

[54] **BI-STABLE CLOSURE FOR FLEXIBLE BAGS**

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[52] U.S. Cl. **222/107, 222/498, 222/544, 150/10**

[51] Int. Cl. **B65d 35/08**

[58] Field of Search 222/81, 92, 107, 222/215, 212, 544, 498, 556, 499, 511, 515, 89, 527, 531, 526, 529, 533, 536, 537, 543, 528; 206/54 AA; 150/10, DIG. 1; 251/4, 331; 229/55, 7, 43, 51 CE

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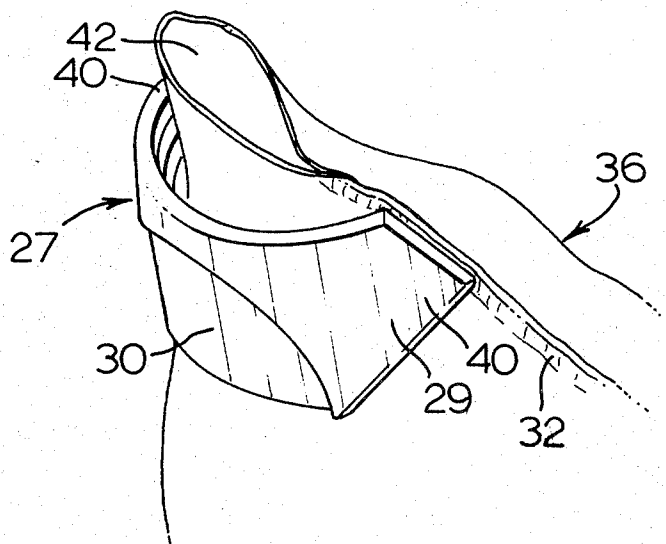
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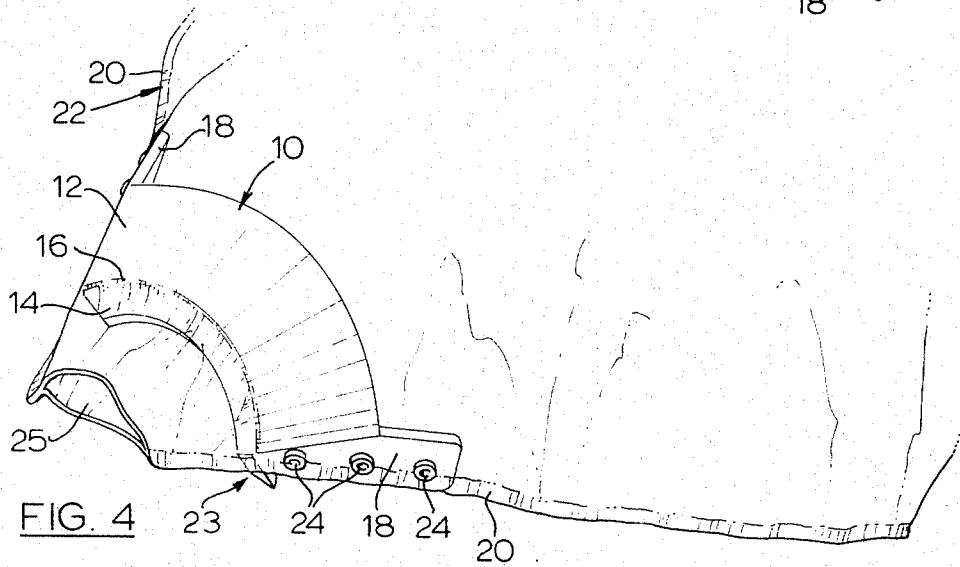
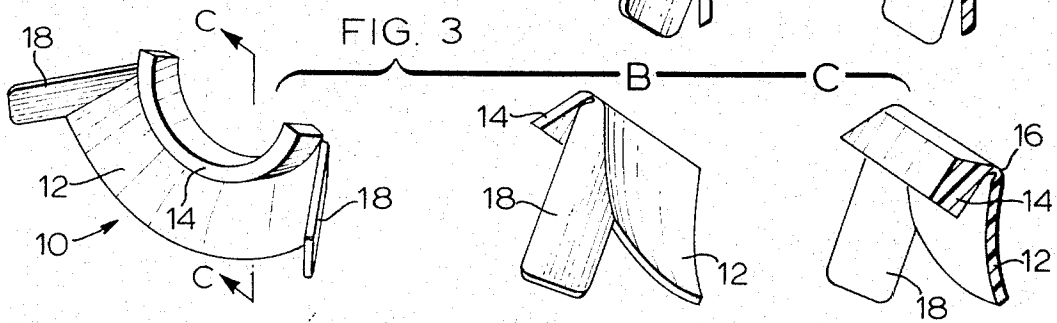
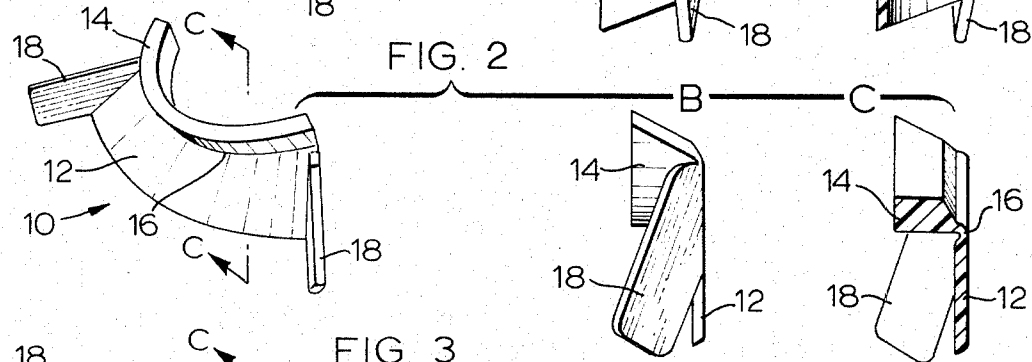
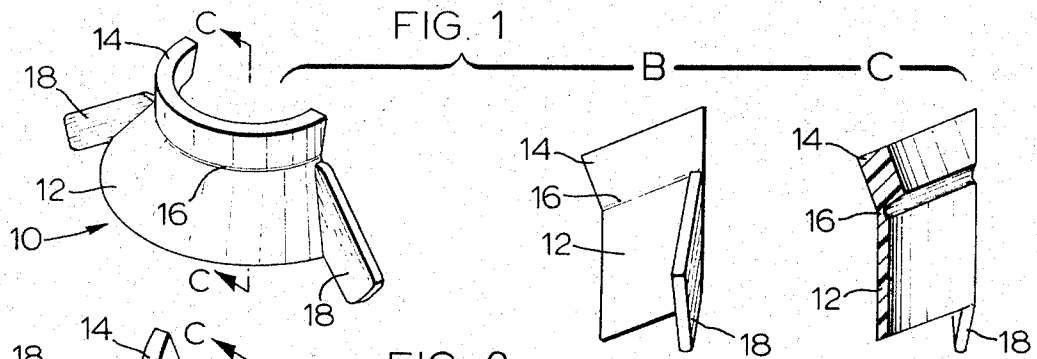
[57] **ABSTRACT**

