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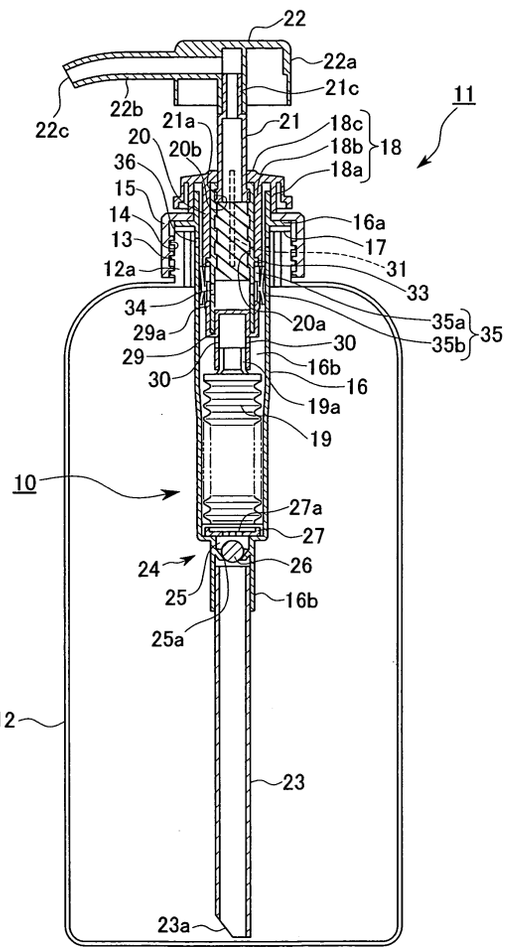
(54) PUMP UNIT AND CONTAINER

(57) A pump unit (10) that pumps liquid inside a container body (12) to the outside is provided with a liquid containing portion and a piston portion that is moveably inserted in the liquid containing portion. The piston portion has a shaft case (20) that is provided inside the liquid containing portion and has a female thread portion (20a) formed on an internal circumferential surface thereof, and has a piston head portion (21 and 22) that protrudes outside the liquid containing portion and has a discharge aperture (22c) formed on the protruding portion, and that has a male thread portion (21a) which screws into the female thread portion (20a) formed on an external circumferential surface, and that is inserted into the shaft case so as to be able to move inside the shaft case. An unthreaded portion (20b) that allows the male thread portion of the piston head portion to rotate freely in the circumferential direction of the shaft case is formed on the shaft case. According to this pump unit, it is possible to freely rotate the discharge aperture of the piston head portion separately from the operation to discharge the liquid inside the container body.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a pump unit that is used, for example, in a pump type container for a hair shampoo or the like used in the home, and also to a container.

BACKGROUND ART

[0002] Conventionally, pump type containers are used as containers for containing, for example, hair shampoo or soap that are used in the home. These pump type containers are composed of a container body and a pump unit that is removably inserted into the container body. Normally, the pump unit is constructed such that when a piston portion is pressed, the piston portion pumps liquid up from the container body as it returns to its original position. The next time the piston portion is pressed, this liquid is discharged from a discharge aperture.

[0003] Such pump units include those that utilize a return operation in which a bellows that contracts when the piston portion is pressed once again expands when the piston portion is released so as to pump liquid into the bellows. When the piston portion is once again pressed, the bellows is contracted so as to discharge the liquid inside the bellows from the discharge aperture (see, for example, Japanese Unexamined Patent Application, First Publication Nos. H10-101115 and H10-211947).

[0004] In order to pump liquid into the bellows or discharge liquid from inside the bellows in accordance with this type of piston pressing operation or return operation, a suction valve and discharge valve are provided on the bellows upstream side and downstream side.

[0005] In a container that is to be manufactured commercially, it is desirable, particularly in a working state, that the direction of the discharge aperture that discharges the liquid can be freely changed. This is because, when the container is, for example, a container for hair shampoo that is used in the home, when the container is used, normally, it is not lifted up and used, but instead the head portion alone is operated so as to discharge liquid while the container itself is left standing.

[0006] Moreover, in addition to this requirement, the problem arises that, if the suction valve or discharge valve comes open if the container falls over, then the liquid runs out from the discharge aperture.

[0007] In order to solve this type of problem, conventionally, in particular, when the container is not in use such as when it is being transported or stored, the piston portion is pressed down so as to compress the bellows, and in this state the container is packaged and stored.

[0008] However, as described above, if the piston portion is pressed down for an extended period of time so that the bellows are left in a compressed state, the bellows become weakened. Even if the compression of the bellows by the piston portion is then released when the container is subsequently used, there are cases when the bellows do not return properly to their original condition. As a result, there is a tendency for the problem to arise that the liquid cannot be sufficiently suctioned so that the operability deteriorates markedly.

[0009] The present invention was conceived in view of the above described circumstances and it is an object thereof to provide a pump unit and container that enable the direction of the discharge aperture to be freely changed when in use, and that when not in use, such as when being transported, prevent liquid from running out, and that also prevent any deterioration in operability that is caused by the bellows and the like being compressed for an extended period of time.

DISCLOSURE OF INVENTION

[0010] In the pump unit of the present invention, an apparatus for solving the above described problems is provided that includes: a liquid containing portion that is inserted into a container body; and a piston portion that is inserted into the liquid containing portion so as to be able to move inside the liquid containing portion, and that causes liquid to be discharged from the liquid containing portion to the outside of the container body by narrowing the volume of the interior of the liquid containing portion, and causes liquid from inside the container body to move to the liquid containing portion by increasing the volume of the liquid containing portion, wherein the piston portion has: a shaft case that is provided inside the liquid containing portion and has a female thread portion formed on an internal circumferential surface thereof; and a piston head portion that protrudes outside the liquid containing portion and has a discharge aperture formed thereon, and that has a male thread portion which screws into the female thread portion formed on an external circumferential surface thereof, and that is inserted into the shaft case so as to be able to move inside the shaft case, and wherein an unthreaded portion that allows the male thread portion of the piston head portion to rotate freely in the circumferential direction of the shaft case is formed on the shaft case.

[0011] According to this pump unit, because the male thread portion of the piston head portion is in a state of being screwed into the female thread portion of the shaft case, if the piston head portion is simply pressed without being rotated, then the piston head portion and the shaft case move integrally and the volume inside the liquid containing portion is narrowed. Accordingly, by performing a pressing operation on the piston head portion, it is possible to discharge liquid from the liquid containing portion to the outside of the container body via a discharge aperture.

[0012] In addition, by forming an unthreaded portion on the shaft case, the piston head portion can be rotated freely inside the shaft case. Accordingly, the piston head

portion can be rotated without moving the shaft case, namely, without changing the volume inside the liquid containing portion. As a result, it is possible to freely rotate the discharge aperture of the piston head portion in a separate operation from the operation to discharge the liquid inside the container body.

[0013] In this pump unit, it is preferable that an urging member (including urging members that are resilient bodies made from resin that are able to return from a direction in which they have extended) that is made from resin is provided on the shaft case and that, when the shaft case is moved in a direction that causes the volume of the liquid containing portion to be narrowed, the urging member urges the shaft case in a return direction.

[0014] If this type of structure is employed, then by stopping the pressing of the piston head portion after the volume of the interior of the liquid containing portion has been narrowed by pressing the piston head portion, the shaft case is restored by the urging member, which results in the piston head portion also being returned to its original position. Accordingly, if a further discharge of liquid is desired, by then once again pressing the piston head after it has returned, the discharge of liquid can be made.

[0015] If the male thread portion of the piston head portion is screwed into the female thread portion of the shaft case by rotating the piston head portion, then without moving the shaft case it is possible to store only the piston head portion inside the shaft case, for example. Accordingly, when, for example, this pump unit is incorporated inside the container body and is being transported, the piston head portion is contained inside the shaft case so that the overall size thereof is made more compact, and the unit can be packaged in that state. Furthermore, because the piston head portion only is moved without the shaft case being moved, during packaging or the like, any reduction in workability is prevented that is caused by failures such as the resin urging member losing its strength and becoming fatigued by receiving a compression force opposing its own urging force for an extended period of time.

[0016] Moreover, in order to solve the above described problems, the above described pump unit is provided in the container of the present invention.

[0017] According to this container, it is possible to freely rotate the discharge aperture of the piston head portion separately from the operation to discharge the liquid inside the container body. Furthermore, any deterioration in operability is prevented that is caused by the urging member being contracted for an extended period of time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a side cross-sectional view showing the schematic structure of the first embodiment of a container that is provided with the pump unit of the present invention.

FIG. 2A is a side cross-sectional view of a shaft case.

FIG. 2B is a side cross-sectional view of a shaft case.

FIG. 3 is a plan view of the principal portions as seen in cross section for describing the rotation locking mechanism of a shaft case relative to a chaplet.

FIG. 4A is a side cross-sectional view showing a closed state of a valve for describing a mechanism in which a piston ring forms a discharge valve.

FIG. 4B is a side cross-sectional view showing a closed state of a valve for describing a mechanism in which a piston ring forms a discharge valve.

FIG. 5 is a component drawing as seen in cross section of principal portions of a piston shaft and piston head.

FIG. 6 is an enlarged view of principal portions of the container shown in FIG. 1 for describing an engagement of a second engaging portion with a first engaging portion.

FIG. 7 is a side cross-sectional view showing a state in which leakage of liquid is prevented when the container shown in FIG. 1 is not in use such as during transportation.

FIG. 8 is a side cross-sectional view for describing a working state of the container shown in FIG. 1.

FIG. 9 is a side cross-sectional view showing the schematic structure of another embodiment of a container that is provided with the pump unit of the present invention.

FIG. 10 is an enlarged view of the principal portions of the container shown in FIG. 9, and is a view for describing a shut-off valve that blocks an air hole.

FIG. 11 is a side cross-sectional view showing a state in which leakage of liquid is prevented when the container shown in FIG. 9 is not in use such as when it is being transported.

FIG. 12 is a side cross-sectional view for describing a working state of the container shown in FIG. 9.

BEST MODE FOR CARRYING OUT THE INVENTION

[0019] The present invention together with the drawings will now be described in detail.

[0020] FIG. 1 shows a first embodiment of a container that is provided with the pump unit of the present invention. The symbol 10 in FIG. 1 is a pump unit, while the symbol 11 is a container. The container 11 is constructed by attaching the pump unit 10 to a container body 12 that contains a hair shampoo or the like in liquid form.

