



(51) International Patent Classification:
B01D 19/00 (2006.01) **B65D 83/00** (2006.01)
B65D 85/84 (2006.01)

(21) International Application Number:
PCT/US2010/051786

(22) International Filing Date:
7 October 2010 (07.10.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/251,430 14 October 2009 (14.10.2009) US

(71) Applicant (for all designated States except US): **ADVANCED TECHNOLOGY MATERIALS, INC.** [US/US]; 7 Commerce Drive, Danbury, CT 06810 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **TOM, Glenn** [US/US]; 8646 Woodcliff Circle, Bloomington, MN 55438 (US). **O'DOUGHERTY, Kevin, T.** [US/US]; 1630 Glenview Court, Arden Hills, MN 55112 (US).

(74) Agents: **WITZANY, Nathan, J.** et al.; Dorsey & Whitney LLP, Suite 1500, 50 South Sixth Street, Minneapolis, MN 55402-1498 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: MATERIAL STORAGE AND DISPENSING SYSTEM AND METHOD WITH DEGASSING ASSEMBLY

(57) Abstract: The present disclosure relates to systems and methods which include a material receiving chamber for receiving a material (e.g., fluid containing medium) and an evacuable chamber configured to have vacuum applied thereto, and are configured to eliminate or at least reduce microbubble formation, eliminate or at least reduce unwanted diffusion of gas into the fluid containing medium being stored/dispensed, and/or remove at least a portion of gas or air bubbles entrained or dissolved in the fluid containing medium. Also disclosed are methods for controlling or reducing the concentration of gas in the material which may be subjected to external pressure during storage and/or dispensing.



WO 2011/046802 A2

MATERIAL STORAGE AND DISPENSING SYSTEM AND METHOD WITH DEGASSING ASSEMBLY

Field of the Invention

[001] The present disclosure relates to improved material storage and/or dispensing systems and methods. More particularly, the present disclosure relates to improved material storage and/or dispensing systems and methods equipped with a degassing assembly.

Brief Summary of the Invention

[002] The present disclosure, in one embodiment, relates to a degassing apparatus which includes a material receiving chamber, plenum, bladder, bag, pouch, compartment, or the like configured to receive a material, for example but not limited to, a fluid containing medium, such as but not limited to, photoresist, etchant, dopant, chemical vapor deposition reagent, solvent, wafer or tool cleaning formulation, chemical mechanical polishing composition, etc., and an evacuable chamber, plenum, bladder, bag, pouch, compartment, or the like configured to have vacuum applied thereto. The system can be constructed or implemented such that the material receiving and evacuable chambers are in at least partial contacting relationship or in a non-contacting relationship. However, other suitable configurations may be employed.

[003] The present disclosure, in another embodiment, relates to a material storage and/or dispensing system having the above-mentioned degassing apparatus.

[004] The present disclosure, in yet a further embodiment, relates to a method of degassing a fluid and/or reducing formation of microbubbles in, for example but not limited to, a fluid, such as but not limited to, photoresist, etchant, dopant, chemical vapor deposition reagent, solvent, wafer or tool cleaning formulation, chemical mechanical polishing composition, etc. The method may include disposing a sleeve in a fluid-tight, leak-tight, or seal-tight manner around, or covering at least, a portion of a material receiving chamber and drawing a vacuum on or evacuating the sleeve. In some embodiments, the over sleeve may enclose at least a portion of the material receiving chamber and can be arranged in such a manner so as to expose or subject an outer surface

or wall of the material receiving chamber to vacuum. In another embodiment, the over sleeve can include a side wall which is in contact or selective gas transfer relationship with an outer surface or wall (or a portion thereof) of the material receiving chamber and may extend peripherally and continuously (or non-continuously) around the material receiving chamber. The inner wall of the over sleeve may create an additional barrier across which gas must travel to reach the evacuable cavity of the over sleeve.

