United States Patent

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[73] Assignee **Seaquist Valve Company, Division of Pittway Corporation**

[54] **SELF-CLEANING VALVE**
14 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **222/402.18,** 222/148, 222/193, 239/308
[51] **Int. Cl.** **B65d 83/14**
[50] **Field of Search** ..... 222/148, 193, 402.1—402.25; 239/307, 308

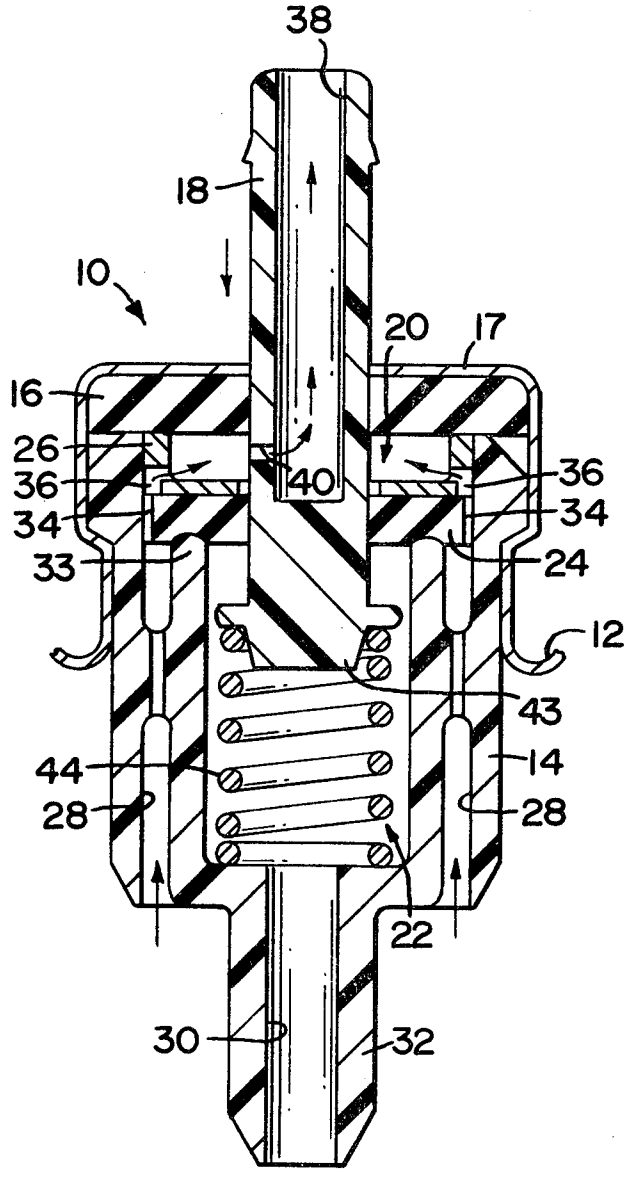
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ABSTRACT: A self-cleaning valve for an aerosol container wherein the propellant cleans the valve prior and subsequent to product discharge. The valve has two stacked isolated chambers, each of which respectively communicates with the aerosol propellant and product. As the valve stem of the valve is depressed, its orifice first passes through the propellant chamber whereupon the valve is cleaned by the propellant and then subsequently to the product chamber whereupon the product is dispensed. The process is reversed when the valve is released, and by use of a valve stem with two vertically spaced discharge orifices, properly spaced with respect to each other, provision is made for a "softer" spray. An adapter is also provided to close the product port and reroute the product to the propellant chamber so that the valve can act as an intermittent spray valve and even as a metering valve.



