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[Continued on next page]

(54) **Title**: BAG INTENDED FOR BEING APPLIED IN AN EXTERNAL CONTAINER FOR FORMING A PRESSURE VESSEL WITH TWO SEPARATE COMPARTMENTS, PRESSURE VESSEL AND SERIES OF PRESSURE VESSELS HAVING DIVERSE DIMENSIONS FABRICATED WITH SUCH A BAG, AS WELL AS METHOD FOR FABRICATING SUCH A SERIES OF PRESSURE VESSELS

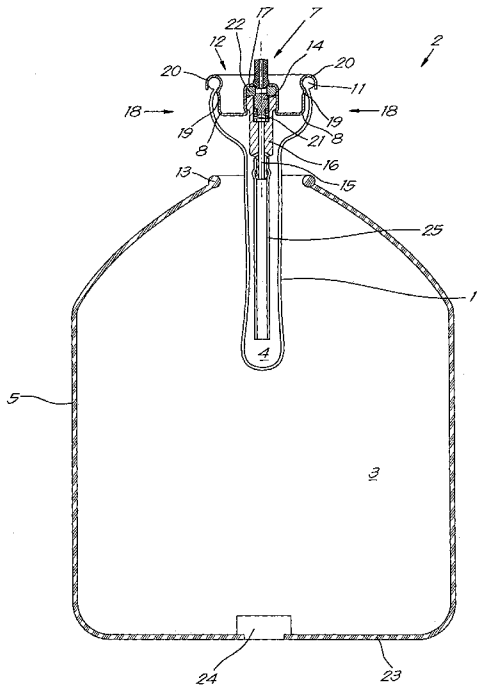

Fig.6

(57) **Abstract**: Bag (1) for application in an external container (2) for forming a pressure vessel (2) with two separate compartments (3,4), that is manufactured from an elastic and stretchable material that is such that the bag (1) can stretch from an unstretched state to a stretched state when the bag (1) is filled with a product (9) or when the bag (1) is inflated with air, whereby the stretching of the bag (1) is reversible and whereby the stretch is so substantial that the bag (1) can be used for constructing pressure vessels (2) of diverse dimensions.

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Bag intended for being applied in an external container for forming a pressure vessel with two separate compartments, pressure vessel and series of pressure vessels having diverse dimensions fabricated with such a bag, as well as method for fabricating such a series of pressure vessels.

The present invention relates to a bag for being applied in an external container for forming a pressure vessel with two separate compartments.

More specifically the invention relates to a bag for being applied in an external container for forming a pressure vessel with two separate compartments, whereby the external container forms a first compartment and the bag is intended to be put in the first compartment as an internal bag to form a second compartment.

It is also the intention here that the bag can be filled with a product.

The present invention also relates to a pressure vessel of the type with two separate compartments that is manufactured with such a bag.

More specifically the invention also relates to such a pressure vessel, whereby a first compartment is formed by an external container, in which an aforementioned bag is provided as an internal bag to form a second compartment, whereby the bag is filled with a product or is intended to be filled with a product, whereby the pressure vessel is

also provided with a valve for the supply of product to and the removal of product from the bag, and whereby both the external container and the internal bag are connected to the valve by means of a gastight connection.

Such pressure vessels of this type with two separate compartments are already known, for example applied in the more recent spray cans, of a type also known under the names of 'piston can', 'can in can', 'bag on valve', 'bag in can', etc.

Such known pressure vessels with two compartments offer a number of advantages with respect to other known pressure vessels with only one compartment that are also often applied in spray cans, in which pressure vessels with only one compartment a propellant and product are stored in one and the same compartment.

A first advantage of such a known pressure vessel with two compartments is that the product and the propellant are each in one of the compartments separately, separated from one another by the aforementioned internal bag, so that there is no mixing of product and propellant, such that the product can remain stable for longer and the product can simply be stored in the bag without having to take account of, and if need be to change, the composition of it on account of possible interactions with the propellant.

Another advantage of the known pressure vessels with two compartments is that, because the product is stored in an internal bag that is put under pressure by a propellant in

the second compartment, 99% of the product can be recuperated, while in the known pressure vessels with only one compartment generally around 5% of the product is still left in the compartment after use.

The known pressure vessels with two compartments, for example for use in the aforementioned known spray cans, are also more environmentally friendly, as the propellant does not leave the pressure vessel.

Moreover compressed air can normally be used as a propellant, so that even after use and/or the destruction of the pressure vessel, no propellant is released that is harmful to the environment.

Moreover the operation of a pressure vessel with two compartments is less noisy and such a pressure vessel with two compartments can be used at any angle without problems, even upside down, which is not the case with known pressure vessels with only one compartment, often applied in certain spray cans, as in such a pressure vessel a suction pipe is generally provided to draw in the product, which for its good operation always has to have its open end immersed in the product.

Another advantage of known pressure vessels with two compartments is that the development of them is much easier, as the same propellant can be used to drive out many products, both more liquid and more viscous products, whereby it is sufficient to modify the head of the pressure vessel with valve, in order to change the opening for

example, or to obtain different outflow rates and/or spray patterns for example in the nozzle that is placed on the valve.

Alongside these many advantages of pressure vessels with two compartments compared to pressure vessels with only one compartment, there are also a number of disadvantages or there are also a number of aspects of the known pressure vessels and with two compartments that are open to improvement.

A first disadvantage of known pressure vessels with two compartments is that upon a change of the volume of product to be stored in the internal container, the volume of the internal bag must be adapted by changing the shape or dimensions of the bag.

Such a change of the volume of product to be stored in the internal container may be necessary when the volume of the external container of the pressure vessel is changed for example, but just as easily such a change of the volume of product to be stored may be desired in an unchanged volume and/or unchanged shape of the external container.

This means that in the event of such a change of the volume of product to be stored, or in the event of a change of the type of product that has to be stored in the pressure vessel, significant changes generally have to be made to the production lines for manufacturing the pressure vessels and for filling the pressure vessels, or a completely different production line has to be used, which brings

about an enormous economic loss, loss of time and/or production loss.

Moreover, when perfecting and testing a new production line or a modification to a production line for pressure vessels, a lot of material is lost and a great deal of waste is created.

Furthermore, it is the case that the valves of pressure vessels are produced with machines specially designed for this purpose, after which they are integrated with other high-technology machines in a subsequent production stage or when filling a pressure vessel.

Such high-technology machines can for example be based on other known 'Form, Fill and Seal' machines, which moreover are specially adapted to the needs of a certain type of pressure vessel with two compartments.

A disadvantage of known pressure vessels with two compartments is that a different internal bag has to be affixed to such a valve according to the application, which is a complicated and expensive matter, and whereby many modifications to production lines and to specialised machines are required.

Another disadvantage of known pressure vessels with two compartments is that their internal bags are made from a laminated material, whereby delamination often occurs after some time through the contact with the product.

Another disadvantage of known pressure vessels with two compartments relates to a problem when filling the bag in such a pressure vessel with product.

During this filling, the product must be forced through the valve at high pressure into the second compartment formed by the bag.

As a result a part of the product often gets into the first compartment, in other words into the part of the pressure vessel between the internal bag and the external container, via the available space between the valve head and the seal of the internal bag around this valve.

This part of the product can cause corrosion in the external container for example, because the product is chemically aggressive for example, whereby this external container must not fail in the slightest on account of the high pressures in the pressure vessel after filling the pressure vessel with product and propellant, whereby possible hazardous situations can arise.

In order to prevent this, the valve housing of the valve is generally clinched under a very high force into a valve seat of the valve, whereby considerable stresses are introduced into the materials, which then give rise to the valve housing breaking away from the valve that is connected to the external container and similar.

Another disadvantage of the known pressure vessels with two compartments is that in the event of a severe impact on the

pressure vessel, for example by dropping the pressure vessel or similar, the internal bag in the pressure vessel can easily tear or break off.

The purpose of the present invention is to provide a solution to the aforementioned and any other disadvantages.

To this end the invention first and foremost concerns a bag for application in an external container for forming a pressure vessel with two separate compartments, whereby the external container forms a first compartment and the bag is intended to be placed in the first compartment as an internal bag to form a second compartment, whereby the bag is also intended to be filled with a product, whereby the bag is manufactured from an elastic and stretchable material that is such that the bag can be expanded from an empty state to a maximum expanded unstretched state, and that the bag can stretch from an unstretched state to a stretched state when the bag is filled with the product or when the bag is inflated with air or another gas, whereby the stretching of the bag is reversible and whereby the stretch is so substantial that the bag can be used for constructing pressure vessels of diverse dimensions.

The invention also relates to a pressure vessel in which a bag according to the invention is applied, and this pressure vessel is of the type with two separate compartments, whereby a first compartment is formed by an external container in which the bag is provided as an internal bag to form a second compartment, whereby the bag is filled with a product or intended to be filled with a

product, whereby the pressure vessel is also provided with a valve for the supply of product to and the removal of product from the bag, and whereby both the external container and the internal bag are connected to the valve by means of a gastight connection, and whereby the bag is manufactured from an elastic and stretchable material, that is such that the bag can be expanded from an empty state to a maximum expanded unstretched state, and that the bag can stretch from an unstretched state to a stretched state when the bag is filled with the product or when the bag is inflated with air or another gas, whereby the stretching of the bag is reversible and whereby the stretch is so substantial that the bag can be used for constructing pressure vessels of diverse dimensions.

