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

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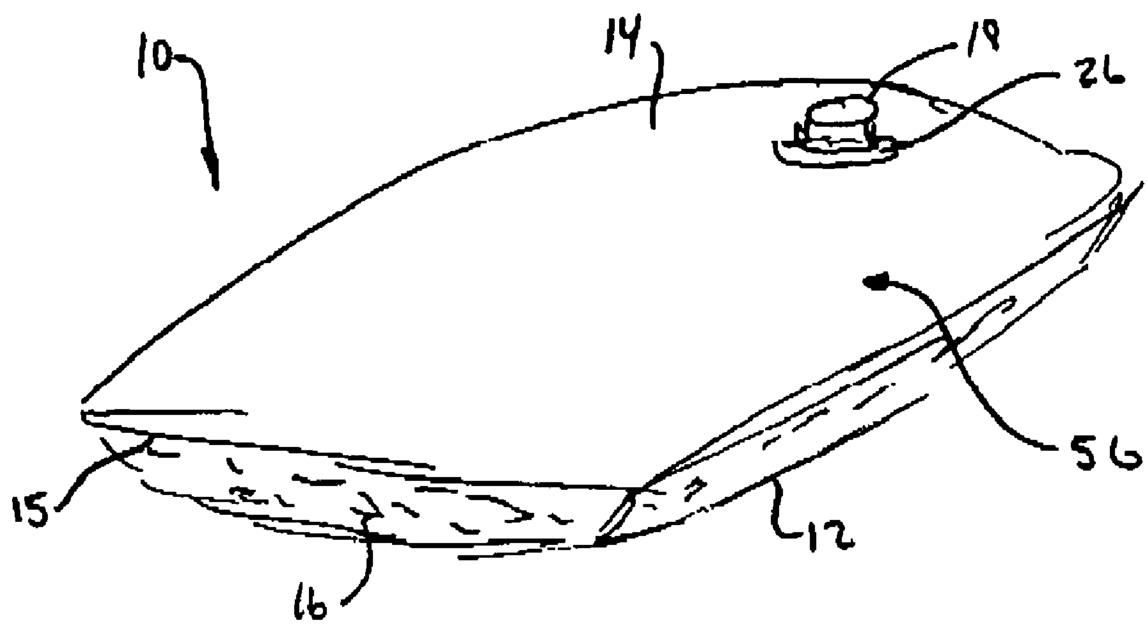
(57) **ABSTRACT**

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 wall. 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. 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.



