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(71) Applicant: APTARGROUP, INC. [US/US]; 475 West Terra Cotta, Crystal Lake, IL 60014 (US).	(72) Inventors: MUELLER, Bruce, M.; 4580 Danbury Drive, Brookline, WI 53045 (US). DANIELS, Richard, J.; 12606 6-1/2 Mile Road, Caledonia, WI 53108 (US). ELLIOTT, John; 38190 North Avenue, Waukegan, IL 60087 (US).					
(74) Agents: ODELL, Paul, M.; Dressler, Goldsmith, Shore & Milhamow Ltd., Suite 4700, Two Prudential Plaza, Chicago, IL 60601 (US) et al.						
<b>(54) Title: DISPENSING CLOSURE WITH A TWIST SLEEVE AND TWO INTERNAL PASSAGES</b>						
<b>(57) Abstract</b>						
<p>A dispensing closure is provided with a body (24, 324, 524) having an outlet passage (40, 340, 540). A sleeve (80, 380, 580) is mounted on the body for rotation relative to the body. The sleeve has a transverse deck (102, 402, 602) defining a discharge passage (120, 420, 620) for communicating with the body outlet passage as the discharge passage moves in an arc relative to the body. In one embodiment, a seal (419, 437) is provided between the sleeve deck and the body around the outlet passage and discharge passage. In a preferred embodiment, an actuator (160, 460, 660) is mounted on the sleeve for rotation with the sleeve. Engaging structures (51, 52, 204, 208; 351, 352, 504, 508; 551, 552, 704, 708) are defined by the body and the actuator for tilting the actuator between a closed position and an open position while the actuator is rotated with the sleeve. The actuator includes engaging portions (204, 208; 504, 508; 704, 708) for engagement with drive members (51, 52; 351, 352; 551, 552) projecting upwardly from the body through openings (110, 112; 410, 412; 610, 612) in the sleeve. Engagement between the drive members and actuator is effected on opposite sides of the pivot axis of the actuator so as to effect tilting of the actuator between an open position and a closed position.</p>						

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DISPENSING CLOSURE WITH A  
TWIST SLEEVE AND TWO INTERNAL PASSAGES  
TECHNICAL FIELD

5       This invention relates to closures for  
containers, and more particularly to a dispensing  
closure which can be manipulated between a closed  
orientation and an open, dispensing orientation.

BACKGROUND OF THE INVENTION

AND

10       TECHNICAL PROBLEMS POSED BY THE PRIOR ART

Designs have been proposed for containers used  
with flowable substances wherein a closure is provided  
for being attached to the container mouth and wherein  
the closure includes a toggle-action actuator, flip-up  
15       spout, or nozzle assembly for dispensing the container  
contents. See, for example, U.S. Patent Nos. 5,058,775  
4,962,869, 4,776,501, 4,645,086 and 3,516,581.

20       The toggle-action closures, such as those  
disclosed in the above-referenced U.S. Patent Nos.  
5,058,775, 4,962,869, and 4,776,501, require that the  
operator push down on a top, rear portion of the closure  
in order to pivot the actuator portion of the closure to  
the dispensing orientation.

25       On the other hand, U.S. Patent No. 4,838,460  
discloses a closure in which a tiltable actuator is  
mounted within a rotatable collar, and rotation of the  
collar operates through a cam ring to tilt the actuator  
between the closed and open positions.

30       While the above-discussed closures may  
function generally satisfactorily for the purposes for  
which they were designed, it would be desirable to  
provide an improved dispensing closure with structural  
and operational advantages.

35       In particular, it would be advantageous to  
provide a dispensing closure which operates by

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convenient means and does not require special operating instructions. To this end, such an improved dispensing closure should operate by means of a common manipulation which is well known to consumers and which is generally 5 used by consumers to open containers.

Preferably, operation of such an improved closure should not require the operator to exert high forces and/or torque. A design requiring only a low force and/or torque would accommodate operation by 10 physically disabled persons, such as arthritic persons.

During shipping, storage, and handling, a closure installed on a container may be inadvertently or accidentally subjected to external forces acting downwardly against the top of the closure. This can 15 cause some types of closures cause to be moved to the open, dispensing position. This can result in spillage of the contents and/or damage of the container as a saleable item.

Accordingly, it would be desirable to provide 20 an improved closure in which the likelihood of inadvertent, premature opening of the closure is eliminated or substantially reduced. Further, it would be beneficial if such an improved closure could operate to prevent inadvertent opening, while at the same time 25 permitting deliberate opening, without damage to the closure.

Also, it would be advantageous if such an improved closure could be incorporated in a design having an aesthetically pleasing, "high style," exterior 30 configuration substantially free of functional details and outwardly projecting features.

Further, it would be advantageous if the components of such an improved design could be 35 relatively easily manufactured and readily assembled.

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Finally, it would be desirable to provide an improved design which would accommodate the torque encountered either during application of the closure to a container in an automatic, high-speed, capping machine 5 or during use of the closure by a person who may inadvertently or intentionally apply an unusually high torque to the closure.

The present invention provides an improved closure which can accommodate designs having the above- 10 discussed benefits and features.

#### SUMMARY OF THE INVENTION

The present invention provides a novel dispensing closure which can have a contemporary, clean design with virtually all features contained within an 15 aesthetically pleasing profile and with virtually no visible functional details or instructional nomenclature. Further, the closure does not open inadvertently when the closure top is subjected to impacts, and the closure components can be relatively 20 easily manufactured and readily assembled.

The closure is adapted to be mounted over the opening in a container, especially a container of the type having a generally flexible wall portion which can be squeezed to assist in dispensing the contents from 25 the container.

The closure includes a body for engaging the container over the opening. The body has an outlet passage for communicating with the container opening. In a preferred form, the body has a transverse end wall 30 in which the outlet passage is defined. Also, in the preferred form, a pair of drive members or posts project upwardly from the body.

A sleeve is mounted on the body for rotation relative to the body about a rotation axis defined by 35 the sleeve. The sleeve has a transverse deck over the

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body. The sleeve defines a discharge passage for communicating with the body outlet passage. In one form of the invention, the discharge passage is offset from the rotation axis so it can be moved in an arc relative to the body outlet passage when the sleeve is rotated.

5 According to one embodiment of the invention, a seal is located between the sleeve deck and the body transverse end wall, and the seal extends around the body outlet passage and the deck discharge passage.

10 In a preferred form of the invention, an actuator is mounted on the sleeve for rotation with the sleeve to occlude flow through the discharge passage from the container when the actuator means is in a closed, non-dispensing position and to permit flow through the discharge passage from the container when the actuator is tilted about a pivot axis to an open, dispensing position. An engaging means is defined by the body and the actuator for tilting the actuator between the closed position and the open position while

15 20 the actuator is rotated with the sleeve.

According to a preferred embodiment, such an actuator is adapted to cooperate with the above-described embodiment of the closure body that includes upwardly projecting drive members. The drive members project through the sleeve. The actuator has engaging portions for engaging the drive members. The engagement between the body drive members and the actuator engaging portions effectively occurs on opposite sides of the pivot axis to effect tilting of the actuator.

30 Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention, from

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the claims, and from the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

In the accompanying drawings that form part of the specification, and in which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a perspective view of the closure of the present invention shown in a non-dispensing, closed orientation on a container;

FIG. 2 is a perspective view of the closure shown in an open, dispensing orientation;

FIG. 3 is an enlarged, exploded, perspective view of the closure with portions of the structure cut away to illustrate interior detail;

FIG. 4 is an enlarged, cross sectional view of the closure in the closed orientation with the actuator removed;

FIG. 5 is a plan view of the closure body and sleeve with the actuator removed as in FIG. 4;

FIG. 6 is a view similar to FIG. 5, but showing the sleeve rotated to place the closure body and sleeve in an open, dispensing orientation;

FIG. 7 is a greatly enlarged, fragmentary, partial cross-sectional view showing the closure body and sleeve being mounted together during an initial assembly operation;

FIG. 8 is a greatly enlarged, partial cross-sectional view taken generally along the plane 8-8 in FIG. 1;

FIG. 9 is a greatly enlarged, partial cross-sectional view taken generally along the plane 9-9 in FIG. 2;

FIG. 10 is a reduced, fragmentary, side elevational view taken generally along the plane 10-10 in FIG. 8 with portions of the sleeve cut away to illustrate interior detail;

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FIG. 11 is a view similar to FIG. 10, but showing an intermediate position of the actuator between the full closed and full open positions;

5 FIG. 12 is a reduced, front elevational view taken generally along the plane 12-12 in FIG. 9 with portions of the sleeve cut away to illustrate interior detail;

10 FIG. 13 is a reduced, rear elevational view taken generally along the plane 13-13 in FIG. 8 with portions of the sleeve and actuator cut away to illustrate interior detail;

15 FIG. 14 is a greatly enlarged, fragmentary, cross-sectional view taken generally along the plane 14-14 in FIG. 13;

FIG. 15 is a view similar to FIG. 14 but showing a position of the components after the sleeve has been rotated through a small arc away from the full open orientation;

20 FIG. 16 is a fragmentary, cross-sectional view taken generally along the plane 16-16 in FIG. 15;

FIG. 17 is a view similar to FIG. 13, but showing a moved position of components wherein the sleeve has been rotated to a position intermediate the full closed and full open positions;

25 FIG. 18 is a greatly enlarged, fragmentary, cross-sectional view taken generally along the plane 18-18 in FIG. 17;

FIG. 19 is an exploded, perspective view of another embodiment of the closure with portions of the structure cut away to reveal interior detail;

30 FIG. 20 is a greatly enlarged, cross-sectional view taken generally along the plane 20-20 in FIG. 19, but with the sleeve and actuator mounted to the body;

FIG. 21 is a reduced, cross-sectional view taken generally along the planes 21-21 in FIG. 20;

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FIG. 22 is a view similar to FIG. 20, but showing the components in a moved, intermediate position;

5 FIG. 23 is a reduced, fragmentary, cross-sectional view taken generally along the plane 23-23 in FIG. 22;

FIG. 24 is a view similar to FIG. 23, but showing the components in a moved position corresponding to the full open condition of the closure;

10 FIG. 25 is a reduced, fragmentary, cross-sectional view taken generally along the plane 25-25 in FIG. 24;

15 FIG. 26 is an exploded, perspective, fragmentary view of another embodiment of the closure with portions of the structure cut away to reveal interior detail; and

FIG. 27 is a greatly enlarged, fragmentary, cross-sectional view of the closure body and sleeve assembled with the actuator removed.

20 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

While this invention is susceptible of embodiment in many different forms, this specification and the accompanying drawings disclose only some specific forms as examples of the invention. The invention is not intended to be limited to the embodiments so described, however. The scope of the invention is pointed out in the appended claims.

30 For ease of description, the closure of this invention is described in an upright position, and terms such as upper, lower, horizontal, etc., are used with reference to this position. It will be understood, however, that the closure of this invention may be manufactured, stored, transported, used, and sold in an orientation other than the position described.

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FIG. 1 shows an embodiment of the dispensing closure of the present invention in the closed, non-dispensing position wherein the closure is represented generally by reference numeral 20. The closure 20 is 5 adapted to be mounted on a container 21 which may have a conventional open mouth defined by a neck 22 (FIG. 3) or other suitable structure.

