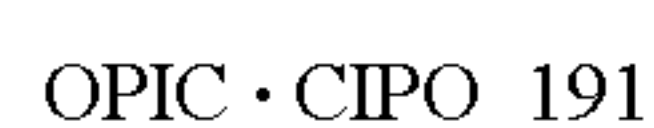




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(54) Title: RAIL CLIP FOR FORMING DOOR AND WINDOW ASSEMBLIES



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

arrangement includes at least two elongate members that each extend along a respective longitudinal axis. A pair of openings are formed in one of the elongate members and oriented to face in a crossing direction relative to the longitudinal axis of the respective member. A pair of connection members is secured to the other of the elongate members of the frame assembly and extends beyond the elongate member so that each connection member cooperates with one of the pair of openings and overlaps an interface between the two elongate members.

ABSTRACT

1
2 A structural connection arrangement and method for connecting at least two sash, stile, mullion,
3 or frame members of window and/or door frame assemblies that are oriented in crossing
4 orientations when connected to one another. The connection arrangement includes at least two
5 elongate members that each extend along a respective longitudinal axis. A pair of openings are
6 formed in one of the elongate members and oriented to face in a crossing direction relative to
7 the longitudinal axis of the respective member. A pair of connection members is secured to the
8 other of the elongate members of the frame assembly and extends beyond the elongate
9 member so that each connection member cooperates with one of the pair of openings and
10 overlaps an interface between the two elongate members.

RAIL CLIP FOR FORMING DOOR AND WINDOW ASSEMBLIES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 61/603,537, filed on February 27, 2012, titled "Rail Clip" and the entire contents of which are expressly incorporated herein.

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] This invention relates to a rail clip assembly, and more particularly, to a rail clip assembly for connecting rails, stiles, sash, mullion, or other elongate frame elements of windows and/or doors together.

[0003] Window and door sash and frame assemblies are commonly formed by connecting a number of elongate members to one another in a desired orientation to achieve a desired size and shape intended to cooperate with a structural frame opening. Window and door frame assemblies also frequently include window openings that can include one or more panes or lights that can be divided by one or more rails, stiles, or mullions. Typically, the corner connections of such structures are formed as mitered corners that facilitate the connection of the respective elongate members so that the cross-sectional areas of the elongate members engage one another in a common plane. Connections formed at intermediate locations along the longitudinal length of an elongate member, or connections associated with elongated members having smaller cross-sectional areas, do not commonly lend themselves to such mitered connections.

[0004] Typically, with elongate members having larger cross-sectional areas, a key passage is provided in the form of an enclosed passage located within an inner area of one of the connected frame or elongate members. The key passage is defined by a series of walls, which are typically integrally formed with each other and with the remaining structure of the frame member, such as in an extrusion or pultrusion process. The formation of such connections can substantially increase the manufacturing and assembly processes associated with forming such connections and limits the applicability of the respective elongate members to any application aside from those for which is specifically configured. Such a connection is also ill-suited for forming the connection between elongate members having smaller cross-sectional areas such as the mullions associated with forming divided lights.

1 **[0005]** Forming mitered connections along the longitudinal length of elongate members also
2 suffers from various drawbacks. Typically, forming a mitered connection between elongate
3 members requires greater preparation of a connection interface to ensure a tight finish joint
4 interface between the connected members. Such connection methodologies also present the
5 potential for reducing the structural integrity of the elongate members that have a reduced
6 cross-sectional shape at an intermediate location to cooperate with a terminal end of a
7 transversely oriented connecting member. The present invention seeks to provide a connection
8 methodology that allows crossing elongate members of window and door frame assemblies to
9 be quickly, conveniently and securely connected to one another in a manner that prevents
10 translation of the members relative to one another after the members have been connected.

11 **[0006]** The present invention contemplates a structural connection arrangement and
12 method of assembling a structural frame assembly. The structural connection arrangement
13 includes a first member and a second member that each has a respective longitudinal axis. At
14 least one opening is formed in one of the members and is oriented in a transverse or crossing
15 direction relative to the respective longitudinal axis. The arrangement includes a pair of
16 connection members for securing the first and second members together. Each connection
17 member includes a first portion that is configured to be coupled to one of the first and second
18 frame members and a second portion that extends beyond an end of the frame member to
19 which it is connected. A tab is formed at an end of the second portion of each connection
20 member and extends in an outward direction that is transverse to a longitudinal axis of the
21 respective connection member. The opening formed in the other of the first and second frame
22 members is shaped to cooperate with the second portion of a respective connection member so
23 that, when the longitudinal axis of the first member is oriented in a transverse orientation relative
24 to the longitudinal axis of the second member, and the connection member is advanced into
25 engagement with the first and second members, the tab moves into alignment and passes
26 through the opening and engages a surface of the second member that is adjacent the opening
27 and faces away from the first member, thereby preventing movement of the second member
28 away from the first member such that the first frame member and second frame member are
29 secured to one another and oriented in transverse directions with respect to the longitudinal
30 axes of the frame members.

31 **[0007]** The invention also contemplates a method of assembling a structural frame
32 assembly, which involves providing a first elongate rail and a second elongate rail that are
33 connectable to each other so that the first elongate rail and the second elongate rail extend in

transverse or crossing directions relative to one another. A first rail clip and a second rail clip are provided, and each cooperates with the first elongate rail and the second elongate rail to extend across an interface between the connected rails. Each rail clip has a first portion that is constructed to engage a common end of the first elongate rail. A second portion of each rail clip cooperates with a respective opening formed in the second elongate rail so that a tab associated with the second portion of each rail clip overlaps a portion of the second elongate rail when the first elongate rail and the second elongate rail are secured to one another.

[0008] Various other features, aspects, and advantages of the invention will be made apparent from the following description taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The drawings illustrate the best mode presently contemplated of carrying out the invention.

