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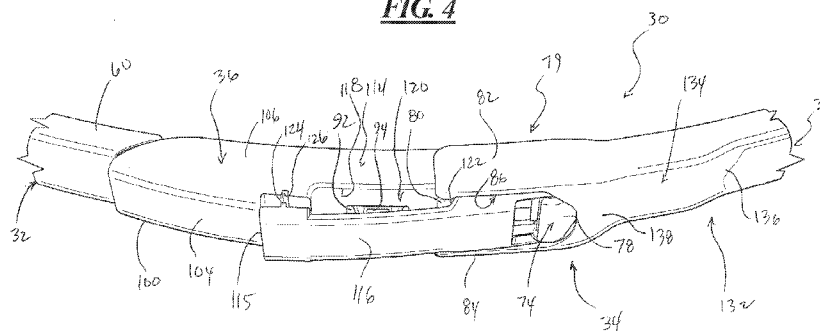
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(54) **Title:** LOCK RING FOR SECURING A CONTAINER LID

FIG. 4

(57) **Abstract:** A low profile lock ring for securing a lid to a drum-type container has a body with a discontinuous ring shape and two free ends. The body has an annular wall and two spaced apart flanges forming a clamping channel facing radially inward. The two flanges define a profile height of the body. A lever has a grip section and a pivot section at opposite ends. The pivot section is pivotally attached to the body near a first of the free ends. The lever is pivotable between a closed position and an open position and has two walls spaced from one another and connected by a third wall. The spacing of the two walls defines a profile height of the lever.

LOCK RING FOR SECURING A CONTAINER LID

Related Application Data

[0001] This patent is related to and claims priority benefit of U.S. provisional application Serial No. 61/672,864 of the same title and filed on 18 July, 2012. The entire content of this prior filed provisional application is hereby incorporated herein by reference.

Background

1. Field of the Disclosure

[0002] The present disclosure is generally directed to drum-type storage containers and more particularly to a split ring clamp or lock ring for securing a lid to such a container, the ring having a slim profile construction.

2. Description of Related Art

[0003] Cylindrical containers or drum containers are known in the art for holding and storing chemicals, industrial materials, and the like. These types of containers are typically large drum sizes and are often constructed of either a metal material such as steel or, particularly in North America, a fiber material. Fiber drums are formed having a metal chime around the top lip or top opening as well as around the closed bottom. In other regions, particularly in Europe and the Far East, such drum containers are often formed of non-metallic and non-fibrous materials, such as plastic materials. With the rapid globalization of commerce, it has become much more common that plastic material is used for fabricating these types of drums, as well as for fabricating their removable lids. In this regard, there are ecological and other advantages associated with use of plastic drums and lids, such as the material being recoverable or recyclable.

[0004] Each container of this type has a replaceable lid retained in position by a split ring clamp or lock ring in order to securely close the top opening. International standards are developing, which may supplant separate national standards to regulate the performance of these types of drums and lids. From a national standpoint, the United States Department of Transportation (DOT), Research and Special Programs Administration, has produced standards and specifications for drum performance. Standards also have been promulgated by the United Nations organization. DOT

standards typically call for drop tests to make sure the drums won't leak when subjected to some abuse or trauma during use.

[0005] The drums to be tested are filled with dry, finely powdered material to a specific net weight. The drums are then closed with the lids and then clamped by the split ring or lock ring. Depending upon the standards involved, the containers are required to withstand a drop from varying heights and at various orientations onto a hard surface such as concrete. To pass such tests or meet the standards, the drums must recover from such drops without rupture or leakage. One international testing approach involves a similar drop test, except that the drums are filled with water instead of powdered materials. Such tests also include a seal test where the drums are filled with water and upended to determine the presence of a leak.

[0006] The lids that typically close these types of drums are formed from stamped metal or molded plastic. The lids are then secured onto the drums by the split ring clamps or lock rings. Such clamps or lock rings have a channel to capture a rim of the lid-to-drum interface. An over-center lever is generally used to draw the ends of the split ring clamp structure together. In the past, these lock rings or clamps were made of steel and were durable and very strong and sturdy, but also quite heavy and expensive. However, for many packaging, transportation, and incinerator container applications, industrial users of such drum containers have sought to avoid metal components such as lids and lock rings or split ring clamping devices. The known metal devices do not burn, are prone to corrode, and can sometimes insert minute metallic contaminants with the material packaged within the containers.

[0007] Plastic lids have been successfully developed, such as is described in U.S. Patent No. 4,718,571. For some period of time, the development of corresponding plastic clamping rings, which could remain competitive in terms of cost and clamping performance, eluded those in the art until a successful all-plastic polymeric two-piece split ring clamp was devised. Such a plastic clamp ring found success in conjunction with fiber type drums, and is described in U.S. Patent No. 5,129,537.

[0008] The two-piece polymeric split ring clamp described in the above noted '537 patent has remained popular for use with fiber-based drums. However, its experimental application for clamping plastic lids on plastic drums demonstrated a need for a more secure union between drum and lid. Plastic drums and lids typically

are less rigid or sturdy than metal drums, fiber drums with steel chimes, and metal lids. Further, the plastic split ring clamp, while advantageously being formed of only two major parts, had exhibited a profile at its over-center pivot level that protruded outwardly a substantial amount from the side of the drum and lid to which it is secured. Such a large protruding ring portion can significantly hinder drum handling. Also, when containers employing plastic lids and plastic drums are subjected to drop tests, excessive stress was imposed, for example, upon the lever pivot shaft or pin that was integrally formed upon the pivot arm of the clamping system.

[0009] U.S. Patent No. 5,713,482 disclosed a split ring clamp or lock ring that provided a degree of improved performance in these areas. However, the ring disclosed in the '482 patent still has a relatively large cross section profile and a relatively large protruding lever.

Summary

[0010] In one aspect according to the teachings of the present disclosure, a lock ring is disclosed for securing a lid to a drum-type container. The lock ring has a body with a discontinuous circular ring shape. The body has a first free end and a second free end and has an annular wall and two spaced apart flanges that together define a clamping channel that faces radially inward. The two flanges define a profile height of the body. A lever has a grip section at one end and a pivot section at an opposite end. The pivot section is pivotally attached to the body near the first free end. The lever is pivotable between a closed position and an open position and has two walls spaced from one another and connected by a third wall. The spacing of the two walls defines a profile height of the lever. A lever end of the body is adjacent the first free end and is formed by the annular wall continuing to the first free end and the two flanges terminating short of the first free end. When the lever is in the closed position, the third wall of the lever lies adjacent the annular wall, the annular wall of the lever end is positioned between the two walls of the lever, and the two walls of the lever lay generally adjacent edges of the annular wall.

[0011] In one aspect of the disclosure, the profile height of the lever can be no greater than the profile height of the body.

[0012] In one aspect of the disclosure, the two walls of the lever can lie generally parallel with the two flanges of the body along the lever end of the body when the lever is in the closed position.

[0013] In one aspect of the disclosure, a clamping end can be provided on the second free end of the body and can have a clamping bar that can be coupled to part of the lever.

[0014] In one aspect of the disclosure, the lock ring can include a clamping end on the second free end of the body and a pocket formed in the third wall of the lever. The clamping end can engage the pocket to indirectly connect the first and second free ends of the body.

[0015] In one aspect of the disclosure, the lock ring can include a clamping end that has a clamping bar between two walls of the clamping end. The clamping bar can engage a pocket on the lever.

[0016] In one aspect of the disclosure, the lock ring can have a clamping end and a clamping bar that are integrally formed as a part of the body and from the same material as the body.

[0017] In one aspect of the disclosure, the lock ring can have a pocket in the lever that can have two slots. One slot can be formed in each of the two walls of the lever and can be adjacent the third wall. A clamping bar of the lock ring can seat in the two slots when connected to the lever.

[0018] In one aspect of the disclosure, the lever can have a cover over a pocket in the third wall. The cover can be a flexible part of the third wall and can have an attached end and a detached end. The detached end can provide access to the pocket for a clamping bar.

[0019] In one aspect of the disclosure, the lock ring can have a pocket in the lever that can have two slots. One slot can be formed in each of the two walls of the lever and can be adjacent the third wall.

