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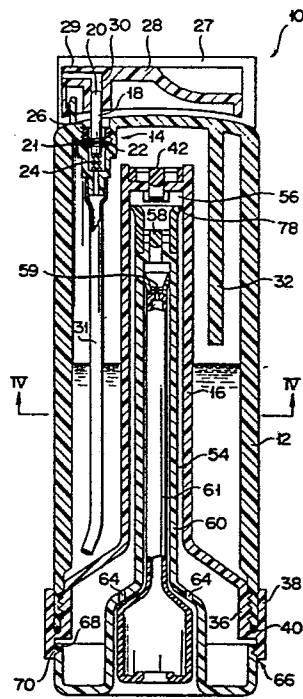
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(54) **Air-pressurized sprayer.**

(57) An air-pressurized sprayer (10) comprises a valve housing (14) attached to the top portion of a container (12) containing a liquid to be sprayed, and a cylinder (16) removably attached to the bottom portion of the container (12) to extend upward inside the container (12). The valve housing (14) includes a descendable nozzle (29), a one-way valve (18) for spraying which opens in connection with a descending action of the nozzle (29), and a pipe (31) for leading the liquid in the container (12) into the spraying valve (18). On the other hand, the cylinder (16) includes a piston (54) having a seal (78) and slidable along the inner peripheral surface of the cylinder, and a one-way valve (42) for air pressurization which allows air pressurized by the slide of the piston (16) to flow into the container (12).

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FIG. 1



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Air-pressurized sprayer

This invention relates to a sprayer, more particularly to an air-pressurized sprayer in which air in a container is pressurized in advance by a pump.

5 Aerosol-type sprayers are well-known sprayers which are advantaged in being capable of continuously spraying a full pressurized liquid and in the ease of handling or operation. Containing high-pressure gas such as Freon gas, however, a liquid container used in one such
10 sprayer need be a pressure-resisting container such as a metal can. Further, it is known that Freon gas, which is generally used as the high-pressure gas to be jetted together with a liquid, may cause air pollution.

15 On the other hand, manual sprayers represented by trigger type or push-button type sprayers pressurize and spray a liquid by a pumping action caused by a swing of a trigger or a descent of a push button without the assistance of any high-pressure gas. Accordingly, these sprayers need no pressure-resisting container, and will
20 never cause air pollution. With the conventional manual sprayers, however, the liquid is pressurized and sprayed with every pumping action. Further, the spraying condition is closely related to the pressurizing force, so that a great pressure need always be applied to obtain
25 highly minute particles of liquid for spraying. For continuous spraying, moreover, the pumping action need

be repeated.

In order to obviate those drawbacks of the conventional manual sprayers, there are provided air-pressurized sprayers in which high-pressure air is accumulated in advance in a container by sliding a piston. In one such sprayer, a nozzle is lowered not for a pumping operation but only to open a valve for spraying. When the nozzle is lowered, a liquid in the container is pressed by highly pressurized air in the container, and is continuously sprayed in the form of minute particles through the spraying valve. To minimize the number of protrusions from the sprayer, the piston is locked to a position where it is fully in during a spraying operation. In doing this, however, the piston need be forced into the lock position against the residual high-pressure air already pressurized in the container, thus requiring large pushing force. To eliminate such drawback, a prior art air-pressurized sprayer is provided with an air intake which is closed during the pumping operation and, on completion of the pumping operation, is connected with the atmosphere to discharge the residual high-pressure air within the cylinder into the atmosphere, thereby removing the resisting force against the locking action of the piston. With the construction utilizing such air intake, however, the air intake need be entirely blocked during the pumping operation, and also the closed state of the air intake must be maintained while applying large pushing force against the residual high-pressure air, thus complicating the pumping operation.

It is therefore an object of this invention to provide an air-pressurized sprayer capable of accumulating high-pressure air in a container without sliding a push button.

To this end, according to the invention, a cylinder is attached to the bottom portion of the container, and a piston is slidden inside the cylinder to

pressurize air therein. The pressurized air is supplied from the cylinder to the container through a valve.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is for purpose of illustration only and is not intended as a definition of the limits of the invention.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Figs. 1 and 2 are a longitudinal sectional view and a top plan view of an air-pressurized sprayer according to an embodiment of this invention, respectively;

Figs. 3A and 3B are longitudinal sectional views of one-way valves for spraying;

Fig. 4 is a transverse sectional view taken along line IV - IV of Fig. 1;

Fig. 5 is a top plan view of a one-way valve for air pressurization;

Fig. 6 is an enlarged partial longitudinal sectional view of a cylinder;

Fig. 7A is a transverse sectional view taken along line VII A - VII A of Fig. 6;

Fig. 7B is a transverse sectional view similar to Fig. 7A and showing a modification of an airtightness release means;

Fig. 8 is an enlarged partial front view of a piston;

Fig. 9 is a longitudinal sectional view of an air-pressurized sprayer according to another embodiment of the invention;

Fig. 10 is a partial longitudinal sectional view of an air-pressurized sprayer according to a third embodiment of the invention;

Fig. 11 is a fragmentary front view of a piston;

Fig. 12 is a partial longitudinal sectional view of an air-pressurized sprayer according to a fourth embodiment of the invention;

5 Figs. 13 and 14 are a top plan view and a longitudinal sectional view of a modification of the one-way valve for air pressurization, respectively;

Figs. 15 and 16 are a rear view and a partially broken side view of an air-pressurized sprayer provided with a child-proof mechanism, respectively;

10 Figs. 17 and 18 are a partial rear view and a partially broken, partial side view of an air-pressurized sprayer provided with another child-proof mechanism, respectively;

15 Figs. 19 and 20 are a rear view and a partially broken, partial side view of an air-pressurized sprayer provided with still another child-proof mechanism, respectively; and

20 Figs. 21 and 22 are a front view of a push button of the sprayer shown in Fig. 19 and an enlarged sectional view of a stopper of the push button.

Now there will be described in detail preferred embodiments of this invention with reference to the accompanying drawings.

25 An air-pressurized sprayer 10 according to a preferred embodiment of the invention, as shown in Fig. 1, includes a valve housing 14 attached to the top portion of a container 12 made from plastic, and a cylinder 16 attached to the bottom portion of the container.

30 The number of components can be reduced to facilitate construction by integrally forming the valve housing 14 with the container 12, as shown in Fig. 1. The valve housing 14 contains a one-way valve 18 for spraying which includes a plastic stem 20, a rubber gasket 22 capable of blocking a lateral hole 21 of the stem, and a compression coil spring 24. The spraying
35 valve 18 is received in the valve housing 14 with a fixing ring 26 screwed in an internally threaded portion

of the valve housing. The stem 20 of the spraying valve 18 is fitted in a passage 30 formed inside a push button 28 which is located within a recess 27 (see Fig. 2) at the top portion of the container 12. The push button 28 is formed integrally with a nozzle 29. Attached to the lower end portion of the valve housing 14 is a pipe 31 for leading a liquid inside the container 12 into the spraying valve 18. Thus, the lateral hole 21 of the stem 20 is released from the blockade by the gasket 22 when the push button 28 is pressed down against the biasing force of the spring 24. As a result, the interior of the container 12 is allowed to communicate with the atmosphere through the spraying valve 18 to be ready for spraying. As shown in Figs. 3A and 3B, the spraying valve 18 may be constructed by integrally forming the stem and compression spring. Such construction leads to a reduction in the number of components and hence to an improvement in the ease of assembling.