[0010] In the drawings:

[0011] FIG. 1 depicts an exploded view of a connection assembly of a door or window assembly according to the present invention.

[0012] FIG. 2 depicts a partial perspective cross-sectional view of an assembled connection assembly shown in FIG. 1.

[0013] FIG. 3 depicts an elevational cross-sectional view of the assembled connection assembly shown in FIG. 2.

[0014] FIG. 4 depicts an elevational side view of the assembled connection assembly shown in FIG. 1.

[0015] FIG. 5 depicts a partial section view taken along line A-A of FIG. 4 and shows one of the rail clips of the connection assembly shown in Fig. 2.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

[0016] Referring now to the drawings, and initially to FIG. 1, an exploded view of a structural connection arrangement or frame assembly 10 according to the present invention is shown. Frame assembly 10 includes a first elongate member or rail 12 and a second elongate member or rail 14, a first connector, connection member, or rail clip 16 and a second connector,

1 connection member, or rail clip 18, and one or more fasteners 20, 22, 24, 26 for connecting
2 each of rail clips 16, 18 to rail 14. Although only one joint is shown, it is appreciated that a
3 window frame, door frame, window sash or sash, frame, or mullion assembly having a desired
4 shape and size can be formed from different numbers of elongate members that are connected
5 to one another in accordance with the description provided herein. That is, it is appreciated that
6 the present invention is usable for connecting or more frame, sash, rail, and/or mullion elongate
7 members to one another and in a desired orientation to form different sized and shaped
8 assemblies.

9 **[0017]** Regardless of the particular application of first and/or second rails 12, 14 forming
10 rails, stiles, mullions, etc. of a frame assembly, first rail 12 is defined by an elongate body 28
11 that extends from a first end 30 to a second end 32. It is appreciated that rails 12, 14 could be
12 provided in any number of shapes, lengths, and/or quantities. In a representative embodiment,
13 a cavity 34 is defined by body 28 and extends along a portion or the entirety of a longitudinal
14 length, indicated by axis 36, of rail 12. It is appreciated that body 28 of rail 12 can be formed of
15 any number of suitable materials, such as metal, plastic and/or fiberglass, for example.

16 **[0018]** Rail 12 includes a first side surface 38, a second side surface 40, a third side surface
17 42, and a fourth side surface 44 that collectively define a circumferential exterior surface of rail
18 12. It is appreciated that surfaces 38, 40, 42, 44 may be shaped to cooperate with structures
19 and/or environments positioned adjacent to the respective frame assembly, whether that be
20 structural members such as lumber, siding, flashing, etc., light structures such as glass panes,
21 and/or other rail members disposed along the length thereof. Surface 38 is constructed to
22 cooperate with rail 14 and surface 42 is contoured to cooperate with adjacent features
23 associated with the framing opening and/or other rail members. In a representative
24 embodiment, surfaces 38, 42 are shaped to be oriented transverse to the plane associated with
25 the overall frame assembly 10 whereas surfaces 40, 44 are generally parallel to the plane
26 associated with the resultant frame assembly such that one surface 40, 44 faces atmosphere
27 and the other surface 40, 44 faces into the enclosed space associated with the frame assembly.

28 **[0019]** It is further appreciated that surface 42 maybe contoured so as to have a generally
29 mirror shape of surface 38 wherein rail 12 is intended to form an intermediary frame member of
30 the overall frame assembly. That is, it is envisioned that surfaces 38 and 42 can each be
31 configured to cooperate with a rail, such as rail 14, such that a rail 14 could extend from the
32 opposite facing sides of rail 12 such that two of the rails are parallel to one another and the

parallel rails are each perpendicular to the third rail. It is further envisioned that other relative rail orientations can be achieved to form any number of frame assembly configurations having any desired number of interconnected rails to form a frame assembly having a desired shape and size.

[0020] Still referring to FIG. 1, rail 12 includes a first opening 46 and a second opening 48 that are longitudinally spaced along axis 36 of rail 12. As explained further below, openings 46, 48 are sized, shaped, and positioned relative to rail 12 so as to cooperate with a respective rail clip 16, 18 for securing abutting rails to one another. Body 28 of rail 12 includes one or more ribs 50, 52, 54, 56 that extend inwardly toward cavity 34. As explained further below, ribs 50, 52, 54, 56 improve the structural strength of rail 12 and can be configured to cooperate with a respective rail clip 16, 18 to prevent twisting or racking of a resultant frame assembly.

[0021] In a similar manner, rail 14 includes a first surface 58, a second surface 60, a third surface 62, and a fourth surface 64 that each face outward relative to an exterior circumferential cross-section of rail 14. Rail 14 is formed by a body 66 that extends in a longitudinal direction, indicated by axis 68, associated with a longitudinal length of rail 14. An end 70 of rail 14 is shaped to cooperate with surface 38 of rail 12 so as to provide a contact engagement or interface between end 70 and surface 38 of rails 12, 14 when the intersecting rails 12, 14 are connected. Body 66 of rail 14 defines a cavity 72 that extends along a portion or the entirety of longitudinal length 68 and a number of ribs 74, 76, 78, 80 extend from an interior surface 82 of body 66 into cavity 72. Rail clips 16, 18 slidably cooperate with a space or channel 84 formed between adjacent ribs 74, 76 and 78, 80 proximate the end of the rail 12, 14 that is to be secured to an adjacent rail. As explained further below, the cooperation of ribs 74, 76 and 78, 80 with a respective rail clip 16, 18 improves the robust non-rotational and non-translational interaction between rail clips 16, 18 and rail 14.

