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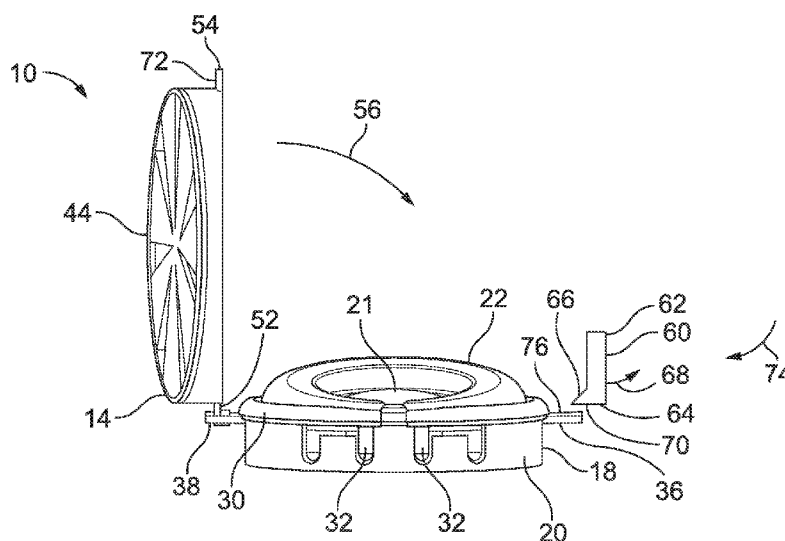
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[Continued on next page]

(54) Title: REFUELING LOCK ASSEMBLY

**FIG. 2**

(57) Abstract: A refueling lock assembly is configured to be secured to a fuel fill pipe of a refueling system. The assembly may include a pipe mount, a cover, and an engageable locking device. The pipe mount is configured to be removably secured to a proximal end of the fuel fill pipe. The cover is movably secured to the pipe mount between an open position and a closed position. The fuel fill pipe is accessible in the open position, but inaccessible in the closed position. The engageable locking device is configured to lock the cover to the pipe mount in a locked closed position.





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REFUELING LOCK ASSEMBLY

RELATED APPLICATIONS

[0001] The present application relates to and claims priority benefits from U.S. Provisional Patent Application 61/671,960, filed July 16, 2012, and U.S. Provisional Patent Application 61/677,628, filed July 31, 2012, both of which are hereby incorporated by reference in their entireties.

FIELD OF EMBODIMENTS OF THE DISCLOSURE

[0002] Embodiments of the present disclosure generally relate to a refueling system for a vehicle, and, more particularly, to a refueling lock assembly that prevents unauthorized access to a refueling system.

BACKGROUND

[0003] Various vehicles, such as automobiles, are powered by gasoline, diesel fuel, or the like. As such, the vehicles typically include fuel systems having a tank configured to retain fuel, such as gasoline or diesel fuel, and a fuel fill pipe that serves as an inlet for supplying fuel to the tank from a fuel nozzle of a refueling station. In general, a fuel fill pipe includes an opening that may be exposed during refueling to receive the nozzle. An exposed end portion of the fuel pipe is of sufficient size to receive a discharge tube of a refueling nozzle. The nozzle typically fits relatively loosely in the fuel fill pipe so that the nozzle may be quickly and easily inserted and removed from the fuel fill pipe.

[0004] Some vehicles include a cap that is removably secured to the fuel inlet. In order to refuel such vehicles, an individual removes the cap, such as through rotation, and then inserts the refueling nozzle. After the vehicle is refueled, the individual securely re-positions the cap back on the fuel inlet.

[0005] Other vehicles include a capless refueling system. In a capless refueling system, no cap is secured to the fuel inlet. Instead, the capless refueling system

may include a movable gate or the like that may be selectively opened and closed during a refueling process. For example, when a refueling nozzle engages the capless refueling system, doors may swing open as the nozzle is urged therein in order to allow the nozzle to be inserted into a refueling channel of a fuel fill pipe. Once the nozzle is removed, the gates or doors may close.

[0006] In order to prevent fuel from being syphoned from vehicles, locks may be used to ensure that access to a fuel tank is restricted. For capless fuel systems, a locking plug may be used. When locked, the plug is locked on or within a fuel inlet. When unlocked, the locking plug is completely removed from the fuel inlet so that an individual may insert a refueling nozzle into a refueling channel of the fuel fill pipe. In general, the locking plug does not interfere with a vacuum relief of the refueling system. For example, the locking plug may not be airtight. Further, the locking plug may not restrict the ability of the capless refueling system doors to swing or rotate into open positions.

[0007] However, users may find direct engagement of a locking plug or cap to be burdensome. For example, a user may find that manipulating a locking plug or cap defeats a purpose of the capless refueling system, in that the user has to directly handle, rotate, or otherwise manipulate portions of the refueling system. Additionally, the locking plug or cap may be lost after removal.

SUMMARY OF EMBODIMENTS OF THE DISCLOSURE

[0008] Certain embodiments of the present disclosure provide a refueling lock assembly configured to be secured to a fuel fill pipe of a refueling system. The refueling lock assembly may include a pipe mount, a cover, and an engageable locking device. The pipe mount is configured to be removably secured to a proximal end of the fuel fill pipe. The cover is movably secured to the pipe mount between an open position and a closed position. The fuel fill pipe is accessible in the open position, but inaccessible in the closed position. The engageable locking device is configured to lock the cover to the pipe mount in a locked closed position.

[0009] In at least one embodiment, the pipe mount may include a hinge or a pivot member, and the cover may include the other of the hinge or the pivot member. The pivot member is pivotally secured to the hinge. The hinge and the pivot member cooperate to allow the cover to pivotally rotate between the closed and open positions. One or both of the hinge or the pivot member may be spring-loaded.

[0010] In at least one embodiment, the pipe mount includes a lock base tab, and the cover includes a lock-engaging tab. At least a portion of the lock-engaging tab may be compressively sandwiched between at least a portion of the lock base tab and at least a portion of the engageable locking device in the locked closed position. The engageable locking device may include a deflectable wedge-shaped engagement member.

[0011] In at least one embodiment, the pipe mount may include one or more lock channels, and the cover may include one or more alignment members configured to be secured with respect to the lock channels in the locked closed position. The lock channel(s) may include a first segment that is perpendicular to a second segment. The lock channel(s) may include one or more first through-holes, and the alignment member(s) may include one more second through-holes. The first and second through-holes may be aligned in the closed locked position. The engageable locking device may also include a lock restraint configured to be securely retained within the aligned first and second through-holes in order to lock the cover to the pipe mount in the closed lock position. The cover is configured to be axially rotated with respect to the pipe mount in order to remove the first and second through holes from alignment when the cover is unlocked from the pipe mount.

[0012] In at least one embodiment, the cover includes a cover ring and a plurality of blocking beams pivotally secured to the cover ring. The blocking beams may include distal tips that converge toward a central opening in the locked closed position. Each of the blocking beams may include a longitudinal channel that slidably retains a post extending from the pipe mount. The locking device may include a rotatable housing connected to a rotation link that connects to the cover ring. The rotatable housing is

engaged to rotate the cover ring to move the plurality of block beams between the open and closed positions.

[0013] In at least one embodiment, the pipe mount may include a capless fuel receiving lid. In at least one embodiment, the proximal end of the fuel pipe may include a capless fuel receiving lid. The pipe mount may include one or more securing devices configured to snapably secure to reciprocal features of the fuel fill pipe.

[0014] In at least one embodiment, the locking device may include a rotatable lock ledge operatively connected to a rotatable cam. The locking device may include a slam lock having a main body and a locking ledge.

[0015] The cover may include one or more vents. The cover may include a circumferential wall connected to an angled covering wall.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0016] Figure 1 illustrates an isometric top view of a refueling lock assembly in an open position, according to an embodiment of the present disclosure.

[0017] Figure 2 illustrates a lateral view of a refueling lock assembly in an open position, according to an embodiment of the present disclosure.

[0018] Figure 3 illustrates an isometric top view of a refueling lock assembly in a closed position, according to an embodiment of the present disclosure.

[0019] Figure 4 illustrates a top view of a refueling lock assembly in a closed position, according to an embodiment of the present disclosure.

[0020] Figure 5 illustrates an isometric top view of a pipe mount, according to an embodiment of the present disclosure.

[0021] Figure 6 illustrates a partial cross-sectional view of a pipe mount secured to a fuel fill pipe, according to an embodiment of the present disclosure.

[0022] Figure 7 illustrates an isometric top view of a refueling lock assembly secured to a fuel fill pipe, according to an embodiment of the present disclosure.

[0023] Figure 8 illustrates a front view of an alignment block of a cover in a lock channel of a pipe mount, according to an embodiment of the present disclosure.

[0024] Figure 9 illustrates a top view of a refueling lock assembly secured to a fuel fill pipe, according to an embodiment of the present disclosure.

[0025] Figure 10 illustrates an isometric exploded view of a refueling lock assembly, according to an embodiment of the present disclosure.

[0026] Figure 11 illustrates an isometric bottom view of a blocking beam, according to an embodiment of the present disclosure.

[0027] Figure 12 illustrates an isometric top view of a pipe mount secured to a fuel fill pipe, according to an embodiment of the present disclosure.

[0028] Figure 13 illustrates an isometric top view of a refueling lock assembly secured to a fuel fill pipe, according to an embodiment of the present disclosure.

[0029] Figure 14 illustrates a simplified view of a locking device operatively connected to a cover ring, according to an embodiment of the present disclosure.

[0030] Figure 15 illustrates a top view of a refueling lock assembly in a locked position, according to an embodiment of the present disclosure.

[0031] Figure 16 illustrates a top view of a refueling lock assembly in an intermediate position, according to an embodiment of the present disclosure.

[0032] Figure 17 illustrates a top view of a refueling lock assembly in an open position, according to an embodiment of the present disclosure.

[0033] Figure 18 illustrates an isometric view of a refueling lock assembly, according to an embodiment of the present disclosure.

[0034] Figure 19 illustrates an isometric top view of a cover of a refueling lock assembly, according to an embodiment of the present disclosure.

[0035] Figure 20 illustrates an isometric top view of a capless fuel receiving lid, according to an embodiment of the present disclosure.

[0036] Figure 21 illustrates an isometric exploded view of a refueling lock assembly in relation to a fuel fill pipe, according to an embodiment of the present disclosure.

[0037] Figure 22 illustrates a locking device in relation to a cover in an unlocked position, according to an embodiment of the present disclosure.

[0038] Figure 23 illustrates a locking device in relation to a cover in a locked position, according to an embodiment of the present disclosure.

[0039] Figure 24 illustrates an isometric exploded view of a refueling lock assembly, according to an embodiment of the present disclosure.

[0040] Figure 25 illustrates an isometric view of a slam lock, according to an embodiment of the present disclosure.

[0041] Figure 26 illustrates an isometric top view of a refueling lock assembly, according to an embodiment of the present disclosure.

[0042] Figure 27 illustrates an isometric top view of a refueling lock assembly secured to a pipe mount, according to an embodiment of the present disclosure.

[0043] Figure 28 illustrates an isometric rear view of a refueling lock assembly secured to a pipe mount, according to an embodiment of the present disclosure.

[0044] Before the embodiments of the disclosure are explained in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The disclosure is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE DISCLOSURE

[0045] Figure 1 illustrates an isometric top view of a refueling lock assembly 10 in an open position, according to an embodiment of the present disclosure. The refueling lock assembly 10 includes a pipe mount 12 and a cover 14 pivotally secured to the pipe mount 12.

[0046] The pipe mount 12 secures to a proximal end 16 of a fuel fill pipe 18 of a refueling system. For example, the pipe mount 12 may be snapably, latchably, or otherwise removably secured to an existing fuel fill pipe 18 in order to adapt the fuel fill pipe 18 to receive the cover 14. Alternatively, the pipe mount 12 may be integrally formed with the fuel fill pipe 18. The fuel fill pipe 18 includes a cylindrical main body 20 defining an internal refueling channel 21. The proximal end 16 may include an angled collar 22 surrounding an inlet 24 of the refueling channel 21. The angled collar 22 may be configured to receive a nozzle of a refueling station (not shown). Optionally, the collar 22 may not be angled, but instead may be perpendicular and flush in relation to the cylindrical main body 20.

[0047] The fuel fill pipe 18 may include a plurality of slots 26 formed through the cylindrical main body 20 proximate to the angled collar 22. As shown in Figure 1, the slots 26 may be vertically oriented and positioned proximate to a base 28 of the angled collar 22.

[0048] The pipe mount 12 includes an annular main body 30 that fits around the cylindrical main body 20 proximate to the base 28 of the angled collar 22. Pipe securing members 32, such as tabs, barbs, clasps, or the like, extend downwardly from circumferential edges near a mid-section 34 of the main body 20. As shown in Figure 1, two pipe securing members 32 straddle the mid-section 34. The pipe securing members 32 are snapably, latchably, or otherwise removably secured into aligned slots 26 of the fuel fill pipe 18, thereby securing the pipe mount 12 to the fuel pipe 18. The pipe mount 12 may include additional pipe securing members 32 at various other portions. The additional pipe securing members 32 may secure into aligned reciprocal slots 26 or other

features of the fuel fill pipe 18. For example, the pipe mount 12 may include pipe securing members 32 regularly positioned around the pipe mount 12, such as at 90 degree intervals, that secure into aligned reciprocal slots 26 of the fuel fill pipe 18.

