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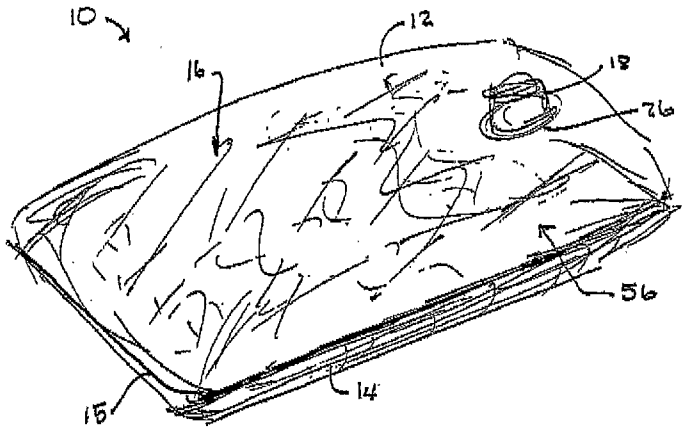
(54) **Title:** COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD



(57) **Abstract:** A collapsible bag for dispensing liquids, including viscous liquids such as syrup and the like, comprising a first wall, a second wall, a spout, a surface variation associated with the first and second walls. The first wall and second wall are connected together to define a fluid chamber therebetween. The first wall and the second wall each have an inner surface facing the fluid chamber and an opposed outer surface. The spout is attached to one of the first and second walls, and has an opening therethrough having an axis substantially perpendicular to the one of the first and second walls to which it is attached. The surface variation is molded into at least a portion of the first wall and at least a corresponding portion of the second wall. The surface variation limits contact between the inner surfaces of the first wall and the second wall so as to define a minimum unstressed volume therebetween wherein at least a portion of the minimum unstressed volume is maintained substantially throughout evacuation of liquid therefrom by suction.

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TITLE OF THE INVENTION

COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a related to of co-pending U.S. Patent Application Serial No. 11/048,622 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD filed February 1, 2005, which is a continuation of U.S. Patent No. 6,851,579 B2 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD which is a continuation of U.S. Patent No. 6,607,097 B2 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD which is a continuation of U.S. Patent Application Serial No. 09/709,144 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD filed November 10, 2000, now abandoned, which is a continuation of U.S. Provisional Patent Application Serial No. 60/164,699 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS, filed November 10, 1999, the entire specification of each of the foregoing application is hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to collapsible bags for dispensing liquid products, and more particularly to collapsible bags having a internal surfaces which provide passageways for the removal of liquid.

[0004] 2. Background Art

[0005] Various collapsible bags or containers are known in the prior art which are adapted to be filled with liquid contents and sealed and which allow their liquid contents to

be suction withdrawn through their annular spouts or fitments. The walls of the bag are typically sheets of plastic, which are typically formed of polyethylene, polypropylene, nylon, or polyester. The liquid contents can be juices, milk, drink syrups or other liquids such as photoprocessing solutions, cleaning chemicals, or cocktail mixes. An example of these collapsible bags is the so-called "bag-in-box" commonly used in the soft drink industry to deliver the drink syrup to the dispensing machine. The bags are fed into filling machines which uncap them, fill them with the syrup (or other liquid), recap them and box them. The boxes structurally support the bags during storage, shipment, and as they are being emptied. The bags are emptied through a spout in the bag accessible through a hole in the box and using a pump.

[0006] A plastic dip tube or dip strip disposed in the bag and secured therein so as to pass over the spout opening or to be secured to the spout opening assists in the withdrawal of the syrup from the bag. The strip prevents the bag from collapsing on the opening and closing it, and also guides the remaining quantities of syrup in the bag to the opening as the syrup continues to be withdrawn. The strip can be attached to the spout and/or to the inside wall of the plastic bag. Alternatively, the dip tube or dip strip can be attached to the perimeter seal of the bag. Examples of dip tubes or dip strips and their collapsible bags are shown in U.S. Patents 4,286,636 (Credle), 4,601,410 (Bond), 5,647,511 (Bond), 5,915,596 (Credle), and 5,941,421 (Overman et at.) and in WO 99/46,169 (Coca-Cola Company). (All of the patents and other 30 publications mentioned anywhere in this disclosure are hereby incorporated by reference in their entireties.)

[0007] In addition to the separate manufacturing step required to make the dip tube or dip strip and the attendant material required to make the dip tube or dip strip, the application to the bag of a dip tube or dip strip requires yet another separate manufacturing step. Generally, after the spout is secured to the bag, the dip tube or dip strip is disposed in the bag by attachment to the spout, the inside wall of the bag or to the perimeter seal of the bag, or a combination of the above. This adds to the manufacturing time and expense. A further disadvantage of the strips, in addition to the cost of manufacturing them, is that they may become dislodged when the bag is filled at high pressure. A still further disadvantage of the strips is that they may create a back pressure and reduce fill rates.

[0008] Certain solutions have provided indentations within the walls of the material. While this has met with some success, there remain drawbacks. First, the indentations or passageways that are associated with the walls are often not suitable for the evacuation of more viscous liquids, such as syrups. Moreover, other such solutions are generally incapable of withstanding the forces associated with the suction evacuation process, such that the passageways generally collapse prior to evacuation.

[0009] It is another object of the invention to overcome shortcomings of the prior art identified above.

[0010] These and other objects of the invention will become apparent in light of the specification and claims appended hereto.

