United States Patent

[11] **3,608,788**

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[33] **Japan**
[31] **42/80,365, 42/80,366, 42/110,576 and 43/70,668**

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[54] **FLUID-DISPENSING PUMP**
9 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **222/384**
[51] **Int. Cl.** **B67d 5/40**
[50] **Field of Search** 222/384, 385

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Primary Examiner—Stanley H. Tollberg
Attorney—Arnold Robinson

ABSTRACT: This disclosure relates to a finger-operated atomizer pump for separating a liquid from a container, and is so formed that, in case a piston is pushed down or is pushed up by a resiliency of a coiled spring when the force of pushing it down is released, a valve body may move vertically to open or close a passage hole connecting an inner chamber of a cylinder and a central hole of the piston. Therefore, there are obtained advantages that the number of the component parts is small, that therefore the trouble and wage for making many component parts can be reduced, that the trouble in assembling them can be reduced and that the products can be provided cheaply.

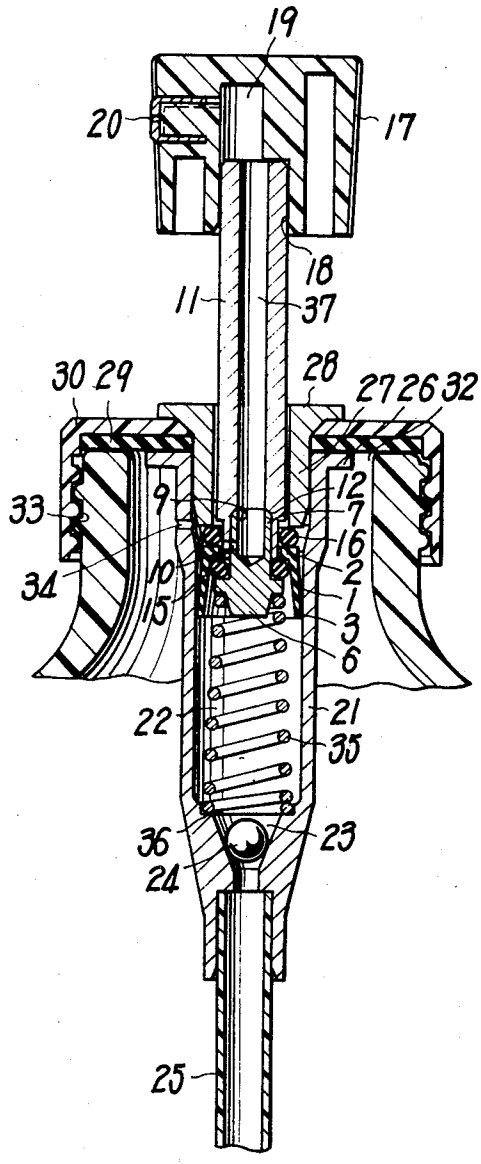


Fig. 1.

