United States Patent [19]

Kondo

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[54] **A SPRING PRESSURE ACCUMULATIVE SPRAY DEVICE**

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[52] **U.S. Cl.** **239/333,** 239/350, 239/579, 222/385

[51] **Int. Cl.** **B05b 11/00**

[58] **Field of Search** ....222/383—385, 321; 239/321, 329, 331, 333,350, 579

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Assistant Examiner—John J. Love
Attorney—E. F. Wenderoth et al.

[57] **ABSTRACT**

This invention relates to a spray device for perfume, hair-spray, insecticide etc., and more especially to a spring pressure accumulative spray device capable of gaining fine spray owing to its high pressure spraying. This spray device is capable of generating highly pressurized pressure accumulative liquid even when the spraying button is pushed by only slight finger force, while no internal pressure operates inside of the receptacle directly so that a pressure-proof receptacle is not necessary and any pressure drop due to a decrease in the amount of contained liquid or any leakage of the liquid while the device is not in use can be prevented. The construction is simple, and the device is a low cost pressure accumulative spray which can be discarded after use.

6 Claims, 7 Drawing Figures

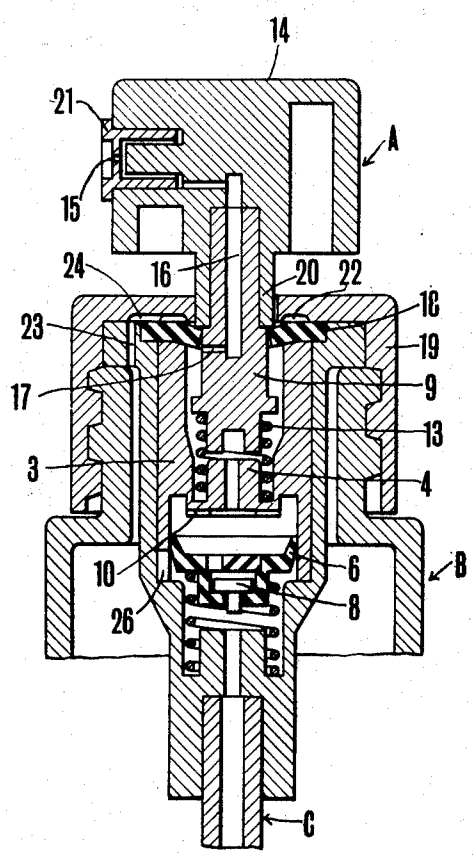


FIG. 1

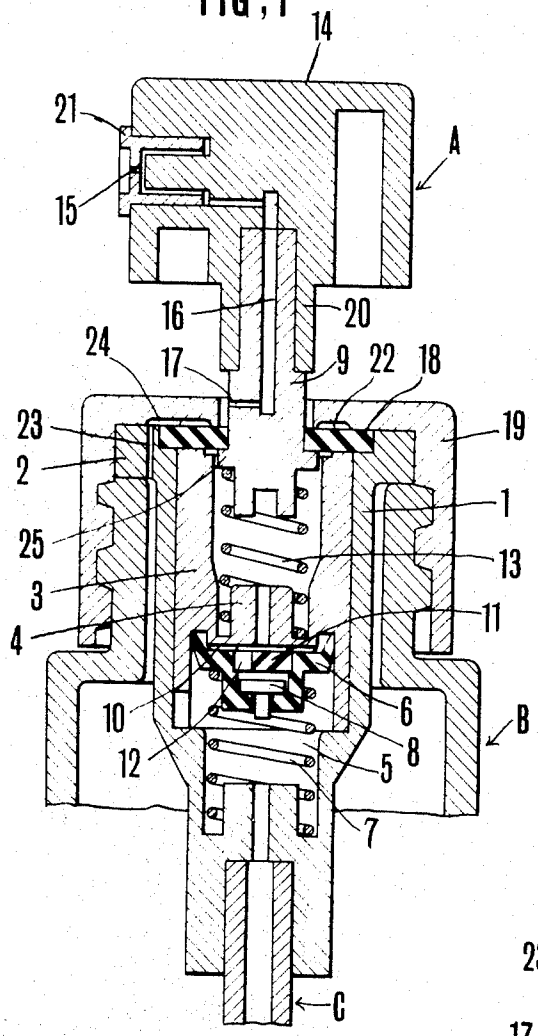

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FIG. 2

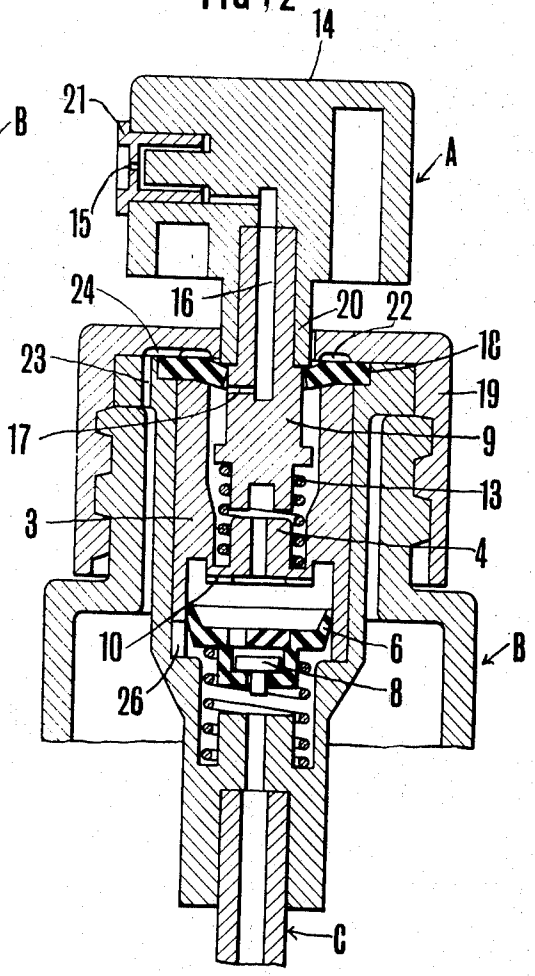

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FIG. 3

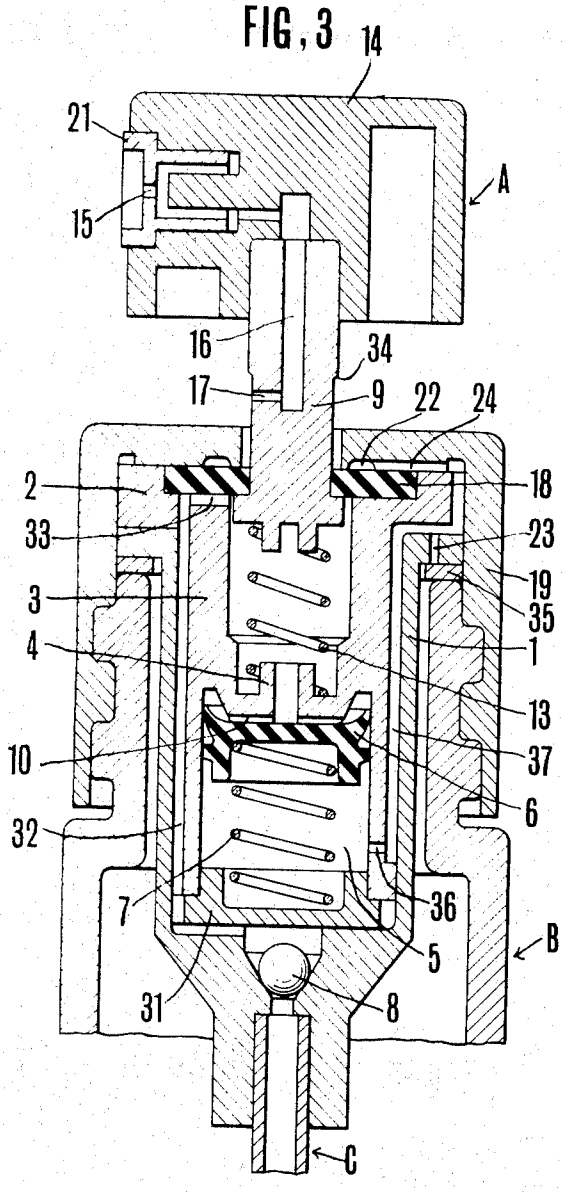

