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(54) **PRESSURE CONTROL SYSTEM**

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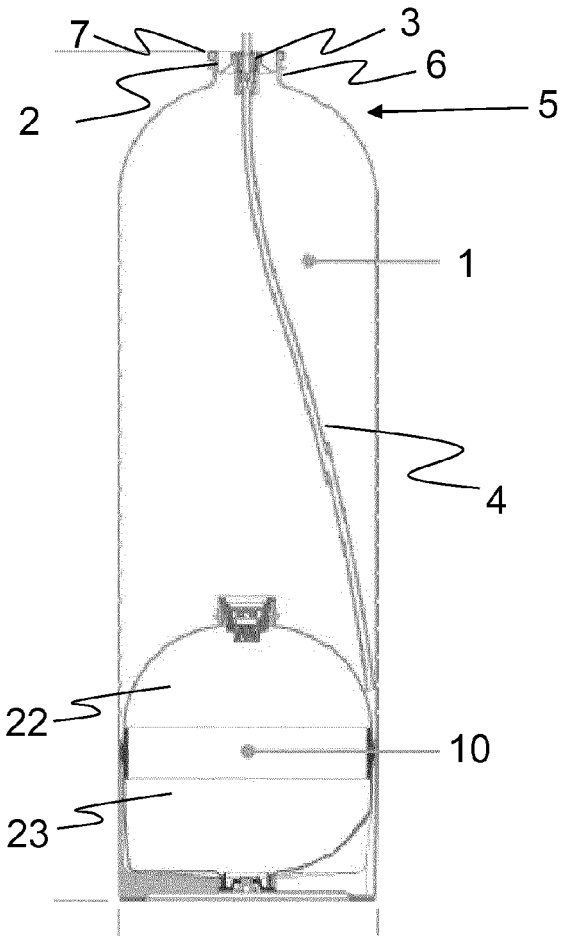
(57) **ABSTRACT**

A novel pressure control system is provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel having an inner chamber, a closed end and an open end, and a pressure control device with a valve, which pressure control device is mounted on the open end of the high-pressure vessel, whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve, wherein the high-pressure vessel is essentially spherical.



