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(54) A FILLING MODULE

(57) A filling module configured to locate on an open container to produce a bag-inbox package for storing bulk flowable material, the filling module comprising:
a lid portion having a filling opening;
a base portion fixed to the lid portion; and
an expandable bag located between the lid portion and the base portion, the bag comprising:
an inlet for introducing flowable material into the bag, the inlet being in communication with the filling opening of the lid portion; and
an outlet for conveying flowable material out of the bag,

wherein the bag is configured to expand when flowable material is introduced into the bag through the inlet,
wherein the base portion is configured to be separated from the lid portion, such that the bag can expand into the open container.

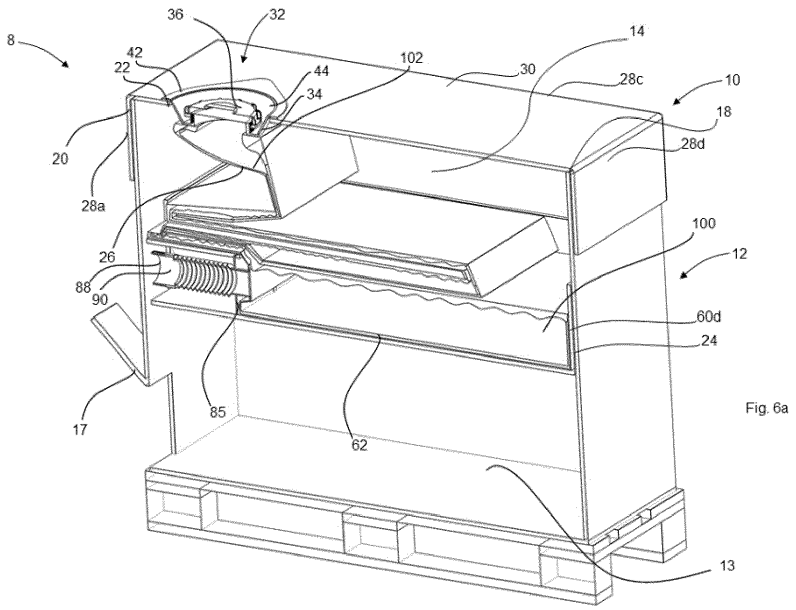

Fig. 6a

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a filling module configured to locate on an open container to produce a bag-in-box package for storing bulk flowable material, and a method of producing a bag-in-box package for storing bulk flowable material.

BACKGROUND OF THE INVENTION

[0002] Bag-in-box packaging is commonly used to store and dispense a range of flowable material, for example consumable liquids such as wine or orange juice. Such low filling volume packaging (typically less than 20 litres) can typically be assembled and filled with an automatic process. A bag is filled with the flowable material prior to the product being sold. Typically, the bag is filled and emptied through a single opening in the bag. The box provides support and protection for the bag.

[0003] For larger filling volumes (typically higher than 200 litres - for example, 500 or 1000 litres), however, a manual, complex and time consuming assembly process is required prior to filling of the bag. Particular problems occur in applications where the bag-in-box packaging is filled from above without specialised filling equipment. In order to fill the bag-in-box packaging, complex arrangements of, for example, connections, hoses and/or brackets are typically required. The complexity of the assembly and filling process can also result in incorrect assembly of the bag-in-box packaging.

[0004] Further, in order to fill the bag-in-box package, an opening in the bag needs to be connected to a supply of the flowable material. It is important to avoid contamination of the material, which can lead to deterioration of the filling material and reduce its lifespan.

[0005] The present teachings seek to overcome or at least mitigate the problems of the prior art.

SUMMARY OF THE INVENTION

[0006] A first aspect of the invention provides a filling module configured to locate on an open container to produce a bag-in-box package for storing bulk flowable material. The filling module comprises: a lid portion having a filling opening; a base portion fixed to the lid portion; and an expandable bag located between the lid portion and the base portion. The bag comprises: an inlet for introducing flowable material into the bag, the inlet being in communication with the filling opening of the lid portion; and an outlet for conveying flowable material out of the bag. The bag is configured to expand when flowable material is introduced into the bag through the inlet. The base portion is configured to be separated from the lid portion, such that the bag can expand into the open container.

[0007] By providing an expandable bag inside a self-contained filling module, filling of an open container is simplified. A user simply needs to locate the filling module on the open container. Once the base portion is separated from the lid portion, bulk flowable material can be introduced through the filling opening into the inlet of the bag, which will expand to form a bag-in-box package. The filling module also acts as a closure for the bag-in-box package, which can then be used to store and transport the flowable material within.

[0008] The base portion may be configured to automatically separate from the lid portion at a predetermined threshold, as a result of the bag being filled with flowable material, such that the bag can expand into the open container.

[0009] As the lid portion separates automatically from the base portion due to the force applied by the mass of the bag being filled, the point of separation can remain consistent as desired.

[0010] The outlet of the bag may be fixed relative to the base portion of the filling module.

[0011] As the outlet of the bag is fixed relative to the base portion of the filling module, as the bag expands and the base portion separates from the lid, the outlet of the bag falls into the open container under gravity, for example, to align with an outlet opening in the open container.

[0012] The outlet of the bag may comprise an opening and a conduit connecting the opening to an internal volume of the bag. The conduit may be extendable and/or rotatable.

[0013] This allows the location of the opening to be adjusted depending on the dimensions of the open container.

[0014] The opening of the outlet of the bag may comprise an outlet valve.

[0015] The outlet valve prevents the flowable material from being conveyed out of the bag until desired by the user, as well as limiting air ingress into the bag as the flowable material is conveyed from the bag.

[0016] The base portion may comprise a tunnel portion to at least partially enclose the conduit of the outlet. The tunnel portion may be fixed or integral with the base portion.

[0017] The tunnel portion helps to protect the conduit as well as locate the outlet of the bag, for example to ensure it is aligned with an outlet opening in the open-topped container.

[0018] The conduit and the opening of the outlet may be of the same material as the bag.

[0019] This results in easier recycling.

[0020] The lid portion may have a top surface and at least one side wall extending generally perpendicular from the top surface. The side wall may be configured to engage with a corresponding side wall of the open-topped container to locate the filling module on the open container before a filling process is sta rted .

[0021] The dimensions of the lid portion can be varied as required to ensure a correct locating of the filling mod-

ule on a range of different open containers, depending on, for example, the volume of bag to be filled.

[0022] The base portion may have a bottom surface and at least one side wall extending generally perpendicular to the bottom surface. The base portion may nest with the lid portion. This reduces the need for an additional lid for the open container and helps to protect the bag from damage as the bag is enclosed.

[0023] The nesting of the lid portion and base portion reduces the space requirements of the filling module for transport and storage.

[0024] The bag may have an unfilled state wherein the bag is folded.

[0025] The folding of the bag reduces the space required before the bag expands.

[0026] In the unfilled state, the bag may comprise at least two surfaces that are attracted to one another.

[0027] This reduces the possibility of air being sucked into the bag during filling. Reduction of air ingress during filling is desirable to protect the product integrity.

[0028] In the unfilled state, the bag may be folded back on itself at least once, to divide the bag into at least a first internal volume and a second internal volume.

[0029] This enables the first internal volume to be filled with flowable material while the second internal volume remains compressed, further reducing air ingress as the bag is filled.

[0030] The inlet may be in a top surface of the bag.

[0031] This enables the bag to be filled easily, for example under gravity.

[0032] The filling opening of the lid portion may comprise a closure arrangement. The closure arrangement may comprise a neck portion fixed to the inlet of the bag and a cap fixed to the neck portion.

[0033] The closure arrangement closes off the bag-in-box package once the bag has been filled with flowable material. Advantageously, the closure arrangement can also help to tamper proof the package and protect the contents as the package is stored and transported.

[0034] The closure arrangement may further comprise an anti-rotation collar fixed to the inlet of the bag. The anti-rotation collar may comprise the neck portion and be non-rotationally fixed to the lid portion. The lid portion may comprise at least one anti-rotation formation to engage an anti-rotation formation on the collar to limit relative rotation of the anti-rotation collar and the lid portion.

[0035] As relative rotation of the collar and lid portion is limited, the bag is not mislocated or damaged when, for example, the bag is filled or the cap is fixed onto the neck portion.

[0036] The inlet and the outlet may be located on the same side of the bag.

[0037] Emptiability of the bag is also increased. Further, as the shortest force line possible is between the inlet and outlet, there is reduced air ingress when the bag is filled.

[0038] The base portion may comprise at least one formation for aiding in emptying of the bag. The formation may be a bottom surface sloped towards the outlet.

[0039] The emptiability of the bag is further increased.

[0040] A further aspect of the invention provides a method of producing a bag-in-box package for storing bulk flowable material. The method comprises: providing a filling module comprising: a lid portion having a filling opening; a base portion fixed to the lid portion; and an expandable bag located between the lid portion and the base portion. The bag comprises: an inlet for introducing flowable material into the bag, the inlet being in communication with the filling opening of the lid portion; and an outlet for conveying flowable material out of the bag. The bag is configured to expand when flowable material is introduced into the bag through the inlet. The base portion is configured to be separated from the lid portion, such that the bag can expand into the open container. The method further comprises locating the filling module on an open container; separating the lid portion of the filling module from the base portion of the filling module; and introducing flowable material into the filling opening of the filling module to expand the bag into the open container in order to produce a bag-in-box package for storing bulk flowable material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of a bag-in-box package filled with bulk flowable material including a filling module according to an embodiment of the present teachings;

Figure 2 is an isometric view of the filling module of Figure 1;

Figure 3 is an exploded isometric view of the filling module of Figure 1;

Figure 4 is an isometric view of the bag-in-box package of Figure 1;

Figure 5 is a cross-sectional view of the filling module 10 of Figure 1 when an expandable bag of the filling module is in an unfilled state;

Figure 6a is a cross-sectional view of the bag-in-box package of Figure 1 along the plane A-A, when the bag is in a partially filled state;

Figure 6b is a cross-sectional view of the bag-in-box package of Figure 1 along the plane A-A, when the bag is in a filled state;

Figure 7 is a cross-sectional view of the bag-in-box package of Figure 1 along the plane A-A, when the

bag has been emptied again;

Figure 8 is an exploded view of the filling module of Figure 1;

Figure 9a is an isometric view of a closure arrangement of the filling module of Figure 1;

Figure 9b is an isometric view of an outlet of the filling module of Figure 1;

Figure 10 is an isometric view of the closure arrangement of Figure 9.

DETAILED DESCRIPTION OF EMBODIMENT(S)

[0042] Figure 1 shows a bag-in-box package of an embodiment of the present teachings generally indicated at 8, including a filling module 10 located on top of an open container 12. The bag-in-box package of this embodiment is suitable for storing bulk flowable material, for example a liquid such as a beverage or paint. Any reference in the following description to relative terms like "upper", "lower", "top", "bottom", "left", "right" is in relation to the orientation of the figures, is for description purposes only and should not be interpreted as limiting in any way.

[0043] The open container 12 in this embodiment is generally cuboidal. However, it shall be appreciated that in alternative embodiments, the open container 12 may be any suitable shape, for example cylindrical or prismic. in this embodiment, as shown best in Figures 6a to 7, the open container 12 has a rectangular base 13. As shown best in Figure 1, four side walls 16a-16d extend perpendicular from the base 13 in an upward direction. The four side walls 16a-16d define an opening 14 opposite the base 13. In this embodiment, the opening 14 has substantially the same area as the base 13. The side wall 16a includes a foldable portion 17 located towards a lower edge of the side wall 16a opposite the opening 14. An upper edge of each of the side walls 16a to 16d defines a top surface 18 of the open container 12 that acts as a rim to locate the filling module 10.

[0044] The foldable portion 17 in this embodiment is formed from a cut away section of the side wall 16a and acts as a flap that can be moved in an upward direction. In order to empty the bag-in-box package 8, as described in more detail below, the foldable portion 17 is folded upwardly about a fold line. In an alternative embodiment, there may be no foldable portion 17 at all - instead, there may simply be an opening in the side wall 16a. In a further alternative embodiment, there may be an opening in the side wall 16a that is exposed by removing a part of the side wall 16a that is fixed to the remainder of the side wall 16a with a frangible connection, for example a perforated line.

[0045] Although not illustrated in the Figures, the open container 12 may include at least one stiffening formation, such as one or more additional walls or ribs, or inlay parts on the side walls 16a to 16d and/or in the corners of the open container 12.

[0046] The filling module 10 locates on the open container 12 when the bag-in-box package 8 is assembled. The filling module 10 locates over the opening 14 so as to close off the opening 14 of the open container 12. The filling module 10 generally has a cross-sectional profile corresponding to the cross-sectional profile of the opening 14 of the open container 12. In this embodiment, the cross-sectional profile of the filling module 10 is rectangular, but it will be appreciated that in alternative embodiments, the filling module 10 may have any suitable cross-sectional profile that corresponds to the open container 12, such as circular or polygonal.

[0047] As illustrated most clearly in Figures 2, 3 and 5, the filling module 10 includes a lid portion 20, a base portion 24 fixed to the lid portion 20, and an expandable bag 26. The expandable bag 26 is located between the base portion 24 and the lid portion 20.

[0048] The expandable bag 26 is configured to expand when flowable material is introduced to the expandable bag 26. The base portion 24 is configured to be separated from the lid portion 20. In this embodiment, the base portion 24 is configured to automatically separate from the lid portion 20 as the expandable bag 26 expands and applies a force to the base portion 24, such that the expandable bag 26 can expand into the open container 12. The base portion 24 separates from the lid portion 20 when the mass of flowable material in the expandable bag 26 exceeds a predetermined threshold. This applies a force to the base portion 24, for example, due to gravity, urging the base portion 24 away from the lid portion 20.

[0049] The open container 12, the lid portion 20 and the base portion 24 may be manufactured from any suitable material, for example corrugated board, cardboard or plastics. The open container 12, lid portion 20 and/or base portion 24 do not need to be manufactured from the same material as one another, but this may increase recyclability.

[0050] As described in more detail below, the expandable bag 26 is folded within the filling module 10. The expandable bag 26 may be manufactured from any suitable flexible material for containing the bulk flowable material, for example a flexible plastic. An example of a suitable flexible plastic is a polyolefin such as polyethylene or polypropylene. The expandable bag 26 may include a single-layer or multi-layer material. Each layer may be a mono-extruded or co-extruded material. Preferably, internal surfaces of the expandable bag 26 are in contact with one another until product is introduced into the expandable bag 26, to minimise the amount of unfolding and thus the amount of air that is sucked into the expandable bag 26 during assembly and filling of the bag-in-box package 8. Although not shown in the Figures, the internal surfaces of the expandable bag 26 may include a material such as a polyisobutylene admixture to make the internal surfaces 'sticky', to keep them in contact as long as possible. Alternatively, the internal surfaces can

be made sticky by using electrostatic charging to give each surface a charge such that they attract one another and stay in contact.

[0051] The base portion 24 includes a bottom surface 62 and at least one side wall extending perpendicular from the bottom surface 62 in an upward direction. In this embodiment, there are four side walls 60a to d extending from the bottom surface 62. A tunnel portion 64 is fixed to the bottom surface 62. Typically, the bottom surface also includes at least one formation for aiding emptying the expandable bag 26. The formation may be, for example, a sloped or stepped bottom surface (not shown).

[0052] The side walls 60a to d and the bottom surface 62 together define the shape of the base portion 24, which is substantially cuboidal in this embodiment.

[0053] The tunnel portion 64 is illustrated most clearly in Figures 6a, 6b and 8. The tunnel portion 64 may be fixed to the base portion 24, or alternatively the tunnel portion 64 may be integral with the base portion 24. The tunnel portion 64 is configured to align with the foldable portion 17 (or corresponding opening in the side wall 16a of the open container 12) when the expandable bag 26 is in a filled state. The tunnel portion 64 of this embodiment has a substantially semi-circular cross-sectional profile, however in alternative embodiments the tunnel portion 64 may have any suitable cross-sectional profile, for example circular or square. As described in more detail below, the tunnel portion 64 has the function of protecting and locating an outlet of the bag 26.

[0054] The lid portion 20 includes a top surface 30 and at least one side wall extending perpendicular to the top surface 30 in a downward direction. In this embodiment, the lid portion 20 has four side walls 28a to d extending from the top surface 30. The side walls 28a to d and the top surface 30 together define the shape of the lid portion 20, which is substantially cuboidal in this embodiment.

[0055] As shown in Figure 1, the filling module 10 is configured to locate on top of the open container 12 before a filling process is initiated. In this embodiment, the top surface 18 of the open container engages the filling module 10. More specifically, the top surface 18 of the open container 12 engages an underside of the top surface 30 of the lid portion 20. The side walls 16a to d of the open container 12 locate between the side walls 28a to d of the lid portion 20 and the side walls 60a to d of the base portion 24. In this way, as the base portion 24 separates from the lid portion 20, the base portion 24 falls into the open container 12. In alternative embodiments, however, the top surface 18 of the open container 12 could, for example, engage a bottom surface of the side walls 28a to d of the lid portion 20 to locate the filling module 10 in the correct location.

[0056] Due to the corresponding shapes of the base portion 24 and the lid portion 20, the base portion 24 nests within the lid portion 20 when the expandable bag 26 is in the unfilled state. It shall be appreciated that in alternative embodiments, however, the lid portion 20 may nest within the base portion 24.

[0057] The base portion 24 and the lid portion 20 are separate components releasably connected when the filling module 10 is assembled. This enables the base portion 24 to be separated from the lid portion 20 when desired, such that the base portion 24 falls into the open container and provides space for the bag 26 to expand into as it is filled. In this embodiment, the releasable connection is an adhesive connection. The lid portion 20 and the base portion 24 are connected by adhesive strips 25 (see Figure 5). The adhesive strips are applied to a top edge of the side walls 60a to d of the base portion 24. The adhesive strips may be positioned at discrete locations on the side walls 60a to d, or may extend continuously or partially along the side walls 60a to d. The adhesive strips engage with the underside of the top surface 30 of the lid portion 20. As described in more detail below, however, there are a range of different types of releasable connection that could be used to releasably connect the lid portion 20 to the base portion 24.

[0058] As shown most clearly in Figures 8 and 10, the lid portion 20 includes a filling opening 22 having a closure arrangement 32, and first and second anti-rotation formations 48, 49 for engaging corresponding formations on the closure arrangement 32. The filling opening 22 is located on the top surface 30 of the lid portion 20. The filling opening 22 may be any suitable shape, for example circular, and enables a source of flowable material to be connected to an inlet of the bag 26 to introduce material into the bag (described in more detail below).

[0059] The closure arrangement 32 is illustrated in most detail in Figures 9a and 10. In this embodiment, the closure arrangement 32 includes a neck portion 34, a cap 36 to be fixed to the neck portion 34, an anti-rotation collar 38, and first and second anti-rotation formations 40, 41 for engaging the anti-rotation formations 48, 49 on the lid portion 20. In this embodiment, the closure arrangement 32 is fixed to the expandable bag 26 so as to enable flowable material to enter the expandable bag 26. More specifically, an underside of the closure arrangement 32 is fixed to the bag 26, as described in more detail below. The neck portion 34 is threaded and the cap 36 has a corresponding internal thread such that it can be screwed onto the neck portion 34 to close off an opening defined by the neck portion 34. It shall be appreciated in alternative embodiments, any suitable arrangement may be used to connect the neck portion 34 and the cap 36, such as a snap-fit connection.

[0060] In this embodiment, the anti-rotation collar 38 is integral with and encircles the neck portion 34. The anti-rotation collar 38 is, therefore, indirectly fixed to the bag 26. The anti-rotation collar 38 includes a flange portion 42, a tapered body portion 44, a recessed portion 46, and the anti-rotation formations 40, 41. The flange portion 42 is configured to locate on the top surface 30 of the lid portion 20, to generally surround the filling opening 22 of the lid portion 20. Extending in a generally downward direction, as shown show most clearly in Figure 10 is the tapered body portion 44. The tapered body portion

44 is intended to help locate the anti-rotation collar 38 in the filling opening 22 to help guide the flowable material into the expandable bag 26 during a filling operation. At the distal end of the tapered body portion 44 is a sealing surface 45, planar with the flange portion 42. The sealing surface 45 contacts the expandable bag 26, as described below, to fix the closure arrangement 32 to the bag 26.

[0061] As shown most clearly in Figure 10, in this embodiment, the first anti-rotation formation 40 on the anti-rotation collar 38 is in the form of a blade portion projecting from an underside of the flange portion 42 and the first anti-rotation formation 48 on the lid portion 20 is a slot configured to receive the blade portion of the anti-rotation collar 38. In this embodiment, the second anti-rotation formation 41 on the anti-rotation collar 38 is a protrusion projecting from the underside of the flange portion 42 and the second anti-rotation formation 49 on the lid portion 20 is a corresponding T-shaped recess configured receive the protrusion. The anti-rotation formations 40, 41, 48, 49 engage with one another to inhibit relative rotation of the anti-rotation collar and the lid portion 20. As described in more detail below, as the anti-rotation collar 38 is fixed to the expandable bag 26, twisting and damage during a filling operation can be minimised.

[0062] The expandable bag 26 is shown most clearly in Figures 5 to 7. When fully expanded, the expandable bag 26 includes a bottom surface 104, a top surface 108, and at least two side surfaces 106a, 106b connecting the bottom surface 104 to the top surface 108. The expandable bag 26 of this embodiment is substantially cuboidal, to substantially correspond to the shape of the open container 12. However, in alternative embodiments, the expandable bag 26 may be any suitable shape. For example, an upper portion of the expandable bag 26 may be substantially triangular in cross-section.

[0063] As shown most clearly in Figure 8, the expandable bag 26 includes an inlet 82 for introducing flowable material into the expandable bag 26, and an outlet 84 for conveying flowable material out of the expandable bag 26. The expandable bag 26 defines an internal volume 86 for storing the flowable material.

[0064] The inlet 82 is secured to the closure arrangement 32, in this embodiment to the sealing surface 45 of the tapered body portion 44 of the closure arrangement 32. In this embodiment, the inlet 82 is welded to the tapered body portion 44 at the sealing surface 45. However, the inlet 82 could be secured to the tapered body portion 44 using an adhesive, or any other suitable securing mechanism may be used. In alternative embodiments, the tapered body portion 44 could be integral with the bag 26. A flow path is therefore defined between the closure arrangement 32 and the inlet 82 to internal volume 86, to facilitate the flow of flowable material into the bag. The shape of the inlet 82 corresponds to the cross-sectional shape of the neck portion 34 and the tapered body portion 44, in order to create a seal and inhibit product from leaking during filling. In this embodiment, the inlet 82, the tapered body portion 44 and the neck portion 34 are substantially circular in cross-section. When the expandable bag 26 is in the filled state, the inlet 82 is located towards a top of the expanding bag 26. In this embodiment, the inlet 82 is located on the top surface 108 of the expandable bag 26.

[0065] The outlet 84 is illustrated most clearly in Figure 9b. In this embodiment, the outlet 84 is an extendable tube projecting from the expandable bag 26. In this embodiment, the outlet 84 includes an outlet flange 87 that engages with an interior surface of the expandable bag 26 to retain the outlet 84 on the bag 26. In this embodiment, the inlet 82 and the outlet 84 are located on the same side of the expandable bag 26. The outlet 84 is located on a side wall of the expandable bag 26, however in alternative embodiments, the outlet 84 may be located at any suitable location on the expandable bag 26, for example on a base surface.

[0066] When the expandable bag 26 is in the filled state, the outlet 84 is located towards the bottom surface 104 of the expandable bag 26. When the expandable bag 26 is in the filled state, the outlet 84 is aligned with the tunnel portion 64 of the base portion 24 for conveying flowable material out of the expandable bag 26. A flow path is therefore defined between the internal volume 86 of the bag 26 and the outlet for conveying flowable material out of the expandable bag 26.

[0067] The outlet 84 includes an opening 88 at its distal end, a conduit 90 connecting the opening 88 to the internal volume 86 of the expandable bag 26 and an attachment plate 85. In this embodiment, the conduit 90 is of the same material as the expandable bag 26. The outlet 84 may also include an outlet valve (not shown) so product can be selectively dispensed from the bag 26. The outlet valve may be of any suitable configuration. For example, the outlet valve may include an actuable mechanism, and actuation of the actuable mechanism facilitates the conveying of flowable material out of the expandable bag 26. The outlet valve can help to minimise the ingress of air into the expandable bag 26.

[0068] The outlet 84 is located within the tunnel portion 64 of the base portion 24 such that the tunnel portion 64 at least partially encloses the conduit 90. In this embodiment, the attachment plate 85 locates in a corresponding groove (not shown) in an internal surface of the tunnel portion 64. However, it should be noted that any suitable fastening may be used that fixes the position of the conduit 90 relative to the tunnel portion 64, and therefore fixes the position of the conduit 90 relative to the base portion 24. The shape of the attachment plate 85 can correspond to the shape of the tunnel portion 64. Therefore, in this embodiment, the attachment plate 85 is substantially semi-circular.

[0069] The conduit 90 may be extendable and/or rotatable. This enables the conduit 90 to be extended/contracted when the user wishes to empty the expandable bag 26, whilst helping to ensure the bag-in-box package 8 is compact. For example, the conduit 90 may be con-

certinaed, as shown in Figure 9b, or telescopic. Alternatively, an outer sleeve (not shown) may be threaded to the conduit 90 such that rotation of the outer sleeve on the conduit 90 causes the outer sleeve to move axially relative to the conduit 90 to lengthen the outlet 84.

[0070] In the unfilled state, the expandable bag 26 is folded back on itself at least once, to divide the expandable bag 26 into at least a first internal volume 100 and a second internal volume 102. The folding of the expandable bag 26 within the lid portion 20 and the base portion 24 provides a compact solution, making the filling module 10 easier to transport and store. When the expandable bag 26 is in the unfilled state, as illustrated, for example, in the embodiment shown in Figure 5, the expandable bag 26 includes first, second and third pairs of surfaces 94a, 94b, 96a, 96b, and 98a, 98b that are attracted to one another, to keep the bag 26 compact until it is filled, and minimise the amount of air that can enter the bag 26.

[0071] In the embodiment of Figure 5, the bottom surface 104 of the expandable bag 26 is located on an interior surface of the bottom surface 62 of the base portion 24. The side surface 106b of the bag 26, located on an opposing side of the expandable bag 26 to the outlet 84, is folded over so as to overlie the bottom surface 104. The interior surface 98a of the side wall 106b and interior surface 98b of the bottom surface 104 are attracted to one another, as described above. The remainder of the expandable bag 26, i.e. the remainder of the side surface 106a, the side surface 106b and the top surface 108 are folded together such that the respective interior surfaces 96a, 96b, 98a, 98b are attracted to one another. When the expandable bag 26 is folded in this arrangement, there are three pairs of attracted surfaces 94a, 94b, 96a, 96b, 98a, 98b, and three different folds. The advantage of folding the expandable bag 26 in this arrangement is that the first internal volume 100 begins to fill with flowable material without the fold defining the first internal volume 100 unfolding, which reduces the amount of air sucked into the expandable bag 26 as the expandable bag 26 is filled.

[0072] With reference to Figures 2 to 6, a method of assembling and filling the bag-in-box package 8 from the filling module 10 into the open container 12 will now be described. The method will be described with reference to the embodiment shown in Figure 1, but it shall be appreciated that any alternative embodiments (for example, as described below) may use substantially the same, or a similar method.

[0073] The expandable bag is folded as shown in Figure 5, and described above. in this embodiment, the adhesive strips 25 are applied between the base portion 24 and the lid portion 20. A supply of flowable material (not shown) is connected to the neck portion 34 of the closure arrangement 32,. The supply of flowable material conveys flowable material through the inlet 82 and into the expandable bag 26. Due to the location and form of the neck portion 34 and the inlet 82 of the bag 26, no separate attachment devices are necessary.

[0074] When a predetermined mass of flowable material has entered the bag, the mass of flowable material applies a force that causes the base portion 24 and the lid portion 20 to separate, e.g. due to gravity. At this point, the force applied by the mass of flowable material has exceeded the force of the adhesive connection between the lid portion 20 and the base portion 24. Typically, the triggering force will be approximately 3 to 5 times the weight of the base portion 24 plus the bag 26, but this can be varied as required. Due to the weight of the contents of the bag 26, the base portion 24 falls into the open container 12 until the outlet 84 is aligned with the foldable portion 17. The first loop of the expandable bag 26 unfolds, however the majority of the expandable bag 26 remains folded, thereby reducing the ingress of air into the expandable bag 26 during the filling process. The first internal volume 100 is filled with flowable material, followed by the second internal volume 102. The expandable bag 26 is filled to a predetermined level, until the expandable bag 26 reaches the filled state, e.g. as shown in Figure 6b.

[0075] The cap 36 is screwed onto the neck portion 34 to close the expandable bag 26. Any appropriate type of tamper-proof seal may also be added at this point. The bag-in-box package 8 can then be stored or transported as desired, until a consumer wishes to dispense product from it, which can be done through the outlet 84, e.g. by opening the valve in the outlet 84. The product will be dispensed from the bag 26 until the product remaining in the bag 26 is below the height level of the outlet 84.

[0076] Although the invention has been described above with reference to one or more preferred embodiments, it will be appreciated that various changes or modifications may be made without departing from the scope of the invention as defined in the appended claims.

[0077] For example, in one alternative embodiment, the lid portion 20 and the base portion 24 may instead be integrally formed or fixed to one another but connected by a frangible portion. The frangible portion may be, by way of example, a series of perforations providing an area of reduced weakness. The perforations would be arranged such that the lid portion 20 separates from the base portion 24 when the mass of flowable material exceeds a predetermined threshold.

[0078] Alternaively, the lid portion 20 and the base portion 24 may be separated by a force exerted by the user that exceeds a predetermined threshold, e.g. prior to the expandable bag 26 being filled. For example, the lid portion 20 may include any suitable type of actuating member, and actuating the member may cause the lid portion 20 and the base portion 24 to separate.

[0079] In a further alternative embodiment, the lid portion 20 may be mechanically fastened to the base portion 24 in any suitable way. For example, the lid portion 20 or base portion 24 may be bridged by one or more snap fit noses. The snap fit noses secure the lid portion 20 and base portion 24 together, but can be configured to separate when the mass of flowable material exceeds a pre-

determined threshold or when a user manually moves the lid portion 20 and the base portion 24 away from one another. For example, the snap fit noses may have a curved edge, so when the side walls of the lid portion 20 or base portion 24 flex, the base portion 24 moves past the curved edge and is released from the lid portion 20.

[0080] Alternatively, the mechanical fastening may be in the form of a series of fasteners extending through corresponding holes in both the lid portion 20 and the base portion 24. The fasteners may extend through the top surface 30 of the lid portion 20, through one or more of the side walls 28a to d of the lid portion 20, through the top edge of the base portion 24, or through one of the side walls 60a to d of the base portion 24. The fasteners can be configured to deform or break at a predetermined threshold to allow the base portion 24 to separate from the lid portion 20.

[0081] In a further alternative embodiment, any suitable arrangement for folding the expandable bag 26 may be used. For example, as illustrated in Figure 7, the side surfaces 106a, 106b may be folded multiple times so as to form a cascading arrangement of folds. Alternatively, the remainder of the side surface 106b and the side surface 106a may be placed vertically against the inlet and outlet side of the filling module 10. As a further alternative, the bottom surface 104 may be located on the bottom surface 62 of the base portion 24, and the expandable bag 26 may be compressed vertically.

[0082] Where the word 'or' appears this is to be construed to mean 'and/or' such that items referred to are not necessarily mutually exclusive and may be used in any appropriate combination.

Claims

1. A filling module configured to locate on an open container to produce a bag-in-box package for storing bulk flowable material, the filling module comprising:

a lid portion having a filling opening;
a base portion fixed to the lid portion; and
an expandable bag located between the lid portion and the base portion, the bag comprising:

an inlet for introducing flowable material into the bag, the inlet being in communication with the filling opening of the lid portion; and
an outlet for conveying flowable material out of the bag,

wherein the bag is configured to expand when flowable material is introduced into the bag through the inlet,
wherein the base portion is configured to be separated from the lid portion, such that the bag can expand into the open container.

2. The filling module of claim 1, wherein the base portion is configured to automatically separate from the lid portion at a predetermined threshold, as a result of the bag being filled with flowable material, such that the bag can expand into the open container.

3. The filling module of claim 1 or claim 2, wherein the outlet of the bag is fixed relative to the base portion of the filling module.

4. The filling module of claim 3, wherein the outlet of the bag comprises an opening and a conduit connecting the opening to an internal volume of the bag, wherein the conduit is extendable and/or rotatable.

5. The filling module of claim 4, wherein the opening of the outlet of the bag comprises an outlet valve.

6. The filling module of claim 5, wherein the base portion comprises a tunnel portion to at least partially enclose the conduit of the outlet, the tunnel portion being fixed or integral with the base portion.

7. The filling module of claim 5 or claim 6 wherein the conduit and the opening of the outlet are of the same material as the bag.

8. The filling module of any previous claim wherein the lid portion has a top surface and at least one side wall extending generally perpendicular from the top surface, the side wall configured to engage with a corresponding side wall of the open-topped container to locate the filling module on the open container before a filling process is started.

9. The filling module of claim 8, wherein the base portion has a bottom surface and at least one side wall extending generally perpendicular to the bottom surface, wherein the base portion nests with the lid portion.

10. The filling module of any previous claim, wherein the bag has an unfilled state wherein the bag is folded, optionally wherein, in the unfilled state, the bag comprises at least two surfaces that are attracted to one another, optionally wherein, in the unfilled state, the bag is folded back on itself at least once, to divide the bag into at least a first internal volume and a second internal volume.

11. The filling module of any previous claim, wherein the inlet is in a top surface of the bag.

12. The filling module of any previous claim, wherein the filling opening of the lid portion comprises a closure arrangement, the closure arrangement comprising a neck portion fixed to the inlet of the bag and a cap fixed to the neck portion, optionally wherein the clo-

sure arrangement further comprises a anti-rotation collar fixed to the inlet of the bag, the anti-rotation collar comprising the neck portion and being non-rotationally fixed to the lid portion, preferably wherein the lid portion comprises at least one anti-rotation formation to engage an anti-rotation formation on the collar to limit relative rotation of the anti-rotation collar and the lid portion .

13. The filling module of any previous claim, wherein the inlet and the outlet are located on the same side of the bag.

14. The filling module of any previous claim, wherein the base portion comprises at least one formation for aiding in emptying of the bag, optionally wherein the formation is a bottom surface sloped towards the outlet.

15. A method of producing a bag-in-box package for storing bulk flowable material comprising:

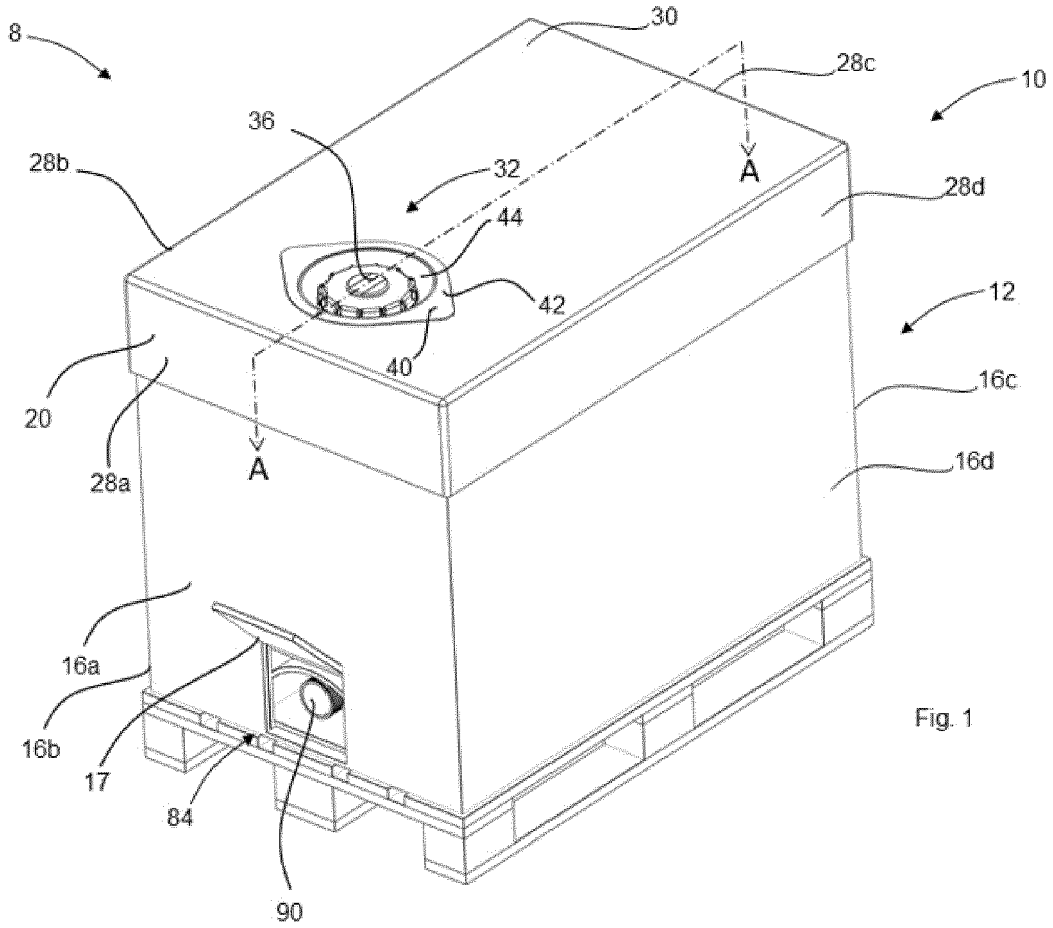
providing a filling module comprising:

a lid portion having a filling opening;
a base portion fixed to the lid portion;
an expandable bag located between the lid portion and the base portion, the bag comprising:

an inlet for introducing flowable material into the bag, the inlet being in communication with the filling opening of the lid portion; and
an outlet for conveying flowable material out of the bag,

wherein the bag is configured to expand when flowable material is introduced into the bag through the inlet,
wherein the base portion is configured to separate from the lid portion, such that the bag can expand into the open container;

locating the filling module on an open container;
separating the lid portion of the filling module from the base portion of the filling module;
introducing flowable material into the filling opening of the filling module to expand the bag into the open container in order to produce a bag-in-box package for storing bulk flowable material.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28b
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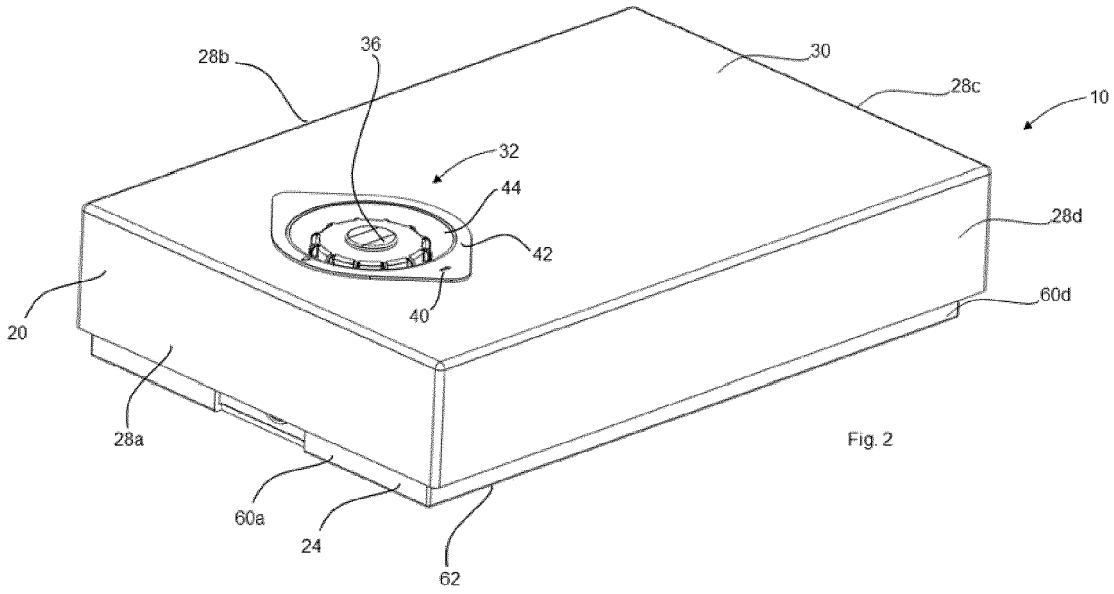
84
90

Fig. 1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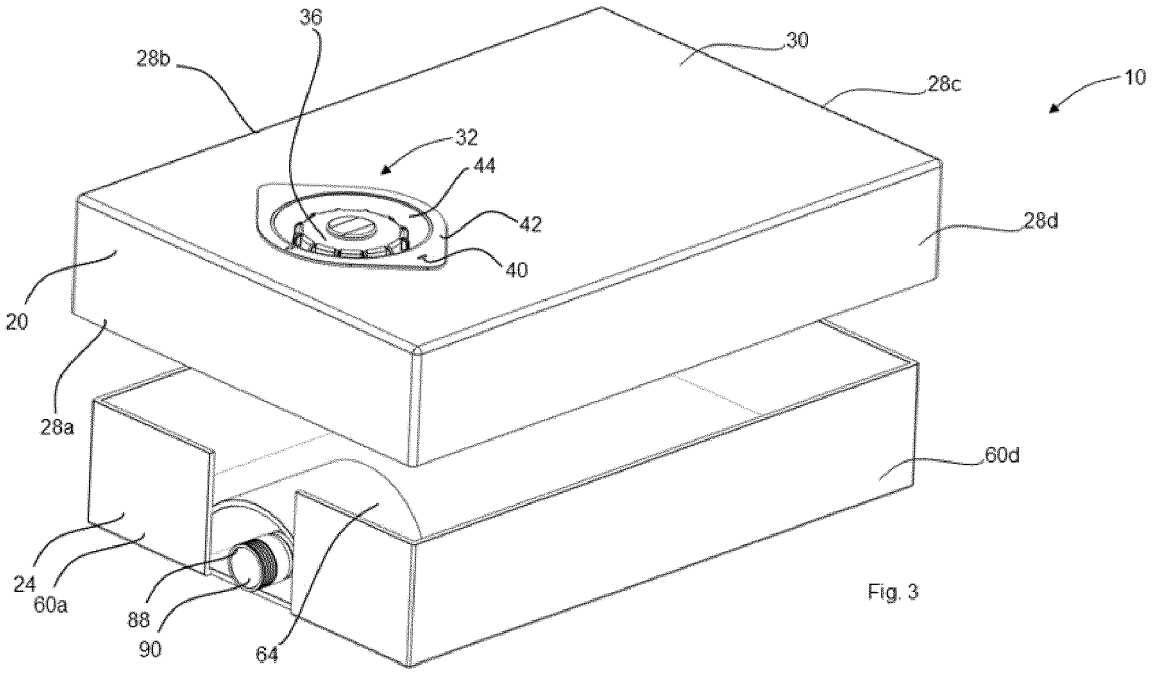
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Fig. 3

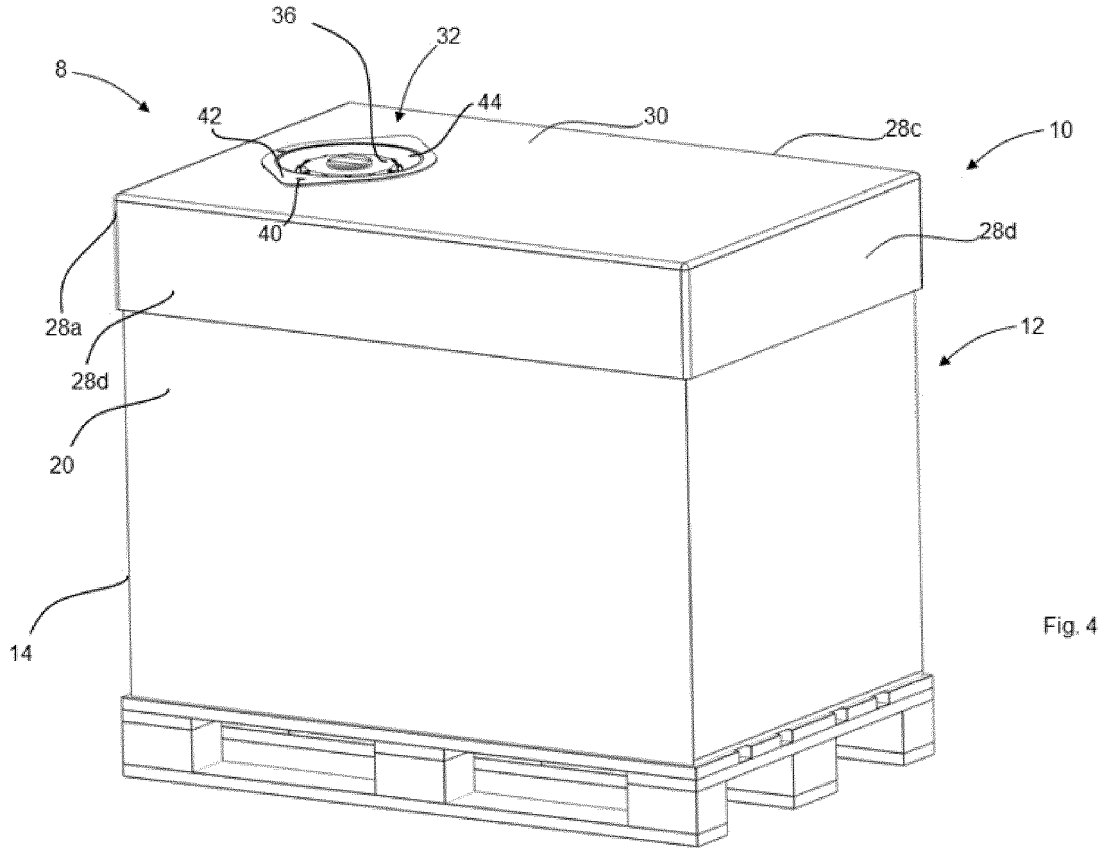
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Fig. 4

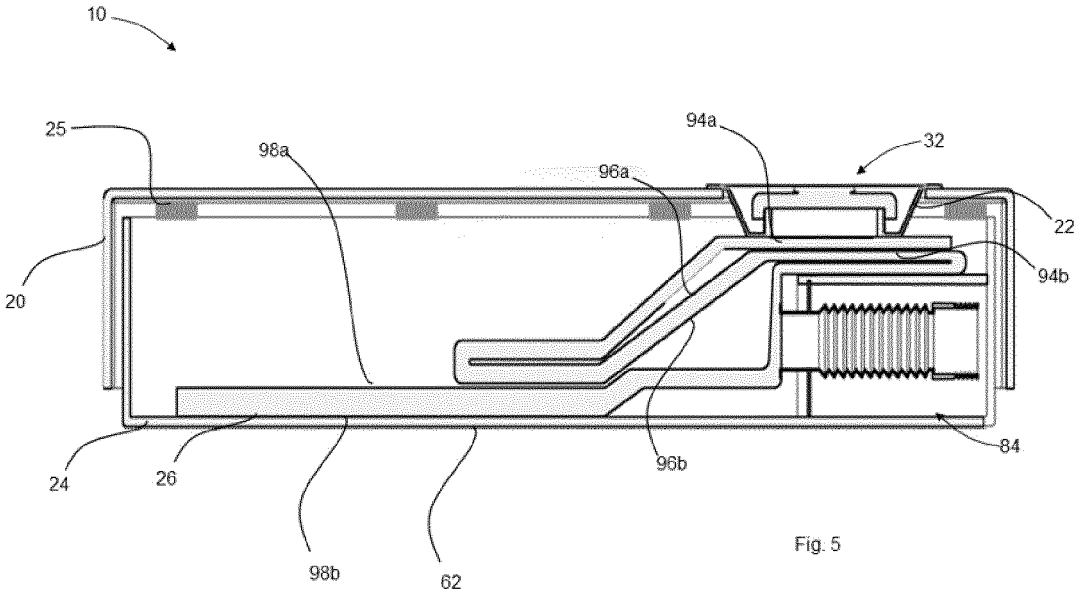
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Fig. 5

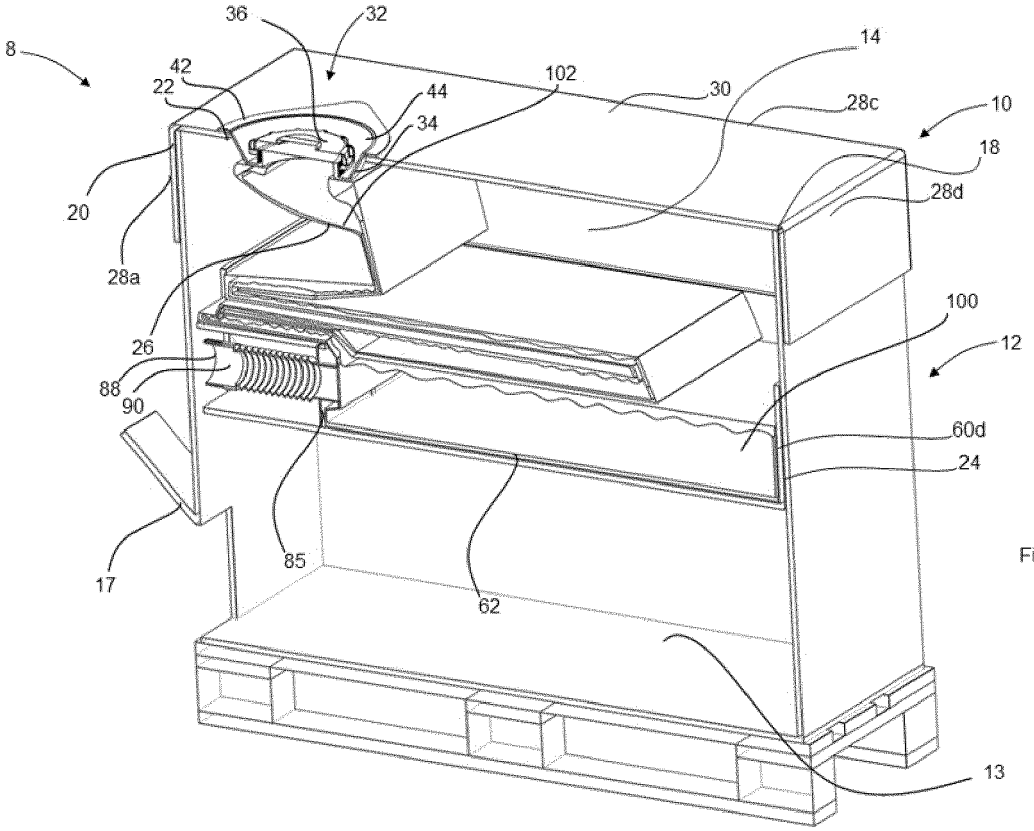
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Fig. 6a

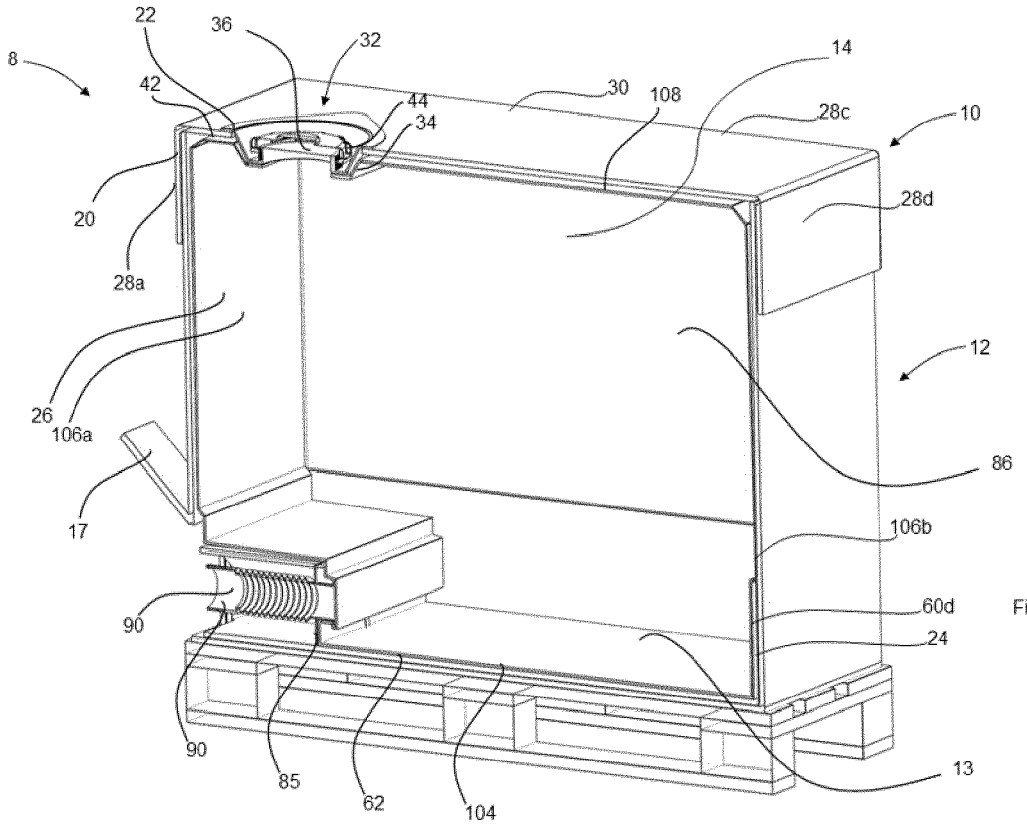
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Fig. 6b

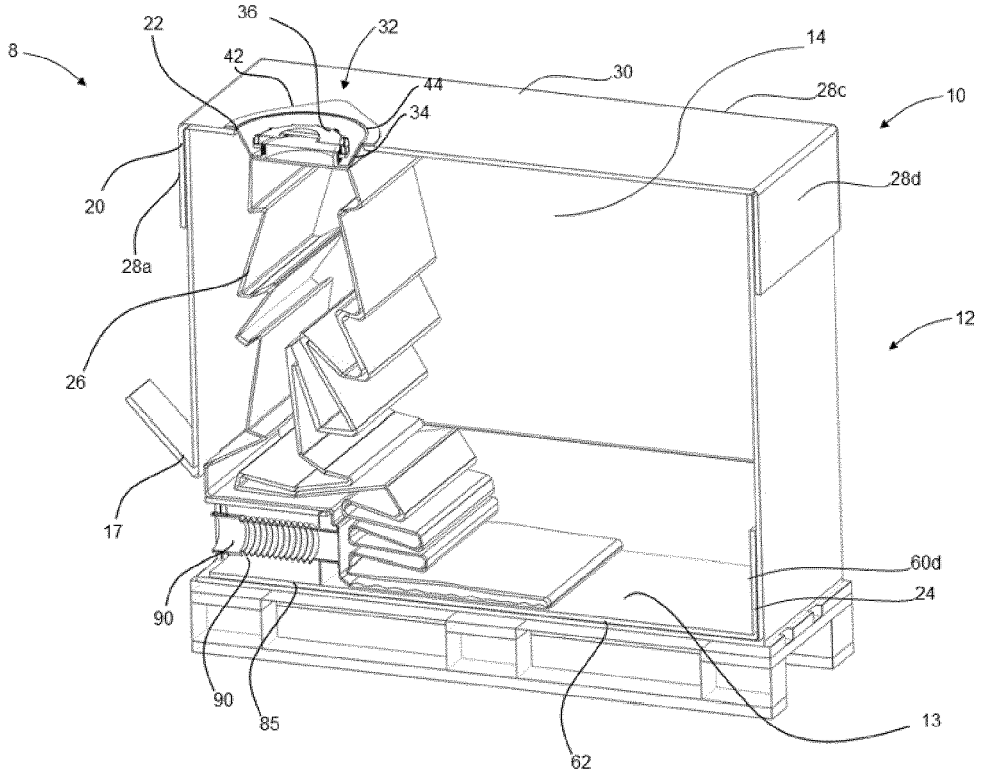
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Fig. 7

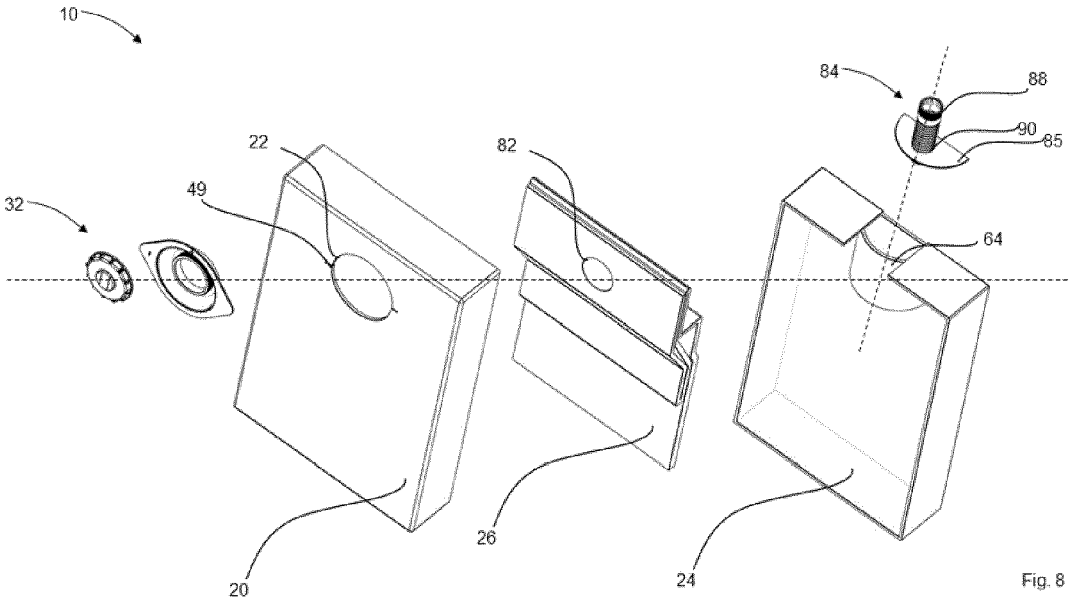
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Fig. 8

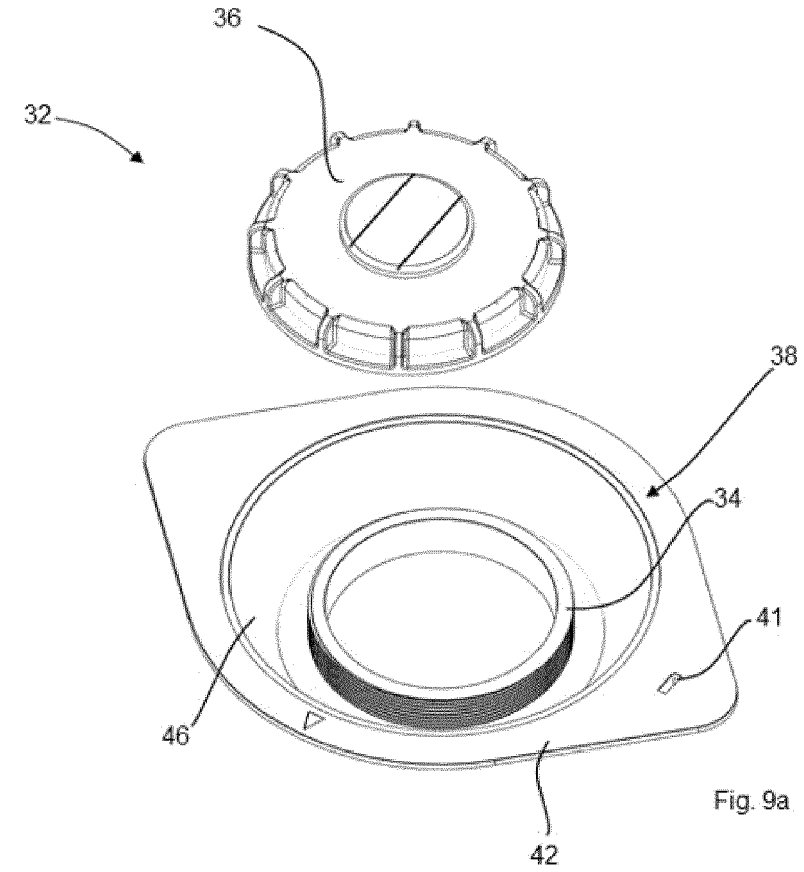

Fig. 9a

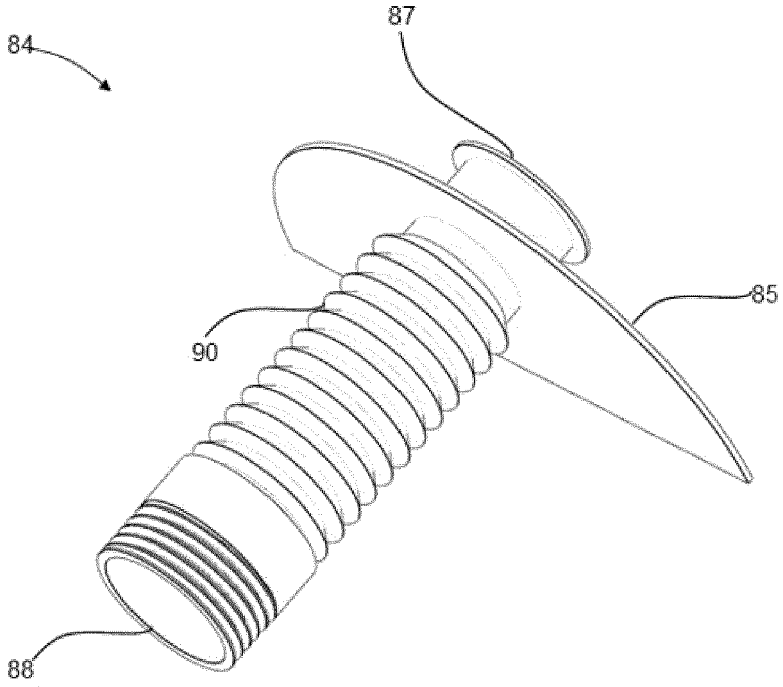

Fig. 9b

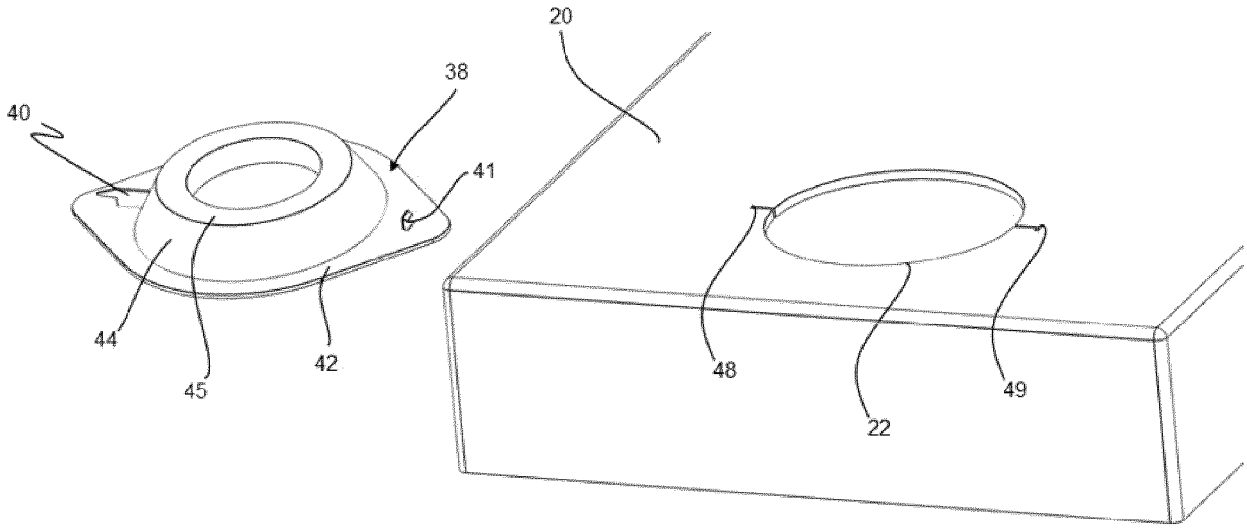

Fig. 10