The closure 20 may be fabricated from a thermoplastic material, or other materials, compatible 10 with the container contents. The container 21 is preferably a squeezable container having a flexible wall or walls which can be grasped by the user and compressed to increase the internal pressure within the container so as to squeeze the product out of the container. The 15 container wall typically has sufficient, inherent resiliency so that when the squeezing forces are removed, the container wall returns to its normal, unstressed orientation.

The closure 20 includes a closure base or body 20 24 (FIGS. 3 and 4) for securement to the container 21. The body 24 includes a generally cylindrical, lower wall 27. A generally transverse closure wall or end wall 28 (FIGS. 3 and 4) extends across the body 24 over the upper end of the wall 27.

The lower, cylindrical wall 27 of the closure body 24 is adapted to engage the outer periphery of the top of the container neck 22 around the container mouth, as with threads 29 (FIGS. 3 and 4). Other suitable engaging means (e.g., snap-fit beads (not illustrated)) 30 may be provided to secure the closure body 24 on the container. Alternatively, in some applications the closure body 24 could be non-releasably attached to, or formed unitary with, the container.

The closure body 24 includes a discharge 35 aperture or passage 40 through the deck 28 as best

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illustrated in FIGS. 3, 5, 6, and 9. In the preferred embodiment, the discharge passage 40 is offset from a rotation axis 42 (FIG. 4) defined by the cylindrical configuration of the body lower wall 27.

5 An annular sealing ring 30 may be provided as shown in FIGS. 4 and 7-9 for engaging an interior edge of the container neck at the container mouth to effect a tight seal. The ring 30 is radially outward of the passage 40.

10 As illustrated in FIGS. 3-9, an upwardly projecting, flexible seal or sealing ring 44 protrudes upwardly from the body end wall 28. Preferably, the seal 44 is concentric with the cylindrical configuration of the body lower wall 27. Thus, the discharge passage 15 40 is axially offset relative to, but lies within, the seal 44.

Outwardly from the seal 44, the closure body end wall 28 defines a peripheral, chamfered or frustoconical cam surface 46 (FIGS. 3, 4 and 7).  
20 Further, a pair of drive members or posts 51 and 52 upwardly from the periphery of the body end wall 28. The drive members 51 and 52 are not located on a diameter of the end wall 28. In a preferred embodiment illustrated, the drive member 51 has a vertical side 54, and the drive member 52 has a vertical side 56. The arc angle between the two sides 54 and 56 is about 123°. The widths of the drive members 51 and 52 is the same, and in terms of an arc angle, the width is about 25°.  
25 As illustrated in FIG. 5, the drive member 51 has a second, vertical side surface 58, and the drive member 52 has a second, vertical side surface 60. The arc angle between the surfaces 58 and 60 is about 187°.  
30

As illustrated in FIG. 3, the top end of the drive member 51 has a surface 64 inclined relative to a plane that is normal to the rotational axis 42 (FIG. 4)

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and has an abutment surface 66 which is oriented parallel to the plane. Similarly, the drive member 52 has a surface 68 which is inclined relative to a plane that is normal to the rotational axis 42 (FIG. 4) and has an abutment surface 70 which is oriented parallel to the plane. Further, the top end of the drive member 51 defines a groove or channel 72, and the top end of the drive member 52 defines a groove or channel 74. The drive members 51 and 52 function to open and close the closure 20 as explained in detail hereinafter.

The closure base or body 24 is adapted to receive a ring or twist sleeve 80, as illustrated in FIGS. 1-13 and 17, so as to accommodate rotation of the sleeve 80 relative to the body 24. To this end, the sleeve 80 includes a generally annular wall 82 in which the body 24 is received. As illustrated in FIG. 3, the sleeve 80 includes four, spaced-apart retention members 84 which each project inwardly from the inner surface of the sleeve side wall 82. Each retention member has an upwardly facing support surface 86 for engaging the bottom of the peripheral portion of the body end wall 28 as shown in FIG. 4.

The sleeve 82 and the body 24 are easily assembled as shown in FIG. 7 by effecting a relative axial displacement as indicated by the arrows 90. The assembly is facilitated by a chamfered or angled surface 94 (FIG. 7) on each retention member 84. The angled surfaces 94 of the retention members 84 engage the frustoconical surface 46 of the closure body end wall 28 as the sleeve 80 and body 24 are moved into engagement. When opposed, axial forces of sufficient magnitude are applied to the sleeve 80 and body 24 there is sufficient temporary deflection or deformation of one or both of the components in the radial direction so that the body

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end wall 28 slides past the retention members 84 and becomes lodged on top of the retention members 84.

As illustrated in FIG. 4, the sleeve 80 includes a transverse deck 102 for engaging the closure 5 body end wall 28 so as to prevent downwardly movement of the sleeve 80 while the sleeve retaining members 84 prevent upward movement of the sleeve 80. The deck 102 defines two spaced-apart slots 110 and 112 (FIGS. 5 and 10 6) for receiving the upwardly projecting members 51 and 52, respectively.

As illustrated in FIG. 4, the sleeve deck 102 has a generally planar, upwardly facing top surface 114 and has a generally planar, downwardly facing bottom surface 116. When the sleeve 80 is properly assembled 15 on the body 24 as illustrated in FIG. 4, the sleeve deck bottom surface 116 compresses, and sealingly engages, the body end wall sealing ring 44.

The sleeve deck 102 also defines a discharge 20 passage 120 which extends through the deck. In the preferred embodiment illustrated in FIG. 4, the sleeve 80 includes a discharge spout or tube 124 which projects upwardly from the deck 102, and the discharge aperture 120 is defined within, and through the tube 124. Further, in the preferred embodiment illustrated in FIG. 25 4, the tube 124 has a generally hollow, cylindrical or annular configuration, and the discharge passage 120 defined by the tube 124 is offset from the rotation axis 42 of the closure. Thus, when the sleeve 80 is rotated about the axis 42 relative to the closure body 24, the 30 discharge passage 120 is moved in an arc relative to the closure outlet passage 40.

The sleeve 80 can be rotated from the position 35 illustrated in FIG. 5, which corresponds to a closed position, to the position illustrated in FIG. 6, which corresponds to an open position. In the closed

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position, the drive member 51 engages one end of the sleeve slot 110 while the drive member 52 engages one end of the sleeve slot 112. On the other hand, when the sleeve 80 is rotated to the open position illustrated in FIG. 6, the drive members 51 and 52 engage the other ends of the slots 110 and 112, respectively.

When the sleeve 80 is in the closed position illustrated in FIG. 5, the discharge tube 124 is not aligned with the body outlet passage 40, but the discharge tube 124 and outlet passage 40 are both within the body seal ring 44. On the other hand, when the sleeve 80 is moved to the position illustrated in FIG. 6 corresponding to the closure open configuration, then the sleeve discharge passage 124 is partially aligned with the body outlet passage 40.

As illustrated in FIGS. 1-3, 8 and 9, the sleeve 80 receives a generally disc-like nozzle assembly, actuator means, or actuator 160. The actuator 160 is mounted on the sleeve 80 for rotation with the sleeve about the axis 42 (FIG. 4). The actuator 160 includes a transverse top wall 162 and a peripheral flange 164 (FIGS. 1, 2, 8 and 9). At each of two diametrically opposed portions of the flange 164 there is a protuberance or pivot member 166 (one being visible in FIG. 3).

The pivot members 166 cooperate with the sleeve 80 to mount the actuator 160 for pivoting movement within the sleeve. To this end, the inner surface of the sleeve wall 82 defines two recesses 168 (FIGS. 1 and 4) for each mating with one of the pivot members 166 to provide a snap-action engagement of the pivot member 166. This accommodates the pivoting movement of the actuator 160 about a pivot axis defined by the pivot members 166 and receiving recesses 168.

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The bottom edge of each pivot member 166 is preferably provided with a chamfer 169 for facilitating assembly. When the sleeve 80 and actuator 160 are assembled, the actuator pivot members 166 and body recesses 168 function as mounting means so that the actuator 160 can be pivoted (by means described in detail hereinafter) until the forward end is exposed above the sleeve 80 as illustrated in FIGS. 2 and 9.

The actuator 160 includes a structure on the bottom surface of the top wall 162 which functions -- depending upon the orientation of the actuator 160 -- to either permit dispensing of flowable material from the body discharge tube 124 or occlude the tube passage 120 so as to prevent flow out of the discharge tube 124. In particular, as shown in FIGS. 3, 8 and 9, the actuator 160 includes a forwardly extending nozzle or channel 170 which merges with, and opens into, a stepped, cylindrical sealing wall 179. The wall 179 surrounds and seals the upper periphery of the discharge tube 124 when the actuator 160 is in the closed position as illustrated in FIG. 8. In particular, the wall 179 forms a seal around the outer periphery of the discharge tube 124 as indicated at the front of the tube 124 by reference number 180 (FIG. 9) and as indicated by the reference numeral 184 at the rear of the tube 124.

Preferably, a sealing plug 186 projects downwardly from the bottom of the actuator top wall 162. The sealing plug 186 has a generally cylindrical or annular configuration and is adapted to enter into the opening at the top of the discharge tube 124 to sealingly occlude the discharge aperture 120 in the tube 124 when the actuator is in the closed position as illustrated in FIG. 8.

On the other hand, when the actuator 160 is tilted to the dispensing position as illustrated in FIG.

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9 (by means described in detail hereinafter), then the front portion of the sealing plug 186 is tilted away from the top of the discharge tube 124 to permit flow of the material out of the discharge aperture in the tube 124 and through the dispensing nozzle 170. When the actuator 160 is tilted to the dispensing position as illustrated in FIG. 9, the wall 179 still continues to seal the outer periphery of the upper end of the discharge tube 124 so that the container contents, while 10 being dispensed into the nozzle 170, cannot leak out around the top of the discharge tube 124.

The actuator 160 includes a novel structure for cooperating with the body drive members 51 and 52 to open and close the closure 20 when the sleeve 80 is rotated. Specifically, the actuator wall 162 defines a downwardly facing engaging surface 190 (FIGS. 3, 8, 9, 12, 14-16 and 18). The surface 190 is adapted to be engaged by the drive member 52 when the actuator 160 is pivoted beyond a certain point toward the open position, 20 and a rear cam rail 202 projects downwardly from the surface 190 for engaging the drive member 52 when the orientation of the actuator 160 is in the range between the full closed position and a partially open position. The rear cam rail 202 defines an angular, partially 25 helical cam ramp 204 (FIGS. 3, 13, 16 and 17). When the actuator 160 is closed, the cam ramp 204 is inclined relative to a plane that is normal to the rotational axis (axis 42 in FIG. 4).

At the front of the actuator 160 there is a 30 downwardly projecting front cam rail 208 (FIGS. 3 and 8-12). The front cam rail 208 has a downwardly angled cam ramp 210 and a short, flat surface 211. When the actuator 160 is closed, the ramp 210 is inclined relative to a plane that is normal to the rotational axis (axis 42 in FIG. 4), and the flat surface 211 is 35

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perpendicular to the axis 42. Preferably, the front cam rail 210 is partially helical and has an inclination which is slightly less steep than the inclination of the rear cam rail cam ramp 204.

