United States Patent

[11] 3,591,088

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[45] Patented **July 6, 1971**

[54] **ATOMIZER SPRAYHEAD CONSTRUCTION**
13 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **239/304,** 222/193, 239/307, 239/337, 239/426
[51] **Int. Cl.** **A62c 13/60**
[50] **Field of Search** 222/193, 94; 239/303, 337, 369, 426, 304, 306, 307

[56] **References Cited**

UNITED STATES PATENTS

2,122,639	7/1938	Faiver	239/303 X
3,040,991	6/1962	Fedit	239/304
3,058,669	10/1962	Drell	239/426 X
3,085,752	4/1963	Drell	239/303 X
3,122,325	2/1964	Mahrt et al.	239/369 X
3,305,134	2/1967	Carmichael et al.	239/304 X
3,390,820	7/1968	Marraffino et al.	222/193
3,454,228	7/1969	Mossop	239/344 X
3,478,933	11/1969	Rousselot	222/193
3,300,144	1/1967	Marraffino	239/307

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ABSTRACT: There is provided an atomizer sprayhead which is formed of two molded components, namely, a cap member and a cup member, the cap member being telescopically engaged over the cup member to define a sprayhead body having an internal, independent reservoir, said cap carrying a hollow depending stem arranged to engage the valve plunger of an aerosol valve assembly, the interior of said stem defining a first or primary expansion chamber, and said cap further carries a depending riser tube adapted to be disposed within said reservoir when the cap and cup telescopically are engaged. Horizontal conduit means are provided communicating between the primary expansion chamber and the discharge orifice, a portion of said means comprising a secondary expansion chamber, and the riser tube and said horizontal conduit means being so arranged so that the discharge jet of product from the latter is directed angularly upward relative to the outlet port of the riser tube to create an area of low pressure thereat, whereby to draw liquid from the reservoir, through the riser tube and out the outlet port into the flowing product stream.

