



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.10.2019 Bulletin 2019/42

(51) Int Cl.:
E05D 1/02 (2006.01) E05D 15/54 (2006.01)

(21) Application number: **19164752.8**

(22) Date of filing: **22.03.2019**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **22.03.2018 US 201862646832 P**
19.03.2019 US 201916358007
19.03.2019 US 201916358057
19.03.2019 US 201916358083

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(54) **SALOON-TYPE LAVATORY DOOR**

(57) A saloon-type door assembly that includes left and right door assemblies that each include a frame adapter having a curved inner surface with a first apex, a front portion and a rear portion, a door adapter that includes a curved outer surface with a second apex a front portion and a rear portion, a door panel associated with the door adapter, at least one front hinge strip secured along a front hinge strip path, and at least one rear hinge strip that is secured along a rear hinge strip path. The front hinge strip path extends from the front portion

of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter. The rear hinge strip path extends from the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter. The door panels are movable between a front open position, a closed position and a rear open position.

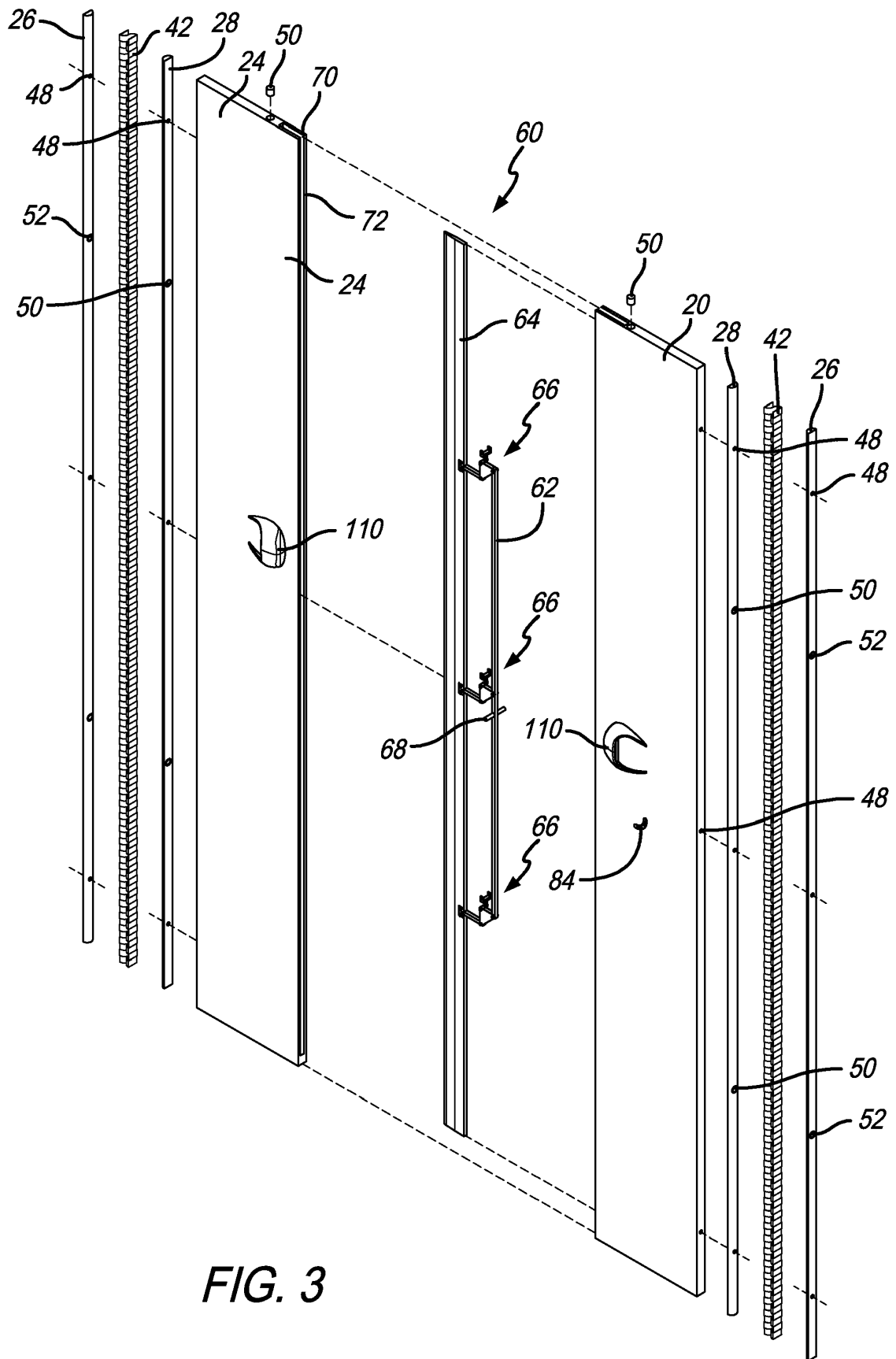


FIG. 3

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 62/646,832, filed March 22, 2018.

FIELD OF THE INVENTION

[0002] The present invention relates generally to a lavatory door, and more particularly to a saloon-type lavatory door for an aircraft, a hinge for a saloon-type lavatory door for an aircraft, and a lock for a saloon-type lavatory door for an aircraft.

BACKGROUND OF THE INVENTION

[0003] Airplane lavatories are known to be uncomfortable and unpleasant experiences for many users. One of the contributing factors to user experience in an airplane lavatory is the lavatory door. Accordingly, a need exists for an improved lavatory door.

SUMMARY OF THE PREFERRED EMBODIMENTS

[0004] In accordance with a first aspect of the present invention there is provided a saloon-type door assembly that includes a right door assembly and a left door assembly. The right door assembly includes a right frame adapter that includes a curved inner surface that defines a first apex, a front portion and a rear portion, a right door adapter that includes a curved outer surface that defines a second apex, a front portion and a rear portion and a right door panel that is associated with the right door adapter. The curved outer surface of the right door adapter opposes the curved inner surface of the right frame adapter. The right door assembly also includes at least one right front hinge strip that is secured along at least a portion of a front hinge strip path and at least one right rear hinge strip that is secured along at least a portion of a rear hinge strip path. The front hinge strip path extends from the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter. The rear hinge strip path extends from the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter. The left door assembly includes a left frame adapter that includes a curved inner surface that defines a first apex, a front portion and a rear portion, a left door adapter that includes a curved outer surface that defines a second apex, a front portion and a rear portion and a left door panel that is associated with the left door adapter. The curved outer surface of the left door adapter opposes the curved inner surface of the left frame adapter. The left door assembly also includes at least one left front hinge strip that is secured along at least a portion of a front

hinge strip path and at least one left rear hinge strip that is secured along at least a portion of a rear hinge strip path. The front hinge strip path extends from the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter. The rear hinge strip path extends from the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter. The right and left door panels are both movable between a front open position, a closed position and a rear open position. The inner surface of the left door panel opposes the inner surface of the right door panel when they are each in the closed position.

[0005] Optionally, the right door assembly may include a plurality of alternating right front hinge strips and right rear hinge strips and the left door assembly may include a plurality of alternating left front hinge strips and left rear hinge strips. Optionally, the plurality of alternating right front hinge strips and right rear hinge strips may be attached to form a right hinge band and the plurality of alternating left front hinge strips and left rear hinge strips may be attached to form a left hinge band. Optionally, the right front hinge strip and the right rear hinge strip may bias the right door panel to the closed position and the left front hinge strip and the left rear hinge strip may bias the left door panel to the closed position. Optionally, the right door panel and the right door adapter may be unitary or monolithically formed and wherein the left door panel and the left door adapter may be unitary or monolithically formed.

[0006] Optionally, the right door adapter may include a flat surface, the front hinge strip path may extend from the flat surface to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface, and the rear hinge strip path may extend from the flat surface to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter. Optionally, the left door adapter may include a flat surface, the front hinge strip path may extend from the flat surface to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and the rear hinge strip path may extend from the flat surface to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter. Optionally, the right frame adapter may include a flat surface, the front hinge strip path may extend from the flat surface of the right door adapter to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter and the rear hinge strip path may extend from the flat surface of the right door adapter to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat

surface. Optionally, the left frame adapter may include a flat surface, the front hinge strip path may extend from the flat surface of the left door adapter to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter and the rear hinge strip path may extend from the flat surface of the left door adapter to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter.

[0007] Optionally, the right frame adapter may include a flat surface, the front hinge strip path may extend from the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface and the rear hinge strip path may extend from the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat surface. Optionally, the left frame adapter may include a flat surface, the front hinge strip path may extend from the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface and the rear hinge strip path extends from the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface. Optionally, the right door adapter may include a flat surface, the front hinge strip path may extend from the flat surface of the right door adapter to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter and the rear hinge strip path may extend from the flat surface of the right door adapter to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter. Optionally, the left door adapter may include a flat surface, the front hinge strip path may extend from the flat surface of the left door adapter to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter and the rear hinge strip path may extend from the flat surface of the left door adapter to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter.

[0008] Optionally, the saloon-type door assembly may include a frame that includes an opening defined therein and the left and right door assemblies may be positioned in the opening. Optionally, the right frame assembly may be monolithically formed with the frame and the left frame assembly may be monolithically formed with the frame. Optionally, the right door panel may include a magnet member disposed adjacent a top edge thereof and the

left door panel may include a magnet member disposed adjacent a top edge thereof. Optionally, the frame may include a header that has a magnet member disposed adjacent a bottom edge thereof that opposes the magnet member of the right door panel and a magnet member may be disposed adjacent a bottom edge thereof that opposes the magnet member of the left door panel.

[0009] Optionally, the door assembly may include a lock assembly that has a blocking member, at least a first linkage assembly and a first handle. The blocking member, first linkage assembly and handle may be associated with one of the left or right door panels and a receiver member defining a pocket is associated with the other of the left or right door panels. Movement of the handle along a curved path from a start position to a finish position may move the blocking member between a first position and a second position where at least a portion of the blocking member is positioned in the pocket. Optionally, the first linkage assembly may include a first triangle member assembly and a first bar member. The first triangle member assembly may include first, second and third corners. The first corner may be pivotably attached to a first end of the first bar member, and a second end of the first bar member may be pivotably attached to the blocking member. The first triangle member assembly may include first, second and third legs. The first leg may extend between the first and second corners, the second leg may extend between the second and third corners, and the third leg may extend between the first and third corners. The first handle may be associated with the third corner of the first triangle member assembly. A first distance may be defined between the handle and the blocking member when the blocking member is in the first position and a second distance may be defined between the handle and the blocking member when the blocking member is in the second position. The second distance may be greater than the first distance.

[0010] Optionally, the lock assembly may include a detent assembly that includes a cap that is biased against the first triangle member assembly. When the handle is in the start position the cap may press against the second leg of the first triangle member assembly and when the handle is in the finish position the cap may press against the first leg of the first triangle member assembly. Optionally, the left frame adapter may include a magnet member disposed adjacent the first apex, and the left door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the left frame adapter, and the right frame adapter may include a magnet member disposed adjacent the first apex, wherein the right door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the right frame adapter. Optionally, the right front hinge strip may not be secured to the curved outer surface of the right door adapter, and wherein the right rear hinge strip may not be secured to the curved inner surface of the right frame adapter, and the left front hinge strip may not be secured to the curved

outer surface of the left door adapter, and the left rear hinge strip may not be secured to the curved inner surface of the left frame adapter.

[0011] In accordance with another aspect of the present invention there is provided a hinge assembly that includes a frame adapter having a curved inner surface that defines a first apex, a front portion and a rear portion, a door adapter that includes a curved outer surface that defines a second apex, a front portion and a rear portion. The curved outer surface of the door adapter opposes the curved inner surface of the frame adapter. The hinge assembly also includes at least one front hinge strip that is secured along at least a portion of at least a portion of a front hinge strip path and at least one rear hinge strip that is secured along at least a portion of a rear hinge strip path. The front hinge strip path extends from the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and the rear hinge strip path extends from the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter. The door adapter is movable relative to the frame adapter between a front open position, a closed position and a rear open position. Optionally, the hinge assembly may include a plurality of alternating front and rear hinge strips. Optionally, the plurality of alternating front hinge strips and rear hinge strips may be attached to form a hinge band. The alternating front hinge strips and rear hinge strips may be attached along an apex portion to form the hinge band. Optionally, the front hinge strip and the rear hinge strip may be made of a material such that they bias the door adapter to the closed position.

[0012] Optionally, the door adapter and/or the frame adapter may each include a flat surface. Optionally, the front hinge strip path may extend from the flat surface to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface, and the rear hinge strip path may extend from the flat surface to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the right frame adapter. Optionally, the front hinge strip path may extend from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, and the rear hinge strip path may extend from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface. Optionally, the front hinge strip path may extend from the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface, and the rear hinge strip path may extend from the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface. Op-

tionally, the front hinge strip path may extend from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, and the rear hinge strip path may extend from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter. Optionally, the flat surface of the door adapter may be generally parallel to a line tangent to the second apex and the flat surface of the frame adapter may be generally parallel to a line tangent to the first apex. Optionally, a door panel may be attached to the flat surface of the door adapter. At least a portion of the front and rear hinge strips may be positioned between the door panel and the door adapter. Optionally, the frame adapter may include a magnet member disposed adjacent the first apex and/or the left door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the left frame adapter. Optionally, the right frame adapter may include a magnet member disposed adjacent the first apex and/or the right door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the right frame adapter. The magnets members may be disposed in openings defined in the inner and outer curved surfaces or may be embedded in the frame and door adapters. Optionally, the front hinge strip may not be secured to the curved outer surface, and the rear hinge strip may not be secured to the curved inner surface.