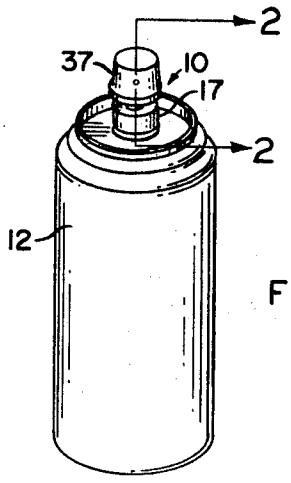


FIG. 1

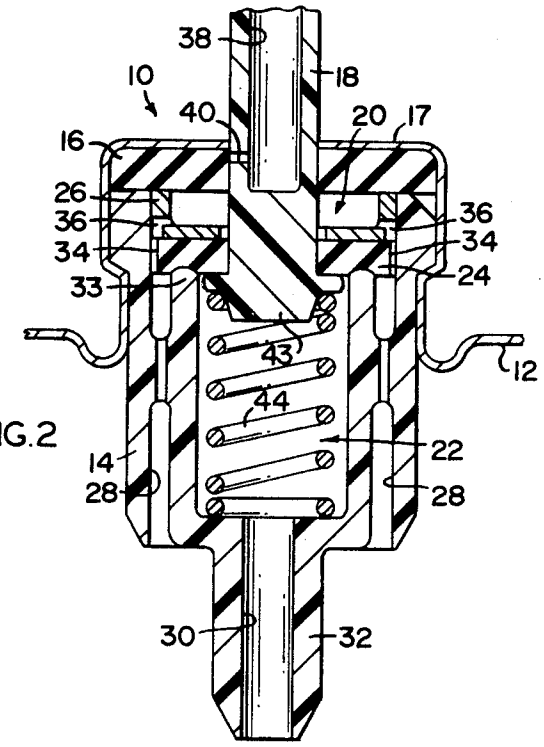


FIG. 2

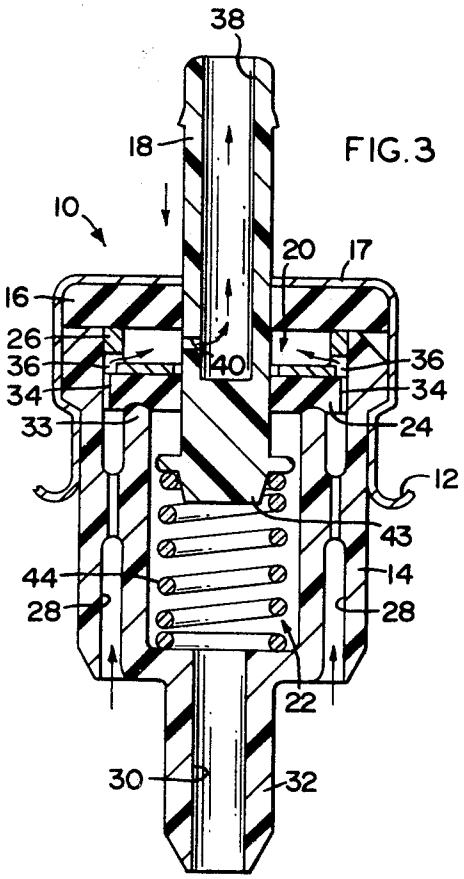


FIG. 3

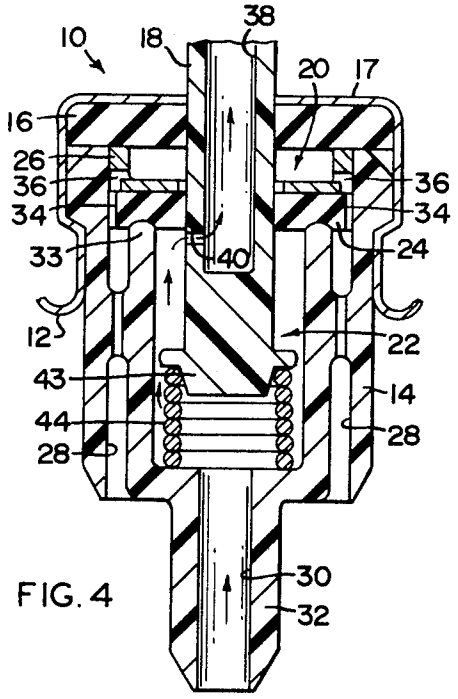


FIG. 4

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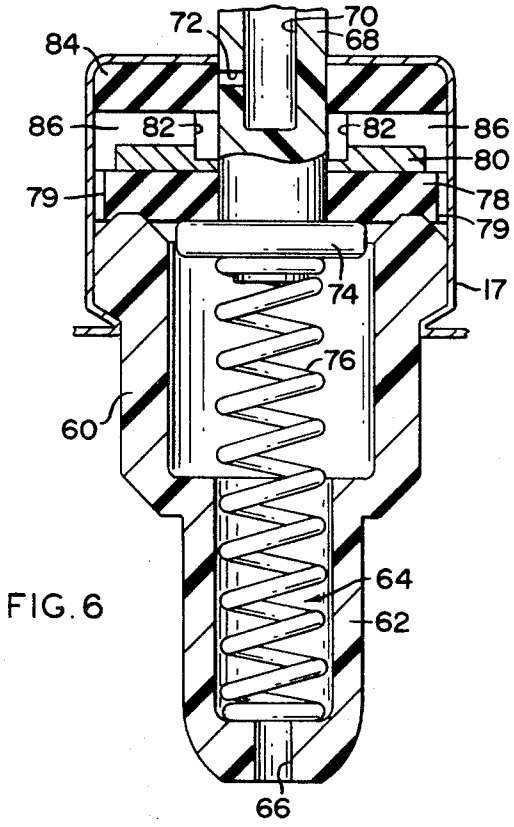


