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(54) **FLIP-TOP CLOSURE CAP**

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(57) **ABSTRACT**

A flip-top cap is provided in which an upper portion is secured to a lower portion by means of a living hinge. An outer skirt forms a lever with an integral radial connecting wall on a side of the cap opposite the living hinge. The outer skirt and the radial connecting wall may be elastically deformed to permit a detent on the upper portion of the cap to escape a recess on the outer skirt for opening the cap. The radial connecting wall is lowered and thinned with respect to heretofore known designs, facilitating opening of the cap. Integral ribs are provided on the base and flip-top portions to prevent twisting and/or lateral movement of the upper portion that could allow for inadvertent opening of the cap.

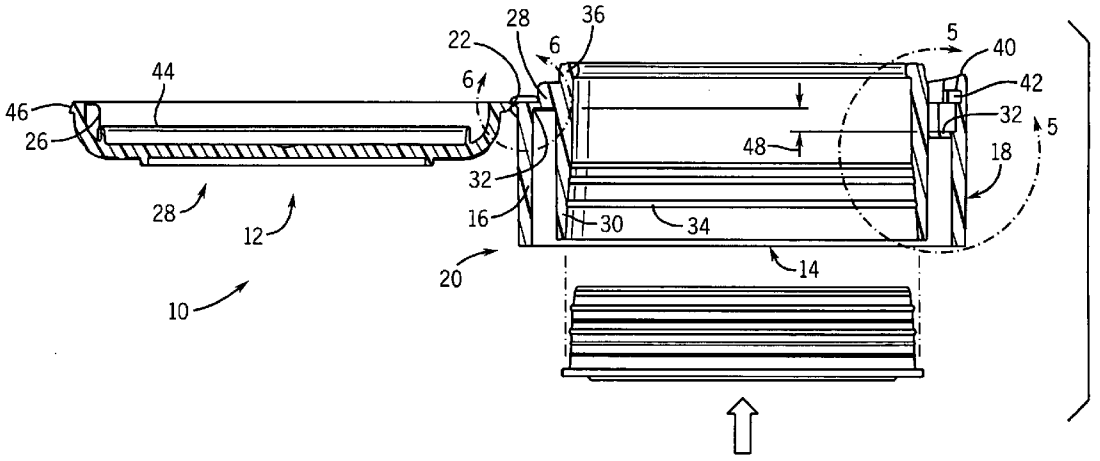


FIG. 1

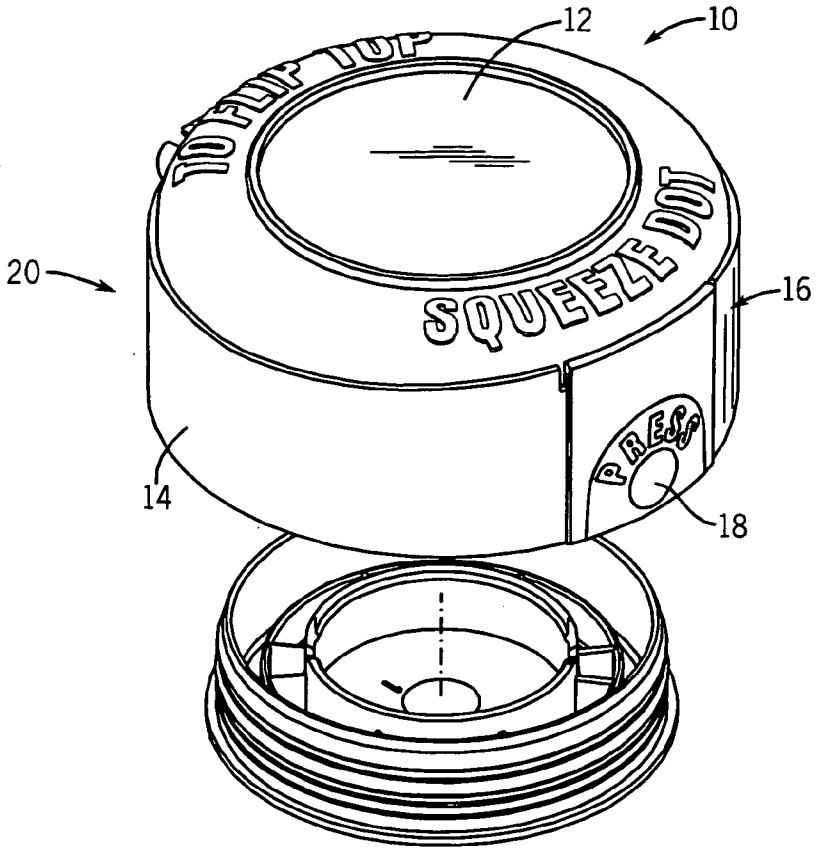
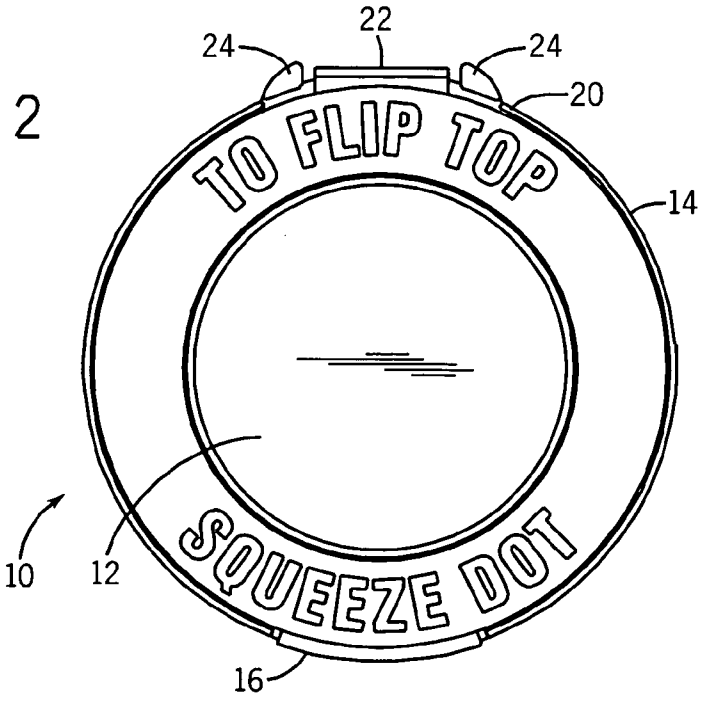

