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DESCRIPTION

CONTAINER WITH DISCHARGE FLOW VELOCITY MECHANISM

Technical Field

The present invention relates to a container with an instillation discharge flow velocity mechanism that easily allows, when contents (liquid) are discharged from the container body, the container body to be pressurized, for example, squeezed by hand so that liquid can be discharged in the form of instillation.

The present invention also relates to a fixed quantity measurement flow velocity control container that has a discharge flow velocity control mechanism and that has a fixed quantity measurement container for measuring a fixed quantity.

Prior Art

Recently, PET bottles mainly used as a drinkable water container have been widely used on the market in various shapes. Plastic bottles mainly used for cleaner containers have a larger variety of container shapes than in the case of PET bottles. Specifically, pouched containers have been widely used as for-repacking containers in view of reduction in waste and reuse of resources.

However, regarding conventional containers, more

attention has been paid to container body but little attention to the outlet. Specifically, such little attention has caused accidents in which the contents spurt out from the container, for example, when a user attempted to tilt a PET bottle having a large capacity, the user failed to control the discharged amount to cause the contents in the container to overflow; or when a user attempted to repackage the contents in a for-repacking pouched container into a plastic bottle, the user improperly grabbed the pouched container to cause the contents to burst out of the outlet or the container body was bent to cause the outlet to deviate from the intended direction, thus causing the contents to splatter onto the surroundings despite the user's intention.

Thus, there has been a need for improving the structure of the outlet so that the liquid in the container is prevented from being improperly discharged from the container. To provide such an improved structure, the present applicant suggested in Japanese Published Unexamined Patent Application No. H10-338278 a technique for controlling the flow velocity of liquid in the outlet.

On the other hand, there is another kind of container (especially eye drop containers) that requires the contents in the liquid container to be discharged in a manner of instillation. Such a liquid requiring an instillation-like discharge includes, in addition to eye drops, various products such as beauty products

and food additives.

A conventional instillation discharge container is designed, as represented by the instillation discharge container for eye drops, to simply allow the container outlet to have a reduced diameter so that the surface tension of the liquid stops the liquid at the outlet. In this design, the contents are forced out of the container when the container body is squeezed by fingers or the like to increase the inner pressure. A conventional container for beauty products or food additives also has a similar design as that for eye drops in which the outlet has a reduced diameter of an outlet. Such a conventional container for beauty products or food additives frequently had a design in which the contents of the container are discharged by shaking the container body rather than squeezing the container body.

However, as anyone has experienced, a force for discharging one drop of the contents out of a container body for eye drops proves difficult to adjust, causing a situation where two drops are discharged even when only one drop is required. In this manner, a conventional container body for eye drops required a user to adjust the discharging force slightly. This prevented the container body from having a wide selection of materials, for example, a hardness or rigidity of the container. This has caused a condition in which only a plastic or glass-made container having appropriate hardness and rigidity can be used because it is very difficult for a soft container body, for example,

a laminated tube to discharge therefrom the contents in a manner of instillation. Accordingly, it was inevitable that only a plastic or glass container with an appropriate hardness and rigidity was used.

In view of the above-described, the container with an instillation discharge flow velocity mechanism according to the present invention solves the above-described conventional problems. This container with an instillation discharge flow velocity mechanism allows the contents therein to be very easily discharged in the manner of instillation. This container with an instillation discharge flow velocity mechanism also provides fewer limitations on the container body and has an outlet that can be applied to various soft containers and that easily provides instillation-like discharge.

Conventionally, pump-type resin-made bottles have been used as a liquid container for cleaners or the like. This bottle is one in which the resin-made bottle container body has at the upper opening section a hand-push-type pump that is squeezed by hand if required to allow the contents to be discharged.

The pump is a so-called plunger pump having a structure in which, when the hand-push section is squeezed, the contents retained in the pump are forced out of the outlet and, when the hand is discharged from the hand-push section, then a return spring forces back the hand-push section and the contents in the container body are suctioned by the outlet. The pump normally

has therein a check ball that functions as a check valve for preventing the contents once suctioned into the pump from flowing back into the container body. The pump body also has at the lower end a narrow tube for suctioning the contents from the bottom section of the container body. This container is very popular and is frequently used for liquids having a relatively high viscosity, for example, cleaners, and shampoos.

However, since this pump requires the use of different materials because the return spring is made of metal, this type of pump is unrealistic in view of cost or the like, although the pump can be technically constructed with a single material. With society increasing demands for environmental protection, such a pump is unrealistic also because the problem of waste must be considered.

This type of pump has therein a check valve for preventing the contents from flowing back. This caused a problem in which the contents in a tube running from the pump to the discharge outlet were retained and dried, causing the dried contents to burst out of the discharge outlet.

Thus, the liquid container of the present invention solves the above-described conventional problems. This liquid container can be constructed with a single material and can have a simple structure. In spite of the simple structure, this liquid container controls the flow velocity to prevent discharge due to carelessness and allows the contents in the discharge tube

to be suctioned in the container body, thus preventing the contents from being retained and dried in the tube.

Furthermore, there have conventionally been various liquids required to be measured such as drugs, beauty products, coating materials, and cleaners. In most cases, a drug is measured by pouring the drug out of a bottle into a measuring cup. There have also been liquid containers for storing liquid used in larger amounts than in the case of ones for drugs, for example, ones for cleaners that have a bottle cap functioning as a measurement cup or that are constructed to have a pump-type synthetic resin-made bottle. In such a container having a bottle cap functioning as a measurement cup, the measurement cup is detached from the container body when used and a user is allowed to measure the required amount freely. However, such a container is not suitable when an accurate amount needs to be measured. In the container having a synthetic resin-made bottle container body, the container body has at the upper opening section a hand-push-type pump that is squeezed by hand if required to discharge the contents. In most cases, this type of container allows the contents to be discharged by a one-hand-push operation in a fixed amount.

However, such a container having a measurement cup is not suitable for accurate measurement because the container requires a user to pour the contents from the container body while reading the scale provided on the measurement cup. Such a container

also had a problem in which an inappropriate pouring operation causes the contents to overflow or a loosely-tightened cap causes the contents to be leaked from the container when the container falls.

Similarly, since the pump-type bottle requires the use of different materials because the return spring is made of metal, the pump-type bottle is unrealistic in view of cost or the like, although the pump can be technically constructed with a single material.

This type of pump has therein a check valve for preventing the contents from flowing back. This caused a problem in which the contents in a tube running from the pump to the discharge outlet are retained and dried, causing the dried contents to burst out of the discharge outlet at the next discharge.

Thus, the fixed quantity measurement flow velocity control container of the present invention solves the above-described conventional problems. This container can be constructed with a single material and can have a simple structure. In spite of the simple structure, this container controls the flow velocity to prevent discharge due to carelessness and allows the contents in the discharge tube to be suctioned in the container body, thus preventing the contents from being retained and dried in the tube. This liquid container also provides an accurate measurement of a fixed quantity of liquid.

Disclosure of the Invention

In other words, the container having a discharge flow velocity control mechanism of the present invention has the characteristics as described below.

(1) A liquid container comprises a discharge route for discharging the contents; this discharge route has a flow velocity control passage having an opening area that allows the surface tension of the contents to block the contents under atmospheric pressure; and when the contents are discharged, then the contents having passed through this flow velocity control passage once has a flow velocity of zero in the passage direction and then fills the main passage of the discharge route provided at the outlet of this flow velocity control passage to be subsequently discharged from the outlet.

(2) The flow velocity control passage is provided in the direction parallel with the main passage of the above-described discharge route.

(3) The flow velocity control passage is provided in the direction orthogonal to the main passage of the above-described discharge route.

(4) The flow velocity control passage is a hole.

(5) The flow velocity control passage is a clearance.

(6) When there are two or more flow velocity control passages with an even number, each pair of flow velocity control passages are provided at opposite positions or are arranged in

a radial pattern.

(7) A means for changing the opening area is provided so that the opening area of the flow velocity control passage can be increased or decreased in a stepwise or stepless manner.