The container 12 is provided with an integral level bar 32 extending downward from the top portion thereof. The level bar 32 functions as a standard for the level of the liquid which is supplied to the container 12 turned upside down, as mentioned later. Having a plurality of ribs 34 integrally extending along the radial direction from the inner surface thereof, as shown in Fig. 4, the container 12 is fully augmented in strength, especially in strength along the radial direction, so that it can satisfactorily stand highly pressurized air.

The cylinder 16 is screwed in the bottom portion of the container 12 to extend thereinto. The cylinder 16 has integrally formed inner and outer walls 36 and 38, the inner wall 36 being screwed in the lower end portion of the container 12 so that the lower end portion of the container is held between the inner and outer walls 36 and 38. An O-ring 40 is interposed between the cylinder 16 and the container 12 to secure liquid-tightness between them. Since the lower end portion of the container

12 is thus held between the inner and outer walls 36 and 38 of the cylinder 16, the engagement between the cylinder and the container 12 may be secure enough to prevent leakage of the liquid even under high pressure.

5 Also, the cylinder 16 may be removably attached to the bottom portion of the container 12 by any other means than screwing.

The cylinder 16 has a valve 42 for air pressurization at the inner end thereof. The pressurization valve 10 42 is a one-way valve which allows only a current of air into the container 12, including a valve plug 48 coupled to a valve body 44 by three rocking strips 46 (see Fig. 5) and capable of moving along the axial direction. A hollow piston 54 is contained in the cylinder 16 so as 15 to be slide inside the cylinder. The piston 54 includes a pair of pistons 60 and 61 respectively having one-way valves 58 and 59 for air suction which allow air to flow into a pressure chamber 56 defined between the cylinder 16 and the piston. Here the piston 61 is smaller in 20 diameter than the piston 60, and the former is slidably contained in the latter. Like the one-way pressurization valve 42 of the cylinder 16, these one-way valves 58 and 59 are each composed of a valve body and a valve plug coupled thereto by rocking strips. As shown in 25 Fig. 1, the large-diameter piston 60 has a number of air intakes 64, and can be locked to the cylinder 16 by a locking means 66. The locking means 66 need only be able to lock the piston body 54 to the cylinder 16 or the container 12 at the spraying operation of the 30 sprayer 10, and may be of various constructions without being limited to the construction of Fig. 1 in which an engaging projection 70 formed on the outer wall 38 of the cylinder is caused to engage an engaging hole 68 formed in the large-diameter piston 60.

35 The air-pressurized sprayer 10 of the above-mentioned construction is operated as follows. First, the container 12 is turned upside down, and the cylinder

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16 is rotated to be released from the engagement with the container 12 and then removed together with the piston 54 from the container 12. Entirely contained in the recess 27 at the top portion of the container 12, the push button 28 will never be pressed even though the container is inverted. Then, the liquid is supplied into the container 12 to, for example, the tip end of the level bar 32. In this invention, the valve housing 14 and the cylinder 16 are attached respectively to the top and bottom portions of the container 12 so that they are separated completely. Accordingly, the supply of the liquid requires only that the cylinder 16 be removed from the container 12, and it is quite unnecessary to disassembly the valve housing 14. Thus, the disassembly and assembly at the liquid supply are facilitated, and loss of members included in the valve housing 14 can be prevented. After the liquid supply, the cylinder 16 is screwed again into the container 12. Then, the lock is released, and the piston 54 is slidden within the cylinder 16. At this time, the large-diameter piston 60 of the piston 54 is reciprocated in one with the small-diameter piston 61 as the latter is kept contained in the former. Air is sucked in through the air intakes 64, and distorts a skirtlike seal of the piston 60 to flow into the pressure chamber 56. The air flows into the pressure chamber 56 also through the air suction valves 58 and 59. The air inside the pressure chamber 56 is pressurized by a pumping action caused by the reciprocation of the piston 54 or the large-diameter piston 60, and flows through the accumulation valve 42 into the container 12 to be accumulated therein. As the accumulation is advanced, the high-pressure air inside the container 12 acts as resistance force on the large-diameter piston 60 to prevent smooth reciprocation of the piston. Since having the smaller diameter than that of the large-diameter piston 60, the small-diameter piston 61 can slide without substantially suffering the

resistance force of the high-pressure air. Accordingly, air under higher pressure can be accumulated in the container 12 by locking the large-diameter piston 60 to the cylinder 16 by the locking means 66 and reciprocating the small-diameter piston 61 inside the large-diameter piston 60. Hereupon, when the piston 54 is pushed into its lock position inside the cylinder 16, the residual pressurized air in the pressure chamber 56 acts as a resistance force. As seen from Figs. 1 and 6, especially from Fig. 6, therefore, the sprayer of the invention comprises an airtightness release means 74 formed in the inner wall of the cylinder 16 between a forced-in position 72 of the piston 54 for pumping operation as indicated by a one-dot chain line and the lock position as illustrated. The airtightness release means 74 is formed of, for example, a groove 76 as shown in Fig. 6. During the pumping operation, a seal 78 of the large-diameter piston 60 reciprocates within a range or region below the forced-in position 72, so that the airtightness of the piston 54 or the large-diameter piston 60 may be maintained effectively. In locking the piston 54, however, the piston 54 is pushed in beyond the forced-in position 72 to have its seal 78 fitted in the groove 76, so that a gap 80 (see Fig. 7A) is created between the seal 78 and the inner wall of the cylinder 16. As a result, the residual pressurized air in the pressure chamber 56 escapes through the gap 80 into the open air to release the airtightness of the large-diameter piston 60. Thus, the piston 54 can be easily moved to its lock position without suffering any resistance thereafter. The airtightness release means 74 need only have a function to release the airtight relationship between the seal 78 and the inner wall of the cylinder 16. Further, the airtightness release means 74 is not limited to the configuration of the entirely circular groove, and may be provided with a number of, e.g. four, projections 82 as shown in Fig.

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7B. To improve the airtight effect, the seal 78 preferably has a groove 84 in which a lubricant can stay. The groove 84 is not limited to the entirely circular groove as shown in Fig. 8, and may alternatively be
5 formed of a number of partial grooves or small recesses. Further, the skirtlike seal 78 may be replaced with an O-ring.

Also, as seen from Fig. 6, the small-diameter piston 61 is provided with another airtightness release
10 means 174 including a groove 176 which is formed in the inner wall of the large-diameter piston 60 between a forced-in position 172 as indicated by a one-dot chain line and a lock position as illustrated. A seal 178 of the small-diameter piston 61 also has a groove 184 for
15 retaining the lubricant. The airtightness release means 174 of the small-diameter piston 61 has the same function as the airtightness release means 74 of the large-diameter piston 60, thereby facilitating the thrusting of the small-diameter piston 61 into the lock position.

20 After the large-diameter piston 60 is locked, the air is fully pressurized by the small-diameter piston 61, and the small-diameter piston 61 is forced into its lock position. Thereafter, when the container 12 is restored to its right position and the push button 28 is
25 lowered inside the recess 27, the blocking of the lateral hole 21 of the stem 20 by the gasket 22 is released, and the liquid pressed by the pressurized air accumulated in the container 12 rises in the pipe 31 and is continuously discharged from the nozzle into the out-
30 side through the lateral hole 21 and passage 30.

Fig. 9 shows another embodiment of the invention. This air-pressurized sprayer 110 differs from the sprayer 10 in that a container 12 is formed integrally with a cylinder 16, and that a cover section 13
35 integrally formed with a valve housing 14 is welded to the container. Instead of welding, the cover section 13 may be screwed into the container 12. A locking means

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66 between a cylinder 16 integrally formed with the container 12 and a large-diameter piston 60 is so designed that an engaging projection 70 formed at the lower end of the container 12 may be fitted in an engaging hole 68
5 formed in the large-diameter piston 60. Since the container 12 and the cylinder 16 are formed integrally, the sprayer 110 is improved in liquid-tightness.