This invention provides a snap-closure for flexible bags, including two curved portions linked through a flexible, integral web. The respective curvatures of the portions and of the web are such that one of the portions can be flexed through a dead-center position to a position of inverted curvature, being held in either position by the resilience of the other portion.

12 Claims, 10 Drawing Figures



SHEET 1 OF 2



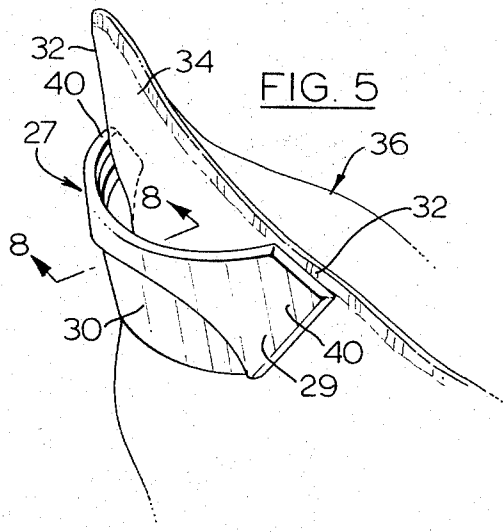


FIG. 5

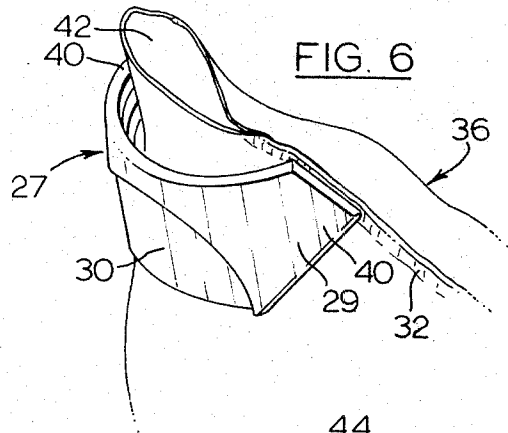


FIG. 6

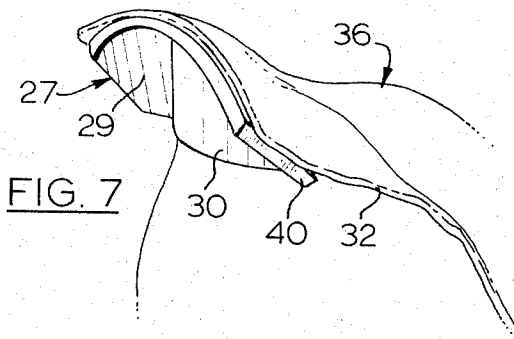


FIG. 7

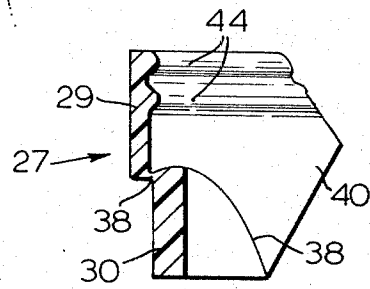


FIG. 8

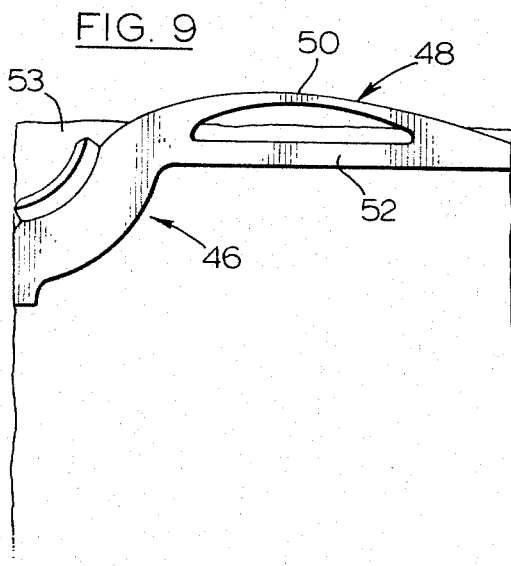


FIG. 9

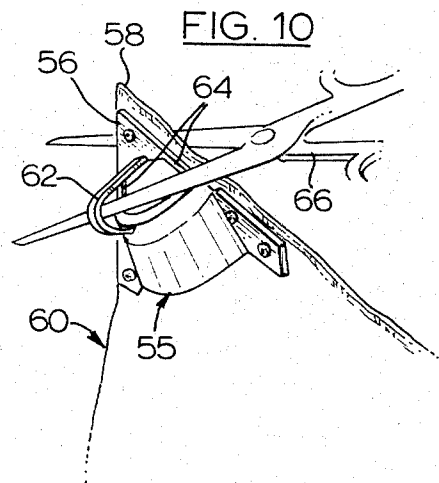


FIG. 10

BI-STABLE CLOSURE FOR FLEXIBLE BAGS

This invention relates generally to closures, and has to do particularly with snap-closures for use with bags made of plastic film and the like.

