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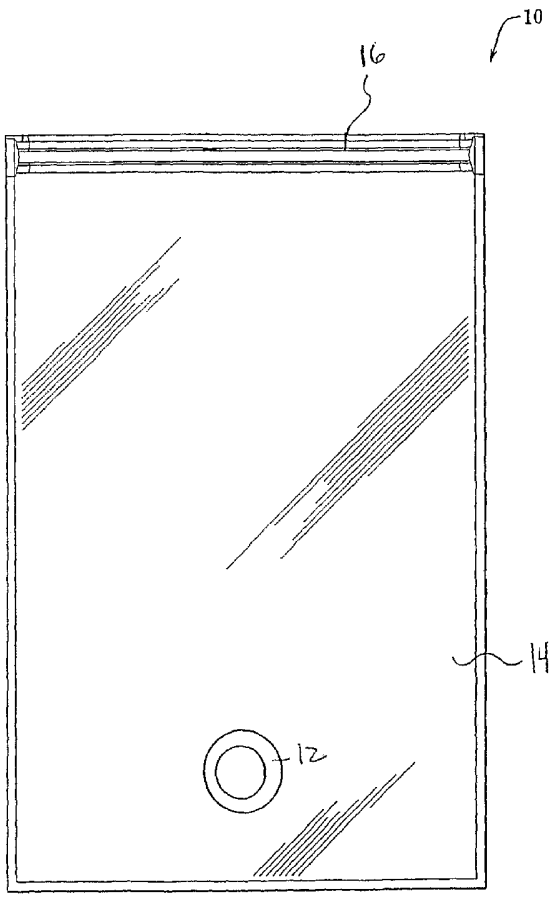
(54) Title: ONE WAY VALVE AND CONTAINER




(57) Abstract: The present invention provides a one way valve having a valve body, a wall, a fluid inlet, and a fluid outlet. The valve has a plunger which is moveable with respect to the valve body from a first position to a second position. The valve also has a diaphragm positioned in the valve body for movement between a third position and a fourth position when the plunger is in the first position. When the diaphragm is in the third position the fluid outlet is closed and when the diaphragm is in the fourth position the fluid outlet is open.

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# ONE WAY VALVE AND CONTAINER

CROSS-REFERENCE TO RELATED APPLICATION:

This is a continuation-in-part of U.S. Patent Application Serial No. 11/020,380, which is incorporated herein by reference and made a part hereof.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT:

Not Applicable.

BACKGROUND OF THE INVENTION:

Technical Field

The present invention relates to a container system for storing articles in a reduced air environment.

Background Art

Collapsible, evacuable storage containers typically include a flexible, fluid-tight bag, an opening through which to place an article in the bag, and a fixture through which to evacuate excess air. A user places an article into the enclosure through the opening, seals the opening, and then evacuates the fluid through the fixture. With the chamber thus evacuated, the article contained therein may be significantly compressed, so that it is easier to transport and requires substantially less storage space. For articles of food, storage life can be increased by removing air from the container and by maintaining this reduced oxygen environment.

Collapsible, evacuable storage containers are beneficial for reasons in addition to those associated with compression of the stored article. For example, removal of the air from the storage container inhibits the growth of destructive organisms, such as moths, silverfish, and bacteria, which require oxygen to survive and propagate. Moreover, such containers, being impervious to moisture, inhibit the growth of mildew.

One such container was developed by James T. Cornwell (U.S. Pat. No. 5,203,458). That patent described a disposable, evacuable container for sealing and compressing contaminated surgical garments for ease of storage and transportation prior to disposal.

Another such container is described in a patent to Akihiro Mori and Ichiro Miyawaki (Japanese Pat. No. 1767786). In that device, the opening through which the stored article is placed requires the application of a heat source, such as a home iron, to form an effective seal.

These and other aspects and attributes of the present invention will be discussed with reference to the following drawings and accompanying specification.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a perspective view of a container and closure assembly of the present invention with the container being in a sealed position;

FIG. 2 is a perspective view of a container and closure assembly of the present invention with the container being in an unsealed position;

FIG. 3 is a cross-sectional view of an embodiment of a valve of the present invention in a closed position;

FIG. 4 is a cross-sectional view of an embodiment of a valve of the present invention in an open position;

FIG. 5 is a top view of an embodiment of a plunger of the present invention;

FIG. 6 is a side view of the plunger shown in FIG. 5;

FIG. 7 is a top view of a valve of the present invention;

FIG. 8 is a bottom view of a valve of the present invention;

FIG. 9 is a side view of a diaphragm of the present invention;

FIG. 10 is a top view of a diaphragm of the present invention;

NEW → FIGs. 11a-e are top plan views of alternative embodiments of container systems of the present invention;

FIG. 11f is a view in partial cross-section along line f-f of FIG. 11e;

FIG. 12 is plan view of a sidewall of a container having objects having varying shapes on a planar surface;

Fig. 13 is a plan view of a sidewall of the container of FIG. 11 having a plurality of regularly spaced rectangular protuberances to define a checkerboard pattern;

Fig. 14 is a plan view of a sidewall having circular protuberances together forming a circular pattern with a series of X-shaped protuberances forming S-shaped lines;

Fig. 15 is a schematic view of a process for texturing a surface of a film;

Fig. 16 is a cross-sectional view of a multiple layered film having a textured surface;

FIG. 17 is a side elevational view of an alternative embodiment of a closure assembly of the present invention in the open position;

FIG. 18 is a side elevational view of an alternative embodiment of a closure assembly of the present invention in the closed position;

FIG. 19 is a top view of the closure assembly of FIG. 18;

FIG. 20 is a bottom view of the closure assembly of FIG. 18; and

FIG. 21 is a schematic view of a closure assembly docked to a pump.

DETAILED DESCRIPTION OF THE INVENTION:

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings, and will be described herein in detail, specific embodiments thereof 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 specific embodiments illustrated.

FIGS. 1 and 2 show a container system **10** having a closure assembly **12** and a container **14**. The closure assembly includes a one-way valve that allows for evacuation of fluid from the container but does not allow a significant quantity of fluid to enter the container through the assembly **12**. In one preferred form of the invention, the container **14** is capable of being opened and closed repeatedly without the use of a tool or heat source by utilizing a zipper **16** or other member for sealing an end of the container. FIG. 2 shows the container in an unsealed position with an opening **18** at an end of the container for loading articles into the container. The container is suitable for storing compressible articles sealed from the surrounding environment and maintaining a fluid tight seal. Excess fluid in the container can be removed by applying a suction to the closure assembly using a household vacuum cleaner or other suction device. Excess fluid can also be removed by pressing the sidewalls of the container to force fluids from the container or by rolling up the container or by applying pressure to the sidewalls in any fashion to remove excess fluids through the closure assembly. Thus, the use of a suction device to remove fluid from the container is optional. Removal of excess fluid reduces the size of the

compressible article and by maintaining a minimal fluid content, such as air and water, inhibits the growth of insects, mold, mildew and other bacteria, which may damage the contents of the container. Moreover, in a preferred form of the invention, the sealed container and closure assembly provide a barrier to the passage of fluids to further inhibit the growth and propagation of bacteria, mold and mildew among other organisms over an extended period of time.

FIGS. 3, 4, 7 and 8 show the closure assembly **12** having a valve body **20**, a plunger **22** and a diaphragm **24**. FIG. 3 shows the closure assembly **12** in a closed position and FIG. 4 shows the closure assembly in an open position. The valve body **20** has an annular flange **26** having a first surface **28** and an opposed second surface **30**, a centrally disposed opening **32** through the flange, and a cylindrical wall **33** extends from the first surface and is disposed circumjacent the opening **32** and defines a first fluid pathway **34** therethrough. The first cylindrical wall has a plurality of circumferentially spaced openings **35**.

A second cylindrical wall **36** extends from the second surface **30** and has a fluid inlet **37** at a distal end and defines a second fluid pathway **38** therethrough that is in fluid communication with the opening **32**. The fluid inlet **37** is sealed by the diaphragm **24** when the closure assembly is in the closed position and is uncovered when the closure assembly is in the open position. The second cylindrical wall **36** is circumferentially surrounded by a plurality of radially extending and circumferentially spaced fins **39** (See also FIG. 8) each of which have an end **40** terminating at an outer periphery **41** of the second cylindrical wall **36**.

A valve supporting surface **42** is positioned in a generally central portion of the second fluid passageway and has a generally cruciform shaped member **43** having a first arm **44** a second arm **46** transverse to the first arm and has a generally circular platform **48** joining the first arm to the second arm. The valve supporting surface **42** extends across the entire diametrical dimension of the second cylindrical wall **36** and extends from the second surface **30** beyond a distal end **49** of the wall. The fins and the cruciform shaped member add rigidity to the valve assembly and reduce the tendency for the fluid inlet **37** to become closed or partially closed by the sidewalls of the container or by articles within the container.

In a preferred form of the invention, the valve body **20** is fabricated from a polymeric material by an injection molding technique. Suitable polymeric materials for the valve body include polymers, copolymers and terpolymers fabricated from one or more chemical groups

including olefins, dienes, amides, esters, vinyl chlorides, vinyl alcohols, vinyl acetates, urethanes, imides, ethers, sulfones, styrenes, acrylonitrile, acrylates, substituted acrylates, and blends of polymers, copolymers and terpolymers derived from these chemical groups. In one preferred form of the invention the valve body is fabricated from the terpolymer acrylonitrile-butadiene-styrene or from the homopolymer polypropylene, or from a copolymer of propylene with minor proportions, say less than 6% by weight, of ethylene.

FIGS. 5 and 6 show the plunger **22** having a generally cylindrical shaped wall **50** defining a central fluid pathway **51**. The plunger **22** has a flange portion **52** and a stem portion **54**. FIG. 6 shows the flange portion includes several circumferentially spaced knobs **56** for hand gripping. The stem portion **54** extends coaxially within the valve body and has a set of threads **58** for cooperative engagement with mating threads **60** in the valve body **12**. In a preferred form of the invention, the threads are coarse for moving the plunger between a first position shown in FIG. 3 to a second position shown in FIG. 4 with less than one complete 360° rotation of the plunger.

It is contemplated that instead of threads, the plunger could have a flange or protuberance that would cooperatively engage a flange or protuberance in the valve body to allow the plunger to slide within the valve body without becoming disassembled. Such a plunger could be moved from the first position to the second position when a vacuum is applied. It is also contemplated there could be a first stop that releasably holds the plunger in the first position and a second stop that releasably holds the plunger in the second position.

FIGS. 9 and 10 show the diaphragm **24** which is dimensioned to fit within the valve body and has a generally uniform thickness across its entire diametric dimension. The diaphragm is moveable from a third position to a fourth position shown respectively in FIGS. 3 and 4 when the plunger is in the first position. When the diaphragm is in the third position it cooperates with the plunger to block the fluid inlet **37** and when the diaphragm is in the fourth position fluid is allowed to flow through the fluid inlet **37** and the fluid passageways **35**. The diaphragm is preferably fabricated from a material that has a density that allows it to be moved in response to a suction applied to the valve body. Suitable materials for the diaphragm include paper, plastic, rubber, cork or metal. In another preferred form of the invention, the diaphragm will have a density of less than about 1.2 g/cc. In yet another preferred form of the invention, the diaphragm will be fabricated from silicone or polyvinyl chloride.