A first important advantage of such a bag according to the invention and of such a pressure vessel in which such a bag is applied according to the invention, is that the bag can be used to store different volumes of product without anything having to be changed for this purpose.

This means that the same internal bag can be used for an entire range of products and in different volumes, and thus in total only a few different standard sizes of the internal bags have to be manufactured, for example according to small, medium and large pressure vessels.

Another advantage of such a bag and such a pressure vessel according to the invention is that the production process and the filling of pressure vessels of diverse dimensions is much easier and can be done more quickly.

Indeed, on the one hand a certain type of bag and a certain type of pressure vessel according to the invention with certain dimensions, a certain shape and certain material properties can be used for a large number of different applications or products, whereby the bag has to be filled with diverse volumes, such that production lines and machines in the production lines, as well as filling machines and similar, no longer have to be modified according to the different applications or products, or separate production lines or separate filling machines or similar do not have to be provided for different applications or products.

The manufacture of the valves of pressure vessels according to the invention, as well as the affixing of an internal bag to the valves and the integration of the valves in the pressure vessel, is somewhat simpler with such a bag and such a pressure vessel according to the invention than with the known pressure vessels with two compartments formed by the known bags.

On the other hand, the same type of internal bag according to the invention can be used for many different applications and products and for pressure vessels with highly diverse dimensions, such that far fewer modifications are required.

Another advantage of a bag according to the invention, as well as a pressure vessel according to the invention, is

that they are far more resistant to an impact, for example as a result of dropping the pressure vessel.

Because the internal bag is highly flexible, upon an impact this bag will give way somewhat, and thus be less inclined to tear than with the known pressure vessels with two compartments.

Another reason why the pressure vessel according to the invention is more resistant to an impact is due to the fact that the base of the stretchable internal bag can touch the base of the external container upon an impact, such that the bag is supported against the base and there is less risk of the bag tearing under the weight of the product in the internal bag.

Moreover a pressure vessel according to the invention still has all the advantages of pressure vessels with two compartments, most of which are listed in the introduction.

According to a preferred embodiment of a bag according to the invention, the bag is provided with an opening that is delimited by a surrounding edge, whereby this surrounding edge is thickened and constructed so as to be able to act as a sealing material to form a gastight connection to the pressure vessel.

Such a bag according to the invention is extremely practical as the sealing of a pressure vessel is thereby greatly simplified and no additional sealing rings or similar are required.

According to another preferred embodiment of a bag and pressure vessel according to the invention is that the internal bag is manufactured from a single layer of material.

Such an embodiment of a bag according to the invention applied to a pressure vessel according to invention of course provides the advantage that no delamination can occur.

The invention also relates to a spray can that comprises a pressure vessel, as described above, or which is constructed as such a pressure vessel.

The advantages of such a spray can according to the invention arise directly from the advantages of the pressure vessel described above, such that no further comment on this is necessary.

Moreover, the invention relates to a series of pressure vessels according to the invention with diverse dimensions of the type with two compartments in which a bag according to the invention is applied that is manufactured from an elastic and stretchable material, as described above, and whereby each pressure vessel, irrespective of its dimensions, is provided with the same type of bag, whereby all the aforementioned bags have the same properties, and more specifically in the maximum expanded unstretched state have the same size and wall thickness.

The invention also relates to a method for manufacturing a series of pressure vessels according to the invention with diverse dimensions, whereby each pressure vessel is of a type with two compartments, as described above, whereby a bag according to the invention is applied, as also described above, and whereby bags according to the invention of the same type, that each have the same dimensions and properties, are used for pressure vessels with diverse dimensions, and which more specifically in the unstretched state have a certain fixed size and wall thickness, irrespective of the dimensions of the pressure vessel.

With the intention of better showing the characteristics of the invention, a few preferred embodiments of a bag, a pressure vessel, and a series of pressure vessels with diverse dimensions according to the invention are described hereinafter by way of an example, without any limiting nature, with reference to the accompanying drawings, wherein:

figures 1 to 3 show a perspective view of a bag according to the invention, respectively in a relaxed state, a maximum expanded unstretched state, and in a stretched state;

figure 4 shows a perspective view of a pressure vessel according to the invention before the valve and the internal bag have been fitted in the external container;

figure 5 schematically shows a perspective view of the pressure vessel of figure 1, after fitting the valve

and the internal bag in the external container and after filling the bag with product;

figure 6 shows a cross-section according to the cut indicated by VI-VI in figure 4 of a first possible embodiment in an unfilled state;

figure 7, analogous to figure 6, shows a cross-section of another possible embodiment of a pressure vessel according to the invention, but this time in the filled state;

figures 8 and 9 again show a cross-section, analogous to figures 6 and 7, for other embodiments of a pressure vessel according to the invention, again in the empty state and filled state respectively;

figure 10 shows a series of pressure vessels of diverse dimensions according to the invention, each time provided with a bag according to the invention of the same type, more specifically in the empty state; and

figure 11 shows the same series as in figure 10, but this time in the filled state.

Figures 1 to 3 show a bag 1 according to the invention that is intended to be applied in a pressure vessel 2 according to the invention, as shown in figures 4 to 11.

A bag 1 according to the invention is manufactured from an elastic and stretchable material.

The bag 1 can be expanded from an empty state, as shown in figure 1, to a maximum expanded unstretched state that is shown in figure 2.

On account of its high elasticity, the bag 1 can be further stretched from an unstretched state to a stretched state, a possibility which is shown in figure 3, when the bag 1 is filled or inflated with air or similar.

The stretch of the bag 1 is hereby reversible, so that a stretched bag 1, shown in figure 3, can return to an unstretched state as was originally the case, for example according to a state shown in figure 1 or 2, when the stretch is removed, for example by letting the bag empty.

It is important that any stretch of a bag 1 according to the invention is so substantial that the bag 1 can be used to construct pressure vessels 2 with diverse dimensions.

A pressure vessel 2 according to the invention is a pressure vessel 2 of the type with two separate compartments 3 and 4.

In this case the pressure vessel 2 is constructed as a spray can 2, for which the invention is primarily intended, but it is not excluded applying a similar technology according to the invention, as described in this text, to other pressure vessels than spray cans 2, for example for larger pressure vessels for storing chemical products or similar.

A first compartment is hereby formed by the space that is bounded between an external container 5 and the bag 1 that is provided in the external container 5 as an internal bag

5, and which depending on the embodiment is also bounded by a part 6 (see for example the embodiment of figure 7) of a valve 7 that extends between the internal bag 1 and the external container 5.

The second compartment 4 is formed by the space in the bag 1 bounded by the wall of the bag 1 and by the parts 8 of the valve 7.

The intention is to store a product 9 in the internal bag 1 by supplying it through the valve 7 in order to subsequently remove it through this valve 7 when using the product 9.

If necessary, a vacuum can be applied to the second compartment 4, for example when the internal bag 1 with the valve 7 is fitted in the external container 5 to form the pressure vessel 2, or at a later time, such as for example just before filling the pressure vessel 2 with product 9.

The external container 5, as well as the internal bag 1, are each connected to the valve 7 by means of a gastight connection 10.

In the embodiment of figures 4 to 6, this is realised by the same common gastight connection 10.

A surrounding edge 11 of an opening 12 in the bag 5 is hereby clamped between the valve 7 and a surrounding edge 13 to the external container 4 to form the aforementioned common gastight connection 10.

In order to be able to realise such a gastight connection 10, the surrounding edge 11 is thickened, so that this thickened surrounding edge 11 can also act as a sealing material to form the gastight connection 10 to the pressure vessel 1.

Such a sealing method according to the invention, by using the bag 1 as a sealing material, is of course highly efficient and requires less material than, as is usually the case, using additional sealing means such as sealing rings or similar.

Figure 6 shows in more detail how the valve 7 and the aforementioned gastight connection 10 are constructed.

The valve 7 is first and foremost a non-return valve 7 with a shutoff 14 that can move back and forth in a passageway 15 of a valve housing 16 between a position in which the passageway 15 is closed and a position in which the passageway 15 is open.

The valve housing 16 is provided with a circular valve seat 17 that extends radially from the valve housing 16 and which is provided on the outside edge 18 with an upright collar 19 with folded edge 20.

In the passageway 15 there is also a spring 21 that presses and clamps the shutoff 14 between the valve housing 16 and a rubber seal 22 that rests against the valve seat 17, so that in the normal state, in which no product 9 is blown

into the bag 1 under pressure, or the shutoff 14 is not pressed away from the rubber seal 22 by an external force, the shutoff 14 is in a position whereby the passageway 15 is closed.

In the embodiment shown in figure 6, the aforementioned surrounding edge 11 of the opening 12 in the bag 1 is introduced into the aforementioned folded edge 20 of the valve seat 17, whereby in this case the surrounding edge 11 is partly rolled up in order to fill the surrounding cavity in the folded edge 20 with the material of the bag 1.

Figure 6 shows the unassembled state, but it is of course the intention that the surrounding edge 13 of the external container is also introduced into the aforementioned folded edge 20 of the valve seat 17, in order to clamp the edge 11 of the bag 1 between the folded edge 20 of the valve seat 17 and the surrounding edge 13 of the external container 5 to form the common gastight connection 10.

Moreover, it is the intention to fill the first compartment 3 with a propellant, which can be done for example by providing the base 23 of the external container with an additional valve 24 through which such a propellant can be introduced into the first compartment 3, but other ways of doing this are not excluded.