BACKGROUND OF THE INVENTION

Bags made of thin plastic are becoming increasingly popular as containers in which certain products are purchased and from which the products can be dispensed, particularly for domestic use. Recently, bags of this kind have been used as containers for liquids such as milk. These bags commonly consist of a one-piece length of thin thermoplastic tubing that is sealed at both ends. Because the bags are non-rigid, storage of the bags poses some problems after the bag has been opened. One approach to this problem is to place the bag in a container that is shaped to hold the bag in an upright position, with one of the corners of the bag extending above the lip of the container so that the contents of the bag may be poured after the corner of the bag has been cut. This approach is not entirely satisfactory, because there is no means for sealing the open corner of the bag after it is used, with the result that the contents of the bag are exposed to the atmosphere. Furthermore, the necessity for maintaining the cut corner of the bag in an uppermost position with respect to the remainder of the bag places certain limitations on the storage of such a bag within the refrigeration or shelf space. Another approach is to pour the contents of the bag into a rigid container which has a lid or other closure, and which includes a built-in spout. This approach has the disadvantage that the container must be cleaned periodically.

OBJECTS OF THIS INVENTION

One object of this invention is to provide a low-cost closure which can be attached easily to a disposable plastic bag or the like, and which operates to open and close a pouring opening of the bag in a positive manner.

Another object of this invention is to provide a closure for a disposable plastic bag, which facilitates the pouring of the contents out of the bag.

GENERAL DESCRIPTION OF THE INVENTION

In view of the disadvantages of the prior art, and the object of the invention set out hereinabove, this invention provides a snap-closure for flexible bags, comprising: a flexible plate portion sufficiently strong to resist creasing, and a resilient collar portion stiffer than the plate portion, the collar seeking an unstressed configuration in which one edge of the collar is crooked, the collar being integral along said one edge with a mating edge of the plate portion though a flexible web, said one edge being more crooked when the collar is unstressed than is said mating edge when the plate portion is flat, whereby the plate portion can be flexed between two stable positions, in each of which the collar portion is substantially at rest. The plate portion is adapted to be attached diagonally between adjacent edges at the corner of the bag. The two stable positions of the plate portion have opposite curvatures, such that in one of the stable positions the cut corner of the bag is unobstructed and can be used as a pouring spout, but in the other stable position both walls of the bag at the cut corner are strung tightly against the plate portion so as to close the bag opening. If desired, the plate portion

of the snap closure can incorporate one or more ribs on the surface directed toward the flexible bag, so that the plate portion in one of its stable positions causes the bag to be strung or drawn tightly against the rib or ribs, thereby providing an effective seal.

GENERAL DESCRIPTION OF THE DRAWINGS

Four embodiments of this invention are shown in the accompanying drawings, in which like numerals denote like parts throughout the several views, and in which:

FIGS. 1, 2 and 3 show the first embodiment of this invention in a first stable position, an intermediate position and a second stable position, respectively;

In each of these figures, part A is a perspective view of the snap-closure, part B is substantially an elevational side view of the snap-closure, and part C is a sectional view of the snap-closure taken at the line C—C in part A;

FIG. 4 is a perspective view of the corner of a flexible bag which has been cut to form an opening, and to which the snap-closure of FIGS. 1, 2 and 3 is attached, the closure being in the stable position shown in FIG. 3;

FIG. 5 is a perspective view of the second embodiment of this invention, in which the closure is attached to an uncut corner of a flexible bag;

FIG. 6 is a perspective view of the same corner of the same bag as in FIG. 5, with the corner being cut;

FIG. 7 is a perspective view of the second embodiment of this invention, in the stable position in which the cut corner of the bag is sealed;

FIG. 8 is a sectional view of the second embodiment closure itself, taken on the line 8—8 in FIG. 5;

FIG. 9 is a plan view of the third embodiment of this invention, attached to one end of a flexible bag; and

FIG. 10 is a perspective view of the fourth embodiment of this invention, attached to a corner of a flexible bag.

DETAILED DESCRIPTION OF THE DRAWINGS

Attention is now directed to FIG. 1 to 4, in which a snap-closure 10 is shown generally to include a plate portion 12 and a collar portion 14. In this embodiment, the plate portion 12 in its first stable position (FIG. 1) has a substantially conical curvature. To be more precise, the plate portion 12 in FIG. 1 follows part of the surface of a conical frustum. The collar portion 14 follows the contour of a circular arc, and has a substantially trapezoidal cross-section as shown in part C of each of the FIGS. 1, 2 and 3. The plate portion 12 is appreciably thinner than the collar portion 14. The entire snap-closure 10 is preferably molded as a single integral piece from a resilient material such as polypropylene, and the plate portion 12 and collar portion 14 are integrally joined together through a flexible web 16. Because the plate portion 12 is substantially thinner than the collar portion 14, this results in the collar portion 14 being stiffer than the plate portion 12, i.e. stiffer in flexing planes parallel to the plane containing the flexible web 16 in FIG. 1. This is so despite the fact that the plate portion 12 has a greater extent in the vertical direction as seen in FIG. 1C.

