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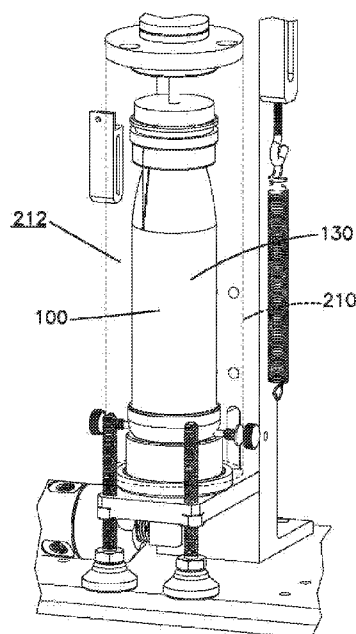
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(54) Title: FLEXIBLE BAG DISPENSING CONTAINER FILLING TECHNIQUE

**Fig.3**

(57) **Abstract:** A method for filling a flexible bag dispensing container includes inserting the flexible bag dispensing container into a cavity of a chamber of a filling system, creating a pressure differential between the flexible bag dispensing container and the cavity of the chamber so as to expel gas entrapped within the flexible bag dispensing container, and dispensing a liquid material into the flexible bag dispensing container. A system for filling an interior space of a flexible bag dispensing container includes a chamber defining a cavity configured to receive the flexible bag dispensing container therein, a pump configured to create a pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber so as to expel gas entrapped within the flexible bag dispensing container, and a material supply source configured to dispense a liquid material into the flexible bag dispensing container.



Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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FLEXIBLE BAG DISPENSING CONTAINER FILLING
TECHNIQUE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application No. 63/110,092 filed November 5, 2020 and U.S. Patent Application No. 63/111,959 filed November 10, 2020, which are incorporated by reference herein in their entireties.

TECHNICAL FIELD

[0002] The present disclosure relates to flexible bag dispensing containers, and more particularly, to methods and systems for filling flexible bag dispensing containers.

BACKGROUND

[0003] Conventionally, a flexible bag dispensing container is filled by first expanding the flexible bag dispensing container with air and then filling the flexible bag dispensing container with a liquid material through a drop tube that is inserted into the flexible bag dispensing container. As the flexible bag dispensing container is filled, at least a tip of the drop tube can be immersed in the fluid material in the flexible bag dispensing container. The drop tube is gradually withdrawn from the flexible bag dispensing container to prevent contamination of the drop tube and a void in the liquid material after retracting the immersed drop tube (such as when the drop tube is retracted too slowly), undesirable air entrapment in a liquid material dispensed from the drop tube (such as if the end of the drop tube is retracted from the liquid material too quickly or slowly), and/or inconsistent filling of flexible bag dispensing containers. Filling with a drop tube generally requires synchronization between flow rate from a filling pump and a retraction rate of the drop tube as the tube is withdrawn, especially when filling with high viscosity fluids and/or variable-viscosity fluids. Without the proper level of control, there is an increased risk of entrapping air in the flexible bag dispensing container during the fill process. The entrapped gases may, in some circumstances, react negatively or undesirably with a product disposed in the flexible bag dispensing container. Further, the entrapped gases can be compressed during dispensing of the flexible bag dispensing container. These compressed gases can then expand after a desired dispense operation of the flexible bag dispensing container (e.g., after the liquid material is dispensed from the flexible bag dispensing container) such that the expanding gases cause the liquid material to continue to dispense after the desired dispense

operation is complete. Therefore, entrapment of gases may be undesirable in certain applications.

SUMMARY

[0004] In an example, a method for filling a flexible bag dispensing container with a liquid material is provided. The method includes inserting the flexible bag dispensing container into a cavity of a chamber of a filling system. The method further includes creating a pressure differential. The pressure differential is created between an interior space of the flexible bag dispensing container and the cavity of the chamber. The interior space of the flexible bag dispensing container has an internal pressure that is lower than an internal pressure of the cavity of the chamber. The pressure differential thereby collapses a flexible bag of the flexible bag dispensing container so as to expel gas entrapped within the interior space from the flexible bag dispensing container. The method further includes dispensing the liquid material into the flexible bag dispensing container. The liquid material is dispensed into the flexible bag dispensing container while the pressure differential is created between the interior space of the flexible bag dispensing container and the cavity of the chamber. The interior space of the flexible bag dispensing container is filled with the liquid material.

[0005] Another example is a system for filling an interior space of a flexible bag dispensing container with a liquid material. The system includes a chamber defining a cavity. The cavity of the chamber is configured to receive the flexible bag dispensing container therein. The system further includes an air movement system in fluid communication with at least one of the chamber and the interior space of the flexible bag dispensing container. The air movement system is configured to create a pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber. The interior space of the flexible bag dispensing container has an internal pressure that is lower than an internal pressure of the cavity of the chamber. The pressure differential thereby collapses a flexible bag of the flexible bag dispensing container so as to expel gas entrapped within the interior space from the flexible bag dispensing container. The system further includes a material supply source. The material supply source is configured to be removably coupled to a port of the flexible bag dispensing container so as to dispense the liquid material through the port and into the interior space of the flexible bag dispensing container. The liquid material is dispensed through the port and into the interior space of the flexible bag dispensing container while the air movement system creates the

pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber.

[0006] In a further example, another method for filling a flexible bag dispensing container with a liquid material is provided. The method includes inserting the flexible bag dispensing container into a cavity of a chamber of a filling system. The flexible bag dispensing container includes a flexible bag. The flexible bag of the flexible bag dispensing container defines an interior space. The flexible bag dispensing container further includes at least one vent. The at least one vent is configured to permit gas entrapped in the interior space to discharge therethrough. The gas entrapped in the interior space are discharged through the at least one vent to the cavity of the chamber. The method further includes dispensing the liquid material into the flexible bag dispensing container. The liquid material is dispensed into the flexible bag dispensing container while gas entrapped within the interior space is expelled from the flexible bag dispensing container through the at least one vent. The interior space of the flexible bag dispensing container is filled with the liquid material.

[0007] In another example, another system for filling an interior space of a flexible bag dispensing container with a liquid material is provided. The system includes a chamber defining a cavity. The cavity of the chamber is configured to receive the flexible bag dispensing container therein. The system further includes a material supply source. The material supply source is configured to be removably coupled to a port of the flexible bag dispensing container so as to dispense the liquid material through the port and into the interior space of the flexible bag dispensing container. The system further includes a sensor. The sensor is configured to detect when the flexible bag dispensing container reaches a predetermined fill level. The sensor is further configured to cause the material supply source to cease dispensing the liquid material into the flexible bag dispensing container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The following description of the illustrative examples may be better understood when read in conjunction with the appended drawings. It is understood that potential examples of the disclosed systems and methods are not limited to those depicted.

[0009] FIG. 1A shows a perspective view of a flexible bag dispensing container according to one example;

[0010] FIG. 1B shows a perspective cross-sectional view of the flexible bag dispensing container of FIG. 1A;

[0011] FIG. 1C shows a perspective view of the flexible bag dispensing container of FIG. 1A collapsed (i.e., without liquid material and/or entrapped gases);

[0012] FIG. 2 shows a perspective view of a filling system for filling an interior space of a flexible bag dispensing container with a liquid material according to one example;

[0013] FIG. 3 shows a perspective view of a chamber of the filling system of FIG. 2, with the chamber shown as transparent to illustrate additional features of the chamber and the flexible bag dispensing container disposed therein;

[0014] FIG. 4 shows a perspective view of a filling system for filling an interior space of a flexible bag dispensing container with a liquid material according to one example in which dual chambers are provided;

[0015] FIG. 5A shows a side view of the chamber of the filling system of FIG. 2, with the chamber shown as transparent to illustrate additional features of the chamber and the at least partially-filled flexible bag dispensing container disposed therein;

[0016] FIG. 5B shows a side view of the chamber of the filling system of FIG. 2, with the chamber shown as transparent to illustrate additional features of the chamber and the collapsed flexible bag dispensing container disposed therein;

[0017] FIG. 6 shows a perspective view of the filling system of FIG. 2, with the chamber rotated and the collapsed flexible bag dispensing container disposed therein, with the chamber prepared to be secured to the system for filling;

[0018] FIG. 7 shows a front cross-sectional view of a portion of the filling system of FIG. 2, illustrating a fitting sealingly connecting the flexible bag dispensing container to a material supply source of the filling system;

[0019] FIG. 8A shows the chamber of the filling system of FIG. 2, with the chamber shown as transparent to illustrate additional features of the chamber and the collapsed flexible bag dispensing container disposed therein;

[0020] FIG. 8B shows a front view of a portion of the chamber of FIG. 8A, with the chamber shown as transparent to illustrate additional features of the chamber and a movable stop disposed therein;

[0021] FIG. 9A shows the chamber of the filling system of FIG. 2, with the chamber shown as transparent to illustrate additional features of the chamber and the at least partially-filled flexible bag dispensing container disposed therein;

[0022] FIG. 9B shows a front view of a portion of the chamber of FIG. 9A, with the chamber shown as transparent to illustrate additional features of the chamber and a movable stop disposed therein;

[0023] FIG. 10 shows a perspective view of the filling system of FIG. 2, with the at least partially-filled flexible bag dispensing container disposed therein prepared to be removed from the system after filling;

[0024] FIG. 11 shows a perspective view of the chamber of FIG. 10, with the chamber rotated and the at least partially-filled flexible bag dispensing container disposed therein sealed with a cap or plug and prepared to be removed from the system after filling;

[0025] FIG. 12 shows a front cross-sectional view of a portion of the filling system of FIG. 2, illustrating the creation of at least a partial vacuum within the flexible bag dispensing container sealingly connected to a fill fitting of the filling system;

[0026] FIG. 13 shows a process flow diagram of a method for filling a flexible bag dispensing container with a liquid material according to one example;

[0027] FIG. 14A shows a front view of a flexible bag dispensing container according to one example with vents; and

[0028] FIG. 14B shows a front cross-sectional view of a second end of the flexible bag dispensing container of FIG. 14A.

DETAILED DESCRIPTION

[0029] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols identify similar components, unless context dictates otherwise. The illustrative examples described in the detailed description and drawings are not meant to be limiting and are for explanatory purposes. Other examples may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented herein. It will be readily understood that the aspects of the present disclosure, as generally described herein and illustrated in the drawings, may be arranged, substituted, combined, and designed in a wide variety of different configurations, each of which are explicitly contemplated and form a part of this disclosure.

[0030] It should be noted that some of the terms used herein may be relative terms. For example, the terms “above” and “below” are relative to each other in location, i.e. a component that is above another component is located at a higher elevation than the other component in a

given orientation, but these terms can change if the device is flipped. The terms “horizontal” and “vertical” are used to indicate direction relative to an absolute reference, i.e. ground level.

[0031] While conventional methods and systems for filling flexible bag dispensing containers have been adequate for their intended purposes, there are some drawbacks to the conventional filling methods and systems. For example, conventional filling systems require a sufficient level of control and/or synchronization between the filling of the flexible bag dispensing container and the withdrawal of the drop tube. However, systems that achieve sufficient levels of control and/or synchronization can be expensive and might not be commonly available. As another example, the use of a drop tube introduces friction to the flow path during the filling process, which may be undesirable in certain applications. As yet another example, conventional filling systems can introduce volumetric filling inconsistencies that cause each flexible bag dispensing container to be filled with different amounts of flowable composition. These inconsistencies can result from such factors as the entrapment of gas within the liquid material and/or the flexible bag dispensing container during filling, uneven unfolding of the flexible bag dispensing container, or an improper retraction rate from the flexible bag dispensing container of a drop tube that is used in performing the filling operation.

[0032] Therefore, there is a need for new methods and systems for filling a flexible bag dispensing container that alleviate, or prevent altogether, one or more of the aforementioned drawbacks. According to various examples, filling systems and methods of the present disclosure create a pressure differential to expel entrapped gases from the flexible bag dispensing container, and then fill the flexible bag dispensing container while the gases are expelled from the flexible bag dispensing container. This is in contrast to conventional systems and methods that fill the flexible bag dispensing container while the flexible bag dispensing container is pressurized. Systems and methods of the present disclosure can fill a flexible bag dispensing container with or without the use of a drop tube. In examples of this disclosure that use a drop tube, retraction of the drop tube can be performed without the level of control and synchronization required by conventional filling systems and methods. In at least some examples, systems and methods of the present disclosure can reduce the risk of entrapping gas within the flexible bag dispensing container over that of conventional filling systems and methods. In at least some examples, systems and methods of the present disclosure can provide for a repeatable fill (e.g., to a consistent fill level or volume) from one filling operation to the next.

[0033] The filling methods and filling systems of the present disclosure can be used in a variety of applications as will be readily appreciated by those skilled in the art. By way of non-limiting example, it is contemplated that the foregoing may be used for filling a flexible bag dispensing container with a liquid material, such as an adhesive or an epoxy.

[0034] Described herein are methods and systems for filling flexible bag dispensing containers with a liquid material. Very generally, a filling system may execute a filling operation in which the filling system collapses an empty flexible bag dispensing container (e.g., to expel gas entrapped in the flexible bag dispensing container) and then fills the flexible bag dispensing container with a liquid material. The flexible bag dispensing container is inserted into a cavity of a chamber of the filling system and a pressure differential is created (e.g., by a pump in fluid communication with an interior space of the flexible bag dispensing container and/or the chamber) between the interior space of the flexible bag dispensing container and the cavity of the chamber. The pressure differential is created such that the interior space of the flexible bag dispensing container has an internal pressure that is lower than a pressure that is outside of the flexible bag dispensing container and within the cavity of the chamber. As a result, the pressure differential thereby collapses a flexible bag of the flexible bag dispensing container so as to expel gas entrapped within the interior space from the flexible bag dispensing container.

[0035] While the pressure differential is created and/or maintained between the interior space of the flexible bag dispensing container and the cavity of the chamber, the liquid material may be dispensed into the flexible bag dispensing container so as to fill the interior space with the liquid material. After the flexible bag dispensing container is collapsed and sealingly connected to the filling system (e.g., subsequently to being collapsed), the flexible bag dispensing container may be filled with the liquid material at a pressure sufficient to overcome both the friction in the flow path of the filling system and the collapsing pressure of the flexible bag dispensing container, thereby enabling the filling system to dispense the liquid material into the flexible bag dispensing container at a desired flow rate. Generally, to effect dispensing of the liquid material into the flexible bag dispensing container, the liquid pressure may exceed the pressure within the cavity of the chamber (i.e., outside of the flexible bag dispensing container). As a result, once the flexible bag dispensing container is filled, the filled flexible bag dispensing container may have little to no gas entrapped therein. In some examples, a movable stop may be positioned such that it is contacted by the flexible bag dispensing container once the flexible bag dispensing container reaches a desired fill level or volume. A sensor may detect movement of

the movable stop, including once the movable stop moves to a position indicating that the flexible bag dispensing container has reached a desired fill level or volume, and the dispensing of the liquid material into the flexible bag dispensing container may be ceased.

[0036] Referring first to FIG. 1A and FIG. 1B, an example flexible bag dispensing container 100 is shown that may be used with the filling methods and filling systems described herein. In FIG. 1A, the flexible bag dispensing container 100 is illustrated in an expanded or at least partially filled state or configuration. In such state, the flexible bag dispensing container 100 may be filled with from about 2 to about 3 psi of air, though this value could vary with different flexible bag dispensing containers, chambers, and/or applications.

[0037] As depicted in FIG. 1A and FIG. 1B, the flexible bag dispensing container 100 may include a flexible wall 130 that defines a flexible bag. The flexible wall 130 may, in certain examples, define an interior space 120 of the flexible bag dispensing container 100. The interior space 120 is configured to hold or otherwise contain a liquid material therein. In certain applications, the interior space 120 may be filled with the liquid material such that the interior space 120 holds or otherwise contains a liquid material therein. In examples, the flexible wall 130 may be formed from a film, such as a multi-layer film. The flexible wall 130 may generally be made of any material suitable for containing the liquid material in the interior space 120, which may be defined thereby. By way of non-limiting example, the flexible wall 130 may be made from monolayer film, coextruded film, laminated film, or combinations thereof. By way of further non-limiting example, the flexible wall 130 may be made of a coextruded film made of the following layers: linear low-density polyethylene (LLDPE); Nylon- ethylene vinyl alcohol (EVOH)-Nylon-LLDPE. In certain examples, the flexible wall 130 may include a film (e.g., a coextruded film) laminated to ethylene acrylic acid copolymer (EAA), foil, an adhesive, medium-density polyethylene (MDPE), or combinations thereof. In examples, the flexible wall 130 may be made from a single or multi-layer material. In examples, the flexible wall 130 may be formed from a high-strength material. The flexible wall 130 may, in certain examples, provide barrier properties against oxygen and/or moisture permeation to preserve shelf life stability. The flexible wall 130 may be inert to the liquid material disposed in the interior space 120. As may be seen with continued reference to FIG. 1A and FIG. 1B, the flexible wall 130 may extend between a first end 106 of the flexible bag dispensing container 100 and a second end 108 of the flexible bag dispensing container 100 that is spaced from the first end 106. In examples, the flexible wall 130 may define the second end 108 of the flexible bag dispensing container 100. The flexible wall 130 of the flexible bag dispensing container 100 may extend

between a first side 130a and an opposite, second side 130b (refer to FIG. 1A and FIG. 1C). The opposing sides 130a, 130b of the flexible wall 130 extend between the first and second ends 106, 108.