FIG. 6

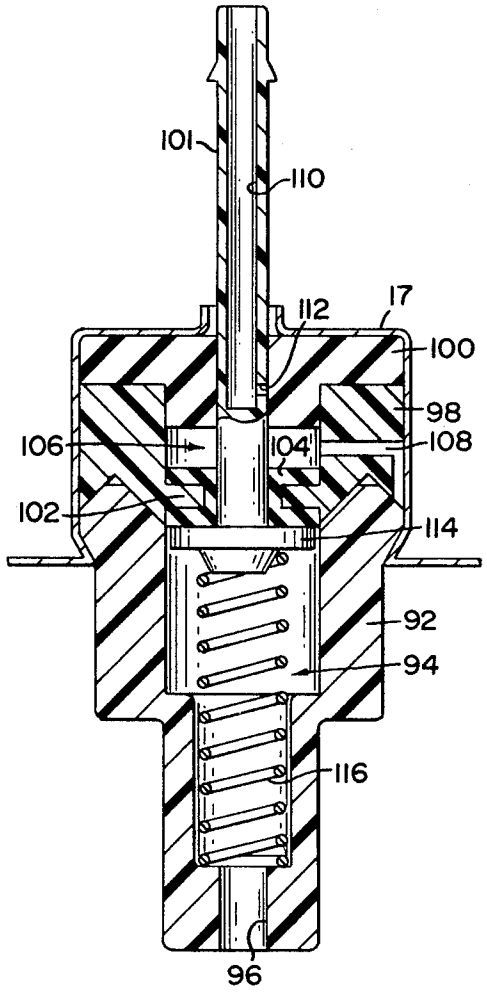


FIG. 7

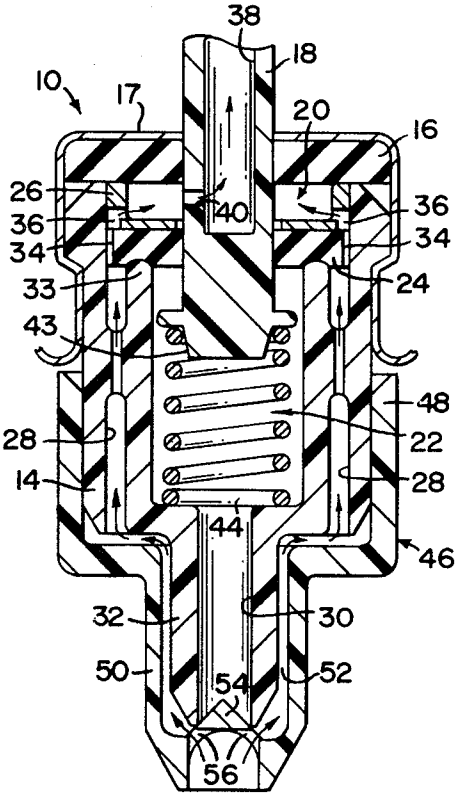


FIG. 5

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FIG. 8

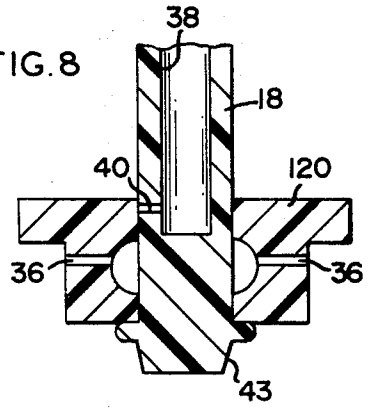


FIG. 9

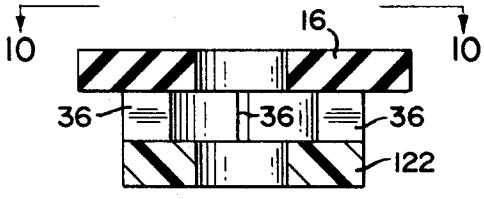
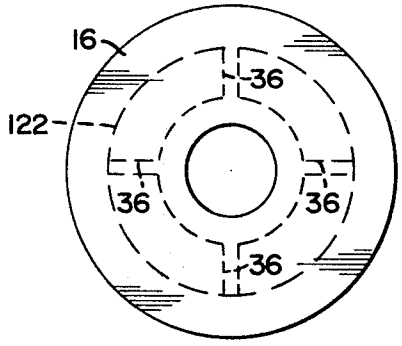


