the step of fastening the clip to the first member.

In another embodiment, the clip has a U shaped member attached on one side to an end of the second leg with the one side and an opposing side of the U-shaped member parallel to the second leg, the opposing side forming the third leg, a bottom portion of the U shape being parallel to the first leg, wherein a bottom portion of the U shape is spaced from the first leg to accommodate a wall of the first member there between and wherein the first member has a slot in a wall thereof accommodating the clip and wherein the step of inserting includes sliding the clip into the slot such that the first leg is received in the hollow of the first member and the

bottom portion of the wall of the first member is accommodated between the bottom portion of the U shaped member and the first leg.

In another embodiment, further including the steps of providing a second clip like the first clip for attaching the first member to the second member; inserting the portion of the second clip receivable in the first member into the hollow of the first member, with the second leg extending from the first member; fastening the second clip to the first member spaced at a predetermined distance from the first clip; inserting the second leg of the second clip into the hollow of the second member; and fastening the second member to the second leg.

Brief Description of the Drawings

For a more complete understanding of the present disclosure, reference is made to the following detailed description of exemplary embodiments considered in conjunction with the accompanying drawings.

FIG. 1 is perspective view of a clip for assembling members in accordance with an embodiment of the present disclosure.

FIG. 2 is a perspective view of the clip of FIG. 1 looking from another direction.

FIG. 3 is a perspective view of the clip of FIGS. 1 and 2 in position for insertion into a first hollow member.

FIG. 4 is a partially phantom perspective view of the clip of FIG. 3 positioned within the first hollow member.

FIG. 5 is a perspective view of the clip and hollow member of FIGS. 3 and 4 coupled to an adjacent member to form an assembly.

FIG. 6 is a cross-sectional view of the assembly of FIG. 5.

FIG. 7 is a perspective view of the cross-section of the assembly of FIG. 6.

FIG. 8 is a perspective view of the assembly of FIGS. 5-7 viewed from another direction.

FIG. 9 is perspective view of a clip for assembling members in accordance with another embodiment of the present disclosure.

FIG. 10 is a perspective view of the clip of FIG. 9 looking from another direction.

FIG. 11 is a partially phantom, perspective view of the clip of FIGS. 9 and 10 in a first insertion position into a slot in a first hollow member.

FIG. 12 is a partially phantom, perspective view of the clip of FIG. 11 as it is rotated into a second insertion position within the first hollow member.

FIG. 13 is a partially phantom perspective view of the clip of FIGS. 11 and 12 in the second insertion position within the first hollow member.

FIG. 14 is a perspective view of the clip and hollow member of FIG. 13 coupled to an adjacent member to form an assembly.

FIG. 15 is a cross-sectional view of the assembly of FIG. 14.

FIG. 16 is a perspective view of the cross-section of the assembly of FIG. 15.

FIG. 17 is perspective view of a clip for assembling members in accordance with another embodiment of the present disclosure.

FIG. 18 is a perspective view of the clip of FIG. 17 looking from another direction.

FIG. 19 is a perspective view of the clip of FIGS. 17 and 18 in position for insertion into a first hollow member.

FIG. 20 is a partially phantom, perspective view of the clip of FIG. 19 positioned within the first hollow member.

FIG. 21 is a perspective view of the clip and hollow member of FIG. 20 coupled

to an adjacent member to form an assembly.

FIG. 22 is a cross-sectional view of the assembly of FIG. 21.

FIG. 23 is a perspective view of the cross-section of the assembly of FIG. 22.

FIG. 24 is perspective view of a clip for assembling members in accordance with another embodiment of the present disclosure.

FIG. 25 is a perspective view of the clip of FIG. 24 looking from another direction.

FIG. 26 is a partially phantom, perspective view of a pair of clips shown in FIGS. 24 and 25 in a first insertion position into a pair of slots in a first hollow member.

FIG. 27 is a partially phantom, perspective view of the clips of FIG. 26 as they are rotated into a second insertion position within the first hollow member.

FIG. 28 is a partially phantom perspective view of the clips of FIGS. 26 and 27 in the second insertion position within the first hollow member.

FIG. 29 is a perspective view of the clips and hollow member of FIG. 28 coupled to an adjacent member to form an assembly.

FIG. 30 is a cross-sectional view of the assembly of FIG. 29.

FIG. 31 is a perspective view of the cross-section of the assembly of FIG. 30.

Detailed Description of Exemplary Embodiments

The present disclosure describes a clip and clip installation process that may be used in conjunction with fasteners to assemble a frame joint from component members. In one embodiment, the clip may be used to join a stile and rail of a door or window frame, e.g., made from hollow members, such as extrusions made from aluminum alloy. The clip may be used to align vertical and horizontal components relative to each other, allowing them to be joined at

the proper angle. The clip may be used to join members of various lengths, such as tall/short top and bottom rails, allowing a variety of structures to be assembled using a common clip, e.g., to produce a variety of frames of different dimensions. The clip may be made from plastic, aluminum or steel depending on the strength needed for the joint connection. In those applications where high strength, low cost and formability are required, steel can be used. Progressive, one-piece steel stamping designs are presented herein, but fabricated steel, machined aluminum, machined plastic, extruded or cast aluminum and extruded or cast plastics could also be used for forming the clip. The present disclosure includes clip installation methods that could be categorized as: inside mounting, outside mounting or slide-in mounting. In one embodiment, the clip may be attached to the members to be joined through the use of blind fasteners. The fastener dimensions may be selected to provide the required strength for the application and may be set using a hydraulic or pneumatic gun, eliminating welding and the inherent heat related problems that it creates. Other types of fasteners can be used for attachment, such as screws, bolts, rivets, spot welds, etc. Typically, the use of the clip and methods of the present disclosure allow a reduction in the number of parts required to join members into a frame structure over conventional approaches. The avoidance of welding may also lead to reductions in labor costs and required skill levels, assembly time, number of parts to assemble and stock, manufacturing costs, rework and scrap. The ease of assembly provided by the clip may also allow assembly to take place in the field versus in the factory.

FIGS. 1 and 2 show a clip 10 for assembling members 11, 13 (see FIG. 5) in accordance with an embodiment of the present disclosure. The clip 10 could be described as having a stacked or double L configuration with a first leg 12 having a first panel 14, an offset 16 and a second panel 18. A second leg 20 extends at an angle, e.g., 90 degrees from the first panel 14, defining the bottom portion of a first L shape and a third panel 22 depends from a reverse curve 24, such

that the third panel 22 extends parallel to the second panel 18 and in line with the first panel 14. The offset 16 has dimensions approximating the thickness of the third panel 22 and permits the third panel 22 to be in line with the first panel 14. A third leg 26 extends from the third panel 22 at an angle, e.g., 90 degrees, forming in conjunction with the third panel 22, another L shape that nests (with a space between second leg 20 and third leg 26) with the L shape formed by the first leg 12 and the second leg 20. The second leg 20 has a flattened U shaped cross-section with a central area 20C, bends 20B and flat portions 20F that overall provide a stiffening function and may mate in complementary fashion with interior surfaces of the member 13. A pair of support wings 28 extend from opposite sides of the first panel 14 with a connected portion 28C extending at an angle, e.g., 90 degrees relative to the first panel 14 to a bend 28B of, e.g., 90 degrees from which extends a lip 28L. A similar pair of support wings 30 with portions 30C, 30B and 30L extend in a similar manner from third panel 22. Holes 32A1-32E permit the passage of fasteners (not shown) like rivets, screws, bolts, etc. through the clip 10.

FIGS. 3 and 4 show the installation of the clip 10 into a hollow structural member 11 that may be made, e.g., from extruded aluminum or plastic. The member 11 has a wall 11W with a shallow U cross sectional shape. Slots S1, S2 in the wall 11W receive the second leg 20 and the third leg 26, respectively, there through and apertures A1, A2 align with apertures 32A1/ 32A2 and, 32B of the clip 10. Because the clip 10 is inserted into the hollow member 11 and then the second leg 20 and third leg 26 are extended through the slots S1, S2, the arrangement can be designated an "inside mount" of the clip 10. When fully inserted into the slots S1, S2, the support wings 28, 30, being complementarily shaped relative to the shallow U shaped wall 11W, bear against the wall 11W and/or the interior 11I of the member 11 to resist torsional forces F1, F2 (clockwise or counterclockwise, see FIG. 5 also) that may be exerted on the clip 10 and members 11, 13. The slots S1, S2 and apertures A1, A2 may be punched, drilled or machined

into the wall 11W.

FIGS. 5 - 8 show an assembly 34 formed from members 11, 13 conjoined by clip 10 and fasteners 36A-36E. The fasteners 36A-36E may be "blind fasteners," such as pop rivets that can be applied from one side of an assembly and have a head portion H, which is larger than the apertures A1, A2 in member 11 (member 13 having similar apertures) and an expandable portion M, which is inserted through aligned apertures, e.g., A1 and 32A1, 32A2 and then expanded (by pulling on a central, breakable core pin with a swage tip) to enlarge the expandable portion M to a dimension larger than the apertures A1, 32A1, 32A2, clamping the member 11 to the clip 10. Blind fasteners do not require access to the side of the assembly 34 opposite to the head portion H. The member 13 is similarly held to the clip 10 by the action of fasteners 36C, 36D and 36E. Other types of fasteners 36 may be used, such as machine or self-threading screws or bolts with mating nuts.

FIGS. 9 and 10 show a clip 110 for assembling members 111, 113 (see FIG. 14) in accordance with an embodiment of the present disclosure. The clip 110 could be described as having a stacked or double L configuration with a first leg 112 having a first panel 114, an offset 116 and a second panel 118. A second leg 120 extends at an angle, e.g., 90 degrees from the first panel 114, defining the bottom portion of a first L shape and a third panel 122 depends from a reverse curve 124, such that the third panel 122 extends parallel to the second panel 118 offset from the plane occupied by the first panel 114. The offset 116 has dimensions approximating the thickness of the third panel 122 plus the thickness of the member 111 (wall 111W) and permits the third panel 122 to abut against the interior surface of the wall 111W while the first panel 114 abuts the exterior surface of the wall 111W, when the clip 110 is installed on member 111 (See FIG. 13). A third leg 126 extends from the third panel 122 at an angle, e.g., 90 degrees, forming in conjunction with the third panel 122, another L shape that nests (with a space between second

leg 120 and third leg 126) with the L shape formed by the first leg 112 and the second leg 120. The second leg 120 has a flattened U shaped cross-section like second leg 20 of FIG. 1. A pair of support wings 129 extend from opposite sides of the first panel 114 extending at an angle, e.g., 90 degrees relative to the first panel 114. Holes 132A1-132E permit the passage of fasteners like rivets, screws, bolts, etc. through the clip 10. Additional holes, like 132F (only shown in FIGS. 9 and 10) may be made to accommodate additional fasteners.

FIGS. 11, 12 and 13 show the installation of the clip 110 into a hollow structural member 111 that may be made, e.g., from extruded aluminum or plastic. The member 111 has a wall 111W with a shallow U cross sectional shape. Slot S1 in the wall 111W receives the second and third panels 118, 122. When the clip 110 is rotated (counterclockwise in these views), the support wings 129 extend into slots S2A and S2B and the aperture 132D aligns with aperture A1 in 111W and apertures 132A1, 132A2 align with aperture A2 in wall 111W. Because the clip 110 is partially inserted into the hollow member 111 from the outside and second leg 120, first panel 114 and third leg 126 remain on the outside of the member 111, the arrangement can be designated an "outside mount" of the clip 110. When fully inserted into the slots S2A, S2B, the support wings 129 bear against the slots S2A, S2B and/or the interior 111I of member 111 to resist torsional forces F1, F2 (See FIG. 4) that may be exerted on the clip 110.

