Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2533233 C 2011/04/19

(11)(21) 2 533 233

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1995/11/17

(41) Mise à la disp. pub./Open to Public Insp.: 1996/05/30

(45) Date de délivrance/Issue Date: 2011/04/19

(62) Demande originale/Original Application: 2 180 859

(30) Priorités/Priorities: 1994/11/17 (JP6-309550); 1994/12/12 (JP6-332015); 1995/02/24 (JP7-061876); 1995/03/29 (JP7-098108); 1995/05/23 (JP7-149463); 1995/10/23 (JP7-274462); 1995/10/23 (JP7-274463); 1995/10/27 (JP7-281046)

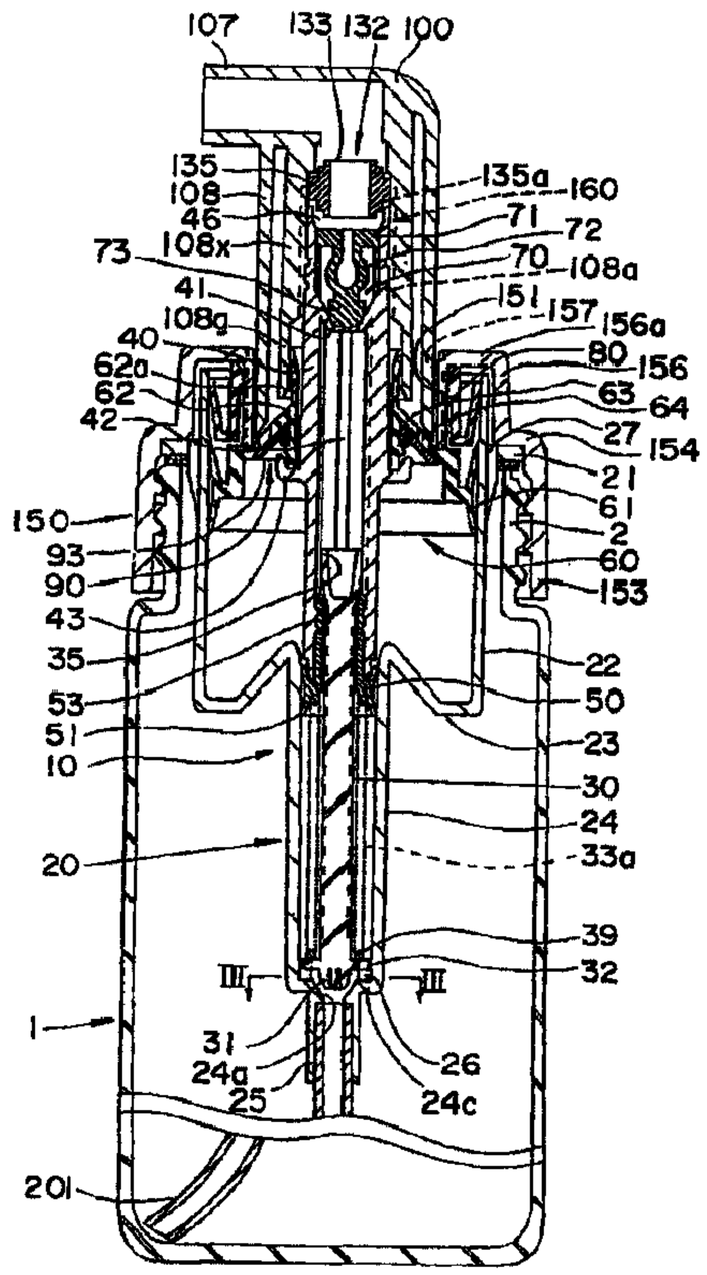
(51) Cl.Int./Int.Cl. *B05B 11/00* (2006.01), *B05B 7/00* (2006.01)

(72) Inventeurs/Inventors:
IIZUKA, SHIGEO, JP;
MIZUSHIMA, HIROSHI, JP;
TSUCHIDA, HARUO, JP;
SAITO, TADAO, JP

(73) Propriétaire/Owner:
YOSHINO KOGYOSHO CO., LTD., JP

(74) Agent: SMART & BIGGAR

(54) Titre : RECIPIENT AVEC UNE POMPE POUR LA LIBERATION DE BULLES
(54) Title: CONTAINER WITH PUMP FOR DISCHARGING BUBBLES



(57) Abrégé/Abstract:
A pump for discharging bubbles is provided on a neck portion of a container body. The pump for discharging bubbles comprises a cylinder for liquid in which a first piston slides, a cylinder for air in which a second piston slides, a pump head on which a nozzle is provided and which is connected to the first piston and the second piston so as to drive the both pistons, a vapor-liquid mixing chamber in which liquid delivered from the cylinder for liquid and air delivered from the cylinder for air are joined and a bubbling member provided between the nozzle and the vapor-liquid mixing chamber. Liquid within the container body and outside air are pumped up to be joined in the vapor-liquid mixing chamber and the vapor-liquid is bubbled via the bubbling member to be discharged in a foamy state from the nozzle by depressing the pump head.

64881-466

ABSTRACT OF THE DISCLOSURE

A pump for discharging bubbles is provided on a neck portion of a container body. The pump for discharging bubbles comprises a cylinder for liquid in which a first piston slides, a cylinder for air in which a second piston slides, a pump head on which a nozzle is provided and which is connected to the first piston and the second piston so as to drive the both pistons, a vapor-liquid mixing chamber in which liquid delivered from the cylinder for liquid and air delivered from the cylinder for air are joined and a bubbling member provided between the nozzle and the vapor-liquid mixing chamber. Liquid within the container body and outside air are pumped up to be joined in the vapor-liquid mixing chamber and the vapor-liquid is bubbled via the bubbling member to be discharged in a foamy state from the nozzle by depressing the pump head.

64881-466D

Container with Pump for Discharging Bubbles

FIELD OF THE INVENTION

The present invention relates to a container provided with a pump for discharging bubbles which is capable of bubbling up liquid (for instance, liquid for cleansing foam, liquid for shaving cream and the like) received in a container body to make the liquid flow in a foamy state.

BACKGROUND OF THE INVENTION

For instance, the container disclosed in International Publication No. WO92/08657 can be exemplified as a container with a pump for discharging bubbles. The container is provided with a container body for receiving liquid having a bubbling property such as a liquid detergent and a pump for discharging bubbles provided on a neck portion of the container body, and they are constructed so that, by depressing a pump head of the pump for discharging bubbles, the liquid is pumped up from the container body and the air is sucked from the outside of the carries body to mix the liquid and the air. And then, the vapor-liquid mixture is bubbled via a net (bubbling member) provided within the pump and the bubbles are discharged from a nozzle of the pump head.

In conventional pump for discharging bubbles, it sometimes happens that the balance of the volumes of the liquid and air to be mixed is lost and the liquid volume becomes smaller than the air volume, and accordingly the bubbling will be incomplete at the first stage of discharging bubbles.

Although the container disclosed Japanese Patent Application No. 6-136411(1994) exists as a container with a pump for discharging bubbles improved such a problem to some extent, it also leaves room for improvements in that it is difficult to change the size of bubbles (diameter of the bubbles), that a measure for preventing a undesired leakage of liquid which is likely to occur when the container is overturned and so on is not complete, and that it sometimes happens that the bubbles adhered to the net (bubbling member) gets dry to clog the net when it is not used, and the bubbles will be formed badly hereafter.

EP 0565713 is directed to a bubble spouting pump vessel. The vessel is operable for the purpose of generating bubbles by mixing air with liquid at a fixed ratio. The air piston of the vessel is directly connected to the pump head. Further, the migration of the valve from the valve seat is limited by a spring.

EP0613782 discloses a foam dispensing pump container wherein the vertical migration of valve is limited to a step of the pump rod portion.

Other pumps for discharging bubbles have had various problems as follows.

(a) It sometimes happens that the sucked outside air intrudes into the container body to bubble the liquid, and the liquid surface within the container body is filled with the bubbles, when the bubbles are discharged.

(b) It is difficult to discharge the bubbles in a straight line form relatively for a long range.

(c) A coil spring for energizing the pump head upwards all the time is received in a region where it is in contact with the liquid, and the contact of the coil spring with the liquid may be not desirable depending on the kind of the liquid received in the container body.

(d) It is not possible to change a discharging form of the bubbles.

(e) There is the possibility that only the air passes through the net (bubbling member) before the liquid passes through the net at the first stage of discharging bubbles, and the bubbles will be discharged unseemly in that case, because the liquid which has remained within the net at the last discharging is formed into larger bubbles by flow of only the air and the large bubbles are discharged from the nozzle of the pump head.

(f) It sometimes happens that the balance of the volumes of the liquid and air to be mixed is lost and the liquid volume becomes smaller than the air volume, and accordingly the bubbling will be incomplete at the first stage of discharging bubbles.

Although the container disclosed Japanese Patent Application No. 6-136411(1994) exists as a container with a pump for discharging bubbles improved in the point of (f), it also leaves room for improvements as follows.

(g) It is difficult to change the size of bubbles (diameter of the bubbles).

(h) A measure for preventing a undesired leakage of liquid which is likely to occur when the container is overturned and so on is not complete.

(i) It sometimes happens that the bubbles adhered to the net (bubbling member) gets dry to clog the net when it is not used, and the bubbles will be formed badly hereafter.

An object of the present invention is to provide a container with a pump for discharging bubble which is capable of discharging bubbles stably in a state that the size of bubbles is fixed from the first stage of discharging bubbles, which is capable of changing the diameter of bubbles easily, and preventing an undesirable leakage of liquid, and in which the net (bubbling member) in not clogged up due to drying.

An object of the present invention is to provide a container with a pump for discharging bubbles in which the liquid is not bubbled before it is bubbled in a bubbling member so that the container body will not be filled with bubbles; a container with a pump for discharging bubbles which is capable of discharging the bubbles in a straight line form relatively for a long range; a container with a pump for discharging bubbles in which a coil spring for energizing a pump head upwards all the time is provided in a position isolated from the liquid; a container with a pump for discharging bubbles which is capable of changing a discharging form of bubbles; a container with a pump for discharging bubble which is capable of discharging bubbles stably in a state that the size of bubbles is fixed from the first stage of discharging bubbles; a container with a pump for discharging bubbles which is capable of changing the diameter of bubbles easily; a container with a pump for discharging bubbles which is capable of preventing an

undesirable leakage of liquid and a container with a pump for discharging bubbles in which the net (bubbling member) in not clogged up due to drying.

DISCLOSURE OF THE INVENTION

The present invention provides a container with a pump for discharging bubbles, comprising:

a container body having a neck portion; and a pump for discharging bubbles provided on the neck portion of the container body, wherein the pump for discharging bubbles comprises:

(a) a cylinder member in which a cylinder for liquid and a cylinder for air inserted into the container body from the neck portion are provided in an axial direction in a concentric arrangement and which has a flange portion mounted on the neck portion;

(b) an attaching trunk which is provided on the neck portion and holds the flange portion of the cylinder member in cooperation with the neck portion;

(c) a pump head which passes through the attaching trunk in a state that it can be moved upward and downward and in which the nozzle is provided on a portion exposed from the attaching trunk;

(d) a stem which has a hollow-cylinder-shape in which upper and lower ends are made open and is received within the cylinder member in a state that it can be moved upward and downward, and in which an upper part thereof is connected to the pump head to be communicated with the nozzle and an annular flange portion is provided on a portion received within the cylinder for air;

(e) a first circular piston which is provided on the lower end of the stem and is capable of sliding on internal surface of the cylinder for liquid upward and downward air-tightly;

(f) a second piston which is provided on an external surface of the stem of the pump head in a state that it can be moved upward and downward with

only a little stroke, closes the opening end of the cylinder for air and has a basic cylinder portion fitted into the external surface of the stem and a seal cylinder portion which can be slid upward and downward fluid-tightly on the internal surface of the cylinder for air, and in which the upper part of the basic cylinder portion is fitted to the lower part of the pump head air-tightly, an air suction valve is provided on a connecting portion for connecting the basic cylinder portion to the seal cylinder portion and the lower part of the basic cylinder portion can be connected to the flange portion of the stem fluid-tightly;

(g) a liquid suction valve which is suspended from the stem in a state that the upper part thereof is inserted into the stem so that it can be moved upward and downward and can be moved upward and downward together with the stem by engaging with the stem, and whose lower part is inserted into the cylinder for liquid in a state that it can be moved upward and downward to make the lower end function as a lower part valve body for opening and closing the liquid entrance of the cylinder for liquid;

(h) a liquid discharge valve arranged on the upper part inside of the stem;

(i) a bubbling member stored between the liquid discharge valve and the nozzle of the pump head;

(j) a vapor-liquid mixing chamber provided between the discharge valve and the bubbling member;

(k) an air passage which is provided among the pump head, the stem and the basic cylinder portion of the second piston and makes the cylinder for air communicate with the vapor-liquid mixing chamber;

(l) a liquid passage formed among the liquid suction valve, the internal surface of the cylinder for liquid and the internal surface of the stem;

(m) a coil spring which energizes the stem in the direction approaching the pump head; and

(n) a limitation mechanism which prevents the upward movement of the liquid suction valve against the cylinder for liquid when the stem is positioned at the upper limit, characterised in that the stroke of the pump head from the commencement of its downward movement when the pump head is depressed from its upper limit until the second piston is moved downward synchronously with the pump head smaller than an opening-closing stroke of the lower-part valve body of the liquid suction valve.