SUMMARY OF THE INVENTION

[0011] The invention comprises a collapsible bag for dispensing liquids, including viscous liquids such as syrup and the like. The bag comprises a first wall and a second wall, a spout, a surface variation defining a minimum unstressed volume. The first wall and the second wall together to define a fluid chamber therebetween. The first wall and the second wall each have an inner surface facing the fluid chamber and an opposed outer surface. The spout is attached to one of the first and second walls and has an opening therethrough having an axis substantially perpendicular to the one of the first and second walls to which it is attached. The surface variation is molded into at least a portion of the first wall and at least a corresponding portion of the second wall. The surface variation limits contact between the inner surfaces of the first wall and the second wall so as to define a minimum unstressed volume therebetween. At least a portion of the minimum unstressed volume is maintained substantially throughout evacuation of liquid therefrom by suction.

[0012] In a preferred embodiment, the minimum unstressed volume between the first and second walls is at least .18 cubic centimeters per square inch of surface area of each of the first wall and the second wall.

[0013] In another preferred embodiment, the first wall and the second wall each comprise a plurality of layers, a first layer of which comprises a heat sealable polymer material and a second layer of which comprises a polymer material having a relative strength greater than that of the first layer.

[0014] In one such preferred embodiment, the first layer comprises a linear low density polyethylene and the second layer comprises a high density polyethylene. In another

such embodiment, the second layer comprises one of the group selected from nylon, high density polyethylene, polypropylene and polyesters.

[0015] In a preferred embodiment, the thickness of each of the first and second walls is less than 10 mils. More preferably, the thickness of each of the first and second walls is less than 8 mils.

[0016] In a preferred embodiment, the first wall and the second wall each have a strength defined by a secant modulus of at least 30,000 psi. More preferably, the first wall and the second wall each have a strength defined by a secant modulus of at least 45,000 psi.

[0017] In another preferred embodiment, the surface variation defines a height of the inner surface of either of the first wall and the second wall that is between 1.3 and 2.5 times that of the thickness of the respective first wall and second wall.

[0018] In another preferred embodiment, the surface variation comprises a repeated pattern of nested alternating elongated ridges defining a plurality of peaks and valleys, wherein adjoining ridges are disposed obliquely relative to each other.

[0019] In one such embodiment, the adjoining ridges are disposed perpendicular to each other.

[0020] In another preferred embodiment, the abutment of the peaks of the elongated ridges of the first wall with the peaks of the elongated ridges of the second wall define a volume of at least 0.36 cubic centimeters per square inch.

[0021] In one such preferred embodiment, each of the elongated ridges has a substantially hemispherical cross-section along at least a portion thereof.

[0022] In another such preferred embodiment, each of the elongated ridges has a

length of between .0625 inches and .1825 inches.

[0023] Preferably, the surface variation extends substantially along at least 85% of a surface area of each of the first and second walls. In another preferred embodiment, the surface variation extends substantially along the entirety of the first and second walls.

[0024] In another preferred embodiment, the first and second walls further comprise a third layer positioned on the second layer opposite the first layer, the third layer comprising a polymer material. In one such embodiment, the third layer comprises a linear low density material of a lower strength than the second layer.

[0025]. In a preferred embodiment, the collapsible bag further comprises an outer first wall and an outer second wall, the outer first wall being positioned on the first wall and the outer second wall positioned on the second wall generally joined at the seals, so as to define a two-ply collapsible bag.

[0026] In another embodiment, the collapsible bag further includes a spout, wherein the spout further comprises an elongated opening and a base flange. The base flange extends about the elongated opening. The flange has a bottom surface wherein the bottom surface includes a plurality of surface channels positioned thereon.

[0027] In one such preferred embodiment, the plurality of surface channels comprise radial grooves. In another such preferred embodiment, the plurality of surface channels comprise a combination of a plurality of concentric circular grooves and a plurality of radial grooves.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The invention will now be described with reference to the drawings wherein:

[0029] Figure 1 of the drawings comprises a perspective view of an embodiment of the collapsible bag for evacuating liquids of the present invention;

[0030] Figure 2 of the drawings comprises a partial perspective view of the collapsible bag, showing, in particular, the unstressed minimum volume thereof;

[0013] Figure 3 of the drawings comprises a partial top elevational view of the first wall of the collapsible bag of the present invention, showing, in particular, the surface variation thereof;

[0032] Figure 4 of the drawings is a partial cross-section of the collapsible bag of the present invention, taken about lines 4-4 of Figure 2;

[0033] Figure 5 of the drawings comprises a perspective view of the spout of the collapsible bag of the present invention;

[0034] Figure 6 of the drawings comprises a side elevational view of a portion of the collapsible bag of the present invention, showing, in particular, the spout thereof;

[0035] Figure 7 of the drawings comprises a cross-sectional view of the collapsible bag of the present invention, taken generally about lines 7-7 of Figure 10, showing, in particular, the multi-layer structure of each of the first and second walls;

[0036] Figure 8 of the drawings comprises a cross-sectional view of another embodiment of the flexible container of the present invention, showing, in particular, a two ply configuration thereof;

[0037] Figure 9 of the drawings comprises a schematic representation of a testing

procedure undertaken with an embodiment of the collapsible bag of the present invention and a comparative container;

[0038] Figure 10 of the drawings comprises a top plan view of the collapsible bag of the present invention, showing, in particular, the seals thereof; and

[0039] Figures 11a and 11b of the drawings comprise an embodiment of the collapsible bag of the present invention, showing, in particular, the seals thereof.

