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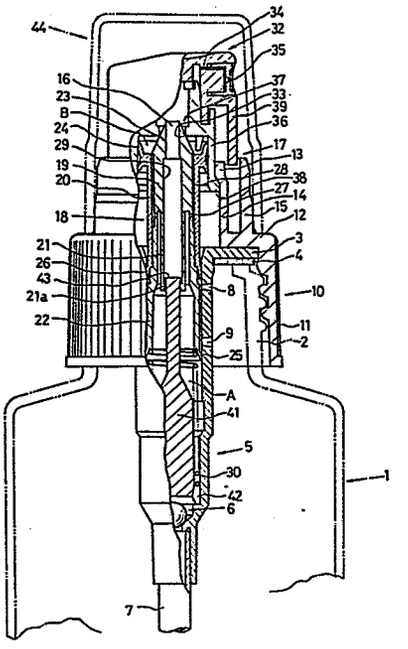
(54) Manually-operated sprayer.

(57) A hand operated spray unit provides for ambient air being drawn through the nozzle (35) into the reservoir (1) between spraying actions to prevent clogging of the nozzle (35). A hollow exit valve stem (19) acts as a mobile suction cylinder on its upward stroke though being swept by an immobile plunger (41).



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Background of the Invention

The present invention relates to a manually-operated sprayer wherein an air cylinder is provided within a manually-operated sprayer in order to suck extenal air from the nozzle hole.

An existingly known manually-operated sprayer provides the structure that the cylinder inserted in the container and the operating member of which lower part is slidably inserted in vertical into said cylinder and is simultaneously energized upward are provided; the liquid within said cylinder is sprayed from the nozzle hole through the discharge valve when the operation member is depressed through the pression head with nozzle hole

formed at the upper end of said operation member; when the operation member is moved upward, the cylinder chamber is pressurized negatively; thereby the liquid in the container is sucked into the cylinder through the suction valve. If the liquid to be sprayed contains dissolved chemical, this substance is hardened when such liquid is dried up, choking the nozzle hole. Namely, the liquid may be adhered within the nozzle hole when the sprayer is used, and when said liquid is dried up, the dissolved substance is hardened at the inside wall of nozzle hole. Accordingly, such precipitate grows large after frequent use and finally it chokes the nozzle hole.

Object of the Inventin

It is an object of the present invention to provide the external air sucking and exhausting mechanism in the sprayer unit itself, eliminate liquid adhered to the inside wall of nozzle hole and thereby prevent choke thereof.

Brief Description of the Drawings

Fig.1 is the vertical cross section of a manually-operated sprayer of the first embodiment of the present invention. Fig.2 to Fig.4 are half cross sections of a manually-operated sprayer of the second,

third and fourth embodiments.

Detailed Description of the Invention

The first embodiment will be explained by referring now to the first preferred embodiment shown in Fig.1. In this figure, 1 is a container; 2 is the neck part of said container wherein the cylinder 5 is provided in such a manner that the outward flange 3 deposited to the upper end thereof is placed on top of said container through the packing 4. Provided at the bottom part of said cylinder is the suction valve 6 which is connected to the suction pipe 7 for sucking the liquid within the container and extended vertically from the lower end of cylinder. The through holes 8, 9 are bored at the upper part of cylinder and the lower part properly separated therefrom.

Said cylinder is secured by the mounting member 10. The mounting member is provided with the inward flange 12 at the upper end of circumferencial wall 11 threaded to the neck part of container and said packing 4 and outward flange 3 of the cylinder are held by said inward flange and the top surface of container from both sides. From the internal circumferential edge of inward flange, the inner engaging cylinder 14 having the engaging passage 13 at the internal surface of upper part

is erected, while from the intermediate part of inward flange the outer engaging cylinder 15 is erected.

The lower part of the operating member 17 is engaged movably in vertical to the inside of said cylinder. In the embodiment shown in the figure, the operating member 17 is composed of the connecting pipe member 18 and the depressing head 32.