[0021] The container body 12 is a cylindrical member having a bottom that is formed from synthetic resin. An aperture portion 12a is formed at a top end portion thereof, and a male thread portion 13 is formed on an outer circumference of the aperture portion 12a. A screw cap 15 that is made from synthetic resin and is provided with

a female thread portion 14 that screws together with the male thread portion 13 is removably attached to the aperture portion 12a. The pump unit 10 is attached to the container body 12 by means of this screw cap "15. Namely, a hole (not shown) is formed in a center portion of the screw cap 15, and by inserting a pipe shaped case 16 that is formed from synthetic resin inside this hole, the pump unit 10 is attached to the container body 12 via the screw cap 15. Note that the case 16 functions as the liquid container portion of the present invention. A flange 16a is formed on an outer circumferential portion of the case 16, and this flange 16a is placed in contact with an internal surface (i.e., a bottom surface) of the screw cap 15. Packing 17 is provided on a bottom surface side of the flange 16a, and the internal surface (i. e., the bottom surface) side of the screw cap 15 is placed in pressure contact via the packing 17 with a top edge portion of the aperture portion 12a so that an airtight seal is formed.

[0022] A chaplet 18 is attached to a portion of the case 16 that protrudes above the screw cap 15. This chaplet 18 has an external cylindrical portion 18a that fits together with the outer circumferential portion of the case 16, an internal cylindrical portion 18b that is inserted inside the case 16, and an apex portion 18c that is formed at a portion directly above the internal cylindrical portion 18b. This chaplet 18 is attached to a top end portion of the case 16, and by nipping the screw cap 15 between the external cylindrical portion 18a and the flange 16a of the case 16, the case 16 is fixed to the screw cap 15.

[0023] The pump unit 10 is provided with a case 16, a bellows 19 that is formed from synthetic resin and is inserted into the case 16, a shaft case 20 that is connected to the bellows 19, a piston shaft 21, a piston head 22, and a suction pipe 23. Note that the shaft case 20, the piston shaft 21, and the piston head 22 constitute the piston portion of the present invention, while the piston shaft 21 and the piston head 22 constitute the piston head portion of the present invention.

[0024] The suction pipe 23 is inserted into the container body 12, and is positioned at a bottom end side of the bellows 19. A suction end 23a that is positioned at a bottom end of the suction pipe 23 is cut on a slant.

[0025] A top end side of the suction pipe 23 is inserted into a connecting pipe 16b that is formed on an external side of a bottom portion of the case 16. A suction valve 24 that only allows liquid to flow from the container body 12 towards the case 16 is provided inside the connecting pipe 16b. The suction valve 24 is formed by a valve chamber 25 that is formed integrally with the connecting pipe 16b, a spherical valve body 26 that is housed inside the valve chamber 25, and a lid member 27 that is positioned at a bottom portion of the case 16.

[0026] An aperture 25a that leads to the suction pipe 23 side is formed on a bottom portion of the valve chamber 25. Liquid inside the container body 12 flows into the valve chamber 25 through this aperture 25a via the suction pipe 23.

[0027] The valve body 26 is housed inside the valve chamber 25 from the top portion aperture side of the case 16. If an external circumferential surface of the valve body 26 is placed in tight contact with an internal circumferential surface of the valve chamber 25 on the aperture 25a side thereof, liquid can be prevented from flowing backwards. Note that the shape of the valve body 26 is not limited to a spherical shape and, provided that the valve body 26 is able to block of the aperture 25a in the valve chamber 25, it is possible to employ a variety of configurations for the valve body 26.

[0028] The lid member 27 is a disk shaped member that is formed having a larger diameter than that of the top portion aperture of the connecting pipe 16b, namely, than that of the aperture on the top portion side of the valve chamber 25. An aperture 27a is formed in the lid member 27 at a position covering the top portion aperture of the valve chamber 25 that allows liquid to pass through but does not allow the valve body 26 to pass through. Examples of the shape of the aperture 27a include a shape that is cut like a cross, however, naturally the shape is not limited to this and a variety of shapes can be employed. The lid member 27 is fixed to the bottom portion of the case 16 by a mechanical device such as a fitting, or by adhesion or fusion, however, it is preferable that the valve body 26 is prevented from accidentally coming out from the interior of the valve chamber 25.

[0029] The bellows 19 is fixed to the lid member 27. The bellows 19 is inserted together with the case 16 into the container body 12 and pumps liquid from inside the container body 12 to the outside of the container body 12. The bellows 19 is an example of the resilient body of the present invention. The bellows 19 is formed like an accordion that is able to be extended or compressed in the longitudinal direction thereof inside the case 16 (i.e., in a vertical direction), and is consequently able to return to its original position along the direction in which it has been extended. A bottom end portion of the bellows 19 is fixed to the lid member 27, as is described above, and is linked to the interior of the valve chamber 25 and the suction pipe 23 via the aperture portion 27a of the lid member 27. The bellows 19 is manufactured from low density polyethylene, and is provided with a predetermined spring constant. The bellows 19 is easily contracted by being pressed, which results in the volume of the interior thereof being reduced. In contrast, when this pressing force is released, the bellows 19 is easily restored to its original state, namely, to its original position in the direction in which has extended. This causes the volume of the interior thereof to increase. Namely, when the volume inside the case 16 is narrowed by the piston portion, the volume inside the bellows 19 is also narrowed. Conversely, when the volume inside the case 16 is increased, the volume inside the bellows 19 is also increased.

[0030] A cylindrical press insertion portion 19a is formed on a top end side of the bellows 19. The press

insertion portion 19a is inserted from below into a piston base 29 that is made from synthetic resin in the shape of a cylinder having a lid. A first connecting hole 30 that connects the interior of the bellows 19 with the interior of the case 16 is provided in the piston base 29. The first connecting hole 30 enables liquid that has been pumped into the bellows 19 from the container body 12, as is described below, to be temporarily discharged to the outside of the bellows 19. Note that the shape and size of the first connecting hole 30 are not particularly restricted and may be optionally set insofar as they do not obstruct the flow of liquid. The number of first connecting holes 30 is also optional.

[0031] The piston base 29 is formed having a smaller diameter than the internal diameter of the case 16. A concave portion (not shown) that fits together with the press insertion portion 19a is formed on a bottom surface side of the piston base 29. A toroidal groove (not shown) that fits together with a bottom end of the shaft case 20 is formed in a top portion side of an outer circumferential portion of the piston base 29.

[0032] The shaft case 20 is formed from synthetic resin in the shape of a pipe. A bottom portion aperture in the shaft case 20 is sealed when a bottom end portion of the shaft case 20 is fitted to the piston base 29. The shaft case 20 is fixed to the chaplet 18 by inserting a top end portion of the shaft case 20 into the internal cylinder 18b of the chaplet 18. As is shown in FIG. 2A and FIG. 2B, a female thread portion 20a is formed on an inner circumferential surface of the shaft case 20. In addition, an unthreaded portion 20b is formed at a top end portion of the inner circumferential surface of the shaft case 20, namely, above the position where the female thread portion 20a is formed. The female thread portion 20a meshes with the male thread portion 21a of the piston shaft 21 (described below). The unthreaded portion 20b is formed in a groove shape that runs in the circumferential direction around the inner circumferential surface of the shaft case 20, and rotatably supports the piston shaft 21 in the circumferential direction thereof without interfering with the male thread portion 21 a of the piston shaft 21.

[0033] FIG 2A shows a case in which the shaft case 20 is formed integrally. FIG. 2B shows a case in which the top end portion side where the unthreaded portion 20b is formed and the bottom portion side where the female thread portion 20a is formed are formed separately, and these are mechanically bonded by being forcibly fitted together or the like, or by adhesion or fusion so as to form a single body. In these drawings, a second connecting hole 34 (described below) is omitted.

[0034] A first engaging portion 20c that extends slightly inwards is formed on a top end of the shaft case 20 running in a circumferential direction of the shaft case 20. As is described below, the first engaging portion 20c is formed so as to extend inwards slightly beyond the apex portion 18c of the chaplet 18.

[0035] As is shown in FIG. 1, a protruding bar 31 is formed on an outer circumferential portion of the shaft case 20 extending in the longitudinal direction of the shaft case 20.

As is shown in FIG. 3, the protruding bar 31 fits into a groove 32 that is formed in the internal cylinder 18b of the chaplet 18. When the piston head 22 is rotated, as is described below, the protruding bar 31 functions as a rotation brake to stop the shaft case 20 rotating in conjunction with the piston head 22. Here, the protruding bar 31 is able to move in the longitudinal direction of the groove 32 and, accordingly, the rising and lowering of the shaft case 20 that accompanies a pressing operation of the piston head 22 (described below) is not obstructed by the fitting of the protruding bar 31 in the groove 32. Note that, in FIG. 3, a single protruding bar 31 is formed in the shaft case 20, and a single groove 32 is also formed in the internal cylinder 18b of the chaplet 18 to correspond to this. However, this number is not particularly restricted, and two or more protruding bars and grooves may be provided.

[0036] A protruding portion 33 is formed substantially in a center portion of an outer circumferential portion of the shaft case 20 running in the circumferential direction thereof. This protruding portion 33 may be formed intermittently or continuously along its entire length provided that it is formed away from the protruding bar 31 so as not to interfere with the protruding bar 31.

[0037] A second connecting hole 34 that connects the interior of the case 16 to the interior of the shaft case 20 is provided at a bottom end portion of the shaft case 20. This second connecting hole 34 enables liquid that has been discharged to the outside from the bellows 19 and has been stored in the case 16, as is described below, to be supplied to the interior of the shaft case 20. In the same way as for the first connecting hole 30, the shape and size of the second connecting hole 34 are not particularly restricted and may be optionally set insofar as they do not obstruct the flow of liquid.
The number thereof is also optional.

[0038] A toroidal piston ring 35 is mounted on an outer circumferential portion of a bottom end portion of the shaft case 20. The piston ring 35 is placed between the protruding portion 33 and a circumferential edge portion 29a of the piston base 29, and is formed by joining together an inner ring 35a that is positioned on the shaft case 20 side and an outer ring 35b is positioned on the case 16 side in a central portion in the vertical direction thereof. A top portion of the inner ring 35a is in contact with the shaft case 20 such that it is able to slide easily, while a bottom portion of the inner ring 35a is formed having a smaller thickness compared to the top portion thereof so as not to cover the second connecting hole 34. The outer ring 35b is tightly attached to the inner circumferential surface of the case 16 such that a sufficient degree of fluid-tightness is secured, while the outer ring 35b is still able to slide. In particular, top and bottom end portions of the outer ring 35b form lip portions (not shown) so that the aforementioned fluid-tightness and

slidability are excellent.

