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(54) **DISPENSING PUMP FOR PRODUCT STORAGE AND DISPENSING CONTAINER AND CONTAINER PROVIDED WITH SUCH A PUMP**

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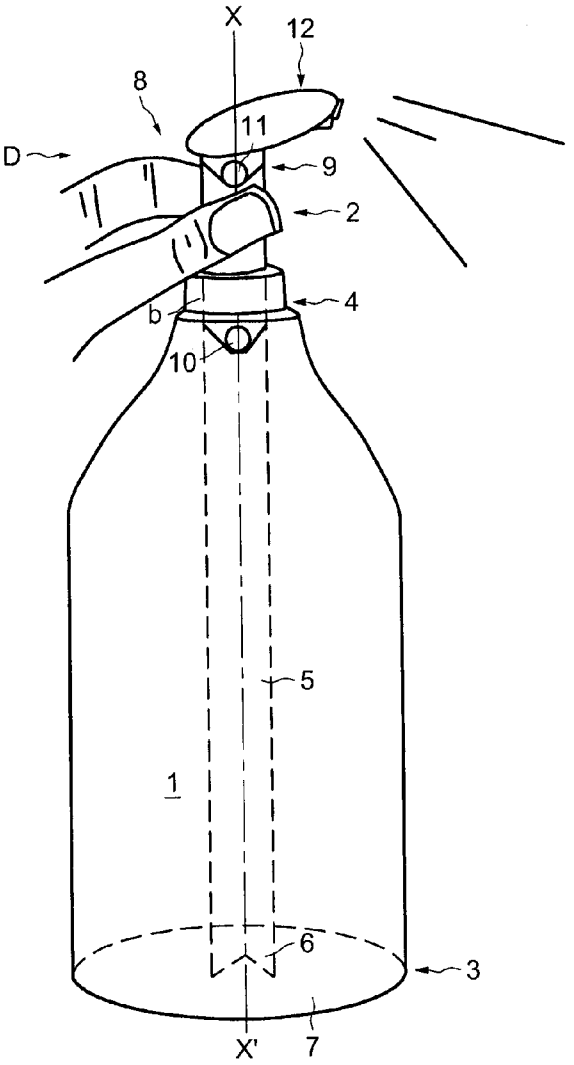
(57) **ABSTRACT**

A pump is arranged to be mounted on a product storage and dispensing container. It includes a variable-volume pumping chamber and a dip tube having a first end able to be inserted inside the container where it picks up product and a product-dispensing second end at the exit from the pumping chamber. The dip tube can be produced by extrusion and typically has two valves and at least one elastically deformable portion running between the valves.