The connecting pipe member 18 is formed with the main cylinder 19 and the engaging cylinder 20 engaged with outer surface of upper part of said main cylinder and the lower part of main cylinder is formed as the double cylinders consisting of the inner cylinder and outer cylinder, with the inner cylinder 21 is shorter than the outer cylinder 22. The upper part of main cylinder is formed as the tapered discharge valve body 23, the upper end of engaging cylinder is located lower than the discharge valve body and the external circumference of said upper end is provided with the large-diameter piston 24. The lower ends of outer cylinder and engaging cylinder are respectively formed as the cylindrical pistons 25, 26 and they are closely placed in contact with the inner wall of cylinder. The upper end of outer cylinder 22 is bored with the through holes 27, 27, the outer surface of upper part of main cylinder is provided with the vertical grooves 28, 28 in connection with said

through holes, and the upper end of said vertical groove is opend to the internal edge of upper end of the engaging cylinder 20. The main cylinder 19 is provided with the air cylinder chamber 29 of which both ends are opening, on the axial line thereof. The aperture of upper end of main cylinder is formed at the exhaust hole 16 connected to the discharge path 34 and the aperture at the lower end of main cylinder is engaged with the upper part of the plunger 41 for air cylinder explained later. The connecting pipe member 18 is urged upward by the spring 30 provided within the cylinder 5.

32 is the depressing head and the discharge valve hole 33 is opened at the center of lower surface and it is connected to the nozzle hole 35 opening at the side of upper part from said discharge valve hole through the exhaust path 34. In addition, from the lower surface of depressing head surrounding the discharge valve hole 33, the larger-diameter cylinder 36 larger than said cylinder is provided vertically, said large-diameter piston 24 is engaged with inside of said cylinder, and the top end of discharge valve body 23 is engaged with the inside of exhaust valve hole, thereby the discharge valve 37 is formed. The large-diameter cylinder 36 is engaged with inside of said inner engaging cylinder and the projected passage 38 provided at the outer circumference of lower end of

large-diameter cylinder is engaged with the engaging passage 13 of inner engaging cylinder. From the outer circumference of lower end of depressing head, the guide cylinder 39 is provided vertically and therefore it can move vertically between the inner side of said mounting member and outer engaging cylinder.

As explained above, the present invention is particularly characterized by the plunger 41 for air cylinder and the air cylinder chamber 29.

The plunger for air cylinder is erected within the cylinder by disposing a plurality of foot pieces 42 provided at the lower end on the upward step formed in the iner surface of lower part of cylinder and its upper half part is formed as the small-diameter part and is engaged movably in vertical with inside of the air cylinder chamber 29. The outer circumference of upper end of plunger for air cylinder is provided with the engaging projected passage 43, and internal circumference of lower end of said inner cylinder is provided with the projected passage 21a which is water-tightly in contact with the outer surface of said plunger. Engagement of them prevents release of plunger for air cylinder. 44 is the cap.

In above structure, when the operating member 17 is depressed, for the first time, through the depress-

ing head 32, since both pressure chamber A which is formed by the internal spaces of cylinder located lower than the piston 25 of which lower part is formed cylindrically and the outer cylinder 22 is connected to the pressure chamber B which is formed by the space of large-diameter cylinder located higher than the large-diameter piston 24 through the through hole 27 and vertical groove 28 because both suction valve and discharge valve are closed, the pump chamber consisting of these pressure chambers is pressurized. When the pump chamber is further pressurized, the connecting pipe member 18 moves downward farther for the depressing head 32 owing to difference of diameters of both cylinders, and thereby the discharge valve 37 opens and the liquid in the pump chamber is sprayed from the nozzle hole.