It will be appreciated that several other constructions are available that would cause the collar portion 14 to be stiffer than the plate portion 12 in planes parallel to that containing the flexible web 16. For example, the collar portion 14 could be made of smaller section, but

could incorporate an inner stiffener of a material such as spring steel. What is essential is that the collar portion 14 be so constructed that it resists more strongly than does the plate portion 12 any deformations away from the FIG. 1 configuration in planes parallel to that containing flexible web 16.

In the appended claims, the recitation that the collar portion is stiffer than the plate portion is intended to convey the situation described immediately above.

It will be noted in FIGS. 1 to 4 that the snap-closure 10 further includes means adjacent opposite ends of the plate portion 12 for attaching the snap closure to a flexible bag. In the embodiment shown, this means takes the form of two attachment tabs 18 which are adapted to be rivetted, heat-sealed or otherwise affixed to adjacent edges 20 at the corner of a flexible bag 22. For reasons which will be explained below, it is essential either that a corner 23 of the plate portion 12 be located substantially on its respective edge 20 of the flexible bag 22, or that there be some provision which ensures that the contents in the interior of the flexible bag 22 cannot move past the snap-closure 10 by any route other than across the plate portion 12. In other words, it must be ensured that the contents of the flexible bag 22 cannot leak to the bag corner around the edges of the plate portion 12.

In FIG. 4, the attachment tabs 18 are shown to be rivetted by integral plastic rivets 24 adjacent their respective edges 20 of the flexible bag 22. To ensure against leakage, it is also desirable that the two walls of the bag be heat sealed together and against the entire area of the attachment tabs 18, so that the contents of the flexible bag 22 cannot move into the location adjacent the attachment tabs 18.

In order to snap the snap-closure 10 from its first stable position shown in FIG. 1 to its second stable position shown in FIG. 3, one simply applies an inverting pressure against the plate portion 12, by shoving the central portion of the plate portion 12 rightwardly (in FIGS. 1 to 3) through a hypothetical plane containing the opposite edges of the plate portion 12.

As the inverting pressure is applied to the plate portion 12, it moves toward and through the intermediate position shown in FIG. 2, to which attention is now directed. In FIG. 2, the plate portion 12 is completely flattened out, while the collar portion 14 has tilted backwardly (counterclockwise in part B and C of FIGS. 1 to 3) and has been slightly opened out, so that it now defines an arc of greater radius than in its stable position of FIG. 1. In FIG. 2, the plane in which the collar portion 14 is being stressed has rotated from the position in FIG. 1 in which the plane is parallel to the plane containing the flexible web 16, to a position in which it is vertically oriented and is parallel to the now flattened plate portion 12.

It must here be understood that the upper edge of the plate portion (where the flexible web 16 is located), because it represents a conical section taken normally to the conical axis, opens out in FIG. 2 to define an arc of greater radius of curvature than the arc defined by that same edge in FIG. 1. In FIG. 1, both the collar portion 14 and the plate portion 12 are unstressed and are at rest, whereas in FIG. 2 the plate portion 12 is forcing the collar portion 14 to open out to a circle of greater radius than is defined in the unstressed position of the collar portion 14 (shown in FIG. 1). It further must be understood that the collar portion 14, while stiffer than

the plate portion 12 in planes approximately normal to the plate portion 12, is not stiffer than the plate portion in planes parallel to the plate portion. This is what permits the plate portion 12 in FIG. 2 to draw the collar portion open to the position shown. The collar portion 14 is not capable of creasing or bending or rupturing the plate portion 12 in the FIG. 2 intermediate position. The plate portion 12 yields very little if at all to the collar portion 14 as the latter attempts to curl the upper edge of the plate portion 12 (where the flexible web 16 is located) to a smaller radius of curvature.