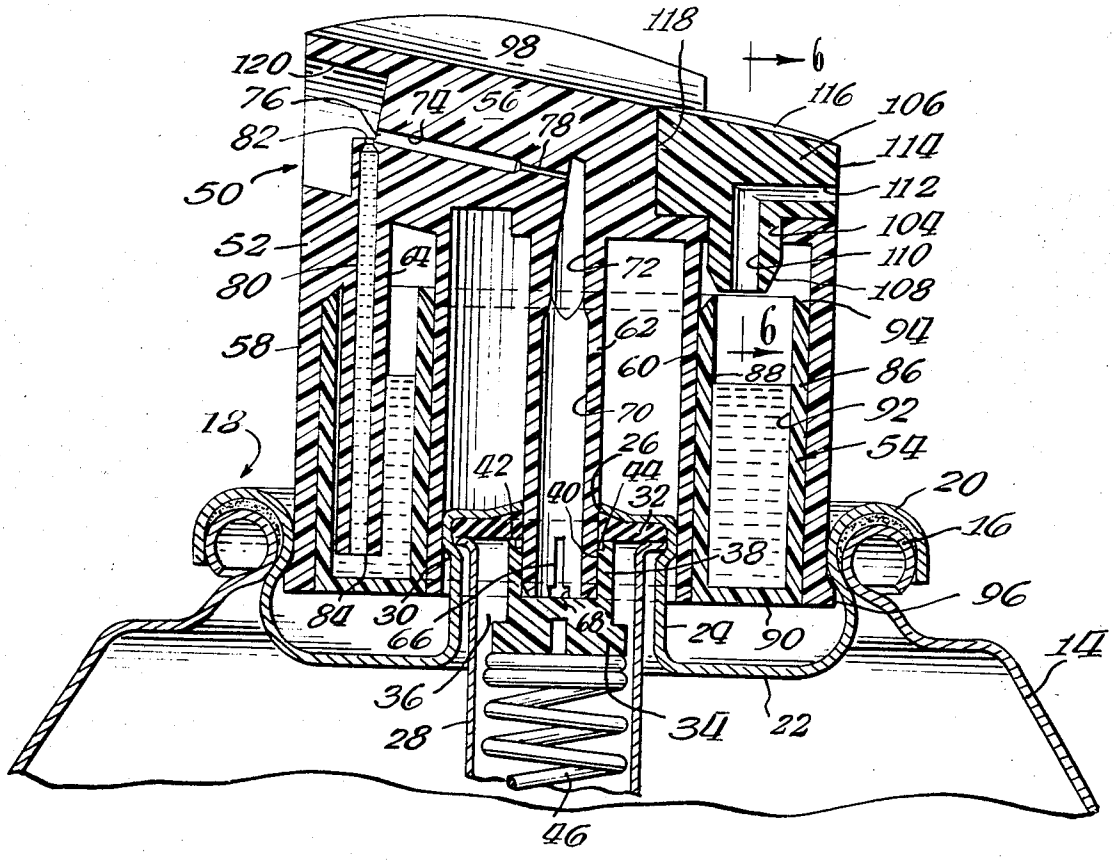


Fig. 1

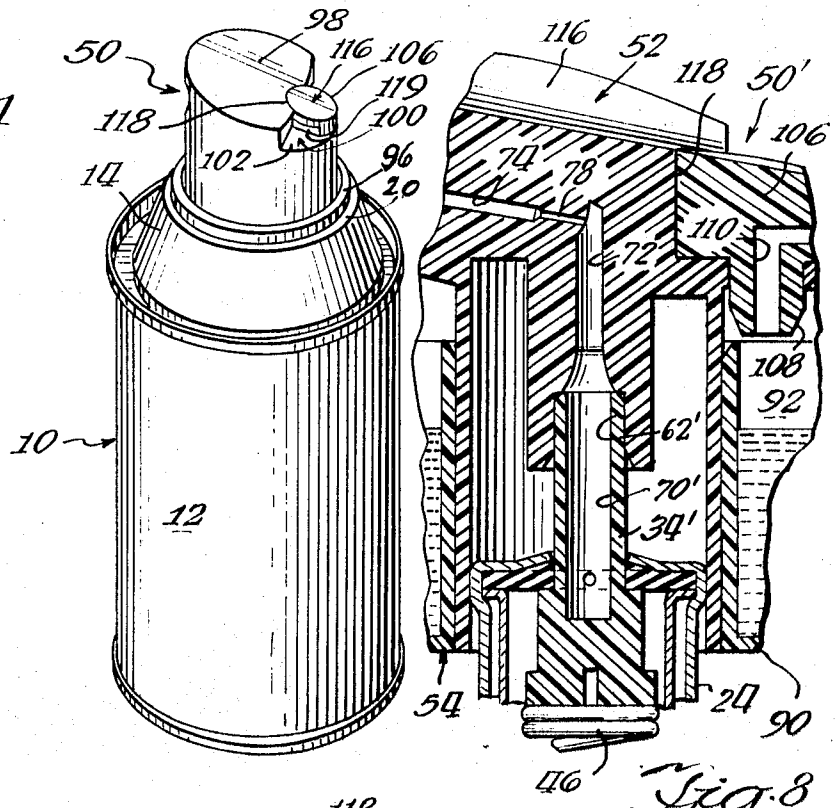
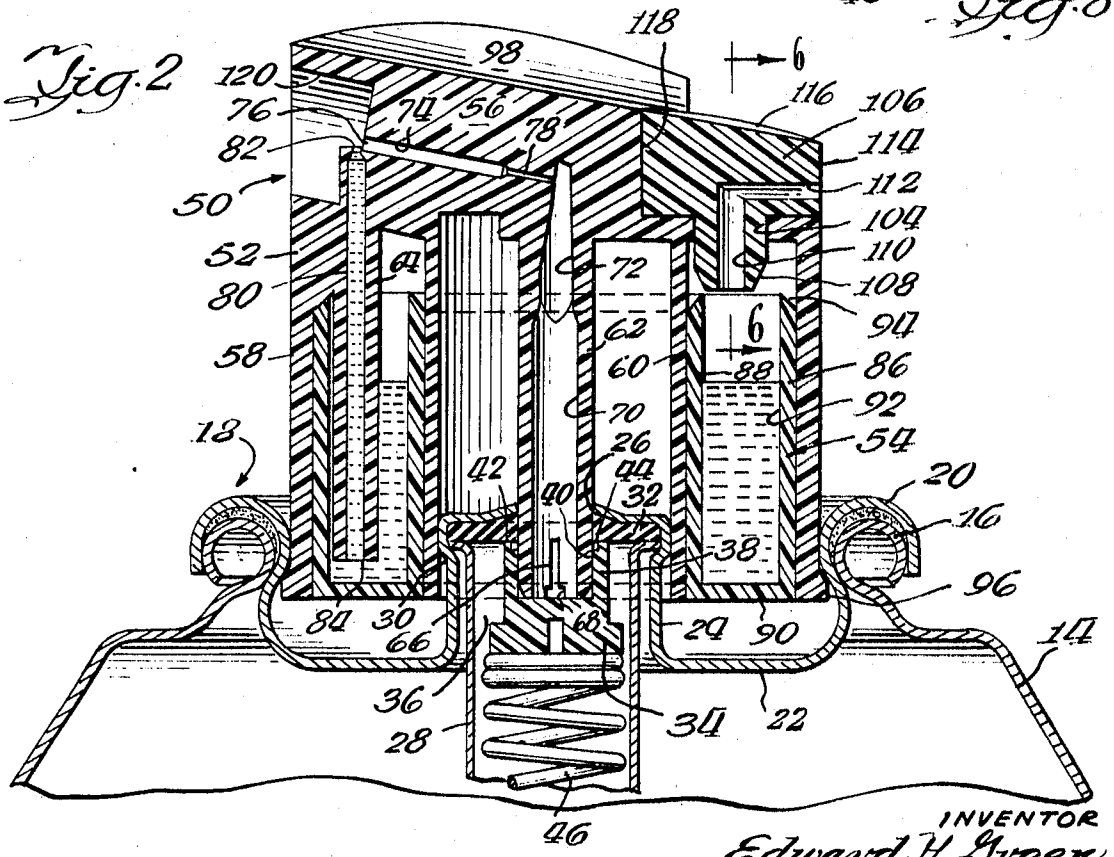