5       When the actuator 160 is in the closed position as illustrated in FIG. 8, the front cam rail 208 is received within the channel 72 at the top of the first drive member 51, and the rear cam rail 202 is received within the channel 74 at the top of the rear 10 drive member 52. When a consumer wishes to open the closure, the container 21 is grasped in one hand and the closure sleeve 80 is grasped in the other hand. Relative rotation is effected between the container 21 and the sleeve 80. Typically, the user would hold the 15 container 21 relatively stationary while the sleeve 80 is rotated on the container 21. Because the closure body 24 is threadingly engaged tightly with the container 21, the body 24 and container 21 remain stationary while the sleeve 80 is rotated in the 20 direction of the arrow 220 illustrated in FIG. 2. This is the conventional, unscrewing direction for a conventional right-hand thread, and most consumers would readily understand from everyday experience that the 25 unscrewing direction 220 is counterclockwise when looking downwardly on the top of the closure 20.

As the sleeve 80 is rotated in the counterclockwise direction as indicated by the arrow 220 in FIG. 2, the actuator 160 is rotated with the sleeve 80 relative to the drive members 51 and 52 which project 30 upwardly from the closure body 24 and are stationary. Rotation of the sleeve 80 causes the actuator front cam rail ramp 210 to engage the drive member 51 and tilt the front of the actuator 160 upwardly. At the same time, the rear cam rail cam ramp 204 moves in the rear drive member 52 to accommodate the downward tilting motion of 35

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the rear portion of the actuator 160. Also, because the rear cam ramp 204 is steeper than the front cam ramp 210, there is no danger of the rear cam ramp 204 initially engaging and binding on the rear drive member 52 as the actuator 160 pivots open. The rear cam rail 202 has a relatively short length, and the rear cam rail 202 becomes completely separated from the rear drive member 52 as the actuator 160 is tilted to the full open position (FIG. 13).

When the actuator 160 is in the full open position, the container contents can be dispensed through the body outlet passage 40 and sleeve discharge tube 124 as shown in FIGS. 6 and 9. In the full open position, the top of the rear drive member 52 is spaced somewhat below the actuator top wall bottom surface 190 as illustrated in FIG. 14.

In order to close the actuator 160, the sleeve 80 is rotated in the clockwise direction as viewed from the top (i.e., in the direction indicated by the arrow 226 in FIG. 1). The actuator 160 rotates with the sleeve 80 so as to move the actuator cam rails 202 and 208 relative to the drive members 52 and 51, respectively. Thus, the front cam rail 208 moves away from the front drive member 51, but the rear cam rail 202 moves toward the rear drive member 52. However, as illustrated in FIG. 15, initially the actuator top wall bottom surface 190 contacts the edge of the angled surface 68 of the rear drive member 52 (FIGS. 15 and 16). As the sleeve 80 is further rotated, the rear portion of the actuator 160 is forced upwardly to pivot the actuator toward the closed position. Further rotation of the sleeve 80 brings the rear cam rail 202 into engagement with the rear drive member 52 as illustrated in FIGS. 17 and 18. The cam ramp 204 of the rear cam rail 202 then engages the bottom of the groove

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74 in the top of the rear drive member 52 to pivot the actuator 160 to the fully closed position. In the fully closed position, the front cam rail surface 211 is located over the front drive member 51 as can be seen in  
5 FIG. 10.

Regardless of the orientation of the actuator 160, the novel sealing system prevents leakage of the container contents between the sleeve deck 102 and closure body 24. In particular, with reference to FIGS. 10 8 and 9, the seal ring 44 on the closure body 24 at all times seals around the periphery of the closure body outlet passage 40 and sleeve discharge tube 124. The container product can be forced out through the discharge passage 120 of the discharge tube 124 only  
15 when the actuator 160 is moved away from the fully closed position, and the seal ring 44 always prevents leakage from between the sleeve deck 102 and closure body end wall 28.

A second embodiment of the closure of the  
20 present invention is illustrated in FIGS. 19-25 wherein the closure is designated generally by the reference number 320. The closure 320 is adapted to be mounted on a container (not illustrated) such as the container 21 described above with reference to FIGS. 1 and 2.

25 The closure includes a closure base or body 324 having a cylindrical lower wall 327 with internal threads 329 for engaging mating threads on the container neck. Other suitable engaging means (e.g., snap-fit beads) may be provided to secure the closure body 324 on  
30 the container. Alternatively, in some applications the closure body 324 could be non-reasonably attached to, or formed unitary with, the container.

An annular sealing ring 330 may be provided as shown in FIG. 21 for engaging an interior edge of the

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container neck at the container mouth to effect a tight seal.

The closure body 324 includes a transverse end wall 328 defining an outlet passage 340 and a peripheral, frustoconical surface 346. The outlet passage 340 is radially offset from a central axis 342 defined by the frustoconical surface 346 and cylindrical wall 327. Projecting upwardly from the body end wall 328 is a seal or bead 347 which extends partially around the outlet passage 340 and which has a straight portion 349 (FIG. 20) extending tangentially from the outlet passage 340. The outer, upper edge of the sealing bead 347 and extension 349 is chamfered.

The closure body 324 also has a front drive member or post 351 and a rear drive member or post 352 which each project upwardly from the periphery of the end wall 328 at the frustoconical surface 346. Preferably, as with the drive members 51 and 52 described above with reference to the first embodiment illustrated in FIGS. 1-18, the drive members 351 and 352 do not lie on a common diameter. Thus, the shortest circular arc between the nearest sides of the drive members 351 and 352 is less than 180°.

As shown in FIG. 19, the top of the front drive member 351 has a drive surface 364 which is inclined relative to a plane normal to the rotational axis 342 and has an abutment surface 366 which is oriented parallel to that plane. Similarly, the rear drive member 352 has a drive surface 368 inclined relative to a plane that is normal to the rotational axis 342 and has an abutment surface 370 which is oriented parallel to the plane.

The closure body 324 is adapted to receive a sleeve 380 mounted thereon as illustrated in FIG. 21. To this end, the sleeve 380 includes a plurality of

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inwardly projecting retainer members 384 which are adapted to slidably engage the frustoconical surface 346 of the closure body 324 as the sleeve 380 is pushed onto the closure body 324. The parts are sufficiently 5 resilient to accommodate a temporary, radial deformation so that the retainer members 384 slip below the peripheral edge of the closure body end wall 328.

10 The sleeve 80 has a transverse deck 402 which defines a pair of spaced-apart peripheral slots 410 and 412 (FIG. 20) for receiving the drive members 351 and 352, respectively.

15 The deck 402 has an upwardly facing surface 414 and a downwardly facing surface 416. Projecting downwardly from the surface 416 is an annular, compressible, seal ring 418. The seal ring 418 sealingly engages the upper surface of the closure body deck 328.

20 Also projecting downwardly from the sleeve deck lower surface 416 is an inner, irregularly shaped seal or bead 419. The seal 419 lies within the annular seal ring 418 and is adapted to receive the seal beads 347 and 349 projecting upwardly from the closure body end wall 328 around the outlet passage 340.

25 The sleeve seal bead 419 defines an enclosed area and has a first cusp 419A, a second cusp 419B, and a third cusp 419C. As illustrated in FIG. 21, the inner and outer edges of the seal bead 419 are chamfered.

30 The sleeve deck 402 defines a discharge passage 420 for communicating with the body outlet passage 340. As illustrated in FIG. 21, the discharge passage is defined within a discharge tube 424, and the bottom of the discharge passage 420 is defined in part by the downwardly projecting seal bead 419 between the second cusp 419B and third cusp 419C.

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The sleeve 380 receives a generally disc-like nozzle assembly, actuator means, or actuator 460 (FIG. 19). The actuator 460 is mounted on the sleeve 380 for rotation with the sleeve 380 about the axis 342 (FIG. 19). The actuator 460 includes a transverse top wall 462 and a peripheral flange 464. At each of two diametrically opposed portions of the flange 464 there is a protuberance or pivot member 466. The pivot members 466 cooperate with the sleeve 380 to mount the actuator 460 for pivoting movement within the sleeve 380. To this end, the inner surface of the sleeve 380 defines two recesses 468 (one recess 468 being visible on the far side in FIG. 19). Each recess 468 mates with one of the pivot members 466 to provide a snap-action engagement of the pivot member 466. This accommodates the pivoting movement of the actuator 460 about the body pivot axis defined by the pivot members 466 and receiving recesses 468.

The actuator 460 is substantially identical to the actuator 160 described above with reference to the first embodiment illustrated in FIGS. 1-18. To this end, the actuator is adapted to be tilted between a closed position (FIG. 21) and an open position (similar to the open position shown for the first embodiment actuator 160 illustrated in FIG. 9).

The actuator 460 includes a channel or nozzle 470 for communicating with the upper end of the sleeve discharge tube 424 when the actuator is in the tilted, open position. When the actuator 460 is closed as illustrated in FIG. 21, the upper end of the discharge tube 424 is sealed closed in the same manner as described above with respect to the first embodiment tube 124 illustrated in FIGS. 1-18.

The actuator 460 includes a novel structure for cooperating with the body drive members 351 and 352

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to open and close the closure 320 when the sleeve 380 is rotated. Specifically, as illustrated in FIG. 19, the actuator 460 includes a front cam rail 508 having a downwardly facing, angled cam surface 510 for engaging the upwardly facing surfaces 364 and 366 of the first drive member 351.

5 The actuator 460 includes a downwardly projecting, rear cam rail 502 having a downwardly angled cam surface 504 for engaging the upwardly facing surfaces 368 and 370 of the rear drive member 352.

10 When the sleeve 380 is rotated, the actuator 460 is carried with the sleeve to move the cam rails 502 and 508 relative to the drive members 351 and 352, respectively. The actuator 460 and drive members 351 and 352 function in substantially the same way as the 15 first embodiment actuator 160 and drive members 51 and 52 described above with reference to FIGS. 1-18.

20 The second embodiment illustrated in FIGS. 19-25 has unique sealing capabilities. When the actuator 460 is fully closed as illustrated in FIGS. 20 and 21, the sleeve seal 419 is positioned to engage the closure body seal 347 and 349 so that the discharge passage 420 is spaced from, and sealed from, the closure body outlet passage 340. In particular, as can be seen in FIG. 20, 25 when the closure is closed, the closure body seal 347 and extension 349 sealingly engage the sleeve seal 419 and sleeve deck lower surface 416 to prevent fluid communication between the closure body outlet passage 340 and the sleeve discharge passage 420. This is 30 effective to prevent leakage into the discharge tube 420 during over-pressure conditions, such as might occur during shipping or handling (e.g., from impacts on the container or temperature increases).

35 When the sleeve 380 is rotated to open the actuator 460, the sleeve deck 402 rotates as illustrated

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in FIGS. 22 and 23 to move the discharge passage 420 and seal bead 419 relative to the closure body outlet passage 340. As the seal bead cusp 419A moves pass closure body seal bead 347, there is interference which 5 causes the sleeve seal 419 and closure body seal bead 347 to slide axially on the chamfered edges. This deflects the sleeve deck 402 a small amount upwardly away from the closure body end wall 328 as illustrated in FIG. 23. An increased amount of torque is required 10 to effect this deformation, and this provides a resistance to rotation of the sleeve. This tends to oppose movement of the closure components away from the fully closed position.