The "Under-The-Cup" process is such an alternative filling method for example.

The propellant is thereby introduced between the folded edge 20 of the valve seat 17 and the surrounding edge 13 of the external container 5, after which the gastight connection 10 is created by pressing and clinching the folded edge 20 of the valve seat 17 together with the thickened edge of 11 of the bag 1 to the surrounding edge 13 of the external container 5.

This clinching to form a gastight connection 10 can be done by deforming the upright collar 19 in a controlled way during assembly for example, such that the upright collar 19 is partially folded under the surrounding edge 13. This clinching method is also called "internal clinching".

Another clinching method to form the gastight connection 10 can consist of rolling the folded edge 20 of the valve seat 17 around the surrounding edge 13 of the external container 5. This clinching method is also called "external clinching".

For rolling the edge 20 of the valve seat 17 around the surrounding edge 13 of the external container 5, valves 7 are already designed in industry with an "extended" edge 20.

Such valves 7 with an "extended" edge 20 can be clinched in a gastight way to spray cans made of polyethylene terephthalate (PET spray cans), for example.

The propellant can be any gas, for example one or another inert gas, but preferably according to the invention a gas

is used that burdens the environment as little as possible, such as air for example.

Of course it is the intention that the propellant exerts a pressure on the bag 1 so that when the shutoff 14 is activated by a user to a position in which the passageway 15 in the valve 7 is no longer closed, the product 9 in the bag 1 can flow out of the bag under the pressure provided by the propellant.

In order to completely or sufficiently empty the bag 1, especially with viscous products, a flow tube 25 is provided on the valve housing 16 in order to extend the passageway 15 in the valve housing 16.

During fabrication of the stretchable bag 1, the inside of this bag 1 can be provided with flow-fostering means 26 that keep the bag 1 open somewhat when emptying the pressure vessel 2, which thus provides a sufficiently large opening to ensure the flow of product 9 into the open valve 7, and consequently to be able to empty the bag 1 completely or at least to the desired extent.

Such flow-fostering means 26 can for example be formed by a few vertical ribs 26 or local elevations or thickenings 26, more or less proportionately distributed over the inside surface of the bag 1.

A characteristic of a pressure vessel 2 according to the invention is the fact that the bag 1 is manufactured from an elastic stretchable and preferably gastight material,

that is such that the bag 1 can stretch from an unstretched state, as shown in figures 1, 2, 6, 8 and 10, to a stretched state, as shown in figure 3, 7, 9 and 11, when the bag 1 is filled with the product 9 or when the bag 1 is inflated with air or another gas.

As already set out in the introduction, it is through this elasticity of the bag 1 that a pressure vessel 2 according to the invention provides many advantages with respect to the existing pressure vessels with two compartments 3 and 4, for example because the volume of product 9 in the bag 1 can be easily adapted without having to use a different bag 1 for this purpose, resulting in many advantages with regard to the production of such a pressure vessel 2, or for example because such a bag is less prone to damage in the event of an impact of the pressure vessel 2, etc.

According to a preferred embodiment of a pressure vessel 2 according to the invention, the bag 1 is manufactured from a material that is stretchable such that the volume occupied by the bag 1 in the stretched state is substantially greater than in the unstretched state, and this with the intention that the same type of bag 1 with certain dimensions and material properties can be used to fill pressure vessels 2 with highly diverse dimensions.

For example the volume that the bag 1 can occupy in the stretched state for a long time, without tearing or being damaged, is at least the double the maximum volume that the bag 1 can occupy when the bag 1 is not stretched, but preferably the volume that the bag 1 can occupy in the

stretched state without appreciable weakening is at least three or more times the maximum volume that the bag 1 can occupy when the bag 1 is not stretched.

Moreover, according to the invention it is important that the material from which the bag 1 is manufactured automatically takes on its original shape and dimensions, or at least approximately so, even after the bag 1 has been in the stretched state for a long time.

Another preferred characteristic of the present invention is that the bag is manufactured from at least one of the following materials:

- a natural rubber (latex);
- a synthetic rubber;
- a silicone rubber;
- a plastic;
- a mixture of a natural rubber and one or more plastics;
- an elastomer;
- a thermoplastic elastomer;
- a polyurethane;
- a hybrid material;
- a nanostructured material;
- an LLDPE (Linear Low Density Polyethylene); or,
- a biopolymer.

Moreover, according to the invention the bag 1 is preferably manufactured from a single layer of material, such that the bag 1 is not liable to the phenomenon of

delamination mentioned in the introduction, which occurs in the bags 1 of known pressure vessels 2 with two compartments 3 and 4 that are manufactured from a number of layers.

According to another preferred embodiment of a pressure vessel 2 according to the invention, the bag 1 is manufactured from a material that is gastight and/or impermeable to the product 9 in the stretched state.

Expressed in less absolute terms, this means that according to the invention the bag 1 in a stretched state must be impermeable to such an extent that a gas in the first compartment 3 under the pressures present in the pressure vessel 2, must be impermeable, or only permeable to an extent acceptable for the application, so that penetration of the propellant from the compartment 3 into the second compartment 4 with the product 9 is avoided as much as possible.

Similarly, the material in the conditions of use is preferably permeable as little as possible to the product 9, in order to counteract the escape of the product 9 from the bag 1 to the first compartment 3 as much as possible, or is only allowed to a very limited extent.

For example, a certain maximum limit can be set for the permeability of the material under the aforementioned conditions, and this to both the propellant and the product 9.

According to an even more preferred embodiment of a pressure vessel 2 according to the invention, the bag 1 is manufactured from a biodegradable material.

Of course this choice is highly advantageous, as such a pressure vessel 2 according to this embodiment is less of an environmental burden than a pressure vessel 2 according to the invention in which the bag 1 is not biodegradable, but which even in this less environmentally-friendly embodiment still yields important ecological benefits, as no propellant is released from the pressure vessel 2 during use.

Figure 7 shows another embodiment of a pressure vessel 2 according to the invention, whereby this time the external container 5 and the bag 1 are each connected to the valve 7 by a separate gastight connection, more specifically by a first gastight connection 27 between the external container 5 and the valve 7 and a second gastight connection 28 between the bag 1 and the valve 7.

To form the second gastight connection 28, the aforementioned surrounding edge 11 of the bag 1 is clamped between the valve seat 17 and a projection 29 that extends radially to the valve housing 16 at some distance below the valve seat 17.

The first gastight connection 27 between the external container 5 and the valve 7 is, as in the previous embodiment, provided with a folded edge 20 of the valve

seat 17, whereby the surrounding edge 13 of the external container 5 is clamped in the folded edge 20.

As shown in more detail in figure 8, to this end a separate rubber seal 30 can be affixed in the folded edge 20 in order to obtain a good seal.

An advantage of this embodiment of a pressure vessel 2 according to the invention consists of the bag 1 and the valve 7 being able to be assembled beforehand, and that it is sufficient to subsequently fit this combination of bag 1 and valve 7 to an external container 5, whereby the final specific shape of the external container 5 plays little or no role.

To this end it is sufficient to manufacture a single type of such a combination of bag 1 and valve 7, or only a limited number of such combinations of bag 1 and valve 7, in order to produce a wide variety of pressure vessels 2, whereby the production time and production costs are also reduced enormously.

The embodiment of a pressure vessel 2 shown in figure 8, is analogous to that of figure 7, even though the second gastight connection between the bag 5 and the valve 7 is realised in a somewhat modified form.

More specifically the clamping of the surrounding and rolled-up edge 11 of the opening 12 in the bag 1 is realised at some radial distance D from the valve housing

16, instead of a groove 31 in the radial projection 29 on the valve housing 16 and a groove 32 in the valve seat 17.

In this way, the opening 12 of the bag 5 formed by the surrounding edge 11 is somewhat larger than in the previous embodiment.

In the embodiment of figure 8, additional transit channels 33 are provided in the projection 29 on the valve housing 16, more specifically in the part of the projection 29 located between the second gastight connection 28 and the wall 34 of the valve housing 16, from which the projection 29 extends radially.

A big advantage of this embodiment according to figure 8 of a pressure vessel 2 according to the invention is that when filling the bag 1 with product 9, the product 9 can be supplied through the passageway 15 that can be closed directly via the shutoff 14, and via the transit channels 33 in the projection 29, such that the bag 1 can be filled with product at a much higher rate, which yields an enormous time saving, especially in mass production.

Figure 9 shows another embodiment of a pressure vessel 2 according to the invention.

As in the previous embodiments of figures 7 and 8, the external container 5 and the bag 1 are each connected to the valve 7 by a separate gastight connection 27 and 28.

The first gastight connection 27 between the container 5 and the valve 7 is hereby unchanged, while the second gastight connection 28 is realised between the projection 29 on the valve housing 16 and a separate mountable piece 35 on the valve 7, and no longer between the projection 29 and the valve seat 17, as in the previous cases.

In this case, this piece 35 consists of a cylindrical element 35 with an internal opening 36 matching the cylindrical outer wall 34 of the valve housing 16, whereby the diameter of this opening 36 is broadened at one end.