According to a preferred embodiment, the second piston is provided with an air hole which makes the inside and the outside of the cylinder for air communicate with one another, the air suction valve of the second piston is made up of an elastic material and comprises a cylinder portion fitted to the basic cylinder portion air-tightly and an annular diaphragm which is projected to the outside from the cylinder portion, and the diaphragm opens and closes the air hole of the second piston.

According to another preferred embodiment, the stem is provided with a taper-surface-shaped valve seat whose lower part has a small diameter in an upper part internal surface thereof, and the liquid discharge valve comprises a fitted plate which is fitted into the internal surface of the stem, a plurality of elastic pieces extending downward from the bottom surface of the fitted plate and a valve body which can be brought into contact with and separated from the valve seat of the stem and is provided on the lower end of the elastic pieces.

According to the present invention there is provided a container with a pump for discharging bubbles, comprising:

a container body having a neck portion; and

a pump for discharging bubbles provided on the neck portion of the container body,

wherein the pump for discharging bubbles comprises:

(a) a cylinder for liquid in which a first piston slides;

(b) a cylinder for air in which a second piston slides;

(c) a pump head on which a nozzle is provided and which is connected to the first piston and the second piston so as to drive the both pistons;

(d) a vapor-liquid mixing chamber in which liquid delivered from the cylinder for liquid and air delivered from the cylinder for air are joined;

(e) a liquid discharge valve which can be brought into contact with and separated from a valve seat provided on a liquid entrance of the vapor-liquid mixing chamber;

(f) a bubbling member provided between the nozzle and the vapor-liquid mixing chamber; and

(g) a limitation member which is provided on the upper part of the valve seat of the liquid discharge valve and limits the vertical-direction-maximum-migration-length from the valve seat of the liquid discharge valve and

liquid within the container body and outside air are joined in the vapor-liquid mixing chamber and the joined vapor-liquid is bubbled via the bubbling member to be discharged in a foamy state from the nozzle by depressing the pump head;

characterised in that the pump further comprises:

(h) a stem which is fixed to a lower portion of the pump head;

(i) a casing within which the bubbling member is provided, the casing having a lower end which is inserted into the stem; wherein

the lower end of the casing functions as the limitation member, and

the vertical-direction-maximum-migration length from the valve seat of the liquid discharge valve is limited within the range of from 0.1mm to 1.0mm.

The vertical-direction-maximum-migration-length of the liquid discharge valve may be set up within the range of from 0.2 mm to 0.3 mm.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a longitudinal section diagram of a container with a pump for discharging bubbles according to one embodiment.

Fig. 2 is a III-III section view diagram of Fig. 1.

Fig. 3 is a longitudinal section diagram of a modified embodiment of a container with a pump for discharging bubbles.

Fig. 4 is a longitudinal section diagram indicating a state that a pump head is positioned at an upper limit in a container with a pump for discharging bubbles according to the present invention.

Fig. 5 is a longitudinal section diagram indicating a state where the pump head is partly depressed in the container.

Fig. 6 is an enlarged longitudinal section diagram indicating the principal part of the container with the pump.

Fig. 7 is another enlarged longitudinal section diagram indicating the principal part of the container with the pump.

Fig. 8 is an enlarged longitudinal section diagram around a liquid discharge valve of the container with the pump; and

Fig. 9 is a diagram indicating a discharging state of bubbles of the container with the pump.

PREFERRED EMBODIMENTS OF THE INVENTION

The preferred embodiments of the present invention will be described with reference to the drawings as follows.

The container with a pump for discharging bubbles according to a preferred embodiment will be described in accordance with Figs. 1 and 2.

The container with a pump for discharging bubbles comprises a container body 1 in which a neck portion 2 is provided on the upper end, a pump

for discharging bubbles 10 provided on the neck portion 2 and an attaching trunk 150 for fixing the pump for discharging bubbles 10 on the neck portion 2.

The pump for discharging bubbles 10 comprises a cylinder member 20, a liquid suction valve 30, a stem 40, a first piston 50, a second piston 60, a liquid discharge valve 70, a first air suction valve 80, a second air suction valve 90, a pump head 100 and a bubbling element 132.

In the cylinder member 20, a flange portion 21 provided on the upper-part external surface is engaged to the upper end portion of the neck portion 2 of the container body 1 to be hung down into the container body 1, and the upper part of the cylinder member 20 functions as a large-diameter cylinder portion 22 and the lower half which is hung down through a bottom plate portion 23 from the lower end of the large-diameter cylinder portion 22 functions as a small cylinder portion 24.

The large-diameter cylinder portion 22 is stood up to the upper part of the flange portion 21, and an air hole 27 to the container body 1 is provided on the basic end portion of the flange portion 21.

A taper cylinder shaped valve seat 24a is provided on the lower end internal surface of the small diameter cylinder portion 24 through an upward stepped portion 24c to hang down a connection cylinder 25 while making it communicate with a valve hole of the valve seat 24a , the upper end portion of suction pipe 201 is fitted into the connection cylinder 25 to hang down the suction pipe 201 to the inside bottom of the container 1, and a plurality of vertical ribs 26 are stood up at regular intervals from the upward stepped portion 24c.

The cylinder member 20 is attached at flange portion 21 by the attaching trunk 150 screwed on the neck portion 2 of the container body 1. In the attaching trunk 150, the flange portion 21 is held between the top wall 154 of the upper end of the peripheral wall 153 screwed on the external surface of the neck portion 2 and the upper end surface of the neck portion 2, and the top wall 156a is provided in the inside projectingly from the rising cylinder portion 156 stood up from the top wall 154 and a central cylinder portion 151 is hung down from the

internal of the top wall 156a. A concave groove 157 can be provided vertically on the internal surface of the central cylinder portion 151. The first air suction valve 80 is fitted to the internal surface of the central cylinder portion 151.

In the first air suction valve 80, an elastic plate which is opened to upper outside is projected from the lower end of a fitting cylinder to the central cylinder portion 151, the elastic plate upper end external surface is in contact with the upper end cylinder part internal surface of the cylinder member 20 with pressure and when the inside of the container body 1 is pressurized negatively due to the decrease in the liquid, the elastic plate upper end portion is widened and the air passes through the space between the upper end surface of the upper end cylinder part of the cylinder member 20 and the top wall 156a, the space between the upper end cylinder part of the cylinder member 20 and the rising cylinder portion 156 and the air hole 27 to get into the container body 1 so as to dissolve the negative pressurization state.

The stem 40 is projected from the small diameter cylinder portion 24 in a state that it is energized upward by the coil spring 39 whose lower end is mounted on the plurality of vertical ribs 26 and is received within the small diameter cylinder portion 24. The first piston 50 is fitted to the lower end of the stem 40, and the internal surface of the fitting cylinder 108 hung down from the pump head 100 with a nozzle 107 is fitted to the upper end of the stem 40.

The liquid discharge valve 70 is provided on the upper part internal surface of the stem 40, and a bubbling element 132 in which both upper and lower ends of a short cylinder 135 are closed with a net 133 is fitted to the upper part internal surface of the fitting cylinder of the upper part of the liquid discharge valve 70.

A fitting plate 71 is formed such that it is attached fittingly to the upper end part internal surface of the stem 40 so that an elastic piece 72 will brings a valve body 73 into contact with a valve seat 41 with pressure by the valve seat 41 of taper shape of lower part small diameter provided on the upper part internal surface of the stem 40 and the liquid discharge valve 70 in which the valve body 73 of lower part small diameter is provided on the lower end of the plurality

of elastic pieces 72 hung down from the lower surface of the fitting plate 71 provided with a hole. A plurality of vertical ribs 42 are provided vertically on the internal surface of the stem 40 in the lower part of the valve seat 41.

The fitting cylinder hung down from the pump head 100 is formed in a dual cylinder shape so as to prevent the fitting cylinder from becoming wall-thicken. Reference numeral 108 in Fig. 1 (and also in Fig. 3) designates the outer cylinder of the fitting cylinder. Reference numeral 108x in Fig. 1 (and also in Fig. 3) designates the inner cylinder of the fitting cylinder. The lower end portion of the fitting cylinder to which the upper part of the stem 40 is fitted functions as a large inside diameter portion 108g. Besides, a vertical groove 108a is provided on the internal surface of the fitting cylinder in the space between the upper end of the large inside diameter portion 108g and the fitting part of the short cylinder 135a, and the external surface of the short cylinder 135 is provided with the vertical groove 135a which makes a vapor-liquid mixing chamber 46 formed on the space between the fitting plate 71 of valve body 73 and the short cylinder 135 and the vertical groove 108a communicate with one another so that both upper ends of vertical grooves 108a and 135a are connected with one another to function as a part of an air passage 160 mentioned later.

A flange portion 43 which projects a cylinder portion to the diagonal upper outside from the outside end of a plate portion which is projected to the outside is provided on the middle portion external surface of the stem 40 so that the flange portion 43 can be engaged to the second piston 60 fitted into the large-diameter cylinder portion 22.

The second piston 60 is formed such that a stepped cylinder portion 63 which is projected from a basic cylinder portion 62 fitted to the external surface of the stem 40 in the upper part of the flange portion 43 is connected to the seal cylinder portion 61 fitted to the large diameter cylinder portion 22, and a passage is provided on the space between the external surface of the stem 40 to which the basic cylinder portion 62 is fitted and the basic cylinder portion 62 by installing a groove 62a on the internal surface vertically and so on, and the upper end of the basic cylinder portion 62 is enlarged to the upper outside to fit the upper

end periphery to the internal wall surface of the large-inside-diameter portion 108g air-tightly.

An air hole 64 is provided on the stepped cylinder portion 63, and an elastic cylinder is fitted air-tightly to the external surface of the basic cylinder portion 62 in the lower part of the stepped cylinder portion 63 to close the air hole 64 an elastic thin plate 93 which is projected to the outside from the elastic cylinder, and the second air suction valve 90 to the inside of the large-diameter cylinder portion 22 is formed by the air hole 64 and the elastic thin plate 93.

However, the second air suction valve 90 may be needless, if the above-mentioned air hole 64 is provided so as to close the lower end surface of the fitting cylinder when the pump head 100 is depressed.

The second piston 60 can be moved upward and downward only a little stroke to the stem 40, and when the stem 40 is descended to the second piston 60 by depressing the pump head 100, the flange portion 43 is separated from the lower end of the basic cylinder portion 62 to open the air passage 160 which is formed by the groove 62a, vertical groove 108a and the like are formed so as to make the inside of the large-diameter cylinder portion 22 and the vapor-liquid mixing chamber 46 communicate with one another. The lower end surface of the fitting cylinder comes into contact with the upper surface of the stepped cylinder portion 63 to push down the second piston 60.

After the stem 40 is descended, when the pump head 100 is released, the flange 43 comes into contact with the lower end surface of the basic cylinder portion 62 to close the air passage, and the second piston 60 and the stem 40 are pushed up together so that the outside air passes through the space between the central cylinder portion 151 and the fitting cylinder 108 and the air hole 64 to get into the large diameter cylinder portion 22.

A liquid suction valve 30 whose lower end functions as a lower-part valve body 31 is projected from the inside of the bottom of the small cylinder portion 24 in a state that the upper part is fitted into the stem 40 so as to be moved upward and downward a little stroke freely by the frictional engagement with the stem 40.