12
10
TO FLIP TOP
SQUEEZE DOT
20
16
PRESS
14
18

FIG. 2


22
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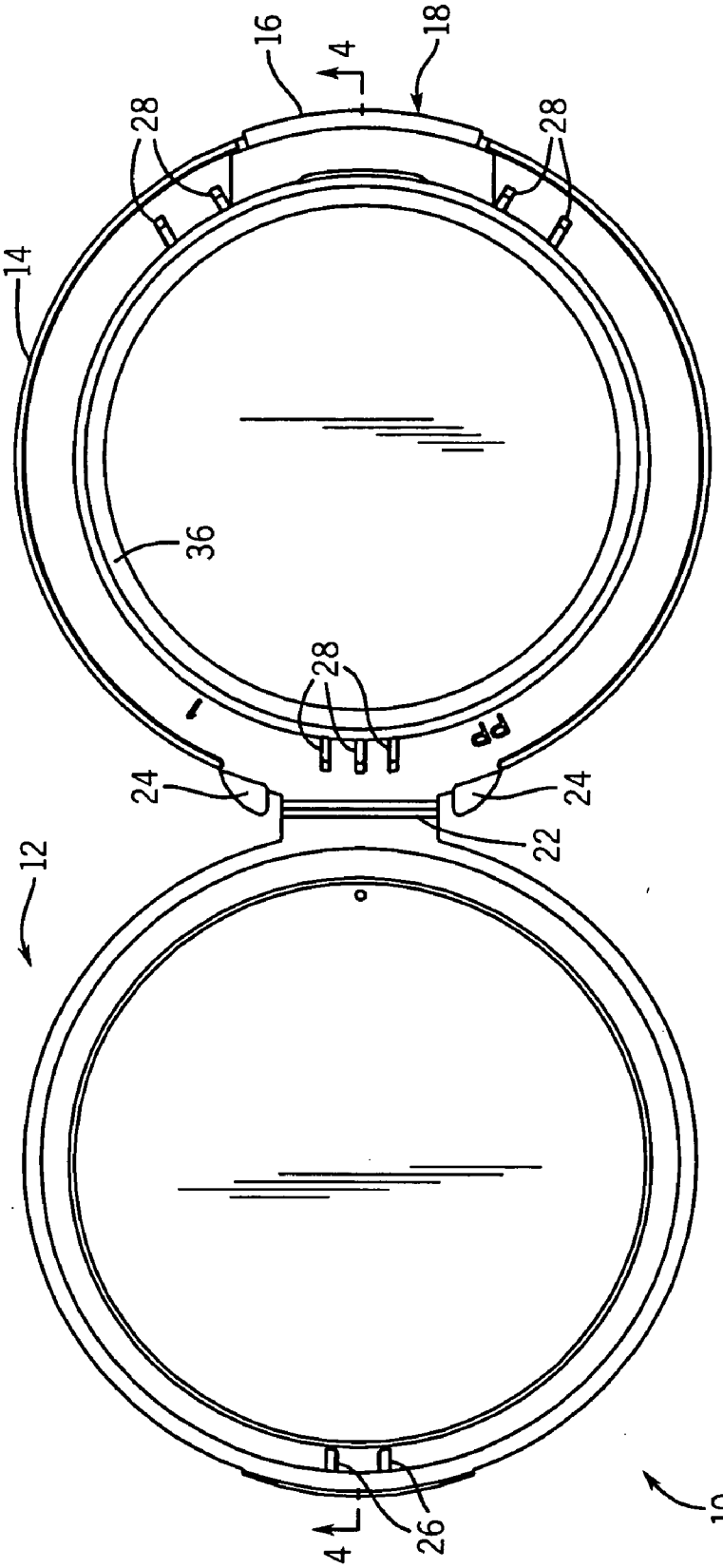