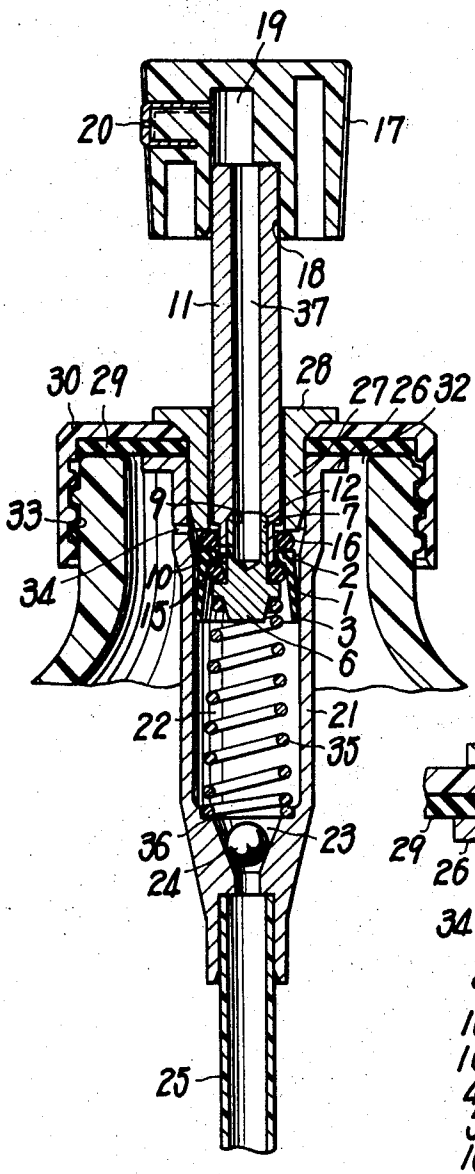


Fig. 2.

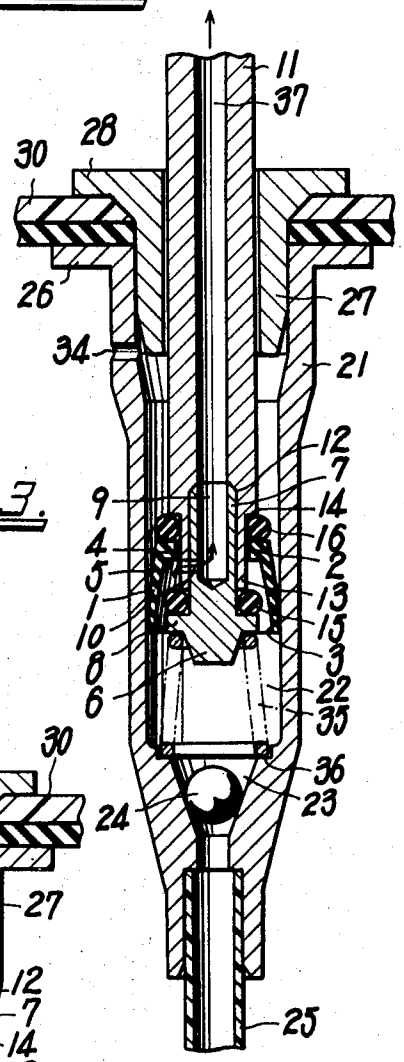
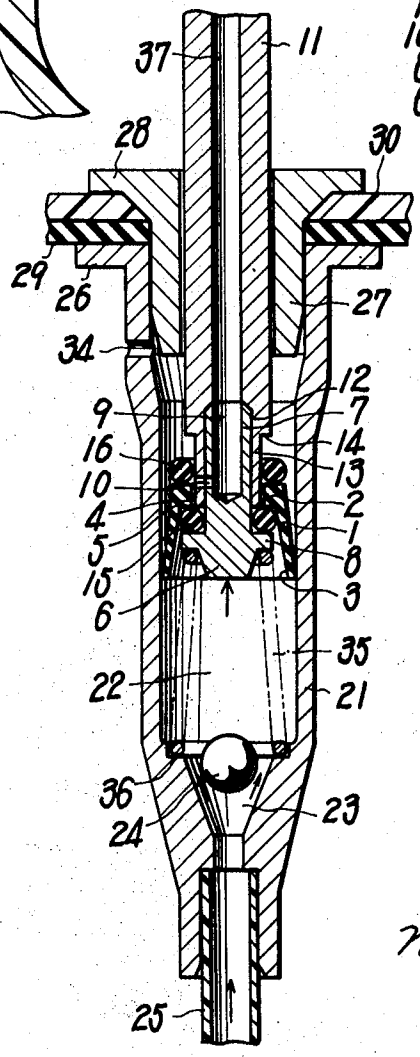


Fig. 3.



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Fig. 4.