FIGS. 14 - 16 show an assembly 134 formed from members 111, 113 and conjoined by clip 110 and fasteners 136A-136E. The fasteners 136A-136E may be "blind fasteners," such as pop rivets that can be applied from one side of an assembly and have a head portion H and an expandable portion M, which is inserted through the aligned apertures, e.g., A1, 132A1, 132A2 and then expanded to enlarge the expandable portion M to a dimension larger than the apertures A1, 132A1, 132A2, clamping the member 111 to the clip 110. The member 113 is similarly held to the clip 110 by the action of fasteners 136C, 136D and 136E. Other

types of fasteners 136 may be used, such as machine or self-threading screws or bolts with mating nuts.

FIGS. 17 and 18 show a clip 210 for assembling members 211, 213 (see FIG. 21) in accordance with an embodiment of the present disclosure. The clip 210 could be described as having an L configuration with a first leg 212 having a flattened U shaped cross section. A second leg 220 extends at an angle, e.g., 90 degrees from the first leg 212, defining the bottom portion of the L shape. A third panel 221 extends back from a reverse curve 223, such that the third panel 221 extends parallel to the second leg 220. An upright panel 225 extends from curve 227 parallel to and spaced from first leg 212 by a spacing approximating the thickness of wall 211W and ends in curve 229. A forth panel 226 extends from curve 229 parallel to panels 220 and 221. The clip 210 could be described as L shaped with a U shaped element composed of panels 221, 225 and 226 attached to the bottom leg 220, such that the bottom portion of the L is bifurcated.

A pair of support wings 228 extend from opposite sides of the first leg 212 with a connected portion 228C extending at an angle, e.g., 90 degrees relative to the first leg 212 to a bend 228B of, e.g., 90 degrees from which a lip 228L extends. Holes 232A-232E2 permit the passage of fasteners like rivets, screws, bolts, etc. through the clip 210.

FIGS. 19 and 20 show the installation of the clip 210 into a hollow structural member 211 that may be made, e.g., from extruded aluminum or plastic. The member 211 has a wall 211W with a shallow U cross sectional shape. A slot S1 in the wall 211W accommodates the clip 210 allowing the leg 220 to project from a level above that of the edge 211E of the member 211 and allowing the apertures A1 and A2 to align with holes 232A and 232B1/ 232B2 (232B2 is not visible in this view). The slot S1 may extend up the wall 211W to any selected extent, so long as the apertures A1, A2, which may occupy any selected position, are positioned

to align with the apertures 232A, 232B1/ 232B2 for given slot S1 dimensions. Because the clip 210 is slipped into the hollow member 211 via the slot and the spacing between panel 225 and leg 212, the arrangement can be designated a "slide mount" of the clip 210. When fully inserted into the slot S1 and fastened by fasteners, as shown in FIG. 21, the support wings 228, being complementarily shaped relative to the shallow U shaped wall 211W, bear against the wall 211W and/or the interior 211I of the member 211 to resist torsional forces F1, F2 that may be exerted on the clip 210 and/or members 211, 213.

FIGS. 21 - 23 show an assembly 234 formed from members 211, 213 and conjoined by clip 210 and fasteners 236A-236E. The fasteners 236A-236E may be "blind fasteners," such as pop rivets that can be applied from one side of an assembly and have a head portion H, which is larger than the apertures A1, A2 in the member 211 (member 213 having similar apertures) and an expandable portion M, which is inserted through the aligned apertures, e.g., A1, 232A and then expanded to enlarge the expandable portion M to a dimension larger than the aperture 232A and clamping the member 211 to the clip 210. The member 213 is similarly held to the clip 210 by the action of fasteners 236C, 236D and 236E. Other types of fasteners 236 may be used, such as machine or self-threading screws or bolts with mating nuts.

FIGS. 24 and 25 show a clip 310 for assembling members 311, 313 (see FIG. 29) in accordance with an embodiment of the present disclosure. The clip 310 could be described as having an L configuration with a first leg 312 having a stub 316 extending at an angle, e.g., 90 degrees, from a first panel 318. A second leg 320 extends at an angle, e.g., 90 degrees from a second panel 322, defining the bottom portion of the L shape, the second panel 322 depending from a reverse curve 324 extending from the first panel 318, such that the second panel 322 extends parallel to the first panel 318. The stub 316 extends from the first panel 318 parallel to the second leg 320, bracing the position of the second leg relative to the second panel 322. Holes

332A1-332D permit the passage of fasteners like rivets, screws, bolts, etc. through the clip 310. The clip 310 features two holding tabs 317A, 317B that prevent the clip 310 from passing through a given slot in a hollow member when it is partially inserted therein to assemble a structure, as shall be described below. Reliefs 319A, 319B, 321A and 321B at the reverse curve 324, stub 316 and bend 323 remove the burr that is produced as a consequence of forming a bend at these locations. A burr could interfere with the insertion and rotation of the clip 310 in a close fitting slot in a member to be joined. The clip 310 is also radiused at 325A and 325B to facilitate insertion into a mating slot in a structural member, such as the rail of a door.

FIGS. 26, 27 and 28 show the installation of a pair of clips 310A, 310B into a hollow structural member 311 that may be made, e.g., from extruded aluminum or plastic. The member 311 has a wall 311W with a shallow U cross sectional shape. Slots S1, S2 in the wall 311W receive the first legs 312 of clips 310A, 310B. When the clips 310A, 310B are inserted fully, the holding tabs 317A, 317B abut against the corresponding slot S1, S2, preventing the clip 310 from passing entirely through the slots S1, S2 into the interior hollow 311I of the hollow member 311. When the clips 310A, 310B are rotated (counterclockwise in these views), the apertures 332A1/332A2 and 332B1, 332B2 align with apertures A1, A2, A3, A4 in wall 311W. Because the clips 310A, 310B are partially inserted into the hollow member 311 from the outside and second leg 320, remains on the outside of the member 311, the arrangement can be designated an "outside mount" of the clip 310.

FIGS. 29 - 31 show an assembly 334 formed from members 311, 313 and conjoined by clips 310A, 310B and fasteners 336A-336H. The fasteners 336A-336H may be "blind fasteners," such as pop rivets that can be applied from one side of an assembly. The member 313 is similarly held to the clips 310A, 310B by the action of fasteners 336E- 336H. Other types of fasteners 336 may be used, such as machine or self-threading screws or bolts with

mating nuts. The clips 310A, 310B may be used in pairs to join two members e.g., 311, 313. One of the clips connects the upper part of the horizontal extrusion (rail) with the vertical extrusion, (stile), while the other clip joins the lower part of the horizontal extrusion (rail) with the vertical extrusion. Since a pair of clips 310A, 310B can accommodate multiple rails of different dimensions by adjusting the position of the slots S1, S2 and the resultant spacing between the clips 310A, 310B, the clips 310A, 310B could be described as "universal." For structures having less demanding requirements of strength and rigidity, a single clip 310 could be used to fasten two members 311, 313.

It will be understood that the embodiments described herein are merely exemplary and that a person skilled in the art may make many variations and modifications without departing from the spirit and scope of the claimed subject matter. For example, while 90 degree assemblies are shown above, the clip 10, 110, 210, 310 may have a shape other than a 90 degree L, wherein the lower portion of the L is oriented at an acute or obtuse angle relative to the upper portion of the L, so that members 11, 13 may be joined at other than 90 degrees. All such variations and modifications are intended to be included within the scope of the appended claims.

CLAIMS

We claim:

1. A clip for attaching a first member to a second member, comprising:

a first leg;

a second leg, the second leg attached to the first leg at a first angle, the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of being received within an interior of the second member, contacting the interior of the second member and being fastened to the second member.

2. The clip of Claim 1, wherein the first leg and the second leg are each capable of being fastened to the first member and the second member, respectively at a plurality of locations.

3. The clip of Claim 1, further comprising a third leg attached to and extending from at least one of the first leg and the second leg in a direction of extension of the second leg, the third leg being spaced from the second leg and being capable of being fastened to the second member.

4. The clip of Claim 1, further comprising a stabilizer member that extends from the first leg and contacts an interior surface of the first member when the clip is fastened thereto limiting the motion of the clip relative to the first member.

5. The clip of Claim 4, wherein the clip is formed from a continuous ribbon of metal that is bent to form the clip with first, second and third legs.

6. The clip of Claim 5, wherein the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper

portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member.

7. The clip of Claim 5, wherein the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from an interior hollow of the first member to a position exterior to the first member with the first leg being retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member.

8. The clip of Claim 5, wherein the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member.

9. The clip of Claim 8, wherein the first member has another slot therein for accommodating the stabilizer of the clip when the clip is fastened to the first member.

10. The clip of Claim 1, further comprising a U shaped member attached on one side to an end of the second leg with opposing sides of the U-shaped member parallel to the second leg, a bottom portion of the U shape being parallel to the first leg.

11. The clip of Claim 10, wherein bottom portion of the U shape is spaced from the first leg to accommodate a wall of the first member there between.

12. The clip of Claim 11, wherein the first member has a slot in a wall thereof

accommodating the clip.

13. The clip of Claim 1, wherein the first leg has first and second parallel walls conjoined at a U-shaped curve.

14. The clip of Claim 13, wherein the first wall of the first leg has a stub wall extending at an angle therefrom and is formed from a continuous length of metal ribbon that is bent into a form defining the first leg and second leg, the bend at the U-shaped curve and the conjunction of the stub wall to the first wall being relieved at opposing edges thereof.

15. The clip of claim 13, further comprising a pair of retainer tabs extending from opposing sides of the clip proximate the first leg, the retainer tabs capable of preventing the clip from passing through a slot that is dimensioned to approximate the width of the first leg.

16. A structure, comprising:

a first member;

a second member;

a clip for attaching the first member to the second member, the clip having a first leg and a second leg, the second leg attached to the first leg at a first angle, the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior hollow of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of being received within an interior of the second member, contacting the interior of the second member and being fastened to the second member.

17. The structure of Claim 16, wherein the clip has a third leg attached to and extending from at least one of the first leg and the second leg in a direction of extension of the second leg, the third leg being spaced from the second leg and being capable of being fastened to the second

member.

18. The structure of Claim 17, wherein the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member and wherein the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from the interior of the first member to a position exterior to the first member with the first leg being retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member.

19. The structure of Claim 17, wherein the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member and wherein the first member has another slot therein for accommodating the stabilizer of the clip when the clip is fastened to the first member.

20. The structure of Claim 17, further comprising a U shaped member attached on one side to an end of the second leg with the one side and an opposing side of the U-shaped member parallel to the second leg, the opposing side forming the third leg, a bottom portion of the U shape being parallel to the first leg and spaced from the first leg to accommodate a wall of the

first member there between and wherein the first member has a slot in a wall thereof accommodating the clip.

21. The structure of Claim 17, wherein the first and second members are a stile and a rail of an extruded aluminum alloy door frame.

22. The structure of Claim 16, wherein the first leg has first and second parallel walls conjoined at a U-shaped curve and the first wall of the first leg has a stub wall extending at an angle therefrom and is formed from a continuous length of metal ribbon that is bent into a form defining the first leg and second leg, the bend at the U-shaped curve and the conjunction of the stub wall to the first wall being relieved at opposing edges thereof and further comprising a pair of retainer tabs extending from opposing sides of the clip proximate the first leg, the retainer tabs capable of preventing the clip from passing through a slot in the first member that is dimensioned to approximate the width of the first leg.

23. A method for joining a first member to a second member, comprises the steps of:

providing a clip for attaching the first member to the second member, the clip having a first leg and a second leg, the second leg attached to the first leg at a first angle, the first leg capable of being joined to the first member and the second leg capable of being joined to the second member, the first leg having a first portion that is capable of being received within an interior hollow of the first member, contacting the interior of the first member and being fastened to the first member, the second leg having a second portion that is capable of extending from the interior of the first member to an exterior thereof and being received within an interior hollow of the second member, contacting the interior of the second member and being fastened to the second member;

inserting the portion of the clip receivable in the first member into the hollow of the first member, with the second leg extending from the first member;

fastening the clip to the first member;

inserting the second leg into the hollow of the second member; and

fastening the second member to the second leg.