In the wall 34, clamping means 37 are also provided in this wall 34, which in this case are compressible and which, when the piece 35 is moved along the valve housing 16, is temporarily compressed until this clamping means 37 can expand again upon a sufficiently large movement of the piece 35 along the valve housing 16 towards the projection 29, so that the expansion thereof in the widening of the opening 36 is possible, and thus the piece 35 is secured between the clamping means 37 and the projection 29, whereby the surrounding edge 11 of the bag 1 is also clamped between the projection 29 and the piece 35 to form the gastight seal 28.

Of course many alternative embodiments of the clamping means 37 are possible without acting outside the scope of the invention.

For example the clamping means 37 can just as well consist of bulges 37 on the valve housing 16 that cannot be

compressed, but which are fastened securely to the valve housing 16 or simply form part of it, and whereby the separate mountable piece 35 is put in place by pressing it forcefully over the bulges 37 in the direction of the projection 29, such that the bulges 37 come to rest in the widening of the opening 36.

The connection between the separate mountable piece 35 and the valve housing 16 can also be realised differently, without necessarily also making use of clamping means 37.

For example parts of the piece 35 and the valve housing 16 can be fused together, for example by applying certain types of welding methods, such as for example ultrasonic welding, induction welding, etc.

With this embodiment of a pressure vessel 2 according to the invention an easily mountable whole is obtained, whereby all kinds of different types of bags 1, for example bags 5 with a suitable shape or volume or bags 1 manufactured from a suitable material as a function of the application, can be mounted on the valve 7 without problems in an extremely flexible way.

In the embodiments discussed above, the gastight connections 10, 27 and 28 between the valve 7 and the container 5 or the bag 1 are realised directly on the valve 7, but this can just as well be realised in other embodiments by making use of intermediate elements without departing from the scope of the invention.

Figures 10 and 11 more explicitly show that the invention also relates to a series of pressure vessels 36 with diverse dimensions.

In the example shown, the series of pressure vessels 36 consists of three pressure vessels 2, more specifically a small pressure vessel 2, a medium pressure vessel 2 and a large pressure vessel 2.

Hereby each pressure vessel 2, irrespective of its dimensions, is provided with the same type of bag 1, whereby each of the three bags 1 have the same properties and more specifically are of the same size and wall thickness in the maximum expanded unstretched state, in accordance with the state shown in figure 2.

This is clearly illustrated in figure 10.

Figure 11 shows the series of pressure vessels 36 according to the invention with diverse dimensions in the state whereby the pressure vessels 2 are filled with product 9.

This clearly shows that the bags 1 are highly stretchable and in so doing can be used in pressure vessels 2 with large dimensional differences, which is of course a considerable advantage with respect to methods for manufacturing pressure vessels 2 of diverse dimensions, as known according to the state of the art.

The present invention is by no means limited to the embodiment of a bag 1, a pressure vessel 2 or a series of

pressure vessels 36 according to the invention, constructed or otherwise as a spray can according to the invention, described as an example and shown in the drawings, but a bag 1, a pressure vessel 2 or a series of pressure vessels 36 as well as a spray can according to the invention can be realised in all kinds of variants, without departing from the scope of the invention.

Claims.

1.- Bag (1) for application in an external container (2) for forming a pressure vessel (2) with two separate compartments (3,4), whereby the external container (5) forms a first compartment (3) and the bag (1) is intended to be placed in the first compartment (3) as an internal bag (1) to form a second compartment (4), whereby the bag (1) is also intended to be filled with a product (9), characterised in that the bag (1) is manufactured from an elastic and stretchable material that is such that the bag (1) can be expanded from an empty state to a maximum expanded unstretched state, and that the bag (1) can stretch from an unstretched state to a stretched state when the bag (1) is filled with the product (9) or when the bag (1) is inflated with air or another gas, whereby the stretching of the bag (1) is reversible and whereby the stretch is so substantial that the bag (1) can be used for constructing pressure vessels (2) of diverse dimensions.

2.- Bag (1) according to claim 1, characterised in that the bag (1) is provided with an opening (12) that is delimited by a surrounding edge (11), whereby this surrounding edge (11) is thickened so as to be able to act as a sealing material to form a gastight connection (10) to the pressure vessel (2).

3.- Pressure vessel (2) in which a bag (1) according to claim 1 or 2 is applied, whereby the pressure vessel (2) is of the type with two separate compartments (3,4), whereby a

first compartment (3) is formed by an external container (5) in which the bag (1)is provided as an internal bag (1) to form a second compartment (4), whereby the bag (1) is filled with a product (9) or intended to be filled with a product (9), whereby the pressure vessel (2) is also provided with a valve (7) for the supply of product (9) to and the removal of product (9) from the bag (1), and whereby both the external container (5) and the internal bag (1) are connected to the valve (7) by means of a gastight connection (10,27,28), characterised in that the bag (1) is manufactured from an elastic and stretchable material, that is such that the bag (1) can be expanded from an empty state to a maximum expanded unstretched state, and that the bag (1) can stretch from an unstretched state to a stretched state when the bag (1) is filled with the product (9) or when the bag (1) is inflated with air or another gas, whereby the stretching of the bag (1) is reversible and whereby the stretch is so substantial that the bag (1) can be used for constructing pressure vessels (2) of diverse dimensions.

4.- Pressure vessel (2) according to claim 3, characterised in that the bag (1) is manufactured from a material that is stretchable such that the volume occupied by the bag (1) in a stretched state is at least double the maximum volume that the bag (1) can occupy when the bag (1) is in its maximum expanded unstretched state.

5.- Pressure vessel (2) according to claim 3 or 4, characterised in that the bag (1) is manufactured from a

material, which in a stretched state is gastight and/or impermeable to the product (9).

6.- Pressure vessel (2) according to any one of the claims 3 to 5, characterised in that the bag (1) is manufactured from a biodegradable material.

7.- Pressure vessel (2) according to any one of the claims 3 to 6, characterised in that the bag (1) is manufactured from a single layer of material.

8.- Pressure vessel (2) according to any one of the claims 3 to 7, characterised in that the bag (1) is manufactured from at least one of the following materials:

- a natural rubber (latex);
- a synthetic rubber;
- a silicone rubber;
- a plastic;
- a mixture of a natural rubber and one or more plastics;
- an elastomer;
- a thermoplastic elastomer;
- a polyurethane;
- a hybrid material;
- a nanostructured material;
- an LLDPE (Linear Low Density Polyethylene); or,
- a biopolymer.

9.- Pressure vessel (2) according to any one of the claims 2 to 8, characterised in that the external container (5)

and the bag (1) are each connected to the valve (7) by a separate gastight connection (27,28), more specifically by a first gastight connection (27) between the container (5) and the valve (7) and a second gastight connection (28) between the bag (1) and the valve (7).

10.- Pressure vessel (2) according to any one of the claims 3 to 8, characterised in that the external container (5) and the bag (1) are connected to the valve (7) by the same common gastight connection (10).

11.- Pressure vessel (2) according to claim 9 or 10, characterised in that a gastight connection (10,28) to the pressure vessel (2) is formed by a thickened surrounding edge (11) of the internal bag (1) that acts as a sealing material to form the gastight connection (10, 28).

12.- Pressure vessel (2) according to claim 11, characterised in that the surrounding edge (11) of an opening (12) in the bag (1) is clamped between the valve (7) and a surrounding edge (13) of the external container (4) to form the aforementioned common gastight connection (10).

13.- Pressure vessel (2) according to any one of the claims 3 to 12, characterised in that the valve (7) is a non-return valve (7) with a shutoff (14) that can move back and forth in a passageway (15) of a valve housing (16) between a position in which the passageway (15) is closed and a position in which the passageway (15) is open, and whereby the valve housing (16) is also provided with a circular

valve seat (17) that extends radially from the valve housing (16) and on the outside edge (18) has an upright collar (19) with folded edge (20).

14.- Pressure vessel (2) according to claims 9 and 13, characterised in that the gastight connection (27) between the external container (5) and the valve (7) is provided at the folded edge (20) of the valve seat (17), whereby a surrounding edge (13) of the external container (5) is clamped into the folded edge (20).

15.- Pressure vessel (2) according to claim 14, characterised in that to form the gastight connection (27) between the external container (5) and the valve (7), the upright collar (19) of the valve seat (17) is partly folded under the surrounding edge (13) of the external container (5).

16.- Pressure vessel (2) according to claim 14, characterised in that to form the gastight connection (27) between the external container (5) and the valve (7), the folded edge (20) of the valve seat (17) is rolled around the surrounding edge (13) of the external container (5).

17.- Pressure vessel (2) according to claims 10, 11 and 13, characterised in that a surrounding edge (11) of an opening (12) in the bag (1) is introduced in the aforementioned folded edge (20) of the valve seat (17), as well as a surrounding edge (13) of the external container (5), and whereby the edge (11) of the bag (1) is clamped between the folded edge (20) of the valve seat (17) and the surrounding

edge (13) of the external container (5) to form the common gastight connection (10).

18.- Pressure vessel (2) according to claims 9, 11 and 13, characterised in that to form the second gastight connection (28), a surrounding edge (11) of the bag (1) is clamped between a projection (29) that extends radially to the valve housing (16) and the valve seat (17).

19.- Pressure vessel (2) according to claim 18, characterised in that the aforementioned projection (29) is provided with one or more transit channels (33), more specifically in a part of the projection (29) located between the second gastight connection (28) and a wall (34) of the valve housing (16) from which the projection (29) extends radially.