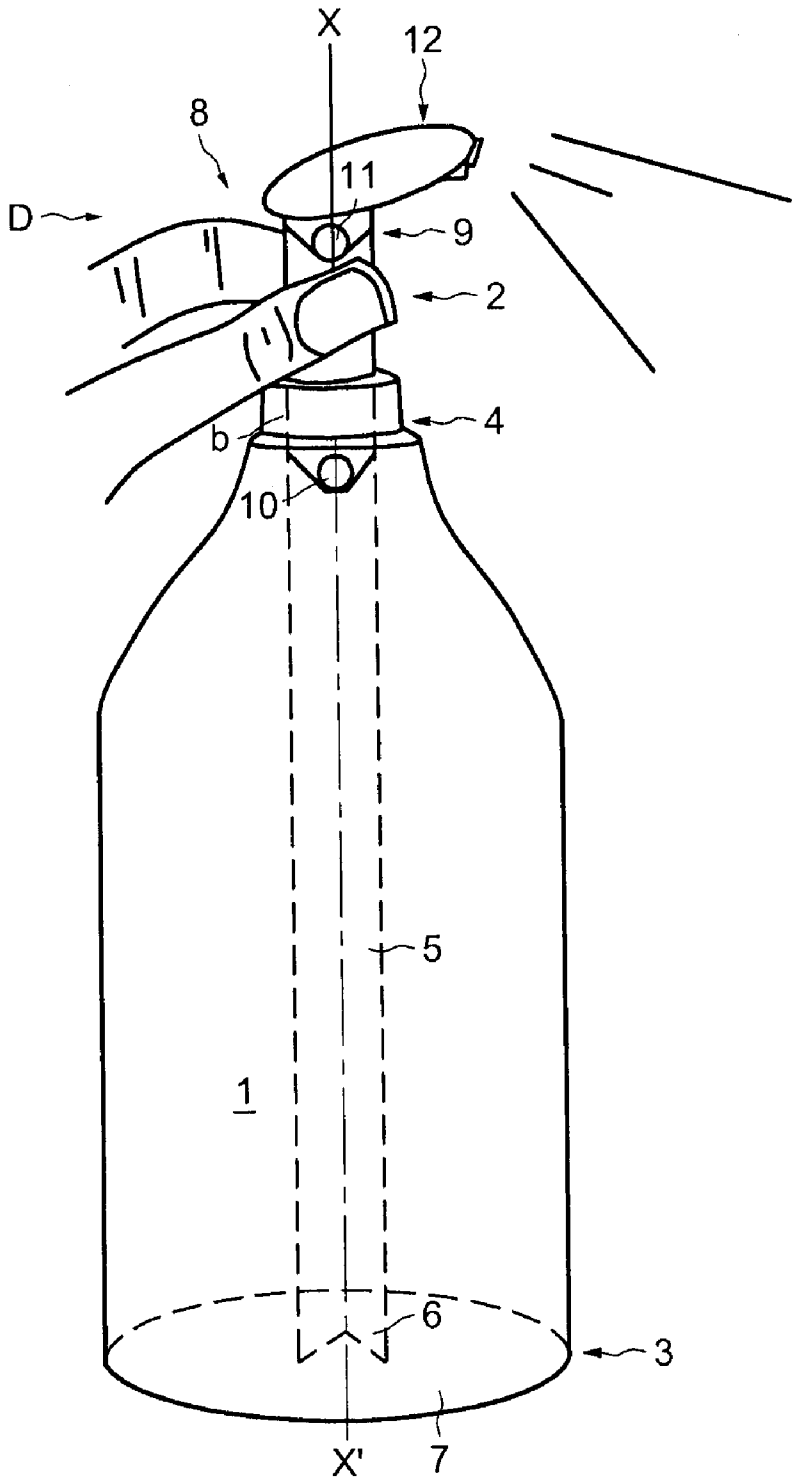


FIG.1

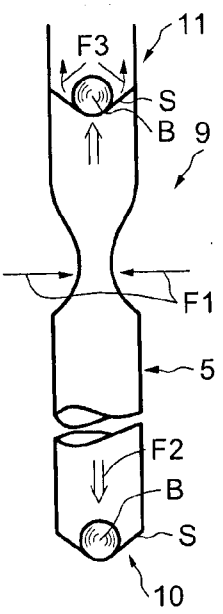


FIG.2

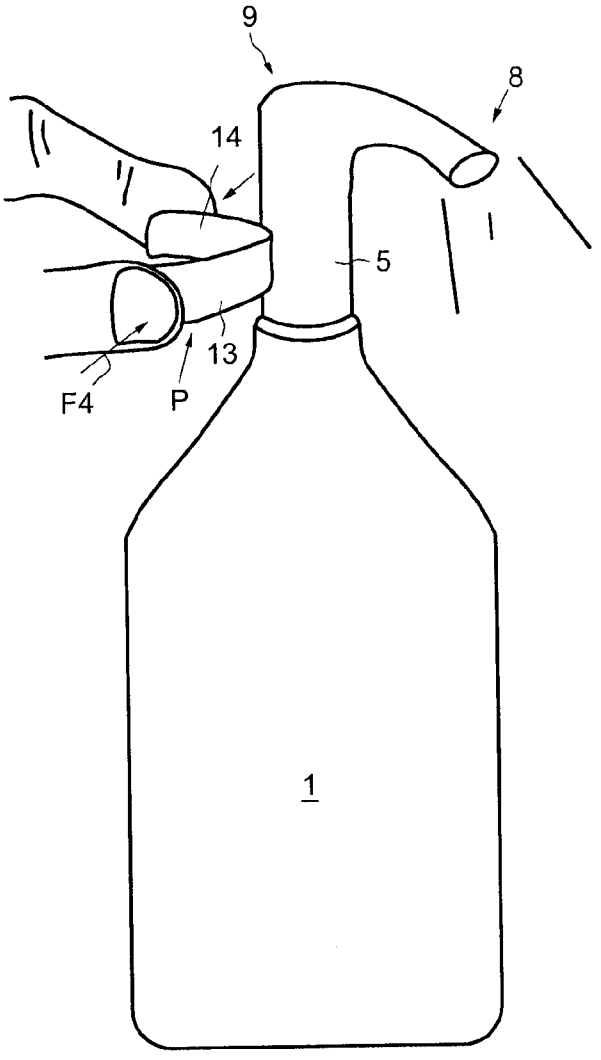


FIG.3

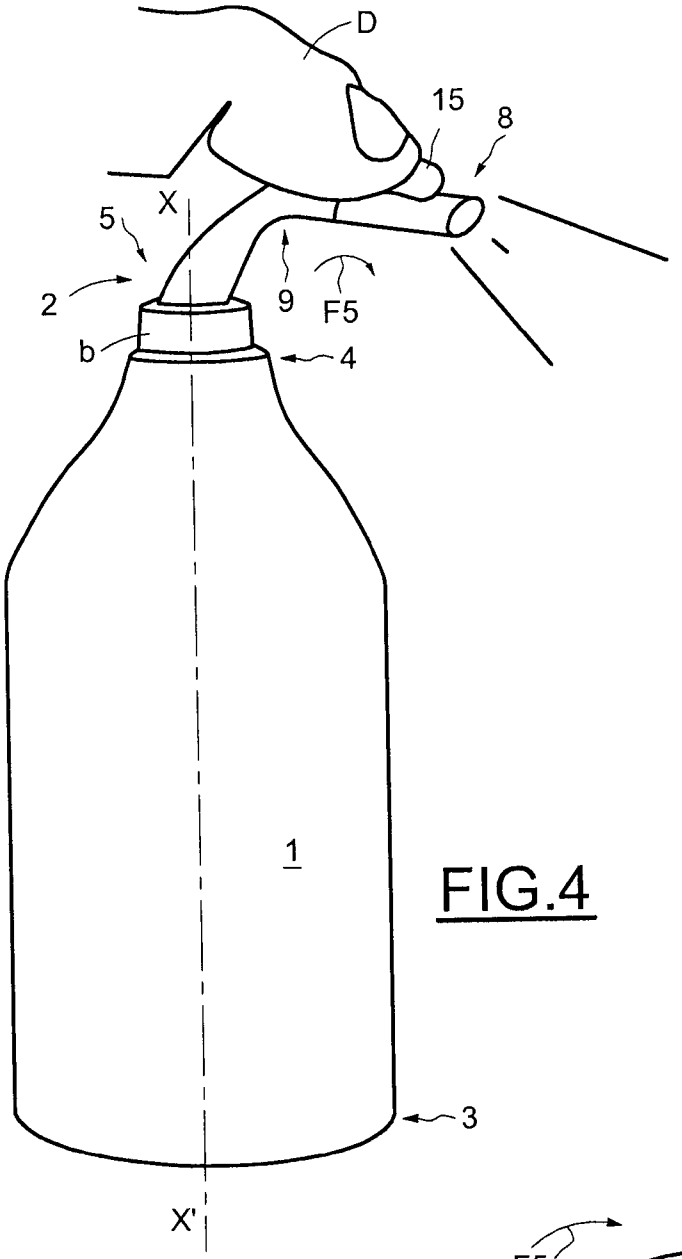


FIG.4

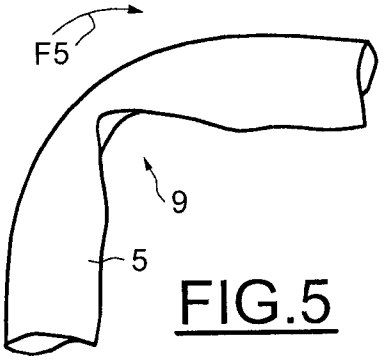


FIG.5

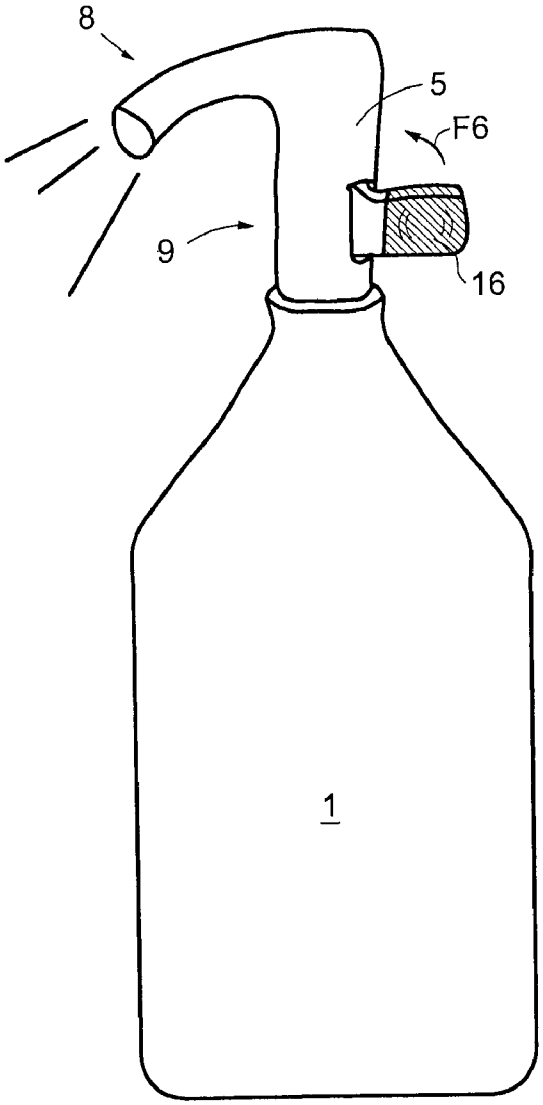


FIG.6

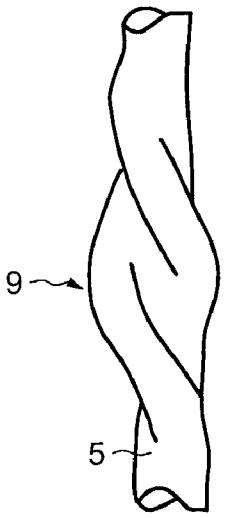


FIG.7

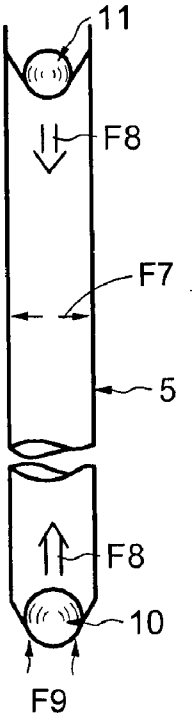


FIG.8

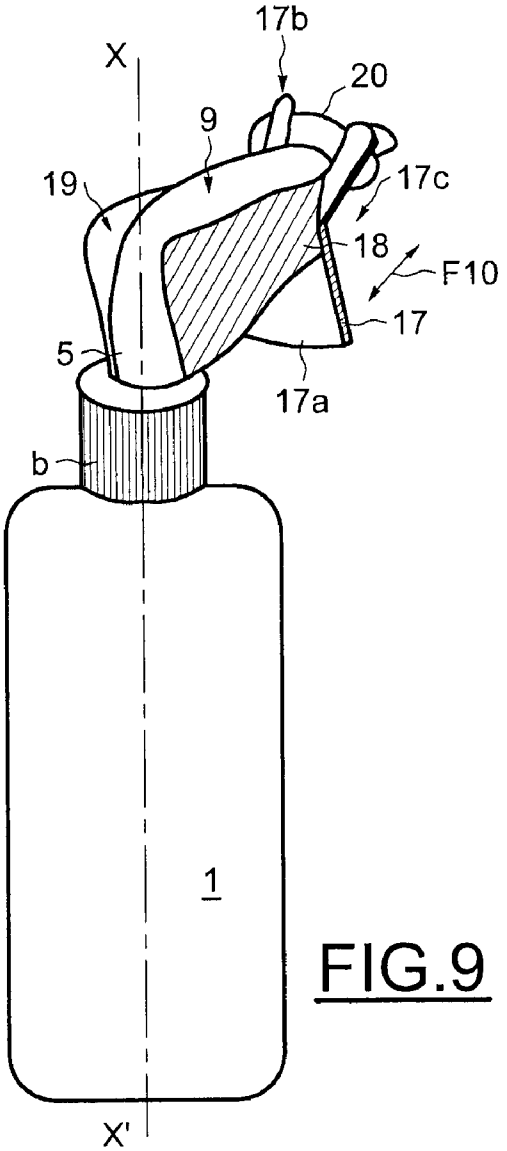


FIG.9

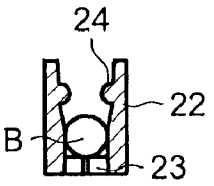


FIG.10

FIG.11

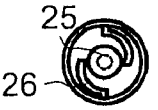


FIG.12

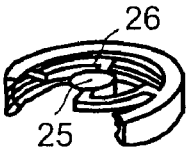


FIG.13

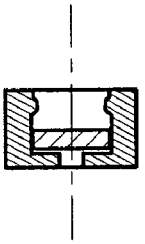


FIG.14

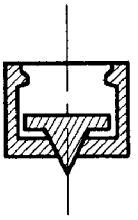


FIG.15

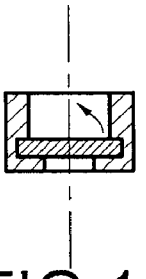


FIG.16

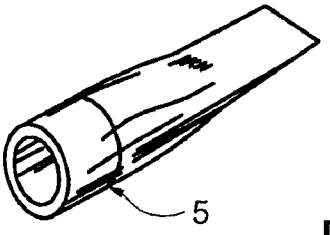