In the first experience of use of sprayer, the air existing in the pump chamber is sprayed. Since the operating member 17 moves downward during spraying operation with the exahust valve 37 being opened, the air cylinder chamber 29 also moves downward and thereby the pluger 41 for air cylinder is inserted into the air cylinder chamber 29, causing the air in said chamber to be sprayed through the discharge valve hole 33. When downward movement of the operating member 17 stops, the discharge valve 37 closes owing to a depressing force of

the spring 30, and when the depressing head is released, the operating member 17 moves upward. Since the pump chamber is pressurized negatively, the suction valve 6 opens, sucking the liquid in the container, and in addition, since the air cylinder chamber is also pressurized negatively, external air is sucked through the nozzle hole, discharge path and discharge valve hole.. Since the liquid is already sucked in the pump chamber, it is sprayed by the next depressing of operating member, and the liquid adhered to the inside wall of nozzle hole by the spraying operation is removed by the suction of external air effectuated when the operating member moves upward.

The embodiments shown in Fig. 2 to Fig.4 indicate the structure wherein both plunger 41 for air cylinder and air cylinder chamber 29 are provided to the sprayers in different structures, respectively.

In the preferred embodiment shown in Fig.2, the lower part of cylinder 5 is formed as the small-diameter cylinder 31, while the upper part is formed as the large-diameter cylinder 36. Inside of the small-diameter cylinder 31 engages with the small-diameter piston 18a provided at the lower end of connecting pipe member 18. From the depressing head 32, the discharge pipe 51 of which lower part is formed as the large-diameter part is

extended vertically, and inside of large-diameter part engages with the cylinder material 53 with large-diameter cylindrical piston 52, this large-diameter cylindrical piston engages with inside of large-diameter cylinder 36, and moreover inside of large-diameter cylinder 36 engages with the large-diameter piston 24 provided to the connecting pipe member 18. To the large-diameter piston 24, pressure of pressure chamber B works downward, while to the small-diameter piston 18a, pressure of pressure chamber B works upward.

The projected passage 54 formed at the inside of upper end of cicumferential wall of cylinder material 53 is provided with the discharge valve hole which is connected to the discharge pipe 51a, and the discharge valve 37 is composed of said valve hole and discharge valve body 23 at the upper end of the connecting pipe member 18. The pressure chamber B is formed with said large-diameter cylindrical piston 52, large-diameter piston 24 provided at the intermediate part of connecting pipe member, inside wall of large-diameter cylinder provided between them and the external wall of connecting pipe.

The air cylinder chamber 29 is formed within the connecting pipe member 18 and the plunger 41 for air cylinder passes through said connecting pipe member 18. At the upper end of connecting pipe member 18, the

exahust hole 16 is bored so that when the plunger 41 for air cylinder moves upward within the connecting pipe member 18, air is sent to the nozzle hole 35. At the internal circumferential surface of upper part of the connecting pipe member 18, the annular projected passage 18b is formed and it is water-tightly in contact with inside of plunger 41 for air cylinder.

In this embodiment, when the operating member 17 is depressed through thedepressing head 32, the pump chamber consisting of the pressure chamber A and pressure chamber B connected through the hole 55 is pressurized as in the case of the first embodiment, and thereby the connecting pipe member 18 moves downward owing to difference of diameters of both cylinders 5, 36, causing the discharge valve 37 to open. Accordingly, the liquid and air are sprayed from the nozzle hole 35. Downward movement of operating member causes the plunger 41 for air cylinder to enter the discharge pipe hole which is also used in common by the air cylinder chamber 29. When downward movement of operating member stops, the discharge valve 37 closes. Meanwhile, when the operating member moves upward, the suction valve 6 opens and the liquid enters the pump chamber. Simultaneously, the vertical part of discharge path, namely the cylinder chamber is negatively pressurized and thereby external air is sucked through

the nozzle hole.

In the embodiment shown in Fig. 3, the upper half of cylinder is formed as the large-diameter cylinder 36. The external surface of lower end of the discharge pipe 51 extended vertically from the depressing head 32 is provided with the large-diameter piston 24 and the external surface of lower part of the connecting pipe member 18 is provided with the cylindrical piston 25 which is in contact with the internal wall of cylinder. The upper part of connecting pipe member 18 is inserted into the lower part of discharge pipe 51, and the discharge valve 37 is formed by the discharge valve body 23 formed at the upper end of connecting pipe member 18 and the discharge valve hole 33 formed by the downward step portion formed at the intermediate part of discharge pipe hole 51a. The suction valve 6 is formed by the valve hole 6a provided at the intermediate part of connecting pipe and the elastic cylinder 6b engaging with the external surface of connected pipe in such a manner as choking said valve hole.