20.- Pressure vessel (2) according to any one of the claims 13 to 19, characterised in that a flow tube (25) is provided on the valve housing (16) in the extension of the passageway (15) in the valve housing (16).

21.- Pressure vessel (2) according to any one of the claims 3 to 20, characterised in that the bag (1) is provided with flow-fostering means (26) consisting of a few vertical ribs (26) or local elevations or thickenings (26) provided on the inside surface of the bag (1).

22.- Spray can, characterised in that it comprises a pressure vessel (2) according to any one of the claims 3 to 21.

23.- Spray can according to claim 22, characterised in that it is constructed as a pressure vessel (2) according to any one of the claims 3 to 21.

24.- Series of pressure vessels (36) of diverse dimensions of the type with two compartments (3,4) whereby a first compartment (3) is formed by an external container (5), in which an internal bag (1) is provided for forming a second compartment (4), whereby the bag (1) is filled with a product (9) or intended to be filled with a product (9), whereby the pressure vessel (2) is also provided with a valve (7) for the supply of product (9) to and the removal of product (9) from the bag (1) and whereby, both the external container (5), and the internal bag (1) are connected to the valve (7) by means of a gastight connection (10,27,28), whereby the bag (1) can be expanded from an empty state to a maximum expanded state, characterised in that the bag (1) is manufactured from an elastic and stretchable material, that is such that the bag (1) can stretch from the maximum expanded state to a stretched state when the bag (1) is filled with the product (9) or when the bag (1) is inflated with air or another gas, whereby the stretching of the bag (1) is reversible and whereby each pressure vessel (2), irrespective of its dimensions, is provided with the same type of bag (1), whereby all aforementioned bags (1) have the same properties and more specifically in the maximum expanded unstretched state have the same size and wall thickness.

25.- Method for manufacturing a series of pressure vessels (2) of diverse dimensions, whereby each pressure vessel (2) is of a type with two compartments (3,4), whereby a first compartment (3) is formed by an external container (5), in which an internal bag (1) is provided for forming a second compartment (4), whereby the bag (1) is filled with a product (9), whereby the pressure vessel (2) is also provided with a valve (7) for the supply of product (9) to and the removal of product (9) from the bag (1) and whereby both the external container (5) and the internal bag (1) are connected to the valve (7) by means of a gastight connection (10,27,28), characterised in that the bag (1) is manufactured from an elastic and stretchable material, that is such that the bag (1) can be expanded from an empty state to a maximum expanded unstretched state and that the bag (1) can stretch from an unstretched state to a stretched state when the bag (1) is filled with the product (9) or when the bag (1) is inflated with air or another gas, whereby the stretching of the bag (1) is reversible and whereby, for pressure vessels (2) of diverse dimensions, bags (1) of the same type are used that each have the same dimensions and properties, and which, more specifically, have a certain fixed size and wall thickness in the unstretched state, irrespective of the dimensions of the pressure vessel (2).