The container used in this invention need not be a pressure-resisting container such as a conventional
10 metal can used for an aerosol sprayer. It is to be understood, however, that pressure-resisting containers of such type can suitably be used. Fig. 10 shows an embodiment using one such conventional pressure-resisting container. This sprayer 210 includes a
15 pressure-resisting metal container 212 which is characterized by its vertical symmetry and by having a steel cover 213 at the lower end, too. A valve housing is fixed to a steel cover (not shown) at the upper end of the sprayer 210 by a clamping ring, while a cylinder 216
20 is fixed to the lower-end steel cover 213 by a clamping ring 217. Numeral 219 designates a plug for liquid supply.

With the sprayer 210 including the pressure-resisting metal container 212 thus formed in the vertically symmetrical configuration, the manufacturing
25 cost of the die for the container is reduced, and the assembly is facilitated. With such construction, moreover, the sprayer may be high in pressure resistance, and the greater part of the conventional pressure-resisting metal container may be utilized
30 directly.

As shown in Figs. 10 and 11, a piston 54 has on its outer surface projections 221 which press the clamping ring 217 toward the cylinder 216. Although four projections 221 are equiangularly arranged in this embodiment,
35 at least one projection will suffice. Substantially U-shaped notches 223 surrounding the projections 221 are

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formed on the outside of the piston 54. In such construction, the projections 221 are pressed against the clamping ring 217 with sufficient elasticity due to the existence of the notches 223. Thus, the clamping
5 ring 217 can securely hold the cylinder 216 between itself and the steel cover 213.

Fig. 12 shows another embodiment utilizing a pressure-resisting metal container. In this sprayer 310, a cylinder 316 is attached to a steel cover 313 by
10 a plastic clamping member 317 which is outsert-formed on the steel cover 313. Namely, the clamping member 317 is provided with an internal-thread portion 319 in which an external-thread portion 321 formed on the outside of the cylinder 316 is screwed so that the cylinder is fixed to
15 the steel cover 313. Further, the clamping member 317 has a downwardly projected seal 323 which abuts on an inner surface 325 of the cylinder 316 to secure liquid-tightness. Although the clamping member 317 and the cylinder 316 are removably connected by
20 screwing in the embodiment of Fig. 12, they may be removably connected by any other suitable means. Naturally, the projected seal 323 may be replaced with any other seal member, such as a skirtlike seal. Numerals 327 and 329 designate a plurality of reinforcing ribs formed on
25 the cylinder 316 and a piston 354, respectively.

Thus, the sprayer 310 capable of easy assembly and easy liquid supply may be provided by outsert-forming on the steel cover 313 the clamping member 317 which includes the means removably connected to the cylinder 316
30 and the seal member for liquid-tightness. Further, the integral formation of the clamping member 317 and the steel cover 313 can completely prevent the loss of the clamping member 317 during the liquid supply.

In any of the above-mentioned embodiments,
35 moreover, a one-way valve 142 for air pressurization as shown in Figs. 13 and 14 may be used in the cylinder instead of using the one-way valve 42 as shown in Fig.

5A. The rocking strips 46 of the valve 42 extend in a flat manner, whereas rocking strips 146 of the valve 142 extend axially or in three dimensions. Therefore, a valve plug 48 of the valve 142 can be enabled to produce sufficient axial biasing force by attaching a valve body 144 of the valve 142 to the tip end of the piston with the valve plug 48 pressing on the valve seat. Accordingly, the valve 142 can have enough resistance force against the air inside the pressure chamber 56, ensuring reliable valve action.

In the air-pressurized sprayers 10, 110, 210 and 310 of the invention, furthermore, the push button 28 is preferably provided with what is called a child-proof mechanism which keeps the push button from careless or unexpected depression for accident prevention. For example, a child-proof mechanism 150, as shown in Figs. 15 and 16, includes a stopper 154 which is formed integrally with the push button 28 through a hinge 152. A rectangular recess 156 for containing the stopper 154 is formed in the peripheral surface of the container 12. As seen from Fig. 15, the recess 156 has a shoulder portion 158 against which e.g. the free end of the stopper 154 abuts. Further, a dent 160 in the shape of e.g. a subsphere is formed in the surface of the recess 156 so that a gap is created between the back side of the stopper 154 and the peripheral surface of the container 12 when the dent is partially covered with the free end portion of the stopper. Numeral 162 designates a dent formed on the top of the push button 28 for smooth location of an operator's finger.

In the sprayer of the above-mentioned construction, the push button 28 can be prevented from descending by the engagement between the shoulder portion 158 and the free end of the push button even if the push button is pressed. Thus, unexpected depression of the push button 28 can be avoided even during storage as well as during packing and exhibition. The engagement between the

stopper 154 and the shoulder portion 158 of the recess 156 can easily be released by swinging the stopper 154 around the hinge 152, as indicated by a one-dot chain line in Fig. 16. By such release of the engagement, the push button 28 is allowed to descend, and the desired spraying operation can be performed with ease by depressing the push button 28 as required. The existence of the dent 160 facilitates the swing of the stopper 154.

The shoulder portion 158 of the recess 156 need only have a function to prevent the push button 28 from descending, and is not limited to the arrangement of Figs. 15 and 16 in which it abuts against the free end of the push button 28. As shown in Figs. 17 and 18, for example, an engaging projection 164 may be projected from the back of the stopper 154 so that the shoulder portion 158 can engage the projection 164. In this case, the dent 160 may be formed greater, so that the stopper 154 can be swung more smoothly.

Figs. 19 to 22 show another child-proof mechanism 170 which includes a seesaw-type stopper 174 formed integrally with the push button 28 through a pair of connection pieces 172. Formed in the peripheral surface of the container 12 is a recess 178 having a shoulder portion 176 against which e.g. the tip end portion of the stopper 174 abuts.

In a sprayer including the child-proof mechanism 170 of the aforesaid construction, the push button 28 is prevented from descending by the engagement between the shoulder portion 176 of the recess 178 and the stopper 174 even if the push button 28 is pressed. The engagement between the stopper 174 and the shoulder portion 176 can easily be released by swinging the stopper 174 in the counterclockwise direction around the connecting pieces 172, as indicated by a one-dot chain line in Fig. 22. By such release of the engagement, the push button 28 is allowed to descend, and the desired spraying

operation can be performed with ease by depressing the push button 28 as required.

5 With a dent 180 for pressing formed on one end portion of the stopper 174, an operator can tactually perceive the proper portion of the stopper 174 to be pressed without visual recognition, thus enjoying increased operating efficiency. Preferably, moreover, a pair of engaging projections 182 each having e.g. a sub-circular cross section are formed on the distal end portion of the stopper 174, and engaging holes 184 to
10 engage the projections 182 are formed in the shoulder portion 176. Such combination of the engaging projections 182 and the engaging holes 184 can ensure full engagement between the stopper 174 and the shoulder portion 176 during storage, thereby positively preventing
15 unexpected depression of the push button 28. It goes without saying that the same effect may be obtained if the engaging holes are formed in the stopper 174 and engaging projections are formed on the shoulder portion 176. In order to prevent the stopper 174 from accidentally engaging the shoulder portion 176 to prohibit the descent of the push button 28 in the middle of a spraying operation, it is advisable to form an engaging projection 186 at the other end portion of the stopper
20 174 and an engaging hole 188 to engage the projection 186 in the push button 28, for example. With such construction, if the engaging projection 186 is previously engaged with the engaging hole 186, the push button 28 is always kept descendable to be ready for
25 continuous spraying. Also in this case, the same effect may be obtained if the engaging hole and engaging projection are formed in the stopper 174 and on the push button 28, respectively.

