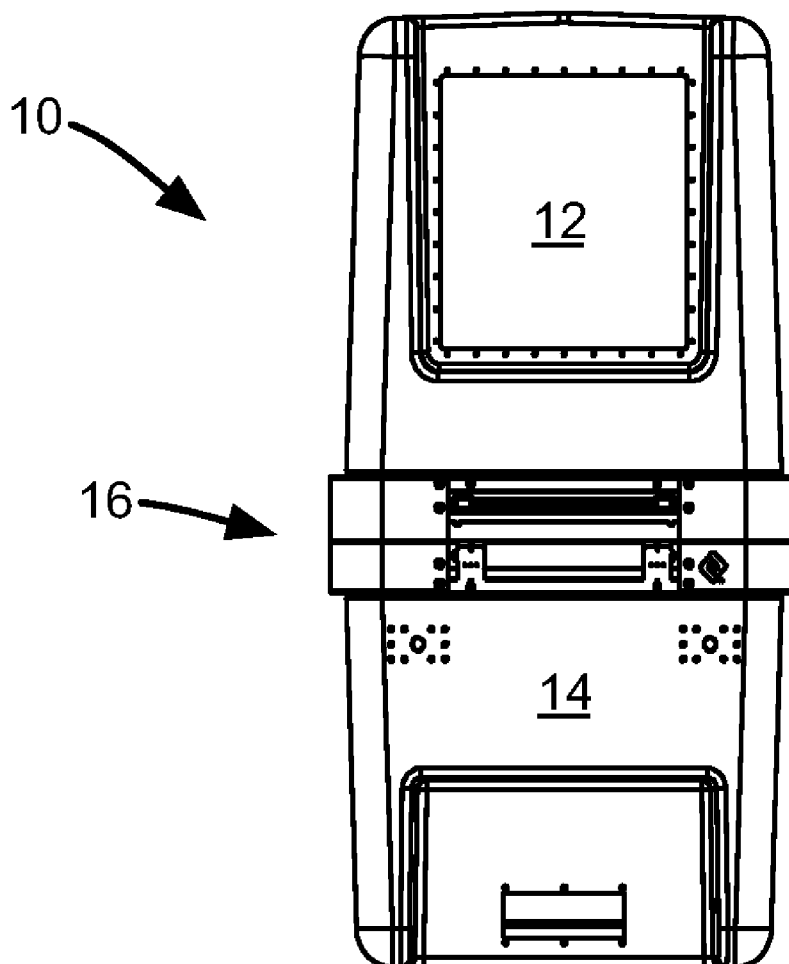




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(19) **United States**(12) **Patent Application Publication**
Becklin et al.(10) **Pub. No.: US 2015/0053683 A1**(43) **Pub. Date: Feb. 26, 2015**(54) **CLOSURE SYSTEM FOR CONTAINERS**(71) Applicant: **Becklin Holdings, Inc.**, Reno, NV (US)(72) Inventors: **Dennis S. Becklin**, Grants Pass, OR (US); **Dean Weathers**, Medford, OR (US); **Adrian P. Tayne**, Grants Pass, OR (US)(73) Assignee: **Becklin Holdings, Inc.**, Reno, NV (US)(21) Appl. No.: **13/974,322**(22) Filed: **Aug. 23, 2013****Publication Classification**(51) **Int. Cl.**
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B65D 45/02 (2006.01)(52) **U.S. Cl.**CPC **B65D 43/0216** (2013.01); **B65D 45/02** (2013.01); **B65D 53/02** (2013.01)USPC **220/324**; 220/345.6; 220/345.3(57) **ABSTRACT**

A closure assembly for sealing a container lid and base is disclosed. The closure assembly includes a male member and a female member that are coupled to a container lid and base, respectively. The female member includes an alignment feature and a gasket channel with a gasket in the gasket channel. The male member includes a corresponding alignment feature and a gasket sealing feature that protrudes into the gasket channel and forms a seal with the gasket when the closure assembly is in a closed position.