FIG.17

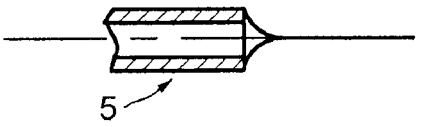


FIG.18

FIG.19

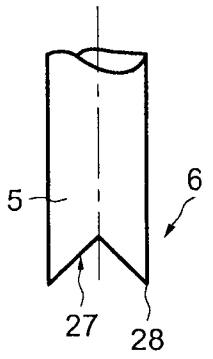


FIG.20

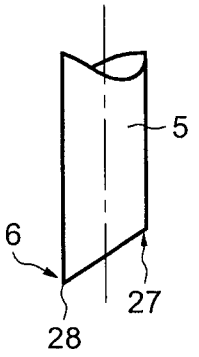


FIG.21

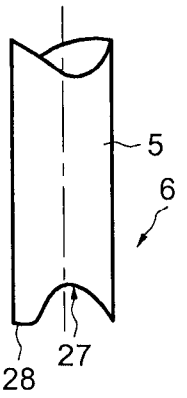


FIG.22

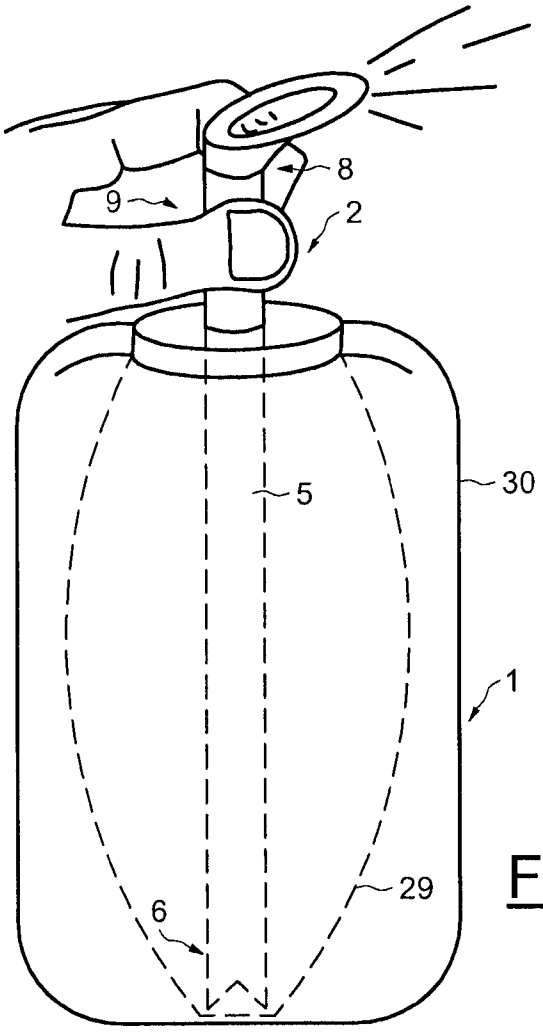


FIG.23

DISPENSING PUMP FOR PRODUCT STORAGE AND DISPENSING CONTAINER AND CONTAINER PROVIDED WITH SUCH A PUMP

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This document claims priority to French Application Number 07 06421, filed on Sep. 13, 2007, and U.S. Provisional Application No. 60/977,987, filed on Oct. 5, 2007, the entire contents of each of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a dispensing pump configured to be mounted on a product storage and dispensing container for dispensing product stored therein.