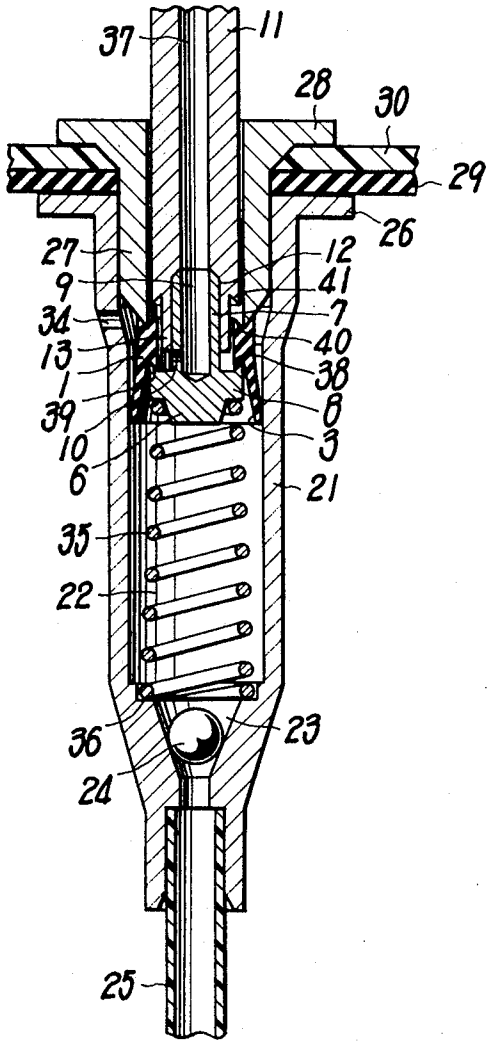


Fig. 5.

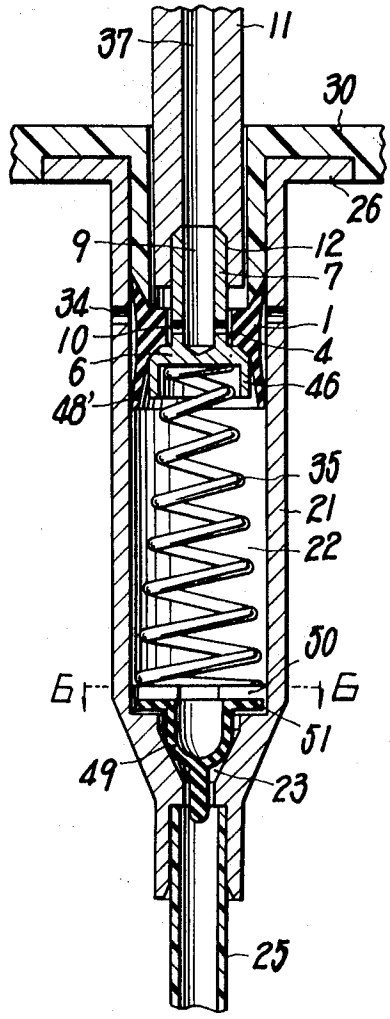
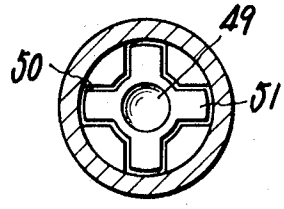


Fig. 6.



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Fig. 7.

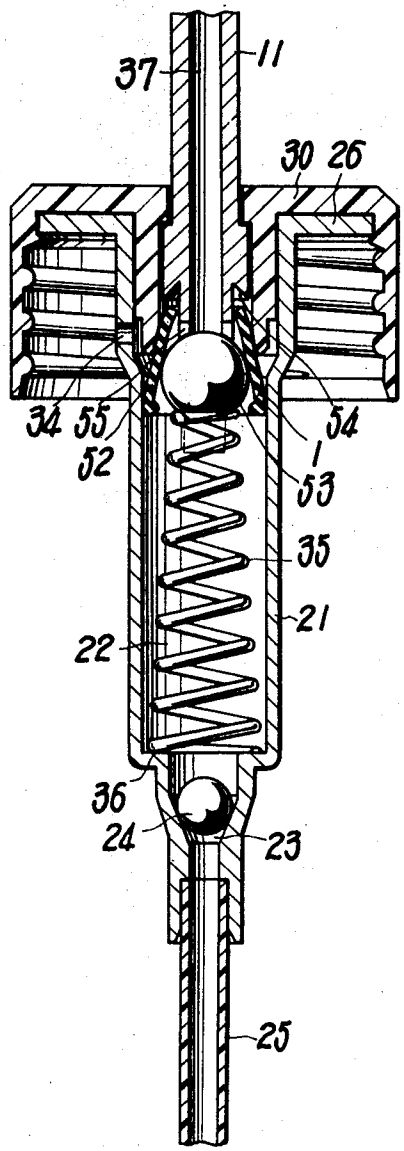
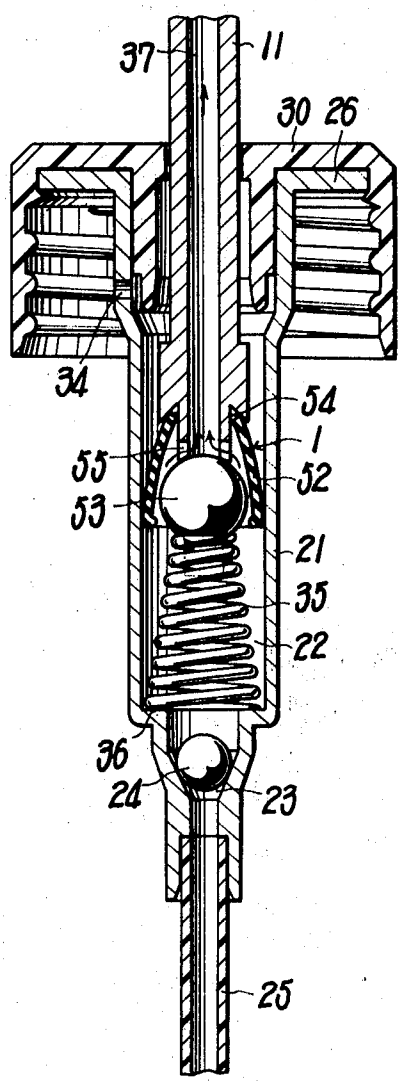


Fig. 8.



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FLUID-DISPENSING PUMP

BACKGROUND OF THE INVENTION

In general, in this type of pump, a liquid already sucked into a cylinder is compressed by keeping a valve fitted to the piston and the cylinder airtight, is introduced into the piston under the pressure and is atomized. The formation for introducing the compressed liquid in the cylinder into the piston and atomizing it is most difficult. The structure so far adopted is so complicated that there are disadvantages that the number of component parts is large, that the assembling is toilsome and that the structure is likely to be clogged with dust, causes many troubles and is not endurable to uses for a long period of time.

SUMMARY OF THE INVENTION

Briefly stated in accordance with one aspect of this invention, there is an atomizer pump wherein a valve body fitted to the lower end of a piston and inserted in a cylinder so as to perform a pumping action is fitted to a fitting member fitted to the lower end of the piston so that the valve body may be movable between the fitting member and the lower end of the piston and further a passage hole for connecting a liquid sucked up into the cylinder to the piston and pushbutton is made in the fitting member so that the passage may be opened by the movable valve body moving up in case the piston is pushed down against the resiliency of a coiled spring and may be closed by the movable valve moving down in case the piston is pushed up by the resiliency of the coiled spring when the force pushing it down is released and a pumping operation may be made. And the main object of the present invention is to greatly reduce the number of component parts so that the material, the cost of making the parts and the wage for assembling them may be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects and additional advantages of the invention will become apparent upon perusal of the following description taken in connection with the drawings, in which:

FIG. 1 is a vertically sectioned elevation of an embodiment of this invention;

FIG. 2 is a vertically sectional view as a piston is pushed down;

FIG. 3 is vertically sectional view as a piston the piston is pushed up;

FIG. 4 is a vertically sectional view of another embodiment;

FIG. 5 is a vertically sectional view of still another embodiment;

FIG. 6 is a cross-sectional view on line 6—6 in FIG. 5;

FIG. 7 is vertically sectional view of another embodiment; and

FIG. 8 is a vertically sectional view as the piston is pushed down in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The main object of the present invention is to greatly reduce the number of component parts so that the material, the cost of making the parts and the wage for assembling them may be reduced.