[0049] The pipe mount 12 also includes a planar lock base tab 36 that extends radially outward from the annular main body 30. As shown, a center of the lock base tab 36 may be 90 degrees from the mid-section 34. The pipe mount 12 also includes a hinge 38 opposite from the lock base tab 36. For example, the hinge 38 may be positioned on the annular main body 30 at a radial spacing that is 180 degrees from the lock base tab 36. The hinge 38 may also extend radially outward from the annular main body 30. The hinge 38 is configured to rotatably connect to the cover 14.

[0050] The pipe mount 12 may be integrally molded and formed as a single piece of material, such as plastic or metal. Optionally, the pipe mount 12 may include separate and distinct portions. For example, the pipe mount 12 may include first and second halves, one of which secures to one half of the fuel fill pipe 18, and another which secures to an opposite half of the fuel fill pipe 18.

[0051] The cover 14 includes a main body 40 having a circumferential rim 42 and a covering wall 44. The circumferential rim 42 is sized and shaped to conform to the angle of the angled collar 22 of the fuel fill pipe 18. Thus, a front portion 46 of the cover 14 may be shorter than a rear portion 48. The covering wall 44 may include a plurality of vents 50 formed therethrough. The vents 50 may be pie-shaped as shown in Figure 1. However, the vents 50 may be various other shapes and sizes. The vents 50 allow vacuum pressure and gases to be released therethrough.

[0052] The cover 14 also includes a pivot member 52 that is pivotally secured to the hinge 38 of the pipe mount 12. For example, the pivot member 52 may be a rod that is pivotally secured within a reciprocal channel formed in the hinge 38, or vice versa. The pivot member 52 and/or the hinge 38 may be spring-loaded in order to force the cover 14 into an at-rest open position. Optionally, the pivot member 52 and the hinge 38

may not be spring-loaded. Alternatively, the cover 14 may include the hinge, while the pipe mount 12 may include the pivot member.

[0053] A lock-engaging tab 54 may extend radially outward from a portion of the circumferential rim 42 that is 180 degrees from the pivot member 52. The lock-engaging tab 54 is configured to overlay the lock base tab 36 of the pipe mount 12 in the closed position. In order to close the cover 14, a user urges the cover in the direction of arc 56. For example, a user may grasp the lock-engaging tab 54 and move it toward the lock base tab 36 in the direction of arc 56 with sufficient force to overcome the spring force of the hinge 38 and the pivot member 52. As the user moves the cover 14 in the direction of arc 56, the cover 14 pivots about the interface of the pivot member 52 and the hinge 38. In order to securely lock the cover 14 in position, a locking device may securely sandwich the lock-engaging tab 54 between an underside of a moveable beam of the locking device and an upper surface of the lock base tab 36 of the pipe mount 12.

[0054] Figure 2 illustrates a lateral view of the refueling lock assembly 10 in the open position, according to an embodiment of the present disclosure. The refueling lock assembly 10 may include a deflectable locking device 60. The deflectable locking device 60 may extend from a portion of a vehicle, such as the fuel fill pipe 18, or from the pipe mount 12, the cover 14, or a locking device secured to the cover 14. The deflectable locking device 60 includes an extension beam 62 having a wedge-shaped engagement member 64 extending from a lower end. As the locking cover 14 is pivoted downward in the direction of arc 56, the lock-engaging tab 54 slides over a ramped surface 66 of the engagement member 64, thereby deflecting the locking device 60 back in the direction of arc 68. The lock-engaging tab 54 continues to slide over the ramped surface 66 until a lower flat edge 70 of the engagement member 64 encounters the lock-engaging tab 54. When the lower flat edge 70 abuts against a top surface 72 of the lock-engaging tab 54, the locking device 60 deflects in the direction of arc 74, such that the lower flat edge 70 overlies the top surface 72 of the lock-engaging tab 54. As such, the lock-engaging tab 54 is trapped between the lower flat edge 70 of the locking device 60 and an upper surface 76 of the lock base tab 36. In this manner, the cover 14 may be

closed and locked over the fuel fill pipe 18. In the closed and locked position, the covering wall 44 prevents access to the fuel fill pipe 18.

[0055] Figure 3 illustrates an isometric top view of the refueling lock assembly 10 in a closed position. As shown in Figure 3, the covering wall 44 prevents access to the fuel fill pipe 18.

[0056] Figure 4 illustrates a top view of the refueling lock assembly 10 in the closed position. As shown in Figure 4, the lock-engaging tab 54 is trapped between the engagement member 66 and the lock base tab 36. In order to open the cover 14, the locking device 60 may be manipulated into an open position. For example, the locking device 60 may include a key channel (not shown in Figure 4) that accepts a compatible key. When the key is inserted into the key channel and turned, the engagement member 66 may turn in response, such as in the direction of arc 80. As the engagement member 66 is turned, the engagement member 66 loses contact with the lock-engaging tab 54. Because the hinge 38 and the pivot member 52 may be spring-loaded, the cover 14 may then automatically pivot open, such as shown in Figures 1 and 2. Optionally, if the hinge 38 and the pivot member 52 are not spring-loaded, a user may grasp the lock-engaging tab 54 and pivot the cover 14 open.

[0057] The cover 14 may swing open in the same direction as a fuel door (not shown) of a vehicle that covers an inlet of the refueling system. Thus, when the fuel door is closed, the fuel door forces the cover to close and lock in response. For example, as the fuel door is closed, the fuel door is urged into the covering wall 44, thereby forcing the cover 14 to move in the same direction as the fuel door.

[0058] Referring to Figures 1-4, the refueling lock assembly 10 may be secured to the fuel fill pipe 18, such as an existing capless fuel fill pipe of a refueling system. The refueling lock assembly 10 mounts to the fuel fill pipe 18 without interfering with the functionality of the fuel fill pipe 18. That is, the refueling lock assembly 10 does not extend into the refueling channel 21 of the fuel fill pipe 18. The refueling lock assembly 10 may be used with respect to a capless refueling system, for

example. Optionally, the refueling lock assembly 10 may replace a cap of a capped system, for example. The refueling lock assembly 10 may be retrofit to existing capped and capless refueling systems.

[0059] Figure 5 illustrates an isometric top view of a pipe mount 90, according to an embodiment of the present disclosure. The pipe mount 90 includes an annular main body 92 configured to secure to a proximal end of a fuel fill pipe. The annular main body 92 includes a circumferential wall 94 having a rim 96 extending from an upper edge. The circumferential wall 94 and the rim 96 define a central opening 97. Regularly-spaced gaps 95 may be formed through the circumferential wall 94, thereby providing flexibility to the circumferential wall 94. Optionally, the circumferential wall 94 may be a contiguous wall. Securing devices or protuberances 98, such as detents, hooks barbs, clasps, or the like, may be regularly spaced about the circumferential wall 94 and inwardly extend therefrom. The securing protuberances 98 are configured to snapably secure to reciprocal portions of a fuel fill pipe.

[0060] Lock channels 100 are formed through outer portions of the circumferential wall 94. The lock channels 100 may be regularly spaced about the circumferential wall 94. Each lock channel 100 includes an inlet 102 that connects to a vertical segment 104. The vertical segment 104 connects to a horizontal segment 106. A top portion 108 of the horizontal segment 106 may angle down from the vertical segment 104 toward a distal tip 110. A through-hole 111 is formed through the horizontal segment 106 proximate to the distal tip 110.

[0061] Figure 6 illustrates a partial cross-sectional view of the pipe mount 90 secured to a fuel fill pipe 112, according to an embodiment of the present disclosure. As shown in Figure 6, the securing devices 98 may snapably secure underneath a reciprocal ridge 114 of the fuel fill pipe 112. In the connected position, the pipe mount 90 may be securely fixed with respect to the fuel fill pipe 112. Alternatively, the pipe mount 90 may be configured to rotate about a central axis of the fuel fill pipe 112.

[0062] Figure 7 illustrates an isometric top view of a refueling lock assembly 120 secured to a fuel fill pipe, according to an embodiment of the present disclosure. The refueling lock assembly 120 includes the pipe mount 90 secured to the fuel fill pipe 112. The refueling lock assembly 120 also includes a cover 122 rotatably secured to the pipe mount 90.

[0063] The cover 122 includes a circumferential wall 124 connected to a covering wall 126, which may include a plurality of vents 128. A locking device extends outwardly from the circumferential wall 124 and is configured to engage a locking restraint that engages the circumferential wall 124 and the pipe mount 90. For example, the locking device 130 may include a cam mechanism operatively connected to a key channel 132 that is configured to accept a compatible key. The key may be inserted into the key channel 132. As the key is turned, the cam mechanism may operatively engage the locking restraint to unlock the cover 122 from the pipe mount 90, or vice versa.

[0064] As shown, a locking restraint 134, such as a pin, bayonet, or the like, inwardly extends from the locking device 130 (for example, the locking restraint 134 may be operatively connected to a cam mechanism) through a passage formed in one of the circumferential walls 124 and into one of the through-holes 111 (shown in Figure 5) of the pipe mount 90. In this position, the locking restraint 134 locks the cover 122 with respect to the pipe mount 90. However, as the locking device 130 is engaged, the cam mechanism moves to remove the locking restraint 134 from the through-hole 111 and the passage formed through the circumferential wall 124. As such, the cover 122 may be rotated and moved with respect to the pipe mount 90, or vice versa, in order to remove the cover 122 from the pipe mount 90.

[0065] As shown in Figure 7, alignment blocks 140 may extend outwardly from the circumferential wall 124 and be retained within the distal tips 110 of the lock channels 100. When the locking restraint 134 is in the locked position, the alignment blocks 140 may be trapped within the lock channels 100. However, when the locking restraint 134 is removed from locking engagement, the cover 122 may be rotated with respect to the pipe mount 90 in the direction of arc 150, in order to remove the alignment

blocks 140 from the lock channels 100. Once the alignment blocks 140 are removed from the lock channels 100, the cover 122 may be removed from the pipe mount 90, thereby allowing access to the fuel fill pipe.

[0066] Figure 8 illustrates a front view of the alignment block 140 of the cover 122 in the lock channel 100 of the pipe mount 90, according to an embodiment of the present disclosure. As shown, the cover 122 is in an unlocked position with respect to the pipe mount 90, as the alignment block 140 is not within the distal tip 110 of the lock channel 100, but, instead, within the vertical segment 104 of the lock channel 100. In this position, the cover 122 may simply be pulled up in the direction of arrow 160 in order to remove the cover 122 from the pipe mount 90.

[0067] In order to securely lock the cover 122 to the pipe mount 90, the cover 122 is pushed down so that the alignment block 140 is moved down into the vertical segment 104. The cover 122 is then rotated with respect to the pipe mount 90 so that the alignment block 140 is moved into the distal tip 110. The alignment block 140 follows a path through the lock channel 100 as shown by arrow 162. In the locked position, the through-hole 111 formed through the pipe mount 90 aligns with a through-hole 170 formed through the alignment block 140. As such, the locking restraint 134 may be inserted therethrough to lock the cover 122 in place with respect to the pipe mount 90. The locking device 130 may be engaged to disengage the locking restraint 134 from the through-holes 111 and 170 in order to allow the cover 122 to be removed from the pipe mount 90.

[0068] As shown, the alignment block 140 may outwardly extend from the circumferential wall 124 of the cover 122. Therefore, the alignment block 140 may not directly extend into the lock channel 100. Optionally, the alignment block 140 may inwardly extend from the circumferential wall 124 and be configured to be movably retained within the lock channel 100. Alternatively, the alignment block 140 may not be used. Instead, the through-hole 170 may simply represent an alignment member.

[0069] Figure 9 illustrates a top view of the refueling lock assembly 120 secured to a fuel fill pipe 112, according to an embodiment of the present disclosure. For the sake of clarity, the covering wall 126 is not shown in Figure 9. As shown in Figure 9, in the locked position, the locking restraint 134 is positioned through a through-hole 170 of an alignment block 140 and a through hole 111 of the pipe mount 90. Accordingly, the cover 122 is securely locked over the fuel fill pipe 112. In order to unlock the cover 122 so that it may be removed from the pipe mount 90, the locking device 130 is engaged to remove the locking restraint 134 from locking engagement with the alignment block 140 and the pipe mount 90. Once the locking restraint 134 is removed, the cover 122 may be rotated and lifted off of the pipe mount 90, as described above.

[0070] The refueling lock assembly 120 includes a single locking restraint 134 that engages one alignment block 140 and one through hole 111. The cover 122 includes a plurality of alignment blocks 140, and the pipe mount 90 includes a plurality of through-holes 111, so that the cover 122 may be mounted in various axially-rotated positions with respect to the pipe mount 90 and still be able to lock thereto. Alternatively, the refueling lock assembly 120 may include a plurality of locking restraints operatively connected to one or more locking devices 130.

[0071] Figure 10 illustrates an isometric exploded view of a refueling lock assembly 200, according to an embodiment of the present disclosure. The refueling lock assembly 200 includes a pipe mount 202 and a cover 203. The cover 203 includes a cover ring 206 operatively connected to a plurality of blocking beams 208.

[0072] The pipe mount 202 includes an annular rim 205. Pipe securing members 207 extend radially outward from the annular rim 205. The annular rim 205 may be angled with respect to the pipe securing member 207. Each pipe securing member 207 may include an arcuate support 209 that curves down from the annular rim 205. One or more detents 210 extend downwardly from the arcuate support 209 and are configured to snapably secure into reciprocal slots formed in a fuel fill pipe.