FIG. 3

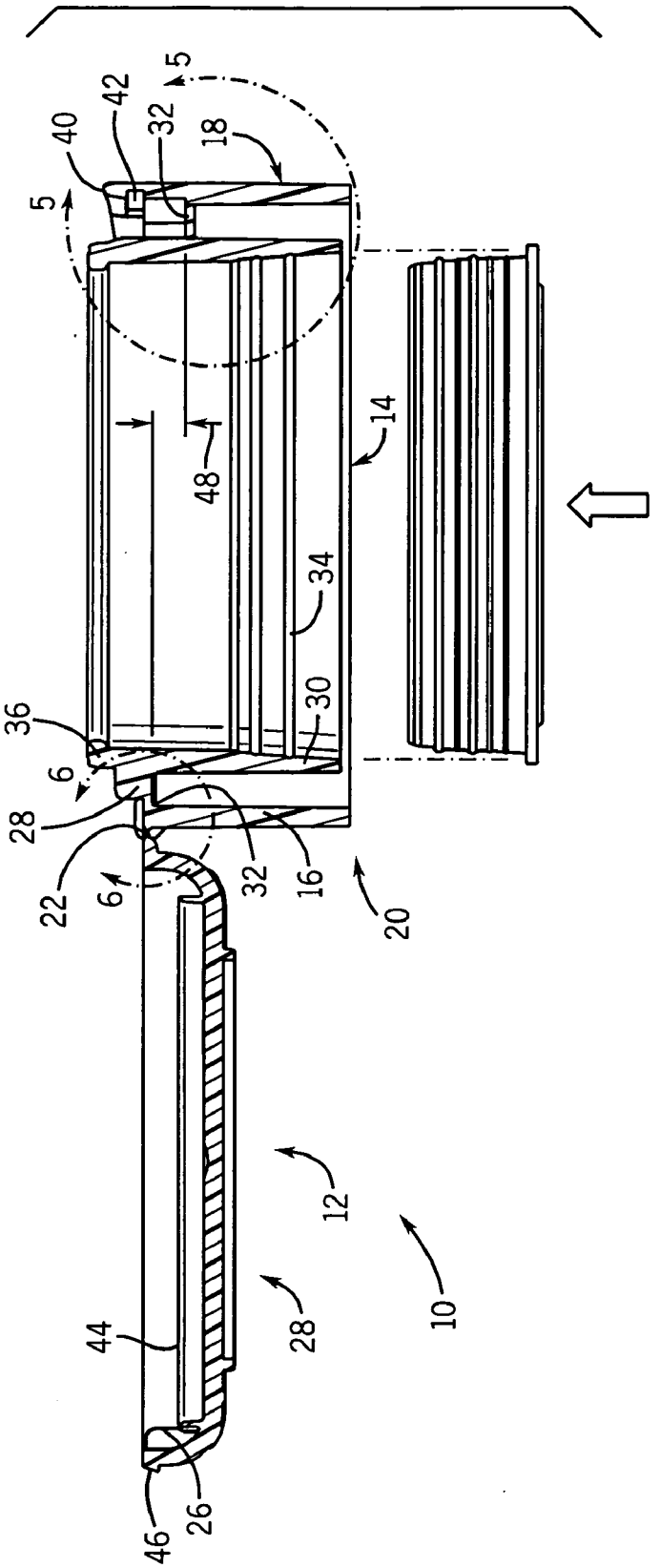

FIG. 4

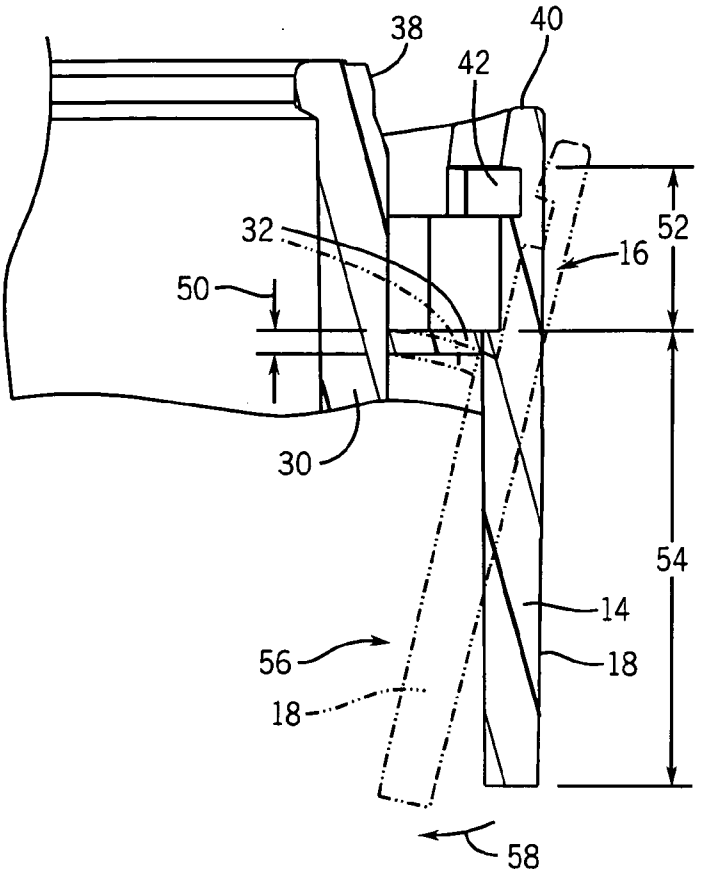

FIG. 5

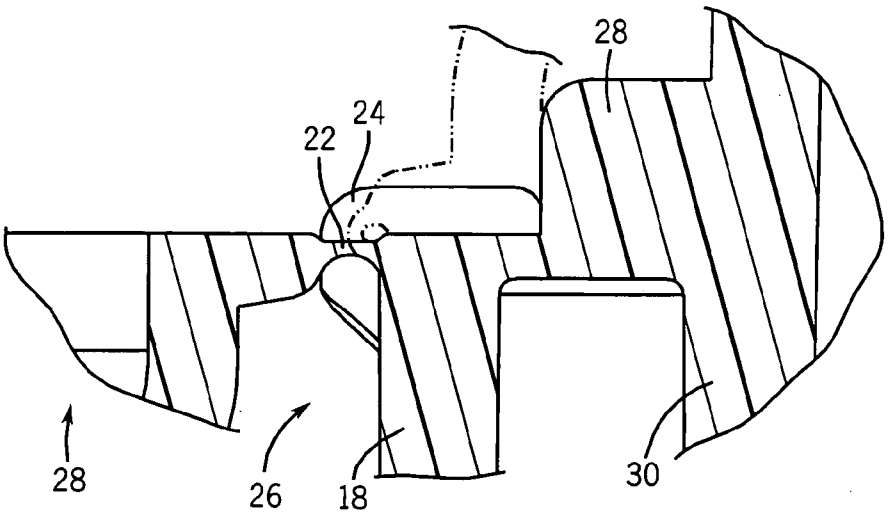

FIG. 6

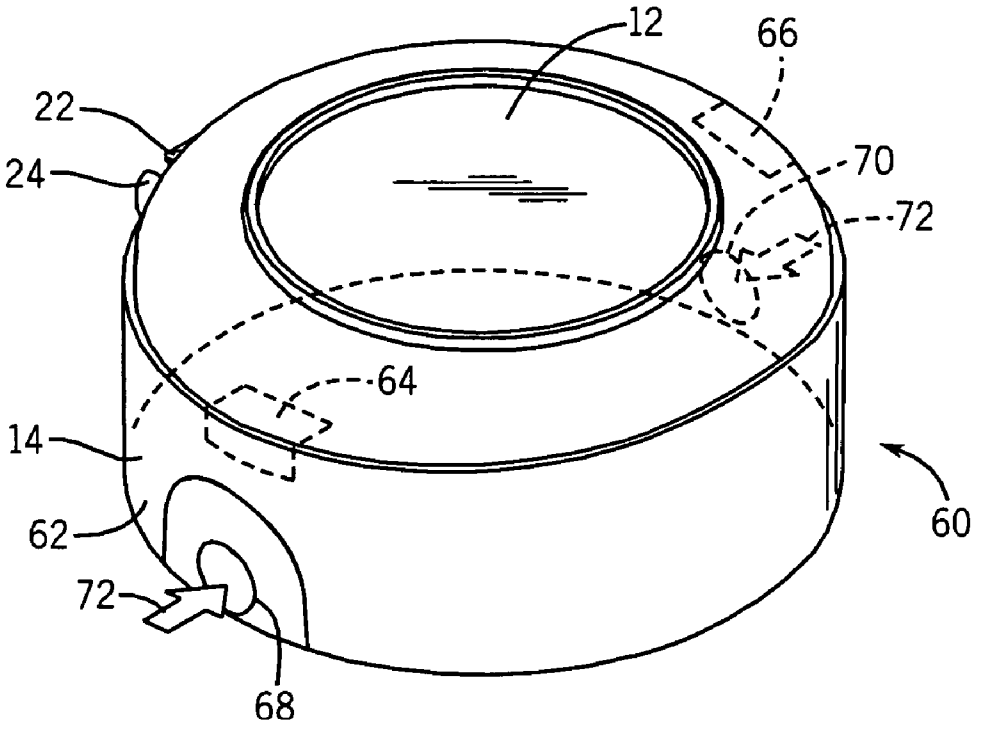

FIG. 7

FLIP-TOP CLOSURE CAP

BACKGROUND

[0001] The present invention relates generally to the field of caps and closures for containers. More particularly, the invention relates to improvements in a flip-top cap that aid in preventing unwanted opening of the cap, while ensuring that the cap can be more easily opened when desired.

[0002] A very wide range of injection molded container caps and closures have been proposed and are currently in use. Many of these are multi-piece closures that close and seal an internal volume by snapping, threading, or otherwise mechanically engaging a separate base element. Other closures are available that incorporate a thinned section of material, commonly referred to as a "living hinge", that allows the cap to be opened, while maintaining the upper or opening portion of the cap attached to a lower portion. The lower portion on these caps is generally secured to a mouth of the container, such as by snapping engagement, threading, and so forth.

[0003] Improvements in single-piece flip-type caps have been made such that certain designs can be opened and closed quite easily by one hand. In one known design, for example, a user depresses an area of an outer skirt on the base portion of the cap to open the upper portion. The base portion flexes by deformation of the outer skirt, allowing a catch on the upper portion of the cap to escape, thereby freeing the upper portion to open by flexure of a living hinge. A cap generally of this type is described in U.S. Pat. No. 5,860,543 commonly assigned with the present invention. Such caps provide great utility in allowing users to simply, quickly and easily open the cap, by squeezing the outer skirt. Such caps can also be closed very easily by reengagement of the snap closure opposite the living hinge.