Fig. 8

Fig. 2



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Fig. 3

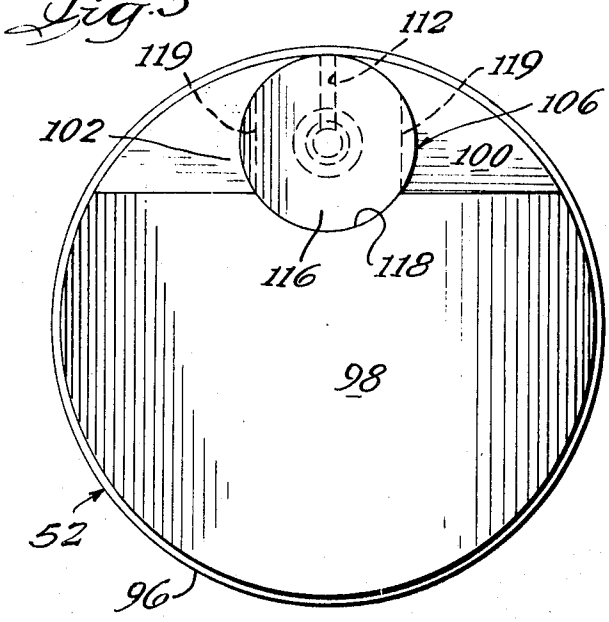


Fig. 5

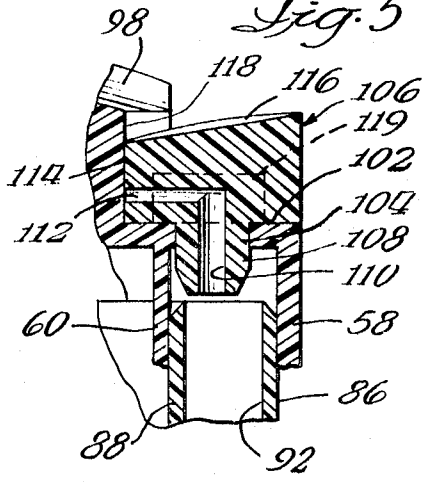


Fig. 6

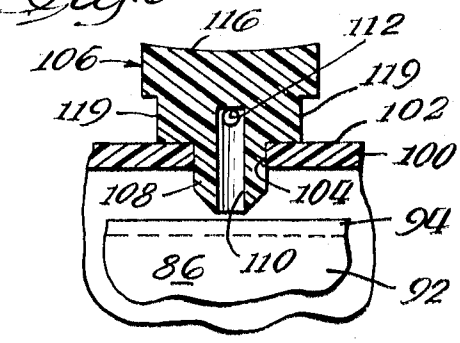
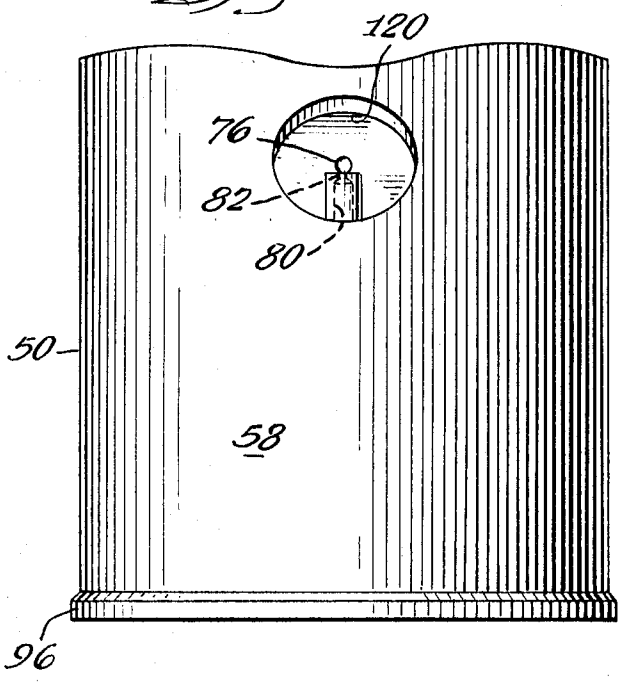