In the appended claims, the recitation that the flexible plate portion is sufficiently strong to resist creasing refers specifically to the above-described ability of the plate portion 12 to withstand the distorting effect of the collar portion 14 in the FIG. 2 position. In order for the collar portion 14 in FIG. 2 position to return to its original curvature, it would have to crease or rupture the plate portion 12, and this it is unable to do.

Attention is now described to FIG. 3, which shows the second stable position for the snap-closure 10. In the FIG. 3 position, the plate portion 12 has been inverted from its FIG. 1 curvature, and the collar portion 14 has rotated still further in the counter-clockwise position as seen in part B and C of FIGS. 1 to 3. However, what has occurred in FIG. 3 is that the collar portion 14 has returned substantially to its original curvature, because the inverting of the plate portion 12 has reduced the radius of curvature of the flexible web 16 to that sought by the collar portion 14. Because the collar portion 14 is strong enough to keep the plate portion 12 flexed in the direction normal to the major dimensions of the latter (i.e. horizontally in part B of FIGS. 1 to 3), FIG. 3 is a stable position for the snap-closure. Although the plate portion 12 is stressed because it is inverted, the force with which it is attempting to return to the FIG. 1 position is not great enough to open out the collar portion 14 through its expanded condition in FIG. 2, the FIG. 2 position being a necessary intermediate between the FIG. 1 and FIG. 3 positions.

It will now be appreciated that the snap-closure 10 can be attached diagonally across adjacent edges 20 at the corner of a flexible bag 22 as shown in FIG. 4. In FIG. 4, the visible surface of the plate portion 12 is opposite to the surface visible in FIGS. 1, 2 and 3, part A. The snap-closure 10 in FIG. 4 is in the second stable position, which is that shown in FIG. 3. Because in FIG. 4 the plate portion 12 curves convex upwardly, and because the edges 20 of the flexible bag 22 are secured to the attachment tabs 18, the two walls of the flexible bag 22 adjacent the plate portion 12 are tightly strung against the curvature of the plate portion 12, and the result is that the contents of the bag 22 cannot pass across the plate portion 12. In FIG. 4, the actual corner of the flexible bag 22 has been cut to leave a diagonal opening 25. When the snap-closure 10 is returned to its FIG. 1 stable position, the plate portion 12 in FIG. 4 becomes concave upwardly, and no longer seals the two walls of the flexible bag 22 against each other. Thus, in the other stable position (the FIG. 1 stable position) the contents of the bag 22 can be poured through the opening 25.

Attention is now directed to FIGS. 5 to 8 inclusive, in which the second embodiment of this invention is illustrated.

In FIG. 5, the snap-closure 27 includes a plate portion 29 and a collar portion 30. In this embodiment,

both the plate portion 29 and the collar portion 30 lie substantially within a single cylindrical surface, although they are slightly displaced radially from each other as seen in FIG. 8.

The snap-closure 27 is secured diagonally across adjacent edges 32 of the corner 34 of a flexible bag 36. Whereas the first embodiment of this invention was attached to the corner of a flexible bag in such a way that the collar portion was closer to the actual corner than the plate portion, in the second embodiment shown in FIGS. 5 to 8 the situation is reversed. In the second embodiment, it is the plate portion 29 which is closer to the corner 34. It will be appreciated, of course, that it does not matter which of the two portions is closer to the actual corner 34 of a bag, so long as the bag itself is attached to the plate portion (the portion which undergoes inversion of curvature).

In the second embodiment of this invention, the plate portion 29 and the collar portion 30 are integral through a flexible web 38 which is located substantially in a plane oblique to the axis of the hypothetical cylindrical surface in or near which the plate portion 29 and the collar portion 30 lie. The slope of the flexible web 38 is such that its highest or upper portion is toward the middle of the snap-closure 27 from which both of its ends slope downwardly in a smooth curve.