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FIG. 4

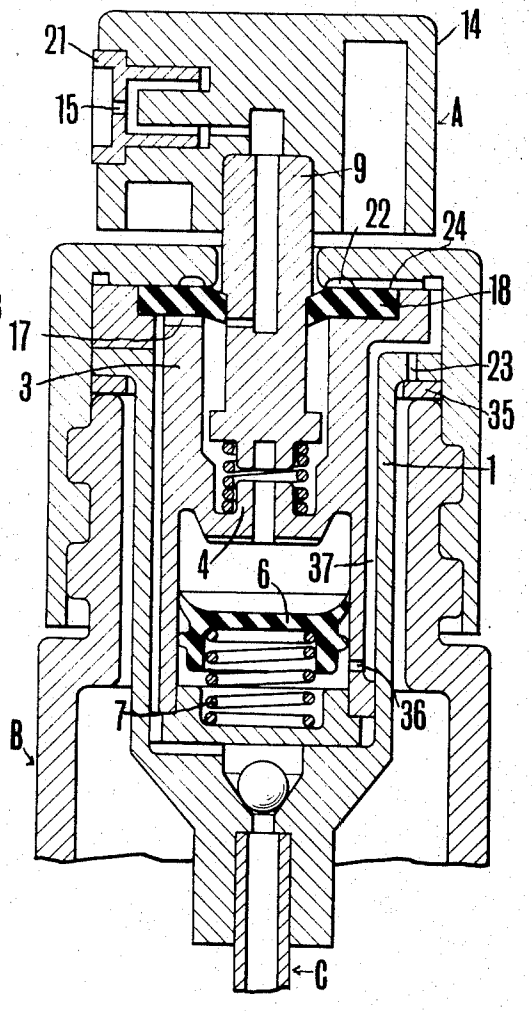

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FIG. 5

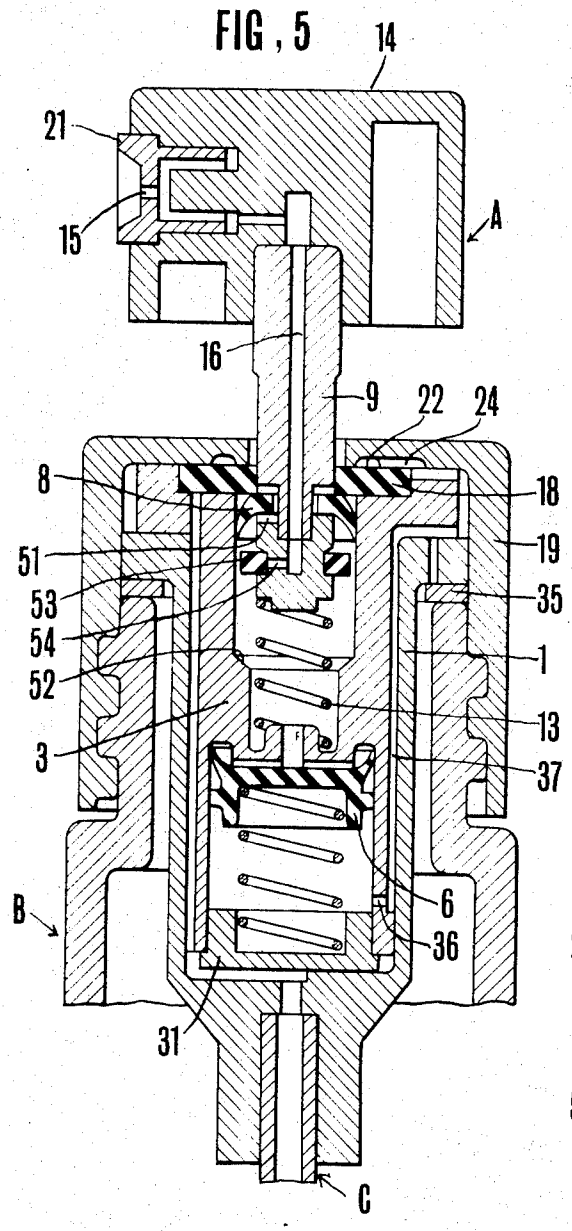

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FIG. 6

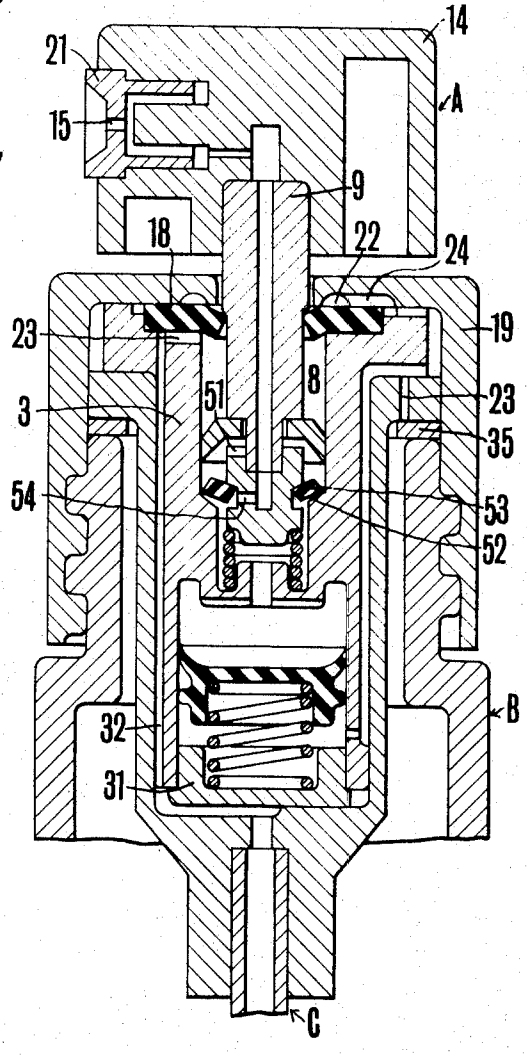
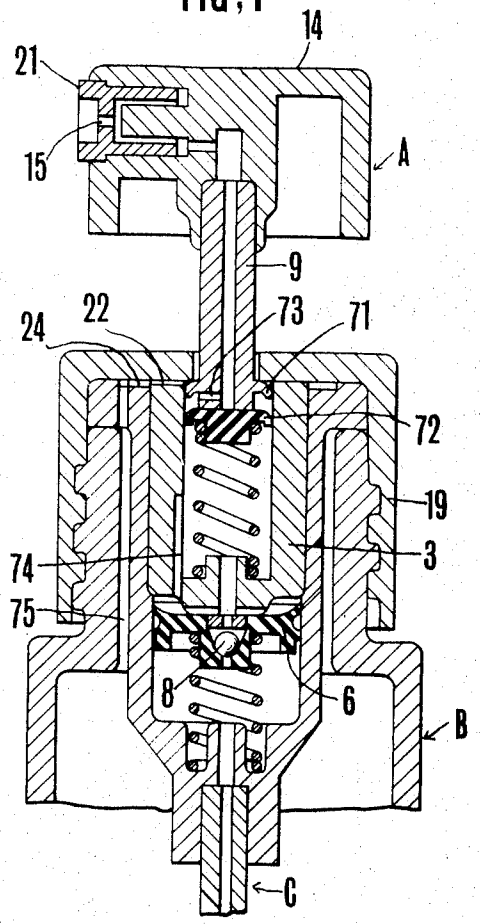

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FIG. 7



SPRING PRESSURE ACCUMULATIVE SPRAY DEVICE

This invention relates to a pressure accumlative spray device employing a spring.

