United States Patent [19]

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[54] AEROSOL TYPE DISPENSER

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[21] Appl. No.: **42,090**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 763,189, Sept. 27, 1968.

[52] **U.S. Cl.** **222/402.24**

[51] **Int. Cl.** **B65d 83/14**

[58] **Field of Search** ..222/402.24, 146 HA, 464, 547; 239/488, 487, 482; 138/42

[56] **References Cited**

UNITED STATES PATENTS

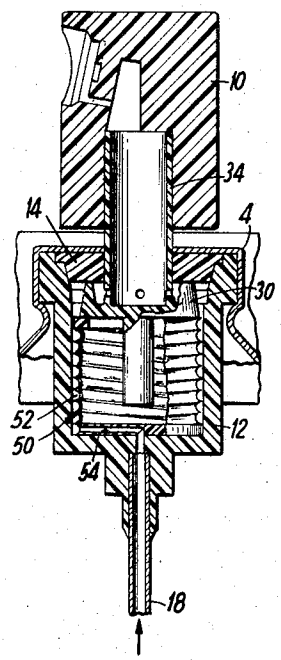
3,217,937	11/1965	Kasparian	222/146 HA
3,412,937	11/1968	Chamberlain	239/488 X
3,498,504	3/1970	Wilkins	222/146 HA

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[57] **ABSTRACT**

An aerosol dispenser for dispensing fluids under pressure in which the dispenser has a spiral restricted passage between the dip tube and valve and through which the fluid to be dispensed passes when the valve is opened, the number of spirals in the restricted passage being not less than one and not more than 100, preferably between six and 50, and the diameter of such restricted passage being such that the fluid is retained therein, except when being dispensed, by capillary action.