[005] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

Brief Description of the Drawings

[006] While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter that is regarded as forming the present invention, it is believed that the invention will be better understood from the following description taken in conjunction with the accompanying Figures, in which:

[007] FIG. 1 is a side sectional view of one embodiment of a material storage and/or dispensing system of the present disclosure.

[008] FIG. 2 is a side sectional view of another embodiment of a material storage and/or dispensing system of the present disclosure.

[009] FIG. 3 is a top sectional view of one embodiment of fitment assemblies of the embodiment of a material storage and/or dispensing system of FIG. 2.

Detailed Description

[010] The present disclosure relates to novel and advantageous material storage and/or dispensing systems and methods. Particularly, the present disclosure relates to novel and advantageous material storage and/or dispensing systems and methods equipped with a degassing assembly. The various embodiments of the present disclosure

may be particularly useful in pressure dispense systems or applications for reducing or eliminating microbubble formation, reducing or eliminating unwanted diffusion of gas into the material being stored/dispensed, and/or removing at least a portion of gas or air bubbles entrained or dissolved in the material.

[0111] Referring to FIG. 1, according to an embodiment of the present invention, a system 10 for storing and/or dispensing a material can comprise an overpack 11, container, vessel, tank, reactor, receptacle, or the like having an annular space 17 therein for receiving or accommodating a material receiving chamber 18 and an evacuable or degassing chamber 16. The evacuable chamber 16 may include an interstitial space, which can be placed under vacuum. Although the use of vacuum can be desirable, in some embodiments, it is also contemplated that the degassing effect can be achieved by venting the evacuable chamber 16 to the ambient atmosphere or environment.

[012] As shown in FIG. 1, although not so limited, at least a portion of the material receiving chamber 18 may be located or enclosed within the evacuable chamber 16 with the evacuable chamber 16 being joined, secured, welded, or the like in a leak-tight, fluid-tight, or pressure-tight manner circumferentially or peripherally around a perimeter of the material receiving chamber 18. In one embodiment, evacuable chamber 16 may be joined to a periphery of the material receiving chamber 18 generally at or near its access opening 20. Access opening 20 can permit passage of materials and can be coupled to an outlet port of the overpack 11. In alternative embodiments, the access opening 20 can be attached to a fitment assembly 13, which in turn can be secured to the outlet port of the overpack 11. One skilled in the art will appreciate that any of a variety of other suitable techniques or mechanisms for securing the material receiving chamber 18 to a material discharge opening on the overpack 11 may be used, including with or without the use of a retainer 12 or fitment assembly 13.

[013] A pressurization port 21 may be provided on the overpack 11 for filling the annular space 17 with a pressurizing fluid, for example but not limited to, air, nitrogen, gas, water, oil, etc., to compress the material receiving chamber 18 and thereby displace the material retained therein through the access opening 20 (or effect pressure dispensing of material). Additionally or alternatively, a pressurization port 21 may be provided on the overpack 11 for venting the annular space 17 to remove pressurizing

fluid to, e.g., fill the material receiving chamber 18. The pressurization port 21 may be positioned in any suitable location on the overpack 11.

[014] A vacuum line 22 may be connected to the evacuable chamber 16, for example but not limited to, via a fitment assembly 15 for evacuating or drawing a vacuum in the interstitial space thereof to reduce or prevent ingress of gas or pressurizing fluid into the material receiving chamber 18 and/or allow egress of gas from within chamber 18. The vacuum line 22 can pass through the pressurization port 21 or through another opening on the overpack 11 provided for that purposes for connection with a vacuum source, for example but not limited to, a vacuum pump, in-house vacuum supply, vacuum generating system, venturi, etc. In the case of the latter configuration, the vacuum line 22 can be sealingly passed through a separately formed opening.

[015] In an embodiment, a spacing member such as a porous insert or sheet of material can be disposed in the interstitial space of the evacuable chamber 16 or between the material receiving chamber 18 and evacuable chamber 16 to maintain a separation distance and thereby avoid or minimize choke-off. Alternatively, at least one of the opposing walls of chamber 18 and chamber 16 may be provided with surface features including, for example but not limited to, surface roughness, protrusions, channels/grooves, depressions, etc., for minimizing or preventing choke-off, for example, when evacuating the evacuable chamber 16.

[016] Material receiving chamber 18 and evacuable chamber 16 may each be constructed of a pliable or collapsible material, which can be compressed to a collapsed state by application of external force and can be expanded to a normally expanded state when compressive force is relieved or removed. Material receiving chamber 18 and evacuable chamber 16 may each be constructed of a non-permeable, semi-permeable, or permeable material. Examples of suitable materials that can be used to fabricate the material receiving chamber 18 and/or the evacuable chamber 16 are described in, for example, published patent application WO 2006/116389, entitled "Material Storage and Dispensing Packages and Methods," the subject matter of which is hereby incorporated by reference herein in its entirety for all purposes. Such materials may include, but are not limited to, polyethylene, polypropylene, polyvinylchloride, polyurethane, polyimide,

polytetrafluoroethylene, and compatible copolymers of monomers thereof, and laminates including at least one layer of such polymers or copolymers.

[017] In another embodiment, shown in FIG. 2, a system 30 for storing and/or dispensing a material can comprise an overpack 31, container, vessel, tank, reactor, receptacle, or the like having an annular space 37 therein for receiving or accommodating a material receiving chamber 38 and an evacuable or degassing chamber 36. The evacuable chamber 36 may include an interstitial space, which can be placed under vacuum. Although the use of vacuum can be desirable, in some embodiments, it is also contemplated that the degassing effect can be achieved by venting the evacuable chamber 36 to the ambient atmosphere or environment.

[018] As shown in FIG. 2, although not so limited, at least a portion of the material receiving chamber 38 may be located or enclosed within the evacuable chamber 36 with the evacuable chamber 36 being secured or otherwise directly coupled to the overpack 31, for example but not limited to, via a separate fitment assembly 43 (see also FIG. 3) and correspondingly separate retaining mechanism(s) 42 disposed on the overpack 31. Access opening 40 can permit passage of materials and can be coupled to an outlet port of the overpack 31. In alternative embodiments, the access opening 40 can be attached to a fitment assembly 33, which in turn can be secured to the outlet port of the overpack 31. One skilled in the art will appreciate that any of a variety of other suitable techniques or mechanisms for securing the material receiving chamber 38 to a material discharge opening on the overpack 31 may be used, including with or without the use of a retainer 32 or fitment assembly 33.

[019] Examples of suitable coupling mechanisms, connector(s), attachment(s), or the like that can be used to separately or independently secure the material receiving chamber 38 and evacuable chamber 36 to the overpack 31 are described in, for example, published patent application WO 2006/116389, entitled "Material Storage and Dispensing Packages and Methods", the subject matter of which was previously incorporated by reference herein in its entirety for all purposes.

[020] A pressurization port 41 may be provided on the overpack 31 for filling the annular space 37 with a pressurizing fluid, for example but not limited to, air, nitrogen, gas, water, oil, etc., to compress the material receiving chamber 38 and thereby

displace the material retained therein through the access opening 40 (or effect pressure dispensing of material). Additionally or alternatively, a pressurization port 41 may be provided on the overpack 31 for venting the annular space 37 to remove pressurizing fluid to, e.g., fill the material receiving chamber 38. The pressurization port 41 may be positioned in any suitable location on the overpack 11.

[021] The evacuable chamber 36 can be evacuated or partially evacuated (generally represented by arrow A) via a vacuum port provided thereon. It will be readily appreciated by those skilled in the art in light of this disclosure that the placement of the vacuum port on the evacuable chamber 36, any associated vacuum line(s), and any opening on the overpack 31 that may be used to connect the evacuable chamber 36 to a vacuum source can be varied depending on the particular need or application.

[022] In a further embodiment, a spacing member such as a porous insert or sheet of material can be disposed in the interstitial space of the evacuable chamber 36 or between the material receiving chamber 38 and evacuable chamber 36 to maintain a separation distance and thereby avoid or minimize choke-off. Alternatively, at least one of the opposing walls of chamber 38 and chamber 36 may be provided with surface features including, for example but not limited to, surface roughness, protrusions, channels/grooves, depressions, etc., for minimizing or preventing choke-off, for example, when evacuating the evacuable chamber 36.

[023] Material receiving chamber 38 and evacuable chamber 36 may each be constructed of a pliable or collapsible material, which can be compressed to a collapsed state by application of external force and can be expanded to a normally expanded state when compressive force is relieved or removed. Material receiving chamber 18 and evacuable chamber 16 may each be constructed of a non-permeable, semi-permeable, or permeable material. Examples of suitable materials that can be used to fabricate the material receiving chamber 38 and/or the evacuable chamber 36 are described in, for example, published patent application WO 2006/116389, entitled "Material Storage and Dispensing Packages and Methods," the subject matter of which is hereby incorporated by reference herein in its entirety for all purposes. Such materials may include, but are not limited to, polyethylene, polypropylene, polyvinylchloride, polyurethane, polyimide,

polytetrafluoroethylene, and compatible copolymers of monomers thereof, and laminates including at least one layer of such polymers or copolymers.

[024] Although not intending to be bound by any particular embodiment, it is contemplated that the inventive embodiments described herein can be used to reduce the concentration of gas in the fluid containing medium as compared with pressure dispense systems or processes where in-situ degassing is not performed. It is also contemplated that one may reduce or eliminate the influx of gas into the fluid containing medium by as compared with pressure dispense systems or processes where in-situ degassing is not performed. Generally, the term P_{sat} may be used herein to describe the levels of gas in the fluid containing medium. A P_{sat} value of one (1) atmosphere means that the gas at one (1) atmosphere pressure is in equilibrium with the liquid. At this pressure, the tendency to form new bubbles from the fluid containing medium or to change the size of bubbles in the fluid containing medium is substantially non-existent. In systems for storing and/or dispensing a material that do not have a degasser assembly as described in the various embodiments herein (e.g., the systems having a single liner and not comprising a secondary liner as described herein), the gas used to drive the fluid from the overpack and bubbles, for example, within the interstitial space and trapped in the folds of the liner, tend to dissolve into the liquid increasing the P_{sat} level. The various embodiments herein can lower the P_{sat} level by extracting the gas and bubbles through the permeable internal liner and into the interstitial space between the material chamber and the evacuable chamber.

[025] In some embodiments, the greater the volume of the head space in the material chamber, the greater the likelihood that the overlying gas will become entrained and/or solubilized in the fluid containing medium of the material chamber, since the fluid containing medium may be subjected to sloshing, splashing, and translation in the material receiving chamber, as well as impact of the material receiving chamber against the rigid surrounding container during transportation of the container. This circumstance will in turn result in the formation of bubbles, microbubbles, and particulates in the fluid containing medium, which degrade the fluid containing medium, and render it potentially unsuitable for its intended purpose. For this reason, in some embodiments, it may be desirable to minimize or eliminate the head space with complete filling of the

interior volume of the material chamber. In particular embodiments of the present disclosure head space from the material receiving chamber can be removed before dispensing by applying a vacuum to the evacuable chamber. Removing head space from the material receiving chamber can be done after filling the material receiving chamber and/or before dispensing the fluid containing medium from the material receiving chamber.

[026] Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

Claims

We claim:

1. A degassing apparatus, comprising:

a material receiving chamber configured to receive a material; and

an evacuable chamber configured to have vacuum applied thereto;

wherein said material receiving and evacuable chambers are in one of at least partial contacting or non-contacting relationship.
2. The apparatus of claim 1, wherein said evacuable chamber is arranged to expose a surface of said material receiving chamber to vacuum when vacuum is applied to said evacuable chamber.
3. The apparatus of claim 1, wherein said material receiving chamber is at least partially disposed within said evacuable chamber.
4. The apparatus of claim 1, wherein said material receiving and evacuable chambers are arranged in abutting relation, or adjacent each other.
5. The apparatus of claim 1, wherein said evacuable chamber is attached circumferentially or peripherally around a periphery of said material receiving chamber and receives at least a portion of said material receiving chamber.
6. The apparatus of claim 1, wherein said evacuable chamber is formed by a sleeve positioned over at least a portion of said material receiving chamber.
7. The apparatus of claim 6, wherein at least a section of said sleeve conforms substantially in shape to said material receiving chamber.
8. The apparatus of claim 1, wherein at least one of said material receiving or evacuable chambers is formed of a non-permeable, semi-permeable or permeable material.

9. The apparatus of claim 1, wherein at least one of said material receiving or evacuable chambers comprises a permselective membrane permeable to diffusing gas but impervious to liquid flow.
10. The apparatus of claim 1, wherein said material receiving chamber comprises a gas permeable membrane for permitting gas to escape while preventing material from escaping therefrom.
11. The apparatus of claim 1, wherein at least one of said material receiving or evacuable chambers is formed of a collapsible material.
12. The apparatus of claim 1, wherein at least one of said material receiving or evacuable chambers is selectively collapsible from a normally expanded state to a collapsed state or are selectively expandable from a collapsed state to the normally expanded state.
13. The apparatus of claim 1, wherein each of said material receiving and evacuable chambers comprises at least one access port.
14. The apparatus of claim 13, further comprising a fitment assembly coupled to at least one of the at least one access ports.
15. The apparatus of claim 1, wherein said material receiving and evacuable chambers are at least partially disposed within a housing.
16. The apparatus of claim 15, wherein said housing is constructed of a substantially rigid material
17. The apparatus of claim 15, wherein said housing is constructed of a non-rigid material.
18. The apparatus of claim 15, wherein said housing comprises at least one access port.
19. The apparatus of claim 15, wherein said housing is configured to receive fluid under pressure from an external pressure source.

20. The apparatus of claim 15, wherein said housing is configured to sustain subatmopsheric or superatmospheric pressure.
21. The apparatus of claim 15, further configured to receive a pressurized fluid in said housing to controllably displace a desired amount of material from said material receiving chamber.
22. The apparatus of claim 1, wherein said evacuable chamber is connected to a vacuum source.
23. The apparatus of claim 13, wherein said evacuable chamber is connected to a vacuum source via said at least one access port.
24. The apparatus of claim 1, wherein said evacuable chamber is configured to at least partially remove gas from said material.
25. The apparatus of claim 21, wherein said evacuable chamber is at least partially interposed between the pressurized fluid and said material receiving chamber to at least partially remove diffusion/flow of pressurized fluid into said material.
26. The apparatus of claim 15, wherein said evacuable chamber is positioned between said housing and said material receiving chamber.
27. The apparatus of claim 15, wherein said evacuable chamber separates said material receiving chamber from said housing.
28. The apparatus of claim 13, wherein said at least one access port of said material receiving chamber allows passage of material into and out of said material receiving chamber.
29. The apparatus of claim 13, wherein at least one access port of said evacuable chamber is adapted to draw a vacuum within said evacuable chamber.

30. The apparatus of claim 1, wherein a porous material is disposed interiorly of said evacuable chamber, or sandwiched between said material receiving and evacuable chambers, to maintain a predetermined separation distance between said material receiving and evacuable chambers to substantially prevent choke-off.
31. The apparatus of claim 1, wherein a surface of material receiving and evacuable chambers comprise surface protrusions or depressions configured and arranged to provide a predetermined separation distance between said material receiving and evacuable chambers, to at least one of form one or more flow passage(s) for fluid being withdrawn or substantially prevent choke-off.
32. The apparatus of claim 1, wherein said material is a fluid.
33. The apparatus of claim 1, wherein said evacuable chamber comprises a substantially gas impermeable membrane for preventing escape of gas therefrom.
34. The apparatus of claim 21, wherein said evacuable chamber comprises a substantially gas impermeable membrane for preventing at least one of escape of gas from or pressurized gas from entering said evacuable chamber.
35. A fluid storage and dispensing system comprising the apparatus of any of the preceding claims.
36. A method of degassing a fluid or preventing formation of microbubbles in a fluid comprising using the apparatus of any one of claims 1-34 or the system of claim 35.
37. A method of degassing a fluid or preventing formation of microbubbles in a fluid, comprising:
- disposing a sleeve in a generally fluid-tight arrangement around or over at least a portion of a material receiving chamber; and
 - evacuating said sleeve to expose said portion of said material receiving chamber to vacuum.
38. A degassing apparatus, comprising:

a material receiving chamber configured to receive a material; and

an evacuable chamber configured to have vacuum applied thereto,

wherein said material receiving and evacuable chambers are at least partially disposed within a housing, said housing being configured to receive a pressurized fluid to controllably displace a desired amount of material from said material receiving chamber, and

wherein said evacuable chamber is at least partially interposed between the pressurized fluid and said material receiving chamber to at least partially remove gas from and/or prevent entry of pressurized fluid into said evacuable and/or material receiving chambers.

1/3

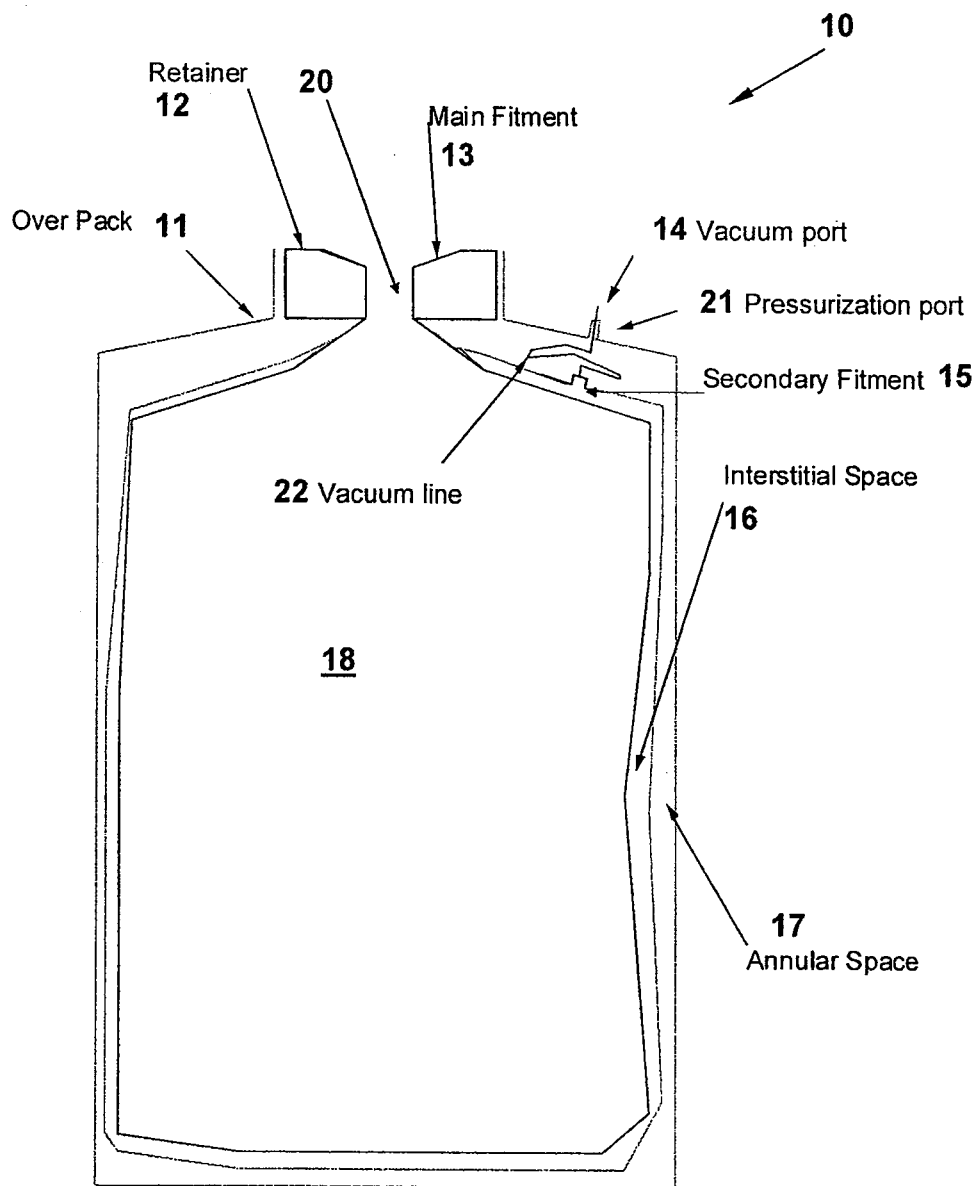


FIG. 1

2/3