[0020] In one aspect of the disclosure, the lever can have a cover over a pocket in the third wall. The cover can be a flexible part of the third wall and having an attached end and a detached end, which can provide access to the pocket and to slots that form a part of the pocket.

[0021] In one aspect of the disclosure, the lock ring can include a hook on the annular wall of the body and spaced from the first free end and a pivot pin on the pivot end of the lever. The pivot pin of the lever can be attached to the hook.

[0022] In one aspect of the disclosure, the lock ring can have a hook that is integrally formed as a part of the annular wall and from the same material as the body and can have a pivot pin that is integrally formed as a part of the lever and from the same material as the lever. The pivot pin of the lever can attach to the hook.

[0023] In one aspect of the disclosure, the lever can have a pivot pin that is detachably connectable to a hook on the body by snapping into a catch carried on the hook.

[0024] In one aspect of the disclosure, the lock ring can include an aperture in the lever end near the first free end of the body and a protrusion on an inside surface of the annular wall within a portion of the clamping channel near the second free end of the body. The protrusion can seat in the aperture when the second free end of the body is connected to the lever and the lever is in the closed position.

[0025] In one aspect of the disclosure, the annular wall and the two flanges of the body can form a generally C- or G-shaped structure in cross-section.

[0026] In one aspect of the disclosure, a lower flange of the two flanges of the body can have a lip formed on an innermost edge thereof. The lip can depend below the lower flange.

[0027] In one aspect of the disclosure, the second free end can be formed having a clamping end that is sized to fit over an outside of the two walls of the lever when the clamping end is connected to the lever.

[0028] In one aspect of the disclosure, the lock ring can include a lock tab that can protrude from a portion of the annular wall and can have a lock hole formed through the lock tab. A pass-through opening can be formed in the two walls of the lever. When the lever is in the closed position, the lock tab can be positioned between the two walls of the lever and the lock hole can be aligned with the pass-through opening in the lever.

[0029] In one aspect of the disclosure, the body and the lever can be formed of molded plastic materials.

Brief Description of the Drawings

[0030] Objects, features, and advantages of the present invention will become apparent upon reading the following description in conjunction with the drawing figures, in which:

[0031] FIG. 1 shows a perspective view of a fiber type storage container or drum with a lid secured by one example of a lock ring constructed according to the teachings of the present disclosure.

[0032] FIG. 2 shows a top view of the drum and lid and the lock ring of FIG. 1.

[0033] FIG. 3A shows a cross-section taken along line 3A-3A in FIG. 2 of the upper end of the drum, the lid, and a band or ring body portion of the lock ring.

[0034] FIG. 3B shows a cross-section taken along line 3B-3B in FIG. 2 of the upper end of the drum, the lid, and a clamping or lever portion of the lock ring.

[0035] FIG. 4 shows a perspective view of the clamping or lever portion of the lock ring of FIGS. 1-3B and with the band or ring body in an engaged or closed configuration and the lever in a closed position.

[0036] FIG. 5 shows the entire lock ring of FIGS. 1 and 2 and the clamping or lever portion of FIG. 4 but with the band or ring body in a disengaged configuration and the lever in an open position.

[0037] FIG. 6 shows an exploded view of the lock ring of FIG. 5 with the lever separated from the band or ring body.

[0038] FIG. 7 shows a cross-section taken along line 7-7 in FIG. 5 of the band or ring body of the lock ring therein.

[0039] FIG. 8 shows a cut-away view of the clamping or lever portion of the lock ring of FIGS. 4-6 and with the band or ring body engaged and the lever partially opened.

[0040] FIG. 9 shows the clamping or lever portion of the lock ring of FIG. 8 but with the lever in the closed position.

[0041] FIG. 10 shows a cross-section taken along line 10-10 in FIG. 9 of the clamping or lever portion of the lock ring.

[0042] FIG. 11 shows a cross-section taken along line 11-11 in FIG. 9 of the clamping or lever portion of the lock ring.

Detailed Description of the Disclosure

[0043] The lock ring disclosed and described herein solves or improves upon one or more of the above-noted and/or other problems and disadvantages with prior known lock rings, split ring clamps, and like clamping devices of this type. The disclosed lock ring has a slim band or ring body and a clamping or lever portion that has a slim profile that matches the height of the majority of the ring body when engaged and closed. The ring body snaps onto or attaches to a container and lid, such as a fiber drum with a metal chime and a plastic lid. The disclosed lock ring is configured so that the lever, when closed, nests within the vertical footprint of a majority of the ring body to produce a very slim cross section lock ring. The lever, when closed also lies very close to flush in a radial outward direction with the largest part of the ring body. The disclosed lock ring including the ring body and lever thus have a slim vertical and radial profile, which improves handling of drums with secured lids. These and other objects, features, and advantages of the disclosed lock ring may become apparent to those having ordinary skill in the art upon reading this disclosure.

[0044] Turning now to the drawings, FIG. 1 shows a container assembly 20 which has a receptacle or drum 22, such as a conventional fiber type drum. The drum 22 can have a metal chime structure 24 at the base end or bottom of the drum to reinforce the fiber drum material. A lid 26 is attached to the drum 22 to close off a top opening of the drum. The lid 26 can be a plastic lid (i.e., polyolefin or the like), a metal lid, a fiber lid or the like. A metal chime structure 28 can also be provided around the top opening, as is known in the art, to reinforce the top opening and add rigidity and strength to the fiber drum material.

[0045] As shown in FIGS. 1 and 2, the lid 26 can be secured to the drum 22 by a lock ring 30, sometimes known generally in the art as a split clamp ring. The lock ring 30 in the disclosed example has a slim profile and can have an all plastic two-piece construction. When secured and clamped or closed around the top of the drum 22, the lock ring 30 secures the lid 26 and clamps it in place on the drum over the top opening. FIGS. 3A and 3B show cross-sections of the top opening of the drum 22

including the lock ring 30 and the lid 26. The lock ring 30 generally has a band or ring body 32 that can have a ring shape and a generally G- or C-shaped cross section over a majority of its length. The lock ring 30 also generally has a clamping or lever portion 34 with a lever 36 that can be manipulated to clamp or release the lock ring.

[0046] With reference to FIGS. 3A and 3B, a typical fiber drum 22 of this type may have a bead 40 formed by the metal chime 28 extending around the top opening of the drum. A groove 42 may be formed under a shoulder 38 that extends around a side wall 44 of the drum 22 below the bead 40. The groove 42 can extend radially inward into the side wall 44 near the top opening and below the bead 40. The typical lid 26 can have a circumferential rim 46 with a depending lip 48 that forms an upward channel 50 around the rim and radially within the lip. A seal or gasket 52 can be seated in the channel 50. When the lid 26 is installed on the drum 22, the bead 40 can seat in the channel 50 and the seal or gasket 52 can be captured and compressed between the bead and the channel surfaces to form a tight lid seal. The shape, size, and contour of the bead 40 and the channel 50 can be formed to closely mirror and mate with one another.

[0047] FIGS. 4-7 show several views of one example of the lock ring 30 and constructed according to the teachings of the present disclosure. FIG. 4 illustrates the ring body 32 in an engaged configuration and the lever 36 of the clamping portion 34 in a closed position. FIG. 5 shows the ring body 32 in a disengaged or detached configuration and the lever 36 in an open position. FIG. 6 shows the lever 36 removed from the ring body 32 and FIG. 7 depicts the cross-sectional shape of a majority of the length of the ring body.

[0048] The lock ring 30 is for fixing or securing the lid 26 to a drum-type container, such as the fiber drum 22. Generally, the majority of the ring body 32 in this example has a C- or G-shape in cross section, as can be seen in FIGS. 3A and 7. This majority segment of the ring body 32 has an upper flange or leg 60, a lower flange or leg 62 spaced below the upper flange, and an annular wall 64 extending between and connecting the upper and lower flanges. The upper and lower flanges 60, 62 extend radially inward from the annular wall 64 and form a clamping channel 66 on the radially inward facing side of the ring body 32. As shown in FIG. 3A, when the lock ring 30 is installed on the drum 22, the top opening of the drum and the lid 26 are captured in the clamping channel 66 of the lock ring. The upper flange 60 is

positioned over the rim 46 of the lid 26. The lower flange 62 is positioned under the shoulder 38 and in the groove 42 of the drum 22.