In a preferred form of the invention, the zipper closure **16** is constructed in accordance with commonly assigned U.S. Patent No. 6,033,113 or U.S. Patent Application No. 2004/0091179A1 each of which is incorporated herein by reference and made a part hereof. The zippered closure is typically made of plastic. Often associated with the zippered closure is a slider that facilitates sealing the zippered closure. The slider closes and can open the zippered closure. Examples of sliders include those disclosed in U.S. Pat. Nos. 6,854,887; 6,306,071; 6,287,001; 6,264,366; 6,247,844; 5,950,285; 5,924,173; 5,836,056; 5,442,837; 5,161,286; 5,131,121; 5,088,971; and 5,067,208 each of which is incorporated herein by reference and made a part hereof.

The container **14** can be rigid, semi-rigid or flexible and, in a preferred form of the invention, should be capable of being sealed to form a fluid tight chamber. The container **14** can be permanently sealed or, as is shown in FIGS. 1 and 2, can be capable of being closed and reopened. What is meant by the term "flexible" is the material used to fabricate the container will have a mechanical modulus when measured according to ASTM D-882 of less than 40,000 psi. The term "semi-rigid" will refer to materials having a mechanical modulus of from 40,000 psi to 100,000 psi. The term "rigid" will refer to materials having a mechanical modulus of greater than 100,000 psi.

For containers that are permanently sealed fluid can be delivered to the container through an access member such as a tube, port, valve, spout, fitment or the like. The access member can remain with the container after filling or can be removed by any suitable method such as by a hot knife or other cutting member. The term "fluid" refers to liquids or gasses.

The container **14** can be fabricated from metal, paper, and plastic. Suitable plastics include the polymers set forth above for the valve body. The container can be fabricated from a monolayer film, a multiple layer film or from more than one ply of material where a portion of the plies are sealed together but the individual plies are not joined across their entire surface area. It is contemplated the container can be fabricated from a multiple layer structure having one or more layers of polymeric materials and one or more layers of paper or metals. Metals such as aluminum are known to provide significant barriers to water vapor transmission and to the transmission of gasses such as oxygen, nitrogen, helium, hydrogen and others. Also, polymers such as ethylene vinyl alcohol and polyamides are commonly used as they also provide

significant barrier properties. Containers can be constructed from a single web of material that is folded, from two webs of material or by a blown extrusion or blow molding or other polymer processing techniques that are well known in the art.

A method of fabricating the container assembly **10** shown in FIGS. 1 and 2 includes the steps of providing a container, making a hole in the container dimensioned to fit the valve body **12**, inserting the valve body **12** into the hole with the second surface **30** extending into the chamber of the container and the flange **26** contacting an outside surface of the container and providing heat directly or indirectly to the flange to weld the flange and valve body **12** to the container.

The container **14** can be evacuated of fluids by first moving the plunger from the first position to the second position either by rotating the plunger, sliding the plunger or the like, then applying a suction through a hose or the like using a household vacuum cleaner or other device such as a pump that is capable of generating a suction to remove fluid from the container through the valve body. Upon applying the suction the diaphragm is free to move from the third position to the fourth position where fluid can flow through the fluid passageways **35** and out of the container. Excess fluids can also be removed by pressing onto the sidewalls of the container to force air out of the container through the closure. After evacuation is complete, the suction should be removed or the pressing on the sidewalls should be discontinued. The diaphragm will be moved by gravity or by suction caused by the reduced pressure environment inside the container to partially or fully close the fluid passageway **37**. The plunger should then be moved back to the first position to maintain a fluid tight seal by locking the diaphragm in the third position.

FIGS. 11a-f show alternative embodiments of the container system **10**. The container shown in FIGS. 11a-e are suitable for use in packaging liquid, solid or particulate food items **62** in addition to being suitable for packaging the compressible articles mentioned above. The container can be permanently sealed along all edges after the container is filled with the desired contents or the container can be provided with a recloseable member to allow for opening and closing of the member and more preferably for repeated opening and closing of the member and

in a preferred form of the invention the recloseable member will be positioned along an edge of the container.

The container **14** has a peripheral seal **75** along three edges of the container and has a recloseable member, which in a preferred form of the container is a zipper **77**, at a fourth edge. The recloseable member is optional and it is contemplated this fourth edge **82** could be initially unsealed and later sealed, by, for example, direct or indirect heating, after placing or filling contents into a chamber **78** of the container. It is contemplated the fourth edge could also be sealed with a different type closure mechanism, such as a clamp, clasp, fastener, cap or by an adhesive, by electrostatic adhesion or other method so long as it is capable of maintaining an airtight seal under the condition in which the container is subjected during normal usage.

The containers of FIGS. 11a-d further have a structure for isolating the closure assembly **12** from the contents **64**, or the chamber **78**, to allow air to flow from the chamber **78** through the closure assembly **12** without evacuating the stored contents **64** of the chamber. In a preferred form of the invention, the isolating structure is a supplemental seal **79** formed by joining the two sidewalls together along the seal line **79**. As shown in FIGS. 11a-d, the supplemental seal **79** surrounds a portion of the closure assembly **12** and provides a fluid pathway **80** from the chamber **78** to the closure assembly **12**.

In a preferred form of the invention, the supplemental seal **79** is a permanent seal that cannot be separated without damaging the container. It is further contemplated the supplemental seal can be a peel seal capable of being opened by a user of the container. Further, the supplemental seal **79** can be a narrow seal, as is shown in FIGS. 11a-d, or can be of greater width to add strength, or to provide another function, to the supplemental seal or to the container or to both. It is further contemplated the supplemental seal **79** can be formed by providing a strip or web of material that is attached at opposed portions thereof to extend between the two sidewalls to form an internal wall within the chamber **78**.

FIG. 11a shows the supplemental seal **79** extending from the bottom edge **81** and terminating short of the top or fourth edge **82**. A first intermediate portion **83** of the seal **79**

extends in a direction generally parallel to the lateral edges **84** and a second portion **85** extends from the first portion **83** in a direction transverse thereto. A third portion **86** surrounds the closure assembly **12**, which is positioned proximate the bottom edge **81** of the container, and tapers outwardly toward the lateral edge to reduce the width of the fluid pathway from a full diameter of the closure to a reduced width. A second supplement seal **87** is generally L-shaped and together with the first seal **79** cooperate to define a fluid opening **88** connecting the chamber **78** to the fluid pathway **80**. The fluid pathway **80** is also generally L-shaped and may sometimes be referred to as a tortuous path. What is meant by the term "tortuous" path is a path that has a twist, turn or curve.

FIG. 11b and 11d show an alternative embodiment of the supplemental seal **79** having a first seal **90** and a second seal **92** defining a first fluid pathway **94** between the first and second seals **90**, **92** and a second fluid pathway **96** between the second seal **92** and the adjacent lateral edge **84**. An opening **98** is provided to the first fluid pathway **94** to allow air to flow in the direction of the arrows in opposite directions in the first and second fluid pathways. In the embodiment shown in FIG. 11b, the bottom edge **81** of the container forms a terminal edge of the first pathway **94** and in the embodiment shown in FIG. 11d a seal line **100** forms a terminal edge of the first pathway **94**.

FIG. 11c shows yet another embodiment of the supplemental seal **79** having a single seal line defining the fluid pathway **80** between the supplemental seal **79** and the adjacent lateral edge **84**. In this embodiment the closure assembly **12** is positioned proximate the top edge **82** of the container. Thus, it should be clear that the closure assembly **12** can be positioned in numerous locations in the container provided it is capable of being isolated from the contents.

While the embodiments shown in FIGS. 11a-d show the closure assembly **12** extending essentially perpendicularly from a planar surface of a sidewall of the container, it is contemplated the closure could extend in a direction other than perpendicularly including in a direction essentially parallel to the planar surface. A portion of the closure assembly can extend

between the sidewalls and be sealed therebetween or a hole can be removed from a portion of one of the sidewalls or a gusset in the sidewall and be sealed to the wall.

FIGS. 11e and 11f show the container could have a gusset **102** along a portion of the length or width of the container and have the closure assembly **12** positioned within the gusseted portion. The closure extends in a direction generally parallel to the planar surface of the sidewalls.

It is contemplated the supplemental seam **79** could be replaced with a tubing that is connected in fluid communication with the closure assembly **12** and the tubing extends to a position above the point the food item will be stored so that an opening in the distal end of the tubing will not evacuate the stored item.

In a preferred form of the invention, an inner surface of one or both sidewalls will have a textured inner surface, contents contacting, forming fluid evacuation passages. The passages will allow fluid to flow through the passages even when the sidewalls are in face to face contact with one another.

FIG. 12 shows a film structure **110** suitable for forming a sidewall of the containers described herein and having a plurality of objects **112** on a planar surface thereof. In a preferred form of the invention, the objects **112** are positioned on a first surface that will form an interior or fluid contacting surface of the sidewall of the container. However, it is contemplated, a surface that will form an exterior surface of a sidewall of the container could have the textured pattern or both the interior and exterior surfaces of a sidewall of the container could have the textured pattern. The objects **112** can be positioned on a single sidewall or both sidewalls of the container. The objects, in a preferred form of the invention, are provided over substantially an entire planar surface of the sidewall but could also be provided only in select areas of the sidewall without departing from the scope of the invention. The objects can be of any shape including regular shapes such as circular, polygonal, straight or curved lines, symbols or the like. The objects can also be irregular or amorphous in form. The objects **112** can be raised protuberances or indentations in these shapes. The objects on one sidewall can also be different

from the objects on the opposing sidewall. The objects **112** can be all of the same shape or can be of any combination of varying shaped objects. In one form of the invention, the objects **112** can be positioned to extend in a line extending longitudinally, lattitudinally, diagonally of the sidewall or a combination of the same. The objects **112** can be of varying sizes provided the objects are effective to provide fluid pathways through the container as excess air is being evacuated.

The objects **112** can form a regular pattern or an irregular pattern. The regular pattern includes objects being placed at the same or essentially the same spacing or a repeating sequence of spacings. The irregular pattern is one where the objects are generally randomly distributed.

In a preferred form of the invention as shown in FIG. 13, a regularly spaced pattern of rectangular-shaped or square-shaped objects **114** having pathways **116** defined therebetween. This checkerboard pattern has at least a first pathway **117** intersecting a second pathway **118**. In a preferred form of the invention, the first pathway instersects the second pathway at a substantially right angle, or the first pathway extends in a direction essentially perpendicular to the second pathway. However, it is contemplated the intersection of pathways can form various angles without departing from the scope of the present invention.

