

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
12 September 2008 (12.09.2008)

PCT

(10) International Publication Number
WO 2008/109035 A1

(51) International Patent Classification:
B67D 3/04 (2006.01) *F16K 31/50* (2006.01)

(74) Agent: FUCHS, Joseph, A.; Rockey, Depke & Lyons, LLC, Suite 5450 Sears Tower, 233 S. Wacker Drive, Chicago, IL 60606 (US).

(21) International Application Number:
PCT/US2008/002793

(22) International Filing Date: 3 March 2008 (03.03.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/904,614 2 March 2007 (02.03.2007) US

(71) Applicant (for all designated States except US): RA-PAK, LLC [US/US]; 1201 Windham Parkway, Suite D, Romeoville, IL 60446.

(72) Inventor; and

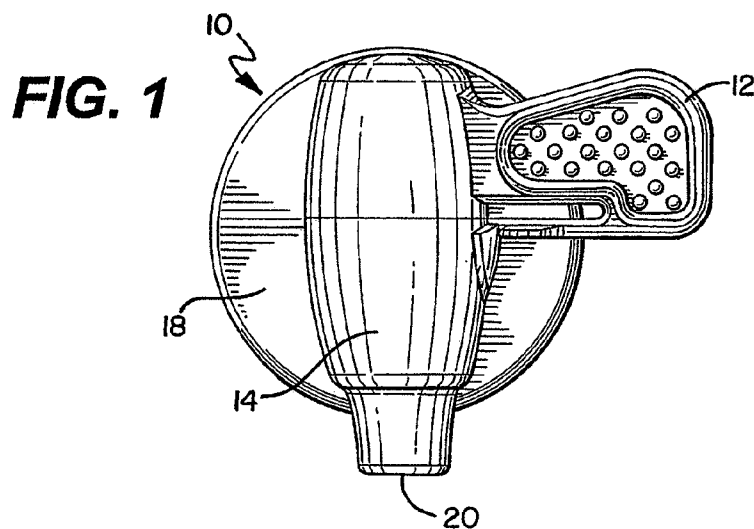
(75) Inventor/Applicant (for US only): SMITH, Mark, A. [US/US]; 12763 Shelly Lane, Plainfield, IL 60544 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL,

[Continued on next page]

(54) Title: CHILD RESISTANT CLOSURE FOR A TAP



(57) Abstract: The present invention provides a tap assembly including (1) a first wall defining a valve chamber having a top surface and a pair of opposed tracks extending axially along an inner surface of the wall, and a fluid outlet, (2) a tap handle mounted to the top surface for rotational movement of the tap handle with respect to the wall, the tap handle having a second wall defining an annular chamber supporting a set of threads, and (3) a generally tubular valve member having a first end and an opposed second end, the first end having a pair of lugs circumferentially spaced from one another, the lugs being positioned within the threads, the second end of the valve member extending into the valve chamber



NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG,
CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

CHILD RESISTANT CLOSURE FOR A TAP

CROSS-REFERENCE TO RELATED APPLICATION:

This Application claims priority to U.S. Provisional Patent Application Serial No. 60/904,614, filed on March 2, 2007, the disclosure of which is incorporated in its entirety herein by reference and made a part hereof.

5 FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT:

Not Applicable.

BACKGROUND OF THE INVENTION:

Technical Field

The present invention relates to a tap for dispensing liquid from a container.

10 Background Art

Tap and valve assemblies have been used within the industry for dispensing fluid from a container to a receptacle or other fluid-receiving device. The typical tap assembly has an attachment member for attaching the tap assembly to a fluid container and a tap handle for positioning a valve member within the body. Moving of the valve member within the body
15 allows for control the flow of fluid through the tap.

Prior art tap dispensing systems have as one of their primary disadvantages a propensity to vibrate open during transportation. Also, tap handles are typically easily manipulated so that children can inadvertently activate the valve allowing the contents of the container to spill causing an unnecessary mess and wastage of the stored product.

20 These and other aspects and attributes of the present invention will be discussed with reference to the following drawings and accompanying specification.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a front elevation view of a tap assembly;

FIG. 2 is an assembly drawing of a tap assembly broken into separate parts;

FIG. 3 is a side elevation view of a tap handle;

5 FIG. 4a is a side elevation view in vertical cross section of one embodiment of a tap handle;

FIG. 4b is a side elevation view in vertical cross section of a second embodiment of a tap handle;

FIG. 5 is a bottom view of a tap handle;

10 FIG. 6a is a side elevation view in cross section of a first embodiment of a valve body of the tap assembly;

FIG. 6b is a CAD drawing of a second embodiment of a valve body of the tap assembly;

FIG. 7 is a front elevation view of a valve stem in cross section;

15 FIG. 8 is a top view of one embodiment of a valve stem;

FIG. 9a is a top view of a second embodiment of a valve stem;

FIG. 9b is a side elevation view of the second embodiment of the valve stem;

FIG. 9c is a front elevation view of the second embodiment of the valve stem;

FIG. 10 is a top view of one embodiment of a chamber of the valve body;

20 FIG. 11 is a top view of a second embodiment of a chamber of the valve body;

FIG. 12 is a detailed view of one embodiment of a pawl of a tap handle inserted into a pocket of a valve body;

FIG. 13a is a detailed view of second embodiment a pawl of a tap handle inserted into a pocket of a valve body;

FIG. 13b is a view taken along line 13b of FIG. 13a showing a view of a second rectangular portion of a pawl;

5 FIG. 14 is a side elevation detailed view in cutaway of one embodiment of a valve assembly showing engaging portions of the tap handle and the valve body;

FIG 15 is a top view of one embodiment of a valve body showing tap handle retaining members;

10 FIG. 16 is a detailed view in side elevation and in cutaway of a second embodiment of a valve assembly showing engaging portions of the tap handle and the valve body;

FIG 17 is a top view of a second embodiment of a valve body showing tap handle retaining members; and

FIG. 18 is breakaway view of an alternate embodiment of a tab having a beveled outer surface.