[0038] The first end 106 of the flexible bag dispensing container 100 may define a port 110. The port 110 may generally be configured to transfer the liquid material between the interior space 120 of the flexible bag dispenser 100 and an exterior 122 of the flexible bag dispensing container 100. In examples, the port 110 may be configured to receive the liquid material therethrough (e.g., for storage of the liquid material), such that the liquid material may be dispensed through the port 110 and into the interior space 120 of the flexible bag dispensing container 100. The port 110 may, in certain examples, be further configured to dispense the liquid material therethrough. In examples, such as that illustrated in FIG. 1A, the flexible bag dispensing container 100 can comprise a cap 110a that is configured to seal the port 110, such as for storage and/or transportation. Generally, the cap 110a may seal the first end 106 of the flexible bag dispensing container 100 so as to prevent the liquid material from discharging therethrough until it is desirable to dispense or otherwise discharge the liquid material (e.g., via the port 110). In examples, the cap 110a may be threaded or otherwise releasably connected to the first end 106 of the flexible bag dispensing container 100 such that liquid material disposed in the flexible bag dispensing container 100 is prevented from being discharged through the port 110. The threads of the cap 110a may be external threads configured to engage internal threads defined by an interior surface of the port 110. Alternatively, the threads of the cap 110a may be internal threads configured to engage external threads of the port 110.

[0039] In examples, the flexible bag dispensing container 100 can comprise a faceplate 110b that defines the port 110. In some examples, the faceplate 110b can be more rigid than the flexible wall 130. For example, the faceplate 110b may be configured such that it does not collapse during filling when the flexible wall 130 is collapsed. The faceplate 110b may, in certain examples, be integrally molded to or formed with the flexible wall 130. The faceplate 110b can optionally include a nosepiece 110d extending from a first face of the faceplate 110b in a direction that extends from the second end 108 toward the first end 106 of the flexible bag dispensing container 100. The nosepiece 110d can define the port 110. The faceplate 110b can optionally include a flange 110e extending from a second face of the faceplate 110b in a direction that extends from the first end 106 toward the second end 108 of the flexible bag dispensing container 100. The cap 110a can be releasably attachable to the nosepiece 110d with corresponding threads to releasably seal the port 110. The faceplate 110b may be formed through

injection molding around the flexible wall 130. A resin forming the faceplate 110b may be injected in a molten state and melt an outer surface of the flexible wall 130. The resin may be the same or substantially the same composition as the outer surface of the flexible wall 130, and the outer surface of the flexible wall 130 and the flange 110e may intermix at an interface. The faceplate 110b and the outer layer of the flexible wall 130 may then solidify to form an integrated structure of essentially uniform composition having no distinct layers at the interface. The faceplate 110b may be molded to the circumference of the flexible wall 130. It will be understood that, in alternative examples, the flexible wall 130 and faceplate 110b can be affixed to one another in any other suitable manner, including manners that do not include injection molding. In examples, the faceplate 110b may define the first end 106 of the flexible bag dispensing container 100.

[0040] With continued reference to FIG. 1A and FIG. 1B, the flexible bag dispensing container 100 may include a seal 140. The seal 140 may be defined at the second end 108 of the flexible bag dispensing container 100. Generally, the seal 140 may seal the second end 108 of the flexible bag dispensing container 100 so as to prevent the liquid material from discharging through the seal 140. The seal 140 may be formed by any suitable technique as will be appreciated by those skilled in the art. By way of non-limiting example, the seal 140 may be formed by applying heat or pressure or both, such as to the second end 108 of the flexible bag dispensing container 100 so as to effectively flatten and attach the flexible wall 130 to itself at the second end 108. Alternatively or in addition thereto, an adhesive (e.g., a pressure-sensitive adhesive) may be utilized so as to effectively attach the flexible wall 130 to itself at the second end 108. The seal 140 may be of any suitable size and/or shape to suit a particular application.

[0041] Turning now to FIG. 1C, the flexible bag dispensing container 100 is illustrated in an unexpanded or at least partially collapsed state or configuration, such as for storage, transportation, and/or prior to filling with the liquid material as described in greater detail herein. The flexible bag dispensing container 100 may be at least partially, such as fully, collapsed before the flexible bag dispensing container 100 is filled with the liquid material. In such situations, any gas entrapped within the interior space 120 of the flexible bag dispensing container 100 may be discharged therefrom, as described in greater detail herein. The flexible bag dispensing container 100 may also be at least partially collapsed after the liquid material is dispensed or otherwise discharged from the flexible bag dispensing container 100. In such situations, any gas entrapped within the interior space 120 of the flexible bag dispensing container 100 may be discharged therefrom, as described in greater detail herein. When the

flexible bag dispensing container 100 is in the collapsed or partially collapsed configuration, at least a portion of the flexible wall 130 may be received into the faceplate 110b, such as in the flange 110e of the faceplate 110b as is illustrated in FIG. 1C. In this way, the flexible bag dispensing container 100 may generally have a smaller footprint when in the collapsed or partially collapsed configuration, which may be useful for more efficient storage, transportation, and/or disposal of the flexible bag dispensing container 100.

[0042] FIG. 2 shows a filling system 200 according to one example, and FIG. 3 shows a chamber 210 of the filling system 200 according to one example. The filling system 200 may, in certain examples, include a fixture or holder configured to hold the chamber 210 in position relative to a material supply source and/or an air supply source (e.g., an air movement system). The fixture may, in examples, include a clamp 203, as is illustrated in FIG. 2, and/or another securement mechanism or fastener to secure the chamber 210 to the fixture. Although FIG. 2 illustrates a clamp 203, any of a variety of different securement mechanisms or fasteners may be utilized, as will be appreciated by those skilled in the art. The filling system 200 may also include, in various examples, other components related to filling one or more flexible bag dispensing containers 100 with a liquid material. By way of non-limiting example, the filling system 200 may include air control valves, gauges, air regulators, air directional control valves, and other related components.

[0043] The filling system 200 may include a controller 205 configured to control various aspects of the filling operation as described herein. In examples, the controller 205 may be a programmable logic controller (PLC), a microprocessor-based controller, a personal computer, or another conventional control device capable of carrying out the functions described herein as understood, as will be appreciated by those skilled in the art. The controller 205 may generally be configured to perform and/or execute the various processes relating to controlling the filling system 200. In some examples, the controller 205 may perform and/or execute the various processes relating to controlling the filling system 200 based upon user input. Alternatively or in addition thereto, the controller 205 may perform and/or execute the various processes relating to controlling the filling system 200 based upon a library of operational cycles or sequences that are stored in a memory unit (not shown) of the controller 205, automatically or otherwise. The memory unit may generally include one or more memory units, and may also be referred to as a storage device. The operational sequences may be recalled and placed in a particular control program, as desired, executing on the controller 205. The operational sequences can be adjusted to accommodate different filling operations, different types of flexible

bag dispensing containers 100, different liquid materials, or different dimensions of the flexible bag dispensing containers 100 or chamber 210, for example through a user interface (not shown).

[0044] In FIG. 3 and FIGS. 5A-B, the chamber 210 is shown as transparent to illustrate additional features of the chamber 210 and the flexible bag dispensing container 100 disposed therein. The chamber 210 may define a cavity 212 therein. The chamber 210 may include a first end 210a and a second end 210b. The first end 210a of the chamber 210 may generally be spaced apart from the second end 210b thereof. The first and second ends 210a, 210b of the chamber 210 may be spaced apart along a longitudinal axis 211 of the chamber 210. The second end 210b of the chamber 210 may define an inlet therein. The inlet 210c may be configured to receive the fluid material so as to fill the flexible bag dispensing container 100. In examples, the cavity 212 may extend between the first end 210a of the chamber 210 and the second end 210b of the chamber. In use, the chamber 210 may be made of a transparent material, such that the cavity 212 may be visible. A transparent chamber 210 may be particularly advantageous in certain applications, such as for enabling a user to see the flexible bag dispensing container 100 within the chamber 210 and/or to see a desired fill line as described herein. In other examples, the chamber 210 could be made of a translucent or opaque material. The chamber 210 and the cavity 212 defined thereby may be of any suitable size, shape, and/or material to suit a particular application. By way of non-limiting example, the chamber 210 and the cavity 212 defined thereby may be cylindrically shaped. By way of further non-limiting example, the chamber 210 may be machined from cast acrylic tubing. By way of further non-limiting example, the chamber 210 may have a wall thickness of about 0.5 inches. Generally, the chamber 210 and the cavity 212 defined thereby may be sized and shaped to receive the flexible bag dispensing container 100 therein, including such that the flexible bag dispensing container 100 may be securedly disposed within the chamber 210. In certain examples, the chamber 210 may define a recess or opening (e.g., that defines the inlet 210c) at the second end 210b of the chamber 210. The recess or opening of the chamber 210 may generally be configured to receive and/or support the faceplate 110b therein, such as is illustrated in FIG. 7 and FIG. 12. In examples, the recess or opening of the chamber 210 may be configured to receive and/or support the nosepiece 110d of the faceplate 110b therein. The recess or opening can be configured to form a seal, and in some examples a hermetic seal, with the faceplate 110b such that leakage of air through the interface between the recess or opening and the faceplate 110b is limited or prevented altogether. In fact, the chamber 210 can be configured such that the entire cavity 212 is sealed, and in some examples hermetically sealed, once the flexible bag dispensing container 100 is secured therein.

The sealing of the cavity 212 of the chamber 210 may assist in ensuring that pressure (e.g., a collapsing pressure) within the cavity 212 of the chamber 210 (e.g., outside of the flexible bag dispensing container 100) is maintained.

[0045] With continued reference to FIG. 2 and FIG. 3 and with further reference to FIG. 13, the filling system 200 and a method of 1300 for filling the flexible bag dispensing container 100 with a liquid material (e.g., using filling system 200) will generally be described. It is to be understood that the filling method 1300 is applicable with filling system 200 but could also be applied using other or additional systems, as will be appreciated by those skilled in the art. Similarly, it is to be understood that the filling system 200 may be used to perform the method 1300 and could also be used to perform other or additional methods, as will be appreciated by those skilled in the art. With specific respect to FIG. 13, it is to be understood that the dashed borders of the steps denote that such steps are optional to method 1300.

[0046] With continued reference to FIG. 13, at step 1301, the flexible bag dispensing container 100 (e.g., the flexible wall 130 thereof) may be stretched. Stretching of the flexible bag dispensing container 100 may facilitate easy insertion of the flexible bag dispensing container 100 into the chamber 210. In examples, the flexible bag dispensing container 100 (e.g., the flexible wall 130 thereof) may be stretched along its longitudinal axis and/or in a longitudinal direction by applying a force to one or both of the first and second ends 106, 108 of the flexible bag dispensing container 100. In examples in which the force is to be applied to only one of the first and second ends 106, 108 of the flexible bag dispensing container 100, the other end of the flexible bag dispensing container 100 may be secured without applying a pulling or stretching force thereto. In examples in which forces are to be applied to both of the first and second ends 106, 108 of the flexible bag dispensing container 100, the forces may be the same or different (e.g., in magnitude or direction) as desired to suit a particular application. As will be appreciated by those skilled in the art, it is to be understood that although the term “stretching” is used, step 1301 does not necessarily involve a physical elongation of the flexible bag dispensing container 100 or the flexible wall 130 thereof. Rather, the flexible bag dispensing container 100 (e.g., the flexible wall 130 thereof) may simply be pulled taut to achieve a maximum length. As will be appreciated by those skilled in the art, stretching of the flexible bag dispensing container 100 may be accomplished by any suitable technique, such as by hand, by using a device or feature of the filling system 200, or by using an external device or feature.

[0047] With reference now to FIG. 3 and FIG. 13, at step 1302, the flexible bag dispensing container 100 may be inserted into the chamber 210 of filling system 200. Chamber

210 may include a cavity 212. The cavity 212 may be configured to receive the flexible bag dispensing container 100 therein. Put another way, the cavity 212 of the chamber 210 may be sized and shaped to receive and contain the flexible bag dispensing container 100 therein, namely during the filling operation. Additional details of the flexible bag dispensing container 100 being disposed in the cavity 212 of the chamber 210 may be seen and understood with reference to FIG. 5A and FIG. 5B. Inserting the flexible bag dispensing container 100 into the chamber 210 (e.g., the cavity 212 thereof) may, in certain examples, include securing the flexible bag dispensing container 100 within the chamber 210. Put another way, the flexible bag dispensing container 100 may be securedly disposed within the chamber 210.

[0048] Step 1302 can further comprise sealing, and in some examples hermetically sealing, the flexible bag dispensing container 100 within the cavity 212 so as to limit, or prevent altogether, leakage of air into or out of the cavity 212. As used herein, the term “leakage” refers to the passing of air through the chamber 210 either from the environment outside of the chamber 210 or to the environment, and excludes the passage of air into or out of the cavity 212 via an air movement system connected to the chamber 210. Sealing the chamber 210 enables a desired pressure to be maintained within the cavity 212.

[0049] In at least some examples, the flexible bag dispensing container 100 may be removably secured within the chamber 100. The flexible bag dispensing container 100 may be removably secured within the chamber 100 by any suitable technique, such as by a fastener 215. Thus, the filling system 200 can comprise at least one fastener 215 that is configured to secure, such as positionally fix, the flexible bag dispensing container 100 within the cavity 212. In examples, the fastener(s) 215 may ensure that the flexible bag dispensing container 100 is prevented from undesirable movement within and/or from being blown out of the container 210. By way of non-limiting example, the fastener 215 may include one or more set screws and/or one or more spring-loaded pins. In some examples, the fastener 215 may be configured to engage the faceplate 110b of the flexible bag dispensing container 100. Though fasteners 215 are illustrated and described, it is to be understood that other methods and structures for securing the flexible bag dispensing container 100 within the chamber 210 may be employed. Generally, the fastener(s) 215 may be configured to provide a sufficient force to secure the flexible bag dispensing container 100 within the chamber 210 when a pressure differential is created between the flexible bag dispensing container 100 and chamber 210, as described in detail herein. Alternatively or in addition to the foregoing, the fasteners 215 may be configured to secure the flexible bag dispensing container 100 within the chamber 210 during the filling operation, while

the pressure differential created between the flexible bag dispensing container 100 and the chamber 210 aids in securing the flexible bag dispensing container 100 within the chamber 210.

[0050] It is to be understood that the filling system 200 may include a single chamber 210, or more than one chamber 210 as desired. With reference to FIG. 4, the system can include a pair of chambers 210. Each chamber 210 is generally configured to receive a respective flexible bag dispensing container 100 therein. The filling system 200 may include as few or as many chambers 210 as desired to suit a particular application. For example, the filling system 200 may include one, two, three, or four or more chambers 210. When multiple chambers 210 are provided, the chambers 210 may be arranged in parallel, such as is illustrated in FIG. 4. In some examples, the filling system 200 can be configured such that the flexible bag dispensing container 100 in one chamber 210 can be filled, while the flexible bag dispensing container 100 in another chamber 210 is being inserted and/or removed from the other chamber 210 (e.g., before or after being filled).

[0051] With reference again to FIG. 13, at step 1303, the chamber 210 (e.g., with the flexible bag dispensing container 100 disposed therein) may be inserted into the filling system 200. Such insertion of the chamber 210 into the filling system 200 may be accomplished manually (e.g., by an operator inserting the chamber 210 into the filling system 200) or automatically (e.g., after a previous chamber has been filled and removed from the filling system 200). For example, FIG. 6 illustrates the chamber 210 with the flexible bag dispensing container 100 disposed therein in the collapsed configuration, with the chamber 210 being inserted into the filling system 200. Introducing and/or inserting the chamber 210 into the filling system 200 in step 1303 may include affixing the chamber 210 to the fixture or holder (e.g., clamping the chamber 210 into the filling system 200 via clamp 203) so as to hold the chamber 210 in position within the filling system 200. In alternative examples, the chamber 210 may be introduced and/or inserted into the filling system 200 (e.g., by affixing the chamber 210 to the fixture or holder and/or clamping the chamber 210 into the filling system 200 via clamp 203) at any point prior to dispensing the liquid material into the flexible bag dispensing container 100 (i.e., step 1304). Step 1303 may, in certain examples, include sealingly connecting the chamber 210 and/or the flexible bag dispensing container 100 to a fitting 260, such as is described below. In such examples, step 1303 may be performed prior to step 1304 described herein. In examples, step 1303 may include bringing the chamber 210 into fluid communication with the air movement system 270, such as is described below. In examples, the flexible bag dispensing container 100 may be in the at least partially collapsed configuration (refer to FIG. 5B) prior to

loading the chamber 210 (with the at least partially collapsed flexible bag dispensing container 100 therein) into the filling system 200 for the dispensing or filling operation, such as is illustrated in FIG. 6, which may assist in ensuring that any gases that are or were entrapped in the flexible bag dispensing container 100 are not introduced to the fitting 260 described herein and/or another part of the fill line of the filling system 200.

[0052] In order to effect dispensing of the liquid material for filling the flexible bag dispensing container 100, the flexible bag dispensing container 100 may be sealingly connected to a material supply source 230. The flexible bag 100 may be sealingly connected to the material supply source 230 by a fitting 260 (e.g., a fitting of the filling system 200), such as a fill tube as illustrated in FIGS. 7 and 12. In examples, the fitting 260 may interface directly with the flexible bag dispensing container 100. The fitting 260 may, in certain examples, interface directly with the faceplate 110b of the flexible bag dispensing container 100. In such examples, the faceplate 110b may create a seal with the fitting 260. The fitting 260 may at least partially extend into the flexible bag dispensing container 100 (e.g., into the interior space 120 thereof). The fitting 260 may extend into the flexible bag dispensing container 100 any desired amount to suit a particular application. By way of non-limiting example, the fitting 260 may be inserted into the interior space 120 of the flexible bag dispensing container 100 so as to extend less than halfway into the interior space 120 of the flexible bag dispensing container 100. In examples, the fitting 260 may be configured to provide the liquid material (e.g., from the material supply source 230 to the chamber 210 (e.g., to the flexible bag dispensing container 100 disposed therein). In some examples, the fitting 260 extends into just the first end 106 of the flexible bag dispensing container 100, such as into, but not beyond, an end of the faceplate 110b. In preferred examples, the fitting 260 extends into, but not beyond, the port 110 or nosepiece 110d of the flexible bag dispensing container 100.

