A device designed to be mounted in a complete container, the device comprising a container neck (3), in which a valve membrane (2) is mounted and fixed, the membrane having an opening (8) in its centre, which interacts with a central pin (9), which is a part of the neck (3), and the membrane and its opening sealing the container, since the membrane with a certain surface pressure till be pressed against the central pin (9), and that the membrane, directly subsequent to an emptying or a partial emptying continuously closes the container anew, this being done without any air flowing backwards and into the partially emptied container.
VALVE FOR A TUBULAR CONTAINER

[0001] The present invention relates to a valve for a tubular container according to what is set forth in the preamble of claim 1.

[0002] The invention will preferably be applied on flexible tubular containers, other types of containers or bags, which are characterized as being collapsible, but the invention can of course also be used on inflexible/shape stable containers.

[0003] The invention can be used to be directly mounted on a tube or another flexible container, but a use in combination with some type of capsule is also a suitable application. A main field of applications are tubes for various purposes, for various mediums or agents.

[0004] Presently used containers, which are provided with known capsules/closings, have a number of drawbacks, which can be eliminated according to the present invention.

[0005] The invention eliminates several of the drawbacks of the presently used container valves, and the main advantages of the present invention are:

[0006] A closing effect is obtained, which means, that a controlled flow is obtained, which means, that a chosen or desired volume flows out from the container every time it is emptied.

[0007] No suction backwards subsequent to a terminated emptying of a desired volume, since the valve is closed again after an emptying has been carried out. In this way air cannot flow back again into the container.

[0008] An improved shelf-life of the enclosed medium is obtained, since no oxygen flows into the container after a terminated emptying.

[0009] An improved shelf-life is obtained, since possible bacteria will find it more difficult to force their way into the container, since the valve will be tight, as soon as the emptying has been terminated.

[0010] The improved tightness of the valve means, that the demand for chemicals in the enclosed medium is reduced, and yet the shelf-life of the contents in the container will not be reduced.

[0011] Thus, the improved tightness means, that the amount of sugar or preservatives in the medium can be reduced, the shelf-life being kept.

[0012] The invention does not require any supplementary closings of the container, e.g. a flip closing is a general term for a type of capsule, which otherwise often is used in the container industry.

[0013] A flexible container, e.g. a tube, will, with a closing design according to the present invention, be advantageous, since it is emptied successively in the same way as a rigid tube, e.g. a tube made of aluminum.

[0014] Consequently, a flexible tube, provided with the invention, can be emptied completely.

[0015] A completely emptied tube is very advantageous. Partly the usefulness of the medium is higher than with many of the presently used flexible tubes and partly a completely emptied tube can be obtained, which without drawbacks can be recycled.

[0016] It is easy to apply the invention, also in a separate capsule or a similar construction of a discharge device, in a container.

[0017] Additional advantages of the present invention are, that the invention is very cost efficient. With the present invention a completely new container valve has been provided, which due to its simplicity, combined with the advantages mentioned above, constitutes a completely new generation of container valves.

[0018] Additional characterizing features and advantages of the present invention are set forth in the following description, reference being made to the enclosed drawings, which show a preferred but not limiting embodiment of the present invention.

[0019] The present invention is depicted in detail in diametrical, partly schematical sections or perspective views:

[0020] FIG. 1 shows a design of a complete container with a mounted valve membrane;

[0021] FIG. 2 shows a design of the valve membrane;

[0022] FIG. 3 shows a design of an interacting container connection; and

[0023] FIG. 4 shows an embodiment of a capsule with a mounted valve membrane.

[0024] FIG. 1 depicts a complete container 1 with a valve. The design shown in the figure is just a preferred embodiment of the complete container with a valve. Of course, within the scope of the invention some portions of the complete valve for a container may be designed in other ways, but the main principle of the present invention will be evident from FIG. 1.

[0025] Thus, the present invention is based on the fact, that a valve membrane 2——called a membrane below——will be mounted in or on the outside of a container neck 3——called a neck below——this neck being designed with an outer thread 4, either completely smooth or only provided with some type of grooves or a collar and consequently it will be possible, if it is at all required, that the container be provided with some type of cap to provide it with such a cap. The need to use a separate cap or lid on the complete container valve does not have anything in common with the valve function, but is may be used together with possible requirements regarding the exposure of the complete container per se.

[0026] The preferred design of neck 3 is shown in FIG. 3.