In said third embodiment, when the operating member 17 is depressed, the liquid in the large-diameter cylinder 36 enters, due to downward movement of the large diameter piston 24, narrow clearance formed by the cylinder 5, external surface of connecting pipe member 18 and

the cylindrical piston 25, causing the connecting pipe member 18 to be depressed, and thereby the discharge valve 37 opens. When downward movement of operating member 17 stops, the discharge valve closes, and when the depressing head is released, the operating member moves upward. Thereby, the pump chamber is mainly formed by the internal space of large-diameter cylinder and is negatively pressurized. Accordingly, the liquid in the container flows into the pump chamber through the suction valve 6. The air cylinder chamber 29 is formed by the internal space of upper part of the connecting pipe and the internal space of discharge pipe hole 51a located higher than the discharge valve hole 33, and external air is sucked into the air cylinder through the nozzle hole and inside air is exhausted in accordance with relative ascent and descent of plunger 41 for air cylinder into/from the air cylinder chamber 29 during vertical movement of the operating member.

The embodiment shown in Fig.4, a large-diameter cylinder is not used. From the depressing head 32, the discharge pipe 51 of which lower half is formed as the large-diameter part 56 is extended vertically and the lower end of said large-diameter part is provided with the cylindrical piston 25. The inside of large-diameter part is working as the air cylinder chamber 29. The

plunger 41 for air cylinder is formed cylindrically with both ends opened as the apertures, forming the discharge valve 37 consisting of the discharge valve hole and ball valve within the upper end thereof, and the upper end of said plunger 41 is water-tightly inserted into the lower part of air cylinder chamber.

Downward movement of operating member 17 makes the plunger 41 for air cylinder relatively move upward within the air cylinder chamber 29 and simultaneously the cylindrical piston 25 move downward within the cylinder 5. Therefore, the liquid stored in the clearance formed between the external surface of air cylinder plunger and the cylinder wall enters the hole of said plunger passing the through hole 57 at the lower end of air cylinder plunger 41. Thereby, the discharge valve 37 opens and the liquid is sprayed from the nozzle hole 35 through the exhaust path 34. When downward movement of operating member 17 stops, the discharge valve closes and when said operating member 17 moves upward, the suction valve opens and the liquid in the container is sucked. Simultaneously, the air cylinder plunger 41 moves backward in the air cylinder chamber 29 keeping the water-tight sealing. Thereby, the chmber becomes broad, negatively pressurizing therein. Thus, external air is sucked through the nozzle hole 35.

With above-mentioned structure, the present invention offers a sprayer wherein the liquid is sucked into the pump chamber from the container loading the cylinder in accordance with upward and downward movements of the operating means erected from the cylinder and is sprayed from the nozzle hole of depressing head formed at the upper end of the operating member, thus characterized in that external air is sucked through the nozzle hole when the operating member moves upward in order to suck the liquid in the container, accordingly the liquid adhered to the inside wall of nozzle hole in each spraying operation can be removed, preventing that a substance precipitated after the liquid is dried up and to be dissolved into the spraying liquid is fixed on the inside wall of nozzle hole and thereby the nozzle hole is choked.

What is claimed is:

(1) A manually-operated sprayer providing the structure that the cylinder 5 loaded in the container 1 and the operating member 17, of which lower part is inserted movably in vertical into said cylinder and is simultaneously urged upward by a spring, are provided; the liquid stored in said cylinder is sprayed from the nozzle hole 35 through the discharge valve 37 when the

operating member is depressed through the depressing head 32 with nozzle hole formed at the upper end thereof; when the operating member moves upward, inside of the cylinder is negatively pressurized and thereby the liquid stored in the container is sucked into the cylinder through the suction valve 6; thus characterized in that;

the air cylinder plunger 41 is erected in said cylinder coaxially therewith; the air cylinder chamber 29 connecting said cylinder and the exhaust path 34 which extends to the nozzle hole from the discharge valve 37 is formed on the axial line of said operating member; and said air cylinder plunger 41 is engaged water-tightly with said air cylinder chamber so that said plunger moves upward and downward relatively within the air cylinder chamber 29 in accordance with vertical movement of said operating member 17 and external air is sucked or exhausted into/from the air cylinder chamber 29 through said nozzle hole 35 and discharge path 34 when the air cylinder chamber 29 becomes broad or narrow in accordance with said vertical movement of plunger.