30 In the child-proof mechanism 150 or 170, as
35 described above, a stopper extending along the direction to press the push button is formed integrally with the push button, and a recess containing the stopper and

having a shoulder portion to engage the stopper is formed in the peripheral surface of the container. With such construction, the push button is prevented from being depressed unless the engagement between the stopper and the shoulder portion of the recess is released, so that unexpected depression of the push button can perfectly be avoided. Further, spraying is allowed when the stopper is swung around the hinge or connecting pieces, and careless depression of the push button is prohibited when the stopper is shifted again to the position to engage the shoulder portion. Thus, with the child-proof mechanism, the push button can be repeatedly brought to the undescendable or locked state to prevent accidents during storage. It is to be understood that the child-proof mechanism of this type can be applied not only to air-pressurized sprayers but also to aerosol-type sprayers.

In the air-pressurized sprayer according to the invention, as described above, a valve housing including a descendable nozzle, a spraying valve which opens in connection with a descending action of the nozzle, and pipe for leading a liquid in a container is attached to the top portion of the container. A cylinder including a piston slidable inside the cylinder and an air pressurization valve which allows air pressurized by the slide of the piston to flow into the container is removably attached to the bottom portion of the container to extend inside the container. Thus, the cylinder and the valve housing are completely separated, so that the liquid supply may be facilitated by removing the cylinder from the container independently of the valve housing. In consequence, loss of members related to the valve housing can be prevented at the time of liquid supply. Since the cylinder, which is attached to the bottom portion of the container to extend therein, is naturally smaller than the container in diameter, resistance force applied to the piston inside the

cylinder by the pressurized air in the container is not very great, and the piston can be reciprocated even after the air pressurization inside the container is advanced well enough. Accordingly, fully pressurized
5 air can be accumulated in the container to ensure spraying of highly minute particles. If necessary, the piston may be made up of large and small pistons for higher pressure.

Further, in the sprayer of the invention, a means
10 for releasing the airtightness between the seal of the piston and the inner wall of the cylinder is formed in the inner wall of the cylinder between the lock position of the piston and the forced-in position of the piston in sliding action. Thus, the airtightness of the piston
15 can be released by the airtightness release means when the piston is pressed toward the lock position beyond the forced-in position after the sliding action. As a result, residual high-pressure air in a pressure chamber defined between a pair of one-way valves separately
20 disposed at the distal ends of the cylinder and the piston escapes into the atmosphere, so that the piston can easily be moved to its lock position without receiving any resistance. Such construction will ensure easy locking, as well as smooth sliding action, of the
25 piston, unlike the prior art construction which requires blocking of an air intake during a pumping action.

Claims:

1. An air-pressurized sprayer comprising a container for containing a liquid to be sprayed and a cylinder attached to the container, the cylinder including a piston having a seal and slidden along the inner peripheral surface of the cylinder to supply pressurized air to the container, and a one-way valve for air pressurization which allows the air pressurized by the slide of the piston to flow into the container;

5 the sprayer (10, 110, 210, 310) characterized in that the cylinder (16, 216, 316) is removably attached to the bottom portion of the container (12, 212) to extend upward inside the container (12, 212), and that a valve housing (14) is attached to the top portion of the container (12, 212), the valve housing (14) including a descendable nozzle (29), a one-way valve (18) for spraying which opens in connection with a descending action of the nozzle (29), and a pipe (31) for leading the liquid contained in the container (12, 212) into the spraying valve (18).

2. An air-pressurized sprayer according to claim 1 further comprising a means for removably locking the piston to the cylinder after sliding, the locking means including an engaging groove and an engaging projection to be fitted in the engaging groove.

3. An air-pressurized sprayer according to claim 1, wherein the valve housing is formed integrally with the container, and a number of radially extending reinforcing ribs are formed integrally with the inner peripheral surface of the container.

4. An air-pressurized sprayer according to any one of claims 1 to 3, wherein the piston includes large- and small-diameter pistons each composed of a hollow body having an air intake valve which allows air to flow into a pressure chamber defined by the piston and the cylinder, the small-diameter piston being slidably

disposed inside the large-diameter piston.

5 5. An air-pressurized sprayer according to any one of claims 1 to 3, wherein the piston is composed of a hollow body having a one-way valve which allows air to flow into a pressure chamber defined by the piston and the cylinder.

10 6. An air-pressurized sprayer according to any one of claims 1 to 3 further comprising an airtightness release means formed in the inner wall of the cylinder between a lock position of the piston and a forced-in position of the piston in sliding action, whereby the airtightness between the seal of the piston and the inner wall of the cylinder will be released.

15 7. An air-pressurized sprayer according to claim 6, wherein the airtightness release means includes a groove capable of defining a gap between the groove and the seal of the piston.

20 8. An air-pressurized sprayer according to claim 6, wherein the airtightness release means includes projections to release the airtightness of the piston by deforming the seal of the piston.

25 9. An air-pressurized sprayer according to any one of claims 1 to 3, wherein the seal of the piston is a skirtlike seal having on its outer peripheral surface a groove in which a lubricant can stay.

30 10. An air-pressurized sprayer according to any one of claims 1 to 3 further comprising a push button having a nozzle and descendably disposed inside a recess at the top portion of the container, and a child-proof mechanism for preventing unexpected descent of the push button, the child-proof mechanism including a stopper formed integrally with the push button and extending along a direction in which the push button is pressed and a recess formed in the outer peripheral surface of the container, the recess of the child-proof mechanism containing the stopper and having a shoulder portion
35 against which the stopper abuts.

11. An air-pressurized sprayer according to claim 10, wherein the stopper of the child-proof mechanism is formed integrally with the push button with a hinge therebetween, and a dent is formed in the outer peripheral surface of the container, the dent being partially covered with the free-end portion of the stopper to create a gap between the back side of the stopper and the outer peripheral surface of the container.

12. An air-pressurized sprayer according to claim 10, wherein the stopper of the child-proof mechanism is a seesaw-type stopper capable of rocking around a pair of connecting pieces.

13. An air-pressurized sprayer according to claim 12, wherein the stopper is provided with a dent for pressing on the one end portion whereby the proper portion of the stopper to be pressed can be tactually perceived.

14. An air-pressurized sprayer according to claim 13, wherein a combination of an engaging projection and an engaging hole for securing the engagement between the stopper and the shoulder portion is disposed between the stopper and the shoulder portion.

15. An air-pressurized sprayer according to claim 14, wherein a combination of an engaging projection and an engaging hole for maintaining the stopper in a position where the stopper is separated from the shoulder portion is disposed between the stopper and the push button.