In the liquid suction valve 30, a plurality of engagement pins 32 are projected radially from the lower part external surface, and as shown in Fig. 62, the engagement pins 32 are fitted to the vertical ribs 26 in the bottom of the small-diameter cylinder portion 24 in a state that they can be moved upward and downward so that the upper limit of the liquid suction valve 30 is determined by enlarging the liquid suction valve 30 to the lower end of the coil spring 39 mounted on the upper end of the vertical rib 26, and the lower limit is determined by bringing the lower part valve body 31 into contact with the valve seat 24a to close the valve when the stem 40 is descended.

A vertical groove 33a is provided on the liquid suction valve 30 and an upper-part valve body 35 which is extended to the diagonal upper outside is provided on the upper end portion of the liquid suction valve 30 so as to engage the upper end external surface of the upper-part valve body 35 to the internal surface of the stem 40 by frictional force.

Further, although the cylinder portion 53 stood up from the seal portion 51 is fitted into the lower part of the stem 40 in the present embodiment, the stem 40 and the first piston 50 may be formed in a body.

In the state shown in Fig. 1, the large and small gaps are formed on the space between the valve seat 24a formed on the bottom internal surface of the small diameter cylinder portion 24 and the lower part valve body 31 of the lower end of the liquid suction valve 30 which is stood up from the inside of the bottom and whose upper part is fitted into the stem 40, and the space between the stepped cylinder portion 63 of the second piston 60 fitted into the large-diameter cylinder portion 22 and the lower end of the fitting cylinder 108 hung down from the pump head 100 respectively.

If the pump head 100 is depressed in the state, the pump head 100, the stem 40 and the liquid suction valve 30 are descended to the second piston 60 and the cylinder member 20, and the second piston 60 is also descended to the cylinder member 20 by contacting the lower end of the fitting cylinder with the stepped cylinder 63, and then the lower part valve body 31 is descended to the valve seat 24a to close the valve.

The air passage 160 is opened by descending the pump head 100 and the like and the air within the large-diameter cylinder portion 22 is pressurized by descending the second piston 60 to get into the vapor-liquid mixing chamber 46. After that, the liquid within the small diameter cylinder portion 24 and the stem 40 are pressurized to open the liquid discharge valve 70, the liquid gets into the mixed air to be mixed with the air and the liquid passes through the bubbling element 132 to be discharged in a foamy state from the nozzle 107, when the valve which is formed by the valve seat 24a and the lower part valve body 31 is closed and the first piston 50 and the stem 40 are descended to the liquid suction valve 30.

If the pump head 100 is released after being depressed, the liquid suction valve 30 and the stem 40 are ascended to the cylinder member 20 and the second piston 60, the flange portion 43 of the stem 40 comes into contact with the lower end surface of the basic cylinder portion 62 to push up the second piston 60, and the liquid suction valve 30 is stopped to the cylinder member 20 and the stem 40 is moved to the upper limit by bringing the engagement pin 32 which is projected radially from the lower part external surface of the liquid suction valve 30 into contact with the lower end surface of the coil spring 39.

The mixing ratio of the air volume and liquid volume can be kept proper even in the beginning of depressing the pump head 100, and the bubbling is never incomplete due to the lack of the air volume for the liquid volume as in the prior art, because, first of all, when the pump head is depressed, the valve seat 24a of the small diameter cylinder portion 24 is closed by the lower part valve body 31 of the liquid suction valve 30 after the air passage 160 for making the large diameter cylinder portion 22 communicate with the vapor-liquid mixing chamber 46 is opened and the pressurized air starts flowing into the vapor-liquid mixing chamber 46, and accordingly the inside of the small diameter cylinder portion 24 between the liquid suction valve 30 and the liquid discharge valve 70 and the inside of the stem 40 are pressurized to open the liquid discharge valve 70 and the liquid gets into the vapor-liquid mixing chamber 46 after the pressurized air starts flowing into the vapor-liquid mixing chamber 46 in the above-mentioned way. This is due to the fact that the gap between the stepped cylinder

portion 63 of the second piston 60 and the fitting cylinder hung down from the pump head 100 is smaller than the gap between the valve seat 24a of the small-diameter cylinder portion 24 and the lower part valve body 31 of the liquid suction valve 30.

The air within the large-diameter cylinder portion 22 does not leak through the air hole 64, and accordingly the air within the large-diameter cylinder portion 22 can be delivered securely to the vapor-liquid mixing chamber 46 through the air passage 160 when the pump head 100 is depressed, because the elastic cylinder of the first air suction valve 80 is fitted air-tightly to part of the external surface of the basic cylinder portion 62 in the lower part of the stepped cylinder portion 63 of the second piston 60, and the air hole 64 provided on the stepped cylinder portion 63 is closed by the elastic thin plate 93 which is projected to the outside from the elastic cylinder to function as the second air suction valve 90 to the inside of the large-diameter cylinder portion 22.

The inside of the stem 40 in the lower part of the liquid discharge valve 70, the inside of the small diameter cylinder portion 24 and the like are filled with the liquid all the time, because the liquid discharge valve 70 is closed elastically by energization, and accordingly the liquid within the stem 40 and the like flow into the vapor-liquid mixing chamber 46 simultaneously with the release of the liquid discharge valve 70 by the depressing of the pump head 100. As a result, the bubbles in which the air and liquid are mixed at the proper ratio can be discharged simultaneously with the depressing of the pump head 100.

Then, a modified embodiment of the container with a pump for discharging bubbles will be described in accordance with Fig. 3.

Although the modified example is almost the same as those shown in Figs. 1 and 2, the constructions of the modified example are partially different from those shown in Figs. 1 and 2. So only the important parts which are different from those shown in Figs. 1 and 2 will be described. In the cylinder member 20, the fitting cylinder portion 28 is stood up from the periphery of the flange portion 21, the fitting cylinder portion 28 is fitted fixedly to the space between the upper part internal surface of the peripheral wall 153 of the attaching trunk 150

and the engagement cylinder 155 hung down from the top wall 154 so that the whole pump for discharging bubbles 10 is formed in a state that it can be removed in a body by removing the attaching trunk 150 from the neck portion 2 of the container body 1.

The upper end portion of the large diameter cylinder portion 22 is projected a little to the upper part of the flange portion 21. Accordingly, the fitting cylinder of the first air suction valve 80 is extended to the lower part of the central cylinder portion 151, the elastic plate is projected to the upper outside through the flange from the lower end of the fitting cylinder, and the upper end of the elastic plate is in contact with the upper end portion of the internal surface of the large-diameter cylinder portion 22 with pressure.

The upper end of the cylinder portion 53 stood up from the seal portion 51 of the firs piston 50 to be fitted into the lower part of the stem 40 is curved to the upper inside, and the upper end surface of the cylinder portion 53 is brought into contact water-tightly with the middle portion external surface of the upper part valve body 35 with pressure in a state that the elastic deformation can occur. The upper-part valve body 35 is provided such that the middle portion within the stem 40 is closed when the stem is ascended so that there is no trouble even if the liquid discharge valve 70 is opened when the container falls down and so on.

The liquid discharge valve 70 is formed in a ball valve, and the casing 131 is fitted to the space between the bubbling element 132 in the upper part of the liquid discharge valve 70 and the liquid discharge valve 70. The upper part of the casing 131 functions as a large diameter portion 131a, the lower half of the bubbling element 132 and fitted into the large-diameter portion 131a, the lower part of the casing 131 is formed to a small-diameter portion 131b and fitted into the upper end portion of the stem 40 and a plurality of blocking pieces 131c are hung down from the lower end surface of the small diameter portion 131b so that the liquid discharge valve 70 does not close the lower end opening of the casing 131 by the pushing up of the liquid passing through the discharge valve hole.

The air passage 160 is formed by the vertical groove 108a of the internal surface of the fitting cylinder 108 to which the upper part of the stem 40 is fitted, a horizontal groove 131e provided on the lower end surface of the large diameter portion 131a and a groove 131f provided vertically on the external surface of the small diameter portion 131b.

The air hole 64 of the second piston 60 is provided on the end portion of the basic cylinder portion 62 of the stepped cylinder portion 63, and the elastic thin plate 93 which functions as a valve body for opening and closing the air hole 64 is in contact with to the middle portion internal surface of the cylinder portion 63a whose outside end portion is provided on the middle portion of the stepped cylinder portion 63 with pressure.

The container with a pump for discharging bubbles will be further described in accordance with Fig. 4 to Fig. 9.

Fig. 4 and Fig. 5 are longitudinal section diagrams of the container with a pump for discharging bubbles, and Fig. 6 to Fig. 8 are enlarged diagrams indicating the principal parts.

In the container with a pump for discharging bubbles, the pump for discharging bubbles 10 is provided on the neck portion of the container body 1. The liquid having a bubbling property such as a liquid for washing faces is received within the container body 1.

The pump for discharging bubbles 10 comprises a cylinder member 20, a liquid suction valve 30, a stem 40, a first piston 50, a second piston 60, a liquid discharge valve 70, a first air suction valve 80, a second air suction valve 90, a pump head 100, a bubbling unit 130 and an attaching trunk 150.

The cylinder member 20 has an annular flange portion 21 on the upper end, and is constructed such that a large-diameter cylinder portion (cylinder for air) 22 of a cylinder shape whose inside functions as a vapor chamber is extended downward from the flange portion 21, a small diameter cylinder portion (cylinder for liquid) 24 of a cylinder shape whose inside functions as a liquid

chamber is extended downward from a bottom plate portion 23 of the large-diameter cylinder portion 22 in a concentric shape, and a connection cylinder 25 is extended downward from the lower end of the small-diameter cylinder portion 24.

In a state that the large-diameter cylinder 22, the small diameter cylinder portion 24 and the connection cylinder 25 are inserted into the container body 1 from the neck portion 2, and a flange portion 21 is mounted on a packing 200 arranged on the upper surface of the neck portion 2, the cylinder member is fixed on the container body 1 by the attaching trunk 150 screwed on the neck portion 2. In the flange portion 21, a plurality of air holes 27 are provided in a region inside than the neck portion 2.

A suction pipe 201 is connected to the attaching trunk 150 of the cylinder member 20, and the lower end of the suction pipe 201 is extended to the bottom of the container body 1.

A central cylinder portion 151 is provided on the center of the attaching trunk 150, and a pump head 100 is projected from the central cylinder portion 151 in a state that it can be moved upward and downward. The bubbling unit 130 is provided within the pump head 100, and the stem 40 which moves in the inside of the cylinder member 20 upward and downward is connected to the lower part of the pump head 100 fixedly. The liquid discharge valve 70 is provided on the inside of the stem 40, and the second piston 60 which slides on the internal surface of the large-diameter cylinder unit 22 air-tightly is provided on the peripheral portion of the stem 40. The second air suction valve 90 is provided on the second piston 60. The first piston 50 which slides on the internal surface of the small diameter cylinder portion 24 fluid-tightly is linked to the lower part of the stem 40, and the liquid suction valve 30 which is connected to the stem 40 and the first piston 50 to be operated and opens and closes the connection cylinder 25, is arranged on the lower portion of the first piston 50.

Each of the constructions will be described in detail below. The liquid suction valve 30, a coil spring 39 and the first piston 50 are received within the small-diameter cylinder portion 24 of the cylinder member 20. The lower end of the liquid suction valve 30 is formed into the lower-part valve body 31 which can

be brought into contact with and separated from the valve seat 24a of a taper surface formed on the lower end of the small diameter cylinder portion 24.

In the liquid suction valve 30, a plurality of engagement pins 32 which are projected to the outside are provided above the lower-part valve body 31, and the engagement pin 32 is inserted between the vertical ribs 26 provided on the lower end of the small diameter cylinder portion 24 in a state that they can be moved upward and downward.

In the liquid suction valve 30, the portion upper than the engagement pins 32 is as a large-diameter portion 33, and the small-diameter portion 34 is linked to the upper part of the large-diameter portion 33. The vertical grooves 33a and 34a which are extended in the vertical direction are formed on the external surface of the large-diameter portion 33 and the peripheral surface of the small-diameter portion 34 respectively. The upper end of the liquid suction valve 30 linked to the small-diameter portion 34 functions as an upper part valve body of a taper cylinder shape whose diameter gets larger as it proceeds upward.