[0003] More specifically, the invention relates to a pump in which product is dispensed by deforming a variable-volume pumping chamber either by hand or using an actuating member.

BACKGROUND OF THE INVENTION

Discussion of Background

[0004] Dispersing pumps are already known in the art. Document EP B 0 900 598, describes a pump for a fluid cosmetic product, which comprises a pumping chamber that can be elastically deformed under the action of a push-button and which is associated with a product inlet valve. The valve communicates with a container on which the pump is mounted and is also associated with a product dispensing valve via which the product is delivered as it leaves the pump.

[0005] According to the pump described in that document, the push-button is actuated in an overall direction that is coaxial with the container, thus imposing limitations on how the pump can be used.

[0006] Furthermore, that pump comprises a relatively high number of parts, which has an impact on its cost of manufacture and on environmental conservation issues.

[0007] Also described, from document EP A 1 243 216, is a dispensing pump for dispensing shampoo and which comprises, mounted in a cylindrical support itself fixed to the neck of a container, a dip tube, a pumping chamber, and an axially actuated dispensing member. Valves are provided on each side of the distribution chamber.

[0008] As already indicated, according to the arrangement described in that document, actuation is in a direction coaxial with the tube. Further, the pump also comprises a relatively high number of parts, making it relatively expensive to manufacture.

[0009] What is more, according to this arrangement, the pumping chamber is produced in the form of a bellows, this meaning that it has to be manufactured separately from the dip tube and the actuating member. Furthermore, the use of a bellows means that it is difficult to have effective control over the deformation experienced by the pumping chamber upon actuation, leading to poor control over the dose dispensed and poor repeatability of dispensed doses. The use of a bellows presents additional problems of reliability, particularly when using a large-diameter pumping chamber, as the bellows is liable to rupture eventually.

[0010] With a view to improving ergonomics, it has been proposed that the pumping chamber be produced in such a way as to make it radially deformable, either by hand or under the action of a trigger provided with an operating lever which, during operation, presses laterally against the deformable wall of the pumping chamber.

[0011] In this regard, reference may be made to FR 2 141 309 which describes an arrangement such as this.

[0012] However, the pump described in that document once again has a relatively high number of parts, making its cost of manufacture relatively high.

[0013] It has further been proposed to produce the pumping chamber in the form of a flexible tube that may extend right into the reservoir to form a dip tube.

[0014] FR 1 508 161, GB A 2 182 726, U.S. Pat. No. 4,631,008, U.S. Pat. No. 3,066,832, U.S. Pat. No. 3,881,641 and FR 2 389 105 provide information as to how to produce such pumps.

[0015] The pumps described in those documents are trigger operated which generally means that the product has to be dispensed in just one position, either head up or head down.

[0016] In any event, the tube used to produce the pumping chamber typically has no valve, which means that if the pump is unused for a lengthy period of time, there is a risk that the product will become impaired and the pump blocked, especially if the product is viscous.

[0017] Furthermore, in numerous solutions recommended in the background art, the doses that can be dispensed are relatively small.

[0018] Finally, reference may be made to FR 2 341 518, which describes another type of dispensing pump comprising a dip tube inserted in a container and internally comprising two valves delimiting a pumping chamber, and a member for actuating the pumping chamber in order to deform it radially.

[0019] However, the dip tube here is made in two parts and comprises, particularly in the region of the pumping chamber, a flexible internal tube and a member covering this tube. This cover member comprises a rigid outer tube, or sleeve, fixed to the neck of the container, and the actuating member comprises a stem that fits in between the elastically deformable tube and the rigid tube and acts upon a part of the dip tube located inside the volume of the container.

[0020] As a result, the dip tube has a relatively complicated structure and its assembly is difficult to reconcile with high production rates.

[0021] Furthermore, the cover member made of a metallic material, being in contact with the product, may cause undesirable interactions with the product and may, in particular, bring about physio-chemical changes to the product, for example it may cause the product to take on a different color.

SUMMARY OF THE INVENTION

[0022] In the light of the foregoing, there is therefore a desire to have a pump which solves all or some of the aforementioned disadvantages and, in particular, is attractive from an aesthetic viewpoint, ergonomic and relatively simple to manufacture, and can be manufactured at relatively low cost.

[0023] A subject of the invention, in one of its aspects, is a dispensing pump arranged to be mounted on a product storage and dispensing container comprising a variable-volume pumping chamber, and a dip tube having a first end able to be inserted inside the container where it picks up product and a product-dispensing second end at the exit from the pumping chamber.

[0024] According to a general feature of this pump, the dip tube has two valves and at least one elastically deformable portion running between the valves that delimit the pumping chamber.

[0025] The invention thus makes it possible, by virtue of the fact that the pumping chamber is produced in the form of an elastically deformable portion of a dip tube delimited by two valves, for letting product into the chamber and for dispensing the product, to produce a pump from a relatively small number of parts and at low cost, making it possible to offer various actuating options, while at the same time reducing the risk of product impairment. In particular, a pump such as this can be produced from a single type of material, thus offering an advantage from the standpoint of the recycling of the parts employed.

[0026] Furthermore, according to another feature of the invention, the tube is produced by extrusion. This arrangement considerably simplifies the manufacture and assembly of the pump, and in particular, the production of the dip tube.

[0027] As a result, advantageously, the elastically deformable portion and the dip tube can be produced as a single piece.

[0028] Advantageously, the first end has an end region set back relative to a free end of the tube.

[0029] It is thus possible to extend the dip tube right down to the closed end of the container, or even into contact with the closed end, where it can collect product, without the free end of the dip tube being blocked off by the wall of that closed end.

[0030] Thus, in one embodiment, the first end of the tube has a cutout.

[0031] For example, the free first end of the tube has at least one slot particularly of triangular, square, or rectangular cross section.

[0032] As an alternative, the free first end of the tube is mitred or has an overall corrugated shape.

[0033] According to a preferred embodiment that generates little or no scrap, this first end of the tube is cut in a relatively easy way using a linear and sequential process. The chosen shape allows part of the dip tube to be in contact with the closed end of the container while at the same time allowing product contained in this container to be collected.

[0034] According to another feature of the pump according to the invention, at least one of the valves is added to the tube and held therein by friction, clamping, or force-fitting.

[0035] It will be noted that, for example, when at rest, the tube typically has a cross-section of constant size.

[0036] Advantageously, the cross section of the tube has a size, particularly a diameter, preferably of between 3 mm and 15 mm, more preferably between 8 mm and 12 mm, and more preferably of about 10 mm.

[0037] The tube may also advantageously engage, if appropriate fixedly, directly with the neck of the container. In other words, the external wall of the tube may engage with the internal wall defined by the mouth of the container.

[0038] In various embodiments, at least one of the valves is formed with an element chosen from a ball valve, a disc valve, a slot valve, a gate valve in which the shutter has a translational movement, a flap valve in which the shutter has a pivoting movement, and a needle valve.

[0039] According to yet another feature of the invention, the second end of the tube has a self-closing peripheral wall capable of opening under the effect of a raised pressure caused when the pumping chamber is deformed.

[0040] In one exemplary embodiment, the pump further comprises a product applicator mounted on the second end of the tube.