Known spray devices suitable for spraying perfume, hair-spray or insecticide, include aerosol type spray devices in which liquidized gas or compressed gas is charged under pressure, and hand operated spray pump types in which a piston is pushed by the force of a finger to spray a liquid. Such devices have been used in especially large quantities.

These known spray devices, however, have various defects. Namely, an aerosol type spray device necessitates the use of large amounts of equipment for filling the container with the spray solvent, and it has some danger of leakage or explosion by fire because of its exposure to internal pressure.

In hand operated spray pump type devices, the spray pattern varies in accordance with the difference of in pushing force of the spraying button, this has the inherent defect such that, when the spray button is pushed slowly, the spray can not be produced.

Accordingly, a spray device in which such spray solvent as an aerosol is not used, and in which a stabilized spray can be gained by merely pushing a spraying button as in an aerosol type has long been sought.

This invention relates to a spring pressure accumulative spray device in which compressed liquid produced by pushing a plunger is retained in a pressurized state by a spring force through a piston, and which is sprayed at a breath when said plunger has reached its lowermost position.

An object of this invention is to provide a spring pressure accumulative spray device in which a stabilized spray can be gained by merely pushing a spraying button regardless of the pushing force.

A second object of this invention is to provide a spring pressure accumulative spray device which generates a highly pressurized pressure accumulative liquid even when the spraying button is pushed by a slight finger force, and in which a fine spray can be gained owing to its high pressure spraying.

A third object of this invention is to provide a spring pressure accumulative spray device in which construction is simple and which is low in cost permitting it to be discarded.

A fourth object of this invention is to provide a spring pressure accumulative spray device in which use of a pressure-proof receptacle is not necessary because no internal pressure operates directly in the receptacle, and which can prevent pressure drop due to a decreasing quantity of the liquid content and leakage when the device is not in use.

FIG. 1 is a vertical section of a spring pressure accumulative spray device showing the state before the spraying button is pushed.

FIG. 2 is a vertical section of a spring pressure accumulative spray device showing the state after the spraying button is pushed.

FIG. 3 is a vertical section of a spring pressure accumulative spray device showing another embodiment in the state before the spray button is pushed.

FIG. 4 is a vertical section of the spring pressure accumulative spray device in FIG. 3 showing the state after the spray button is pushed.

FIG. 5 is a vertical section of a spring pressure accumulative spray device showing a further embodiment in the state before the spraying button is pushed.

FIG. 6 is a vertical section of the spring pressure accumulative spray device in FIG. 5 showing the state after the spraying button is pushed.

FIG. 7 is a vertical section of a spring pressure accumulative spray device showing a still further embodiment of the invention.

The characteristics and features of this invention will become clear from following discription.

In FIG. 1, spray device A according to this invention is mounted by any known method on the open end of receptacle B which can be held by one hand.

Namely, spray device A is provided with a main body 1 having a flange 2, and this body 1 is provided with a longitudinally extending bore in relation to receptacle B. At lower part of main body 1, a suction pipe C is fitted into the body which extends to the bottom part of receptacle B (not shown).

In the bore of main body 1, cylinder 3 is inserted, and hanger stopper 4 having a penetrating hole is provided inside of said cylinder 3. Inside of said cylinder 3, highly pressurized accumulative liquid can be retained, so that it is preferable to make cylinder 3 of a synthetic resin having a high strength, e. g. polyacetal or polypropylene.

Inside of bore 5 of the main body, piston 6 is provided slidably inside the wall of said bore 5 in an air-tight state, said piston 6 being formed of synthetic resin or other material with proper elasticity, and the sliding part is formed to have a gradually thinner wall thickness toward the tip end in order to facilitate its return motion. The lower part of said piston 6, a compression spring 7 is provided in order to push said piston 6 upwards.

A check-valve 8 is provided on piston 6 to prevent flow-back of pressurized liquid produced when plunger 9 is pushed into receptacle B.

However, said check-valve 8 can be opened when said plunger 9 has been returned.