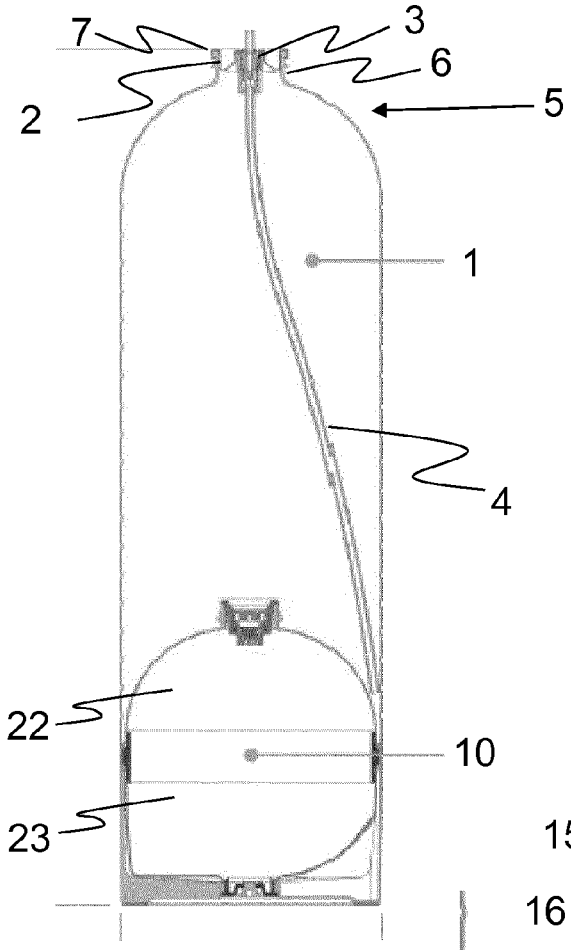


Fig. 1

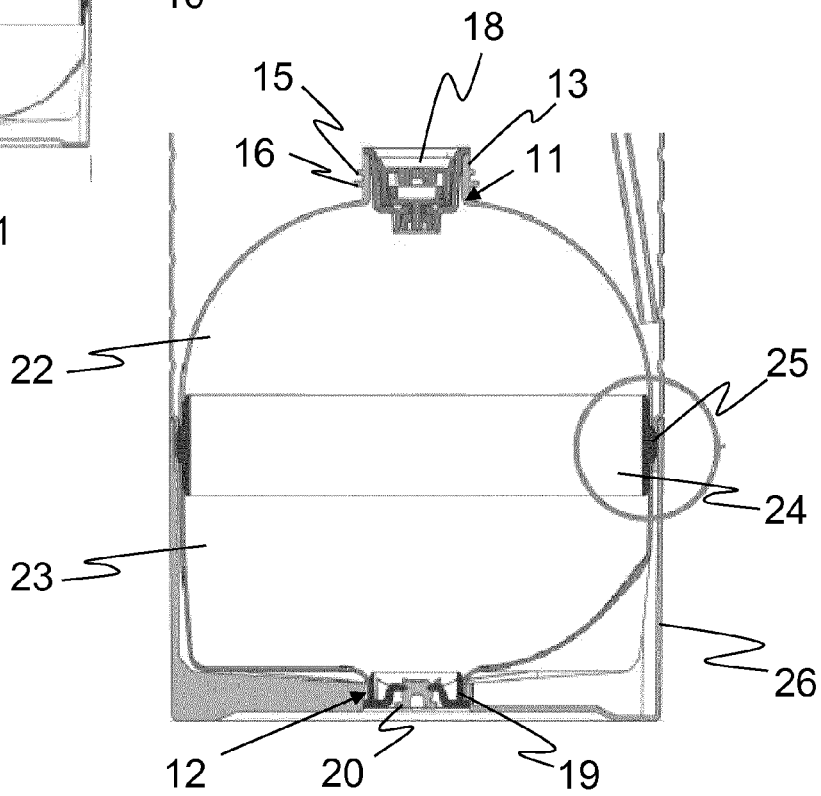


Fig. 2

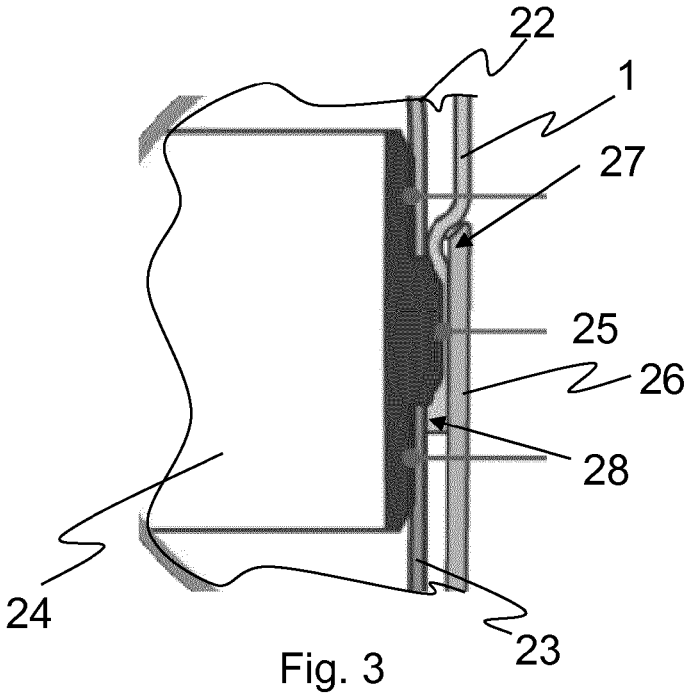


Fig. 3

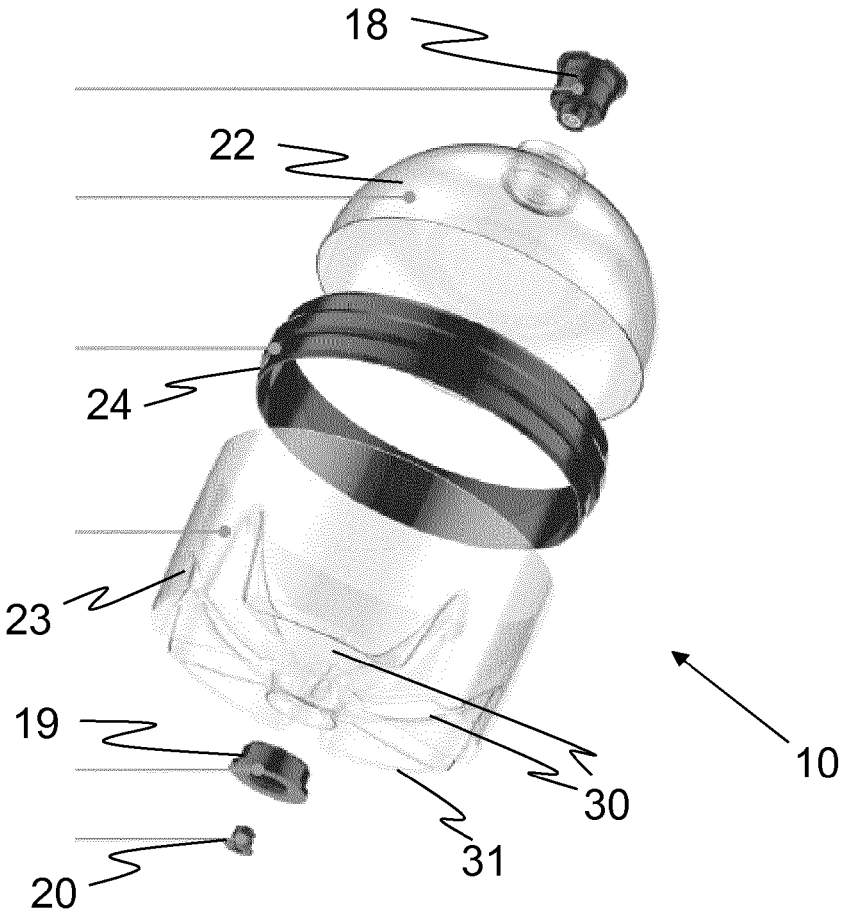


Fig. 4

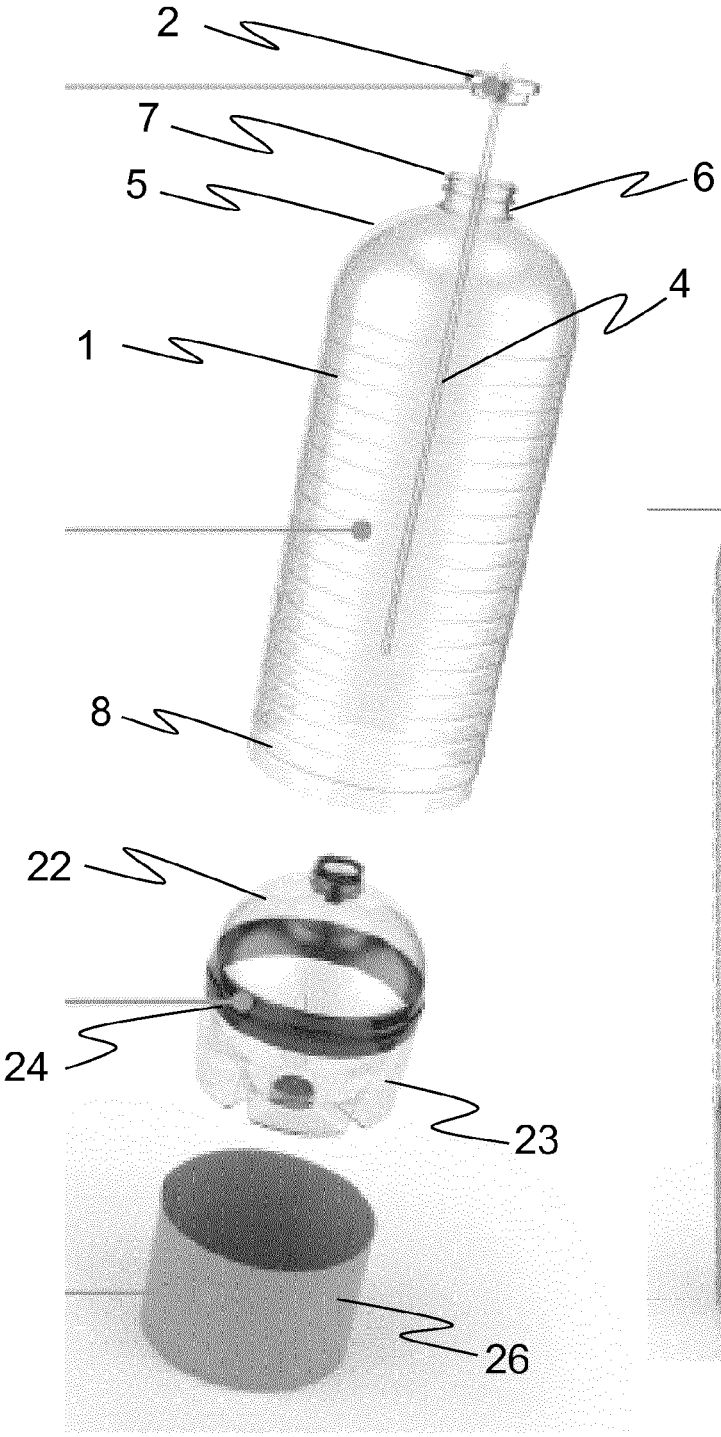


Fig. 5

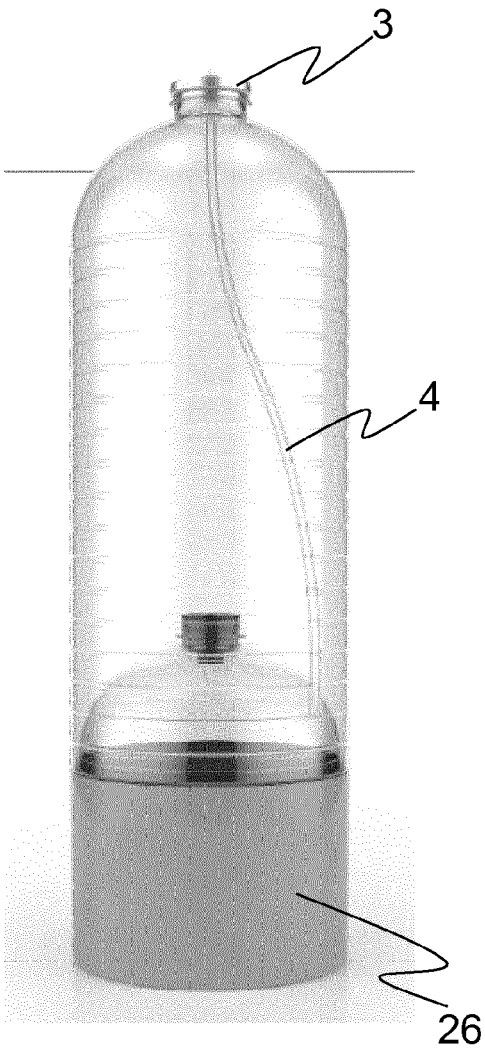


Fig. 6

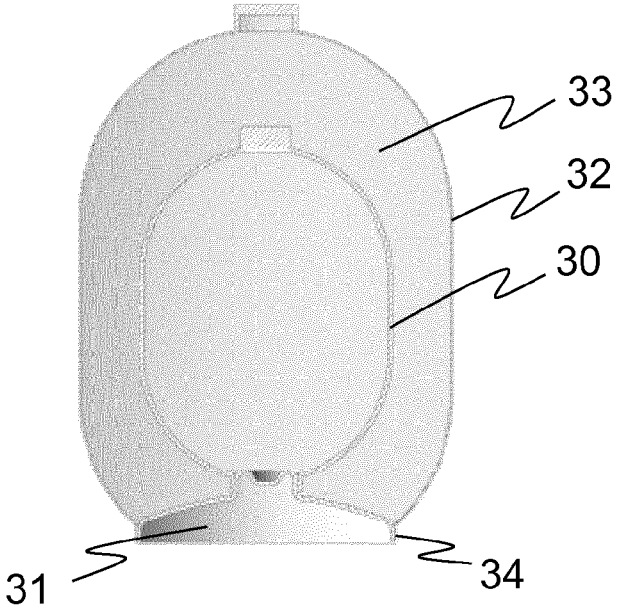


Fig. 7

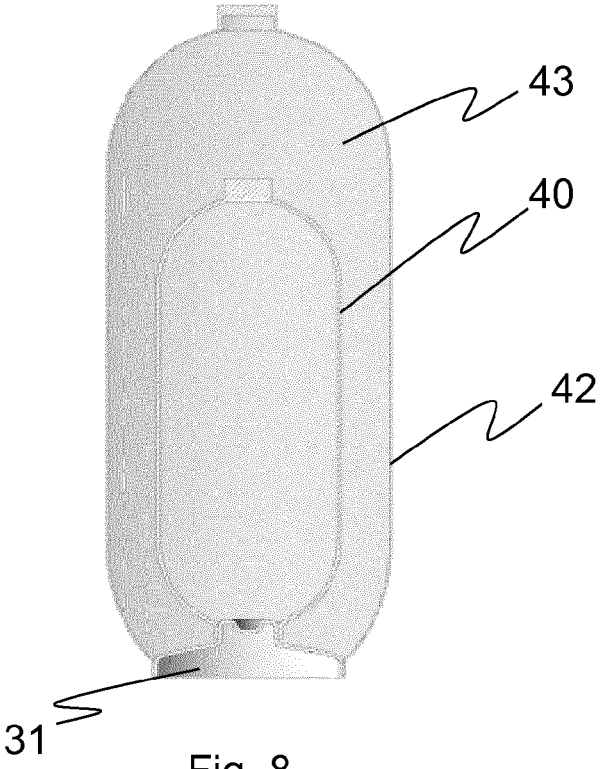


Fig. 8

PRESSURE CONTROL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a National Stage application of International Patent Application No. PCT/EP2016/051435, filed on Jan. 25, 2016, which claims priority to European Patent Application No. EP15152766.0, filed on Jan. 27, 2015, each of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The invention pertains to a a pressure control system provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel having an inner chamber and a closed end and an open end, and a pressure control system with a valve, which pressure control device is mounted on the open end of the high-pressure vessel, whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve.

BACKGROUND OF THE INVENTION