[0041] It may also comprise a pump actuating member capable of deforming the pumping chamber. The actuating member may be designed to create suction within the tube. It may be positioned between a dispensing valve and a mouth of the container defining a mounting opening for the tube. More generally, the actuating member may run between the opening and the dispensing head. This actuating member may be mounted such that it can be removed, if appropriate so that it is interchangeable.

[0042] This actuating member can thus be provided on an external part of the tube that projects out of the container. In other words, this member may extend outside the interior volume defined by the container, and may potentially do so exclusively. The mouth may itself form an actuating surface that the user may, for example, use as a surface to which he or she applies force in order to deform the cross section of the tube, particularly by folding or bending it. This external part may also be large enough to allow the user to operate the tube with his or her fingers directly, such as by compressing the tube.

[0043] The dispensing valve may also be provided in the external part of the dip tube that projects out of the container. The inlet valve may for its part lie within the interior volume of the container. As an alternative, the inlet valve may also be provided outside of this volume.

[0044] For example, the actuating member may comprise a clamp.

[0045] It may also comprise a tab capable of allowing the tube to be twisted.

[0046] The actuating member may also comprise a member for lengthening the tube.

[0047] For example, the actuating member may comprise a trigger equipped with a first end region that can be actuated by hand, and with a second end region, at the opposite end to the first end region with respect to an axis about which the trigger is articulated and which region is firmly attached to the tube.

[0048] Another subject of the invention, in another of its aspects, is a product storage and dispensing container comprising a reservoir for storing the product. This container further comprises a pump as defined hereinabove.

[0049] According to another feature of the container, the first end of the dip tube extends, inside the reservoir, down near to the closed end of the reservoir, or even into contact with the closed end

[0050] In one embodiment, the reservoir contains a flexible pouch on which the pump is mounted.

[0051] The container may further comprise a rigid outer shell surrounding the reservoir.

[0052] In another embodiment, the reservoir is made of a rigid material, the pump comprising an air intake passage.

[0053] A further subject of the invention is a method of dispensing a product using a pump as defined hereinabove, this method involving the steps of deforming the dip tube by locally reducing the cross section of the tube at least in the region lying between the valves, collecting a dose of product, and filling the pumping chamber by releasing the tube.

[0054] In one embodiment, when the tube is being deformed, it is being deformed by bending it.

[0055] The tube may also be deformed by compressing it.

[0056] The tube may alternatively be deformed by lengthening the tube.

[0057] As an alternative, the tube may be deformed by twisting it.

[0058] Another subject of the invention is a dispensing pump intended to be mounted on a product storage and dispensing container, comprising a variable-volume pumping chamber, and a dip tube having a first end able to be inserted inside the container where it picks up product and a product-dispensing second end at the exit from the pumping chamber, in which the dip tube defines an axis of elongation and at rest has a cross section of substantially constant size, the tube comprising two valves, at least one elastically deformable portion running between the valves that delimit the pumping chamber. A tube such as this could then preferably be produced by extrusion, or otherwise, using rotational molding or injection molding.

[0059] A further subject of the invention is a dispensing pump intended to be mounted on a product storage and dispensing container, comprising a variable-volume pumping chamber, and a dip tube having a first end able to be inserted inside the container where it picks up product and a product-dispensing second end at the exit from the pumping chamber, in which the tube comprises two valves, at least one elastically deformable portion running between the valves that delimit the pumping chamber and in which this tube has a part external to the container that can be actuated by hand by the user by pressing his or her fingers directly onto the portion or using a product-dispensing actuating member attached around this external part.

[0060] A further subject of the invention is a dispensing pump intended to be mounted on a product storage and dispensing container, comprising a variable-volume pumping chamber, and a dip tube having a first end able to be inserted inside the container where it picks up product and a product-dispensing second end at the exit from the pumping chamber. The tube comprises two valves, at least one elastically deformable portion running between the valves that delimit the pumping chamber. The pump includes means of twisting the tube that act as a product-dispensing actuating member.

[0061] As should be apparent, the various embodiments of the invention can provide a number of advantageous features and benefits. It is to be understood that, in practicing the invention, an embodiment can be constructed to include one or more features or benefits of embodiments disclosed herein, but not others. Accordingly, it is to be understood that the preferred embodiments discussed herein are provided as examples and are not to be construed as limiting, particularly since embodiments can be formed to practice the invention that do not include each of the feature of the disclosed examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0062] A better understanding of the invention will be gained from reading the following description in conjunction with the accompanying figures. The figures are offered purely as a guide and by way of example, and in no way limit the invention.

[0063] FIG. **1** is a perspective view of a product storage and dispensing container equipped with one exemplary embodiment of a pump according to the invention;

[0064] FIG. **2** is an outline diagram illustrating the operation of the pump of FIG. **1**;

[0065] FIG. **3** illustrates a first alternative form of the pump of FIG. **1**;

[0066] FIG. **4** shows a second alternative form of the pump of FIG. **1**;

[0067] FIG. **5** illustrates the principle of operation of the pump of FIG. **4**;

[0068] FIG. **6** shows a third alternative form of the pump of FIG. **1**;

[0069] FIG. **7** illustrates the principle of operation of the pump of FIG. **6**;

[0070] FIG. **8** is an outline diagram illustrating another way of using a pump according to the invention;

[0071] FIG. **9** is a perspective view of a fourth alternative form of a pump according to the invention, employing the principle illustrated in FIG. **8**;

[0072] FIGS. **10** to **19** illustrate various embodiments of the valves that form part of a pump according to the invention;

[0073] FIGS. **20** to **22** schematically illustrate various embodiments of the free end of the dip tube; and

[0074] FIG. **23** illustrates one way of using a pump according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0075] Referring now to the drawings, like reference numerals are used to designate identical or corresponding parts throughout the several views.

[0076] FIG. **1** depicts, schematically and in perspective, a product storage and dispensing container **1** provided with a pump **2** according to the invention.

[0077] In the position illustrated in FIG. **1**, the assembly has an overall axis X-X' depicted in a position assumed to be vertical.

[0078] In the exemplary embodiment depicted, the container **1** comprises a reservoir that has a closed bottom end **3** and an open top end **4** forming a neck, on which the pump **2** is mounted, for example by screwing.

[0079] The container is, for example, intended to contain a cosmetic or care product. The cosmetic product is to be understood to mean a product as defined in Commission Directive 93/35/EC of 14 Jun. 1993.

[0080] However, it would not constitute a departure from the scope of the invention if any other fluid, liquid or viscous product were to be contained in the container **1** and dispensed by the pump **2**.

[0081] As can be seen in FIG. **1**, the pump **2** essentially consists of a dip tube **5** which comprises a lower end **6** via which the product contained in the container **1** enters the tube **5** and which extends into the container toward the closed bottom end **3** of the container **1**, particularly in contact with the end wall **7** of the container, and an opposite top end **8** which extends out of the container and via which the product is dispensed as it leaves the pump.

[0082] In the embodiment shown in FIG. **1**, the tube **5**, at rest, advantageously has a cross section of constant size. This cross section is advantageously circular but could equally well be of another shape such as polygonal, particularly square, or oval. This cross section may have a size and, in particular a diameter, preferably between 3 mm and 15 mm, more preferably of between 8 mm and 12 mm, and in particular of about 10 mm.