24. The method of Claim 23, wherein the clip has a pair of longitudinally offset L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel connecting the upper portions of the L shapes, the upper portions of the L shapes being co-planar, the clip having a plurality of apertures formed therein to receive fasteners to fasten the clip to the first member and the second member and wherein the first member has a plurality of slots extending through a wall thereof, the slots capable of passing the second leg and the third leg there through from the interior hollow of the first member to a position exterior to the first member with the first leg being retained within the hollow of the first member, such that the second leg and third leg are capable of being attached to the second member and further comprising the steps of:

extending the second leg and the third leg through corresponding ones of the plurality of slots in the first member after the step of inserting and prior to the step of fastening the clip to the first member.

25. The method of Claim 23, wherein the first member has a slot therein to accommodate a portion of the clip, the clip having a pair of longitudinally spaced L shapes, the second and third legs forming the bottom portion of the L shapes and the first leg forming the upper portion of the L shapes, the first leg including an offset panel that is received through the slot in the first member and that connects the upper portions of the L shapes, the upper portions of the L shapes being offset in depth to allow an upper portion of the upper L shape to abut an interior surface of the first member while an upper portion of the lower L shape abuts an exterior surface of the first member and wherein the first member has another slot therein for accommodating a stabilizer of

the clip when the clip is fastened to the first member and wherein the step of inserting includes

inserting the portion of the clip extendable into the slot in the first member into the slot; and further comprising the step of

rotating the clip until the upper portion of the upper L shape abuts an interior surface of the first member, after the step of inserting and prior to the step of fastening the clip to the first member.

26. The method of Claim 23, wherein the clip has a U shaped member attached on one side to an end of the second leg with the one side and an opposing side of the U-shaped member parallel to the second leg, the opposing side forming the third leg, a bottom portion of the U shape being parallel to the first leg, wherein a bottom portion of the U shape is spaced from the first leg to accommodate a wall of the first member there between and wherein the first member has a slot in a wall thereof accommodating the clip and wherein the step of inserting includes sliding the clip into the slot such that the first leg is received in the hollow of the first member and the bottom portion of the wall of the first member is accommodated between the bottom portion of the U shaped member and the first leg.

27. The method of Claim 23, further comprising the steps of providing a second clip like the first clip for attaching the first member to the second member;

inserting the portion of the second clip receivable in the first member into the hollow of the first member, with the second leg extending from the first member;

fastening the second clip to the first member spaced at a predetermined distance from the first clip;

inserting the second leg of the second clip into the hollow of the second member; and fastening the second member to the second leg.