(8) The influx inlet of the contents of the flow velocity control passage is opened to the container body and the contents directly flow from the container body into the flow velocity control passage.

(9) The influx inlet of the contents of the flow velocity control passage has a guide route for guiding the contents from the container body; this guide route has at the outlet side the flux inlet; and the contents flow via this guide route into the flow velocity control passage.

The container with the discharge flow velocity mechanism of the present invention has the characteristics as provided below.

(10) A liquid container comprises a discharge route for discharging the contents; this discharge route has a flow velocity control passage having an opening area that allows the surface tension of the contents to block the contents under atmospheric pressure; when the contents are discharged, then the contents having passed through this flow velocity control passage once have a flow velocity of zero in the passage direction and then fill the main passage of the discharge route provided at the outlet side of this flow velocity control passage to be

subsequently discharged from the outlet; and when the discharge step is completed, then the contents in the discharge route are suctioned into the container body to prevent the contents under a normal condition from being retained in the discharge route.

(11) The flow velocity control passage and the container body have therebetween a cover member for separating this flow velocity control passage in the container body; this cover member has at the inner side a space having a desired capacity; this space is communicated with the container body only by a narrow tube; fluid pressure in the container has no direct influence on the flow velocity control passage; and resistance in this narrow tube causes the inner pressure of the container body to be attenuated to prevent the inner pressure from reaching the flow velocity control passage.

The fixed quantity measurement flow velocity control container of the present invention also has the characteristics as provided below.

(12) A liquid container, comprising an outlet for discharging contents; the discharge route further comprising a flow velocity control passage having an opening area of such a degree that it is sealed by the contents themselves by the surface tension of the contents under atmospheric pressure, wherein, when the contents are discharged, the flow velocity of the contents passing through the flow velocity control passage in the direction of the passage once becomes zero, and the contents

are discharged from an outlet after filling the main passage of the discharge route provided on the outlet side of the flow velocity control passage; when the discharge step is completed, then the contents in the discharge route are suctioned into the container body to prevent the contents under a normal condition from being retained in the discharge route; and a measurement container having therein the above-described main passage is provided.

(13) After the contents are discharged from the outlet into the measurement container, the restitutive force of the container causes a negative pressure in the container to allow excessive contents equal to or larger than a fixed quantity to be measured to be collected in the container body so that the fixed quantity to be measured remains in the measurement container for measurement.

(14) The fixed quantity to be measured is determined by the height from the bottom surface of the measurement container of the outlet provided in the measurement container in a protruded manner; and this measurement container can be moved in the upward and downward directions so that the height of the outlet from the bottom surface of the measurement container can be arbitrarily adjusted.

The flow velocity control passage and the container body have therebetween a cover member for separating this flow velocity control passage in the container body; this cover member

has at the inner side a space having a desired capacity; this space is communicated with the container body only by a narrow tube; fluid pressure in the container has no direct influence on the flow velocity control passage; and resistance in this narrow tube causes the inner pressure of the container body to be attenuated to prevent the inner pressure from reaching the flow velocity control passage.

Best Mode for Carrying Out the Invention

Hereinafter, embodiments of the present invention will be described in detail.

(Embodiment 1)

Fig. 1 is a perspective view illustrating a container with an instillation discharge flow velocity mechanism having an instillation discharge liquid outlet. The container body 1 has at the upper part the discharge tube 3 having the outlet 2 and the retaining cap 4 for fixing this discharge tube 3 to the container body 1. The retaining cap 4 has at the upper end a cap 5 for preventing the contents from being improperly discharged when the container is not being used and for protecting the outlet 2. This cap 5 is designed to fit the stepped portion 6 provided at the outer circumference of the upper end of the above-described retaining cap 4. The cap 5 and the stepped portion 6 are both designed to have some convex form and concave form so that they are retained together when applied with an

appropriate squeezing force.

Fig. 2 is an enlarged cross sectional view of the main section in the vicinity of the outlet. The bottle-like container body 1 has at the upper part the opening 7 and the discharge tube 3. The discharge tube 3 is fixed such that the flange 8 is provided on the upper end surface of the opening section 7 of the container body 1 and is screwed by the retaining cap 4 to the container body 1. This container body 1 is made of relatively soft and easily-flexible material, for example, synthetic resin. More specifically, the container body 1 is preferably made of synthetic resin material, for example, polypropylene, a laminated tube, and a composite film.

The discharge tube 3 is made of a hard synthetic resin and has a shape having the flange 8 as shown in Fig. 3 to fit the opening section 7 of the container body 1. The discharge tube 3 is a tube-like member that has at the center the discharge passage (hereinafter referred to as a main passage) 9. As shown in Fig. 3, the lower part of this main passage 9 does not penetrate the discharge tube 3 and the lower end is blocked by the bottom section 10. The bottom section 10 has in the vicinity thereof a cross section having micro sectional holes (hereinafter referred to as micropassage) 12 as a flow velocity control passage that is provided at the side wall 11 in the direction orthogonal to the above-described main passage 9. This micro passage 12 has a diameter that is closed by surface tension or a capillary

phenomenon of the stored liquid. When the stored liquid includes air bubbles, then the micro passage 12 has a so-called vapor lock condition in which the liquid under atmospheric pressure does not easily pass through the micro passage 12. The diameter of the micro passage 12 is desirably determined depending on the surface tension or viscosity of the liquid and preferably is 0.3mm to 1.5mm when the liquid is a water-like fluid having a low viscosity.

This micro passage 12 in Fig. 3 has a length that is the same as the thickness of the discharge tube 3. The micro passage 12 is not limited to any particular shape and has a cross section that may be freely selected to be circular, triangular, square or other shapes. The micro passage 12 preferably has a sufficient length that allows the contents at the outlet of this passage to flow out in a stabilized manner (in a rectified manner). Specifically, the micro passage 12 having an excessively short length causes the contents to be diffused at the outlet, thus preventing the contents from colliding with one another in an intended manner.

The reason will be described below.

As shown in Fig. 4, the micro passages 12 are provided so as to oppose each other with an intention of allowing the contents (liquid) discharged from the micro passage 12 into the main passage 9 to collide with one another almost at the center of the main passage 9 as shown in Fig. 5 so that the discharge

flow velocity is 0 (zero). This prevents the contents having a flow velocity when the contents pass through the micro passage 12 from being discharged from the outlet 2.

Furthermore, the more the diameter of the micro passage 12 is reduced, the greater the restriction on the amount of the contents passing through the micro passage 12. However, this requires more time to allow the main passage 9 to be filled with the contents and also reduces the sensitivity of the container body 1 to an external pressure (finger squeezing force). Specifically, this allows adjustment of the number of drips of the contents dripped from the outlet 2 to be dependent on the length of time during which the container body 1 is squeezed by fingers rather than the force for squeezing the container body 1, thus providing drip control in a very easy manner. The drip speed depends on the flow velocity of the contents when the contents pass through the micro passage, depending on the level of external pressure (force for squeezing the container body 1). However, the drip control can put emphasis either on the time during which the container body 1 is squeezed or the force for squeezing the container body 1 by changing the effective area of the opening (hole diameter) of the micro passage 12. The size of the opening area of the micro passage 12 can be appropriately balanced by the flexibility of the container body 1, thus providing fine adjustment to the characteristics of the contents stored in the container and the drip conditions.

When the container with an instillation discharge flow velocity mechanism of Embodiment 1 thus constructed is used, the container body 1 is reversed and applied with pressure by squeezing the container with fingers as shown in Fig. 6. Then, the container body 1 deforms as shown by the broken line in Fig. 6 to allow the inner pressure of the container to increase. Then, contents (liquid) flow from the container body 1 into the micro passage 12 as shown in Fig. 7. Then, the contents are squeezed as shown in Fig. 5 from the micro passage 12 to the center of the main passage 9 and are discharged with the same speed and collide with one another, thus once having a speed of 0 (zero). Thereafter, the surface tension allows, without causing the contents to burst out of the outlet 2, the contents to slide along the inner wall of the main passage 9 and then to be gradually filled in the main passage 9 as shown by the broken line in Fig. 7, after which the contents overflow and are dripped from the outlet 2.