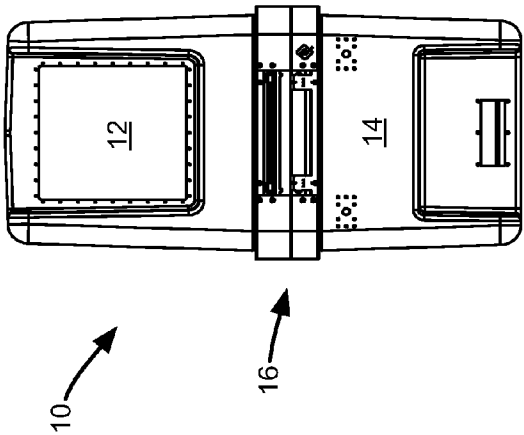


Fig. 1A

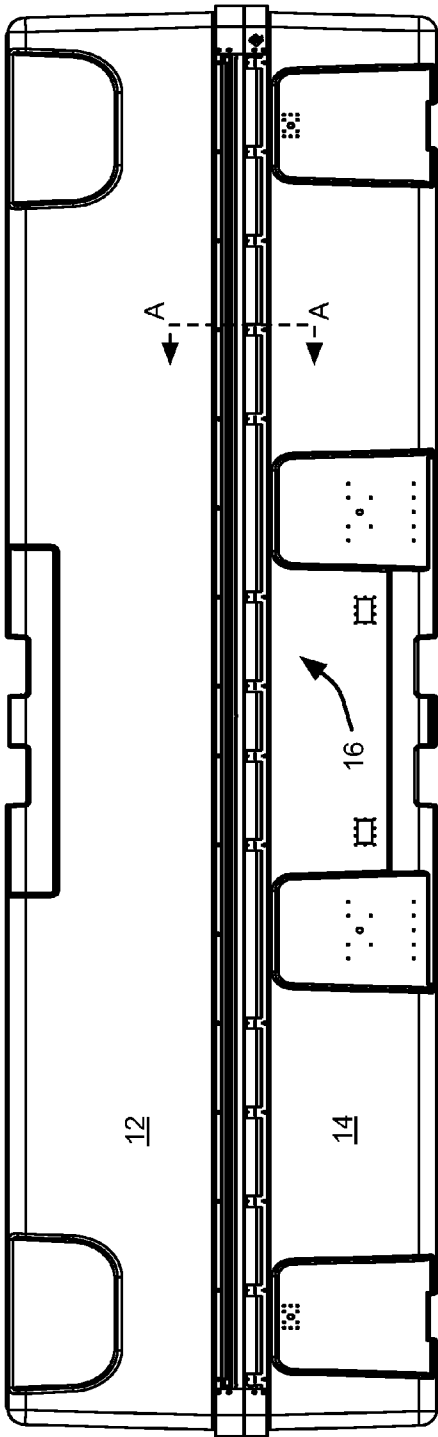


Fig. 1B

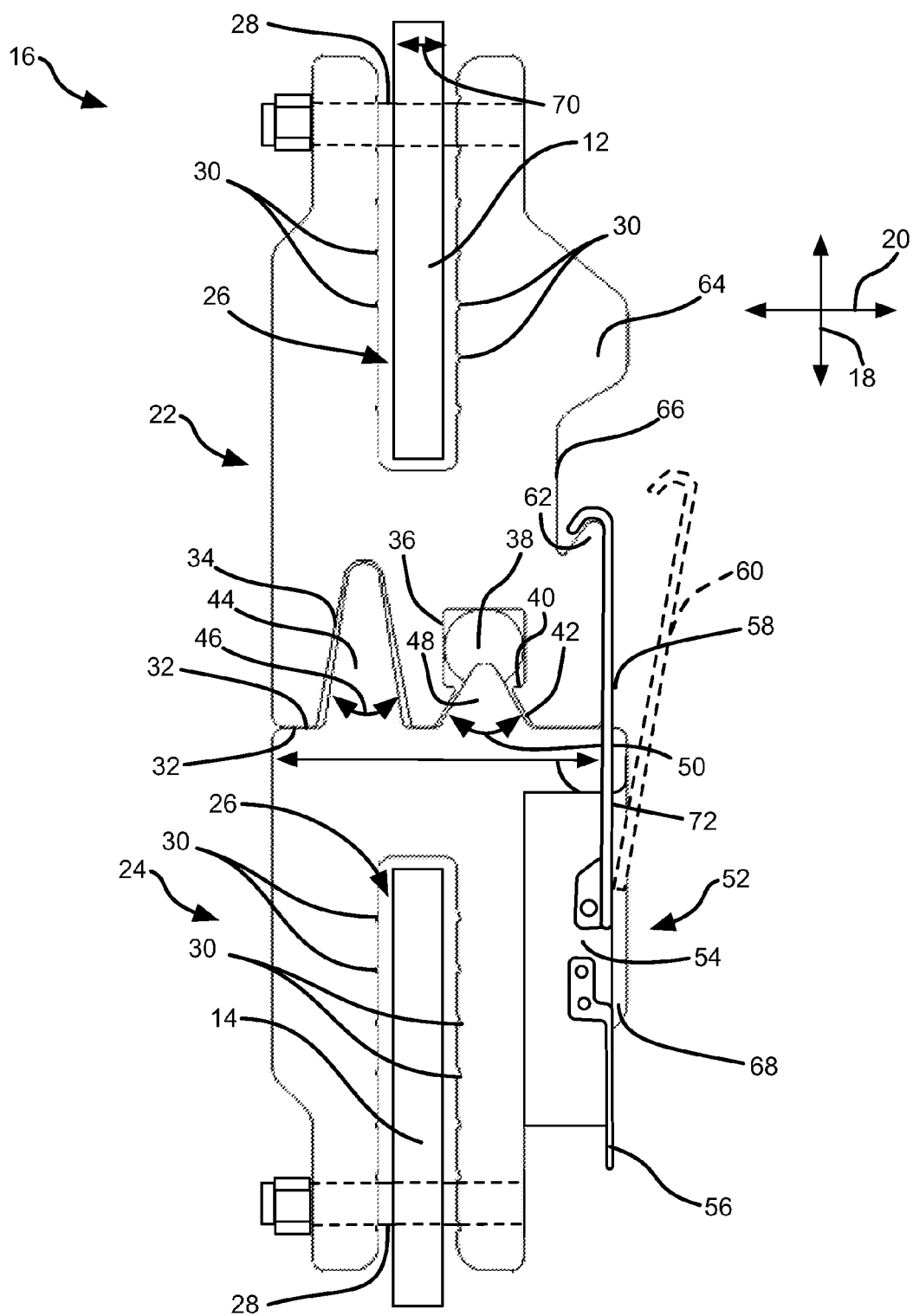


Fig. 2

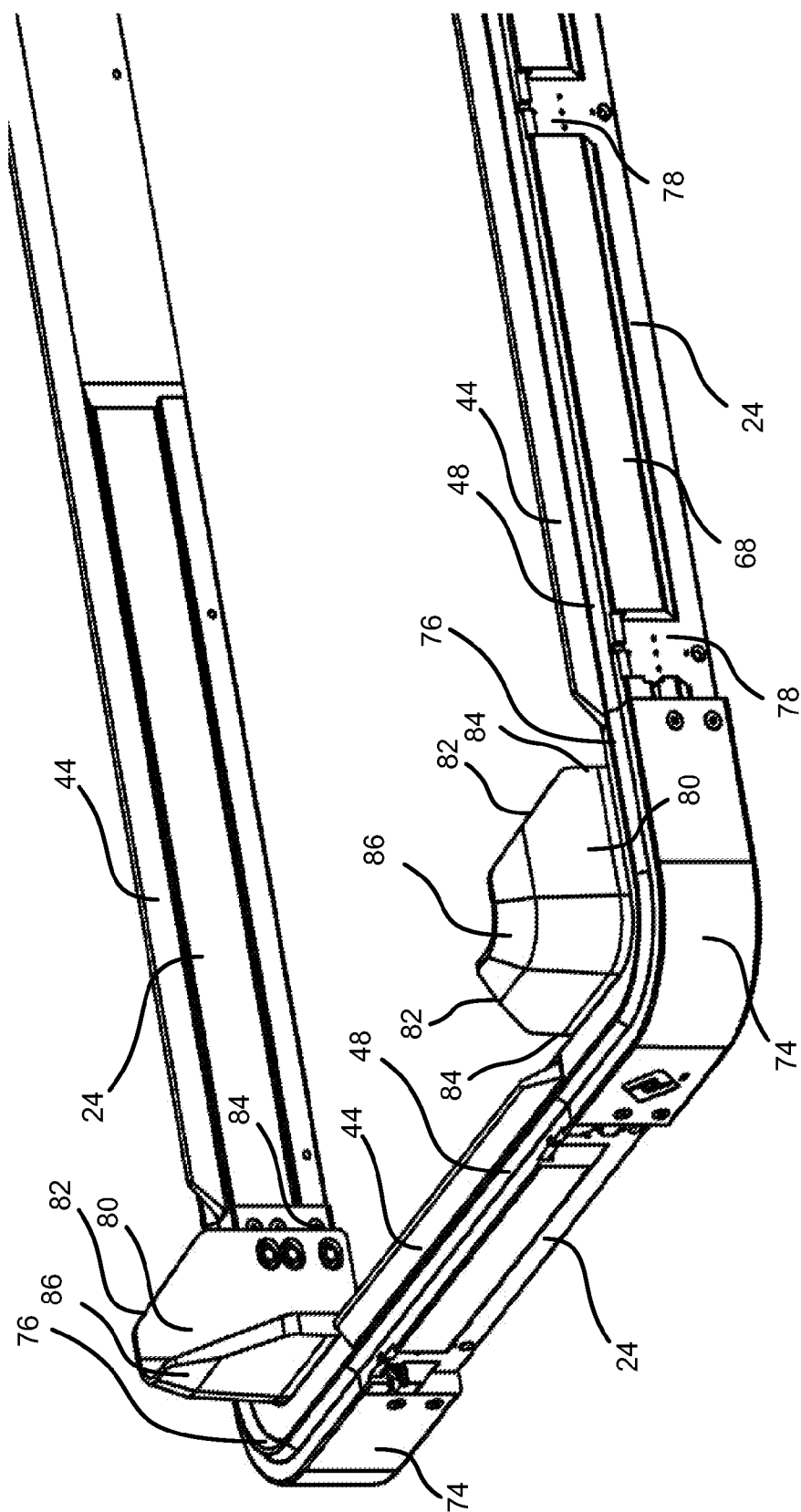


Fig. 3

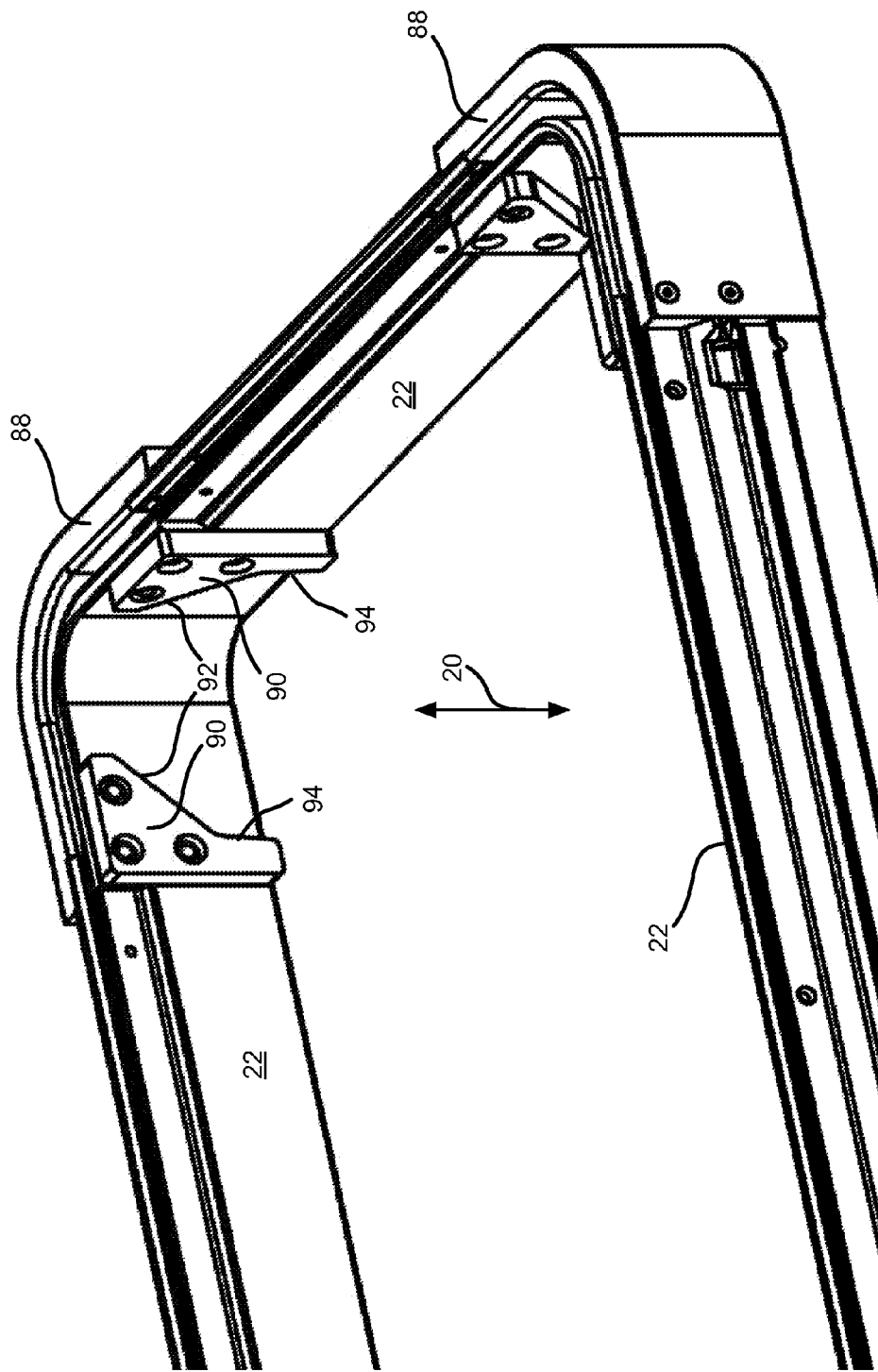


Fig. 4

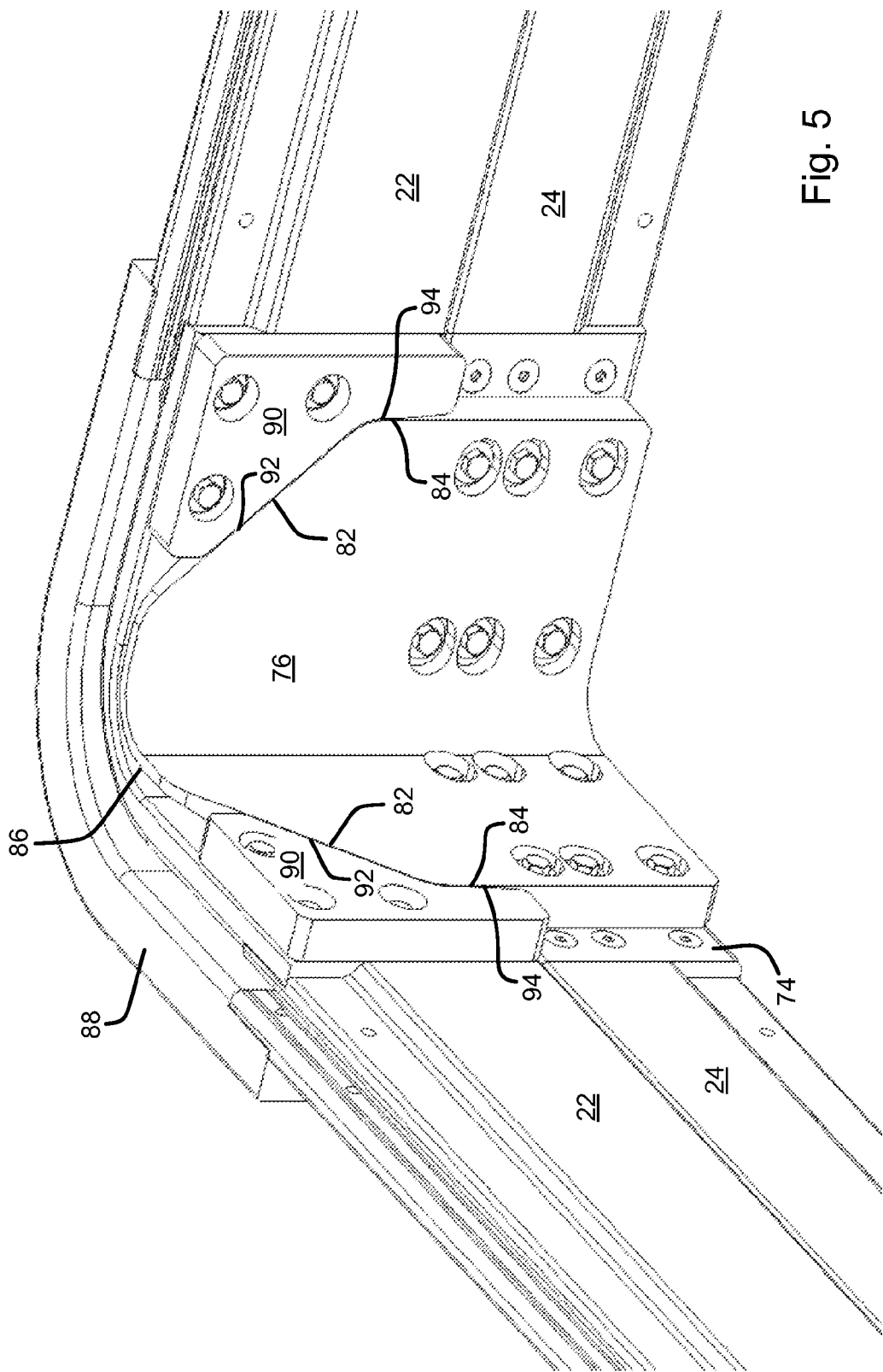


Fig. 5

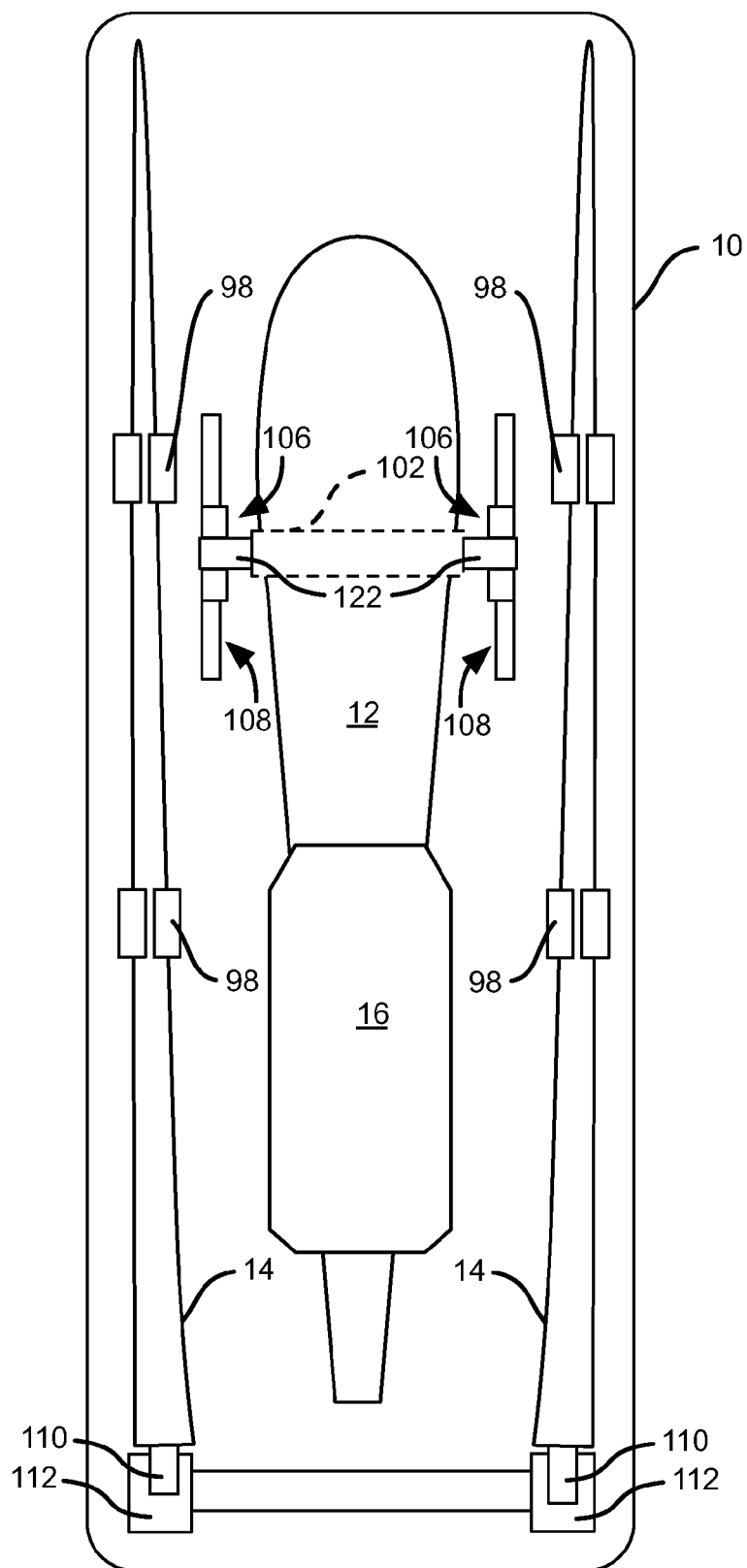


Fig. 6

CLOSURE SYSTEM FOR CONTAINERS

FIELD OF THE INVENTION

[0001] The present invention relates to a closure system for containers having an alignment feature, a sealing feature, a latch, and a latch protection feature.

BACKGROUND OF THE INVENTION

[0002] Containers for electronic equipment for use in remote or hostile environments, such as military installations, must be strong, resilient, and resistant to the harsh environments in which they are used. Delicate and expensive electronic equipment is particularly subject to damage if exposed to moisture or debris such as sand or dirt. However, space in such installations is at a premium, so the above needs must be met without resorting to an excessively bulky system. Also, the containers should provide easy access and reparability. Accordingly, there is a need for a strong, resilient, accessible container closure system that is easy to access, repair, and prevents alien substances from entering the container.

SUMMARY OF THE INVENTION