[0003] Such a pressure control system is described in WO-A-2005/082744, wherein the high-pressure vessel is substantially cylindrical with a tapered neck portion and a flange, on which a ring-shaped insert or closure with a step-like funnel is mounted. The pressure control device of this document is provided within the ring-shaped closure by a cup-like cylinder having a closed end and an open end, in which a piston with a downward protruding stem and a broader cylindrical end portion is movable mounted. At the open end of the step-like funnel an O-ring is pinched by a ring-cylinder, whereas the broader cylindrical portion of the stem and the O-ring provide a valve which is moved reciprocated by the pressure of the air in the chamber formed by the piston and the cup-like cylinder with its closed end. The high-pressure vessel must stand an overpressure of 8 bar so that the construction should be very stable. For this reason the high-pressure vessel is widened gradually towards its lower end with a broader end portion and an inwardly projecting rim, on which the end of a plastic fluid dispensing container rests. The bottom part of the high-pressure vessel has a ring-shaped depression which is reinforced with a central opening, in which a so-called Nicholson plug of rubber is pressed.

[0004] In the present construction the high-pressure vessel is closed by a moulded bottom plate. With today's plastic material not all conditions as strength, creep, air permeability, resistance to heat and cold, chemical resistance against known chemicals, etc. can be fulfilled. If the vessel has to be enlarged, forces on the bottom plate will become much larger, so that the maximum volume of the present vessel is restricted.

[0005] The volume of the high-pressure vessel is further restricted by the production process of stretch blow moulding, i.e. in order to obtain a reinforced opening at both ends of the high-pressure vessel the process of stretching the heated plastic depends on the thickness of the preform before stretching. In practice the preform can be expanded only to a predefined width and length to obtain the prescribed stability.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a pressure control system with a high-pressure vessel which may have a larger volume as the known high-pressure vessel. This object of the invention is accomplished by a pressure control system with the features of claim **1**.

[0007] According to embodiments of the invention, the pressure control system provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel having an inner chamber and a closed end and an open end. The pressure control system further comprised a pressure control device with a valve, which pressure control device is mounted on the open end of the high-pressure vessel, whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve. A further feature of the invention is that the high-pressure vessel is essentially spherical. Through the essentially spherical shape of the high-pressure vessel, the high-pressure vessel has a larger volume compared with other vessel shapes.

[0008] The present invention has the main advantage, since the vessel is spherical that can withstand larger forces so that the diameter of the high-pressure vessel can be enlarged and the vessel can be provided for higher pressures.

[0009] A further advantage of the present invention is that the production of the high-pressure vessel is more cost effective.

[0010] Further advantages of the invention can be derived from the dependent claims and from the description below.

[0011] According to an embodiment of the fluid dispensing system, the high-pressure vessel comprises an upper hemisphere and a lower hemisphere connected by a ring shaped member. The ring shaped member allowes a pressure proved connection between the upper hemisphere and a lower hemisphere.