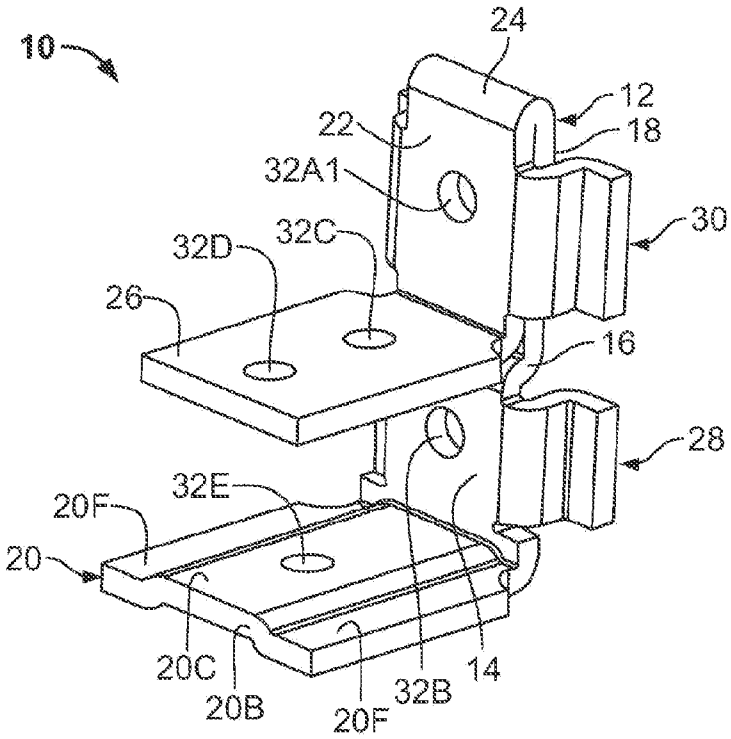

10
24
12
22
18
32A1
30
32D
32C
26
16
28
32E
20F
20
20C
20B
20F
32B
14

FIG. 1

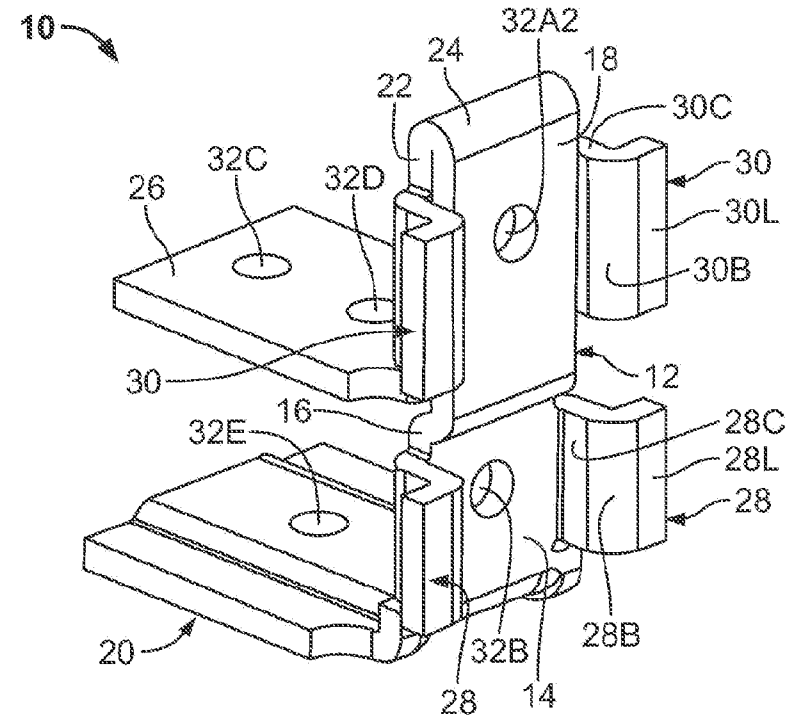

10
32A2
24
18
22
30C
32C
32D
30
26
30L
30B
12
30
16
28C
32E
28L
28
28B
20
32B
28
14

FIG. 2

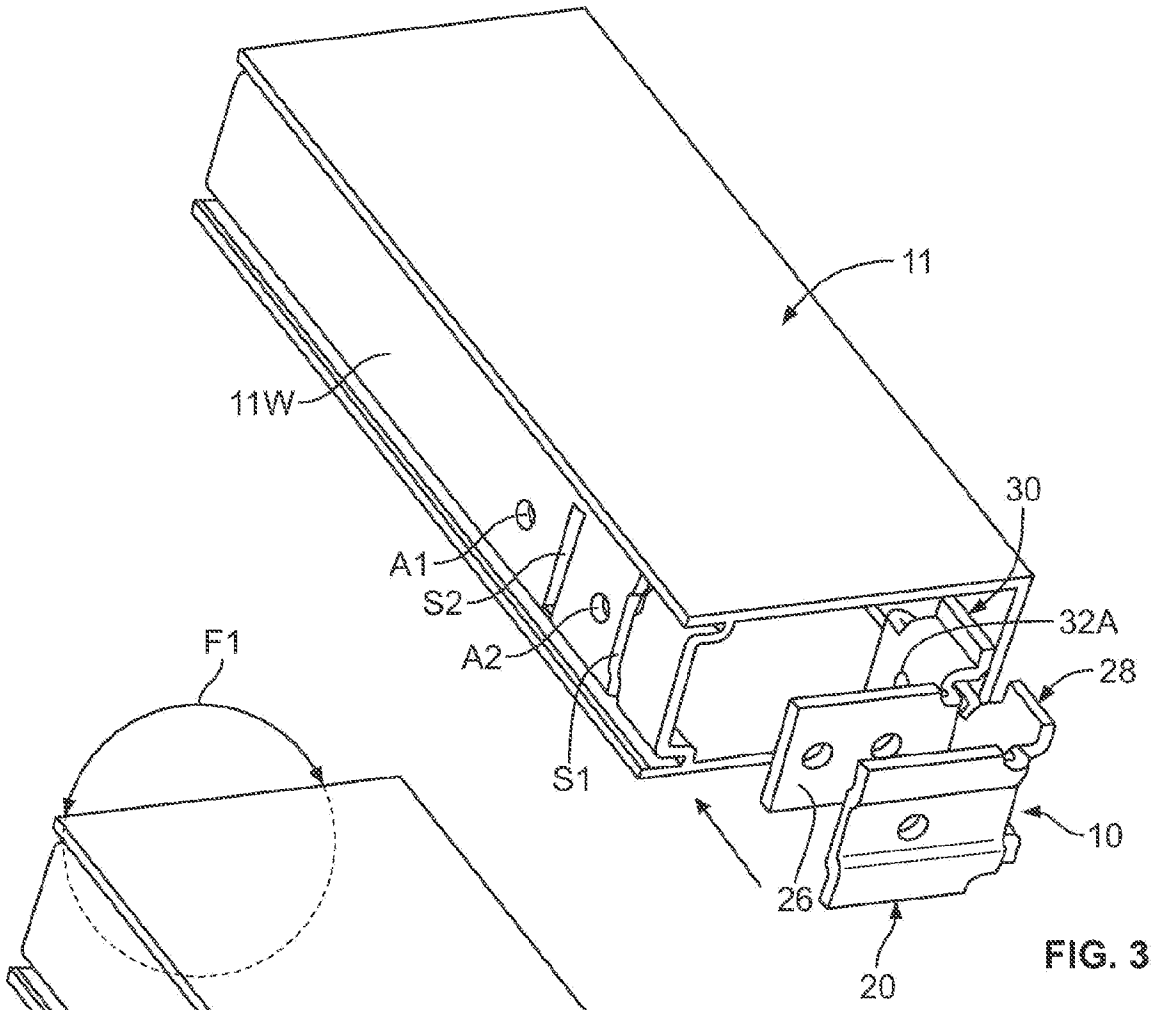


FIG. 3

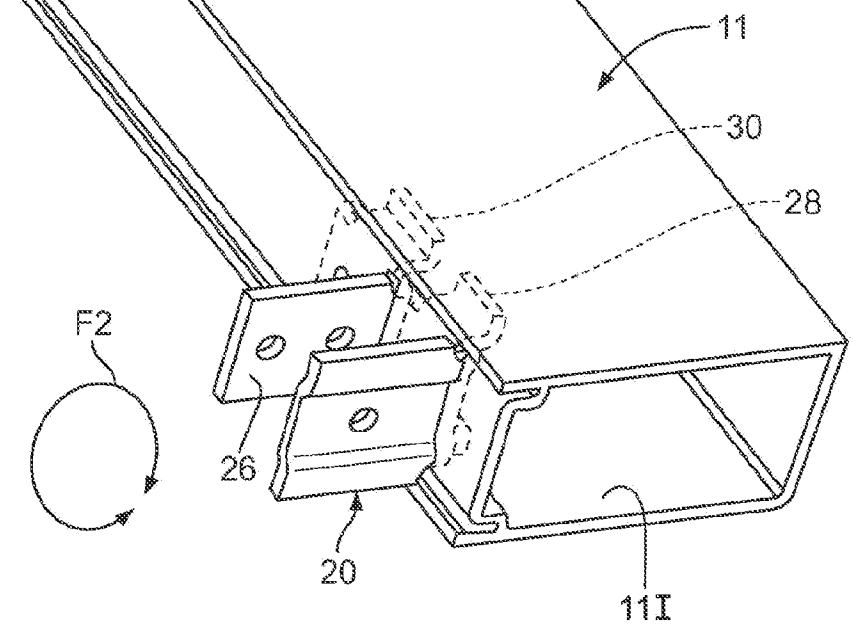


FIG. 4

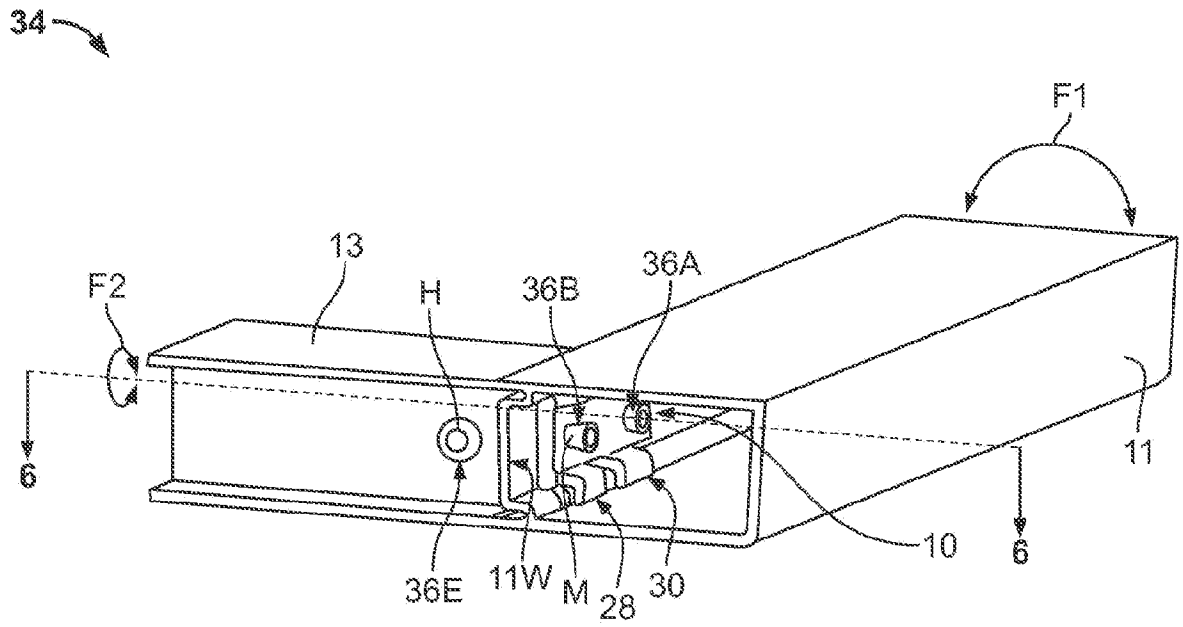

34
F1
13
F2
H
36B
36A
6
11
10
6
36E
11W
M
28
30

FIG. 5

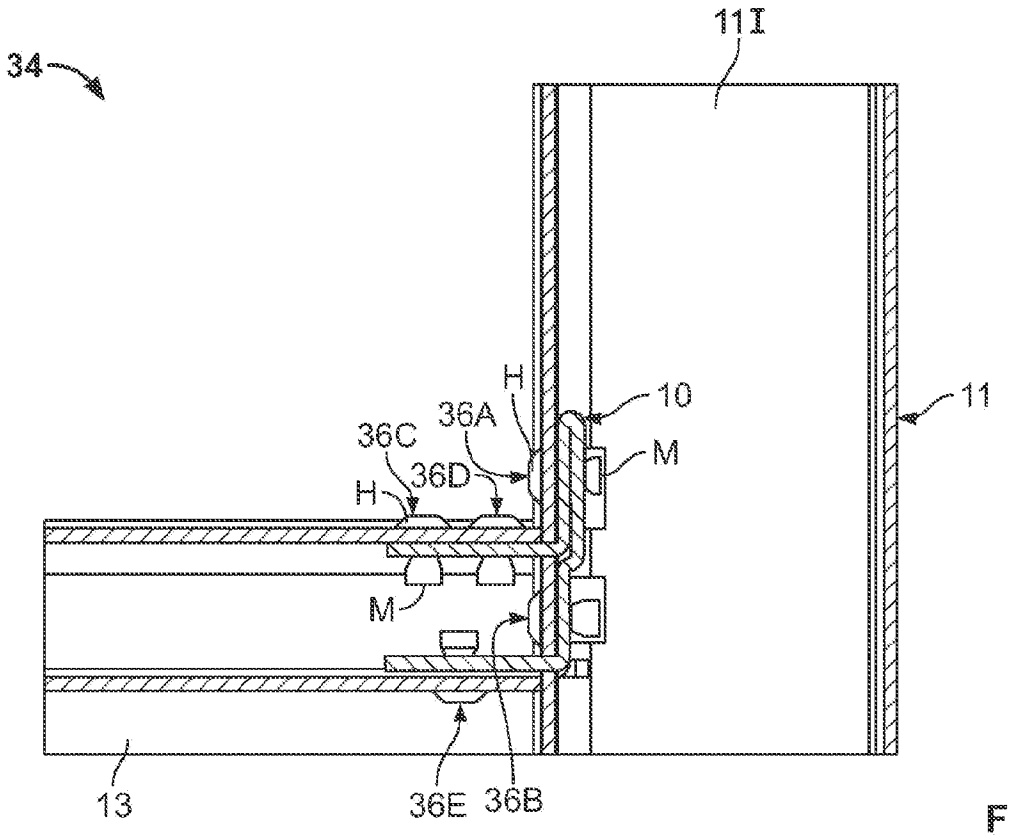

34
11I
H
10
11
36A
36C
M
36D
H
M
13
36E
36B

FIG. 6

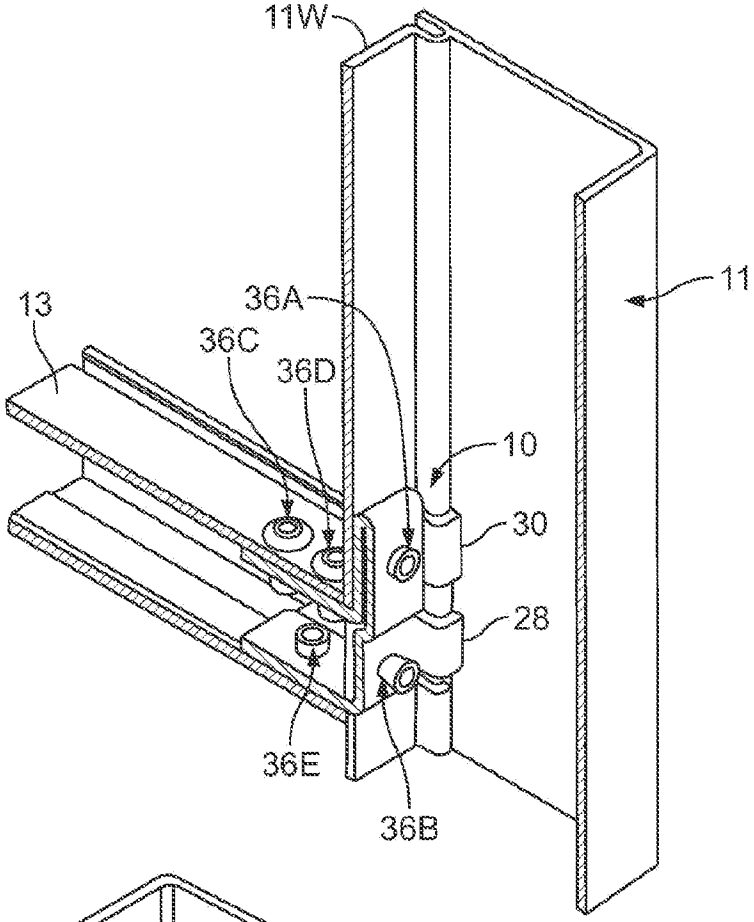


FIG. 7

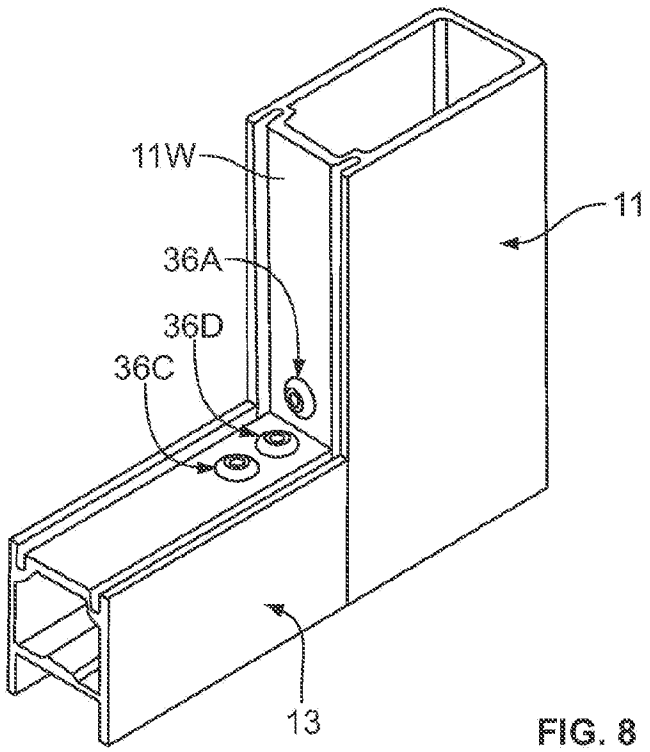


FIG. 8

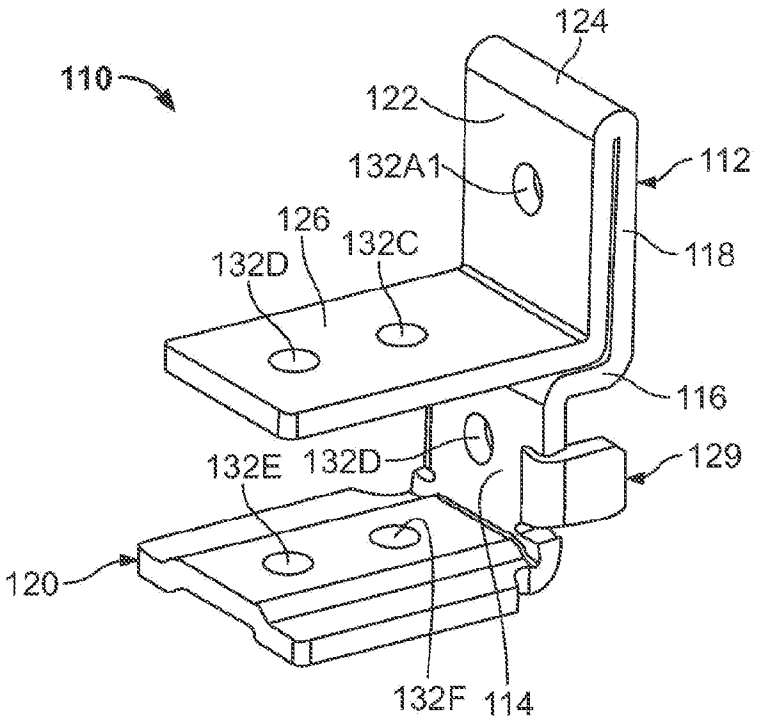

110
124
122
132A1
112
126
132C
132D
118
116
132E
132D
129
120
132F
114

FIG. 9

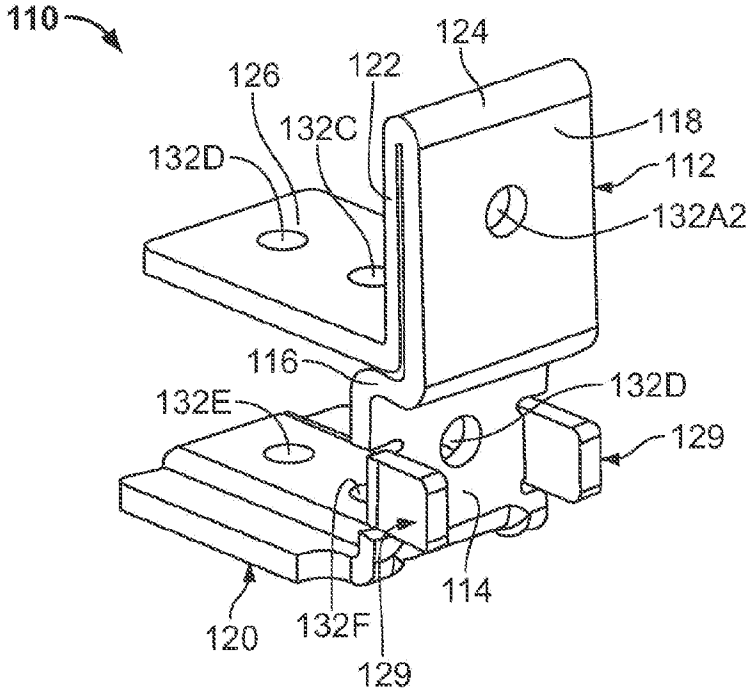

110
124
126
122
132C
118
132D
112
132A2
116
132D
132E
129
114
120
132F
129

FIG. 10