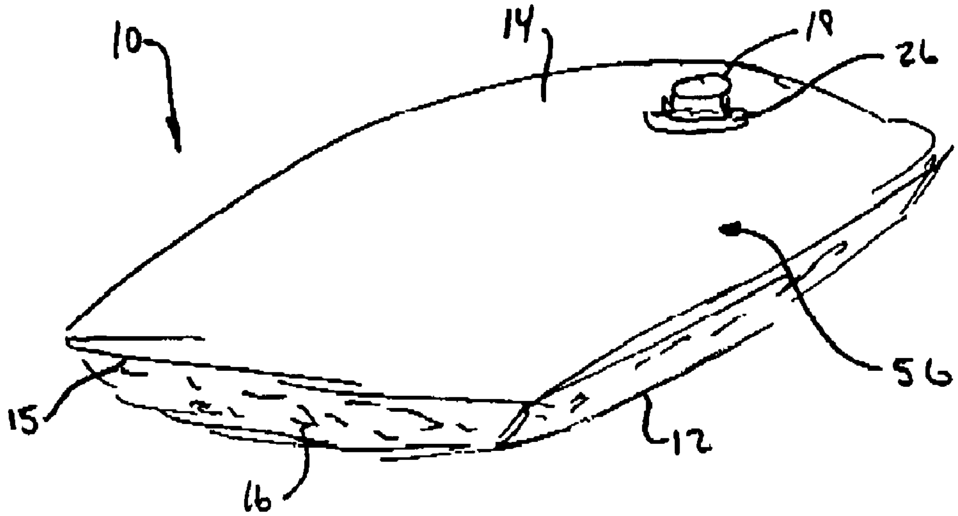


FIGURE 1

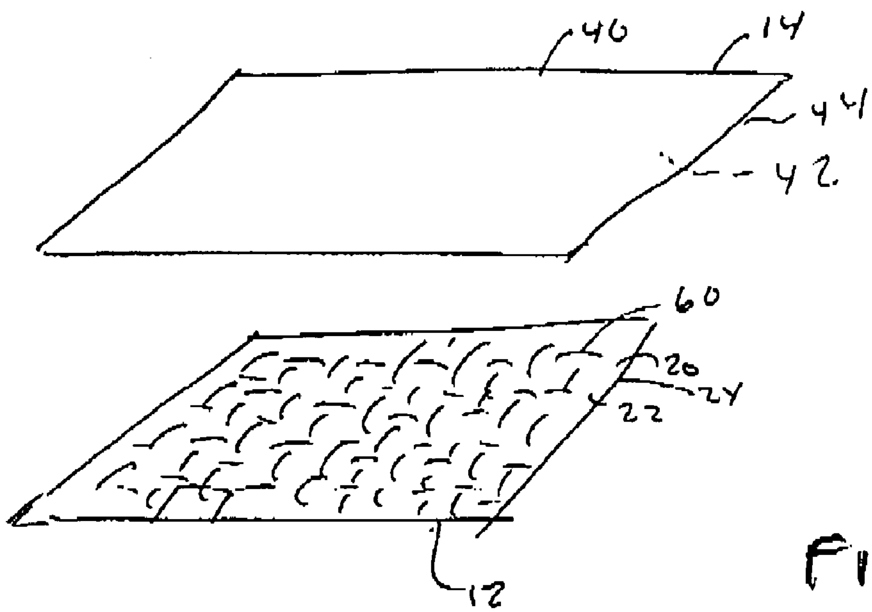


FIGURE 2

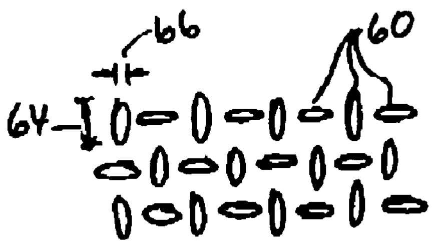


FIGURE 3

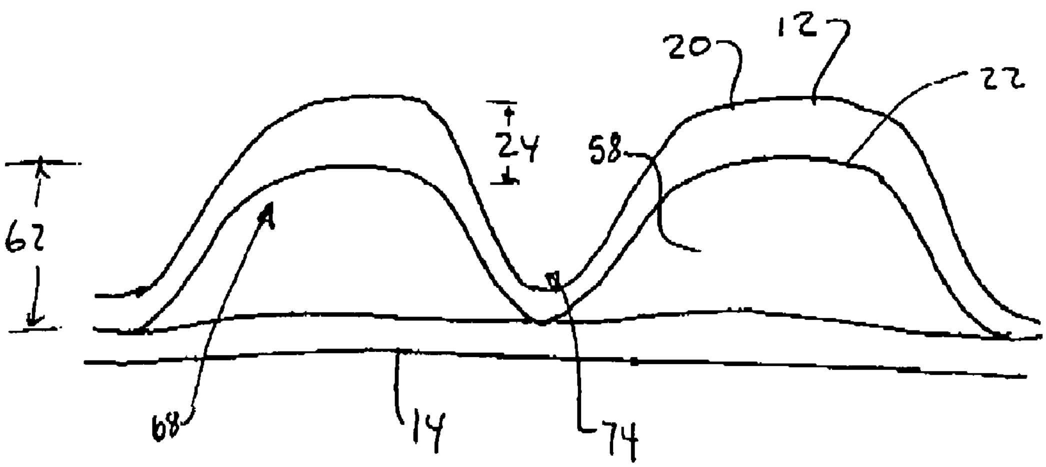


FIGURE 4

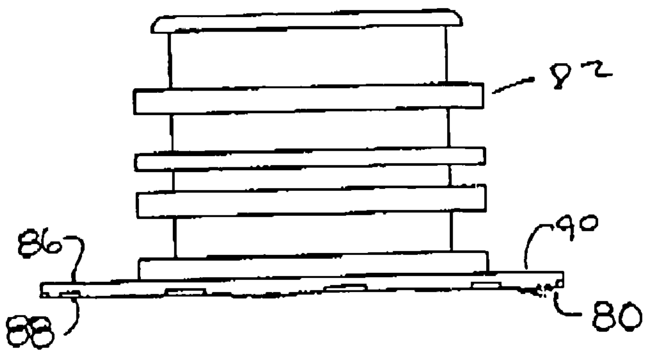


FIGURE 5A

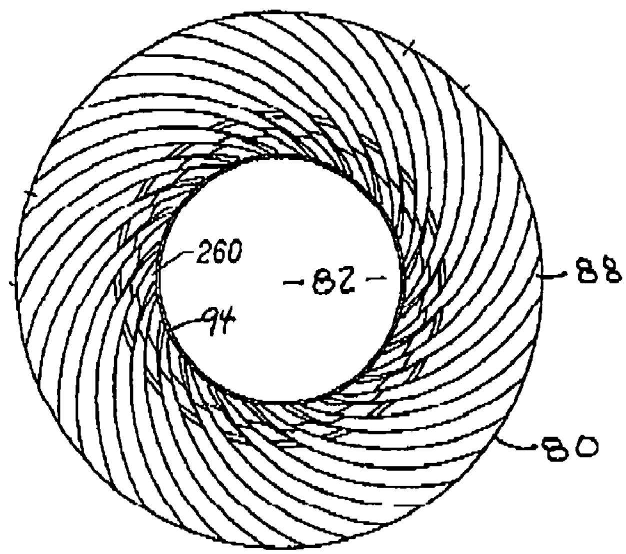


FIGURE 6B

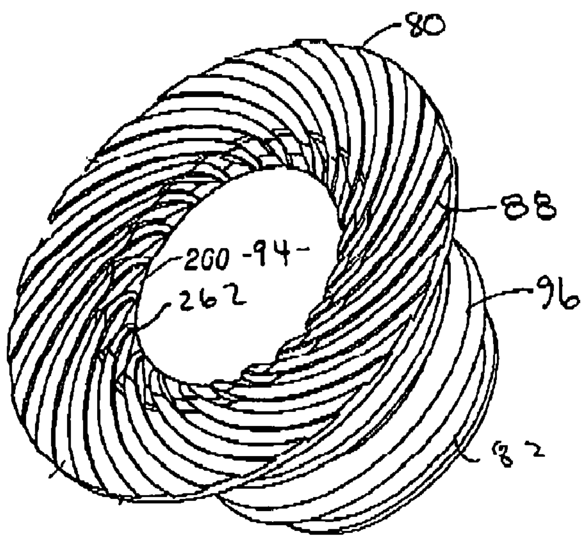


FIGURE 6A

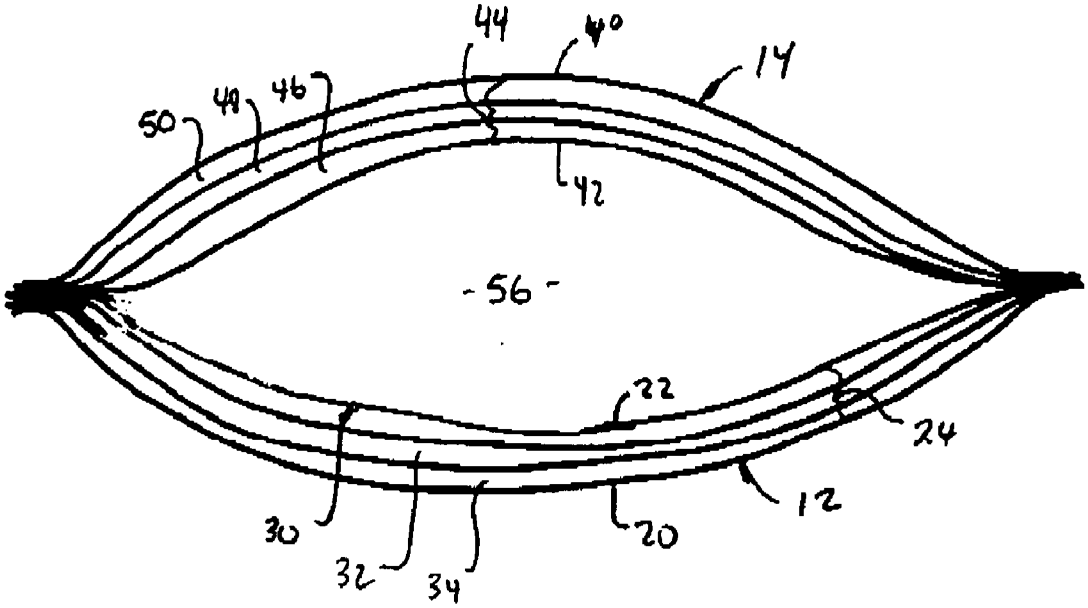


FIGURE 7

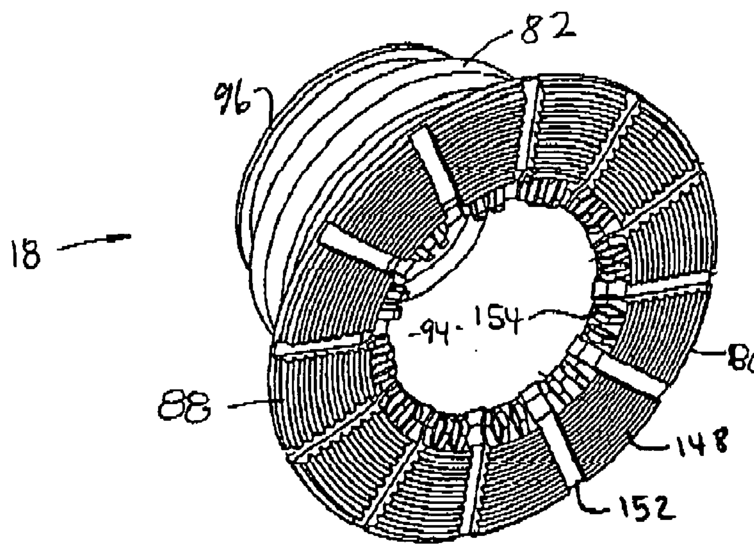


FIGURE 5B

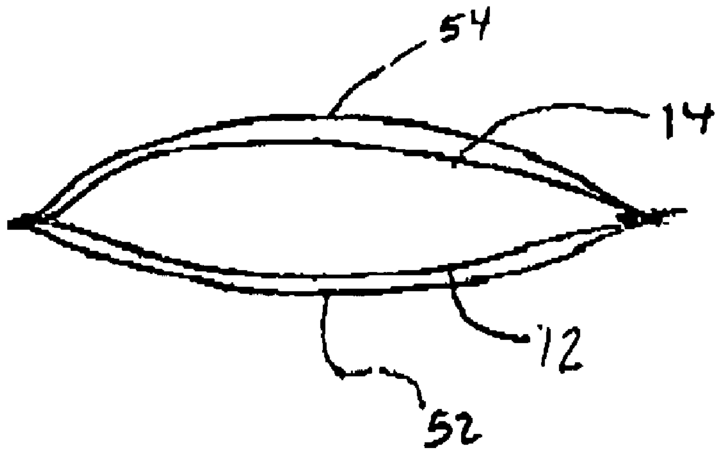


FIGURE 8

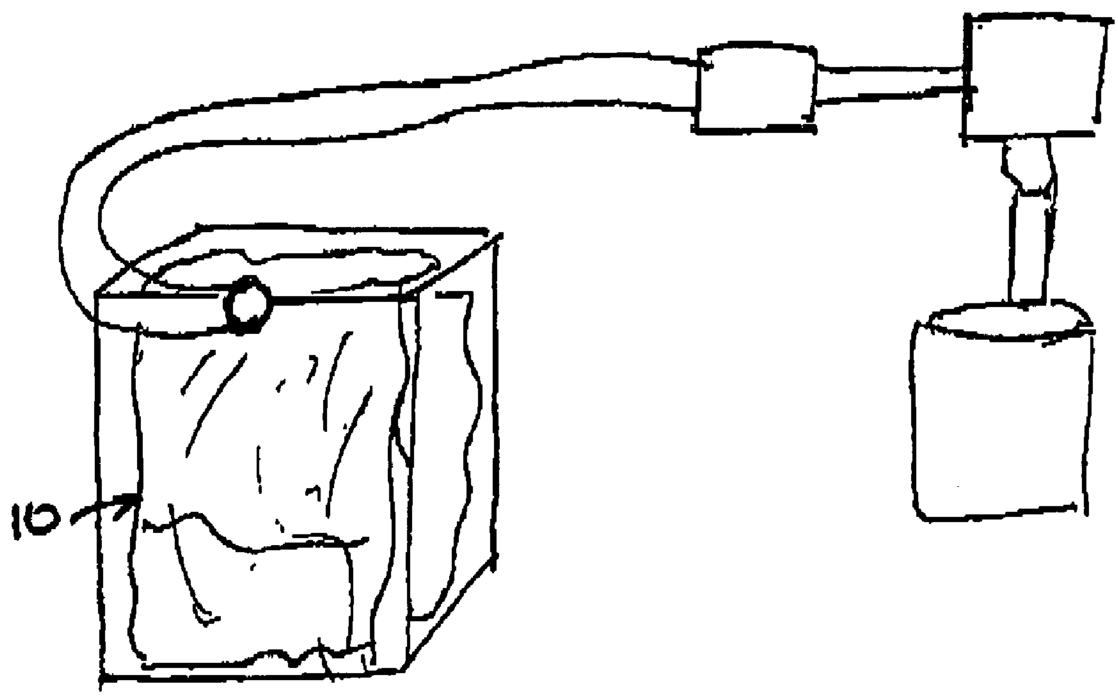


FIGURE 9

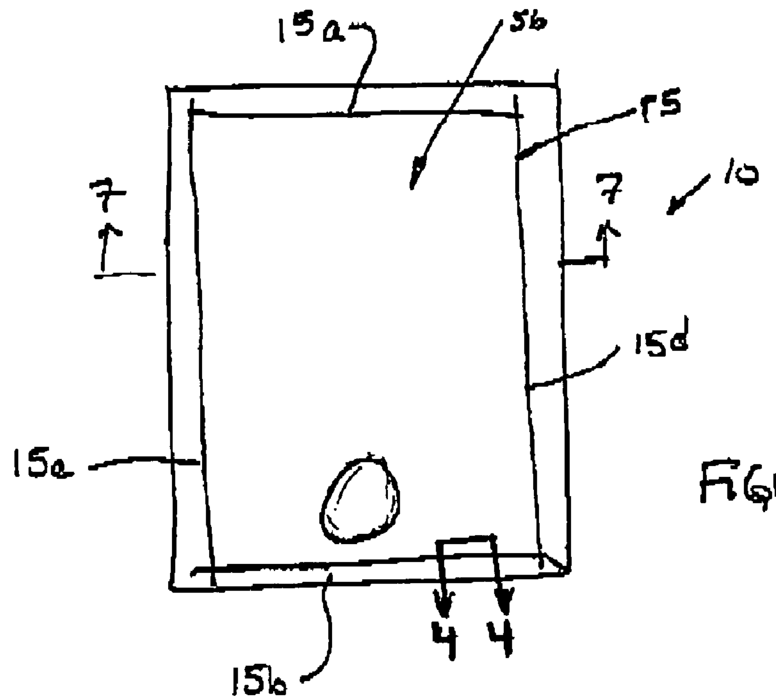


FIGURE 10

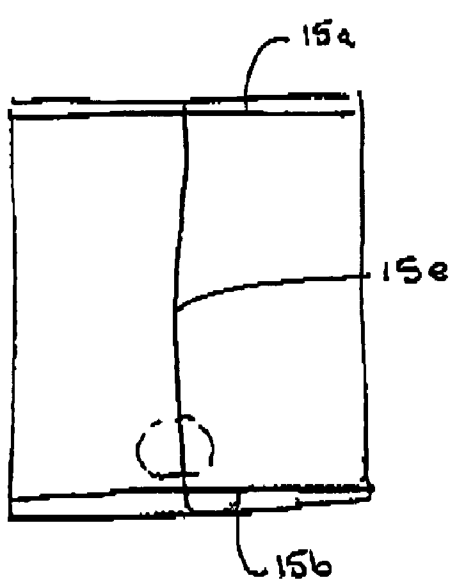


FIGURE 11a

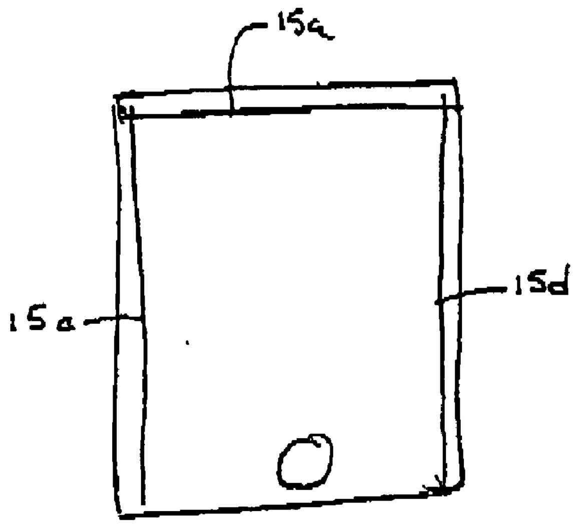


FIGURE 11b

COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is related to co-pending U.S. application Ser. No. 11/197,236 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD filed Jul. 27, 2005. This application is also related to co-pending U.S. patent application Ser. No. 11/048,622 