[0053] Generally, the fitting 260 interfaces with the flexible bag dispensing container 100 so as to be sealingly connected therewith. In examples, the fitting 260 may engage with or otherwise interface with the flexible bag dispensing container 110 with a seal disposed therebetween. For example, as described above and illustrated in FIG. 7 and FIG. 12, the faceplate 110b or another portion of the flexible bag dispensing container 100 may include a seal 110c that engages with or otherwise interfaces with the fitting 260 to provide a substantially fluid-tight seal, thereby sealingly connecting the fitting 260 and the flexible bag dispensing container 100. The seal 110c may be defined at an inner surface of the port 110 of the flexible bag dispensing container 100. As a result, leakage of air and/or liquid material between the

fitting 260 and the flexible bag dispensing container 100 may be prevented during introduction into the flexible bag dispensing container 110 via the fitting 260.

[0054] The filling system 200 can comprise the fitting 260. The fitting 260 can define a fill tube that is configured to be received in the port 110 of the flexible bag dispensing container 100. However, the fitting 260 may generally be provided in any suitable size, shape, form, and/or material to suit a particular application. As will be appreciated by those skilled in the art, in certain examples, the fitting 260 may be omitted and the flexible bag dispensing container 100 and the material supply source 230 may be in fluid communication with one another by being directly connected to one another. For example, the material supply source 230 may be directly and removably connected to the flexible bag dispensing container 100, such as by being directly and removably coupled to the port 110 of the flexible bag dispensing container 100. In certain examples, the method can comprise a step of pre-charging the fitting 260 or at least a portion thereof with the liquid material, prior to fluidly coupling the fitting 260 to the flexible bag dispensing container 100. Pre-charging the fitting 260 with the fluid material can limit, or prevent altogether, the introduction of air from the fitting 260 into the flexible bag dispensing container 100. With continued reference to FIG. 13, at step 1302A, a pressure differential may be created between the flexible bag dispensing container 100 and the chamber 210. In examples, the pressure differential may be created between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210. The pressure differential between the flexible bag dispensing container 100 and the chamber 200 may generally be such that the flexible bag dispensing container 100 has an internal pressure that is lower than an internal pressure of the cavity 212 of the chamber 210. Such a pressure differential may thereby collapse the flexible wall 130 of the flexible bag dispensing container 100, such as is illustrated in FIG. 6. The collapsing of the flexible wall 130 of the flexible bag dispensing container 100 may, in turn, cause gas entrapped within the interior space 120 of the flexible bag dispensing container 100 to be expelled therefrom. As described herein, collapsing of the flexible wall 130 of the flexible bag dispensing container 100 to expel gases entrapped within the interior space 120 of the flexible bag dispensing container 100 therefrom (e.g., in step 1302A) may be performed prior to sealingly engaging the flexible bag dispensing container 100 with the fitting 260 (e.g., in step 1303), which may assist in ensuring that any gases that are or were entrapped in the flexible bag dispensing container 100 are not introduced to the fitting 260 and/or another part of the fill line of the filling system 200. For example, prior to inserting the chamber 210 into the fitting system 200 and/or prior to sealingly connecting the chamber 210 or flexible bag

dispensing container 100 to the filling system 200, such as to the fitting 260 thereof (e.g., in step 1303), the flexible wall 130 of the flexible bag dispensing container 100 may be collapsed from an expanded state, such as illustrated in FIG. 5A, to a collapsed state, such as is illustrated in FIG. 5B (e.g., in step 1302A). As described herein, collapsing of the flexible wall 130 of the flexible bag dispensing container 100 may be accomplished by applying a positive pressure between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 and/or applying a suction to the interior space 120 of the flexible bag dispensing container 100.

[0055] As described herein, step 1303 may include inserting the chamber 210 (e.g., with the flexible bag dispensing container 100 disposed therein) into the filling system 200. Inserting the chamber 210 into the filling system 200 may, in certain examples, including moving the chamber 210 relative to the filling system 200. In such examples, the chamber 210 may be moved onto the fitting 260 of the filling system 200. The chamber 210 (e.g., the flexible bag dispensing container 100 disposed therein) may be sealingly connected to the filling system 200 (e.g., to the fitting 260 thereof). In alternative examples, inserting the chamber 210 into the filling system 200 may include moving the filling system 200 or a portion thereof relative to the chamber 210. In such examples, the fitting 260 may be moved so as to be at least partially inserted into the chamber 210. Again, the chamber 210 (e.g., the flexible bag dispensing container 100 disposed therein) may be sealingly connected to the filling system 200 (e.g., to the fitting 260 thereof).

[0056] As illustrated in FIG. 8A and FIG. 9A, the chamber 210 may define a fill port 202. The fill port 202 may, in certain examples, be positioned between the movable stop 214 and the second end 210b of the chamber 210 (i.e., on the same side of the movable stop 214 as the cavity 212 of the chamber 210). The fill port 202 may extend through a wall of the chamber 210 so as to facilitate the introduction and/or exhaustion of air between the cavity 212 of the chamber 210 and an exterior of the chamber 210. An air movement system 270 may be in fluid communication with the fill port 202 (refer to FIG. 8A), as described below. In examples, the air movement system 270 may be configured to introduce a positive pressure via the fill port 202. The pressure introduced via the fill port 202 may generally be applied to the cavity 212 of the chamber 210 (e.g., between the movable stop 214 and the second end 210b of the chamber 210). Pressure introduced to the chamber 210 (e.g., to the cavity 212 thereof) to collapse the flexible bag dispensing container 100 (e.g., the flexible wall 130 thereof) may be introduced via the fill port 202 in direct fluid communication with the cavity 212 of the chamber 210.

[0057] The filling system 200 may include an air movement system 270. In examples, creation of the pressure differential may be accomplished by the air movement system 270, such as a building air supply system, an air compressor, or a pump. The air movement system 270 may be in fluid communication with the cavity 212 of the chamber 210 (refer to FIG. 8A, for example) and/or the interior space 120 of the flexible bag dispensing container 100 (refer to FIG. 12, for example). In such examples, the air movement system 270 may include a vacuum pump. In some examples, the air movement system 270 may be in fluid communication with the chamber 210 (e.g., via fill port 202) and may be configured to apply a pressure (e.g., a positive pressure) thereto (e.g., to the cavity 212 thereof). In such examples, a positive pressure may be applied (e.g., by the air movement system 270) to the cavity 212 of the chamber 210 (e.g., via fill port 202) that is greater than an internal pressure of the interior space 120 of the flexible bag dispensing container 100, thereby collapsing the flexible wall 130 of the flexible bag dispensing container 100.

[0058] In examples, the pressure differential may quickly collapse the flexible wall 130 of the flexible bag dispensing container 100. By way of non-limiting example, the pressure differential may collapse the flexible wall 130 of the flexible bag dispensing container 100 in about one second or less. In certain examples, the flexible wall 130 of the flexible bag dispensing container 100 may be quickly collapsed and/or collapsed such that the opposing sides 130a, 130b of the flexible wall 130 of the flexible bag are brought toward one another during collapsing (compare, for example, to FIG. 1A and FIG. 1C), as contrasted with accordion-style flexible bag dispensing containers in which the flexible wall thereof is collapsed from one end to an opposite end. The flexible walls of conventional accordion-style flexible bag dispensing containers are generally collapsed in a slower and more gradual and controlled manner to ensure that the bags collapsed end-to-end in an accordion-style manner and to ensure that the walls thereof do not crack because such walls are typically made of an aluminum or similar material that is susceptible to cracking during quick and/or side-to-side collapsing; as a consequence, such conventional accordion-style flexible bag dispensing containers must generally be gradually collapsed as described above (i.e., from end-to-end). The positive pressure applied to the cavity 212 of the chamber 210 may be of any suitable value and/or from any suitable source to suit a particular application. By way of non-limiting example, the positive pressure applied to the cavity 212 of the chamber 210 may be from about 5 to about 10 psig and/or from about 5 to about 10 psi greater than the internal pressure of the interior space 120 of the flexible bag

dispensing container 100, though this value could vary with different flexible bag dispensing containers, chambers, and/or applications.

[0059] In other examples, the air movement system 270 may be in fluid communication with the flexible bag dispensing container 100 and may be configured to apply a suction thereto (e.g., to the interior space 120 thereof), such as is illustrated in FIG. 12. In such examples, a suction may be applied (e.g., by the air movement system 270) to the interior space 120 of the flexible bag dispensing container 100 (e.g., by creating a vacuum or partial vacuum within the interior space 120 of the flexible bag dispensing container 100), such that the interior space 120 of the flexible bag dispensing container 100 has an internal pressure that is less than a pressure outside of the flexible bag dispensing container 100 and within the cavity 212 of the chamber 210, thereby collapsing the flexible wall 130 of the flexible bag dispensing container 100. In examples, the suction may be applied (e.g., by the air movement system 270) to the interior space 120 of the flexible bag dispensing container 100 (e.g., by creating a vacuum or partial vacuum within the interior space 120 of the flexible bag dispensing container 100) prior to inserting the chamber 210 into the filling system 200 and/or prior to sealingly connecting the chamber 210 or flexible bag dispensing container 100 to the filling system 200 (e.g., the fitting 260 thereof). As will be appreciated by those skilled in the art, the air movement system 270 illustrated in FIG. 12 and described as being configured to apply a suction to the flexible bag dispensing container 100 may be the same or a different air movement system as described elsewhere herein, such as air movement system 270 illustrated in FIG. 8A. For example, the air movement system 270 may include an air movement device (e.g., a pump) configured to apply a positive pressure between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 (e.g., via port 202), another air movement device (e.g., a vacuum pump) configured to apply a suction to the interior space 120 of the flexible bag dispensing container 100, and another air movement device (e.g., a pump) configured to apply air pressure between the movable stop 214 and the first end 210a of the chamber 210 (e.g., via port 204).

[0060] As illustrated in FIG. 12, the filling system 200 may include a port 206. The port 206 may be disposed adjacent to the second end 210b of the chamber 210. The port 206 may be in fluid communication with an air chamber 208 of the filling system 200. In some examples, the port 206 and/or the air chamber 208 can be defined between the faceplate 110b of the flexible bag dispensing container 100 and the chamber 210. The filling system 200 is configured to selectively place the port 206 and the air chamber 208 in fluid communication with

the port 110 of the flexible bag dispensing container 100. The air chamber 208 may receive air introduced via the port 206. The air movement system 270 may be in fluid communication with the port 206, such that the air chamber 208 may discharge air to the air movement system 270 via the port 206. In examples, the fitting 260 may extend through the air chamber 208 and may be sealingly connected to the chamber 210 and/or the flexible bag dispensing container 100 for the introduction of the liquid material into the interior space 120 of the flexible bag dispensing container. In examples, such as illustrated in FIG. 12, at least a partial vacuum may be created within the interior space 120 of the flexible bag dispensing container 100. The air movement system 270 may be configured to create the at least partial vacuum. The at least partial vacuum may be created by drawing air from the flexible bag dispensing container 100 out of the port 206. The at least partial vacuum may, in examples, be created by sealingly connecting the chamber 210 to the fitting 260 prior to sealingly engaging the fitting 260 with the flexible bag dispensing container 100 (e.g., at step 1303), such as is illustrated in FIG. 12. As suction is applied to the interior space 120 of the flexible bag dispensing container 100, the flexible bag dispensing container 100 will be in the unexpanded or at least partially collapsed state or configuration. Once the flexible bag dispensing container 100 is in the unexpanded or at least partially collapsed state or configuration, the fitting 260 may be moved into sealing engagement with the flexible bag dispensing container 100 (e.g., the port 110 thereof), with the port 206 and/or the air chamber 208 no longer in fluid communication with the flexible bag dispensing container 100 (e.g., the port 110 thereof).

[0061] Once a desired degree of collapsing has occurred, the flexible bag dispensing container 100 may be sealingly engaged with the fitting 260, such as is illustrated in FIG. 7 and FIG. 8A. The suction (e.g., the vacuum pressure in the fitting 260) may then be ceased and/or switched to exhaust and the flexible bag dispensing container 100 may be filled with the liquid material as described herein. In one example, the fitting 260 can be configured to move relative to the chamber 210 so as to move into (e.g., and out of) sealing engagement with the flexible bag dispensing container 100. The suction applied to the interior space 120 of the flexible bag dispensing container 100 (e.g., via creation of at least a partial vacuum within the interior space 120 of the flexible bag dispensing container 100) may be of any suitable value and/or by any suitable technique to suit a particular application. By way of non-limiting example, the suction created within the interior space 120 of the flexible bag dispensing container 100 may cause the internal pressure of the interior space 120 of the flexible bag dispensing container to be from about 2 to about 3 psia and/or from about 11 to about 13 psi less than the internal pressure of the

cavity 212 of the chamber 210 (e.g., outside of the flexible bag dispensing container 100), though this value could vary with different flexible bag dispensing containers, chambers, and/or applications.

[0062] As will be appreciated by those skilled in the art, creation of the pressure differential may be accomplished by a combination of each of the foregoing examples as well. That is, in certain examples, a positive pressure may be applied between the outer surface of the flexible bag dispensing container 100 and the inner surface of the cavity 212 of the chamber 210 and/or a suction may be created within the interior space 120 of the flexible bag dispensing container 100, thereby collapsing the flexible wall 130 of the flexible bag dispensing container. As described herein, creating the pressure differential and collapsing the flexible wall 130 of the flexible bag dispensing container 100 may advantageously expel gas entrapped within the interior space 120 from the flexible bag dispensing container 100.

[0063] In examples, the filling system 200 may include a valve 220, such as is illustrated in FIG. 6. The valve 220 may, in certain examples, be connected to the material supply source 230 and/or the filling system 200 (e.g., the fitting 260 thereof). In examples, the valve 220 may interconnect the material supply source 230 and the fitting 260. The valve 220 may be in fluid communication with the flexible bag dispensing container 100 (e.g., the interior space 120 thereof). In examples, the valve 220 may be sealingly connected to the flexible bag dispensing container 100 by the fitting 260. Step 1302A may include operating the valve 220 to create the pressure differential between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210. The valve 220 may be configured to shut off pressure between the material supply source 230 (e.g., when the chamber 210 is pressurized) and the flexible bag dispensing container 100, such as is illustrated in FIG. 7. By way of non-limiting example, the valve 220 may be a high-pressure valve, such as an EFD 736HPA series valve from Nordson Corporation of Westlake, Ohio.

[0064] With reference back to FIG. 2, the system 200 further includes a material supply source 230. Generally, the material supply source 230 may contain the liquid material to be dispensed into the flexible bag dispensing container 100. The material supply source 230 may generally be made of any material suitable for containing the liquid material therein. The material supply source 230 may be in fluid communication with the flexible bag dispensing container 100 (e.g., via the fitting 260).

[0065] With reference again to FIG. 13, in step 1304, the liquid material is dispensed into the flexible bag dispensing container 100. In examples, the liquid material can be dispensed

from the material supply source 230 by operating a pump (e.g., a pump of the material supply source 230) and/or otherwise pressurizing the material supply source 230. The liquid material may be dispensed into the flexible bag dispensing container 100 while the pressure differential is created and/or maintained between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 so as to at least partially fill the interior space 120 of the flexible bag dispensing container 100 with the liquid material. In examples, the internal pressure of the interior space 120 of the flexible bag dispensing container 100 may generally increase as the liquid material is dispensed therein. For example, in certain examples in which the liquid material is dispensed into the flexible bag dispensing container 100 under pressure (e.g., the material supply source 230 is pressurized), the internal pressure of the interior space 120 of the flexible bag dispensing container 100 may become greater than the internal pressure of the cavity 212 of the chamber 210 (e.g., outside of the flexible bag dispensing container 100), thereby resulting in the liquid material being dispensed under pressure causing the flexible bag dispensing container 100 to expand.

[0066] FIG. 8A depicts the flexible bag dispensing container 100 in the collapsed and unfilled state, and FIG. 9A depicts the flexible bag dispensing container 100 after being at least partially filled with the liquid material while the pressure differential is created and/or maintained between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210. Generally, to effect dispensing of the liquid material into the flexible bag dispensing container 100, the liquid pressure may exceed the pressure within the cavity 212 of the chamber 210 (i.e., outside of the flexible bag dispensing container 100). As described herein, the liquid material may be dispensed from the material supply source 230. In examples, the liquid material may be dispensed through the port 110 of the flexible bag dispensing container 100 and into the interior space 120 thereof. Generally the liquid material may be dispensed into the flexible bag dispensing container 100 (e.g., by being provided from the material supply source 230) with sufficient pressure to overcome the internal pressure of the chamber 210 and/or the friction in the flow path so as to dispense the liquid material into the flexible bag dispensing container 100 at a desired flow rate. As described above, in order to effect dispensing of the liquid material for filling the flexible bag dispensing container 100, the flexible bag dispensing container 100 may be sealingly connected to the fitting 260. In examples, the faceplate 110b (e.g., the port 110 defined thereby) of the flexible bag dispensing container 100 may be sealingly connected to the fitting 260. As described above, the fitting 260 may at least partially extend into the flexible bag dispensing container 100 (e.g., into the interior

space 120 thereof) and may interface with the flexible bag dispensing container 100 so as to be sealingly connected therewith. As described above, in certain examples, the fitting 260 or at least a portion thereof may be pre-charged with the liquid material. Pre-charging the fitting 260 or at least a portion thereof may help to ensure that air is not undesirably introduced into the interior space 120 of the flexible bag dispensing container 100 prior to and/or during filling of the flexible bag dispensing container 100 with the liquid material.