Fig. 4



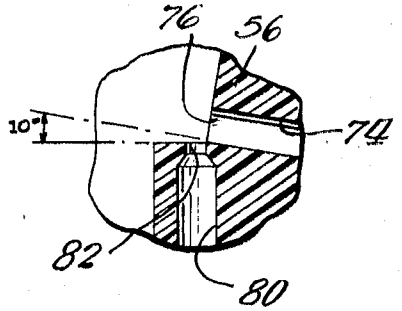


Fig. 7

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ATOMIZER SPRAYHEAD CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to pressurized dispensing packages and, more particularly, is concerned with the provision of an improved actuator cap or sprayhead construction for such packages, characterized by the inclusion of additional atomizer means as a part thereof.

2. Description of the Prior Art

Dispensing of personal products such as hair lacquers, deodorants, room fresheners, and the like, by means of pressurized packaging such as typified by the well-known aerosol packages, has achieved wide acceptance. Most of these products are scented and usually consist of a basic functional formulation and a characteristic odorant component. Often it was considered advantageous for the packager to package a basic formulation, say a hair lacquer, in an aerosol dispensing package and provide some means whereby the user could select a personal perfume, for example, and introduce same to the basic formulation of hair lacquer simultaneously with dispensing of same from the aerosol canister. It has been known to provide the actuator cap or sprayhead with reservoir means to hold a quantity of liquid under nonpressurized conditions, and means have been provided to introduce the contents of the reservoir means to the flow of discharge material from the aerosol container as the same was being discharged in the atmosphere through the sprayhead.

Difficulties immediately were encountered in providing a satisfactory dispensing system for such purpose as described. Leakage from the reservoir was of considerable concern. Failure of the nonpressurized material to be transferred in proper quantity from the reservoir to the main stream of pressurized product was encountered. Inadequate mixing of pressurized and nonpressurized material likewise was characteristic of earlier attempts to provide atomizer sprayhead structures. Additionally, in some structures the construction was such as to result in the reservoir being pressurized whereupon dispensing of the contents of the reservoir was materially hampered. Facile loading of the nonpressurized material into the reservoir means that had been provided was not characteristic of those structures. Ease and convenience of mounting and operation also were not functional characteristics of those few prior attempts to provide an atomizer sprayhead construction. All in all, a better, more efficient and effective atomizer sprayhead construction was desired.

Accordingly, the object of the present invention is to provide such an improved, more efficient and effective atomizer sprayhead construction having an internal reservoir adapted to receive and store a quantity of nonpressurized liquid and small bore conduit means for conducting said liquid to a location immediately forwardly adjacent the discharge orifice of the sprayhead so that the passage of expanding pressurized product over the mouth of said small bore conduit means will conduct the nonpressurized liquid from the reservoir into the expanding stream of pressurized product in a fully mixed, nebulized or atomized condition.

It is a further object of this invention to provide an atomizer sprayhead construction for an aerosol dispenser package wherein said sprayhead has an internal reservoir for holding nonpressurized liquid isolated from communication with the interior pressurized package, and internal pressurization of the reservoir is obviated by providing a venting means therefor to the atmosphere.

A still further object of this invention is to provide an atomizer sprayhead having additional atomizer means provided therein, said means comprising a reservoir for containing product to be atomized, capillary means leading from the reservoir to the mouth located immediately adjacent or forward of the discharge orifice in the sprayhead, said discharge orifice communicating with the interior of the pressurized

package by way of a horizontally arranged secondary expansion conduit and a hollow primary expansion conduit formed in a depending hollow stem as a part of the sprayhead construction and arranged to operate an aerosol valve assembly provided mounted upon the pressurized package canister.

SUMMARY OF THE INVENTION

A sprayhead for pressurized dispensing packages wherein is provided an additional atomizer means characterized by a vented internal reservoir for receiving and storing nonpressurized liquid and formed within the sprayhead and small bore conduit means also formed within the sprayhead leading from the reservoir to a delivery mouth disposed closely adjacent the discharge orifice of the spray downstream thereof, the sprayhead adapted to be coupled to an aerosol valve assembly mounted on a canister containing pressurized product and movable to cause a stream of expanding pressurized product from the discharge orifice over the delivery mouth drawing the nonpressurized liquid from the reservoir through the conduit means and out the delivery mouth entraining same in the stream of pressurized product.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a pressurized dispensing package carrying the sprayhead constructed in accordance with the herein invention.