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD filed Feb. 1, 2005, which is a continuation of U.S. Pat. No. 6,851,579 B2 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD which is a continuation of U.S. Pat. No. 6,607,097 B2 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD which is a continuation of U.S. patent application Ser. No. 09/709,144 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS AND METHOD filed Nov. 10, 2000, now abandoned, which is a continuation of U.S. Provisional Patent Application Ser. No. 60/164,699 entitled COLLAPSIBLE BAG FOR DISPENSING LIQUIDS, filed Nov. 10, 1999. The entire specification of each of the foregoing applications 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. Pat. Nos. 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).

[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 an object of the invention to overcome shortcomings of the prior art identified above.

[0010] This 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. 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 0.18 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 the first wall that is between 1.3 and 2.5 times that of the thickness of the first 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 second wall is planar and the spout is attached to the second wall.

[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 0.0625 inches and 0.1825 inches.

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

[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. In certain embodiments the bottom surface of the flange includes a plurality of gussets.

[0028] In certain such embodiments, the gussets are positioned proximate the elongated opening and a plurality of gussets extend between pairs of radial grooves. The gussets preclude the creation of a seal by the first wall about the base of the elongated opening.

[0029] In another embodiment, a plurality of recesses are formed on opposing sides of ridges to preclude the formation of a seal by the first wall about the base of the elongated opening.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The invention will now be described with reference to the drawings wherein:

[0031] FIG. **1** of the drawings comprises a perspective view of an embodiment of the collapsible bag for evacuating liquids of the present invention;

[0032] FIG. **2** of the drawings comprises a partial perspective view of the collapsible bag, showing, in particular, the unstressed minimum volume thereof;

[0033] FIG. **3** of the drawings comprises a partial top plan view of the first wall of the collapsible bag of the present invention, showing, in particular, the surface variation thereof;

[0034] FIG. **4** of the drawings is a partial cross-section of the collapsible bag of the present invention, taken about lines **4-4** of FIG. **10**;

[0035] FIG. **5***a* of the drawings comprises a side elevational view of the spout of the collapsible bag of the present invention;

[0036] FIG. **5***b* of the drawings comprises a perspective view of a portion of the collapsible bag of the present invention, showing, in particular, the spout thereof;

[0037] FIG. **6***a* of the drawings comprises a perspective view of the spout of the collapsible bag of the present invention;

[0038] FIG. **6***b* of the drawings comprises a bottom plan view of a the spout of the collapsible bag of the present invention;

[0039] FIG. **7** of the drawings comprises a cross-sectional view of the collapsible bag of the present invention, taken generally about lines **7-7** of FIG. **10**, showing, in particular, the multi-layer structure of each of the first and second walls;

[0040] FIG. **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;

[0041] FIG. **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;

[0042] FIG. **10** of the drawings comprises a top plan view of the collapsible bag of the present invention, showing, in particular, the seals thereof; and

[0043] FIGS. **11***a* and **11***b* 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

[0044] 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.