[0049] If desired, the upper and/or lower flanges and the rim and/or shoulder can be contoured so that the ring body 32 snaps onto the assembled drum and lid. However, in this example, the rim and top opening are merely captured in the clamping channel of the lock ring 30 when installed. The size of the clamping channel 66 can be sized so as to create a snug or interference fit with the spacing of the shoulder 38 and the bead 40 and rim 46 when installed. FIG. 3B shows the clamping or lever portion 34 of the lock ring 30 in the closed position, which tightly secures the lock ring around the drum 22 and thus retains and secures the lid 26 on the drum.

[0050] As shown in FIGS. 5 and 6, the ring body 32 is a split ring with two free ends 70, 72. A boss or hook 74 is integrally molded as part of the ring body 32 and protrudes radially outward from a surface of the annular wall 64. The hook 74 is spaced circumferentially a first distance from a first of the free ends 70 at the split in the ring body. The hook 74 has a concave face that defines a catch 76, which faces away from the first free end 70. The hook 74 has a robust body 78 that is sturdy and strong and integrally joined to the ring body 32 in this example.

[0051] The second free end 72 of the body 32 at the split is configured to form a clamping end 79 of the lock ring 30. The clamping end 79 has an integrally molded clamping bar 80 that extends vertically or widthwise across the ring body 32 between upper and lower walls 82, 84. The walls 82, 84 are continuations of the upper and lower flanges 60, 62 at the second free end 72. The clamping bar 80 is exposed at the second free end 72 through an opening 86 in the ring body 32. The annular wall 64 terminates at a distance from the free end 72 to form the opening 86, as shown in FIGS. 5 and 6. The upper and lower walls 82, 84 of the clamping end 79 are larger in an outward radial direction of the lock ring 30 and are spaced further apart than the adjacent upper and lower flanges 60, 62 of the ring body 32. As discussed below, the lever 36 is narrower or vertically shorter than the spacing of the walls 82, 84. Thus, the tallest portion of the lock ring 30 is defined by the walls 82, 84 on the clamping end 79 of the ring body 32. As noted below, the height of this tallest portion can be reduced by reconfiguring the lever and clamping end of the ring body.

[0052] As shown in FIGS. 5, 6, 8, and 9, a lever end 88 of the ring body 32 is formed adjacent the first free end 70. The upper and lower flanges 60, 62 terminate a distance from the first free end 70 of the ring body 32. This leaves only the annular wall 64 and curved regions 90 along the edges of the annular wall over the lever end 88. The lever end 88 has a length in this example that coincides with the length and location of the lever 36 when in the closed position, as discussed below.

[0053] A lock tab 92 protrudes from the radially outward facing surface of the annular wall 64. The lock tab 92 is spaced circumferentially further from the first free end 70 than the hook 74. In this example, both the lock tab 92 and the hook 74 are on the lever end 88 portion of the annular wall 64 as shown in FIG. 6. A hole 94 is provided through the lock tab 92 and is oriented vertically in this example.

[0054] As shown in FIGS. 5, 6, 8, and 9, an aperture or way 96 can be formed on the ring body 32 near the first free end 70 in the annular wall 64 on the lever end 88. A corresponding protrusion or key 98 can project from an inside surface of the annular wall 64 on the clamping end 79 within the clamping channel 66. When the lever end 88 and the clamping end 79 are engaged, the protrusion 98 can seat in the aperture 96. This arrangement can help increase the hoop strength of the lock ring 30 and reduce stress on the other engaged components during use, as discussed below.

[0055] The lock ring body 32 can vary in configuration and construction from the example described herein. The size and dimensions of the lever end components and the clamping end components can be altered. Though the ring body and the aforementioned components are all formed as one integral piece of the same material, the ring body can be formed of one piece and one material and one or more of the lock tab, hook, protrusion, and clamping bar can be formed as separate pieces and be attached to the ring body. In another example, the entire lever end 88 and/or clamping end 79 can also be constructed as separate pieces that are attached to the ring body. However, the one-piece unitary construction of the ring body as disclosed herein can provide a lock ring that is easy to manufacture, ship, store, and stock, that requires little to no assembly, and that is relatively robust, strong and sturdy.

[0056] With reference again to FIGS. 5, 6, 8, and 9, the lever 36 of the lock ring 30 in this example is an over-center lever that is pivotally and detachably connected to the ring body 32. The lever 36 can have an elongate grip section 100 at one end that

can be easily grasped by a user and that can provide mechanical advantage to clamp the lock ring 30 closed. The other end of the lever 36 can be a pivot section 102 that is connectable to the ring body 32. The lever 36 in this example is generally U- or C-shaped in cross-section and has an outer vertical wall 104 that extends between and connects upper and lower walls 106, 108.

[0057] The pivot section 102 of the lever 36 can have a pivot pin 110 that is integrally formed as a part of the lever. The pivot pin 110 extends between the upper and lower walls 106, 108 across the end of the pivot section 102. A clearance hole 112 is provided through the vertical wall 104 at the end of the pivot section 102 and exposes the pivot pin 110. The hook 74 is configured to fit through the clearance hole 112 as shown in FIGS. 5, 6, and 9 when assembled and provides clearance for the hook when pivoting the lever. The pivot pin 110 can snap into the catch 76 on the hook 74 to easily attach the lever 36 to the ring body 32 without the use of or need for tools, as depicted in FIG. 9. No separate pivot pin, metal or otherwise, need be installed and no separate installation or attachment steps for such a pin are needed as a result. Thus, the lever 36 can be easily attached to and detached from the ring body 32.

[0058] In this example, a central section 114 of the lever 36 has a flexible finger or cover 116 formed by part of the vertical wall 104. One end 115 of the cover 116 is detached from the lever 36 while the other end remains attached via a flexible connection or joint, such as a living hinge or the like. A slot 118 is formed along each of the upper and lower walls 106, 108 adjacent the cover 116. The detached end 115 and the slots 118 separate three sides of the cover 116 from the lever 36. The cover 116 can thus flex about the other attached end. A pocket 120 is defined beneath the cover in the lever 36 between the slots 118. The cover 116 generally lies over the pocket. Blind ends 122 of the slots 118 are adjacent the proximal or attached end of the cover 116. The blind ends 122 and the attached end of the cover 116 form a closed end of the pocket 120 closer to the pivot pin 110. The detached end 115 of the cover 116 defines an opening onto the pocket 120, accessible when the cover is flexed radially outward away from the lever 36. As shown in FIGS. 4, 8, and 9, an inside face of the cover 116 can include a rib or protrusion 124. A notch or receiver 126 can be provided on a surface of the vertical wall 104 or on a contact surface 128 provided at the distal end within the pocket 120 as shown. When the cover 116 is fully closed,

the rib 124 can seat in the notch 126 to stabilize the cover 116 when the lever is closed and the lock ring 30 is clamped onto the drum 22.

[0059] To install the lock ring 30, the clamping channel 66 is mounted over the container bead 40 to secure the lid 26 in place as described above and shown in FIGS. 1-3A. If not already attached, the pivot pin 110 of the lever 36 can be snapped onto the hook 74. The grip section 100 of the lever 36 can be pivoted away from the ring body 32 about the pivot pin 110 to an open position even beyond that shown in FIG. 5. The cover 116 can be flexed away from the central section 114 of the lever 36 and the clamping bar 80 can be slid under the detached end 115 and into the pocket 120. In doing so, the first free end 70 and second free end 72 will partially overlap one another in this example, as shown in FIG. 8, with the clamping bar 80 positioned circumferentially past the first free end 70 and the hook 74. The lever 36 can then be pivoted back toward the ring body 32. As the lever 36 is moved from the open position to a partially closed position, the clamping bar 80 will slide along the slots 118 to the blind ends 122, as shown in FIG. 8. The lever 36 can then be further pivoted to a closed position against the ring body 32 as shown in FIG. 9. Because the clamping bar 80 is captured in the slots 118 and bottomed out against the blind ends 122, the second free end 72 and the clamping end 79 are drawn further over the first free end 70 and the lever end 88 of the ring body 32. This reduces the circumference of the ring body 32 so that the lock ring 30 clamps down around the drum 22 and lid 26.