[0073] Posts 212 extend upwardly from an upper surface of the annular rim 205. The number of posts 212 may be the same as the number of blocking beams 208. The posts 212 are configured to be retained within longitudinal channels (not shown in Figure 10) formed through the blocking beams 208.

[0074] The cover ring 206 includes downwardly-extending posts 213. The number of posts 213 may equal the number of blocking beams 208. Each post 213 is configured to be rotatably retained within a reciprocal opening 214 formed in a proximal end 216 of a blocking beam 208. Accordingly, the blocking beams 208 are configured to pivot about the posts 213.

[0075] Figure 11 illustrates an isometric bottom view of a blocking beam 208, according to an embodiment of the present disclosure. The blocking beam 208 is generally a linear beam having opposed ends 220 and 222 and opposed sides 224 and 226. A longitudinal channel 228 is formed through a portion of the length of the blocking beam 208. The longitudinal channel 228 may be formed through a lower surface 230 of the blocking beam 208. The opening 214 (shown in Figure 1) may be formed through an upper surface 232 of the blocking beam 208. The longitudinal channel 238 may extend from a location proximate to the end 222 toward the end 220. The channel 238 may have a length greater than half the length of the blocking beam 208. However, the channel 238 may have a length that is greater or less than shown in Figure 11.

[0076] Figure 12 illustrates an isometric top view of the pipe mount 202 secured to a fuel fill pipe 240, according to an embodiment of the present disclosure. The detents or tabs 210 of the pipe securing members 207 are secured into reciprocal slots 242 formed through a proximal end 244 of the fuel fill pipe 240. The arcuate supports 209 of the rear pipe securing members 207a may be longer than that of the front pipe securing member 207b in order to angle the angular rim 204 with respect to the fuel fill pipe line 240. However, the pipe securing members 207a and 206b may be the same length and configuration in order to provide an annular rim that is generally flat (that is, not angled).

[0077] Figure 13 illustrates an isometric top view of the refueling lock assembly 200 secured to the fuel fill pipe 240, according to an embodiment of the present disclosure. Referring to Figures 10, 11, and 13, the blocking beams 208 are pivotally secured to the cover ring 206. For example, the openings 214 of the blocking beams 208 pivotally retain the posts 213 of the cover ring 206. At the same time, the longitudinal channels 228 of the blocking beams 208 slidably retain the posts 214 of the annular rim 205 of the pipe mount 202, which is securely fixed in place with respect to the fuel fill pipe 240. Therefore, when the cover ring 206 is rotated about its central axis in the direction of arc 260, distal tips 262 of the blocking beams 208 rotate toward the cover ring 206 away from a central opening 264. When the cover ring 206 is rotated in a direction that is opposite the direction of arc 260, the distal tips 262 rotate back toward the central opening 264.

[0078] Figure 14 illustrates a simplified view of a locking device 270 operatively connected to the cover ring 206, according to an embodiment of the present disclosure. The locking device 270 may include a rotatable housing having a key channel 272 configured to receive a compatible key 274. The rotatable housing is operatively connected to a rotation link 276 that is also operatively connected to the cover ring 206. For example, the rotation link 276 may be belt, rod, chain, or the like that securely connects around outer portions of the cover ring 206. In an embodiment, the cover ring 206 includes an outer groove that receives the rotation link 276. The rotation link 276 may include teeth that fit into reciprocal openings formed in the outer groove. As the locking device 270 rotates, a corresponding rotation is caused in the rotation link 276, which, consequently, causes the cover ring 206 to rotate. The locking device 270 may include one or more cam mechanisms, gears, or the like configured to translate the rotational movement of the locking device 270 to rotational movement of the cover ring 206 by way of the rotation link 276. The locking device 270 and the rotation link 276 may be used with respect to any of the embodiments of the present disclosure.

[0079] While shown as being underneath the cover ring 206, the locking device 270 may be at various other locations. For example, the locking device 270 may be positioned over and to the side of the cover ring 206.

[0080] Figure 15 illustrates a top view of the refueling lock assembly 200 in a locked position, according to an embodiment of the present disclosure. As shown, in the locked position, the distal tips 262 of the blocking beams 208 converge toward a center of the central opening 264. The blocking beams 208 cooperate to prevent access to the fuel fill pipe 240. In order to gain access to the fuel fill pipe, a key is inserted into the key channel 272 of the locking device 270.

[0081] Figure 16 illustrates a top view of the refueling lock assembly 200 in an intermediate position, according to an embodiment of the present disclosure. As the key turns the locking device in the direction of arc 280, the cover ring 206 responsively rotates in the direction of arc 260. The distal tips 262 retreat toward the cover ring 206, thereby causing an opening to form over the central opening 264.

[0082] Figure 17 illustrates a top view of the refueling lock assembly 200 in an open position, according to an embodiment of the present disclosure. In the unlocked position, the distal tips 262 of the blocking beams 208 are removed from a blocking position over the central opening 264. Accordingly, the fuel fill pipe 240 may be accessed. In order to close the central opening 264, the locking device 270 is rotated back in the direction of arc 290 to the position shown in Figure 15. Accordingly, the cover ring 206 rotates back in response, and the distal tips 262 of the blocking members 208 converge back toward one another, as shown in Figure 15.

[0083] Figure 18 illustrates an isometric view of a refueling lock assembly 300, according to an embodiment of the present disclosure. The refueling locking assembly 300 includes a cover 302 having a locking device 304. The cover 302 fits over a capless fuel receiving lid 306 that may mount to a fuel fill pipe (not shown in Figure 18). The capless fuel receiving lid 306 may serve as a pipe mount.

[0084] Figure 19 illustrates an isometric top view of the cover 302 of the refueling lock assembly 300, according to an embodiment of the present disclosure. The cover 302 includes an outer circumferential wall 308 and a covering wall 310. Linear vents 312 may be formed through the covering wall 310. However, the vents 312 may be various other shapes and sizes. The cover 302 is configured to rotatably secure to a fuel fill pipe, over the capless fuel receiving lid 306. The locking device 304 is configured to selectively lock and unlock the cover 302 with respect to the fuel fill pipe. The locking device 304 includes a key channel 314 that receives a compatible key 316. The key 316 may be turned within the key channel 314 between locked and unlocked positions.

[0085] Figure 20 illustrates an isometric top view of the capless fuel receiving lid 306, according to an embodiment of the present disclosure. The capless fuel receiving lid 306 includes an outer circumferential rim 320 that supports a moveable interior gate 322. The rim 320 is configured to fit onto a fuel fill pipe line. The gate 322 is configured to open when a fuel nozzle abuts into the gate 322. For example, the gate 322 may swing open.

[0086] Figure 21 illustrates an isometric exploded view of the refueling lock assembly 300 in relation to a fuel fill pipe 350, according to an embodiment of the present disclosure. The capless fuel receiving lid 306 is securely mounted to a proximal end of the fuel fill pipe 350. The cover 302 may include peripheral vents 352, as shown in Figure 21.

[0087] The locking device 304 includes a housing 354 that receives a rotatable cam 356. The rotatable cam 356 is operatively connected to a rotatable lock ledge 358.

[0088] Figure 22 illustrates the locking device 304 in relation to the cover 302 in an unlocked position, according to an embodiment of the present disclosure. As shown, the cover 302 may include inwardly-directed lugs 360 that extend from interior surfaces of the circumferential wall 308. The lock ledge 358 is proximate to a lug 360. In the unlocked position, the lock ledge 358 does not extend inwardly past the

circumferential wall 308. In order to lock the cover 302 to the fuel fill pipe, the lock ledge 358 is rotated inwardly past the circumferential wall 308.

[0089] Figure 23 illustrates the locking device 304 in relation to the cover 302 in a locked position, according to an embodiment of the present disclosure. As shown in Figure 23, the lock ledge 358 has been rotated inwardly past the circumferential wall 360. The locking device 304 may lock the cover 302 onto the fuel fill pipe by compressively sandwiching a portion of the fuel fill pipe or the lid 306 between a portion of the lock ledge 358 and the lug 360.

[0090] Figure 24 illustrates an isometric exploded view of a refueling lock assembly 400, according to an embodiment of the present disclosure. The refueling lock assembly 400 is similar to the embodiments described with respect to Figures 5-9. The refueling lock assembly 400 includes a pipe mount 402 and a cover 404 having a locking device 406 rotatably secured to the pipe mount 402.

[0091] Figure 25 illustrates an isometric view of slam lock 410, according to an embodiment of the present disclosure. The slam lock 410 may secure into a housing of the locking device 406 shown in Figure 24. The slam lock 410 includes a main body 412 defining a key channel (not shown) that accepts a compatible key 414. The slam lock 410 includes a locking ledge 416 that snapably locks the cover 404 to the pipe mount 402. The key 414 may be engaged to rotate the locking ledge 416 out of secure engagement with the cover 404 and the pipe mount 402 in order to unlock the cover 404 from the pipe mount 402. The slam lock 410 may be used in conjunction with any of the locking devices shown and described with respect to the present application.

[0092] Figure 26 illustrates an isometric exploded view of a refueling lock assembly 500, according to an embodiment of the present disclosure. The refueling lock assembly 500 includes a base ring 502 that supports a lock 504 and a covering flap 506. Securing members 508 inwardly extend from an inner circumference 510 of the base ring 502. The securing members 508 may be snaps, ramps, latches, barbs, and/or the like

configured to securely mate with reciprocal features formed on a pipe mount to secure the refueling lock assembly 500 to the pipe mount.

[0093] A spring housing 512 extends upwardly from an upper edge 514 of the base ring 502. For example, the spring housing 512 may include an arcuate beam 516 that extends upwardly from the upper edge 514 and integrally connects to containment tube 518 that may be perpendicularly oriented with respect to a central passage 520 of the base ring 502. The containment tube 518 houses a spring member, such as coil spring, therein.

[0094] The covering flap 506 includes a planar flap 522 configured to be selectively moved between positions that are over or away from the central passage 520. The covering flap 506 is configured to selectively cover an inlet of a fuel line. The covering flap 506 includes opposed tube connectors 524 that are pivotally connected to opposite ends of the containment tube 518. The tube connectors 524 are operatively connected to the spring member within the containment tube 518.

[0095] The lock 504 may be operatively connected and/or proximate to one of the opposed tube connectors 524 and is configured to selectively lock and unlock the covering flap 506. For example, the spring member within the containment tube 518 forces the covering flap 506 in the open position, as shown in Figure 26. When the lock 504 is engaged, such as through a key, the lock 504 may overcome the spring force constant and lock the covering flap 506 in position. Thus, when the covering flap 506 is pivoted downward in the direction of arc 530 into a closed position, the lock 504 may be engaged to lock the covering flap 506 in the closed position. When the lock 504 is unlocked, the force constant of the spring member within the containment tube 518 forces the covering flap 506 open. As such, the refueling lock assembly 500 includes the spring-biased covering flap 506 that may be locked into a closed position through the lock 504, and, when the lock 504 is disengaged, such as through movement of a key, the covering flap 506 pivots open through the force constant of the spring within the containment tube 518.

[0096] Figure 27 illustrates an isometric top view of a refueling lock assembly secured to a pipe mount 540, according to an embodiment of the present disclosure. As shown, the base ring 502 secures around an outer circumference of the pipe mount 540. The covering flap 506 is configured to be closed over an inlet passage 542 of the pipe mount 540.

[0097] Figure 28 illustrates an isometric rear view of the refueling lock assembly 500 secured to the pipe mount 540, according to an embodiment of the present disclosure. The lock 504 may include an engagement member 550, such as a beam, latch, barb, clasp, or the like, that is moveably secured thereto. The engagement member 550 is configured to be selectively moved into and out of the lock 504. For example, in the locked position, the engagement member 550 may extend outwardly from the lock 504, as shown in Figure 28. In the unlocked position, the engagement member 550 recedes into the lock 504.

[0098] The tube connector 524 proximate to the lock 504 includes a protuberance 560, such as a ridge, bump, or the like, that radially extends outwardly therefrom. In the locked position, the engagement member 550 of the lock 504 is wedged between the protuberance 560 and the upper edge 514 of the base ring 502, thereby preventing the covering flap 506 from opening. However, when the lock is disengaged, such as through a key rotation, the engagement member 550 recedes into the lock 504 and disengages from the protuberance 560. As such, the force of the spring within the containment tube 518 forces the covering flap 506 open in the direction of arc 570 until the protuberance 560 abuts into the upper edge 514 of the base ring 502. As such, the protuberance 560 ensures that the covering flap 506 is not over-rotated or opened past a certain predefined point.

[0099] Embodiments of the present disclosure provide refueling lock systems that may be used to prevent unauthorized access to a fuel fill pipe. The refueling lock systems may include pipe mounts that provide bases that may be retrofit to existing inlets of refueling systems. The pipe mounts are configured to securely retain covers that may be locked in place in order to prevent access to the fuel fill pipes.

[00100] Embodiments of the present disclosure provide refueling lock systems that are easy and intuitive to use. Embodiments of the present disclosure provide refueling lock systems having mounting areas or points that do not require a capless component redesign, recertification, or professional service. Accordingly, the embodiments may be quickly and easily retrofit to existing refueling systems.