FIG. 2 is a fragmentary enlarged sectional view of the package shown in FIG. 1.

FIG. 3 is a top plan view of the sprayhead constructed in accordance with the invention.

FIG. 4 is an elevational front view of the sprayhead constructed in accordance with the invention.

FIG. 5 is an enlarged detailed section of the vent means carried by the sprayhead of the invention shown here in closed condition.

FIG. 6 is an enlarged section taken along lines 6–6 of FIG. 2.

FIG. 7 is an enlarged fragmentary detail of the sprayhead according to the invention and illustrating the relationship of the discharge ports of the riser tube and of the sprayhead.

FIG. 8 is a fragmentary sectional detail of a modified embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention contemplates novel means for providing additional atomizer means in an actuator cap or sprayhead for a pressurized package. An internal reservoir is formed within the sprayhead and a vertically arranged riser tube disposed therein to terminate in a secondary orifice; the sprayhead is provided with an internal expansion chamber means and a principal discharge orifice and a secondary, substantially horizontally arranged, expansion conduit communicates therebetween. The secondary orifice is located downstream of, but closely adjacent to, the primary discharge orifice. Now, a jet of expanding pressurized material is discharged over the secondary orifice defining a localized region of low pressure. This condition causes liquid from the reservoir to be drawn up the riser tube and be sucked into the jet stream at a rate sufficient to atomize the liquid into minute particles of droplets immediately dispersed into the rapidly moving stream of discharged pressurized product. The riser tube has a capillary passage upwardly terminating in the secondary orifice, with the latter preferably being of reduced diameter. Ordinarily, the liquid contents of the reservoir wets the riser tube once the liquid is introduced into the reservoir. An entry to the reservoir is provided for introducing liquid thereto, and a vented plug is provided for closing off entry to the reservoir. The plug is removable and, in fact, is provided with a pair of flats and an undercut portion to facilitate manipulation thereof. The plug is capable of being rotated for selectively exposing the vent to the atmosphere. The sprayhead, according to the invention, is formed of two molded components, one being an outer cap carrying the riser tube integral therewith, and the other being

a top opening ringlike cup telescopically engageable within the cap and defining a reservoir chamber. When the cap and cup are engaged frictionally telescopically, the lower portion of the cap fits within the well of the conventional aerosol valve covering and is provided with an annular rib or outwardly directed abutments symmetrically arranged so as to retain the sprayhead therewithin although same is capable of limited vertical movement within the well of the valve cover provided.

Referring now to the drawings, in FIG. 1 there is illustrated a pressurized package designated generally by reference character **10** and comprising a cylindrical canister **12** having an upper dome **14** terminating in a curled lip **16** to provide an open top which is closed off by a valve cover member **18** wherein is mounted the dispenser valve mechanism.

The cover member **18** comprises a sheet-metal cuplike structure having an upper curled lip **20** adapted to be crimped over lip **16** and sealed by means of suitable gasketing material conventionally provided thereat. The cover member has a well **22**, in the center of which there is an integral upstanding generally cylindrical boss **24**. Boss **24** is provided with a central opening **26** in its top wall and is crimped to the outwardly flared upper end of a valve housing **28** as at **30**. The housing **28** is sealed at its top end by means of a rubberlike gasket **32** sandwiched between the top wall of boss **24** and the flared upper end of the valve housing **28**.

A valve plunger **34** is disposed within the interior chamber **36** of the valve housing **28** and includes a generally cylindrical portion **38** in which is defined an upwardly opening socket **40**. An annular sealing rim **42** surrounds the socket **40** and is provided with an inwardly opening galley formation **44**. A helical spring **46** is disposed within the chamber **36**. The spring **46** urges the plunger **34** upward so that the rim **42** normally is biased tightly to engage the bottom surface of the gasket **32** so as to seal off the interior of the chamber **36** from the atmosphere. The pressurized material within the canister cannot escape from the chamber **36** while the plunger is in this defined position.

The pressurized package **10** is completed with a sprayhead embodying the herein invention and designated generally by reference character **50**. Sprayhead **50** is formed of a pair of molded members, namely, a cap **52** and a cup **54** telescopically, frictionally engaged therewithin.