15 DETAILED DESCRIPTION OF THE INVENTION:

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings, and will be described herein in detail, specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific
20 embodiments illustrated.

FIGS. 1 and 2 show one preferred form of a tap assembly 10 having a tap handle 12, a valve body 14 and a valve stem 16. The stem 16 can be inserted into the body 14 and the tap handle 12 can be attached to the body by hand or by machine. In one preferred form of the invention, these parts are snap fit together to form the assembly such that it is difficult to
25 disassemble the parts without breaking or damaging them to some degree. The tap assembly 10 has a portion 18 for attaching the assembly to a liquid filled container (not shown) for dispensing the contents of the container through an exit 20 in the valve body 14 into a

receiving vessel (not shown). The tap handle 12 can be moved by rotating it with respect to an axis 22 (FIG. 3) causing the valve stem 16 to move vertically, in reciprocating fashion, from a first position where the tap is sealed, and no fluid is allowed to flow through the exit 20, to a second open position where fluid is allowed to flow through the valve body and through the exit 20.

FIGS. 3-5 show the tap handle 12 having a head portion 30 and a tail portion 32. The head portion 30 has a first outer wall 34 concentrically disposed about a second inner annular wall 36 defining an annular chamber 38 between the walls. The second inner annular wall 36 defines a central chamber 40 for receiving a portion of the valve stem 16. A set of threads 42 are positioned on an inner surface 44 of the second inner annular wall 36 and extend from a proximal end 46 to a distal end 48 of the second inner annular wall 36. The threads have two generally U-shaped tracks 50a and 50b each having a bottom wall 51 and two upstanding, opposed sidewalls 52. Each track extends along a spiral path with one track rotating clockwise about axis 22 and the opposed track rotating counterclockwise about the axis 22. The opposed sidewalls 52 are horizontally spaced from one another to define a width of the track and have a height defining a depth of the tracks. Each of the tracks has a lead-in section 54 at the proximal end of the wall 46 circumferentially spaced from one another by 180°. The lead-in section of the tracks has greater width than the remaining portions of the tracks. The tracks are provided to receive a pair of lugs 56 (FIGS. 8, 9) on the valve stem 16 where the valve stem lugs 56 can move from the proximal end 46, where the valve is in a closed position, to the distal end 48 of the tracks, where the valve is in a fully opened position. The valve stem 16 can be moved from the closed position to the fully opened position, in one preferred form of the invention, by rotation of the tap handle from about 120° to about 180° the axis 22.

The head portion 30 of the tap handle 12 carries an attaching member 70 for attaching the tap handle to the body 14 and to allow for rotational movement of the tap handle 12 about the axis 22. In one preferred form of the invention shown in FIGS. 4a and 14, the attaching member 70 has an annular collar 71 and an annular flange 72. The collar 71 is defined by a reduced diameter portion of the outer wall 34. The annular flange 72 has top surface 73 extending radially outward from the wall 34 to an end point 74 where the end point has a diameter that is larger than that of the annular collar 71 but smaller than the diameter of the

outer wall 34. A front surface 75 extends from the end point downwardly and tapers axially inwardly to an end point 76. As will be discussed below, the collar 71 and the annular flange 72 are inserted into an annular space in the valve body 14 such that the tap handle 12 is retained within the valve body 14 yet able to rotate about the axis 22 by a user of the tap assembly 10.

In a more preferred form of the invention shown in FIGS. 4b and 15, the attaching member 70 will have a second annular collar 77 on an opposite side of the annular flange 72 from the first annular collar 71.

The tail portion 32 of the tap handle 12 has a finger-grasping portion 60 having a textured planar surface 62, which in one preferred form of the invention shown in FIGS. 1 and 3, is defined by a plurality of horizontally spaced protuberances 64 each having a generally circular shape when viewed in horizontal cross section. A latch member 66 depends from a bottom edge 68 of the finger-grasping portion 60 and extends from a distal end 69 of the tail portion 32 inwardly toward the head portion 30 of the tap handle 12. The latch member 66 has an arm 70, a flange 72 extending from each opposed lateral edge from an intermediate portion of the arm 70 to form a generally arrow-shaped flange section 73, and a pawl 74 at a distal end of the arm 70. As will be described in greater detail below, the pawl 74 is dimensioned to releasably engage a pocket 79 on the valve body 14 as shown in FIGS. 12 and 13a,b to prevent rotational movement of the tap handle 12 about the axis 22.

In one preferred form of the invention the pawl 74 is generally rectangular in shape as shown in FIG. 12 and locks within a generally rectangular shaped detent or pocket 79 on the valve body 14. In a more preferred form of the invention shown in FIGS. 13a,b, the pawl 74 will have a T-shape defined by a first rectangular shaped section 80 extending in generally the same direction as the arm and a second rectangular shaped section 82 transversely disposed to the first rectangular section and being attached to the first rectangular section 80 at an intermediate portion of the second rectangular portion. The valve body 14 has a corresponding T-shaped pocket 79 (FIG. 6b) for receiving the T-shaped pawl 74. FIG. 13b shows the second rectangular section 82 in elevation having a leading surface 83 that tapers inwardly from a top surface 84 to a bottom surface 85. Optionally, the trailing edge 86 can have a complementary taper.

A gap 90 is provided between the arm 70 and a bottom edge 92 of the tail portion 32 of the tap handle 12. The gap 90 provides space for the arm to deflect when pressed by a user of the tap delivering a force in a direction generally in line with the axis 22. Moving the arm upward unlocks the arm by causing the pawl 74 to extend outside of the pocket 79 to allow
5 for rotation of the tap handle 12 about the axis 22. The tap handle provides a child protective feature to prevent opening of the valve by an under-aged user of the tap 10 and assists in preventing inadvertent opening of the tap 10 during shipping, use or at other times.