[0012] According to a further embodiment of the fluid dispensing system, the vessel is made by injection blow moulding from extruded PET. Injection blow moulding from PET is an economical method for production vessels. PET is suitable for high pressure applications.

[0013] According to another embodiment of the fluid dispensing system the lower hemisphere comprises at least three outstanding lobes. The lobes may have a triangle shaped base.

[0014] According to a further embodiment of the fluid dispensing system, the ring shaped member comprises a middle protruding ring part having a width substantially larger than the width of the ring shaped member for receiving the upper and lower hemispheres. Through the larger width of the middle protruding ring part compared to the ring shaped member for receiving the upper and lower hemispheres, the upper and lower hemispheres can be pressed over the ring shaped member for receiving the upper and lower hemispheres.

[0015] According to another embodiment of the fluid dispensing system, the ring shaped member comprises carbon black and is connected to the upper and lower hemispheres by laser-welding. Through the carbon black the laser beam will absorbed by the plastic such that may connectable by laser-welding.

[0016] According to a further embodiment of the fluid dispensing system, the ring shaped member is glued to the upper and lower hemispheres. The ring shaped member may be glued by a hot melt glue to the upper and lower hemi-

spheres. Gluing allows a solid connection between the ring shaped member and the upper and lower hemispheres. Especially for smaller quantities gluing can be an economical option.

[0017] According to another embodiment of the fluid dispensing system the neck portion of the top opening may be reinforced. The neck portion may comprising two parallel reinforcing rings. The reinforcing may increase the strength of the neck portion.

[0018] According to a further embodiment of the fluid dispensing system the high-pressure vessel is mounted on its bottom side on a support and the fluid dispensing container is mounted also on its bottom side to the support, such that the container is surrounding the pressure vessel by releasing a spherical space containing the fluid to be dispensed. The high-pressure vessel and the dispensing container may have an ellipsoid shape. Through the arrangement of the high-pressure vessel inside the fluid dispensing container, the spherical space is released between the high-pressure vessel and the container.

BRIEF DESCRIPTION OF THE FIGURES

[0019] In the following, the invention is described in greater detail, by way of example, with reference to the accompanying drawings. It shows:

[0020] FIG. **1** is a plastic liquid container with a pressure control system with a spherical high-pressure vessel,

[0021] FIG. **2** shows an elevation of the high-pressure vessel in FIG. **1**,

[0022] FIG. **3** shows an elevation of the connection between the upper and lower part of the high-pressure vessel in FIG. **2**,

[0023] FIG. **4** shows a perspective and exploded view of the high-pressure vessel with the upper pressure control device and the lower Nicholson plug,

[0024] FIG. **5** shows a perspective and exploded view on the fluid dispensing container and the high-pressure vessel and the cylindrical bottom part,

[0025] FIG. **6** shows the fluid dispensing container in assembled mode,

[0026] FIG. **7** shows a fluid dispensing container and a high-pressure vessel both having an ellipsoid shape, and

[0027] FIG. **8** shows a fluid dispensing container and a high-pressure vessel both having an elongate ellipsoid shape.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] In FIGS. **1** and **2** a fluid dispensing container **1** of plastic material e.g. PET is shown which has an upper closure **2** with a valve **3** and a dip tube **4**. The upper end **5** of the container **1** is spherical with a neck part **6** having a rim **7**. The closure **2** is mounted on rim **7**. The lower open end **8** of the container **1** is connected to a high-pressure vessel **10** which has an essentially spherical form. On top of the high-pressure vessel **10** there is a top opening **11** and on the bottom there is a bottom opening **12**. The neck portion **13** of the top opening is reinforced, i.e. has a larger thickness as the wall thickness of the vessel **10**. In addition two parallel reinforcing rings **15** and **16** are provided on the neck portion **13**. A pressure control device **18** is mounted on the neck portion **13** in the same manner as described in WO-A-2005/082744. The pressure control device **18** has essentially the same construction as described therein. The bottom opening **12** is provided with an adapter ring **19** with a larger thickness as the wall thickness of the vessel **10**, which is closed by a Nicholson plug **20** of rubber. The adapter ring **19** is preferably moulded with the high-pressure vessel **10**.