[00101] Embodiments of the present disclosure provide refueling lock systems that are configured to accommodate fuel housing pockets of different shapes and sized. Because fuel doors may be located on either the driver or passenger side of a particular vehicle, sizing and packaging constraints may differ from car platform to car platform. However, embodiments of the present disclosure provide refueling lock systems that are configured to be adaptable and ambidextrous, in that the systems may fit and/or be retrofit to a wide variety of car platforms in that that they may locked to a particular fuel pipe in multiple positions. Further, embodiments of the present disclosure provide systems that are configured to sealingly engage vapor recovery booted nozzles unimpeded by any locking cover.

[00102] While various spatial and directional terms, such as top, bottom, lower, mid, lateral, horizontal, vertical, front and the like may be used to describe embodiments of the present disclosure, it is understood that such terms are merely used with respect to the orientations shown in the drawings. The orientations may be inverted, rotated, or otherwise changed, such that an upper portion is a lower portion, and vice versa, horizontal becomes vertical, and the like.

[00103] Variations and modifications of the foregoing are within the scope of the present disclosure. It is understood that the embodiments disclosed and defined herein extend to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present disclosure. The embodiments described herein explain the best modes known for practicing the disclosure and will enable others skilled in the art to utilize the disclosure. The claims are to be construed to include alternative embodiments to the extent permitted by the prior art.

[00104] Various features of the disclosure are set forth in the following claims.

CLAIMS

1. A refueling lock assembly configured to be secured to a fuel fill pipe of a refueling system, the refueling lock assembly comprising:

a pipe mount that is configured to be removably secured to a proximal end of the fuel fill pipe;

a cover that is movably secured to the pipe mount between an open position and a closed position, wherein the fuel fill pipe is accessible in the open position, and wherein the fuel fill pipe is inaccessible in the closed position; and

an engageable locking device that is configured to lock the cover to the pipe mount in a locked closed position.

2. The refueling lock assembly of claim 1, wherein the pipe mount comprises one of a hinge or a pivot member, and the cover comprises the other of the hinge or the pivot member, wherein the pivot member is pivotally secured to the hinge, wherein the hinge and the pivot member cooperate to allow the cover to pivotally rotate between the closed and open positions.

3. The refueling lock assembly of claim 2, wherein one or both of the hinge or the pivot member is spring-loaded.

4. The refueling lock assembly of claim 1, wherein the pipe mount comprises a lock base tab, and the cover comprises a lock-engaging tab, and wherein at least a portion of the lock-engaging tab is compressively sandwiched between at least a portion of the lock base tab and at least a portion of the engageable locking device in the locked closed position.

5. The refueling lock assembly of claim 4, wherein the engageable locking device comprises a deflectable wedge-shaped engagement member.

6. The refueling lock assembly of claim 1, wherein the pipe mount includes one or more lock channels, and wherein the cover comprises one or more alignment members configured to be secured with respect to the lock channels in the locked closed position.

7. The refueling lock assembly of claim 6, wherein the one or more lock channels comprise a first segment that is perpendicular to a second segment.

8. The refueling lock assembly of claim 1, wherein the one more lock channels include one or more first through-holes, and the one or more alignment members include one more second through-holes, wherein the first and second through-holes are aligned in the closed locked position.

9. The refueling lock assembly of claim 8, wherein the engageable locking device comprises a lock restraint configured to be securely retained within the aligned first and second through-holes in order to lock the cover to the pipe mount in the closed lock position.

10. The refueling lock assembly of claim 8, wherein the cover is axially rotated with respect to the pipe mount in order to remove the first and second through holes from alignment when the cover is unlocked from the pipe mount.

11. The refueling lock assembly of claim 1, wherein the cover includes a cover ring and a plurality of blocking beams pivotally secured to the cover ring, wherein the plurality of blocking beams have distal tips that converge toward a central opening in the locked closed position.

12. The refueling lock assembly of claim 11, wherein each of the plurality of blocking beams includes a longitudinal channel that slidably retains a post extending from the pipe mount.

13. The refueling locking assembly of claim 11, wherein the locking device comprises a rotatable housing connected to a rotation link that connects to the cover ring, wherein the rotatable housing is engaged to rotate the cover ring to move the plurality of block beams between the open and closed positions.

14. The refueling locking assembly of claim 1, wherein the pipe mount comprises a capless fuel receiving lid.

15. The refueling locking assembly of claim 1, wherein the proximal end of the fuel pipe includes a capless fuel receiving lid.

16. The refueling locking assembly of claim 1, wherein the locking device comprises a rotatable lock ledge operatively connected to a rotatable cam.

17. The refueling locking assembly of claim 1, wherein the locking device comprises a slam lock having a main body and a locking ledge.

18. The refueling locking assembly of claim 1, wherein the cover comprises one or more vents.

19. The refueling locking assembly of claim 1, wherein the cover comprises a circumferential wall connected to an angled covering wall.

20. The refueling locking assembly of claim 1, wherein the pipe mount comprises one or more securing devices configured to snapably secure to reciprocal features of the fuel fill pipe.