[0013] There may be provided a hinge assembly comprising: a frame adapter that includes a curved inner surface that defines a first apex, wherein the curved inner surface includes a front portion and a rear portion, wherein the frame adapter includes a flat surface that is generally parallel to a line tangent to the first apex; a door adapter that includes a curved outer surface that defines a second apex, wherein the curved outer surface includes a front portion and a rear portion, wherein the door adapter includes a flat surface that is generally parallel to a line tangent to the second apex, wherein the curved outer surface of the door adapter opposes the curved inner surface of the frame adapter, a plurality of alternating front hinge strips and rear hinge strips, wherein the front hinge strips extend along a front hinge strip path, wherein the front hinge strip path extends from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, wherein the rear hinge strip path extends from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, wherein the door adapter is movable relative to the frame adapter between a front open position,

a closed position and a rear open position, and wherein the front hinge strips and the rear hinge strips bias the door adapter to the closed position. The plurality of alternating front hinge strips and rear hinge strips may be attached to form a hinge band. The alternating front hinge strips and rear hinge strips may be attached along an apex portion to form the hinge band. The frame adapter may include a magnet member disposed adjacent the first apex, and the door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the frame adapter.

[0014] In accordance with another aspect of the present invention there is provided a lock assembly that includes a blocking member, and a first linkage assembly that includes a first triangle member assembly and a first bar member. The first triangle member assembly includes first, second and third corners. The first corner is pivotably attached to a first end of the first bar member and a second end of the first bar member is pivotably attached to the blocking member. The first triangle member assembly includes first, second and third legs. The first leg extends between the first and second corners, the second leg extends between the second and third corners, and the third leg extends between the first and third corners. The lock assembly also includes a first handle associated with the third corner of the first triangle member assembly. Movement of the handle along a curved path from a start position to a finish position moves the blocking member between a first position and a second position. A first distance is defined between the handle and the blocking member when the blocking member is in the first position and a second distance is defined between the handle and the blocking member when the blocking member is in the second position, wherein the second distance is greater than the first distance.

[0015] Optionally, the lock assembly may include a vertical bar and/or a second linkage assembly. The first handle may extend outwardly from the vertical bar or the first triangle member assembly. The third corner of the first linkage assembly may be pivotably attached to the vertical bar. The second linkage assembly may include a second triangle member assembly and/or a second bar member. The second triangle member assembly may include first, second and third corners. The first corner may be pivotably attached to a first end of the second bar member and the third corner may be pivotably attached to the vertical bar. The second end of the second bar member may be pivotably attached to the blocking member. The second triangle member assembly may include first, second and third legs. The first leg may extend between the first and second corners, the second leg may extend between the second and third corners and the third leg may extend between the first and third corners.

[0016] Optionally, the lock assembly may include a receiver member that has a pocket defined therein. In the first position the blocking member may not be received in the pocket and in the second position the blocking

member may be received in the pocket. Optionally, the third leg of the first triangle member assembly may be longer than the first and second legs and the first and second legs of the first triangle member assembly are the same length. Optionally, the lock assembly may include a detent assembly that includes a cap that is biased against the first triangle member assembly. When the handle is in the start position the cap may press against the second leg of the first triangle member assembly and when the handle is in the finish position the cap may press against the first leg of the first triangle member assembly. Optionally, the triangle member assembly may include a detent surface. The cap may slide along the detent surface when the handle is moved from the start position to the finish position. Optionally, the leading portion or edge of the blocking member may define an elliptical cross-section and the pocket may define an elliptical cross-section for receiving the blocking member.

[0017] Optionally, the left frame adapter may include a magnet member disposed adjacent the first apex and the left door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the left frame adapter. Optionally, the right frame adapter may include a magnet member disposed adjacent the first apex and the right door adapter may include a magnet member disposed adjacent the second apex that opposes the magnet member of the right frame adapter. The magnets members may be disposed in openings defined in the inner and outer curved surfaces or may be embedded in the frame and door adapters.

[0018] There may be provided a lock assembly comprising: a vertical bar having at least a first handle extending outwardly therefrom, a blocking member, a first linkage assembly that includes a first triangle member assembly and a first bar member, wherein the first triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the first bar member, wherein the third corner is pivotably attached to the vertical bar, wherein a second end of the first bar member is pivotably attached to the blade, wherein the first triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners, a second linkage assembly that includes a second triangle member assembly and a second bar member, wherein the second triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the second bar member, wherein the third corner is pivotably attached to the vertical bar, wherein a second end of the second bar member is pivotably attached to the blade, wherein the second triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the

first and third corners, a receiver member that includes a pocket defined therein, wherein movement of the handle along a curved path from a start position to a finish position moves the blocking member between a first position and a second position, wherein a first distance is defined between the vertical bar and the blocking member when the blocking member is in the first position and a second distance is defined between the vertical bar and the blocking member when the blocking member is in the second position, wherein the second distance is greater than the first distance, and wherein in the first position the blocking member is not received in the pocket and in the second position the blocking member is received in the pocket, and a detent assembly that includes a cap that is biased against the first triangle member assembly, wherein when the handle is in the start position the cap presses against the second leg of the first triangle member assembly, and wherein when the handle is in the finish position the cap presses against the first leg of the first triangle member assembly. The triangle member assembly may include a detent surface, and the cap may slide along the detent surface when the handle is moved from the start position to the finish position. A leading portion of the blocking member may define an elliptical cross-section. The pocket may define an elliptical cross-section for receiving the blocking member. The third leg of the first triangle member assembly may be longer than the first and second legs, and the third leg of the second triangle member assembly may be longer than the first and second legs. The first and second legs may be the same length.

[0019] The present invention may provide a lavatory door with higher reliability than existing bi-fold lavatory doors while maintaining space efficiency. Optionally, the invention may be a saloon-type door. It will be appreciated by those of ordinary skill in the art that a saloon-type door, also known in the art as cafe doors, may include two opposing panels that open in the middle thereof and often use bidirectional hinges that close the door regardless of which direction it is opened by incorporating springs or other biasing members.

[0020] The door assembly disclosed herein may include a plurality of subsystems, including the hinge and door stop mechanism, the lock and gap seal mechanism, and the door panels. The hinge may provide a self-closing door that preferably allows up to and including 180 degree rotation each way. This is important so that the user is not boxed in when exiting the lavatory if the door only opens 90 degrees outward into the aisle. Another important design concern for the lavatory door was to allow egress in case of an emergency. If the door only opens 90 degrees into the aisle when opened, this would block passage through the aisle. A hinge design with 180 degree rotation allows a user to push the panel until it is flat against the wall, allowing easy passage through the aisle in case of emergency. The hinge assembly may include strips of material. Materials for use in the hinge can include synthetic polymer fabrics such as ripstop nylon,

ripstop polyester, HDPE (High Density Polyethylene) and Nylon blends, and UHMWPE (Ultra High Molecular Weight Polyethylene) fabric also known as Dyneema. These synthetic polymer fabrics may have the necessary value ranges of strength and toughness to prevent the door panel from sagging while also being able to flex 180 degrees without experiencing plastic deformation or failure. Optionally, a DCF Hybrid UHMWPE material (Dyneema mixed with polyester) is used due to its stiffness as well as flexibility.

[0021] In order for the hinge to function properly it may require that each side of the hinge (wall and lavatory door panel) require a radius that is one half of the door panel width. In order to self-close the door afterwards, magnets may be included between the door panel and the frame to bring the door back to center after being opened. Optionally, the magnets can be omitted. Optionally, one or two magnets may be placed at the top or bottom of the panel that are strong enough to pull the door back to center. Optionally, more than two magnets may be included. To prevent the closing panels from brushing against a user, magnets may be inserted into the door and wall panels that connect when the door is fully open on the opposite end of the closing magnets giving them a mechanical advantage and allowing the door to stay open when it is fully opened and then to close by itself once a close is initiated by the user are used.

[0022] The lock or stop assembly may include a blade member or blocking member that resides inside one of the door panels and runs most or all of the length of the panel. The blade member may be connected to a four-bar linkage mechanism. The opposite door panel may include a receiver into which the blocking member may be inserted when the door is locked. The blocking member may block the doors from being opened. The receiver can simply be a pocket cut or carved into the opposite door panel or can be an insert that includes a pocket that is secured in the opposite door panel.

[0023] Optionally, the assembly may also include a detent assembly that provides a "feel" for the user that that the lock assembly was either locked or unlocked. In other words, the detent may provide a tactile indicator that the assembly is fully locked or unlocked. Optionally, the detent assembly may include a bi-stable cam and spring mechanism.

[0024] The lock assembly may also include triangular brackets that pivotably attach to the long vertical linkage that includes the user handle and bar members or linkages that apply the direct force to the blocking member in order to move it. It will be appreciated that the length of two legs of the triangle may be changed to adjust the mechanical advantage properties of the mechanism and that if the leg attached to the vertical linkage the user moves is longer than the leg attached to the bar member there is a greater mechanical advantage. Optionally, the door panels may be made of a honeycomb material and are between 0.5" and 0.75" in thickness. Optionally, the handles may not extend outwardly from the door so far

as to be in the way, but also may not easily catch on users' clothing or bags.

[0025] The blocking member may be moved by the four-bar linkage (as a result of movement of the handle along the curved path) and may provide the blocking member with a quarter-circle path of motion. This may cause the blocking member to move horizontally or outwardly from its initial or first position approximately one inch as well as vertically up one inch. Optionally, the four-bar mechanism may consist of the blocking member, three rectangular linkages or bar members that connect the blade to one corner of the triangular members and the triangular members. The triangular members or brackets may have a fixed point at the second corners, about which they pivot to produce the desired motion. The triangular members may be connected at the third corner to each other (via the vertical linkage) to maintain consistent motion. These three bracket assemblies may make up the four-bar linkage to ensure that the motion of the blade will be all translation and no rotation (two bracket assemblies can be used). At the fixed corner of the triangular member, a biaxial mechanism may be used to force the lock to either be in the locked or the unlocked position, with no stopping in an intermediate position. As the door is locked, the spring may be compressed as the corner of the triangle member presses into the spring. Once the handle has been moved past the halfway point of the path and the spring is past the corner of the triangle member or detent block, the spring may force the blocking member the rest of the way.

[0026] Optionally, the legs of the triangular brackets may have a ratio of 1:1 because that ratio may provide the desired motion and a reasonable force. Optionally, each of the triangle members may include a detent assembly associated therewith. However, optionally, a single detent assembly may be included.

[0027] Optionally, the profile of the edge of the blocking member may be an ellipse to assist with indexing the door panels in the center position and limit the friction forces of the inserting of the blocking member into the receiver. Optionally, the components of the lock assembly may mainly comprise HDPE to provide the lock with stiffness, low weight and low friction forces. However, other plastics, metals and other materials may be used for any of the components.

[0028] The handle may be made of aluminum, but can be made of other metal or plastic and may be designed to help prevent users' clothing or bags from catching on the handle if they decide to push the door in. Optionally, the door assembly may include four handles: two on the inside and two on the outside. This may provide the option for the user to push or pull on the doors when entering or exiting. The handle may be fairly small and may allow for pulling with at least two fingers and at most four fingers.

[0029] Any feature described herein in relation to one aspect, embodiment or example may be combined with any other feature described herein in relation to any other

aspect, embodiment or example, as appropriate and applicable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The invention may be more readily understood by referring to the accompanying drawings in which:

FIG. 1 is a perspective view of a wall that includes a saloon-type door assembly positioned therein in accordance with a preferred embodiment of the present invention;

FIG. 2 is a perspective view of the saloon-type door assembly of FIG. 1 with the door panels in the open position;

FIG. 3 is an exploded perspective view of the saloon-type door assembly of FIG. 1;

FIG. 3A is a detailed view of a portion of the hinge band;

FIG. 3B shows the hinge band from FIG. 3A stretched out;

FIG. 3C shows an alternate hinge band in a stretched out position;

FIG. 4A is a top plan view of an embodiment of a hinge assembly;

FIG. 4B is a perspective view of the hinge assembly shown in FIG. 4A;

FIG. 5A is a top plan view of another embodiment of a hinge assembly;

FIG. 5B is a perspective view of the hinge assembly shown in FIG. 5A;

FIG. 6A is a top plan view of another embodiment of a hinge assembly;

FIG. 6B is a perspective view of the hinge assembly shown in FIG. 6A;

FIG. 7 is an exploded view of a lock assembly in accordance with a preferred embodiment of the present invention;

FIG. 8 is a side elevational view of the lock assembly with the blocking member in the first position and the handle in the start position;

FIG. 9 is a side elevational view of the lock assembly with the blocking member partially moved toward the second position;

FIG. 10 is a side elevational view of the lock assembly with the blocking member in the second position and the handle in the finish position;

FIG. 11 is a cross-sectional top elevational view showing the blocking member in the first position;

FIG. 12 is a cross-sectional top elevational view showing the blocking member moving into the pocket; and

FIG. 13 is a cross-sectional top elevational view showing the blocking member in the second position.