[0003] In one aspect of the invention, a closure assembly for a container includes a first wall and a second wall that come together to close the container. The closure assembly further includes a female member including a main body including a first compression stop interface. The female member further defines a channel formed in the main body and configured to receive the first wall of the container to secure the female member to the first wall of the container. A female alignment feature and a gasket channel containing a gasket are formed in the first compression stop interface.

[0004] The closure assembly further includes a male member including a main body including a second compression stop interface. The male member further defines a channel formed in the main body and configured to receive the second wall of the container to secure the male member to the second wall of the container. A male alignment feature protrudes from the second compression stop interface and extends into the female alignment feature. A male gasket sealing feature protruding from the second compression stop interface and into the gasket channel, wherein the male gasket sealing feature forms a seal with the gasket. A latch couples the male member to the female member, the latch having an outer extent. One or more of the female and male members further define a bumper extending beyond the outer extent of the latch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings, in which:

[0006] FIGS. 1A and 1B are end and side views of a container in accordance with an embodiment of the present invention;

[0007] FIG. 2 is a side cross-sectional view of a container closure system in accordance with an embodiment of the present invention;

[0008] FIG. 3 is a partial isometric view of a male corner portion of a closure system in accordance with an embodiment of the present invention;

[0009] FIG. 4 is a partial isometric view of a female corner portion of a closure system in accordance with an embodiment of the present invention;

[0010] FIG. 5 is a partial isometric view of male and female corner portions engaged with one another in accordance with an embodiment of the present invention; and

[0011] FIG. 6 is a top plan view of a disassembled UAV stored in a container in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] FIG. 1 illustrates a container 10 having a lid 12, a base 14, and a closure assembly 16 according to embodiments of the present invention. The lid 12 and base 14 can be any two container portions that come together in a clamshell configuration. The closure assembly 16 can be used more broadly to join any two shell members together. The container 10 can be virtually any type of container, including large-scale, military style containers, or smaller containers for household use.

[0013] FIG. 2 is a cross sectional view taken along line A-A of FIG. 1 to better illustrate the closure assembly 16. The closure assembly 16 may be understood with respect to a vertical direction 18 that generally corresponds to vertical when the container 10 is resting on a flat surface and a horizontal direction 20 that is generally parallel to a surface on which the container 10 is resting. The directions 18, 20 provide a frame of reference in understanding the structures disclosed but may have any actual orientation with respect to actual vertical and horizontal directions.

[0014] The closure assembly 16 includes a female member 22 and a male member 24. The female member 22 is coupled to the lid 12 and the male member 24 is coupled to the base 14, and the female member 22 is coupled to the male member 24 to form a sealable closure for the container 10. The female member 22 includes a channel 26 that receives a portion of the lid 12, e.g. a rim or edge portion of the lid 12. The female member 22 can be coupled to the lid 12 by an adhesive material (not shown), such as an epoxy resin, in the channel 26. The channel 26 is generally U-shaped. A plurality of bolts 28 can be placed through the female member 22 and through a portion of the lid 12 at various locations around the lid 12 to further secure the female member 22 to the container 10. Other suitable couplings, such as snap-fit joints, press-fit joints, or the equivalent can also be used to join the female member 22 to the lid 12. The channel 26 can include grooves 30, teeth, or other texturing feature, on an interior surface of the channel 26 to prevent the lid 12 from receding from the channel 26. A similar channel 26 may be included on the male member 24 to couple the male member 24 to an edge or rim portion of the base 14. The channels 26 may be generally oriented along a vertical direction 18, with the channel 26 of the female member 22 opening upwardly and the channel 26 of the male member 24 opening downwardly.