[0027] FIG. 1 shows, that it is advantageous to mount membrane 2 inside neck 3 of complete container 1. The membrane is fastened in an axial direction by mounting it above and downwards into neck 3. The membrane has an inner surface 5 with a diameter, which is adjusted to the cooperative inner diameter of neck 3 in order to obtain a tight joint between the membrane and the neck. Also, the membrane will be locked in an axial direction, locked upwards, since the membrane is pressed downwards past an inner thick portion 6, provided in the upper portion of the neck, and downwards by a central portion 7 of neck 3. In the centre of the membrane there is an opening 8, which tightly seals against central portion 7 and a central pin 9 in the central portion.

[0028] When an outer force is applied against the container, a positive pressure will be obtained in the container, which means, that the container will be exposed to internal forces, which press the membrane upwards, i.e. away from the container and mainly away in an axial direction. The membrane has obtained a tested stiffness/flexibility, which means, that the membrane, when the load on it is increased and the interior pressure is increased, will be deformed in such a way, that the surface pressure, which exists in the unloaded condition, i.e. in the condition, when no exterior forces influence the container, this surface pressure between opening 8 in the membrane and central pin 9 being reduced and, when the high pressure in the container will be increased even more, finally resulting in the formation of a gap 29 between central pin 9 and opening 8 in the membrane——see FIG. 16. This gap is
completely dependent on the high pressure, which is obtained in the container and on the physical properties of the contained medium, such as viscosity and rheological properties in general.

[0029] As soon as the positive pressure ceases, the membrane will return to its rest position—FIG. 1a—i.e. the membrane will then directly seal via the contact, which is developed between central pin 9 and opening 8 in the membrane and a surface 14, or portions of this surface, which are in contact with central pin 9.

[0030] This means, that the amount of the contents in the container flowing out, whenever a positive pressure is applied on the container, will be limited. As soon as the pressure ceases, the outflow will also cease, which means, that always a controlled outflow will be obtained, having a desired volume, as a result on each occasion.

[0031] The embodiment shown in FIG. 1, including a container neck and a fastening of a membrane is just to be regarded as a preferable embodiment, but this does not stop other embodiments of the neck and the membrane fastening from being included in the present invention. The membrane may e.g. be applied on the outer side of and around the container neck, but the membrane can also in its periphery be locked by some type of threaded ring or a ring pressed on the neck or the like.

[0032] FIGS. 2a and 2b show membrane 2 in an external and sectional view respectively.

[0033] The membrane preferably is made by injection moulding and the material suitably is a polymer-based plastic material. The membrane preferably is made of the same base material, of which the container is made of, on which it is mounted, although certain modifications of the properties of the materials in the various portions are done in order to obtain desirable mechanical properties, e.g. flexibility. The same base material in the membrane and the container means, that the recycling of the container belongs to the same recycling classification.

[0034] Membrane 2 is made in a continuous way as a cylinder 15 having an open bottom and an upper surface 16. Cylinder 15 has an exterior surface 5, which dimensionally is coordinated with the container and its neck 3, with which it will interact. In order to secure the tightness between these portions exterior surface 5 will be designed in order to split an upper outer corner 18 in two parts of a V-shaped groove 31, which means, that a fraction of the material thickness in surface 5 is designed as a flexible sealing lip 32 having an outer point 33, which height-wise is on the same level as corner 18 but in a radial direction outside surface 5, this lip, when the membrane is mounted in neck 3, being pressed against the neck and its inner diameter 25, thereby improving the tightness between the interacting surfaces.

[0035] In order to additionally improve the tightness between membrane 2 and neck 3 surface 5 on the membrane will have a lower end 34, which has a design, which improves the tightness between the membrane and the neck. Thus, surface 5 is in the lower part designed with an outer oblique plane 35, having an angle of about 15-30° from the vertical line, said oblique plane extending from lower end 34 of the membrane all the way up to corner 36, which preferably is sharp, i.e. without an outer radius between oblique plane 35 and an adjacent plane 37, which with about 30°-45° from the vertical line returns to surface 5. Corner 36 lies diameter-wise somewhat outside surface 5 and consequently also in this lower portion of the envelope surface of the membrane an improved tightness function is obtained, when the membrane is mounted in neck 3.