FIG. 10



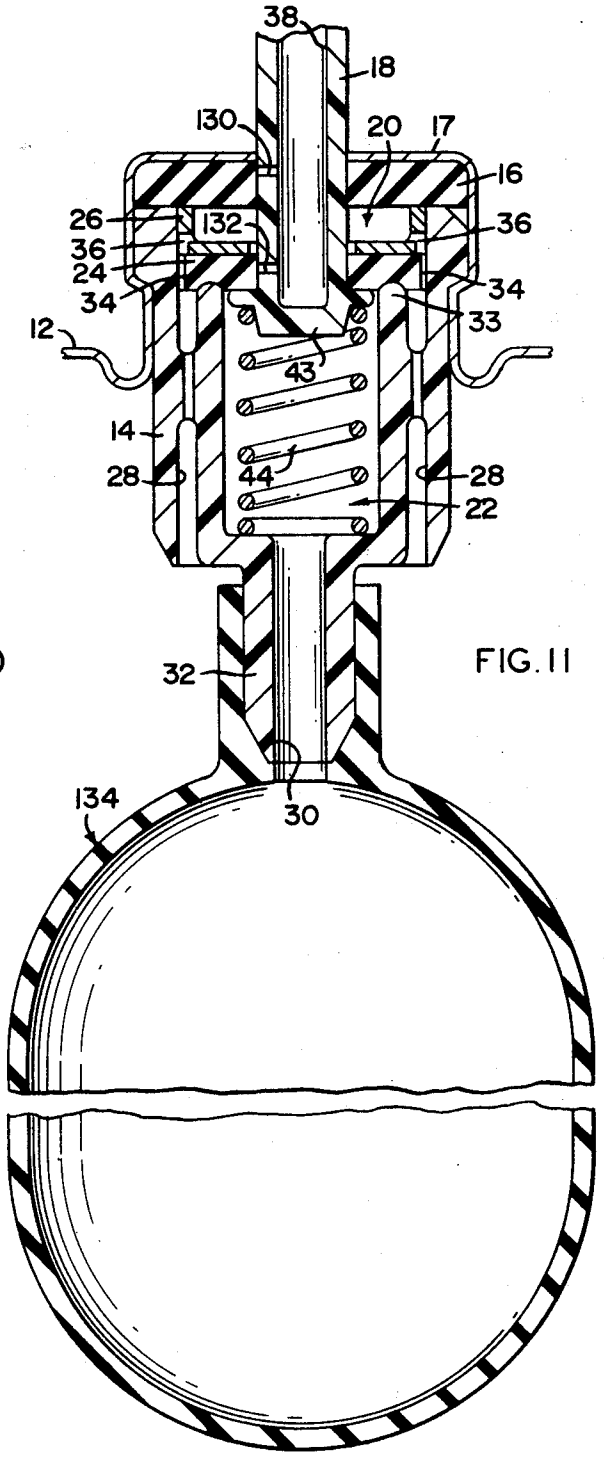


FIG. 11

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SELF-CLEANING VALVE

This invention relates to an aerosol valve; more particularly to a self-cleaning aerosol valve.

In the usual valve for dispensing the contents of an aerosol container, there are provided flow passageways of relatively small cross section through which the contents are forced during the dispensing process. These passageways are easily clogged, particularly when viscous fluids, such as paint, or products which leave a large crystalline residue, such as starches and fabric finishes, are dispensed. This reduces the effectiveness of the valve, and frequently, even renders the valve inoperative.

Self-cleaning valves have been devised to reduce this clogging. However there is still need for a self-cleaning valve which is simpler in construction, more economical to manufacture, and more efficient in operation.

Also, no known self-cleaning valve will dispense a product when the aerosol container is inverted. As a consequence, a user must maintain the aerosol valve in an upright position while dispensing the product, even though the nature of the object being sprayed would make it more efficient and more convenient to spray it with the container in an inverted position.

Another disadvantage of known self-cleaning valves is that they cannot easily be changed from a continuous spraying type to one which only sprays a metered amount of product each time the valve is activated. There are generally two types of aerosol valves: one type sprays the aerosol product continuously while the other sprays only a metered amount of product each time the valve stem of the valve is depressed. Heretofore, it has been necessary to manufacture two different valves to accomplish both of these spraying actions. A single valve which could be easily modified to spray either continuously or intermittently would be more economical.

Still another disadvantage of known self-cleaning valves is that there is no provision to easily regulate the quantity of propellant consumed in cleaning the valve. Consequently, more propellant than necessary is often expended. The quantity of cleaning propellant needed to adequately clean a valve is dependent upon the viscosity and drying characteristics of the product being discharged—for example, paint, a rapid drying viscous product, requires more propellant than a fluid of lesser viscosity. It is important for economical reasons that only the requisite amount of propellant be expended; excessive propellant costs more and requires a larger aerosol container to store it.

Therefore, it is an object of this invention to provide an aerosol valve which is self-cleaning to maintain dispensing efficiently.

Another object is to provide a self-cleaning aerosol valve which is cleaned by propellant prior and subsequent to the product discharge.