Further, check-valve 8 may be replaced by spherical or other shaped valves as shown in FIG. 3 and FIG. 4, or this check-valve 8 may be omitted by providing a groove 10 at the underside of hanger stopper 4 and then causing said groove 10 to communicate with a penetrating hole of hanger stopper 4.

A plug 11 is provided on piston 6 in order to prevent check-valve 8 from moving to an improper site, and a penetrating hole 12 for liquid is provided on this plug 11.

On plunger 9 which is fitted into the upper end part of compression spring 13, a longitudinal penetrating hole 16 communicating with nozzle 15 in the spraying button 14 and an orifice 17 penetrating in the lateral direction from said penetrating hole 16 are provided.

An elastic annular packing 18 made of rubber or the like is positioned around plunger 9 in order to prevent leakage of liquid by retaining it in an air-tight state between the upper face of cylinder 3 and cap 19.

A spraying button 14 is fitted onto the upper projection part of plunger 9. The button is provided with an annular projection 20 having a larger outer diameter than that of plunger 9 and which extends downwards.

A spraying nozzle 21 is fitted into said spraying button 14. When the liquid passage of this nozzle 21 is formed as a spiral, the spraying liquid is given a revolv-

ing motion so that an extremely fine spray can be obtained.

The inside upper face of cap **19** is provided with an annular groove **22** and a groove **24** which allows this annular groove **22** to communicate with a longitudinal hole **23** provided in the flange part of main body **1.**

In this embodiment (FIG. 1 and FIG. 2), said longitudinal hole **23** communicates with receptacle B, but this may be closed by a flexible seal packing as shown in FIG. 3 – FIG. 6.

Cap **19** and main body **1** are fixed to each other so as not to be easily separated, moreover cap **19** is screwed onto receptacle B by screw threads.

Further, a stepped flange part **25** is provided on lower part of plunger **9.**

The device shown in FIG. 1 according to this invention is constructed as mentioned above, and the spraying operation of the liquid in receptacle B by this device is as follows.

Namely, when spraying button **14** is pushed downward as shown in FIG. 2, the liquid in cylinder **3** is compressed by plunger **9.** Compressed liquid lowers piston **6** corresponding to the compressed amount, because check-valve **8** is closed in this case, and liquid is further retained in the pressurized state because said piston **6** is pushed upwards by compression spring **7.**

When spraying button **14** is pushed further, orifice **17** communicates with the inside of cylinder **3,** and said pressurized liquid is sprayed from nozzle **15** through longitudinal penetrating hole **16.**

Further, when the spraying operation is finished, the finger force pushing spraying button **14** is removed, then plunger **9** starts its upward movement by the repulsion force of compression spring **13.** By this upward movement of plunger **9,** a vacuum is generated inside of cylinder **3,** and this suction force operates so that liquid in receptacle B is supplied to the inside of cylinder **3** through pipe C and opened check-valve **8.** In this case, the thin wall part of the sliding part of piston **6** tends to bend inwards and is opened by the suction force accompanied by the upward movement of plunger **9.** Therefore check-valve **8** may be omitted, ahd liquid may be passed inside of cylinder **3** from the peripheral sliding part of piston **6.**

When the liquid in receptacle B is used successively by spraying, the amount of liquid is decreased successively, as a result, a vacuum is generated in receptacle B. This vacuum is not preferable because it prevents the supply of liquid into cylinder **3** and makes it difficult to spray in succession.

But in the spray device according to this invention, when spraying button **14** is pushed, packing **18** is bent by the annular projection **20** of this spraying button so as to open slightly between the upper face of packing **18** and the lower face of cap **19,** in this way air pass through annular groove **22,** and enters the inside of receptacle B through groove **24** and longitudinal hole **23,** thus the creation of a vacuum in receptacle B can be prevented.

Further, when the spraying button **14** of this device A is not being pushed, packing **18** is pushed up air-tightly by the stepped flange part **25** formed at the lower part of plunger **9,** and the inlet for external air is closed, so the leakage of liquid from receptacle B can be prevented.