1/14

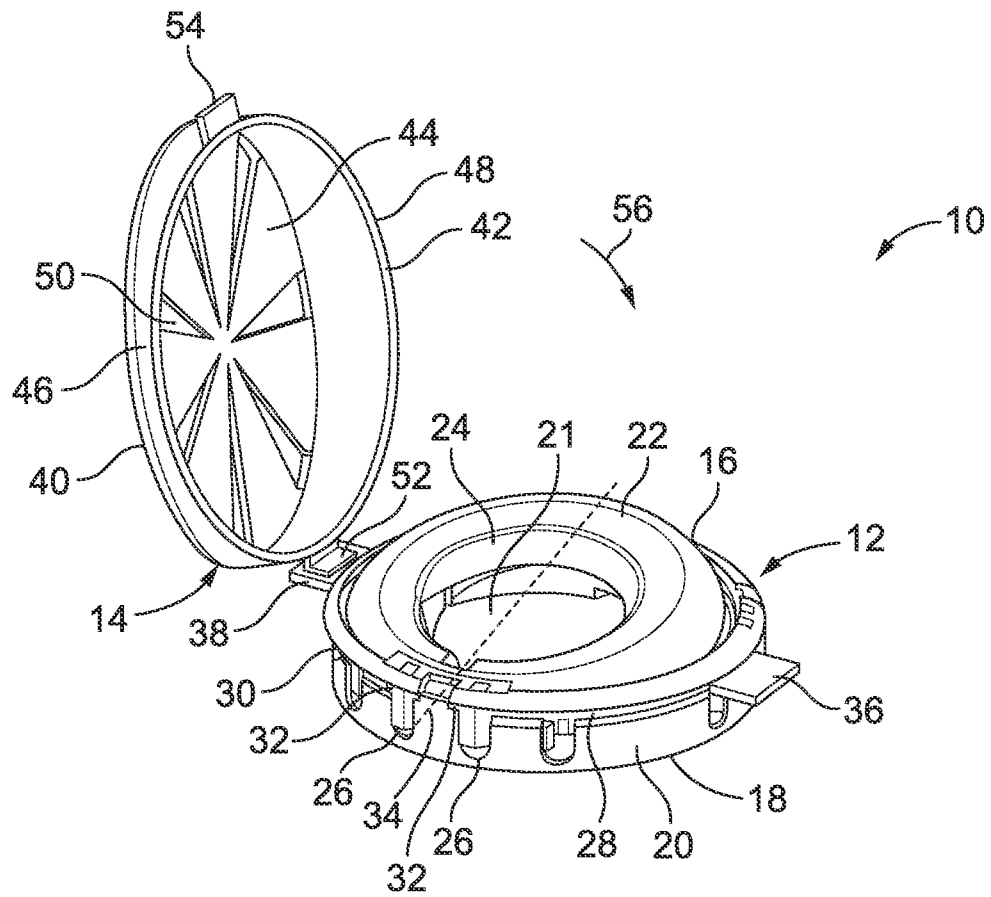


FIG. 1

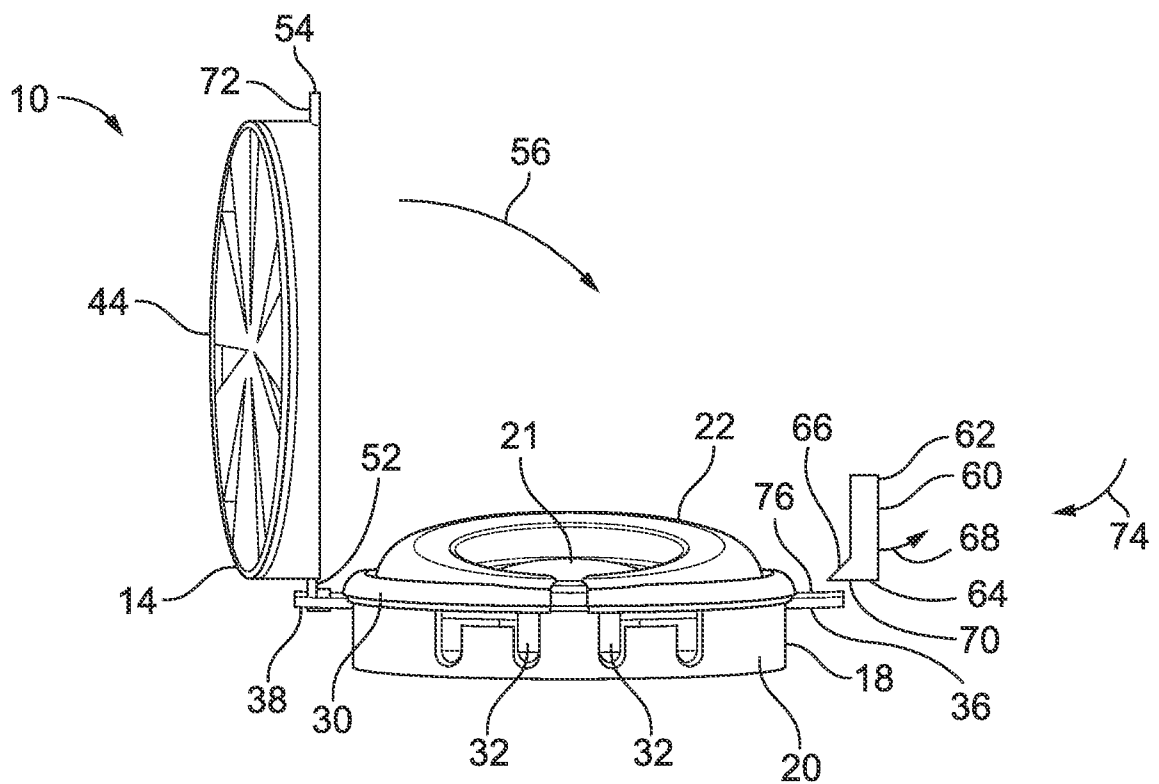


FIG. 2

2/14

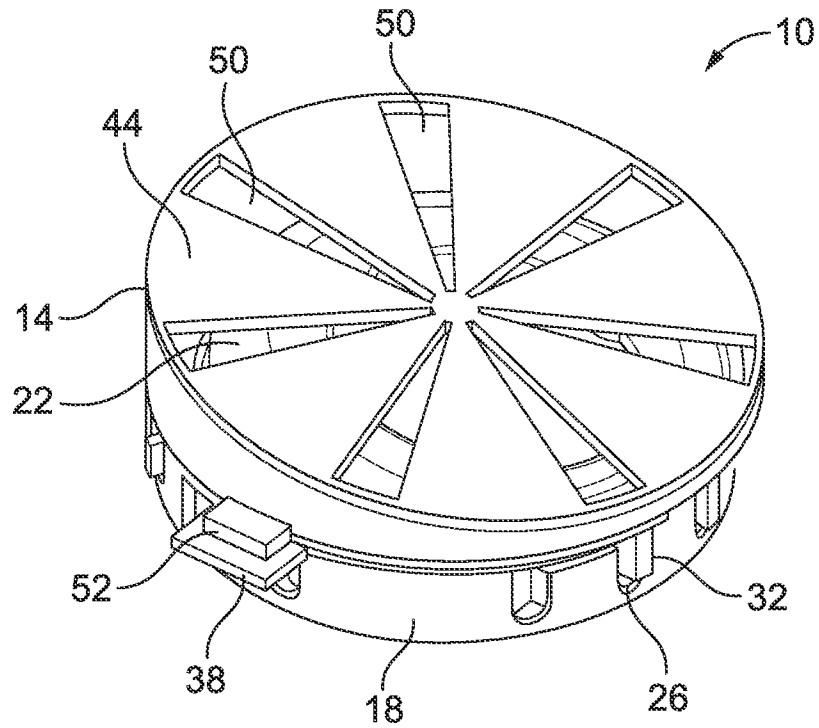


FIG. 3

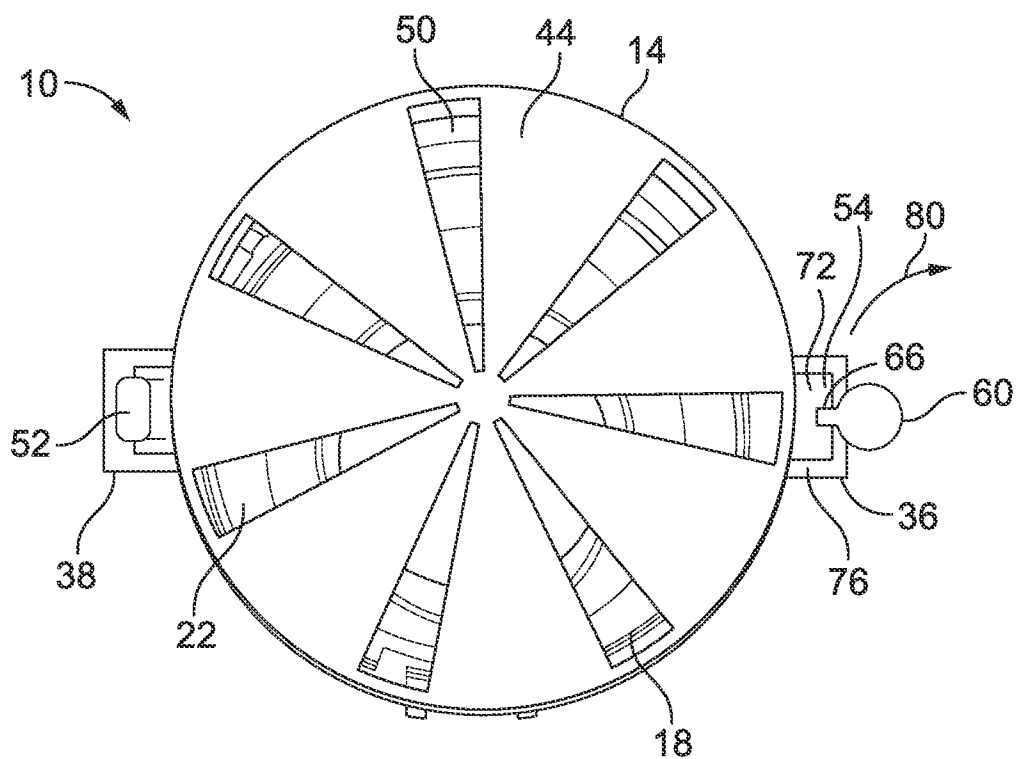


FIG. 4

3/14

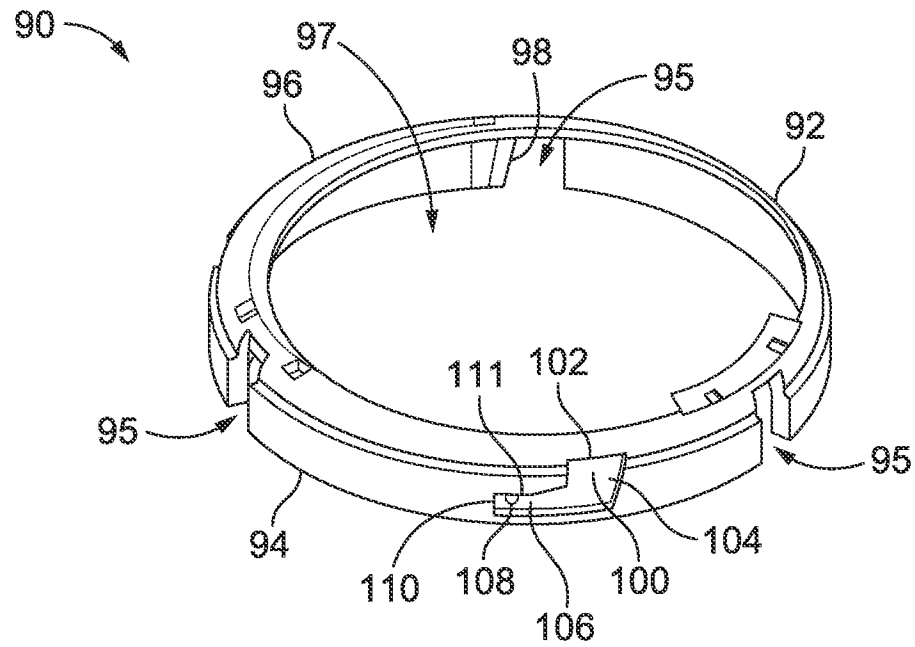


FIG. 5

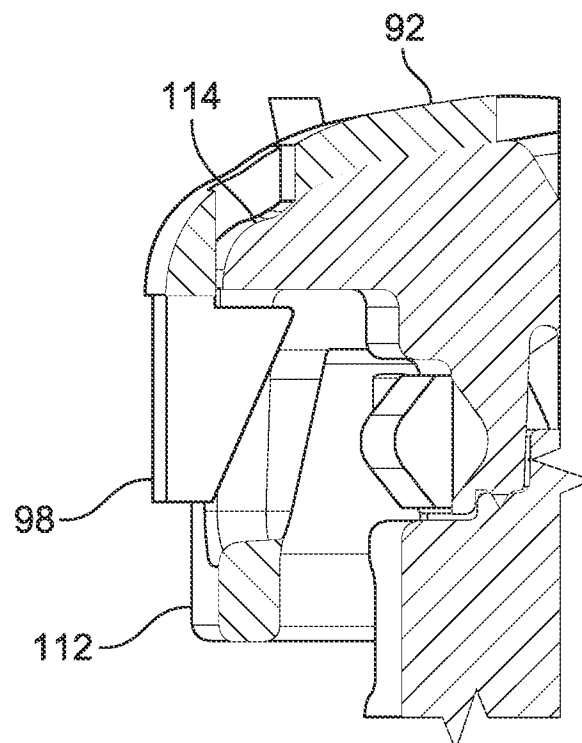


FIG. 6

4/14

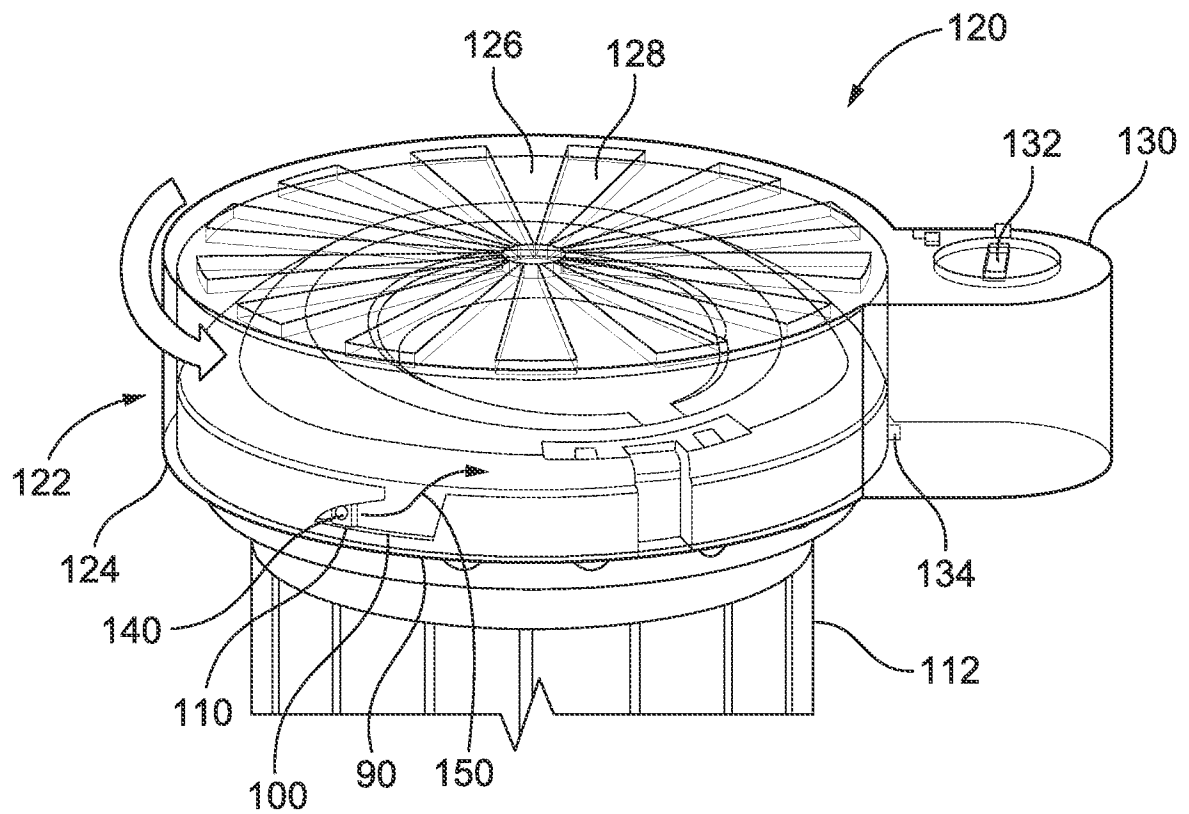


FIG. 7

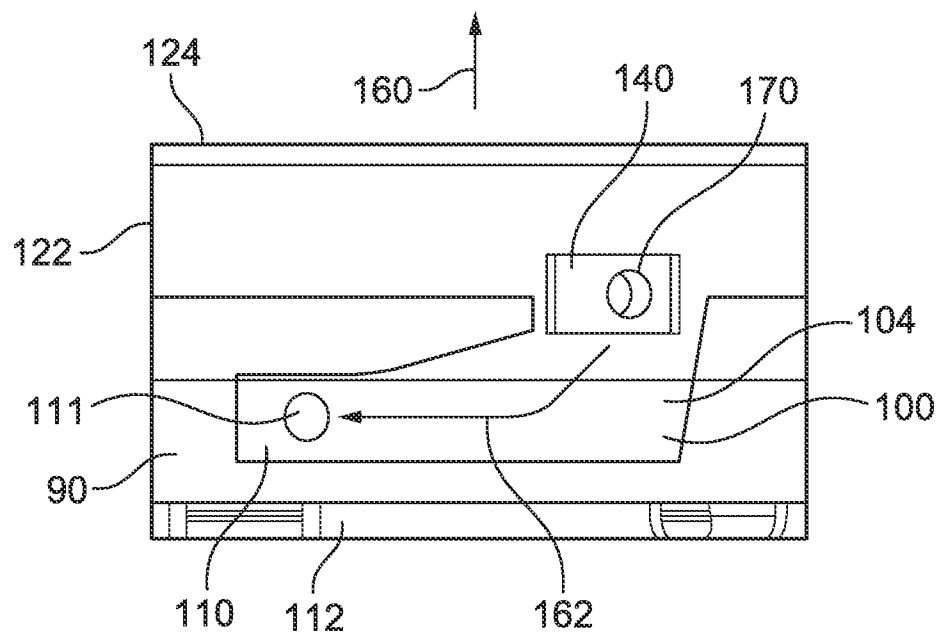


FIG. 8

5/14

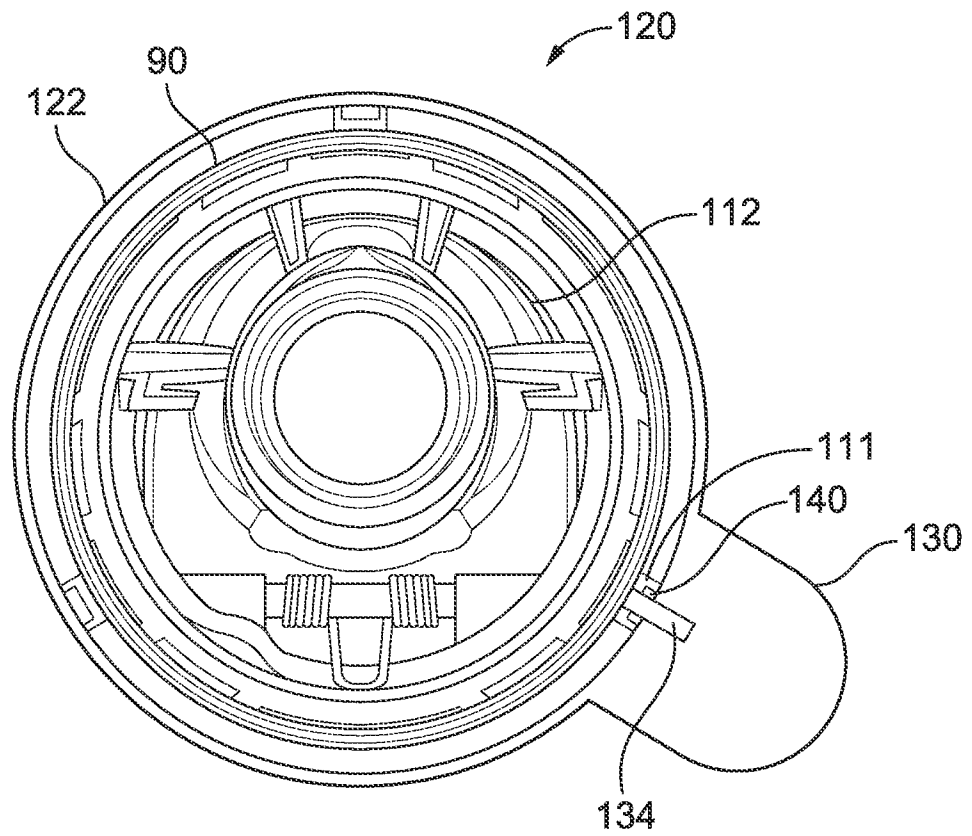


FIG. 9

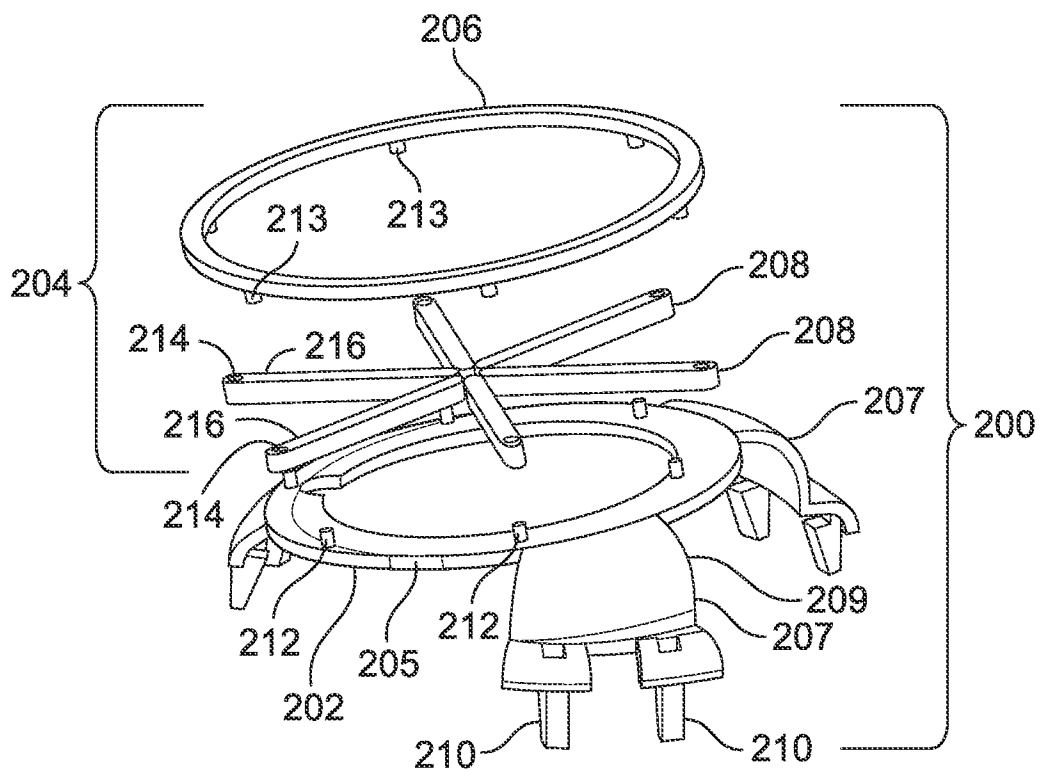


FIG. 10

6/14

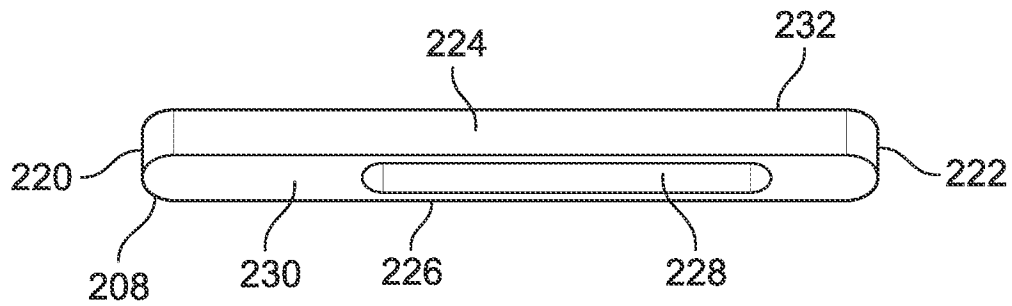


FIG. 11

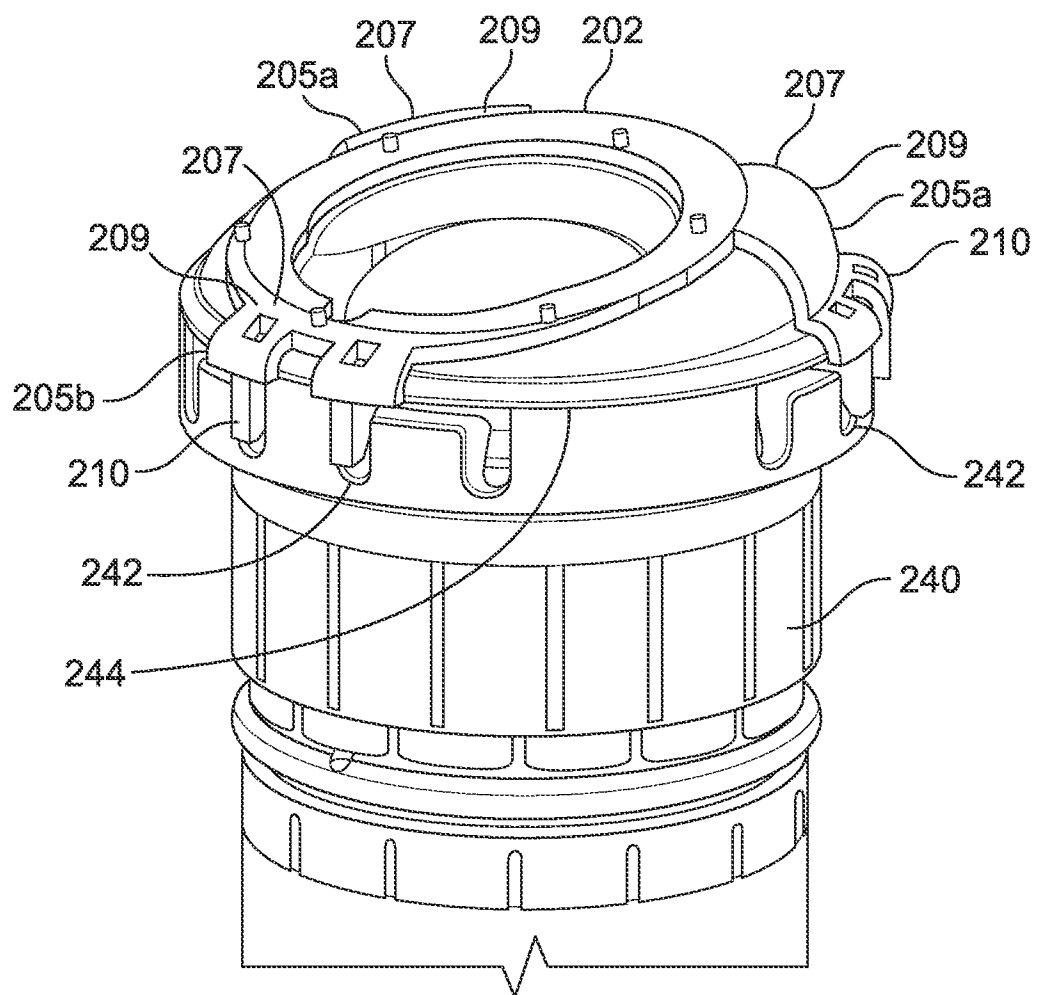


FIG. 12

7/14

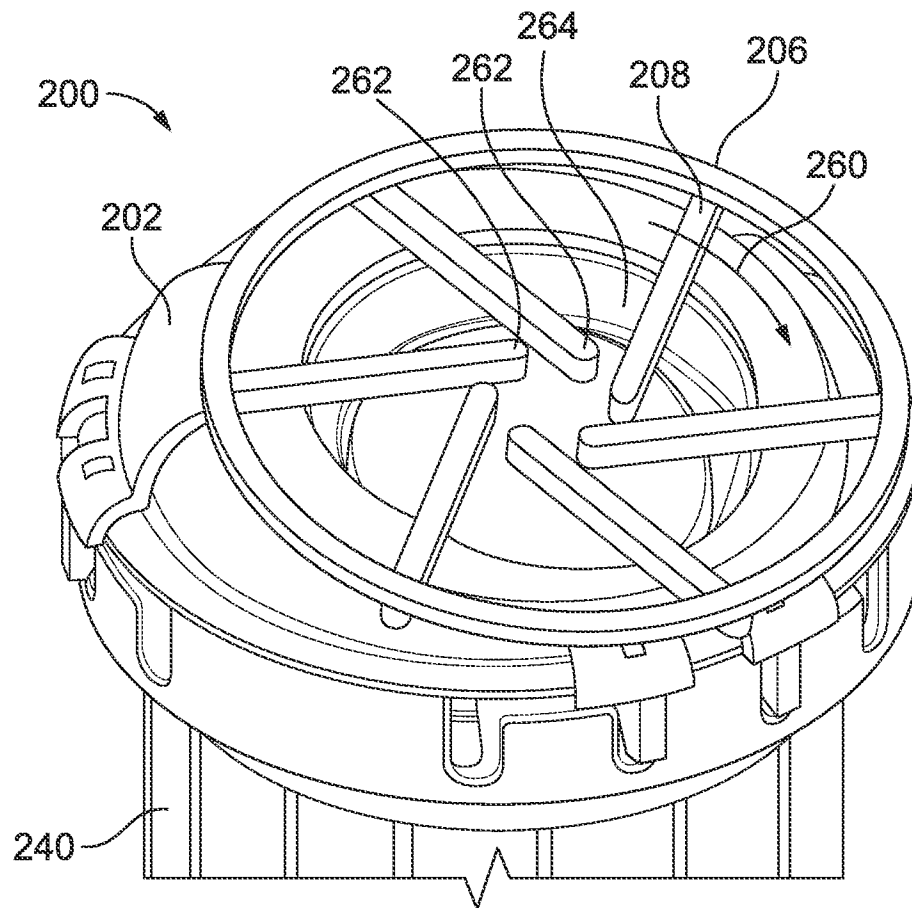


FIG. 13

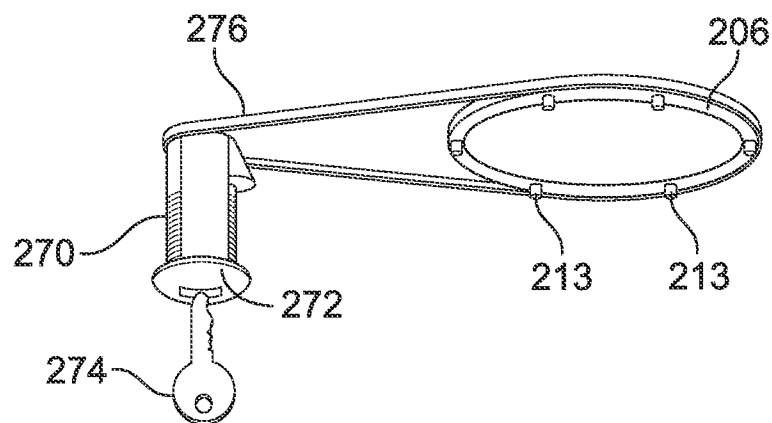


FIG. 14

8/14

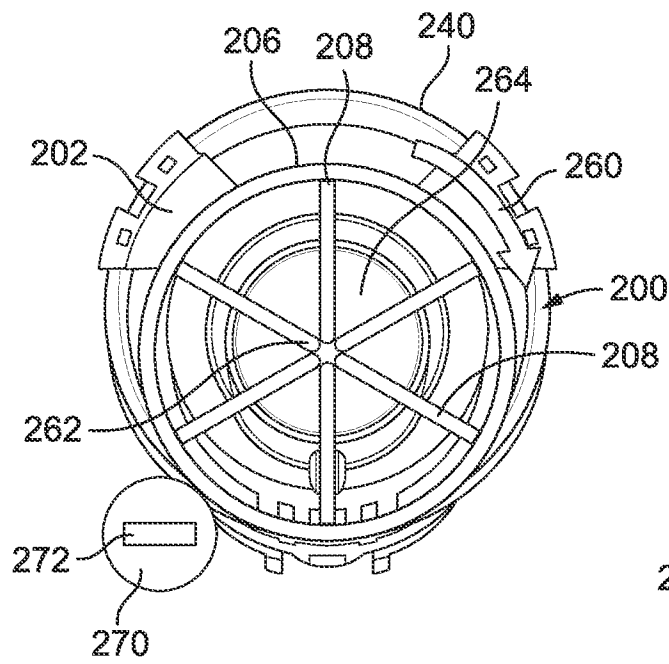