The first piston 50 is formed in a hollow cylinder shape in which the upper and lower ends are opened, the lower part of the first piston 50 functions as a seal portion 51 which slides on the internal surface of the small-diameter cylinder portion 24 fluid-tightly, and the upper part opening margin of the first piston 50 functions as a valve seat 52.

The upper part valve body 35 of the liquid suction valve 30 is projected upward from the upper-part opening of the first piston 50 and can be brought into contact with and separated from the valve seat 52 of the first piston 50 to open and close the upper part opening of the first piston 50.

As shown in Fig. 4, normally, in the inside of the first piston 50, the small-diameter portion 34 of the liquid suction valve 30 is inserted into the space between the internal surface of the first piston 50 and the small-diameter portion 34 in a state that there is the enough space between them. As shown in Fig. 5, when the stem 40 is descended by depressing the pump head 100, the large-diameter portion 33 of the liquid suction valve 30 can be inserted into the

space between the internal surface of the first piston 50 and the large-diameter portion 33 in a state that there is the enough space between them, and the liquid passage is secured by the vertical groove 33a at the time.

The coil spring 39 is provided on the space between the upper end of the vertical rib 26 and the first piston 50 in the cylinder member 20, and energizes the first piston 50 upward. On the other hand, the engagement pin 32 of the liquid suction valve 30 can hold the lower end of the coil spring 39 engagedly from the downward, and accordingly the engagement pin 32 controls the upper limit of the liquid suction valve 30 when it is moved upward.

The stem 40 is formed in a cylinder shape in which the upper and lower ends are opened, and is received within the large-diameter cylinder portion 22 and the small-diameter cylinder portion 24 in a state that it can be moved upward and downward. The upper part of the first piston 50 is inserted into and fixed on the lower part of the stem 40, and the seal portion 51 is projected from the lower part of the stem 40.

The valve seat 41 of an annular shape which is projected in a cross section of an L-like shape is formed on the inside upper part of the stem 40. In the inside of the stem 40, the upper side of the valve seat functions as a vapor-liquid mixing chamber 46, and the inside of the valve seat functions as a liquid entrance to the vapor-liquid mixing chamber. The spherical liquid discharge valve 70 which can be brought into contact with and separated from the valve seat 41 is received within the vapor-liquid mixing chamber in a state that it can be moved. The liquid discharge valve 70 functions as a check valve, and comes into contact with the valve seat 41 to prevent the liquid and air from returning to the part lower than the valve seat 41.

In the inside of the stem 40, a plurality of vertical ribs 42 which are extended in the vertical direction are provided on the portion from a region on which the first piston 50 is fixed, to the lower part of the valve seat 41 in a state that they are dispersed with respect to the circumferential direction. As shown in Fig. 5, the upper-part valve body 35 and small-diameter portion 34 of the liquid suction valve 30 can be inserted into the inside of the vertical rib 42, when the

pump head is depressed to make the stem 40 descend. At the time, the space between the vertical ribs 42 and the vertical groove 34a in the small-diameter portion 34 of the liquid suction valve 30 function as a liquid passage.

The pump head 100 linked to the upper part of the stem 40 is formed in a topped cylinder shape in which the outside cylinder portion 101, the inside cylinder portion 102 and the top board portion 103 are formed in a body. The nozzle 107 is opened to the upper-part one side of the outside cylinder portion 101, and the nozzle 107 is linked to the inside cylinder portion 102 through the bubble passage formed on the upper-part inside of the pump head 100. In the inside of the inside cylinder portion 102, the bubbling unit 130 is received within the upper part fixedly, and the upper part of the stem 40 is inserted into the lower side of the bubbling unit 130 fixedly.

In the internal surface of the inside cylinder portion 102, a plurality of vertical grooves 102a which are extended in the vertical direction are provided on the region to which the stem 40 is fitted inwardly in a state that they are dispersed with respect to the circumferential direction. The upper end of the vertical groove 102a is extended to the position a little upper than the upper end of the stem 40, and the vertical groove 102a functions as an air passage. The lower end portion of the inside cylinder portion 102 is formed in thin wall, and functions as a cylinder-shaped valve body 102b.

The bubbling unit 130 comprises a casing 131 of a hollow cylinder shape in which the upper and lower ends are opened and two bubbling elements 132 provided on the casing 131. The upper side of the casing 131 functions as a large-diameter portion 131a and the lower end of the casing 131 functions as a small diameter portion 131b, the large-diameter portion 131a is inserted into and fixed on the inside of the inside cylinder portion 102, and the small-diameter portion 131b is inserted into the stem 40 in a state that there is the gap in the diametral direction. Besides, there is the gap between the bottom of the large-diameter portion 131a and the upper end of the stem 40, and the gaps function as an air passage.

The bubbling element 132 is formed in a state that the net (bubbling member) 133 is provided on one end opening of the cylinder body in which the upper part and lower part are opened. In the bubbling element 132 arranged on the lower end of the casing 131, the net 133 is provided on the lower end opening of the cylinder body. In the bubbling element 132 arranged on the upper side of the casing 131, the net 133 is provided on the upper end opening of the cylinder body.

A plurality of vertical grooves which are extended upward from the lower end surface are formed on the lower-part internal surface of the small diameter portion 131b of the casing 131 so that the passage for liquid and air can be secured even when the liquid discharge valve 70 comes into contact with the lower end of the small diameter portion 131b.

The small-diameter portion 131b has a function as a limitation member for controlling the upward movement region of the liquid discharge valve 70, and as shown in Fig. 8, the distance between the valve seat 41 and the small-diameter portion 131b is set up so that the movement length S in which the liquid discharge valve 70 is moved upward in the vertical direction to come into contact with the lower end of the small-diameter portion 131b will be from 0.1 mm and to 1.0 mm.

In the periphery of the stem, the annular flange portion 43 which is projected to the outside is formed near the center in the vertical direction, and the annular rising wall 44 is provided upwardly and projectingly on the upper surface of the flange portion 43. The internal surface of the rising wall 44 is formed on the taper surface whose diameter gets wider as it proceeds upward.

In the stem 40, the second piston 60 is fitted outwardly to the space between the flange portion 43 and the pump head 100 in a state that it can be moved upward and downward a little. The second piston 60 is formed in a hollow cylinder shape in which the upper and lower ends are opened, the utmost outside portion is formed on the seal cylinder portion 61 which slides on the internal surface of the large-diameter cylinder portion 22 of the cylinder member 20 air-tightly, the utmost inside portion is formed on the basic cylinder portion 62 to

which the stem 40 is fitted outwardly, and the seal cylinder portion 61 and the basic cylinder portion 62 are connected with one another by the stepped cylinder portion 63 whose cross section is bent in a step shape.

The upper part of the basic cylinder portion 62 is in contact with the internal surface of the cylinder-shaped valve body 102b of the pump head 100 with pressure air-tightly in a state that it can be slid. The air holes 64 are provided in the portion where the basic cylinder portion 62 is connected to the stepped cylinder portion 63 in a state they are dispersed with respect to the circumferential direction, and the air holes are opened and closed by relative upward and downward movement between the pump head 100 and the second piston 60. Namely, the air holes 64 are closed when the pump head 100 is moved upward and downward relatively to the second piston 60 and the cylinder-shaped valve body 102b of the pump head 100 comes into contact with the portion where the basic cylinder portion 62 is connected to the stepped cylinder portion 63, and the air holes 64 are opened when the cylinder-shaped valve body 102b is separated from the above-mentioned connection portion.

The lower end of the basic cylinder portion 62 is brought into contact with and separated from the rising wall 44 of the stem 40 by relative upward and downward movement between the stem 40 and the second piston 60. In the external surface of the stem 40, a plurality of vertical grooves 45 which are extended in the vertical direction are provided in the region to which the basic cylinder portion 62 is fitted outwardly in a state that they are dispersed with respect to the circumferential direction. The vertical groove 45 is linked to the inside of the large-diameter cylinder portion 22 when the lower end of the basic cylinder portion 62 is separated from the rising wall 44 of the stem 40, and the vertical groove 45 is shut off from the inside of the large-diameter cylinder portion 22 when the lower end of the basic cylinder portion 62 comes into contact with the rising wall 44.

The second air suction valve 90 is fixed on the lower part of the basic cylinder portion 62. The second air suction valve 90 is provided with an annular diaphragm 91 of upward taper which is extended in the diametral direction outside from the lower end. The diaphragm 91 has an elasticity, and the outside

marginal portion of the diaphragm 91 is normally brought into contact with the lower surface of the stepped cylinder portion 63 with pressure to be sealed, and it is operated so that the outside margin of the diaphragm 91 is pulled downward by the negative pressure within the large-diameter cylinder portion 22 to be separated from the stepped cylinder portion 63.

In the attaching trunk 150, the cylinder-shaped rib 152 is provided on the outside of the central cylinder portion 151, and the first air suction valve 80 which seals the space between the attaching trunk 150 and the internal surface of the large-diameter cylinder portion 22, is fixed on the lower end of the cylinder-shaped rib 152. The seal cylinder portion 81 of the first air suction valve 80 attached to the large-diameter cylinder portion 22 is formed in a taper cylinder shape to be extended in the diagonal upper direction and has an elasticity. Besides, it is operated so that the upper end part of the seal cylinder portion 81 is pulled to the diametrical direction inside by the negative pressure within the container body 1 to be separated from the internal surface of the large-diameter cylinder portion 22.

Further, a clear cover 202 is detachably provided on the attaching trunk 150.

Then, the operation of the container with a pump for discharging bubbles in the embodiment will be described.

Fig. 4 and Fig. 6 indicate a state that the pump head 100 is not yet depressed, namely, a state that the pump head is positioned at the upper limit. First of all, the cover 202 is removed when the bubbles are discharged.

In the state that the pump head is not yet depressed, the liquid suction valve 30 is pushed up by the coil spring 39 through the first piston 50, the lower-part valve body 31 is separated from the valve seat 24a of the cylinder member 20, and the inside of the small diameter cylinder portion 24 is made to communicate with the inside of the container body 1 through the suction pipe 201. The upper-part valve body 35 of the liquid suction valve 30 is in contact with the valve seat 52 of the first piston 50 to close the upper-part opening of the first

piston 50. The lower end of the basic cylinder portion 62 of the second piston 60 is attached to the rising wall 44 of the stem 40, the first air suction valve 80 is in contact with the stepped cylinder portion 63 of the second piston 60 and the large-diameter cylinder portion 22 of the cylinder member 20 with pressure, and the lower end of the cylinder-shaped valve body 102b of the pump head 100 is separated from the stepped cylinder portion 63 of the second piston 60 to open the air hole 64.

If the pump head 100 is depressed in the above-mentioned state, the stem 40 and the first piston 50 will be descended together with the pump head 100. As a result, as shown in Fig. 7, the upper part valve body 35 of the liquid suction valve 30 is separated from the valve seat 52 of the first piston 50 to open the upper-part opening of the first piston 50. At almost the same time, the inside of the small-diameter cylinder portion 24 is pressurized by descending of the first piston 50, the liquid suction valve 30 is descended by the hydraulic pressure within the small-diameter cylinder portion 24, and the lower-part valve body 31 comes into contact with the valve seat 24a to close the lower-part opening of the small diameter cylinder portion 24. On the other hand, the second piston 60 is standing by the frictional force between the seal cylinder portion 61 and the large-diameter cylinder portion 22 right after the depressing of the pump head 100 has been started. As a result of descending the stem 40 in the state, the lower end of the basic cylinder portion 62 of the second piston 60 is separated from the rising projection 44 of the stem 40, and the lower end of the cylinder-shaped valve body 102b of the pump head 100 comes into contact with the stepped cylinder portion 63 of the second piston 60 to close the air hole 64.

The second piston 60 is descended together with the pump head 100, the stem 40 and the first piston 50, after the lower end of the cylinder-shaped valve body 102b of the pump head 100 comes into contact with the stepped cylinder portion 63 of the second piston 60.

If the pump head 100 is descended after that, the liquid within the small-diameter portion 24 pressurized by the first piston 50 passes through the upper-part opening of first piston 50 and the vertical grooves 33a and 34a of the liquid suction valve 30 and passes through the space between the vertical ribs 42

of the stem 40 to be pushed out to the upper-part of the upper part valve body 35, and pushes up the liquid discharge valve 70 with the hydraulic pressure from the valve seat 41 to flow into the vapor-liquid mixing chamber 46 (See Fig. 2). On the other hand, the air received within the large-diameter cylinder portion 22 passes through the space between the flange portion 43 and rising projection 44 of the stem 40 and the lower end of the basic cylinder portion 62 in the second piston 60, passes through the vertical groove 45 of the stem 40, passes through the vertical groove 102a of the inside cylinder portion 102 in the pump head 100, and passes through the passage between the casing 131 of the bubbling unit 130 and the stem 40 to flow into the vapor-liquid mixing chamber 46.