FIGS. 1, 2, 6a,b; 10, 11, and 14-17 show various aspects of two preferred forms of the valve body 14. FIG. 6a,b show the container attaching member 18 having a face plate 110
10 and a first annular wall 112 extending axially away from an inner surface 114 of the face plate 110. The first annular wall 112 defines a fluid passageway 116 therethrough, and, in a preferred form of the invention, is generally cylindrical in shape. The first annular wall 112 has an outer surface 118 with a series of axially spaced rings 120 having differing diameters. The rings 120 assist in forming a fluid tight seal with a receptacle of a container that is
15 dimensioned to form a fluid tight seal with the first annular wall 112. Suitable containers include, for example, flexible bags, semi-rigid containers, rigid containers, cartons or other type fluid container. The fluid container can be made from polymeric material, paperboard or other suitable material.

A second wall 122 extends axially away from a front surface 124 of the face plate 110
20 and defines a fluid channel 126 therethrough. The fluid channel 126 is in fluid communication with the fluid passageway 116.

A valve housing 130 is attached to the second wall 122 and extends in a direction transverse, and more preferably generally perpendicular, to the direction in which the second wall 122 extends. It is contemplated, however, that the valve housing 130 can extend in line
25 with the second wall 122 or replace it all together. In a preferred form of the invention, the valve housing 130 is defined by a third wall 131 having in consecutive order, from top to bottom, a first section 136 having a first diameter, a second section 138 having a second diameter larger than the first diameter and a third section 140 having a third diameter smaller than the second diameter. The third wall is generally cylindrical and is concentrically
30 disposed about the axis 22. The first section 136 is for receiving the attaching member 70 of the tap handle. The second section 138 provides at least two sets of opposed guides 134

circumferentially spaced approximately 180° from one another and each set of opposed guides 134 extending axially along opposed portions of an inner surface 135 of the third wall 131 in which opposed projections from the valve stem 16 slide therein. The third section 140 defines the fluid outlet 20.

5 In one preferred form of the invention shown in FIG. 6a, each guide set 134 is defined by a pair of spaced protuberances 137 extending along essentially an entire height (or length) of the intermediate section 138 and radially inwardly from an inner surface of the intermediate section defining a track 139 therebetween. Each track 139 is dimensioned to receive a wing 200 extending from opposite sides of the valve stem (FIG. 10). In a more
10 preferred form of the invention shown in FIGS. 6b and 11, each guide 134 is generally concave-shaped chamber 147 defined between the outer wall 135 and a chord wall 141 extending between opposed points 143 along an arcuate portion of the inner wall 135 and inwardly into the valve chamber 132. The chord wall 141 has a portion removed along its height to define a slot 144. FIG. 11 shows each concave shaped chamber is dimensioned to
15 receive a generally T-shaped wing 200' extending from opposed portions of the valve member 12 such the valve member is more securely retained in the channel upon experiencing axially inwardly directed forces which may dislodge the wing from the channel shown in FIGS. 6a and 10. The guide sets 134 restrict the movement of the valve member 16 in the valve chamber to reciprocating movement, up and down or back and forth, in the valve
20 chamber in response to rotation of the valve stem, to move the valve assembly 10 between closed and open positions.

An annular groove 150 is provided between the first section 136 and the intermediate section 138 to define an outer cylindrical wall section 152 and an inner cylindrical wall 154 each concentrically disposed about the axis 22. The groove 150 is dimensioned to receive the
25 attaching member 70 of the tap handle 12. A retaining member 156 is provided to lock the attaching member 70 into the groove so that it is difficult to remove the tap handle from the valve body after the parts are assembled together. In one form of the invention the retaining member 156 extends from an inner surface 158 of the outer cylindrical wall 152, and, as shown in FIG. 15, is a plurality of circumferentially spaced annular protuberances 160
30 separated by gaps 161 that fit into and engage the collar 71 of the tap handle 12 as shown in FIG. 14. Each of the annular protuberances 160 has a generally flat top surface 162 and front

edge 164 and a generally U-shaped notch 166. The top and front edges engage the collar 71 of the tap handle 12 as shown in FIG. 14 and the flange 72 of the tap handle fits within the U-shape notch 166. It is contemplated the annular protuberances 160 and gaps 161 could be replaced by a single annular protuberance that extends about the full circumference of the wall 152 and without gaps.

In a more preferred form of the invention the retaining member 156 includes a plurality of circumferentially spaced, segmented tabs 180 each having a portion extending axially inwardly into the groove 150 from the inner surface 158 of the outer cylindrical wall section 152. In one preferred form of the invention shown in FIG. 16, the tabs 180 have a generally flat upper surface 182, a generally flat front surface 184, a generally flat bottom surface 186 and an inwardly (toward the groove 150 inward from the outer wall 152) and downwardly sloping return wall 188. Unlike the U-shape notch 166 that has a rounded bottom surface 190 of the embodiment shown in FIG. 14, the flat bottom surface 186 and return wall 188 meet at a sharp point 192 to define a generally V-shaped notch. A substantial portion of a length of the top surface 73 of the flange 72 of the tap handle 12 is in registration with the bottom surface 186. Further, the end point of the flange 74 is positioned within the sharp point 192 so that the tap handle 12 is securely retained within the groove 150 of the body 14.

In another preferred form of the invention, the upper surface 182 and the front surface 184 will meet at a downwardly and inwardly sloping beveled surface 195 shown in FIG. 18. During assembly, the beveled surface 195 will serve as a lead-in when attaching the tap handle 12 to the body 14. During insertion of the attaching member 70 into the groove 150, the flange 72 of the tap handle 12 will engage the beveled surface 195 and the flange will deflect radially inwardly of the body 14 and then snap radially outwardly when the flange 72 is in registration with the V-shaped notch 192. When the attaching member 70 is fully inserted into the groove 150, the second annular collar 77 will extend nearly into the full depth of the groove 150 to further increase the retention force between the tap handle 12 and the body 14 when compared to the embodiment shown in FIG. 14 where the attaching member 70 has no second collar distal from the flange 72.