In this manner, the contents in front of the outlet 2 are allowed to have a discharge velocity (flow velocity) of 0 (zero). This prevents the contents from being discharged from the outlet 2 with a flow velocity when the contents pass through the micro passage 12. This allows the contents to flow out of the container in a very slow manner to prevent, even when the container body 1 is improperly applied with an external pressure, the contents from bursting out of the outlet 2, thus providing fine adjustment

of the drip amount in a very easy manner. Specifically, the timing at which one drop is dripped can be easily anticipated, the number of drips can be easily counted, and the contents can be discharged continuously.

After the contents are discharged, when the external pressure applied to the container body 1 is removed, restitutive force of the container body 1 allows the forced air to be suctioned into the container body 1 and allows the contents in the discharge route to be returned into the container body 1. This prevents the contents from being left in the main passage 9, provides the outlet 2 with a very good ability to stop the liquid, and prevents excessive drip.

Furthermore, the main passage 9 has no retained contents, thus preventing the contents from flowing out of the outlet 2 unless the main passage 9 is filled with the contents, even when the container body 1 is improperly applied with an external pressure. The micro passage 12 has the diameter which is closed by surface tension or capillary phenomenon or has a so-called vapor lock condition when having therein air bubbles in which the liquid under atmospheric pressure does not easily pass through the micro passage 12, as above-described. The micro passage 12 also has no retained contents by the suctioning power when the container recovers.

The diameter of the outlet 2 may be one that allows the contents under atmospheric pressure to remain by the capillary

phenomenon and that prevents the contents from dripping. For example, the diameter of the outlet 2 for a water-like liquid having a low viscosity is preferably 1.5mm to 3mm but may be appropriately changed depending on the characteristics of the contents or the application of the container. There is, of course, no need to use the same inner diameter for the outlet 2 and the main passage 9 and the main passage 9 may have a reduced or increased inner diameter.

Although the number of the micro passage 12 may be one, it then requires a means for reducing the flow velocity when there is a spurting out of the liquid from the micro passage 12 to zero by allowing the liquid to collide with the wall surface, for example. However, it is desirable in an actual case to provide a plurality of micro passages 12 so as to oppose one another, as shown in Fig. 8 and each drawing. This intends to provide, when there is a further reduced distance from the outlet of the micro passage 12 to a position at which the flow velocity is 0 (zero), the resistance in the flow passage, thereby preventing the spurting out in an improved manner. As shown in Fig. 8(b), when there are three or more micro passages 12, the micro passages 12 may be provided in a radial pattern so that the contents spurting out of the micro passage 12 can collide almost at the center. Furthermore, Fig. 8(c) illustrates the case where there are four micro passages 12. When the number of the micro passages is an even number, pairs of micro passages

may be provided in a parallel manner, as shown in Fig. 8(a).

The micro passage 12 also may have another configuration as shown in Fig. 9. Specifically, when the velocity at which the liquid flow from the micro passage 12 in the influx direction is eliminated (or reduced to zero), various cases may be assumed in which influx of the contents from the micro passage 12 collides with a wall or another opposing influx of the contents or the flow direction must be changed. For example, cases as shown in Fig. 9 may be assumed in which: "(a)" denotes a case in which the influx of the contents from the micro passage 12 of the side wall 11 collides with the opposing inner wall; "(b)" denotes a case in which the main passage 9 has at the center of the bottom section the collision wall 13 that is sandwiched by the direction along which the micro passage 12 of the side wall 11 is provided so that the influx of the contents collides with this wall in this direction; "(c)" denotes a case in which the influx of the contents from the micro passage 12 provided at a position not opposing to the side wall 11 collide with the opposing inner wall of a not-right angle and this case allows the contents to change the flowing direction to flow along the inner wall of the main passage 9, thus causing a vortex in the main passage 9; and "(d)" denotes a case in which the micro passage 12 is the same as that described in "(c)" but the inner wall of the front surface to which the contents flow has the wall 14 provided in an orthogonal direction to which the influx of contents

collides. The number "1" added to the reference numbers of Fig. 9 denotes a longitudinal sectional view and the number "2" denotes a transverse sectional view at the position of the micro passage. "(e)" denotes a case in which a position opposing the angle of the lower end edge portion of the discharge tube 3 has a notch to provide the micro passage 12 and this case allows, as shown in "(e)-2," the contents to flow into the main passage 9 almost along the bottom surface and "(e)-3" denotes a transverse sectional view at the position of the micro passage; "(f)" denotes a case in which the micro passage 12 is provided at a position dislocated from the opposing side wall in the longitudinal direction; "(g)" denotes a case in which the above-described "(b)" in which the micro passages 12 are provided so as to be dislocated from each other in the longitudinal direction; "(h)" denotes a case in which the micro passage 12 is provided running from the side wall 11 to the corner of the bottom surface of the main passage 9 in an oblique direction; and "(I)" denotes a case in which the micro passage 12 is provided running from the side wall 11 or the bottom surface to the inner wall in an oblique direction. The case "(I)" desirably has the collision wall 15 as shown (I) to prevent the contents from flowing in an upward direction when colliding with the inner wall.

(Embodiment 2)

Fig. 10 is a front surface longitudinal sectional view of the discharge tube 3 illustrating Embodiment 2 of the container

with an instillation discharge flow velocity mechanism according to the present invention. The method for attaching this discharge tube 3 to the upper opening section 7 of container body 1 is the same as that in Embodiment 1. This embodiment has a structure that simplifies the processing of the micro passage 12 in Embodiment 1. Although Embodiment 1 described that the micro passage desirably has a diameter of 1mm or less, it is very difficult in an actual manufacturing step to provide a diameter of 1mm or less. Thus, this embodiment improves the problem of the above-described Embodiment 1.

Specifically, the main passage 9 of the discharge tube 3 penetrates the upper and lower ends as shown in Fig. 10 and the bottom end surface 16 has the groove 17 providing the micro passage 12 as shown in Fig. 11. This bottom end surface 16 is fitted with the cap 18. The cap 18 has at the side surface and at a position engageable with the micro passage 12 the lateral hole 19 that has a cross sectional area larger than that of the micro passage 12. The cap 18 has the inner bottom surface 20 (Fig. 12) that is fitted so as to have close contact with the bottom end surface 16 of the discharge tube 3 and the close contact part is welded or adhered to provide integration. The groove 17 is blocked by the inner bottom surface 20 of the cap 18 to have a tube-like closed section, thereby providing the micro passage 12. Fig. 12 is a front view illustrating when the discharge tube 3 is separated from the cap 18.

This micro passage 12 in Fig. 10 has a length that is the same as the thickness of the discharge tube 3. The micro passage 12 is not limited to any particular shape and has a cross section that may be freely selected to be circular, triangular, square or other shapes. The micro passage 12 preferably has a sufficient length that allows the contents at the outlet of this passage to flow out in a stabilized manner (in a rectified manner). Specifically, the micro passage 12 having an excessively short length causes the contents to be diffused at the outlet, thus preventing the contents from colliding with one another in an intended manner.

The container with an instillation discharge flow velocity mechanism of Embodiment 2 thus constructed can be used as in the above-described Embodiment 1.

Fig. 13 is a perspective view illustrating the positional relation between the lateral hole 19 provided in the cap 18 and the micro passage 12. In Fig. 13, "(a)" denotes the most basic structure; and "(b)" denotes a case in which two pairs of micro passages are provided in an orthogonal direction as shown in Fig. 8(c). In the case where pairs of a plurality of micro passages 12 are provided in a radial pattern in this way, the above-described pairs of micro passages are allowed to respectively have different cross sectional areas and the cap 18 is rotatably engaged with the bottom end surface 16 of the discharge tube 3 without being welded or adhered thereto. This

allows as shown in Fig. 13(b) the rotation of the cap 18 to provide selection of the micro passage 12 fittable to the lateral hole 19. This allows a step-wise change of discharge in accordance with the number of the pairs of micro passages.