[0036] Upper surface 16 has a waved design and an opening 8 in its centre. The shape of the waved surface has been tested in order to provide the elasticity and the mobility in the surface, which the function requires. Preferably the wave shape will be designed to have a downwardsly, towards the container directed first partial surface 19, which starts from the outer corner 18, formed between the upper part of outer surface 5 and the outer part of first partial surface 19. First partial surface 19 is changed more or less directly from outer corner 18 into a downwardsly directed portion, which extends, with about one third of the length of outer surface 5 and downwards to lower end 34 of the membrane, and first partial surface 19 is changed via a radial portion 20 into a second partial surface 21, which extends upwards to opening 8 in the membrane, which lies in the same plane or somewhat above outer corner 18.

[0037] Second partial surface 21 ends towards the centre of the membrane with an upper corner 22, which is the end of second partial surface 21, this end having a somewhat enlarged and consequently wider sectional surface, this sectional surface constituting surface 14, which concludes partial surface 21 and also is the interface of opening 8, surface 14 having an upper corner 22. Corner 22 consequently is the upper point on surface 14. Surface 14 has an angle from the centre of the membrane, which is α and which has been tested in order to obtain a guaranteed contact between a casing surface 23 on central pin 9 and surface 14 on the membrane and a number of sealing lips 30, which are provided on this surface. Preferably 2-4 sealing lips 30 are used and they constitute just small pointed ring-shaped portions on surface 14 having a height of about 0.05-0.3 mm. The membrane is thanks to its special design of upper surface 16 flexible and this design must be carried out in a tested way.

[0038] The following examples of the dimensions of the various portions of membrane, having e.g. an outer diameter of 20 mm, can be used: The material thickness of outer surface 5 is about 0.5, whereas upper surface 16 preferably is somewhat thinner. The radius between partial surfaces 19 and 20 preferably is about 1 mm and opening 8 about 2-3 mm.

[0039] FIG. 2c depicts a design of a membrane, which is provided with a safety device or a protective cover 38, designed to prevent an improper use or emptying of the container. By directly in the manufacturing process add a protective cover to the membrane a possible requirement necessary to prevent an improper use of the container has been made feasible. The design of the protective cover can of course differ within the scope of the present invention, and the example shown in FIG. 2c is only one alternative design and its geometrical shape will not be described in more detail.

[0040] When an injection moulding is done, it is possible to carry out a transfer from opening 8 in the membrane and from upper corner 22 of the opening to protective cover 38 with a thin-walled portion or a transfer surface 39, which preferably has a material thickness of only 5-10 hundreds of a millimetre and consequently is easy to deform/break, when the container will be used.

[0041] FIG. 3 shows the design of a container connection, which interacts with the membrane. The figure shows a preferred design of the container, e.g. a tube, but within the scope of the invention the container may of course be designed in
other ways. The important feature of the connection is the design of container neck 3 per se.

[0042] The neck has an outer portion 24 with an outer thread 4. This thread is not necessary for the function of the complete container valve, but it can be used for e.g. an outer cap, a capsule or the like for the container. Outer portion 24 has an inner diameter 25, which interacts with outer surface 5 of the membrane and with sealing lips 32 and 36 respectively, which preferably are mounted on surface 5. In order to retain the membrane in an axial direction and prevent, that the membrane is dropped, neck 3 is provided with a thick portion 6. Thick portion 6 is mounted close to the upper portion of neck 3 and preferably constitutes a circular segment having a curve height, which has the same size as or is less than the radius of thick portion 6. In its lower inner part neck 3 has a transition zone 26 to the container itself. In this cone there are a number of spokes 27. These spokes partly constitute stop means for the membrane, when it is mounted downwards into neck 3, and partly they connect outer portion 24 of the neck with a central portion 7, which is designed in the centre of the container and consequently in the centre of neck 3. Between the spokes, which preferably are three or four, there is a space, in which the medium in the container flows out, when the container is emptied.

[0043] Central portion 7 has a central pin 9, which extends upwards to or preferably somewhat beyond the lower edge of thick portion 6. Since the central pin extends somewhat beyond the thick portion, this means, that it also reaches upwards to and somewhat beyond opening 8 in membrane 2. This being possible, since upper outer corner 18 of the membrane is fastened directly below thick portion 6, and also that opening 8 in the membrane, in its rest position, is positioned at the level of corner 18. Since the central pin extends through and a small distance beyond opening 8 in the membrane, it has been possible to control the outflow from the container during the emptying of the container. Thus, a dosing effect is obtained, i.e. a chosen or desired volume will flow out of the container each time the container is emptied.