FIG. 14 shows another preferred form of the invention having a plurality of circular protuberances **120** grouped together with X-shaped protuberances **124** on a sidewall. The circular protuberances **120** are grouped to define a circular shape **122** pattern. The X-shaped protuberances **124** are grouped to define a repeating S-shaped pattern **126**. The x-shaped pattern is positioned within the circular shaped **122** pattern to define a sum object **127**. The sum object **127** is shown to be a company logo **127** but could also be other indicia such as a trademark, a tradename, instructions for use of the film or object made from the film or other identifying or useful information or advertising that can be viewed through one of the sidewalls or both.

A plurality of sum objects **127** are shown connected together to define a web of interconnected sum objects **127**. It is contemplated that the sum objects **127** could be positioned in other relationships and other patterns without departing from the scope of the invention. Of

course it is also contemplated that any combination of shapes of protuberances can be used and that more than two different shapes can be used together to form patterns of various shapes and sizes.

FIG. 15 shows a texturing station **159** for imparting the pattern on the film. The method comprises the steps of: (1) providing a first sheet of material **160**, (2) providing a second sheet of material **162**, (3) positioning the first sheet **160** or the second sheet **162** to overlap at least a portion of the other sheet to define an interference zone **164**, (4) directing a first polymeric material **165** into the interference zone **164** to adhere the first sheet **160** to the second sheet **162** to form a layered structure **166** (FIG. 16), and (5) texturing a surface of the first sheet or the second sheet to form a pattern on the surface.

In a preferred form of the invention, the first sheet and the second sheet are polymeric films as described above. However, it is contemplated that the first sheet and/or the second sheet could be selected from paper or metal foil provided that one of the layers is capable of maintaining the pattern during regular use of the layered structure **166**.

The first sheet **160** can be a monolayer structure or a multiple layered structure as set forth above. The monolayer structure can be of a polymer blend of the polymeric components. The multiple layered structure can have a layer or more than one layer of a polymer blend of the polymeric components. In one preferred form of the invention the first sheet is a film having a layer of a polyolefin and more preferably an ethylene and α-olefin copolymer, and even more preferably is an LLDPE. Such a first sheet having an LLDPE layer has been found to be well suited to form a seal layer or innermost layer of the container **14** as LLDPE forms strong, durable seals.

In another preferred form of the invention, the first sheet **160** can also be a multiple layered polymeric structure having a first layer of a polyolefin and a second layer to provide additional attributes to the film such as scratch resistance, barrier to the transmission of gasses or water vapor or the like. Suitable materials to form a barrier material includes ethylene and vinyl alcohol copolymers, polyamides, polyesters, PVDC and metal foil to name a few. One preferred

multiple layered film to form the first sheet **160** has a first layer of LLDPE and a second layer of ethylene vinyl alcohol copolymer.

The second sheet **162** is also preferably a monolayer polymeric film or a multiple layered polymeric film selected from the films and polymeric materials detailed above. In one preferred form of the invention, the second sheet **162** is a barrier material and more preferably a polyamide or polyester and even more preferably nylon 6. The first sheet **160** and the second sheet **162** can be preformed and provided on spooled rolls **168** or the sheets can be laminated or otherwise produced in line.

The step of positioning the first sheet **160** in an overlapping relationship with the second sheet **162** is accomplished using standard polymeric sheet handling machinery. In a preferred form of the invention, either the first sheet **160** is positioned with respect to the second sheet **162**, or the second sheet **162** is positioned with respect to the first sheet **160** or both sheets are positioned with respect to one another so that in any instance the peripheries of the first and second sheet are essentially in complete registration.

The step of directing the first polymeric material **165** into the interference zone **164** to adhere the first sheet **160** to the second sheet **162** to form the layered structure **166** can be carried out by flowing polymeric material in a molten form into the interference zone **164**. Molten polymeric material can be provided under pressure to the interference zone **164** using an extrusion die **170**. The polymeric material may be extruded as a single polymeric material or a blend of polymeric materials. The polymeric material may also have multiple layers coextruded from a coextrusion die. It is also contemplated that the first polymeric material can be an adhesive that can be sprayed or otherwise spread or distributed into the interference zone **164**. In a preferred form of the invention, the first polymeric material is a polyolefin and more preferably, an ethylene homopolymer and even more preferably a LDPE.

The step of texturing the film can include the step of imparting a desired pattern described above onto the first sheet **160** or the second sheet **162** or both. The step can be carried out prior to the step of joining the sheets together, substantially or essentially simultaneously

with the step of adhering the first and second sheets together, as shown in FIG. 15, or after the step of adhering the first sheet to the second sheet. In a preferred form of the invention, the step of texturing is carried out substantially simultaneously with the joining step.

The step of texturing the film includes the step of bringing the sheet or layered structure to be textured into cooperative engagement with a surface having the desired pattern thereon. In a preferred form of the invention, the surface **171** is located on a roll and more preferably a chill roll **172**. The chill roll **172** can be fabricated from any suitable material such as metal, plastic or cork. The chill roll **172** can have the pattern extending inward of its outer surface or can extend outward from its outer surface. The sheet or structure is held in cooperative engagement against the chill roll **172** using a back-up roll **174**. The back-up roll **174** can be made from metal, rubber, plastic or paper and most preferably rubber. It should be understood that either the chill roll **172**, the back-up roll **174** or both can carry the pattern.

After the layered structure **166** passes the chill roll, it proceeds along to a spooling station or to be fabricated into useful objects like the container **14**.

Figure FIG. 16 shows the layered structure **166** having the first sheet **160** joined to the second sheet **162** by polymeric material **165**. Objects **112** are shown on the first sheet **160** but could be positioned on sheet **162** or both sheets **160** and **162** without departing from the present invention.

FIGS. 17 and 18 show an alternative embodiment of the closure assembly **12** from the one shown in FIGS. 1-10. Any references to the closure assembly or valve **12** or **212** herein should be taken to mean any closure assembly or valve disclosed herein, that is, any closure assembly can be used with any container.

The closure assembly **212** shown in FIGS. 17 and 18 has a valve body **220**, a threaded cap **222** (See also FIG. 19) and a diaphragm **224**. FIG. 17 shows the closure assembly **212** in an open position and FIG. 18 shows the closure assembly in a closed position. The valve body **220** has an annular flange **226** having a first surface **228** and an opposed second surface **230**, a centrally disposed opening **232** through the flange, and a cylindrical wall **233** extends from the first surface and is disposed circumjacent the opening **232**. The threaded cap and the cylindrical

wall each have a set of mating threads to move the assembly from an open position to a closed position. The threaded cap has a diaphragm contacting surface to press the diaphragm against the opening **232** when the assembly is in the closed position.

The cylindrical wall **233** has a first set of threads **235** on a surface, and preferably on an external surface, for mating with a second set of threads **237** positioned on a surface of the threaded cap and preferably on an internal surface of the threaded cap **222.** Thus, the threaded cap is mounted to the cylindrical wall **233** and is moveable by rotation from an open position to a closed position. It is contemplated the threads **235** could be positioned on an internal surface of the cylindrical wall **233**. It is also contemplated the second set of threads **237** could be located on an exterior surface of the threaded cap **222**.

In a preferred form of the invention, the threaded cap **222** has a top surface **240**, a centrally disposed fluid exit **241**, a first annular wall **242** and a second annular wall **244** each spaced axially from the fluid exit **241** and having an annular space **246** positioned between the first and second annular walls. The annular space **246** is dimensioned to receive the cylindrical wall **233** and to provide a fluid pathway **248**. As shown in FIGS. 17 and 18, an inner surface of the first annular wall **242** carries the second set of threads **237** for threadably connecting the threaded cap to the cylindrical wall **233**. However, it is contemplated the second set of threads could be positioned elsewhere such as on an exterior surface of the first annular wall **242** or on an exterior surface of the second annular wall **244** or on an interior surface of the second annular wall.

Thus, as shown in FIGS. 17 and 18, the threaded cap **222** has the second set of threads on an internal surface of the first annular wall **242** for mating with the first set of threads on an exterior surface of the cylindrical wall **233**. However, the present invention further contemplates positioning the second set of threads on an exterior surface of the second annular wall (adjacent the annular space **246**) for mating with the first set of threads positioned on an interior surface of the cylindrical wall. It is further contemplated the second set of threads could be positioned on an interior surface of the second annular wall (adjacent the fluid exit **241**) for mating with the first set of threads positioned on an exterior surface of the cylindrical wall. It is also contemplated the second set of threads could be positioned on an exterior surface of the first annular wall **242**) for mating with the first set of threads positioned on an interior surface of the

cylindrical wall wherein the second annular wall is optional or could serve as the diaphragm contacting surface.

Further shown in FIGS. 17 and 18, the second annular wall **244** has a through hole **250** connecting the fluid pathway **248** to the fluid exit **241** when the closure assembly is in the open position (FIG. 17). In a preferred form of the invention, the through hole **250** extends radially of the threaded cap and in a line transverse to an axis of the opening **232**. A distal end or diaphragm contacting portion **251** of the first annular wall extends a distance "D" beyond a distal end **252** of the second annular wall and preferably the distance "D" is equal to or less than a thickness of the diaphragm so that the diaphragm is held in fluid tight engagement with the valve support surface **254** to seal the opening **232**.

An annular tubing stop **255** is provided extending radially inwardly from the second annular wall **244** and is positioned adjacent the through hole **250** to prevent a tubing from a pump or other suction device from clogging the through hole **250** during evacuation of excess air from the container.

FIG. 20 shows a plurality of radially extending and circumferentially spaced fins **256** extending from surface **230** of the annular flange **226** and positioned circumjacent opening **232**. A cruciform shaped member **257** also extends from the surface **230** having a first arm **258** a second arm **259** transverse to the first arm and has a generally circular platform **260** joining the first arm to the second arm. The cruciform shaped member **257** and the radially extending flanges **256** prevents blockage of the opening **232**, by a sidewall or by other object, during evacuation of the container.

In a preferred form of the invention, the valve body **220** and the threaded cap **222** of the closure assembly **212** can be fabricated from a polymeric material as described above for the valve body **20**. The diaphragm **224** is made from the same material and is similarly dimensioned as the diaphragm **24** shown in FIGS. 9 and 10.

FIG. 21 shows a pump **270** connected by a fluid pathway **272** to the closure assembly **212**. The pump is used to evacuate excess air and other undesired fluids from the container without evacuating the contents from the container. In this air sealed package the contents, when they are food articles, can be preserved for a longer period of time than other food containers where the excess fluid is not evacuated. Suitable pumps include an electric pump, a battery

driven pump, a hand or foot operated pump or the like. It is also contemplated creating a suction using a tubing where suction is created in a leg of the tubing connected to the closure assembly by running water through a second leg of the tubing from a water source such as a household water faucet. In a preferred form of the invention the pump is capable of pulling a vacuum of 5 to 10 inches of water. The fluid pathway **272** can be a length of tubing or can be a fitment on the pump for docking to the closure assembly.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

CLAIMS

What is claimed is:

1. A closure assembly comprising:

a valve body having an annular flange, a fluid opening through the flange, a cylindrical wall extends from the annular flange and is positioned circumjacent the opening and has a first set of threads on a portion of a surface of the cylindrical wall;

a diaphragm positioned within the cylindrical wall and dimensioned to cover the fluid opening; and

a threaded cap having a top surface, a fluid exit, a diaphragm contacting surface, and a second pair of threads on a portion of a surface thereof, the threaded cap is mounted on the valve body by cooperative engagement of the first set of threads and the second set of threads, the threaded cap is moveable with respect to the valve body between an open position of the closure assembly to a closed position of the closure assembly where the diaphragm contacting surface presses the diaphragm against the opening of the valve body.