[0039] Here, in the normal state shown in FIG. 1 and FIG. 4A (i.e., in a state in which the piston head 22 is not being pressed), the space between the protruding portion 33 and a circumferential edge portion 29a of the piston base 29 is sufficiently wider than the height of the inner ring 35a of the piston ring 35. Moreover, in this state, the piston ring 35 is in press contact with the circumferential edge portion 29a of the piston base 29.

As a result, the second connecting hole 34 is blocked by the inner ring 35a of the piston ring 35 so as to be fluid-tight. By blocking the second connecting hole 34 using the piston ring 35 and the piston base 29 so that the second connecting hole 34 is made fluid-tight, or alternatively by opening up the second connecting hole 34, as is described below, the piston ring 35 and the piston base 29 function as a discharge valve for discharging liquid.

[0040] Note that, as is shown in FIG. 1, an air hole 36 is formed in the case 16 higher than the highest position to which the piston ring 35 is able to be raised. This air hole 36 connects the interior of the container body 12 to the outside via the space between the case 16 and the internal cylindrical portion 18b of the chaplet 18 and via the space between the case 16 and the external cylindrical portion 18a of the chaplet 18. The air hole 36 prevents what is known as "collapse" that is caused by a change in the liquid volume inside the container body 12.

[0041] The top portion side of the case 16 that provides the area of movement of the piston ring 35 has a larger diameter than the bottom portion side thereof where the bellows 19 are housed.

[0042] The piston shaft 21 is a circular cylinder shaped member made from synthetic resin that is continuous with the shaft case 20 and is inserted from above so as to be able to move in the shaft case 20. As is shown in FIG. 5, a male thread portion 21 a is formed on a bottom end portion of the piston shaft 21.

[0043] The male thread portion 21a screws together with the female thread portion 20a that is formed on the shaft case 20, and is able to be rotated in the circumferential direction thereof by means of an unthreaded portion 20b. Namely, as a result of the male thread portion 21a of the piston shaft 21 being screwed into the female thread portion 20a, the piston shaft 21 is able to move relatively to the shaft case 20. If, however, the male thread portion 21a is not screwed into the female thread portion 20a so that the piston shaft 21 is able to rotate at the unthreaded portion 20b, the piston shaft 21 is able to rotate freely without causing the shaft case 20 to move.

[0044] A second engaging portion 21b is formed on the piston shaft 21 slightly above the male thread portion 21a. This second engaging portion 21b protrudes outwards from the outer circumferential surface of the piston shaft 21, and is formed by a protruding bar that runs in the circumferential direction of the piston shaft 21. The second engaging portion 21b is constructed so as to removably engage with the first engaging portion 20c of the shaft case 20. Namely, as is shown in FIG. 6, in a working state in which the piston head 21 is lifted up to its highest position, and the male thread portion 21a is placed inside the unthreaded portion 20b of the shaft case 20, by then lifting the second engaging portion 21b onto the first engaging portion 20c so that the second engaging portion 21b is positioned above the first engaging portion 20c, the second engaging portion 21b is engaged with the first engaging portion 20c. In addition, at this time, because the male thread portion 21a of the piston head 21 is positioned below the first engaging portion 20c, the result is that the first engaging portion 20c is sandwiched between the second engaging portion 21b and the male thread portion 21a.

In this structure, in a working state when the piston head 21 has been lifted up relative to the shaft case 20, a fluid-tight state is secured between the top portion aperture of the shaft case 20 and the piston shaft 21.

[0045] Note that, as is described above, because the edge on the inner side of the apex portion 18c of the chaplet 18 is formed slightly retracted from the edge of the first engaging portion 20c, it does not interfere with the second engaging portion 21b.

[0046] As is shown in FIG. 1, a narrow-diameter connecting pipe 21c is formed at a top end portion of the piston shaft 21, and the piston head 22 is connected to the connecting pipe 21c.

[0047] The piston head 22 is integrally connected to the connecting pipe 21c, and is formed by a head body 22a and a discharge pipe 22b that is connected to the piston shaft 21. The head body 22a is able to be removably fitted onto the external cylinder portion 18a of the chaplet 18. The discharge pipe 22b is connected to the piston shaft 21, and liquid inside the container body 12 is discharged from a discharge aperture 22c that is formed by a distal end aperture of the connecting pipe 22b.

[0048] Next, a method of using the container 11 that is provided with the pump unit 10 having the above described structure will be described.

[0049] When the container 11 is not in use such as when it is being transported or stored, the piston head 22 is first pushed down slightly from the state shown in FIG. 1 so that the bottom end of the male thread portion 21a of the piston shaft 21 is moved from the unthreaded portion 20b to the female thread portion 20a side. In this state, the piston shaft 21 is rotated. As a result, due to the meshing of the male thread portion 21a with the female thread portion 20a, the piston shaft 21 moves to the bellows 19 side inside the shaft case 20 so that the second engaging portion 21b of the piston shaft 21 is lifted over the first engaging portion 20c and drops down. By then moving (i.e., dropping) it further, as is shown in FIG. 7, the piston shaft 21 is contained inside the shaft case 20.

In addition, the piston head 22 fits into the external cyl-

inder portion 18a of the chaplet 18 so that this portion is covered.

[0050] As a result, because the piston shaft 21 and the piston head 22 are contracted, packaging and the like of the container 11 is easy. Moreover, in this state, because the piston head 22 is not able to be further pressed down, it is not possible for the liquid inside to be forcibly discharged.

[0051] In addition, because the piston shaft 21 is contained inside the shaft case 20 without the shaft case 20 being pressed down, the bellows 19 are not compressed but are maintained in an expanded state. Accordingly, no failures such as fatigue and the like are generated in the bellows 19 by the bellows 19 being compressed for an extended period of time.

[0052] Moreover, in this state, because the second connecting hole 34 is blocked by the piston ring 35, the interior of the case 16 and the bellows 19 side and shaft case 20 side are not connected. Accordingly, even if the container 11 falls over, the liquid inside the container body 12 and bellows 19 is unable to pass through the shaft case 20 and be discharged from the discharge pipe 22b.

[0053] Furthermore, because the piston shaft 21 is not exposed to the outside, there is no soiling of the piston shaft 21.

[0054] Next, in order to transform the container 11 from the state shown in FIG. 7 into a working state, the piston head 22 is rotated so that the male thread portion 21a of the piston shaft 21 is made to lift up along the female thread portion 20a of the shaft case 20. As a result, the second engaging portion 21b of the piston shaft 21 passes the unthreaded portion 20b, is lifted over the first engaging portion 20c of the shaft case 20, and moves to the top portion side thereof where it is engaged.

[0055] As a result, the piston shaft 21 and the shaft case 20 are integrated, and the container 11 is placed in the working state shown in FIG. 1. At this time, by sandwiching the first engaging portion 20c of the shaft case 20 between the second engaging portion 21b and the male thread portion 21a of the piston head 21, as is described above, the piston head 21 and the shaft case are integrated, and a fluid-tight state between these two is further secured.

[0056] Moreover, because the male thread portion 21a of the piston shaft 21 is still positioned within the unthreaded portion 20b, if the piston head 22 is simply rotated without being pressed, then the piston shaft 21 (i.e., the piston head 22) can be freely rotated without interfering with the shaft case 20.

[0057] In this state, as is shown in FIG. 8, if the piston head 22 is pressed down, then the male thread portion 21a of the piston shaft 21 is placed in a state of engagement with the female thread portion 20a of the shaft case 20. Accordingly, the piston shaft 21 and the shaft case 20 move integrally, so that when the shaft case 20 is lowered, the bellows 19 is compressed.

[0058] If the piston head 22 is pressed in this manner, then as is shown in FIG. 4B, the shaft case 20 and the piston base 29 are lowered, and shifts downwards relative to the piston ring 35 that is in tight contact with the internal surface of the case 16. As a result, the bottom end portion of the internal ring 35a of the piston ring 35 and the circumferential edge portion 29a of the piston base 29 are separated so that the second connecting hole 34 is opened, and the interior of the case 16 and the interior of the shaft case 20 are open to each other. Note that, because the protruding portion 33 is formed on the shaft case 20, if, after the second connecting hole 34 has been opened, the pressing of the piston head 22 is continued further, then the internal ring 35a of the piston ring 35 is pushed down integrally with the shaft case 20 by the protruding portion 33.

[0059] If the shaft case 20 is pressed down in this manner, the air inside the bellows 19 is compressed and the suction valve 24 is shut. As a result, the air inside the bellows 19 passes through the first connecting hole 30 and enters the case 16. It then further passes through the second connecting hole 34 and enters the shaft case 20. It then passes through the hole in the piston shaft 21 and the discharge pipe 22b and is discharged to the outside.

[0060] Next, if the pressing of the piston head 22 is released, the bellows 19 are restored in the extension direction and are returned to the state shown in FIG. 1. As a result, the interior of the bellows 19 changes to a negative pressure. In addition, at this time, the piston base 29 moves upwards to accompany the return of the bellows 19 in the extension direction. As a result of this, the piston ring 35 is also pushed upwards by the piston base 29. Consequently, the circumferential edge portion 29a of the piston base 29 is once again placed in tight contact with the internal ring 35a of the piston ring 35, and the second connecting hole 34 is once again blocked.

[0061] At this time, the rise of the internal ring 35a of the piston ring 35 is restricted by the bottom end of the internal cylindrical portion 18b of the chaplet 18 so that this rise is not more than is necessary. As a result, a sufficiently tight contact is secured between the circumferential edge portion 29a of the piston base 29 and the internal ring 35a.

[0062] When the piston ring 35 and the piston base 29 are lifted up in this manner and the second connecting hole 24 is blocked, the volume of a liquid holding portion 16c that is formed by the space inside the case 16 that is also outside the bellows 19 is also increased. Consequently, this space also changes to a negative pressure in the same way as the interior of the bellows 19.

[0063] When the interiors of the liquid holding portion 16c and the bellows 19 change to a negative pressure in this manner, the valve body 26 of the suction valve 24 is lifted up so that the suction valve 24 is opened. This results in the liquid being suctioned from the con-

tainer body 12 through the suction pipe 23 and into the bellows 19 so that the interior of the bellows 19 is filled with the liquid.

[0064] Next, if this pressing operation is repeated, the suction valve 24 is closed. As a result, any flow of the liquid inside the bellows 19 back into the container body 12 is obstructed, so that the liquid in the bellows 19 is discharged into the liquid holding portion 16c. In addition, new liquid from the interior of the container body 12 flows into the bellows 19.