DETAILED DESCRIPTION OF THE INVENTION

[0040] While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and described herein in detail several specific embodiments with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated.

[0041] It will be understood that like or analogous elements and/or components, referred to herein, may be identified throughout the drawings by like reference characters. In addition, it will be understood that the drawings are merely schematic representations of the invention, and some of the components may have been distorted from actual scale for purposes of pictorial clarity.

[0042] Referring now to the drawings and in particular to Figure 1, the collapsible bag of the present application is shown generally at 10. The collapsible bag includes first wall 12, second wall 14, seals 15, surface variation 16 and spout 18. The collapsible bag may be configured in any number of different sizes. Seals 15 join first wall 12 and second wall 14 so as to define a fluid chamber 56.

[0043] More specifically, with reference to Figure 10, the first wall and the second wall may comprise two separate sheets of material joined by top seal 15a, bottom seal 15b, and opposing side seals 15c and 15d. One such container is commonly referred to as the pillow container. Such containers may have alternative constructions, such as a three seal pillow container shown in Figure 11a, wherein a sheet of material is used to form the front wall and the back wall. In such an embodiment, vertical seal 15e joins the two ends of the

single sheet of material along second wall 14, thereby forming the front and back walls. Furthermore, top seal 15a and bottom seal 15b, along with side folds complete the fluid chamber. In still other embodiments, such as the embodiment shown in Figure 11b, a single sheet may be folded about one edge. In turn, top seal 15a (or bottom seal 15b) along with two side seals 15c and 15d along with the fold at the other of the top and bottom seal together join the walls to define cavity 56. Of course, other constructions are likewise contemplated, including both variations to the foregoing, combinations of the foregoing and other constructions as well.

[0044] It is contemplated that the fluid chamber may comprise any number of different sizes and shapes. One common shape comprises a 2.5 gallon bag of a generally rectangular shape wherein the length of the bag is approximately 17" and the width of the bag is approximately 21". Other common configurations comprise a 5 gallon bag having a generally rectangular shape with a length of 18.75" and a width of 24". Of course, the invention is not limited to these configurations. Preferably, spout 18 is located proximate one of the top seal and the bottom seal between the opposing side edges of the bag. Of course, other positions of the seal are likewise contemplated.

[0045] The invention is generally directed to the evacuation of liquids which are contained within the fluid chamber 56. Any number of liquids are contemplated for use in association with the collapsible bag of the present invention. One of the more difficult classes of liquids to be evacuated from a collapsible bag comprises liquids which are generally viscous such as syrups and pastes. Such liquids are typically more difficult to evacuate due to their mechanical properties, and general resistance to flow.

[0046] With reference to Figure 4, first wall 12 is shown in outer surface 20, inner surface 22, thickness 24 and opening 26 (Figure 1). Inner surface 22 contacts the fluid within the fluid chamber. Thickness 24 is generally less than 10 mils and most preferably less than 8 mils. While greater thicknesses have been contemplated, one advantage of the present invention is that proper evacuation can be achieved with a relatively thin film. The strength of the material is such that the secant modulus is between 30,000 psi and 80,000 psi, and most preferably in excess of 45,000 psi. Opening 26 extends from inner surface 22 to outer surface 20. The opening in the present invention is substantially circular and substantially uniform, while other configurations are likewise contemplated.

[0047] First wall 12 comprises a two layer film, and preferably a three layer film. It will be understood that such a film may be produced in any number of different manufacturing processes without departing from the scope of the invention. One such manufacturing process may comprise a lamination process. Another such manufacturing process may comprise a co-extrusion process. Other manufacturing processes are contemplated and considered within the scope of the invention. In certain embodiments, a single layer film is contemplated for use.

[0048] One embodiment of the three layer film is shown in Figure 7 as comprising first layer 30, second layer 32 and third layer 34. The first layer is in contact with the liquid positioned within the fluid chamber 56. First layer 30 comprises a material which facilitates sealing with the corresponding layer of the second wall. In the present invention, first layer 30 comprises a linear low density polyethylene (LLDPE). Such a layer may have a thickness of approximately 3 mils and a density of 0.922 grams per cubic centimeter. Of course, materials

having a greater or a lesser thickness are contemplated for use.

[0049] Second layer 32 comprises a material which is typically more rigid (i.e., stronger) than the first layer. The second layer increases the ability of the overall first wall to retain the surface variations in both an unstressed condition, and in a stressed orientation as liquid is withdrawn from the fluid chamber through suction. In the preferred embodiment the second layer comprises an HDPE. The thickness of the second layer is generally less than that of the first layer in the contemplated embodiment. In the present invention, the thickness of the second layer is approximately 1.2 mils, and the material has a density of approximately 0.990 grams per cubic centimeter.

[0050] Third layer 34 comprises a material which typically exhibits improved characteristics relative to heat sealing and/or stress cracks relative to the second material. The third layer preferably comprises a LLDPE material. The material has a thickness of approximately 1.5 mils in the present embodiment, and has a density of approximately 0.930 grams per cubic centimeter in the present embodiment.