Even the case "(a)" allows the cap 18 to be rotatable to move the lateral hole 19 to a position having no micro passage 12 so that the fit of the lateral hole 19 to the micro passage 12 can be cancelled, thereby allowing the cap 18 to function as an inner stopper for prohibiting discharge.

The structure as above-described allows the micro passage 12 to have a groove-like shape rather than a hole-like shape, thus allowing the micro passage 12 to be formed by a mold in an easier manner. Similarly, the lateral hole of the cap 18 also may be larger than the cross sectional area of the micro passage 12 and does not require strict accuracy. As a result, the lateral hole of the cap 18 may be provided by either drilling or molding and thus can be easily processed.

However, although both of the above-described two embodiments are very preferable ones for an instillation-like discharge, these two embodiments cause, when the container is reversed, the contents to remain at the height of the influx inlet of the micro passage 12, for example, position "WL" shown by the broken line, as shown in Fig. 7. This causes a new problem in which, once the contents remain in this way, the retaining cap 4 must be detached to remove the discharge tube 3 from the

container body 1 so that the contents are discharged.

(Embodiment 3)

Fig. 14 is a front view of the discharge tube 3 illustrating Embodiment 3 of the container with an instillation discharge flow velocity mechanism according to the present invention. In Fig. 14, "(a)" represents a front view and "(b)" represents a center longitudinal sectional view. The method for attaching this discharge tube 3 to the upper opening section of the container body is the same as that in Embodiment 1. This embodiment provides a structure for solving the above-described problem. Specifically, this embodiment provides a structure in which all of the contents can be discharged while the container is being reversed.

As shown in Fig. 14(b) and Fig. 15, the main passage 9 penetrates the upper and lower ends as in Embodiment 2; the bottom end surface 16 has the groove 17 for providing the micro passage 12; and the longitudinal groove 21 is provided that extends from the influx inlet position of this micro passage 12 (lower end edge portion of the discharge tube 3) to the external wall of the discharge tube 3 and toward the upper flange 8. This longitudinal groove 21 has a cross sectional area that is larger than that of the micro passage 12. This bottom end surface 16 is engaged with the cap 18 the inner bottom surface 20 of which is provided so as to have close contact with the bottom end surface 16 of the discharge tube 3 so that the close contact part is

welded or adhered to provide integration. The above-described groove 17 is blocked by the inner bottom surface 20 of the cap 18 to have a tube-like closed section, thereby providing the micro passage 12. The inner side wall of the cap 18 has close contact with the longitudinal groove 21 to block this, thereby providing the tube-like passage 22 having a closed section. Then, the upper end position 23 of the cap 18 functions as the influx inlet to the tube-like passage 22. Thus, the change in the height of the cap 18 (depth) "h" provides the adjustment of the height of the position at which the contents flow in.

When the container with an instillation discharge flow velocity mechanism of Embodiment 3 thus constructed is used, the container is reversed as in the above-described Embodiment 1 and as shown in Fig. 6 to apply a pressure to the container body 1 by squeezing the container body 1 by fingers. Then, the container body 1 deforms as shown by the broken line in Fig. 6 to allow the inner pressure of the container to increase. Then, the contents (liquid) flow as shown in Fig. 16 from the container body 1 via a position of the discharge tube 3 in the vicinity of the flange 8 into the tube-like passage 22 to once flow back to the tube-like passage 22 toward the container body 1 (upper direction in the drawing), after which the contents reach the influx inlet of the micro passage 12 (lower end edge portion of the discharge tube 3). Then, the contents flow into the micro passage 12 and are squeezed as shown in Fig. 5 from the micro

passage 12 to the center of the main passage 9 and are discharged at the same speed and collide with one another, thus once having a speed of 0 (zero). Thereafter, the surface tension allows, without causing the contents to burst out of the outlet 2, the contents to slide along the inner wall of the main passage 9 and then to be gradually filled in the main passage 9 as shown by the broken line in Fig. 7, after which the contents overflow and are dripped from the outlet 2.

The structure as above-described allows the contents in the reversed container to be securely discharged without remaining in the container.

The existence of this tube-like passage 22 additionally provides the resistance in the tube passage, thus contributing to more effective prevention of the spurting out of the contents due to improper pressurization to the container body 1.

(Embodiment 4)

Fig. 17 is a center longitudinal sectional view of the discharge tube 3 illustrating Embodiment 4 of the container with an instillation discharge flow velocity mechanism according to the present invention. Fig. 18 is a bottom surface view illustrating the bottom end surface 16 of the discharge tube 3. The method for attaching this discharge tube 3 to the upper opening section 7 of the container body 1 is the same as that in Embodiment 1. Although the above-described three embodiments described a case in which the flow velocity control

passage is the tube-like, this embodiment illustrates a case where the flow velocity control passage is a clearance. Specifically, this embodiment is the same as the above-described Embodiment 2 except for that flow velocity control passage is provided to have a clearance.

Specifically, the discharge tube 3 penetrates the upper and lower ends as shown in Fig. 17 and as in Embodiment 2, and the cap 18 is fitted into the bottom end surface 16. The bottom end surface 16 has therein, in order to allow the end surfaces 16 and the bottom surface of the cap 18 to have therebetween the clearance passage 25 working as a flow velocity control passage, the projection or protruded part (hereinafter projection) 24 having a height the same as that of the clearance. This clearance passage desirably has a height that has a cross sectional area similar to that of the micro passage 12 in each of the above-described embodiments. The cap 18 has at the side surface the lateral hole 19 that is provided to fit the clearance passage 25 and that has an opening area larger than the effective area of the opening of this clearance passage. The cap 18 is fitted so that the inner bottom surface 20 (Fig. 12) has a close contact with the above-described projection 24 of the discharge tube 3 and the close contact part is welded or adhered to provide integration. The contents flow into the main passage 9 so as to enter from the lateral hole 19 of the cap 18 into the clearance passage 25 to exude therefrom. If the contents flowing through

the clearance passage 25 in this case have a high flow velocity, then a structure for allowing the contents flowing from opposing positions in the main passage 9 to collide with one another can control the flow velocity, thus preventing the spurting out of the contents from the outlet 2 and providing fine adjustment of drip in an easy manner.

When a plurality of pairs of clearance passages 25 in this case are provided to have a radial pattern as in Embodiment 2 and as shown in Fig. 8, the above-described pairs of clearance passages 25 are allowed to respectively have different cross sectional areas (or widths) and the cap 18 is rotatably engaged with the bottom end surface 16 of the discharge tube 3 without being welded or adhered thereto. This allows as shown in Fig. 13(b) the rotation of the cap 18 to provide the selection of the micro passage 12 fittable to the lateral hole 19. This allows a step-wise change of discharge in accordance with the number of the pairs of clearance passages.

Even in the case of Fig. 13(a) in which one pair of flow velocity control (clearance) passages is provided, the cap 18 is allowed to be rotatable to move the lateral hole 19 to a position having no clearance passage 25 so that the fit of the lateral hole 19 to the clearance passage 25 can be cancelled, thereby allowing the cap 18 to function as an inner stopper for prohibiting discharge. When the clearance height of the clearance passage 25 is changed in the width direction, then the opening area can

be arbitrarily changed depending on the fit condition with the above-described lateral hole 19, thus providing a discharge control in a stepless manner.

(Embodiment 5)

Fig. 19 is a center longitudinal sectional view of the discharge tube 3 illustrating Embodiment 5 of the container with an instillation discharge flow velocity mechanism according to the present invention. Fig. 20 shows the bottom end surface 16 of the discharge tube 3. The method for attaching this discharge tube 3 to the upper opening section 7 of the container body 1 is as in Embodiment 1. This embodiment is a combination of the above-described Embodiment 3 and the above-described Embodiment 4.