[0083] The lower end **6** of the dip tube may extend into contact with, or, preferably, up to 10 mm away from, the end wall of the container.

[0084] The tube **5** may be mounted on the container using a fastener. This fastener may involve a clip-fastening, screw-fastening or crimping ring to be mounted on the neck of the container as a tight fit.

[0085] For example, in its middle, the tube **5** may be provided with a threaded ring b, screw-fastened onto the neck of the container and thus holding the tube **5** in place, for example through friction.

[0086] The container may alternatively be provided with a cap (not depicted) that fits over the top end of the tube.

[0087] With reference also to FIG. **2**, one way in which the pump works is essentially based on deforming a pumping head formed by a manually accessible portion **9** of the tube **5** which therefore extends out of the container **1**.

[0088] Thus, the dip tube **5** is at least partly made of an elastically deformable material, particularly the portion **9**. For example, for a tube having an internal diameter of 10 mm and an external diameter of 14 mm, the stiffness constant of the tube, axially measured using a texturometer, is preferably 4000 N/m. However, regardless of the internal diameter and of the external diameter, the stiffness constant of the tube is advantageously between 3000 N/m and 6000 N/m, to ensure comfortable and efficient working of the tube.

[0089] The tube **5** and the portion **9** are typically produced as one piece.

[0090] Advantageously, the tube **5** is made as one piece by extruding a flexible plastic. As an alternative, this tube could just as well be produced by a molding operation, such as a rotational molding or an injection molding operation.

[0091] However, producing the tube by extrusion is also advantageous in that it allows the production of a very long tube, for example one more than three centimeters, particularly more than eight centimeters, and even more particularly more than twelve centimeters long, with a diameter that is constant.

[0092] The tube **5** is also advantageously a one-walled tube, that is to say a tube that has no sleeve or outer wall. For preference, all the component parts of the pump are made of one and the same type of material such as one or more plastic.

[0093] In the exemplary embodiment illustrated in FIGS. **1** and **2**, deformation is produced by taking hold of the tube **5** by hand, in the portion **9** that forms the pump body and, in particular, by squeezing it between two fingers D, for example between the thumb and index finger, so as to apply a force in a radially inward direction (arrow F**1**).

[0094] As can be seen in FIG. **2**, which illustrates the principle of operation of the pump, the manually operable region **9** is delimited by a bottom valve, referenced **10**, and by a top valve, referenced **11**, positioned facing one another so that they operate in the same direction.

[0095] It will be noted in this regard that, because the tube is made as one piece and, in particular, because the tube can be produced by extrusion, it is possible to produce a dip tube that has an elastically deformable region delimiting a pumping chamber and also incorporating valve seats S.

[0096] In the example depicted, the bottom and top valves consist of valves of the ball valve type, with the balls, such as B, resting, when at rest, on a seat S. They are each positioned in the tube **5** in such a way that when a raised pressure caused by a force, in this instance a transverse force, is applied to the tube in such a way as to cause a resultant deformation that leads to a localized reduction in cross section, one of the valves, namely the bottom valve **10**, closes (arrow F**2**), while the other valve, namely the top valve **11**, opens and a dose of product is dispensed through the top valve **11** and then to the pump outlet (arrow F**3**).

[0097] After the product has been dispensed, when the tube **5** is released, the elastically deformable region **9** returns to its initial position. The resultant suction causes the top valve **11** to close, the bottom valve **10** to open and resultant filling of the deformable region **9** of the dip tube.

[0098] In other words, the elastically deformable and manually operable region **9** of the dip tube **5** constitutes a variable-volume pumping chamber axially delimited by the bottom and top valves, which can be locally compressed in order to reduce its volume and cause a dose of product to be dispensed. The pumping chamber, following release, returns to its initial volume in order to admit product because of the elasticity of the wall of which the tube is made. The lower end **6** of the tube **5** is therefore desired to be upstream of the pumping chamber while the top end **8** extends downstream of the pumping chamber.

[0099] It is typical to produce the tube and, in particular, the pumping chamber, from a material that can easily be deformed by hand, while being unlikely to allow unwanted actuation of the pump, and which is capable of returning to its initial position, at the same time drawing in product, all this according to the nature of the product to be drawn in.

[0100] As indicated earlier, producing the tube using extrusion is advantageous insofar as it allows the production of a tube and, in particular, of a pumping chamber, that provides better control of the dose of product dispensed.

[0101] It is typical in this regard to choose a material with a shore hardness of less than 45 D and a bending modulus of less than 200 MPa.

[0102] By way of example, the tube **5** may be made of elastomer, for example elastomers of the SBR or CR type, such as the elastomers marketed under the names NEOPREN® or BAYPREN®, of the EPDM or EPM type, such as the neoprenes marketed under the names VISTALON®, POLYSAR EPM®, BUNA EP® or NORDEL®, of the FPM or FKM type, such as the elastomers marketed under the trade names TECHNOFLON®, FLUOREL®, AFLAS® or VITON®, of the MQ, MVQ, MPQ, FVMQ or FMQ type, such as the elastomers marketed under the trade names TYGOPRENE®, SYLOPRENE®, SYLASTIC®, FSE®, SYLON®, ELASTOSIL®, or RHODORSIL®, of the EVM type such as the LEVAPREN, LEVAMELT®, BAYMOD L® elastomers, or alternatively of the AU or EU type.

[0103] Use may also be made of thermoplastic elastomers of the TPO or TPV type, such as the elastomers marketed under the names ENGAGE®, SANTOPRENE®, TREFSIN®, SARLINK® or ALCRYN®, or the SBC, TPU, PEBA type or those based on Propylene Ethylene such as the elastomers marketed under the names MULTIFLEX TPE®, PEBAX® or ADFLEX®.

[0104] However, use could equally be made of flexible thermoplastics of the EVA or VLDPE type, such as the thermoplastics marketed under the names EVATANE®, GREENFLEX®, ESCORENE ULTRA® or CLEARFLEX®.

[0105] The arrangement that has just been described makes it possible to produce a pump essentially consisting of a dip tube internally provided with two, bottom and top, valves which between them delimit a pumping chamber, the pump therefore being produced with a reduced number of parts, this advantageously having an impact on its cost of manufacture and also on environmental protection issues.

[0106] Further, by virtue of the fact that the pump is produced with a small number of parts, the number of materials of different kinds in contact with the fluid that has to be circulated is minimized. Furthermore, actuating the pump by deforming the dip tube by hand allows, as will be described in detail later, wide flexibility in its use, allowing various operating options and furthermore allowing for particularly quiet operation.

[0107] Thus, for one and the same tube, it is possible to deform the pumping chamber in different ways, by lengthening it, by twisting it, by rubbing it, etc.

[0108] It will also be noted that, in use, the amount of product dispensed depends on the extent to which the tube is deformed. Specifically, the dose of product dispensed by the pump is equal to the variation in volume caused by the mechanical deformation applied to the flexible tube. It is therefore possible to deliver different doses, from one use to another, according to the user's desires and, if appropriate, to deliver large quantities of product.