[0060] As shown in FIG. 10, the upper and lower walls 106, 108 of the lever 36 nest into position along the curved regions 90 on the lever end 88 of the ring body. The upper and lower walls 106, 108 can be configured so that they lie parallel with the upper and lower flanges 60, 62 of the adjacent ring body 32 in the closed position. The upper and lower walls 106, 108 can thus be positioned where the upper and lower flanges 60, 62 flanges would otherwise be on the lever end 88 of the ring body. This configuration of the lever 36, ring body 32, and lever end 88 can produce a closed, clamped lock ring 30 that has profile height that is essentially that of the ring body itself over nearly the entire circumference of the lock ring. On known lock rings, the lever, clamping end, and lever end each typically have a much taller profile height and are considerably taller than the height of the ring body. The combined, stacked heights of these parts of a conventional, known lock ring are thus much larger than

that of the ring body itself. The construction of the lock ring 30 thus has a significantly lower profile height over its entire circumference than the typical height of a conventional lock ring with the lever closed and clamped.

[0061] The pocket 120 creates a pass-through opening defined through the central section 114 of the lever 36 and across the slots 118, as shown in FIG. 11. The lock tab 92 lies within the interior of the lever 36 in the closed position. The hole 94 is aligned with the slots 118 and thus the pass-through opening of the pocket 120. The lock tab 92 is also positioned upstream of the clamping bar 80 in the closed position as well. The hole 94 through the lock tab 92 is thus accessible across the pocket 120 or pass-through opening. See FIGS. 6, 9, and 11. A lock strap 130 or a locking tie or lock is depicted in FIG. 2 and can be threaded through the hole 94 and across the slots 118 or pass-through opening of the pocket 120 to secure the lever 36 in the closed position. The lock strap 130 being fixed to the lock tab 92 will create a barrier within the slots 118 and hole 94 to prevent the lever 36 from being pivoted away from the ring body 32. The lock strap 130 and the lock tab 92 also create a barrier lengthwise along the slots 118 to prevent the clamping bar 80 from sliding or translating toward the access opening of the pocket 120 at the detached end 115 of the cover 116. The lock strap 130 can also be configured to secure the cover 116 in place with the rib 124 seated and held in the notch 126. This can prevent the clamping bar 80 from forcing the cover 116 open in the radially outward direction in the event the container assembly is exposed to a drop or other type of impact. As noted above, the key or protrusion 98 on the inside of the clamping end 79 can also seat in the aperture 96 in the lever end 88 when closed and clamped. The engaged aperture 96 and key 98 can help take up some of the tensile stress that would otherwise be applied to the pivot pin 110 and hook 74 and to the clamping bar 80 and lever pocket 120. Thus, the lock ring 30 can be locked and retained in the closed and clamped configuration. When closed, clamped, and locked, the disclosed lock ring 30 secures the lid 26 to the drum 22, has a very low profile, unobtrusive height, and yet provides a very strong, sturdy, and durable structure.

[0062] In the closed and clamped configuration of FIGS. 1, 2, and 9, the first and second free ends 70, 72 of the ring body 32 at the split are indirectly engaged at multiple connection points and overlap one another. The ring body 32 will be under significant tension when closed, clamped, and locked on the drum 22. The

construction of the lock ring 30 distributes the tensile loads among the several connection points.

[0063] As shown in FIGS. 4-6 and 9, the clamping end 79 of the ring body 32 is slightly larger than the adjacent ring body flanges 60, 62 and annular wall 64. A transition section 132 between the ring body 32 and the clamping end walls 82, 84 has a stepped up segment 134 of a size between that of the ring body 32 and the clamping end 79. The stepped up segment 134 is connected to the ring body 32 at a first adjoining region 136 and connected to the clamping end 79 at a second adjoining region 138. In the closed and clamped position, the upper and lower walls 82, 84 of the clamping end 79 lie against the outside surfaces of the upper and lower walls 106, 108 on the lever 36. Thus, the clamping end walls 82, 84 define the tallest profile height portions of the lock ring 30. These can be formed relatively thin and still provide sufficient strength under tension during use, particularly with the multiple connection points provided between the split ends of the lock ring 30 when closed and clamped.

[0064] As shown in FIGS. 10 and 11, the lower flange 62 of the ring body 32 can have a downturned lip 142 over the length of the lower flange. The lip can be constructed to add stiffness and rigidity to the ring body and can define the lowermost dimension of the lock ring 30.

[0065] As shown in FIGS. 8 and 9, the lever end 88 of the ring body 32 can be sized to fit and seat within the upper and lower flanges of the ring body at the stepped up segment 134 near the clamping end 79. Because the lever end 88 has no upper and lower flanges 60, 62 in this region of the ring body 32, the vertical spacing of the flanges in the stepped up segment 134 near the clamping end 79 can be relatively narrow, further lowering the permissible vertical profile the lock ring 30. The hook 74 on the lever end 88 of the ring body 32 is positioned to pass through the opening 86 in the clamping end 79, also as shown in FIGS. 1 and 9. The radial protruding dimension of the hook 74 can be such that it lies flush with the vertical wall of the clamping end 79 when closed and clamped. Thus, the radial depth of the lock ring 30 can also have a relatively low profile compared to known lock rings. The maximum dimension in the radial direction is defined by the height of the lever 36, and specifically the cover 116, when closed and clamped.

[0066] Both the ring body 32, within the clamping channel 66, and the lever 36, within the walls 104, 106, and 108 (see FIG. 8, for example) can have one or more lengthwise, vertical, and/or other ribs 150 or additional features to add strength and rigidity to the disclosed lock ring, if desired. Also, the slots 118 and pocket 120 can include reinforced portions (not shown) that extend radially inward. The reinforced portions can be provided with a through-hole that aligns with the lock tab 92 and hole 94 when the lever 35 is closed, for added strength and rigidity, if desired, as well. The lock tab 92 can be closely captured in a gap defined by such reinforcing structure if desired.

[0067] As will be evident to those having ordinary skill in the art upon reading this disclosure, the specific configuration and construction of the lock ring disclosed and described herein can vary from the example shown. Positional relationships, sizes, shapes, surface contours, and the like can vary and yet function as intended. Features of the lock ring can also be added or removed, as well as altered, without departing from the spirit and scope of the present invention. In addition, the material used to form the unitary lock ring disclosed and described herein can vary considerably as well. However, the material should be suitable to allow for formation of the various disclosed features of the lock ring. The material can be a moldable plastic type material and the materials of the lever 36 and ring body 32 need not be the same.

[0068] The slim profile lock ring disclosed herein is particularly useful for fiber-type drums with steel chimes and plastic or other lid types. The steel chimes of the drum will add significant strength and rigidity to the drum structure. Thus, the lock ring need only provide hoop strength, i.e., strength under tension, because it does not need to perform the additional function to retain the shape of the drum top opening and lid, particularly in the event of a sudden drop or other impact on the drum of the container assembly.

[0069] The size and shape of the container assembly can vary as well. Thus, the size and shape of the lid and the lock ring can also vary to accommodate. The disclosed lock ring can be utilized on containers other than fiber type drums, if deemed to be suitable for a particular application.

[0070] When installed, a snap-on structure of the lock ring, lid, and drum, if provided, may help retain the lock ring on the assembled lid and container. The ring

body can be configured to snap over a lid lip and container shoulder in other ways while still providing a force-fit or positive engagement between the ring body and the lid and drum. Thus, the configuration and construction of the ring body, drum top opening, and lid rim components can be varied from the example herein and yet function as intended.

[0071] The diameter of the ring body is sized so that it can readily fit around the circumference of the assembled lid and drum in the open configuration. When installed, and when the pivot pin is received in the hook, the user can begin to pivot the lever toward the closed position in the direction toward the ring body. This motion will draw the two ring body free ends together, reducing the circumference of the lock ring and securing the ring around the lid and container. Various parts, such as the pivot pin and hook, the clamping bar, slots, and pocket, and the lock tab and pass-through opening across the pocket, can be reversed on the parts, if desired and feasible, while the basic function of the lock ring is maintained.

[0072] Although certain lock ring features, functionality, and components have been described herein in accordance with the teachings of the present disclosure, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all embodiments of the teachings of the disclosure that fairly fall within the scope of permissible equivalents.