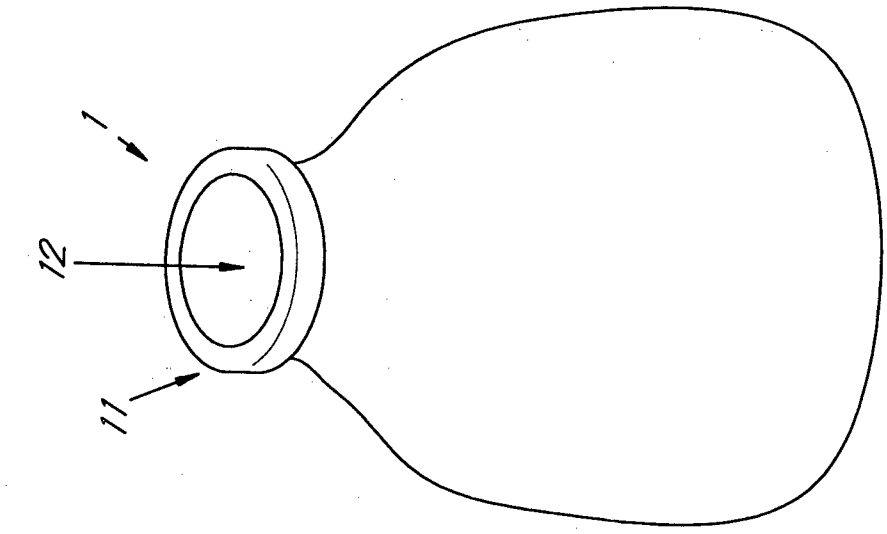

Fig.3

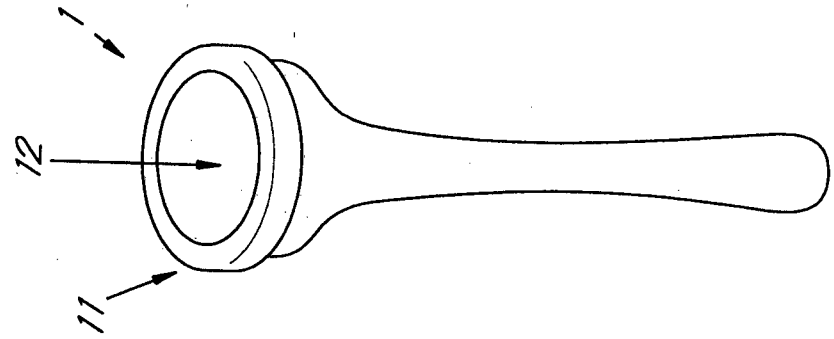

Fig.2

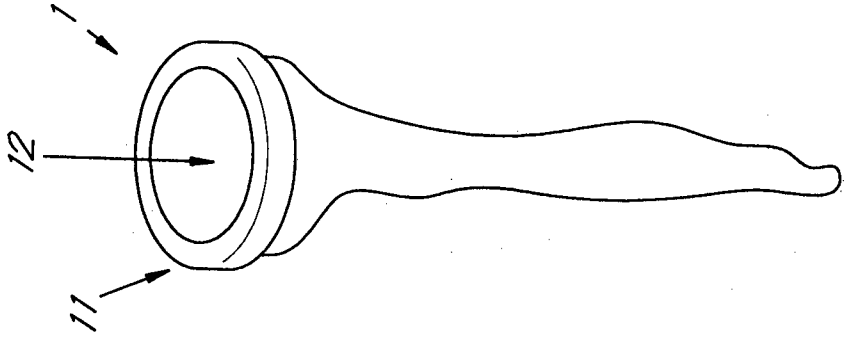

Fig.1

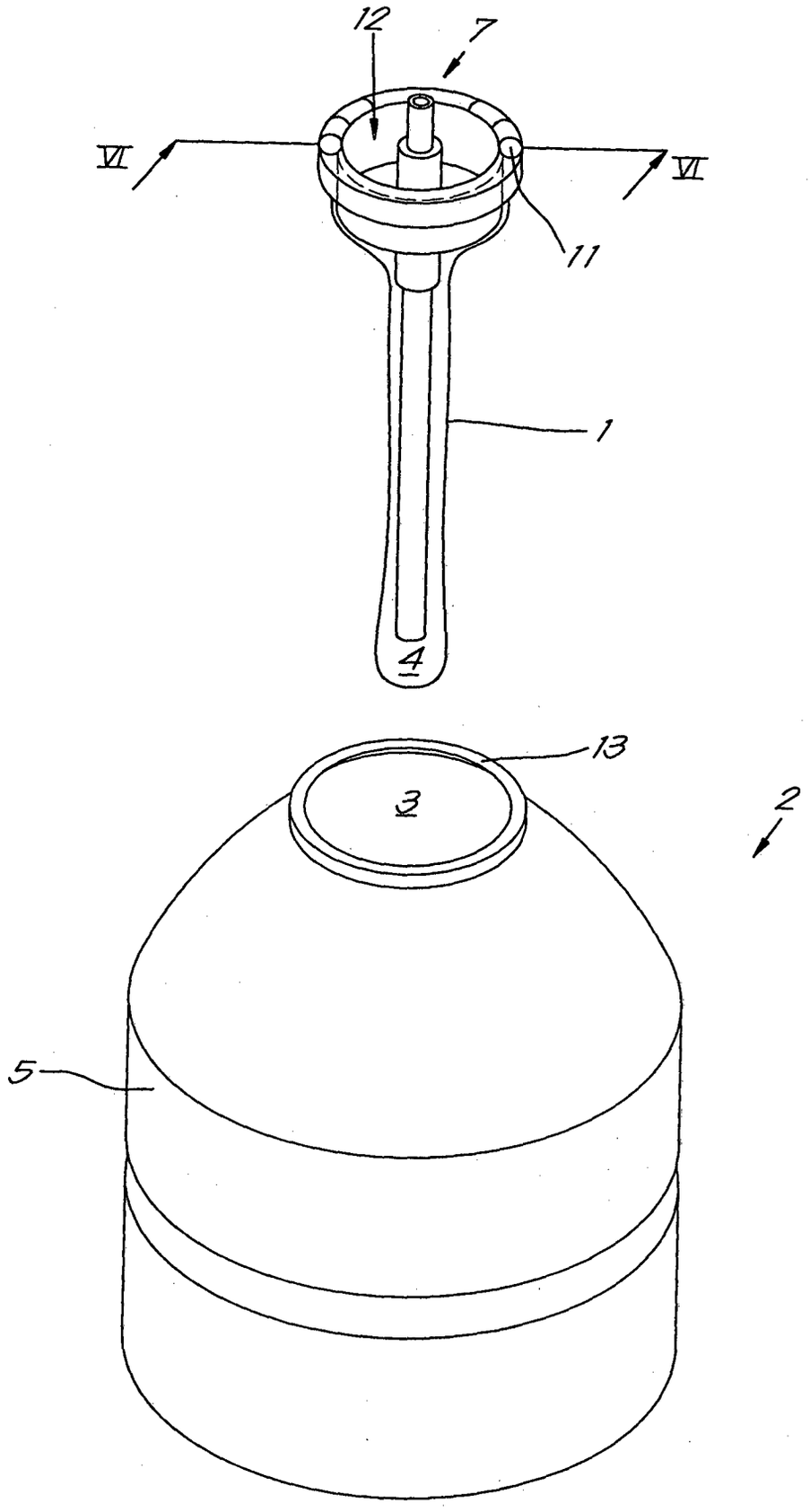

Fig.4

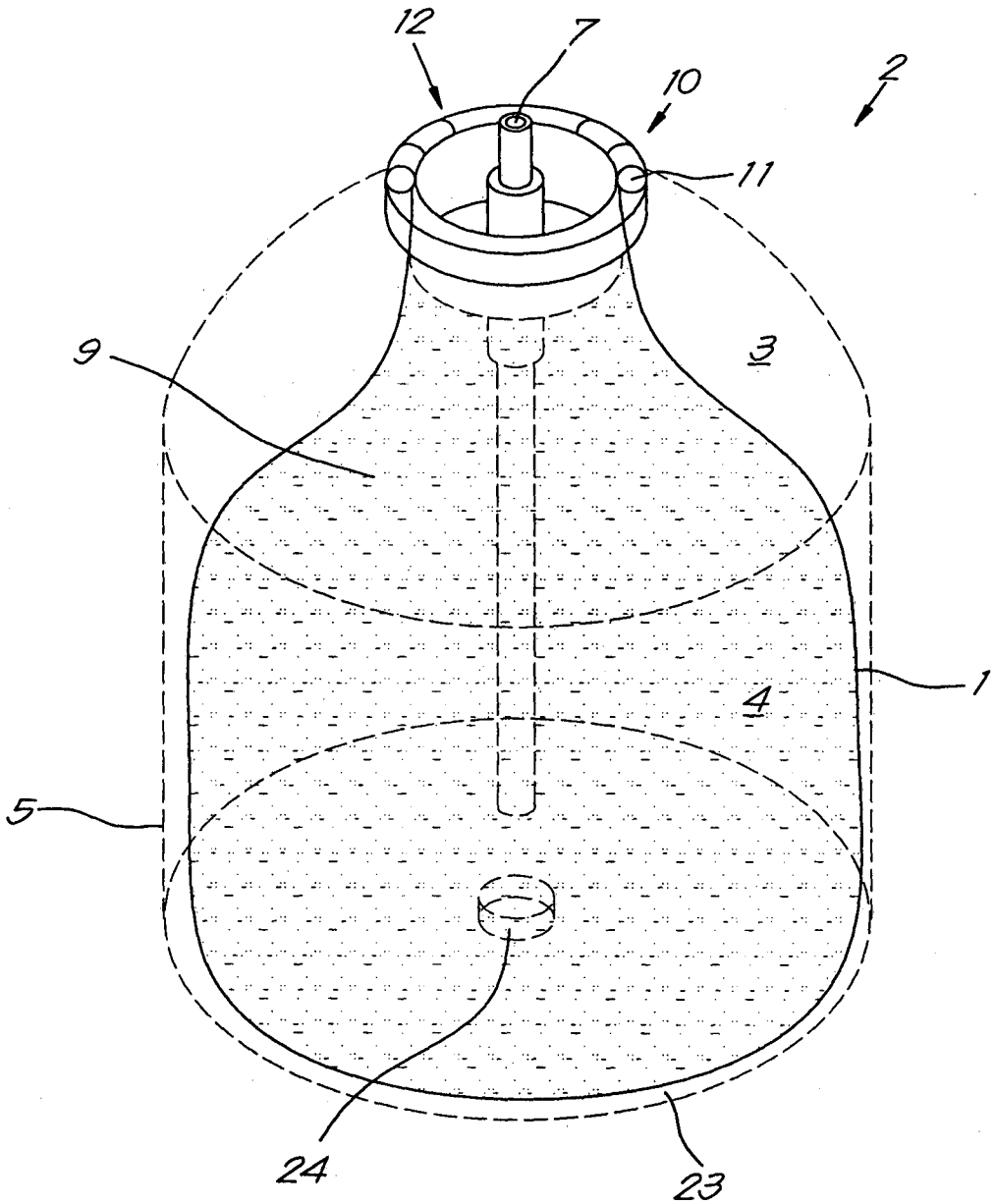

Fig.5

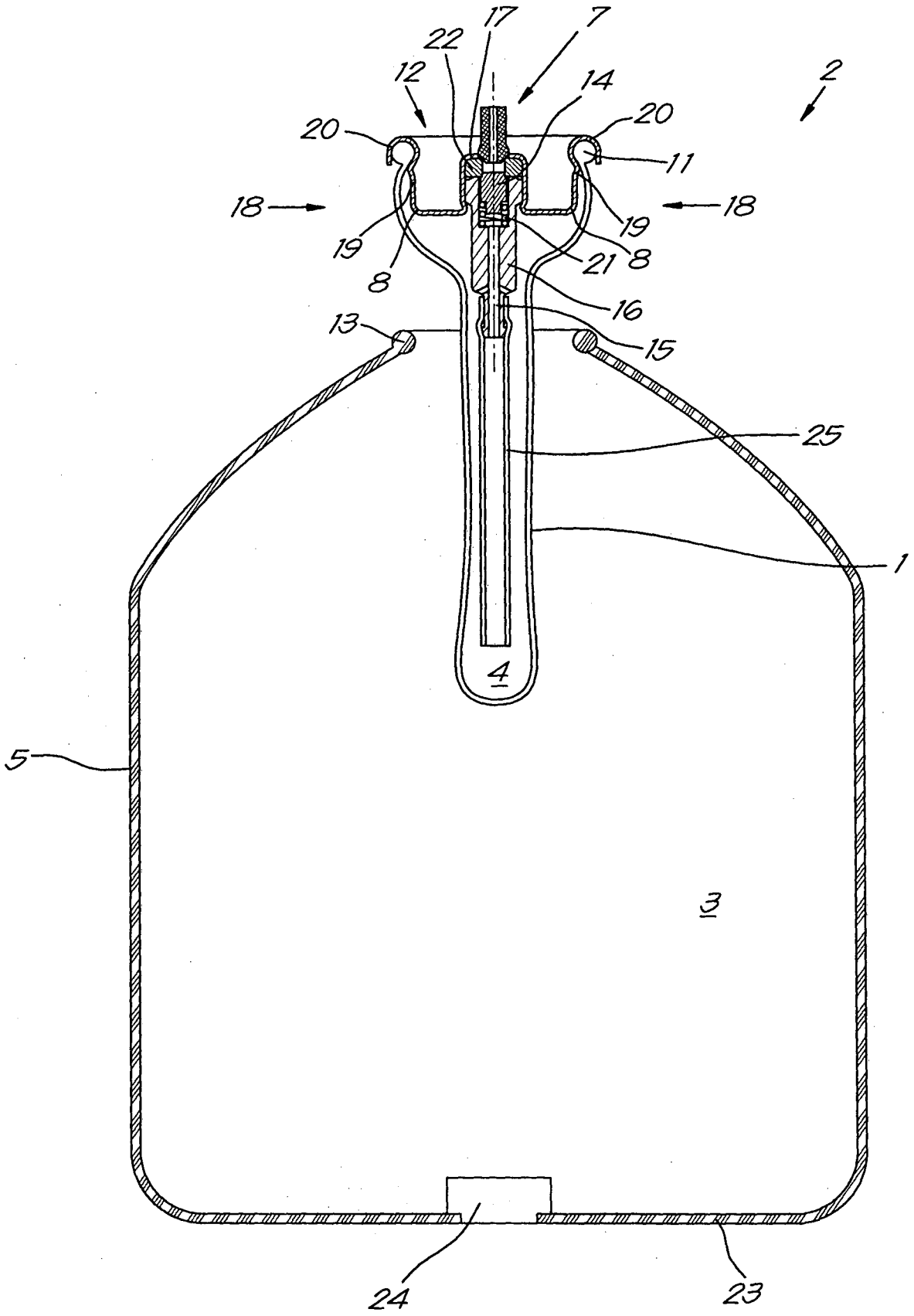

Fig.6