Specifically, the main passage 9 penetrates the upper and lower ends as shown in Fig. 19 and as in Embodiment 2 and the bottom end surface 16 has the clearance passage 25 for providing a flow velocity control passage. The longitudinal groove 21 is provided from the influx inlet position of this clearance passage 25 (lower end edge portion of the discharge tube 3) via the external wall of the discharge tube 3 toward the upper flange 8. This longitudinal groove 21 has a cross sectional area that is larger than the opening area of the clearance passage 25. This bottom end surface 16 is engaged with the cap 18 the inner bottom surface 20 of which is provided so as to have a close contact with the bottom end surface 16 of the discharge tube

3 so that the close contact part is welded or adhered to provide integration. The above-described groove 17 is blocked by the inner bottom surface 20 of the cap 18 to have a tube-like closed section, thereby providing the clearance passage 25. The inner side wall of the cap 18 has a close contact with the longitudinal groove 21 to block this, thereby providing the tube-like passage 22 having a closed sectional area. Then, the upper end position 23 of the cap 18 functions as the influx inlet of the contents to the tube-like passage 22. Thus, the change in the height of the cap 18 (depth) "h" provides the adjustment of the height of the position at which the contents flow in.

According to such a structure as above-described, the contents flow from the container body 1 via a position of the discharge tube 3 in the vicinity of the flange 8 into the tube-like passage 22 to once flow back to the tube-like passage 22, after which the contents reach the influx inlet of the clearance passage 25. The existence of this tube-like passage 22 additionally provides the resistance in the tube passage, thus contributing to more effective prevention of spurting out of the contents due to improper pressurization to the container body 1.

(Embodiment 6)

Fig. 21 is a center longitudinal sectional view of the discharge tube 3 illustrating Embodiment 6 of the container with an instillation discharge flow velocity mechanism according to the present invention. The method for attaching this discharge

tube 3 to the upper opening section 7 of the container body 1 is as in Embodiment 1.

As shown in Fig. 21, the main passage 9 penetrates the upper and lower ends and the main passage 9 has a diameter that is enlarged in the vicinity of the lower end. The stopper 27 engaged with this enlarged section 26 is provided. The stopper 27 has at the side surface the longitudinal groove 28 as shown in Fig. 22(a) for providing a micro passage. The stopper 27 is sized and provided so that the stopper 27 has some clearance when the upper end bumps against the stepped portion of the enlarged section 26 of the above-described discharge tube 3. Then, the longitudinal groove 28 has a cross sectional area that is almost the same as the cross sectional area of the tubular micro passage 12 having a diameter of 1mm or less in each of the above-described embodiments.

Specifically, the longitudinal groove and the micro passage 28 are provided from the lower end edge portion of the discharge tube 3 to be parallel with the main passage 9 and then to reach via the orthogonal clearance to the main passage 9.

As shown in Fig. 22(b), the stopper 27 has therein the longitudinal groove 28 and has at the upper end the lateral groove 29. In this case, the lateral groove 29 may be used as a flow velocity control passage and the longitudinal groove 28 may have a cross sectional area larger than that of the lateral groove 29. Alternatively, the longitudinal groove 28 and the lateral

groove 29 may be both used as a flow velocity control passage if resistance in the tube passage needs to be strong. The reference numeral "30" in Fig. 22(b) denotes a dent functioning a chamber in which the liquid collides. This dent is desirably provided and is applicable to all embodiments of the present invention.

When the structure as above-described is used, the contents (liquid) having been pressurized when the container body 1 is squeezed flow into the above-described longitudinal groove 28 in a limited amount due to the large resistance in the tube passage. Additional resistance is provided by the ending point of the longitudinal groove 28 bent at a right angle and another resistance is added by the flow velocity control passage or a clearance from the ending point to the main passage 9. After passing through these clearance and/or flow velocity control passage, the liquid collides in the main passage 9 to once have a zero flow velocity, after which the liquid is filled in the main passage 9 and is dripped from the outlet 2.

Fig. 23 is a schematic diagram illustrating Embodiment 7 of the present invention. In Embodiment 7, the container body is called the tube container 31. Specifically, the upper end opening section 7 of the tube container 31 is fixed with the discharge tube 3 by the retaining cap 4, as shown in each of the above-described embodiments. The discharge tube 3 also has at the upper circumference the screw 32 to which the cap 5 is

screwed and fixed to protect the outlet 2.

In this manner, the discharge tube 3 of the instillation discharge flow velocity control of the present invention also can be applied to a soft container. Specifically, the discharge tube 3 also can be applied to the pouched container.

(Embodiment 7)

Fig. 24 is a perspective view illustrating the container with discharge flow velocity mechanism of the present invention. The container body 1 has at the upper part the outlet cap 34 having the outlet 33 and the retaining cap 4 for fixing the discharge tube 3 into which this outlet cap 34 is engaged to the container body 1.

Fig. 25 is an enlarged cross sectional view of the main part in the vicinity of the outlet. The bottle-like container body 1 has at the upper part the opening 7 and the discharge tube 3. The discharge tube 3 is fixed such that the flange 8 is provided on the end surface of the opening section 7 of the container body 1 and is screwed by the retaining cap 4 to the container body 1. This container body 1 is provided by a relatively-flexible material, for example, synthetic resin. More specifically, this container body 1 is preferably made of synthetic resin material, for example, polypropylene, polyethylene, or a laminate tube.

The flange 8 of the discharge tube 3 has at the lower part a cover member 35 for covering the lower part that is provided

to isolate this discharge tube 3 in the container body. The lower end edge portion of the cover member 35 is inserted with the narrow tube 36. The cover member 35 and the discharge tube 3 have therebetween the space 37 having a desired capacity. This space 37 is communicated with the interior of the container body only via this narrow tube 36. The lower end edge portion of this narrow tube 36 reaches as shown in Fig. 24 the bottom section of the container body 1 in order to suction the contents from the bottom section.

The structure as above-described prevents the fluid pressure in the container from directly influencing on the micro passage (which is described later); allows the inner pressure of the container to be attenuated by resistance in the tube passage of the narrow tube 36; and the existence of the inner space 37 of the cover member 35 (which has no retained contents under a normal condition) prevents spurting out of the contents from the outlet 33 even when the container body 1 is improperly squeezed strongly to cause the inner pressure to rapidly increase. Even when the container body 1 is caused to fall or to tumble, the lower end edge portion of the narrow tube 36 is allowed to be placed above the fluid level, thus preventing the pressure of the contents from being applied to the micro passage and preventing spurting out or leakage of the contents.

The discharge tube 3 is a tube-like member that has an external shape having the flange 8 as shown in Fig. 26(a) in

order to fit to the opening section 7 of the container and that has at the center the main passage (hereinafter referred to as main passage) 9. As shown in Fig. 26, this main passage 9 does not penetrate the upper end. The upper end has at the side surface the discharge opening 2 to which the outlet cap 34 is engaged. This outlet cap 34 is engaged in a rotatable manner and can be provided to a position fittable with the discharge passage inlet 38 and the above-described discharge opening 2. Thus, the discharge opening cap 34 when not being used can be rotated to cancel the fitting relation between the discharge passage inlet 38 and the discharge opening 2, thereby preventing the contents from flowing out.

On the other hand, the lower end is blocked by the bottom cap 18. The bottom end surface 16 and the bottom cap 18 of the discharge tube 3 have at the interface the cross section micro holes (hereinafter referred to as micro passage) 12 functioning as a micro passage in the direction orthogonal to the above-described main passage 9. This micro passage 12 has a size or the like that is the same as that of the above-described Embodiment 1. As shown in Fig. 26(b), the method as shown in the above-described Embodiment 2. is used in which the discharge tube 3 forms at the lower end surfaces 16 the groove 17 so that the groove 17 is closed by the bottom cap 18 to provide the tube-like passage 12. The arrangement and operation of the tube-like passage 12 are similar to the above-described

Embodiment 1.