FIG. 6b also shows one preferred form of the invention having a second annular protuberance 196 extending from an outer surface 197 of the inner cylindrical wall 154. The second annular protuberance 196 cooperates with the tabs 180 to retain the tap handle 12.

FIGS. 2 and 6b show a platform 202 projecting from the outer wall 130, and in a preferred form of the invention on a portion of the outer wall opposite from where one of the guides 134 extends inside the valve chamber. In one preferred form of the invention the platform 202 has a generally quadra-spherical shape (one quarter of a sphere) having an upper surface 204 having a portion removed to define the pocket 79, which is described in detail above.

FIG. 6b shows a preferred form of the platform 202 having a leading edge 240 that tapers downwardly and outwardly from the top surface 204 to form a lead-in or camming surface 240. The camming surface 240 cooperatively engages the leading edge 83 of the second rectangular section 82 of the pawl 74 when moving the tap handle 12 from an open position to a closed position. The pocket 79 of the platform 202 has a generally T-shape to conform to the shape of the pawl 74. A first portion 242 of the pocket 79 is for engaging the first rectangular section 80. The first portion 242 of the pocket 79 is shown having a front 244 and rear 246 vertically extending side walls and a horizontally extending bottom wall 248 connecting the front and rear 244, 246 front and rear walls. In a preferred form of the invention, the front wall 244 will taper 249 inwardly of the and upwardly from the bottom wall 248. The taper 249 provides an axially downward force to the pawl 79 of the latch 70 when the tap handle is rotated in a clockwise direction without providing a lifting force to the latch 70. Thus, the taper 249 assist in inadvertent actuation of the valve.

A second portion 250 of the pocket 79 is generally rectangular in shape to receive the second rectangular portion 82 of the pawl 74. The second portion 250 of the pocket 79 has a depth sufficient to receive the top and bottom surfaces 82, 85 of the second rectangular portion 82 such that the top surface 82 of the pawl 74 is flush with or below surface 204 of the platform 202.

FIGS. 2, 7-9, show two preferred forms of the valve stem 16. FIGS. 7 and 8 show the valve stem 16 has a generally tubular body 210 defining a generally hollow core 212. A first end 211 of the valve stem has a ring 214 and a pair of circumferentially spaced and radially

outwardly projecting lugs 56. In a preferred form of the invention two lugs are provided and are spaced 180° from one another. A second end 215 of the valve stem 16 has flared 216 distal end having a diameter greater than that of an intermediate portion 217 of the valve stem and defines a sealing ring having a height 218. The height 218 of the sealing ring is adequate to seal the end of the fluid outlet 20 when the valve assembly is in the closed position. A pair of circumferentially spaced wings 200 extend radially outwardly from the tubular body 210, along a length of the intermediate portion 217 of the valve stem 16, and, in one preferred form of the invention, has a generally rectangular shape when view in horizontal cross section or from the top as shown in FIG. 8, and a generally E-shape when viewed in a side elevation view as shown in FIG. 7. Each of the wings is spaced approximately 90° from a lug 56. The E-shape is preferred over a fully filled in rectangular piece as there is a material savings by removing portions 220. The valve stem 16 of FIG. 7 is suitable for use with the valve body 14 shown in FIG. 6a and to slide within the guide 134 as shown in FIG. 10.

A second embodiment of the valve stem 16 is similar to the first embodiment but the wings 200 are modified to have a T-shape when viewed from the top (FIG. 9a) and a C-shape when viewed from a front elevation view (FIG. 9c). The top of the T has a generally rectangular surface 230 with tapering corners 232 to act as a lead in when inserting the valve stem into the valve body 14 with the T-shaped wings 200 inserted into the concave shaped chamber 147 as shown in FIG. 11.

To operate the valve assembly 10 starting in the closed position as shown in FIG. 1, the valve stem 12 will be fully inserted into the valve body such that the flared distal end of the stem inserted into an end portion of the fluid outlet 20 to prevent the flow of fluid. The opposed lugs 56 of the valve stem 16 will be positioned, one of each, into the U-shaped tracks 50a,b of the tap handle 12. The pawl 74 of the tap handle will be positioned within the pocket 79 as shown in FIGS. 12, 13. A user of the tap will press the arm 70 upward to disengage the pawl 74 from the pocket 79 and rotating the tap handle about the axis 22 in a clockwise direction. The rotational movement of the tap handle will cause an upward movement of the valve member as the lugs 56 travel along the tracks 50a,b and the valve member is directed by the guides 134 to move the flared portion of the valve member out of contact with an end wall of the spout 20 to allow fluid to flow outward from the tap assembly 10. To close the valve the tap handle is rotated counterclockwise until the pawl is within the

pocket 79. Of course, it is contemplated that the direction of rotation could be reversed such that a counterclockwise rotation opens the valve assembly 10 and a clockwise rotation closes the valve assembly 10.

5 The parts of the tap assembly 10 are generally formed from polymeric materials using techniques such as injection molding. Suitable polymeric materials include polyolefins, polyamides, polyesters, PVC, polycarbonates and the like. Suitable polyolefins include homopolymers, copolymers and terpolymers from alpha-olefins having from two to eight carbon atoms. Suitable copolymers include ethylene and propylene with monomers selected from these alpha-olefins, excluding of course those having the same number of carbon atoms.

10 From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims

CLAIMS

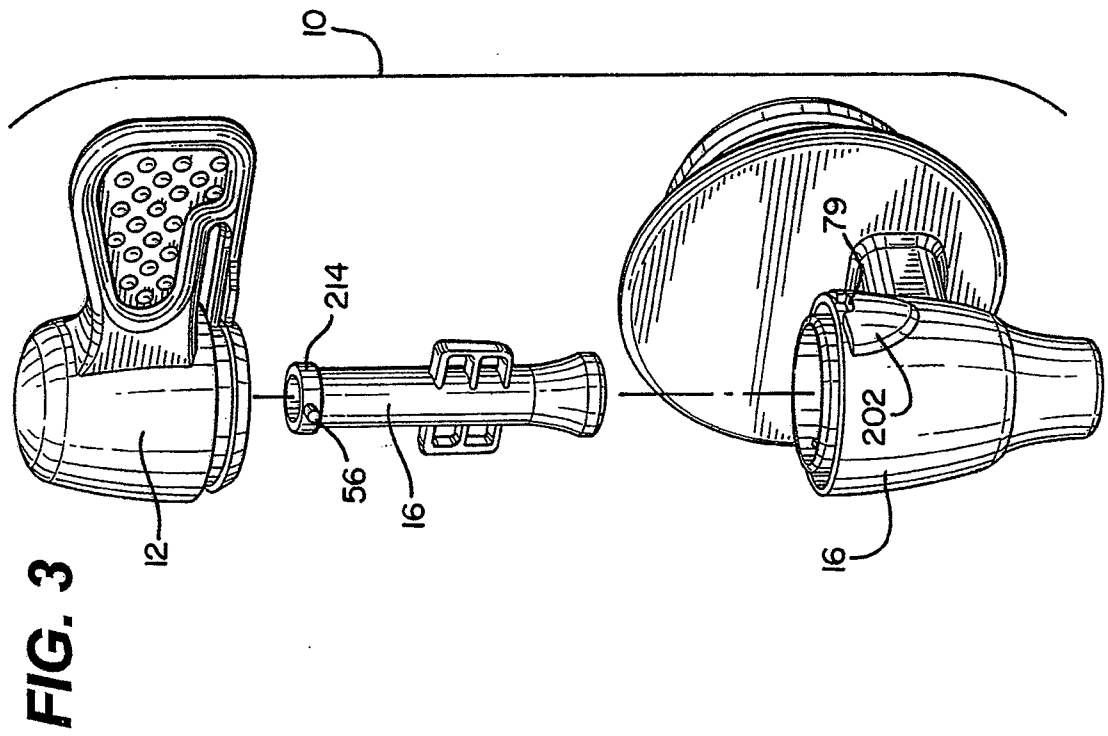
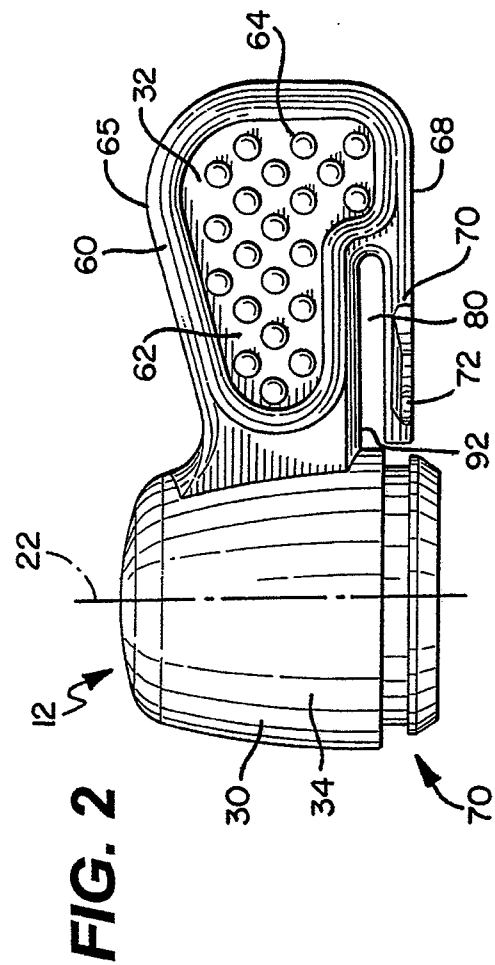
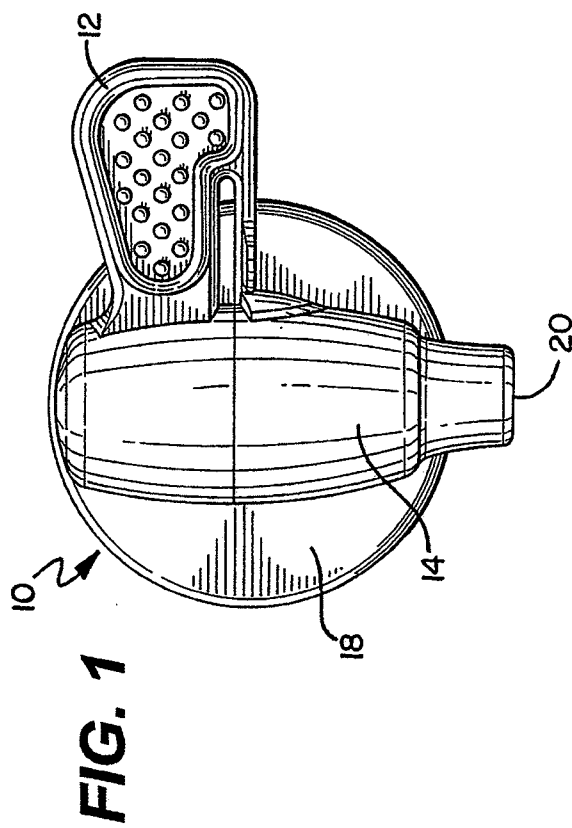
What is claimed is:

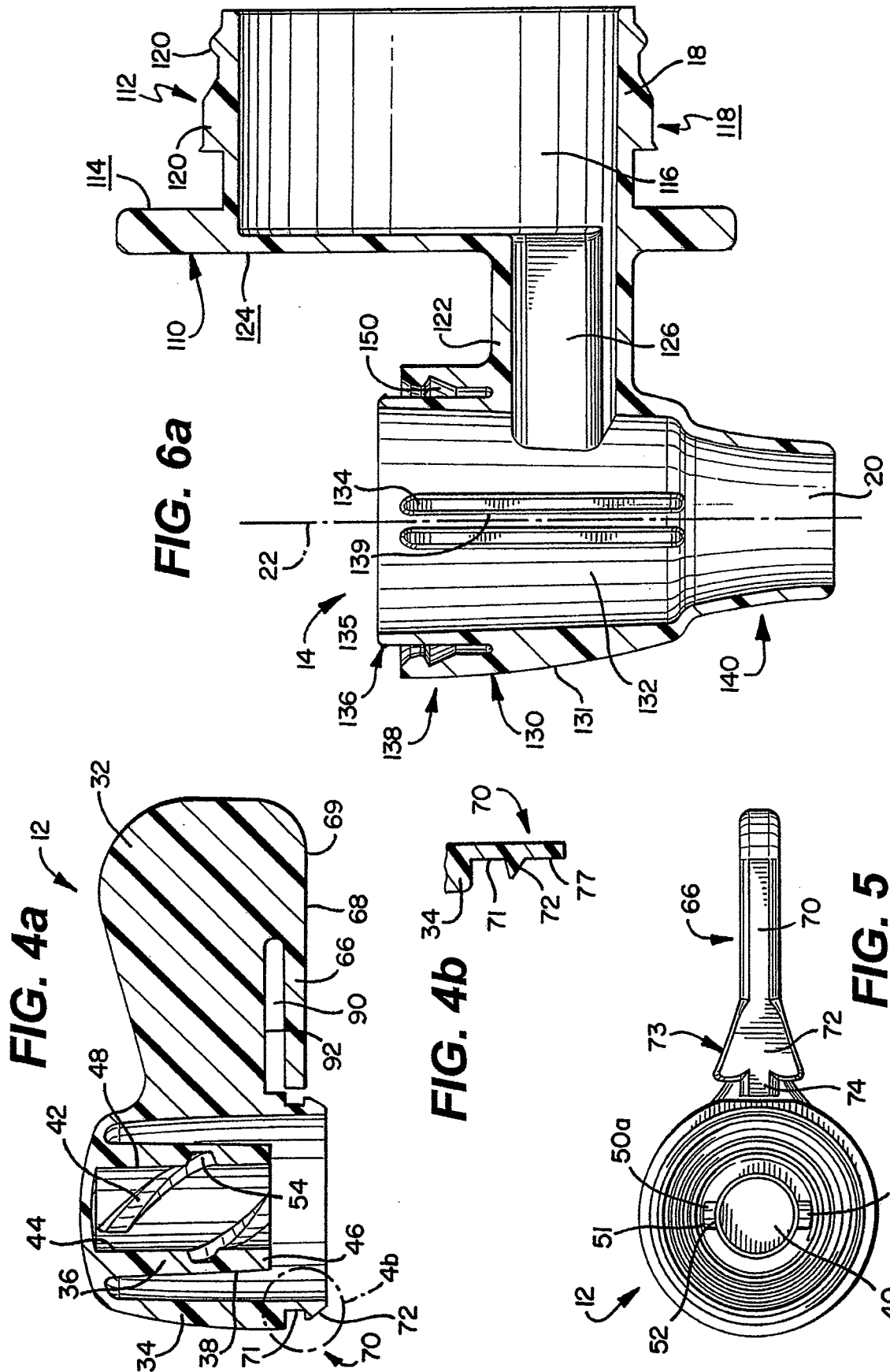
1. A tap assembly comprising:

a first wall defining a valve chamber having a top surface and a pair of opposed tracks extending axially along an inner surface of the wall, and a fluid outlet;

a tap handle mounted to the top surface for rotational movement of the tap handle with respect to the wall, the tap handle having a second wall defining an annular chamber supporting a set of threads; and

a generally tubular valve member having a first end and an opposed second end, the first end having a pair of lugs circumferentially spaced from one another, the lugs being positioned within the threads, the second end of the valve member extending into the valve chamber, the valve member is responsive to movement of the tap handle to move from a first position where the fluid outlet is sealed by the second end of the valve member to a second position where the fluid outlet is not sealed by the second end of the valve member and fluid is allowed to flow through the fluid outlet.





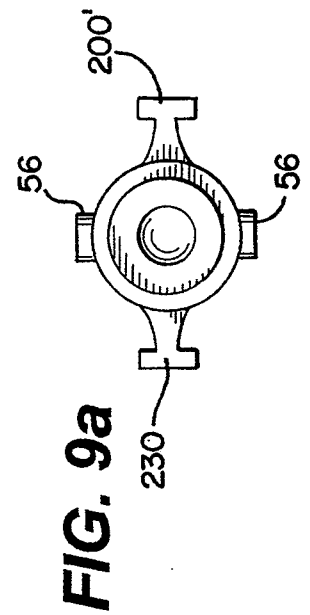
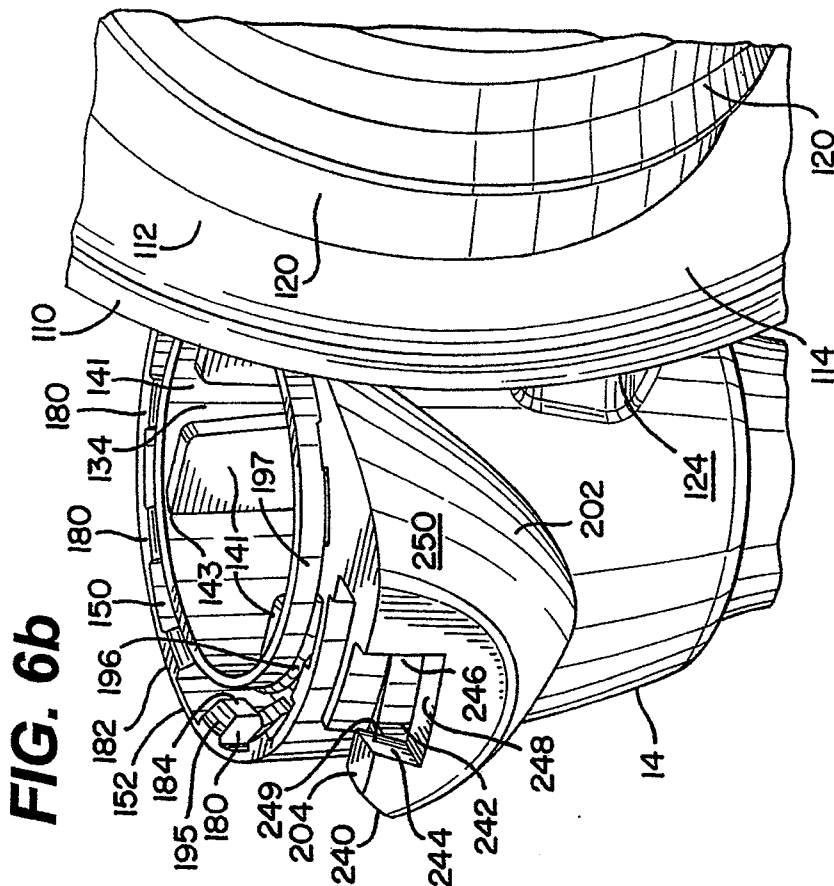
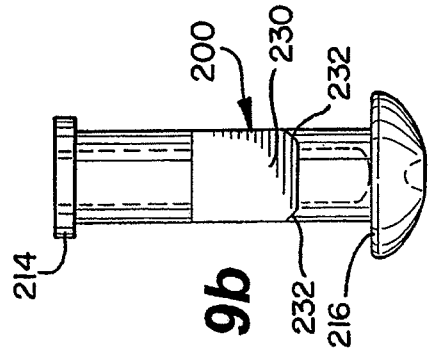
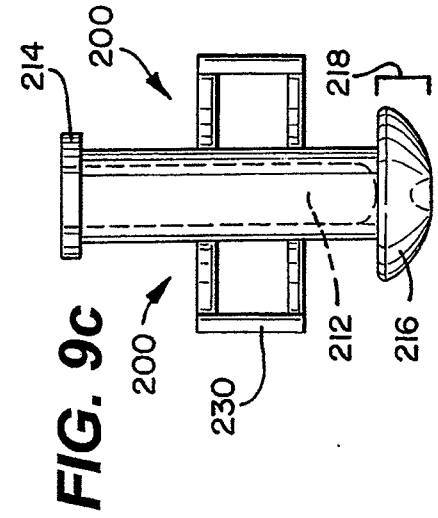
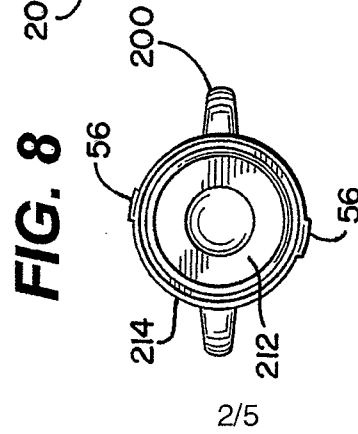
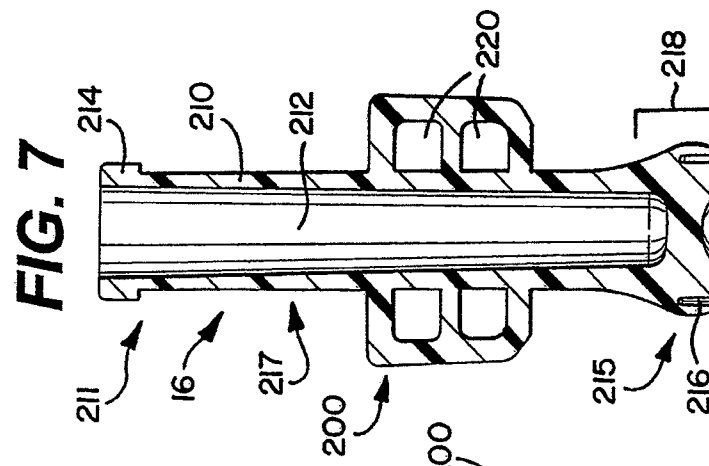


FIG. 10

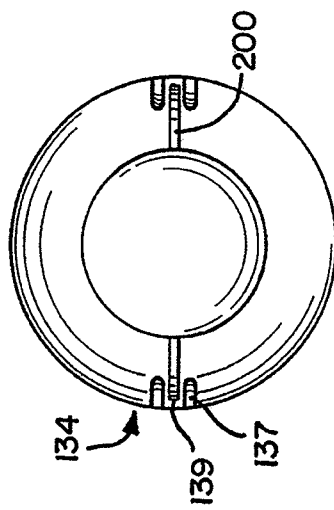


FIG. 12

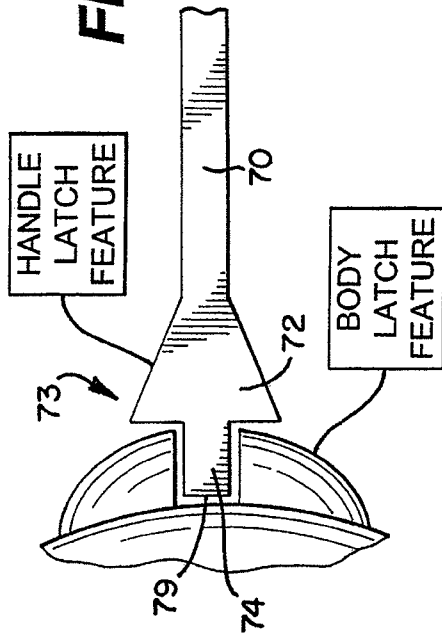


FIG. 11

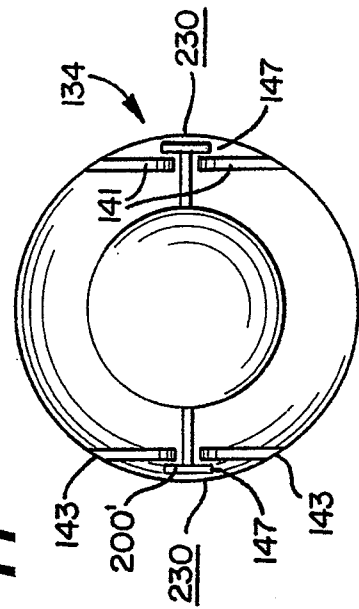


FIG. 13a

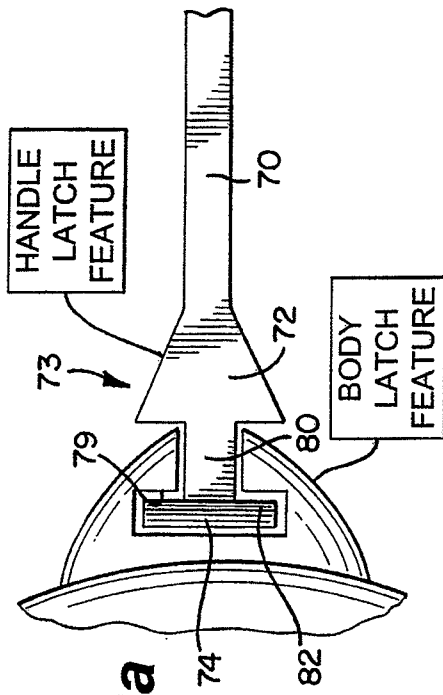
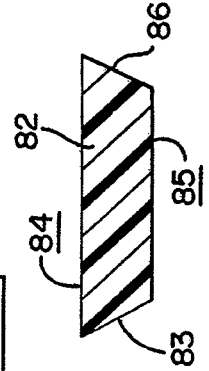
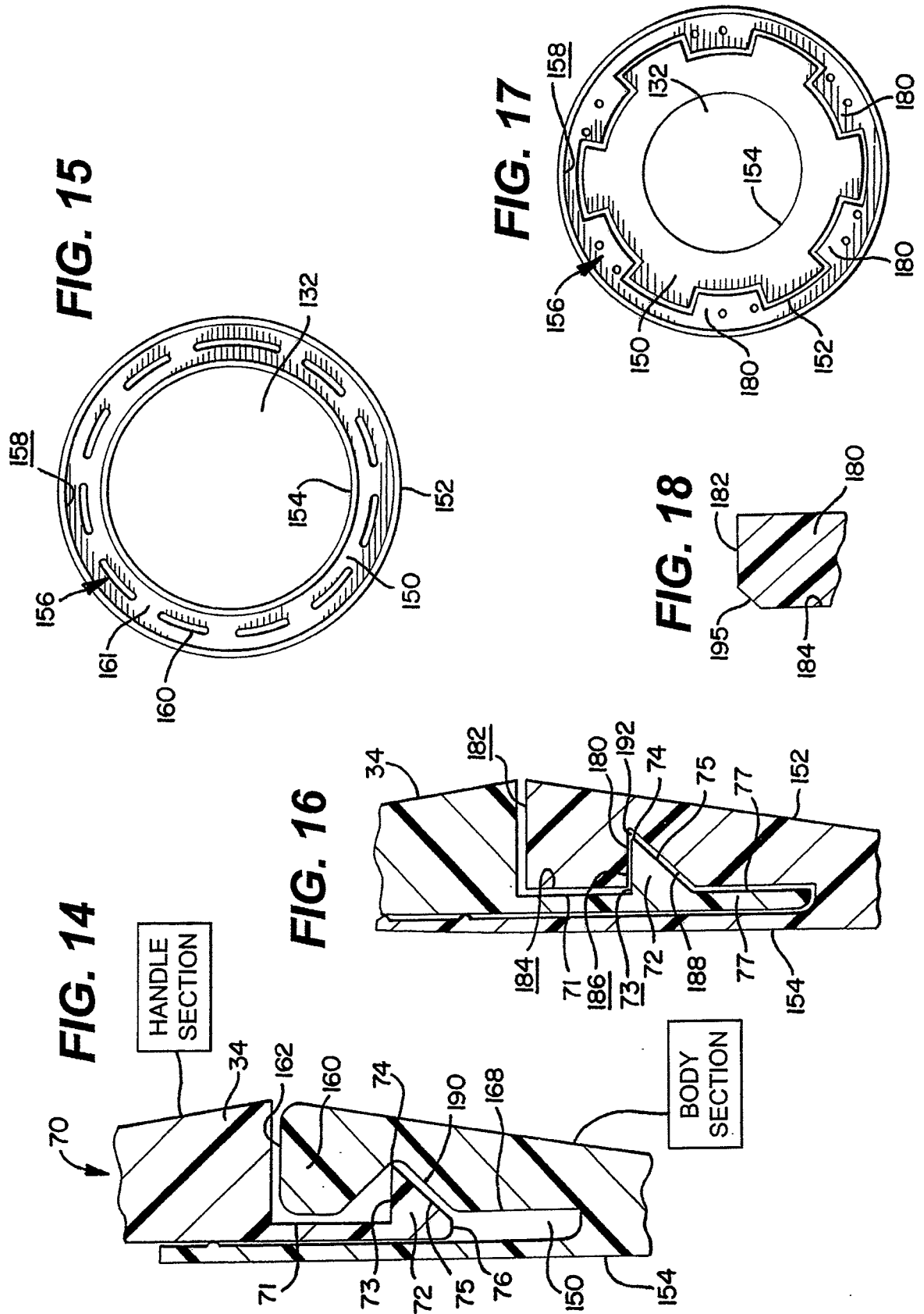


FIG. 13b





INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/002793

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B67D 3/04; F16K 31/50 (2008.04)

USPC - 222/552; 251/269

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) - B67D 3/04; F16K 31/50 (2008.04)

USPC - 222/91, 521-524, 548-554; 251/266-270, 311

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)

PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2,186,499 A (RIVA) 09 January 1940 (09.01.1940) entire document	1

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


* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

11 June 2008

Date of mailing of the international search report

25 JUN 2008

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774