[0051] In certain embodiments, the third layer may be omitted, leaving only the first layer and the second layer. In other embodiments, additional layers may be employed, such as, for example, an oxygen barrier layer, an outer layer having advantageous mechanical properties (such as wear characteristics, abrasion characteristics, creasing characteristics, etc.). In still other embodiments, such as the embodiment shown in Figure 8, a multi-ply collapsible bag is contemplated. In such an embodiment, in addition to the first wall and the second wall, a separate ply of material (connected to the respective wall at seals) may be positioned so as to overlay same, such as first ply 52 and second ply 54. In still other

embodiments, the collapsible bag may comprise multiple separate layers of material. Finally, in other embodiments, a single layer having the properties identified above.

[0052] Second wall 14 is shown in Figure 7 as comprising outer surface 40, inner surface 42 and thickness 44. It will be understood that the second wall may comprises a film that is similar to that identified above with respect to the first wall. It will be understood that for a given embodiment, the properties of the first wall may be different than those of the second wall.

[0053] Surface variation 16 is shown in Figures 2 and 3 as comprising, in a preferred embodiment, alternating nested elongated members, such as elongated members 60. The nested elongated members may be positioned on one or both of the inner surfaces of the first wall and the second wall. Preferably, the elongated members are positioned on both of the first wall and the second wall. The elongated members are formed by pressing a pattern onto the film (preferably heating the film prior to formation thereof, and chilling after the formation thereof).

[0054] A cross-sectional view of the surface variation is shown in Figure 4. As can be seen, the surface variation defines a height 62 differential between peaks and valleys on the inner surface of the first wall. The height exceeds the thickness 24 of the first wall. While various dimensions are contemplated, the height is between 1.3 and 2.5 times the thickness of the first wall. The disparity in the thickness of the first wall relative to the height enhances resistance to collapsing of the container. In the embodiment shown in Figure 4, the height is approximately 2 times the thickness of the film. In such a configuration, the elongated member includes a vertical component which is quite resistant to collapsing.

[0055] With reference to Figure 3, each elongated member is positioned at obliquely relative to any adjoining elongated member in such an embodiment. Each of the alternating elongated members include length 64, width 66 and cross sectional configuration 68 (Figure 4). The combined elongated members define a plurality of peaks and valleys in the respective first wall and second wall. The spacing between adjoining alternating elongated members is shown at 74. The length of the elongated members can be varied without departing from the scope of the present invention. It is contemplated that the length of the elongated members be approximately 0.0625 inches and 0.1875 inches and the width of the elongated members be approximately 30 to 70 mils. In the embodiment shown, the length of the elongated members is approximately 0.125 inches and the width is approximately 50 mils.

[0056] Such a surface variation as described provides a plurality of pathways in various directions. Moreover, the surface variations are such that they can cooperate with each other so that intimate contact between the inner surfaces of the first wall and second wall is precluded proximate the surface variation. Specifically, when the first wall and the second wall are positioned in an abutting configuration, voids representing areas where contact between the two walls is not achieved, due to the configuration of the surface variation, collectively define an unstressed volume 58. Through maintenance of this unstressed volume fluid can be evacuated from within the collapsible bag.

[0057] With reference to Figure 2, the minimum unstressed volume configured for the passage of fluid in the present invention comprises at least 0.18 cubic centimeters per square inch of wall having a surface variation. This minimum represents a condition wherein a maximum contact between the opposing walls is realized, but wherein the two opposing

walls are not drawn or otherwise pressed into each other by outside forces. In the present embodiment, such a condition exists when the peaks of the respective elongated members of the first wall are positioned within the valleys of the second wall. Wherein the two walls are shifted such that the corresponding peaks of the elongated members of the first and second walls contact each other, the unstressed volume is approximately 0.36 cubic centimeters per square inch. Indeed the unstressed volume is generally distributed along a large portion of the surface area of the elongated member, even when the overlapping walls are at maximum contact.

[0058] Of course other surface variations are contemplated for use, wherein the patterns of the opposing walls are such that a minimum unstressed volume can be maintained, and wherein the minimum unstressed volume defines a path through the bag cavity toward, and, to the spout. Such a configuration may include members having a substantially different shape than the elongated members, and it will be understood that the invention is not limited to the elongated members 60.

[0059] In addition to the unstressed volume, the material from which the first wall and the second wall is formed must be of adequate strength, surface configuration (i.e., depth, height, etc.) and/or thickness so that upon evacuation of the collapsible bag through suction preserves at least a portion of the minimum unstressed volume. The coordination of same provides serves to maintain a portion of the minimum unstressed volume upon evacuation by way of suction.

[0060] Spout 18 is shown in Figures 5 and 6 as comprising base flange 80 and wall member 82. The spout is generally positioned between opposing side seals spaced apart the

top seal. The spout is generally closer to the top seal as compared to the bottom seal. Of course, variations in the positioning of the spout are likewise contemplated.

[0061] Base flange 80 includes top surface 86 and bottom surface 88. Top surface 80 includes sealing region 90. The sealing region comprises the region wherein the film is sealed to the flange. Bottom surface 88 includes channels positioned on spout 18. The channels may comprise any number of different shapes and configurations, many of which are shown in the co-pending priority application to which the present application is a continuation-in-part. The configuration of the spout shown in the priority applications has been incorporated by reference herein.

[0062] The wall member 82 extends from the top surface of the base flange. The wall member includes an internal surface 94 and an external surface 96. The external surface may include additional flanges which facilitate the grasping and retaining thereof by filling and packaging equipment. The internal surface defines an elongated opening. Of course, a number of different sizes, shapes and configurations are contemplated for use in the spout, and the invention is not limited to a substantially circular spout having a particular length.