(2) The manually-operated sprayer according to claim 1, wherein the projected inner cylinder 21 is provided below the discharge valve body 23 forming the discharge valve 37, the air cylinder chamber 29 is formed

in said inner cylinder and the exhaust hole 16 connecting to the discharge path 34 is provided at the upper end of discharge valve body 23.

(3) The manually-operated sprayer according to claim 2 wherein the engaging projected passage 43 is provided at the external circumference of upper end of the plunger 41 for air cylinder, the projected passage 21a is provided at the internal surface of lower end of the inner cylinder 21, thereby the air cylinder plunger 41 can no longer be pulled out of the cylinder.

(4) The manually-operated sprayer according to claim 1 wherein the discharge valve body 23 of discharge valve 37 is formed at the upper end of the connecting pipe member 18, the air cylinder chamber 29 is formed within said connecting pipe member, the large-diameter piston 24 and small-diameter piston 18a for opening the discharge valve 37 are provided at the connecting pipe member 18, and the air cylinder plunger 41 engages water-tightly with inside of connecting pipe member 18.

(5) The manually-operated sprayer according to claim 1, wherein the discharge valve body 23 of discharge valve 37 is formed at the upper end of connecting pipe member 18, the air cylinder chamber 29 is formed within

said connecting pipe member, the cylindrical piston 25 for opening the discharge valve 37 is provided to said connecting pipe member 18, and the air cylinder plunger, 41 engages water-tightly with inside of connecting pipe member 18.

(6) The manually-operated sprayer according to claim 1 wherein the cylindrical piston 25 is provided at the lower end of discharge pipe 51 connected to the nozzle hole 35 of the operating member 17, said cylindrical piston is capable of sliding within the cylinder 5, the air cylinder chamber 29 is formed within the discharge pipe 51, the air cylinder plunger 41 engages water-tightly with inside of said air cylinder chamber, said air cylinder plunger 41 is formed cylindrically with both upper and lower ends opened as the apertures, and therein provided is the discharge valve 37 connecting the cylinder 5 and air cylinder chamber 29.