Cap **52** has a substantially cylindrical body portion **56**, a pair of depending cylindrical skirt portions **58** and **60**, depending hollow tubular stem **62**, and a depending capillary "riser" tube **64** disposed between the pair of skirts **58** and **60**. The stem **62** is of size and configuration whereby the lower end thereof slidably and sealingly is engaged through the center opening **26** of the boss **24** and center opening of the perforate gasket **32** to terminate within the socket **40** of the valve plunger **34**. A bottom opening through-slot **66** is formed at the lower end of the stem **62**, the upper end of slot **66** opening to the gallery **44** and being enlarged at the lower end as at **68** whereby to provide drippage collection means preventing clogging of the upper end of the slot by residual pressurized material. The upper end of slot **66** reaches only to the annular rim **42** of the valve plunger **34** and does not extend into the gasket at any time. A precise cross-sectional area opening at the upper end of the slot **66** is exposed to the flow of pressurized material when the annular rim **42** is unseated as by actuation of the stem **62** downwardly against the bias of spring **46**. The specific slot formation here described does not form any part of the herein invention and different types of slot formations, as well as plunger formations, easily can be utilized within the scope of the herein invention.

The hollow stem **62** defines an expansion chamber **70** interior thereof, extending into the body **56** of the cap **52** through a vertical passage **72**. The body **52** is provided with an internal, horizontally arranged secondary expansion conduit **74** terminating at its outer end in a discharge orifice **76** and being connected at its inner end with the upper portion of vertical passage **72** through narrow connecting passageway **78**. Connecting passage **78** may be eliminated, in which case conduit **74** is continuous to communicate to passage **72**. For ease in molding, it is preferred that the diameter of the horizontal conduit decreases from a maximum at the discharge orifice end thereof to the passage **72**.

The riser tube **64** has a narrow bore axial passage **80** of capillary dimension. Passageway **80** terminates at its upper end in the cap body **56** in a narrow diameter delivery mount **82** located immediately forward of the discharge orifice **76**. The lower end **84** of the passageway **80** terminates interior of a reservoir as described hereinafter.

The cup **54** of the sprayhead **50** is a top-opening, cylindrical ring having spaced sidewalls **86** and **88** and a floor or bottom wall **90**. The walls **86** and **88** and bottom **90** define a chamber **92** capable of containing a selected quantity of liquid. The outer diameter of the cup **54** is selected to be substantially equal to the inner diameter of skirt **58**. The thickness of wall **86** is selected whereby said wall is received between the inner surface of skirt **58** and the riser tube **64**.

The width of the cup **54** is selected to be equal to the distance between skirts **58** and **60**. Accordingly, the skirts **58** and **60** are fitted tightly and frictionally over the cup with the bottom wall **90** of the cup flush with the lower edges of skirts **58** and **60**.

The upper edges **94** of the cup walls are tapered so as to facilitate entry thereof between the skirts **58** and **60**. The cap or sprayhead **50** is assembled by the telescopic engagement of cap **52** over the cupt **54**, with chamber **92** defining an internal reservoir in the assembled sprayhead **50**.

The lower edge of skirt **58** is provided with an outwardly directed annular ring or protrusion **96** so that when the assembled sprayhead is fitted within the well **22**, the protrusion **96** functioning as stop means to prevent easy withdrawal or removal of the sprayhead from the package, said protrusions engaging under the inner curl of the valve cover as shown in FIG. **2**. An annular rib may be utilized instead of protrusions **96**. Clearly, the outer diameter of the assembled sprayhead **50** is substantially the same as the inner diameter of the valve cup **18** while the inner diameter of the skirt **60** is selected to be substantially equal to the outer diameter of the upper end of the boss **24**. In this manner, the sprayhead **50** is engaged tightly but yet vertically movable within the well of the valve cover. Thus, the sprayhead **50** can be urged toward the bottom of well **22** to unseat the valve plunger **34** to cause discharge of pressurized product from the interior of the canister.

The cap **52** has a sloping and concave top surface **98** terminating in a depressed ledge **100** located diametrically opposite the discharge orifice **76**. The ledge **100** has a relatively planar floor **102** and an opening **104** is formed in said floor **102**, preferably centrally along the ledge **100**.

A plug **106** is provided which carries a depending stem **108** constructed and arranged sealingly to engage through the opening **104**. An axial passageway **110** is provided in the stem **108** opening at its lower end to the open top of cup **54** (hence, to reservoir **92**) and communicating at its upper end with a horizontal passageway **112** formed in the plug **106** and opening to the short wall **114** of the plug.

The plug **106** is of generally cylindrical configuration and has a slanted, concave top surface **116** forming a continuation of the concave top **98** of the cap **52** when the plug **106** is engaged in operating condition. A portion of plug **106** is received within a recess **118** formed in the cap **52** adjacent the ledge **100**. The plug **106** has a pair of undercut flatted portions **119** to enable one to grasp the plug **106** for removal and/or rotation thereof, as will be explained hereinafter.