What Is Claimed Is:

1. A lock ring for securing a lid to a drum-type container, the lock ring comprising:

a body having a discontinuous circular ring shape, the body having a first free end and a second free end, the body having an annular wall and two spaced apart flanges together defining a clamping channel facing radially inward, the two flanges defining a profile height of the body;

a lever having a grip section at one end and a pivot section at an opposite end, the pivot section pivotally attached to the body near the first free end, the lever pivotable between a closed position and an open position and having two walls spaced from one another and connected by a third wall, the spacing of the two walls defining a profile height of the lever; and

a lever end adjacent the first free end of the body, the lever end formed by the annular wall continuing to the first free end and the two flanges terminating short of the first free end,

wherein, when the lever is in the closed position, the third wall of the lever lies adjacent the annular wall, the annular wall of the lever end is positioned between the two walls of the lever, and the two walls of the lever lay generally adjacent edges of the annular wall.

2. The lock ring according to claim 1, wherein the profile height of the lever is no greater than the profile height of the body.

3. The lock ring according to claim 1, wherein the two walls of the lever lie generally parallel with the two flanges of the body along the lever end of the body when the lever is in the closed position.

4. The lock ring according to claim 1, wherein a clamping end is provided on the second free end of the body, the clamping end having a clamping bar that can be coupled to part of the lever.

5. The lock ring according to claim 1, further comprising:
a clamping end on the second free end of the body;
a pocket formed in the third wall of the lever, wherein the clamping end engages the pocket to indirectly connect the first and second free ends of the body.

6. The lock ring according to claim 5, wherein the clamping end has a clamping bar between two walls of the clamping end, the clamping bar engaging the pocket on the lever.

7. The lock ring according to claim 6, wherein the clamping end and clamping bar are integrally formed as a part of the body and from the same material as the body.

8. The lock ring according to claim 6, wherein the pocket includes two slots, one formed in each of the two walls of the lever and adjacent the third wall, the clamping bar being seated in the two slots.

9. The lock ring according to claim 8, wherein the lever has a cover over the pocket in the third wall, the cover being a flexible part of the third wall and having an attached end and a detached end, the detached end providing access to the pocket and slots for the clamping bar.

10. The lock ring according to claim 5, wherein the pocket includes two slots, one formed in each of the two walls of the lever and adjacent the third wall.

11. The lock ring according to claim 10, wherein the lever has a cover over the pocket in the third wall, the cover being a flexible part of the third wall and having an attached end and a detached end, the detached end providing access to the pocket and slots.

12. The lock ring according to claim 1, further comprising:
a hook on the annular wall of the body and spaced from the first free end; and
a pivot pin on the pivot end of the lever, the pivot pin attached to the hook.

13. The lock ring according to claim 12, wherein the hook is integrally formed as a part of the annular wall and from the same material as the body and the pivot pin is integrally formed as a part of the lever and from the same material as the lever.

14. The lock ring according to claim 12, wherein the pivot pin is detachably connectable to the hook by snapping into a catch carried on the hook.

15. The lock ring according to claim 1, further comprising:
an aperture in the lever end near the first free end of the body; and
a protrusion on an inside surface of the annular wall within a portion of the clamping channel near the second free end of the body,
wherein the protrusion seats in the aperture when the second free end of the body is connected to the lever and the lever is in the closed position.

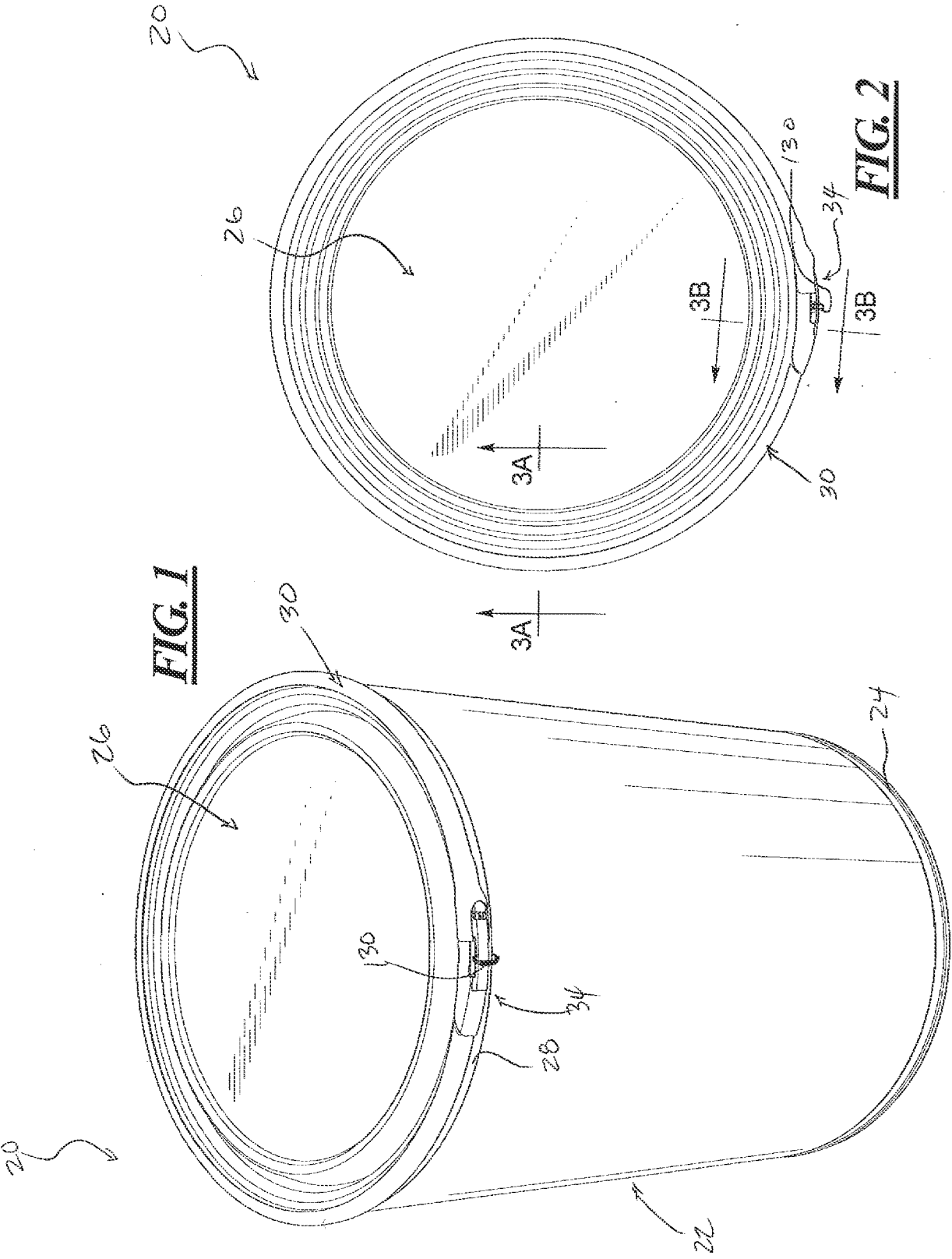
16. The lock ring according to claim 1, wherein the annular wall and the two flanges of the body form a generally C- or G-shaped structure in cross-section.

17. The lock ring according to claim 1, wherein a lower flange of the two flanges of the body has a lip formed on an innermost edge thereof, the lip depending below the lower flange.

18. The lock ring according to claim 1, wherein the second free end is formed having a clamping end that is sized to fit over an outside of the two walls of the lever when the clamping end is connected to the lever.

19. The lock ring according to claim 1, further comprising:
a lock tab protruding from a portion of the annular wall and having a lock hole formed therethrough; and
a pass-through opening formed in the two walls of the lever,
wherein, when the lever is in the closed position, the lock tab is positioned between the two walls of the lever and the lock hole is aligned with the pass-through opening in the lever.