[0044] The central pin has an envelope surface 23, which is somewhat convex. On the same level from the bottom of central portion 7 and on the same level, as the lower edge of thick portion 6 is positioned on, central pin 9 has a diameter, which is somewhat larger than opening 8 in the membrane. This means, that, when the membrane is mounted in container neck 3, the membrane and its inner surface 14 will be in contact with envelope surface 23 of the central pin. This contact is possible thanks to the shape of the membrane and the chosen dimensions of opening 8 in the membrane and of central pin 9, a certain tested pressure having been selected between said portions and consequently a tightness for the container has been obtained. When an emptying has been ended, i.e. when the outer pressure on the container ceases/is removed, the positive pressure in the container will disappear. The membrane will then directly try to obtain its unloadeed position. This means, that the membrane tries to find a position, in which an as low residual tension as possible will be obtained. Since central pin 9 has a somewhat larger diameter than opening 8 in the membrane, a surface pressure between the membrane and the central pin is directly obtained and the opening out from the container is blocked. Since the closing takes place directly, as soon as the positive pressure disappears, an inflow of air into the partly emptied container is prevented. A flexible container, e.g. a tube, will with a membrane and a central pin according to the present invention in an advantageous way be successively emptied in the same way as an inflexible tube, e.g. a tube made of aluminium. Thus, the successive emptying of a container according to the invention will be directly visually read compared to the emptying of existing flexible containers, which normally return to their "filled shapes".

[0045] The present invention allows also a complete emptying of a flexible tube and this means, that a larger portion of the contents in the container will be emptied than e.g. in existing flexible tubes.

[0046] Thanks to the immediate closing of the container preferably it is also possible to obtain an improved shelf-life for the enclosed medium in the container, since no air is allowed to flow into the container subsequent to a terminated emptying. An improved shelf-life is obtained also, because it will be more difficult for possible bacteria to force their way into the container; and another advantage resides in the fact, that an improved shelf-life means, that a demand for chemicals in the included medium is reduced without a shelf-life reduction compared to the state of the art. Another advantage of the invention is, that it strictly functionally is not necessary to use any other supplemental closing in the store keeping or availability phase. Many modern closings also are provided with a so called flip capsule or the like as a part of a complete valve for a tubular container.

[0047] By varying the dimensions of opening 8 in relation to central pin 9 and also choosing different materials and material thicknesses of the membrane it will always be possible to manufacture a membrane, which is able to meet the requirements of a special medium or a special application.

[0048] FIG. 4 shows another embodiment of a mounting of a membrane.

[0049] In this case the membrane is mounted in a capsule, which in its turn may comprise a number of embodiments, which will not be described in detail in this text.

[0050] However, the fact that this membrane, also in this type of application, provides a satisfactory function, depends of course on the construction of the interacting parts in such a way, that the membrane will function in the same way as has been described above, reference being made to FIGS. 1-3.

[0051] In FIG. 4 an embodiment of a capsule with a mounted membrane is shown.

[0052] FIG. 4a depicts a capsule 40, which is provided with a cap 41, provided with two transversal stiffening members 42, which have a length/height, which means, that they, when cap 41 is closed, directly abut upper inner corner 22 of the membrane at opening 8 and consequently guarantee the tightness of the container, when the container is transported and/or kept in storage.

[0053] The fastening of the membrane in the capsule is completely identical with how the membrane is mounted in the container, in a tube with its neck 3, in case the container is not designed to be provided with a capsule. Thus, the capsule has a corresponding thick portion 6, above which the membrane is pressed down, and the membrane is stopped at its lower end 34 by central portion 7 with its spokes 27.