[0022] Surface 58 of rail 14 includes a slot, groove or channel 86 having one or more openings 88, 90 associated therewith. Surface 58 can include one or more cutouts 92, 94 96, 97 in communication with channel 86 and disposed on opposite lateral sides of openings 88, 90 relative to longitudinal axis 68. Fasteners 20, 22, 24, 26 each include a head portion 98 and a threaded stem portion 100. Cutouts 92, 94, 96, 97 are shaped to generally correspond to a diameter of head portion 98 of fasteners 20, 22 such that head portions 98 of fasteners 20, 22 can seat between wall portions 104, 106 of surface 58, which generally flank channel 86 when fasteners 20, 22 secure rail clip 16 to rail 14.

[0023] Each rail clip 16, 18 includes a first opening 108 and the second opening 110 that are each shaped to threadingly engage the threaded stem portion 100 of a respective fastener 20, 22, 24, 26. Each rail clip includes a first portion 112, which includes openings 108, 110, and a second portion 114 that extends beyond an end 116 of the first portion 112 of a respective rail clip 16, 18. As explained further below, first portion 112 of each rail clip 16, 18 is shaped to overlap and cooperate with rail 14 whereas second portion 114 of each rail clip 16, 18 is shaped to extend into and cooperate with an adjacent rail 12 such that rail clips 16, 18 traverse the interface between end 70 of rail 14 and surface 38 of rail 12 when rails 12, 14 are connected to one another.

[0024] Referring to FIGS. 1 and 2, each rail clip 16, 18 can be configured so as to be used with fiberglass elements but understandably are not necessarily limited and may be used with elements of varying construction, and may be formed of other materials such as metals, plastics, and/or natural materials such as wood and the like. The rail clips 16, 18 may be constructed from plastic by injection molding operation or similar process known in the art. In the alternative, rail clips 16, 18 may be constructed from metal by die casting or using a die stamping process. The rail clips 16, 18 may be configured to be coupled to elongate rails or rail element by a coupling arrangement such as via use of one or more fasteners or alternative mechanical fastening such as via the use of rivets, adhesives or the like.

[0025] Each rail clip 16, 18 includes a rib 120 that extends from a body 122 of a respective rail clip 16, 18. Each rib 120 extends in a direction that crosses a longitudinal axis 124 of the corresponding rail clip 16, 18. First portion 112 of each rail clip 16, 18 includes a first section 126 and a second section 128 that extend along longitudinal axis 124. Rib 120 extends about a perimeter of second section 128 of each rail clip 16, 18. Rib 120 includes one or more interior ribs 130 that can extend between the perimeter of the respective rail clip 16, 18 and about opening 108. Ribs 120, 130 enhance the structural rigidity of second section 128 of each respective rail clip 16, 18. That portion of rib 130 that extends about opening 108 also provides a more robust structural interaction between the threaded stem portion 100 of the respective fastener 20, 24 and the body 122 of the respective rail clip 16, 18.

[0026] As shown in FIG. 2, rail clip 18 cooperates with an interior wall 131 of rail 14 and an exterior wall 132 of rail 14 extends over the interior wall 131. Exterior wall 132 includes one or more openings 134, 135 that are oriented to facilitate the passage of fasteners 24, 26 through exterior wall 132, into engagement with interior wall 131, and through interior wall 131 and into

engagement with rail clip 18. The position of fasteners 24, 26 between walls 131, 132 of rail 14 renders fasteners 24, 26 hidden from view thereby improving the aesthetic appearance of the resultant frame assembly 10.

[0027] Still referring to FIG. 2, second portion 114 of each rail clip 16, 18 includes a ridge or tab 136 that is offset from end 116 of the first portion 112 of the respective rail clip 16, 18 by a stem 138. Tab 136 of each rail clip 16, 18 is shaped to pass through a respective opening 46, 48 of rail 12. Referring to FIGS. 3 and 5, when rails 12 and 14 are secured to one another, stem 138 extends through a respective opening 46, 48 formed in body 28 of rail 12 such that tab 136 can be positioned in the cavity 34 of rail 12. When fully assembled, tab 136 engages an interior surface 140 of body 28 of rail 12. Fasteners 20, 22 engage first portion 112 of rail clip 16 and fasteners 24, 26 engage first portion 112 of rail clip 18. Cooperation of fasteners 20, 22, 24, 26 with the respective rail clip 16, 18 draws tabs 136 in opposite directions 142, 144 relative to the respective opening 46, 48 such that a portion of body 28 of rail 12 is captured between a surface 148 of each tab 136 and end 70 of rail 14. As should be appreciated from FIG. 3, a largest distance between a periphery of openings 46, 48 is approximately the same as a largest distance between the stems 138 of adjacent rail clips 16, 18 but is less than the largest distance between tabs 136 of adjacent clips 16, 18 such that tabs 136 extend into rail 12 and overlap a portion of the body 28 of rail 12 that is adjacent the respective opening 46, 48. Representatively, tabs 136 extend in a plurality of radial directions from a distal end of stem 138. For example, tabs 136 may extend from stem 138 in a radial direction approximately 180 rotational degrees relative to the longitudinal axis of the respective rail clip 16, 18.

[0028] Still referring to FIGS. 3 and 5, during assembly or connection of rails 12, 14, rail clips 16, 18 can be loosely secured to rail 14 via partial engagement of one or both of fasteners 20, 22, 24, 26 with the respective rail clip 16, 18. Alternatively, each rail clip could be constructed to include a living hinge proximate the interface of first and second sections 126, 128 of each first portion 112 so that, if fastener 22 is driven into full engagement with rail clip 16, rail clip is allowed to bend or deflect so that tab 136 can be fully aligned with a corresponding opening 46 formed in rail 12.