Further, when a particular quantity of spraying liquid such as medicine is desired to be sprayed, the device may be provided with a groove **26** at the lower part of cylinder **3** to return the extra compressed liquid back to receptacle B.

The spray device shown in FIG. **3** will now be explained.

In the drawing, the corresponding parts as in FIG. **1** and FIG. **2** are denoted with same characters.

Spray device A shown in FIG. **3** has a check valve **8** of spherical shape, which is provided at the bottom part of a valve box. The, bottom part of cylinder **3** is air tightly closed by plug **31,** and is formed so that liquid in the receptacle can enter cylinder **3** from groove **33** at the upper part of cylinder **3** through pipe C and passage **32** between the main body **1** and cylinder **3.**

In this case, plunger **9** also differs from that shown in FIG. **1** the stepped part **34** is formed directly on the outer peripheral surface of this plunger.

Further, the inside upper face part of cap **19** is provided with an annular groove **22** and a groove **24** which allows this annular groove **22** to communicate with longitudinal hole **23** provided on the flange part of main body **1,** longitudinal hole **23** shown in this embodiment is closed by a flexible seal packing **35,** while the abovementioned longitudinal hole **23** (FIG. **1**) communicates with the inside of receptacle B.

A hole **36** is provided at the lower part of cylinder **3,** and this hole **36** communicates with passage **37** between main body **1** and cylinder **3.**

When the inside liquid is sprayed using the abovementioned spray device A shown in FIG. **3,** liquid in cylinder **3** is compressed by plunger **9** when the spraying button is pushed. Then, piston **6** also descend in accordance with the descending of plunger **9,** but compressed air generated at the lower part of this piston **6** passes through hole **36** and passage **37** between main body **1** and cylinder **3,** then through groove **24** and annular groove **22,** and opens packing **18** by discharging air pressure so as to be vented, and one part of the air passes through longitudinal hole **23,** and opens seal packing **35** by the air pressure and enters inside of receptacle B.

In the embodiment shown in FIG. **5,** the same parts as in FIG. **1** – FIG. **4** are denoted by the same characters.

In this spray device A, a check-valve **8** is provided on plunger **9.** Check-valve **8** shown in FIG. **5** is made of an elastic material, and its outer periphery part is formed so as to be fitted closely but slidably in the inner wall of cylinder **3,** while there is a slight clearance between the small diameter part of plunger **9** and the inserted part of the check-valve **8** as shown in FIG. **5.** When plunger **9** is pushed downward as shown in FIG. **6,** check-valve **8** compresses the liquid in cylinder **3** air-tightly, and when it returns, the liquid in receptacle B is supplied to cylinder **3** through a groove **51.**

When said check-valve **8** returns, its outer periphery part is bent downwards and is opened, so that liquid can be supplied through this clearance. Further, the bottom part of cylinder **3** is closed air-tightly by plug **31,** and the liquid in receptacle B can enter into cylinder **3** from groove **33** at the upper part of cylinder **3** through pipe C and passage **32** between main body **1** and cylinder **3.**

In FIG. **5,** on the inside upper face part of cap **19,** annular groove **22** and groove **24** which allows groove **22** to communicate with a longitudinal hole **23** on the flange part of the main body **1** are also provided as in

FIG. 3, and said longitudinal hole 23 communicates with the inside of the receptacle, but it is closed by flexible seal packing 35.

As seen in FIG. 6, when plunger 9 reaches its lowermost position, valve 53 is bent by the stepped part 52 provided on the inside of cylinder 3, and orifice 54 is opened to the spray liquid.

The spray device shown in FIG. 7 differs from the spray device shown in FIG. 1 – FIG. 6, in that the packing 18 to be inserted between cap 19 and cylinder 3 is omitted.

At the lower part of plunger 9, pistons 71 and 72 are provided, which slide on the inner wall of cylinder 3 in closely contacting state, and an orifice 73 is provided between these pistons 71 and 72.