[0067] As the liquid material is dispensed into the flexible bag dispensing container 100, step 1305 may be executed and a fill level or volume of the flexible bag dispensing container (i.e., the level or volume of the liquid material present within the interior space 120 of the flexible bag dispensing container 100) may be detected. Detecting the fill level or volume of the flexible bag dispensing container 100 may provide for a more repeatable fill (e.g., to a consistent fill level). In certain examples, the filling system 200 may be configured such that when one of the flexible bag dispensing container 100 has been filled to a desired level, the filling system 200 may be configured to automatically cease dispensing liquid material and/or to relieve pressure or cease applying pressure to the chamber 210. In examples in which multiple chambers 210 are provided, one chamber 210 may be in a filling mode (e.g., the liquid material is being dispensed into the flexible bag dispensing container 100 disposed therein), and one or more other chambers 210 may be loaded or unloaded to the filling system 200, either automatically or by an operator, without concern that the flexible bag dispensing container 100 within the chamber 210 in the filling mode will be overfilled with the liquid material beyond a desired fill level. In other examples, the filling system 200 may be operated manually and the operator may manually cease dispensing liquid material and/or relieve pressure or cease applying pressure to the chamber 210 once the liquid material in the corresponding flexible bag dispensing container reaches a desired fill level. In such examples, a determination that the desired fill level has been reached may be made by the operator by identifying that the flexible bag dispensing container 100 has reached (e.g., by expansion) a fill line present on the chamber 210 or another part of the filling system 200, although other examples of the disclosure are not so limited. In further examples, the filling system 200 may be fully automated and may be configured to automatically load, fill, and/or unload chambers 210 and corresponding flexible bag dispensing container 100 as necessary or desired.

[0068] Alternatively or in addition to detecting the fill level or volume of the flexible bag dispensing container 100, a metered shot approach may be employed to achieve a consistent fill level. In such examples, the material supply source 230 may be preloaded with a

predetermined volume of the liquid material. The predetermined volume may be chosen to correspond to an internal volume of the flexible wall 130 (e.g., to the volume of the interior space 120). For example, the predetermined volume of liquid material preloaded into the material supply source 130 may be substantially equal to the internal volume of the flexible wall 130. As such, dispensing step 1304 may be carried out until all, or substantially all, of the predetermined volume of the liquid material in the material supply source 230 is dispensed into the flexible bag dispensing container 100. In such examples, the preloaded material supply source 230 may be a positive displacement pump or other metering pump. Employing such a preloaded material supply source 230 helps to ensure that a desired fill level may be achieved for a given flexible bag dispensing container 100. The internal volume of the flexible wall 130 of the flexible bag dispensing container 100 and/or the predetermined volume of the liquid material in the material supply source 230 may be preprogrammed into the controller 205.

[0069] Alternatively or in addition to the previously-described metered shot approach, the liquid material may be dispensed into the flexible bag dispensing container 100 until a desired and/or predetermined fill level has been reached. Generally, the predetermined fill level may be chosen to correspond to an internal volume of the flexible wall 130 (e.g., to the volume of the interior space 120). In other examples, the liquid material may be dispensed into the flexible bag dispensing container 100 for a desired and/or predetermined amount of time. Generally, the predetermined amount of time may be chosen to correspond to an internal volume of the flexible wall 130 (e.g., to the volume of the interior space 120). In such examples, dispensing of the liquid material into the flexible bag dispensing container 100 may be manually (e.g., by an operator) or automatically ceased when the predetermined fill level has been reached and/or when the predetermined amount of time has elapsed. Dispensing the liquid material into the flexible bag dispensing container until the fill level has been reached and/or for a predetermined amount of time helps to ensure that a desired fill level may be achieved for a given flexible bag dispensing container 100. In such examples in which the liquid material may be dispensed into the flexible bag dispensing container 100 for a desired and/or predetermined amount of time, it may be desirable to predetermine the volumetric flow rate of the liquid material.

[0070] Prior to the fill level reaching the predetermined fill level, the pressure differential can be created or maintained between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210, thereby collapsing the flexible wall 130 of the flexible bag dispensing container 100. As described herein, the pressure

differential may be created or maintained by applying or maintaining a positive pressure between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210. Subsequently, when the fill level reaches the predetermined fill level, the positive pressure may be removed from between the flexible bag dispensing container 100 and the cavity 212 of the chamber 210. As described herein, the liquid material may be dispensed into the interior space 120 of the flexible bag dispensing container 100 at a pressure sufficient to overcome both the friction in the flow path of the filling system 200 and the collapsing pressure of the flexible bag dispensing container 100, thereby enabling the filling system 200 to dispense the liquid material into the interior space 120 of the flexible bag dispensing container 100 at a desired flow rate. During filling of the interior space 120 of the flexible bag dispensing container 100 with the liquid material, the internal pressure of the interior space 120 of the flexible bag dispensing container 100 may generally become greater than the internal pressure of the cavity 212 of the chamber 210, thereby causing the flexible bag dispensing container 100 to expand and be filled with the liquid material.

[0071] As described herein, the fill level of the flexible bag dispensing container 100 may be manually determined by an operator, such as by identifying when the flexible bag dispensing container 100 (e.g., the flexible wall 130 thereof) has reached (e.g., by expansion) a fill line present on the chamber 210 or the flexible bag dispensing container (e.g., in examples in which the chamber 210 and/or flexible wall of the flexible bag dispensing container 100 is transparent) or another part of the filling system 200, although other examples of the disclosure are not so limited. Alternatively or in addition to the previously-described manual processes, the filling system 200 may be configured to automatically detect the fill level. Similarly, once the predetermined fill level has been reached, the filling system 200 may be configured to automatically relieve pressure used to create the pressure differential and/or cease dispensing of the liquid material.

[0072] The filling system 200 may employ any of a variety of features to aid in determining the fill level of the flexible bag dispensing container 100. For example, as illustrated in FIG. 5A and FIG. 5B, a movable stop 214 may be disposed in sealing engagement within the chamber 210. The movable stop 214 may be disposed proximate the first end 210a of the chamber 210. In examples, the movable stop 214 may generally be disposed at or adjacent to one end of the cavity 212 of the chamber 210. Generally, the movable stop 214 may be configured to travel along the longitudinal axis 211 of the chamber 210 toward the first end 210a thereof (e.g., along shoulder bolt 216). The movable stop 214 may be configured to move (e.g.,

slide along shoulder bolt 216) upon being contacted by the flexible bag dispensing container 100, such as when the flexible bag dispensing container 100 expands toward the first end 210a of the chamber 210 as illustrated in FIG. 5A and FIG. 9B. Conversely, when the flexible bag dispensing container 100 is in the collapsed or nonexpanded state, the movable stop 214 is not contacted within the chamber 210 as illustrated in FIG. 5B and FIG. 8B (e.g., does not move or slide along shoulder bolt 216).

[0073] While the pressure differential is created and/or maintained between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210, and prior to the liquid material being dispensed into the flexible bag dispensing container 100, the movable stop 214 may generally be at its minimum distance from the second end 210b of the chamber 210 (e.g., at its maximum distance from the first end 210a of the chamber 210) along the longitudinal axis 211. In some examples, the movable stop 214 may be urged or biased away from the first end 210a of the chamber 210 by a pressure applied between the movable stop 214 and the first end 210a of the chamber 210 (i.e., applied on an opposite side of the movable stop 214 from the cavity 212 of the chamber 210). As illustrated in FIG. 8A and FIG. 9A, the chamber 210 may define a fill port 204. The fill port 204 may, in certain examples, be positioned between the movable stop 214 and the first end 210a of the chamber 210 (i.e., on the opposite side of the movable stop 214 as the cavity 212 of the chamber 210). The fill port 204 may extend through a wall of the chamber 210 so as to facilitate the introduction and/or exhaustion of air between the space defined between the movable stop 214 and the first end 210a of the chamber 210 and an exterior of the chamber 210. The filling system 200 may include an air movement system 270 in fluid communication with the fill port 204 (refer to FIG. 9A). The air movement system 270 may be configured to apply a positive pressure via the fill port 204. In examples, the fill port 204 may be positioned between the movable stop 214 and the first end 210a of the chamber 210 (i.e., on an opposite side of the movable stop 214 from the cavity 212 of the chamber 210). The fill port 204 may extend through a wall of the chamber 210 so as to facilitate the introduction and/or removal of air between a portion of the chamber 210 defined between the movable stop 214 and the first end 210a of the chamber 210 and an exterior of the chamber 210. The air movement system 270 may be in fluid communication with the fill port 204. In examples, the air movement system 270 may be configured to introduce a positive pressure via the fill port 204. As will be appreciated by those skilled in the art, the air movement system 270 illustrated in FIG. 8A and described as being configured to apply a positive pressure between the movable stop 214 and the first end 210a of the chamber 210 via the fill port 204

may be the same or a different air movement system as described above, such as air movement system 270 illustrated in FIG. 12. For example, as described above, the air movement system 270 may include an air movement device (e.g., a pump) configured to apply a positive pressure between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 (e.g., via port 202), another air movement device (e.g., a vacuum pump) configured to apply a suction to the interior space 120 of the flexible bag dispensing container 100, and another air movement device (e.g., a pump) configured to apply air pressure between the movable stop 214 and the first end 210a of the chamber 210 (e.g., via port 204).

[0074] The pressure introduced via the fill port 204 (e.g., by the air movement system 270) may generally be applied between the movable stop 214 and the first end 210a of the chamber 210. Such pressure may be greater than an internal pressure of the cavity 212 of the chamber 210, thereby causing the movable stop 214 to be urged or biased away from the first end 210a of the chamber 210 and to cause the movable stop 214 to remain stationary under the applied pressure until contacted by the flexible bag dispensing container 100 as described below. By way of non-limiting example, a positive pressure applied between the movable stop 214 and the first end 210a of the chamber 210 may be from about 10 to about 15 psi (as compared to a pressure of about 5 psi through fill port 202). Generally, the positive pressure applied between the movable stop 214 and the first end 210a of the chamber 210 may be sufficient to overcome the pressure causing the flexible wall 130 of the flexible bag dispensing container 100 to collapse, to overcome piston friction (e.g., friction between the movable stop 214 and the wall of the chamber 210), and to provide a force to resist movement of the movable stop 214 upon initial contact by the flexible bag dispensing container 100. Alternatively or in addition to the application of a pressure as described above, the movable stop 214 may be urged or biased away from the first end 210a of the chamber 210 due to gravitational forces, magnetic forces, biasing forces of a spring, and/or other biasing techniques known in the art. As illustrated in FIG. 8A and FIG. 8B, when the flexible bag dispensing container 100 is in the collapsed or nonexpanded state, the movable stop 214 moves away from the first end 210a of the chamber 210 (i.e., toward the port 110 of the flexible bag dispensing container 100). The extent of the travel of the movable stop 214 along the longitudinal axis 211 and toward the second end 210b of the chamber (e.g., away from the first end 210a of the chamber 210) may be limited by a shoulder bolt 216 as shown in Fig. 9B or other stop.

[0075] Once the movable stop 214 has traveled to its minimum distance from the second end 210b of the chamber 210 (e.g., its maximum distance from the first end 210a of the

chamber 210) along the longitudinal axis 211, a positive pressure may be applied to the material supply source 230 for dispensing the liquid material into the flexible bag dispensing container 100. By way of non-limiting example, the positive pressure applied to the material supply source 230 for dispensing the liquid material into the flexible bag dispensing container 100 may be from about 50 to about 10,000 psi as long as the equipment being used is rated to withstand such pressures. As the liquid material is dispensed into the flexible bag dispensing container 100, the flexible bag dispensing container 100 generally expands toward the first end 210a of the chamber 210. As the flexible bag dispensing container 100 is filled and expands, the flexible bag dispensing container 100 will contact the movable stop 214, thereby causing the movable stop 214 to move toward the first end 210a of the chamber 210 (i.e., away from the port 110 of the flexible bag dispensing container 100), as illustrated in FIG. 9A and FIG. 9B. As the flexible bag dispensing container 100 is filled, expands, and contacts the movable stop 214, the movable stop 214 is generally caused to move toward the first end 210a of the chamber 210 (e.g., away from the second end 210b of the chamber 210), thereby increasing the distance between the movable stop 214 and the second end 210b of the chamber 210.

[0076] Movement of the movable stop 214 toward the first end 210a of the chamber 210 may generally coincide with filling and expansion of the flexible bag dispensing container 100 (e.g., expansion toward the first end 210a of the chamber 210). As the movable stop 214 is moved toward the first end 210a of the chamber 210, the movable stop 214 will eventually reach a point along the longitudinal axis 211 corresponding to the desired and/or predetermined fill level of the flexible bag dispensing container 100. In examples, the filling system 200 may include a sensor holder 218 supporting a sensor (not shown) configured to detect movement of the movable stop 214. The sensor may detect when the movable stop 214 has travelled to the point along the longitudinal axis 211 corresponding to the desired and/or predetermined fill level of the flexible bag dispensing container 100. The sensor may be any suitable technique for detecting movement of the movable stop 214. By way of non-limiting example, the sensor may be a Hall effect sensor and the movable stop 214 may include a magnet to facilitate tripping of the sensor (i.e., to indicate that the predetermined fill level has been reached). By way of further non-limiting example, movement of the movable stop 214 of about 0.25 inches or greater along the longitudinal axis 211 toward the first end 210a of the chamber 210 may cause the sensor to trip.

[0077] In examples, once the filled and expanded flexible bag dispensing container contacts the movable stop 214 and causes the movable stop 214 to move and trip the sensor, the

positive pressure being applied between the movable stop 214 and the first end 210a of the chamber 210 may be switched to vacuum pressure, such as about 26.5 inHg, so as to retract the movable stop 214. The vacuum pressure may generally be sufficient to overcome piston friction (e.g., friction between the movable stop 214 and the wall of the chamber 210). Once the sensor is tripped, the pressure applied to create the pressure differential between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 may be ceased or relieved (e.g., by going to exhaust). Once the sensor is tripped, the pressure applied to dispense the liquid material (if any) may also be ceased or relieved (e.g., by going to exhaust), such as by closing the valve 220. In examples, the timing of ceasing or relieving the foregoing pressures may be simultaneous or may be staggered in certain applications depending on the rheology of the liquid material being dispensed. For example, ceasing or relieving the pressure applied to dispense the liquid material (if any) may be delayed by about 0.3 seconds.

[0078] After the pressures are removed as described above, the clamp 203 of the filling system 200 may be released, and the chamber 210 can be removed from the fixture. As described herein, the chamber 210 may be removed (e.g., from the filling system 200) manually or automatically. The chamber 210 may generally be removed from the filling system 200 prior to step 1306. The flexible bag dispensing container 100 may then be removed from the fitting 260, as illustrated in FIG. 10. As described herein, the flexible bag dispensing container 100 may be removed from the fitting 260 manually or automatically. The flexible bag dispensing container 100 may generally be removed from the fitting 260 prior to step 1306. Upon removal from the system 200, the chamber 210 may be rotated (e.g., 180°) back to its original loading orientation, illustrated in FIG. 11. To remove the flexible bag dispensing container 100 from the chamber 210, the fasteners 215 (if any) may be released. As desired or necessary, step 1307 may be executed to apply a positive pressure between the interior space 120 of the flexible bag dispensing container 100 and the cavity 212 of the chamber 210 to facilitate removal of the flexible bag dispensing container 100 from the chamber 210.

[0079] With reference again to FIG. 13, after the dispensing step 1305 is completed (e.g., when the predetermined fill level is reached), the flexible bag dispensing container 100 may be closed in step 1306. As illustrated in FIG. 10, the flexible bag dispensing container 100 (e.g., the port 110 thereof) may be sealed with a cap 110a so as to prevent the liquid material from discharging therethrough until it is desirable to dispense or otherwise discharge the liquid material (e.g., via the port 110). It is to be understood that, in alternative examples, step 1306

may be performed (if at all) after step 1308. In examples in which step 1307 is performed, step 1306 may generally be performed prior to step 1307 and/or step 1308.

[0080] At step 1308, the flexible bag dispensing container 100 may be removed from the chamber 210. As described herein, the flexible bag dispensing container 100 may be removed from the chamber 210 manually or automatically. Thereafter, a new flexible bag dispensing container may be inserted into the chamber 210 (e.g., manually or automatically) and the process may be repeated for filling the new flexible bag dispensing container.

[0081] As described herein, expelling gas entrapped within the interior space 120 of the flexible bag dispensing container 100 prior to filling the flexible bag dispensing container 100, sealingly connecting the flexible bag dispensing container 100 in fluid communication with the material supply source 230 (e.g., via the fitting 260), and/or creating and maintaining the pressure differential during dispensing of the liquid material into the flexible bag dispensing container 100 helps to minimize the risk of entrapping gas within the flexible bag dispensing container 100 during filling. As also described herein, providing a translucent chamber 210, a movable stop 214, and/or a sensor helps to provide a repeatable fill (e.g., to a consistent fill level).

[0082] Although the filling system 200 is shown with a particular orientation and the flexible bag dispensing container 100 is inserted into the chamber 210 in a corresponding orientation, it is to be understood that the filling system 200 and/or the chamber 210 could be oriented in any number of a variety of different configurations. For example, the filling system 200 may be configured with the chamber 210 oriented vertically, and the flexible bag dispensing container 100 could be filled by dispensing the liquid material into the flexible bag dispensing container 100 from above or below the flexible bag dispensing container 100 (i.e., with the port 110 at the first end 106 of the flexible bag dispensing container 100 positioned above or below the second end 108 of the flexible bag dispensing container 100). In other examples, the filling system 200 may be configured with the chamber 210 oriented horizontally, and the flexible bag dispensing container 100 could be filled by dispensing the liquid material into the flexible bag dispensing container 100 from one side or the other of the flexible bag dispensing container 100 (i.e., with the port 110 at the first end 106 of the flexible bag dispensing container 100 positioned to the right or to the left of the second end 108 of the flexible bag dispensing container 100). In certain applications, such as with the use of high viscosity liquid materials, it may be useful to orient the chamber 210 substantially vertically and fill the flexible bag dispensing container 100 from above by dispensing the liquid material into the flexible bag dispensing container 100 from

above the flexible bag dispensing container 100 so as to take advantage of gravitational forces during the filling operation.