20. The lock ring according to claim 1, wherein the body and the lever are formed of molded plastic materials.



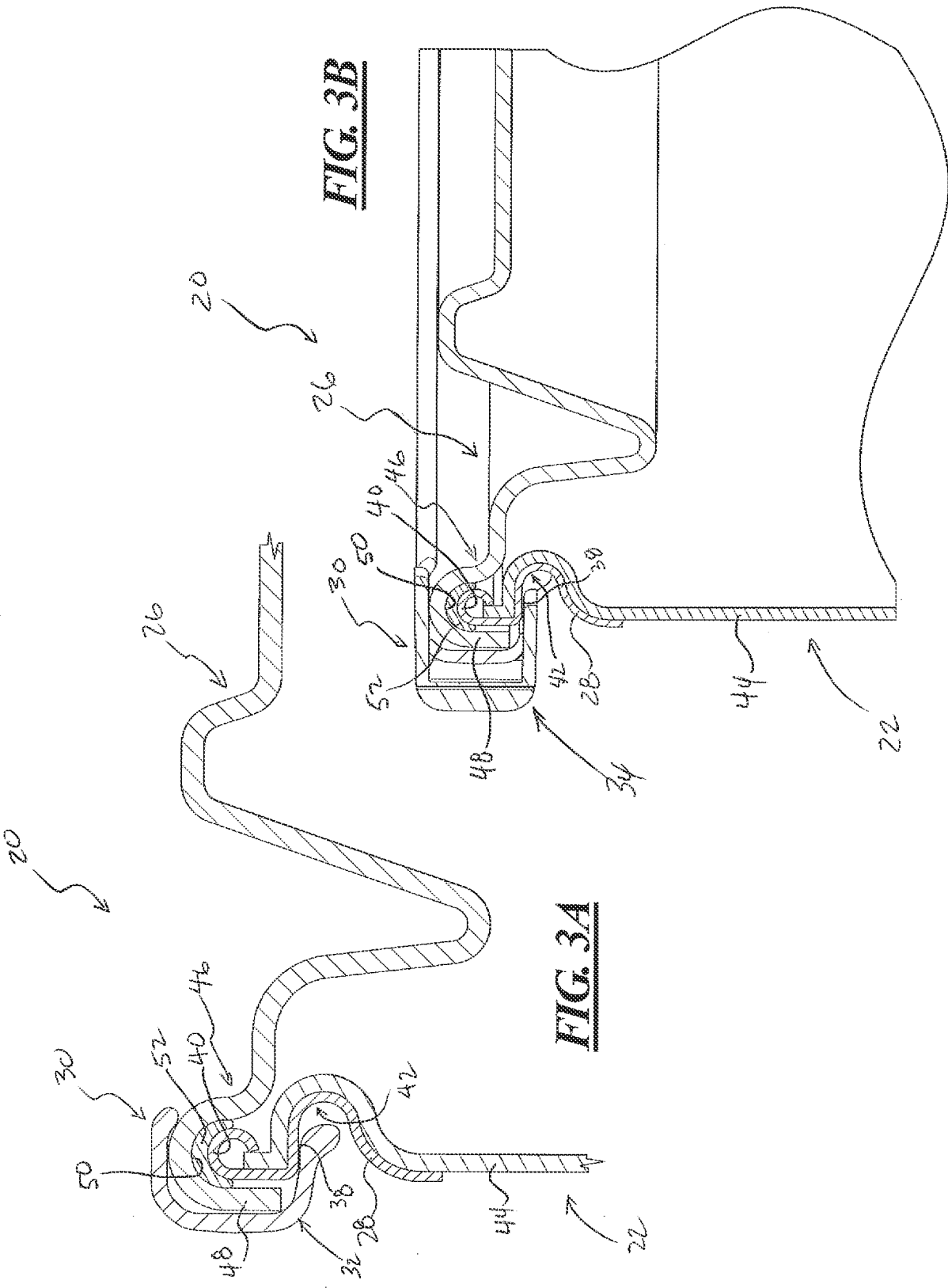
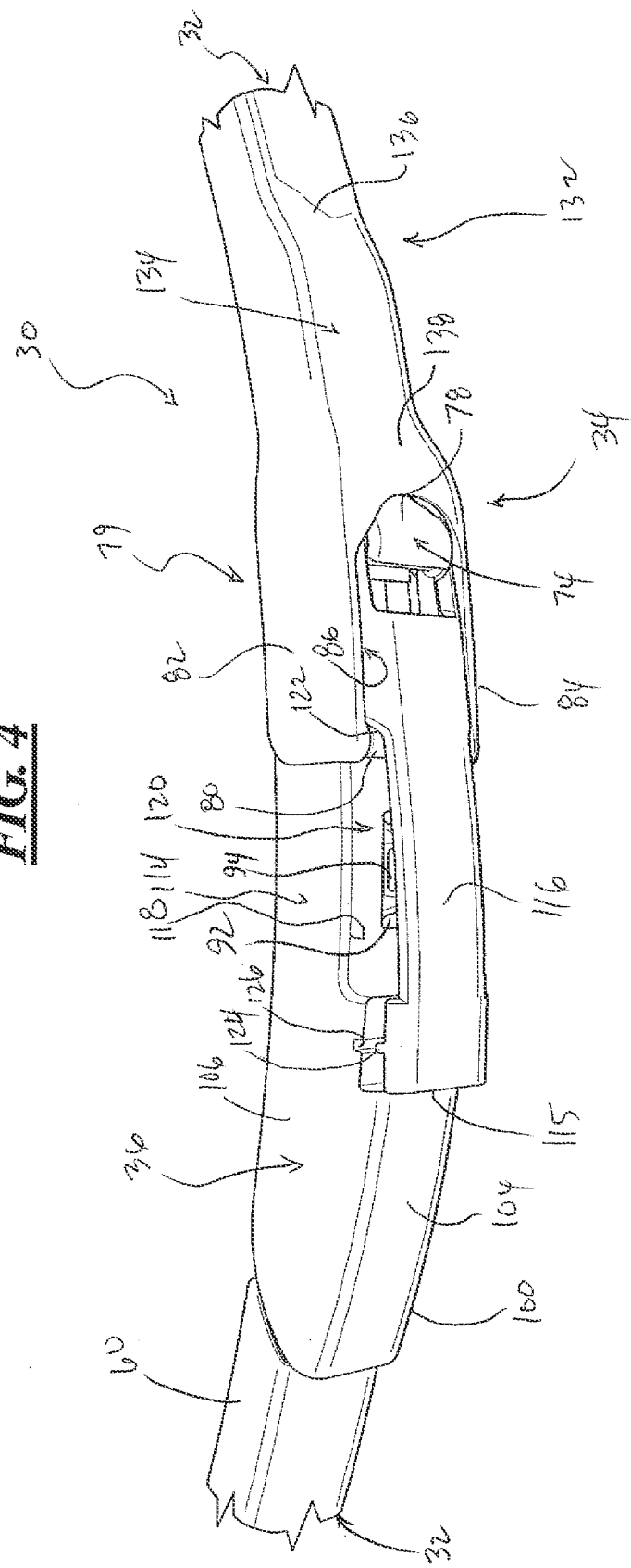