Still another object is to provide a self-cleaning aerosol valve which discharges aerosol product even when the container is inverted.

A further object is to provide a self-cleaning aerosol valve with a metering adapter to convert the valve from a continuous spraying type to one which only sprays a metered amount of product each time the valve stem of the valve is depressed.

A still further object is to provide a self-cleaning valve with means to easily regulate the quantity of propellant consumed in cleaning the valve.

Another object is to provide a self-cleaning valve which is simple in construction, economical to manufacture, and highly efficient in operation.

Another object is to provide a valve which may be custom designed to be an initial self-cleaning valve to a valve which blends propellant and product for a "softer" spray.

Another object is to provide a valve which effects propellant vapor blending of product either before, during or after initial product spray.

Another object is to provide a unique codispensing valve.

Another object is to provide a valve capable of blending propellant and product or two products in the valve itself.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

In accordance with these objects, the invention comprises a self-cleaning aerosol valve that is cleaned by propellant prior and subsequent to the product discharge. This is accomplished by providing a sealed valved body having an upper propellant or cleaning chamber, and a lower isolated product chamber. Respectively, the chambers are in communication with the aerosol propellant and product within the aerosol container to which the valve is attached.

Reciprocating within the valve body is a valve stem adapted to be vertically moved from an uppermost position where its orifice is sealed by a sealing gasket, to an intermediate position where its orifice is within the cleaning chamber, and finally to a lowermost position where its orifice is within the product chamber. When the valve stem is released, a spring returns it to its initial position. Each time the orifice is within the cleaning chamber, propellant is discharged therethrough to clean the valve. When the orifice is within the product chamber, the product is discharged.

Advantageously, the valve is constructed to dispense the product even when the aerosol container is in an inverted position. When the container is inverted, the product, instead of the propellant, is in communication with the cleaning chamber and hence is dispensed when the valve stem orifice is moved into it.

In a modification, the valve may be combined with a metering adapter that seals the product opening, and directs the product into the cleaning chamber. Thereafter, each time the valve stem is depressed, a metered amount of product will be dispensed when the valve stem orifice passes through the cleaning chamber.

In another modification, the cleaning chamber is formed in part by upper and lower gaskets which can easily be interchanged with each other to vary the volume of the cleaning chamber; thereby regulating the quantity of propellant consumed in cleaning the valve.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. **1** is an isometric view of the valve of this invention typically installed on an aerosol container.

FIGS. **2**, **3** and **4** are cross-sectional views taken along the lines **2–2** of FIG. **1** and illustrate the operational sequence of the valve.

FIG. **5** is a cross-sectional view of the valve shown in FIGS. **2**, **3**, and **4** coupled with a metering adapter.

FIG. **6** is a cross-sectional view of a modification of the valve.

FIG. **7** is a cross-sectional view of a second modification of the valve.

FIG. **8** is a cross-sectional view of a one-piece gasket-spacer-gasket that may be used in the various valve embodiments.

FIG. **9** is a cross-sectional view of a two-piece gasket and spacer-gasket that also may be used.

FIG. **10** is a top view of the spacer-gasket portion of FIG. **9**, taken along lines **10–10**.

FIG. **11** is a cross-sectional view of a third modification of the valve.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings in detail, there is illustrated in FIG. **1**, an isometric view of the valve, designated **10**, typically attached to an aerosol container **12**. As more clearly seen in FIG. **2** through **4**, the valve generally comprises a substantially cylindrical, plastic valve body **14** sealed by an upper annular sealing gasket **16**, when crimped to the aerosol con-

tainer 12, via mounting cup 17 as shown. Typically, an aerosol propellant and product, also respectively designated a first and second fluid, are stored within the container. The lower closed end of valve stem 18 reciprocates within the valve body.

Within the confines of the valve body are a cleaning or propellant chamber 20 and a product chamber 22 isolated from each other by a partitioning gasket 24 and spacer 26. Propellant passageways 28, only two of which are shown, are concentrically located within the outside wall of the valve body for transfer of propellant to the cleaning chamber. The product chamber communicates via passageway 30 of the dip tube tail 32 upon which a conventional dip tube, not shown, with the product in the lower portion of the aerosol container.

Partitioning gasket 24 is seated on an inner rim 33 of the valve body 14. It is an elastic member having a central opening for slidably receiving and sealing the valve stem 18. It also has a plurality of gasket ports 34 aligned with the propellant passageways 28 in the valve body.

Spacer 26, positioned between upper sealing gasket 16 and partitioning gasket 24, is a rigid, annular member preferably made of plastic. It acts to press the partitioning gasket 24 firmly against the inner rim 33 of the valve body to seal and isolate the product chamber 22 from the cleaning chamber 20. The wall of the spacer is ported with plurality of spacer ports 36 which are aligned with the gasket ports 34 of the partitioning gasket 24.