[0031] Like numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] The following description and drawings are illustrative and are not to be construed as limiting. Numerous specific details are described to provide a thorough understanding of the disclosure. However, in certain instances, well-known or conventional details are not described in order to avoid obscuring the description. References to one or an embodiment in the present disclosure can be, but not necessarily are references to the same embodiment; and, such references mean at least one of the embodiments.

[0033] Reference in this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Moreover, various features are described which may be exhibited by some embodiments and not by others. Similarly, various requirements are described which may be requirements for some embodiments but not other embodiments.

[0034] The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks: The use of highlighting has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted.

[0035] It will be appreciated that the same thing can be said in more than one way. Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein. No special significance is to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

[0036] Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given below. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit

the scope of the disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions, will control.

[0037] It will be appreciated that terms such as "front," "back," "top," "bottom," "side," "short," "long," "up," "down," "aft," "forward," "inboard," "outboard" and "below" used herein are merely for ease of description and refer to the orientation of the components as shown in the figures. It should be understood that any orientation of the components described herein is within the scope of the present invention.

[0038] Referring now to the drawings, wherein the showings are for purposes of illustrating the present invention and not for purposes of limiting the same, FIGS. 1-13 show a saloon-type door assembly that includes a hinge assembly and lock assembly. In an exemplary embodiment, the door assembly can be used in aircraft lavatories. However, this is not a limitation on the present invention and the assembly can be used in other places where a door is desired.

[0039] As shown in FIGS. 1-3, the saloon-type door assembly 10 generally includes a right door assembly 12, a left door assembly 14, and a lock assembly 60. The saloon-type door assembly 10 is positioned in a wall or door frame 100 that defines a door opening 102. The frame 100 includes a header 104. Each of the right door assembly 12 and left door assembly 14 are movable between a closed position (see FIG. 1) and a front open position (see FIG. 2) and a rear open position. FIG. 2 shows the right and left door assemblies open to about 90° in the front open position. However, it will be appreciated that the right and left door assemblies can open anywhere between 90° and 180°. In a preferred embodiment, the right door assembly 12 includes a right hinge assembly 18 and a right door panel 20 and the left door assembly 14 includes a left hinge assembly 22 and a left door panel 24.

[0040] FIGS. 4A-6B show different embodiments of the hinge assemblies. For ease of description only the left hinge assembly 22 is shown and described. It will be appreciated that the description also applies to the right hinge assembly 18 and associated components. As shown in FIGS. 4A-4B, the left hinge assembly 22 includes a left frame adapter 26 and a left door adapter 28. The left frame adapter 26 includes a curved inner surface 30 that defines a first apex 32. The curved inner surface 30 includes a front portion 30a and a rear portion 30b. The left door adapter 28 includes a curved outer surface 34 that defines a second apex 36. The curved outer surface 34 includes a front portion 34a and a rear portion 34b. As shown in FIG. 4A, the curved inner surface 30 opposes the curved outer surface 34. It will be appreciated that the front and rear portions of the curved inner and outer surfaces are defined by or divided by the first and second apexes 32 and 36 (see the dashed line in

FIG. 4A).

[0041] As shown in FIGS. 4A-4B, the hinge assembly includes front and rear hinge strips. Preferably, the left hinge assembly 22 (and left door assembly 14) includes at least one front hinge strip 38 that is secured along at least a portion of a front hinge strip path and at least one rear hinge strip 40 that is secured along at least a portion of a rear hinge strip path. The front hinge strip path extends from the front portion 34a of the curved outer surface 34 of the left door adapter 28 to the rear portion 30b of the curved inner surface 30 of the left frame adapter 26. The rear hinge strip path extends from the rear portion 34b of the curved outer surface 34 of the left door adapter 28 to the front portion 30a of the curved inner surface 30 of the left frame adapter 26. In a preferred embodiment, the left hinge assembly 22 includes a plurality of alternating front and rear hinge strips 38 and 40 that extend vertically thereon. The hinge strips can be separate pieces or they can form a hinge band 42 (where they are all connected together), as shown in FIGS. 3-3B. In a preferred embodiment, the alternating front and rear hinge strips are connected along the portions that cover the apexes of the curved inner and outer surfaces to form the hinge band 42. In this embodiment, the connected portion of the hinge band 42 is referred to herein as the apex portion 42a. FIG. 3A shows the hinge band 42 with a connected apex portion 42a. FIG. 3B shows the hinge band 42 in a stretched or laid out position. In other words, it shows the front and rear hinge strips prior to being wrapped around the frame and door adapters. FIG. 3C shows an alternate hinge band orientation where the front and rear hinge strips only extend in one direction and either wrap around the frame adapter or the door adapter.

[0042] In the embodiment shown in FIGS. 4A-4B, the left door adapter 28 includes a flat surface 44 opposite the curved outer surface 34. In a preferred embodiment, the front and rear hinge strips 38 and 40 are secured to this surface. As a result, the front and rear hinge strip paths start from the flat surface 44. The left frame adapter 26 also preferably includes a flat surface 46 that can be a part of the hinge strip path. In a preferred embodiment, flat surfaces 44 and 46 are generally parallel to a line tangent to the associated apex 32 and 36 of the curved inner or outer surface 30 and 34. In a preferred embodiment, the front and rear hinge strips 38 and 40 are adhered to the frame adapter 26 and door adapter 28 (or frame and door panel) along surfaces other than the curved inner and outer surfaces 30 and 34 (e.g., flat surfaces 44 and 46 and/or the front and rear surfaces of the door panel or frame). In other words, in this embodiment, the front and rear hinge strips are not secured to the curved inner and outer surfaces 30 and 34. This allows the strips in the areas adjacent to the curved inner and outer surfaces to move or stretch during opening and closing. In another embodiment, the front and rear hinge strips are secured to the curved inner and outer surfaces 30 and 34.

[0043] It will be appreciated that, generally, the left door

adapter 28 is associated with the left door panel 24. This is a broad way of saying the left door adapter 28 can be a separate piece that is attached to the left door panel 24 (FIG. 4A) or the left door adapter 28 is monolithically formed with or a part of left door panel 24 (FIG. 5A). Specifically, in FIGS. 4A-4B, the left door panel 24 includes an inner surface 24a to which the left door adapter 28 is attached. It will also be appreciated that, generally, the left frame adapter 26 is associated with the frame 100 on the left side of the wall where the door assembly 10 is mounted. This is a broad way of saying the left frame adapter 26 can be a separate piece that is attached to the frame 100 (FIG. 4A) or the left door adapter 28 is monolithically formed with or a part of the frame 100 (FIG. 5A). Specifically, in FIGS. 4A-4B, the frame 100 includes an inner surface 100a to which the left frame adapter 26 is attached.

[0044] The left door adapter 28 can be secured to the left door panel 24 via threaded fasteners, rivets, adhesive, glue, etc. Furthermore, the left door adapter 28 can be secured directly to the portions of the front and rear hinge strips 38 and 40 that are interposed between the left door adapter 28 and the left door panel 24. The left frame adapter 26 can be secured to the frame 100 via threaded fasteners, rivets, adhesive, glue, etc. Furthermore, the left frame adapter 26 can be secured directly to the portions of the front and rear hinge strips 38 and 40 that are interposed between the left frame adapter 26 and the frame. FIG. 3 shows openings 48 in the various adapters for securing the adapters to the frame or the door panels.

[0045] It will be appreciated that the left and right door panels 24 and 20 are both movable between a front open position, a closed position and a rear open position and the inner surface of the left door panel opposes the inner surface of the right door panel when they are each in the closed position. The front and rear hinge strips 38 and 40 bias the left and right door panels to the closed position.

[0046] FIGS. 5A-5B show an embodiment where the front and rear hinge strips 38 and 40 do not extend to a flat surface on the back of the left frame adapter 26 or left door adapter 28. This can be used in an embodiment where the left frame adapter 26 and left door adapter 28 are monolithically formed with the frame 100 and left door panel 24, respectively (i.e., where the inner and outer curved surfaces are formed on the frame and the left door panel).

[0047] FIGS. 6A and 6B show an embodiment where the front and rear hinge strips 38 and 40 are a hybrid of the embodiments shown in FIGS. 4A-5B. This can be used, for example, where the curved outer surface 34 is formed directly on the left door panel 24 and the left frame adapter 26 is used to attach to the frame 100.

[0048] As shown in FIGS. 2 and 3, in a preferred embodiment, the right door panel 20 includes a first magnet member 50 disposed adjacent a top edge thereof and the header 104 of the frame 100 includes a second mag-

net member 52 disposed adjacent a bottom edge thereof. Furthermore, the left door panel 24 includes a first magnet member 50 disposed adjacent a top edge thereof and the header 104 of the frame includes a second magnet member 52 disposed adjacent a bottom edge thereof. These magnet members 50 are used to help move or pull the left and right door panels 20 and 24 to the closed position. The door assemblies can also include opposing magnet members 50 and 52 in the door adapter 28 and the frame adapter 26 (see FIG. 3). These magnets also help pull the left and right door panels and/or the left and right hinge assemblies back to the closed position.

[0049] FIGS. 7-13 show a preferred embodiment of the lock assembly 60 for locking the left and right door panels 24 and 20 in the closed position. As shown in FIGS. 7-10, generally, the lock assembly 60 includes a vertical linkage or vertical bar 62, a blocking member 64, and one or more linkage assemblies 66 that connect the vertical bar 62 to the blocking member 64. Preferably, the vertical bar 62 includes handles 68 extending outwardly therefrom.

[0050] As shown in FIGS. 2-3, the lock assembly 60 is positioned in the left and right door panels 24 and 20. In a preferred embodiment, the lock assembly 60 also includes a receiver member 70 that includes a pocket 72 defined therein. In use, the blocking member 64 is received in the pocket 72 to lock the door assembly 10 or to prevent the door panels from being opened. The receiver member 70 can simply be a pocket 72 cut or carved into the door panel or can be an insert (see FIGS. 11-13) that includes the pocket 72 defined therein and that is secured in the door panel. In the embodiment shown in FIGS. 2-3, the blocking member 64 and associated components are secured in the right door panel 20 and the receiver member 70 is associated with the left door panel 24. For example, the blocking member 64 and associated components can be positioned in or housed in a space in the right door panel 20 that is defined between the front and rear surfaces. However, this arrangement can be reversed.

[0051] In a preferred embodiment, each linkage assembly 66 includes inner and outer triangle members 74a and 74b that form a triangle member assembly 74, a bar member 76 and a detent assembly 78. In another embodiment, one of the inner or outer triangle members can be omitted and only a single triangle member can be used in the linkage assembly 66. This arrangement is still referred to herein as a triangle member assembly 74. The triangle member assembly 74 and bar member 76 cooperate to form a four bar linkage. As shown in FIG. 7, various components of the linkage assembly 66 can be secured together using threaded fasteners 80, brackets 82 and the like. Other mechanical fasteners, such as rivets, welding, glue, etc. can also be used.

[0052] As shown in FIG. 8, the triangle member assembly 74 (of each linkage assembly 66) includes first, second and third corners 75a, 75b and 75c. The first corner 75a is pivotably or rotatably attached to a first end

76a of the bar member 76 and the third corner 75c is pivotably or rotatably attached to the vertical bar 62. The second end 76b of the bar member 76 is pivotably or rotatably attached to the blocking member 64. As shown in FIG. 8, the triangle member assembly 74 also includes first, second and third legs 75d, 75e and 75f. In a preferred embodiment, the first and second legs 75d and 75e are the same length, and the third leg 75f is longer than the first and second legs 75d and 75e. In another embodiment, the first and second legs can be different lengths. In another embodiment, the third length can be shorter than one or more of the first and second legs.

[0053] As shown in FIGS. 2 and 8, the handle 68 extends outwardly through a curved slot 84 that is defined in the right door panel 20 (or left door panel if the arrangement is reversed). The curved slot 84 allows the handle 68 to be moved along a curved path. Because the handle 68 extends outwardly from the vertical bar 62, movement of the handle 68 along the curved path causes the vertical bar 62 to move along a similar curved path having the same curvature or shape. Furthermore, because the third corners 75c of the triangle member assemblies 74 are pivotably attached to the vertical bar 62, movement of the vertical bar 62 along the curved path causes movement of the third corners 75c of the triangle member assemblies 74 along a similar curved path having the same curvature or shape. As a result of this movement, the blocking member 64 moves horizontally (to the right in FIGS. 8-10) and away from the vertical bar 62 and handle 68.

[0054] With reference to FIGS. 8-10, the movement of the blocking member 64 is shown. FIG. 8 shows the blocking member 64 in the first position and the handle 68 in the starting position (where the doors can be opened), FIG. 9 shows the blocking member 64 after the handle 68 has been partially moved along the curved path, and FIG. 10 shows the blocking member 64 in the second position and the handle 68 in the finish position (where the doors cannot be opened). During movement of the handle 68 along the curved path, as a result of the movement of the third corner 75c, the triangle member assembly 74 pivots about the second corner 75b and the first corner 75a moves upwardly and to the right, which also moves the first end 76a of the bar member 76. As a result of the length of the third leg 75f of the triangle member assembly 74, and the connection of the second end 76b of the bar member 76 to the blocking member 64, the blocking member 64 moves outwardly and to the right (as well as upwardly). In use, this movement causes the blocking member 64 to be received in the pocket 72. See FIGS. 11-13, which show the blocking member 64 moving into the pocket 72. Therefore, a first distance is defined between the handle 68/vertical bar 62 and the blocking member 64 when the blocking member is in the first position and a second distance is defined between the handle 68/vertical bar 62 and the blocking member 64 when the blocking member 64 is in the second position and received in the pocket. It will be appreciated that the

second distance is greater than the first distance. It will also be appreciated that as a result of both the vertical bar and handle having a horizontal component of movement during movement of the blocking member (when locking the doors), the distance the blocking member 64 moves relative to the insert member 70 is greater than the movement of the blocking member 64 relative to the vertical bar 62 (the second distance).

[0055] It will be appreciated that a simpler version of the lock assembling 60 includes only a single linkage assembly 66 with a single triangle member assembly 74. In this embodiment, the vertical bar 62 can be omitted and the handle 68 can extend from the third corner 75c of the triangle member assembly 74. As long as the handle 68 is associated with the third corner 75c either directly (i.e., located on the corner) or indirectly (i.e., located on the vertical bar 62 that is attached to the third corner) such that it can move the third corner 75c along the curved path, the assembly will work properly. In a preferred embodiment, the first leg 75d is generally vertically oriented in the first or start position and the second leg 75e is generally horizontally oriented in the first or start position.

[0056] The detent assembly 78 is provided to hold the blocking member 64 in the first or second position. In a preferred embodiment, the detent assembly 78 includes a bracket 86, a spring 88 and a cap 90. The bracket 86 is mounted or otherwise secured to the door panel and within a space or opening within the door panel. The spring 88 extends downwardly from the bracket so that the cap 90 engages with and is pressed against the second corner 75b of the triangle member assembly 74. In the start position (shown in FIG. 8), the cap 90 presses against the second leg 75e of the triangle member assembly 74 and in the finish position (shown in FIG. 10) the cap 90 presses against the first leg 75d. In a preferred embodiment, the triangle member assembly 74 second corner 75b includes a detent surface 92 that extends between the first leg 75d and the second leg 75e and over the second corner 75b. As the triangle member assembly 74 pivots from the start position to the finish position, the cap 90 rides or slides on the detent surface 92. As shown in FIG. 7, in a preferred embodiment, the detent surface 92 is defined on an insert 94 that is sandwiched between the inner and outer triangle members 74a and 74b. In another embodiment, the insert 94 can be secured to a single triangle member.

[0057] FIGS. 11-13 show cross-sectional plan views of the blocking member 64, receiver member 70 and pocket 72 as the blocking member moves between the first position and second position. It will be appreciated that the blocking member 64 can be any shape that allows it to fit within the pocket and prevent the doors from being opened. In a preferred embodiment, the profile or shape of the leading or distal surface 95 of the blocking member 64 is a portion of an ellipse or defines an elliptical cross-section (when viewed from above) to assist with indexing the left and right door panels 24 and 20 in the center

position and limit the friction forces of the inserting of the blocking member 64 into the receiver member 70 and pocket 72. The ellipse has a major axis extending parallel to the direction of movement of the blocking member 64 and a minor axis extending laterally thereto. In such an embodiment, preferably the pocket 72 includes the same elliptical shape for receiving the blocking member 64. Preferably, the receiver member 70 includes inclined or curved edges 96 at the leading edge thereof that helps guide the blocking member 64 into the pocket 72.

[0058] As shown in FIGS. 1-3, in a preferred embodiment, the right and left door panels 20 and 24 include handles 110 thereon for opening and closing the door panels. Preferably, the handle 110 includes rounded edges and generally has a U-shape. When positioned on a door panel, the main body portion 112 of the handle 110 defines a pocket 114 with the door panel and defines an opening 116 that faces horizontally outwardly. In use, the user puts their hand through the opening 116, into the pocket 114 and pulls or pushes to open the doors.

[0059] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." As used herein, the terms "connected," "coupled," or any variant thereof, means any connection or coupling, either direct or indirect, between two or more elements; the coupling of connection between the elements can be physical, logical, or a combination thereof. Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. Where the context permits, words in the above Detailed Description of the Preferred Embodiments using the singular or plural number may also include the plural or singular number respectively. The word "or" in reference to a list of two or more items, covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list.

[0060] The above-detailed description of embodiments of the disclosure is not intended to be exhaustive or to limit the teachings to the precise form disclosed above. While specific embodiments of and examples for the disclosure are described above for illustrative purposes, various equivalent modifications are possible within the scope of the disclosure, as those skilled in the relevant art will recognize. Further, any specific numbers noted herein are only examples: alternative implementations may employ differing values, measurements or ranges.

[0061] The teachings of the disclosure provided herein can be applied to other systems, not necessarily the system described above. The elements and acts of the various embodiments described above can be combined to provide further embodiments. Any measurements described or used herein are merely exemplary and not a

limitation on the present invention. Other measurements can be used. Further, any specific materials noted herein are only examples: alternative implementations may employ differing materials.

[0062] Any patents and applications and other references noted above, including any that may be listed in accompanying filing papers, are incorporated herein by reference in their entirety. Aspects of the disclosure can be modified, if necessary, to employ the systems, functions, and concepts of the various references described above to provide yet further embodiments of the disclosure.

[0063] These and other changes can be made to the disclosure in light of the above Detailed Description of the Preferred Embodiments. While the above description describes certain embodiments of the disclosure, and describes the best mode contemplated, no matter how detailed the above appears in text, the teachings can be practiced in many ways. Details of the system may vary considerably in its implementation details, while still being encompassed by the subject matter disclosed herein. As noted above, particular terminology used when describing certain features or aspects of the disclosure should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features or aspects of the disclosure with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the disclosures to the specific embodiments disclosed in the specification unless the above Detailed Description of the Preferred Embodiments section explicitly defines such terms. Accordingly, the actual scope of the disclosure encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the disclosure under the claims.

[0064] Accordingly, although exemplary embodiments of the invention have been shown and described, it is to be understood that all the terms used herein are descriptive rather than limiting, and that many changes, modifications, and substitutions may be made by one having ordinary skill in the art without departing from the spirit and scope of the invention.

Claims

1. A saloon-type door assembly comprising:

a right door assembly that includes

a right frame adapter that includes a curved inner surface that defines a first apex, wherein the curved inner surface includes a front portion and a rear portion, a right door adapter that includes a curved outer surface that defines a second apex, wherein the curved outer surface includes a front portion and a rear portion, wherein

the curved outer surface of the right door adapter opposes the curved inner surface of the right frame adapter, a right door panel, wherein the right door adapter is associated with the right door panel, at least one right front hinge strip that is secured along at least a portion of a front hinge strip path, wherein the front hinge strip path extends from the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter, at least one right rear hinge strip that is secured along at least a portion of a rear hinge strip path, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter,

a left door assembly that includes

a left frame adapter that includes a curved inner surface that defines a first apex, wherein the curved inner surface includes a front portion and a rear portion, a left door adapter that includes a curved outer surface that defines a second apex, wherein the curved outer surface includes a front portion and a rear portion, wherein the curved outer surface of the left door adapter opposes the curved inner surface of the left frame adapter, a left door panel, wherein the left door adapter is associated with the left door panel, at least one left front hinge strip that is secured along at least a portion of a front hinge strip path, wherein the front hinge strip path extends from the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter, and at least one left rear hinge strip that is secured along at least a portion of a rear hinge strip path, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter,

wherein the right door panel is movable between a front open position, a closed position and a rear open position, wherein the left door panel is movable between a front open position, a closed position and a rear open position, and wherein the inner surface of the left door panel

opposes the inner surface of the right door panel when they are each in the closed position.

2. The door assembly of claim 1

wherein the right door assembly includes a plurality of alternating right front hinge strips and right rear hinge strips, and wherein the left door assembly includes a plurality of alternating left front hinge strips and left rear hinge strips; and, optionally, wherein the plurality of alternating right front hinge strips and right rear hinge strips are attached to form a hinge band, and wherein the plurality of alternating left front hinge strips and left rear hinge strips are attached to form a hinge band;

or

wherein the right front hinge strip and the right rear hinge strip bias the right door panel to the closed position, and wherein the left front hinge strip and the left rear hinge strip bias the left door panel to the closed position;

or

wherein the right door panel and the right door adapter are monolithically formed, and wherein the left door panel and the left door adapter are monolithically formed;

or

wherein the right door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface, wherein the rear hinge strip path extends from the flat surface to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter, wherein the left door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter, and wherein the rear hinge strip path extends from the flat surface to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter; and, optionally, wherein the right frame adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the right door adapter to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter, wherein the rear hinge strip path extends from the flat surface of the right door adapter to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat surface, wherein the left frame adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the left door adapter to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface, wherein the rear hinge strip path extends from the flat surface of the left door adapter to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter;

adapter to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter, wherein the rear hinge strip path extends from the flat surface of the left door adapter to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter;

or

wherein the right frame adapter includes a flat surface, wherein the front hinge strip path extends from the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat surface, wherein the left frame adapter includes a flat surface, wherein the front hinge strip path extends from the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface; and, optionally, wherein the right door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the right door adapter to the front portion of the curved outer surface of the right door adapter to the rear portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter, wherein the rear hinge strip path extends from the flat surface of the right door adapter to the rear portion of the curved outer surface of the right door adapter to the front portion of the curved inner surface of the right frame adapter and to the flat surface of the right frame adapter, wherein the left door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the left door adapter to the front portion of the curved outer surface of the left door adapter to the rear portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter, and wherein the rear hinge strip path extends from the flat surface of the left door adapter to the rear portion of the curved outer surface of the left door adapter to the front portion of the curved inner surface of the left frame adapter and to the flat surface of the left frame adapter;

or

further comprising a frame that includes an opening defined therein, wherein the left and right door assemblies are positioned in the opening; and, option-

ally,

(i) wherein the right frame assembly is monolithically formed with the frame, and wherein the left frame assembly is monolithically formed with the frame; or

(ii) wherein the right door panel includes a magnet member disposed adjacent a top edge thereof, wherein the frame includes a header, wherein the header includes a magnet member disposed adjacent a bottom edge thereof that opposes the magnet member of the right door panel, wherein the left door panel includes a magnet member disposed adjacent a top edge thereof, and wherein the header includes a magnet member disposed adjacent a bottom edge thereof that opposes the magnet member of the left door panel;

or

further comprising a lock assembly, wherein the lock assembly includes a blocking member, at least a first linkage assembly and a first handle, wherein the blocking member, first linkage assembly and handle are associated with one of the left or right door panels and a receiver member defining a pocket is associated with the other of the left or right door panels, wherein movement of the handle along a curved path from a start position to a finish position moves the blocking member between a first position and a second position where at least a portion of the blocking member is positioned in the pocket; and, optionally, wherein the first linkage assembly includes a first triangle member assembly and a first bar member, wherein the first triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the first bar member, wherein a second end of the first bar member is pivotably attached to the blocking member, wherein the first triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners, wherein the first handle is associated with the third corner of the first triangle member assembly, and wherein a first distance is defined between the handle and the blocking member when the blocking member is in the first position and a second distance is defined between the handle and the blocking member when the blocking member is in the second position, wherein the second distance is greater than the first distance; and, further optionally, wherein the lock assembly includes a detent assembly that includes a cap that is biased against the first triangle member assembly, wherein when the handle is in the start position the cap presses against the second leg of the first triangle member assembly, and wherein when the handle is in the finish position the cap presses against the first leg of the first triangle member assembly;

gle member assembly, and wherein when the handle is in the finish position the cap presses against the first leg of the first triangle member assembly; or

wherein the left frame adapter includes a magnet member disposed adjacent the first apex, wherein the left door adapter includes a magnet member disposed adjacent the second apex that opposes the magnet member of the left frame adapter, wherein the right frame adapter includes a magnet member disposed adjacent the first apex, wherein the right door adapter includes a magnet member disposed adjacent the second apex that opposes the magnet member of the right frame adapter;

or

wherein the right front hinge strip is not secured to the curved outer surface of the right door adapter, and wherein the right rear hinge strip is not secured to the curved inner surface of the right frame adapter, wherein the left front hinge strip is not secured to the curved outer surface of the left door adapter, and wherein the left rear hinge strip is not secured to the curved inner surface of the left frame adapter.

25 3. A lock assembly comprising:

a blocking member,

a first linkage assembly that includes a first triangle member assembly and a first bar member, wherein the first triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the first bar member, wherein a second end of the first bar member is pivotably attached to the blocking member, wherein the first triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners, and

a first handle associated with the third corner of the first triangle member assembly, wherein movement of the handle along a curved path from a start position to a finish position moves the blocking member between a first position and a second position, wherein a first distance is defined between the handle and the blocking member when the blocking member is in the first position and a second distance is defined between the handle and the blocking member when the blocking member is in the second position, wherein the second distance is greater than the first distance.

4. The lock assembly of claim 3 further comprising:

a vertical bar, wherein the first handle extends outwardly from the vertical bar, wherein the third corner of the first linkage assembly is pivotably attached to the vertical bar,

a second linkage assembly that includes a second triangle member assembly and a second bar member, wherein the second triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the second bar member, wherein the third corner is pivotably attached to the vertical bar, wherein a second end of the second bar member is pivotably attached to the blocking member, wherein the second triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners;

or

further comprising a receiver member that includes a pocket defined therein, wherein in the first position the blocking member is not received in the pocket and in the second position the blocking member is received in the pocket; and, optionally, wherein a leading portion of the blocking member defines an elliptical cross-section.

or

wherein the third leg of the first triangle member assembly is longer than the first and second legs; and, optionally, wherein the first and second legs of the first triangle member assembly are the same length;

or

further comprising a detent assembly that includes a cap that is biased against the first triangle member assembly, wherein when the handle is in the start position the cap presses against the second leg of the first triangle member assembly, and wherein when the handle is in the finish position the cap presses against the first leg of the first triangle member assembly; and, optionally, wherein the triangle member assembly includes a detent surface, and wherein the cap slides along the detent surface with the handle is moved from the start position to the finish position; and, further optionally, wherein the pocket defines an elliptical cross-section for receiving the blocking member.

5. A lock assembly comprising:

a vertical bar having at least a first handle extending outwardly therefrom,
a blocking member,
a first linkage assembly that includes a first triangle member assembly and a first bar member, wherein the first triangle member assembly in-

cludes first, second and third corners, wherein the first corner is pivotably attached to a first end of the first bar member, wherein the third corner is pivotably attached to the vertical bar, wherein a second end of the first bar member is pivotably attached to the blade, wherein the first triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners,

a second linkage assembly that includes a second triangle member assembly and a second bar member, wherein the second triangle member assembly includes first, second and third corners, wherein the first corner is pivotably attached to a first end of the second bar member, wherein the third corner is pivotably attached to the vertical bar, wherein a second end of the second bar member is pivotably attached to the blade, wherein the second triangle member assembly includes first, second and third legs, wherein the first leg extends between the first and second corners, wherein the second leg extends between the second and third corners, and wherein the third leg extends between the first and third corners,

a receiver member that includes a pocket defined therein, wherein movement of the handle along a curved path from a start position to a finish position moves the blocking member between a first position and a second position, wherein a first distance is defined between the vertical bar and the blocking member when the blocking member is in the first position and a second distance is defined between the vertical bar and the blocking member when the blocking member is in the second position, wherein the second distance is greater than the first distance, and wherein in the first position the blocking member is not received in the pocket and in the second position the blocking member is received in the pocket, and

a detent assembly that includes a cap that is biased against the first triangle member assembly, wherein when the handle is in the start position the cap presses against the second leg of the first triangle member assembly, and wherein when the handle is in the finish position the cap presses against the first leg of the first triangle member assembly.

6. The lock assembly of claim 5 wherein the triangle member assembly includes a detent surface, and wherein the cap slides along the detent surface with the handle is moved from the start position to the finish position; and, optionally,

wherein a leading portion of the blocking member defines an elliptical cross-section; and, optionally, wherein the pocket defines an elliptical cross-section for receiving the blocking member; and, optionally, wherein the third leg of the first triangle member assembly is longer than the first and second legs, and wherein the third leg of the second triangle member assembly is longer than the first and second legs; and, optionally, wherein the first and second legs are the same length.

7. A hinge assembly comprising:

a frame adapter that includes a curved inner surface that defines a first apex, wherein the curved inner surface includes a front portion and a rear portion,
 a door adapter that includes a curved outer surface that defines a second apex, wherein the curved outer surface includes a front portion and a rear portion, wherein the curved outer surface of the door adapter opposes the curved inner surface of the frame adapter,
 at least one front hinge strip that is secured along at least a portion of at least a portion of a front hinge strip path, wherein the front hinge strip path extends from the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter, and
 at least one rear hinge strip that is secured along at least a portion of a rear hinge strip path, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter,
 wherein the door adapter is movable relative to the frame adapter between a front open position, a closed position and a rear open position.

8. The hinge assembly of claim 7

further comprising a plurality of alternating front and rear hinge strips; and, optionally, wherein the plurality of alternating front hinge strips and rear hinge strips are attached to form a hinge band; and, further optionally, wherein the alternating front hinge strips and rear hinge strips are attached along an apex portion to form the hinge band;
 or
 wherein the front hinge strip and the rear hinge strip bias the door adapter to the closed position;
 or
 wherein the door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface, wherein the rear hinge strip

path extends from the flat surface to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the right frame adapter; and, optionally,

(i) wherein the frame adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, wherein the rear hinge strip path extends from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface;

or

(ii) further comprising a door panel attached to the flat surface of the door adapter; and, optionally, wherein at least a portion of the front and rear hinge strips is positioned between the door panel and the door adapter.

or

wherein the frame adapter includes a flat surface, wherein the front hinge strip path extends from the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface, wherein the rear hinge strip path extends from the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface; and, optionally, wherein the door adapter includes a flat surface, wherein the front hinge strip path extends from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, wherein the rear hinge strip path extends from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter; and, further optionally, wherein the flat surface of the door adapter is generally parallel to a line tangent to the second apex, and wherein the flat surface of the frame adapter is generally parallel to a line tangent to the first apex;

or

wherein the frame adapter includes a magnet member disposed adjacent the first apex, and wherein the door adapter includes a magnet member disposed adjacent the second apex that opposes the magnet member of the frame adapter;

or

wherein the front hinge strip is not secured to the

curved outer surface, and wherein the rear hinge strip is not secured to the curved inner surface.

9. A hinge assembly comprising:

a frame adapter that includes a curved inner surface that defines a first apex, wherein the curved inner surface includes a front portion and a rear portion, wherein the frame adapter includes a flat surface that is generally parallel to a line tangent to the first apex, 5
a door adapter that includes a curved outer surface that defines a second apex, wherein the curved outer surface includes a front portion and a rear portion, wherein the door adapter includes a flat surface that is generally parallel to a line tangent to the second apex, wherein the curved outer surface of the door adapter opposes the curved inner surface of the frame adapter, 10
a plurality of alternating front hinge strips and rear hinge strips, wherein the front hinge strips extend along a front hinge strip path, wherein the front hinge strip path extends from the flat surface of the door adapter to the front portion of the curved outer surface of the door adapter to the rear portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, wherein the rear hinge strip path extends from the flat surface of the door adapter to the rear portion of the curved outer surface of the door adapter to the front portion of the curved inner surface of the frame adapter and to the flat surface of the frame adapter, 15
wherein the door adapter is movable relative to the frame adapter between a front open position, a closed position and a rear open position, and wherein the front hinge strips and the rear hinge strips bias the door adapter to the closed position. 20
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10. The hinge assembly of claim 9 wherein the plurality of alternating front hinge strips and rear hinge strips are attached to form a hinge band; and, optionally, wherein the alternating front hinge strips and rear hinge strips are attached along an apex portion to form the hinge band; and, further optionally, wherein the frame adapter includes a magnet member disposed adjacent the first apex, and wherein the door adapter includes a magnet member disposed adjacent the second apex that opposes the magnet member of the frame adapter. 45
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55

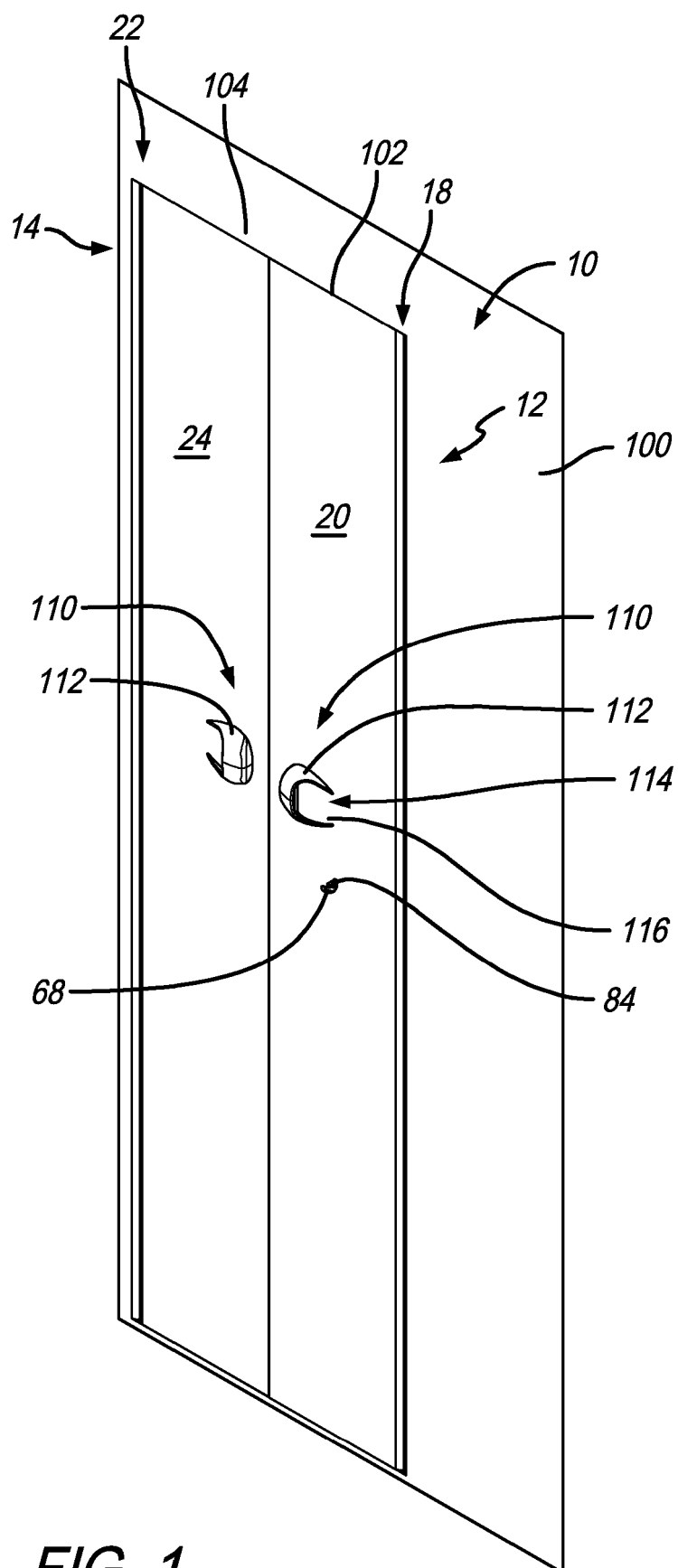
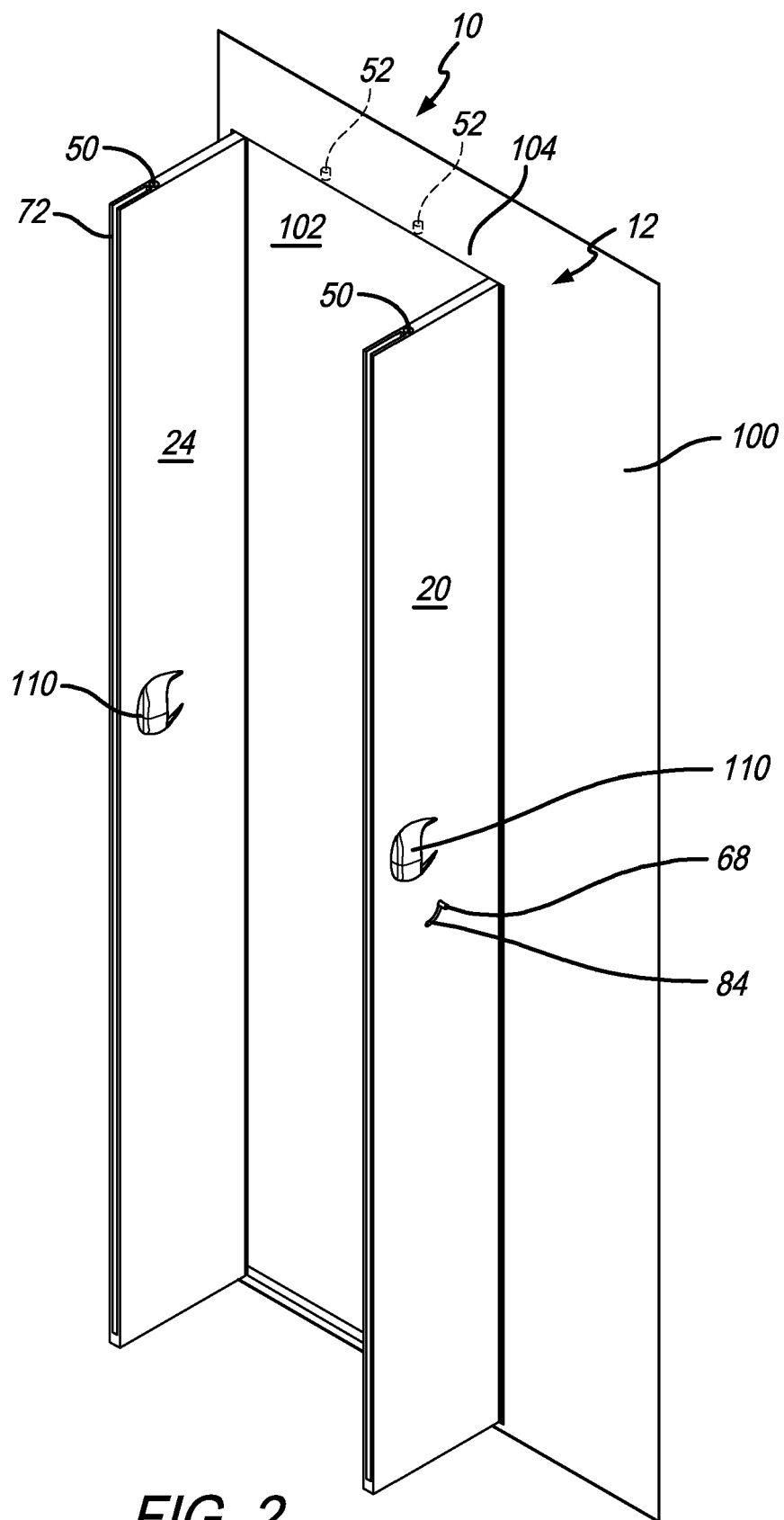