2. The assembly of claim 1 wherein the first set of threads is on an exterior surface of the cylindrical wall.

3. The assembly of claim 1 wherein the first set of threads is on an interior surface of the cylindrical wall.

4. The assembly of claim 1 wherein the second set of threads is on an external surface of the threaded cap.

5. The assembly of claim 1 wherein the second set of threads is on an interior surface of the threaded cap.

6. The assembly of claim 1 wherein the threaded cap has a first annular wall and a second annular wall spaced from the first annular wall and defining an annular space therebetween.

7. The assembly of claim 6 wherein the second set of threads is positioned on a surface of the first annular wall.

8. The assembly of claim 7 wherein the second set of threads is positioned on an exterior surface of the first annular wall.

9. The assembly of claim 7 wherein the second set of threads is positioned on an interior surface of the first annular wall.

10. The assembly of claim 6 wherein the second set of threads is positioned on a surface of the second annular wall.

11. The assembly of claim 10 wherein the second set of threads is positioned on an interior surface of the second annular wall.

12. The assembly of claim 10 wherein the second set of threads is positioned on an exterior surface of the second annular wall.

13. The assembly of claim 6 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the first annular wall.

14. The assembly of claim 6 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the second annular wall.

15. The assembly of claim 6 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the second annular wall.

16. The assembly of claim 6 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the first annular wall.

17. The assembly of claim 6 wherein the diaphragm contacting surface is positioned on the first annular wall.

18. The assembly of claim 6 wherein the diaphragm contacting surface is positioned on the second annular wall.

19. The assembly of claim 18 wherein the first annular wall extends a first distance from the top surface and the second annular wall extends a second distance from the top surface wherein the first distance is greater than the second distance.

20. The assembly of claim 19 wherein the second annular wall has a through hole extending in a direction transverse to an axis of the flange.

21. A closure assembly comprising:

a valve body having an annular flange, a fluid opening through the flange, a cylindrical wall extends from the annular flange and is positioned circumjacent the opening and has a first set of threads on a portion of a surface of the cylindrical wall;

a diaphragm positioned within the cylindrical wall and dimensioned to cover the fluid opening; and

a threaded cap having a top surface, a fluid exit, a first annular wall and a second annular wall spaced from the first and defining an annular space therebetween, the first flange has a second pair of threads on a portion of a surface thereof, the threaded cap is mounted on the valve body by cooperative engagement of the first set of threads and the second set of threads, the threaded cap is moveable with respect to the valve body between an open position of the closure assembly to a closed position of the closure assembly.

22. The assembly of claim 21 wherein the second annular wall has a through hole that connects the fluid opening to the fluid exit when the closure assembly is in an open position.

23. The assembly of claim 22 wherein the through hole extends radially of the valve body.

24. The assembly of claim 21 wherein the second annular wall has a distal end that abuts the diaphragm against the fluid opening when the closure assembly is in the closed position.

25. The assembly of claim 21 wherein the cylindrical wall is positioned within the annular space.

26. The assembly of claim 21 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall.

27. The assembly of claim 26 wherein the second set of threads is positioned on an interior surface of the first annular wall.

28. The assembly of claim 26 wherein the second set of threads is positioned on an interior surface of the second annular wall.

29. The assembly of claim 21 wherein the first set of threads is positioned on an interior surface of the cylindrical wall.

30. The assembly of claim 29 wherein the second set of threads is positioned on an exterior surface of the first flange.

31. The assembly of claim 29 wherein the second set of threads is positioned on an exterior surface of the second flange.

32. The assembly of claim 21 wherein the first annular wall extends a first distance from the top surface and the second annular wall extends a second distance from the top surface and wherein the first distance is greater than the second distance.

33. The assembly of claim 32 wherein the diaphragm has a thickness and wherein a difference between the first distance and the second distance is less than the thickness of the diaphragm.

34. A container assembly comprising:

a container having opposed sidewalls;

(a) a closure assembly connected to a sidewall, the assembly comprising:

a valve body having an annular flange, a fluid opening through the flange, a cylindrical wall extends from the annular flange and is positioned circumjacent the opening and has a first set of threads on a portion of a surface of the cylindrical wall;

(b) a diaphragm positioned within the cylindrical wall and dimensioned to cover the fluid opening; and

(c) a threaded cap having a top surface, a fluid exit, a diaphragm contacting surface, and a second pair of threads on a portion of a surface thereof, the threaded cap is mounted on the valve body by cooperative engagement of the first set of threads and the second set of threads, the threaded cap is moveable with respect to the valve body between an open position of the closure assembly to a closed position of the closure assembly where the diaphragm contacting surface presses the diaphragm against the opening of the valve body.

35. The assembly of claim 34 wherein the closure assembly extends from a planar surface of one of the sidewalls.

36. The assembly of claim 35 wherein the closure assembly extends in a direction essentially perpendicular to the planar surface.

37. The assembly of claim 34 wherein the closure assembly extends from an edge of a sidewall of the container.

38. The assembly of claim 37 wherein a portion of the closure assembly extends between the opposed sidewalls.

39. The assembly of claim 34 wherein the closure assembly extends in a direction essentially parallel to a planar surface of one of the sidewalls.

40. The assembly of claim 39 wherein the first set of threads is on an exterior surface of the cylindrical wall.

41. The assembly of claim 39 wherein the first set of threads is on an interior surface of the cylindrical wall.

42. The assembly of claim 39 wherein the second set of threads is on an external surface of the threaded cap.

43. The assembly of claim 39 wherein the second set of threads is on an interior surface of the threaded cap.

44. The assembly of claim 39 wherein the threaded cap has a first annular wall and a second annular wall spaced from the first annular wall and defining an annular space therebetween.

45. The assembly of claim 44 wherein the second set of threads is positioned on a surface of the first annular wall.

46. The assembly of claim 45 wherein the second set of threads is positioned on an exterior surface of the first annular wall.

47. The assembly of claim 45 wherein the second set of threads is positioned on an interior surface of the first annular wall.

48. The assembly of claim 44 wherein the second set of threads is positioned on a surface of the second annular wall.

49. The assembly of claim 48 wherein the second set of threads is positioned on an interior surface of the second annular wall.

50. The assembly of claim 48 wherein the second set of threads is positioned on an exterior surface of the second annular wall.

51. The assembly of claim 44 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the first annular wall.

52. The assembly of claim 44 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the second annular wall.

53. The assembly of claim 44 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the second annular wall.

54. The assembly of claim 44 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the first annular wall.

55. The assembly of claim 44 wherein the diaphragm contacting surface is positioned on the first annular wall.

56. The assembly of claim 44 wherein the diaphragm contacting surface is positioned on the second annular wall.

57. The assembly of claim 56 wherein the first annular wall extends a first distance from the top surface and the second annular wall extends a second distance from the top surface wherein the first distance is greater than the second distance.

58. The assembly of claim 57 wherein the diaphragm has a thickness and the difference between the first distance and the second distance is less than the thickness of the diaphragm.

59. The assembly of claim 44 wherein the second annular wall has a through hole extending in a direction transverse to an axis of the flange.

60. The assembly of claim 34 wherein at least one of the sidewalls has a texture on a portion of a planar surface.

61. The assembly of claim 60 wherein the texture has a plurality of objects.

62. The assembly of claim 61 wherein the objects extend above the planar surface.

63. The assembly of claim 62 wherein the objects extend below the planar surface.

64. The assembly of claim 63 wherein the objects define a first fluid pathway intersecting a second fluid pathway.

65. The assembly of 61 wherein the objects define a checkerboard pattern.

66. A storage assembly comprising:

a container having opposed sidewalls defining a fluid tight chamber, the container having opposed first and second ends and opposed lateral edges;

a closure assembly connected to the container and being moveable from an open position to a closed position wherein in the open position fluid can be removed from the chamber through the closure assembly; and

a structure for separating the closure assembly from the chamber.

67. The storage assembly of claim 66 wherein the structure is a supplemental seal defining a fluid pathway and the closure assembly is positioned in the fluid pathway.

68. The storage assembly of claim 67 wherein the closure assembly is positioned proximate and end of the container.

69. The storage assembly of claim 67 wherein the closure assembly is positioned proximate a lateral edge of the container.

70. The assembly of claim 66 wherein the container has a recloseable zipper at one end of the container.

71. The assembly of claim 66 wherein the supplemental seal extends from the first end and terminates short of the second end.

72. The assembly of claim 67 wherein the supplemental seal extends generally parallel to the lateral edges and is in closer proximity to one lateral edge than the other lateral edge and the fluid pathway is defined between the supplemental seal and the closer lateral edge.

73. The assembly of claim 66 wherein the closure assembly has a valve body, a diaphragm positioned in the body and a threaded cap on the valve body and moveable between and open position and a closed position.

74. The assembly of claim 73 wherein the valve body has an annular flange, a fluid opening through the flange, a cylindrical wall extending from the annular flange and is positioned circumjacent the opening and has a first set of threads on a portion of a surface of the cylindrical wall.

75. The assembly of claim 74 wherein the first set of threads is located on an exterior surface of the cylindrical wall.

76. The assembly of claim 73 wherein the threaded cap has a top surface having a first annular wall and a second annular wall each extending therefrom and axially spaced from one another defining an annular space therebetween.

77. The assembly of claim 76 further comprising a second set of threads is positioned on a surface of the first annular wall.

78. The assembly of claim 77 wherein the second set of threads is positioned on an exterior surface of the first annular wall.

79. The assembly of claim 77 wherein the second set of threads is positioned on an interior surface of the first annular wall.

80. The assembly of claim 77 wherein the second set of threads is positioned on a surface of the second annular wall.

81. The assembly of claim 80 wherein the second set of threads is positioned on an interior surface of the second annular wall.

82. The assembly of claim 80 wherein the second set of threads is positioned on an exterior surface of the second annular wall.

83. The assembly of claim 77 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the first annular wall.

84. The assembly of claim 77 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the second annular wall.

85. The assembly of claim 77 wherein the first set of threads is positioned on an exterior surface of the cylindrical wall and the second set of threads is positioned on an interior surface of the second annular wall.

86. The assembly of claim 77 wherein the first set of threads is positioned on an interior surface of the cylindrical wall and the second set of threads is positioned on an exterior surface of the first annular wall.