[0015] The female and male members 22, 24 may define a compression stop interface 32, which can include several different surfaces, contact one another when the closure system 16 is closed. The compression stop interface surfaces 32 can be generally flat, but can have other profiles, such as jagged, or having other complementary patterns. The female member 22 may include a female alignment feature 34 having a V-shaped, or other concave, profile. The female member 22 may also include a gasket channel 36 with a gasket 38 inside. The gasket 38 can be made of a suitable sealing, resilient

material, such as silicone sponge gasket. The gasket channel 36 may have a retention lip 40 to hold the gasket 38 in the channel 36. Below the gasket channel 36, the female member 22 may further define a seat 42. The seat 42 may define an opening into the gasket channel 36. The seat 42 may also be flared or have some other concave shape.

[0016] The male member 24 includes a male alignment feature 44 that corresponds to the female alignment feature 24 in size, shape, and position such that the male alignment feature 44 fits within the female alignment feature 34 when the closure assembly 16 is in the closed position. The alignment features 34, 44 can be sloped to facilitate alignment when closing the container 10. For example, the male alignment feature may include a convex shape conforming to the concave shape of the female alignment feature 34. In the illustrated embodiment, the male alignment feature 44 defines a taper angle 46 that is smaller than or equal to a corresponding flare angle of the female alignment feature 34. Stated differently, an opening of the female alignment feature 34 (e.g. at the compression stop interface 32 of female member 22) may be equal to or larger than a base of the male alignment feature 44 (e.g. at the compression stop interface 32 of the male member 24).

[0017] The male member 24 may also include a male gasket sealing feature 48 that, when the container 10 is closed, protrudes into the female member 22 into the gasket channel 36 to such a degree that it deforms the gasket 38 to create a seal for the container 10. The male gasket sealing feature 48 can be comparable to the male alignment feature 44 in shape. In the pictured embodiment, however, the male and female alignment features 34, 44 are significantly taller in vertical direction 18 than the male gasket sealing feature 48 and the gasket channel 36. This may advantageously protect the gasket sealing feature 48 from scratching or other damage that might impair its ability to create a seal with the gasket 38. The gasket sealing feature 48 may define a taper angle 50 that generally corresponds to a flare angle of the seat 42 such that the gasket sealing feature 48 may fit within the seat 42. As shown in FIG. 2, the seat 42 has a depth such that at least a portion of the gasket sealing feature 48 protrudes into the gasket channel 36 and engages the gasket 38.

[0018] In some embodiments the female alignment feature 34 can include a gasket channel and gasket into which the male alignment feature 44 protrudes. In some embodiments the closure assembly 16 can include multiple alignment features and multiple gasket channels. The gasket channel 36 can extend around the entire perimeter of the container 10 to create a full seal. In other embodiments, the gasket channel can extend around a portion of the container 10. The male and female alignment features 34, 44 can also extend around the entire perimeter of the container 10, or only a portion. For example, the male alignment feature 44 can be a post and the female alignment feature 34 can be a blind hole.

[0019] The closure assembly 16 may include a latch 52 to secure the closure assembly 16 in the closed position. The latch has a main body 54, a lever 56, and a latch arm 58. As shown by the dotted representation 60, the latch arm has an open position (dotted) and a closed position enabling the container 10 to be opened and closed. The latch 52 may be secured to the male member 24 and the female member 22 may include a latch strike 62 that extends from the main body of the female member 22. The latch arm 58 engages with the latch strike 62 to secure the closure assembly 16 in the closed position with the compression stop interfaces 32 pressed

together and with the male gasket sealing feature 48 pressed sealably against the gasket 38.

[0020] The closure assembly 16 may also include a bumper 64 formed on the female member 22. The bumper 64 may protect the strike 62 and the portion of the arm 58 engaging the strike 62. For example, the male member 24 may define a recess 66 above the strike 62 that enables the arm 58 to move into and out of engagement with the strike 62. The bumper 64 may be positioned vertically above the recess 66 and protrude horizontally outwardly a greater extent than the strike 62 and the horizontal extent of the latch arm 58 when engaging the strike 62. The bumper 64 may be positioned such that at least a portion thereof that extends horizontally outwardly further than the strike 62 and/or a portion of the latch arm 58 engaged therewith is vertically offset from the strike 62 by an amount between 1.1 and 5 times the vertical travel of the latch arm 58 required to move the latch arm 58 into and out of engagement with the strike. In this manner, the bumper 64 may absorb many collisions that might otherwise impact the strike 62 and latch arm 58.

[0021] In some embodiments, a bumper 68 may secure to the male member 24. The bumpers 68 may extend horizontally outwardly from the main body of the male member 24 a greater extent than the latch 52. In some embodiments, the latch 52 may seat within a cutout portion of the bumper 68. The bumper 68 may extend from the compression stop interface 32 downwardly along a major vertical extent of the latch 52. In this manner, collisions that might impact the latch 52 and thereby cause damage or unintended opening of the latch may be prevented or otherwise reduced. In the illustrated embodiment, the bumper 68 does not extend vertically downward completely past the lever 56 of the latch 52 thereby providing accessibility in order to open and close the latch 52. However, in other embodiments, the bumper 68 does extend vertically along the entire extent of the latch 52 including the lever 56.

[0022] In the illustrated embodiment, the lid 12 and base 14 may have a material thickness 70 at the edge portions positioned within the channels 26. The female member 22 and male member 24 may have a horizontal width 72 that is substantially greater than the thickness 70. For example, the compression stop surface 32 may have a width 72 that is between four and eight, preferably between five and seven times the width 70. In this manner, the closure system 16 provides rigidity to the lid 12 and base 14 and resists twisting and bending that would make mating of the lid 12 and base 14 difficult. However, in other embodiments, where weight is more critical, the thickness 72 may be smaller and the other benefits of the disclosed closure system may nonetheless be achieved. Likewise, the lid 12 and base 14 may be made thinner due to rigidity of the members 22, 24. Also, the complexity of the members 22, 24 may be achieved using an extrusion process, or a pultrusion process in the case of composite materials, whereas the lid 12 and base 14 are also made by a relatively simple manufacturing process such as molding sheets of material, rotational molding, vacuum infusion process (VIP), or some other process.