5 Claims, 5 Drawing Figures



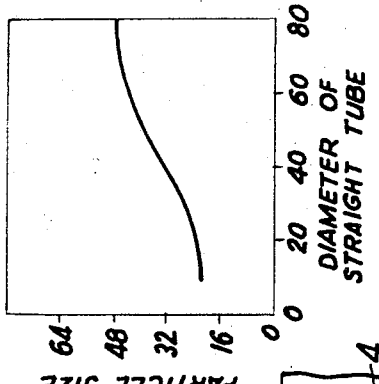


FIG. 4

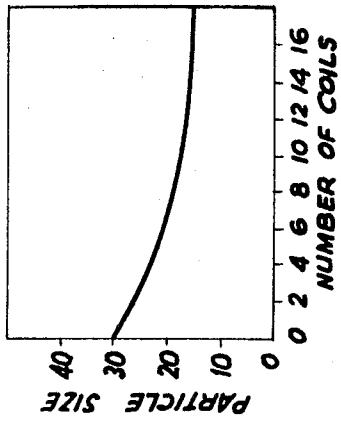


FIG. 5

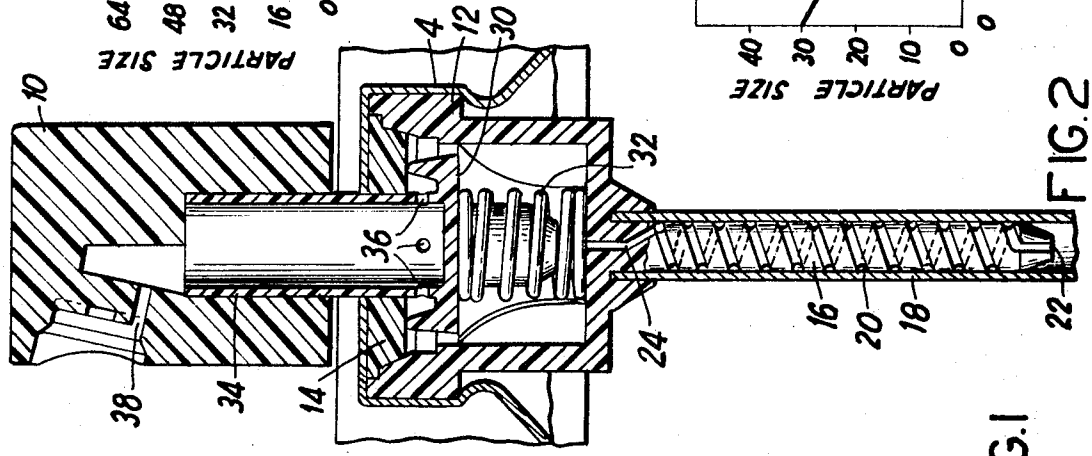


FIG. 2

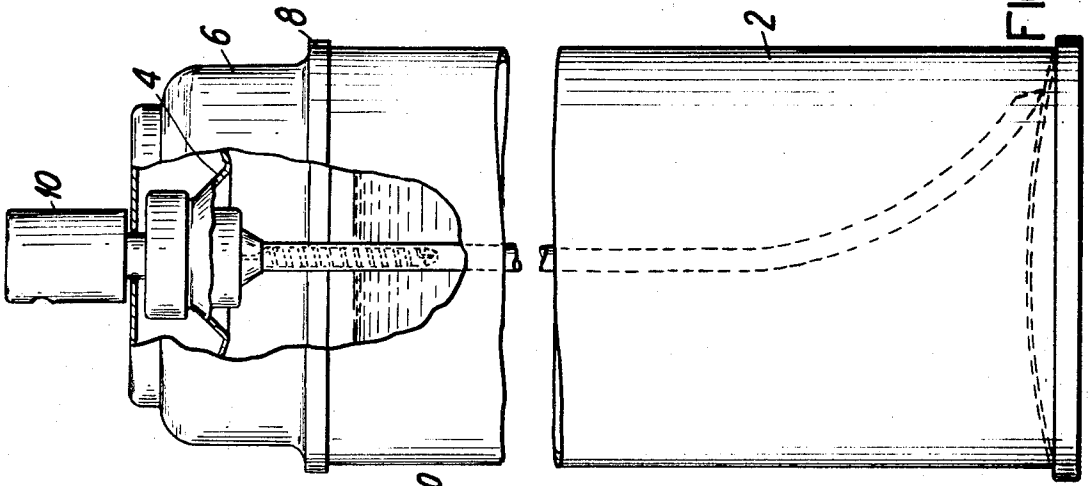


FIG. 1

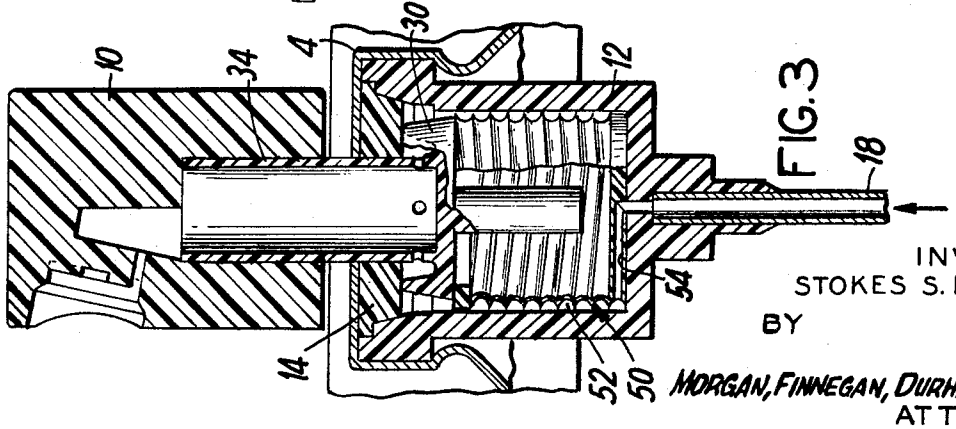


FIG. 3

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AEROSOL TYPE DISPENSER

This application is a continuation-in-part of U.S. Application Ser. No. 763,189, filed Sept. 27, 1968 and relates to aerosol dispensers and, more particularly, to such dispensers wherein a liquid spray is discharged from the dispenser by a propellant gas when a dispenser valve on such aerosol dispenser is actuated.