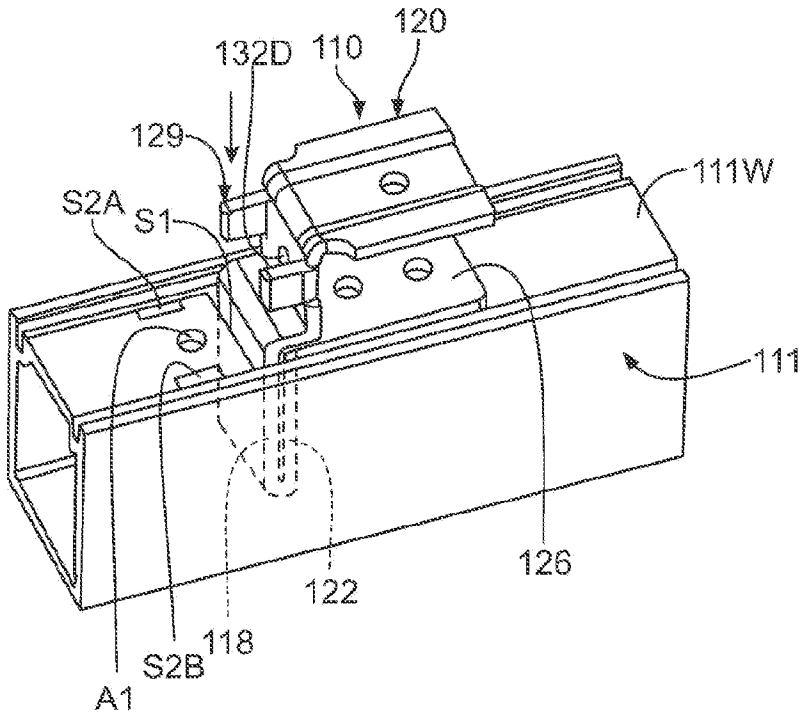

120
132D
110
129
111W
S2A
S1
111
126
122
118
S2B
A1

FIG. 11

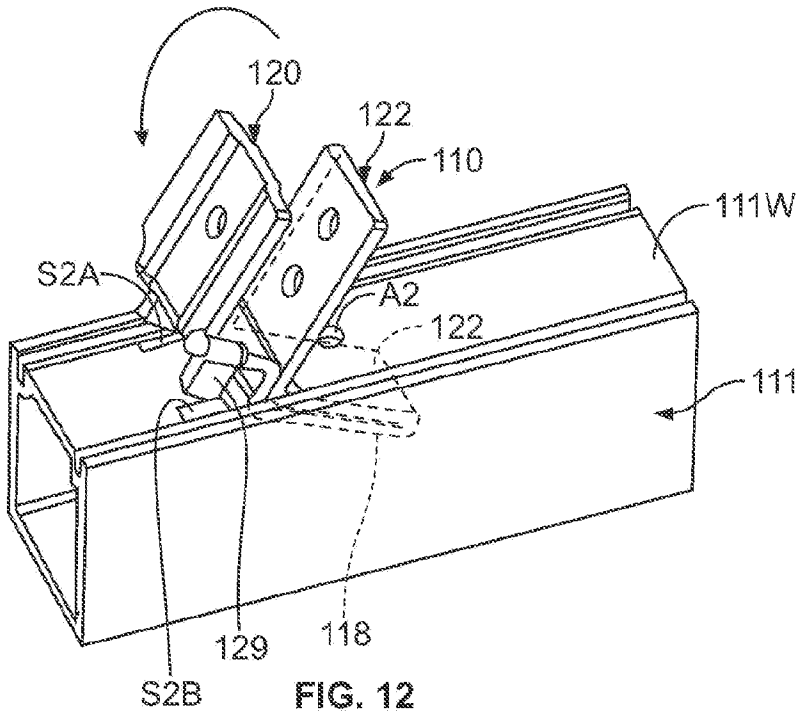

120
122
110
111W
S2A
A2
122
111
129
118
S2B

FIG. 12

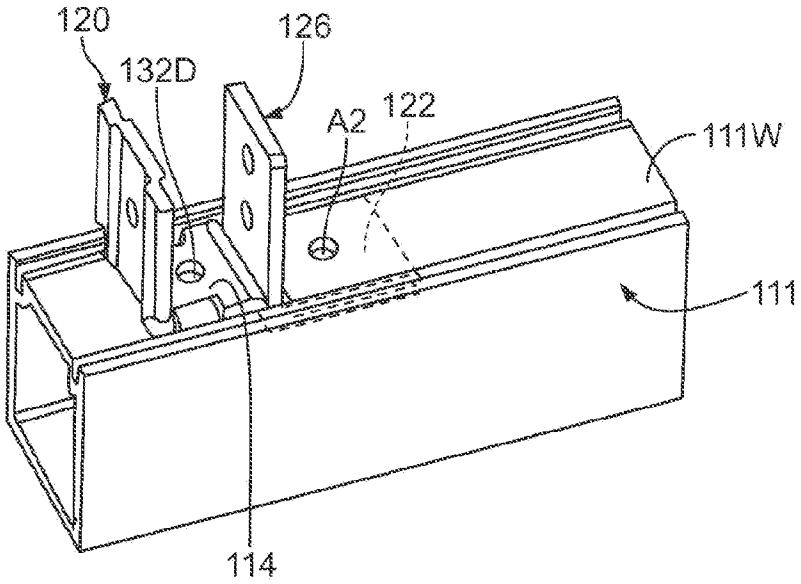

120
126
132D
122
A2
111W
111
114

FIG. 13

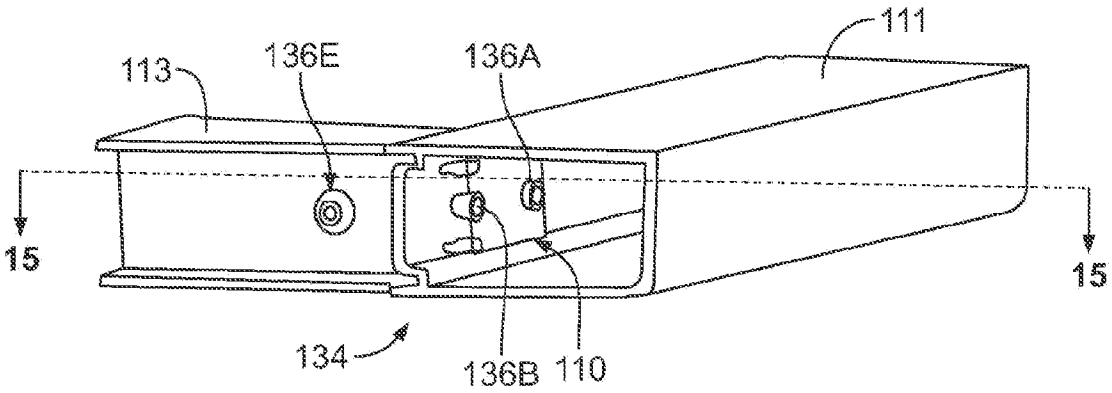

111
113
136E
136A
15
15
134
136B
110

FIG. 14

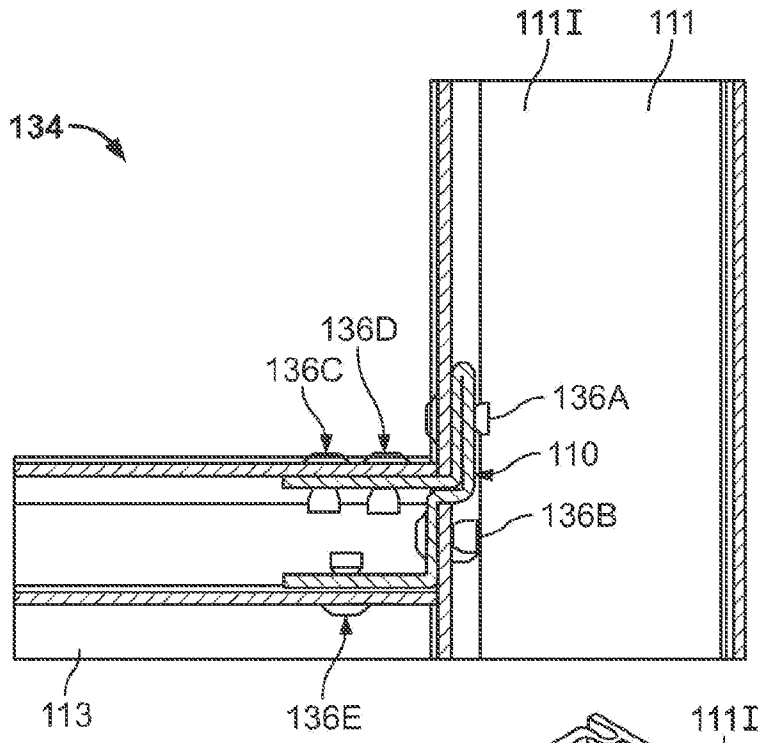

111I
111
134
136D
136C
136A
110
136B
113
136E

FIG. 15

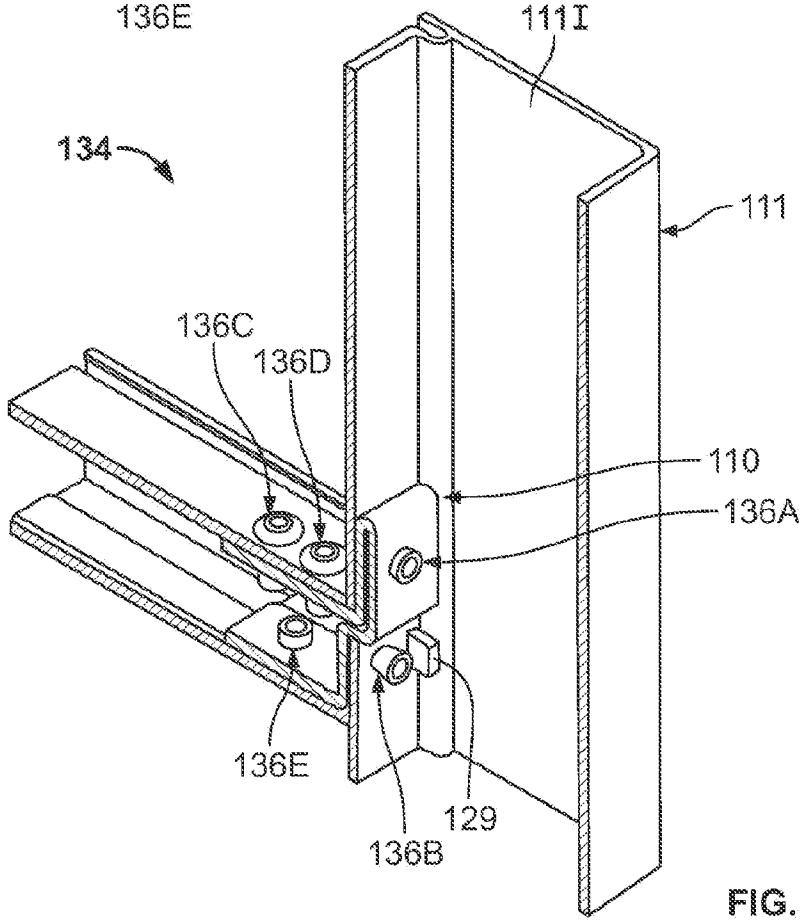

111I
134
111
136C
136D
110
136A
136E
129
136B

FIG. 16

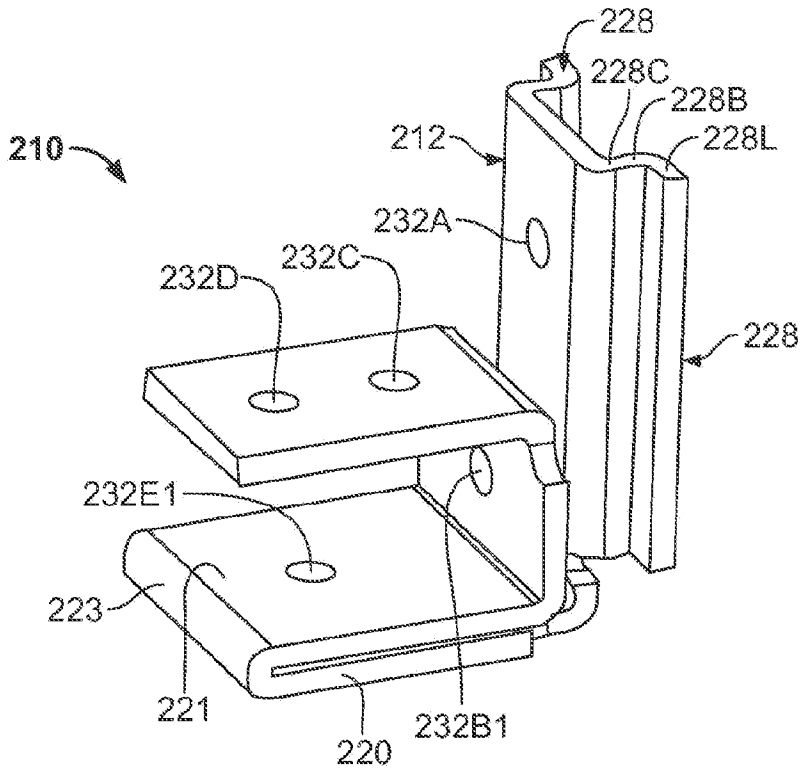

228
228C
228B
228L
212
210
232A
232C
232D
228
232E1
223
221
220
232B1

FIG. 17

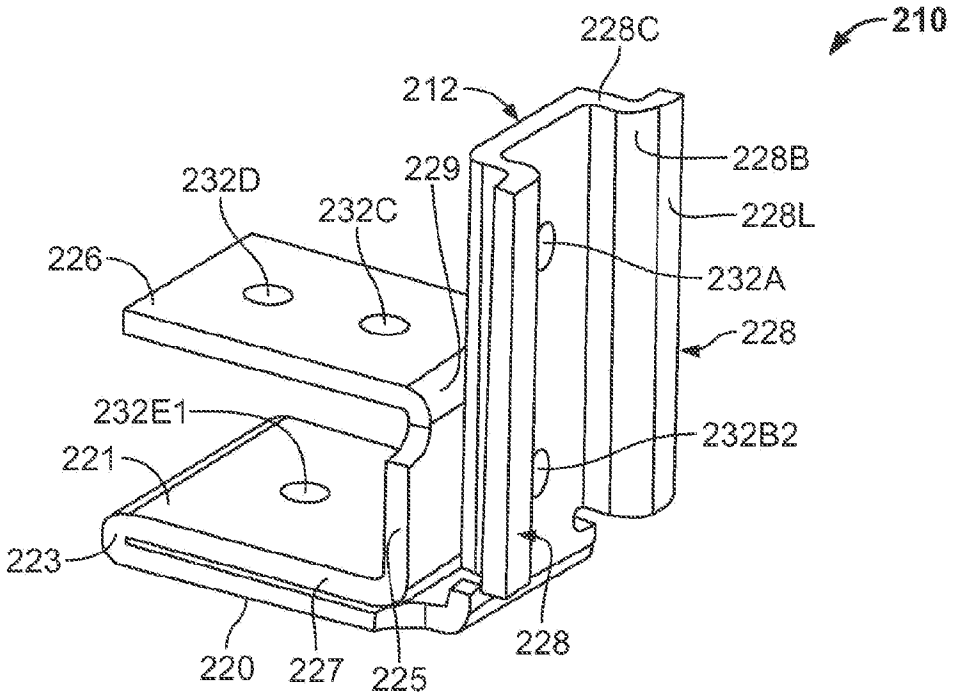

210
228C
212
228B
229
232D
232C
228L
226
232A
228
232E1
232B2
221
223
220
227
225
228

FIG. 18

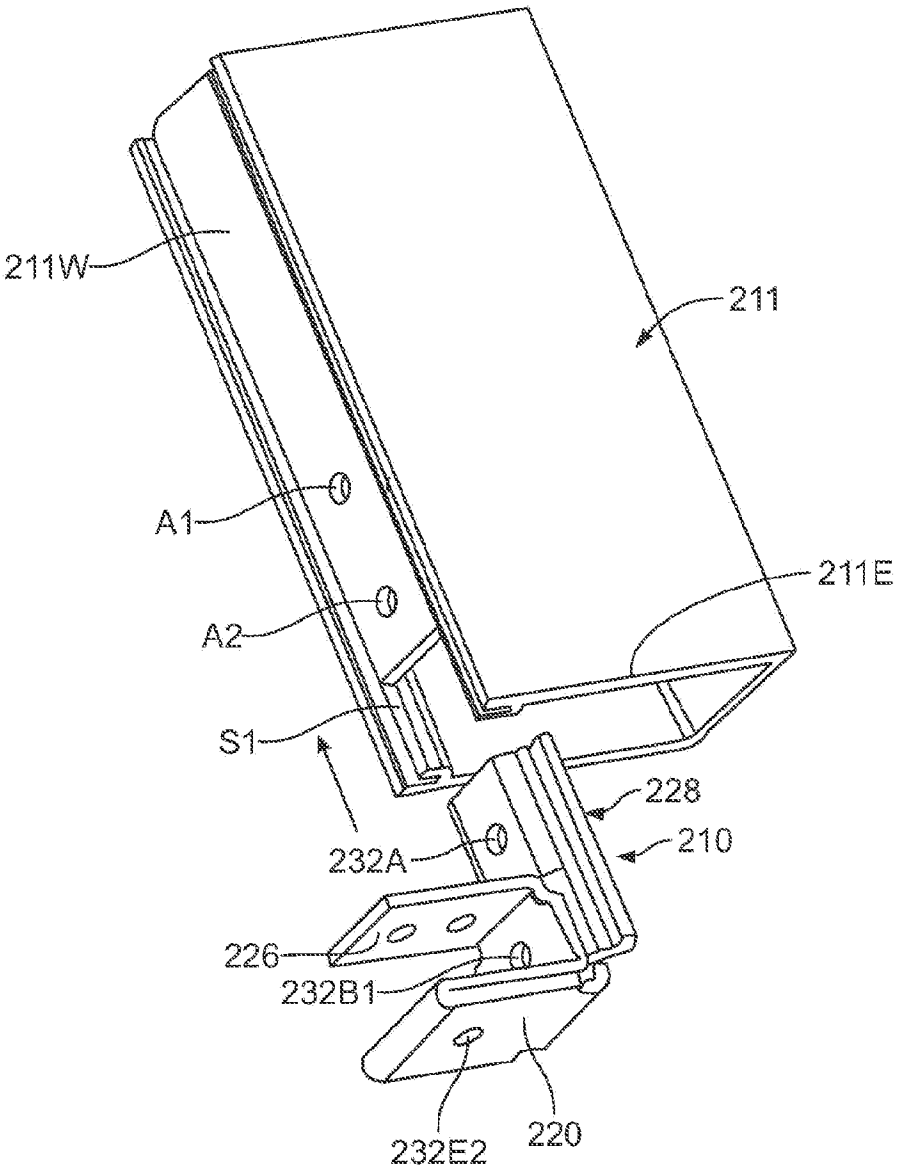


FIG. 19

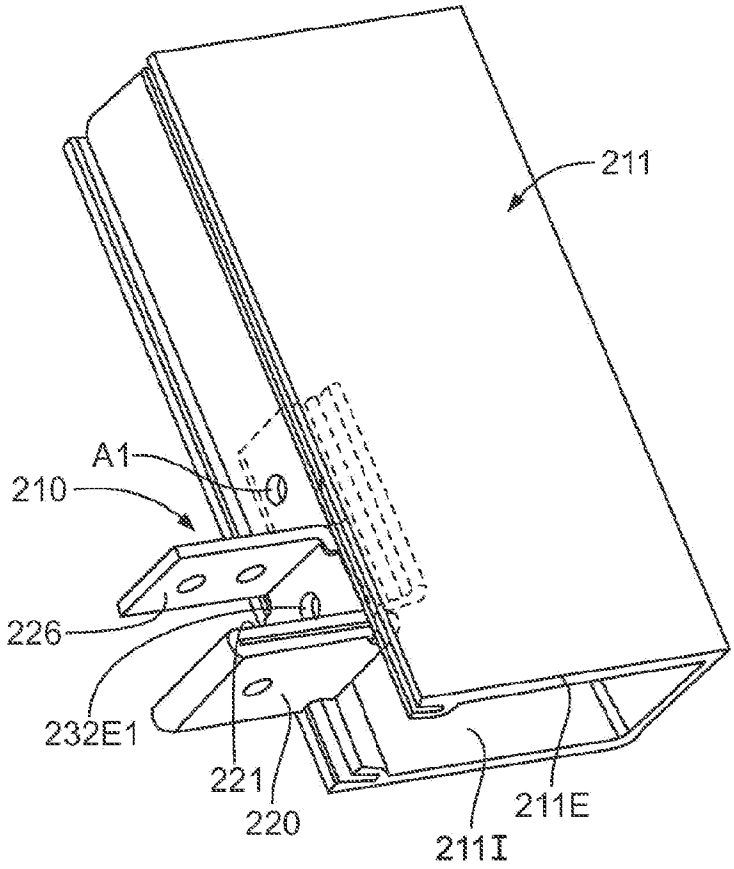