[0063] In operation, the collapsible container is generally filled by filling equipment to a desired weight or volume. Once filled, the collapsible bag is generally boxed for shipment and dispensing. The collapsible bag may be transported varying distances prior to evacuation. Once the destination is reached, a withdrawing device is attached to the container. The withdrawing device generally operates through suction to remove the liquid within the fluid chamber.

[0064] The box having the collapsible bag may be positioned in any number of

different containers. For example, the collapsible can be predominantly lying on the first wall or the second wall, wherein the spout may be in a downward or upward direction. Moreover, the container may be canted toward the spout. In other configurations, the collapsible bag may be resting predominantly on its side edges wherein the spout may be elevated. Finally, the collapsible bag may be positioned on the back seal such that the spout is positioned near the top of the container. Such a configuration is generally the most difficult for suction evacuation and generally presents problems during evacuation. In particular, with prior art containers, the flow from the bottom of the container is choked off from the spout because a portion of the container between the bottom region and the spout has substantially fully collapsed onto itself, thereby substantially precluding any flow of material.

[0065] In the present invention, the surface variations insure that in a unstressed position, a minimum volume is maintained between the first wall and the second wall. By way of the maintaining means, at least a portion of the minimum volume is maintained between the first wall and the second wall to preclude the collapsing of the walls against each other, which, in turn, chokes off the flow in the container as portions of the container become isolated from the spout. Thus, even through a suction evacuation process of relatively thick fluids, such as syrup and the like, virtually complete evacuation of the container can be achieved – even when the spout is positioned proximate the top of the collapsible container during evacuation.

[0066] Certain testing was carried out relative to an embodiment of instant container and containers available in the market. The embodiment of the container of the present application comprised a 2.5 gallon container having surface variations extending about the

entirety of the first and second walls thereof. The first wall and the second wall comprise a three layer film, wherein the first layer is a LLDPE having a thickness of approximately 3 mils; the second layer comprises a HDPE having a thickness of approximately 1.2 mils; and the third layer comprises a LLDPE material having a thickness of approximately 1.5 mils, such that the film comprises a thickness of approximately 5.7 mils. The surface variations have a height of approximately 12 mils and comprise an alternating set of nested elongated members. The length of the elongated members is approximately 0.125 inches, and the elongated members have a semi-circular cross-section.

[0067] A conventional spout was attached to the container (i.e., a spout having a substantially uniformly flat bottom surface of the base flange. The formed container was filled a conventional post mix syrup having a specific gravity of approximately 1.25. The weight of the container was measured and recorded. The container was then placed in an evacuation test in a vertical orientation wherein the spout of the container is positioned proximate in an uppermost orientation, as is shown in Figure 9. The syrup was evacuated cyclically from the container. In particular, one cycle consists of suction of syrup at a flow rate of 7.5 ounces for ten seconds, followed by a period of ten seconds in which the suction ceased. Such a process continued for a period of fifteen minutes. The process was stopped and the container was again measured to determine the quantity of fluid that was, in fact, removed from the container during the test. The measurements were again recorded.

[0068] The same procedure was undertaken with respect to a commercially available container having relatively shallow pathways pressed into the inner surface thereof. **[Ken, do you have any measurements here?]** Such a container includes a plurality of pathways

pressed into the inner surfaces of each of the first and second walls. The pathways are in a waffle pattern so as to define a plurality of square protuberances.

[0069] The comparative results are identified in the chart below. In particular, the chart identifies the competitive bag, and the relative quantity of syrup remaining in the bag after the fifteen minute period of the test. The initial weight of the syrup was approximately 25 pounds. The final weight of the syrup after the fifteen minute test is tabulated below.

Test Run Number	Competitive Container Weight After Test	Container Produced In Accordance With The Present Invention
Test 1	6.44 pounds	0.14 pounds
Test 2	15.84 pounds	0.12 pounds
Test 3	4.62 pounds	0.06 pounds
Test 4	6.04 pounds	0.16 pounds

[0000] As can be seen from the data, the container of the present invention consistently removed a substantially greater amount of fluid from within the container. In particular, while substantially all of the syrup was removed from the container made in accordance with the present invention, the flow was essentially choked off during evacuation of the comparative container. In many instances several pounds of the syrup remained in the comparative container after the thirteen minute time limit expired. The container produced in accordance with the present invention substantially consistently removed a vast majority of the syrup from within the container.

[0070] The foregoing description merely explains and illustrates the invention and the invention is not limited thereto except insofar as the appended claims are so limited, as those skilled in the art who have the disclosure before them will be able to make modifications without departing from the scope of the invention.

WHAT IS CLAIMED IS:

1. A collapsible bag for dispensing liquids, including viscous liquids such as syrup and the like, comprising:

- a first wall and a second wall connected together to define a fluid chamber therebetween, the first wall and the second wall each having an inner surface facing the fluid chamber and an opposed outer surface;

- a spout attached to one of the first and second walls, the spout having an opening therethrough having an axis substantially perpendicular to the one of the first and second walls to which it is attached; and

- a surface variation molded into at least a portion of the first wall and at least a corresponding portion of the second wall, the surface variation limiting contact between the inner surfaces of the first wall and the second wall so as to define a minimum unstressed volume therebetween, wherein at least a portion of the minimum unstressed volume is maintained substantially throughout evacuation of liquid therefrom by suction.

2. The collapsible bag of claim 1 wherein the minimum unstressed volume between the first and second walls is at least .18 cubic centimeters per square inch of surface area of each of the first wall and the second wall.