Further, a groove 74 is provided on the inner wall of cylinder 3, which communicates with said orifice 73. Therefore, when spraying button 14 is pushed downward, plunger 9 descends, and the liquid inside cylinder 3 is compressed. At the same time the piston 6 also descends. When orifice 73 of plunger 9 has reached to the position of groove 74, the liquid in cylinder 3 is sprayed from nozzle 15 through groove 74 and orifice 73.

When plunger 9 has descended, the air at the outside of receptacle B passes through the clearance between plunger 9 and cap 19, then enters into receptacle B through groove 24 and longitudinal groove 75. This prevents the creation of a vacuum in the receptacle when the liquid is sprayed from nozzle 15.

As mentioned above, the spray device according to this invention can create fine spray such as is required for insecticides, hair-sprays or inhale medicines and the like by a high pressure spray.

Namely, in order to gain high pressure, the pressing force of the liquid may be enlarged by the repulsion force of spring 7, but on the other hand, this is not preferable because this increases the manual force required to push the plunger.

To remove this defect, in this invention, the diameter of piston 6 is enlarged compared with the diameter of piston 9 as a result, the pushing force of spraying button 14 can be decreased, utilizing the "law of transmission relating to liquid pressure" i.e. "Pascal's principle."

As mentioned above, in the device of this invention, the pressure accumulation of spray liquid and the spraying operation can be preformed at the same time by merely pushing the spraying button, so that usage is simplified. Moreover, a high pressure accumulative spray liquid can be gained by only slight finger pushing force regardless of the manner in which the spraying button is pushed. Further, a fine spray can be created by its high pressure, which could not be achieved in customary spray device.

I claim:

1. A spring pressure accumulative spray device comprising a main body adapted to be air tightly mounted on a receptable and a cap means for securing said main body to said receptacle; a first compression chamber located within said main body, a plunger means having a first end located at least partly within said first chamber and extending out of said first chamber through said cap means, a spraying button mounted on the second end of said plunger and having a nozzle therein, an orifice located in said plunger at a point remote from said second end and a bore hole within said plunger connecting said nozzle to said orifice, said plunger being mounted for recipricating movement within said first chamber and a first spring means normally urging said plunger out of said first chamber; said orifice communicating with said first chamber when said plunger is moved into its extreme innermost position within said first chamber; a second compression chamber located within said main body and connected to said first compression chamber, a piston means located in said second chamber and being adapted to closely contact the side walls of said second chamber, said piston being mounted so as to be movable within said second chamber independently of the movement of said plunger and second spring means urging said piston into said second chamber; and check-valve means for selectively permitting liquid in said receptacle to flow into one of said chambers.

2. A spring pressure accumulative spray device as claimed in claim 1 wherein said piston has a larger diameter than the diameter of said plunger.

3. A spring pressure accumulative spray device as claimed in claim 1 wherein a flexible packing means is positioned around said plunger and between the uppermost part of said housing and said cap means, an air passage formed in said housing and adapted to communicate with the interior of said receptacle, means carried by said plunger for flexing said packing means when said plunger is in substantially its extreme innermost position, whereby said air passage is permitted to communicate with the ambient atmosphere.

4. A spring pressure accumulative spray device as claimed in claim 1 wherein said plunger carries spaced apart first and second pistons, each of said first and second pistons being adapted to contact the inner surface of said first chamber, said orifice being located between said first and second pistons, and a groove located in the inner wall of said first chamber, whereby said orifice is adapted to communicate through said groove with the compressed liquid in said first chamber when said plunger is moved into its innermost position.

5. A spring pressure accumulative spray device as claimed in claim 1 wherein said plunger carries a flexible means which normally obstructs the opening of said orifice and means located within said first chamber for temporarily moving said flexible means from said orifice when said plunger is moved into its innermost position, whereby said orifice is permitted to communicate with said first chamber.

6. A spring pressure accumulative spray device as claimed in claim 4 wherein means are provided for allowing the interior of said receptacle to communicate with the ambient atmosphere when said plunger is moved from its outermost position.

* * * * *