The sealing gasket 16, the spacer 26, and the partitioning gasket 24 may, if desired, be molded of one piece numbered 120 (as seen in FIG. 8) of a soft resilient plastic; such as polyvinyl chloride, polyethylene, and ethylene/vinyl acetate copolymer, or the spacer 26 and one of the gaskets, particularly the partitioning gasket 24 may be molded as one piece (numbered 122) while the other gasket, particularly the sealing gasket 16, may be made separately of a different material, such as rubber or other plastic. Such allows for a larger range of products and propellants that may be used with the valve since chemical compatibility is accomplished.

Valve stem 18 is adapted to receive on its upper end, a conventional aerosol spray button 37 (see FIG. 1) for spraying the aerosol contents. To pass the contents from the container to the button, the valve stem is molded with a longitudinal channel 38 open at its upper end for communication with the valve button and ported at its lower end with a valve stem orifice 40 for communication with the cleaning chamber 20 and product chamber 22. The bottom of the valve stem is closed by an enlarged flanged base 42. A valve spring 44, spanned between the bottom of the product chamber 22 and boss 43 biases the valve stem upwardly.

With the valve stem in its uppermost position, as shown, in FIG. 2, the valve is closed because sealing gasket 16 seals the valve stem orifice 40. In this position, the propellant within the container is in free communication with the cleaning chamber 20 through valve body passageways 28, ports 34, and spacer ports 36. The product, under propellant pressure, is in free communication with the product chamber 22 via the dip tube, not shown, and the dip tube tail passageway 30.

When the valve stem is depressed downwardly to its intermediate position, as shown in FIG. 3, the discharge orifice 40 is within the cleaning chamber 20. At this time, the valve is cleaned as the propellant passes through valve stem orifice 40, and then upwardly through channel 38 to the button, whereupon it is discharged.

When the valve stem is in its lowermost position, shown in FIG. 4, orifice 40 is within product chamber 22. The product is then forced by propellant pressure upwardly through the orifice, and channel 38, before being sprayed by the button.

As should be obvious, when the valve stem is released, spring 44 returns the valve stem to its closed position; the valve is once again cleaned when the valve stem orifice 40 passes through the cleaning chamber 20.

Importantly, this valve structure has the additional advantage of discharging the product even when the container is in an inverted position. When the container is inverted, the aerosol contents interchange their normal relationship: the propellant ascends toward the bottom of the container, and the product settles around the valve body. As a result, the product, instead of the propellant, enters the cleaning chamber 20 through valve body passageways 28, gasket ports 34, and spacer ports 36. When the valve stem is subsequently depressed to its intermediate position where its orifice is within the cleaning chamber, the product is forced through the valve orifice and sprayed through the button.

In FIG. 5, the valve, shown in FIGS. 2 through 4, is combined with a metering adapter 46 which changes the valve from a continuous spray type valve to an intermittent spray-type valve. The adapter is preferably made of plastic and is best described as being cup shaped. Its upper end 48 has a diameter approximating the diameter of the valve body so as to establish a close fit between them when assembled as shown. It also has a stepped lower end 50 with an inside diameter larger than the outside diameter of the dip tube tail 32 of the basic valve so as to establish an adapter passageway 52 leading to the valve body passageways 28. A cone-shaped plug 54 located in the bottom of the adapter plugs the product passageway 30. Adjacent the plug are spaced adapter ports 56 in communication with the adapter passageway 52. A dip tube, not shown, attaches to the outside of the lower end 50.

Since the product passageway 30 is sealed by the adapter plug 54, the product does not enter the product chamber; instead, it is forced by propellant pressure into the cleaning chamber 20 through adapter ports 56, adapter passageway 52, valve body passageways 28, gasket ports 34, and spacer ports 36. Thereafter, when the valve stem is depressed, the product is sprayed in a metered amount dependent upon the volume of cleaning chamber 20. On the downward stroke of the valve stem, a similar amount of product is sprayed. Hence an intermittent spray, a "Spray Pulse" is effected. Advantageously, if so desired, a continuous spray may also be obtained by maintaining the valve stem orifice within the cleaning chamber.

A first modification of the valve is shown in FIG. 6. Here, in lieu of passageways within the valve body, a clearance is provided between the valve body and the container.

As shown, the valve comprises valve body 60 which is generally tubular with a stepped reduced diameter at its lower end comprising a dip tube tail 62 to which a dip tube, not shown, is attached. The interior of the body comprises product chamber 64 in communication with product via product passageway 66.