3. The collapsible bag of claim 1 wherein the first wall and the second wall each comprise a plurality of layers, a first layer of which comprises a heat sealable polymer material and a second layer of which comprises a polymer material having a relative strength

greater than that of the first layer.

4. The collapsible bag of claim 3 wherein the first layer comprises a linear low density polyethylene and the second layer comprises a high density polyethylene.

5. The collapsible bag of claim 3 wherein the second layer comprises one of the group selected from nylon, high density polyethylene, polypropylene and polyesters.

6. The collapsible bag of claim 1 wherein the thickness of each of the first and second walls is less than 10 mils.

7. The collapsible bag of claim 4 wherein the thickness of each of the first and second walls is less than 8 mils.

8. The collapsible bag of claim 1 wherein the first wall and the second wall each have a strength defined by a secant modulus of at least 30,000 psi.

9. The collapsible bag of claim 1 wherein the first wall and the second wall each have a strength defined by a secant modulus of at least 45,000 psi.

10. The collapsible bag of claim 1 wherein the surface variation defines a height of the inner surface of either of the first wall and the second wall that is between 1.3 and 2.5 times

that of the thickness of the respective first wall and second wall.

11. The collapsible bag of claim 1 wherein the surface variation comprises a repeated pattern of nested alternating elongated ridges defining a plurality of peaks and valleys, wherein adjoining ridges are disposed obliquely relative to each other.

12. The collapsible bag of claim 11 wherein the adjoining ridges are disposed perpendicular to each other.

13. The collapsible bag of claim 11 wherein the abutment of the peaks of the elongated ridges of the first wall with the peaks of the elongated ridges of the second wall define a volume of at least 0.36 cubic centimeters per square inch.

14. The collapsible bag of claim 11 wherein each of the elongated ridges has a substantially hemispherical cross-section along at least a portion thereof.

15. The collapsible bag of claim 11 wherein each of the elongated ridges has a length of between .0625 inches and .1825 inches.

16. The collapsible bag of claim 1 wherein the surface variation extends substantially along at least 85% of a surface area of each of the first and second walls.

17. The collapsible bag of claim 1 wherein the surface variation extends substantially along the entirety of the first and second walls.

18. The collapsible bag of claim 3 wherein the first and second walls further comprise a third layer positioned on the second layer opposite the first layer, the third layer comprising a polymer material.

19. The collapsible bag of claim 18 wherein the third layer comprises a linear low density material of a lower strength than the second layer.

20. The collapsible bag of claim 1 further comprising an outer first wall and an outer second wall, the outer first wall being positioned on the first wall and the outer second wall positioned on the second wall so as to define a two-ply collapsible bag.

21. The collapsible bag of claim 1 wherein the spout further comprises:

- an elongated opening; and

- a base flange extending about the elongated opening;

- the flange having a bottom surface, wherein the bottom surface includes a plurality of surface channels positioned thereon.

22. The collapsible bag of claim 21, wherein the plurality of surface channels comprise radial grooves.

23. The collapsible bag of claim 21, wherein the plurality of surface channels comprise a combination of a plurality of concentric circular grooves and a plurality of radial grooves.

24. A collapsible bag for dispensing liquids, comprising:

- a first wall and a second wall connected together to define a fluid chamber therebetween, the first wall and the second wall each having an inner surface facing the fluid chamber and an opposed outer surface, each of the first and second walls comprising at least two layers, a first layer and a second layer, wherein the second layer has a rigidity greater than that of the first layer;

- a spout attached to one of the first and second walls, the spout having an opening therethrough having an axis substantially perpendicular to the one of the first and second walls to which it is attached;

- a surface variation molded into at least a portion of the first wall and at least a corresponding portion of the second wall, the surface variation limiting contact between the inner surfaces of the first wall and the second wall, wherein the surface variation exceeds the thickness of the underlying first wall and second wall upon which it is positioned, wherein at least a portion of the minimum unstressed volume is maintained substantially throughout evacuation thereof by suction.

25. The collapsible bag of claim 24 wherein the surface variation defines a minimum unstressed volume therebetween of at least .18 cubic centimeters per square inch of surface

area of each of the first wall and the second wall.