[0065] Subsequently, as is shown in FIG. 8, when the piston head 22 is again pressed, the suction valve 24 is shut, and any flow of the liquid inside the liquid holding portion 16c and the bellows 19 back towards the container body 12 is obstructed. The liquid inside the liquid holding portion 16c and the bellows 19 whose flow back towards the container body 12 has been obstructed is discharged to the outside via the hole in the piston shaft 21, the discharge pipe 22b, and the discharge aperture 22c. At this time, simultaneously with the pushing out of the liquid inside the bellows 19 by a single pressing operation of the piston head 22, the volume of the liquid holding portion 16c inside the case 16 is narrowed by the piston base 29 and the piston ring 35, so that liquid inside this liquid holding portion 16c is also pushed out. As a result, a greater volume of liquid can be discharged than is the case conventionally. Namely, compared with when the discharge is achieved using only the compression force of the bellows 19, a greater quantity of liquid can be discharged equivalent to the amount that the volume of the liquid holding portion 16c has been narrowed.

[0066] Next, when the pressing on the piston head 22 is released, as is described above, at the same time as the bellows 19 returns to its original position and the interior of the bellows 19 is changed to a negative pressure, the liquid holding portion 16c also changes to a negative pressure. This results in liquid being suctioned from the container body 12 into the bellows 19 and from the interior of the bellows 19 into the liquid holding portion 16c. The interiors of the liquid holding portion 16c and the bellows 19 each become filled with liquid. At this time, because the piston base 29 is in tight contact with the internal ring 35a of the piston ring 35, the second connecting hole 34 is closed and back flow of liquid from the piston head 22 side to the container body 12 interior side is obstructed.

[0067] Note that in the above operation, because the interior of the container 12 is connected via the air hole 36 to the outside of the container 11, when the liquid is discharged from the container body 12, air flows in from the outside corresponding to the volume of liquid that has been discharged. As a result, the generation of "collapse" in the container body 12 is prevented, and the shape of the container body 12 is constantly maintained in substantially its original shape.

[0068] In this type of pump unit 10 and container 11 that uses the pump unit 10, by forming the unthreaded portion 20b on the shaft case 20, the piston shaft 21 can be rotated freely inside the shaft case 20. Accordingly, it is possible to rotate the piston head 22 without moving the shaft case 20, namely, without contracting the bellows 19. As a result, because it is possible to freely rotate the direction of the discharge aperture 22c of the piston head 22 separately from the operation to discharge the liquid inside the container body 12, the user friendliness of the container 11 (i.e., of the pump unit 10) is improved.

[0069] Moreover, because it is possible to move only the piston head 22 and the piston shaft 21 without moving (i.e., depressing) the shaft case 20, the resin bellows 19 are maintained in an expanded state and are not compressed even during packaging and the like.

[0070] In addition, because the first connecting hole 30 is provided in the press insertion portion 19a in the top portion of the bellows 19, and because the second connecting hole 34 is provided in the shaft case 20, the bellows 19 and the shaft case 20 are connected together via the liquid holding portion 16c inside the case 16 by the first connecting hole 30 and the second connecting hole 34. Accordingly, liquid that has been suctioned into the bellows 19 is held not only inside the bellows 19 but also in the liquid holding portion 16c. As a result, if the piston head 22 is pressed after the liquid has been accumulated in the bellows 19 and the liquid holding portion 16c, it is possible to discharge the liquid from inside the bellows 19 by compressing the bellows 19, and at the same time, it is possible to discharge the liquid from the liquid holding portion 16c by narrowing the volume of the liquid holding portion 16c. Accordingly, compared with when the discharge is achieved using only the compression force of the bellows 19, a greater quantity of liquid can be discharged equivalent to the amount that the volume of the liquid holding portion 16c has been narrowed.

[0071] Moreover, by engaging the second engaging portion 21b of the piston shaft 21 with the first engaging portion 20c of the shaft case 20, it is possible to ensure that the space between the piston shaft 21 and the shaft case 20 is fluid-tight. As a result, even if the container 11 is inadvertently knocked over during use, liquid inside the container body 12 is prevented from leaking out from the gap between the piston shaft 21 and the shaft case 20.

[0072] Note that, in the present embodiment, when the shaft case 20 is moved in a direction in which it narrows the volume inside the case (i.e., a liquid containing portion) 16, the resin bellows 19 is used as a member that urges the shaft case 20 in a direction that restores the volume inside the case 16. However, in the present embodiment, because liquid is accumulated not only inside the bellows 19, but also in the liquid holding portion 16c of the case 16, instead of the bellows 19, it is also possible to use, for example, a resin coil spring (i.e., an urging member) and cause liquid from the suction pipe 23 to flow directly into the liquid holding portion 16c. In

addition, it is also possible to use another optional structure, namely, a structure that is cylindrical and has returning force (i.e., urging force) equivalent to a spring as the resilient body instead of the bellows 19.

[0073] FIG. 9 shows another embodiment of a container provided with the pump unit of the present invention. The symbol 40 in FIG. 1 is a pump unit, while the symbol 41 is a container. Note that, in the pump unit 40 and container 41 shown in FIG. 9, the same symbols are given to component elements that are the same in the pump unit 10 and container 11 shown in FIG. 1, and a description thereof is omitted.

[0074] In the pump unit 10 shown in FIG. 1, once liquid has been supplied from inside the bellows 19 to the liquid holding portion 16c of the case 16, it is then supplied to the interior of the shaft case 20. This pump unit 40 and container 41 differ principally from the pump unit 10 and container 11 shown in FIG. 1 in that, in the pump unit 40 shown in FIG. 9, liquid from inside the bellows 42 is supplied directly to a shaft case 43.

[0075] Namely, in this pump unit 40 and container 41, a valve rod 44 is placed above the lining pipe 16b inside the case 16. This valve rod 44 is a rod shaped member that extends upwards from a bottom portion side (i.e., the connecting pipe 16b side) of the case 16. A through hole for liquid 44a that is connected to the connecting pipe 16b is formed inside the valve rod 44. A valve portion 44b that expands outwards is formed on a top end portion of the valve rod 44. A lidded, cylindrical fixing portion 44c that fixes the valve rod 44 to an inner surface of the case 16 is also formed at a bottom portion side of the valve rod 44, and a bottom end portion of the bellows 42 is fixed to the fixing portion 44c. The hole (i.e., the liquid through hole 44a) that is formed in the fixing portion 44c has a smaller diameter than that of the spherical valve body 26 of the suction valve 24 so that the valve body 26 is prevented from being removed from the top of the valve chamber 25.

[0076] The bellows 42 is manufactured from low density polyethylene in an accordion shape that is able to be extended or contracted in the longitudinal direction thereof inside the case 16 (i.e., in a vertical direction), and is consequently able to return to its original position along the direction in which it has extended. By inserting the valve rod 44 inside the bellows 42, the bellows 42 is connected to the suction pipe 23 via the liquid through hole 44a in the valve rode 44 and the connecting pipe 16b. The bellows 42 is easily contracted by being pressed, which results in the volume of the interior thereof being reduced. In contrast, when this pressing force is released, the bellows 42 is easily restored to its original state, namely, to its original position in the direction in which has extended. This causes the volume of the interior thereof to increase. The bellows 42 also has a predetermined spring constant.

[0077] A cylindrical press insertion portion 42a is formed at a top end side of the bellows 42, and a partition 42b is formed inside the press insertion portion 42a. A hole (not shown) is formed in a center portion of the partition 42b. This hole is formed such that it can be removably engaged with the valve portion 44b of the valve rod 44, and the aperture of this hole is blocked so as to be fluid-tight when the hole is engaged with the valve portion 44b. By employing this type of structure, the valve portion 44b and the partition 42b function as a valve. In addition, the press insertion portion 42a is inserted into the bottom end side of the shaft case 43 so as to be fluid-tight.

[0078] In the same way as the shaft case 20 shown in FIG. 1, the shaft case 43 is provided with a female thread portion 20a, an unthreaded portion 20b, and a first engaging portion 20c (not shown). The shaft case 43 differs from the shaft case 20 in that a large diameter portion 45 is formed on a bottom end portion of an outer circumferential portion of the shaft case 43, and in that a concave portion 46 (see FIG. 10) is formed at a position corresponding to the air hole 16d that is formed in the case 16, and a shut-off valve 47 is mounted inside this concave portion 46.

[0079] The diameter of the large diameter portion 45 is larger than that of other locations on the shaft case 43 by an amount that corresponds to the thickness of the internal cylindrical portion 18b of the chaplet 18. As a result, the large diameter portion 45 is substantially in contact with an internal surface of the case 16. By employing this type of structure, rattling of the shaft case 43 inside the case 16 is prevented.

[0080] The shut-off valve 47 is formed from polyethylene or another elastomer, and, as is shown in FIG. 10, is constructed by integrally connecting an engaging portion 47a, which is mounted inside the concave portion 46, with a valve body 47b, which is positioned on the case 16 side and opens and shuts the air hole 16d, in central portions in the height direction of each. The valve body 47b is formed so as to be tightly attached to the inner circumferential surface of the case 16 such that fluid-tightness is secured, while the valve body 47b is still able to slide along the case 16. In particular, top and bottom portions of the valve body 47b are formed as lip portions (not shown) so that excellent fluid-tightness and slidability are secured.

[0081] As is shown in FIG. 9, when the shaft case 43 has risen to its highest position inside the case 16, the shut-off valve 47 blocks the air hole 16d. When the shaft case 43 is lowered inside the case 16 by the operation of the piston head 22, the air hole 16d is opened.

[0082] In the same way as the example shown in FIG. 1, a piston head portion that is formed by the piston shaft 21 and the piston head 22 is provided with a male thread portion 21a and a second engaging portion 21b. This piston head portion differs from the example shown in FIG. 1 in that a discharge valve 48 that only allows the discharge of liquid from the piston shaft 21 side to the piston head 22 side is provided inside the connecting pipe 21c.

[0083] The discharge valve 48 has the same structure

as the above described suction valve 24. The discharge valve 48 is provided with a valve chamber 49 that is formed integrally with the connecting pipe 21c, and has a spherical valve body 50.

[0084] Next, a method of using a container 11 that is provided with a pump unit 10 having the above structure will be described.