87. The assembly of claim 76 further comprising a diaphragm contacting surface on the threaded cap.

88. The assembly of claim 87 wherein the diaphragm contacting surface is positioned on the first annular wall.

89. The assembly of claim 87 wherein the diaphragm contacting surface is positioned on the second annular wall.

90. The assembly of claim 76 wherein the first annular wall extends a first distance from the top surface and the second annular wall extends a second distance from the top surface wherein the first distance is greater than the second distance.

91. The assembly of claim 90 wherein the diaphragm has a thickness and the difference between the first distance and the second distance is less than the thickness of the diaphragm.

92. The assembly of claim 66 wherein at least one of the sidewalls has a texture on a portion of a planar surface.

93. The assembly of claim 93 wherein the texture has a plurality of objects.

94. The assembly of claim 93 wherein the objects extend above the planar surface.

95. The assembly of claim 93 wherein the objects extend below the planar surface.

96. The assembly of claim 93 wherein the objects define a first fluid pathway intersecting a second fluid pathway.

97. The assembly of 93 wherein the objects define a checkerboard pattern.

98. The assembly of claim 93 wherein the objects have a generally circular shape.

99. The assembly of claim 93 wherein the objects have a polygonal shape.

100. The assembly of claim 93 wherein the objects have an irregular shape.

101. The assembly of claim 93 wherein the objects are generally S-shaped.

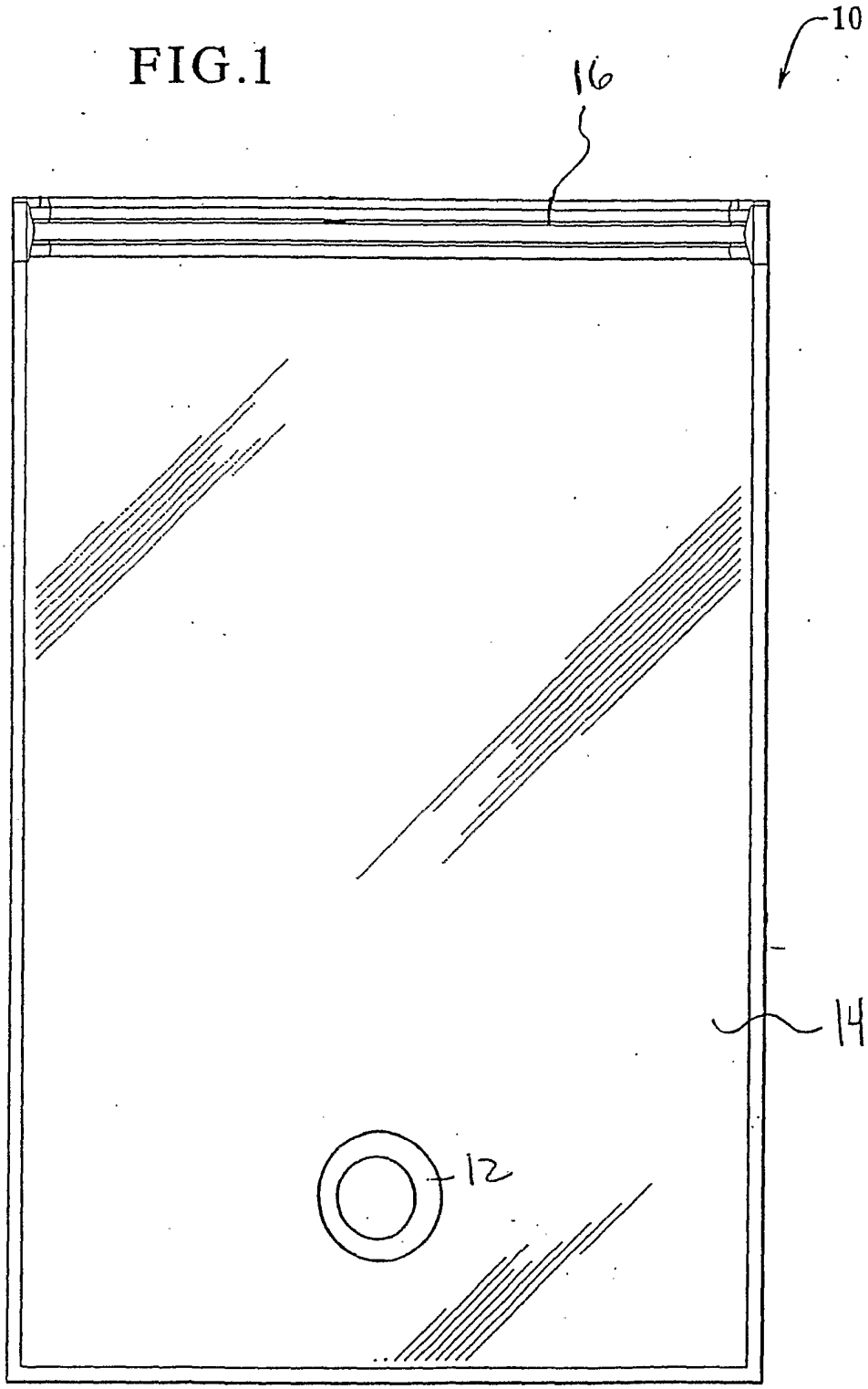
102. The assembly of claim 101 wherein the S-shaped objects extend from the first end to the second end.

103. The assembly of claim 93 wherein the texture is embossed.

104. The assembly of claim 103 wherein the sidewall is fabricated in an extrusion lamination and embossing process.

105. The assembly of claim 103 wherein the step of embossing is carried out essentially simultaneously with the step of extrusion lamination.

FIG.1



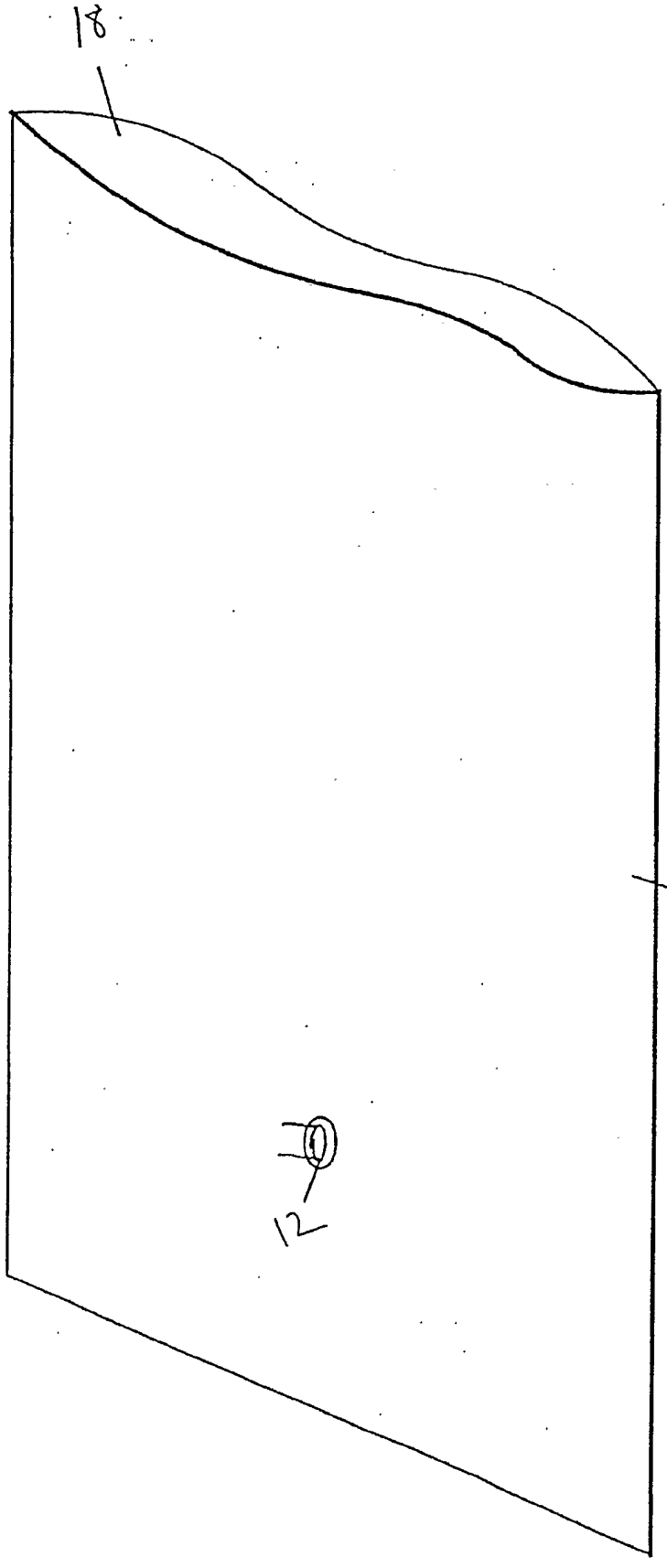



FIG. 2

FIG. 3

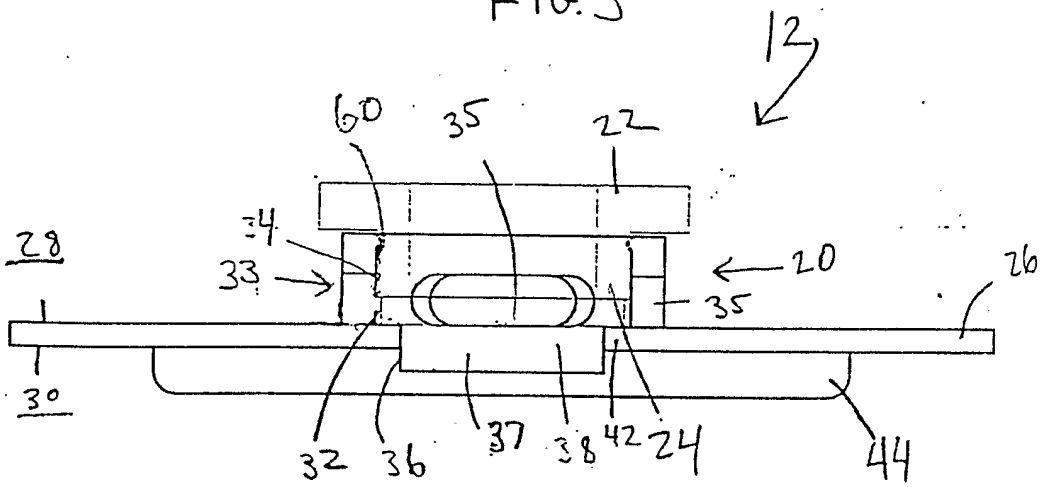

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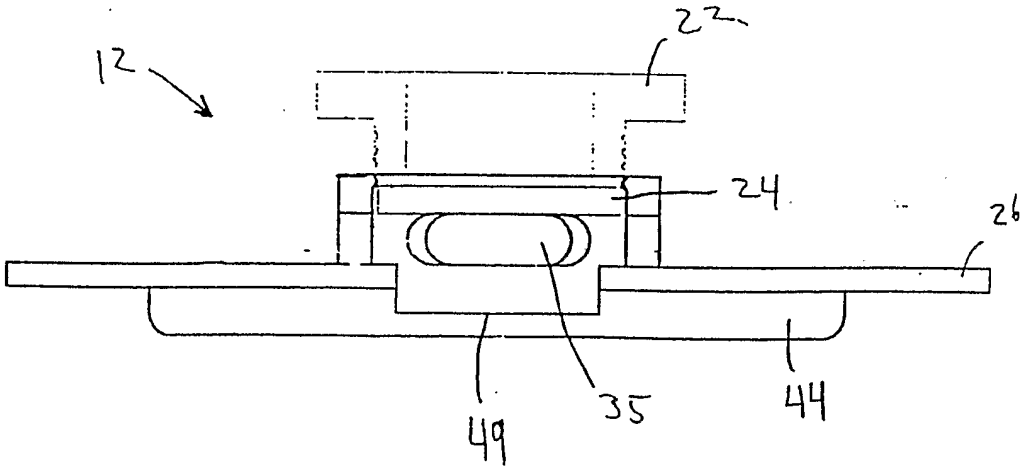
FIG. 4