26. The collapsible bag of claim 24 wherein the liquid comprises a viscous liquid such as syrup and the like.

5

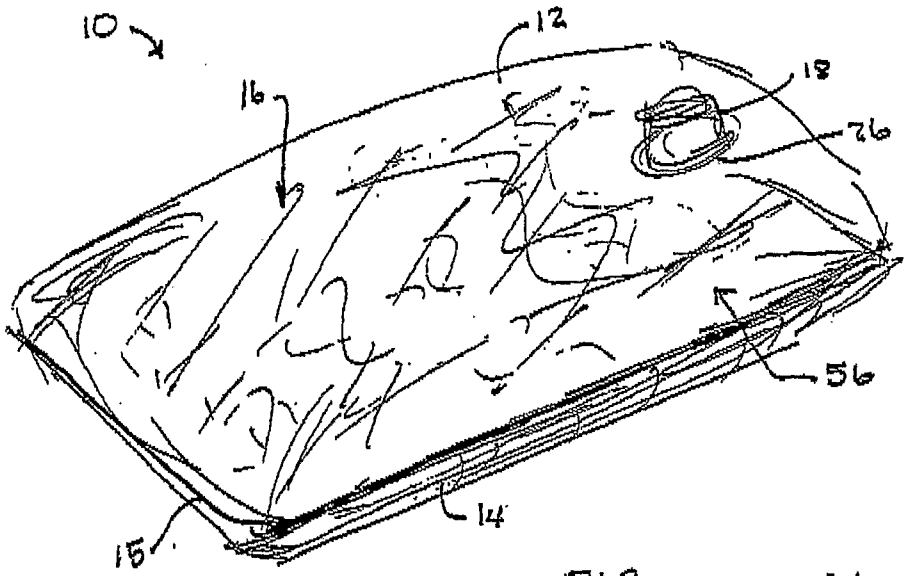

FIGURE 1

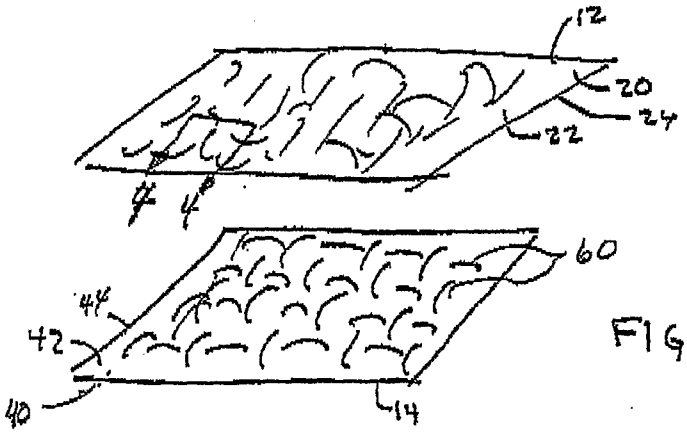

FIGURE 2

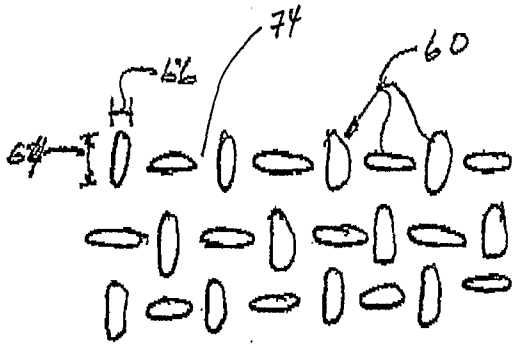

FIGURE 3

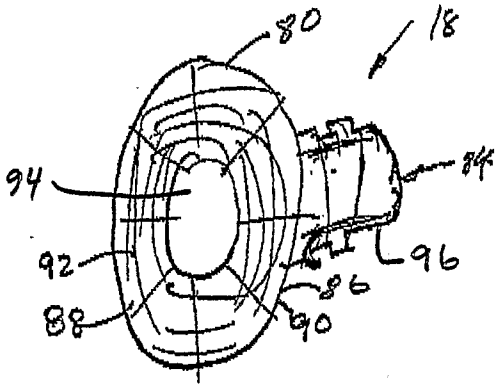

FIGURE 5

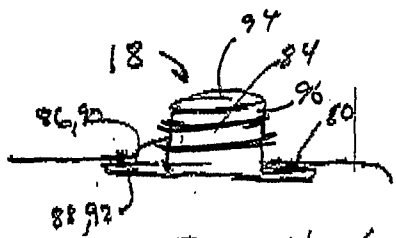

FIGURE 6