Fig. 1

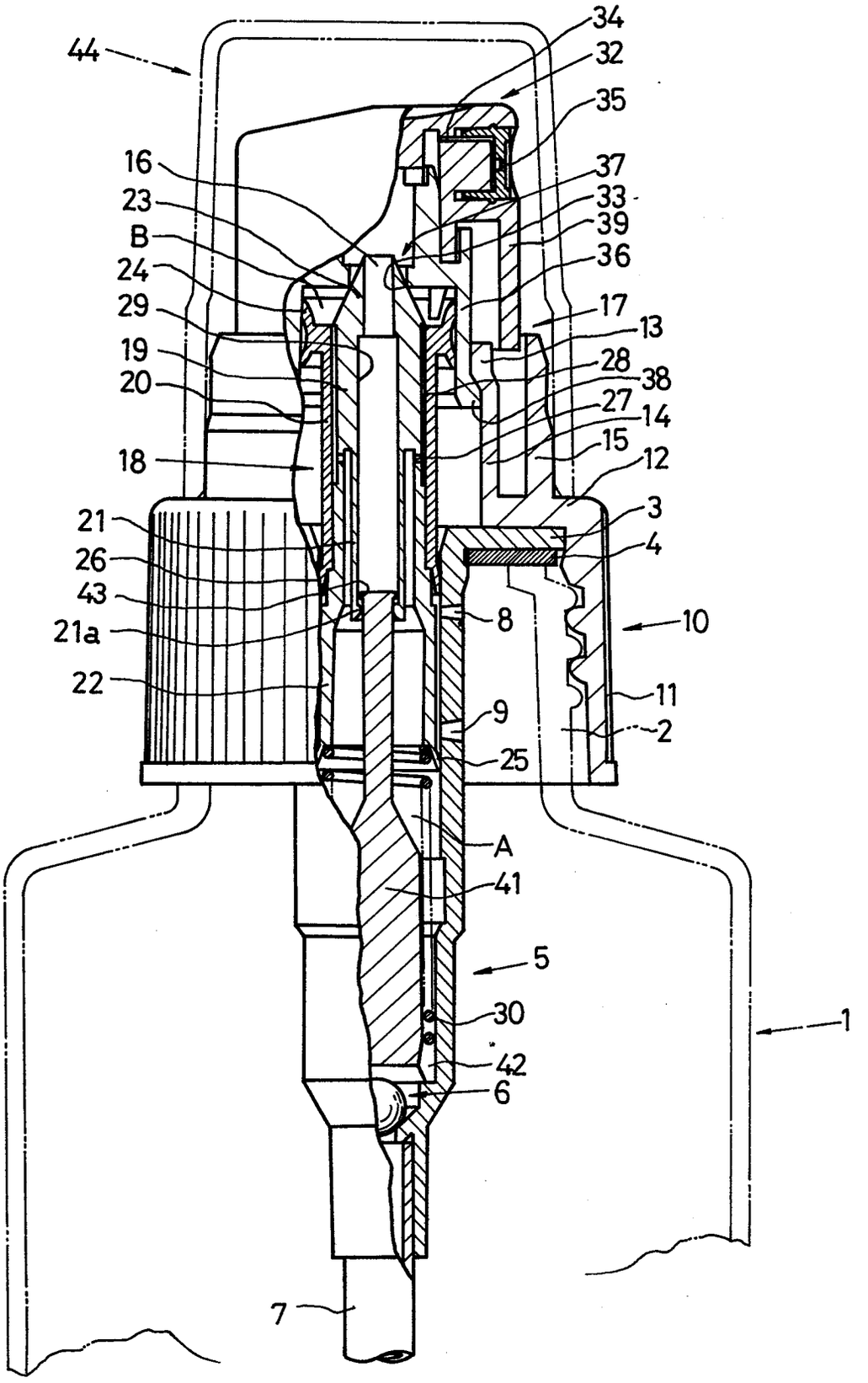
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Fig. 2