Then, the liquid and air are joined and mixed in the vapor-liquid mixing chamber to be delivered into the bubbling unit 130. After that, the liquid is bubbled when it passes through the upper and lower two nets 133 of the bubbling unit 130 and the bubbled liquid is pushed into the bubble passage 105 of the pump head 100 to be discharged from the nozzle 107 of the pump head 100. Fig. 9 indicates a discharging state of the bubbles at this time.

When the finger is off from the pump head 100 after the depressing of the pump head 100 has been completed, the hydraulic pressure within the small-diameter cylinder portion 24 and the air pressure within the large-diameter cylinder portion 22 fall, the liquid discharge valve 70 comes into contact with to the valve seat 41, and the first piston 50, the stem 40 and the pump head 100 is pushed upward by the elasticity of the coil spring 39.

Hereupon, the second piston 60 is standing by the frictional force between the seal cylinder portion 61 and the large-diameter cylinder portion 22 right after the pushing up of the stem 40 has begun. As a result of ascending the stem 40 in the state, the internal surface of the rising wall 44 of the stem 40 comes into contact with the lower end of the basic cylinder portion 62 of the second piston 60 with pressure, and the space between the inside of the large-diameter cylinder portion 22 and the vertical groove 45 of the stem 40 is shut off. At the same time, the lower end of the cylinder-shaped valve body 102b of the pump head 100 is separated from the stepped cylinder portion 63 of the second piston 60 to open the air hole 64.

The first piston 50, the stem 40, the second piston 60 and the pump head 100 are ascended together after the internal surface of the rising wall 44 comes into contact with the lower end of the basic cylinder portion 62.

The inside of the small diameter cylinder portion 24 is pressurized negatively when the first piston 50 is ascended, and accordingly the liquid suction valve 30 is pulled up, the lower-part valve body 31 is separated from the valve seat 24a, and the inside of the small-diameter cylinder portion 24 is made to communicate with the inside of the container body 1. As a result, the liquid within the container body 1 is sucked up into the small-diameter cylinder portion 24 as the first piston 50 is ascended.

The inside of the container body 1 is pressurized negatively when the liquid is pumped up into the small-diameter cylinder portion 24, and accordingly the seal cylinder portion 81 of the first air suction valve 80 is drawn in the direction away from the internal surface of the large-diameter cylinder portion 22.

Besides, the inside of the large-diameter cylinder portion 22 is also pressurized negatively as the second piston 60 is ascended, and accordingly the diaphragm 91 of the second air suction valve 90 is drawn downward to be separated from the stepped cylinder portion 63 of the second piston 60, and the gap is generated.

As a result of operating of the first air suction valve 80 and the second air suction valve 90 in the above-mentioned way, the outside air is sucked into the attaching trunk 150 from the space between the central cylinder portion 151 of the attaching trunk 150 and the pump head 100. Then, part of the air passes through the air hole 64 of the second piston 60 to get into the large-diameter cylinder portion 22, and the other air passes through the air hole 27 of the flange portion 21 in the cylinder member 20 to get into the container body 1. Accordingly, the pressures within the large-diameter portion 22 and the container body 1 are equal to the air pressure, the first piston 50 and the second piston 60 are ascended smoothly, and the liquid is pumped up into the small-diameter cylinder portion 24 smoothly.

As mentioned hereinbefore, when the finger is off from the pump head 100 after the depressing of the pump head 100 has been completed, the hydraulic pressure within the small-diameter cylinder portion 24 falls, and the liquid discharge valve 70 separated upward from the valve seat 41 is descended to be brought into contact with the valve seat 41 so as to close the liquid entrance of the vapor-liquid mixing chamber 46.

It takes a little time to bring the liquid discharge valve 70 into contact with the valve seat 41 so as to close the liquid entrance, and the liquid and air within the vapor-liquid mixing chamber 46 flow into the stem 40 positioned in a portion lower than the valve seat 41 in the meantime. The air which has flown into the stem 40 at this moment may have a bad effect upon the pump for discharging bubbles 10 such as deteriorating the pump efficiency for the liquid and generating large bubbles at the beginning of discharging bubbles, when the bubbles are discharged for the next time.

However, in this pump for discharging bubbles 10, since the maximum movement range of the liquid discharge valve 70 from the state that it is in contact with the valve seat 41 to the state that it is moved to the vertical upper direction is limited within the range of from 0.1 mm to 1.0 mm by the small-diameter portion 131b of the bubbling unit 130, the time required for bringing the liquid discharge valve 70 separated from the valve seat into contact with the valve seat 41 is reduced extremely, and the liquid entrance of the vapor-liquid mixing chamber 46 can be closed in a moment. Accordingly, the air that flows backward into the stem 40 from the vapor-liquid mixing chamber 46 can be removed almost completely.

As a result, the pump efficiency for the liquid is improved, and as shown in Fig. 9 the small bubbles are generated from the beginning of discharging without generating the large bubbles.

Further, it has been confirmed that the particularly preferred result can be obtained and the effect is remarkable, if the vertical movement range from the state that the liquid discharge valve 70 is in contact with the valve seat 41 to the state

that the liquid discharge valve 70 comes into contact with the small diameter portion 131b of the bubbling unit 130 is within the range of 0.2 mm - 0.3 mm.

INDUSTRIAL APPLICABILITY

As mentioned hereinbefore, the container with a pump for discharging bubbles of the present invention have many advantages as follows. It is capable of performing the operation of discharging bubbles securely, it is capable of forming the bubbles securely, it is capable of discharging the bubbles from the nozzle securely, further, it is capable of changing the discharging form of the bubbles and it is capable of setting up the diameter of the bubble at a user's request. Accordingly, the container with a pump for discharging bubbles of the present invention is useful as a container for receiving the solutions which are used in a foamy state such as daily necessaries like the cleansing foam and shaving foam and the washing foam used for washing the tires of automobiles and the windows.

64881-466D

CLAIMS:

1. A container with a pump for discharging bubbles, comprising:

a container body having a neck portion; and the pump for discharging bubbles provided on the neck portion of the container body, wherein the pump for discharging bubbles comprises:

(a) a cylinder member in which a cylinder for liquid and a cylinder for air inserted into the container body from the neck portion are provided in an axial direction in a concentric arrangement and which has a flange portion mounted on the neck portion;

(b) an attaching trunk which is provided on the neck portion and holds the flange portion of the cylinder member in cooperation with the neck portion;

(c) a pump head which passes through the attaching trunk in a manner which permits the pump head to be moved upward and downward and in which a nozzle is provided on a portion exposed from the attaching trunk;

(d) a stem which has a hollow-cylinder-shape in which upper and lower ends are made open and is received within the cylinder member in a state so that it is capable of moving upward and downward, and in which the upper part thereof is connected to the pump head to be communicated with the nozzle and an annular flange portion is provided on a portion received within the cylinder for air;

(e) a first circular piston which is provided on the lower end of the stem and is capable of sliding on an internal surface of the cylinder for liquid upward and downward air-tightly;

(f) a second piston which is provided on an external surface of the stem of the pump head in a state so that it is capable of moving upward and downward, closes the opening end of the cylinder for air and has a basic cylinder portion fitted into the external surface of the stem and a seal cylinder portion which is capable of sliding upward and downward fluid-tightly on an internal surface of the

cylinder for air, and in which an upper part of the basic cylinder portion is fitted to a lower part of the pump head air-tightly, an air suction valve is provided on a connecting portion for connecting the basic cylinder portion to the seal cylinder portion and a lower part of the basic cylinder portion is capable of connecting to the flange portion of the stem fluid-tightly;

(g) a liquid suction valve which is suspended from the stem in a state that an upper part thereof is inserted into the stem so that it is capable of moving upward and downward and is capable of moving upward and downward together with the stem by engaging with the stem, and whose lower part is inserted into the cylinder for liquid in a state that it is capable of moving upward and downward to make the lower end function as a lower part valve body for opening and closing a liquid entrance of the cylinder for liquid;

(h) a liquid discharge valve arranged on the upper part inside of the stem;

(i) a bubbling member stored between the liquid discharge valve and the nozzle of the pump head;

(j) a vapor-liquid mixing chamber provided between the discharge valve and the bubbling member;

(k) an air passage which is provided between the pump head, the stem and the basic cylinder portion of the second piston and makes the cylinder for air communicate with the vapor-liquid mixing chamber;

(l) a liquid passage formed between the liquid suction valve, the internal surface of the cylinder for liquid and the internal surface of the stem;

(m) a coil spring which energizes the stem in the direction approaching the pump head; and

(n) a limitation mechanism which prevents the upward movement of the liquid suction valve against the cylinder for liquid when the stem is positioned at the upper limit, characterised in that the stroke of the pump head from the commencement of its downward movement when the pump head is depressed

from its upper limit until the second piston is moved downward synchronously with the pump head smaller than an opening-closing stroke of the lower-part valve body of the liquid suction valve.

2. The container with a pump for discharging bubbles according to Claim 1, wherein the second piston is provided with an air hole which makes the inside and an outside of the cylinder for air communicate with one another, the air suction valve of the second piston is made up of an elastic material and comprises a cylinder portion fitted to the basic cylinder portion air-tightly and an annular diaphragm which is projected to an outside from the cylinder portion, and the diaphragm opens and closes the air hole of the second piston.

3. The container with a pump for discharging bubbles according to Claim 1, wherein the stem is provided with a taper-surface-shaped valve seat whose lower part has a small diameter provided at an internal surface of the upper part of the stem, and the liquid discharge valve comprises a fitted plate which is fitted into the internal surface of the stem, a plurality of elastic pieces extending downward from a bottom surface of the fitted plate and a valve body which is capable of being brought into contact with and separated from the valve seat of the stem and is provided on a lower end of the elastic pieces.

4. A container with a pump for discharging bubbles, comprising:

a container body having a neck portion; and

the pump for discharging bubbles provided on the neck portion of the container body,

wherein the pump for discharging bubbles comprises:

(a) a cylinder for liquid in which a first piston slides;

(b) a cylinder for air in which a second piston slides;

(c) a pump head on which a nozzle is provided and which is connected to the first piston and the second piston so as to drive both pistons;

(d) a vapor-liquid mixing chamber in which liquid delivered from the cylinder for liquid and air delivered from the cylinder for air are joined;

(e) a liquid discharge valve which is capable of being brought into contact with and separated from a valve seat provided on a liquid entrance of the vapor-liquid mixing chamber;

(f) a bubbling member provided between the nozzle and the vapor-liquid mixing chamber; and

(g) a limitation member which is provided on an upper part of the valve seat of the liquid discharge valve and limits a vertical-direction-maximum-migration-length from the valve seat of the liquid discharge valve and

liquid within the container body and outside air are joined in the vapor-liquid mixing chamber and the joined vapor-liquid is bubbled via the bubbling member to be discharged in a foamy state from the nozzle by depressing the pump head;

characterised in that the pump further comprises:

(h) a stem which is fixed to a lower portion of the pump head;

(i) a casing within which the bubbling member is provided, the casing having a lower end which is inserted into the stem; wherein

the lower end of the casing functions as the limitation member, and

the vertical-direction-maximum-migration length from the valve seat of the liquid discharge valve is limited within the range of from 0.1 mm to 1.0 mm.

5. The container with a pump for discharging bubbles according to Claim 4, wherein the vertical-direction-maximum-migration-length of the liquid discharge valve is set up within the range of from 0.2 mm to 0.3 mm.