FIG. 15

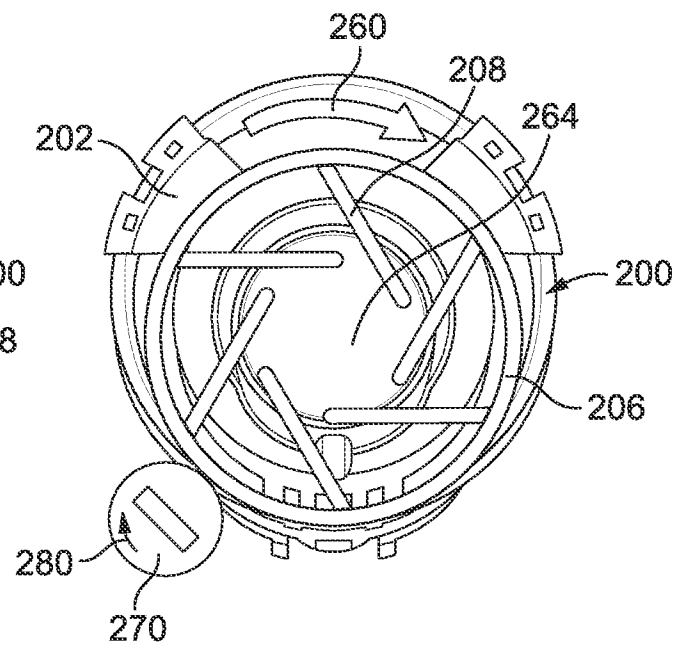


FIG. 16

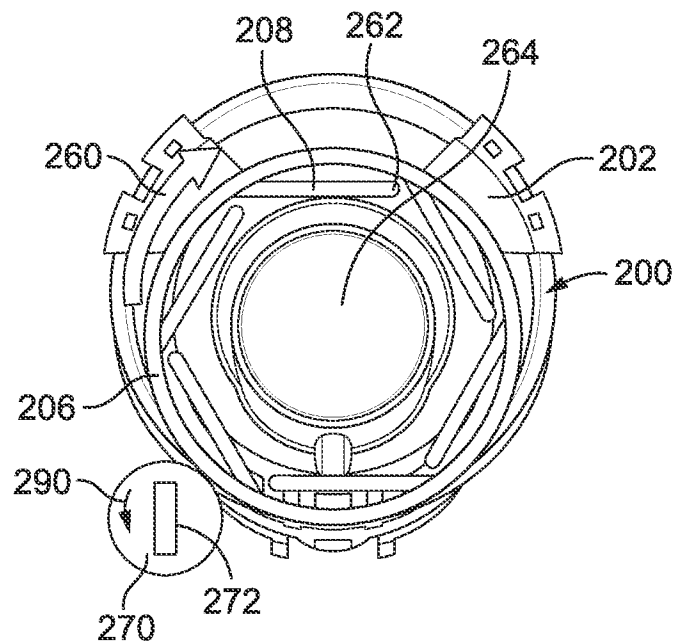


FIG. 17

9/14

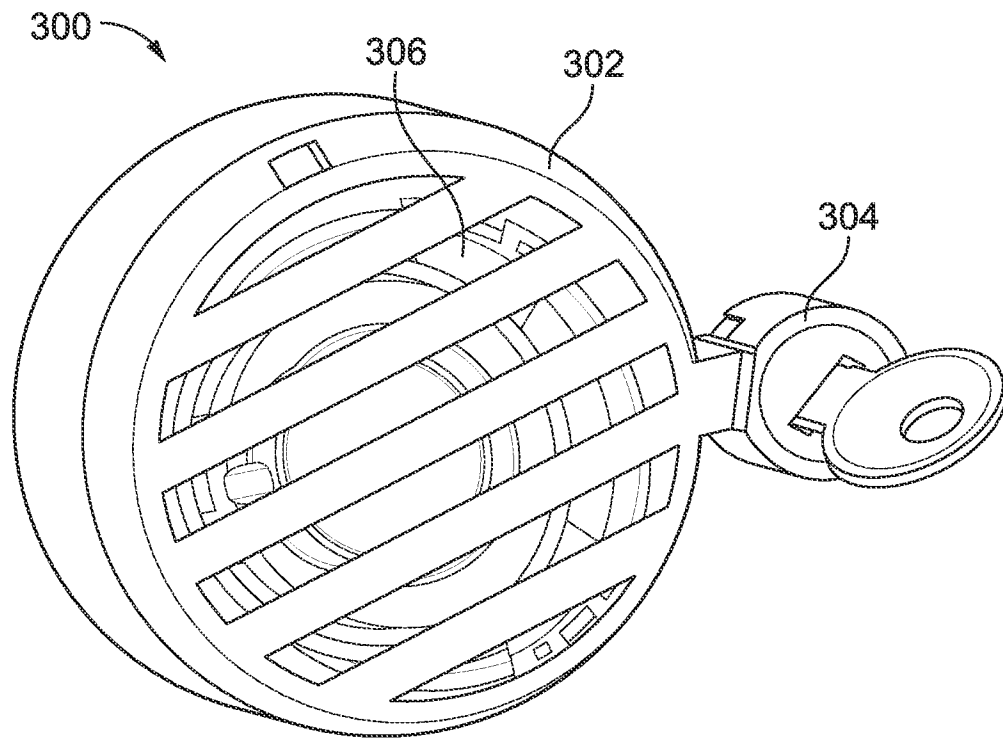


FIG. 18

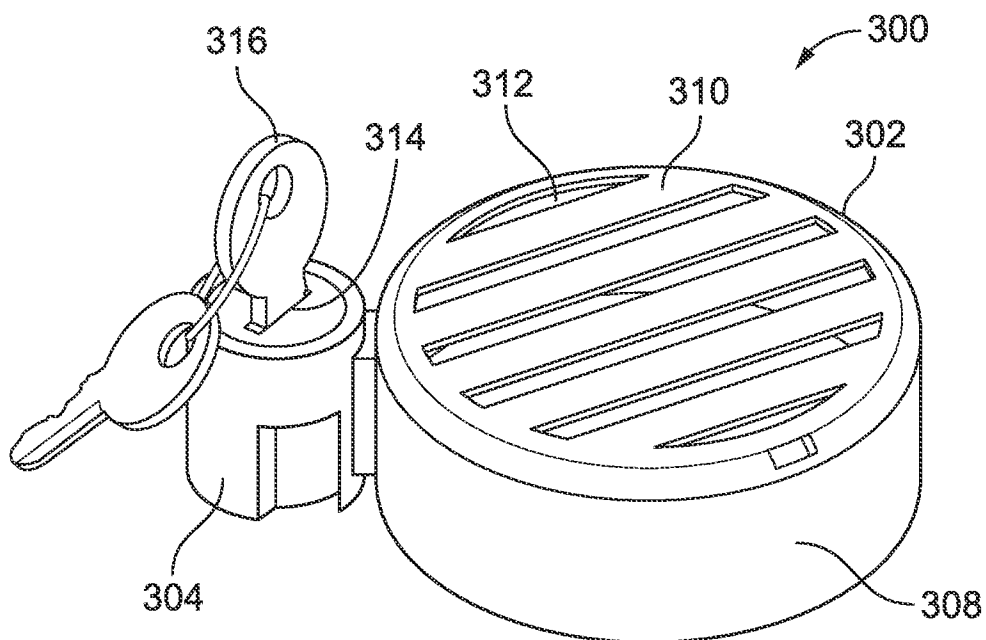


FIG. 19

10/14

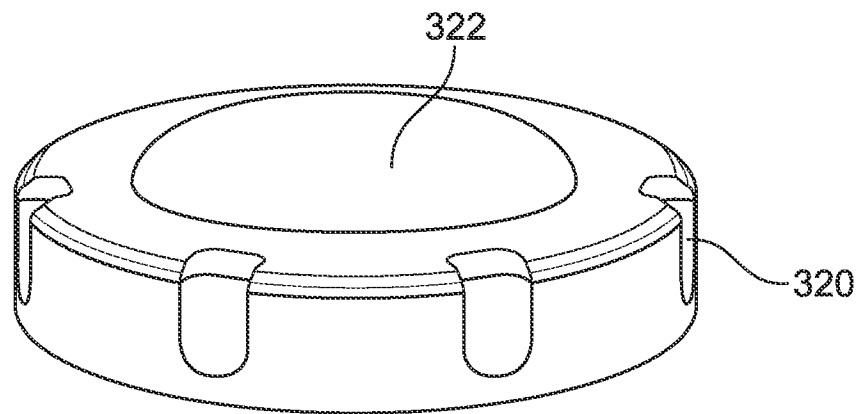


FIG. 20

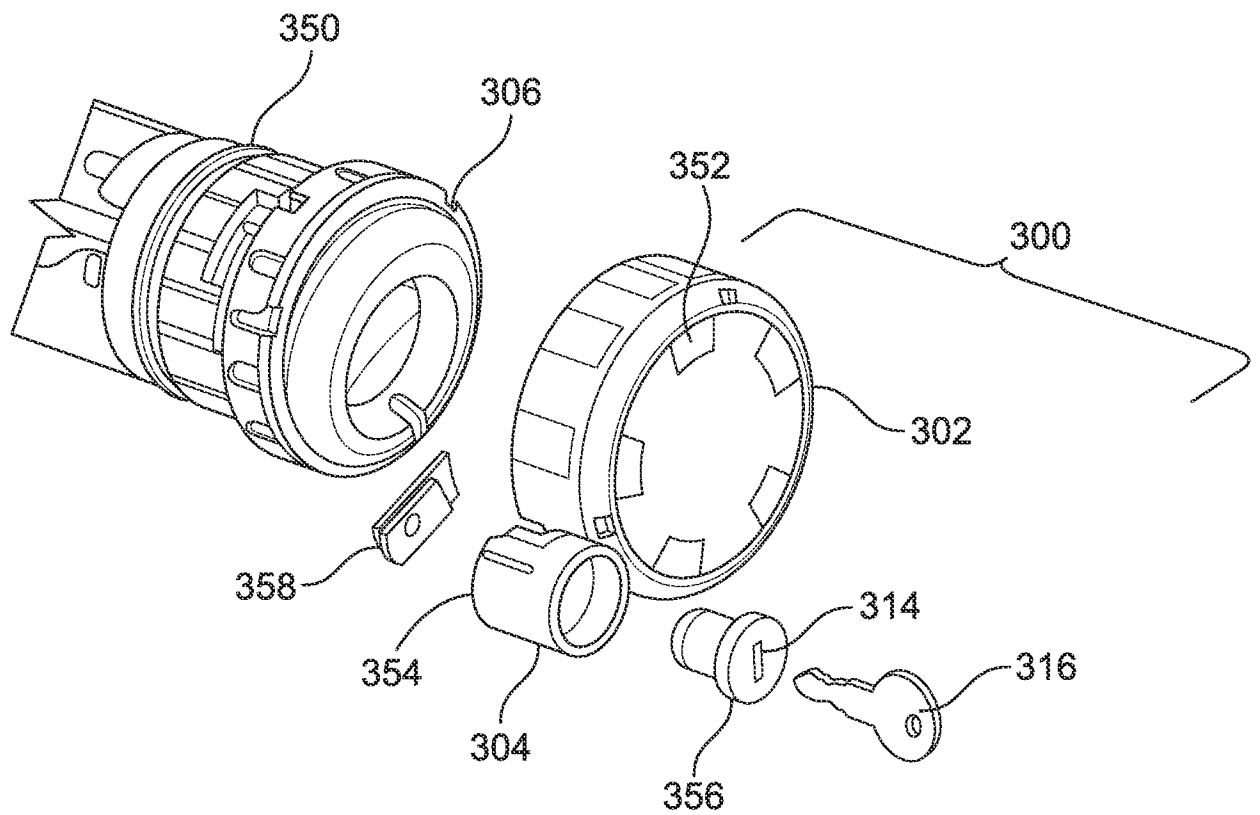


FIG. 21

11/14

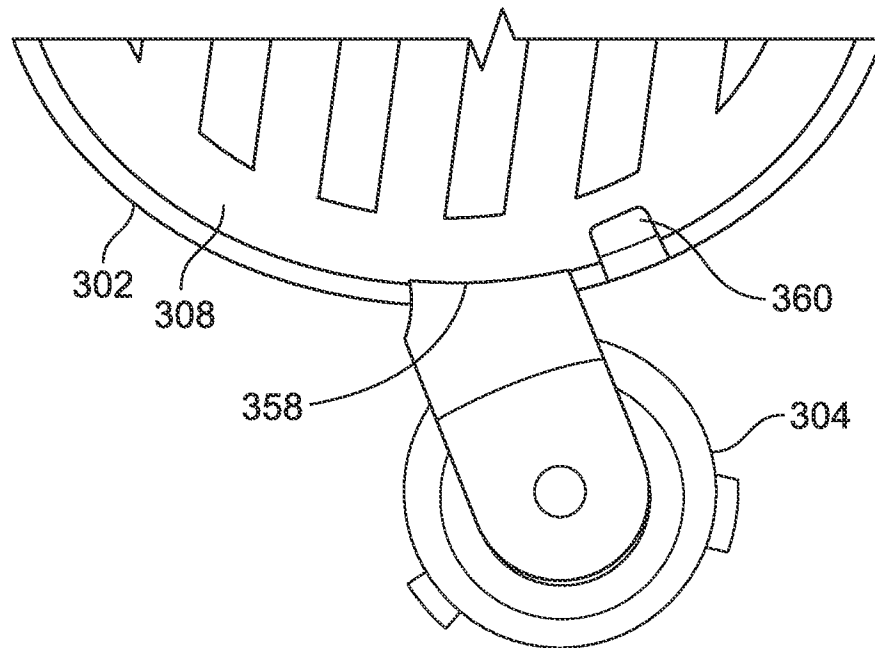


FIG. 22

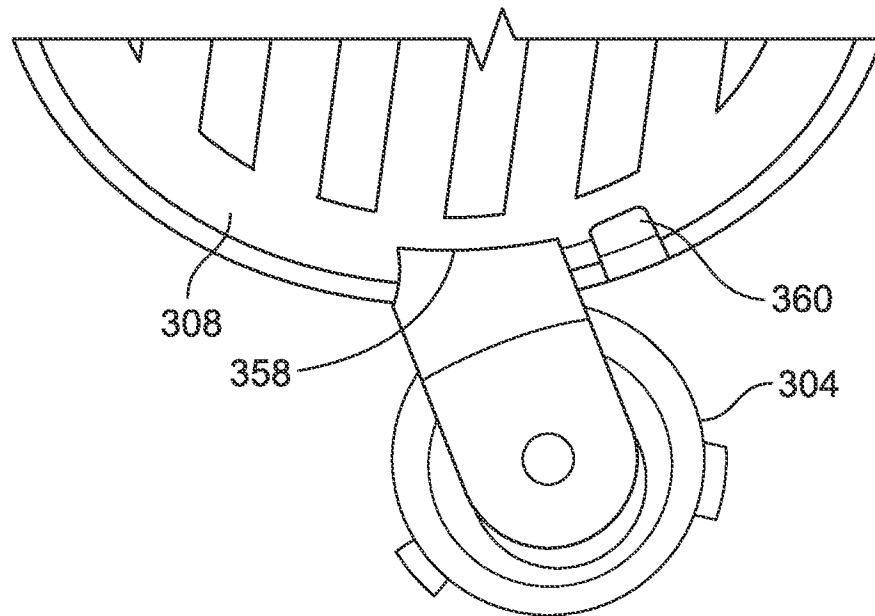


FIG. 23

12/14

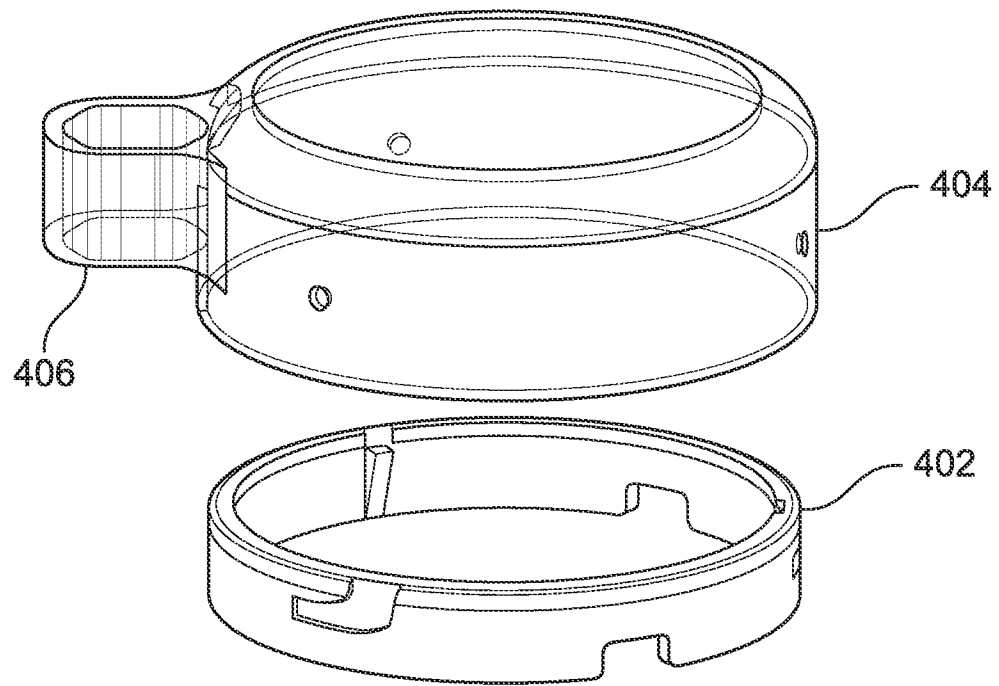


FIG. 24

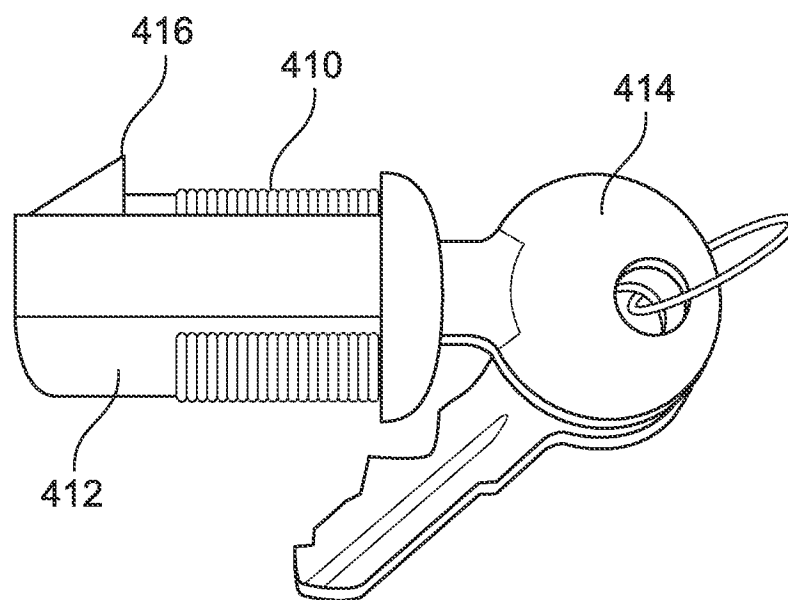


FIG. 25

13/14

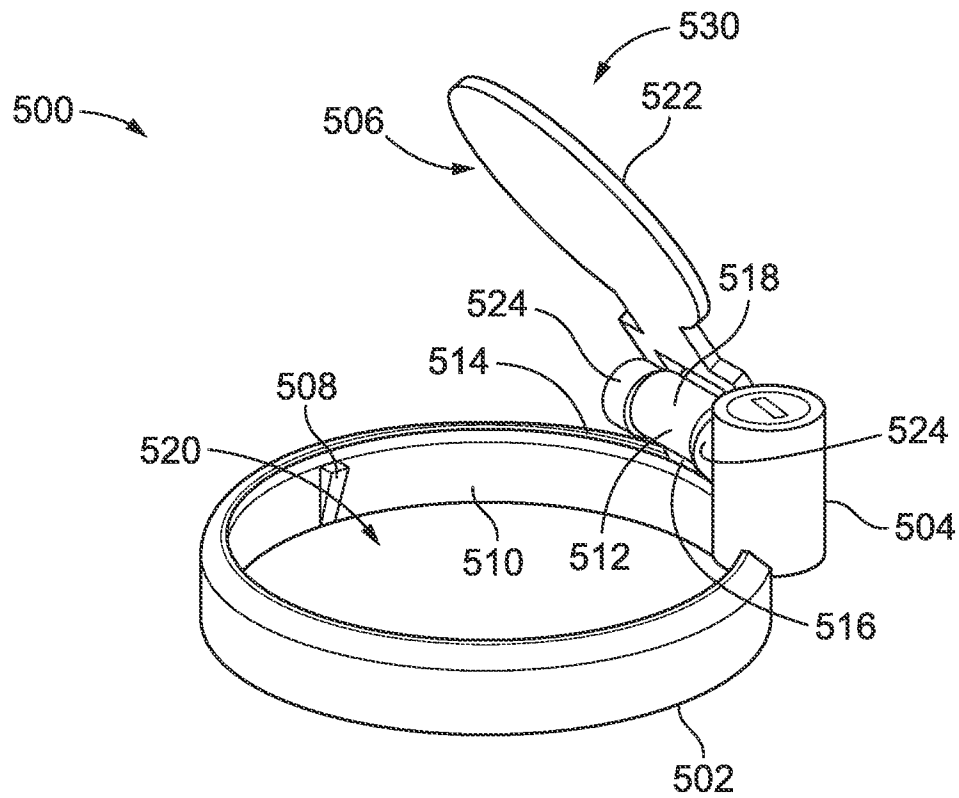


FIG. 26

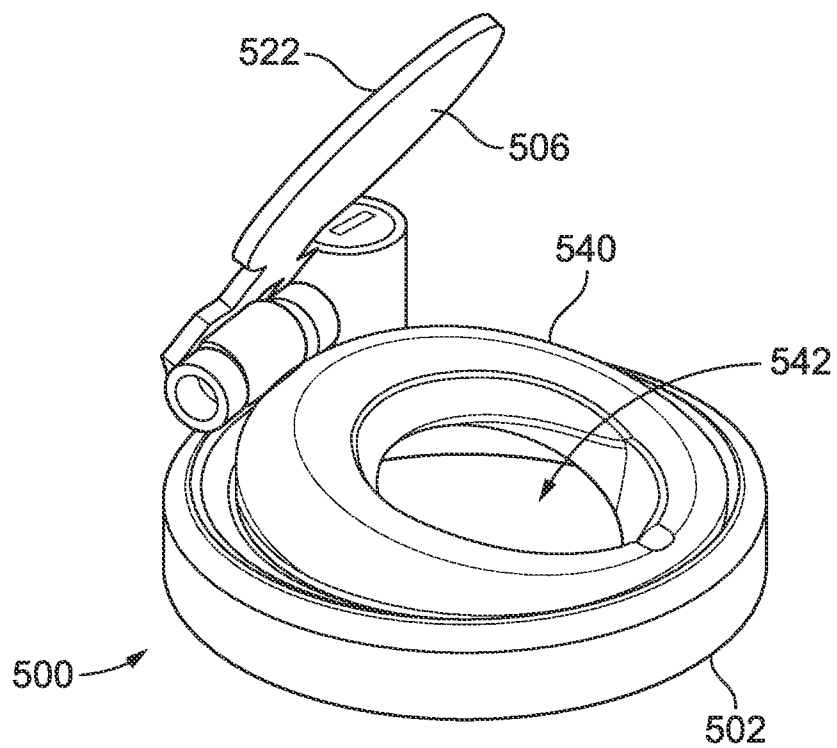


FIG. 27

14/14

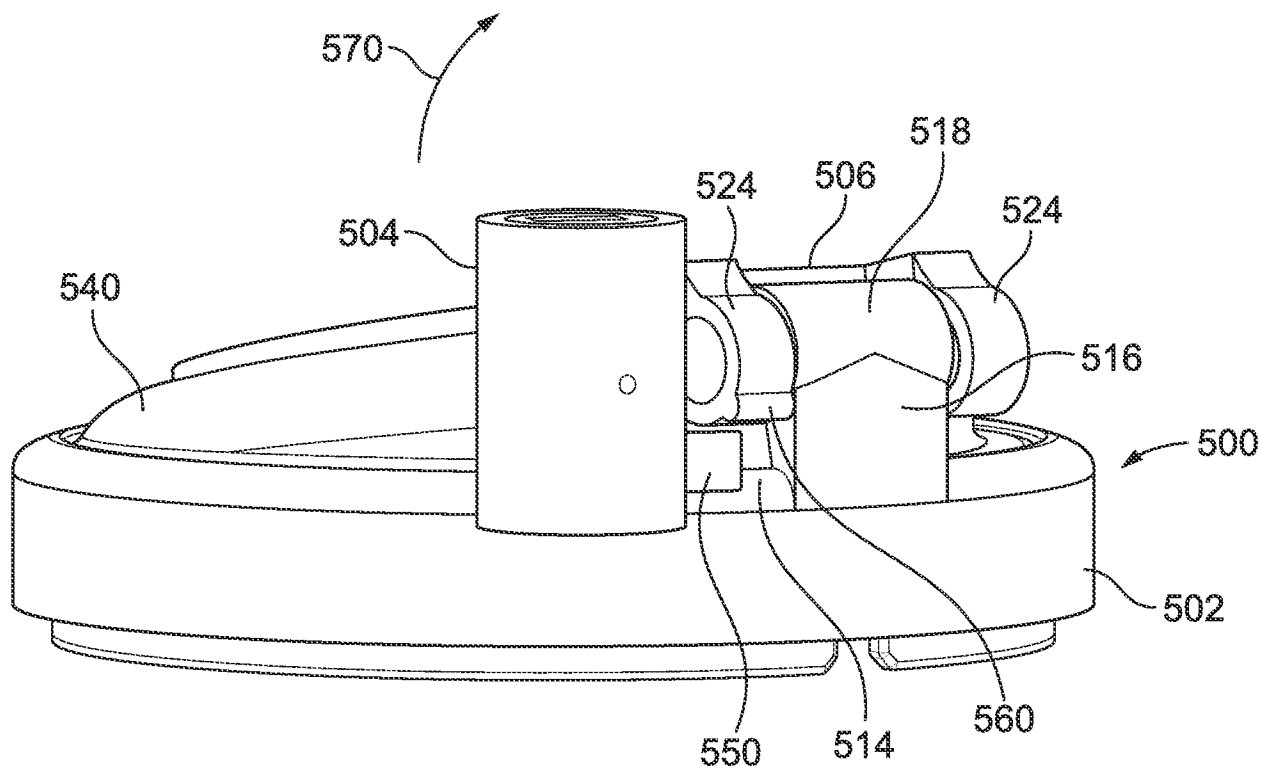


FIG. 28

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/050086