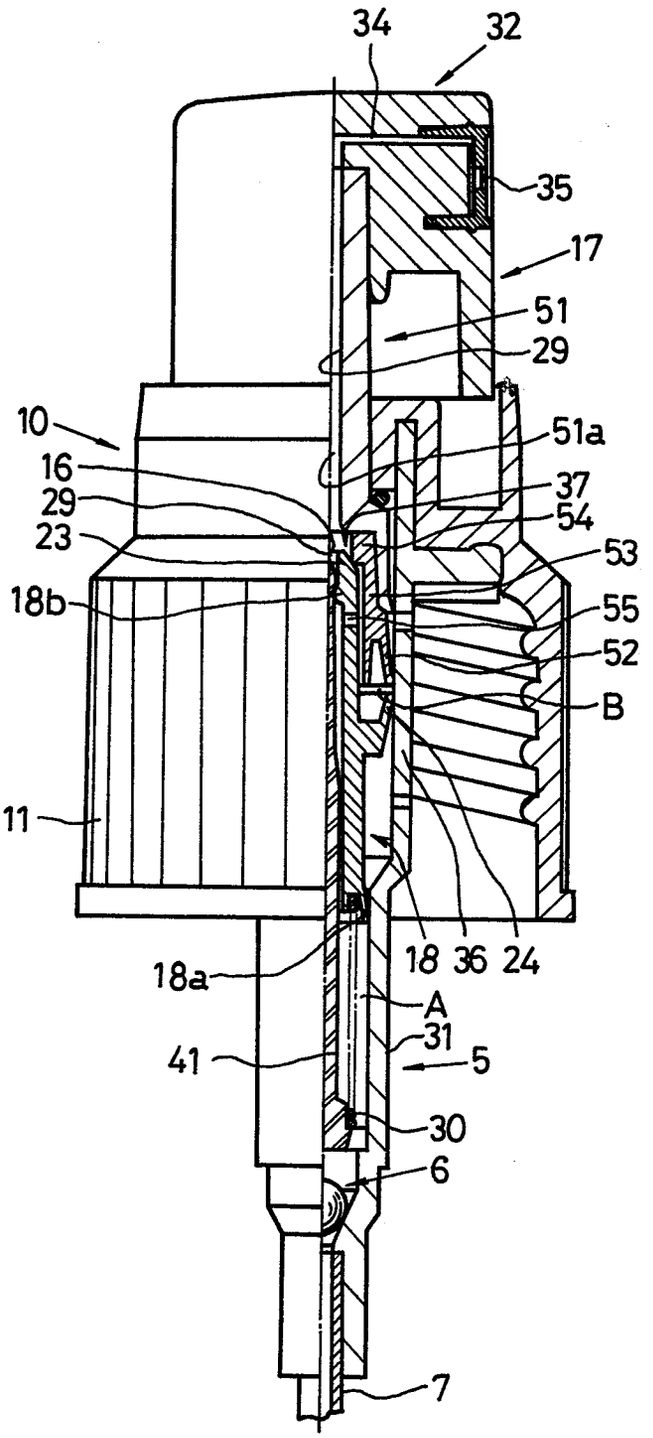
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Fig. 3