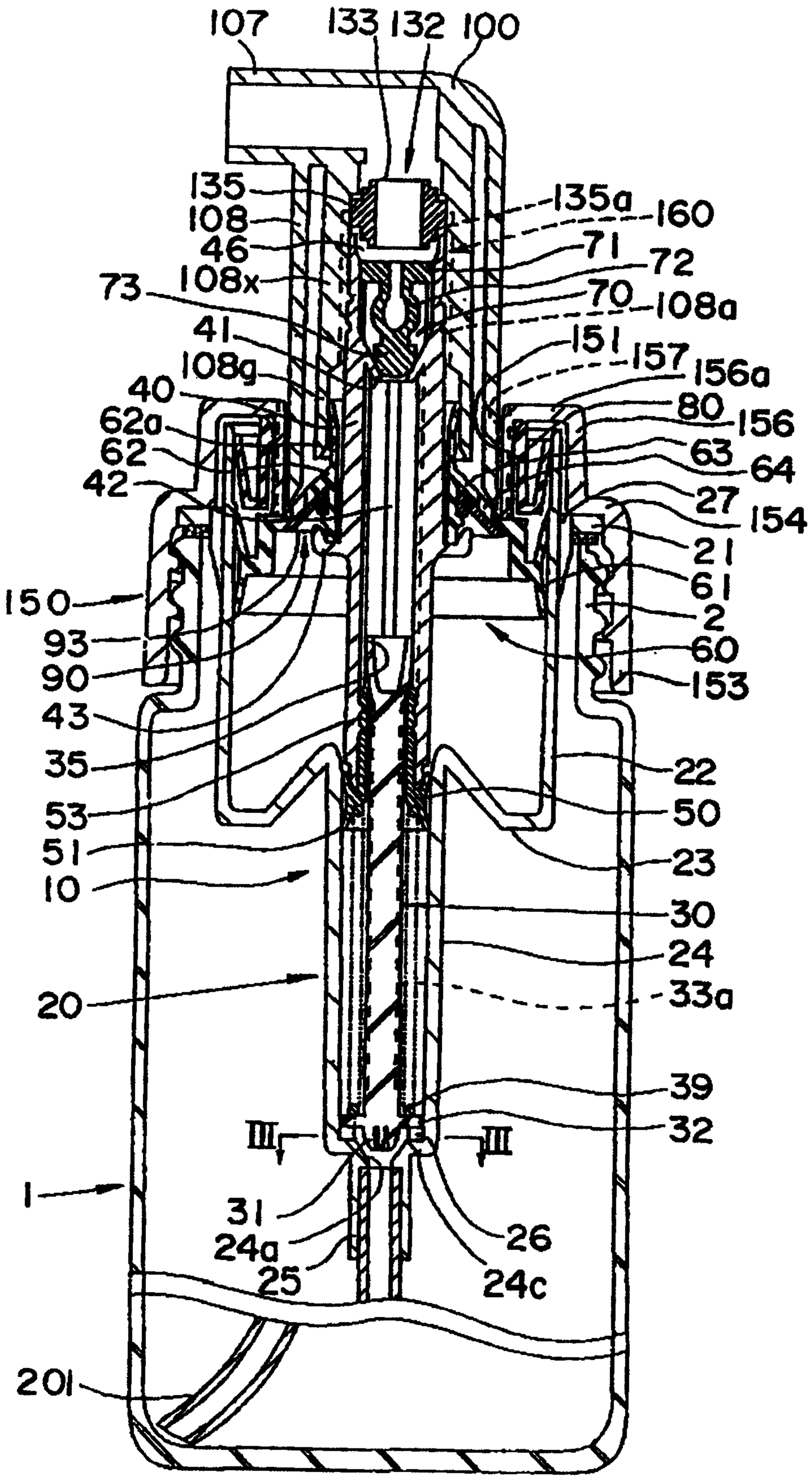

107
133
132
100
135
108
46
73
108x
41
108g
40
62a
62
42
150
93
90
43
35
53
51
10
20
1
201
135a
160
71
72
70
108a
151
157
156a
80
156
63
64
27
154
21
61
2
60
153
22
50
23
30
24
33a
39
32
III
III
31
24a
25
26
24c

FIG. 1

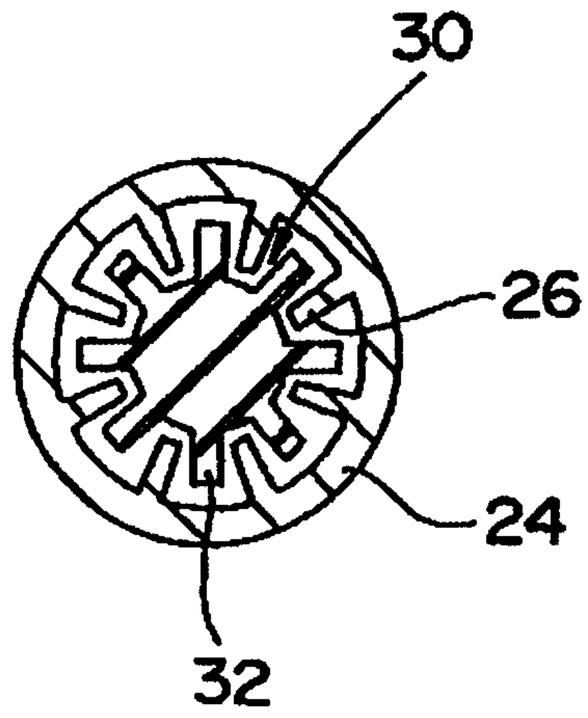


FIG. 2

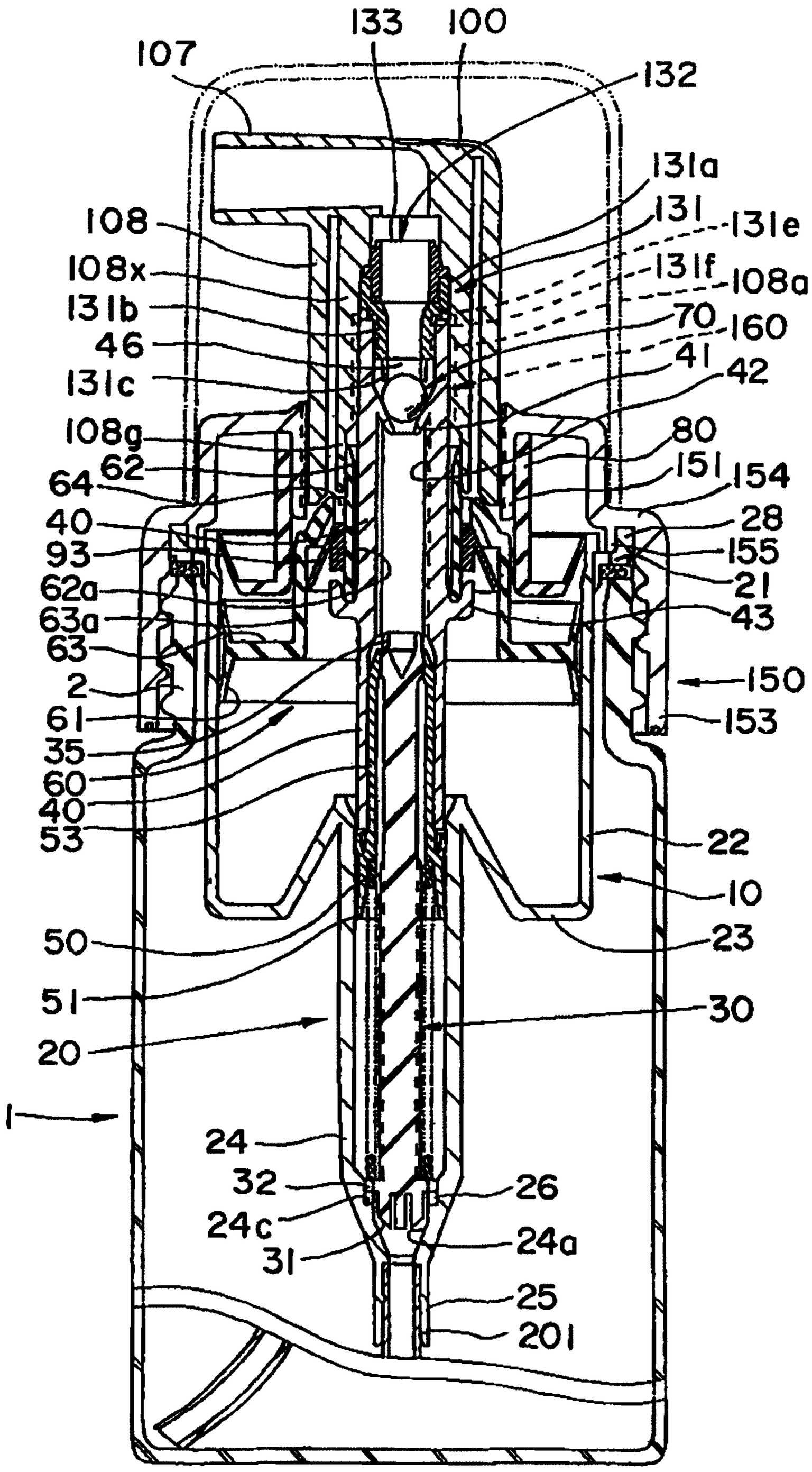

133
100
107
132
131a
131
131e
131f
108a
70
160
41
42
80
151
154
28
155
21
43
150
153
22
10
23
30
108
108x
131b
46
131c
108g
62
64
40
93
62a
63a
63
2
61
35
60
40
53
50
51
20
1
24
32
24c
31
26
24a
25
201

FIG. 3

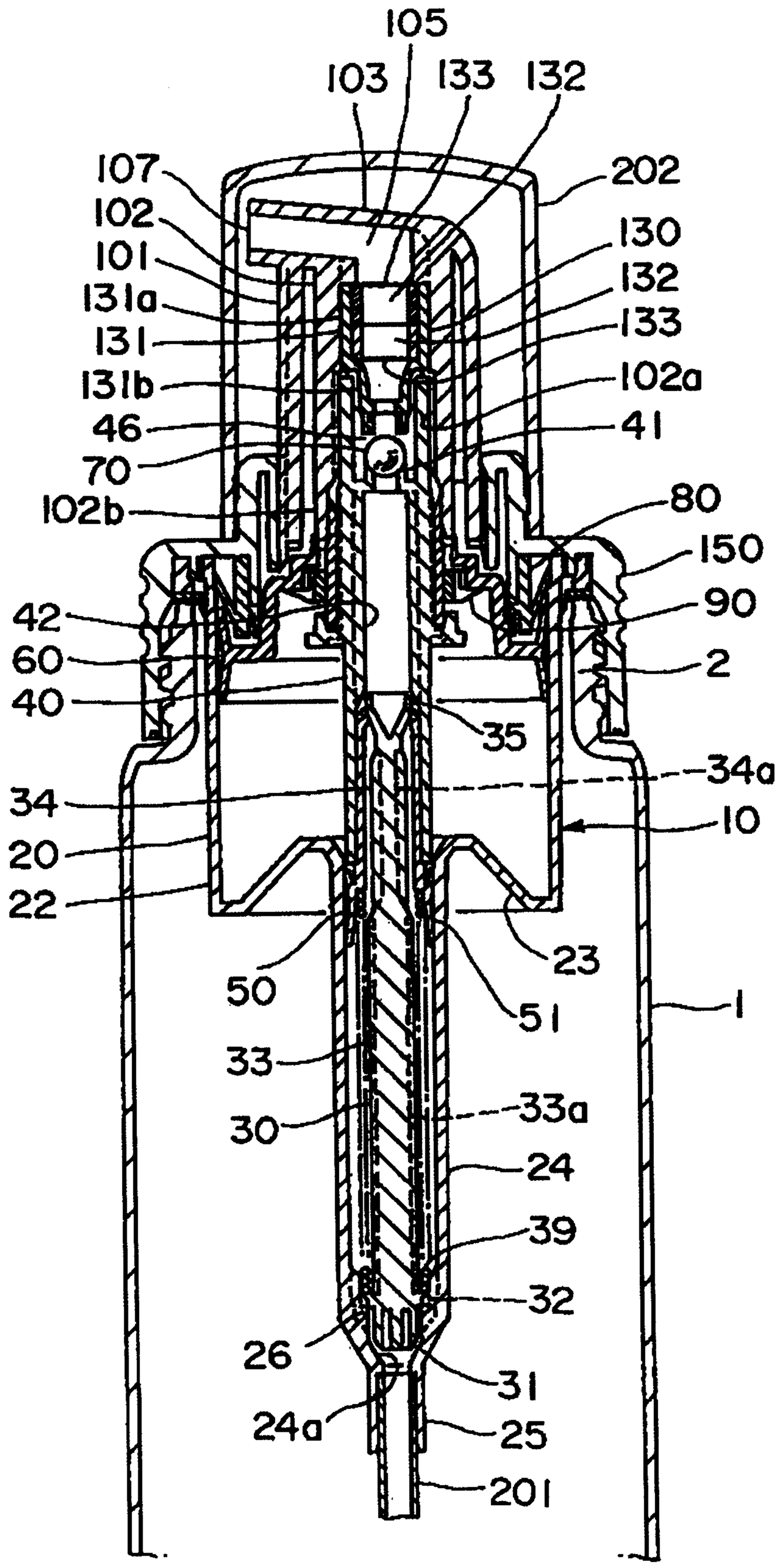

105
103
133
132
107
202
102
130
101
132
131a
133
131
102a
131b
41
46
70
80
102b
150
90
42
2
60
40
35
34a
34
10
20
22
23
50
51
1
33
33a
30
24
39
32
26
31
24a
25
201