During use the horizontal passageway **112** of plug **106** is open to the atmosphere to provide venting for the internal reservoir **92**. The plug **106** is removable to enable filling of reservoir **92** through the opening **104** with the user's choice of perfume or like odorant. Perhaps a small funnel (not shown) would be useful in such transfer from a source of the perfume. When not in use, the plug **106** is rotated to the condition shown in FIG. **5**, closing off the reservoir **92** from the atmosphere and hence preventing leakage and/or evaporation.

It should be noted that the secondary expansion conduit **74** is placed at an angle relative to the mouth **82** of passageway **80** of the riser tube **64** so that the jet discharged from the discharge orifice **76** passes over the mouth **82** at an upwardly directed acute angle. This disposition aids in the atomization and nebulization of the material emitted from the riser tube into the jetstream of pressurized product. This relationship may be expressed in terms of the axes of the conduit **74** and passage **80** or in terms of the intersecting planes occupied by the orifice **76** and delivery mouth **82**, said planes intersecting at an angle selected between 90° and 180°.

It also should be noted that diameter of the capillary passage **80** is selected so that fluid is present continually therein so long as there is fluid within the reservoir **92**. Hence, the mouth of the capillary passage **80** always is wet so long as there is fluid in the reservoir **92**.

The region or area of low pressure created at the mouth **82** of the capillary passage **80** of the riser tube **64** by the passage of the jet of expanding pressurized material discharged from discharge orifice **76** not only causes the fluid to rise from the reservoir but draws same from the mouth **82**, incorporating same into the fast-moving jet. In this manner, the nonpressurized material intimately is mixed in atomized and nebulized condition with the material being dispensed from the canister. For example, in the embodiment illustrated herein, the diameter of the axial passageway **80** of riser tube **64** was one thirty-second of an inch, the diameter of the mouth **82** was one sixty-fourth of an inch, the diameter of the secondary expansion conduit **74** and of the discharge orifice **76** was 0.025 inches while the diameter of the connecting passage **78** was 0.020 inches. The capacity of the reservoir **92** was selected to be about two milliliters. The angle of inclination of the secondary expansion conduit **74** and discharge orifice **76** relative to the mouth **82** was selected to be 10°.

As described, the sprayhead **50** according to the invention is utilized with the type of valve assembly in which a sprayhead and integral stem is operatively assembled to an interior valve plunger having an upwardly opening socket. Other well-known valve structures are available wherein the stem and plunger arrangement are integral, with the stem containing the primary expansion chamber, extending sealingly and slidably outward of the valve cover boss to cooperate with a tubular socket formed in sprayhead or actuator button. From the above discussion relative the sprayhead of FIGS. **1** through **7**, it can be seen that the tubular stem **62** can be replaced by a tubular socket arrangement **62'** of sprayhead **50'** shown diagrammatically in FIG. **8**. This socket arrangement **62'** would be capable of cooperating with the outwardly extending hollow stem of an integral stem and plunger aerosol valve arrangement **34'** also illustrated in FIG. **8**, the primary expansion chamber **70'** being defined with said stem. Metering opening **66'** also is provided in arrangement **34'**. The other features of the invention described in FIGS. **1** through **7** would be included in sprayhead **50'** as shown in FIG. **8**. What is desired to be secured by Letters Patent of the United States is:

I claim:

1. A sprayhead for pressurized packages reciprocable as a unit and comprising a body, said body having first means unitary therewith to effect actuating connection between said body and an aerosol valve assembly mounted upon the pressurized package, a discharge orifice and first passage means in the body for leading pressurized product through the body from said first means to said discharge orifice when the sprayhead is actuated, an internal reservoir within said body arranged to contain nonpressurized product, capillary dimension passage means in said body leading from said reservoir to the atmosphere opening at a location forwardly of said discharge orifice and reservoir venting means on said sprayhead, actuation of said sprayhead causing a jet of pressurized product to pass over the open capillary dimension passage means drawing the nonpressurized product therefrom and thereby from the vented reservoir to provide a nebulized mixture of said pressurized and nonpressurized products.

2. The sprayhead construction as claimed in claim **1** in which said body is formed as a pair of telescopically engageable members, one being a cap and the other being a cup, the cap frictionally engaging over the cup in a substantially permanent assembly to define said body.

3. The sprayhead construction as claimed in claim **1** in which said venting means comprises an opening in the body of diameter sufficient to enable filling of the reservoir, a plug removably received in said body and said plug having a passageway adapted to communicate between the interior of said body and the exterior hereof.

4. The sprayhead construction as claimed in claim **3** in which the plug is constructed and arranged for selective rotation to close off said passageway from the exterior of the body.

5. The sprayhead construction as claimed in claim **1** in which said capillary dimension passage means opens to the atmosphere by way of a narrower diameter mouth.