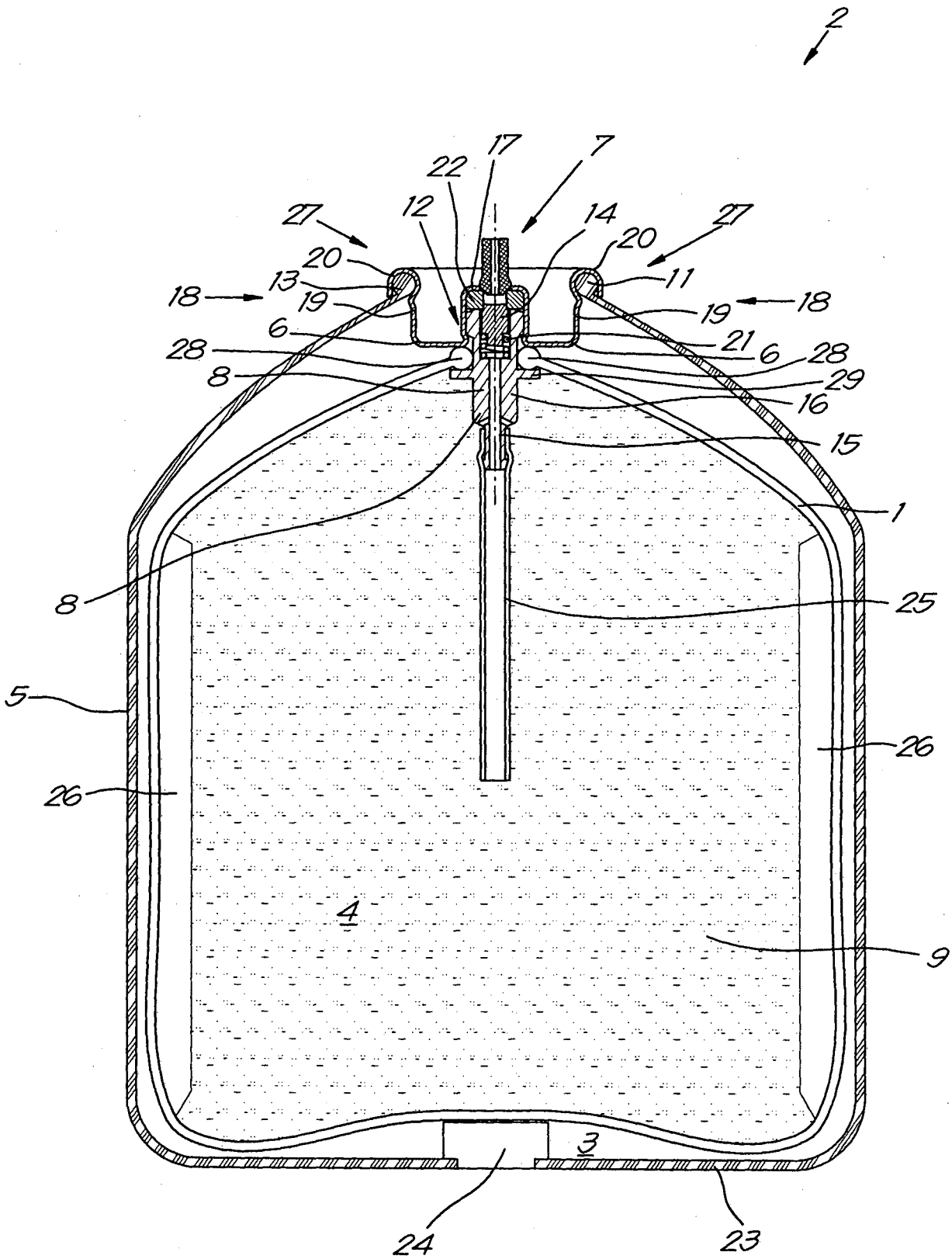
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Fig.7

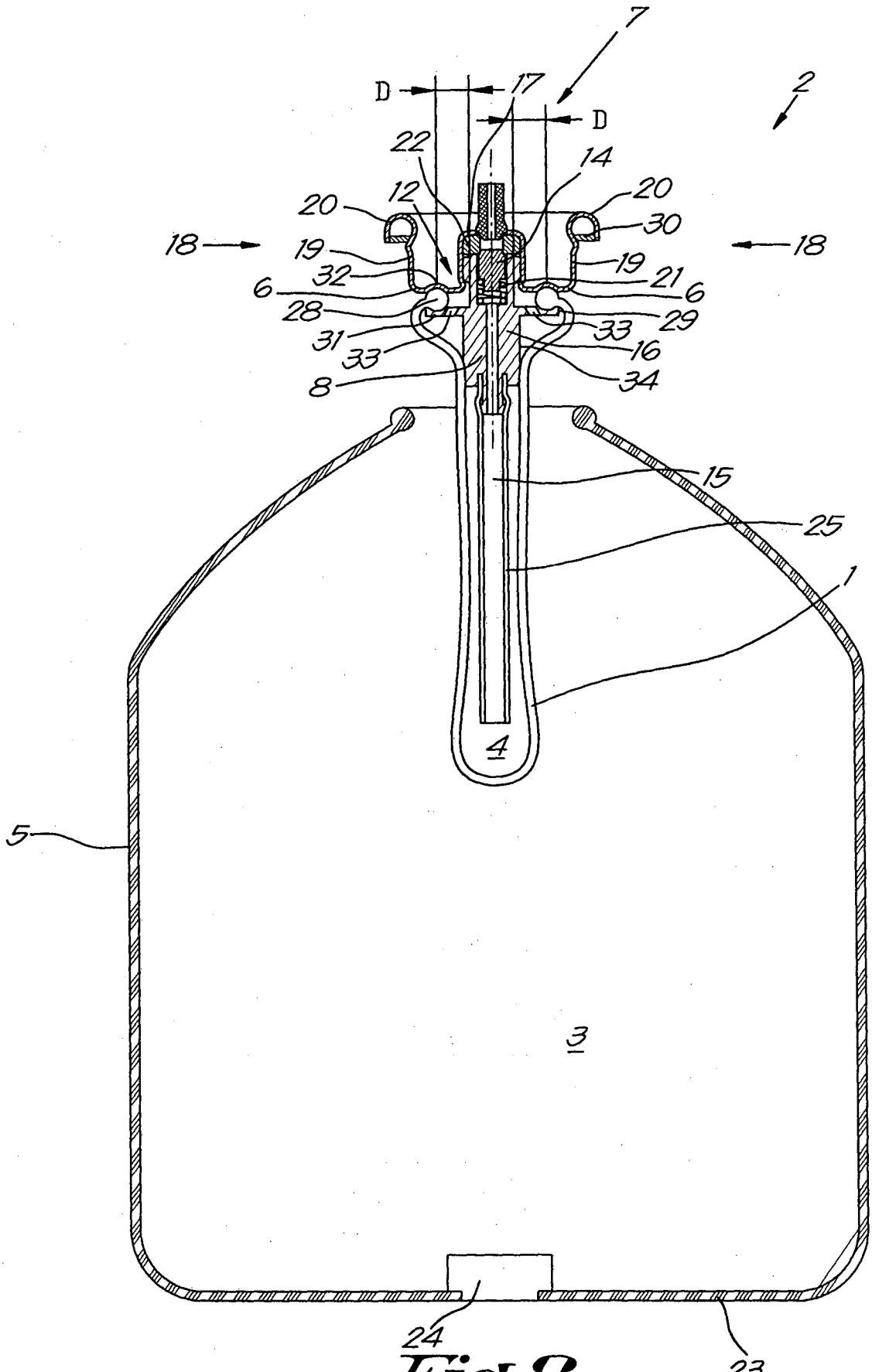
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Fig.8

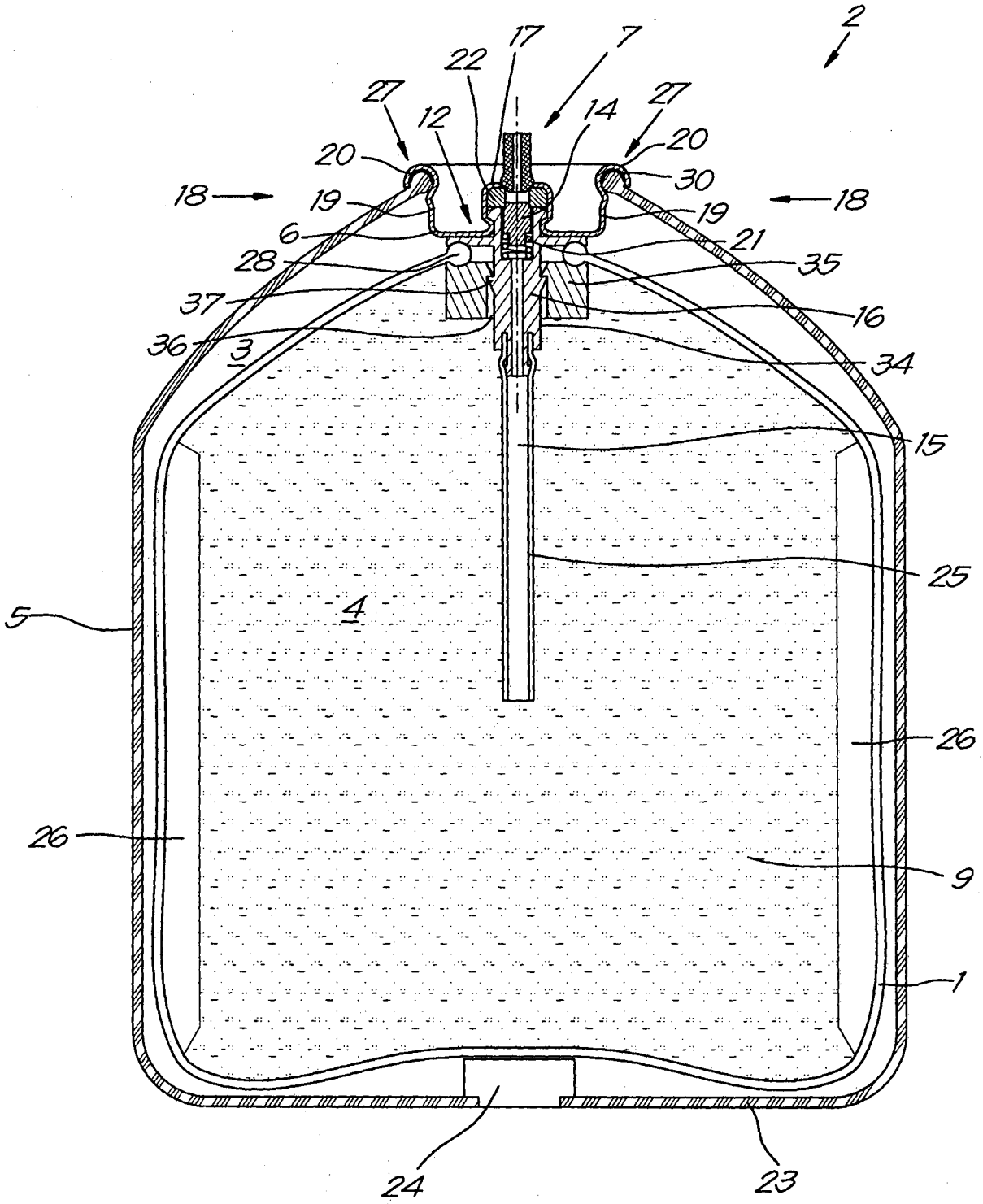
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Fig.9

