PRODUCT SHUT-OFF

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ABSTRACT OF THE DISCLOSURE

Enclosing the ejector of an aerosol dispenser having separate product and propellant containers within a hermetic chamber and providing the chamber with an environmental pressure in excess of the pressure within the product container provides a pneumatic product shut-off to prevent escape of product from the ejector discharge orifice.

This invention has to do with liquid product shut-off means in a dispensing container of the "isolation" type, in which, in its best form, a pressurized, gaseous or gasifiable liquid propellant is held in a vessel that is mounted within but is otherwise separate from the container for the fluent product to be dispensed, and in which the propellant and the product are isolated from one another until mixed at or near the discharge port, in the course of discharge.

In such dispensers, a valve located in the head structure normally prevents outflow of the pressurized propellant but, on being opened, permits flow of propellant in gaseous vapor form to the discharge port. By the action of an ejector (sometimes called a "venturi") near the discharge port, to which separate flow lines from the product container and the propellant are respectively connected, the outflow of the propellant when the valve is opened reduces the pressure in the product flow line and a simultaneous outflow of the product is brought about. By suitably directing the stream of propellant with respect to the stream of fluent product, atomization of the product commonly is effected and a spray discharge is produced.

A dispensing unit of the "isolation" type is described in United States application Ser. No. 521,885, filed Jan. 20, 1966, now Patent No. 3,528,469.

In the aforesaid type of dispenser, the propellant vessel is valved, but the product container, unless separately valved, is open to the atmosphere through the product flow line (eduction tube) which originates within the product container and terminates in an open orifice in the valve actuating product ejector. The product container is thus not sealed during shipment or when the dispenser is not in use and consequently opportunity exists for product leakage when the container is inverted and the discharge orifice is below the product level. Moreover, where the product is of a volatile nature, some evaporation may take place through the access afforded by the product eduction tube.

It is an object of the present invention to provide means to prevent product leakage from an aerosol dispenser of the "isolation" type which means are simple, effective, and economical.

The product shut-off of this invention in its broadest aspect comprises means for effecting a gas pressure in the product flow line between the product level therein and the discharge orifice in excess of the gas pressure within the product container, thereby preventing passage of product through the product flow line to the discharge orifice. The generation of gas pressure in the product flow line may be effected by forming a hermetically sealed chamber about the discharge nozzle and in open communication therewith (to which the product flow line is in direct contact), and further providing means for effecting a reduction in the volume of said chamber, the volume displacement generating an increase in gas pressure which is translated to the product flow line.

In one form, a cap is provided to hermetically enclose a valve operating button having an ejector and discharge nozzle therein. The cap is designed to engage a portion of the dispenser to hermetically isolate the button from the atmosphere, and additionally, is designed to be displacable with respect to the dispenser while maintaining hermetic integrity so that the volume originally included within the cap is reduced during such displacement. The displacement of the cap, from its initial engagement with the dispenser to its final position, provides pressure to displace product within the product flow line downwardly, thereby providing a pneumatic seal in the product flow line. Additionally, this displacement of the product clears the discharge orifice of excess product, thereby preventing blockage of the orifice by dried product residue.

The appended drawings illustrate variant forms of my improved device which are described in the following, with reference to those drawings, in which:

FIG. 1 is a vertical section of an aerosol dispenser of the "isolation" type mounted within a surrounding product container and showing the embodiment of the product shut-off means of the present invention;
FIG. 2 is a partial vertical section of a further embodiment of the present invention;
FIG. 3 is a partial view in vertical section of a further embodiment;
FIG. 4 is a vertical section of a still further embodiment;
FIG. 5 is a vertical section of another cap embodying the invention; and
FIG. 6 is a vertical section showing the embodiment of FIG. 5 in place on an aerosol dispenser.

In FIG. 1, the product container 10 holds a liquid product 9. Mounted at the otherwise open top of the container, and largely within it, is a smaller container 20 which holds under pressure a propellant that is either a gas or, preferably (as shown), a vaporizable liquid 21 of high volatility such as is commonly used in aerosol dispensers, e.g., a chlorinated hydrocarbon such as those sold under the names Freon and Genetron. In the form shown, the propellant container is of metal and the product container is of a plastic material, such as polyethylene.

To mount the propellant container 20, the upper part of the product container 10 is provided with a groove 21 which is joined with a bead 22 formed in the outer wall of the propellant container 20 by a snap fit. A mounting cup 19 of conventional configuration is sealed to the upper rim of the open-top propellant container 20 by a conventional rolled seam 23. Mounting cup 19 is provided with a valve mounting pedestal 24 which is adapted to receive and secure a propellant valve unit 20.

The valve unit 30 includes a valve body 35 having a hollow valve stem 38. The valve body 35 is biased upwardly against resilient sealing means 32 by a spring 34. The valve body 35 includes a product passage 36 which extends through the valve body to a point above the terminal end of the hollow valve stem 38. At the lower end, the product passage 36 communicates with a product eduction tube 8. The concentric location of the product passage 36 within the hollow valve stem 38 provides an annular space 40 which is used as a propellant passage. An orifice 39, which is closed by the resilient valve gasket 32, communicates the interior of the propellant container 20 with the propellant passage 40 of the valve stem 38.

An actuator button 50 is mounted on valve stem 38.
with passages in alignment with those of the valve 30. In operation, depression of the actuator button 50 moves valve stem 38 downwardly to expose valve orifice 39 to propellant vapor under pressure within the propellant container 20. The valve gasket 32 is deformed away from the orifice 39 by the downward motion of the valve stem in a well known manner. Propellant vapor rushes through the valve orifice 39 into the propellant passage 40 of the valve stem thereby releasing a stream of propellant gas to the appropriate passages within the actuator button 50.

Actuator button 50 is provided with a vertical propellant passage 53 which communicates with a horizontal passage 52 which in turn is directed toward the discharge orifice 51. The actuator button 50 also includes a product chamber 54 which communicates with the upper extremity of the product passage 36. When propellant gas is released through the valve orifice 39 to the propellant passage 53, a reduction in pressure occurs in chamber 54 adjacent the upper end of the product passage 36. Product from the product container 10 ascends the product flow line 8 as a result of this reduction in pressure and product appearing in chamber 54 of the actuator button is ejected as a spray of droplets from the discharge orifice 51. Before and after use of the dispenser, the pressure within the product flow line 8 and that within the product container 10 return to atmospheric pressure since they are in communication with each other. To enhance such communication the product container may be provided with atmospheric vents. The product within the product flow line recedes to the level of the product in the container.


Now to a description of the product shut-off. In FIG. 1, a cap 60 is provided which encloses the actuator button 50 and hermetically engages the valve mounting pedestal 24 at an initial position on the upper portion of the pedestal 24, thereby forming a sealed chamber about the actuator 50, which is in open communication with the product flow line 8.

By moving the cap 60 downwardly on the upstanding wall of the pedestal 24 while maintaining the hermetic seal between the cap 60 and the pedestal 24 a reduction in the volume of the chamber surrounding the actuator 50 occurs. This reduction in volume results in an increased pressure in the chamber, including the product flow line above the liquid level, greater than the pressure in the product container and thereby prevents flow of liquid toward the discharge orifice if the package is inverted or turned on its side. In FIG. 1, the broken lines show the position of the cap 60 when the chamber is under increased pressure. Depending upon the magnitude of the volume change, varying pressures will be generated and consequently, the position of the product in the product flow line may be controlled.

In the present invention a column of air is provided in the upper portion of the tube which, by virtue of the small dimensions of the tube and the viscosity and surface tension of the product, will serve to prevent outflow of product from the tube, provided of course that the air, or other gas, used in the chamber is sufficiently insoluble in the product.

Since the outer product container may be flexible squeezing or dropping the container may force product up the product flow line and out the ejector orifice. The shut-off of the present invention provides a back pressure which counteracts the rise in container pressure caused by such squeezing or dropping. Since the pressure within the cap will increase as product travels up the product flow line as a result of such squeezing or dropping, the pressure within the cap will exceed the pressure inside the container. The tendency for the product to escape is therefore greatly reduced.

The cap in its preferred form is molded of treated polypropylene. Polypropylene may be rendered impermeable to air, yet permeable to fluorinated-chlorinated hydrocarbons such as conventional liquefied propellants by methods such as electrostatic treatment, which methods are known in the art. By providing a cap permeable to the propellant gas, any seepage of propellant through the valve unit will be harmlessly vented to the atmosphere, while the air pressure established by compression of the air within the cap will remain constant to provide the desired seal.

The pressure available for effecting the seal is a function of the change in volume of air included within the cap between the initial and final positions of the cap. Thus, the pressure available is maximized by maximizing the difference in volume between the two cap positions. Increasing the distance the cap moves between its initial and final positions increases the pressure available. Thus, the cap of FIG. 1 is designed to snugly engage the upper extremity of the valve mounting pedestal 24 and the distance available for cap motion is limited only by the height of the valve mounting pedestal above the mounting cup 19. In a preferred form of the present invention, the cap is secured in its final position with the upper wall of the cap close to, but not touching the top of the actuator button 50.

Referring now to FIG. 2, a cap 60 embodying the present invention is shown. The cap of FIG. 2 is of larger diameter than that of FIG. 1 and covers the entire head structure of the propellant container 20. In its first position (essentially atmospheric pressure) the cap 60 engages the exterior surface 61 of the mouth 62 of the product container 10, which container is hermetically sealed to the propellant container 20, to thereby form a chamber about the ejector located in actuator 50. By moving the cap 60 downwardly to a position shown by the dotted lines, while retaining the seal between the cap 60 and the surface 61 a volume decrease and corresponding pressure increase takes place in the chamber. However, the principle of the product shut-off is the same.

Referring now to FIG. 3, a still further embodiment of the present invention is illustrated wherein the cap 60 is provided with an inner cylindrical member 64 (so-called double barrel cap) which engages the mounting pedestal 24 to provide the necessary seal. The outer wall of the cap slips over the periphery of the product container to present an appearance similar to that cap of FIG. 2. The sealing however, takes place at valve mounting pedestal 24 as was the case in the embodiments illustrated in FIG. 1.

Referring now to FIG. 4, a still further embodiment of the present invention is illustrated wherein the cap 60 is provided with an external bead 65 which is configured to engage with a groove 25 formed in the mounting cup 19 of the propellant container 20. Such groove 25 is formed by a method of joining the mounting cup 19 to the propellant chamber 20 wherein the cup and chamber are assembled and then sealed together by a groove rolling procedure which results in groove 25. The cap 60 of the embodiment of FIG. 4 initially establishes a sealed chamber by engagement of the bead 65 with the upper extremity of the mounting cup 19. As the cap 60 is telescoped downwardly, the volume of the chamber defined by the cap is reduced, thereby increasing the pressure of the entrapped air. The bead 65 snaps into the groove 25 to provide a secure attachment of the cap 60 with the dispenser.

FIGS. 5 and 6 show another embodiment of the present invention wherein the cap 60 is formed of a relatively thin flexible plastic to permit the cap itself to telescope. The cap is mounted on the container in the manner described in reference to FIG. 4 wherein a bead 65 is provided to engage a groove 25 in the peripheral wall of the mounting cup 19. FIG. 5 shows the cap 60 in its initial expanded configuration. The cap is so formed as to allow
it to be telescopically collapsed to the configuration of FIG. 6 by downward force on the top surface of the cap. In collapsing the cap of FIG. 5 to the condition illustrated in FIG. 6, the volume of air trapped within the cap is substantially reduced thus providing the desired pressure increase. As the cap is collapsed toward the configuration of FIG. 6, the shape imparted to the plastic material during the formation of the cap in the original configuration of FIG. 5 will cause the cap to snap into the shape of FIG. 6. When the condition of FIG. 6 is achieved, the shape releases stress in the plastic introduced during the initial phase of the collapsing motion.

While the preferred embodiments of the present invention derive the desired pressurized environment for the ejector by telescopically moving the cap with respect to the dispenser head structure, the invention may be employed with a cap which is provided with a pressurized environment after securing the cap to the container. The pressure may be provided by injecting a gas under pressure into the interior of the cap through a hollow needle inserted through the cap wall. By employing a suitably slim needle, the puncture will reseal upon withdrawal of the needle. An alternative to the above method is placing a quantity of volatile material such as Dry Ice under the cap to provide the desired pressure upon vaporization. A still further alternative is the employment of an impermeable cap having a flexible portion which permits a brief actuation of the propellant valve securing the cap to the dispenser. Such brief actuation will provide the desired pressure in the cap yet will not cause dispensing of the product because of the short duration of the propellant release and the fact that the pressure increase adjacent the ejector will exceed the reduction is pressure in the product tube caused by the velocity of the propellant stream. Caps employing the above methods of pressurization may be formed in accordance with the illustrated embodiments of FIG. 1–4.

It should be understood that while gas generating means have been illustrated in terms of a chamber which changes in volume to thereby provide a positive gas pressure in the product flow line which is in excess of the pressure in the product container, that said gas pressure may be generated in situ by flow of product toward the ejector when the ejector is enclosed within a sealed chamber, particularly in the case where the product flow line is of small size. For example, if the propellant and propellant containers are inverted or turned on side, upon flow of liquid toward the ejector, compression of gas in the product flow line will occur and the liquid will move toward the ejector only until compression of the gas elevates the pressure above that in the pressure container.