6. The sprayhead construction as claimed in claim **1** in which said first passage means comprises an elongate substantially horizontal conduit terminating in said discharge orifice and being disposed upwardly inclined relative to the capillary dimension passage means at the atmosphere opening thereof.

7. A depressable sprayhead reciprocable as a unit and for a pressurized dispensing package of the type which includes a hollow stem unitary therewith and mountable to the dispensing valve assembly and a discharge orifice communicating with the interior of said stem, said sprayhead having an internal reservoir adapted to receive and store a quantity of nonpressurized liquid, open-ended narrow bore conduit means communicating between the reservoir and a mouth located downstream of the discharge orifice of said sprayhead, with the axes of the mouth and discharge orifice intersecting at an acute angle and venting means for said reservoir whereby passage of expanding pressurized product over the mouth of the said narrow bore conduit means will draw the nonpressurized liquid from the reservoir into the expanding stream of pressurized product in an intermixed, nebulized condition therewith.

8. The construction as claimed in claim **10** in which the said sprayhead is formed of a cap member and a cup member telescopically engageable within said cap member to define the internal reservoir, said cap member having an outer skirt and outward extending protrusion means formed thereon closely adjacent the lower portion thereof defining stop means for retaining the sprayhead on the package, but said sprayhead nevertheless being reciprocable as a unit.

9. In a valve assembly for an aerosol dispenser package of the type which is characterized by a sealing gasket having an aperture, a valve member beneath the gasket having the upper end surface thereof defining an annular rim, a spring normally urging said valve member upwardly to seal said rim against the underside of the gasket about the aperture in the latter, a hollow stem extending through the aperture in the gasket in peripherally sealed engagement therewith and operatively engaged with said valve member, the stem having a metering opening at the lower end thereof arranged to be selectively exposed to the interior of the package on unseating of the rim, and a sprayhead having a discharge orifice and passageway means communicating between the discharge orifice and the hollow stem and being reciprocable as a unit, the improvement comprising, said sprayhead having an internal reservoir defined therein independent of said passageway means and hollow stem and capable of receiving and storing nonpressurized liquid therewithin, selectively operable venting means between said reservoir and the exterior of the sprayhead, a narrow diameter capillary bore formed in said sprayhead and terminating at one end in a discharge mouth located forwardly and closely adjacent to the discharge orifice, said bore having its other end disposed within the reservoir, depression of said sprayhead as a unit unseating the rim to permit pressurized product therepast, through the metering opening into the hollow stem, through the passageway means to the discharge orifice from whence said pressurized product is jetted over the

discharge mouth simultaneously to draw nonpressurized liquid from the reservoir through the narrow bore and from the discharge mouth into the jetted stream of pressurized product to form an intimate nebulized mix of pressurized and nonpressurized products.

10. The structure as claimed in claim **15** in which the diameter of the discharge mouth is less than the diameter of the bore.

11. The structure as claimed in claim **9** in which the axes of the discharge orifice and the discharge mouth intersect at an acute angle.

12. The structure as claimed in claim **9** in which the planes of the discharge orifice and discharge mouth intersect at an angle between 90 and 180°.

13. In a pressurized package dispensing system of the type which includes an internal valve assembly mounted within a valve cover in turn mounted upon a canister containing pressurized product, the valve cover having an upstanding boss and a surrounding well formation, and a sprayhead mounted for vertical movement within said well operable to actuate said valve assembly from the exterior thereof; said sprayhead comprising, a body, means in the body defining an internal reservoir for receiving and storing nonpressurized liquid, a discharge orifice formed in said body opening to the atmosphere, first conduit means formed in said body for leading pressurized product from the canister past the valve assembly through the body to said discharge orifice for discharge thereof in a jetlike stream, capillary tube means within said body and having one end thereof extending into said reservoir and a reduced diameter delivery orifice at the opposite end thereof, said delivery orifice located immediately adjacent to and downstream from said discharge orifice, actuation of said sprayhead causing the jetlike stream of pressurized product to pass over the delivery orifice drawing nonpressurized liquid from the capillary tube means and reservoir for entrainment within said stream in a nebulized condition, and means venting means comprising a plug member carrying a depending stem and a passageway extending through the stem and body to terminate to one side portion thereof, said sprayhead body having an opening formed therein communicating to said internal reservoir and said plug being rotatably engageable upon said body with the stem engaged through said opening.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,591,088 Dated July 6, 1971

Inventor(s) EDWARD H. GREEN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 40 change "10" to --7--. Column 7, line 6, change "15" to --9--. Column 8, line 14, insert after "venting" --said reservoir to the atmosphere, and said venting--.

Signed and sealed this 23rd day of November 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents