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STORAGE BAG

Field of the Invention

The present invention relates to a bag arranged to allow passage of air between
5 inside the bag and atmosphere when the bag is being filled, whilst inhibiting
passage of air from between inside the bag and atmosphere in a bag filled or
partially filled state.

Background of the Invention

10 Various types of bag are used for industrial packaging of products for shipping
and/or storage. Three common types of machines for filling such bags are: (i)
augur machines, which, basically, employ a screw feeder arrangement; (ii)
impeller machines, using a rotary vane impeller; and (iii) pneumatic machines
which fluidise the product for filling the bag.

15 For filling of bags by a pneumatic packer, product is forced into the bag by
pressurised air. Thus, if allowances are not made for the pressurised air inside
the bag, the bag quickly fills up with this air, inhibiting the bag filling rate. One
approach is for the bag design to allow passage of air from the bag interior to
20 atmosphere. This prevents a build-up of air pressure inside the bag during
filling. For many types of products which are to be stored in the bags, this
requirement does not impose any serious limitations. However, some products
are sensitive to contamination from atmosphere; for example, the products are
hygroscopic in nature (e.g. some powders), and/or are liable to be contaminated
25 by odours in the air, (e.g. cocoa powder).

One design of bag provides an impermeable barrier to protect the product from
contamination but, because of the need for release of air from inside the bag
during filling, the impermeable barrier is punctured to allow air from the
30 pneumatic packing machine to exhaust to atmosphere. However, puncturing of
the impermeable layer defeats the original purpose of the layer: to protect the
contents of the bag from contamination.



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Therefore, it can be seen that existing bag designs for pneumatic packers may compromise the quality of these products.

- 5 In view of the foregoing design considerations, the designer or manufacturer of such a valve bag is caught up in a "Catch-22" situation: does one compromise product quality to ensure high filling rate?

- One design which attempts to overcome this problem is illustrated in Figure 1.
- 10 Figure 1a shows a valve bag 101 in cross-section. The bag 101 includes an inner permeable layer 103, an intermediate impermeable layer 105, an outer permeable layer 107, and an aperture 109 in fluid communication with an inside 111 of the inner layer 103. A filling vent of a pneumatic packer (not shown) is inserted into the side opening 109 for filling of the bag 101. The impermeable
- 15 intermediate layer 105 is typically a layer of PE film, thereby providing the barrier to ensure minimal contamination of the product from the external environment and the bag interior upon filling. The layer 105 completely surrounds the inner layer 103, with at least one overlapping portion at point(s) 105a such that one end of a first part 105c of the layer 105 overlaps the
- 20 opposite end of a second part 105b of the layer 105 at these portions. When one valve is provided, the intermediate layer is made up of a layer of film which completely surrounds the inner layer, one end 105c overlapping the end 105b. These one or more valves of layer 105 thus allow passage of air in the valve bag during filling. When the interior 111 of the inner bag layer starts to fill with
- 25 product, the product exerts a force on the inside of the inner layer 103. This force causes the inner and outer layers 103, 107 to come together, thereby causing the valve(s) 105a to close and inhibit passage of air between the inside of the bag and atmosphere.
- 30 A disadvantage of this arrangement is that, generally speaking, such bags are made with standard machines and the range of overlap which can be provided for the layer(s) 105 is extremely limited. That is, the intermediate layer 105

must effectively surround the inner layer completely, subject to there being one or more check valves 105a. The valve(s) is/are formed from an overlap of portions 105b, 105c and, essentially, the larger the overlap, the better the sealing effect of the valve will be. However, a large overlap between portions of this layer 105 can be difficult to achieve with the standard machinery.

Summary of the Invention

The invention is defined by claim 1 of the appended claims. Accordingly, the required overlap between ends 105b, 105c of an intermediate layer of the known bag of Figure 1 is dispensed with completely. Thus, an efficient check valve function may be provided without the constraints of the standard bag assembly machinery.

Some optional features of the invention are defined by the dependent claims. In one aspect, the invention also provides a method of filling and/or storing a bag as claimed.

Brief Description of the Drawings

Embodiments of the invention will now be described by way of example, with reference to the accompanying drawings, of which:

Figure 1 is a cross-sectional view of a known valve bag;

Figure 2 illustrates a bag according to a first embodiment of the invention;

Figure 3 illustrates a bag according to a second embodiment of the invention;

Figure 4 illustrates a bag according to a third embodiment of the invention;

Figure 5 illustrates a bag according to a fourth embodiment of the present invention;

Figure 6 illustrates a bag according to a fifth embodiment of the present invention;

Figure 7 illustrates a bag according to a sixth embodiment of the present invention;

Detailed Description of Embodiments

Figure 2a is a cross-sectional view of a first embodiment and illustrates the bag
5 in a bag filling state. Figure 2b is a cross-sectional view of the bag of Figure 2a
in a bag filled state.

Referring to Figure 2a, the bag 201 includes an inner layer 203 which
comprises a portion of impermeable material 204 and a portion of permeable
10 material 205. The bag 201 has an outer layer 209 which comprises a portion of
permeable material 208 and a portion of impermeable material 207 arranged, in
this embodiment, substantially adjacent the permeable portion 205 of the inner
layer 203. The bag has a longitudinal axis 200 (in the present view the axis is
perpendicular to the page). Bag layers 203 and 209 and the respective portions
15 205 and 207 of permeable and impermeable materials are arranged for relative
radial movement respective to the longitudinal axis 200 of the bag 201 in the
direction of arrows 211.

When the bag is being filled in a bag filling state, air and product (not shown)
20 are forced into inside 213 the inner layer 203 from a pneumatic packer (not
shown) connected to an aperture of the bag (also not shown) in fluid
communication with the inside 213 of the bag. Because the impermeable
portion 207 is arranged in relation to the permeable portion 205 to define a flow
path for passage of air; that is, air from the pneumatic packer exhausts to
25 atmosphere from the bag interior 213 through the permeable portion 205 of the
inner layer 203 along the paths 206 between the inner layer 203 and the
impermeable portion 207 of the outer layer through the permeable portion 208
of the outer layer 209.

30 It will be appreciated the illustration in Figure 2 is not intended to convey any
meaning of respective dimensions of the inner and outer layers of the bag but,
simply, to illustrate the bag and the valve function conceptually. Thus, the

dimensions of a gap between the inner and outer layers and the range of radial movement in the direction 211 are not likely to be significant.

Referring to Figure 2b, the bag in a bag filled state is shown. (It will be appreciated that a bag filled state will include any state in which the bag may contain product. That is, the bag may be fully or partially filled.) Product (not shown) in the bag interior 213 has caused the portions 205, 207 to move radially in the direction 211 so that these portions now abut one another as shown in Figure 2b. This arrangement causes the exhaust paths 206 to close, thereby inhibiting flow of air from between atmosphere and the inner layer. Thus, ingress of air from atmosphere to inside 213 the inner layer 203 is inhibited.

It is appreciated that the extent to which the impermeable portion 207 of the outer layer 209 overlaps the permeable portion 205 of the inner layer 203 can be variable and is not limited by the manufacturing processes applied to known bags. Accordingly, the impermeable portion 207 does not have to overlap the permeable portion 205 completely. Indeed, the extent of the overlap depends upon various factors such as the sensitivity of the stored products and the storage time of the products and any range of overlap may be performed by judicious assembly of the bag layers. Therefore, if the products are particularly sensitive to the external environment (e.g. cocoa), the surface area of the impermeable portion 207 may be arranged to be larger than a corresponding surface area of the permeable portion 205. Therefore, in the filled state of Figure 2b, permeable portion 205 is completely covered by the corresponding impermeable portion 207 and flow of air is completely inhibited; that is, blocked. However, the impermeable portion 207 need only cover the permeable portion 205 partially to inhibit passage of air between inside 213 the inner layer 205 and atmosphere.

Thus, by providing the inner layer 203 which comprises both portions of permeable and impermeable material 205, 204, opposite ends of the layer 105 overlapping each other as in Figure 1 is thus not required. Accordingly,

embodiments may also use less impermeable material which is expensive, and this may consequently reduce manufacturing costs.

5 A further advantage of the embodiment of Figure 2 over the known arrangement is that the bag is made up of only two layers, thereby simplifying the assembly/manufacturing process significantly and, perhaps, reducing corresponding costs.

10 Further, when the bag of Figure 2 is stored in the correct manner – that is, the bag is in a bag stored state – correct orientation of the bag (or, more specifically, correct orientation of the valve) allows the valve function to be enhanced. This happens under the action of gravity. If the bag is stored such that the valve is oriented to be on an underside of the bag, the force of gravity acting on the bag helps also to close the valve, thereby enhancing the sealing
15 effect. Alternatively or additionally, if a plurality of bags are stacked one on top of the other, the effect of a bag on the bag directly below it, depending on the orientation of the valves, is that the force of gravity on the upper bag will enhance the sealing effect of at least the lower bag and perhaps the upper bag too.

20 It should be appreciated that the respective permeable and impermeable portions of the bag can be manufactured according to numerous techniques which are known to a skilled person. For instance, the impermeable portions of the bag can be made by coating the relevant portions of the bag with plastic, whilst the permeable portions can be made by producing perforations or holes
25 on an impermeable material or, simply, making the portion of permeable material such as paper.

In embodiments, the plastic for the portions of impermeable material is selected
30 according to its electrostatic properties. Thus, when a plastic material is used to form the impermeable portions, the impermeable portion of the outer layer 207 will be attracted to the impermeable portion of the inner layer 203 by

electrostatic charges in the portions; that is, one layer will be adhered to another. Such an attraction between the corresponding portions of the layers will enhance the inhibition of passage of air in the directions 206. A “tacky” material – i.e. one that is sticky – may also be used to enhance the sealing function.

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Figure 3a is a perspective view of a second embodiment. Figure 3b shows a cross-sectional view of the bag of Figure 3a.

It will be appreciated that similar principles of operation apply for the bag
10 illustrated in these figures.

Referring to Figure 3a, the bag 301 includes an inner layer which comprises a portion of permeable material 303 and a portion of impermeable material 305. In this embodiment, the outer layer of the bag is a first outer layer 307 of
15 impermeable material which surrounds the permeable portion 303 of the inner layer. The first outer layer(s) 307 is/are disposed between the inner layer 303 and a second outer layer 309, which may be made entirely of permeable material. The respective layers of the embodiment are held in their positions either by conventional gluing means at the top/bottom ends (with respect to the
20 longitudinal axis 300).

Referring to Figure 3b, the bag provides similar functionality to the bag of Figure 2 so that air exhausts to atmosphere from inside the inner layer 303 in the direction of the arrows 306. Similarly, when the bag is filled, product in the bag
25 causes abutment of the permeable portion 303 of the inner layer against the impermeable portion 307 of the first outer layer, and inhibits air from flowing between the atmosphere and the bag interior.

Note that the outer layer(s) 307 surround the inner layer partially in this
30 embodiment. Thus, less material is used for this layer. Further, the outer layer comprises a plurality of impermeable portions 307 and the inner layer has a corresponding number of permeable portions. However, depending on the

particular arrangement, it is not necessary for there to be an exact correspondence in the number of permeable and impermeable portions.

Figure 4a is a perspective view of a third embodiment. Figure 4b shows a cross-sectional view of the bag according to the third embodiment.

The bag of figures 4a and 4b is similar to that of Figures 3a and 3b. The inner layer is made up of permeable portions 403 and impermeable portions 404. The (first) outer layer 407 is made up of impermeable material and surrounds the inner layer only partially. Thus, air exhausts to atmosphere through the check valve made up of the overlap of these portions as illustrated by arrows 406.

Figure 5 is a perspective view of a fourth embodiment

Referring to Figure 5, an end 509 of the first outer layer 507 of the bag 501 is affixed to the inner layer. In embodiments, the end 509 is affixed to the inner layer for the full length of the bag, indicated by dashed line 509a. Typically, the end of the outer layer 507 is affixed using glue. However, any suitable attachment means which is known to a skilled reader can be applied.

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This embodiment advantageously may increase the size of the air passage for the exhaust of air to atmosphere as, by affixing the first end of the outer layer to the inner layer, this is retained in position and air pressure from inside the bag cannot move this end from its fixed position. The air permeability of the bag is increased as the valve between the corresponding permeable portion of the inner layer and impermeable portion of the first inner layer 507 is now larger.

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Figure 6 is plan view of a fifth embodiment.

Referring to Figure 6, the bag 601 includes a side opening (aperture) 602 for filling, an inner layer comprising a portion of permeable material 603 and a portion of impermeable material 605, and an outer layer 607 of impermeable

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material with the top horizontal end 609 of the outer layer 607 being affixed to the inner layer. The aperture 602 is located adjacent a first end 610 of the bag.

5 The corresponding permeable portion and, optionally, impermeable portion of the bag 601 are arranged adjacent the first end 610. Such an arrangement is of a practical consideration as, during filling, the force of gravity (not shown) means that product will settle on the bottom, second end 612 of the bag. Thus, the product will not exert a force on the permeable portion to close the valve until the bag is near full, thereby ensuring a more efficient exhaustion of air to
10 atmosphere.

Figures 7a and 7b are cross-sectional views of a sixth embodiment.

Referring to these figures, the inner layer of the bag 701 is made up of a first
15 inner layer 703 of permeable material and a second inner layer 705 of impermeable material. The bag also has an outer layer 709 of permeable material. At least one end 707 of the second inner layer 705 is affixed to the first inner layer 703 by conventional attachment means. The second inner layer 705 partially surrounds the first inner layer. Typically, a conventional attachment
20 means can be gluing, but is however not restricted to such. This is a significant feature of the bag and may be provided independently. The end 707 may be affixed to an impermeable portion of the inner bag layer to ensure exhaustion of air from inside the bag is not impeded by the fixed part.

25 This embodiment may advantageously increase the air permeability of the bag as the passage of air flow 706 between the corresponding permeable portion of the first inner layer 703 and impermeable portion of the second inner layer 705 is increased.

30 Various modifications to the embodiments described above can be made. For example, the outer layer of the bag may comprise a plurality of portions of impermeable material, with the inner layer comprising a corresponding plurality

of permeable portions to achieve a similar result. This arrangement will accordingly allow a higher flow of air from the bag interior to the atmosphere, thereby achieving a higher air permeability of the bag during a bag-filling state.

- 5 Thus, although the invention has been described above using particular embodiments, many variations are possible within the scope of the claims, as will be clear to the skilled reader, without departing from the invention.

CLAIMS

1. A bag comprising:
 - an aperture for filling the bag;
 - 5 an inner layer having a portion of permeable material and a portion of impermeable material; and
 - an outer layer having a portion of impermeable material arranged in relation to the permeable portion of the inner layer to allow passage of air between inside the inner layer and atmosphere during a bag filling state, and to
 - 10 inhibit passage of air between inside the inner layer and atmosphere in a bag filled state or in a bag stored state.
2. The bag of claim 1, wherein the permeable portion of the inner layer and the impermeable portion of the outer layer are arranged to allow relative radial
- 15 movement between the portions, thereby to define a path for passage of air through the permeable portion of the inner layer to atmosphere in a bag filling state, wherein, in a bag filled state, product in the bag causes at least part of the permeable portion of the inner layer to abut the impermeable portion of the outer layer thereby to inhibit passage of air between inside the inner layer and
- 20 atmosphere.
3. The bag of claim 1 or claim 2, wherein a surface area of the impermeable portion of the outer layer is greater than a surface area of the impermeable portion of the inner layer.
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4. The bag of any preceding claim, wherein the bag further comprises a second outer layer, the outer layer being disposed between the inner layer and the second outer layer.
- 30 5. The bag of claim 4, wherein the outer layer is arranged to surround the inner layer partially.

6. The bag of any preceding claim, wherein the outer layer comprises an end which is affixed to the inner layer.

7. The bag of claim 6, wherein the end of the outer layer is affixed to the impermeable portion of the inner layer.

8. The bag of any preceding claim, wherein the outer layer comprises a plurality of portions of impermeable material and the inner layer comprises a corresponding plurality of permeable portions.

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9. The bag of any preceding claim, wherein the inner layer comprises first and second inner layers, the first inner layer corresponding to the permeable portion and the second inner layer corresponding to the impermeable portion, the second inner layer surrounding the first inner layer partially and being affixed to the first inner layer.

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10. The bag of any preceding claim, wherein the aperture and the portion of permeable material in the inner layer are arranged adjacent a first end of the bag.

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11. The bag of any preceding claim, wherein the portions of impermeable material in the inner and outer layers are formed from a plastic material selected for electrostatic properties of the plastic for the portions of impermeable material in the inner and outer layers to be attracted to one another thereby to enhance inhibition of passage of air between inside the inner layer and atmosphere in the bag filled state or in a bag empty state.

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12. A method of filling a bag according to any of claims 1 to 11 with a product and/or storing the bag.

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