Reciprocating within the product chamber, as in the primary embodiment, is a valve stem 68 having a similar longitudinal channel 70 and an orifice 72 located in its sidewall. Its bottom 74 is closed and is also flanged. Valve spring 76 biases the valve stem upwardly.

Located in consecutive order above the valve body is a partitioning gasket 78 for sealing the product chamber, a spacer 80 for forming a cleaning chamber 82, and an upper sealing gasket 84. The sealing gasket 84 has a central opening which receives the valve stem 68 and seals its orifice 72.

As in the primary embodiment, the partitioning gasket 78 includes gasket ports 79 along its outer perimeter to pass propellant and a central opening to receive and seal the valve stem 68.

Spacer 80 is annular with a plurality of spacer ports 86 aligned with gasket ports 79 for the passage of propellant. The height of the spacer is such that when the valve is affixed to the aerosol container, the spacer exerts pressure on the partitioning gasket 78 to press it firmly against the upper end of the valve body to effectively seal the product chamber. A central, annular recess within the spacer functions as the cleaning chamber 82.

The operation of this valve is similar to the previous embodiment. When the valve is in its uppermost or closed position, shown in FIG. 6, the valve stem orifice 72 is sealed by sealing gasket 84; the product chamber 64 is filled with the aerosol product via product passageway 66; and the propel-

lant enters the cleaning chamber **82** by passing between the valve body and the valve mounting cup **17**—the relatively small clearance between them is sufficient to pass the gaseous propellant—and from there, through the gasket ports **86** and spacer ports **88**.

When the valve stem is depressed to its intermediate position, orifice **72** is within the cleaning chamber whereupon propellant passes through and cleans the orifice, channel **70**, and the button.

The product is similarly discharged, when the valve stem is depressed to its lowermost position where orifice **72** is within the product chamber **64**.

The above process is reversed when the valve stem is released and spring **76** returns it to its closed position.

A second modification is shown in FIG. **7**. It offers the advantage of being able to easily and quickly change the volume of the cleaning chamber to thereby regulate the quantity of propellant consumed each time the valve is cleaned.

The valve body **92** of this modification is similar in shape to the valve body of the modification shown in FIG. **6**. The interior of the valve body constitutes a product chamber **94** that receives the aerosol product through a product passageway **96** and dip tube, not shown, attached to the dip tube tail of the valve body. The top wall of the valve body is peaked as shown to engage a mating cavity within an annular spacer **98** located between the valve body sealing gasket **100**. A valve stem **101** reciprocates within the body.

The spacer **98**, preferably plastic, has a central opening with a shoulder or step **102** ringing its lower sidewall. Snapped over the shoulder **102** is an annular partitioning gasket **104** having a groove along its outer wall to receive the shoulder. The partitioning gasket slidably seals the valve stem and isolates the product chamber **94** from a cleaning chamber **106** disposed within the central opening of the spacer. To pass propellant to the cleaning chamber, a plurality of spacer ports **108**, only one of which is shown, extend transversely from the cleaning chamber to the outer wall of the spacer and then downwardly to the valve body.

As in the previous modification, the clearance between the valve body and the mounting cup **17** provides a passageway for the flow of propellant to spacer ports **108**.

As before, the valve stem **101** includes a channel **110**, an orifice **112**, and a flanged closed base **114** within product chamber **94**. A spring **116** biases the valve stem in an upward direction.

The upper sealing gasket **100**, an annular body with a thicker central portion that extends into the spacer opening, functions to seal the aerosol container, valve stem **101**, and its orifice **112**.

The operation of this modification is similar to the previous modification. When the valve stem is in its uppermost or closed position, as shown, orifice **112** is sealed by sealing gasket **100**. The product is forced by the propellant pressure into product chamber **94** via the dip tube and passageway **96**. The propellant fills the cleaning chamber by flowing between the valve body and container and then through spacer ports **108**.

Afterwards, when the valve stem is depressed to its intermediate position where orifice **112** is within cleaning chamber **106**, the propellant escapes through and cleans the orifice, channel **100** and the button, not shown, on the top of the valve stem.

When the valve stem is depressed to its lowermost position, orifice **112** is within the product chamber **94** and the product is discharged in a similar manner.

The process is reversed when the valve stem is released and returned by spring **116** to its closed position.

As previously stated, the primary advantage of this modification is that the quantity of propellant consumed in cleaning the valve may be easily regulated. This is accomplished merely by changing the thickness of the partitioning gasket **108**; thereby varying the volume of cleaning chamber **106**. For example, for viscous aerosol products, like paint, which require a relatively large amount of cleaning propellant, a greater thickness for the gasket should be used to increase the volume of the cleaning chamber. Conversely, for products of thinner viscosity, the gasket may be decreased in thickness to reduce its volume. Since there is only a narrow clearance between the valve body and the crimped aerosol container **12** for the propellant to pass through, the buildup of propellant within the cleaning chamber **106** is not instantaneous. Therefore, substantially only the propellant that is within the cleaning chamber **106** is consumed in cleaning the valve as the valve stem orifice moves across the chamber.