[0085] When the container 11 is not in use such as when it is being transported or stored, as is shown in FIG. 11, the piston head 22 is first rotated so that the piston shaft 21 is contained inside the shaft case 43. In addition, the piston head 22 fits into the external cylinder portion 18a of the chaplet 18 so that this portion is covered. As a result, because the piston shaft 21 and the piston head 22 are contracted, packaging and the like of the container 11 is easy. Moreover, in this state, because the piston head 22 is not able to be further pressed down, it is not possible for the liquid inside to be forcibly discharged.

[0086] In addition, because the piston shaft 21 is contained inside the shaft case 43 without the shaft case 43 being pressed down, the bellows 42 are not compressed but are maintained in an expanded state. Accordingly, no failures such as fatigue and the like are generated in the bellows 42 by the bellows 42 being compressed for an extended period of time.

[0087] In addition, because the valve portion 44b of the valve rod 44 fits into the hole (not shown) in the partition 42b of the press insertion portion 42a of the bellows 42 so that the aperture of the hole is blocked so as to be fluid-tight, even if the container 41 falls over, the liquid inside the container body 12 is unable to be discharged from the discharge aperture 22c via the bellows 42.

[0088] Because the shaft case 43 is at its highest position inside the case 16 without being pressed down, the shut-off valve 4 blocks the air hole 16d. As a result, even if the container 41 is inadvertently knocked over, liquid inside the container body 12 is prevented from leaking outside through the gap between the chaplet 18 and the shaft case 43 via the air hole 16d.

[0089] Next, in order to put the container 41, which is in the state shown in FIG. 11, in a working state, the same operation is performed as for the container 11 shown in FIG. 1.

[0090] As a result, in the same way as for the container 11, the piston shaft 21 and the shaft case 43 are integrated, and the container 41 is placed in the working state shown in FIG. 9. At this time, by sandwiching the first engaging portion 20c of the shaft case 20 between the second engaging portion 21b and the male thread portion 21a of the piston head 21, the piston head 21 and the shaft case 43 are integrated, and a fluid-tight state between these two is further secured.

[0091] Moreover, because the male thread portion 21a of the piston shaft 21 is positioned within the unthreaded portion 20b, if the piston head 22 is simply rotated without being pressed, then the piston shaft 21 (i.e., the piston head 22) can be freely rotated without interfering with the shaft case 43.

[0092] In this state, as is shown in FIG. 12, if the piston head 22 is pressed down, then the shaft case 43 and the piston shaft 21 with which it is integrated are lowered, so that the bellows 42 is contracted. If the piston head 22 is pressed down, then the shut-off valve 47 is also lowered in conjunction with the lowering of the shaft case 43 and the air hole 16d is opened up by the shifting of the shut-off valve 47 from a position where it blocks the air hole 16d.

[0093] When the shaft case 43 is pressed down and the bellows 42 is compressed, the partition 42b of the press insertion portion 42a of the bellows 42 is lowered below the valve portion 44b of the valve rod 44, and the engagement between the valve portion 44b and the hole (not shown) in the partition 42b is released, so that the hole in the partition 42b is opened.

[0094] Moreover, although the air inside the bellows 42 is compressed as a result of the bellows 42 being compressed, because the suction valve 24 is shut, the air inside the bellows 42 flows into the shaft case 43, and is discharged to the outside through the hole in the piston shaft 21, the discharge valve 48, and the discharge pipe 22b.

[0095] Next, when the pressing of the piston head 22 is released, the bellows 42 are restored in the extension direction and are returned to the state shown in FIG. 9. As a result, the interior of the bellows 42 changes to a negative pressure. In addition, at this time, the shaft case 43 also moves upwards in conjunction with the return of the bellows 42 in the extension direction. As a result of this, the shut-off valve 47 once again blocks the air hole 16d.

[0096] When the interior of the bellows 42 changes to a negative pressure, the valve body 26 of the suction valve 24 is lifted up so that the suction valve 24 is opened. As a result, liquid is suctioned from the container body 12 through the suction pipe 23 and into the bellows 42, so that the interior of the bellows 42 is filled with liquid.

[0097] Next, as is shown in FIG. 12, if this pressing operation is repeated, the suction valve 24 is closed. As a result, any flow of the liquid inside the bellows 42 back into the container body 12 is obstructed, so that the liquid in the bellows 42 flows into the shaft case 43, and is further discharged to the outside through the hole in the piston shaft 21, the discharge valve 48, and the discharge pipe 22b.

[0098] Next, when the pressing on the piston head 22 is released, as is described above, the bellows 42 is restored and the interior of the bellows 42 changes to a negative pressure. Liquid is suctioned from the container body 12 into the bellows 42, and the interior of the bellows 42 is filled with liquid. In addition, the shaft case 43 is also lifted up in conjunction with the restoral of the bellows 42, and the shut-off valve 47 once again blocks the air hole 16d.

[0099] Note that, in the above described operation, because the interior of the container body 12 is connected with the outside of the container 41 by the air hole 16d and by the space between the chaplet 18 and the shaft case 43, when liquid is discharged from the interior of the container body 12, air corresponding to the volume of discharged liquid flows in from the outside. As a result, the generation of "collapse" in the container body 12 is prevented, and the shape of the container body 12 is constantly maintained in substantially its original shape.

[0100] In this type of pump unit 40 and container 41 that uses the pump unit 40, by forming the unthreaded portion 20b on the shaft case 40, the piston shaft 21 can be rotated freely inside the shaft case 43. Accordingly, because it is possible to freely rotate the direction of the discharge aperture 22c of the piston head 22 separately from the operation to discharge the liquid inside the container body 12, the user friendliness of the container 41 (i.e., of the pump unit 40) is improved.

[0101] Moreover, because it is possible to move only the piston head 22 and the piston shaft 21 without moving (i.e., depressing) the shaft case 43, the resin bellows 42 are maintained in an expanded state and are not compressed even during packaging and the like. Accordingly, no failures such as fatigue and the like are generated in the bellows 42 by the bellows 42 being compressed for an extended period of time. As a result, it is possible to reliably prevent any deterioration in the workability of the pump unit 40 that is caused by the bellows 42 being compressed for an extended period of time.

[0102] Because the shut-off valve 47 is provided at a position on the shaft case 43 that corresponds to the air hole 16d formed in the case 16, during use, the air hole 16d is opened by the operation of the piston portion, resulting in the pressure inside the container body 12 being maintained at substantially atmospheric pressure. In addition, when not in use, the air hole 16d is shut by the shut-off valve 47 so that leakages of liquid from the air hole 16d are prevented.

[0103] Because the shaft case 43 does not rotate around the case 16 in the circumferential direction of the case 16, irrespective of the fact that the bellows 42 are formed in a spiral configuration, the shaft case 43 is not rotated by the torque of the bellows 42. As a result, the shut-off valve 47 that is provided on the shaft case 43 is kept at a position corresponding to the air hole 16d. Moreover, it is possible to prevent torque from the spiral-shaped bellows 42 being transmitted to the piston head 22 so that malfunctions such as deteriorations in the operability thereof are prevented.

[0104] Note that the present invention is not limited to the above described examples, and various modifications are possible insofar as they do not depart from the purpose of the present invention. For example, as is described above, it is also possible to use another optional structure, namely, a structure that is cylindrical and has returning force (i.e., urging force) equivalent to a spring as the resilient body instead of using the bellows 19.

INDUSTRIAL APPLICABILITY

[0105] As has been described above, in the pump unit of the present intention and the container provided with this pump unit, because an unthreaded portion is formed on the shaft case, it is possible for the piston head portion to be freely rotated inside the shaft case. As a result, it is possible to freely rotate the discharge aperture of the piston head portion separately from any operation to discharge liquid from inside the container body, so that the user-friendliness of the pump unit is improved.

[0106] Furthermore, by rotating the piston head portion so that the male thread portion of the piston head portion is screwed into the female thread portion of the shaft case, without moving the shaft case it is possible to store only the piston head portion inside the shaft case, for example. As a result, during packaging or the like, any reduction in workability is prevented that is caused by failures such as the resin urging member losing its strength and becoming fatigued by receiving a compression force opposing its own urging force for an extended period of time.

Claims

1. A pump unit that is inserted into a container body and pumps liquid from inside the container body to the outside of the container body, comprising:

a liquid containing portion that is inserted into the container body; and

a piston portion that is inserted into the liquid containing portion so as to be able to move inside the liquid containing portion, and that causes liquid to be discharged from the liquid containing portion to the outside of the container body by narrowing the volume of the interior of the liquid containing portion, and causes liquid from inside the container body to move to the liquid containing portion by increasing the volume of the liquid containing portion, wherein the piston portion has: a shaft case that is provided inside the liquid containing portion and has a female thread portion formed on an internal circumferential surface; and a piston head portion that protrudes outside the liquid containing portion and has a discharge aperture formed thereon, and that has a male thread portion which screws into the female thread portion formed on an external circumferential surface, and that is inserted into the shaft case so as to be able to move inside the shaft case, and wherein

an unthreaded portion that allows the male

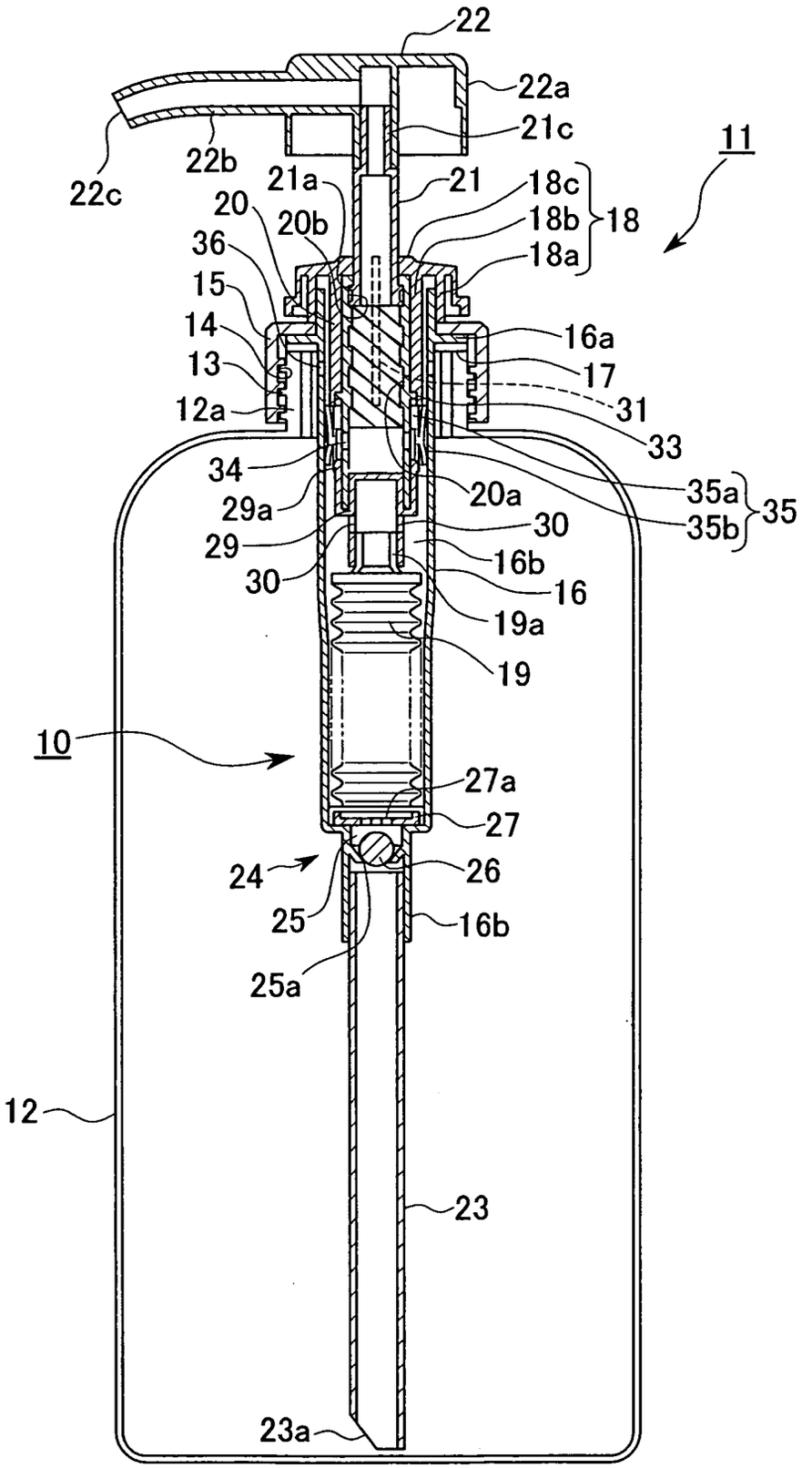
thread portion of the piston head portion to rotate freely in the circumferential direction of the shaft case is formed on the shaft case.

2. The pump unit according to claim 1, wherein an urging member that is made from resin is provided on the shaft case and, when the shaft case is moved in a direction that causes the volume of the liquid containing portion to be narrowed, the urging member urges the shaft case in a return direction.

3. The pump unit according to claim 2, wherein the urging member is a resilient body made from resin that is able to return from a direction in which it has extended.

4. A container that is provided with the pump unit according to any one of claims 1 to 3.

FIG. 1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26
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16b
25a
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23
23a

FIG. 2A

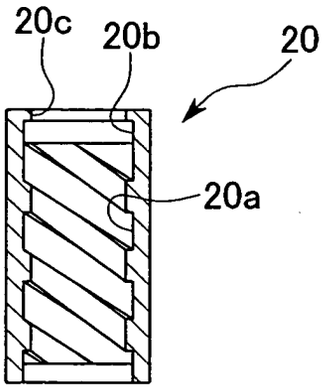


FIG. 2B

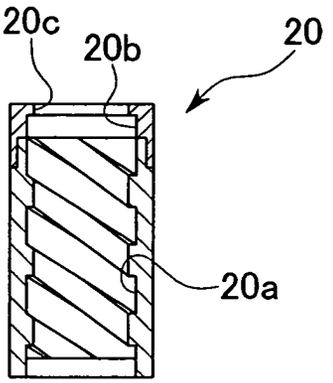


FIG. 3

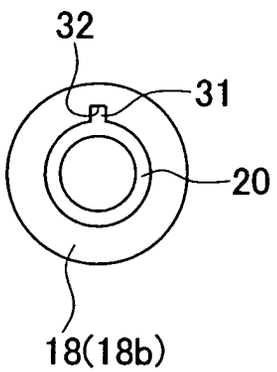
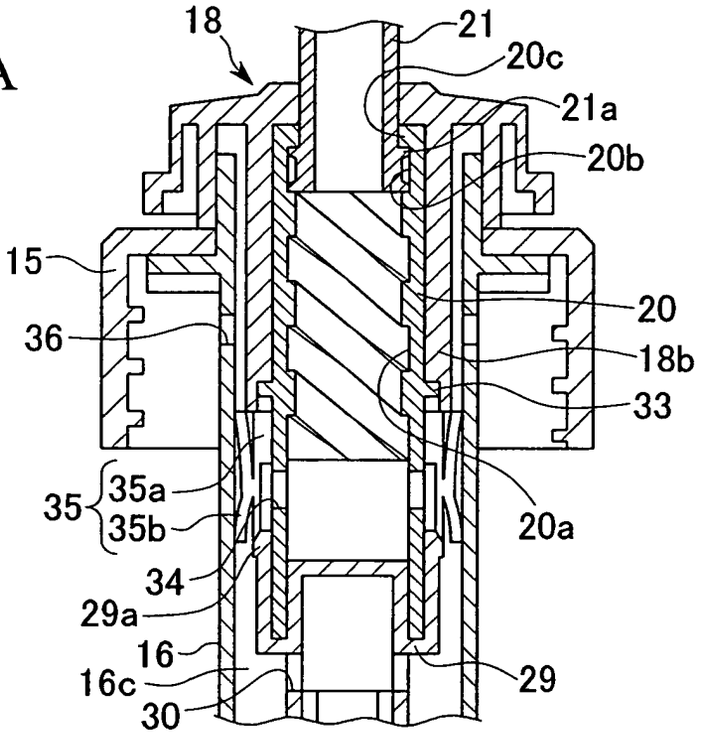


FIG. 4A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21
20c
21a
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20a
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29a
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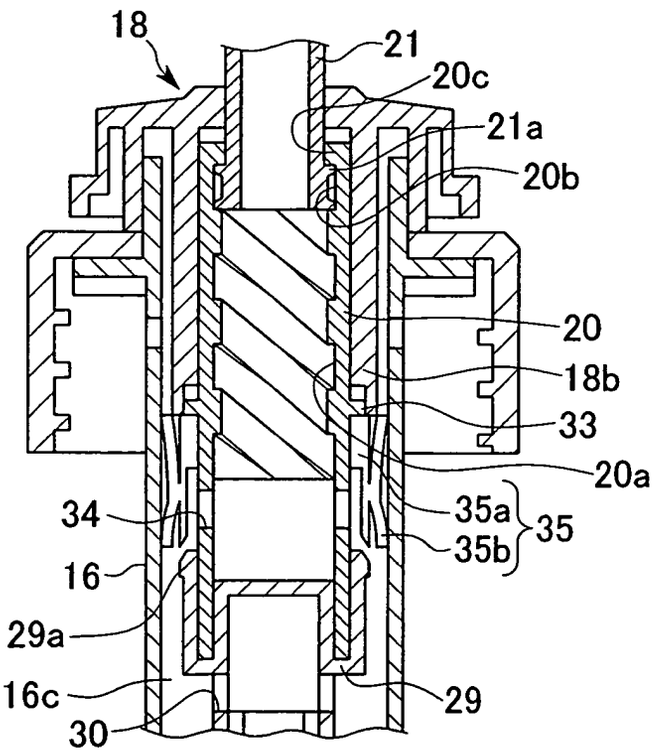
16c
29
30

FIG. 4B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21
20c
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FIG. 5