It is common practice in the manufacture and loading of aerosol dispensers to provide such dispensers with a dip tube, attached, at one of its ends, to the dispenser valve or valve chamber and, at its other end, immersed in the liquid to be dispensed. Usually, such dip tube extends downwardly into the dispenser to the bottom of the dispenser housing so that most, if not all, of the liquid in such dispenser may be discharged before the dispenser is discarded. Such dispenser may be used a number of times before the contents are exhausted and the dispenser is discarded.

Aerosol dispensers are utilized for packaging and dispensing a wide variety of liquids. When the dispensing valve is actuated, usually by depressing the stem of the valve extending outwardly from the top of the dispenser, the liquid is sprayed out of the dispenser, usually through an orifice in the valve stem. The liquid is discharged through and out of the orifice in a spray pattern. With some materials, for example quick drying hair sprays, the uniformity of this spray pattern and the size of the liquid particles in the pattern sprayed are of particular importance. Variations in such pattern and variations in the size of the liquid particles while, from time to time, the contents of the dispenser are being used, can adversely effect the spray application of the liquid and the effectiveness of such liquid. For example, if the dispenser is held at the same distance from the hair being sprayed with quick drying hair spray and the spray pattern in one application differs from the spray pattern in another application, the amount of sprayed liquid applied and the drying thereof will vary. Likewise, if from application to application the liquid particle size varies, the amount applied and drying will vary.

Various attempts have, heretofore, been made to improve the spray pattern and uniformity of the particle size of liquids sprayed from aerosol dispensers. Such attempts have included arrangements in the valves, the orifices and the internal diameter of the dip tube. Such arrangements have been expensive, tended to clog or otherwise adversely effect dispensing or, for a variety of reasons, have been found to be impractical.

In the instant invention, it has been discovered that the uniformity of the spray pattern and the uniformity of the particle size can be substantially improved for aerosol dispensing of liquids, for example, quick drying hair sprays, by providing the dip tube, or passageway between the liquid contained in the dispenser and the dispensing valve, with a spiral or convolute passage of restricted size through which the liquid, propelled by the propellant gas, is passed. Such passageway, as will be described in more detail, may be in the form of a pin or boss extending into the dispensing valve end of the dip tube or a spiral accordianed sleeve in the valve body chamber.

In the instance of the pIn or boss, the outer surface is provided with a spiral groove communicating, at one end, with the I.D. of the dip tube and, at its other end,

with the dispensing valve chamber. Such pin or boss may be molded as an integral part of the valve chamber housing or may be formed separately and inserted into the valve end of the dip tube. In either event, as will be later described, the spiral groove on the outer surface of the pin or boss and the inner wall of the dip tube cooperate to form the spiral or convolute passage of restricted size.

Where the spiral or convolute passage is in the form of a spiral, accordianed sleeve in the valve body chamber, the sleeve fits into and cooperates with the inner wall of the valve body chamber so as to form, with such inner wall, the desired spiral or convolute passage of restricted size. In this embodiment, as will be more fully described, the accordianed sleeve may also act as the spring for the valve. Thus, the sleeve, made from a resilient plastic, is compressed when the dispensing valve is opened and, when the valve is released, expands to close the valve. Because the liquid to be dispersed will pass through the spiral or convolute passage only when the valve is open and such sleeve is compressed, the spiral opening in such sleeve should be of sufficient size so that, when the dispersing valve is opened and the sleeve is compressed, the spiral passage will be of sufficient size to permit the required restricted flow.

The internal diameter of the spiral or convolute passage in the instant invention will depend upon the liquid to be dispersed, the viscosity of such liquid at the dispensing temperature, usually 70° F. the prevailing temperature at which aerosol dispensers are used, and similar factors. For purposes of the instant invention, the internal diameter of the spiral or convolute passageway is of such size that the liquid will be held in such passageway by capillary action.

The substantial improvements in the uniformity of spray pattern and uniformity of particle size, afforded by the instant invention, result in a more uniform rate of discharge from the aerosol dispenser extending over the life of such dispenser. Likewise, the spray pattern and mixture remain more uniform over the life of such dispenser. The maintenance in uniformity of the mixture can be of substantial importance where, as in the instance of a quick drying hair spray, such mixture, if not uniform can become flammable Additionally, in the instant invention, the entrainment and discharge of the propellant propellant gas is avoided and the liquid, as it is discharged, is maintained in equilibrium. Higher pressure, lower cost propellant gases, such as CO_2 and NiO_2, can be substituted for higher cost Freon. The latter is of substantial importance because of the cost reduction effected.

The exact theory of the improvements of the instant invention, other than in performance and costs, is not known. It is believed, however, that Newton's Laws, as applied to circular motion, and Bernouli's Theorem, and the increased frictional flow and turbulent flow afforded thereby, combined to provide an infinite number of expansion changes along the spiral or convolute tube passage. Thus, the flow path with the spiral or convolute tube of the instant invention is increased between about 2 to about 24 micro-seconds as compared to a straight tube of the same internal diameter but without the spiral or convolute portion. The increase in flow path time will, of course, depend upon

the number of spirals. The number of spirals may be as low as one or in excess of 100. For most liquids, six to 50 spirals are preferred.

The instant invention will be more fully described and better understood in the following description of preferred embodiments of the invention taken with the appended drawing in which:

FIG. 1 is a view, partly broken away, of one embodiment of the invention;

FIG. 2 is an enlarged view, in section, of the embodiment of FIG. 1;

FIG. 3 is an enlarged view, similar to FIG. 2 but showing a second embodiment of the invention;

FIGS. 4 and 5 are graphs showing the effects of tube diameter and the number of coils in the spiral on the size of particles, with the size of the particles measured in microns and the internal diameter of the tube measured in thousands of an inch.

Referring to the drawings, particularly FIGS. 1 and 2 showing one of the embodiments of the invention, the dispenser comprises container 2, usually a metal can, having a cap 4, crimped or otherwise suitably fixed to container 2. Cover 6 is removably attached to container 2 by shoulder 8, the cover extending over the upper end of valve button 10 to prevent accidental displacement of the valve when cover 6 is in place, as is conventional on the type of aerosol container illustrated.

With particular reference to FIG. 2, valve chamber housing 12 and valve chamber cover 14 are held in fixed position in cap 4. Pin 16, which, preferably, is formed as an integral part of housing 12, but may be a separate unit, extends downwardly, from housing 12, into dip tube 18. Around its periphery, pin 16 has a spiral groove 20, connected, at its lower end by passage 22 with the interior of dip tube 18 and, at its upper end, by passage 24 with the interior of valve chamber housing 12. As will be later described, spiral groove 20 and the interior wall of dip tube 22 form a spiral passageway between dip tube 22 and the interior of valve chamber housing 12.

Valve 30 is held in seated engagement with valve chamber cover 14 by compression spring 32. Stem 34, which is hollow, of valve 30 extends upwardly into valve button 10. At its lower end, stem 34 has a plurality of ports 36 which, when valve 30 is opened, permit liquid to pass from container 2 through stem 34 and to be discharged through orifice 38 in valve button 10.

With the exception of pin 16, groove 20 and passages 22, 24, the construction of the aerosol dispenser of FIGS. 1 and 2 are conventional. The contents of container 2, under pressure in such container, are sprayed out through orifice 38 when cover 6 is removed and valve button 10 is depressed. When valve button 10 is released, valve 30 is closed by spring 32, cutting off the discharge of spray through orifice 38.

As has been noted, the internal diameter of the spiral or convolute passageway formed by groove 20 and the inner wall of dip tube 18 is, preferrably, of such size that the liquid to be dispensed will be held in such passageway by capillary action. Larger passageways, while they afford some of the advantages of the instant invention, in the instance of many liquids to be dispensed, do not afford the full advantages.