FIG. 4

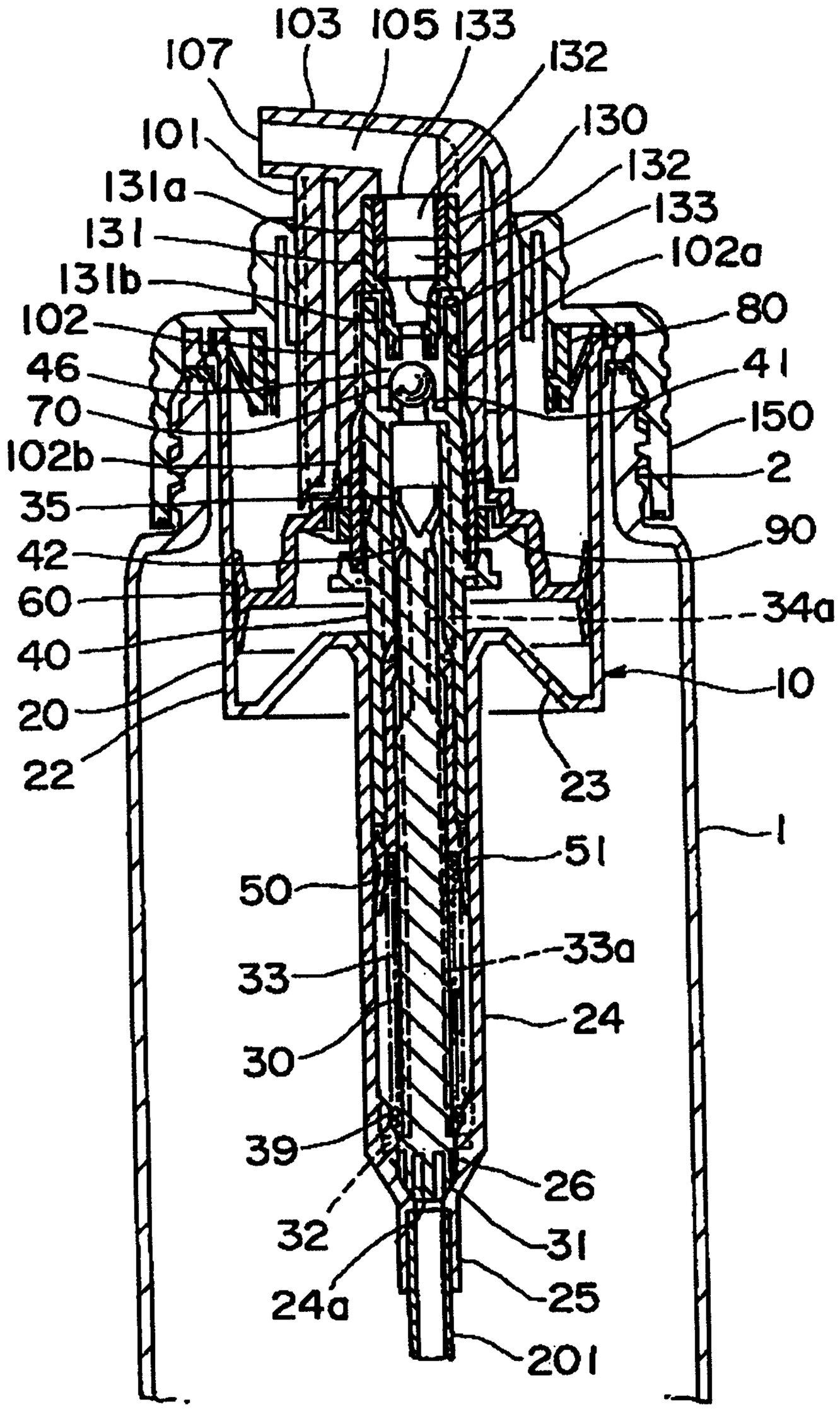

103
105
133
107
132
101
130
131a
132
131
133
131b
102a
102
80
46
41
70
150
102b
2
35
90
42
60
34a
40
10
20
22
23
1
51
50
33a
33
24
30
39
26
32
31
24a
25
201

FIG. 5

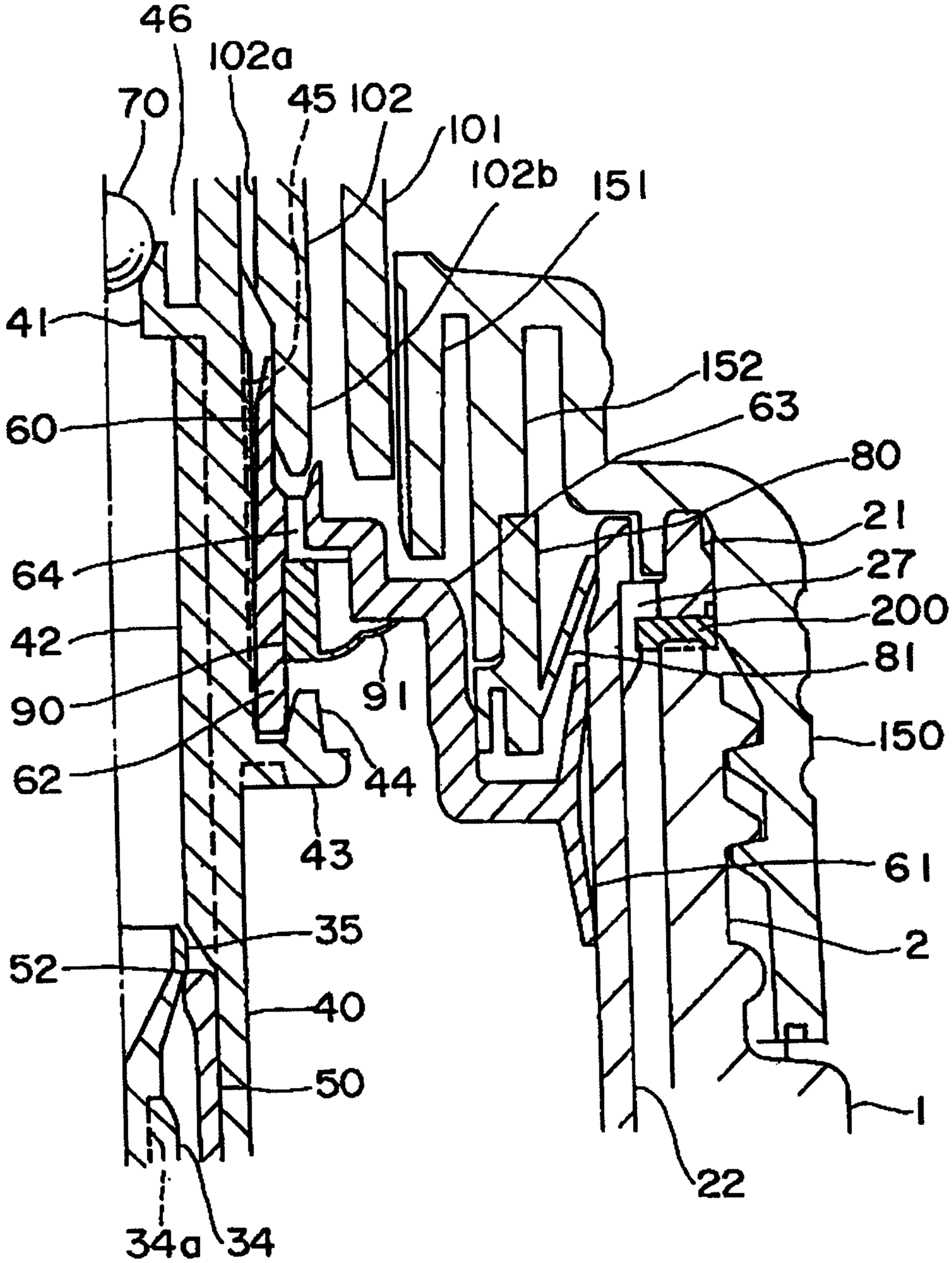

46
102a
70
45
102
101
102b
151
41
152
60
63
80
64
21
27
200
42
81
90
91
150
62
44
43
61
35
2
52
40
50
1
22
34a
34

FIG. 6

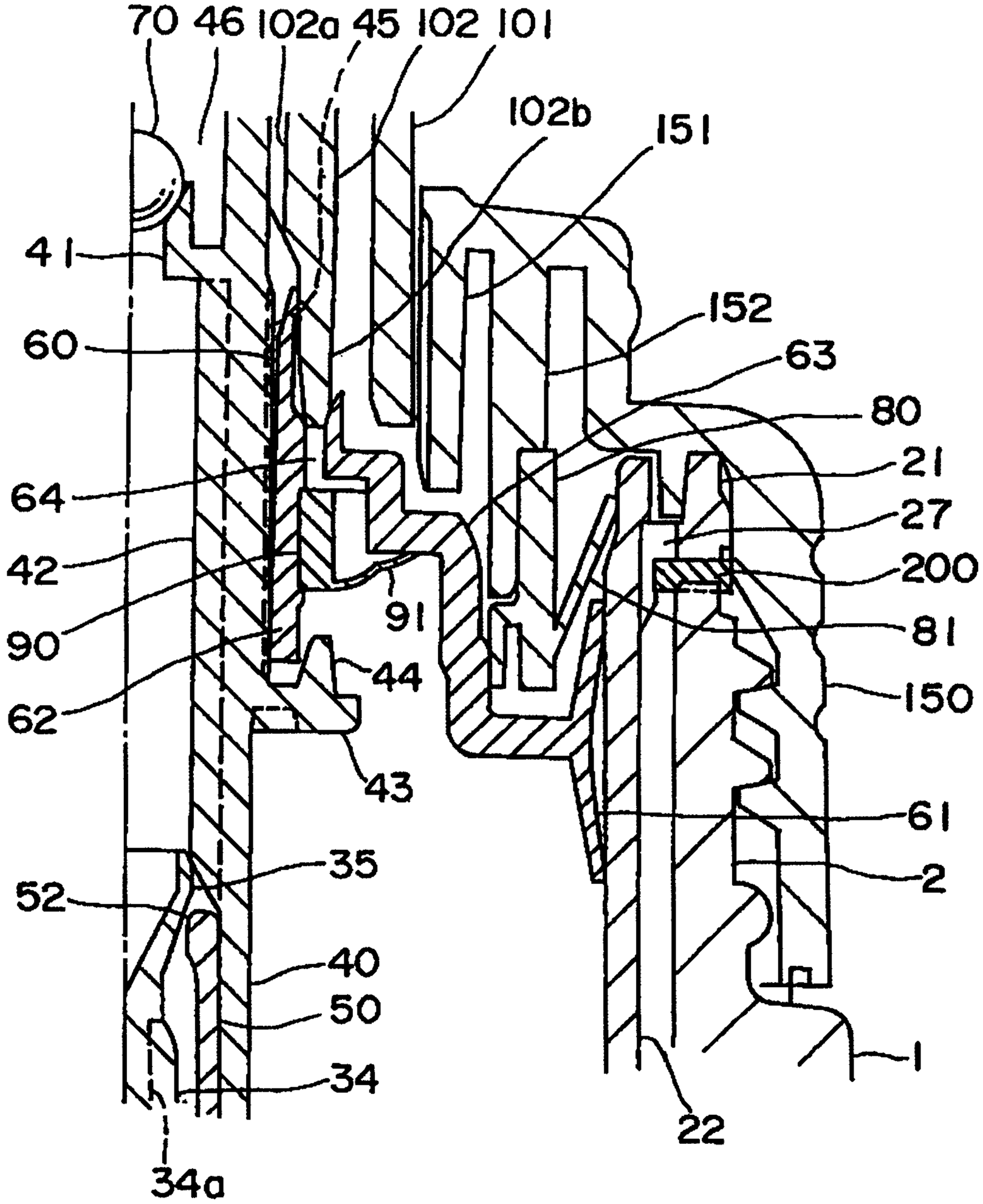

70
46
102a
45
102
101
102b
151
41
60
152
63
80
64
21
27
42
200
91
90
81
44
150
62
43
61
35
2
52
40
50
34
1
22
34a