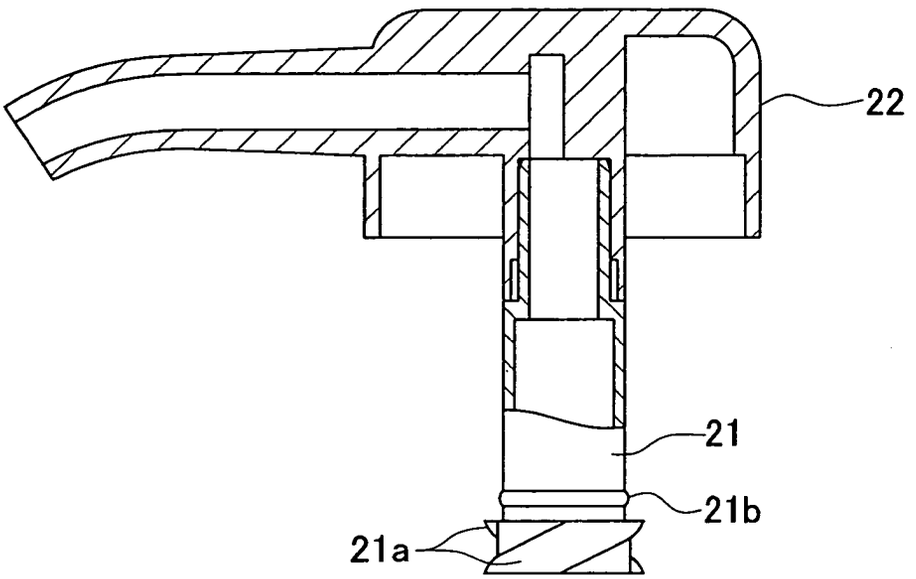


FIG. 6

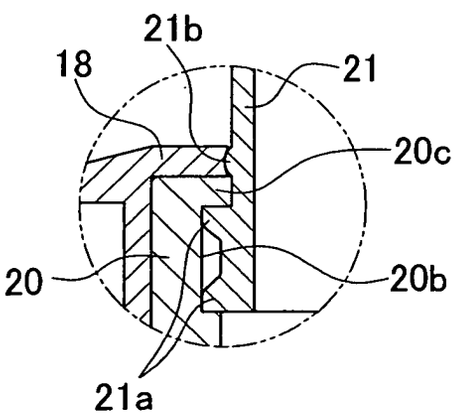


FIG. 7

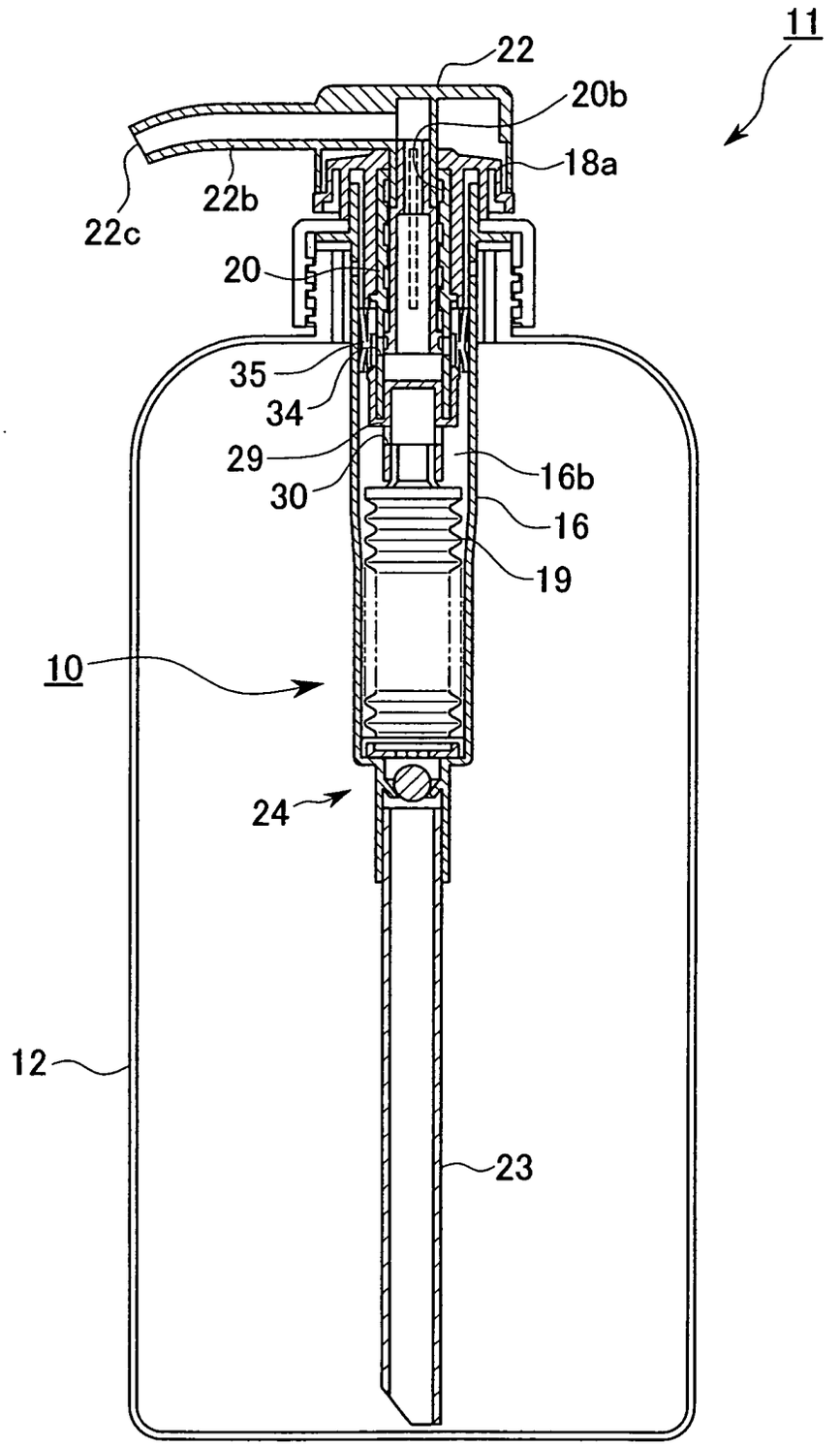


FIG. 8

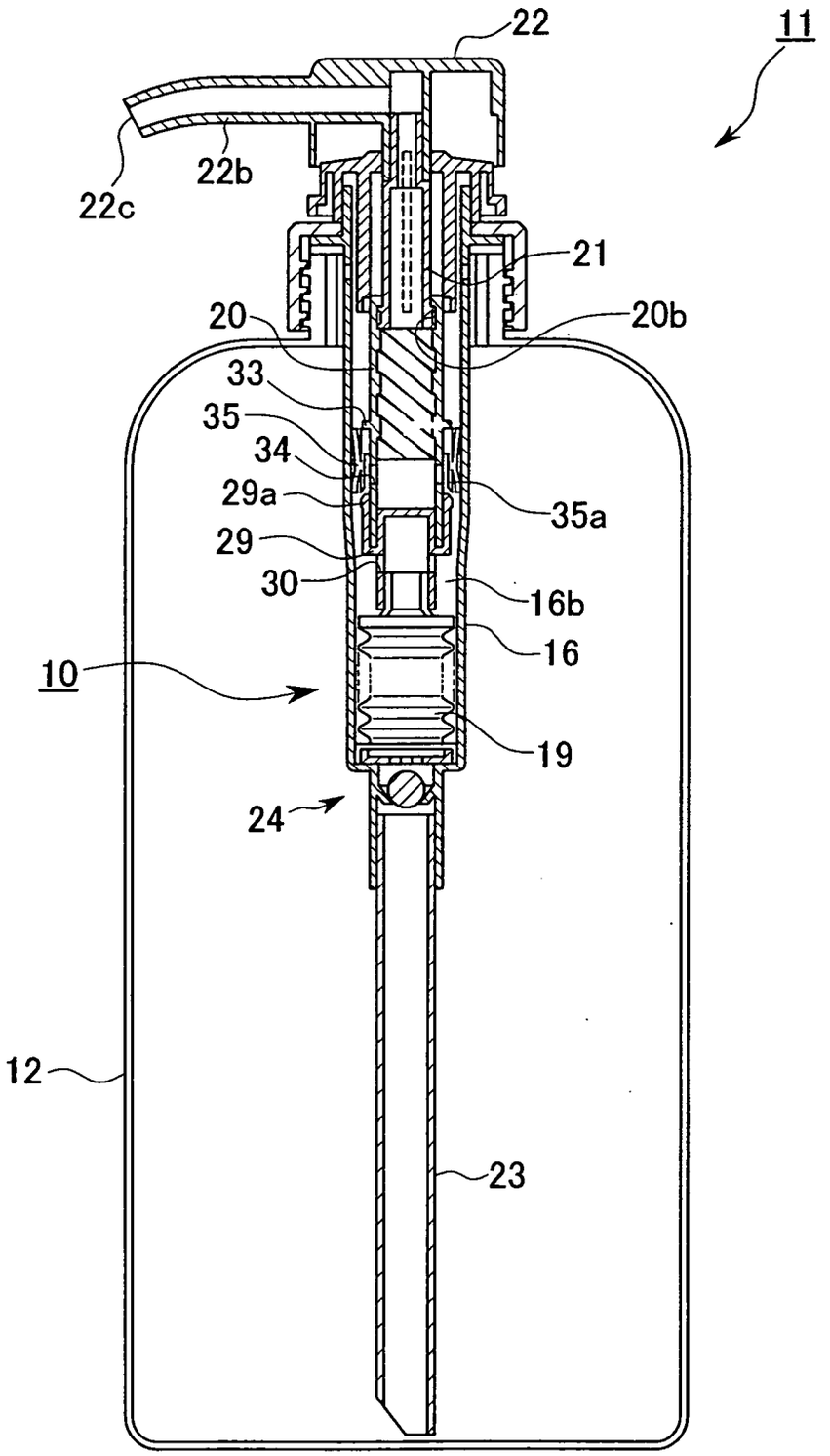
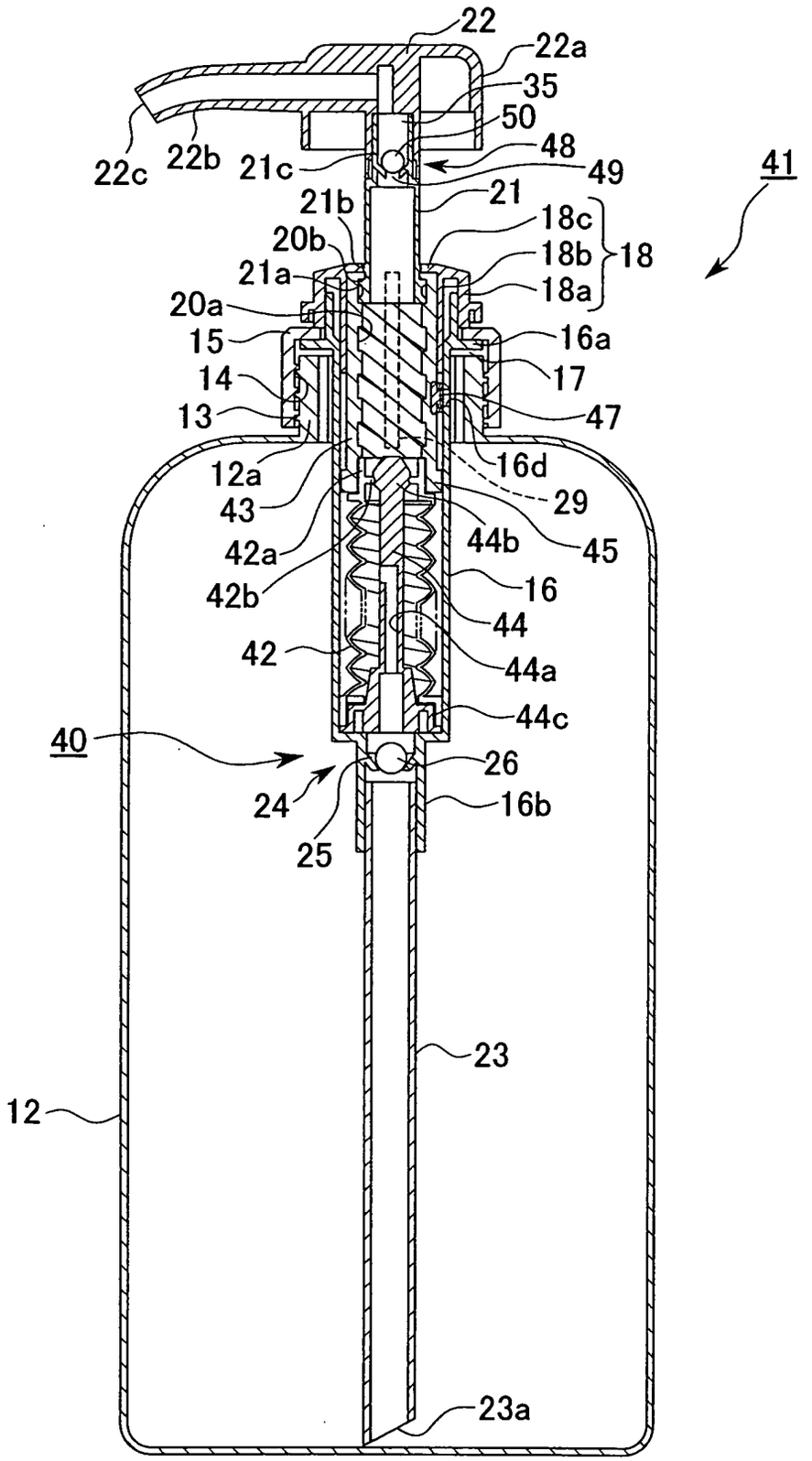