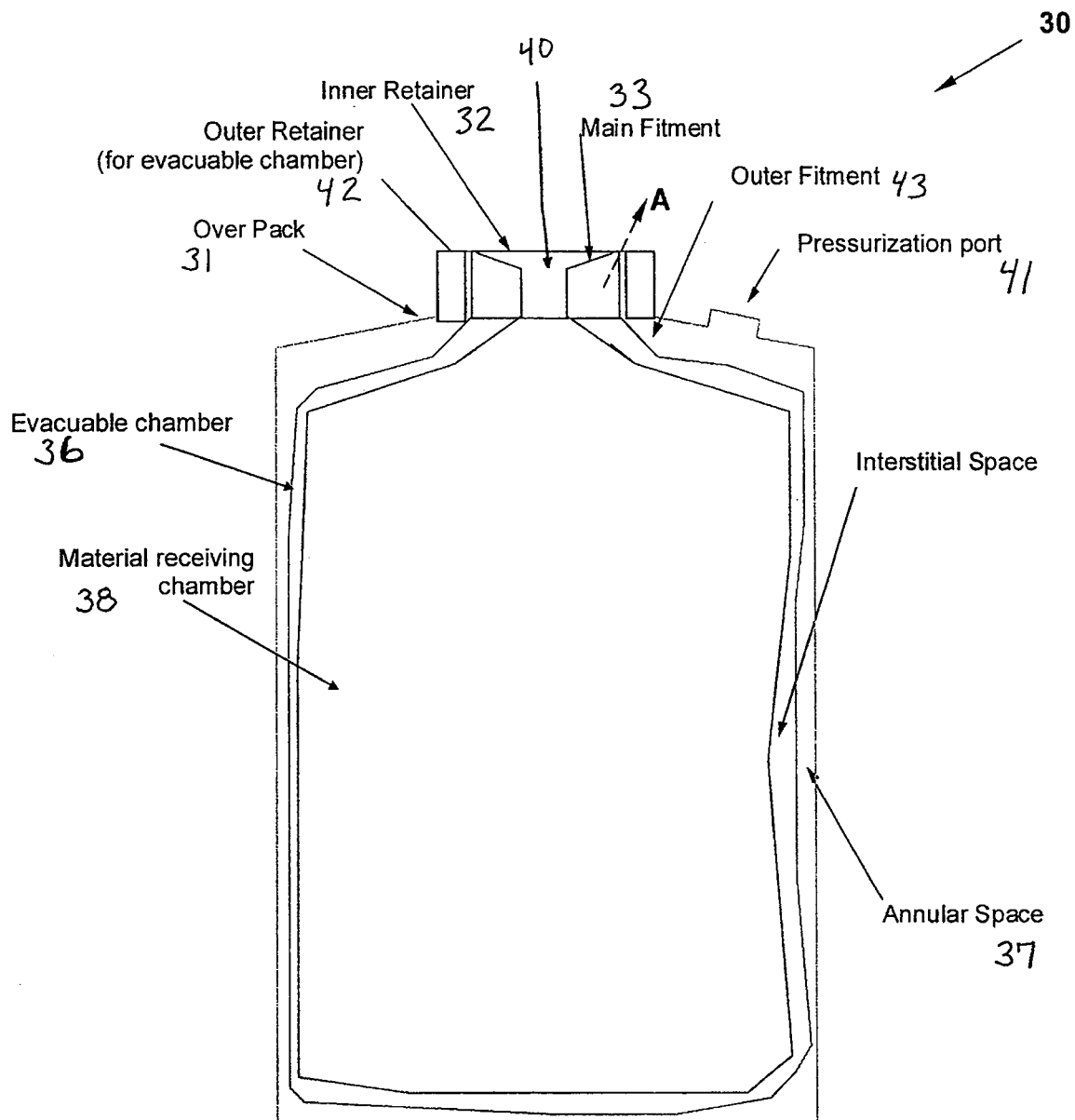


FIG. 2

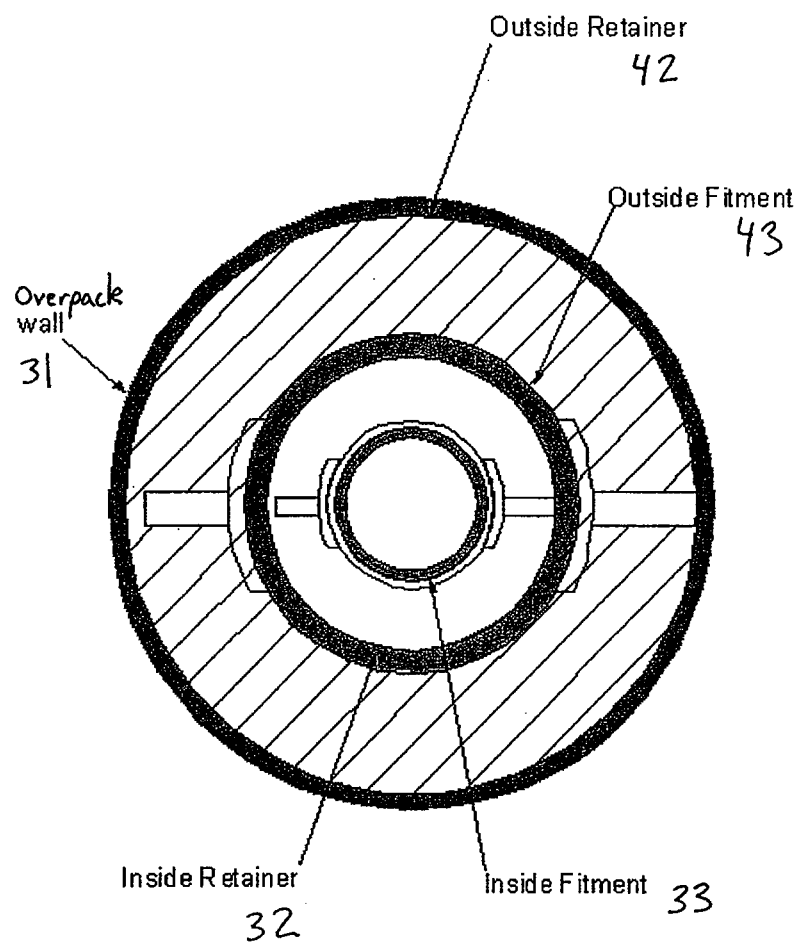


FIG. 3