FIG. 1

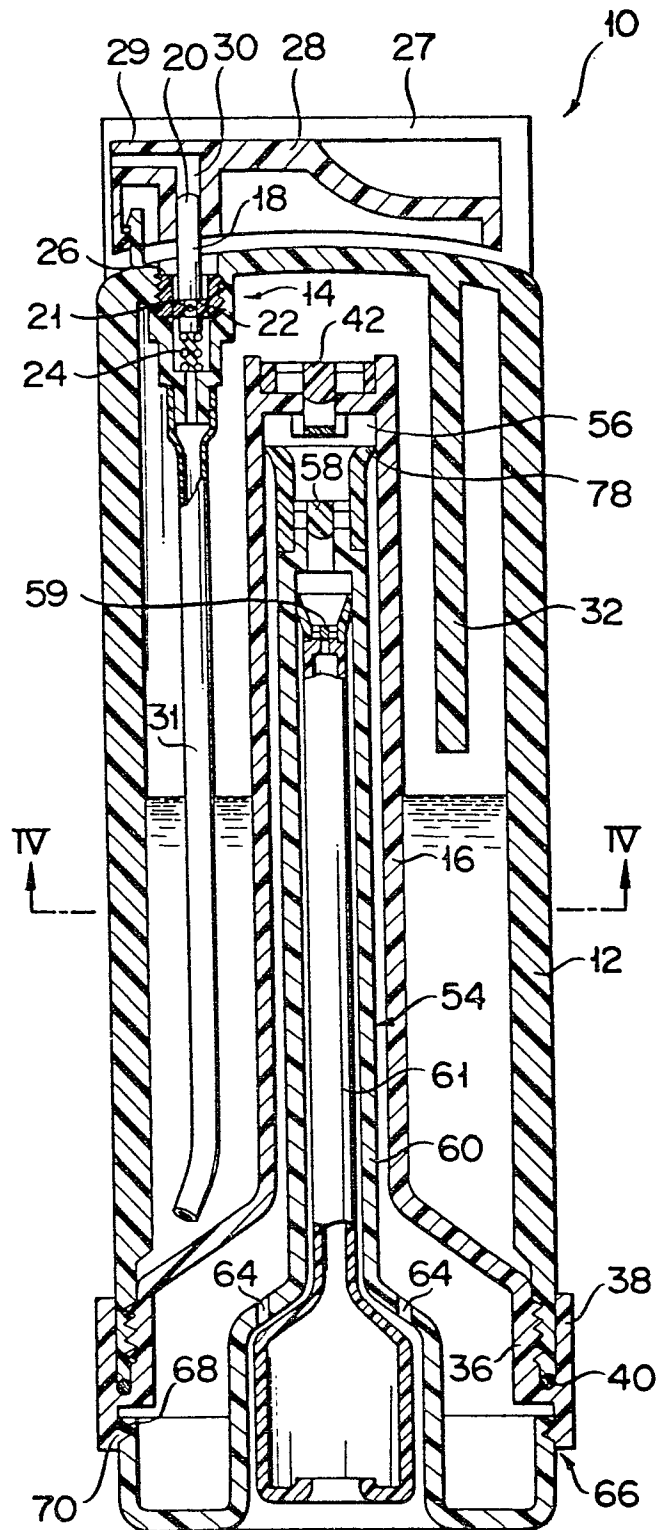


FIG. 2

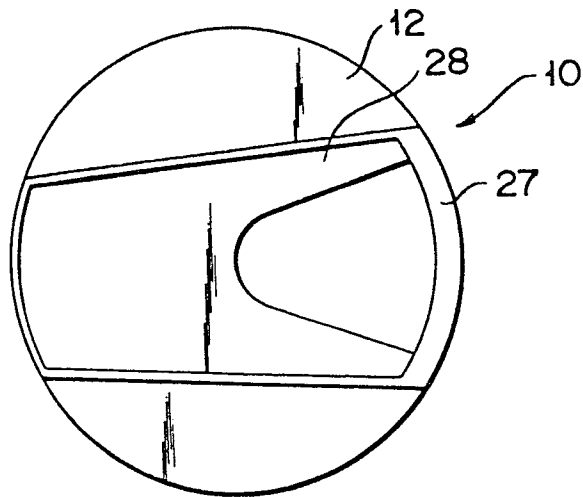


FIG. 3A

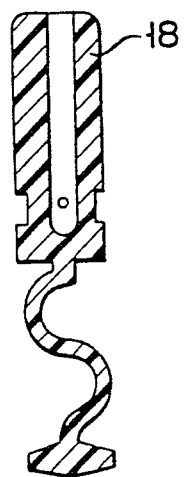


FIG. 3B

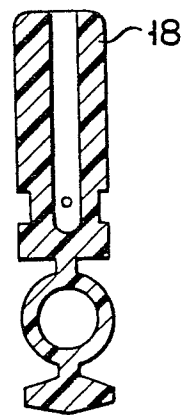


FIG. 4

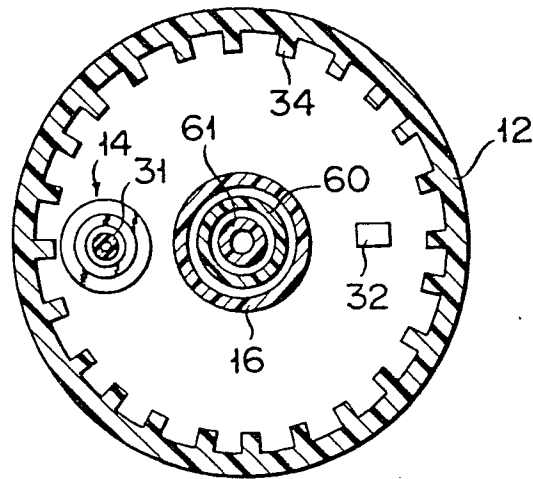


FIG. 5