[0029] Once rails 12, 14 have been positionally associated so that rail clips 16, 18 extend across the interface between rail 12 and rail 14, fully tightening fasteners 20, 22, 24, 26 translates tab 136 in respective directions 142, 144 associated with rail 12 and out of axial alignment with the corresponding opening 46, 48 so that the respective tab 136 overlaps a

portion of rail 12 that surrounds the respective opening 46, 48. The interaction of tab 136 of rail clips 16, 18 with rail 12 prevents separation of rail 12 and rail 14 in a direction along the longitudinal axis 68 of rail 14, and the cooperation of stems 138 of rail clips 16, 18 and the perimeter of the respective opening 46, 48 prevents translation or movement of rail 14 relative to rail 12 in a direction aligned with the longitudinal axis 36 of rail 12. It is further appreciated that, although a parallel relationship is shown between the surface of tab 136 and surface 140, tab 136 could include an angled contour and/or include a wedge shaped surface which would act to advance or bias the end of rail 14 into tighter engagement against surface 38 of rail 12 as fasteners 20, 22, 24, 26 are advanced and tighten the respective rail clips 12, 14 against the interior surface 140 of rail 12. IN addition, the stems 138 of rail clips 16, 18 and the side edges of the respective opening 46, 48 are sized so as to prevent translation or movement of rail 14 relative to rail 12 in a direction transverse to the longitudinal axis 36 of rail 12.

[0030] Referring to FIG. 4, rail clips 16, 18 are shaped to slidably cooperate with the channel 84 defined by adjacent ribs 74, 76 and 78, 80 along the longitudinal length of the respective rail clip 16, 18. Slidable but snug cooperation of rail clips 16, 18 such that the rail clips 16, 18 are flanked by the adjacent ribs 74, 76 and 78, 80 provides a robust structural interaction that maintains the desired orthogonal alignment between surfaces 40, 44 of rail 12 with surfaces 60, 64 of rail 14, respectively. When multiple rails are connected to form a door frame, window frame, sash or mullion assembly, the cooperation of stems 138 with openings 46, 48, tabs 136 with interior surface 140 of rail 12, and the flanking cooperation of rail clips 12, 14, with a respective pair of ribs 74, 76, and 78, 80 of rail 14 provides a frame assembly that is structurally robust in the three orthogonal directions associated with axis 36, axis 68, and the axis normal to both axis 36 and 68.

[0031] Although the above description relates to a configuration in which rails 12, 14 are intended to have a perpendicular association, it is appreciated that the present invention is suitable to other configurations wherein not all, or perhaps any, of the respective elongate members are oriented orthogonally to one another. That is, it is appreciated that the present invention is suitable for joining together elongate members that are not oriented in a perpendicular relationship. Regardless of the relative orientation of the respective members, the connection methodology disclosed above is suitable for coupling of differently sized and shaped rails and upright elongate elements or members. That is, the rail clips 16, 18 enable an operator to join any size rail to any corresponding size upright element, e.g., stile, mullion, frame, etc. The rail clips 16, 18 of the present invention further enable the fixing of integral

1 mullions to one another as well as fixing the mullions to the rails, stiles, or other frame members
2 in the desired locations. In addition, rail clips 16, 18 are capable of joining patio door rails and
3 stiles to one another. Further, rail clips 16, 18 of the present invention are easier and cheaper to
4 manufacture than traditional connection solutions such as corner keys.

5 **[0032]** An example of a system and method for forming frame assemblies has been
6 described, but those of skill in the art will be aware of many options and alternatives to the
7 equipment, frame members, and method steps described can be used.

8 **[0033]** Various embodiments are described in detail with reference to the drawings, wherein
9 like reference numerals represent like parts and assemblies throughout the several views.
10 Reference to various embodiments does not limit the scope of the claims attached hereto.
11 Additionally, any examples set forth in this specification are not intended to be limiting and
12 merely set forth some of the many possible embodiments for the appended claims.

CLAIMS

I claim:

1. A structural connection arrangement, comprising:
 - a first member having a longitudinal axis;
 - a second member having a longitudinal axis and at least one opening formed in the second member and oriented in a transverse direction relative to the longitudinal axis;
 - a pair of connection members for securing the first and second members together, each connection member comprising:
 - a first portion configured to be coupled to the first member and a second portion that extends beyond an end of the first member;
 - a tab formed at an end of the second portion of each connection member opposite the first portion and offset from the end of the first member, each tab extending in a direction that is transverse to a longitudinal axis of the first portion of a respective connection member; and
 - wherein the at least one opening of the second member is shaped to cooperate with the second portion of a respective connection member so that, when the longitudinal axis of the first member is oriented in a transverse direction relative to the longitudinal axis of the second member and the connection member is advanced into engagement with the first and second members, the tab moves into alignment and passes through the opening and engages a surface of the second member that is adjacent the opening and faces away from the first member to prevent movement of the second member away from the first member.
2. The structural connection arrangement of claim 1 wherein the first portion is configured to be coupled to the first member by a coupling arrangement.
3. The structural connection arrangement of claim 1 wherein the first portion is configured to be coupled to first member by at least one fastener.
4. The structural connection arrangement of claim 3 wherein the at least one fastener is further defined as a first fastener and a second fastener that each engage the first portion and are spaced from one another along a longitudinal axis of the respective connection member.

5. The structural connection arrangement of claim 3 wherein the first member includes a first cutout and a second cutout that are each shaped to cooperate with a head of the at least one fastener.

6. The structural connection arrangement of claim 1 wherein the first portion of each connection member includes a wider portion that extends along the longitudinal axis from a location proximate an interface between the first portion and the second portion.

7. The structural connection arrangement of claim 6 further comprising at least one rib formed on the wider portion of each connection member, the at least one rib extending in a transverse direction relative to the longitudinal axis of the first portion of each connection member and away from the first member.