[0023] The closure assembly 16 can be used with any two components sufficiently similar to a lid and base assembly. Any two web-like structures similar to the lid 10 and base 12 can be joined by the closure assembly 16. For example, in the illustrated embodiment, edge portions of the lid 12 and base 14 are oriented along the vertical direction 18, portions of the lid 12 and base 14 may transition to a drafted angle of at least

two degrees above the closure channel into which it is bonded. The closure assembly 16 can be retrofitted to an existing structure or container to provide additional rigidity to the container. The additional structure and thickness of the assembly 16 gives the container more strength, and makes aligning the lid and base of the container more easy to align and close. The gasket 34 and alignment features provide a leak-resistant seal that can withstand a harsh external environment and protect the contents of the container. The closure assembly 16 can be made using an inexpensive extrusion process because, in at least some embodiments, the profile shown in FIG. 2 is uniform along its length. Non-uniform features may then be formed, e.g. machined) in the extruded member to achieve the closure system 16 shown.

[0024] Although certain structures are disclosed above as being features of or secured to the female member 22 or the male member 24, such an arrangement may be switched. For example, though the female alignment feature 34 and gasket channel are secured to the same member in FIG. 2, in other embodiments these features may be formed in different members. Likewise, although the male alignment feature 44 and gasket sealing feature 48 are secured to the same member in FIG. 2, in other embodiments these features may be formed on different members. Likewise, the strike 62 and latch 52 may be secured to either of the male and female members 22, 24.

[0025] Referring to FIG. 3, the male members 24 may be joined together by male corner members 74. For example, the corner members 74 may define receivers in which the male members 24 insert. Likewise, the corner members 74 may define protuberances that insert within receivers defined by the male members 24. The corner members 74 may define curved gasket sealing features 76 that abut the gasket sealing features 48 of the male members 24 joined to the corner members 74. The gasket sealing features 76 may have a similar cross section to the gasket sealing features 48. In this manner, near-continuous engagement with a gasket is enabled. In the illustrated embodiment, the corner members 74 do not include a curved structure abutting the male alignment features 44 of the male members 24 secured to the corner members 74. In some embodiments, a continuous alignment feature is included in the corner member 74 to bolster engagement between the lid 12 and base 14. As is apparent in FIG. 3, the male members 24 may define cutouts 78. The cutouts 78 may intersect the bumper 68 and provide a recess to receive the latch 52. Although not shown in FIG. 3, the corner members 74 may also include channels 26 for receiving an edge portion of a base 14.

[0026] In some embodiment, the corner members 74 may include corner protrusions 80 secured thereto or formed thereon. The corner protrusions 80 are positioned inwardly from the sealing features 76 and extend vertically outward more than the sealing features 76. As is apparent in FIG. 3, the extent of the corner protrusions 74 vertically above the compression stop interface 32 is also larger than the extent of the male alignment features 44. For example, the vertical extent of the corner protrusion 74 is between two and eight times that of the sealing feature 76. The corner protrusions 76 may define a sloped or angled surfaces 82 that join straight surfaces 84. The sloped surfaces 82 may define a tapered portion. The corner protrusion 76 may further define a chamfered upper portion 86. In some embodiments, the corner member protrusion 76 is formed monolithically with the corner member 74 or may fasten to the corner member 74 as shown. In still

other embodiments, the corner protrusion 76 may be formed by two plates that protrude in a similar fashion, each being secured to one arm of the corner member 74.

[0027] Referring to FIG. 4, female members 22 may further secure to female corner members 88. The female corner members 88 may define inner stops 90 secured to or formed on the corner members 88. The inner stops 90 of a corner member 88 may define slopes surfaces 92 and straight surfaces 94 sized and configure to engage the sloped surfaces 82 and straight surfaces 84 of the corner protrusions 80, respectively of the male corner members 74. The inner stops 90 therefore define a receiver for receiving the corner protrusions 80 and facilitate alignment of the corner members 88 with the male corner members 74.

[0028] Referring to FIG. 5, in use the female and male members 22, 24 may be engaged with one another and the male and female corner members 74, 88 may also be engaged with one another as shown. The sloped surfaces 82 of the protuberance 76 engaged the sloped surfaces of the stops 90. Likewise, the straight surfaces 84 of the protuberance 84 engage the straight surfaces 94 of the stops 90. The actual configuration of the surfaces 82, 84 may define any convex shape and surfaces 92, 94 may define any concave shape such that the surfaces 82, 84 may be positioned in engagement with the surfaces 92, 94 in order to align the male members 24 and female members 22. As is apparent in FIG. 5, the chamfered surface 86 is offset from the female corner member 88 when engaged. In this manner, the chamfered surface accommodates slight misalignments between the corner members 74, 88 during installation of the lid 12 onto the base 14.

[0029] Referring to FIG. 6, a container 10 using the closure system 16 described herein may be used to store various items. For example, a unmanned aerial vehicle (UAV) may be stored in the container 10. For example, wings 96 of the UAV may be supported and retained within the cradles 98, such as disclosed in U.S. application Ser. No. _____/_____ filed Aug. _____, 2013 and entitled RETENTION SYSTEM AND METHOD FOR A WING (Attorney Docket No. ECSC-1-1024), which is hereby incorporated herein by reference in its entirety.

[0030] In such embodiments, a plurality of cradles 98 may secure to the container 10 either directly or indirectly by means of a fixture or frame member. The wing 96 is mounted within the cradles 98 and is thereby retained against movement during shipping. The remainder of the UAV may also secure within the container 10, including the fuselage 100. For example, the fuselage 100 may have a fastening system 102 and indexing members 104 secured thereto as described U.S. application Ser. No. _____/_____ filed Aug. _____, 2013 and entitled FUSELAGE INDEXING SYSTEM AND METHOD (Attorney Docket No. ECSC-1-1026), which is hereby incorporated herein by reference. The container 10 may further have receivers 106 for engaging the indexing members 104 and a corresponding frame 108 mounting the receivers to the container 10 as described in disclosed in U.S. application Ser. No. _____/_____ filed Aug. _____, 2013 and entitled FUSELAGE INDEXING SYSTEM AND METHOD (Attorney Docket No. ECSC-1-1026).