FIG. 7

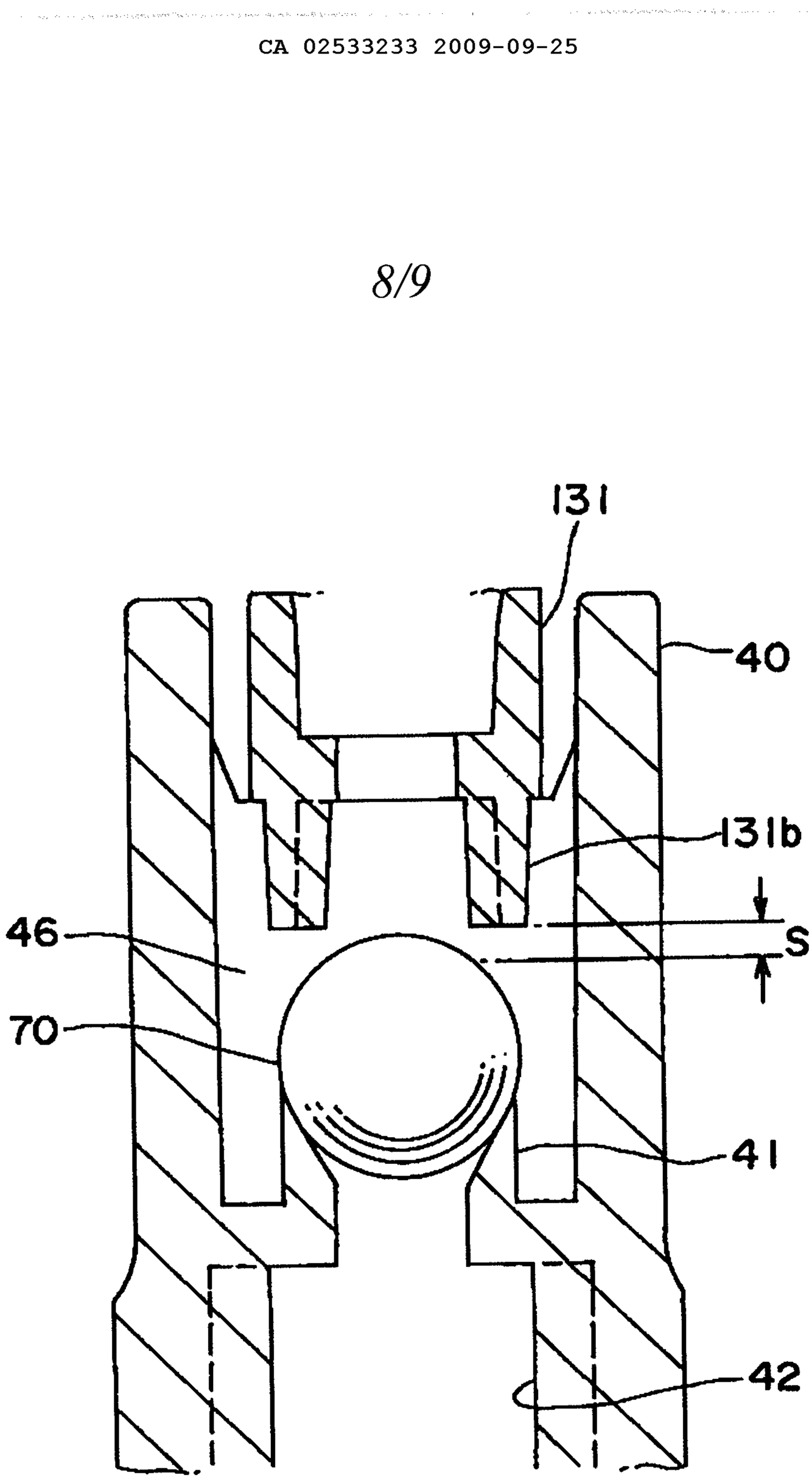


FIG. 8

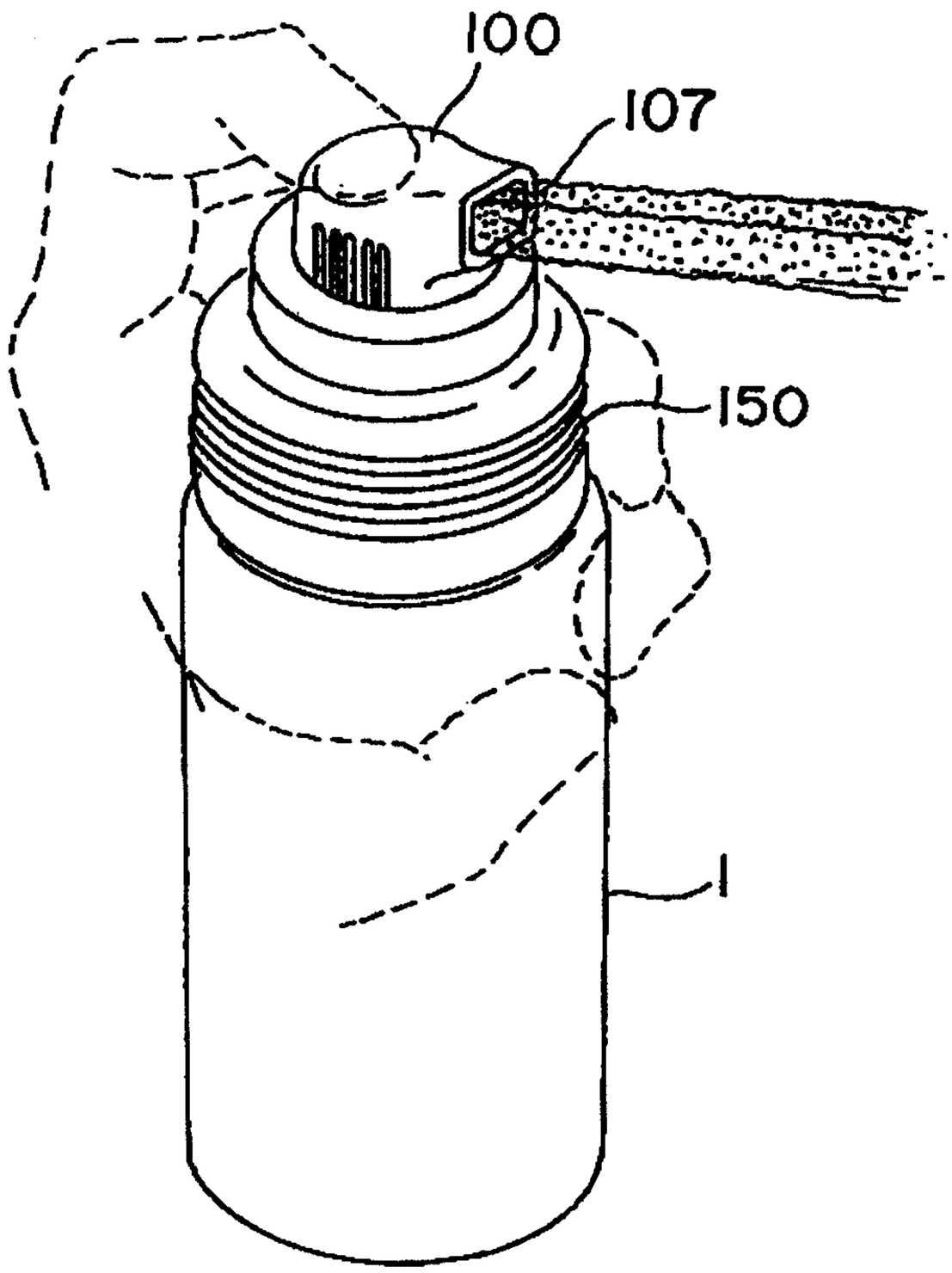
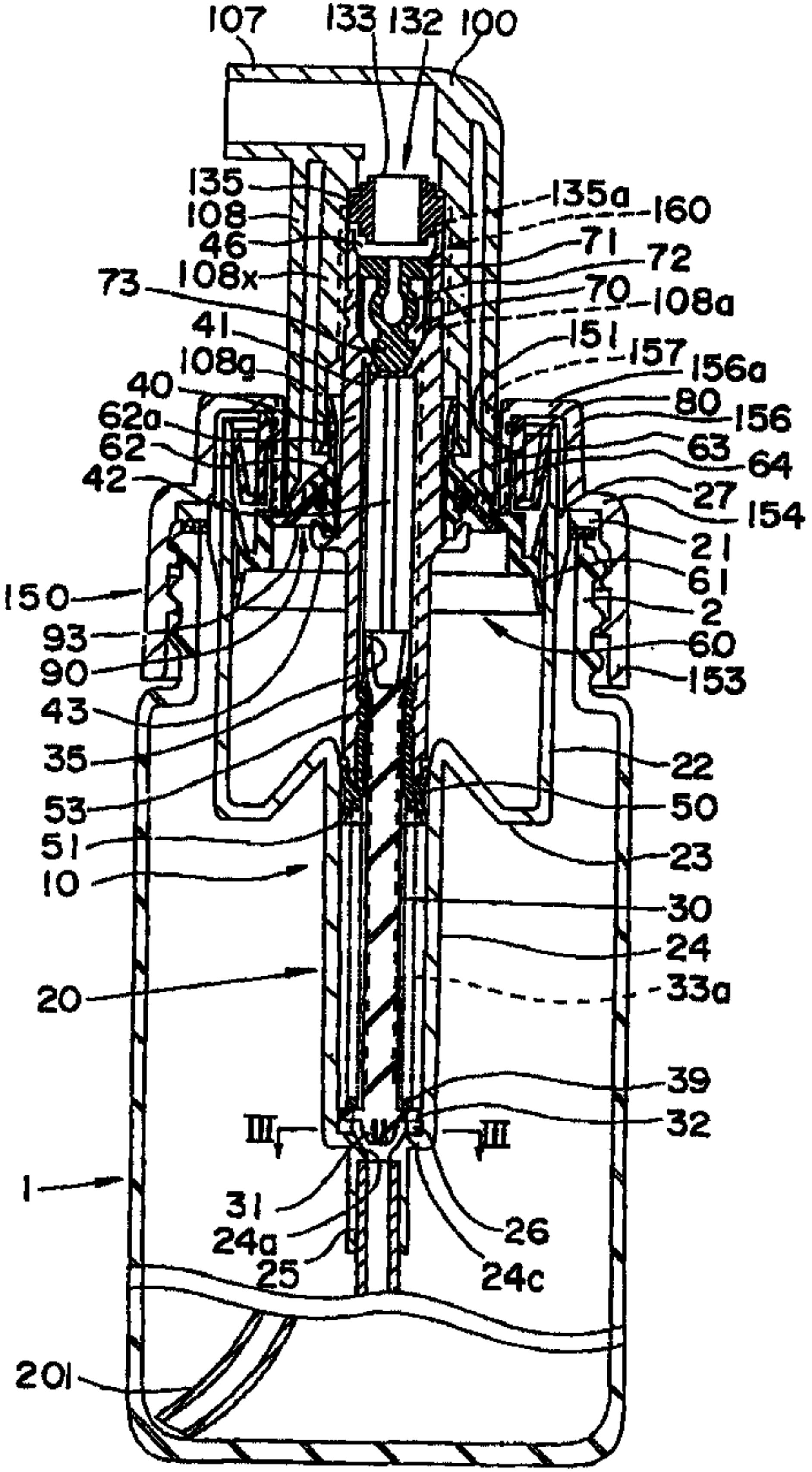


FIG. 9


107
133
132
100
135
108
46
73
108x
41
108g
40
62a
62
42
150
93
90
43
35
53
51
10
20
201
135a
160
71
72
70
108a
151
157
156a
80
156
63
64
27
154
21
61
2
60
153
22
50
23
30
24
33a
39
32
III
III
1
31
24a
25
26
24c