Another object of the present invention is to reduce the number of component parts by movably fitting a valve body to a piston so that a liquid in a cylinder may open and close a connecting hole leading to the piston.

A further object of the present invention is to separately form a valve body fitting member and a piston and make a connecting hole in this fitting member so that the connecting hole may be opened and closed positively enough by its combination with the valve.

A still further object of the present invention is to make it possible to adopt a structure adapted to the nature of the liquid in the formation of a valve body by the combination of the fitting portion of the valve body and the fitting member made separate from the piston.

The formation of the present invention for sufficiently and positively attaining the above-mentioned objects shall be explained with reference to the drawings.

In the drawings, 1 is a valve body formed of such elastic material as a rubber or synthetic resin so as to be in the form of a tube thin at the lower end 3 and thick at the upper end 2. The upper end 2 is made a little smaller in the diameter and a hole 4 is made in the center so as to form a shoulder portion 5 of the inner peripheral edge. 6 is a fitting member for the valve body 1 and has a thin long tubular portion 7. A flange-shaped edge 8 is provided to project on the lower outer periphery of the tubular portion 7. A deep concave hole 9 is made in the center of the tubular portion 7. A side hole 10 is made near the bottom of the concave hole 9 so as to connect with the hole 9. This tubular portion 7 is screwed into a concave hole 12 at the lower end of a piston 11 by having a male screw thread made on its outer periphery or is firmly forcibly fitted into the hole 12 and is fixed so as not to close the side hole 10. Further, the portion fixing the tubular portion 7 of the fitting member 6 at the lower end of the piston 11 is a smaller diameter tube portion 13 formed to be of a smaller diameter so as to form a step portion 14 between it and the piston body. 15 and 16 are O-rings. The O-ring 15 is fitted between the lower portion of the shoulder portion 5 within the valve body 1 and the upper surface of the flange-shaped projecting edge 8 of the fitting member 6. The O-ring 16 is fitted between the upper portion of the valve body 1 and the lower step portion 14 of the piston body 11. The distance between the lower step portion 14 of the piston body 11 and the flange-shaped edge 8 of the fitting member 6 must be such that the O-rings 15 and 16 of the above-mentioned valve body 1 may be fitted and the O-ring 16 and the valve body 1 may move up to open the side hole 10. A pushbutton 17 is fitted to the upper end of the piston 11. This pushbutton 17 is of a known structure wherein a concave hole 19 is made following a concave hole 18 for fitting the piston rod 11 and an atomizing orifice 20 is made on one side. 21 is a cylinder made gradually smaller below an inner chamber 22, provided with a conical hole 23 in which a small ball 24 is fitted airtightly and having a suction pipe 25 fitted below it. A flange-shaped portion 26 is provided at the upper end. A fastening plug lid 27 is screwed or firmly forcibly fitted from above the inner chamber 22. This fastening plug lid 27 is also provided with a flange-shaped portion 28. A screwed lid 30 having a packing 29 within it is fastened between this flange-shaped portion 28 and the flange-shaped portion 26 of the cylinder 21. This screwed lid 30 is fitted by being screwed to a male screw thread 33 on the outer periphery of the opening portion 32 of a container 31. 34 is an air-venting hole made in the upper portion of the cylinder 21. 35 is a coiled spring received at the upper end on the lower surface of the flange-shaped edge 8 of the fitting member 6 and at the lower end on an upper step portion 36 of the conical hole 23 below the inner chamber 22 of the cylinder 21 so as to act to push up with its resiliency the piston 11 inserted in the inner chamber 22 of the cylinder 21, the fitting member 6 fitted to the lower end of the piston 11, the valve body 1 and the O-rings 15 and 16 as pushed down against the resiliency.

As the present invention is formed as in the above, the valve body 1 is movably fitted to the fitting member 6 so as to open and close the side hole 10 connecting the inner chamber 22 of the cylinder 21 and the central hole 37 of the piston 11 to atomize a liquid. When the piston 11 is pushed down, the valve body 1 moves up to the step portion 14 of the piston 11 together with the O-ring 16 due to the frictional resistance of the inner chamber 22 of the cylinder 21 and opens the side hole 10 so that the liquid in the inner chamber 22 of the cylinder 21 may be fed under pressure into the central hole 37 of the piston 11. In such case, the O-ring 16 and the upper portion of the valve body 1 are airtightly in contact with each other to prevent the leakage of the liquid. This state is shown in FIG. 2. Further, when the finger pressure on the piston 11 is released, the piston 11 moves up due to the resiliency of the coiled spring 35. When it moves up, the valve body 1 is pushed

down by the frictional resistance of the inner chamber **22** of the cylinder **21**, the inner top surface of the valve body **1** comes airtightly into contact with the lower O-ring **15**, is thus positioned below the side hole **10** and breaks the connection between the side hole **10** and the inner chamber **22** of the cylinder **21** so that the liquid in the container **31** may be sucked resiliently into the inner chamber **22** in the cylinder **21** through the suction pipe **25**. This state is shown in FIG. **3**. In such case, the outside atmosphere communicates through the small hole **34** made in the upper peripheral wall of the cylinder **21** to send in air by the decrease of the liquid in the container **31**. Further, while the piston **11** pushed up by the resiliency of the coiled spring **35**, this small hole **34** is kept tightly closed with the valve body **1** and O-ring **16** so that the liquid in the container **31** may be prevented from flowing out even if the container falls down.

Next, FIG. **4** shows another embodiment. In FIG. **4**, though it is the same as in FIG. **1** that the valve body **1** is so formed as to be large at the lower end **3** and small at the upper end, an engaging portion **38** is formed above the inner periphery of the valve body **1**, the flange-shaped edge **8** of the fitting member **6** is made thicker, an upwardly rising engaging projecting edge **39** is made on the peripheral edge of the upper surface of the fitting member **6** so as to engage with the above-mentioned engaging step portion **38** of the valve body **1** and further an outwardly inclined slope **40** is made at the upper end of the valve body **1** and the step portion of the piston **11** is formed to be an inwardly inclined slope **41** so that, in both pushing down the piston **11** and pushing it up by the resiliency of the coiled spring **35** by releasing it, the piston may be kept airtight and may be positive in the operation.

FIG. **5** shows a further embodiment. The valve body **1** is formed to be small in the diameter in the middle of the outer periphery and expanded at both upper and lower ends and to have a projecting edge substantially in the middle of the inner periphery so as to be H-shaped in the vertical section. The fitting member **6** is formed with a lower expanded portion **46** to be covered on the outer periphery with the lower expanded portion **48'** of the valve body **1**. Instead of the small ball **24** shown in FIGS. **1** through **4**, a nipple-shaped elastic body **49** is fitted in the conical hole **23** below the cylinder **21**. However, it is not restrictive. The same operation and effect can be attained even with the small ball. As shown in FIG. **6**, crossed grooves **50** are made in the bottom of the cylinder **21** and the elastic body **49** also has crossed peripheral edges **51** fitting said crossed grooves **50** loosely with a clearance between them.

FIGS. **7** and **8** show still other embodiments. The valve body **1** is formed to be of such vertical section **52** as is larger at the lower end and gradually smaller toward the upper end, the fitting member is entirely omitted and a ball **53** is used. With this ball **53**, sufficient airtightness is kept. Further, when the piston **11** pushed down with a finger against the resiliency of the coiled spring **35**, a clearance through which the liquid can pass is obtained between the valve body and the ball **53**. In this case, a slope **54** inclined inward to the lower surface of the piston **11** may only be formed at the upper end of the valve body **1** so that the valve body **1** may not be opened outward at the upper end by the pressure of the liquid. Further, the right and left of the lower end surface of the piston **11** are cut to form a connecting passage **55**. The coiled spring **35** is made gradually smaller in the diameter toward the upper end or the ball **53** side so that the ball **53** may be always retained in the center.