[0109] It will also be noted that, whereas in the exemplary embodiment described, the tube may be mounted on the container by a fastener, it may also as an alternative be possible to mount the tube in such a way that it comes into direct contact with the internal wall of the neck so that the neck holds the tube in place by friction so as to obtain a sealed assembly, it then being possible to omit the fixing ring.

[0110] It is noted that, with a view to making the pump easier to use, the top end **8** may be provided with a dispensing member. It is possible, in this regard, and as illustrated in FIG. **1**, to provide the tube **5** with a dispensing head **12**, for example push-fitted onto the top end **8** of the tube to make dispensing easier, and in particular to improve precision. In particular, the dispensing head may comprise a duct of small cross section or may be fitted with a nozzle provided with a swirl-inducing system.

[0111] Of course, as an alternative, other types of applicator or dispensing member may be mounted on the top end of the tube **5**. Members such as a porous element, rollerball, etc. type may be used in this regard.

[0112] The invention is not restricted to the embodiment described, and other embodiments are illustrated in FIGS. **3** to **23**.

[0113] Whereas in the embodiment described previously with reference to FIGS. **1** and **2**, the tube was deformed by squeezing the tube manually between two fingers D, with reference to FIG. **3** it is possible to fit the pump head with a pump actuating member.

[0114] However, it is noted that in these various embodiments, the pumping chamber extends, at least in part, outside of the container. In other words, when it is intended to be operated by hand, the user can easily position his or her fingers on the elastically deformable pumping chamber in order to actuate it by hand. Likewise, when use is made of an actuating member, this member is mounted on the outside of the container in such a way that it can be replaced should it malfunction or changed if there is any desire to change the way in which the pumping chamber is actuated.

[0115] In the exemplary embodiment depicted in FIG. **3**, the tube is provided with a clamp P of which two branches **13** and **14** locally surround the manually accessible region **9** and can be brought closer together by hand (arrow F**4**) in order to deform the tube transversely. The clamp P may be made of an elastically deformable material capable of avoiding preventing the filling of the pumping chamber. As an alternative, the clamp may be made of a rigid, non-deformable, material provided with an articulation returned to the rest position in the released position, by virtue of the flexibility of the tube.

[0116] Furthermore, whereas in the exemplary embodiments already described, the tube is deformed by compressing it, it is also possible, as an alternative and as illustrated in FIGS. **5** and **6**, to envisage deforming the tube by bending it (arrow F**5**).

[0117] In this embodiment, which essentially differs from the embodiments already described only in the way in which the pump head is actuated, from a rest position in which the tube runs essentially along the axis X-X' of the container, it is simply necessary to exert a lateral force on the free end **8** of the tube in order to bend it and thereby cause a localized reduction in cross section causing a resultant reduction in the volume of the pumping chamber.

[0118] The free end of the tube may then be provided with a fixed stop produced, for example, in the form of a relief **15**, to make the pump head easier to actuate. However, as an alternative, the mouth of the container, particularly the internal edge delimiting the opening of this mouth, may form a surface actuating the pumping chamber by folding the tube at this point.

[0119] According to a third alternative form illustrated in FIGS. **6** and **7**, the pumping chamber is deformed by applying torsion to the tube by twisting it. This can be done by applying a torsional force to the tube and thereby reducing the volume of the pumping chamber. As visible in FIG. **6**, the pump head may then be fitted with a tab **16** to make it easier to apply the torsional force (arrow F**6**).

[0120] With reference now to FIG. **8**, the tube may alternatively be deformed by elongating it.

[0121] In other words, when a tensile force is applied to the tube, the resultant deformation leads to a reduction in cross section along the pumping chamber and causes product to be dispensed through the top valve **11**.

[0122] By contrast, when the tube is released, the pumping chamber returns to its initial position (arrow F**7**) which causes suction in the pumping chamber. This suction causes the top valve **11** to close, the bottom valve **10** to open (arrow F**8**) and the product to be sucked in through the bottom valve **10** (arrow F**9**).

[0123] With reference to FIG. **9**, to make it easier to lengthen the tube, a lengthening member may be provided on the ring b, this member comprising a trigger **17** comprising a first end region **17***a* that can be actuated by hand in a direction that is generally transverse (arrow F**10**), a second end region **17***b* firmly attached to the free end **8** of the tube, and a middle part **17***c* bearing against or articulated to a base **18** secured to the ring b.

[0124] In this embodiment, dispensing is in a direction essentially transverse or essentially oblique to the overall axis X-X' of the tube, the pumping chamber then being configured in such a way as to form an elbow inserted and guided in a groove **19** made in the base.

[0125] For example, in this embodiment, the second end region **17***b* forms a fork on which there rests a collar **20** made near the free end of the tube **5** and, in particular, the face of the collar situated on the opposite side to the end of the tube **5**. As a result, when pressure is exerted on the first end region **17***a*, the second end region **17***b* applies a lateral or, in general, an oblique, force to the collar **20** and as a result causes the pumping chamber to lengthen.

[0126] This deformation by lengthening causes a reduction in the cross section of the tube and causes a dose of product of a size corresponding to the amount of deformation to be dispensed.

[0127] Following release, the elasticity of the tube on the one hand fills the pumping chamber and, on the other hand, repositions the trigger in its initial position.

[0128] As already mentioned, in the various embodiments described, the pumping chamber is delimited by a bottom valve **10** and by a top valve **11**. In the embodiment visible in FIGS. **1**, **2** and **8**, the top and bottom valves each consist of a ball valve.

[0129] In this case, as illustrated in FIG. **10**, the valve comprises a body **22** which has a generally cylindrical external peripheral surface and a closed end provided with one or more passages **23** and which internally comprises a housing accommodating a ball B delimited, on the one hand, by the closed end **23** and, on the other hand, by an annular seat **24** against which the ball B rests when the valve is in the open position.

[0130] However, it is possible to use, in place of a ball valve, a slot valve (FIG. **11**), a disc valve (FIGS. **12** and **13**) in which a moving disc **25**, held by elastically deformable lateral branches such as **26**, closes a product flow orifice, or alternatively a gate valve in which the shutter can move translationally (FIG. **14**), a needle valve (FIG. **15**), or alternatively a flap valve in which the shutter is able to pivot (FIG. **16**).

[0131] It is noted that, in the embodiment illustrated in FIGS. **12** and **13**, the valve is produced from a flexible material, for example a flexible elastomer. Although this has the disadvantage of creating a restriction, it remains very simple to produce.

[0132] In the various envisaged embodiments, the inlet or bottom valve **10** that lets product into the chamber may be provided in the interior volume of the container, while the delivery valve that dispenses product may extend outside of the container, that is to say beyond the neck of the container.

[0133] It will be noted in this regard that, as already mentioned, the pumping chamber extends at least partly outside of the container. In other words, the dip tube comprises a part which is inserted in the container and thus falls inside the interior volume of the container and extends as far as the mouth, and a part external to the container, that projects out of the container and of its mouth. This projecting part may serve to attach the actuating member.

[0134] At least the internal part may have no covering sheath or external sleeve, over at least 50% of its height, preferably over 75% of its height, and as a preference over its entire height, so that over its height via which the tube is intended to be inserted into the tube in contact with the product, the volume reserved for the product in the container can be greater. It is also possible to envisage at least the external part of the tube having no cover member. The tube may possibly be devoid of any cover member over its entire height, possibly except for the height of a dispensing head attachment section. This partial or complete lack of cover member makes it possible to avoid potential physio-chemical modifications to the product contained in the container, particularly when this cover member is made of (a) metallic material(s).