12
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44

FIG 5

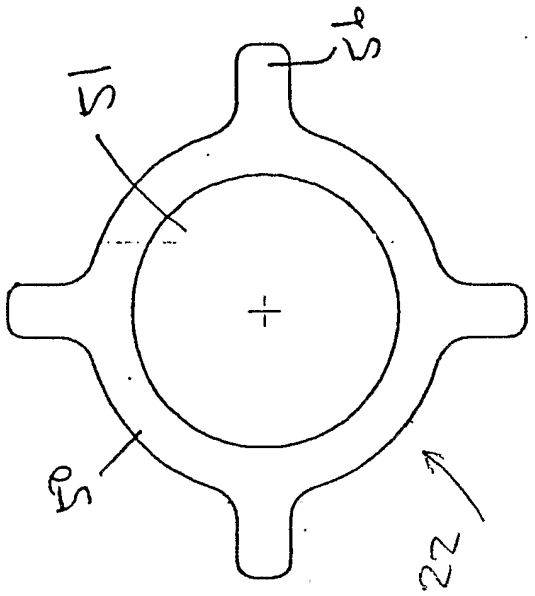



FIG 6

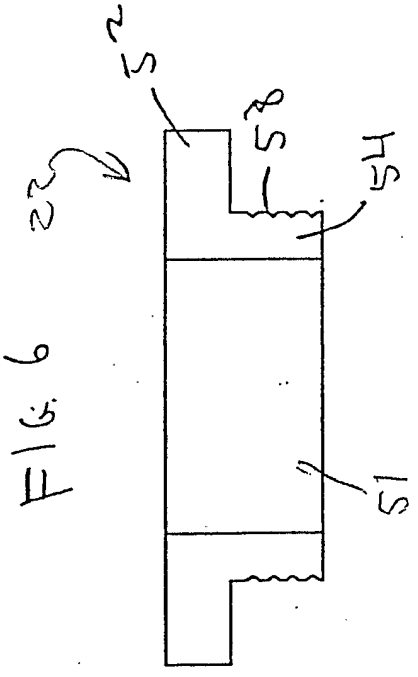


FIG 7

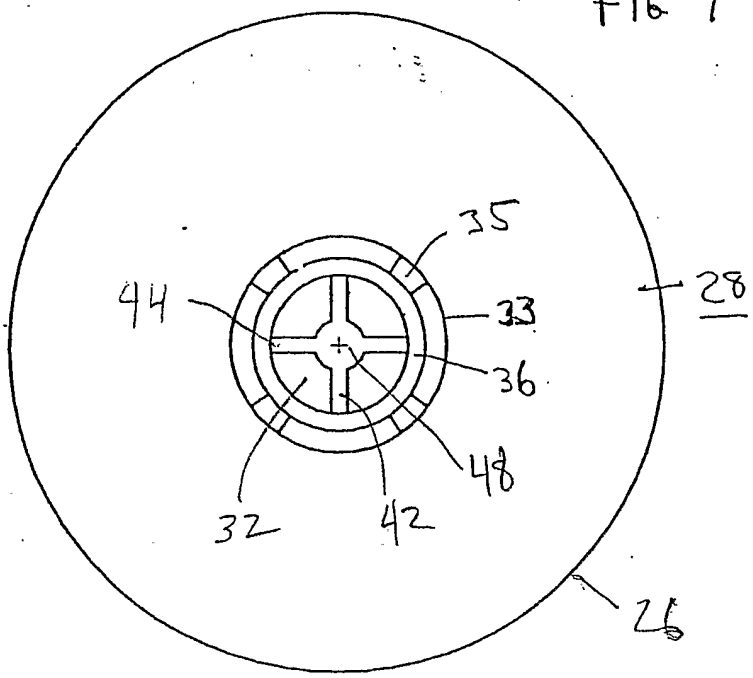
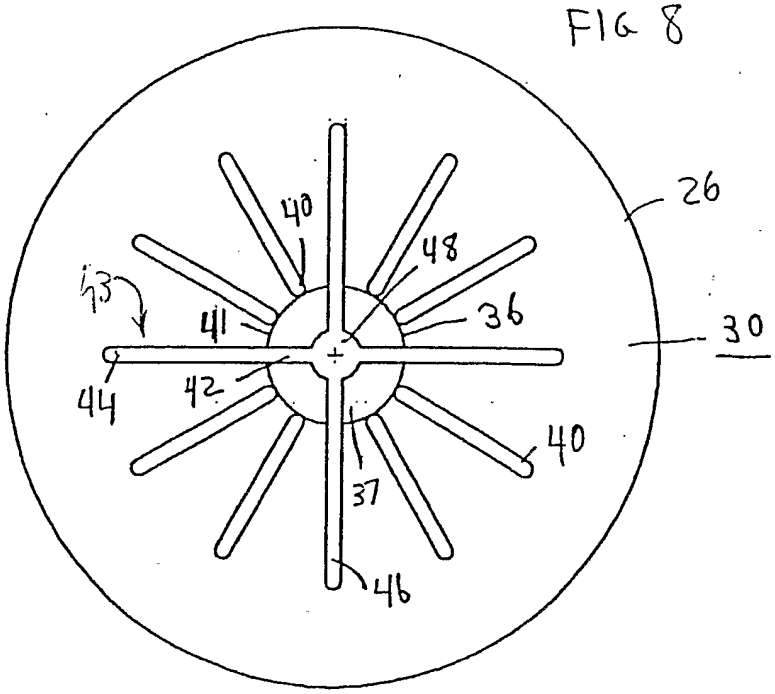



FIG 8



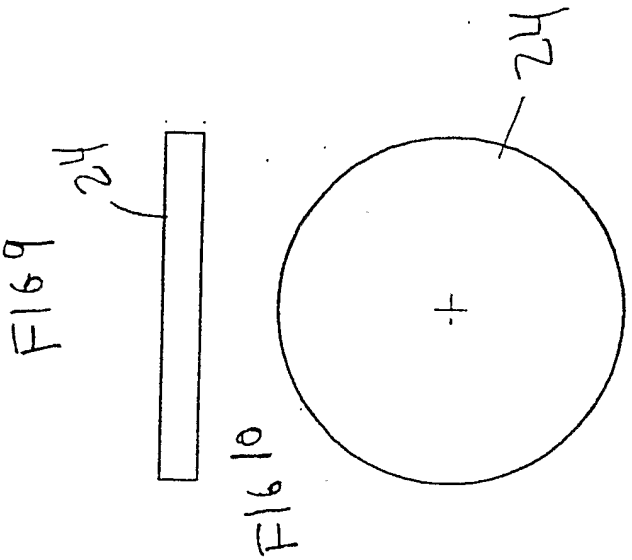



Fig 9

Fig 10

FIG. 11a

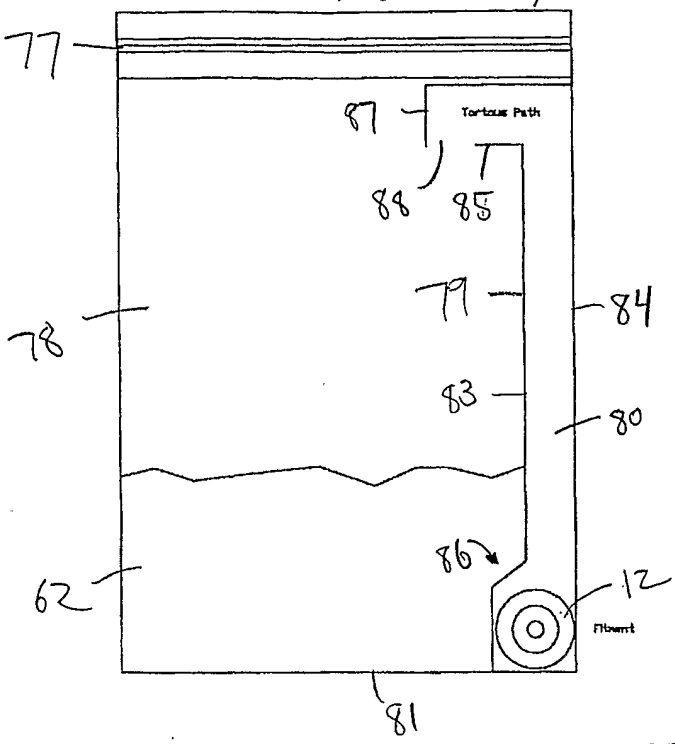
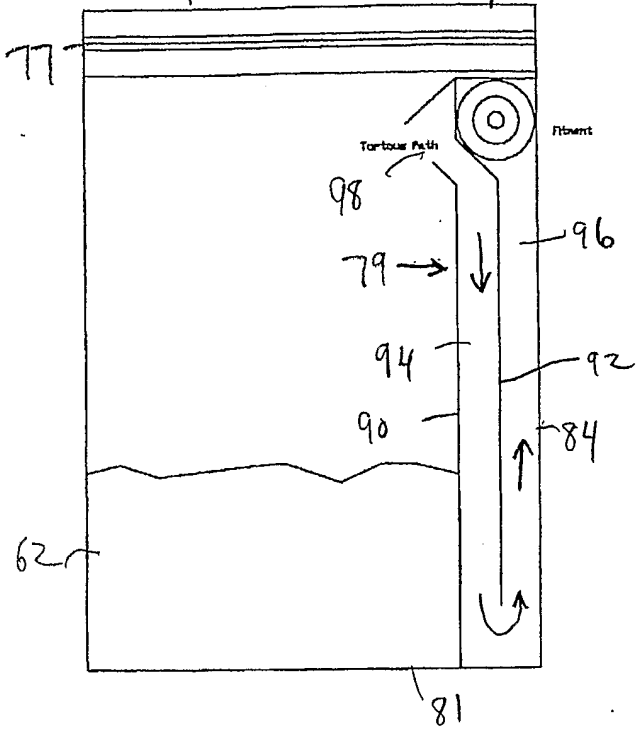