When the liquid container of Embodiment 7 thus constructed is used, the container body 1 is applied with pressure by squeezing the container body 1 with fingers as shown in Fig. 27. Then, the container body 1 deforms to allow the inner pressure of the container to increase. Then, the contents (liquid) flow from the bottom section of the container body 1 via the narrow tube 36 into the space in the cover member 35 and then flow into the micro passage 12, as shown in Fig. 28. Then, the contents are squeezed as shown in Fig. 5 from the micro passage 12 to the center of the main passage 9 and are discharged at the same speed and collide with one another, thus once having a speed of 0 (zero). Thereafter, the surface tension allows, without causing the contents to burst out of the outlet 33, the contents to slide along the inner wall of the main passage 9 and then to be gradually filled in the main passage 9 as shown by the broken line in Fig. 5, after which the contents overflow and is leaked from the outlet 33.

In this manner, the contents in front of the outlet 33 are allowed to have a discharge velocity (flow velocity) of 0 (zero). This allows the contents to flow out of the outlet 33 in a very slow manner to prevent, even when the container body 1 is improperly applied with an unexpected external pressure, the contents from bursting out of the outlet 33, thus providing fine adjustment of the drip amount in a very easy manner.

When the discharge is completed, a hand is separated from the container body 1 to allow the restitutive force of the container body 1 to cause the interior of the container body to have a negative pressure. Then, the negative pressure allows as shown in Fig. 29 the contents in all of the passages from the outlet 33 to the narrow tube 36 to be returned into the container body 1. A tube having a diameter similar to that of this micro passage originally retains the liquid by the capillary phenomenon. However, Embodiment 7 allows the contents to be returned into the container body 1 without being retained by the negative pressure in the container body. To be accurate, the lower end edge portion of the narrow tube 36 even in this case has therein a small amount of retained contents due to the capillary phenomenon, depending on the balance between the atmosphere pressure and the inner pressure of the container.

As a result, most of the discharge route running from the outlet 33 to the lower end edge portion of the narrow tube 36 under a normal condition has no retained contents. This prevents, although the contents in the container body 1 reaches the outlet 33 with a slightly-increased time when the container body 1 is squeezed by hand, the spurting out of the contents even when the container body 1 is improperly applied with an external pressure.

This also prevents the contents in the discharge route from being retained and dried. This prevents the spurting out

of the contents fixed to the outlet 33 even when the container once used is reused. Furthermore, unnecessary dripping of the contents also can be prevented.

In addition, the diameter of the outlet 33 may be one that allows the contents under atmospheric pressure to be retained by the capillary phenomenon and prevents the contents from being dripped. For example, the diameter of the outlet 33 for a water-like liquid having a low viscosity is preferably 1.5mm to 3mm but may be appropriately changed depending on the characteristics of the contents or the application of the container.

(Embodiment 8)

Fig. 30(a) is a center longitudinal sectional view of the discharge tube 3 illustrating Embodiment 8 of the container with discharge flow velocity mechanism of the present invention. Fig. 30(b) illustrates the bottom end surface of the discharge tube 3. The method for attaching this discharge tube 3 to the upper opening section of the container body 1 is as in Embodiment 7. The above-described Embodiment 7 showed a case in which the micro passage is tube-like. This embodiment shows a case in which the micro passage is a clearance.

As shown in Fig. 30(a), the main passage penetrates the upper and lower ends and the cap 18 is fitted into the bottom end surface 16. The bottom end surface 16 has therein, in order to allow this end surfaces 16 and the inner bottom surface of

the cap 18 to form therebetween the clearance passage 25 working as a micro passage, the projection or protruded part (hereinafter projection) 24 having a height identical to the clearance. The size, layout and operation of this clearance passage 25 are the same as those in the above-described Embodiment 4.

(Embodiment 9)

Fig. 31 is a front surface longitudinal sectional view of the discharge tube illustrating the container with discharge flow velocity mechanism of Embodiment 9 of the present invention. The method for attaching this discharge tube to the upper opening section of the container body 1 is as in Embodiment 7.

As shown in Fig. 31, the main passage 9 of the discharge tube 3 penetrates the upper and lower ends and the main passage 9 has a diameter that is provided to be enlarged in the vicinity of the lower end. This enlarged section 26 is engaged with the stopper 27. The stopper 27 has a structure as shown in Fig. 22(a) that is the same as that of the above-described Embodiment 6.

(Embodiment 10)

Fig. 32 is a perspective view illustrating the fixed quantity measurement flow velocity control container of the present invention. The container body 1 has at the upper part the discharge opening 2; the retaining cap 4 for fixing the discharge tube 3 having this discharge opening 2 to the container body 1; and the measurement container 42.

Fig. 33 is an enlarged cross sectional view of the main part in the vicinity of the measurement container. The bottle-like container body 1 has at the upper part the opening section 7 and the discharge tube 3. The discharge tube 3 and the container body 1 have structures the same as those of the above-described Embodiment 7 but differ in that the discharge opening 2 is directed directly above.

The discharge tube 3 is equipped with the tube-like section 43 having a desired length as shown in Fig. 33 the tip end of which is provided as the discharge opening 2. This tube-like section 43 is axially inserted into the measurement container 42. The upper end of the measurement container 42 is provided at a position higher than this discharge opening 2. Fig. 34(a) is a center longitudinal sectional view of the discharge tube 3 and Fig. 34(b) is a bottom surface view of the discharge tube 3.

When the fixed quantity measurement flow velocity control container of Embodiment 10 thus constructed is used, then the container body 1 is applied with pressure by squeezing the container body 1 with fingers as shown in Fig. 35. Then, the container body 1 deforms to allow the inner pressure of the container to increase. Then, the contents (liquid) flow from the bottom section of the container body 1 via the narrow tube 36 into the space in the cover member 35 and then flow into the micro passage 12, as shown in Fig. 36. Then, the contents are

forced as shown in Fig. 5 from the micro passage 12 to the center of the main passage 9 and are discharged at the same speed and collide with one another, thus once having a speed of 0 (zero). Thereafter, the surface tension allows, without causing the contents to burst out of the discharge opening 2, the contents to slide along the inner wall of the main passage 9 and then to be gradually filled in the main passage 9 as shown by the broken line in Fig. 5, after which the contents overflow and are dripped from the discharge opening 2.

According to a conventional concept, when the contents are discharged from the protruded discharge tube 43 in the measurement container, the discharge opening 2 must collide with the inner wall of the measurement container 42 as shown in Fig. 37 because the discharge of the contents toward the opening section of the measurement container 42 causes a risk of spurting out of the contents.

However, the fixed quantity measurement flow velocity control container of the present invention allows the contents in front of the discharge opening 2 to once have a discharge velocity (flow velocity) of 0 (zero). This prevents the contents from being discharged from the discharge opening 2 with a flow velocity when the contents pass through the micro passage 12. This allows the contents to flow in a very slow manner to prevent, even when the container body 1 is improperly applied with an unexpected external pressure, the contents from bursting out

of the discharge opening 2, thus providing fine adjustment of the discharge amount in a very easy manner. Specifically, the discharge amount of the contents can be easily adjusted even when the contents are discharged slowly. This perfectly prevents the spurting out of the contents even when the opening of the measurement container 42 is directed in the upward direction as shown in Fig. 36.

As shown in Fig. 36, the contents discharged from the discharge opening 2 overflow in the measurement container to raise the water level WL higher than the height of this discharge opening 2. When a user releases force by hand after grabbing the container body 1 in this condition, then the restitutive force of the container body 1 allows container body 1 to have therein a negative pressure. Then, the negative pressure allows as shown in Fig. 38 the contents having a water level higher than the height of this discharge opening 2 to be suctioned again into the discharge opening 2, thus the contents in all of the passages to the narrow tube 36 are returned into the container body 1. The water level WL is determined by the height of the discharge opening 2. A tube having a diameter similar to that of this micro passage originally retains the liquid by the capillary phenomenon. However, Embodiment 10 allows the contents to be returned into the container body 1 without being retained by the negative pressure in the container body 1.

As a result, this allows the contents retained (remained)

in the measurement container to always have a fixed amount and prevents the contents from being influenced by the discharge amount or discharge velocity from the container body 1.

Also, the discharge route running from the discharge opening 2 to the lower end edge portion of the narrow tube 36 under a normal condition has therein no retained contents. This prevents, even when the container is tilted to discharge the measured contents from the measurement container, excessive contents from flowing out of the discharge opening 2 and also prevents the contents from being discharged even when the container 1 falls unexpectedly.