The precise theory of the improvements in uniformity attained in the instant invention, as has been hereinabove noted, is not known with certainty. It is believed, however, that the reduced diameter, increased length and relatively confined spiral flow, speeds the flow velocity, increases the flow length and increases the turbulence in such flow. Hence, the pressure drop exists on a greater volume of liquid or fluid for a longer length of time which, in turn, increases the amount of gas being released in the liquid. The angular velocity imparted by the spiral or convolute configuration of the passageway exerts *g* forces on the flowing fluid, increasing the temperature of such fluid and the turbulence therein. Velocity may be as high as 300 feet per second, or higher, and result in greater reduction in pressure so that the liquid may be said to be supersaturated with the propellant gas. Turbulence helps to disperse the liquid and the gas and to release the gas from the liquid.

The reduction in internal diameter, alone, reduces particle size. This is best shown in FIG. 4 where the diameter of a straight tube in thousands of an inch are plotted against particle size in microns where 90 percent of the particles in the spray are smaller than the indicated particle size on the graph. In FIG. 5, the effect of the number of coils on particle size is shown. In formulating the data for both graphs a liquid base of ethanol and a propellant of diflucrodichloro methane was used. In the instance of FIG. 5, the internal diameter of the coil passage was 0.030 inch with a coil diameter of five-eighths inch. These dimensions, however, should not be taken as indicative of preferred dimensions in the apparatus of the instant invention. Such dimensions will vary from liquid to liquid, propellant gas to propellant gas, internal container pressure, temperatures and similar variables. These tests do show, however, the improvements to be attained in the instant invention and the synergistic effects thereof.

Referring now to FIG. 3 showing a second embodiment of the instant invention, the spiral or convolute passageway in the fluid passage flow from dip tube 18 to the valve is combined in an accordianed member in valve chamber housinG 12, thereby combining the spiral or convolute passageway with the spring for closing the valve and eliminating the spring, as in FIG. 1, as a separate element. In FIG. 3, accordian sleeve member 50, having spiral groove 52 along its outer wall is fitted into valve chamber housing 12 so that the inner wall of housing 12 and spiral groove 52 form a spiral passageway opening, at one end, through passage 54, into dip tube 18 and opening, at the other end, into the upper end of valve chamber housing 12. Accordian sleeve member 50 is of resilient material, such as plastic, which, as valve 30 is opened by depressing button 10, is compressed and, when button 10 is released, expands to close valve 30 and maintain such valve closed or seated until button 10 is again depressed. Sleeve 50 fits loosely into housing 12 with the projecting edges of the spiral wall in close proximity to the inner wall of housing 12 to form therewith the desired, restricted spiral or convolute fluid passageway.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of

the features shown and described or portions thereof, but it is recognized that various modifications are possible.

What is claimed is:

1. An aerosol dispensing pressure container having a dip tube immersed at one of its ends In the liquid in said container to be dispersed and connected at its opposite end to a valve which, when open, allows said liquid in said container to pass through said dip tube and be dispensed and, when closed, maintains said liquid under pressure in said dip tube and said container, a spiral passageway member at the valve end of said dip tube in which said spiral passageway member is a resilient accordian member seated, at one of its ends, against said valve seat and seated, at its opposite end, against a wall of the valve housing and forming between said valve and said wall a resilient member for closing said valve.

2. An aerosol dispensing pressure container, as recited in claim 1, in which said spiral passageway member has a spiral groove extending along its outer wall, said spiral groove and the inner wall of said valve housing forming said spiral passageway for restricting the flow of said liquid when said valve is open.

3. An aerosol dispensing pressure container, as recited in claim 2, in which said spiral passage is of a diameter in which the liquid in said container will be retained by capillary action.

4. An aerosol dispensing pressure container, as recited in claim 3, in which the number of spirals in said spiral passage are not less than one and not more than 100.

5. An aerosol dispensing pressure container, as recited in claim 4, in which the number of spirals in said spiral passage are not less than six and not more than 50.

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