FIG. 1



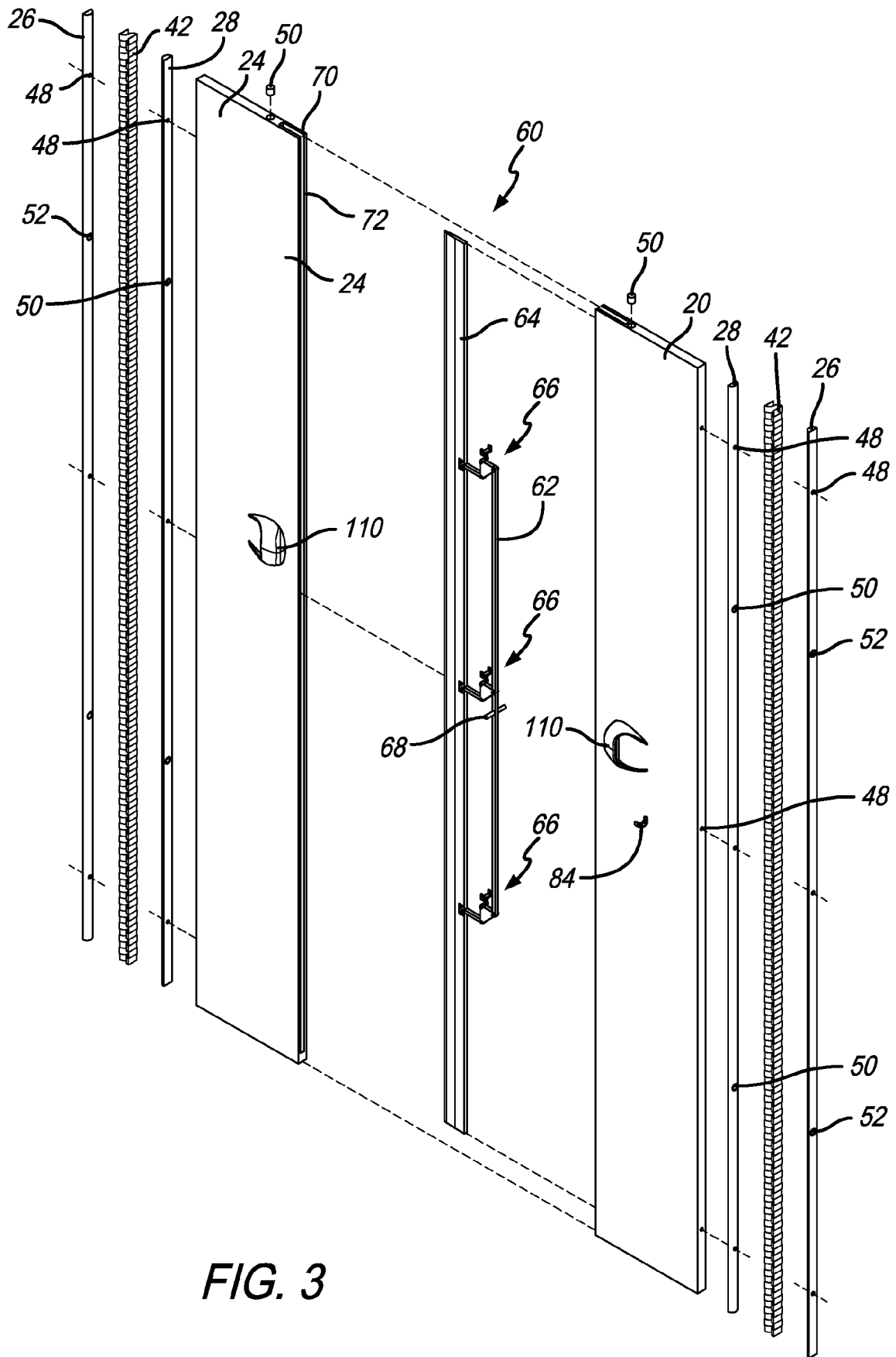


FIG. 3

FIG. 3A

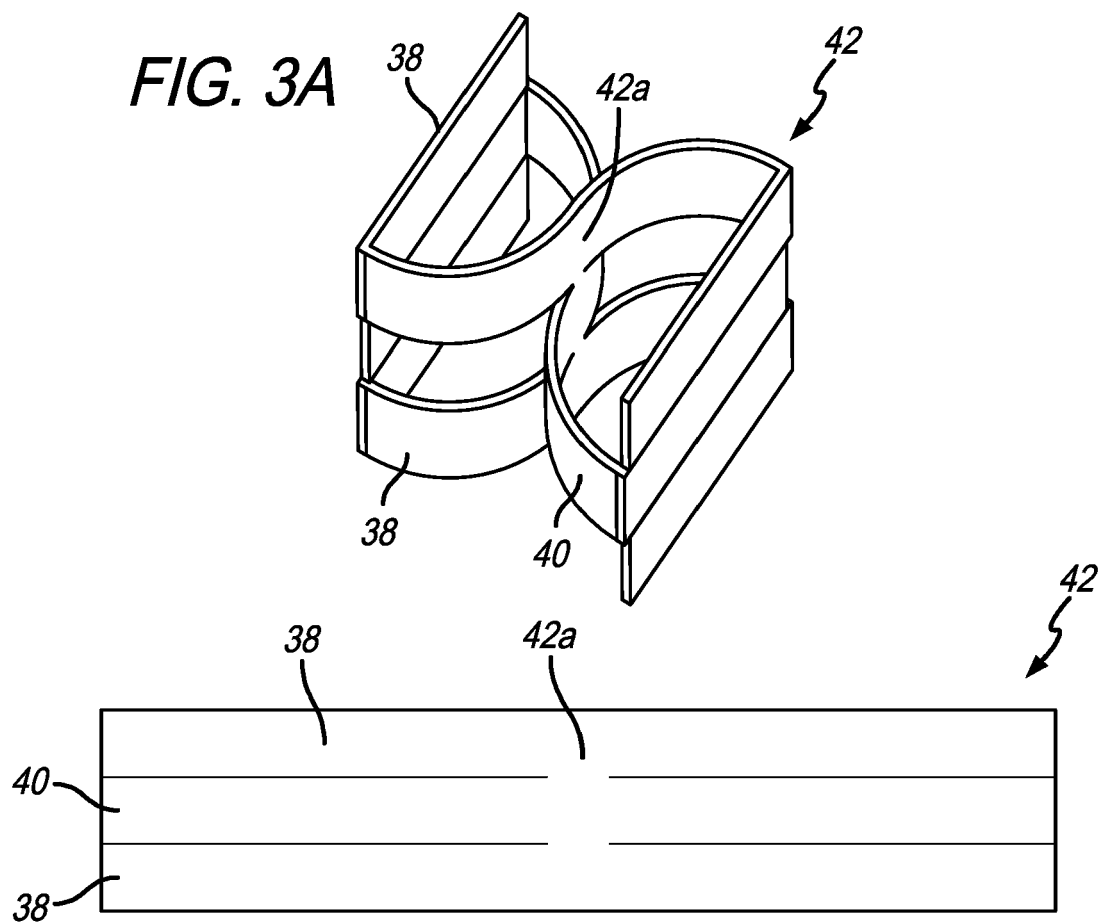


FIG. 3B

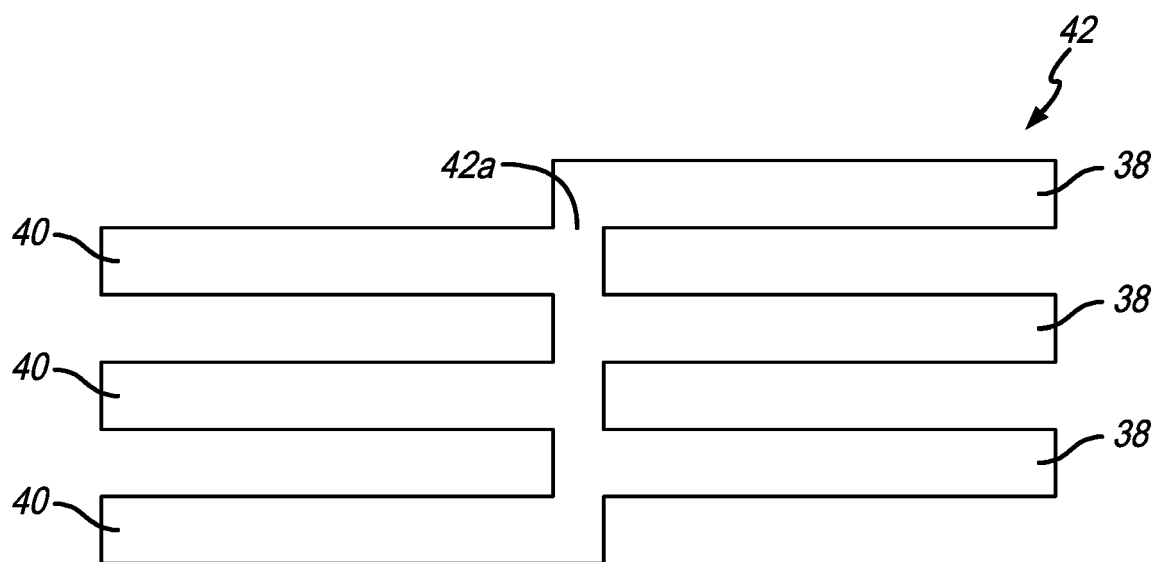


FIG. 3C