8. A structural frame assembly comprising:

a first frame member and a second frame member, each frame member defined by a body that extends along a longitudinal axis, a cavity that extends in the longitudinal direction and is defined by the body of each respective frame member;

a first connector and a second connector that are each defined by a body that extends along a longitudinal axis;

a ridge formed proximate an end of each connector and extending in a radially outward direction from the body relative to the longitudinal axis of the respective connector; and

a first opening and a second opening formed in one of the first frame member and the second frame member such that, when the first frame member and the second frame member are positioned in contact engagement with one another, a first portion of both of the first connector and the second connector cooperate with the cavity of one of the first frame member and the second frame member and a second portion of both of the first connector and the second connector pass through a respective one of the first and second openings such that the ridge is disposed in the cavity of the other of the first frame member and the second frame member and cooperates with a surface of the body that faces the cavity of the other of the first frame member and the second frame member such that the first frame member is secured to the second frame and the longitudinal axis of the first frame member extends in a transverse direction relative to the longitudinal axis of the second frame member.

9. The structural frame assembly of claim 8 wherein the transverse direction is further defined as the longitudinal axis of the first frame member being transverse to the longitudinal axis of the second frame member.
10. The structural frame assembly of claim 8 further comprising a fastener that passes through one of the first frame member and the second frame member and engages a respective one of the first connector and the second connector.
11. The structural frame assembly of claim 10 further comprising another fastener that passes through the one of the first frame member and the second frame member and engages the respective one of the first connector and the second connector such that the fastener and the another fastener are offset from one another along the longitudinal axis of the one of the first frame member and the second frame member.
12. The structural frame assembly of claim 11 further comprising a reinforcing rib defined by the body of each of the first connector and the second connector and positioned proximate cooperation of at least one of the fastener and the another fastener with the respective one of the first connector and the second connector.
13. The structural frame assembly of claim 12 wherein the reinforcing rib is offset from an area of the body associated with the other of the at least one of the fastener and the another fastener.
14. The structural frame assembly of claim 8 wherein the ridge extends in an outward radial direction so that the ridge has a generally semi-circular shape.
15. The structural frame assembly of claim 14 wherein the ridge is offset from a terminal end of one of the first frame member and the second frame member having the longitudinal axis that is aligned with the longitudinal axis of a respective connector member associated with the ridge.
16. The structural frame assembly of claim 8 further comprising a third frame member having a construction that is the same as one of the first frame member and the second frame member such that the one of the first, second, and third frame members is oriented transverse to the others of the first, second, and third frame members and the others of the first, second,

and third frame members are parallel to each other when the first, second, and third frame members are secured to one another.

17. A method of assembling a structural frame assembly, the method comprising:
providing a first elongate member and a second elongate member that are connectable to each other so that the first elongate member and the second elongate member extend in crossing directions relative to one another; and
providing a first clip and a second clip that each have a first portion that is constructed to engage a common end of the first elongate member and a second portion that cooperates with a respective opening formed in the second elongate member so that a tab associated with the second portion of each clip overlaps a portion of the second elongate member when the first elongate member and the second elongate member are secured to one another.
18. The method of claim 17 further comprising providing a first fastener and a second fastener that cooperate with the first elongate member and the first portion of each of the first clip and the second clip.
19. The method of claim 18 further comprising forming each respective opening in the second elongate member in a shape similar to a cross-sectional shape of the tab of a respective one of the first clip and the second clip.
20. The method of claim 19 further comprising spacing the respective opening associated the first clip from the respective opening associated with the second clip so that a distal portion of the tab associated the first clip and a distal portion of the tab associated with the second clip are further apart than a largest distance between an outer perimeter of the respective openings associated with the first clip and the second clip.

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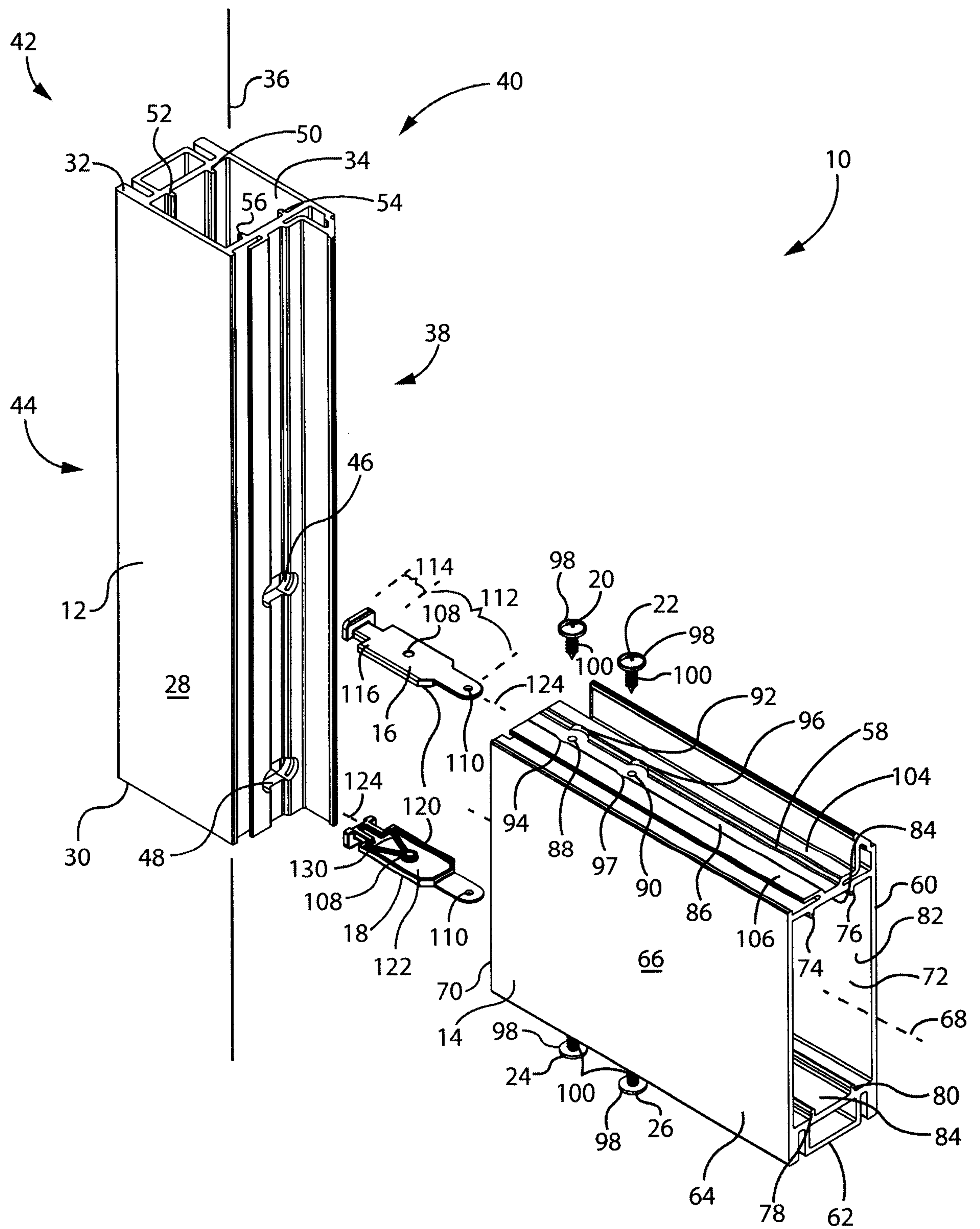