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60K15/04

ADD.

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)

B60K

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 505 637 A (LIONEL CHASE) 25 April 1950 (1950-04-25)	1-3,14, 15,20
Y	figures 1-7	4,16,17

X	US 2 017 837 A (ANSCHICKS RUDOLPH J) 22 October 1935 (1935-10-22)	1-4
	figures 1-3	

X	GB 660 945 A (WILLIAM FRAMPTON SILK) 14 November 1951 (1951-11-14)	1,2,4
	figures 1-3	

Y	US 1 809 186 A (STANT KYLE E) 9 June 1931 (1931-06-09)	4
	figures 1-4	

	-/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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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

"&" document member of the same patent family

Date of the actual completion of the international search

2 October 2013

Date of mailing of the international search report

16/10/2013

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Yildirim, Ismet

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/050086

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 621 154 A1 (JOURNEE PAUL SA [FR]) 26 October 1994 (1994-10-26) figure 2	16,17

A	US 5 507 324 A (WHITLEY II WARWICK M [US] ET AL) 16 April 1996 (1996-04-16) figure 4	5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/050086

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US 2017837	A	22-10-1935	NONE
GB 660945	A	14-11-1951	NONE
US 1809186	A	09-06-1931	NONE
EP 0621154	A1	26-10-1994	DE 69400812 D1 05-12-1996 DE 69400812 T2 27-02-1997 EP 0621154 A1 26-10-1994 ES 2096419 T3 01-03-1997 FR 2704299 A1 28-10-1994
US 5507324	A	16-04-1996	NONE