The means employed as the product shut-off whether the caps shown in the drawings or otherwise necessarily must be removable or returnable to a position wherein the gas pressure in the product flow line may be removed or dissipated so that product may flow to the ejector upon actuation of the propellant valve.

The improvement of this invention, which provides a liquid product shut-off in an “isolation” type of product dispenser by providing a gas pressure in the product line above the liquid level greater than the pressure in the product container has application in a conventional aerosol dispenser wherein product and propellant are maintained in a valve without chamber. With many aerosol products, the residual material remaining in the discharge line of the actuator after actuation of the valve, particularly at and near the discharge orifice, will dry and clog, more or less, the discharge orifice with a consequent adverse effect upon the spray characteristics. In some instances, drying completely closes the discharge orifice. By generating a gas pressure in a sealed chamber enclosing the discharge orifice, the liquid product is compressed rearwardly in the discharge line and kept away from the discharge orifice where exposure to the atmosphere would hasten drying and clogging. Thus, a cap of the type heretofore described could be mounted on the pedestal portion of the mounting cup of a conventional aerosol container to form a sealed chamber enclosing the discharge orifice and the chamber decreased in volume by downward movement along the upstanding wall of the pedestal. Likewise, a cap which is mounted to the periphery of the container could be used.

It will be apparent that many modifications may be made within the scope and spirit of my invention and, accordingly I do not wish to be limited otherwise than as indicated by the terms of the appended claims.

What is claimed is:

1. A dispensing unit for liquids having separate product and propellant containers and wherein separate product and propellant flow lines lead from their respective containers to an ejector, the method of effecting a seal for the product flow line comprising providing a chamber defined by a cap which encloses the ejector and hermetically sealing said chamber and subsequently increasing the pressure within said chamber while retaining the hermetic seal thereby generating an increase in gas pressure in the product flow line above that of the product container.

2. The method of claim 1, sealingly engaging an upper portion of said propellant container and said cap to form a closed chamber about said ejector, and subsequently moving said cap downwardly relative to said upper portion of the propellant container while maintaining the hermetic seal thereby reducing the volume of said chamber and increase the gas pressure in the product flow line.

3. The method of claim 2, and further including a mounting cup having a central pedestal, atop and spaced from which is the ejector, sealingly engaging the pedestal and the cup to form a closed chamber having said ejector and subsequently moving said cap downwardly on the side wall of the pedestal while maintaining the hermetic seal to thereby reduce the volume of said chamber.

4. In the method of claim 1, sealingly engaging an upper portion of said propellant container and said cap to form a closed chamber about said ejector, and subsequently collapsing said cap while maintaining the hermetic seal to thereby reduce the volume of said chamber and increase the gas pressure in the product flow line.

5. In a dispenser of the isolation type having a product container, a separate valveless chamber container mounted with its containing parts within the propellant container and open at its upper end and a head structure closing the upper end of said product container, the head structure comprising a discharge ejector in its upper part together with separate generally parallel passages establishing flow lines to said discharge ejector from the lower part of said head structure, said lines terminating within the area of the upper end of said propellant container closed by said head structure and one of said lines being in open communication with said propellant container, valve means in the head structure for controlling propellant flow through said one flow line and means establishing separate flow communications from the product container to the lower end of the other of said flow lines in the head structure, the improvement which comprises a hermetically sealed chamber for generating a gas pressure about the discharge ejector in excess of the pressure in the product container when the propellant valve is closed to thereby provide a product shut-off, said hermetically sealed chamber being defined by a cap which encloses the ejector and at least a portion of the top closure of the propellant container, said cap being collapsible so as to decrease the volume of said chamber while retaining the hermetic seal.

6. In a dispenser, for use in discharging the contents of the product container comprising a propellant container having an open top, a head structure joined to said propellant container to close its top surface, said head
structure comprising (a) a discharge ejector, (b) passages establishing separate product and propellant flow lines to the discharge ejector, said propellant line being in open communication at its lower end with said propellant container to permit flow therethrough, and (c) manually operable valve means for said propellant flow line; together with a dip tube connected to the lower end of the product flow line, said product flow line extending from said head structure through a lower portion of the wall of the propellant container, the improvement comprising means for generating a gas pressure about the discharge ejector in excess of the pressure in the product container when the propellant valve is closed to thereby provide a product shut off, said means for generating said gas pressure comprising a hermetically sealed chamber defined by a cap which encloses the ejector and at least a portion of the top closure of the propellant container, said cap being collapsible and adapted to retain the collapsed configuration so as to decrease the volume of said chamber while retaining the hermetic seal.

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