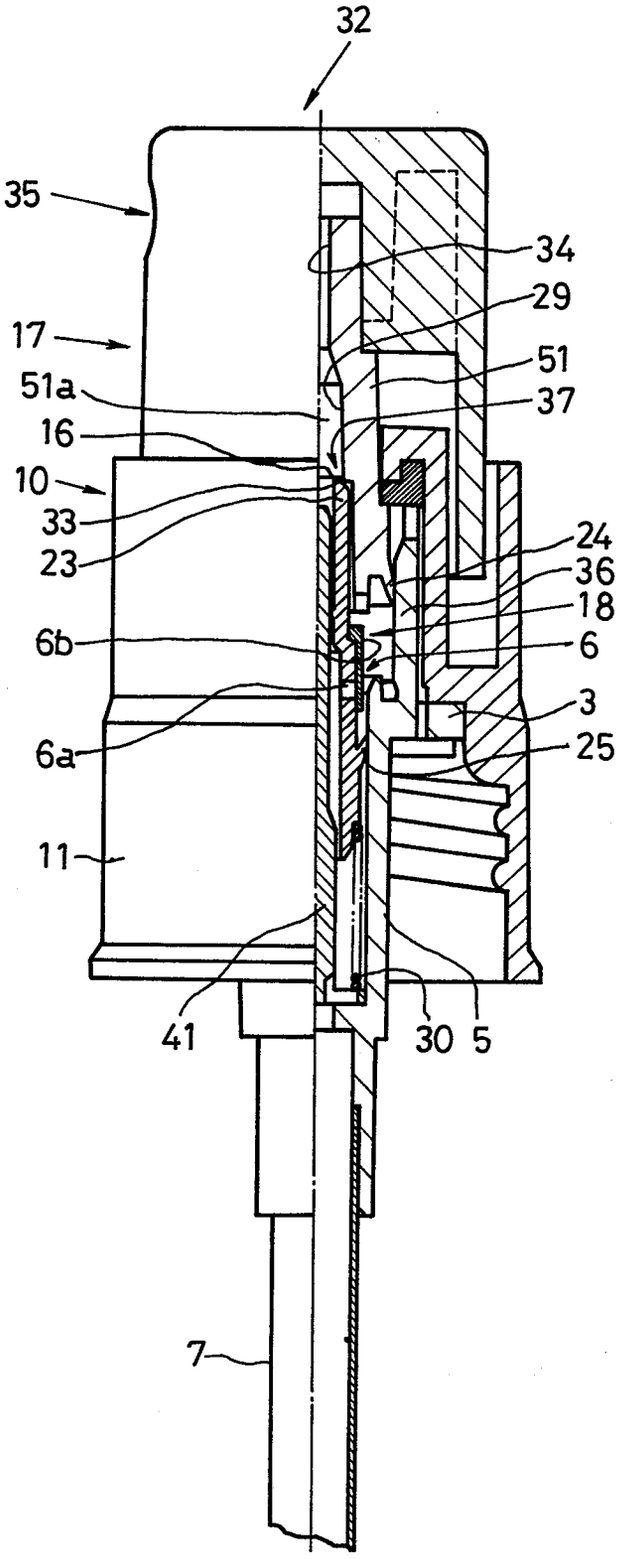
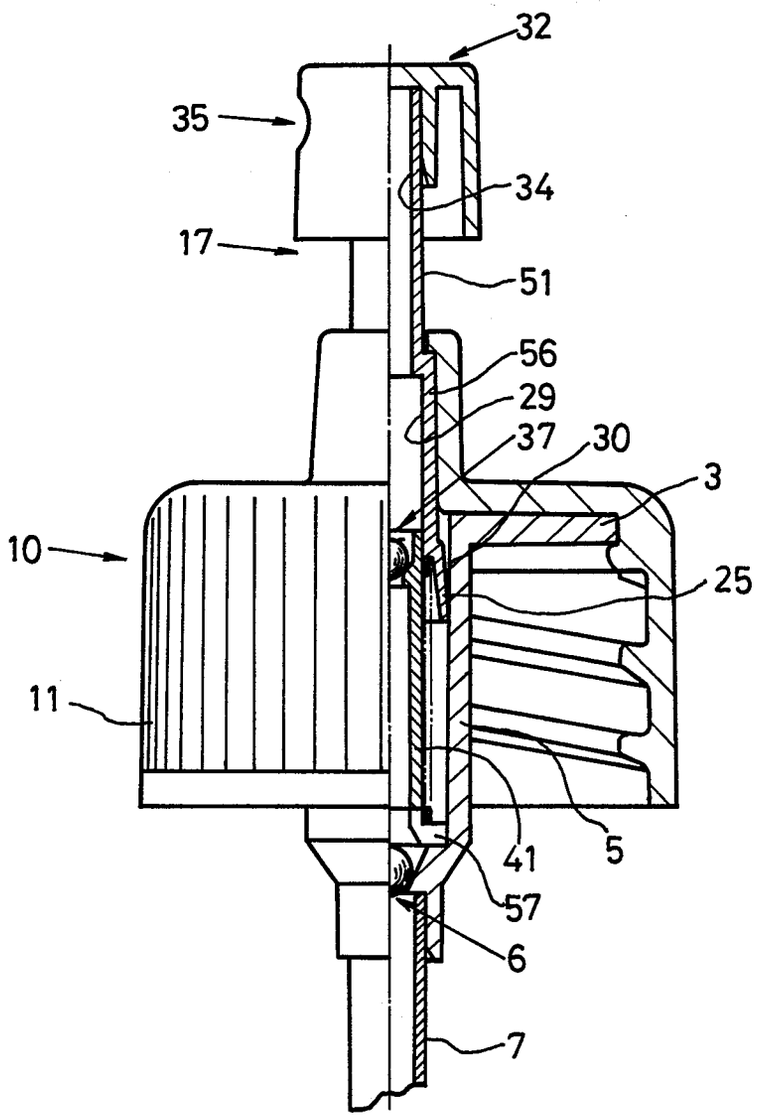


Fig. 4



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EUROPEAN SEARCH REPORT

0126175
Application number

EP 83 10 5039

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	FR-A-2 434 943 (WASSILIEFF)		B 05 B 11/02
A	GB-A-2 043 766 (YOSHINO KOGYOSHO)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

B 05 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23-01-1984	WOHLRAPP R.G.

CATEGORY OF CITED DOCUMENTS

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