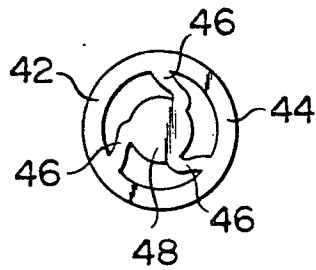


FIG. 6

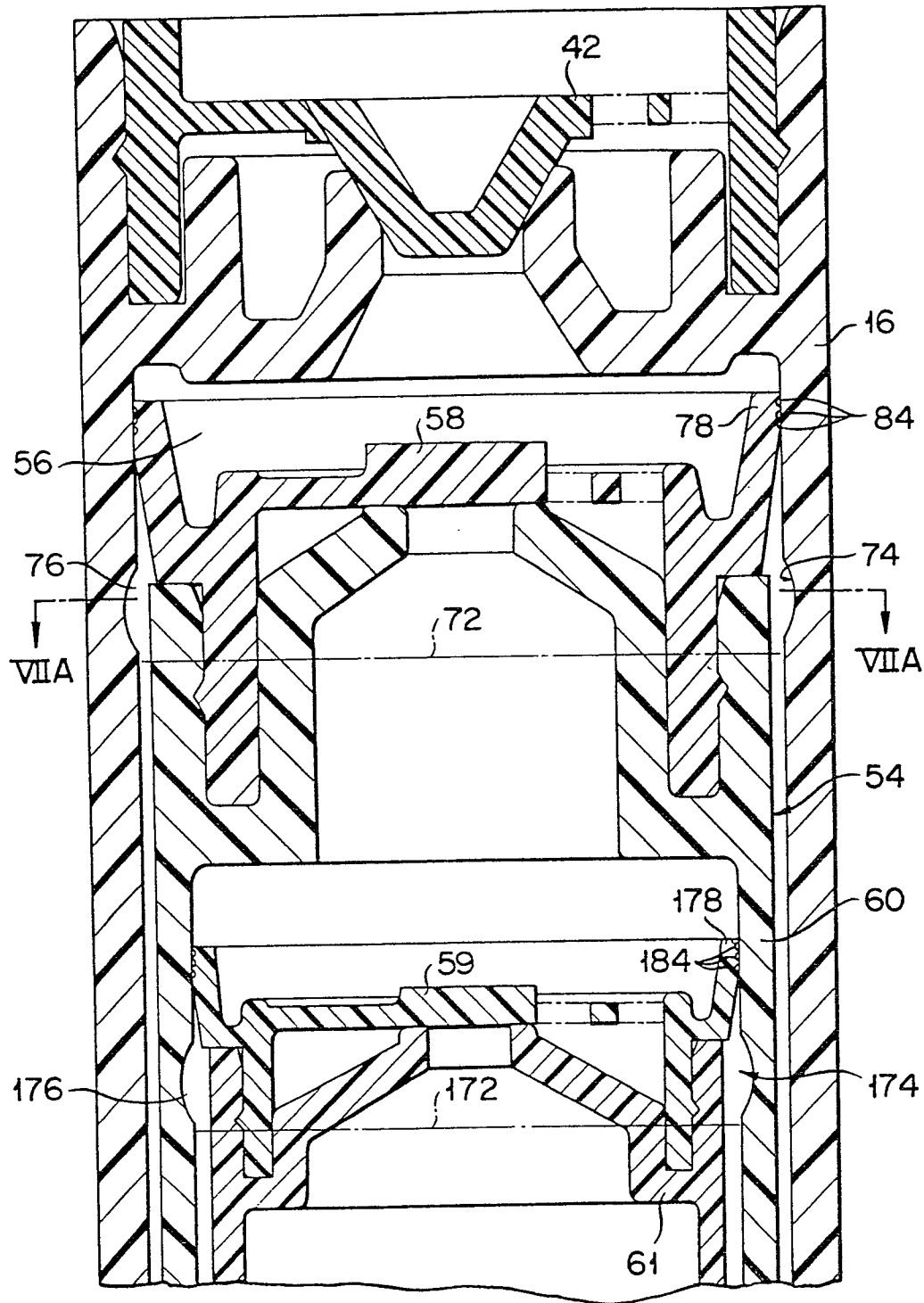


FIG. 7A

FIG. 7B

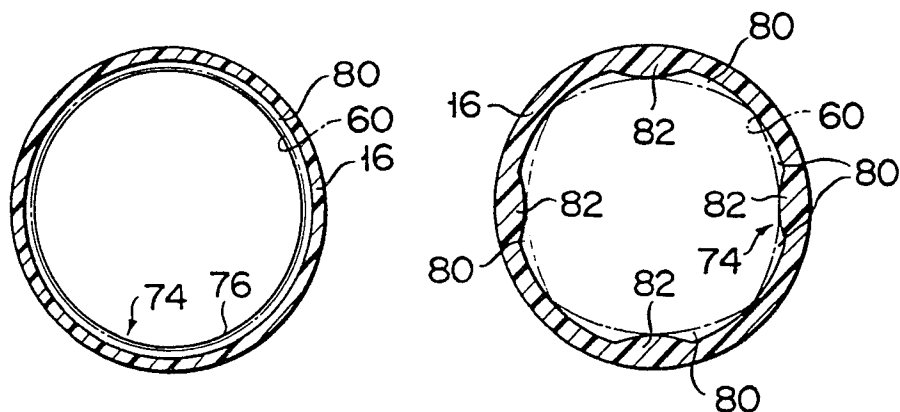


FIG. 8

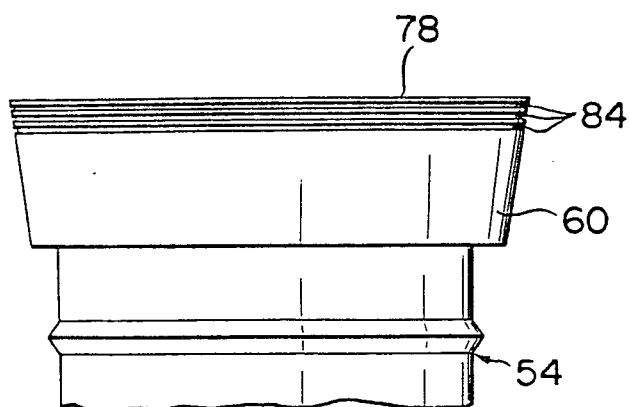
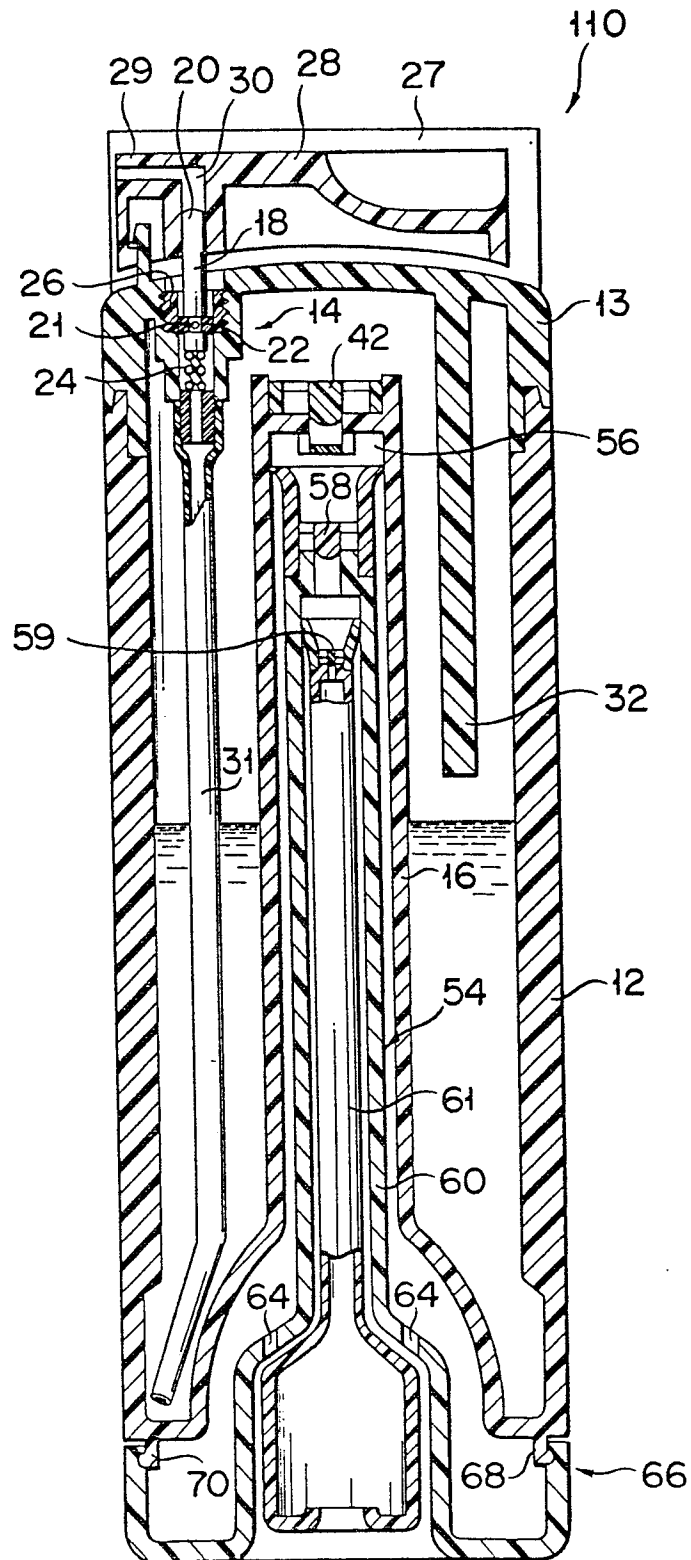
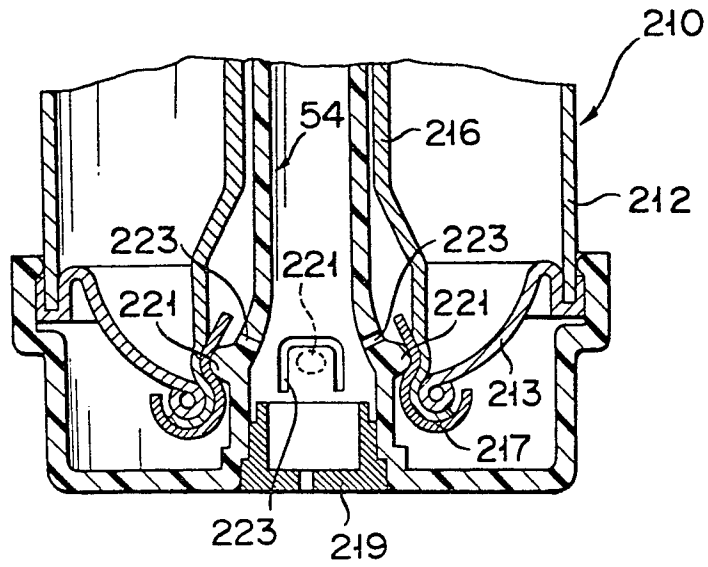