[0004] However, caps of this type have proven to have certain drawbacks related to their relative ease of opening. That is, because of the geometry of the outer skirt, the caps may be inadvertently opened by dropping the container and thereby contacting the region that is depressed by the user for opening. Conversely, if the geometry is altered, the cap can prove difficult to open, requiring significant deformation of the outer skirt before the latch mechanism is freed. Further, thicknesses of component portions of the cap may affect the ability or ease of use. It has been found, for example, that the thickness of a rib or extension that serves as a fulcrum for the trigger mechanism on the outer skirt of the type described above may make deformation of the outer skirt difficult. Finally, in such caps incorporating living hinges, movement of the upper or opening portion of the cap with respect to the base, including twisting, front-to-back and side-to-side movement, can occur about the living hinge, permitting the cap to snap open in an undesirable manner.

[0005] There is a need, therefore, for improved cap designs that avoid such drawbacks. The art would benefit from a design generally similar to those of previous designs such as that described above, but that effectively permit the cap to be opened when desired, while precluding or reducing the chances of accidental opening.

BRIEF DESCRIPTION

[0006] The present invention provides an improved cap designed to respond to these needs. The cap may be used in any range of settings, but is particularly well-suited for use with containers designed for dispensing liquids and particulate materials. In a current design, for example, the cap itself can form a container by receipt of an insert or plug that closes a bottom portion of the cap (such as for holding and dispensing pharmaceuticals). In such arrangements, the cap itself may partially form the container. The cap includes an inner skirt that is designed to be affixed to a container. An outer skirt surrounds the inner skirt and includes a region that forms a deformable lever. The outer and inner skirt are part of a base of the cap. An upper or opening portion of the cap is secured to the base by a living hinge. The upper portion includes a latch or detent that is engaged with the base when the cap is closed. The geometry, placement and thickness of molded sections of the cap facilitate escape of the detent from the latching portion of the lever when the cap is desired to be opened.

[0007] The cap is further improved by the provision of one or more ribs or abutment elements that prevent twisting of the upper portion of the cap about the living hinge, as well as and lateral movement of the upper portion on the base. Once closed, then, the upper portion is prevented from moving and thereby opening. The cap may also include integral bumpers that protect the living hinge from damage in the event the cap or container is dropped.

DRAWINGS

[0008] These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0009] FIG. **1** is a perspective view of an exemplary flip-top cap in accordance with aspects of the present invention;

[0010] FIG. **2** is a top plan view of the cap of FIG. **1** illustrating placement of a lever portion and a living hinge, along with bumper elements that prevent damage to the living hinge in the event the cap is dropped;

[0011] FIG. **3** is a top plan view of the cap of FIGS. **1** and **2** shown with the cap opened;

[0012] FIG. **4** is a sectional view of the cap shown in FIG. **3** taken along line **4-4** and illustrating improved geometries of the lever and associated elements;

[0013] FIG. **5** is a detailed view of a portion of the cap shown in FIG. **4**, illustrating improved placements and configurations of the components that allow for deformation of the outer skirt for opening the cap;

[0014] FIG. **6** is a detailed view of the cap shown in section of FIG. **4**, illustrating a placement of a bumper adjacent to the living hinge to protect the hinge structure, as well as an exemplary rib that aids in preventing twisting or lateral movement of the upper portion of the cap when closed; and

[0015] FIG. **7** is a more diagrammatical view of an exemplary cap in accordance with aspects of the invention that incorporates a plurality of latches rather than a single latch structure.

DETAILED DESCRIPTION

[0016] Turning now to the drawings, and referring first to FIG. **1**, a cap **10** is illustrated for a container. The cap may

be designed to fit on a mouth of the container to permit dispensing of contents from the container, particularly liquid or particulate contents that can flow out of the container through the cap when open. In a present embodiment, illustrated in the figures, the cap receives a plug or insert I that closes the bottom of the cap, and creates an interior volume that may be accessed by opening the cap. Such arrangements are particularly suitable, for example, for storing pharmaceuticals and other items. Also, it should be noted that in such arrangements, the cap itself may be said to partially form the container.

[0017] The cap **10** generally includes an upper flip-top portion **12** that closes an opening in the cap when placed in the closed position illustrated in FIG. **1**. As described more fully below, the upper flip-top portion **12** can be snapped into place on a lower portion **14**. The lower portion forms an outer skirt **16** around its periphery. The outer skirt **16**, in turn, presents a front side in which a depressible lever location **18** is provided. The front side **18** is diametrically opposed to a rear side **20** of the outer skirt. As more fully described below, by depressing or exerting a force at the lever location **18** and at a location on the rear side opposite that location, the upper portion of the cap is permitted to open, thereby permitting access to the contents of the container.

[0018] FIG. **2** is a top plan view of the cap illustrated in FIG. **1**. As more generally shown in FIG. **2**, the cap presents a rear side **20** opposite the front side, with a living hinge structure **22** is disposed on the rear side **20** opposite the depressible lever location **18** (see FIG. **1**). As illustrated in the subsequent figures and as described more fully below, the living hinge **22** is formed of a thinned segment of flexible material such that the cap can be opened and closed repeatedly during its life, with the upper portion of the cap remaining securely attached to the lower portion by means of the hinge. Also shown in FIG. **2** are a pair of bumpers or posts **24** disposed on either side of the living hinge **22**. As described more fully below, the posts **24** serve to protect the hinge from damage in the event the cap or container is dropped.

[0019] FIG. **3** is a top plan view of the cap of FIGS. **1** and **2** with the upper portion of the cap opened with respect to lower portion. As shown in FIG. **3**, the cap is made up of a base or lower portion **14** and a flip-top upper portion **12**. As noted above, the lower portion or base **14** is secured to the flip-top upper portion **12** by the intermediary of a flexible living hinge **22**. As will be appreciated by those skilled in the art, the cap **10** may be made by a number of manufacturing processes, although a presently preferred process includes injection molding. The various features described herein may be particularly designed to permit a two-piece mold that allows for extraction of the unitary cap structure (including the lower base portion **14** and the flip-top upper portion **12**).

[0020] As is also visible in FIG. **3**, the upper flip-top portion **12** of the cap includes ribs **26** designed to abut structures of the base portion when the cap is closed. Similarly, the base portion **14** includes ribs **28** at several locations that contact the inner surface of the upper portion **12** when the cap is closed. As described in greater detail below, the ribs **26** and **28** act to prevent or limit twisting movement of the upper portion of the cap on the lower portion (e.g., about the living hinge **22**) as well as translational movement in side-to-side and front-and-back directions. Such ribs have been found quite helpful in preventing unintentional opening of the cap due to such movement. It should be noted that at least some of the ribs may limit such side-to-side and front-to-back movement without necessarily contacting the opposite portion of the cap until some slight movement has occurred. This is the case for certain of the ribs adjacent to the lever location **18** in a present embodiment.

[0021] Referring to FIG. **3** in conjunction with FIG. **4**, which is a sectional view through the open cap of FIG. **3**, the base portion **14** of the cap also includes an inner skirt **30** which extends generally parallel to the outer skirt **16**. A space is provided between the inner and outer skirts that permits deformation of the outer skirt for opening and closing of the cap as described below. The outer skirt **16** is spaced from inner skirt **30** by a radial connecting wall **32**. The wall not only secures the skirts with respect to one another and serves to support the living hinge **22** adjacent the rear side of the cap, but also serves as a fulcrum point for the front side of the outer skirt for opening and closing the cap as described below. The inner skirt **30** is also provided with a securement structure **34** which, in a present embodiment, may be adapted for snap-type engagement or threaded engagement with the upper neck of a container, or for receiving an insert I (or other structure with which the cap is designed to function). An upper extension **36** of the inner skirt **30** is designed to contact the upper portion **28** of the cap when closed and is provided with a sealing surface around its outer periphery for this purpose.

[0022] The outer skirt **16** extending above the radial connecting wall **32** is provided with a latch surface **40** below which a recess **42** is formed. As described more fully below, the latch surface **40** and the recess **42** serve to maintain the upper portion **12** of the cap in a closed position when latched, but permits flip-type movement of the upper portion about the living hinge **22** for opening.

[0023] The upper portion **12** of the cap includes a sealing ring **44** that extends from its upper panel toward the inside of the cap. When closed, sealing ring **44** contacts the sealing surface of the upper extension **36** of the cap to form a tight seal. Other sealing structures may, of course, be envisaged, including compressible structures, tempered-proof arrangements, and so forth, which may be temporarily or permanently installed in either the lower portion or the upper portion of the cap. Finally, the upper portion **12** of the cap is provided with a detent **46** which corresponds in location to the recess **42** of the outer skirt of the base portion. When the living hinge **22** is flexed to allow the upper portion to swing over the lower portion and close the cap, this detent **46** slightly deforms or toggles the outer skirt by contacting the latch surface **40**. When compressed slightly more over the lower portion, the detent **46** then enters into the recess **42** to latch the upper portion over the lower portion by relaxation of the deformation in the outer skirt.

[0024] It should be noted that, as visible in the view shown in FIG. **4**, on the front side of the cap the radial connecting wall **32** is located relatively lower along the outer skirt and inner skirt than is the case on the rear side **20**. As discussed in greater detail below, the height difference **48** shown in FIG. **4** has been found to effectively lower the fulcrum point for pivoting the deformable outer skirt, thereby facilitating

opening of the cap. That is, as described below, on the front side of the cap, radial connecting wall **32** forms the fulcrum point for pivoting the front side of the outer skirt when deformed for opening the cap. The height difference **48** facilitates this operation.

[**0025**] By way of example, in a presently contemplated embodiment for a cap of the type illustrated in the figures having a mouth opening of 1.622 inches (at the smallest diameter of the upper extension **36**), the radial connecting wall **32** at the front side of the cap has a height difference **48** of approximately 0.140 inches. In the same cap design, the outer skirt **16** has a height of approximately 0.835 inches, such that the distance from the upper surface of the radial connecting wall **32** to the bottom of the outer skirt is approximately 0.561 inches. Moreover, in the same design, the radial connecting wall **32** at the same location on the front side between the inner skirt and outer skirt (as well as at all other locations around the periphery of the inner skirt) has a thickness of approximately 0.030 inches.