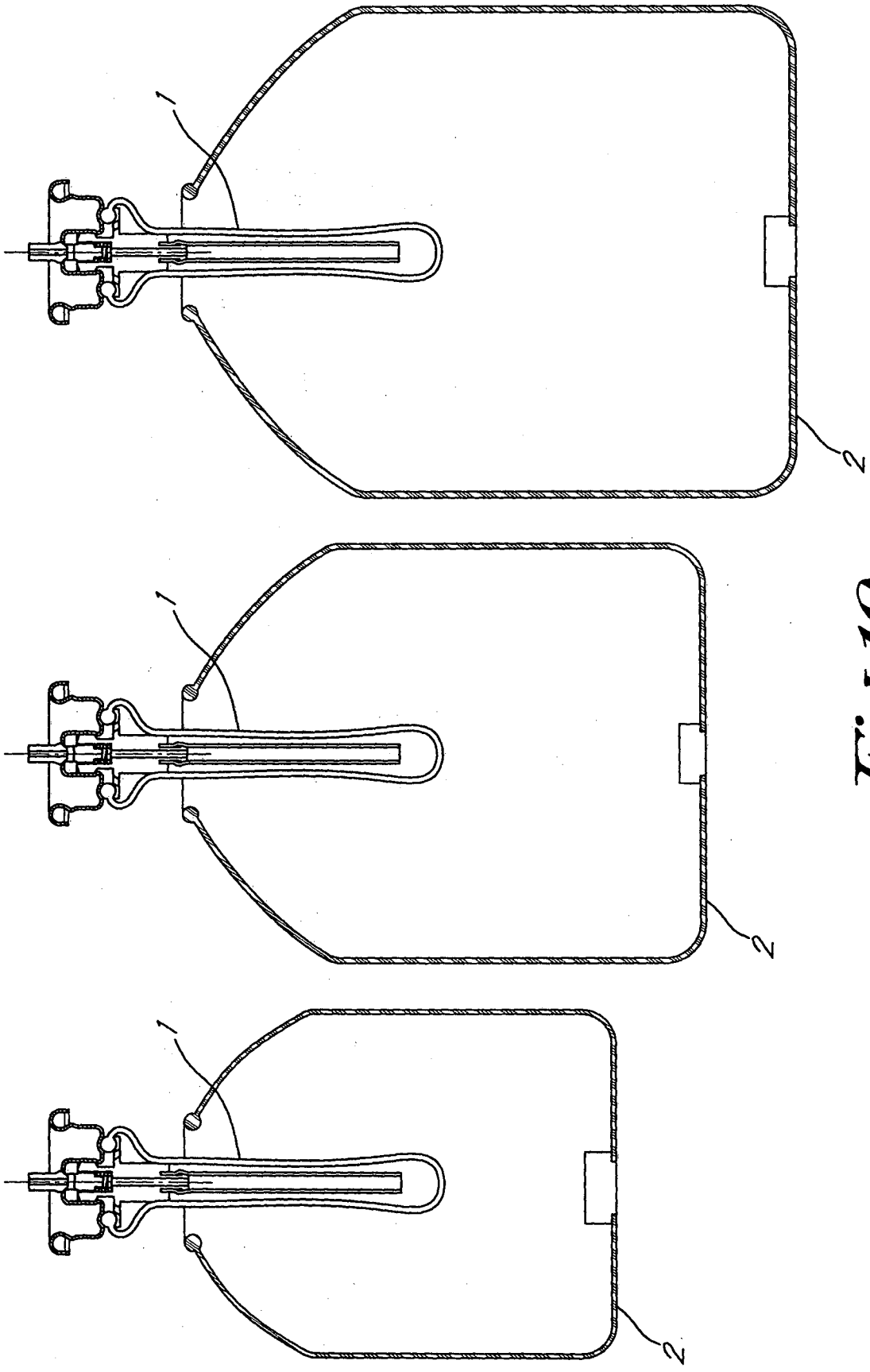

Fig.10

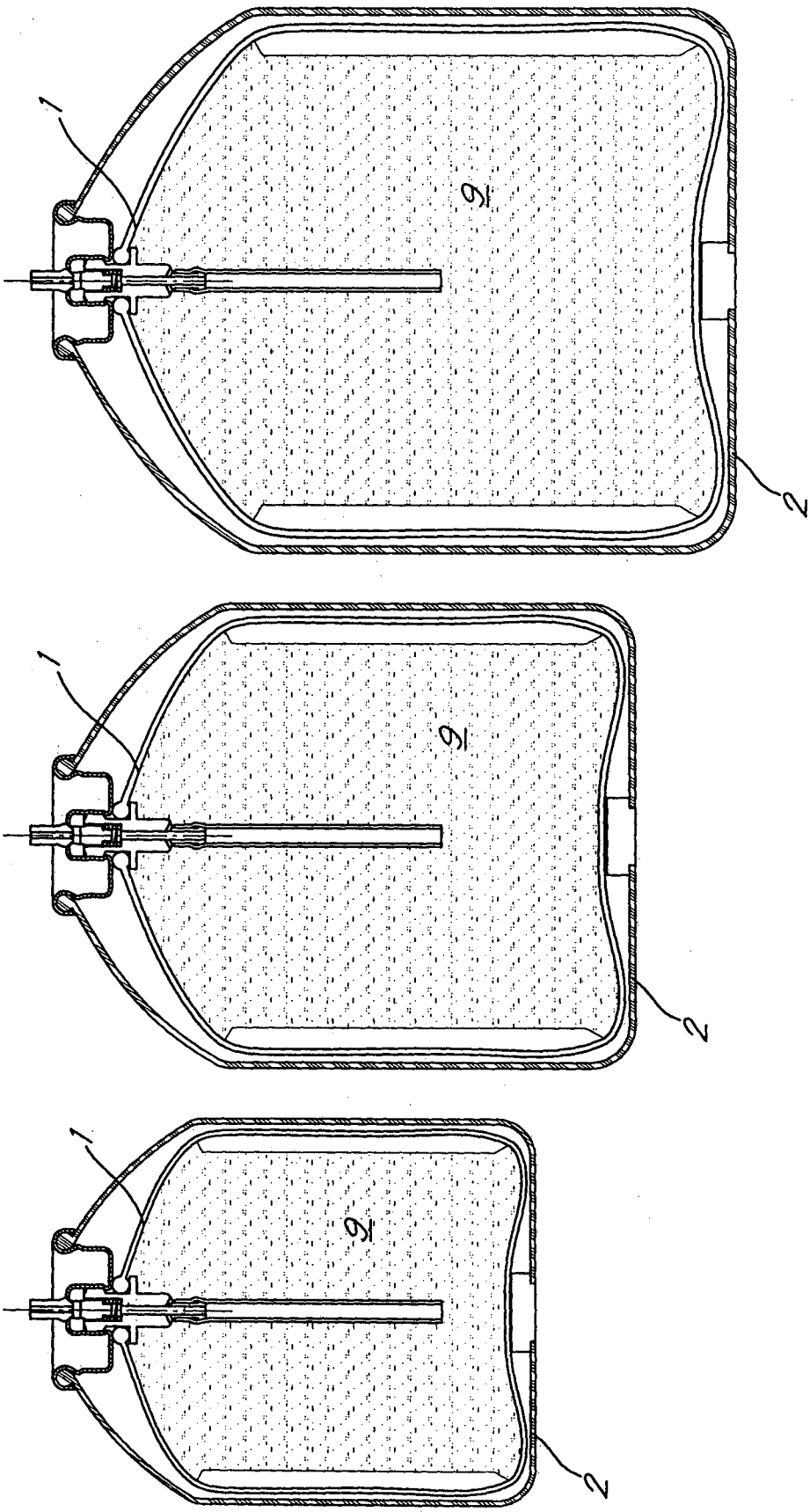

Fig.11