FIG. **11** illustrates a third modification of the valve of this invention. Here, the valve stem **18** has two discharge orifices **130** and **132**, the upper orifice **130** being sealed by upper annular sealing gasket **16** and the lower orifice **132** being sealed by partitioning gasket **24**, when the valve is fully closed. By varying the thicknesses of gaskets **16** and **24**, and spacer **26** and/or by preselected placement of said orifices **130** and **132** with respect to said gaskets and with respect to each other, the valve may be designed to achieve propellant vapor blending or product before, during or after initial product spray. Thus, "softer" sprays, i.e., sprays which are not cold due to initial sprays, by early admixture with product with emolient therein can be accomplished. Other advantages can also obviously be derived from the use of a double-orificed valve stem.

Also, with the double-orificed valve stem, one can affix an inner collapsible container **134** to the dip tube tail to create a codispensing valve, which can dispense two products, with the container in an inverted position, mixing them in the stem.

It should now be obvious from the above description that a self-cleaning aerosol valve has been provided. Advantageously, the valve is cleaned prior and subsequent to the product discharge. Another significant advantage is that the valve enables an aerosol product to be discharged even when the container is inverted. Conveniently, the valve may easily be combined with a metering adapter to convert the valve from a continuous spraying type to an intermittent spraying type; one which sprays a metered amount of produce each time the valve stem is depressed. Economically, the valve may also be adapted to regulate the quantity of propellant consumed in cleaning it by merely regulating the thickness of included gaskets. Features not to be overlooked are (1) the valve is highly efficient in operation and (2) simple in construction, which makes it economical to manufacture.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described:

What I claim is:

1. A valve for an aerosol container comprising a tubular valve body sealing means sealing the upper end of said valve body, a cleaning chamber disposed in the upper portion of said valve body, said cleaning chamber in communication with a first fluid within said container, a product chamber disposed in the lower portion of said valve body and isolated from said cleaning chamber, said product chamber in communication with a second fluid within said container, a valve stem reciprocally mounted within said valve body, said valve stem having therein a longitudinal extending channel open at its upper end and having a discharge orifice adjacent its lower end, said sealing means sealing said discharge orifice when said valve stem is in its uppermost position, and said valve stem adapted to be reciprocated between said uppermost position to an intermediate position where the orifice is within the cleaning

chamber and to a lowermost position where the orifice is within the product chamber.

2. The valve of claim 1 further including, in combination, a metering adapter having means to stop the communication of the cleaning chamber with said first fluid and of the product chamber with said second fluid and to reroute the second fluid into the cleaning chamber.

3. The valve of claim 1 wherein said second fluid communicates with said cleaning chamber when the container is inverted.

4. The valve of claim 1 wherein passageways are provided in the valve body for passing the first fluid to the cleaning chamber.

5. The valve of claim 4 further including, in combination, a metering adapter having means to stop communication of the cleaning chamber with the first fluid and of the product chamber with said second fluid and rerouting the second fluid into the cleaning chamber via said valve body passageways.

6. The valve of claim 1 wherein a clearance is provided between the valve body and container for passing the first fluid to the cleaning chamber.

7. The valve of claim 1 wherein the cleaning chamber is formed by a spacer between said sealing means and a partitioning gasket isolates the product chamber.

8. The valve of claim 7 wherein the volume of the cleaning chamber may be regulated by varying the thickness of said spacer and said sealing means and said partitioning gasket.

9. The valve of claim 1 wherein a clearance is provided between the valve body and container for passing the first fluid to the cleaning chamber, said cleaning chamber being formed by a spacer lying between said sealing means and a partitioning gasket that isolates the product chamber and the volume of the cleaning chamber being regulated by varying the thickness of said spacer and said sealing means and said partitioning gasket.

10. The valve of claim 1 wherein said cleaning chamber is enclosed by said valve body sealing means and a partitioning seal means between said cleaning chamber and said product chamber.

11. The valve of claim 10 wherein said valve body sealing means and said partitioning seal means are integral.

12. The valve of claim 11 wherein said valve body sealing means and said partitioning seal means are made of different material.

13. The valve of claim 10 wherein said valve stem has an additional discharge orifice vertically spaced from said discharge orifice, each orifice being disposed opposite said valve body sealing means and said partitioning seal means respectively.

14. The valve of claim 11 wherein said second fluid is contained within a flexible walled inner container within said aerosol container.