The collar portion 30 is shaped somewhat as a curved circular segment, whereas the plate portion 29 has what might be called a double-winged shape. Toward the centre of the snap-closure 27 (near the middle of the flexible web 38) the plate portion 29 has a comparatively small dimension in the axial direction of the hypothetical cylindrical surface, while the collar portion 30 has a relatively thick dimension. Additionally, the collar portion 30 is thicker than the plate portion 29 in a radial direction with respect to the hypothetical cylindrical surface, as seen in FIG. 8. Because of this, the collar portion 30 can be said to be stiffer than the plate portion 29 in planes normal to the axis of the hypothetical cylindrical surface, and in planes parallel to the planes substantially containing the flexible web 38 when the snap-closure 27 is in the at-rest position shown in FIGS. 5 and 6. In the appended claims, the last-described situation is defined by the recitation that the collar portion is stiffer than the plate portion.

As seen in FIGS. 5, 6 and 7, the remote portions of the two "wings" 40 of the plate portion 29 are attached to the edges 32 of the flexible bag 36, this attachment being by any suitable means such as rivets, heat-sealing, glue, etc.

When the snap-closure 27 is in the first stable position shown in FIGS. 5 and 6, and when the corner 34 of the flexible bag 36 has been cut or snipped off as seen in FIG. 6, the contents of the flexible bag 36 can be poured out through the resultant opening 42.

In order to seal the opening 42, the plate portion 29 is inverted to the position of FIG. 7, by, in effect, pushing the central part of the plate portion 29 rightwardly (as seen in FIGS. 5 and 6) through the hypothetical plane containing the remote edges of the plate portion 29. As the plate portion 29 is being inverted, it reaches an intermediate stage (not shown) in which both the plate portion 29 and the collar portion 30 lie substantially in a single, flat plane. Then, the plate portion 29 inverts to the position shown in FIG. 7, and the collar portion 30 snaps back substantially to its original curved position. In the FIG. 7 configuration, the walls

of the flexible bag 36 are pulled tightly across the narrow inverted plate portion 29, and thus the opening 42 is closed to prevent leakage of the contents of the bag.

The plate portion 29 is provided with one or more ribs 44 on the inside surface (the surface adjacent the bag 36), in order to permit a more effective seal of the opening 42.

Attention is now directed to FIG. 9, which shows the third embodiment of this invention, in which a snap-closure 46 is integral with a carrying handle 48 which includes a handle portion 50 and a brace portion 52, the latter being for the purpose of stiffening the upper edge of the bag 53 so that carrying the bag by the handle portion 50 will not exert a "draw string effect" on the upper portion of the bag 53 in which all portions of the upper end of the bag are drawn together.

FIG. 10 shows the fourth embodiment of this invention in which a snap-closure 55 similar to the first embodiment includes a tab 56 attached to the corner 58 of a flexible bag 60, the tab 56 being joined to the snap-closure 55 by a flexible strap member 62. If desired, the tab 56 can also be connected to the snap-closure 55 by two strut members 64. To create an opening in the corner 58 of the bag, scissors 66 are inserted between the flexible strap member 62 and the bag 60 to cut the corner and also the strut members 64 if they are present. By so doing, the removed corner piece is retained with the bag by virtue of the flexible strap member 62 until the bag is emptied and discarded. This is of advantage where it is crucial to avoid misplacing or losing the removed corner part of the bag, for example in a large salad bowl where it would be extremely difficult to find.

The appended claims include a recitation that the collar seeks an unstressed configuration in which one edge of the collar is crooked, and some amplification of this recitation is desirable. The word "crooked" as applied to the collar does not necessarily imply circular curvature, or any specific curvature for that matter. For example, it would be possible to construct a workable snap-closure in which the collar edge where the flexible web is located has a series of slight bends between which the edge is substantially straight. In other words, the collar edge could be shaped like a portion of a many-sided polygon. Furthermore, it is important to realize that it is the edge of the collar that is crooked, because a further recitation in the claims indicates that the edge of the collar is more crooked when the collar is unstressed than is the mating edge of the plate portion when the plate portion is flat. Thus, for the second embodiment of this invention shown in FIGS. 5 to 8, the degree of curvature of the collar portion 30 (the degree to which the edge of the collar portion 30 is crooked) is determined by measuring in the plane of the flexible web 38, to the extent that the web 38 defines a plane. It is not absolutely essential that the web 38 define a plane. If the degree to which the edge of the collar portion 30 is crooked is determined in this manner for the second embodiment, it will be found that this edge is more crooked when the collar portion 30 is at-rest (as it is in FIG. 5) than is the mating edge of the plate portion 29 when the plate portion 29 is flattened out (i.e. when in its intermediate position between the two stable positions shown in FIGS. 5 and 7 respectively).