[0083] In certain examples described herein, the flexible bag dispensing container or flexible bag dispensing container 100 may include one or more vents 150. Generally, the vent(s) 150 may be configured to permit gases entrapped in the interior space 120 to discharge therethrough (e.g., to the exterior 122 of the flexible bag dispensing container 100). In examples in which the flexible bag dispensing container 100 is disposed within the cavity 212 of a chamber 210 as described herein, the vent(s) 150 may be configured to permit gases entrapped in the interior space 120 to discharge therethrough into the cavity 212 of the chamber 210. In certain examples, the vent(s) 150 may be configured to permit the entrapped gases to discharge therethrough without permitting the liquid material to discharge therethrough. In certain examples, the vent(s) 150 may be configured to be sealed closed after permitting the entrapped gases to discharge therethrough (e.g., after the flexible bag dispensing container 100 is removed from the chamber 210). In such examples, the vent(s) 150 may be sealed closed by any suitable technique, such as by applying heat or pressure or both, by crimping, and/or by applying ultrasonic vibration to sealingly close the vent(s) 150. In other examples, the vent(s) 150 may remain open after the flexible bag dispensing container 100 is at least partially filled with the liquid material. In such examples, the vent(s) 150 may be of a size and shape that permits gases to pass through the vents without permitting the liquid material to pass therethrough. The size and/or the shape of the vent(s) 150 may be determined based on a viscosity of the liquid material. For example, higher viscosity materials are generally thicker than lower viscosity materials and hence flow more slowly than lower viscosity materials. As a result, the vent(s) 150 may have a larger cross-sectional dimension for liquid materials having higher viscosities than for liquid materials having lower viscosities.

[0084] As desired, the vent(s) 150 may be open or closed after the flexible bag dispensing container 100 is at least partially filled with the liquid material, such as depending on the chemistry and/or rheology of the liquid material. Some liquid materials may effectively self-seal when exposed to air and/or some liquid materials may have a viscosity that is so high that such liquid materials are incapable of discharging through the vent(s) 150 to the exterior 122 of the flexible bag dispensing container 100. The vent(s) 150 may generally be formed by any suitable technique. By way of non-limiting example, when one or more of the vents 150 is defined by and/or in the seal 140, such vent(s) 150 may be formed by selectively preventing the

application of heat and/or pressure in one or more discrete areas of the seal 140, thereby defining the one or more vents 150.

[0085] In certain examples of the flexible bag dispensing container 100 in which multiple vents 150 are provided, each of the multiple vents 150 may be similarly structured. However, it is to be understood that in examples of the flexible bag dispensing container 100 in which multiple vents 150 are provided, the vents 150 need not be structurally similar to one another. For example, the flexible bag dispensing container 100 may, in certain examples, include multiple vents 150, any one or more of which may be structured as desired.

[0086] The vent(s) 150 may be of any suitable size, shape, and/or number to suit a particular application. By way of non-limiting example, the flexible bag dispensing container 100 may include one, two, three, or four or more vents 150. By way of further non-limiting example, the vent(s) 150 may have a length of at least 9mm, as measured from an inlet 156 to an outlet 158 of the vent(s) 150. By way of further non-limiting example, the vent(s) 150 may have a cross-sectional dimension (e.g., a width) of from about 1mm to about 2.5mm, including a cross-sectional dimension of at least 1.5mm.

[0087] FIG. 14A and FIG. 14B show a flexible bag dispensing container 100' according to one example in which the flexible bag dispensing container 100' includes vents 150. In the example illustrated in FIG. 14A and FIG. 14B, the flexible bag dispensing container 100' includes three vents 150a, 150b, and 150c. In this example, the vents 150a-150c extend through the seal 140 and are defined by (i.e., formed in) the seal 140, although other examples are not so limited. For the sake of clarity and brevity, in this example, only the particulars of vent 150a are labeled and described, though it is to be understood that vents 150b, 150c may have a similar structure and/or function. Vent 150a is defined by an inner surface 152. Vent 150a also includes an inlet 156 at the interior space 120 of the flexible bag dispensing container 100'. Vent 150a further includes an outlet 158 at the exterior 122 of the flexible bag dispensing container 100'. In this example, the inner surface 152 of vent 150a is tapered as vent 150a extends in a direction from the interior space 120 of the flexible bag dispensing container 100' to the exterior 122 of the flexible bag dispensing container 100', although other examples are not so limited. Put another way, the inner surface 152 of vent 150a is tapered as vent 150a extends from the inlet 156 to the outlet 158 thereof, although other examples are not so limited. In this example, the inner surface 152 of vent 150a is tapered outwardly, such that the inlet 156 of vent 150a has a cross-sectional dimension that is less than a cross-sectional dimension of the outlet 158 of vent 150a.

[0088] While vent 150a illustrated in FIG. 14A and FIG. 14B is defined by an inner surface 152 that tapers outwardly, it is to be understood that the vent(s) 150 of the flexible bag dispensing container 100' described herein may be defined by inner surface(s) 152 that taper inwardly (i.e., such that the inlet 156 has a smaller cross-sectional dimension than the outlet 158), that taper outwardly (i.e., such that the inlet 156 has a larger cross-sectional dimension than the outlet 158), or that are not tapered (i.e., such that the inlet 156 has a cross-sectional dimension substantially equal to that of the outlet 158). The extent to which the inner surface(s) 152 taper (including whether such inner surface(s) 152 tapers at all) may be selected to suit a particular application. For example, it has been found that an outwardly-tapering inner surface 152 (i.e., such that the inlet 156 has a smaller cross-sectional dimension than the outlet 158) may assist in configuring the vent 150 to permit entrapped gases to discharge therethrough without permitting liquid material to discharge therethrough. Put another way, the tapering and/or the shape of the vent(s) 150 may be selected so as to inhibit the liquid material from being discharged through the vent(s). In certain non-depicted examples, the inner surface 152 of the vent 150 may at least partially define a non-linear passageway, such as a serpentine passageway, between the inlet 156 and outlet 158 of the vent 150.

[0089] In certain examples, such as is illustrated in FIG. 14A and FIG. 14B, the seal 140 may include a first corner 142 at a first side 102 of the flexible bag dispensing container 100'. The seal 140 may further include a second corner 144 at a second side 104 of the flexible bag dispensing container 100'. The second side 104 of the flexible bag dispensing container 100' may generally be spaced from the first side 102 of the flexible bag dispensing container 100', such that the first and second corners 142, 144 of the seal 140 are spaced from one another. Further yet, the seal 140 may include a midpoint 141. The midpoint 141 of the seal 140 is generally positioned midway between the first and second corners 142, 144 of the seal 140. In examples, the vent(s) 150 may be positioned between the first and second corners 142, 144 of the seal 140. In the example illustrated in FIG. 14A and FIG. 14B, each of vents 150a-150c are positioned between the first and second corners 142, 144 of the seal 140. In this example, vent 150a is positioned closer to the second corner 144 of the seal 140 than the midpoint 141, vent 150b is positioned substantially centrally between the first and second corners 142, 144 of the seal 140 (e.g., at the midpoint 141 of the seal 140), and vent 150c is positioned closer to the first corner 142 of the seal 140 than the midpoint 141.

[0090] The seal 140 may include an inner edge 148 at the interior space 120 of the flexible bag dispensing container 100'. In some examples, such as is illustrated in FIG. 14A and

FIG. 14B, the inner edge 148 of the seal 140 may be substantially linear as the inner edge 148 extends toward the first and second corners 142, 144 of the seal 140 and/or as the inner edge 148 extends between the first and second sides 102, 104 of the flexible bag dispensing container 100'. In this example, the inlet 156 of the vent 150 may be defined in the inner edge 148 of the seal 140, although other examples are not so limited.

[0091] Similarly, the seal 140 may include an outer edge 146 at the exterior 122 of the flexible bag dispensing container 100'. In some examples, such as is illustrated in FIG. 14A and FIG. 14B, the outer edge 146 of the seal 140 may be substantially linear as the outer edge 146 extends between the first and second corners 142, 144 of the seal 140 and/or as the outer edge 146 extends between the first and second sides 102, 104 of the flexible bag dispensing container 100'. In such examples, the seal 140 may be in the form of a flat seal. In this example, the outlet 158 of the vent 150 may be defined in the outer edge 146 of the seal 140, although other examples are not so limited. As such, in this example, the outer edge 146 of the seal 140 may be shaped the same as or generally complementary to the inner edge 148 of the seal 140, although other examples are not so limited.

[0092] In certain examples, the flexible bag dispensing container 100', such as the seal 140, may include a side seal 160. In some examples, the flexible bag dispensing container 100' can include first and second side seals 160 that are spaced from one another. Each side seal 160 may extend along a direction that extends from the second end 108 toward the first end 106 of the flexible bag dispensing container 100'. For example, each side seal 160 can extend from the inner edge 148 and/or the outer edge 146 toward the first end 106. In certain non-depicted examples, one or more vents 150 may be defined by and/or in the side seal 160. The vent(s) 150 may extend through one or both of the side seals 160. As described with respect to the seal 140, each side seal 160 may be formed by any suitable technique as will be appreciated by those skilled in the art. By way of non-limiting example, each side seal 160 may be formed by applying heat or pressure or both, such as along the first side 102 and/or the second side 104 of the flexible bag dispensing container 100' so as to effectively flatten and attach the flexible wall 130 to itself therealong. Alternatively or in addition thereto, an adhesive (e.g., a pressure-sensitive adhesive) may be utilized so as to effectively attach the flexible wall 130 to itself therealong.

[0093] A flexible bag dispensing container including one or more vents 150 (such as flexible bag dispensing container 100' illustrated in FIG. 14A and FIG. 14B) may be filled using the filling system 200 discussed above or any other suitable filling system. In some examples,

the flexible bag dispensing container 100' can be filled using a method similar to that described above in relation to Fig. 13, albeit without creating the pressure differential in step 1302A. As previously described with respect to step 1302 of FIG. 13, the flexible bag dispensing container 100' may be inserted into a chamber 210 (e.g., a cavity 212 thereof). Further, similarly to as previously described with respect to step 1303, the chamber may be inserted into a filling system, such as filling system 200 previously described.

[0094] Then, without performing step 1302A of FIG. 13 and without collapsing the flexible bag dispensing container 100', the flexible bag dispensing container 100' may be filled by dispensing the liquid material into the flexible bag dispensing container 100 as previously described in relation to step 1304 of FIG. 13. The liquid material may, in examples, be dispensed into the flexible bag dispensing container 100' as gas entrapped within the interior space 120 of the flexible bag dispensing container 100 is expelled from the flexible bag dispensing container 100', such as through the vent(s) 150. The gas entrapped within the interior space 120 of the flexible bag dispensing container 100' may at least partially be caused to be expelled from the flexible bag dispenser container 100' by the dispensing of the liquid material into the flexible bag dispensing container 100'. Put another way, dispensing the liquid material into the interior space 120 of the flexible bag dispensing container 100' may, at least partially, cause gas entrapped within the interior space 120 of the flexible bag dispensing container 100' to be urged or pushed toward the vent(s) 150 and, ultimately, out of the flexible bag dispensing container 100' via the vent(s) 150. The gas entrapped within the interior space 120 of the flexible bag dispensing container 100' may, in certain examples, be expelled from the interior space 120 of the flexible bag dispensing container 100' as the flexible bag dispensing container 100' is at least partially filled with the liquid material and/or after the flexible bag dispensing container 100' is at least partially filled with the liquid material. While filling the flexible bag dispensing container 100', the fill level of the flexible bag dispensing container 100' can be detected in a manner similar to that described above in relation to step 1305 of FIG. 13, and at least one of steps 1306 to 1308 can be performed to remove the flexible bag dispensing container 100' from the chamber.

[0095] In some examples, the flexible bag dispensing container 100' can be filled without evacuating any of the gas entrapped therein prior to filling. In other examples, at least a portion of the gas entrapped within the flexible bag dispensing container 100' can be evacuated prior to filling. For example, it may be desirable in certain applications to discharge gas entrapped within the flexible bag dispensing container 100' (e.g., via the port 110 and/or the

vent(s) 150 of the flexible bag dispensing container 100') prior to filling so as to at least partially collapse the flexible bag dispensing container 100', such as for storage and/or transportation. Discharging at least some of the gas prior to filling can result in more rapid filling as there would be less gas to discharge through the narrow vents 150.

[0096] Discharging the entrapped gas during filling or prior to use of the flexible bag dispensing container 100' can limit, or prevent altogether, situations in which the liquid material disposed in the flexible bag dispensing container 100' could react negatively or undesirably with entrapped gas. Further, discharging the entrapped gas during filling or prior to use of the flexible bag dispensing container 100' can limit, or prevent altogether, situations in which entrapped gas within the flexible bag dispensing container 100' expand during a dispense operation of the flexible bag dispensing container 100' (e.g., as the liquid material is dispensed from the flexible bag dispensing container 100'), and such expansion could result in the expanding gases causing the liquid material to continue to dispense after a desired dispense operation is complete, such as due to the expansion of the compressed gas.

[0097] In alternative examples, the vented flexible bag dispensing container 100' may be filled with the liquid material as previously described with respect to FIG. 13, including performing step 1302A to evacuate the flexible bag dispensing container 100'. In certain examples employing a vented flexible bag dispensing container, creating a pressure differential between the chamber 210 (e.g., the cavity 212 thereof) and the flexible bag dispensing container 100' (e.g., the interior space 120) thereof so as to collapse the flexible bag dispensing container 100' prior to filling may be unnecessary and/or omitted due to the presence of the vent(s) 150 that facilitate discharge of gas entrapped within the interior space 120 of the vented flexible bag dispensing container 100'.

[0098] It should be noted that the illustrations and descriptions of the examples shown in the figures are for exemplary purposes only, and should not be construed limiting the disclosure. One skilled in the art will appreciate that the present disclosure contemplates various examples. Additionally, it should be understood that the concepts described above with the above-described examples may be employed alone or in combination with any of the other examples described above. It should further be appreciated that the various alternative examples described above with respect to one illustrated example can apply to all examples as described herein, unless otherwise indicated.

[0099] Unless explicitly stated otherwise, each numerical value and range should be interpreted as being approximate as if the word "about," "approximately," or "substantially"

preceded the value or range. The terms “about” and “approximately” can be understood as describing a range that is within 15 percent of a specified value unless otherwise stated.

[00100] Conditional language used herein, such as, among others, “can,” “could,” “might,” “may,” “e.g.,” and the like, unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain examples include, while other examples do not include, certain features, elements, and/or steps. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more examples or that one or more examples necessarily include these features, elements and/or steps. The terms “comprising,” “including,” “having,” and the like are synonymous and are used inclusively, in an open-ended fashion, and do not exclude additional elements, features, acts, operations, and so forth.

[0100] While certain examples have been described, these examples have been presented by way of example only and are not intended to limit the scope of the inventions disclosed herein. Thus, nothing in the foregoing description is intended to imply that any particular feature, characteristic, step, module, or block is necessary or indispensable. Indeed, the novel methods and articles described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions, and changes in the form of the methods and articles described herein may be made without departing from the spirit of the inventions disclosed herein. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of certain of the inventions disclosed herein.

[0101] It should be understood that the steps of the exemplary methods set forth herein are not necessarily required to be performed in the order described, and the order of the steps of such methods should be understood to be merely exemplary. Likewise, additional steps may be included in such methods, and certain steps may be omitted or combined, in methods consistent with various examples of the present invention.

[0102] Although the elements in the following method claims are recited in a particular sequence with corresponding labeling, unless the claim recitations otherwise imply a particular sequence for implementing some or all of those elements, those elements are not necessarily intended to be limited to being implemented in that particular sequence.

[0103] It will be understood that reference herein to “a” or “one” to describe a feature such as a component or step does not foreclose additional features or multiples of the feature. For instance, reference to a device having or defining “one” of a feature does not preclude the

device from having or defining more than one of the feature, as long as the device has or defines at least one of the feature. Similarly, reference herein to “one of” a plurality of features does not foreclose the invention from including two or more, up to all, of the features. For instance, reference to a device having or defining “one of a X and Y” does not foreclose the device from having both the X and Y.

What is Claimed:

1. A method for filling a flexible bag dispensing container with a liquid material, the method comprising:

inserting the flexible bag dispensing container into a cavity of a chamber of a filling system;

creating a pressure differential between an interior space of the flexible bag dispensing container and the cavity of the chamber such that the interior space of the flexible bag dispensing container has an internal pressure that is lower than an internal pressure of the cavity of the chamber, the pressure differential thereby collapsing a flexible bag of the flexible bag dispensing container so as to expel gas entrapped within the interior space from the flexible bag dispensing container; and

dispensing the liquid material into the flexible bag dispensing container, while the pressure differential is created between the interior space and the cavity, so as to fill the interior space with the liquid material.

2. The method of claim 1, wherein the creating step includes applying a positive pressure between the interior space of the flexible bag dispensing container and the cavity of the chamber, thereby collapsing the flexible bag.

3. The method of claim 1, wherein the creating step includes applying a suction to the interior space of the flexible bag dispensing container, thereby collapsing the flexible bag.

4. The method of claim 1, wherein the creating step includes each of (a) applying a positive pressure between the interior space of the flexible bag dispensing container and the cavity of the chamber and (b) applying a suction to the interior space of the flexible bag dispensing container, thereby collapsing the flexible bag.

5. The method of claim 1, further comprising detecting a fill level of the flexible bag dispensing container.

6. The method of claim 5, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container until the fill level reaches a predetermined fill level corresponding to an internal volume of the flexible bag.