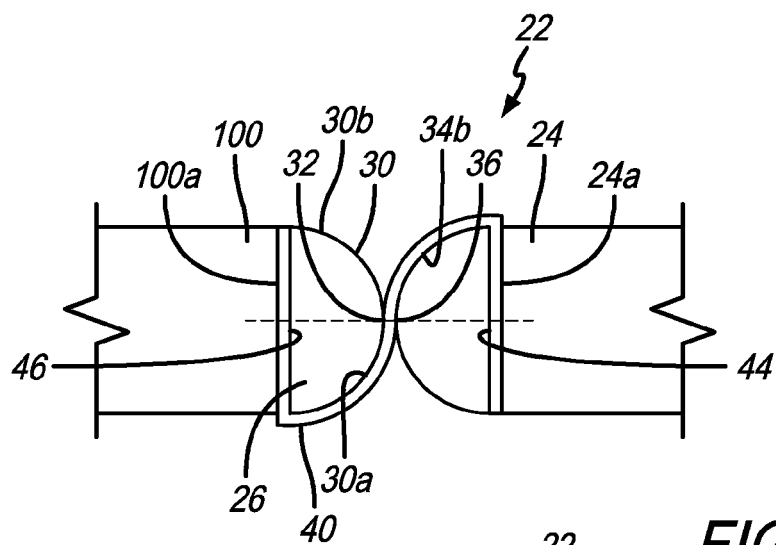


FIG. 4A

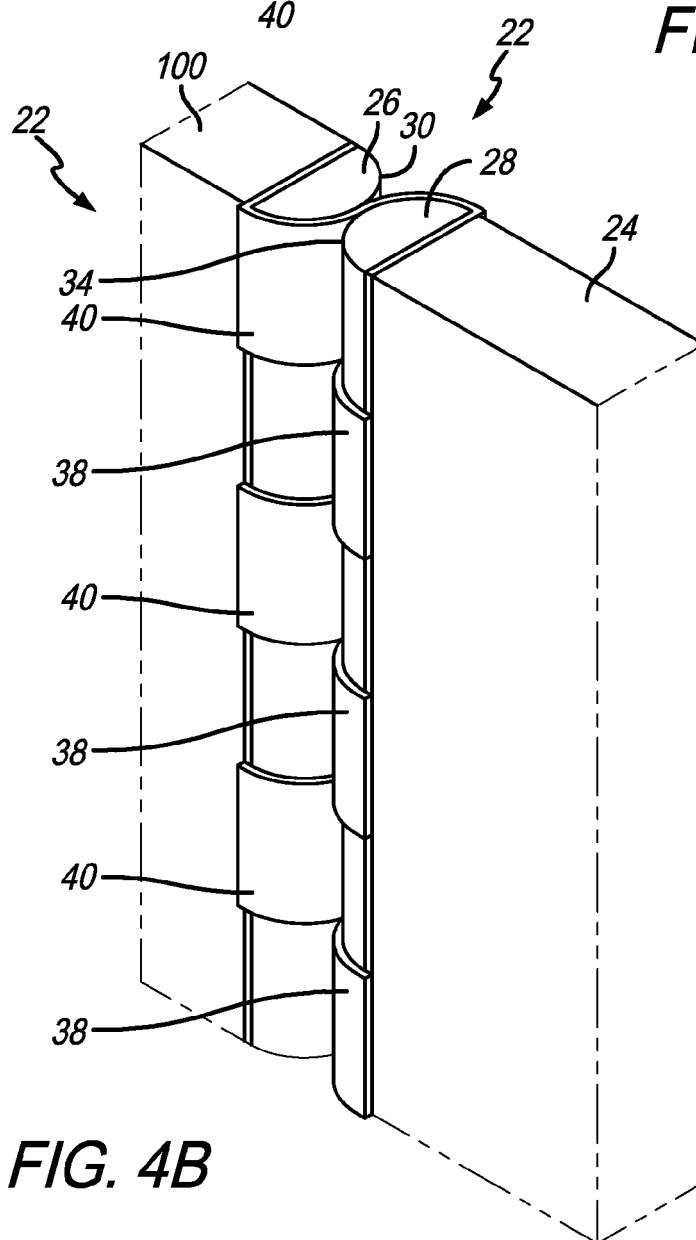
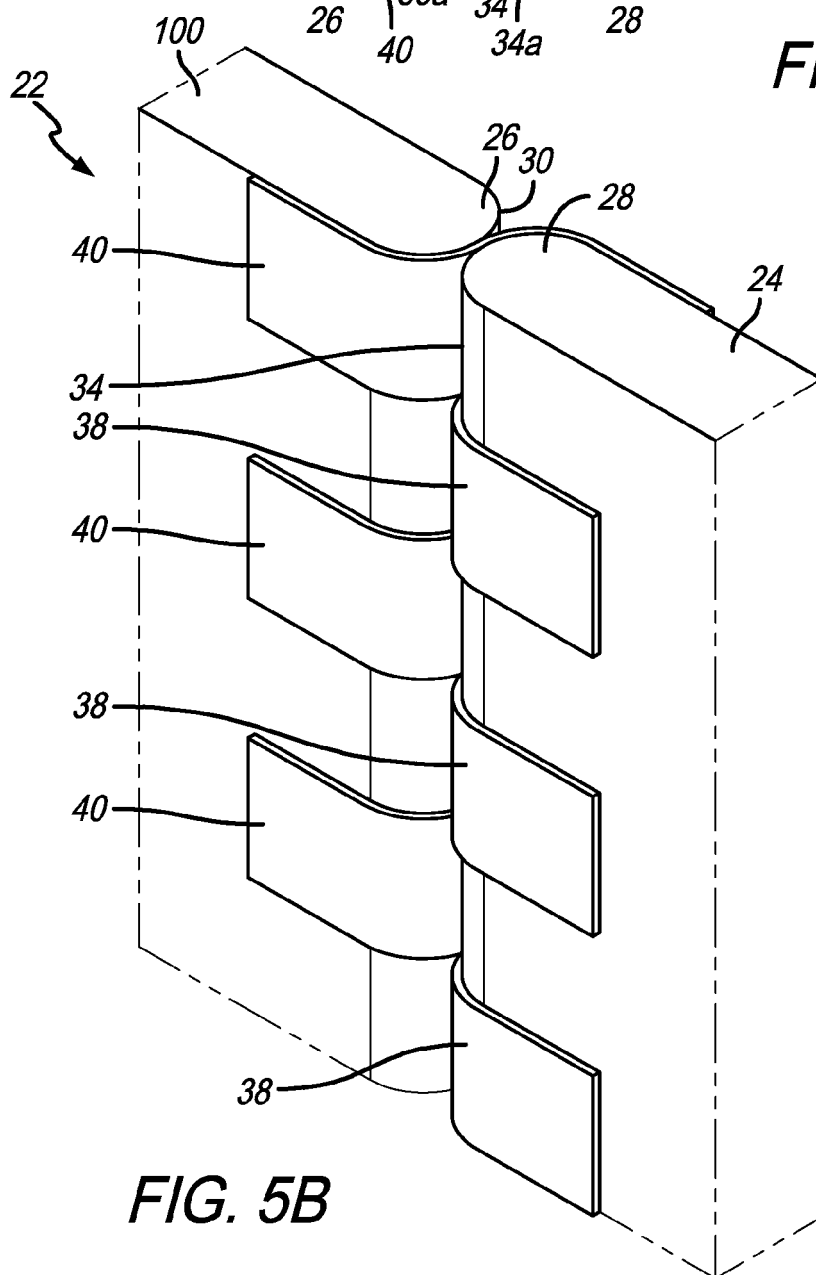
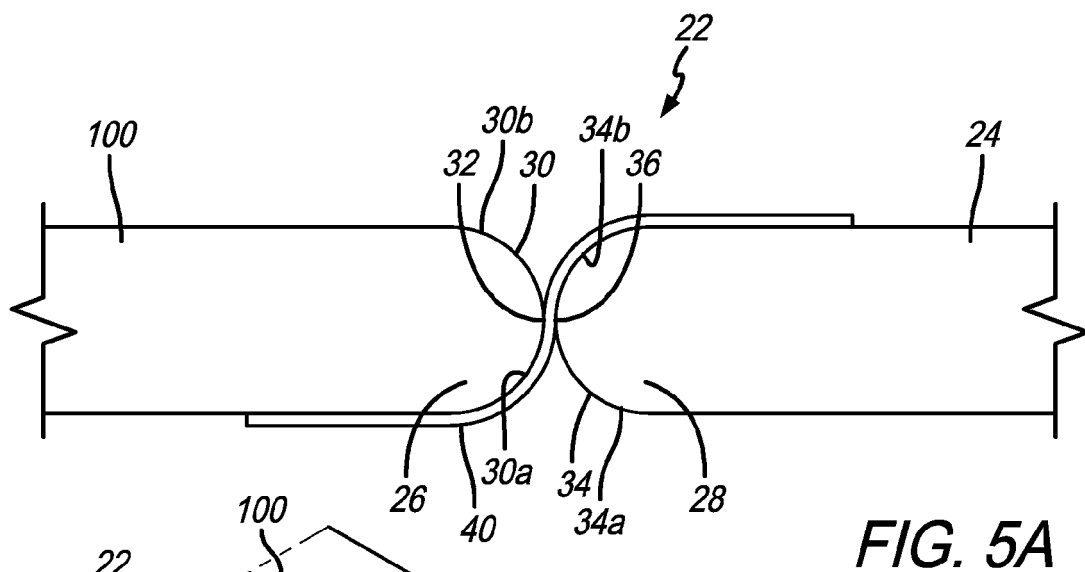