FIG 11b




CT

FIG 11c

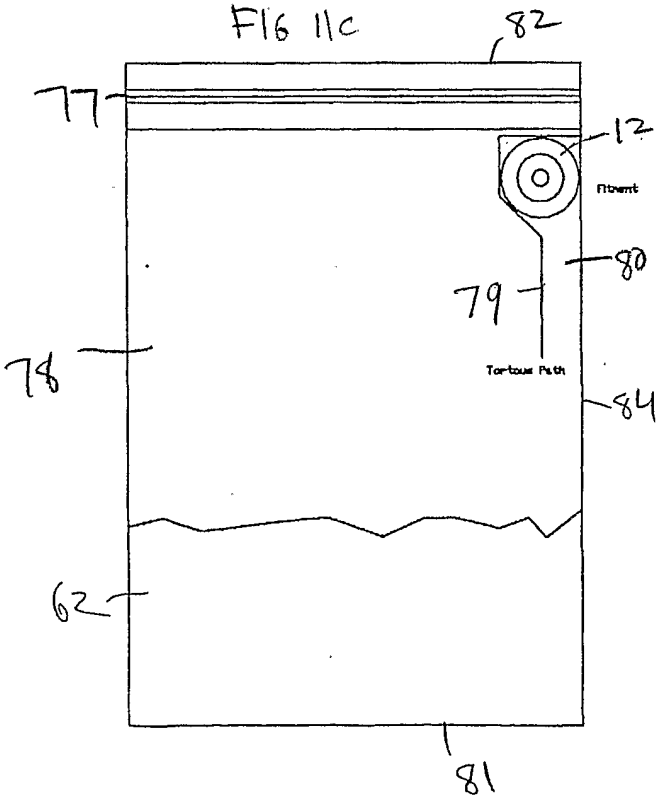



FIG. 11d

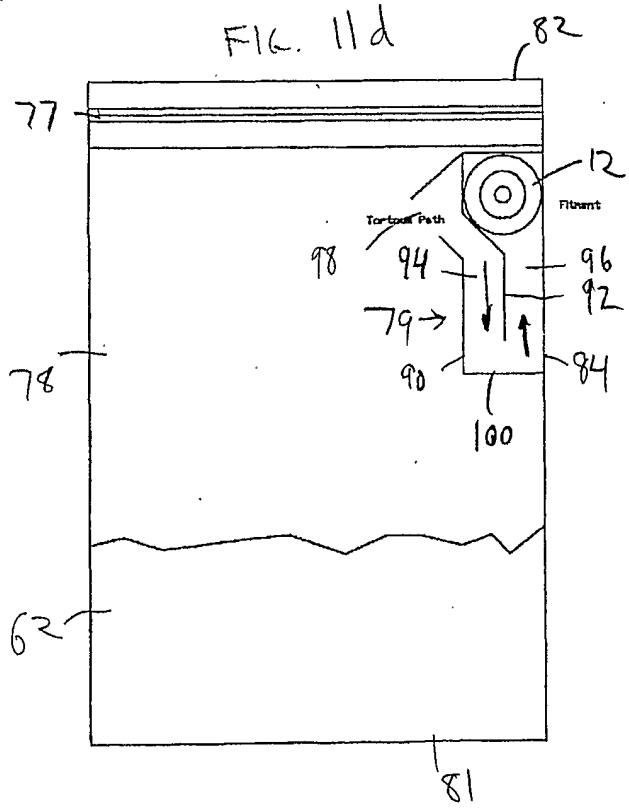
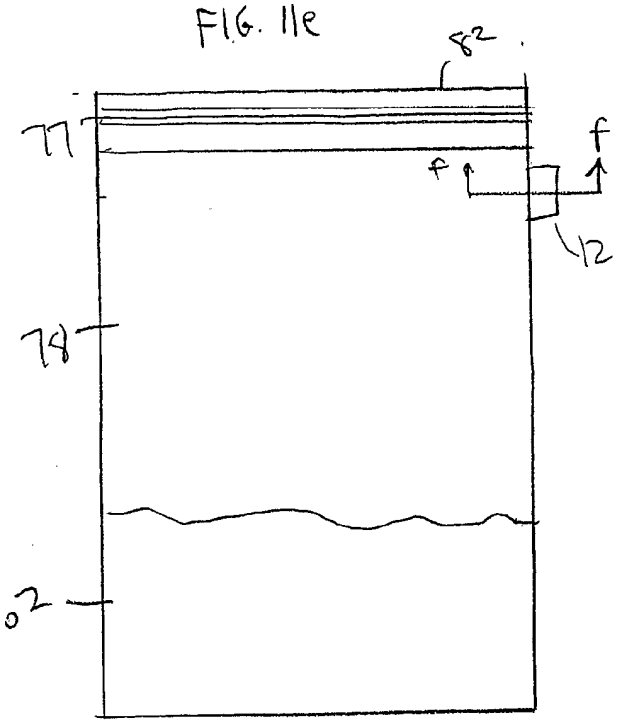