[0045] 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.

[0046] Referring now to the drawings and in particular to FIG. **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**.

[0047] More specifically, with reference to FIG. **10**, the first wall and the second wall may comprise two separate sheets of material joined by top seal **15***a*, bottom seal **15***b*, and opposing side seals **15***c* and **15***d*. 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 FIG. **11***a,* wherein a sheet of material is used to form the front wall and the back wall. In such an embodiment, vertical seal **15***e* joins the two ends of the single sheet of material along second wall **14**, thereby forming the front and back walls. Furthermore, top seal **15***a* and bottom seal **15***b*, along with side folds complete the fluid chamber. In still other embodiments, such as the embodiment shown in FIG. **11***b,* a single sheet may be folded about one edge. In turn, top seal **15***a* (or bottom seal **15***b*) along with two side seals **15***c* and **15***d* 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.

[0048] 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 21" and the width of the bag is approximately 17". Other common configurations comprise a 5 gallon bag having a generally rectangular shape with a length of 24" and a width of 18.75". 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.

[0049] 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.

[0050] With reference to FIG. **4**, first wall **12** is shown in outer surface **20**, inner surface **22** and thickness **24**. 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. It will be understood that such a range provides the necessary strength and rigidity while maintaining a certain flexibility which permits filling, transport and handling of the bag without causing failure and leakage.

[0051] 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.

[0052] One embodiment of the three layer film is shown in FIG. **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 approximately 0.922 grams per cubic centimeter. Of course, materials having a greater or a lesser thickness are contemplated for use. Additionally, densities between approximately 0.910 and 0.930 grams per cubic centimeter are contemplated for such a layer.

[0053] 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 which is capable of substantially plastic deformation while retaining its integrity. 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 0.960 grams per cubic centimeter. Of course, materials having greater or a lesser thickness are contemplated for use. Additionally, densities between approximately 0.945 and 0.970 grams per cubic centimeter are contemplated for such a layer.

[0054] 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. Of course, materials having a greater or a lesser thickness are contemplated for use. Additionally, densities between approximately 0.910 and 0.930 grams per cubic centimeter are contemplated for such a layer.

[0055] 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 FIG. **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 may be employed.

[0056] Second wall **14** is shown in FIG. **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. It is contemplated that a portion of the second wall may include surface variations (i.e., the area of the opposing wall opposite the surface variations in a first wall is substantially planar). In addition, it is contemplated that portions of the first wall and portions of the second wall may include surface variations which do not contact each other. Opening **26** (FIG. **1**) extends through the second wall. The opening in the present invention is substantially circular and substantially uniform, while other configurations are likewise contemplated.

[0057] Surface variation **16** is shown in FIGS. **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 through plastic deformation by pressing a pattern onto the film (preferably heating the film prior to formation thereof, and chilling during and/or after the formation thereof).

[0058] A cross-sectional view of the surface variation is shown in FIG. **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 FIG. **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.

[0059] With reference to FIG. **3**, each elongated member is positioned obliquely relative to any adjoining elongated member in such an embodiment (in this case perpendicular). Each of the alternating elongated members include length **64**, width **66** and cross sectional configuration **68** (FIG. **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 0.030 inches to 0.070 inches. In the embodiment shown, the length of the elongated members is approximately 0.125 inches and the width is approximately 0.050 inches.

[0060] 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** shown in FIG. **4**. Through maintenance of this unstressed volume, fluid can be evacuated from within the collapsible bag.

[0061] With reference to FIG. **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 substantial 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 contemplated embodiment, the second wall is substantially planar, but the configuration (i.e., rigidity, strength and flexibility) of the first wall and the second wall are such that the minimum unstressed volume is maintained during vacuum withdrawal of the fluid contents therewithin. 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.

[0062] Of course, other surface variations are contemplated for use, wherein the patterns in the first wall 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**.

[0063] 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.

[0064] Spout **18** is shown in FIGS. **5***a* and **5***b* 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. It is highly preferred, although not required that the spout be positioned in the second wall, opposite the first wall having the surface configurations positioned thereupon. In such a configuration, the bottom surface of the flange is able to interface with the surface configurations of the first wall greatly enhancing the resistance to choking about the spout.