7. The method of claim 6, further comprising:
prior to the fill level reaching the predetermined fill level, applying a positive pressure between the interior space of the flexible bag dispensing container and the cavity of the chamber, thereby collapsing the flexible bag; and

when the fill level reaches the predetermined fill level, removing the positive pressure from between the interior space of the flexible bag dispensing container and the cavity of the chamber.

8. The method of claim 7, further comprising:
removing the flexible bag dispensing container from the chamber; and
closing the flexible bag dispensing container such that the liquid material is prevented from escaping the flexible bag dispensing container.

9. The method of claim 1, wherein the creating step includes operating a valve to create the pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber.

10. The method of claim 1, further comprising:
prior to the dispensing step, sealingly connecting the flexible bag dispensing container to a material supply source within which the liquid material is disposed.

11. The method of claim 10, wherein the dispensing step includes providing the liquid material from the material supply source with sufficient pressure to overcome the internal pressure of the cavity of the chamber.

12. The method of claim 10, wherein the material supply source is preloaded with a predetermined volume of the liquid material that is substantially equal to an internal volume of the flexible bag, and wherein the dispensing step includes dispensing substantially all of the

predetermined volume of the liquid material from the material supply source into the flexible bag dispensing container.

13. The method of claim 10, further comprising sealingly connecting the material supply source to the flexible bag dispensing container with a fitting, wherein the fitting at least partially extends into the flexible bag dispensing container.

14. The method of claim 13, wherein sealingly connecting the material supply source to the flexible bag dispensing container with the fitting includes inserting the fitting less than halfway into the interior space of the flexible bag dispensing container.

15. The method of claim 1, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container for a predetermined amount of time corresponding to an internal volume of the flexible bag.

16. The method of claim 1, wherein the pressure differential collapses the flexible bag of the flexible bag dispensing container within about one second of creating the pressure differential.

17. The method of claim 1, wherein the pressure differential collapses the flexible bag of the flexible bag dispensing container such that opposing sides of a flexible wall defining the flexible bag are brought toward one another during such collapsing.

18. A system for filling an interior space of a flexible bag dispensing container with a liquid material, the system comprising:

a chamber defining a cavity configured to receive the flexible bag dispensing container therein;

an air movement system in fluid communication with at least one of the chamber and the interior space of the flexible bag dispensing container, the air movement system configured to create a pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber such that the interior space of the flexible bag dispensing container has an internal pressure that is lower than an internal pressure of the cavity of the chamber, the pressure differential thereby collapsing a flexible bag of the flexible bag dispensing container so

as to expel gas entrapped within the interior space from the flexible bag dispensing container;
and

a material supply source configured to be removably coupled to a port of the flexible bag dispensing container so as to dispense the liquid material through the port and into the interior space of the flexible bag dispensing container while the air movement system creates the pressure differential between the interior space of the flexible bag dispensing container and the cavity of the chamber.

19. The system of claim 18, wherein the material supply source is preloaded with a predetermined volume of the liquid material that is substantially equal to an internal volume of the flexible bag.

20. The system of claim 18, further comprising a movable stop disposed in sealing engagement within the chamber adjacent a first end thereof, the movable stop configured to travel along a longitudinal axis of the chamber toward the first end thereof.

21. The system of claim 20, wherein the movable stop is configured to remain stationary under a pressure applied between the movable stop and the first end of the chamber until contacted by the flexible bag dispensing container when the flexible bag dispensing container reaches a predetermined fill level.

22. The system of claim 20, further comprising a sensor configured to detect movement of the movable stop upon contact by the flexible bag dispensing container and to cause the material supply source to cease dispensing the liquid material into the interior space of the flexible bag dispensing container.

23. The system of claim 18, further comprising a fitting sealingly connecting the material supply source to the flexible bag dispensing container, wherein the fitting at least partially extends into the flexible bag dispensing container.

24. The system of claim 18, wherein the chamber is made of a transparent material.

25. The system of claim 18, wherein the flexible bag dispensing container is securedly disposed within the chamber.

26. The system of claim 25, wherein the flexible bag dispensing container is removably secured within the chamber by at least one of a set screw and a spring-loaded pin.

27. A method for filling a flexible bag dispensing container with a liquid material, the method comprising:

inserting the flexible bag dispensing container into a cavity of a chamber of a filling system, the flexible bag dispensing container including a flexible bag defining an interior space and at least one vent configured to permit gas entrapped in the interior space to discharge therethrough to the cavity of the chamber; and

dispensing the liquid material into the flexible bag dispensing container, while gas entrapped within the interior space is expelled from the flexible bag dispensing container through the at least one vent, so as to fill the interior space with the liquid material.

28. The method of claim 27, further comprising detecting a fill level of the flexible bag dispensing container.

29. The method of claim 28, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container until the fill level reaches a predetermined fill level corresponding to an internal volume of the flexible bag.

30. The method of claim 27, further comprising:
prior to the dispensing step, sealingly connecting the flexible bag dispensing container to a material supply source within which the liquid material is disposed.

31. The method of claim 30, wherein the material supply source is preloaded with a predetermined volume of the liquid material that is substantially equal to an internal volume of the flexible bag, and wherein the dispensing step includes dispensing substantially all of the predetermined volume of the liquid material from the material supply source into the flexible bag dispensing container.

32. The method of claim 30, further comprising sealingly connecting the material supply source to the flexible bag dispensing container with a fitting, wherein the fitting at least partially extends into the flexible bag dispensing container.

33. The method of claim 32, wherein sealingly connecting the material supply source to the flexible bag dispensing container with the fitting includes inserting the fitting less than halfway into the interior space of the flexible bag dispensing container.

34. The method of claim 27, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container for a predetermined amount of time corresponding to an internal volume of the flexible bag.

35. The method of claim 27, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container until the flexible bag dispensing container contacts a movable stop configured to travel along a longitudinal axis of the chamber toward a first end thereof, the movable stop disposed in sealing engagement within the chamber adjacent the first end thereof.

36. The method of claim 35, further comprising:
applying a pressure between the movable stop and the first end of the chamber such that the movable stop remains stationary under the applied pressure until contacted by the flexible bag dispensing container when the flexible bag dispensing container reaches a predetermined fill level.

37. The method of claim 35, wherein the dispensing step includes dispensing the liquid material into the flexible bag dispensing container until movement of the movable stop upon contact by the flexible bag dispensing container is detected by a sensor.

38. A system for filling an interior space of a flexible bag dispensing container with a liquid material, the system comprising:

a chamber defining a cavity configured to receive the flexible bag dispensing container therein;

a material supply source configured to be removably coupled to a port of the flexible bag dispensing container so as to dispense the liquid material through the port and into the interior space of the flexible bag dispensing container; and

a sensor configured to detect when the flexible bag dispensing container reaches a predetermined fill level and to cause the material supply source to cease dispensing the liquid material into the flexible bag dispensing container.

39. The system of claim 38, wherein the material supply source is preloaded with a predetermined volume of the liquid material that is substantially equal to an internal volume of a flexible bag of the flexible bag dispensing container.

40. The system of claim 38, further comprising a movable stop disposed in sealing engagement within the chamber adjacent a first end thereof, the movable stop configured to travel along a longitudinal axis of the chamber toward the first end thereof.

41. The system of claim 40, wherein the movable stop is configured to remain stationary under a pressure applied between the movable stop and the first end of the chamber until contacted by the flexible bag dispensing container when the flexible bag dispensing container reaches the predetermined fill level.

42. The system of claim 40, wherein the sensor is configured to detect movement of the movable stop upon contact by the flexible bag dispensing container and to cause the material supply source to cease dispensing the liquid material into the flexible bag dispensing container.

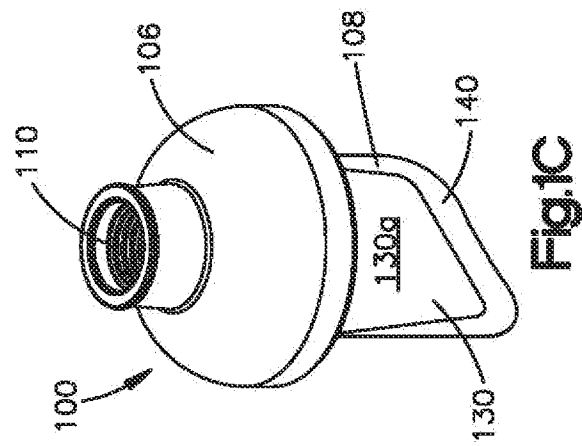
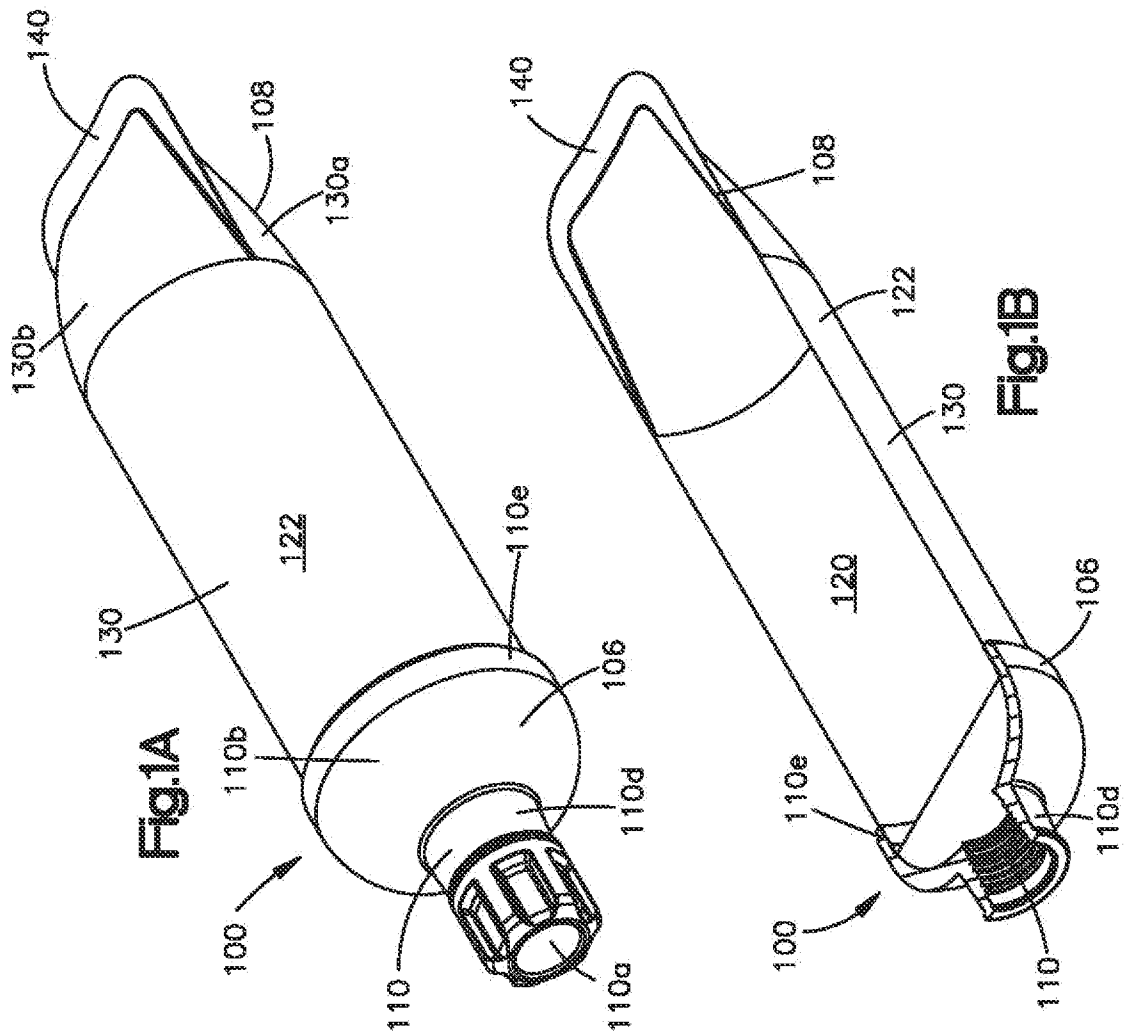
43. The system of claim 38, further comprising a fitting sealingly connecting the material supply source to the flexible bag dispensing container, wherein the fitting at least partially extends into the flexible bag dispensing container.

44. The system of claim 38, wherein the chamber is made of a transparent material.

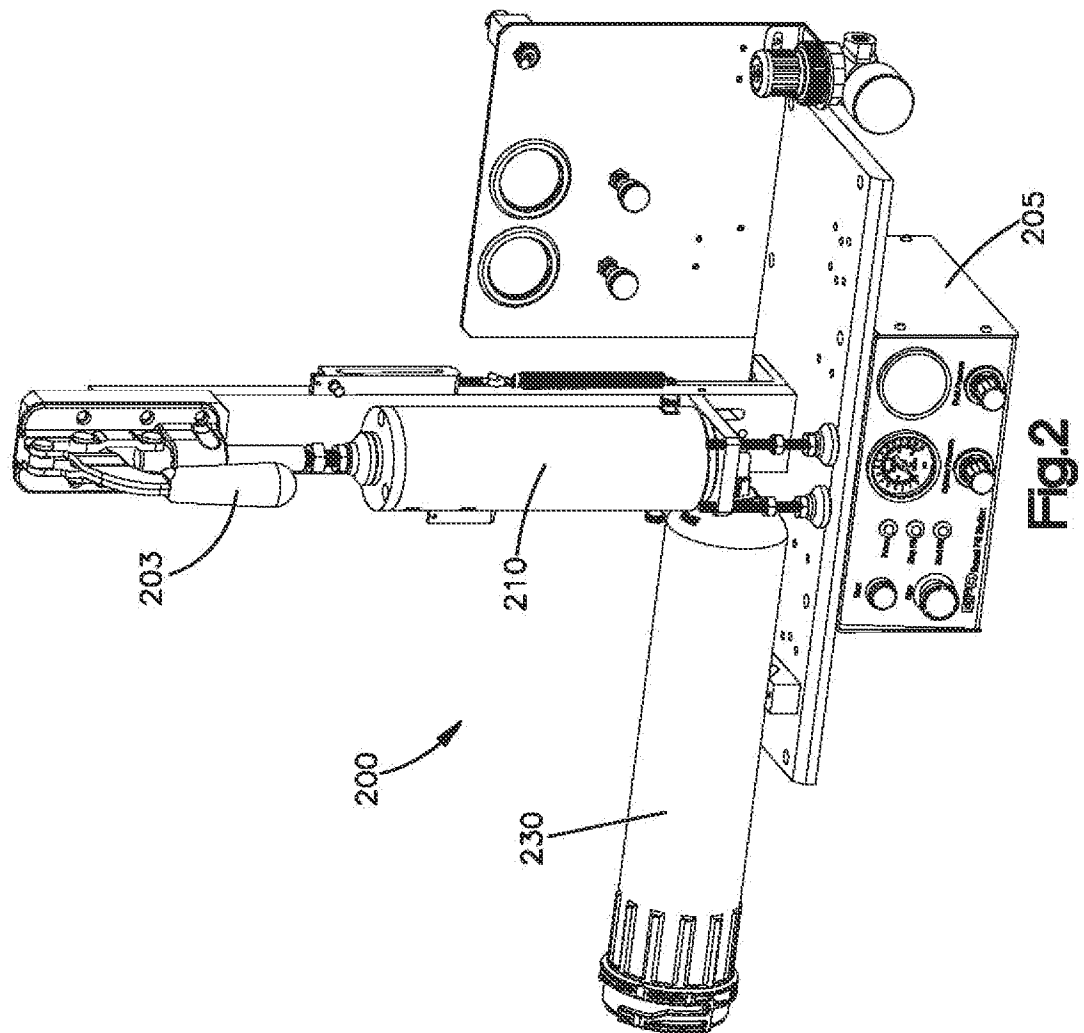
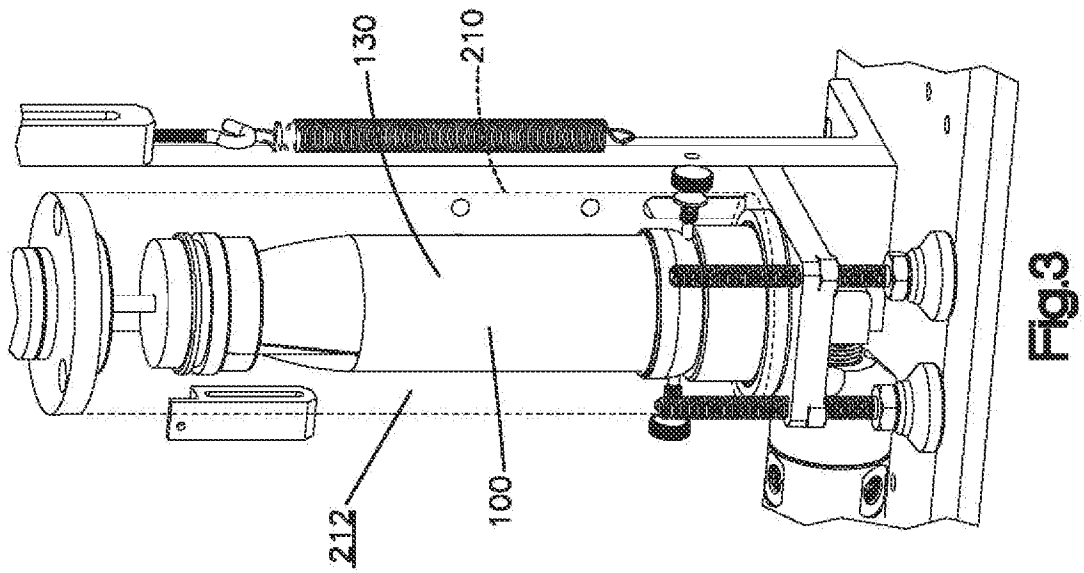
45. The system of claim 38, wherein the flexible bag dispensing container is securedly disposed within the chamber.

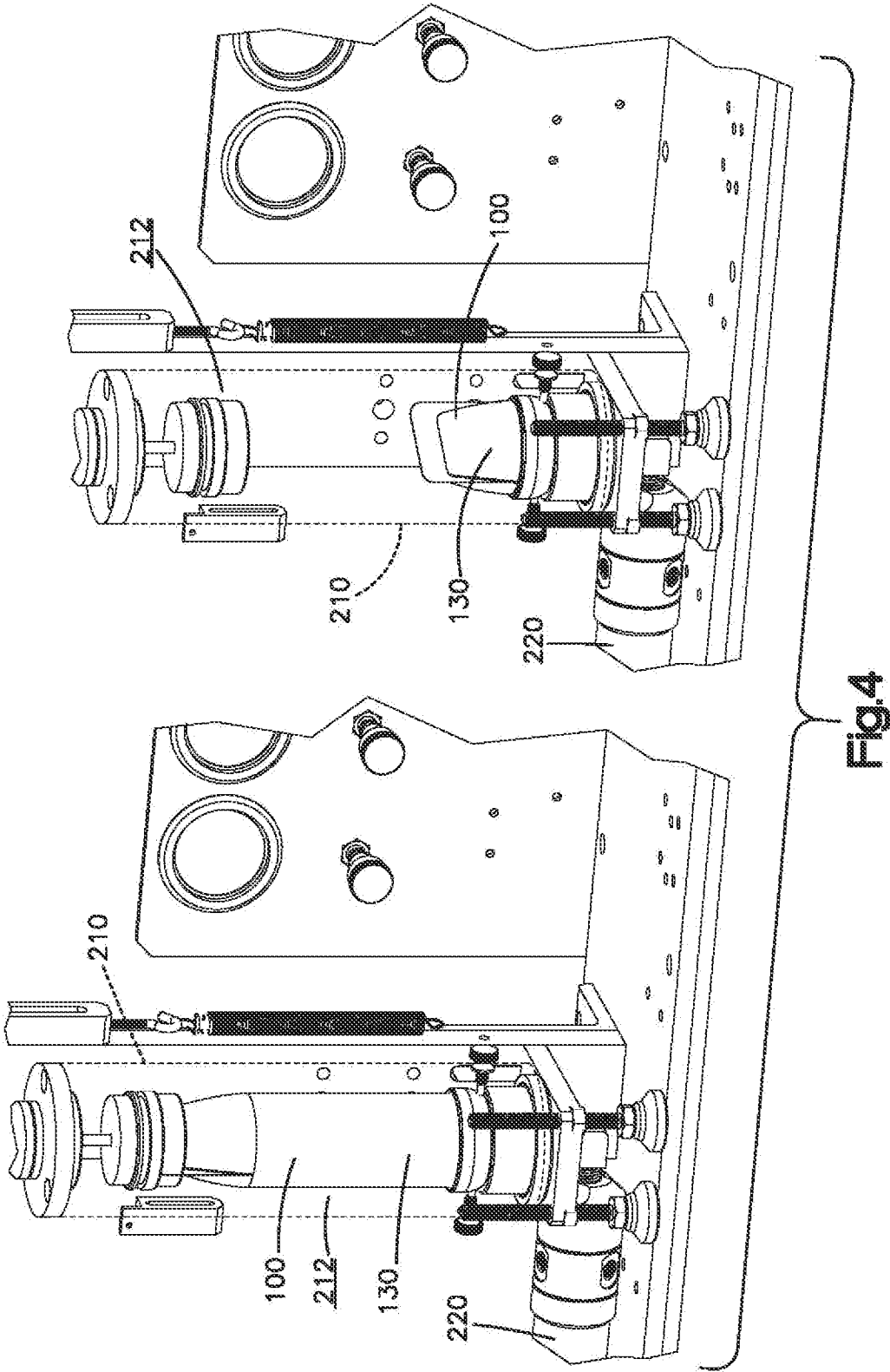
46. The system of claim 45, wherein the flexible bag dispensing container is removably secured within the chamber by at least one of a set screw and a spring-loaded pin.

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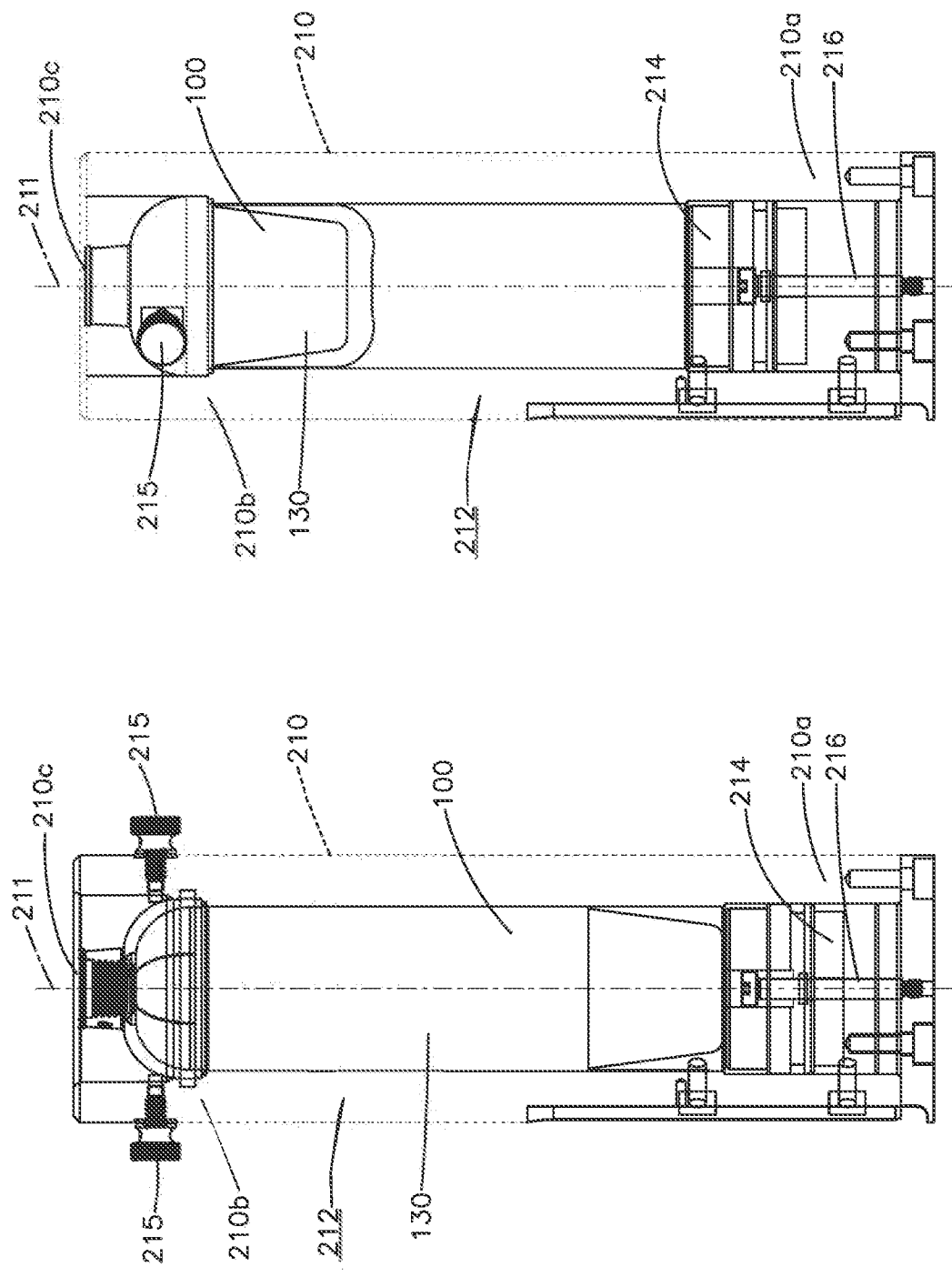


Fig.5B

Fig.5A

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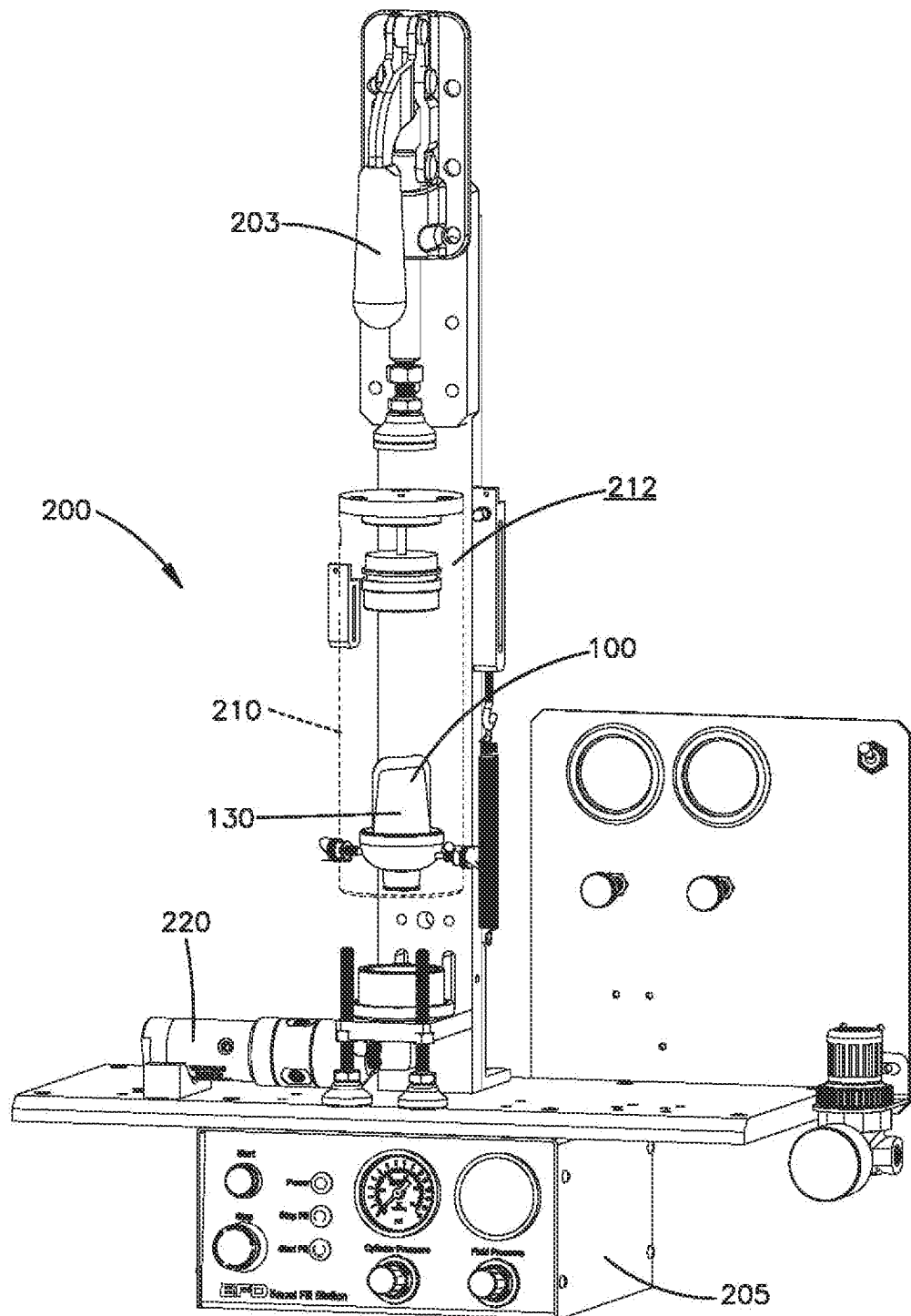


Fig.6

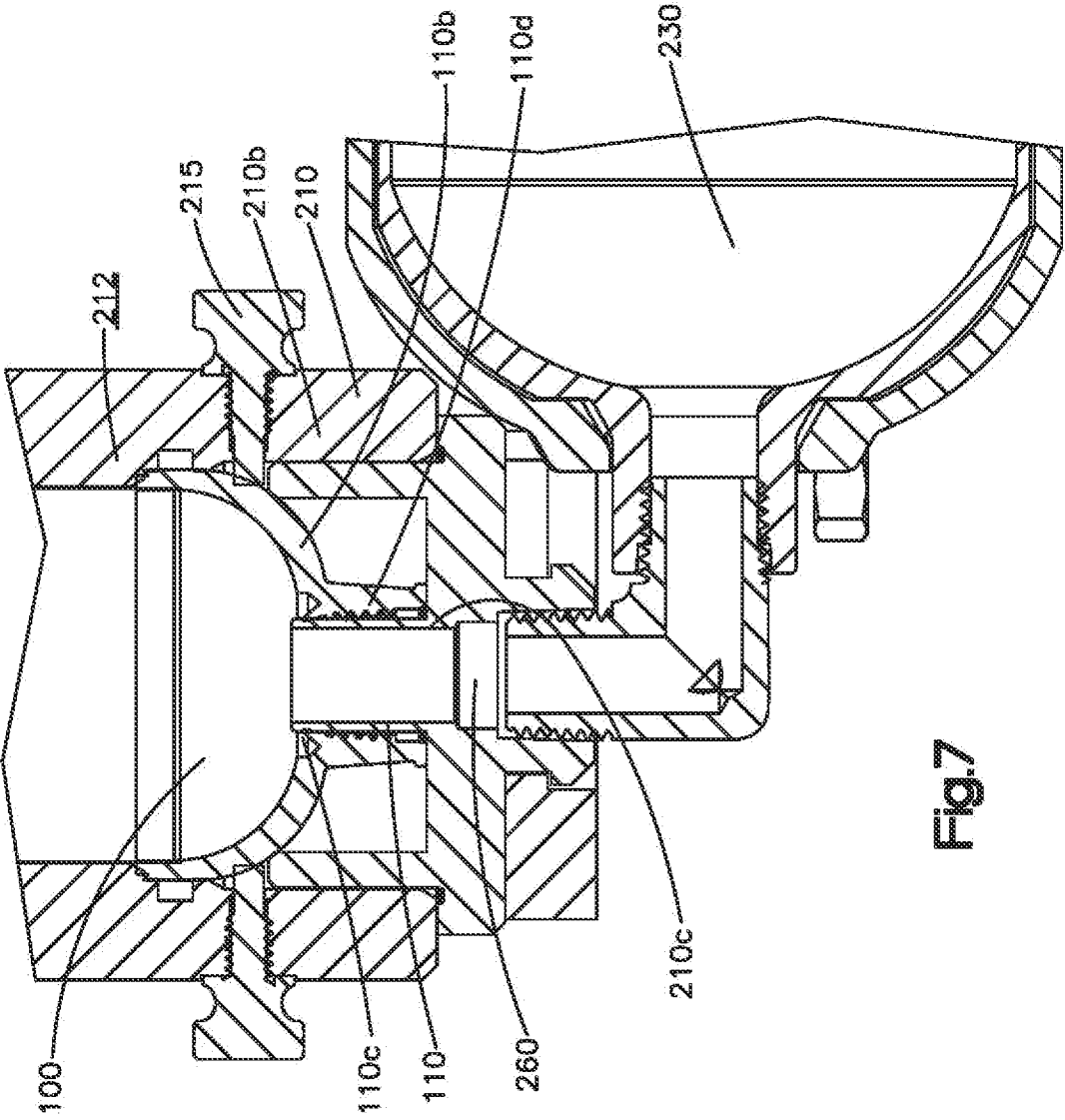
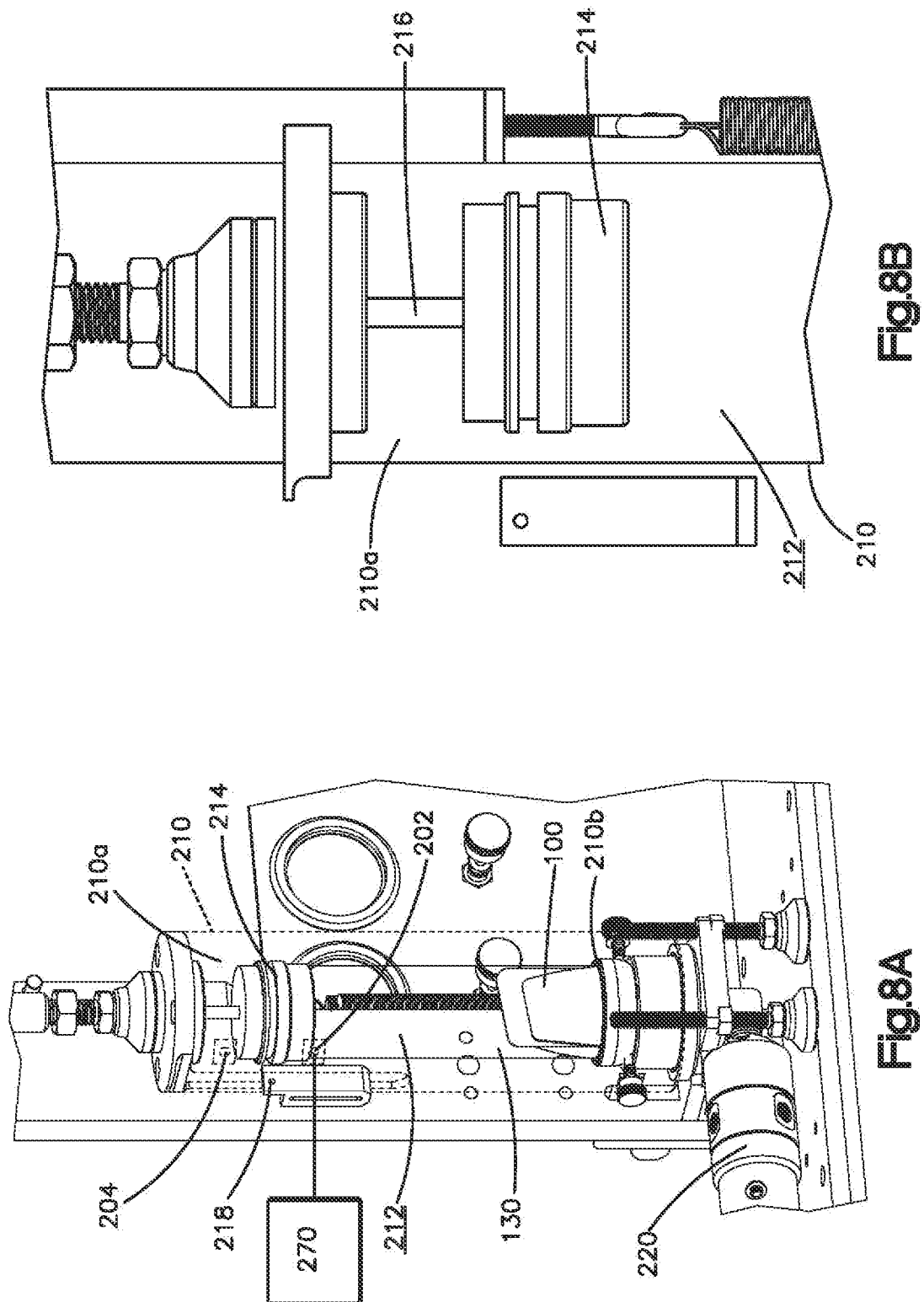


Fig.7



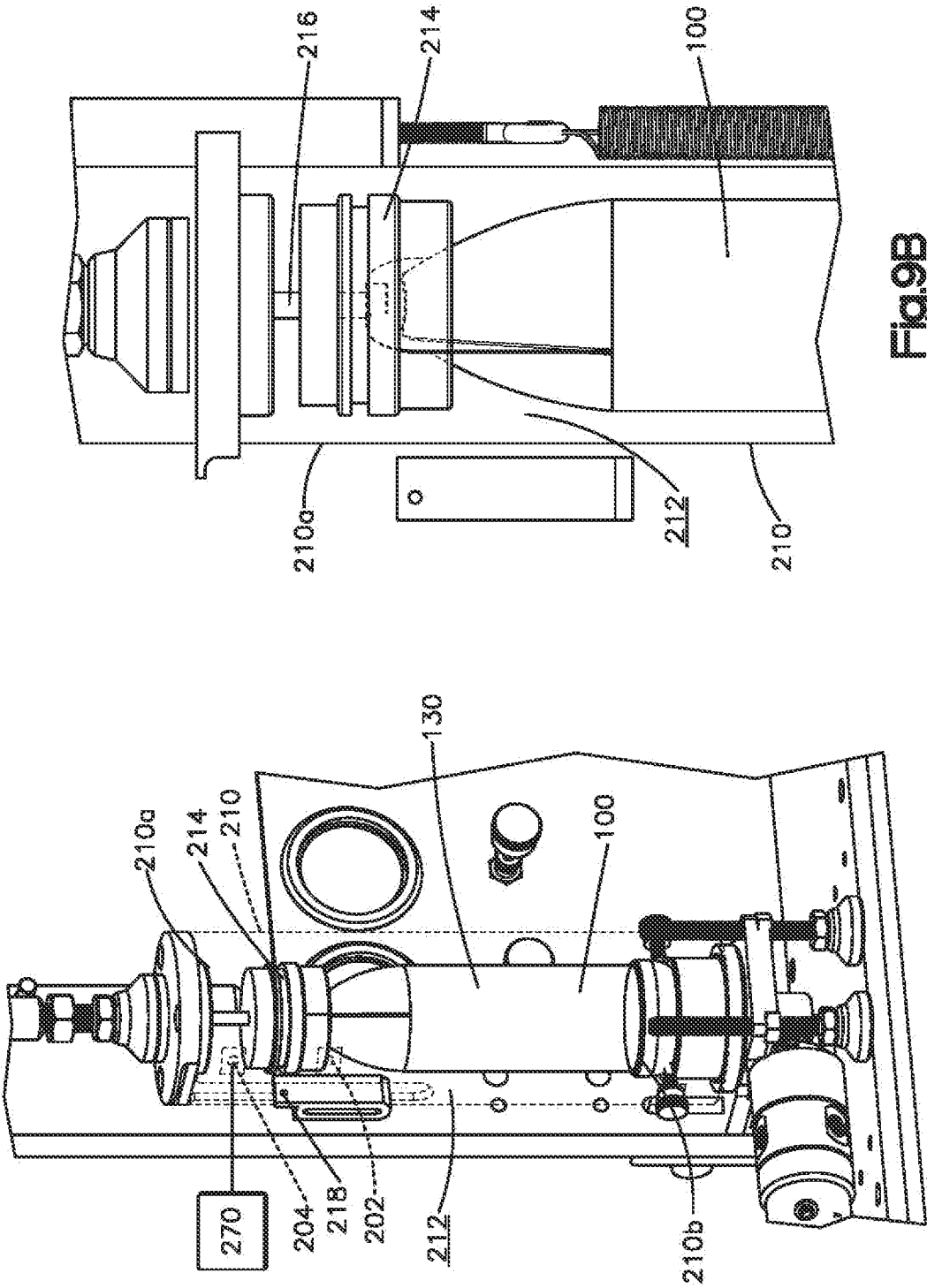
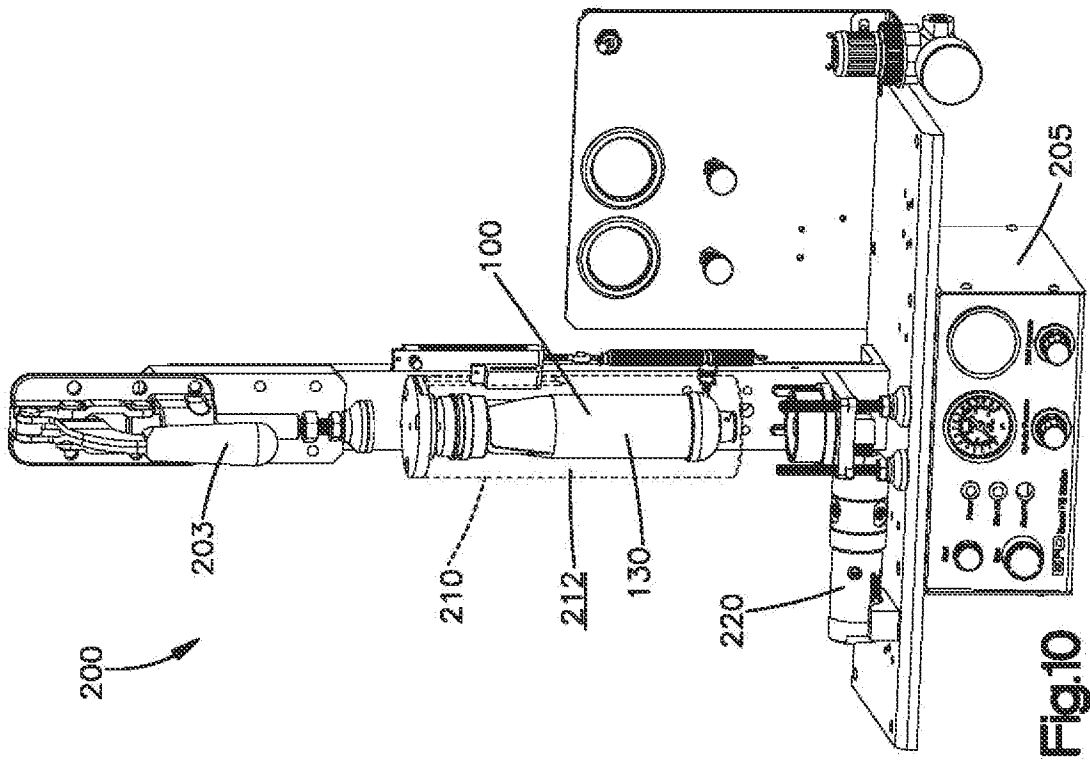
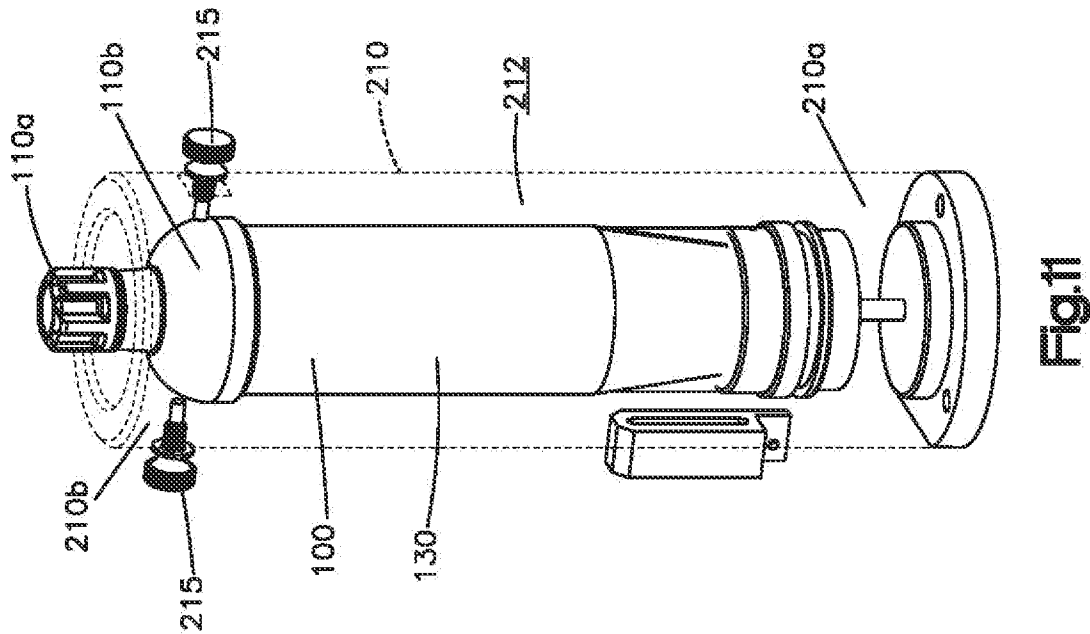


Fig.9B

Fig.9A



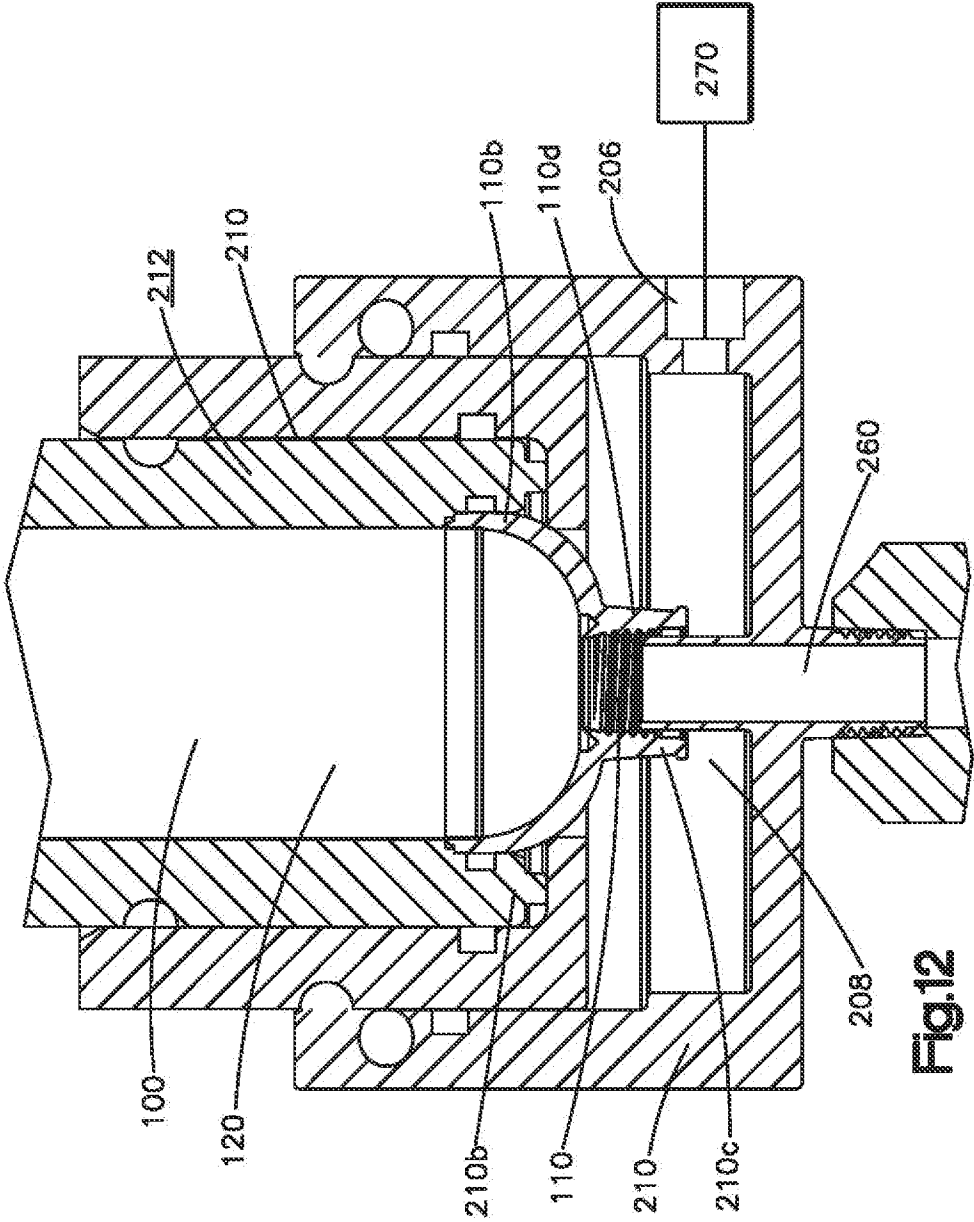


Fig.12

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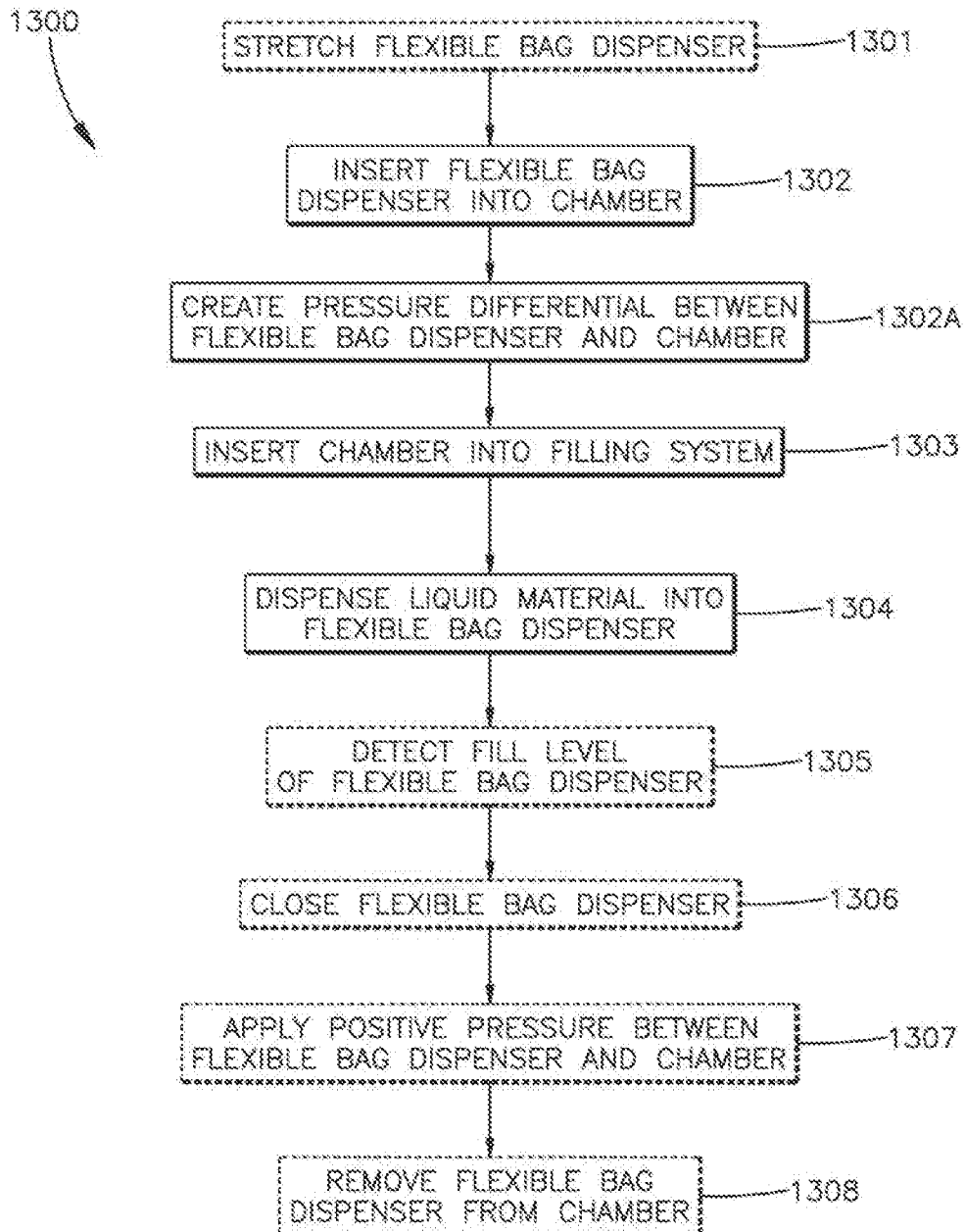


Fig.13