211
A1
210
226
232E1
221
220
211I
211E

FIG. 20

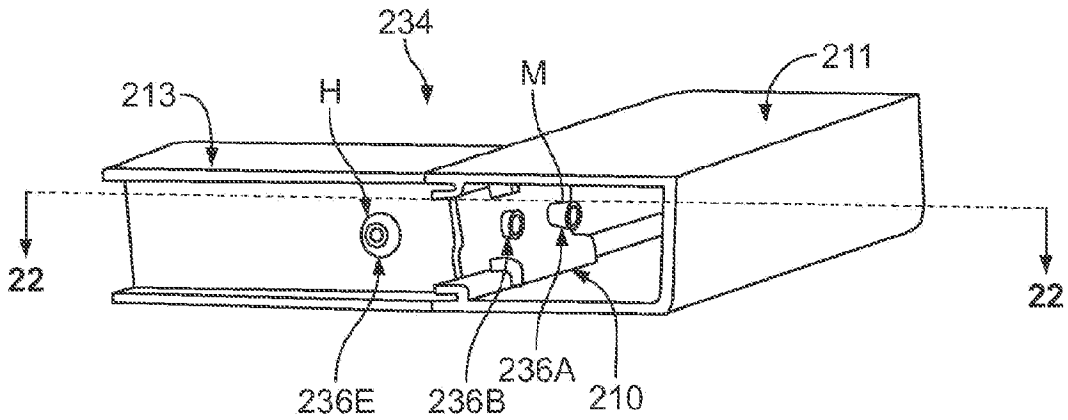

234
213
H
M
211
22
22
236E
236B
236A
210

FIG. 21

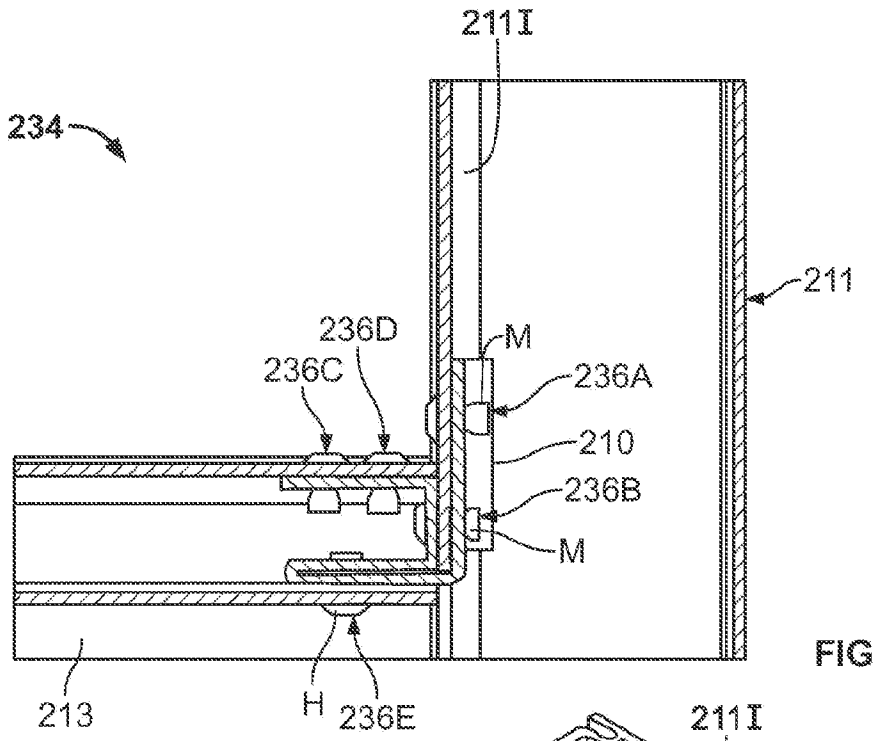

211I
234
211
236D
M
236C
236A
210
236B
M
213
H
236E

FIG. 22

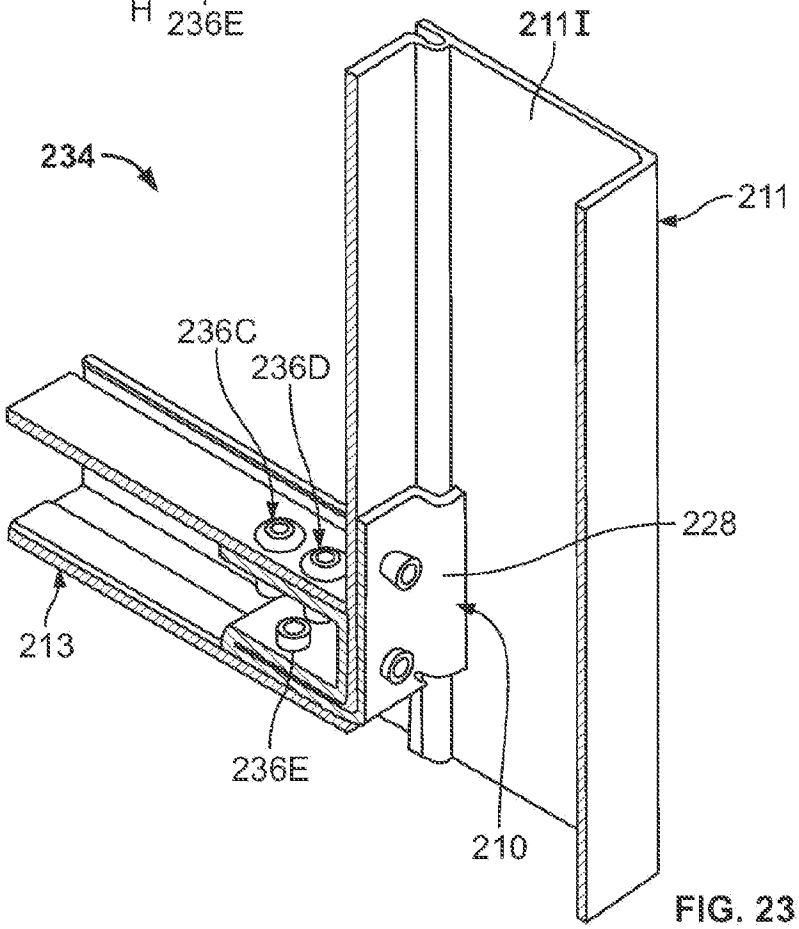

211I
234
211
236C
236D
228
213
236E
210

FIG. 23

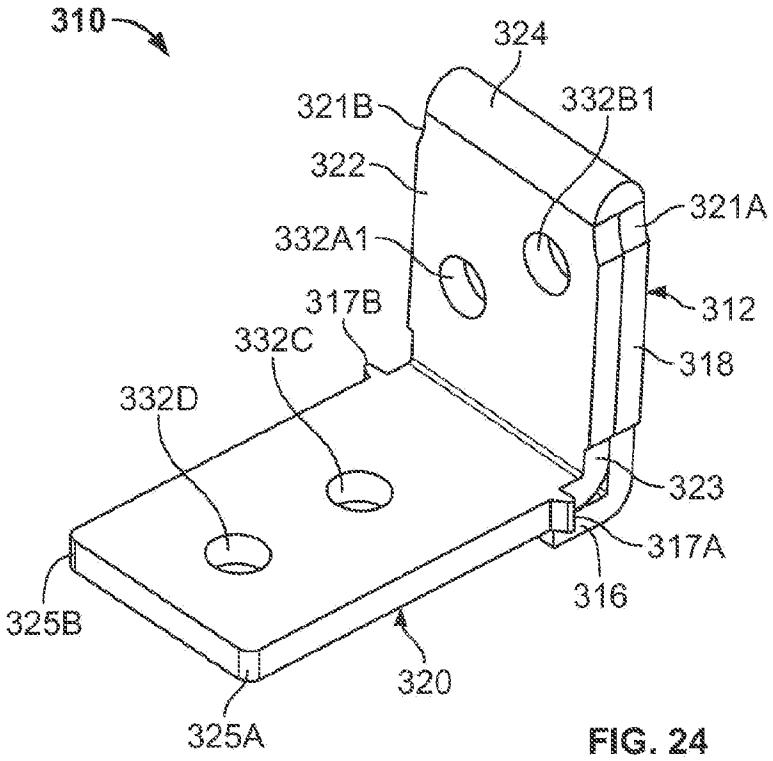

310
324
321B
332B1
322
321A
332A1
312
317B
318
332C
332D
323
317A
316
325B
320
325A

FIG. 24

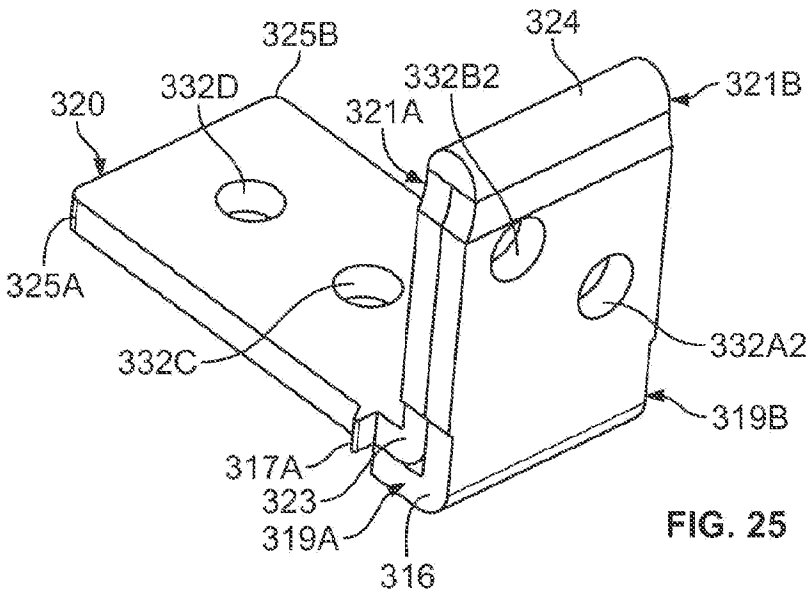

325B
324
332D
332B2
321B
320
321A
325A
332A2
332C
319B
317A
323
319A
316

FIG. 25

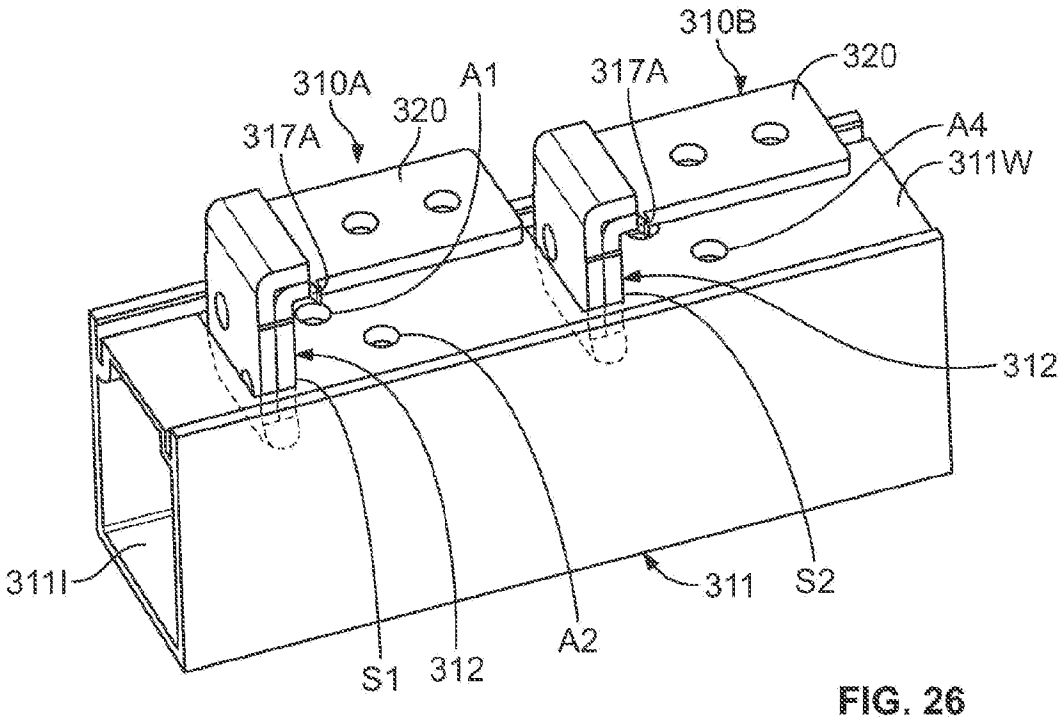

310B
320
317A
A1
310A
320
317A
A4
311W
312
311I
311
S2
S1
312
A2

FIG. 26

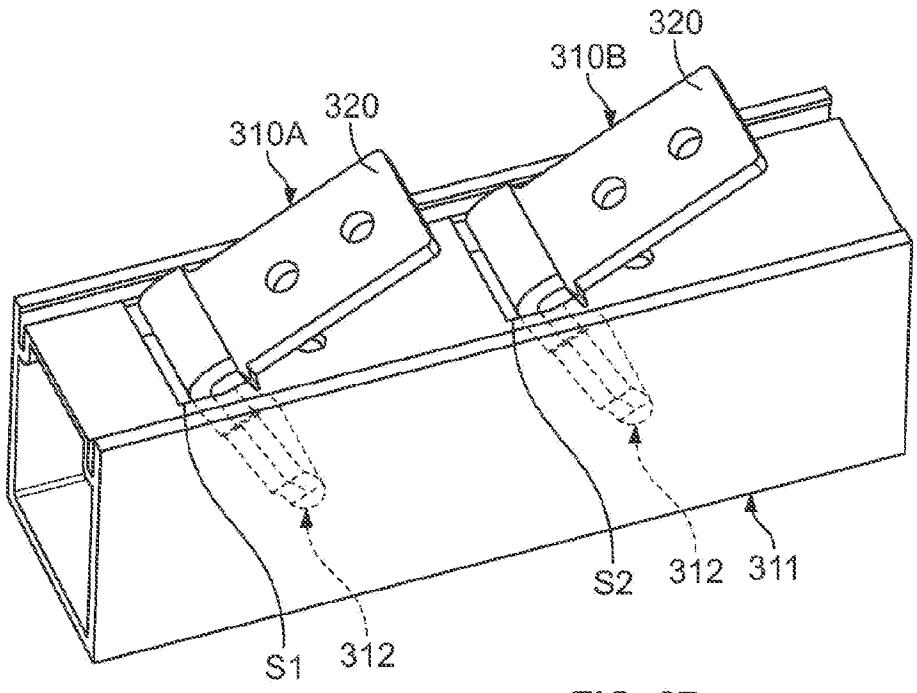

320
310B
320
310A
S2
312
311
S1
312

FIG. 27

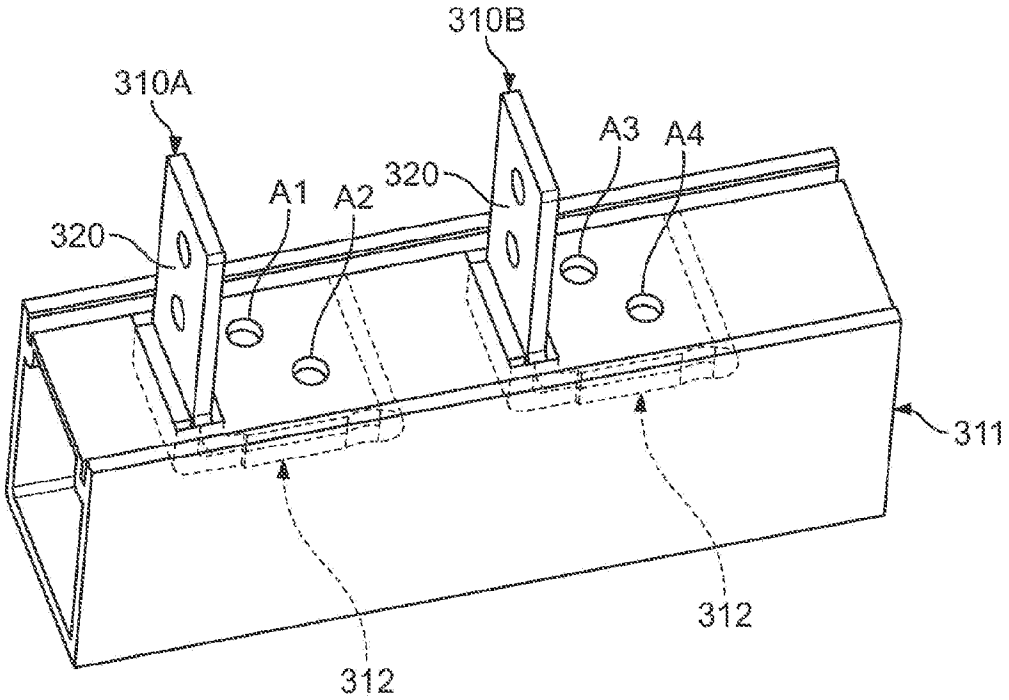

310B
310A
A3
A4
320
A1
A2
320
311
312
312

FIG. 28