This also prevents the contents in the discharge route from being retained and dried. This prevents the spurting out of the contents fixed to the discharge opening 2 even when the container once used is reused.

In addition, the diameter of the discharge opening 2 may be one that allows the contents under atmospheric pressure to be retained by the capillary phenomenon and prevents the contents from being dripped. For example, the diameter of the discharge opening 2 for a water-like liquid having a low viscosity is preferably 1.5mm to 3mm but may be appropriately changed depending on the characteristics of the contents or the application of the container.

(Embodiment 11)

Fig. 39 is a perspective view illustrating the fixed

quantity measurement flow velocity control container of Embodiment 2 of the present invention. The method for discharging the contents from the container body 1 and the basic structure of the discharge route are the same as those of the above-described Embodiment 10.

As shown in Fig. 40 and Fig. 41, this embodiment allows the measurement container 42 to be movable in the upward and downward directions. Specifically, almost the entire lower part of the tube-like section 43 of the discharge tube 3 is screwed with the screw 44 and the measurement container 42 is screwed with the screw 45 fitted for the screw 44 of this tube-like section 43. The upper end of the screw section 45 of the measurement container 42 has at the center a cap-like shape having an opening. This opening is inserted with the tube-like section 43. The opening has at a part making a contact with tube-like section 43 at the O-ring 46 for preventing the contents in the measurement container from being leaked.

The structure as above-described allows the measurement container 42 to move in the upward and downward directions while being rotated. A fixed quantity to be measured in the measurement container is determined by the height h from the bottom of the measurement container 42 to the discharge opening 2, that is, to the water level WL. Thus, when the measurement container 42 is raised to the upper limit as shown in Fig. 40, the minimum fixed quantity to be measured is provided. On the other hand,

when the measurement container 42 is lowered to the lower limit as shown in Fig. 41, then the maximum fixed quantity to be measured is provided. Thus, the length of the tube-like section 43 and the screw sections 44 and 45 and the inner diameter and height of the measurement container 42 can be appropriately changed to measure various capacities.

In addition, the tube-like section 43 has at the exterior the scale 49 as shown in Fig. 39, thereby arbitrarily determining the fixed quantity to be measured.

Also, a means for moving the measurement container 42 in the upward and downward directions is not limited to the screw as above-described. This means may be the method for merely sliding the measurement container 42 unless the method is one for preventing the contents from being leaked without moving the measurement container 42 without careful consideration.

(Embodiment 12)

Fig. 42(a) is a front surface longitudinal sectional view of the discharge tube illustrating the fixed quantity measurement flow velocity control container of Embodiment 12 of the present invention. Fig. 42(b) shows the bottom end surface of the discharge tube.

The method for attaching this discharge tube to the upper opening section of the container body 1 is as in Embodiment 1. Although the above-described Embodiment 1 described a case in which the micro passage is the tube-like, this embodiment

describes a case in which the micro passage is a clearance.

(Embodiment 13)

Fig. 43 is a front surface longitudinal sectional view of the discharge tube illustrating Embodiment 13 of the liquid container of the present invention. This discharge tube 3 uses the stopper structure of the above-described Embodiment 6. The method for attaching the discharge tube 3 to the upper opening section of the container body 1 is as in Embodiment 12.

Another structure also may be provided as shown in Fig. 44 in which the measurement container 42 is rotated to block the discharge opening 2. Specifically, as shown in Fig. 44(a), the upper end of the tube-like section 43 of the discharge tube 3 is closed, the main passage 9 does not penetrate the upper and lower ends, and the discharge opening 2 is provided in the side wall. Specifically, the contents are discharged in the lateral direction, as shown in Fig. 37. The measurement container 42 has at the inner side the projected opening 46 that has the slit 51 at a position corresponding to this lateral discharge opening 2.

The structure as above-described allows the measurement container 42 to be rotated so that the position of the discharge opening 2 is fitted to the position of the slit 51 as shown in Fig. 44(a). This allows the contents to flow from the discharge opening 2. After the measurement container 42 is used, then the measurement container 42 is appropriately rotated to cancel

the fitting relation between the slit 51 and the discharge opening 2 as shown in Fig. 44(b), thereby preventing the contents from flowing out of the discharge opening 2. The tube-like section 43 and a part having no slit 51 have therebetween a seal for preventing the contents from being leaked from the measurement container. This prevents cleaning liquid or water from entering the discharge opening 2 when the measurement container 42 is to be washed, for example.

Industrial Applicability

The container with an instillation discharge flow velocity mechanism according to the present invention constructed as above-described can be applied to various containers so long as the container is a flexible liquid container and provides the instillation-like discharge of the contents easily.

Specifically, in the case of a conventional instillation discharge container a representative example of which is a container for eye drops, the container has a problem in which a force added to the container for instillation discharge requires to be cautiously adjusted. However, the container with an instillation discharge flow velocity mechanism according to the present invention provides a flow velocity control to control the discharge flow velocity. This reduces the sensitivity of the container body to the pressurization due to carelessness. This allows the drip discharge amount to be adjusted very easily.

This also prevents the spurting out of the contents from the outlet.

Thus, one drop can be discharged without having a cautious attitude. A user is also allowed to count a few drops while discharging the contents in an easy manner.

The present invention does not necessarily require a hard container as in a conventional instillation container and also can be applied to a flexible container, for example, tube container.

The present invention also can be applied to various containers so long as the container is a flexible liquid container, thus providing adjustment of the discharge amount of the contents in an easy manner.

The present invention also prevents the contents under a normal condition from being retained in the discharge route. This prevents the contents from being discharged even when the container body is pressurized due to carelessness.

Also, when the discharge is completed, the restitutive force of the container body causes a negative pressure in the container body to allow the contents in the discharge route to be suctioned into the container body. This prevents the contents from being retained or fixed to the outlet, thus preventing the spurting out of the fixed contents even when the contents are discharged at the next discharge.

Furthermore, any flexible liquid container can be used

to provide an easy measurement while adjusting the discharge amount of the contents in an easy manner.

Also, the combination of such a discharge control container with the measurement container allows the fixed quantity to be measured to be determined by the height of the outlet in the measurement container. This securely provides the measurement of a fixed quantity while being perfectly blocked by the influence of the discharge amount or the discharge velocity.

The contents under a normal condition are prevented from being retained in the discharge route. This prevents the contents from being discharged even when the container body is pressurized due to carelessness. This prevents an excessive discharge larger than the measured amount from being discharged, thus providing a higher measurement accuracy.

After the discharge is completed, the restitutive of the container body causes a negative pressure in the container body to allow the contents in the discharge route to be suctioned into the container body. This prevents the contents from being retained or fixed to the outlet, thus preventing the spurting out of the fixed contents even when the contents are discharged at the next discharge.

Furthermore, the measurement container can be detached and washed, thus the container is made hygienic.