FIG. 4B



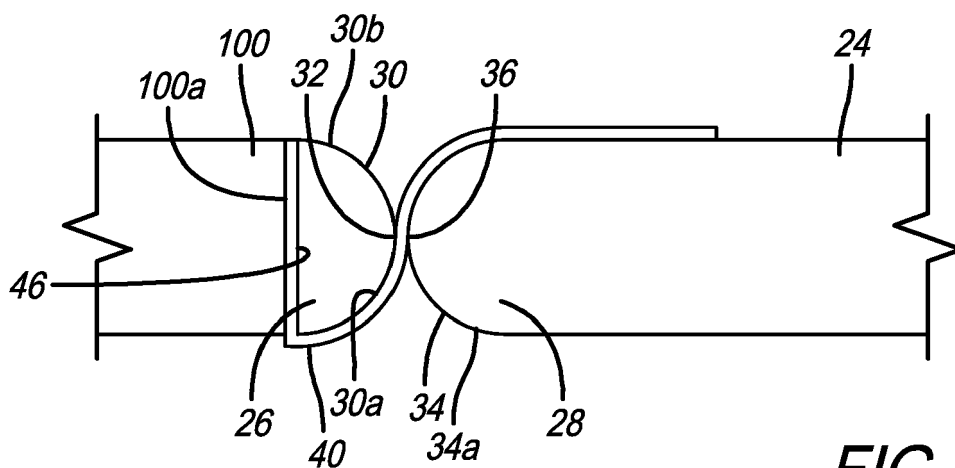


FIG. 6A

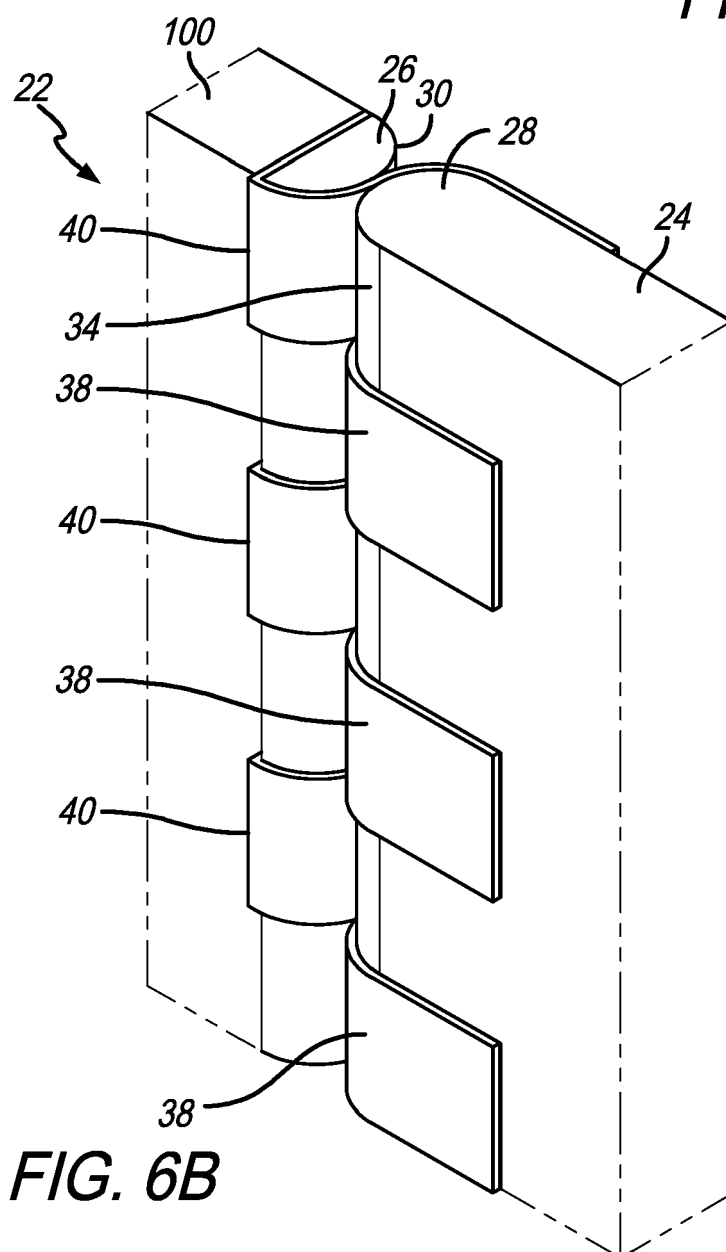


FIG. 6B

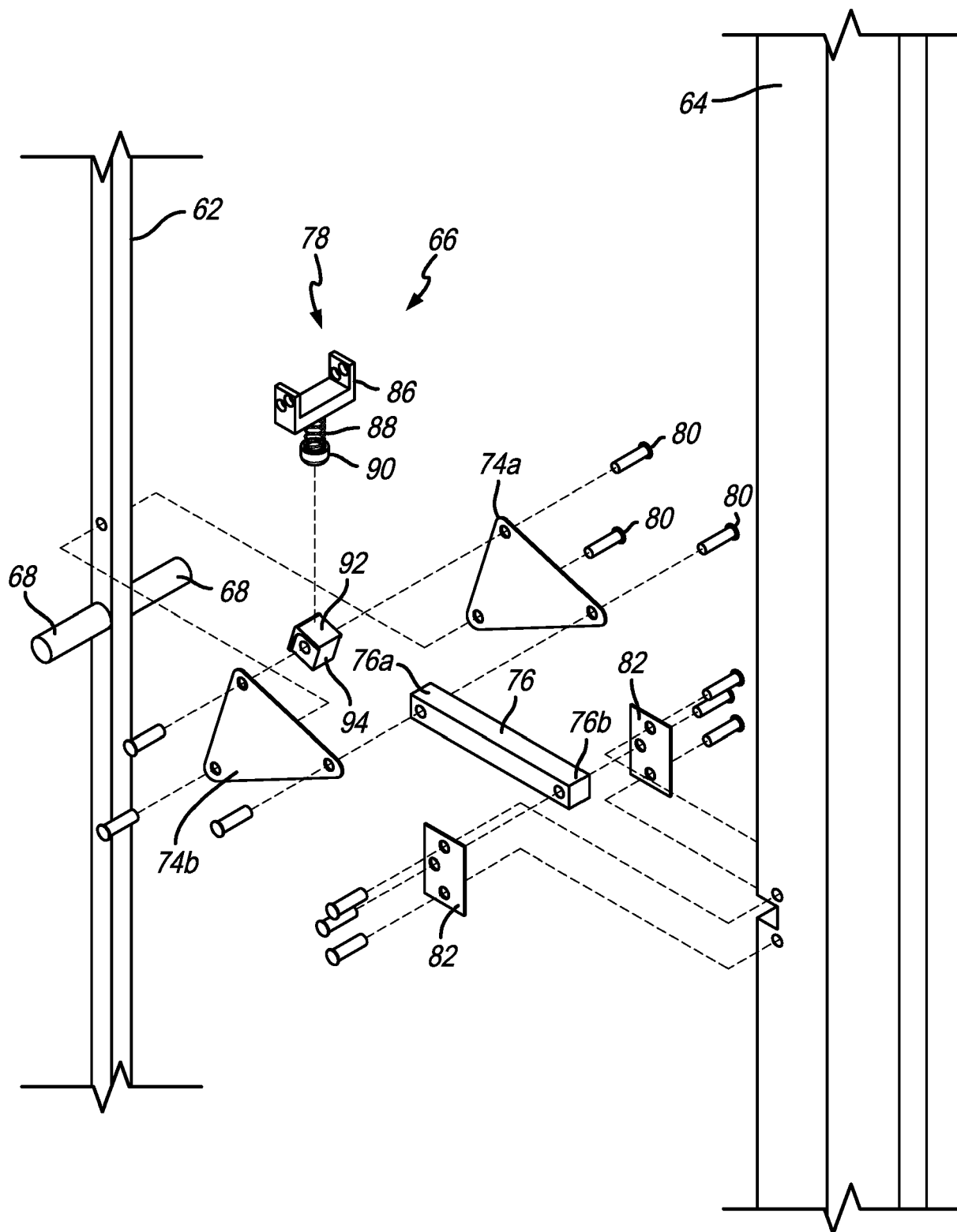


FIG. 7

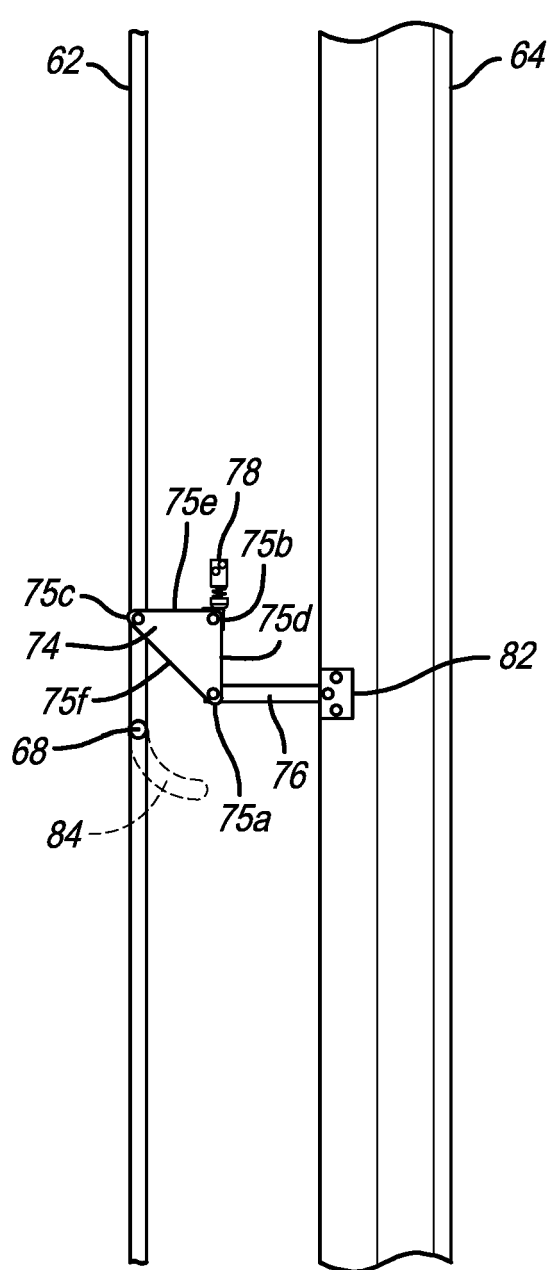


FIG. 8

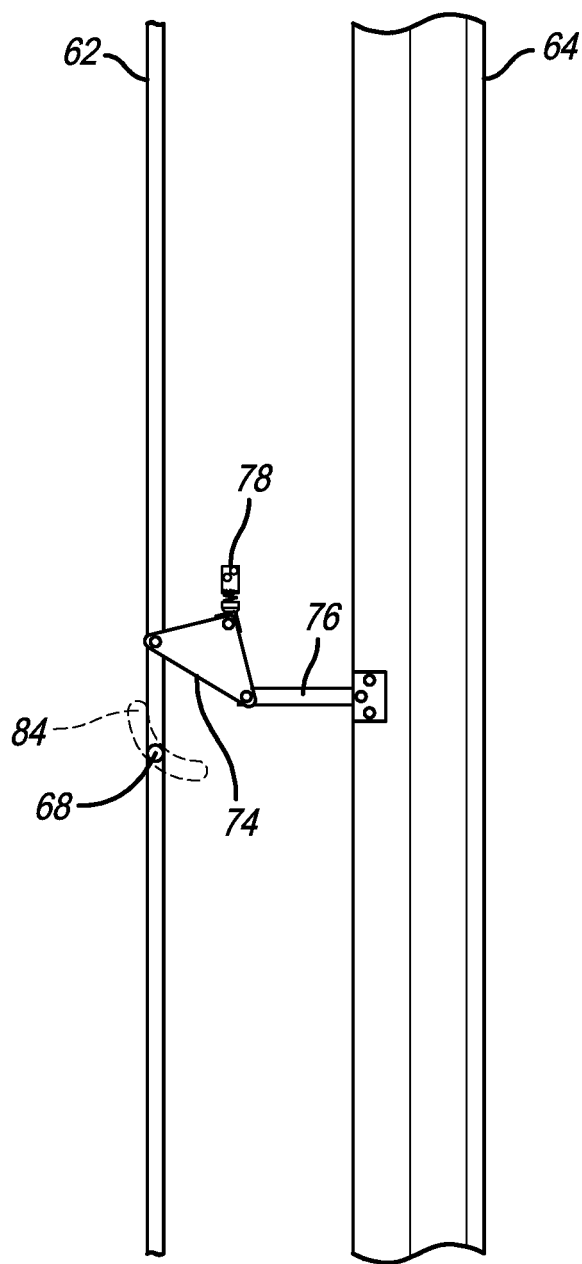


FIG. 9

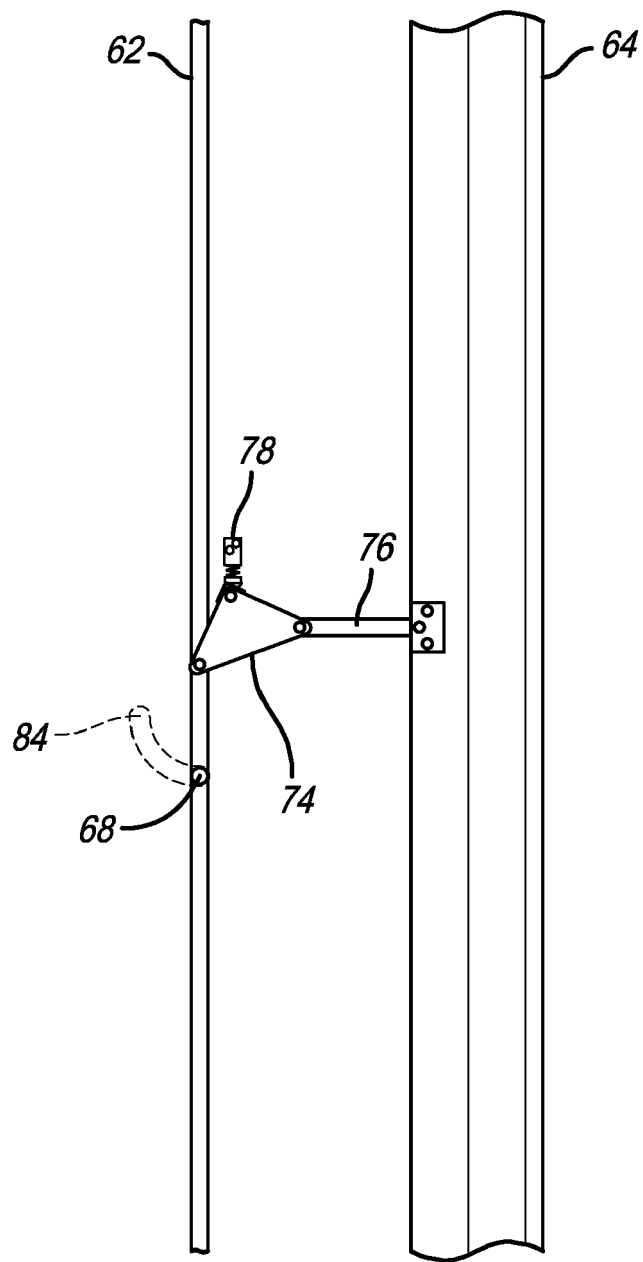


FIG. 10

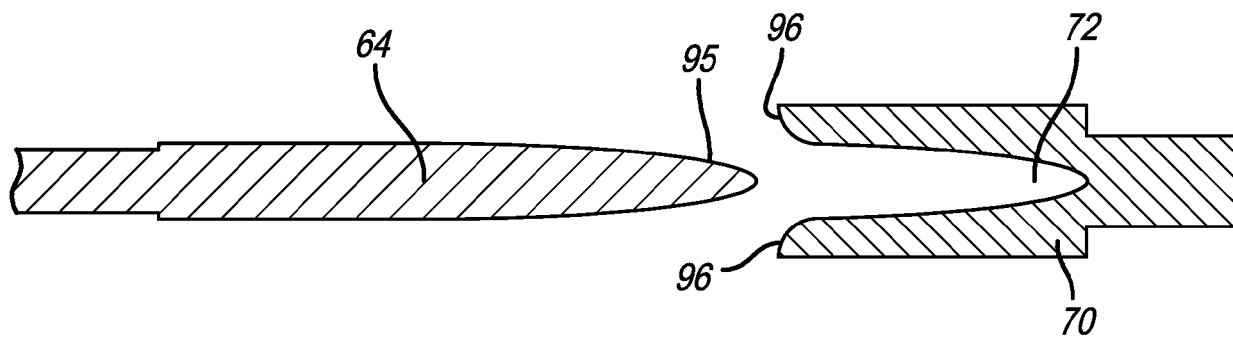


FIG. 11

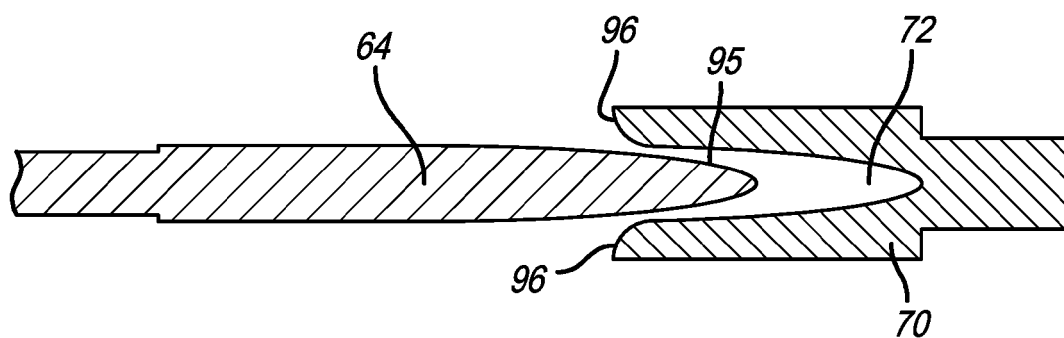


FIG. 12

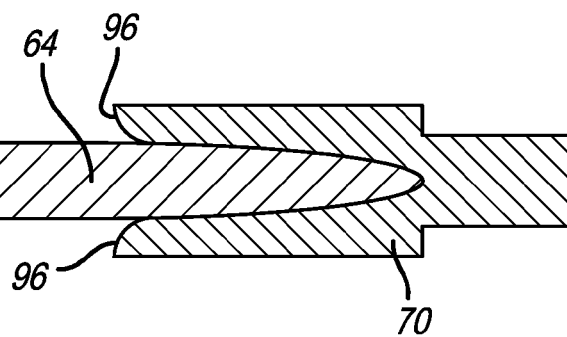


FIG. 13

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 62646832 A [0001]