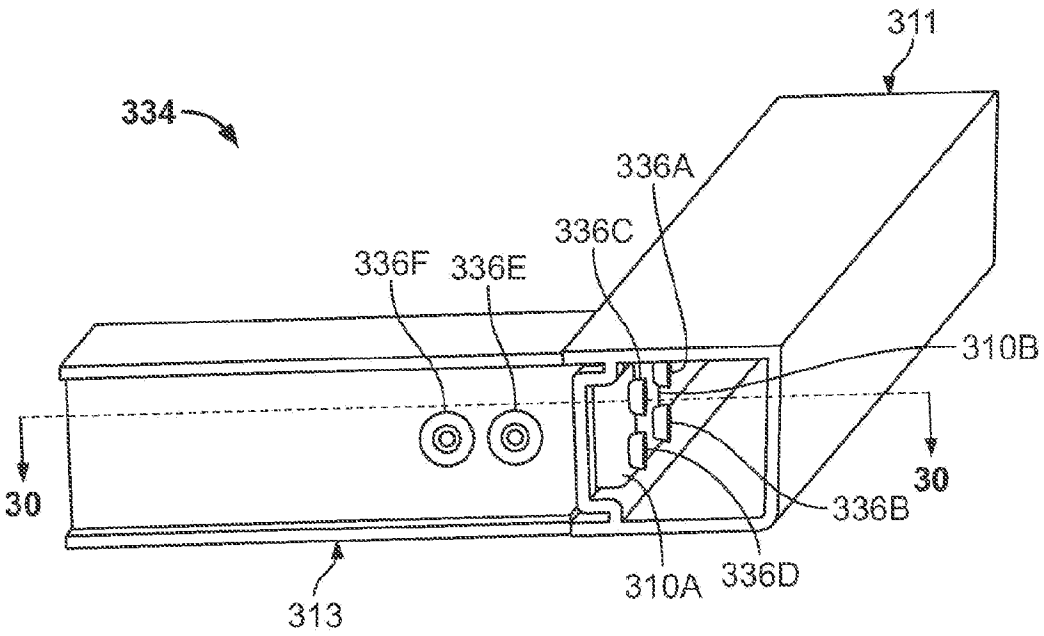

311
334
336A
336C
336F
336E
310B
30
30
336B
313
310A
336D

FIG. 29

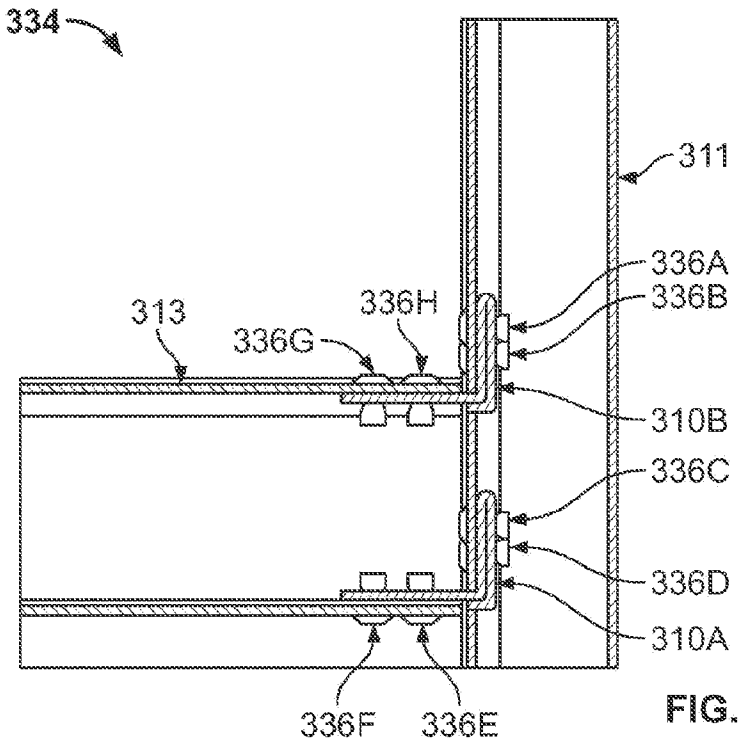

334
311
336A
336B
313
336H
336G
310B
336C
336D
310A
336F
336E

FIG. 30

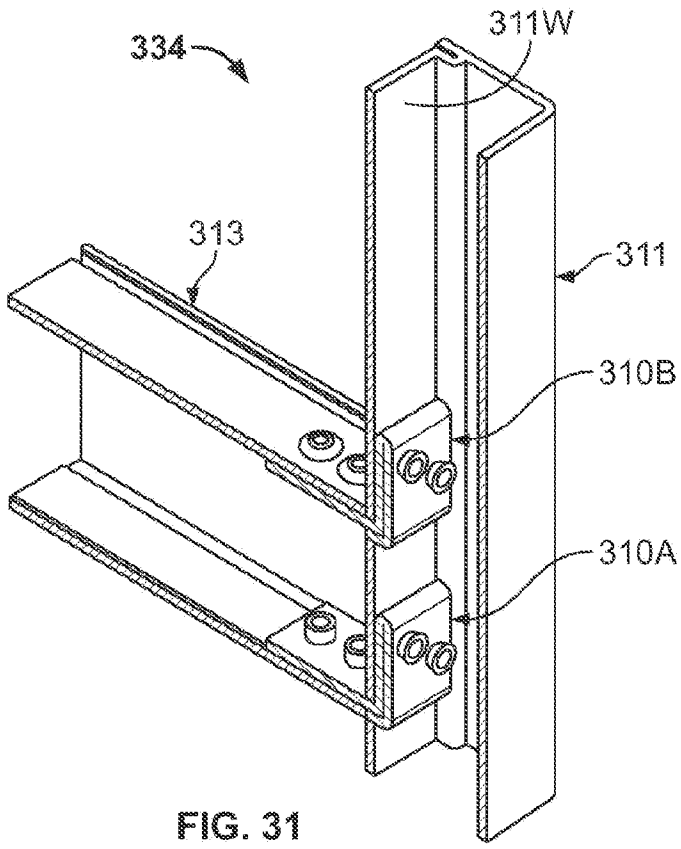

311W
334
313
311
310B
310A

FIG. 31

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/056443

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E04B 2/74 (2014.01)
CPC - E04B 2/7425 (2014.11)
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)
IPC(8) - E04B 2/74, 2/76; E04C 2/40 (2014.01)
CPC - E04B 2/7425, 2002/7462, 2002/7466 (2014.11)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 16/245; 52/239; 160/206 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase, Google Patents, Google, YouTube.
Search terms used: L-shaped, end panel, clips, angle, brackets, one-ear, stamped, toilet, two-ear,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,010,708 A (EVANS et al) 30 April 1991 (30.04.1991) entire document	1, 2, 4, 5, 13, 14, 16
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Y		3, 6, 10-12, 15, 17 , 22
Y	JACKNOB CORP. TOILET PARTITION HARDWARE. Online catalog. 02 April 2009 (02.04.2009). [retrieved on 25.11.2014]. Retrieved from the Internet. <URL: http://www.jacknob.com/pdf/Jacknob_Catalog_906.pdf>. entire document	3, 6, 10-12, 17
Y	US 8,046,957 B2 (TOWERSEY et al) 01 November 2011 (01.11.2011) entire document	15, 22
A	US 3,662,808 A (EDEUS) 16 May 1972 (16.05.1972) entire document	1-27
A	US 5,737,887 A (SMEENGE) 14 April 1998 (14.04.1998) entire document	1-27
A	US 2010/0300016 A1 (EICKHOF) 02 December 2010 (02.12.2010) entire document	1-27

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"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
25 November 2014	30 DEC 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774