[**0026**] As best illustrated in FIG. **5**, the lowering of the radial connecting wall **32** on the front side of the cap, and the thinning of the radial connecting wall at the same location, as compared with existing caps, has been found to greatly facilitate opening of the cap by deformation of the outer skirt **16**. In the view of FIG. **5**, the normal position of the outer skirt **16** is shown in solid lines, and a deformed or deflected position is shown in dashed lines. The cap is opened by exerting a force at the depressible level location **18** and on the rear side of the cap, which effectively deforms the outer skirt **14**. In a present embodiment, the wall thickness of the outer skirt **16** on the front and rear sides is somewhat greater than at other locations around the wall, stiffening these locations somewhat and causing the deformation of the outer skirt to be concentrated between these locations. Similarly, such stiffening of the front side at the depressible lever location **18** tends to make this section of the outer skirt to rock without excessive bending along its height. At the same time, the reduction in thickness of the radial connecting wall, as compared to earlier designs, causes elastic flexure of the connecting wall as shown in dashed lines in FIG. **5**. Such pivoting motion of the outer skirt and flexure of the connecting wall can continue until the cap opens. When so deflected, the recess **42** is moved outwardly permitting the detent **46** of the upper portion of the cap (see FIG. **4**) to escape the recess and thereby allow opening of the cap.

[**0027**] By way of example, for a commercially available cap of the type described in U.S. Pat. No. 5,860,543, mentioned above, the distance **52** indicated in FIG. **5** is 0.058 inches, whereas, by lowering the connecting wall **32**, distance **52** was increased on a cap of the same general size to 0.198 inches. For the same two caps, the distance **54** was consequently decreased from 0.701 inches to 0.561 inches. The thickness **50** of the connecting wall was also decreased from 0.042 inches to 0.030 inches. As will be appreciated by those skilled in the art, the inclusion of ribs **26** and **28** (see FIG. **3**) in the inventive design had an effect of limiting movement of the upper portion of the cap. This constraint, however, reduced the extent to which the upper portion could be pulled back during deformation of the outer skirt for opening the cap. However, the lengthening of the lever extension represented by distance **52** allowed the recess **42** to be more fully withdrawn from the detent of the upper portion for opening. Any added difficulty due to the shortening of the lower lever extension represented by distance **54**, then, was at least partially countered by the thinning of the connecting wall **32**.

[**0028**] The particular design of the cap illustrated in the figures has been found both to facilitate opening of the cap and to resist unwanted opening. As noted above, the unwanted opening of heretofore known caps of similar designs has been attributed, at least in part, to twisting of the upper portion of the cap with respect to the base or by lateral (side-to-side and/or front-and-back) movement of the upper portion, in such a way as to allow the detent **46** (see FIG. **4**) to escape engagement within recess **42** (see FIG. **5**). To prevent such twisting and lateral displacement, the cap provided by the invention has been equipped with integral ribs **26** and **28** (see FIG. **3**). Moreover, to prevent damage to the living hinge, integral bumpers or posts **24** are provided on either side of the hinge.

[**0029**] FIG. **6** illustrates a section through one of the ribs **28** on the base portion that prevents movement of the upper portion (in conjunction with other ribs not visible in the figure). The upper portion of the cap is shown in its closed position in dashed lines in FIG. **6**. As can be seen in that position, the ribs contact the inner surface of the upper portion to stabilize the upper portion in place when closed. Certain of the ribs may be slightly spaced from the inner surface of the upper portion. In a current design, two of the ribs on the front side contact the inner surface, while two other ribs are slightly spaced from it (see FIG. **3**).

[**0030**] Also shown in FIG. **6** is one the integral bumpers or posts **24** (visible behind the sections hinge), which are preferably immediately adjacent to the living hinge **22** at a location extending from the outer skirt **16**. When the upper portion **12** of the cap is closed back over the lower portion **14**, the posts guard and protect the hinge from damage.

[**0031**] FIG. **7** shows an alternative configuration of a flip-tip cap incorporating the innovations detailed above, but with a pair of latch structures. In this embodiment, the cap **60** again includes an upper portion **12** and a lower portion **14** joined by a living hinge **22**. An outer skirt **62** again surrounds an inner skirt (not shown). However, rather than a single latch structure, a pair of latches **64** and **66** are provided on either side of the skirt. The latches may be generally similar to the latch arrangement described above. The placement of the latches on either lateral locations (e.g., at 90 degrees of the hinge **22**) creates opposed locations **68** and **70** that are depressed to cause deformation of the outer skirt by exertion of opposed forces, as indicated by arrows **72**.

[**0032**] While only certain features of the invention have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

1. A flip-top cap comprising:

a base portion;

the flip-top portion joined to the base by a living hinge, the flip top portion comprising a detent opposite the living hinge for maintaining the flip-top portion closed over the base portion;

the base portion comprising an inner skirt and an outer skirt surrounding the inner skirt and spaced from the inner skirt by a radial connecting wall, the outer skirt forming a latch lever on a side thereof opposite the living hinge, the latch lever being pivotal by elastic deformation of the radial connecting wall and the outer skirt when a force is exerted on the latch lever and an opposite side of the cap, the latch lever including a recess for capturing the detent of the flip-top portion;

wherein the radial connecting wall is disposed at a lower elevation on the outer skirt at a location adjacent to the latch lever than at a location adjacent to the living hinge.