Brief Description of the Drawings

Fig. 1 is a perspective view illustrating the container with an instillation discharge flow velocity mechanism according to the present invention. Fig. 2 is an enlarged cross sectional view of the main part in the vicinity of the outlet. Fig. 3 is a longitudinal sectional view illustrating the discharge tube. Fig. 4 is a transverse sectional view taken at the line A-A in Fig. 3. Fig. 5 is an enlarged cross sectional view of the main part illustrating the flow velocity control liquid passage. Fig. 6 is a perspective views illustrating when the container is used. Fig. 7 is a longitudinal sectional view of the main part of the container being used. Fig. 8(a) to Fig. 8(c) are bottom surface views of the discharge tube illustrating the pattern of the flow velocity control liquid passage. Fig. 9(a) to Fig. 9(I) are cross sectional views illustrating the structure of the micro passage. Fig. 10 is an enlarged cross sectional view of the main part illustrating Embodiment 2. Fig. 11 shows the bottom surface of the discharge tube. Fig. 12 is an assembly diagram illustrating the structure of the discharge tube. Fig. 13(a) and Fig. 13(b) are perspective views illustrating the cap attached to the container. Fig. 14(a) and Fig. 14(b) are a front view and a longitudinal sectional view illustrating the discharge tube of Embodiment 3, respectively. Fig. 15 shows a bottom surface of the discharge tube. Fig. 16 is a longitudinal sectional view of the main part of the discharge tube being used. Fig. 17 is a longitudinal sectional view of the main part

illustrating Embodiment 4. Fig. 18 shows the bottom surface of the discharge tube. Fig. 19 is a longitudinal sectional view of the main part illustrating Embodiment 5. Fig. 20 shows the bottom surface of the discharge tube. Fig. 21 is a longitudinal sectional view of the main part illustrating Embodiment 6. Fig. 22(a) and Fig. 22(b) are perspective views illustrating an exemplary structure of the stopper. Fig. 23 is a perspective view illustrating Embodiment 7. Fig. 24 is a perspective view illustrating the container with discharge flow velocity mechanism of the present invention. Fig. 25 is an enlarged cross sectional view of the main part in the vicinity of the outlet. Fig. 26(a) is a longitudinal sectional view illustrating the discharge tube and Fig. 26(b) is a bottom surface view illustrating the discharge tube. Fig. 27 is a perspective view illustrating the container being used. Fig. 28 is a longitudinal sectional view of the main part illustrating the container being used (during discharge). Fig. 29 is a longitudinal sectional view of the main part illustrating the container being used (while the contents are being suctioned). Fig. 30(a) is a longitudinal sectional view illustrating the discharge tube of Embodiment 2 and Fig. 30(b) is a bottom surface view illustrating the discharge tube of Embodiment 2. Fig. 31 is a longitudinal sectional view illustrating the discharge tube of Embodiment 3. Fig. 31 is a perspective view illustrating the fixed quantity measurement flowout control container of the

present invention. Fig. 32 is an enlarged cross sectional view of the main part in the vicinity of the outlet. Fig. 33(a) is a longitudinal sectional view illustrating the discharge tube and Fig. 33(b) is a bottom surface view illustrating the discharge tube. Fig. 34 is an enlarged cross sectional view of the main part illustrating the micro passage. Fig. 35 is a perspective view illustrating the container being used. Fig. 36 is a longitudinal sectional view of the main part illustrating the container being used (during discharge). Fig. 37 is a cross sectional view illustrating the conventional concept. Fig. 38 is a longitudinal sectional view of the main part illustrating the container being used (while the contents are suctioned). Fig. 39 is a perspective view illustrating Embodiment 2. Fig. 40 is an enlarged cross sectional view of the main part in the vicinity of the outlet illustrating the measurement container at the upper limit. Fig. 41 is an enlarged cross sectional view of the main part in the vicinity of the outlet illustrating the measurement container at the lower limit. Fig. 42(a) and Fig. 42(b) are a longitudinal sectional view and a bottom surface view illustrating the discharge tube of Embodiment 3, respectively. Fig. 43 is a longitudinal sectional view illustrating the discharge tube of Embodiment 4. Fig. 44 is a perspective view illustrating the structure for closing the outlet.

What is claimed is:

1. An instillation container with discharge flow velocity mechanism, wherein:

a liquid container comprises a discharge route for discharging contents;

the discharge route has a flow velocity control passage having an opening area that allows the surface tension of the contents to block the contents under atmospheric pressure; and

when the contents are discharged, then the contents having passed through the flow velocity control passage once have a flow velocity of zero in the passage direction and then fill a main passage of the discharge route provided at an outlet of the flow velocity control passage to be subsequently discharged from an outlet.

2. The container with an instillation discharge flow velocity mechanism according to Claim 1, wherein the flow velocity control passage is provided in the direction parallel with the main passage of the discharge route.

3. The container with an instillation discharge flow velocity mechanism according to Claim 1, wherein the flow velocity control passage is provided in the direction orthogonal to the main passage of the discharge route.

4. The container with an instillation discharge flow velocity mechanism according to any of Claims 1 to 3, wherein the flow velocity control passage is a hole.

5. The container with an instillation discharge flow velocity mechanism according to any of Claims 1 to 3, wherein the flow velocity control passage is a clearance.

6. The container with an instillation discharge flow velocity mechanism according to any of Claims 1 or 3 to 5, wherein, when there are two or more flow velocity control passages with an even number, each pair of flow velocity control passages are arranged at opposite positions or are arranged in a radial pattern.

7. The container with an instillation discharge flow velocity mechanism according to any of Claims 1 to 6, wherein a means for changing the opening area is provided so that the opening area of the flow velocity control passage can be increased or decreased in a stepwise or stepless manner.

8. The container with an instillation discharge flow velocity mechanism according to any of Claims 1 to 7, wherein an influx inlet of the contents of the flow velocity control passage is opened to a container body and the contents directly flow from the container body into the flow velocity control passage.

9. A container with an instillation discharge flow velocity mechanism according to any of Claims 1 to 7, wherein:

the influx inlet of the contents of the flow velocity control passage has a guide route for guiding the contents from the container body;

the guide route has at the outlet side the influx inlet;

and

the contents flow via this guide route into the flow velocity control passage.

10. A container with a discharge flow velocity mechanism, wherein:

a liquid container comprises a discharge route for discharging the contents;

the discharge route has a flow velocity control passage having an opening area that allows the surface tension of the contents to block the contents under atmospheric pressure;

when the contents are discharged, then the contents having passed through the flow velocity control passage once have a flow velocity of zero in the passage direction and then fill a main passage of the discharge route provided at an outlet of this flow velocity control passage to be subsequently discharged from an outlet; and

when the discharge step is completed, then the contents in the discharge route are suctioned into a container body to prevent the contents under a normal condition from being retained in the discharge route.

11. The container with the discharge flow velocity mechanism according to Claim 10, wherein:

the flow velocity control passage and the container body have therebetween a cover member for separating the flow velocity control passage in the container body;

the cover member has at the inner side a space having a desired capacity;

the space is communicated with the container body only by a narrow tube;

fluid pressure in the container has no direct influence on the flow velocity control passage; and

resistance in the narrow tube causes the inner pressure of the container body to be attenuated to prevent the inner pressure from directly reaching the flow velocity control passage.

12. A fixed quantity measurement flow velocity control container, wherein:

a liquid container comprises an outlet for discharging the contents;

the discharge route has a flow velocity control passage having an opening area that allows the surface tension of the contents to block the contents under atmospheric pressure;

when the contents are discharged, then the contents having passed through this flow velocity control passage once have a flow velocity of zero in the passage direction and then fill a main passage of the discharge route provided at an outlet of the flow velocity control passage to be subsequently discharged from an outlet;

when the discharge step is completed, then the contents in the discharge route are suctioned into a container body to

prevent the contents under a normal condition from being retained in the discharge route; and

a measurement container having therein the main passage in a protruded manner is provided.

13. The fixed quantity measurement flow velocity control container according to Claim 12, wherein, after the contents are discharged from the outlet into the measurement container, the restitutive force of the container causes a negative pressure in the container to allow excessive contents equal to or larger than a fixed quantity to be measured to be collected in the container body so that the fixed quantity to be measured remains in the measurement container for measurement.

14. The fixed quantity measurement flow velocity control container according to Claim 12 or 13, wherein:

the fixed quantity to be measured is determined by the height from a bottom surface of the measurement container of the outlet provided in the measurement container in a protruded manner; and

the measurement container can be moved in the upward and downward directions so that the height of the outlet from the bottom surface of the measurement container can be arbitrarily adjusted.

15. The container with the discharge flow velocity mechanism according to any of Claim 12 to 14, wherein:

the flow velocity control passage and the container body

have therebetween a cover member for separating the flow velocity control passage in the container body;

the cover member has at the inner side a space having a desired capacity;

the space is communicated with the container body only by a narrow tube;

fluid pressure in the container has no direct influence on the flow velocity control passage; and

resistance in the narrow tube causes the inner pressure of the container body to be attenuated to prevent the inner pressure from reaching the flow velocity control passage.