FIG. 9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22b
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21b
18c
20b
18b
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20a
16a
15
17
14
47
13
16d
12a
29
43
44b
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42a
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42b
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42
44a
44c
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16b
25
23
12
23a

FIG. 10

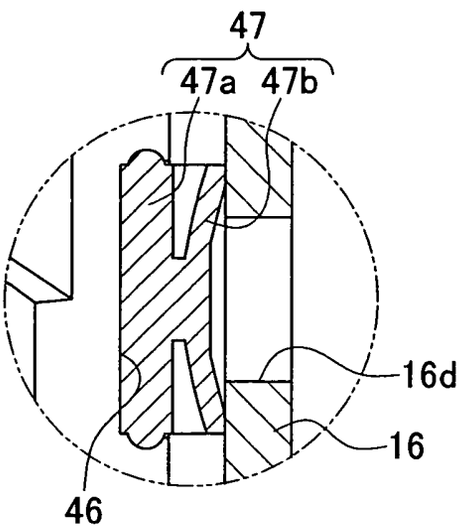
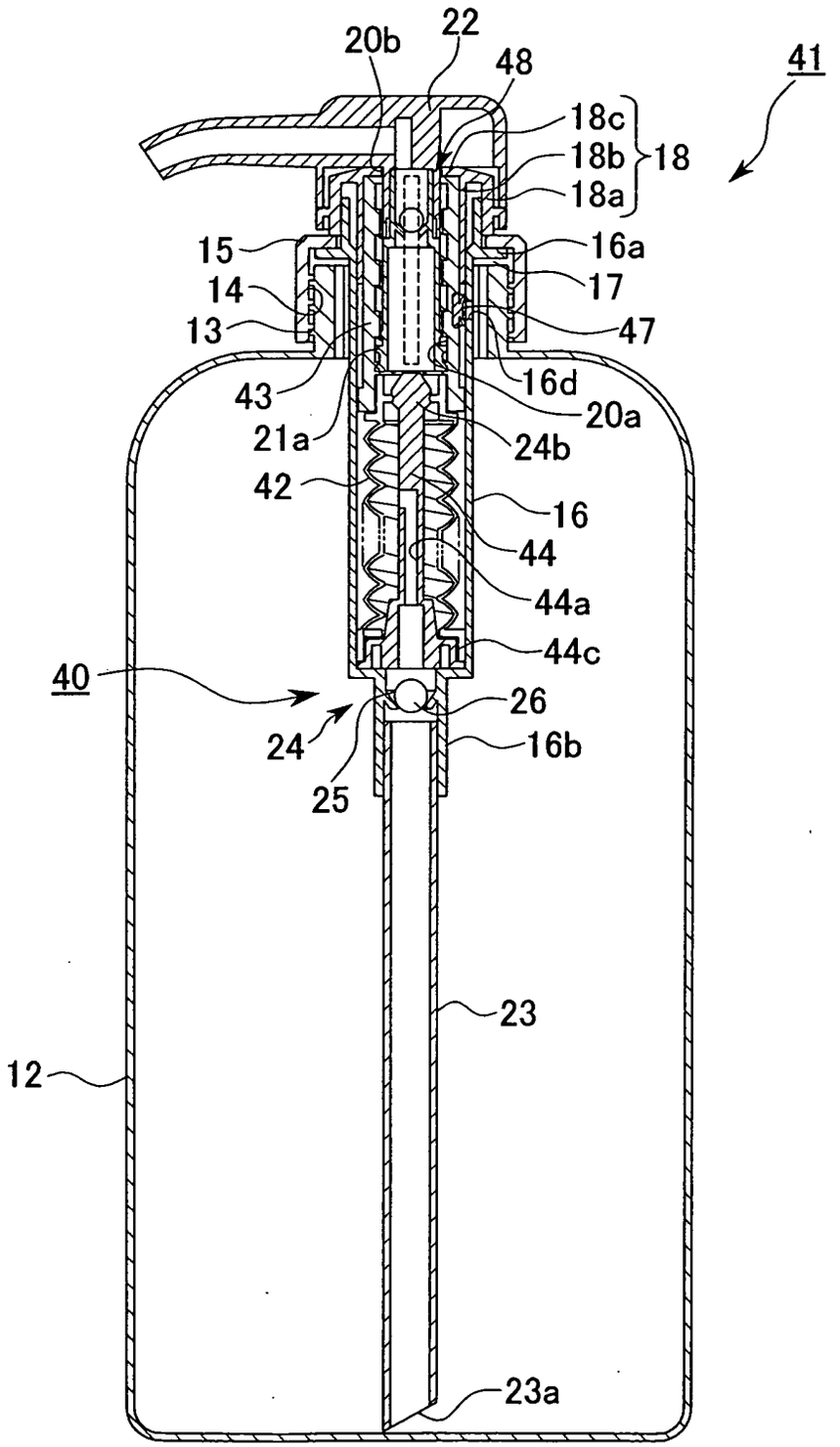


FIG. 11


20b
22
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41
18c
18b
18
18a
15
16a
14
17
13
47
43
16d
20a
21a
24b
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16
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44a
44c
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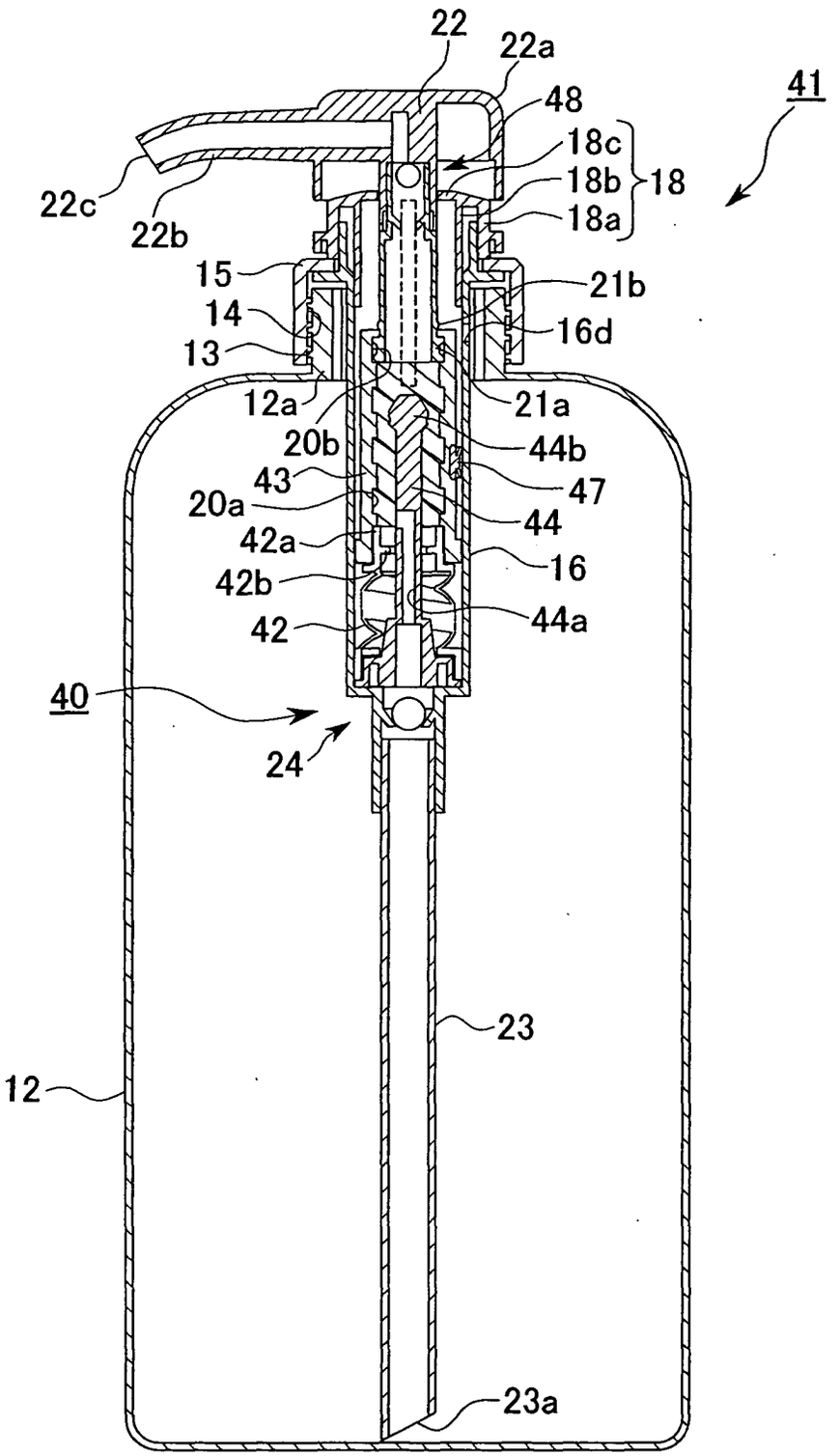
26
24
16b
25
23
12
23a

FIG. 12


22
22a
48
41
18c
18b
18
18a
22c
22b
15
21b
14
16d
13
12a
21a
20b
44b
43
47
20a
44
42a
16
42b
44a
42
40
24
23
12
23a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/14205

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B05B11/00, B65D47/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B05B11/00, B65D47/34, B65D83/00, F04D9/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2004
Kokai Jitsuyo Shinan Koho	1971-2004	Toroku Jitsuyo Shinan Koho	1994-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 33936/1984(Laid-open No. 145282/1985) (Yoshino Kogyosho Co., Ltd.), 26 September, 1985 (26.09.85), Full text; Figs. 1 to 2 (Family: none)	1-4
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 77040/1991(Laid-open No. 19177/1993) (Yoshino Kogyosho Co., Ltd.), 09 March, 1993 (09.03.93), Full text; Figs. 1 to 6 (Family: none)	1-4

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 February, 2004 (09.02.04)	24 February, 2004 (24.02.04)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/14205

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model application no. 67184/1992(laid-open no. 24762/1994) (Mitani Valve Co., Ltd.), 05 April, 1994 (05.04.94), Full text; Figs. 1 to 5 (Family: none)	1-4
A	JP 10-101115 A (Yoshino Kogyosho Co., Ltd.), 21 April, 1998 (21.04.98), Full text; Figs. 1 to 8 (Family: none)	1-4

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