As in the above, the present invention is so formed that, in case the piston is pushed down or is pushed up by the resiliency of the coiled spring when the force of pushing it down is released, the valve body may move vertically to open or close the passage hole connecting the inner chamber of the cylinder and the central hole of the piston. Therefore, there are obtained advantages that the number of the component parts is small, that therefore the trouble and wage for making many component parts can be reduced, that the trouble in assembling them can be reduced and that the products can be provided cheaply. Further, the valve body is varied in the form as exemplified in the working drawings so as to be able to be used in response to the concentration and other properties of the liquid. Therefore, there is an advantage that more economical products can be provided. Further, the present invention has features that the valve body is movable, is low in the frictional resistance, is high in the durability and is endurable to uses for a long period of time.

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

1. An atomizer pump wherein a valve body fitted to the lower end of a piston and inserted in a cylinder so as to perform a pumping action is formed to be large at the lower end and smaller in the diameter toward the upper end, an inwardly slope is formed in the lower portion of the piston so as to fit the upper end of the above-mentioned valve body to prevent it from expanding outward and further a ball normally pressed up on the lower surface with a coiled spring is kept in contact with the inner surface of the valve body so that, in case the piston is pushed down, the valve body may be expanded outward by the pressure of a liquid to make a clearance between the valve body and the ball and feed the liquid into the piston and, in case the piston is released and is pushed up by the force of the coiled spring, the valve body may be contracted by the frictional resistance of the inner periphery of the cylinder so as to be airtightly kept in close contact with the ball surface and suck the liquid in a container into the cylinder.

2. A fluid-dispensing pump comprising:

1. a chamber defined by a wall and including an upper portion having a venting hole and a lower portion having a one-way valve formed by a movable sealing member seated in a conical hole;
2. a fastening plug lid inserted into said upper portion of said chamber;
3. a piston rod extending through said fastening plug lid into said chamber, and including a central hole extending through its length for discharge of fluid, and a step portion;
4. a fitting member connected to the end of said piston rod within said chamber and including side and central holes in communication with each other, and with said piston rod central hole in communication with said fitting member central hole, and further including a flanged portion; and
5. valve means slidingly engaged between said fitting member and said chamber wall and operative to enable said pump to dispense fluid only on the downstroke of said piston rod by effecting communication of said fitting member side hole with said lower portion of said chamber during the downstroke of said piston rod, and sealing said fitting member side hole from said lower portion of said chamber during the upstroke of said piston rod, the travel of said valve means being limited between said step portion of said piston rod and said flanged portion of said fitting member.

3. The fluid-dispensing pump according to claim **2**, further comprising a spring member disposed between and in engagement with said fitting member and said conical hole at said lower portion of said chamber to automatically effect the upstroke of the piston rod upon release of downward pressure from said piston rod after effectuation of said downstroke.

4. The fluid-dispensing pump according to claim **2**, including a first O-ring disposed between said valve means and said step portion of said piston rod, and a second O-ring disposed between said valve means and said flanged portion of said fitting member.

5. The fluid-dispensing pump according to claim **2**, wherein said valve means is generally conically shaped, with a wide portion engaging said chamber wall and a narrow portion having a flanged portion extending inwardly toward said piston rod.

6. The fluid-dispensing pump according to claim 2, wherein said valve means has a small middle portion and larger upper and lower portions, said upper and lower portions being in engagement with said chamber wall.

7. The fluid-dispensing pump according to claim 2, wherein said valve means effects a fluidtight seal with said step portion of said piston rod during downstroke and effects a fluidtight seal with said flanged portion of said fitting member during the upstroke.

8. The fluid-dispensing pump according to claim 2, wherein said movable sealing member is a ball.

9. The fluid-dispensing pump according to claim 2 wherein said movable sealing member is a nipple-shaped elastic body.