FIG. 1

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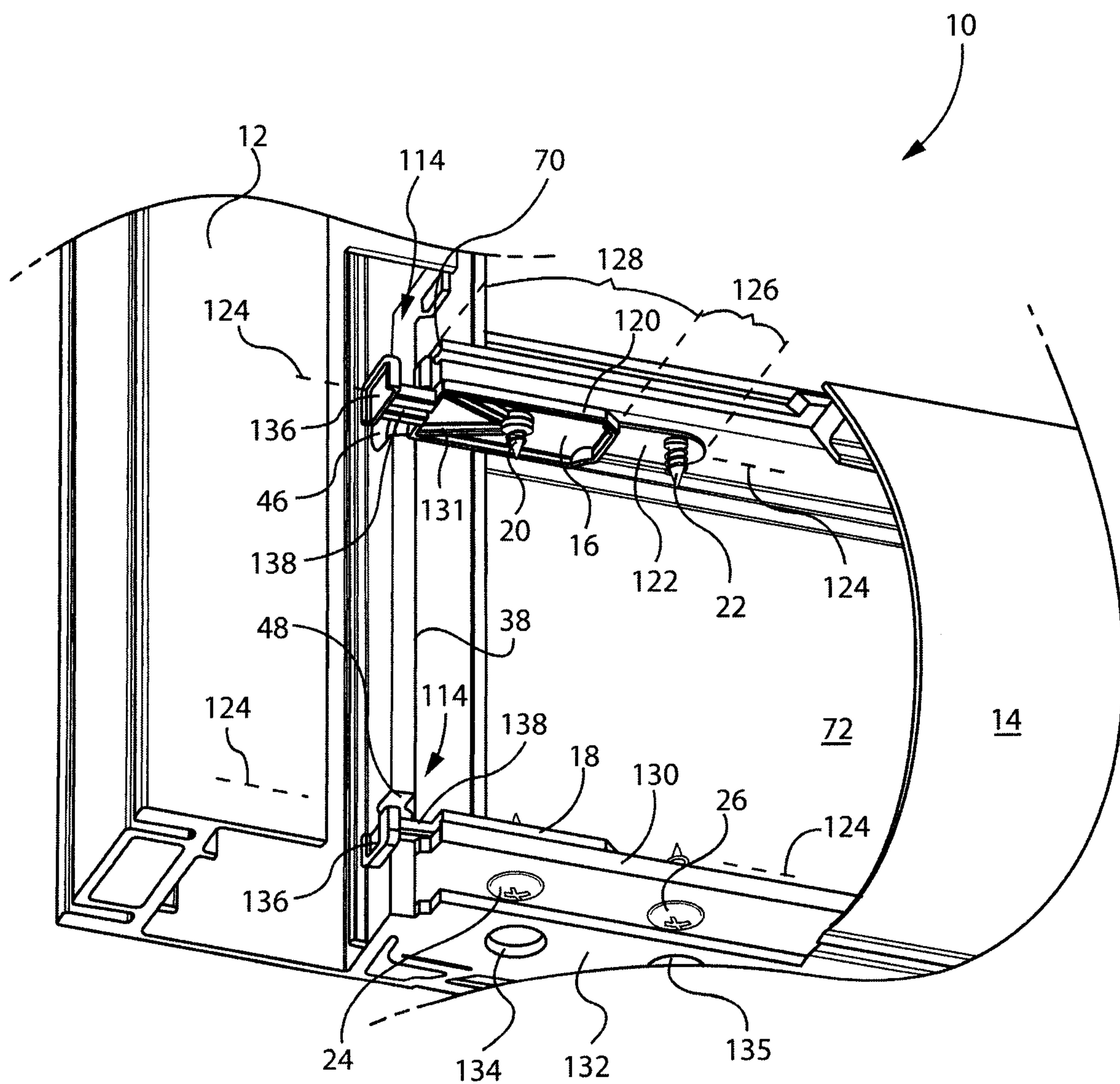