[0029] The vessel **10** is provided of an upper vessel half or hemisphere **22** and a lower vessel half or hemisphere **23** which have both an essentially half-spherical form. Both hemispheres **22** and **23** are connected by a connecting ring **24**, which is made of a thermoplastic elastomer material as e.g. PP, PS PMMA or PC which can be welded with PET. The connecting ring or ring shaped member **24** has a middle protruding ring part **25** such that the lower open end of vessel half **22** is pressed on the connecting ring **24**. A cylindrical bottom part or base cup **26** is circumventing the lower vessel half **23** and is also welded or glued to the connecting ring **24**. The adapter ring **19** is formed to be connected with the lower neck of the base cup **26**.

[0030] Basically the two hemispheres **22** and **23** are produced by injection blow moulding from PET and can be identical and connected mirrored to each other. Extruded PET has the property to absorb very high lateral forces, so that the hemispheres **22** and **23** can withstand high pressures of more than 8 bar.

[0031] In FIG. **3** the connection of the connecting ring **24** to the upper half **22**, the lower half **23**, the fluid dispensing container **1** and the base cup **26** can be seen in more detail. The upper end **27** of the base cup **26** is overlapping the lower end **28** of the container **1**.

[0032] FIG. **4** shows the high-pressure vessel **10** in perspective and exploded view. The lower hemisphere **23** has four outstanding lobes **30** which are evenly distributed over its bottom part **31**. In practice the number of outstanding lobes **30** must be at least three. The lobes **30** have a triangle shaped base.

[0033] FIG. **5** shows the combination of the fluid dispensing container or bottle **1** with the high-pressure vessel **10** and the cylindrical bottom part or base cup **26** in exploded view and FIG. **6** the combination in assembled mode.

[0034] FIG. **7** shows a high-pressure vessel **30** which has a stretched ellipsoid shape and an outer fluid dispensing container **32** which has a similar stretched ellipsoid shape of larger diameter such that a spherical space **33** is released between the high-pressure vessel **30** and the container **32**. The high-pressure vessel **30** is mounted on its bottom side on a truncated conical support **31**. The dispensing container **32** is mounted on the bottom side on the outer rim **34** of the support **31**.

[0035] As can be seen in FIG. **8** the high-pressure vessel **40** and the fluid dispensing container **42** have a larger elongated shape as in FIG. **7**, so that a larger volume of fluid can be contained in the container **42**.

[0036] While the present invention has been illustrated and described with respect to a particular embodiment thereof, it should be appreciated by those of ordinary skill in the art that various modifications to this invention may be made without departing from the spirit and scope of the present.

What is claimed is:

1. A pressure control system provided for maintaining a constant predetermined excess pressure in a fluid dispensing container, comprising a high-pressure plastic vessel having an inner chamber, a closed end and an open end, and a pressure control device with a valve, which pressure control

device is mounted on the open end of the high-pressure vessel, whereas a passageway is provided from the inner chamber to the outside, which is controlled by the valve, wherein the high-pressure vessel is essentially spherical.

2. The pressure control system according to claim **1**, wherein the high-pressure vessel comprises an upper hemisphere and a lower hemisphere connected by a ring shaped member.

3. The pressure control system according to claim **1**, wherein the vessel is made by injection blow moulding from extruded PET.

4. The pressure control system according to claim **2**, wherein the lower hemisphere comprises at least three outstanding lobes.

5. The pressure control system according to claim **4**, wherein the lobes have a triangle shaped base.

6. The pressure control system according to claim **2**, wherein the ring shaped member comprises a middle protruding ring part having a width substantially larger than the width of the ring shaped member for receiving the upper and lower hemispheres.

7. The pressure control system according to claim **6**, wherein the ring shaped member comprises carbon black and is connected to the upper and lower hemispheres by laser-welding.

8. The pressure control system according to claim **6**, wherein the ring shaped member is glued to the upper and lower hemispheres.

9. The pressure control system according to claim **8**, wherein the ring shaped member is glued by a hot melt glue to the upper and lower hemispheres.

10. The pressure control system according to claim **1**, wherein the neck portion of the top opening is reinforced.

11. The pressure control system according to claim **10**, wherein the neck portion comprising two parallel reinforcing rings.

12. A fluid dispensing container comprising a pressure control system according to claim **1**, wherein the high-pressure vessel is mounted on its bottom side on a support and the fluid dispensing container is mounted also on its bottom side to the support, such that the container is surrounding the pressure vessel by releasing a spherical space containing the fluid to be dispensed.

13. The fluid dispensing container according to claim **12**, wherein the high-pressure vessel and the dispensing container have an ellipsoid shape.

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