FIG. 11e




11f

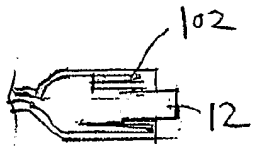


FIG. 12

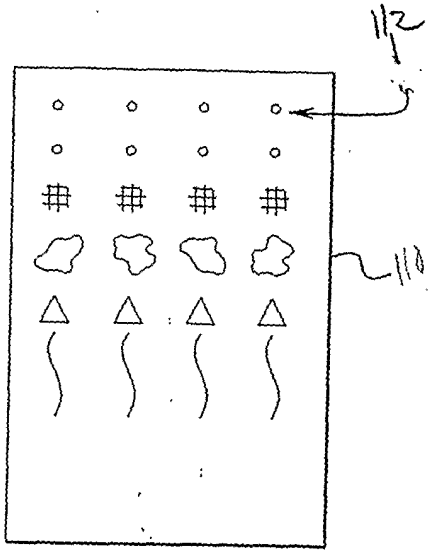



FIG. 13

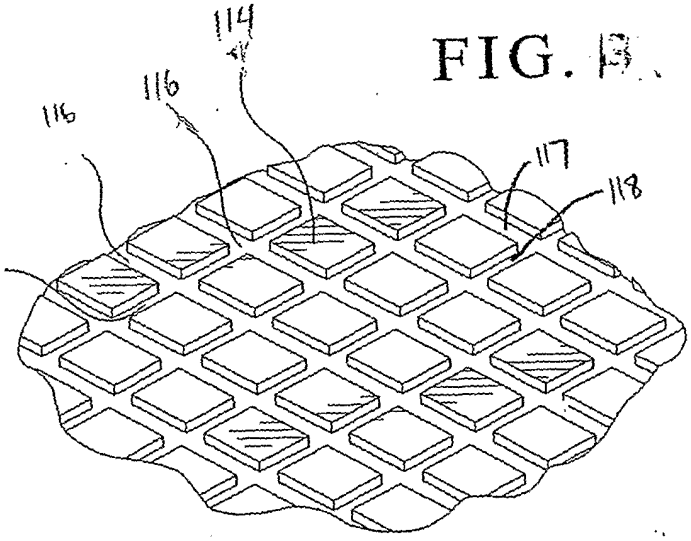


FIG. 14

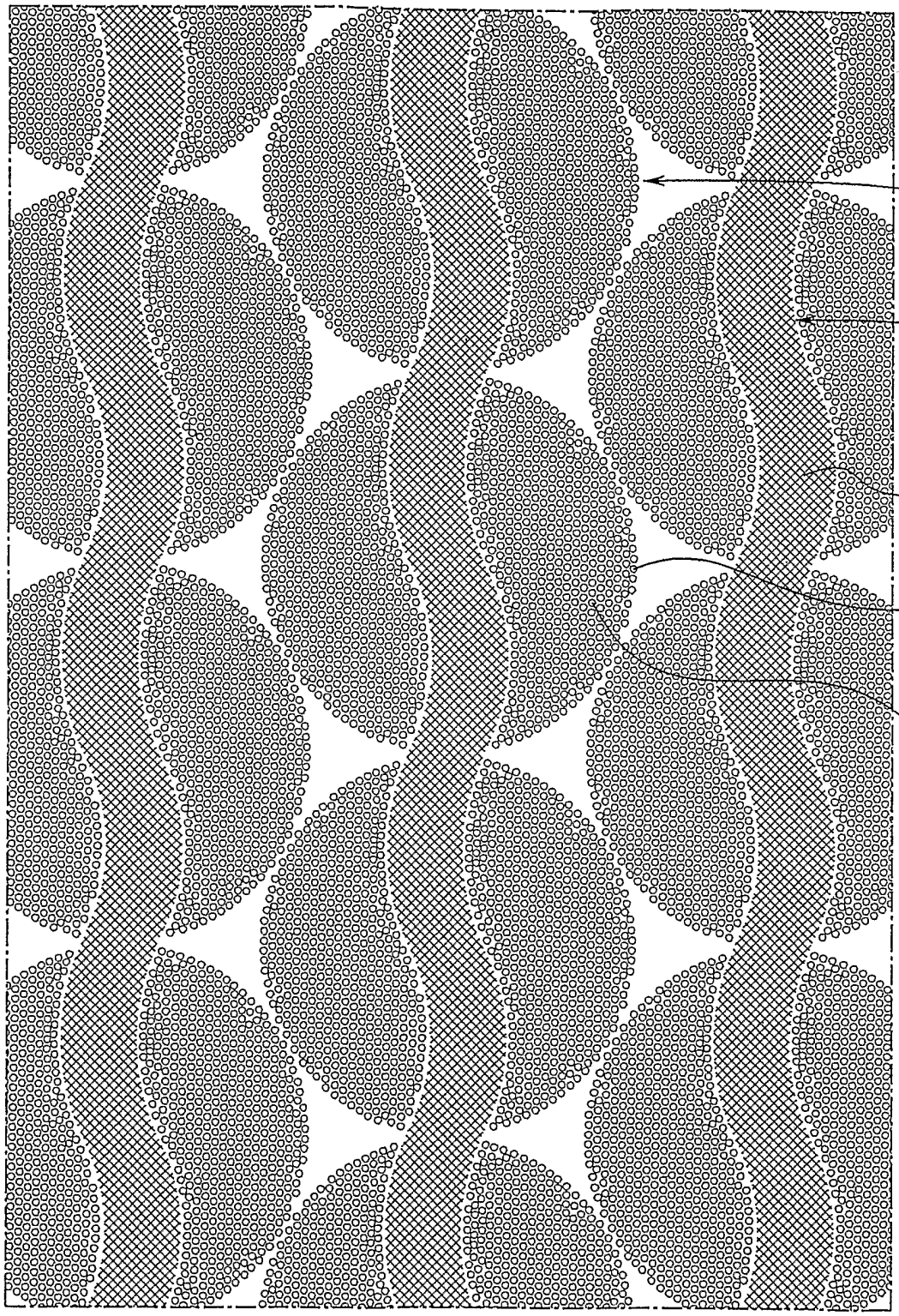


FIG. 15

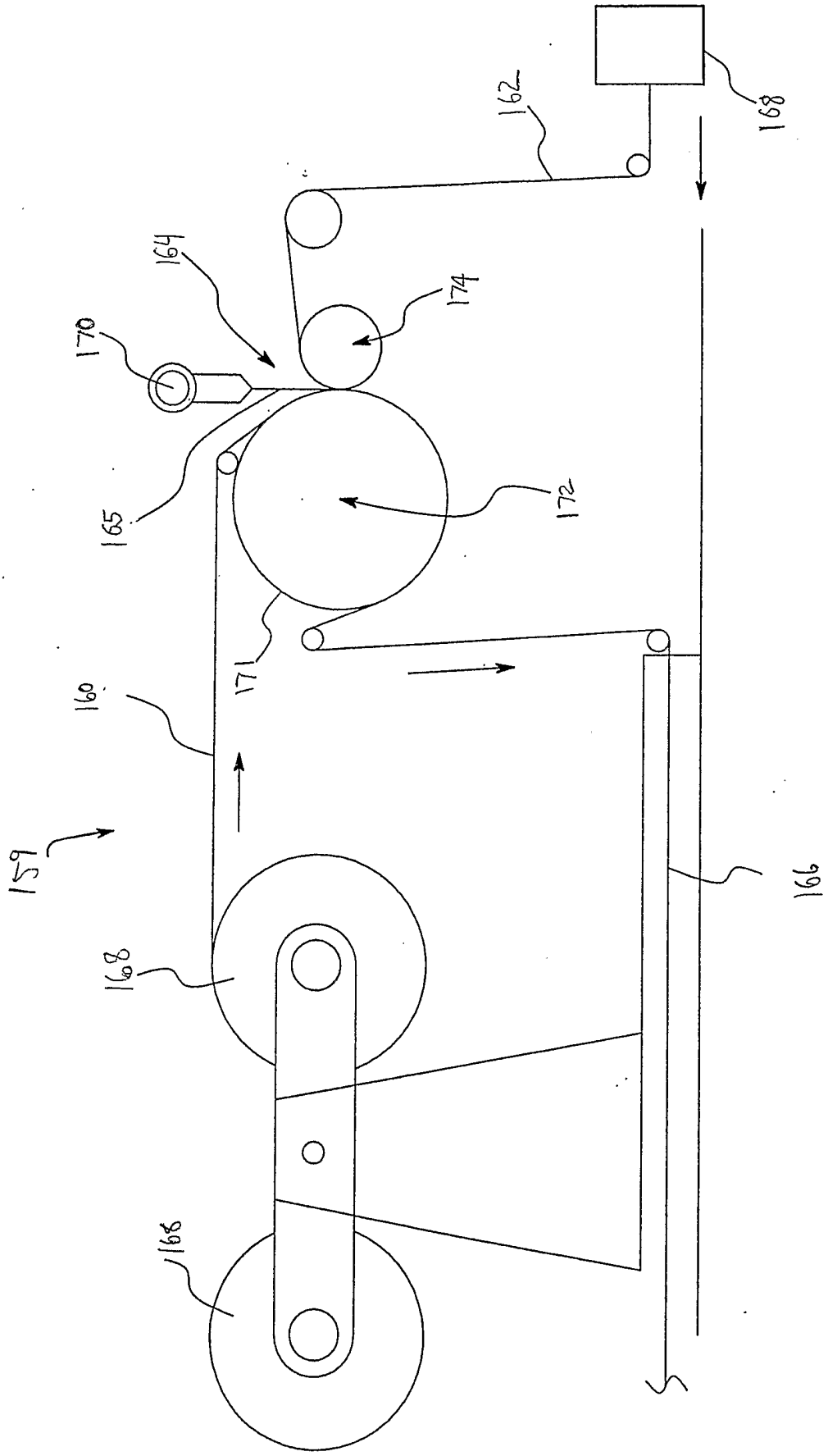


FIG. 16

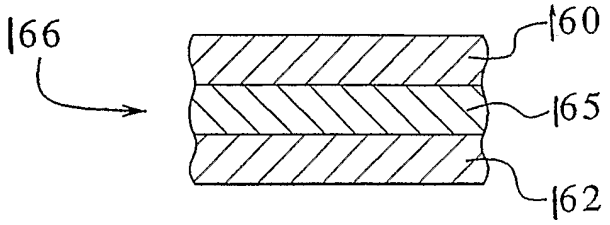
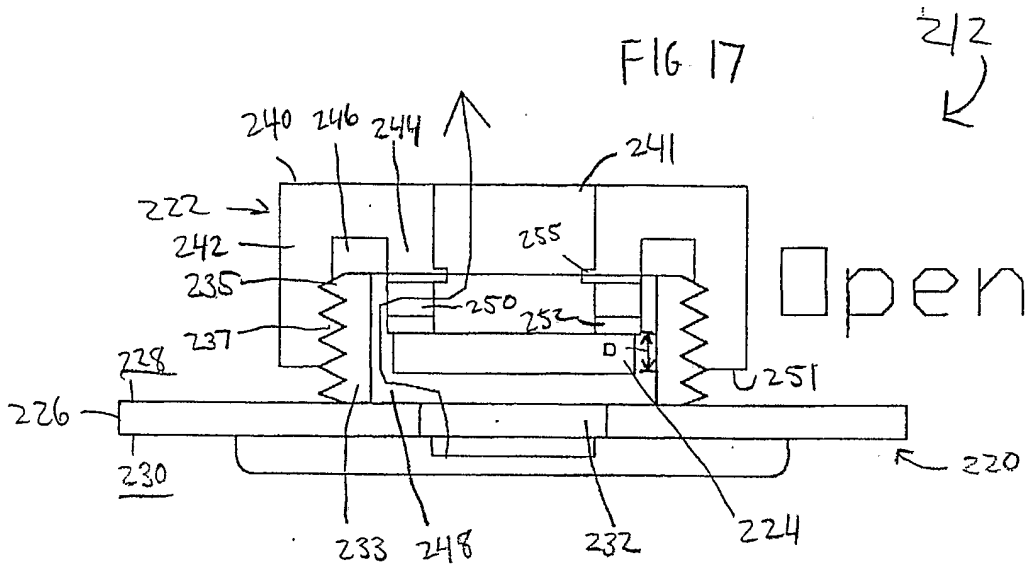


FIG 17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252
237
D
251
228
226
Open
230
220
233
248
232
224

FIG. 18

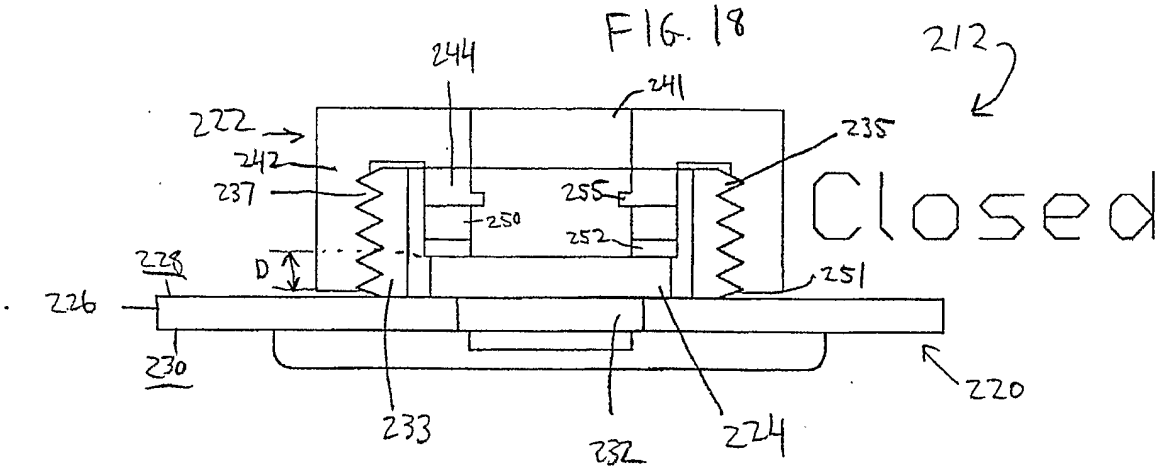
212
244
241
222
235
242
237
255
250
252
D
251
228
226
Closed
230
220
233
232
224

FIG. 19

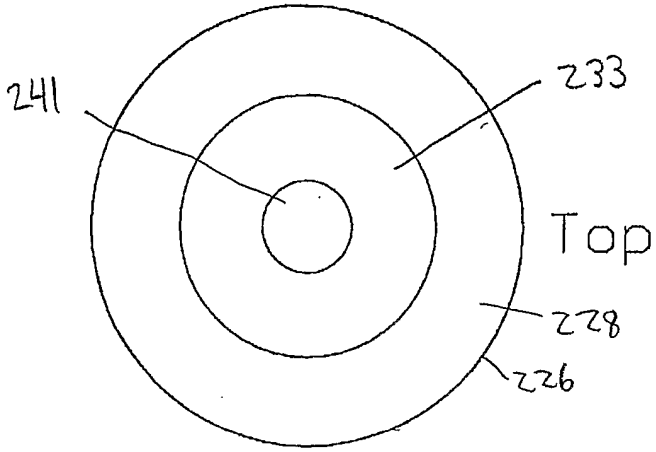


FIG. 20

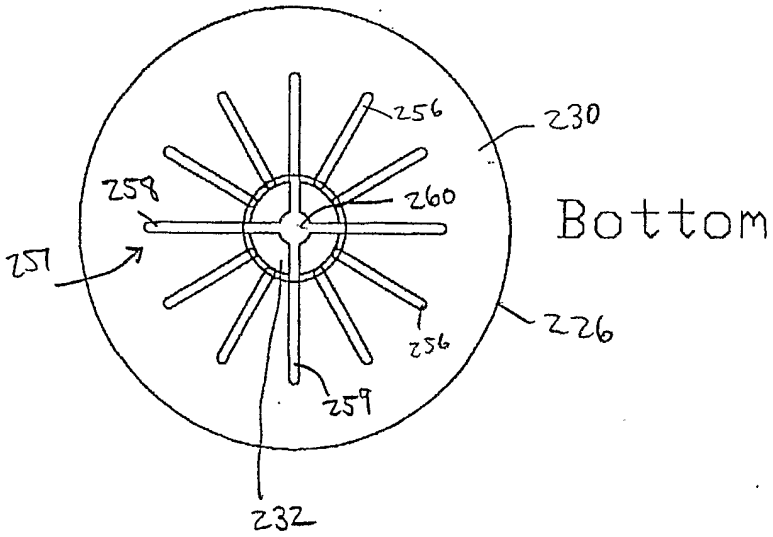

FIG. 21