FIG. 2

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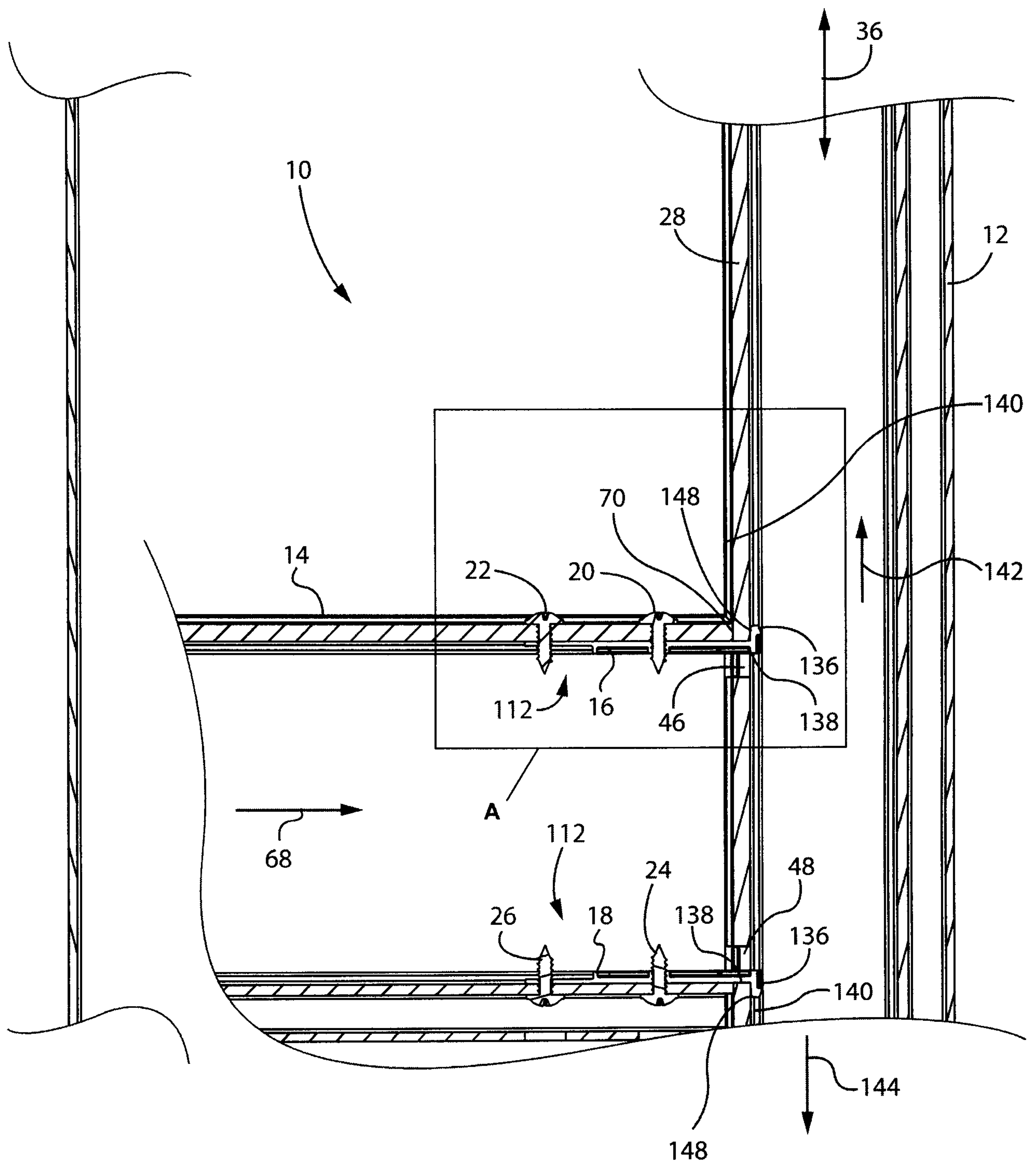
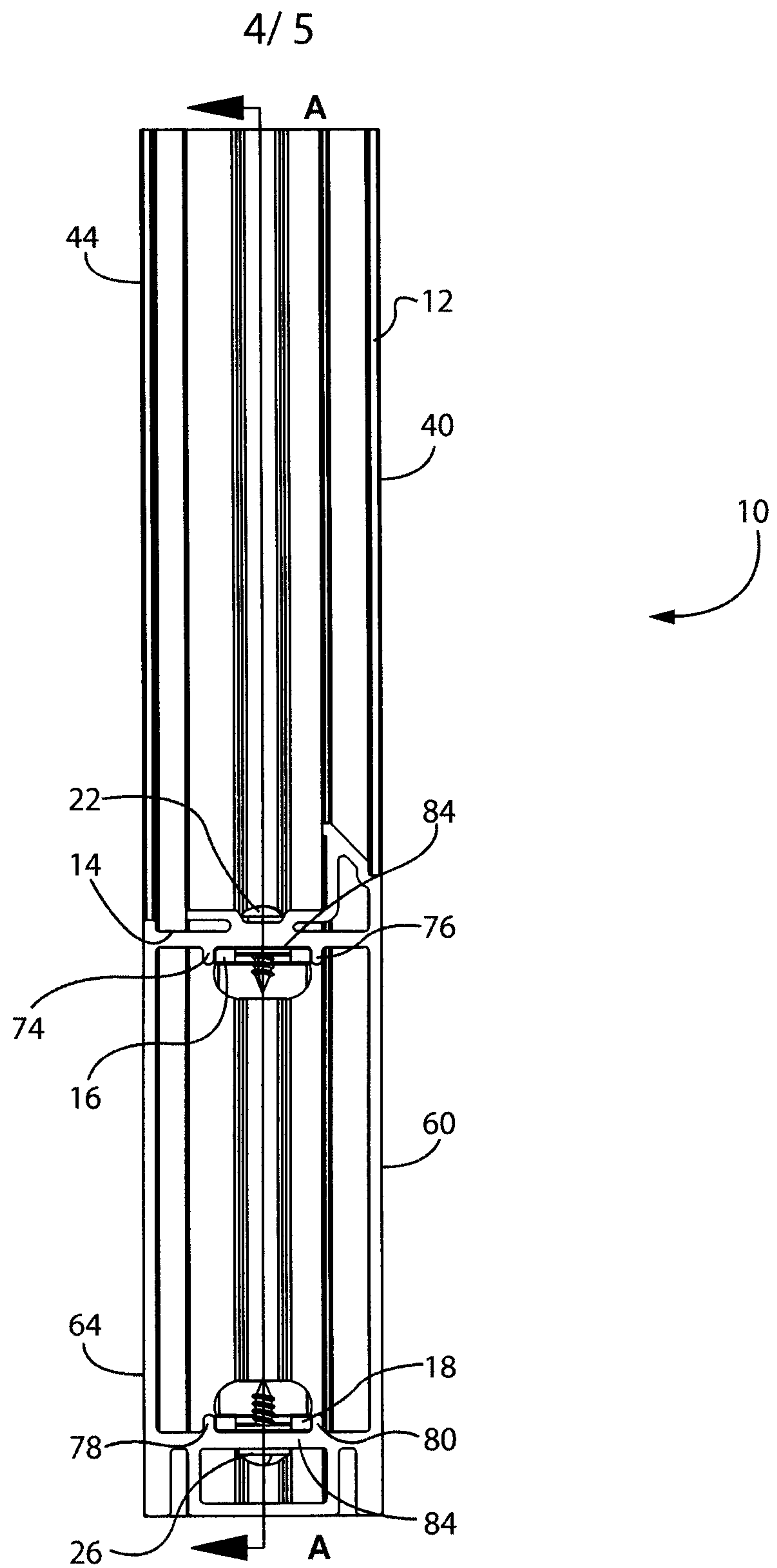