FIG. 4



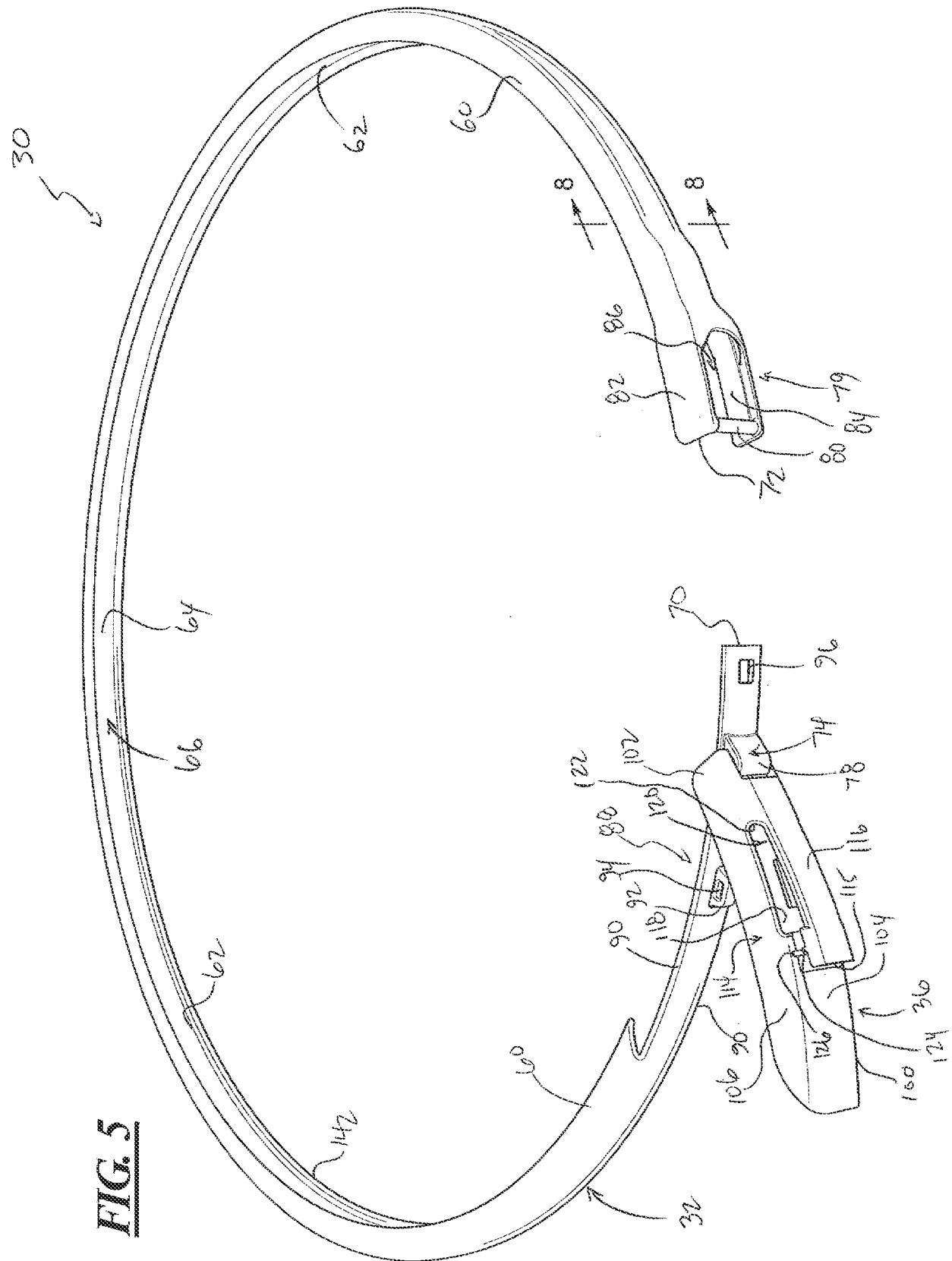
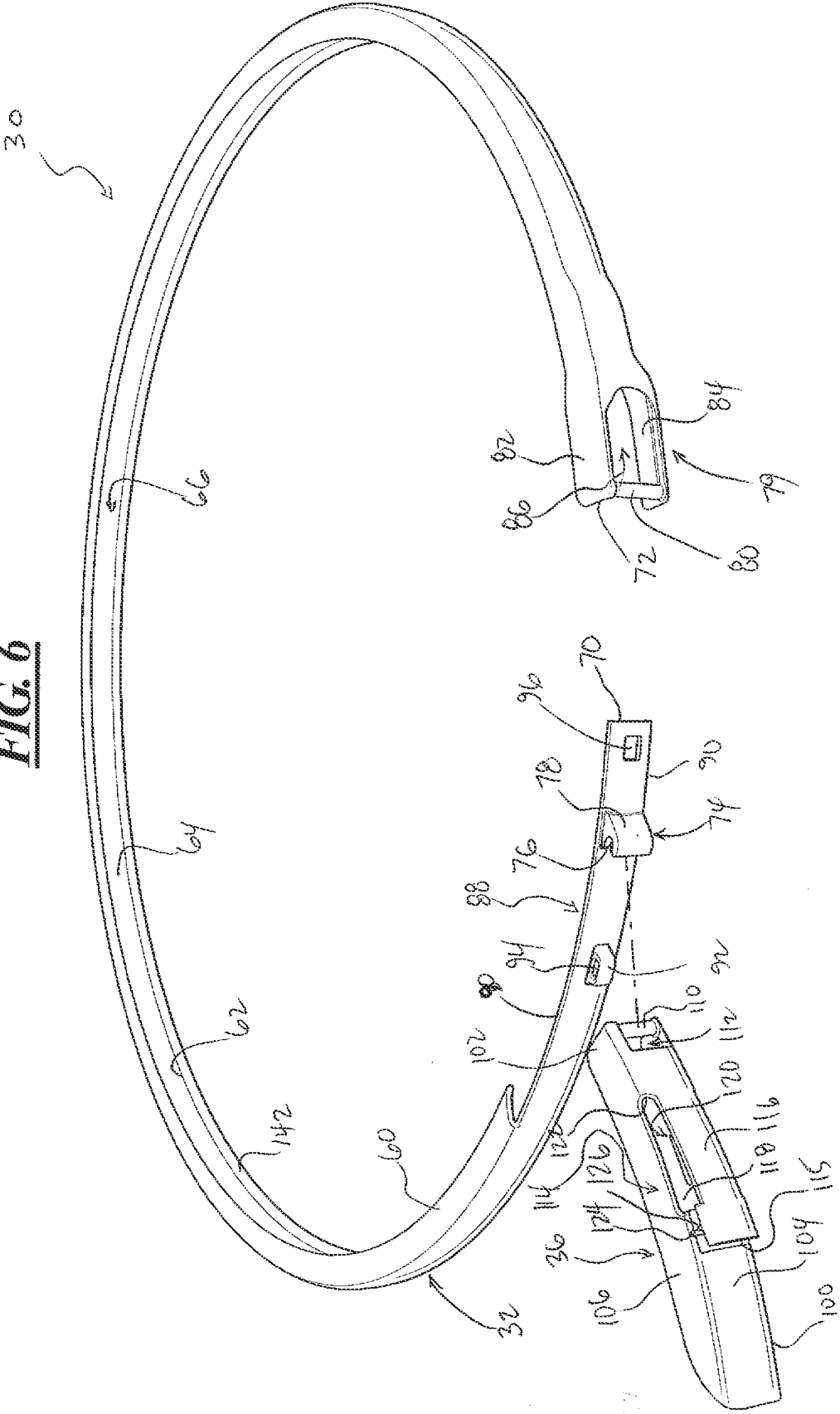
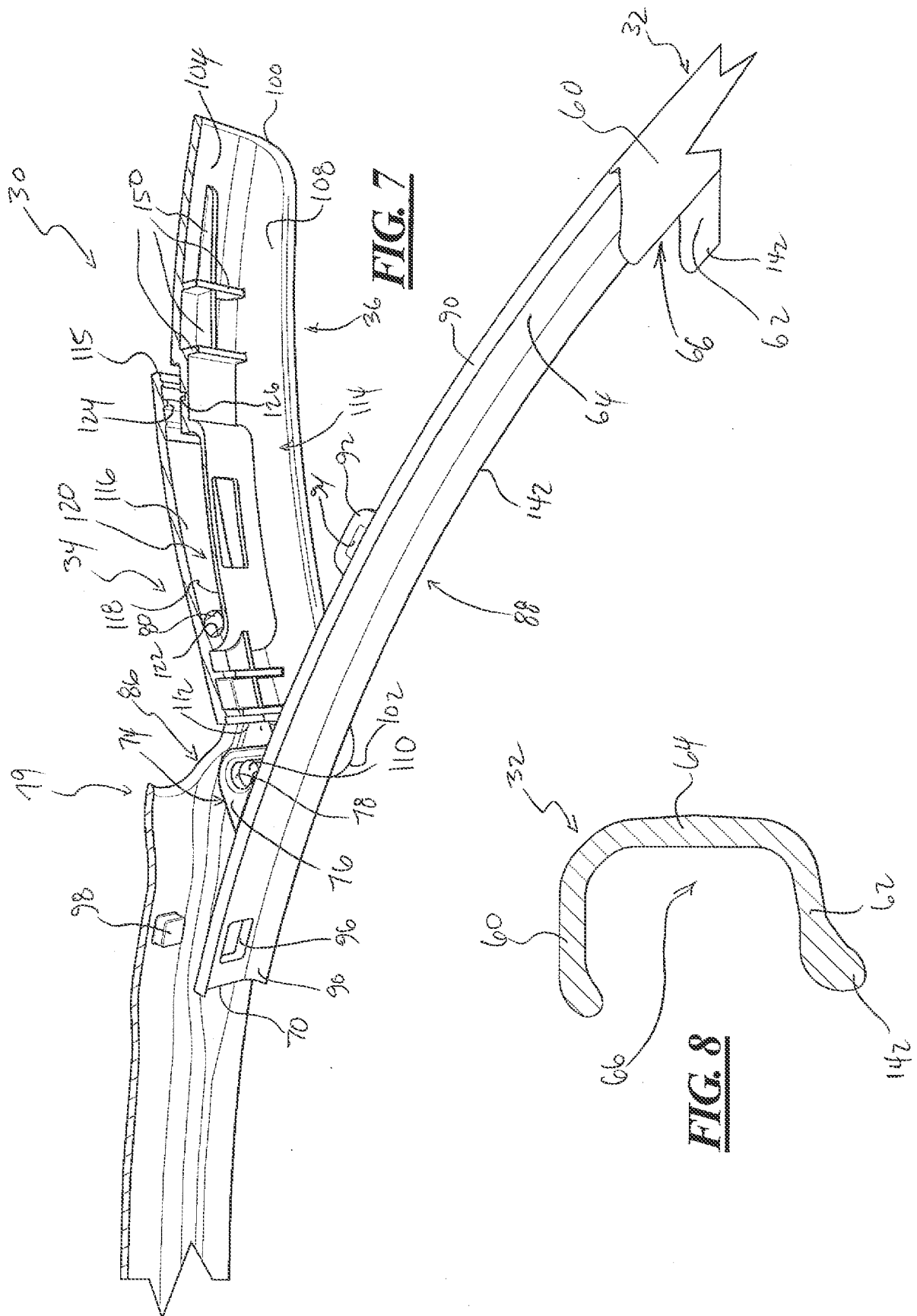
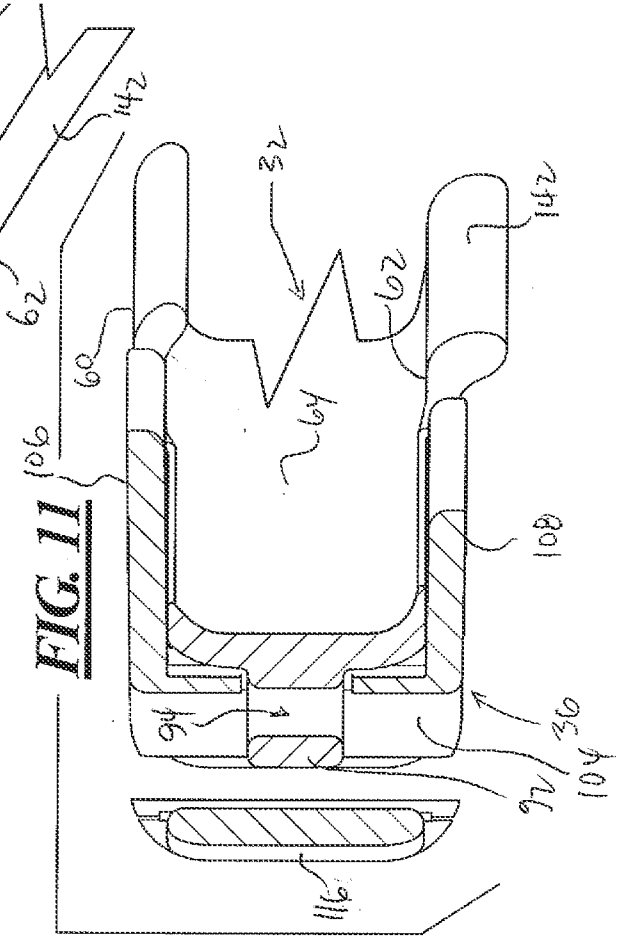
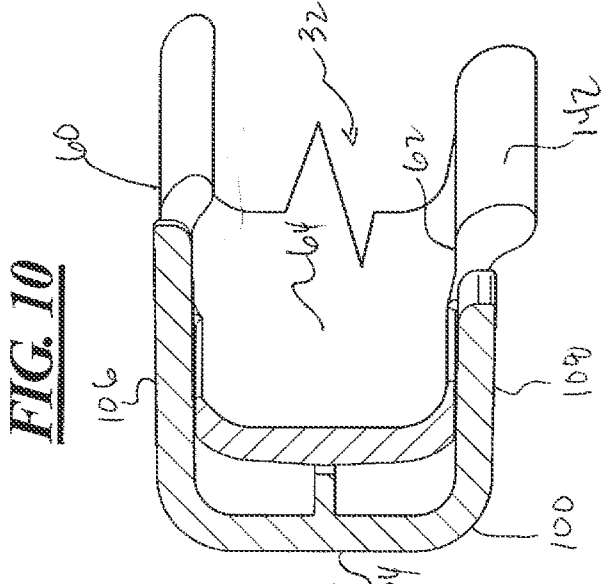
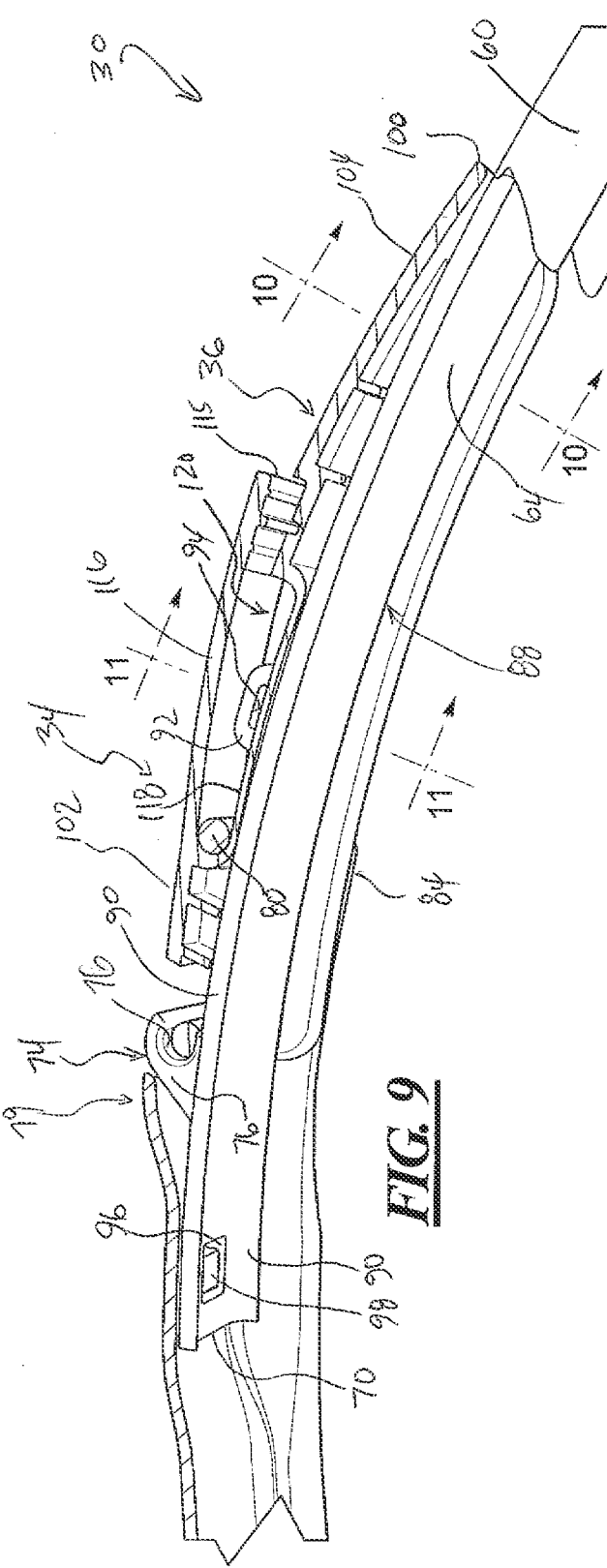


FIG. 5

FIG. 6







INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/051164

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B65D 45/34 (2013.01)

USPC - 220/321

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B65D 45/00, 45/32, 45/34 (2013.01)

USPC - 24/68C, 68R, 273; 220/319, 320, 321; 292/256.6, 256.65, 256.69, Dig. 11

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

CPC - B65D 45/345 (2013.01)

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

PatBase, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,713,482 A (BÖRDNER et al) 03 February 1998 (03.02.1998) entire document	1-20
Y	US 857,197 A (PATTERSON) 18 June 1907 (18.06.1907) entire document	1-20

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

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

24 November 2013

Date of mailing of the international search report

13 DEC 2013

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