[0065] Base flange **80** includes top surface **86** and bottom surface **88**. As is shown in FIG. **5**A, top surface **88** 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**. In the embodiment shown, the spout includes concentric ridges **148**, radial grooves **152** and gussets **154**. The gussets are positioned at the edge of the spout opening and between pairs of radial grooves. In the embodiment shown, multiple gussets are positioned between each pair of radial grooves. The gussets cooperate with the first wall surface configurations to preclude the creation of a seal between the first wall and the edge of the spout. In other embodiments, as is shown in FIGS. **6***a* and **6***b*, recesses such as recess **260** may be positioned between ridges, such as ridge **262**, so as to preclude the creation of a seal between the first wall and the edge of the spout. In other embodiments, 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 related application. The configuration of the spout shown in the related applications has been incorporated by reference herein.

[0066] 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.

[0067] 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.

[0068] The box having the collapsible bag may be positioned in any number of different containers. For example, the collapsible bag 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 (FIG. **9**). 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.

[0069] 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 (FIG. **9**). By way of the above defined construction, 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.

[0070] Certain testing was carried out relative to an embodiment of present invention and a container available commercially. The embodiment of the container of the present application comprised a 2.5 gallon container (21" by 17" rectangular pillow type container). 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 first wall included surface variations having a height of approximately 12 mils and comprise an alternating set of nested elongated members (FIGS. **2** and **3**). The second wall was substantially planar. The length of the elongated members is approximately 0.125 inches, and the elongated members have a semi-circular cross-section.

[0071] The test was carried out two times. First, a spout of the type shown in FIGS. **6***a* and **6***b* was attached to the container. In the second test, a flat bottom planar spout was utilized. In each case, the formed container was filled a conventional post mix syrup having a specific gravity of approximately 1.25. The weight of the filled 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 the top in a substantially uppermost orientation, as is shown in FIG. **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.

[0072] The same procedure was undertaken with respect to a commercially available container having relatively shallow pathways pressed into the inner surface of each of the respective walls, the pathways having an approximate depth of about 0.0018 inches. 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. The spout of such a container is substantially planar.

[0073] 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 (Spout of FIG. 6a)	Container Produced In Accordance With The Present Invention (Spout having a flat planar bottom)
Test 1	6.44 pounds	.10 pounds	.08 pounds
Test 2	15.84 pounds	.08 pounds	.10 pounds
Test 3	4.62 pounds	.10 pounds	.10 pounds
Test 4	6.04 pounds	.08 pounds	.08 pounds

[0074] 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 fifteen 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.

[0075] 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, 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 0.18 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 second wall is substantially planar, and wherein the spout is attached to the second wall.

4. 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.

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

6. The collapsible bag of claim **4** wherein the second layer comprises one of the group selected from nylon, high density polyethylene, polypropylene and polyesters.

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

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

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 30,000 psi.

10. 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.

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

12. 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.

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

14. The collapsible bag of claim **12** wherein each of the elongated ridges has a substantially hemispherical cross-section along at least a portion thereof.

15. The collapsible bag of claim **12** wherein each of the elongated ridges has a length of between 0.0625 inches and 0.1825 inches.

16. The collapsible bag of claim **1** wherein the surface variation extends substantially along at least 85% of a surface area of the first wall.

17. The collapsible bag of claim **1** wherein the surface variation extends substantially along the entirety of the first wall.

18. The collapsible bag of claim **4** 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. The collapsible bag of claim **22** wherein the bottom surface of the flange includes a plurality gussets positioned proximate the elongated opening.

25. The collapsible bag of claim **22** wherein a plurality of gussets are positioned between pairs of radial grooves.

26. The collapsible bag of claim **22** wherein a plurality of recesses are formed on the bottom surface of the flange proximate the elongated opening.

27. 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, 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 upon which it is positioned, wherein at least a portion of the minimum unstressed volume is maintained substantially throughout evacuation thereof by suction.

28. The collapsible bag of claim **27** wherein the surface variation defines a minimum unstressed volume therebetween of at least 0.18 cubic centimeters per square inch of surface area of each of the first wall and the second wall.

29. The collapsible bag of claim **27** wherein the liquid comprises a viscous liquid such as syrup and the like.

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