[0054] In FIG. 4b the cap on the capsule has been opened and the figure shows a position, in which the membrane is in its open position, i.e. when there is a gap 29 between central pin 9 and opening 8 in the membrane. This membrane posi-
1. A device designed to be mounted on a container, preferably on a bottle or a tube (28), the device comprising a container neck (3)—called a neck below—in which a valve membrane (2)—called a membrane below—is mounted, the membrane (2) being fixed in the neck (3), upwards by means of a thick portion (6) and downwards by means of one or several spokes (27), the membrane comprising an outer cylinder (15) with portions, designed in particular way, to obtain a reinforced tightness effect against an inner diameter (25) of the neck (3), as well as an upper surface (16), which has a tested shape, the membrane in its central area being provided with an opening (8), which interacts with a central pin (9), being a part of the neck (3), the opening (8) having a surface (14), which is designed in order to guarantee the tightness function, interacting with the central pin (9), having an envelope surface (23), which is convex to a certain degree and also the central pin is somewhat longer or is disposed slightly higher up than the thick portion (6), and consequently above the opening (8) of the membrane, the object being to obtain a controlled outflow from the container, and also the central pin (9), in that portion, where the membrane is sealing against this envelope surface, being provided with a diameter, which is somewhat larger than the opening (8), which means, that the membrane is not able to reach its neutral position and consequently that a sealing force between the membrane and the central pin is obtained, the membrane also having a tested stiffness and flexibility, which means, that the membrane is deformed at a positive pressure in the bottle/tube (28), a gap (29) being obtained between the membrane and the central pin, which means, that the positive pressure disappears or that the medium in the container flows out, and when the positive pressure disappears, the surface pressure between the surface (14) at the opening of the membrane and the central pin will be obtained again, which means, that the membrane is sealing again, and this leads in its turn to, that the container does not leak outwards or that no air can pass into the container, characterized in that the membrane (2) is constructed as a cylinder (15) with an opening at its bottom and having an upper surface (16), the cylinder (15) having an exterior surface (5), which interacts with the interior diameter (25) of the neck (3), the exterior surface (5) being provided with a sealing lip (32) and a corner (36) in order to reinforce the surface pressure between the neck (3) and the cylinder (15) and consequently guarantee the tightness between the neck (3) and the membrane (2).

2. A device according to claim 1, characterized in that the membrane (2) is mounted in the interior of the neck (3) and is locked in an axial direction, upwards by means of said thick portion (6), disposed in the interior of the neck (3), and downwards by means of a central portion (7) and by means of one or several spokes (27), which connect the neck (3) with the central portion (7).

3. A device according to claim 1, characterized in that the upper surface (16) of the membrane (2), which starts out from an outer corner (18) at the upper portion of the exterior surface (5) and extends inwards towards the centre with a first partial surface (19), which more or less directly from the corner (18) has a downwardly, towards the container, extended portion, designed at a radial portion (20) to be transformed into a second partial surface (21), which extends upwards towards the opening (8) of the membrane, the opening being disposed on roughly the same height level as the outer corner (18).

4. A device according to claims 1 and 3, characterized in that the secondary partial surface (21) is terminated inwards towards the centre with an upper corner (22), which constitutes the upper point of the surface (14) on the inner portion of the second partial surface (21), said inner portion constituting the interface of the opening (8); and in that the surface (14) has an angle outwards from the centre of the membrane, the angle having been tested, and in that on the surface (14) there are one or several sealing lips (30), designed to afford an improved contact surface against the envelope surface (23) on the central pin (9).

5. A device according to claim 1, characterized in that the membrane (2) has a tested stiffness/flexibility, which means, that the membrane, during an increased loading, an increased interior pressure, is deformed, resulting in that the surface pressure, which in the unloaded position exists between the surface (14) on the membrane and the central pin (9) will decrease and, when the positive pressure in the container is increased even more, will finally result in, that the gap (29) is obtained between the central pin (9) and the surface (14).

6. A device according to claims 1 and 6, characterized in that as soon as a positive pressure in the container ceases to exist, the membrane will directly return to a position, in which the surface pressure between the surface (14) and the central pin (9) will again be fully developed.

7. A device according to claim 1, characterized in that the envelope surface (23) of the central pin (9) is slightly convex and on the same level above the bottom of the central portion (7), and on the same level as the lower edge of the thick portion (6) the central pin (9) has a diameter, which is slightly larger than the opening (8) in the membrane, which means, that, when the membrane is mounted in the container neck (3), the membrane and its inner surface (14) with its upper corner (22) will be in contact with the envelope surface (23), this having been obtained with a certain tested surface pressure, since the membrane has been pressed upwards in relation to the bottom of the central portion (7), the diameter of the central pin being larger than the opening in the membrane.

8. A device according to claim 1, characterized in that the central pin (9) extends a small distance higher from the bot-
9. A device according to claims 1 and 7, characterized in that no air can flow into the container subsequent to a terminated emptying.

10. A device according to claims 1 and 9, characterized in that a flexible container, e.g. a tube, is successively emptied in the same way as a rigid tube, since no air flows into and “fills up” the container.

11. A device according to claims 1 and 10, characterized in that an improved shelf-life for the container medium is obtained, since no air will be permitted to flow into the container.