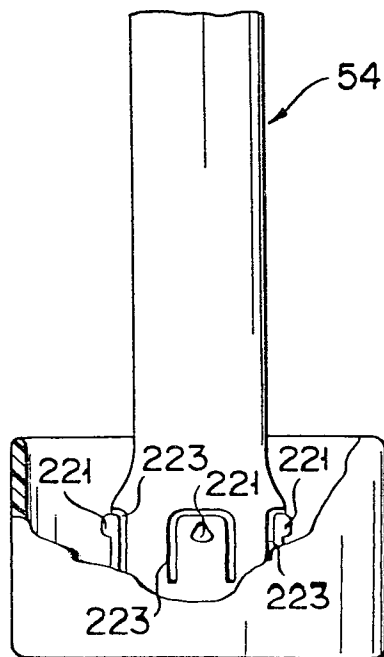
FIG. 9



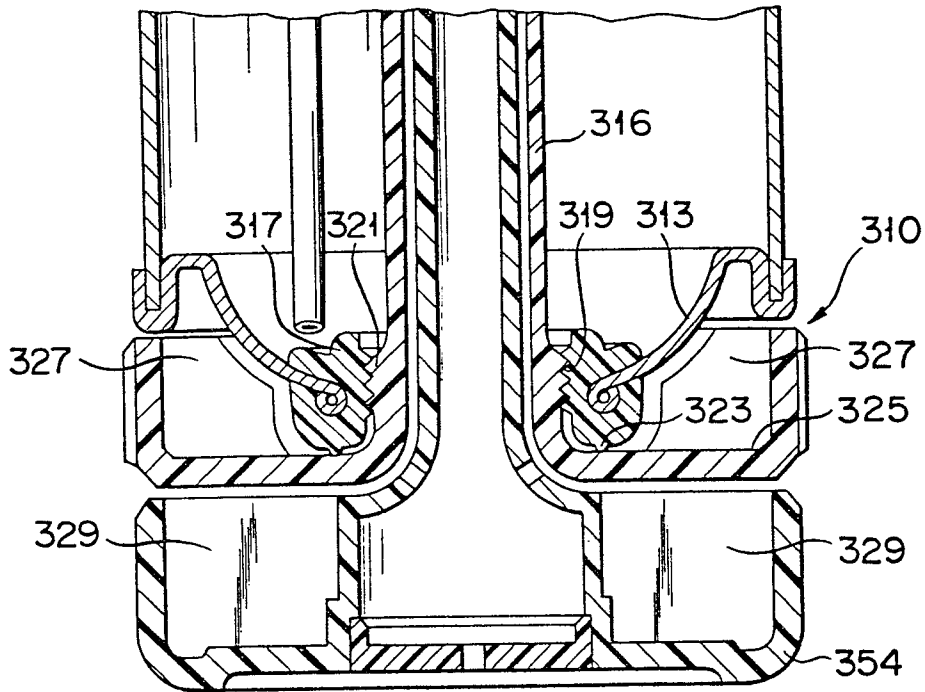
F I G. 10



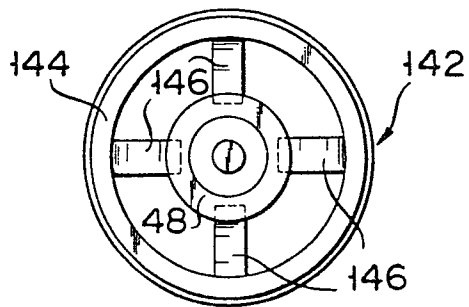
F I G. 11



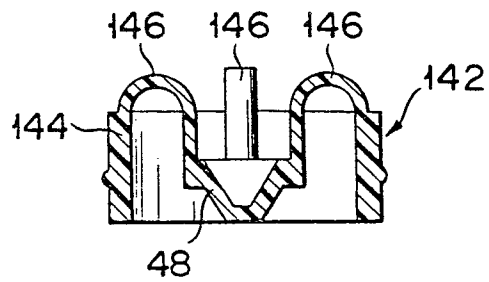
F I G. 12



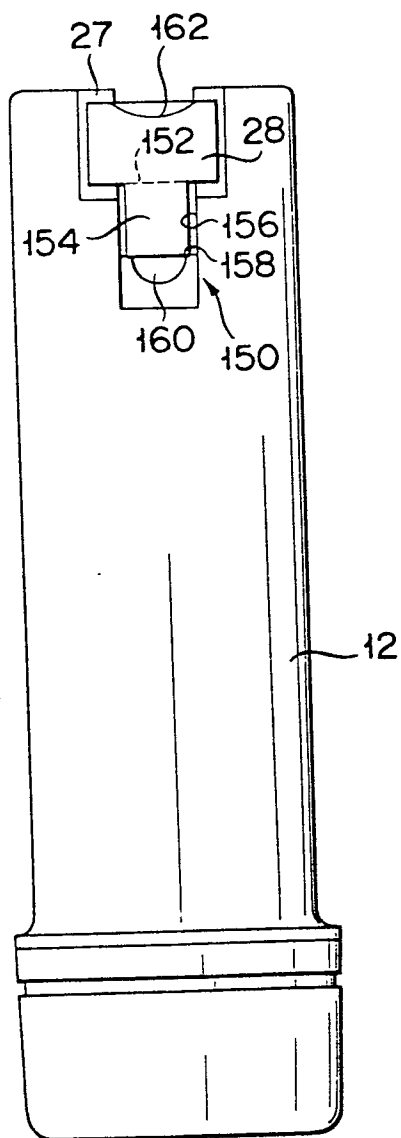
F I G. 13



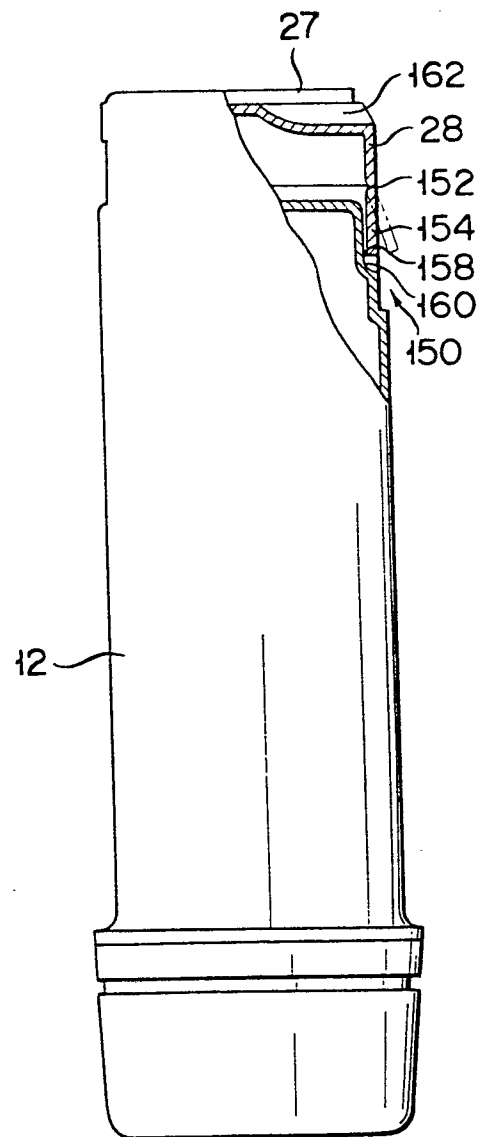
F I G. 14



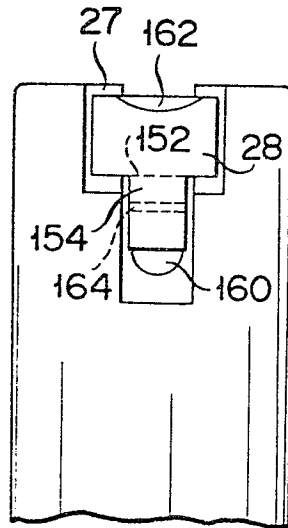
F I G. 15



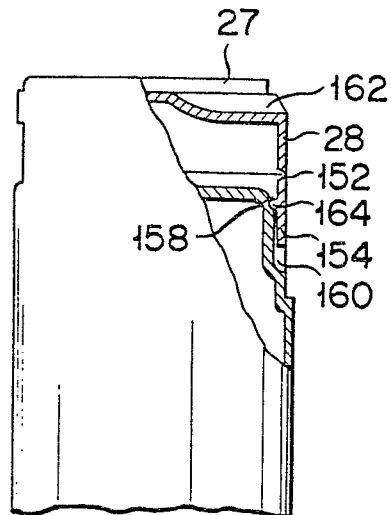
F I G. 16



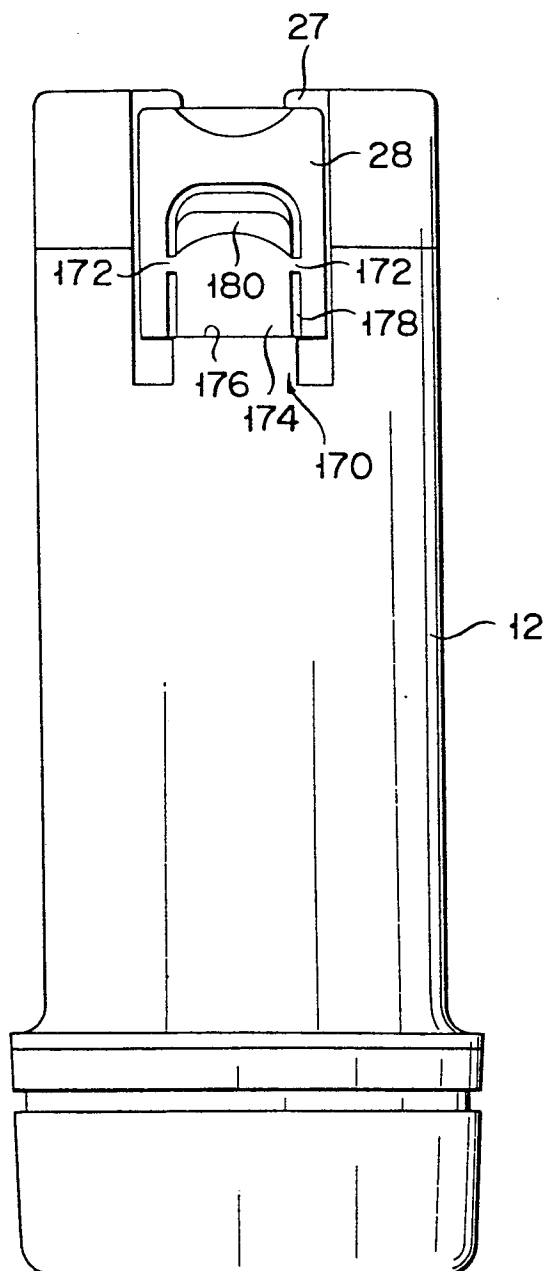
F I G. 17



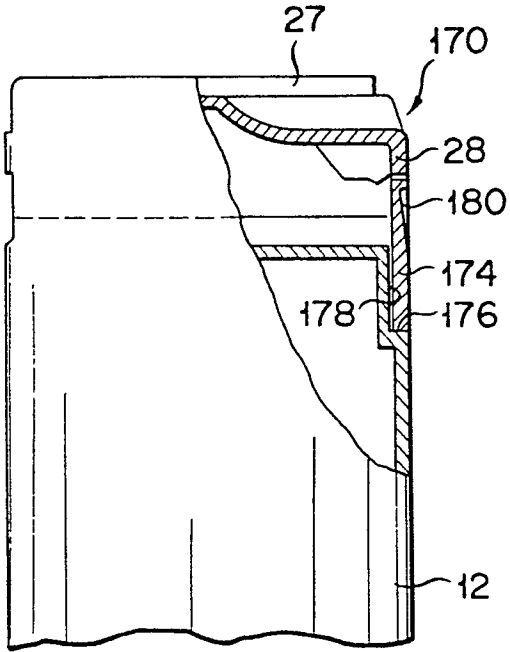
F I G. 18



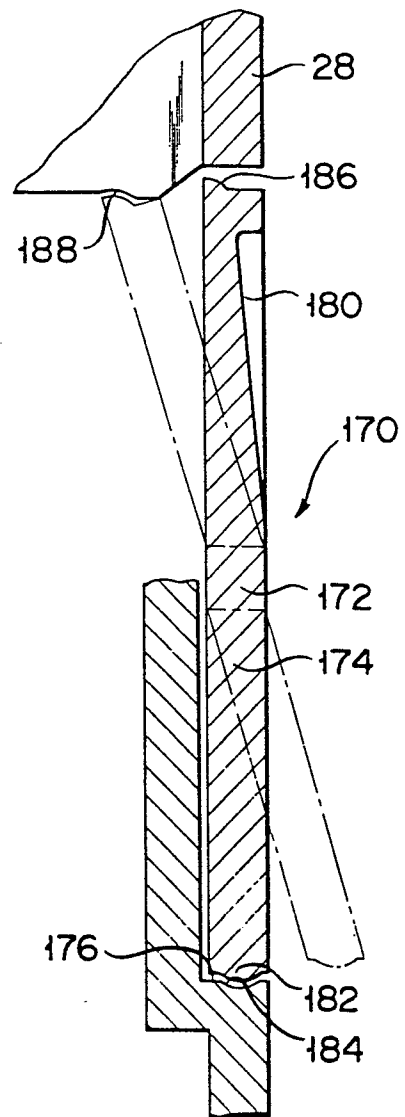
F I G. 19



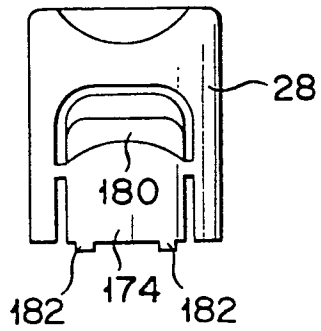
F I G. 20



F I G. 22



F I G. 21





European Patent
Office

EUROPEAN SEARCH REPORT

0037496

Application number

EP 81102097.3

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 955 720</u> (MALONE) --	1	B 65 D 83/14 F 04 B 9/14
A	<u>US - A - 3 848 778</u> (MESHBERG) --	10-15	
A	<u>US - A - 3 348 740</u> (O'DONNELL) ----	10-15	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			B 65 D 83/00 B 05 B F 04 B 9/00 F 04 B 19/00
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document
Place of search VIENNA		Date of completion of the search 12-06-1981	Examiner MELZER