[0031] A spar 110 of the wing 96 may be further restrained by means of the spar retention system 112 as described in U.S. application Ser. No. _____/_____ filed Aug. _____, 2013 and entitled WING SPAR RETENTION SYSTEM AND METHOD (Attorney Docket No. ECSC-1-1025), which is hereby incorporated herein by reference. In this manner,

movement of the wing **96** transverse to the longitudinal axis thereof may be restrained by means of the cradles **98** and movement along the longitudinal axis may be restrained by the spar retention system **112**.

[0032] As is apparent from the foregoing description, the disclosed closure system **16** for a container **10** provides a stiff, self-aligning closure that reduces time and effort to install the lid **12** on the base **14**. The closure system **16** provides inherent stiffness to the container **10** which helps it maintain shape and resist large forces during the large pressure changes seen during air transport. The closure system **16** further resists relative lateral movement between lid **12** and base **14** assemblies during large lateral accelerations experienced during shipping.

[0033] While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A closure assembly for a container having a first wall and a second wall that come together to close the container, the closure assembly comprising:

a female member comprising—

- a main body including a first compression stop interface;
- a channel formed in the main body configured to receive the first wall of the container to secure the female member to the first wall of the container;
- a female alignment feature formed in the first compression stop interface; and
- a gasket channel in the first compression stop interface, wherein the gasket channel contains a gasket;

a male member comprising—

- a main body including a second compression stop interface;
- a channel formed in the main body configured to receive the second wall of the container to secure the male member to the second wall of the container;
- a male alignment feature protruding from the second compression stop interface and extending into the female alignment feature; and
- a male gasket sealing feature protruding from the second compression stop interface and into the gasket channel, wherein the male gasket sealing feature forms a seal with the gasket;

a latch coupling the male member to the female member, the latch having an outer extent; and

a bumper extending beyond the outer extent of the latch.

2. The closure assembly of claim **1**, wherein the male alignment feature protrudes outwardly from the second compression stop interface a greater extent than the male gasket sealing feature.

3. The closure assembly of claim **1**, wherein female member and male member are formed according to one of an extrusion process and a pultrusion process.

4. The closure assembly of claim **1**, where in the channels of the male and female members define a plurality of at least one of grooves and ridges.

5. The closure assembly of claim **1**, wherein the first and second compression stop interface are at least three times a thickness of the first and second walls.

6. The closure assembly of claim **1**, wherein the male and female include a plurality of apertures disposed along the channel for receiving fasteners.

7. The closure assembly of claim **1**, wherein the main body of the male member defines a cutout for receiving the latch.

8. The closure assembly of claim **1**, wherein the gasket channel defines a flared seating surface defining an opening and a gasket chamber connected to the opening, the gasket being positioned within the gasket chamber and the opening being smaller than a width of the chamber, and the male gasket sealing feature being tapered to conform to the flared seating surface.

9. The closure assembly of claim **1**, wherein:

the male member further comprises corner protrusions positioned inwardly from the male alignment feature and the male gasket sealing feature and protruding outwardly from the second compression stop interface a greater extent than the male alignment feature and male gasket sealing feature, the corner protrusions defining first engagement surfaces;

the female member further comprises corner receivers positioned inwardly from the female alignment feature and the gasket channel and extending from the first compression stop interface in a same direction as the female alignment feature, the corner receivers defining second engagement surfaces configured to mate with the first engagement surfaces.

10. The closure assembly of claim **1**, wherein the male alignment feature defines a taper angle and the female alignment feature defines a flare angle, the flare angle being greater than the taper angle.

11. A container comprising:

a first container shell defining a first rim;

a second container shell defining a second rim;

a female member comprising

- a main body including a first compression stop interface;
- a channel formed in the main body having the first rim secured therein;
- a female alignment feature formed in the first compression stop interface; and
- a gasket channel in the first compression stop interface, wherein the gasket channel contains a gasket;

a male member comprising

- a main body including a second compression stop interface;
- a channel formed in the main body having the second rim secured therein;
- a male alignment feature protruding from the second compression stop interface and extending into the female alignment feature; and
- a male gasket sealing feature protruding from the second compression stop interface and into the gasket channel, wherein the male gasket sealing feature forms a seal with the gasket;

a latch coupling the male member to the female member, the latch having an outer extent; and

a bumper extending beyond the outer extent of the latch.

12. The container of claim **11**, wherein the male alignment feature protrudes outwardly from the second compression stop interface a greater extent than the male gasket sealing feature.

13. The container of claim **11**, wherein female member and male member are formed according to one of an extrusion process and a pultrusion process.

14. The container of claim **11**, where in the channels of the male and female members define a plurality of at least one of grooves and ridges.

15. The container of claim **14**, further comprising an adhesive positioned in the channels of the male and female members.

16. The container of claim **10**, further comprising a plurality of first fasteners extending through the female member and the first rim and a plurality of second fasteners extending through female member and the second rim.

17. The closure assembly of claim **1**, wherein the main body of the male member defines a cutout for receiving the latch.

18. The closure assembly of claim **1**, wherein the gasket channel defines a flared seating surface defining an opening and a gasket chamber connected to the opening, the gasket being positioned within the gasket chamber and the opening being smaller than a width of the chamber, and the male gasket sealing feature being tapered to conform to the flared seating surface.

19. The closure assembly of claim **1**, wherein:

the male member further comprises corner protrusions positioned inwardly from the male alignment feature and the male gasket sealing feature and protruding outwardly from the second compression stop interface a greater extent than the male alignment feature and male gasket sealing feature, the corner protrusions defining first engagement surfaces;

the female member further comprises corner receivers positioned inwardly from the female alignment feature and the gasket channel and extending from the first compression stop interface in a same direction as the female alignment feature, the corner receivers defining second engagement surfaces configured to mate with the first engagement surfaces.

20. The closure assembly of claim **1**, wherein the male alignment feature defines a taper angle and the female alignment feature defines a flare angle, the flare angle being greater than the taper angle.

* * * * *