[0135] With reference to FIGS. **17** to **19**, as far as the top valve **11** is concerned, the second end **8** of the pumping chamber may alternatively be produced in the form of a self-closing peripheral wall, that is to say of a wall which is closed in the rest position (FIGS. **17** and **18**). By contrast, when a raised pressure is created in the pumping chamber, this end opens up spontaneously to allow the fluid to flow. When the pumping chamber is released, the end of the pumping chamber will spontaneously close itself again to let product into the chamber.

[0136] In the various embodiments envisaged in FIGS. **10** to **16**, the valves are preferably produced in the form of an added element inserted into the dip tube **5** and held therein by friction, clamping or force fitting. This embodiment has the advantage of reducing costs and enhancing ease of use.

[0137] By way of example, according to one of the advantageous features, the valves are kept in place by elastic deformation of the tube. Preferably, the valves have a length greater than their diameter.

[0138] In the various embodiments, the dip tube **5** will preferably be produced in such a way that its free end bears against the surface of the end wall **7** of the container **1**. Thus, in use, the container **1** can be completely emptied, it then becoming easier for liquid to be drawn up from the closed end of the container.

[0139] However, in order to prevent the end wall **7** from being sucked in and blocking the lower end **6** of the dip tube, this end of the tube is configured in such a way that it has an end region **27** which is set back from the free end **28**. For example, with reference to FIG. **20**, this set-back region may be produced in the form of a slot of triangular, square or rectangular overall shape. However, as an alternative, it is equally possible to configure the free end in the form of a mitre (FIG. **21**) or in a corrugated form (FIG. **22**). These various shapes are grouped together under the common heading of cutout.

[0140] It is noted that the pump system that has just been described may advantageously be used under conditions of the "airless" type, that is to say packages in which the products are stored out of contact with the air. In this case, as illustrated in FIG. **23**, the container essentially comprises a flexible pouch **29** on which the pump **2** is mounted. The reservoir may alternatively also have a rigid outer shell **30** that conceals or protects the flexible pouch **29**.

[0141] However, it is equally possible to use the pump that has just been described on rigid containers. In this case, air intake passages which serve in particular to lead atmospheric pressure into the container before or during the filling of the chamber are advantageously provided in the pump. Air intake can also be obtained due to the elastically deformable material.

[0142] It is further noted that the invention is not of course restricted to the embodiments described or envisaged. In particular, the embodiments whereby the tube is made as a single piece by extrusion, the embodiments whereby the tube at rest has a cross-section of constant size, the embodiments whereby the elastically deformable pumping chamber is accessible from the outside, and the embodiments whereby use is made of pumping chamber actuating means that involve applying torsion to or twisting the tube may be envisaged independently of one another and, as appropriate, combined with all the other alternative forms envisaged earlier.

[0143] It should be noted that numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A dispensing pump to be mounted on a product storage and dispensing container, the dispensing pump comprising:

a variable-volume pumping chamber disposed in a dip tube, the dip tube including a first end configured to be inserted into the container where the dip tube picks up product and including a product-dispensing second end connected to an exit of the pumping chamber,

wherein the dip tube includes two valves and at least one elastically deformable portion running between the valves, and the valves delimit the pumping chamber.

2. The pump according to claim **1**, wherein the elastically deformable portion and the dip tube are a single integral piece.

3. The pump according to claim **2**, wherein the stiffness constant of the tube is between 3000 N/m and 6000 N/m.

4. The pump according to claim **3**, wherein the stiffness constant of the tube is 4000 N/m.

5. The pump according to claim **1**, wherein the first end has an end region set back relative to a free end of the tube.

6. The pump according to claim **5**, wherein the first end of the tube includes a cutout.

7. The pump according to claim **6**, wherein the free first end of the tube includes at least one slot.

8. The pump according to claim **7**, wherein the slot has a triangular, square, or rectangular cross-section.

9. The pump according to claim **6**, wherein the free first end of the tube is mitred.

10. The pump according to claim **6**, wherein the free first end of the tube has an overall corrugated shape.

11. The pump according to claim **1**, wherein at least one of the valves is a distinct component from the tube and held in the tube by friction.

12. The pump according to claim **1**, wherein, when at rest, the tube has a cross section of constant size.

13. The pump according to claim **12**, wherein the cross section of the tube has a diameter of between 3 mm and 15 mm.

14. The pump according to claim **13**, wherein the tube has a diameter of between 8 mm and 12 mm.

15. The pump according to claim **13**, wherein the tube has a diameter of 10 mm.

16. The pump according to claim **1**, wherein the tube engages directly with a neck of the container.

17. The pump according to claim **1**, wherein at least one of the valves includes at least one of a ball valve, a disc valve, a slot valve, a gate valve in which a gas has a translational movement, a flap valve in which a flap has a pivoting movement, and a needle valve.

18. The pump according to claim **1**, wherein the second end of the tube has a self-closing peripheral wall that moves under the effect of a raised pressure caused when the pumping chamber is deformed.

19. The pump according to claim **1**, further comprising a product applicator mounted on the second end of the tube.

20. The pump according to claim **1**, wherein the dip tube is an extruded tube.

21. The pump according to claim **1**, further comprising a pump actuating member that deforms the pumping chamber.

22. The pump according to claim **21**, further comprising an actuating member positioned between a dispensing valve and a mouth of the container which mouth defines a mounting opening for the tube.

23. The pump according to claim **21**, wherein the actuating member comprises a clamp.

24. The pump according to claim **21**, wherein the actuating member comprises a tab accessible by a user and that allows the tube to be twisted.

25. The pump according to claim **21**, wherein the actuating member comprises a member for lengthening the tube.

26. The pump according to claim **25**, wherein the actuating member comprises a trigger equipped with a first end region that can be actuated by hand, and with a second end region, at the opposite end to the first end region with respect to an axis about which the trigger is articulated and which region is firmly attached to the tube.

27. The product storage and dispensing container comprising a reservoir that stores the product, the container including a pump according to claim **1**, mounted on the reservoir.

28. The container according to claim **27**, wherein the first end of the dip tube extends, inside the reservoir, to within 10 mm of the closed end of the reservoir.

29. The container according to claim **28**, wherein the dip tube is in contact with the closed end of the reservoir.

30. The container according to claim **27**, wherein the reservoir contains a flexible pouch on which the pump is mounted.

31. The container according to claim **30**, further comprising a rigid outer shell surrounding the reservoir.

32. The container according to claim **27**, wherein the reservoir comprises a rigid material, and the pump comprises an air intake passage.

33. The method of dispensing a product using a pump according to claim **1**, comprising the steps of:

deforming the dip tube by locally reducing the cross section of the tube at least in the region lying between the valves;

collecting a dose of product; and

filling the pumping chamber by releasing the tube.

34. The method according to claim **33**, wherein deforming the tube includes bending the tube.

35. The method according to claim **33**, wherein deforming the tube includes compressing the tube.

36. The method according to claim **33**, wherein deforming the tube includes lengthening the tube.

37. The method according to claim **33**, wherein deforming the tube includes twisting the tube.

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