However, if sufficient torque is exerted on 15 the sleeve 380, the components are sufficiently deformed to accommodate the movement of the sleeve seal bead 419 to the open position as illustrated in FIGS. 24 and 25. In the open position, the closure body seal bead 347 is seated on the other side of the cusp 419A and is 20 retained in the open position by the cooperating configuration of the cusps 419A, 419B and 419C. In the open position, a portion of the sleeve discharge passage 420 overlies a portion of the closure body outlet passage 340. This establishes communication between the 25 container interior and the discharge tube 424. Of course, in the open position, the actuator 460 is tilted away from the top of the discharge tube 424 (in a manner analogous to the orientation of the first embodiment actuator 160 illustrated in FIG. 9), and the container 30 contents can be dispensed through the closure.

When the sleeve 380 is rotated through the 35 intermediate position between the full closed and full open positions as illustrated in FIGS. 22 and 23, the slight outward displacement of the center of the sleeve deck 402 will break the seal between the sleeve seal

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bead 419 and the top surface of the body end wall 328. However, the potential for leakage at that point is of little concern because the container is typically not being squeezed to discharge the contents at that time 5 and because the momentary interruption in sealing of the bead 419 against the body end wall 328 is very brief. Further, the annular, resilient seal 418 completely surrounds the seal bead 419 and prevents any leakage radially outwardly of the seal ring 418.

10 In each of the two embodiments of the closure illustrated in FIGS. 1-25, it will be appreciated that the body outlet passage (40 or 340) is not fully aligned with the sleeve deck discharge passage (120 or 420). However, in other, alternate designs, alignment of the 15 two passages in the full open condition may be desired and could be effected by appropriate placement of the outlet passage and discharge passage in the body and sleeve, respectively.

20 Further, snap-fit engagement structures may be provided at the full closed position and the full open position for providing a tactile sensation to the user when the full open and full closed positions have been reached.

25 A third, and presently most preferred, embodiment of the closure of the present invention is illustrated in FIGS. 26 and 27, and the closure is designated generally by the reference number 520 in FIG. 26. The closure 520 is adapted to be mounted on a container, such as the container 21, described above 30 with reference to FIGS. 1 and 2.

35 The closure includes a closure base or body 524 having a cylindrical lower wall 527 with internal threads 529 (FIG. 27) for engaging mating threads on the container neck. Other suitable engaging means (e.g., snap-fit beads) may be provided to secure the closure

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body 524 on the container 21. Alternatively, in some applications the closure body 524 could be non-reasonably attached to, or formed unitary with, the container.

5 An annular sealing ring 530 may be provided as shown in FIG. 27 for engaging an interior edge of the container neck at the container mouth to effect a tight seal.

10 The closure body 524 includes a transverse end wall 528 defining an outlet passage 540 and a peripheral, frustoconical surface 546 (FIG. 26). The outlet passage 540 is concentric about a central axis 542 (FIG. 27) defined by the frustoconical surface 546 and cylindrical wall 527. Projecting upwardly from the 15 body end wall 528 is an annular seal wall 546 having a circumferential sealing bead 547. The wall 546 extends around, and is concentric with, the outlet passage 540.

20 The closure body 524 also has a front drive member or post 551 and a rear drive member or post 552 which each project upwardly from the periphery of the end wall 528 at the frustoconical surface 546.

25 Preferably, as with the drive members 51 and 52 described above with reference to the first embodiment illustrated in FIGS. 1-18, the drive members 551 and 552 do not lie on a common diameter. Thus, the shortest circular arc between the nearest sides of the drive members 551 and 552 is less than 180°. The drive members 551 and 552 have substantially the same configuration as the drive members 51 and 52, 30 respectively.

35 The closure body 524 is adapted to receive a sleeve 580 mounted thereon as illustrated in FIG. 27. To this end, the sleeve 580 includes a cylindrical wall 582 with a plurality of inwardly projecting retainer members 584 which are adapted to slidably engage the

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frustoconical surface 546 of the closure body 524 as the sleeve 580 is pushed onto the closure body 524. The parts are sufficiently resilient to accommodate a temporary, radial deformation so that the retainer members 584 slip below the peripheral edge of the closure body end wall 528.

The sleeve 580 has a transverse deck 602 which defines a pair of spaced-apart peripheral slots 610 and 612 (FIG. 20) for receiving the drive members 551 and 552, respectively.

The deck 602 has an upwardly facing surface 614 and a downwardly facing surface 616 (FIG. 27). Projecting downwardly from the surface 616 is an annular, seal flange or ring 618. The seal flange 618 sealingly engages the outer surface of the closure body sealing wall bead 547.

The sleeve deck 602 defines a discharge passage 620 (FIG. 27) for communicating with the body outlet passage 540. As illustrated in FIG. 27, the discharge passage 620 is defined within a discharge tube 624.

The sleeve 580 receives a generally disc-like nozzle assembly, actuator means, or actuator 660 (FIG. 26). The actuator 660 is mounted on the sleeve 680 for rotation with the sleeve 680 about the axis 542 (FIG. 27). The actuator 660 includes a transverse top wall 662 and a peripheral flange 664.

At each of two diametrically opposed portions of the flange 664 there is a protuberance or pivot member 666. The pivot members 666 cooperate with the sleeve 580 to mount the actuator 660 for pivoting movement within the sleeve 580. To this end, the inner surface of the sleeve 580 defines two recesses 668 (one recess 668 being visible on the far side in FIG. 27). Each recess 668 mates with one of the pivot members 666

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to provide a snap-action engagement of the pivot member 666. This accommodates the pivoting movement of the actuator 660 about a pivot axis defined by the pivot members 666 and receiving recesses 668.

5 The actuator 660 is substantially identical to the actuator 160 described above with reference to the first embodiment illustrated in FIGS. 1-18. To this end, the actuator 660 is adapted to be tilted between a closed position and an open position (similar to the 10 closed and open positions shown for the first embodiment actuator 160 illustrated in FIGS. 1 and 2).

15 The actuator 660 includes a channel or nozzle 670 for communicating with the upper end of the sleeve discharge tube 624 when the actuator is in the tilted, open position. When the actuator 660 is closed, the upper end of the discharge tube 624 is sealed closed in the same manner as described above with respect to the first embodiment tube 124 illustrated in FIGS. 1-18.

20 The actuator 660 includes a structure for cooperating with the body drive members 551 and 552 to open and close the closure 520 when the sleeve 580 is rotated. The structure is the same as in the first embodiment of the actuator 160 described above with reference to FIGS. 1-18.

25 Specifically, as illustrated in FIG. 26, the actuator 660 includes a front cam rail 708 having a downwardly facing, angled cam surface 710 for engaging the upwardly facing surfaces of the first drive member 551. The actuator 660 also includes a downwardly projecting, rear cam rail 702 having a downwardly angled cam surface 704 for engaging the upwardly facing surfaces of the rear drive member 552.

30 When the sleeve 580 is rotated, the actuator 660 is carried with the sleeve to move the cam rails 702 and 708 relative to the drive members 551 and 552,

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respectively. The actuator 660 and drive members 551 and 552 function in substantially the same way as do the first embodiment actuator 160 and drive members 51 and 52 described above with reference to FIGS. 1-18.

5           The third embodiment illustrated in FIGS. 26 and 27 has unique sealing capabilities. Owing to the sleeve seal flange 618 and the body seal wall 546, the fluid passing from the container through the body outlet passage 540 and sleeve discharge passage 620 is always 10 prevented from leaking out between the sleeve 580 and body 524 -- regardless of whether the actuator 660 is open or closed.

15           In all three embodiments of the closure shown in FIGS. 1-27, suitable modifications may be made to employ other forms of actuators instead of the pivotally mounted, tilting actuator illustrated and described.

20           The closure of the present invention may be fabricated in various suitable configurations for use with a variety of containers, for use with a variety of container/closure attachment modes, and for use in a variety of applications.

25           The closure of the present invention can be readily molded from thermoplastic materials (e.g., polypropylene and ABS) in a design that provides a "high-style" exterior configuration which is substantially free of functional details.

30           Indeed, because the closure can be provided with a smooth, cylindrical sleeve surrounding a flat actuator top, a user confronted with such a closure on a container would typically attempt to open the closure by rotating the sleeve in the unscrewing direction (for the conventional right-hand thread which is so widely used throughout the world). Even if the user had not previously used such a closure, the user would 35 undoubtedly attempt to open the closure by unscrewing it

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in the conventional manner. Of course, this would provide the desired result of the dispensing closure being moved to the dispensing, open orientation.

Because the closure is susceptible to being so easily opened by the ordinary person without special instructions, it is believed that the closure can be effectively used on containers without providing opening instructions. Thus, the exterior of the closure can provide a "high-style", smooth, slick, exterior surface configuration unencumbered by instructional nomenclature or indicia which are so often found on other types of closures.

It will be readily apparent from the foregoing detailed description of the invention and from the illustrations thereof that numerous variations and modifications may be effected without departing from the true spirit and scope of the novel concepts or principles of this invention.

## WHAT IS CLAIMED IS:

1. A dispensing closure for an opening to a container, and closure comprising:

5 a body that can be located on said container over said opening, said body having a transverse end wall defining an outlet passage through said end well for communicating with said container opening;

10 a sleeve mounted on said body for rotation relative to said body about a rotation axis defined by said sleeve, said sleeve having a transverse deck over said body end wall, and said deck defining a discharge passage through said deck for communicating with said body outlet passage and for being opened and closed; and

15 a seal which is located between said sleeve deck and said body transverse end wall and which extends around said body outlet passage and said deck discharge passage.

20 2. The closure in accordance with claim 1 in which said seal includes (A) a flange on said sleeve projecting from said deck around said discharge passage toward said body transverse end wall; and (B) an annular seal wall on said body projecting from said body transverse end wall around said body outlet passage toward said sleeve deck, said annular seal wall being 25 concentric with, and in sealing engagement with, said sleeve flange.

30 3. The closure in accordance with claim 2 in which

35 said body annular seal wall is radially inwardly of said sleeve flange; and

30 said seal wall includes a circumferential bead projecting radially outwardly to sealingly engage said sleeve flange.

35 4. The closure in accordance with claim 1 in which

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      said body end wall defines an upwardly facing top surface;

      said sleeve deck defines a downwardly facing bottom surface spaced from said body end wall; and

5      said seal includes a first seal member projecting from said sleeve bottom surface to engage said body end wall top surface.

      5. The closure in accordance with claim 4 in which said sleeve deck has a second seal member projecting downwardly from said sleeve deck bottom surface around said discharge passage and within said first seal member for engaging said body end wall top surface outwardly of said body outlet passage.

      15. The closure in accordance with claim 1 in which said closure further includes an actuator mounted on said sleeve for rotation therewith to occlude flow from said container when said actuator means is in a closed, non-dispensing position and to permit flow from said container when said actuator means is tilted about a pivot axis to an open, dispensing position; and

      20. said closure includes engaging means defined by said body and said actuator for tilting said actuator between said closed position and said open position while said actuator is rotated with said sleeve.

      25. The closure in accordance with claim 1 in which said sleeve discharge passage is located to move in an arcuate path when said sleeve is rotated.

      30. The closure in accordance with claim 1 in which said seal includes a seal member projecting upwardly from said body transverse end wall to engage said sleeve deck.

      9. The dispensing closure in accordance with claim 1 in which

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a said discharge passage is movable in an arc to selectively shift into and out of communication with said body outlet passage when said sleeve is rotated;

5        said sleeve deck has a downwardly projecting seal around said discharge passage; and

      said body transverse end wall has an upwardly projecting seal member extending at least partially around said body outlet passage for engaging said sleeve deck and sleeve seal within said sleeve seal.

10      10. The closure in accordance with claim 1 in which said closure body is separate from, but releasably attachable to, said container.

      11. A dispensing closure for an opening to a container, and closure comprising:

15      a body that can be located on said container over said opening, said body having an outlet passage for communicating with said container opening and having a pair of upwardly projecting drive members;

20      20. a sleeve mounted on said body for rotation relative to said body about a rotation axis defined by said sleeve, said sleeve having a transverse deck over said body, said sleeve deck defining opening means for receiving said drive members which extend therethrough, and said deck also defining a discharge passage through said deck for communicating with said body outlet passage; and

25      30. an actuator mounted on said sleeve for rotation therewith to occlude flow through said discharge passage from said container when said actuator means is in a closed, non-dispensing position and to permit flow through said discharge passage from said container when said actuator means is tilted about a pivot axis to an open, dispensing position, said actuator including engaging portions for engagement with said body drive members, the engagement between said

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body drive members and said actuator engaging portions effectively occurring on opposite sides of said pivot axis to effect tilting of said actuator.

5 12. The closure in accordance with claim 11 in which each said drive member is a post having at least one drive surface inclined relative to a plane that is normal to said rotational axis and having an abutment surface oriented parallel to said plane.

10 13. The closure in accordance with claim 12 in which the top of each said post has an upwardly open channel.

14. The closure in accordance with claim 12 in which a circular arc between said posts is less than 180°.

15 15. The closure in accordance with claim 11 in which said actuator engaging portions include two spaced-apart, downwardly projecting cam rails which each have a cam ramp inclined relative to a plane that is normal to said rotation axis.

20 16. The closure in accordance with claim 15 in which said cam ramps are partially helical and have different inclinations.

25 17. The closure in accordance with claim 15 in which one of said rails has an abutment surface oriented parallel to said plane.

30 18. The closure in accordance with claim 15 in which said actuator engaging portions include a planar surface of said actuator from which said cam rails project whereby at least one of said posts engages said planar surface during a part of the rotation of said sleeve and engages one of said cam rails during another part of the rotation of said sleeve.

35 19. The closure in accordance with claim 11 in which said body is separate from, but releasably attachable to, said container.

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20. The closure in accordance with claim 11  
in which

5        said sleeve deck opening means includes two  
spaced-apart slots defined in said deck outwardly of  
said discharge passage; and

one of said drive members projects through one  
of said slots and the other of said drive members  
projects through the other of said slots.

21. The closure in accordance with claim 11  
10      in which

      said body outlet passage and said sleeve  
discharge passage are each radially offset from said  
rotation axis;

15      said body transverse end wall has a generally  
planar, upwardly facing, top surface;

      said sleeve deck has a generally planar,  
downwardly facing, bottom surface;

20      said sleeve further includes a generally  
annular seal flange projecting downwardly from said deck  
bottom surface toward body end wall top surface; and

      said body end wall has an annular seal wall  
projecting upwardly toward said sleeve deck, said  
annular seal wall being concentric with, and in sealing  
engagement with, said sleeve seal flange.

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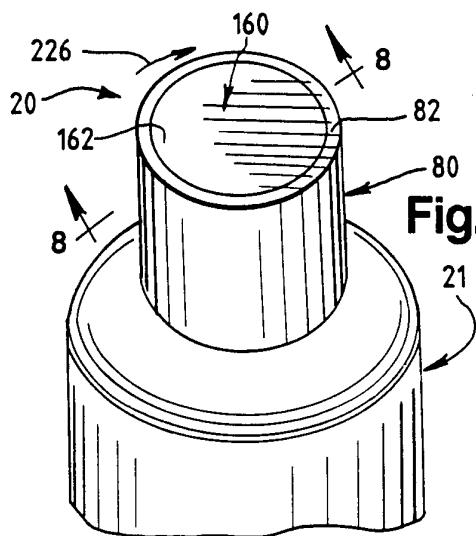


Fig. 1

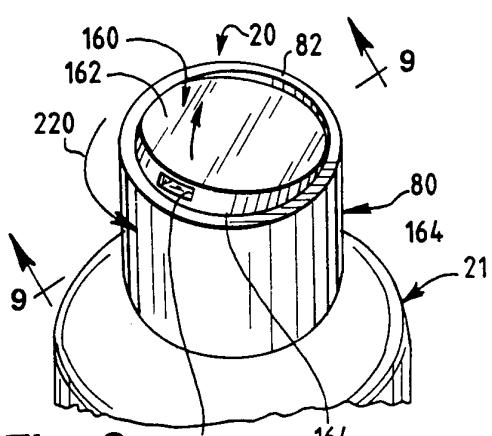


Fig. 2

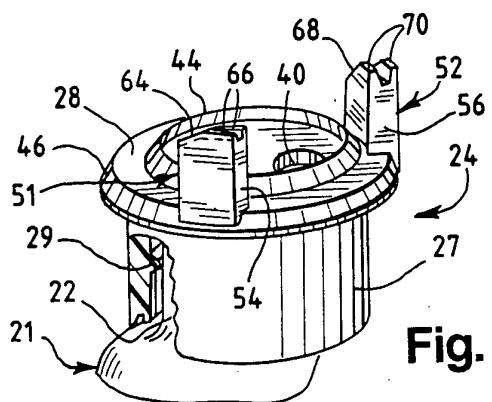
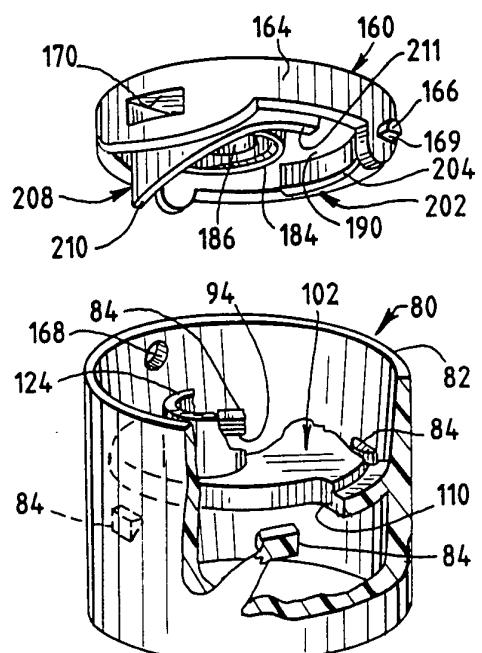
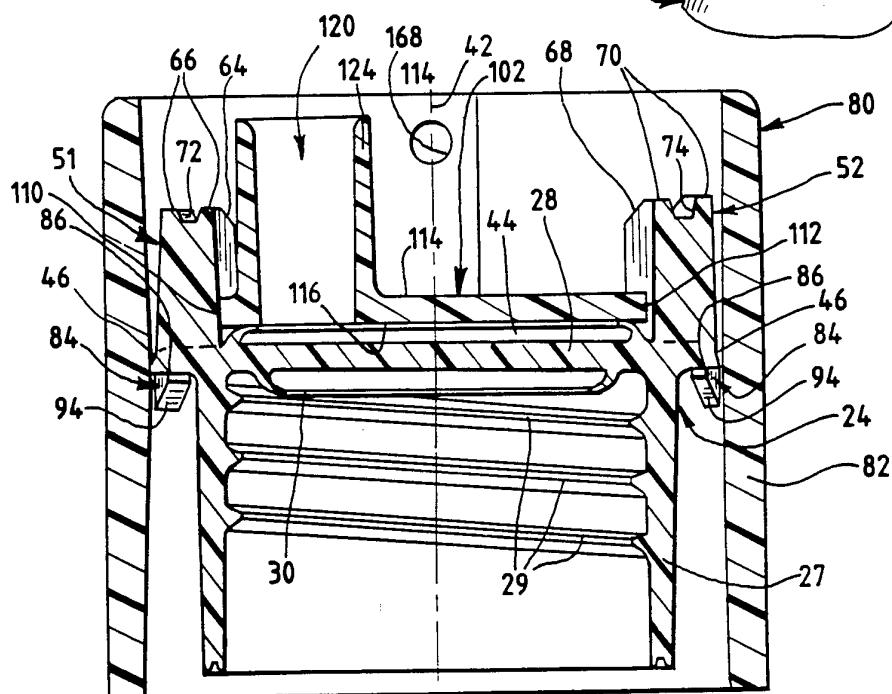
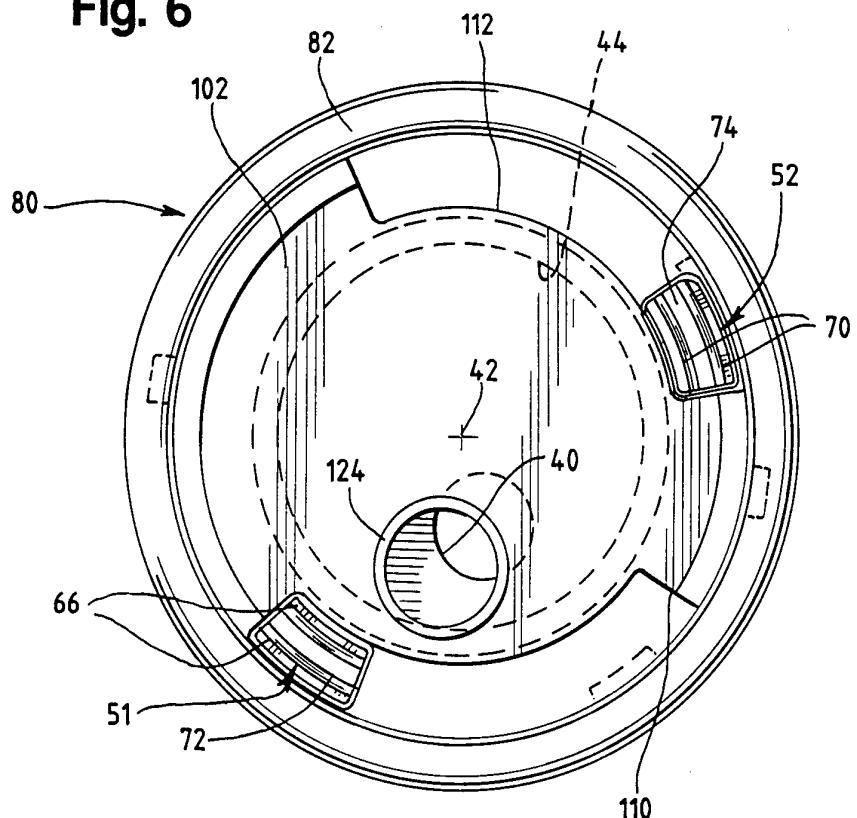


Fig. 4



**Fig. 6**



**Fig. 5**

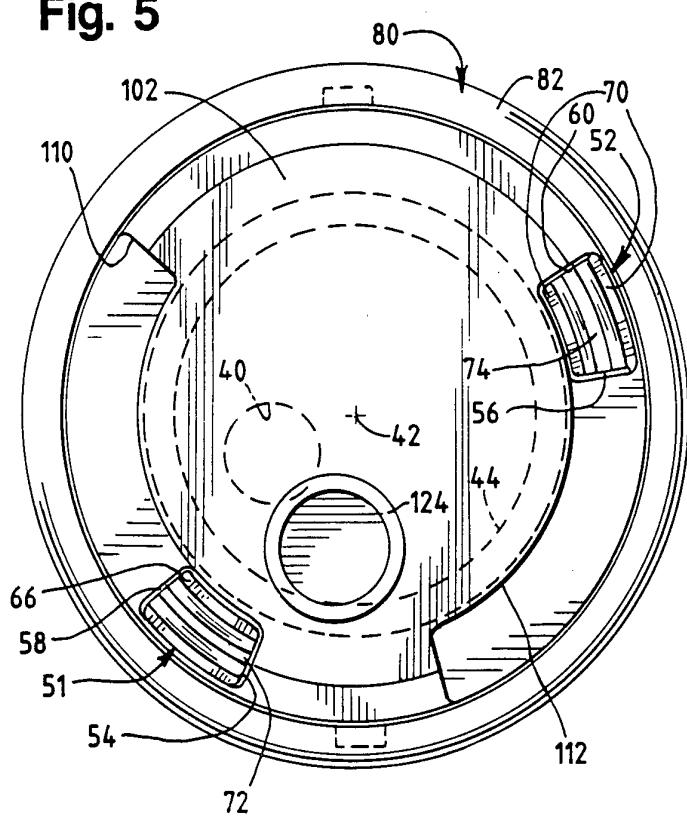
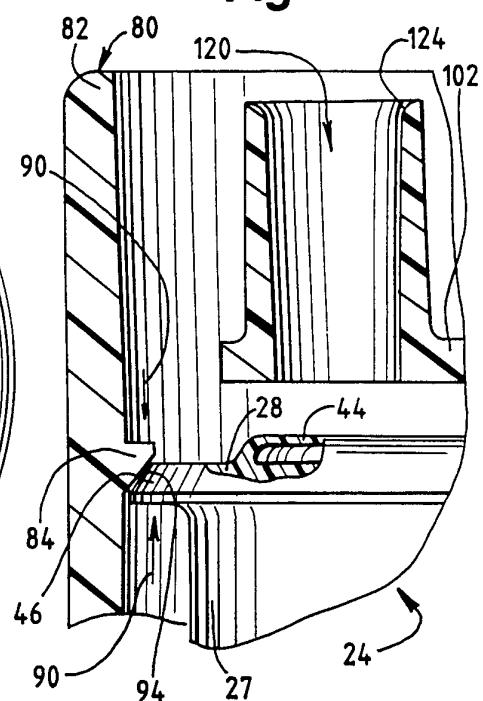
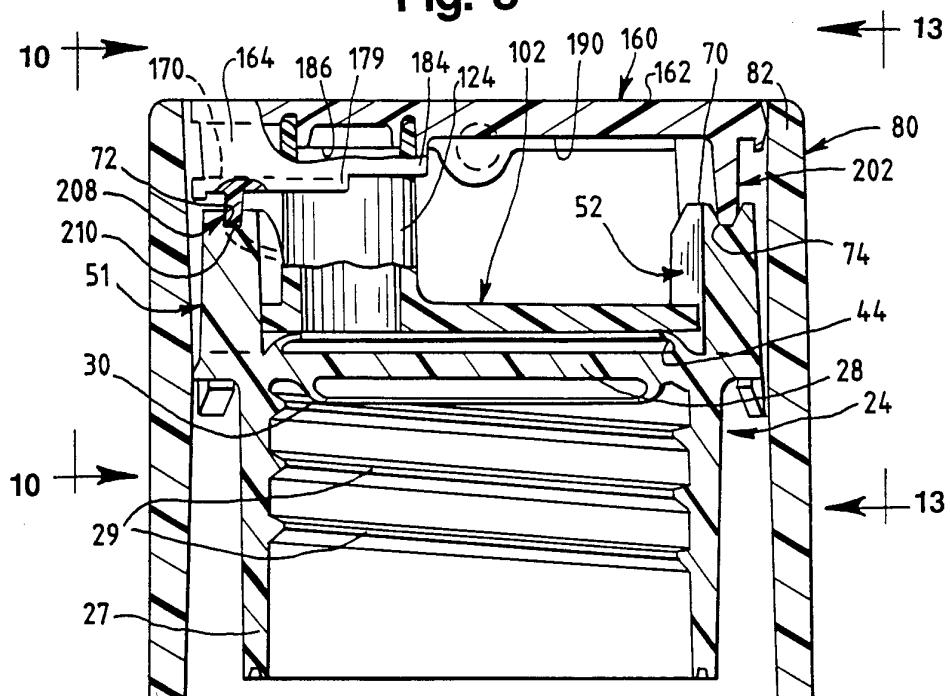


Fig. 7

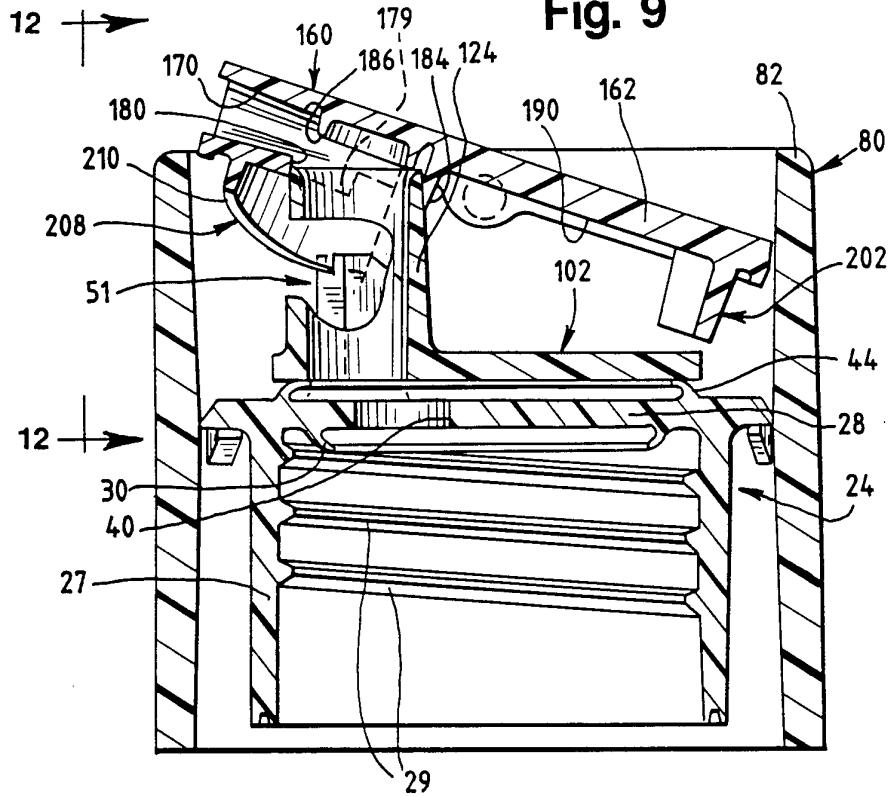


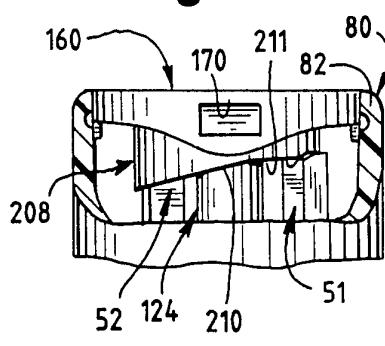
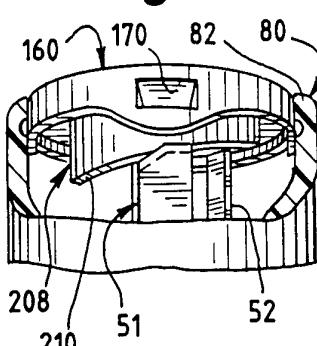
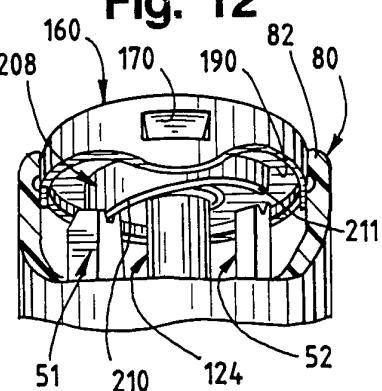
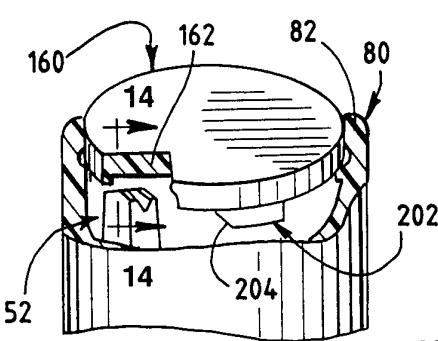
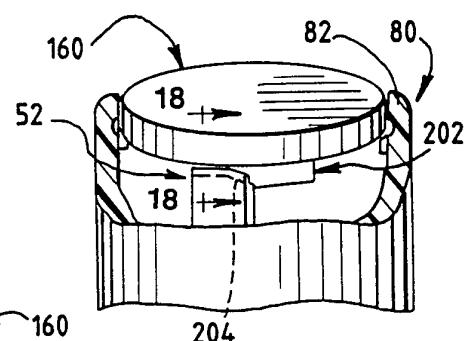
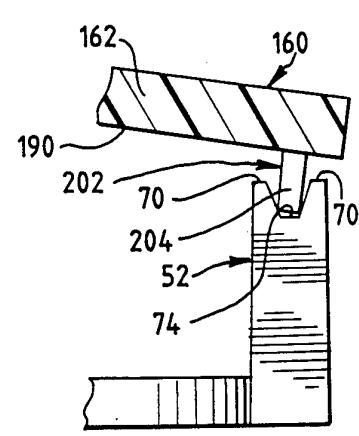
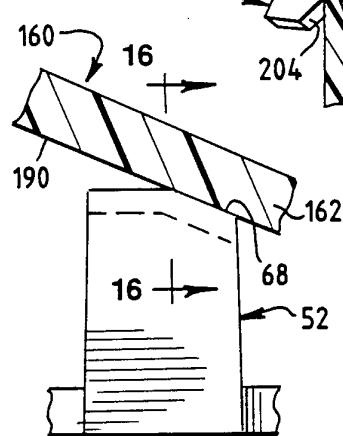
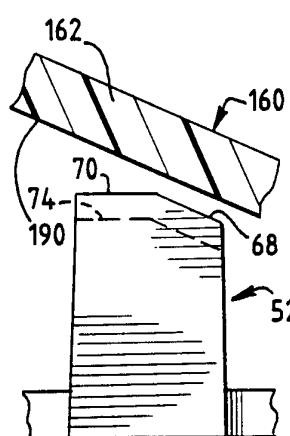
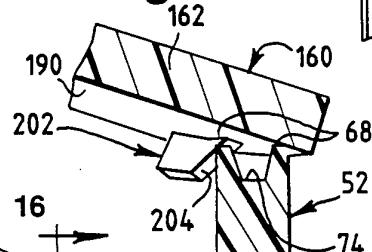
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**Fig. 8**



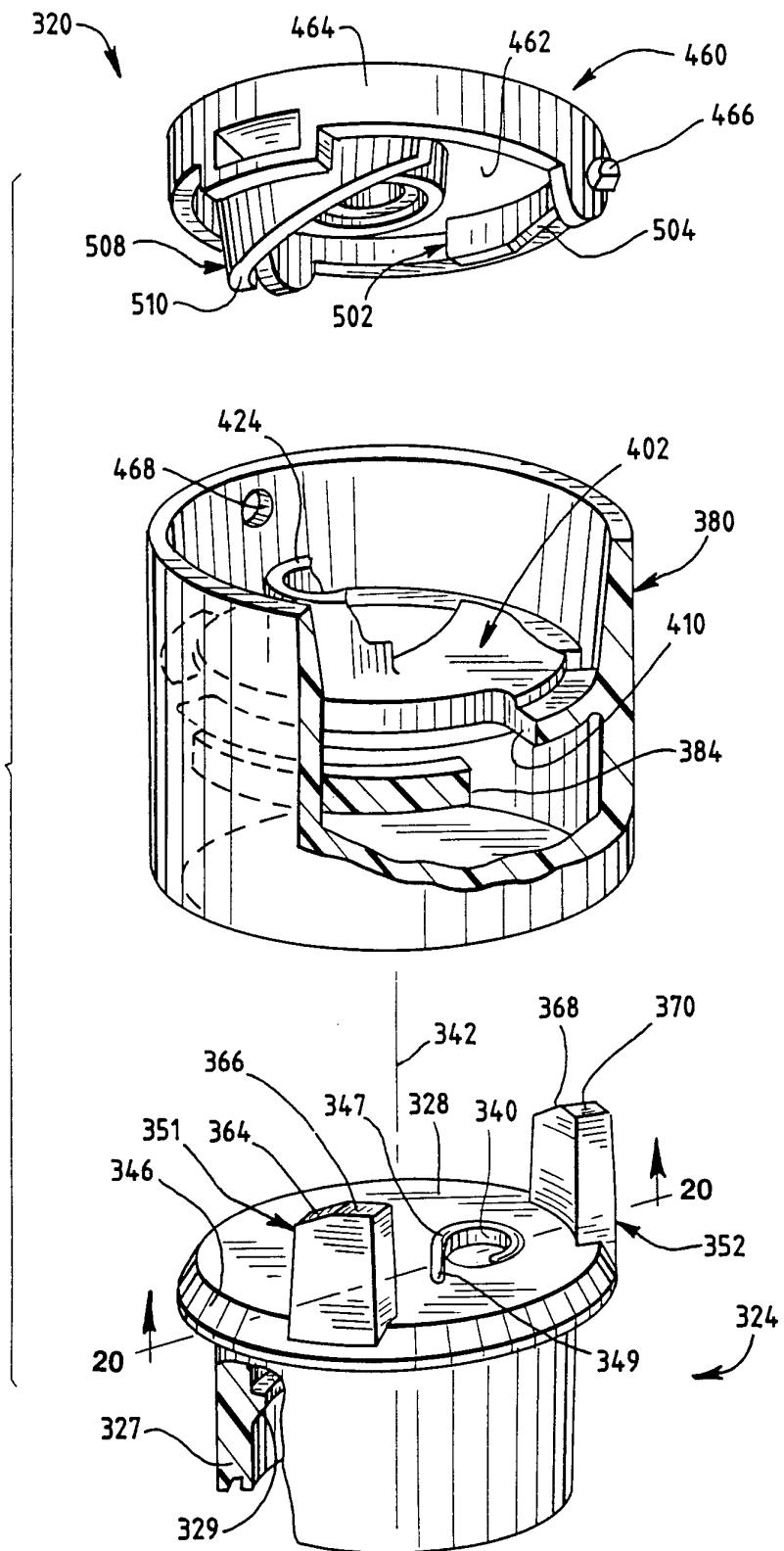
**Fig. 9**



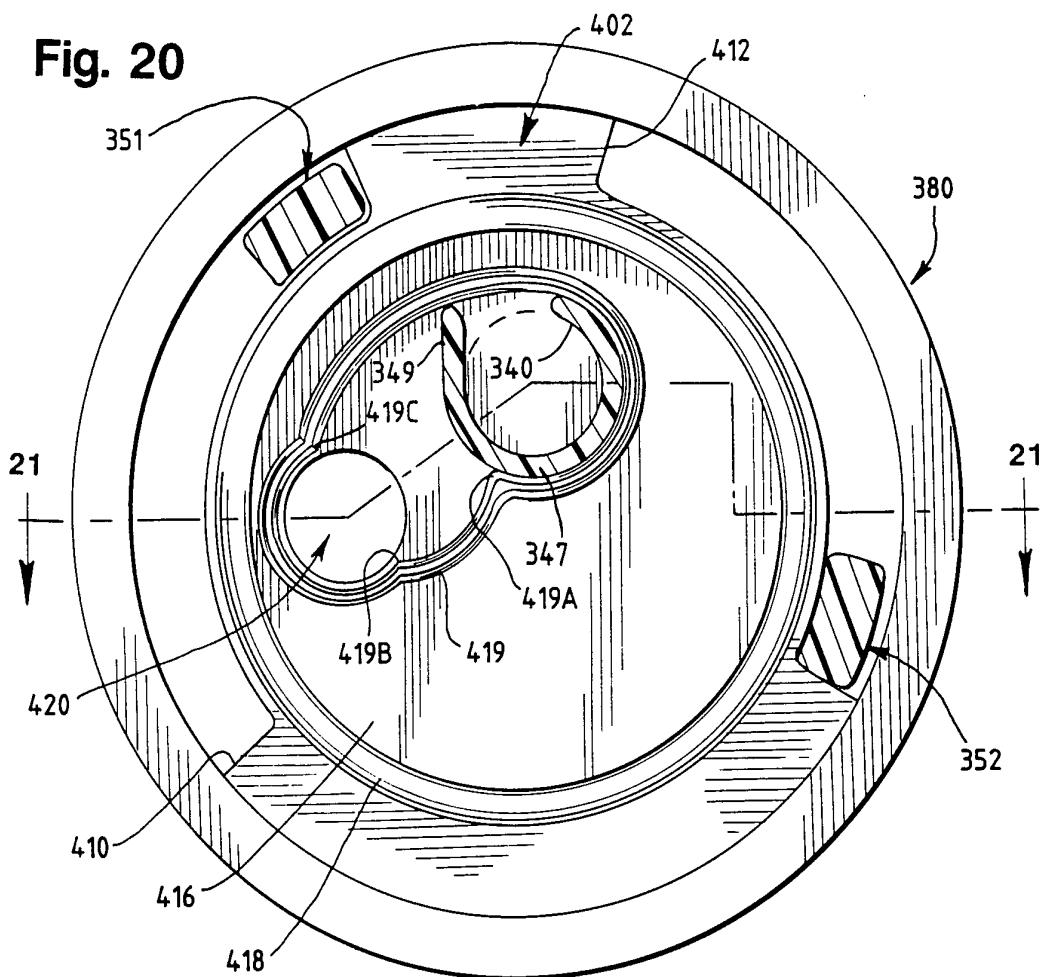
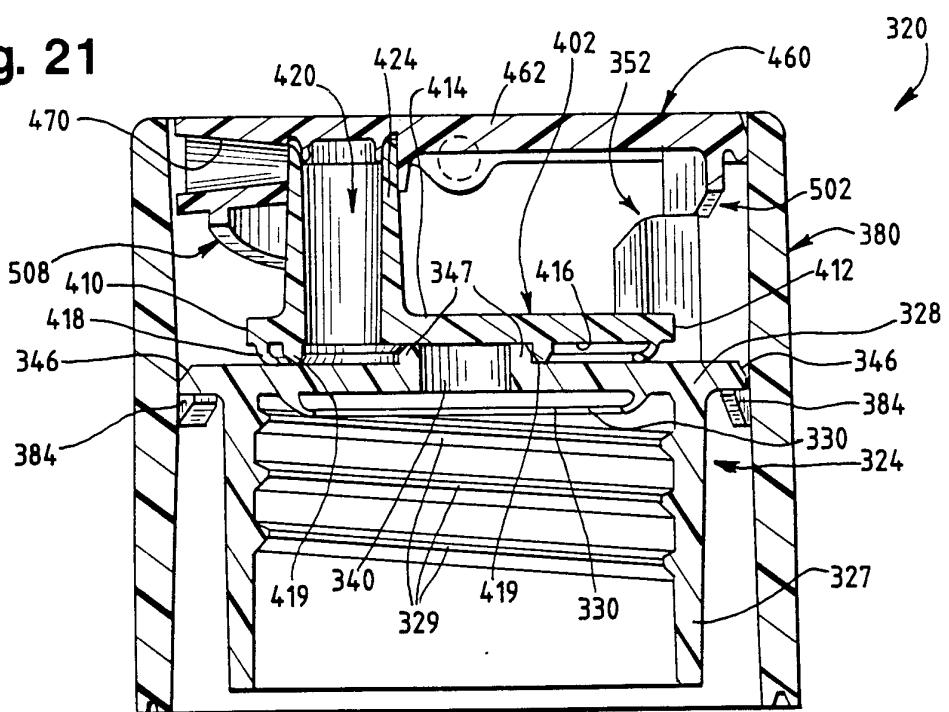
**Fig. 10****Fig. 11****Fig. 12****Fig. 13****Fig. 17****Fig. 16****Fig. 14****Fig. 15****Fig. 18**

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Fig. 19



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**Fig. 20****Fig. 21**

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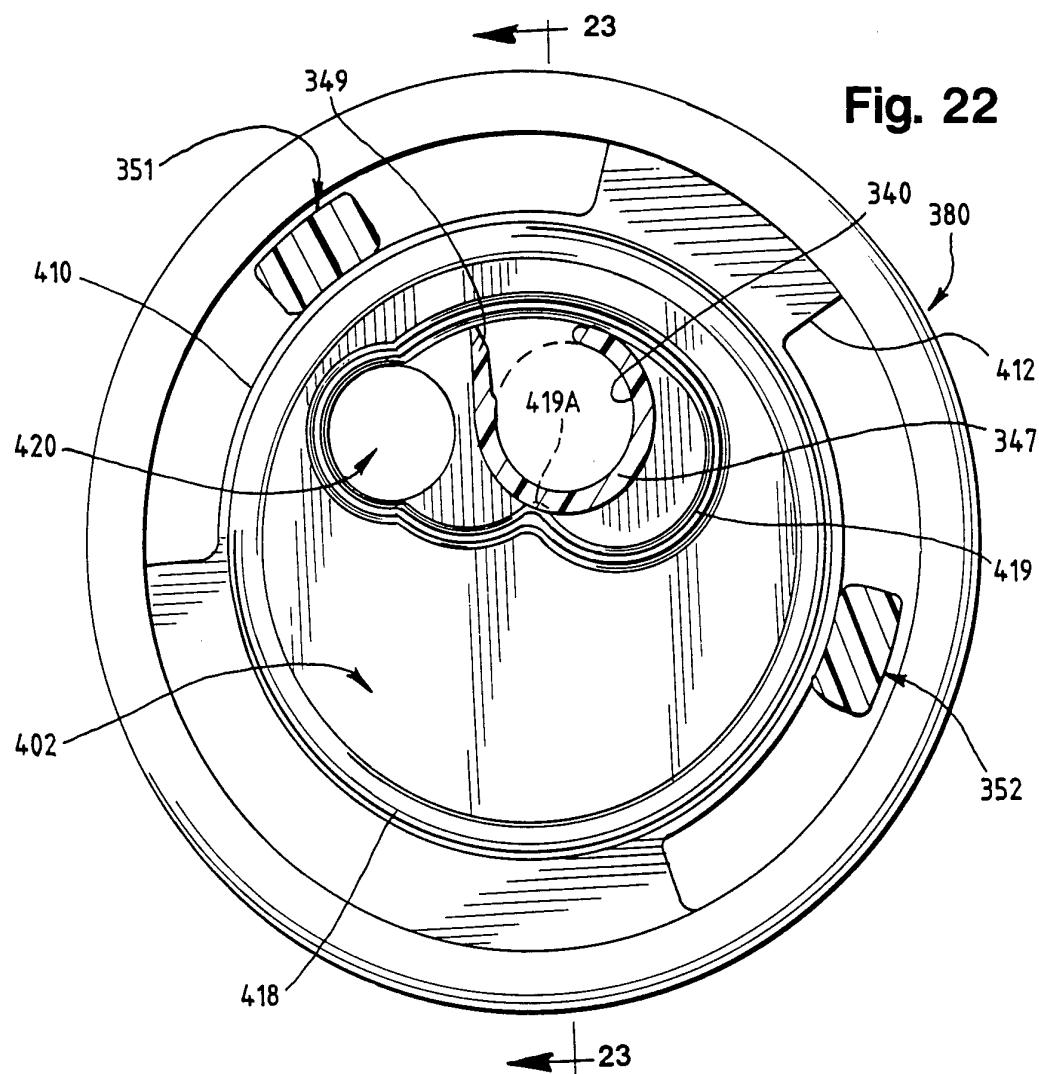
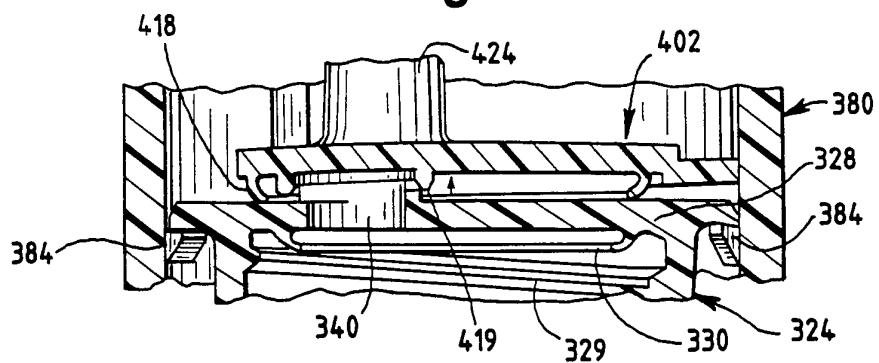
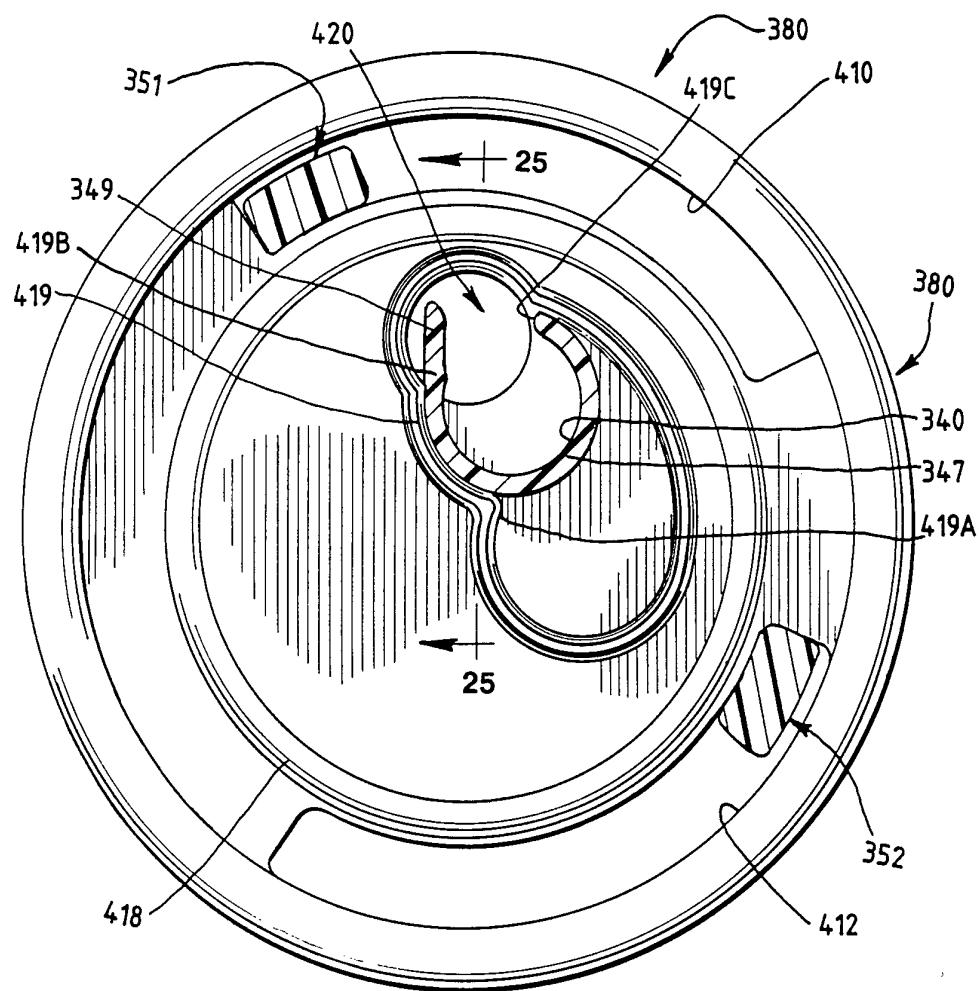
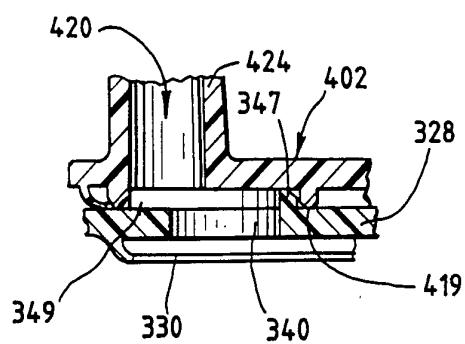


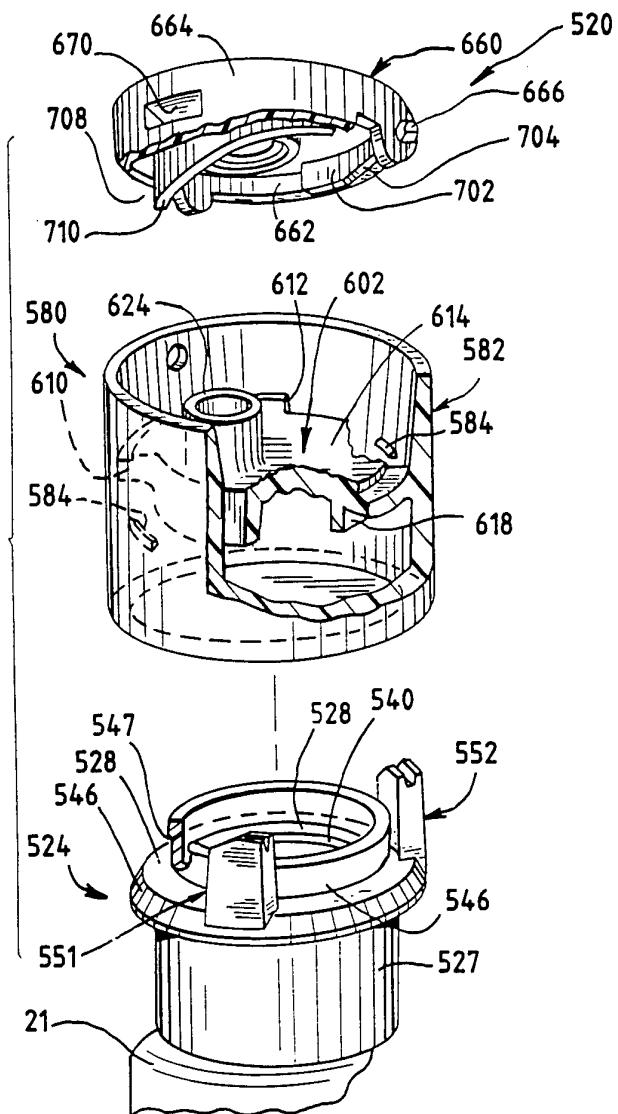
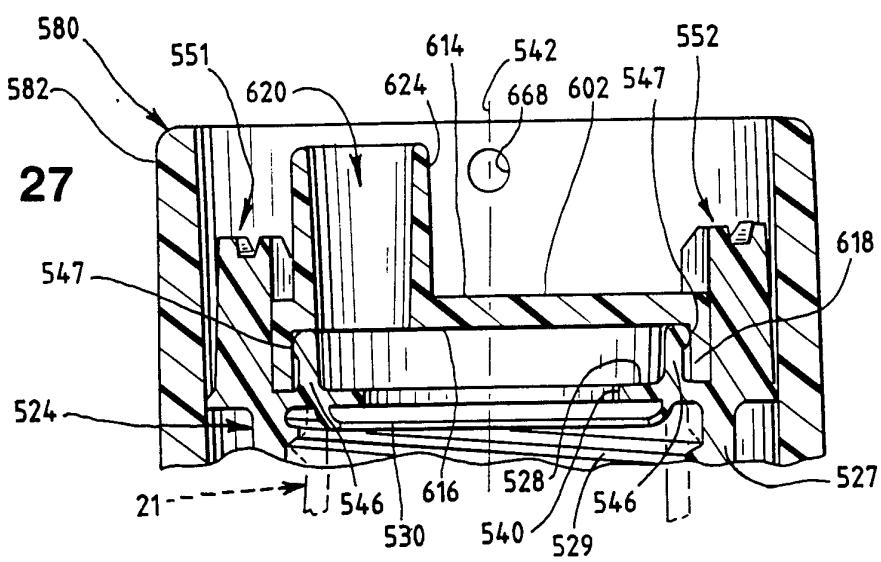
Fig. 23



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**Fig. 24****Fig. 25**

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**Fig. 26****Fig. 27**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US93/12050

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B65D 47/20

US CL :222/505

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)

U.S. : 222/503, 505, 507, 531, 532, 548, 550, 553, 556

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)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB, A, 2182027, (Gach) 07 May 1987, Page 1, line 63 to page 2, line 35.	1-2, 7-10
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Y		3-5
A	US, A, 5,279,451 (Mueller et. al.) 18 January 1994, col. 4, line 12 to col. 13, line 4.	
A	US, A, 5,199,617 (Bennett) 06 April 1993, col. 2, line 30 to col. 3, line 40.	

 Further documents are listed in the continuation of Box C.  See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be part of particular relevance		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
"E" earlier document published on or after the international filing date	"X"	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
"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)	"Y"	document member of the same patent family
"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		

Date of the actual completion of the international search	Date of mailing of the international search report
06 APRIL 1994	APR 25 1994
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer <i>Kenneth Bomberg</i> KENNETH BOMBERG
Facsimile No. NOT APPLICABLE	Telephone No. (703) 308-1113