Another way of defining the above relationship is to say that any two spaced points along the web are closer together in true distance when the collar is unstressed

than they are when the plate portion is flat, whereby the plate portion defines a curved surface when the collar is unstressed, and whereby the closure can be flexed between two stable positions through an intermediate dead-center position.

Another way of defining the above relationship is to say that the true rectilinear distance between points on the collar adjacent the web separated by a given distance measured along the web when the collar is unstressed is less than the true rectilinear distance between adjacent points on the plate portion when flat, the adjacent points being separated by the same given distance measured along the web.

It is in order to avoid the difficulty of interpreting the word "curved" that the appended claims make use of the word "crooked" when referring to the curved or bent edges of the portions.

The snap-closure disclosed herein may be constructed from a number of well-known materials. Any material which exhibits the "living hinge" property in thin sections is satisfactory. Among the well-known materials are the following:

polypropylene
linear polyethylene
nylon (T.M. Reg.)
delrin (T.M. Reg.)

What I claim is:

1. A snap-closure for flexible bags, comprising:

a flexible plate portion sufficiently strong to resist creasing and rupture,

and a resilient collar stiffer than the plate portion, the collar seeking an unstressed configuration in which one edge of the collar is crooked, the collar being integral along said one edge with a mating edge of the plate portion through a flexible web, said flexible web being more crooked when the collar is unstressed than it is when the plate portion is flat, whereby the plate portion can be flexed between two stable positions.

2. An overtoggling snap closure for flexible bags, comprising:

a resilient but flexible plate portion,

and a resilient collar stiffer than the plate portion, the collar seeking an unstressed crooked configuration and being integral with said plate portion along one edge of the latter through a flexible web, any two spaced points along the web being closer together in true distance when the collar is unstressed than they are when the plate portion is flat, whereby the plate portion defines a curved surface when the collar is unstressed, and whereby the closure can be flexed between two stable positions through an intermediate dead-center position.

3. The invention claimed in claim 2, in which the collar when unstressed is configured as the arc of a circle,

and in which said one edge of the plate portion has a concave curvature when the plate portion is flat, said concave curvature having a larger radius than said collar when the latter is unstressed.

4. The invention claimed in claim 2, in which the plate portion has means adjacent opposite ends of said one edge for attachment to the corner of a flexible bag.

5. The invention claimed in claim 4, in which the thickness of the plate portion is smaller than that of the collar and greater than that of the web, and in which the plate portion is conically curved when unstressed.

6. The invention claimed in claim 2, in which the plate portion is stiff enough to resist creasing under forces applied parallel with the plate portion when the latter is flat.

7. In combination:

a flexible bag having a corner adapted to be opened as a pouring spout,

and a snap-closure spanning between adjacent bag edges at said corner, the snap-closure comprising: a resilient but flexible plate portion, and a resilient collar stiffer than the plate portion, the collar seeking an unstressed crooked configuration and having an edge integral with said plate portion along one edge of the latter through a flexible web, any two spaced points along the web being closer together in true distance when the collar is unstressed than they are when the plate portion is flat, whereby the plate portion defines a curved surface when the collar is unstressed, and whereby the closure can be flexed between two stable positions through an intermediate dead-center position.

8. The invention claimed in claim 7, in which said one edge of the plate portion is concave when the plate portion is flat, and the said collar edge when unstressed is in a substantially circular curve.

9. The invention in claim 8, in which the plate portion is part of a frusto-conical surface, and in which said one edge corresponds to the conical section of smaller diameter, the plate portion having means adjacent opposite ends of said one edge for attachment to said adjacent bag edges at said corner.

10. The invention claimed in claim 7, in which the snap-closure includes a handle portion by which the bag can be supported.

11. The invention claimed in claim 7, which also includes a tab attached to the corner of said bag and joined to said snap-closure by a flexible strap member, the bag being adapted to be opened by cutting between the tab and the snap closure without severing the strap member.

12. The invention claimed in claim 7, in which the plate portion incorporates a sealing rib adapted to contact the flexible bag.

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