FIG. 3



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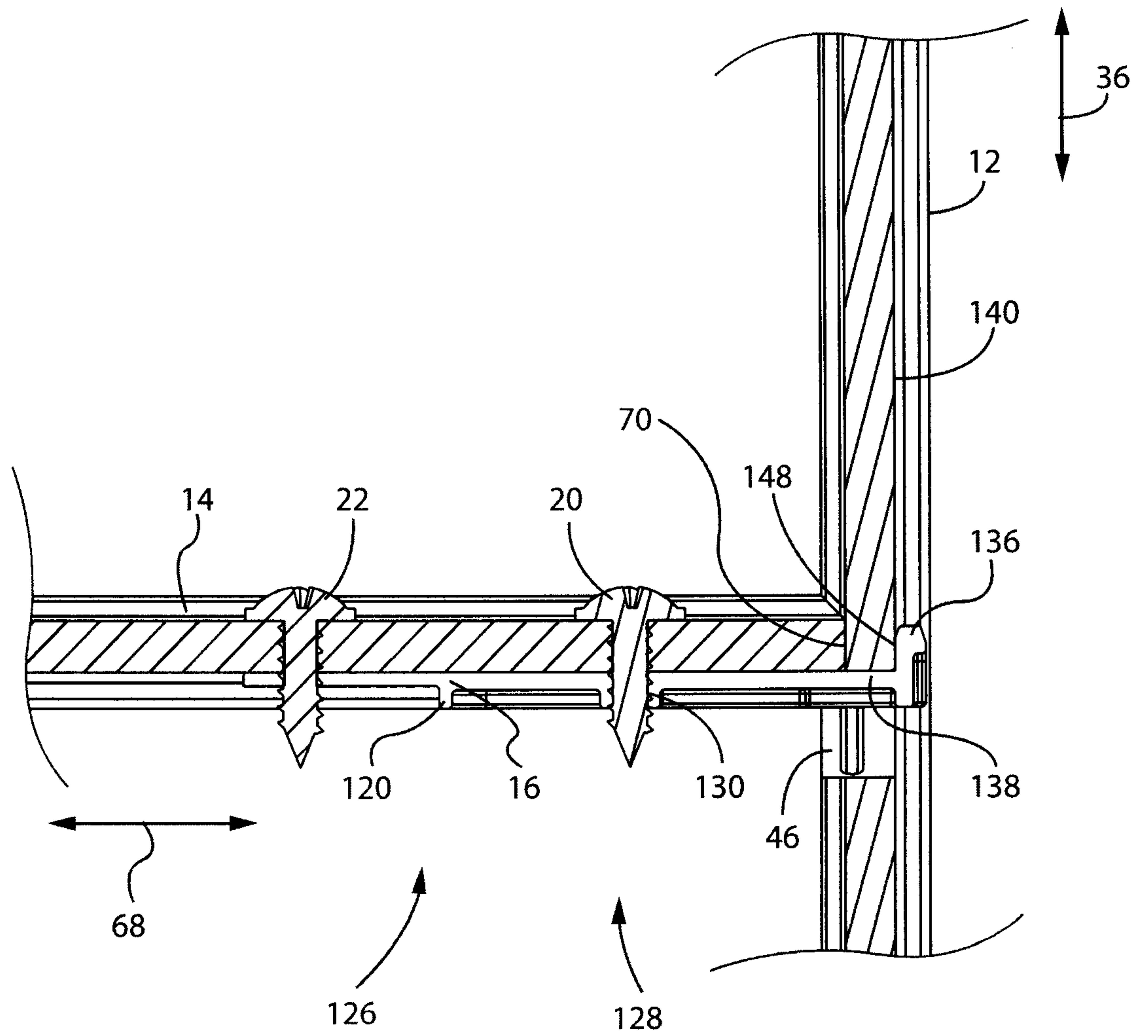


FIG. 5