2. The cap of claim 1, wherein the outer skirt is substantially continuous around a circumference of the base portion.

3. The cap of claim 1, wherein the base portion includes a plurality of ribs configured to contact the flip-top portion when closed over the base portion to prevent twisting and/or lateral movement of the flip-top portion on the base portion.

4. The cap of claim 3, wherein the flip-top portion includes a plurality of ribs configured to contact the base portion to prevent movement of the flip-top portion with respect to the base portion when closed over the base portion.

5. The cap of claim 1, wherein the latch lever includes a latch surface that contacts the detent of the flip-top portion to elastically deform the outer skirt and thereby to permit the detent to enter into the recess upon closing the flip-top portion over the base portion.

6. The cap of claim 1, further comprising a plurality of bumpers extending from the base portion for protecting the hinge from damage.

7. The cap of claim 1, wherein the outer skirt has a non-uniform circumferential thickness, whereby the latch lever elastically deforms a different amount than other portions of the outer skirt.

8. The cap of claim 7, wherein the outer skirt is thicker in regions adjacent to the latch lever and to the living hinge than at other locations around its circumference.

9. A flip-top cap comprising:

a base portion;

the flip-top portion joined to the base portion by a living hinge, the flip-top portion comprising a detent opposite the living hinge for maintaining the flip-top portion closed over the base portion;

the base portion comprising an inner skirt and an outer skirt surrounding the inner skirt and spaced from the inner skirt by a radial connecting wall, the outer skirt forming a latch lever on a side thereof opposite the living hinge, the latch lever being pivotal by elastic deformation of the radial connecting wall and the outer skirt when a force is exerted on the latch lever and an opposite side of the cap, the latch lever including a recess for capturing the detent of the flip-top portion;

wherein the radial connecting wall is disposed at a lower elevation on the outer skirt at a location adjacent to the latch lever than at a location adjacent to the living hinge; and

wherein the base portion includes a plurality of ribs configured to contact the flip-top portion when closed over the base portion to prevent twisting and/or lateral movement of the flip-top portion on the base portion.

10. The cap of claim 9, further comprising a pair of bumpers disposed immediately adjacent to and on either side of the living hinge.

11. The cap of claim 9, wherein the latch lever includes a latch surface that contacts the detent of the flip-top portion to elastically deform the outer skirt and thereby to permit the detent to enter into the recess upon closing the flip-top portion over the base portion.

12. The cap of claim 9, wherein the outer skirt is substantially continuous around a circumference of the base portion.

13. The cap of claim 9, wherein the flip-top portion includes a plurality of ribs configured to contact the base portion to prevent movement of the flip-top portion with respect to the base portion when closed over the base portion.

14. The cap of claim 9, wherein the outer skirt has a non-uniform circumferential thickness, whereby the latch lever elastically deforms a different amount than other portions of the outer skirt.

15. The cap of claim 9, wherein the outer skirt is thicker in regions adjacent to the latch lever and to the living hinge than at other locations around its circumference.

16. A flip-top cap comprising:

a base portion;

the flip-top portion joined to the base portion by a living hinge, the flip-top portion comprising a detent opposite the living hinge for maintaining the flip-top portion closed over the base portion;

the base portion comprising an inner skirt and an outer skirt surrounding the inner skirt and spaced from the inner skirt by a radial connecting wall, the outer skirt forming a latch lever on a side thereof opposite the living hinge, the latch lever being pivotal by elastic deformation of the radial connecting wall and the outer skirt when a force is exerted on the latch lever and an opposite side of the cap, the latch lever including a recess for capturing the detent of the flip-top portion;

wherein the radial connecting wall is disposed at lower elevation on the outer skirt at a location adjacent to the latch lever than at a location adjacent to the living hinge; and

wherein the base portion includes a pair of bumpers configured to contact the flip-top portion when closed over the base portion to prevent twisting and/or lateral movement of the flip-top portion on the base portion.

17. The cap of claim 16, wherein the bumpers are disposed immediately adjacent to and on either side of the living hinge.

18. The cap of claim 16, wherein the latch lever includes a latch surface that contacts the detent of the flip-top portion to elastically deform the outer skirt and thereby to permit the detent to enter into the recess upon closing the flip-top portion over the base portion.

19. The cap of claim 16, wherein the outer skirt has a non-uniform circumferential thickness, whereby the latch lever elastically deforms a different amount than other portions of the outer skirt.

20. The cap of claim 16, wherein the outer skirt is thicker in regions adjacent to the latch lever and to the living hinge than at other locations around its circumference.

21. A flip-top cap comprising:

a base portion;

the flip-top portion joined to the base portion by a living hinge, the flip-top portion comprising a pair of latches disposed at opposite locations with respect to one another around its periphery for maintaining the flip-top portion closed over the base portion;

the base portion comprising an inner skirt and an outer skirt surrounding the inner skirt and spaced from the inner skirt by a radial connecting wall, the outer skirt forming a pair of latch levers at locations of the latches of the flip-top portion, the latch levers being pivotal by elastic deformation of the radial connecting wall and the outer skirt when a force is exerted on the latch levers to release the latches of the flip-top portion for opening the cap;

wherein the base portion includes a plurality of ribs configured to contact the flip-top portion when closed over the base portion to prevent twisting and/or lateral movement of the flip-top portion on the base portion.

* * * * *