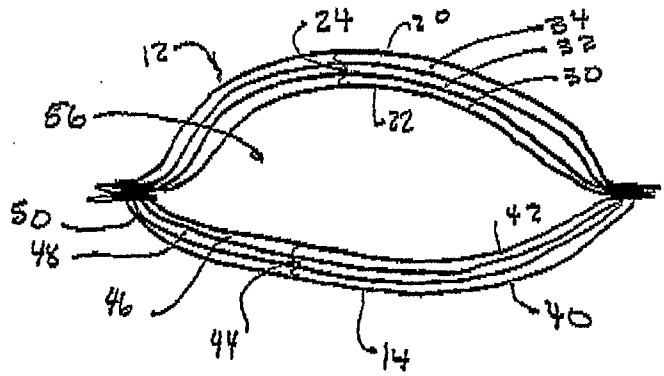

FIGURE 7

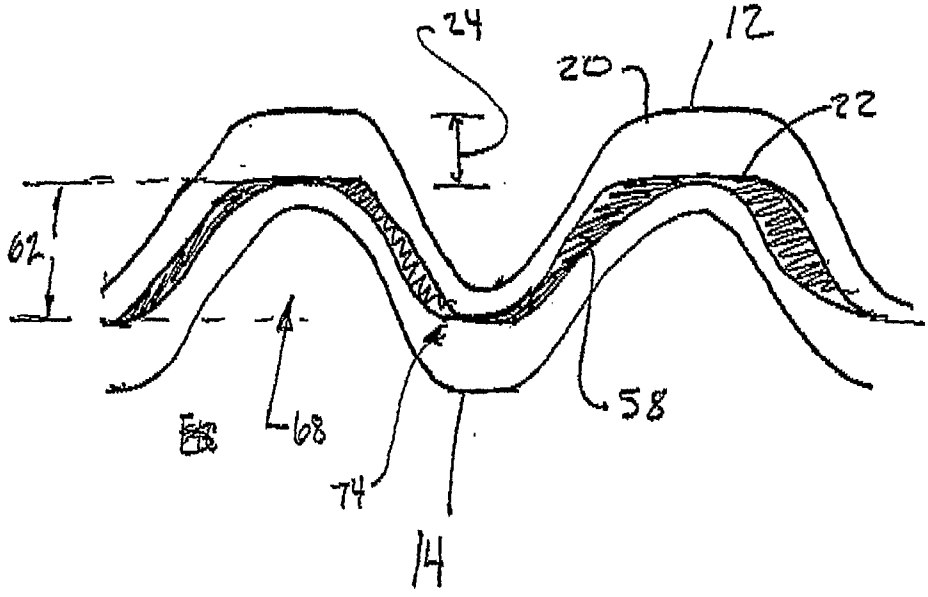

FIGURE 4

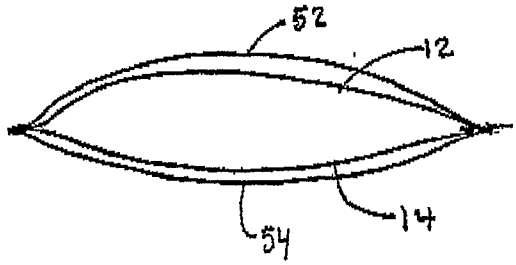

FIGURE 8

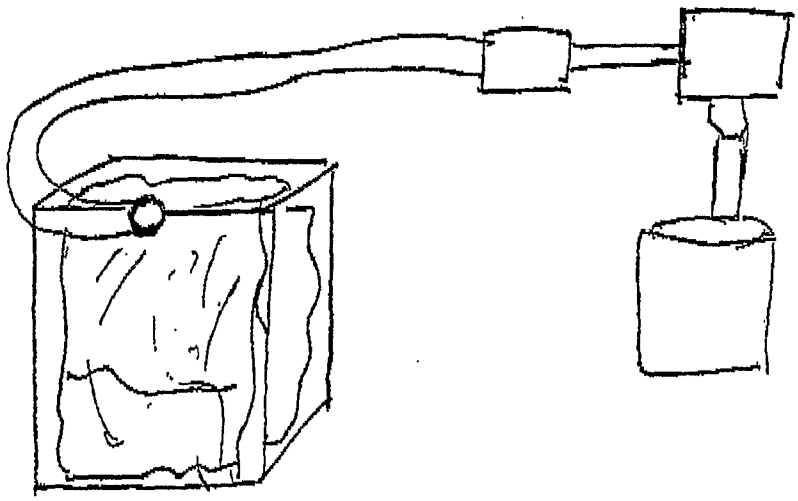

FIGURE 9

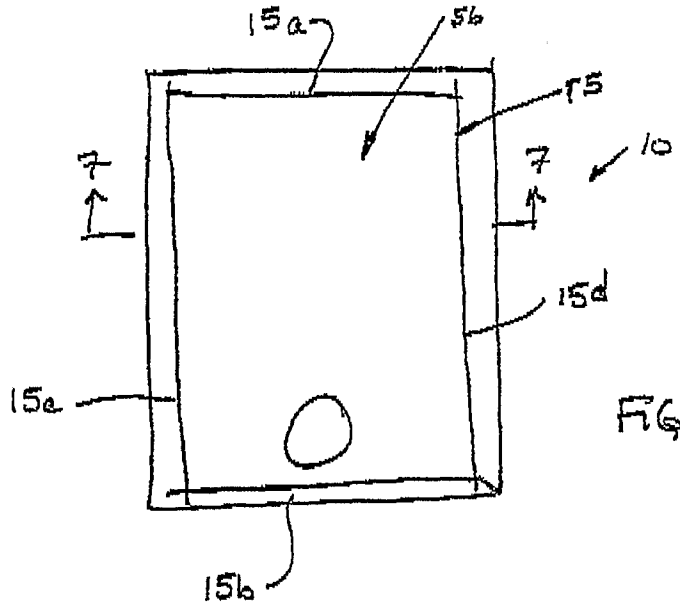

FIGURE 10

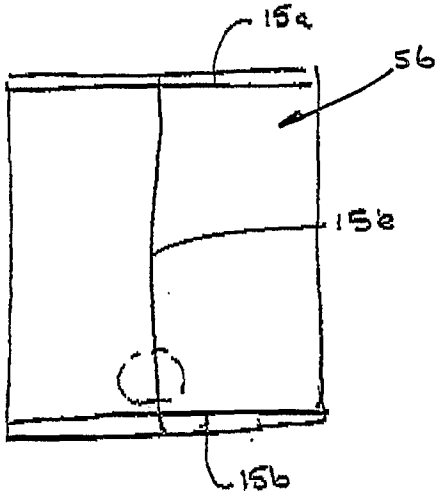

FIGURE 11a

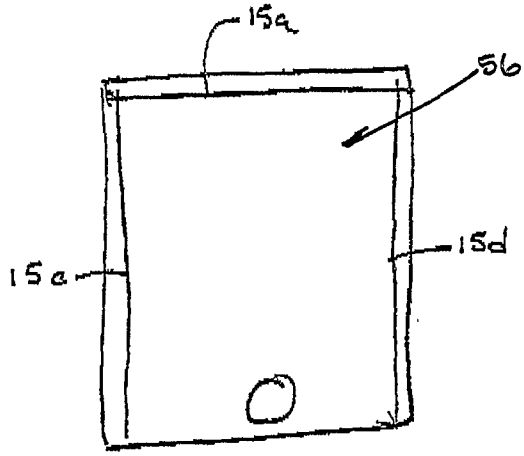

FIGURE 11b