ABSTRACT: A valve assembly for a self-venting and product rechargeable dispenser for spraying solutions under pressure of gas within the dispenser through a first valve in an upper chamber of the valve housing and adapted to be connected to a supply container for being refilled with solution and gas through a second valve in a lower chamber of the valve housing while permitting gas within the dispenser to escape therefrom to the atmosphere through the first valve thus lowering the pressure in the dispenser while being fed. An inner continuous seal is provided which blocks communication between the upper and lower chamber, as a result of which product emission takes place only through the first valve in the upper chamber.
The invention, in general, relates to a dispensing device for aerosol products and, more in particular, to a valve assembly incorporating means to simultaneously refill and automatically vent the interior of the aerosol container.

Valve assemblies of this kind for self-venting during charging of refillable containers used in conjunction with a main supply container in a so-called "mother-daughter" container combination are commonly known and one, for example, has been described in my copending U.S. Pat. application Ser. No. 639,194, filed May 17, 1967, now U.S. Pat. No. 3,432,080.

To adequately explain the novel features and particular improvements of the subject device over the art, initially reference will be briefly made to the valve arrangement described in the above application.

Disclosed therein is a dispensing and recharging valve assembly for use, for example, in a portable or "daughter" aerosol package, wherein the valve assembly generally includes a recharging passage through a central shaftlike core and the valve housing. The recharging passage communicates with the interior of the container via either of two alternate routes. One of these comprises a first valve means, a first inner gasket and a second bypass passage, the first valve means being adapted to a first discharge passage through the interior of the valve housing.

The other route comprises a second passage or bypass lateral of the first passage and a second valve means or port communicating the bypass with the exterior of the valve housing. Both routes terminate at adjacent inlets remote from the said first and second valves, disposing them near the bottom of the container which the valve assembly is adapted to be secured.

The valve assembly includes a third valve means located outwardly of the first two named valve means, communicating the interior of the valve housing with the atmosphere via a third passage extending axially between the core and an actuating stem enclosing the core. A second gasket is provided normally closing the third valve means.

Even though this prior valve structure has proven practicable for many purposes, certain drawbacks have been encountered which influence its maximum effectiveness. For instance, in order to relieve the vapor head that prevents complete recharging of the container, the venting passage or bypass arrangement of the prior valve necessitates the use of a double dip tube or equivalent valve housing structure extending to or near the bottom of the container. Without such dip tube arrangement "vapor tapping", that is, propellant gas bleed-off, can occur during the dispensing mode of operation of the valve. This susceptibility to vapor tapping arises from the provision of the aforesaid second valve means or port needed to afford communication in the upper chamber of the valve housing between the two alternative routes of fluid flow through the valve assembly. Should the valve actuating stem and associated valve core be incompletely depressed during normal dispensing operation, it is possible in this earlier design because of incomplete seating of the first gasket means relative to the second valve means or port to allow fluid to flow through both of the alternate routes in the valve. In the event, therefore, that the inlet of either route is disposed in the head region of the container, and thus to propellant gas, the aforesaid vapor tapping action will occur.

To overcome such disadvantage, it therefore is an object of this invention to provide a valve assembly for a self-venting and refillable aerosol dispenser wherein, when the container is actuated to dispense and vent solely through a first passage and valve means and to be refilled through a second independent passage and valve means, the first valve means being operable independently of the second valve means so that no vapor tapping can occur.

It has been found that the prior design sometimes presents difficulty in manufacture due to close tolerance limits that must be maintained in respect to the gasket which cooperates with the port communicating the bypass passage with the interior of the container. Under certain conditions of use, this gasket may swell due to reaction with the product in the container, or it may be physically overcompressed by excessive operating pressure applied to the dispensing button in actuating the valve, resulting in overexpansion laterally and partial blocking of the bypass port.

A still further object of the invention is to provide an improved valve seat and gasketing design which positively prevents the inadvertent blocking of the bypass port as well as preventing establishment of alternate interconnected discharge routes of communication through the valve housing under all conditions of operation.

Other objects and advantages of the invention will be apparent from the specification and claims, when considered in connection with the attached sheets of drawings, wherein like characters represent like parts and, in which:

FIG. 1 is a vertical sectional view through a valve assembly and associated container, the valve being shown in normal closed position, parts being omitted or broken away for purposes of clarity of illustration;

FIG. 2 is a view similar to that of FIG. 1 except that the valve is shown in its open or dispensing position; and

FIG. 3 is a view illustrating the valve and associated container in the recharging mode of operation.

Referring now more particularly to the drawings, a container 10 is fitted with a dispensing valve assembly indicated generally at 12 having an actuator and dispensing button 14, whereby the contents C of the container may normally be discharged through the orifice 16 of the actuator button upon axial depression of the button to the position shown in FIG. 2.

Valve assembly 12 comprises a tubular housing 20 of molded plastic or the like. Housing 20 has a stepped inner side wall 22 and a centrally and axially apertured upper and lower wall, 24 and 26, respectively, with an upper and lower chamber, 28 and 30, respectively, intermediate these walls.

A tubular valve stem 32, again of molded plastic or the like, is received through upper wall 24 of the housing and is axially reciprocable within limits in the housing. The stem has a portion normally projecting out of housing 20, and the actuator button 14 has a socket 33 for the reception of the upper end of stem 32 with a friction fit forming a peripheral seal about the upper end of the stem.

Valve assembly 12 is secured in the mouth 34 of container 10 by a mounting flange 36 which encloses an enlarged head 18 of the housing and is crimped about the lips of container mouth 34 to seal the valve assembly to the container 10, in a well known manner. Flange 36 includes a central portion 37 which is formed with a central aperture 38 which is coaxial with the aperture in the upper wall 24 of the housing and loosely encircles the projecting valve stem 32 and acts as a guide therefor. A first resilient annular grommet 40 is clamped between the central portion 37 of the flange 36 and a first step 42 in the inner wall of the housing. Grommet 40 closely encircles valve stem 32 to form a sliding but fluid tight seal therewith.

Formed at the inner end of the valve stem 32 is a first annular shoulder or enlargement 44. This enlargement abuts upwardly against grommet 40 under the pressure of a spring 46 disposed in lower chamber 30, in a known manner, and as will be more fully explained presently, a first port 48 is formed through the side wall of stem 32, immediately above its shoulder or enlargement 44, and is normally obturated by the inner wall of grommet 40, as shown in FIG. 1.

By depressing actuator button 14, as seen in FIG. 2, valve stem 32 slides relative to grommet 40 and opens port 48 in upper chamber 28, thereby providing communication between the interior of container 10 and spray orifice 16 of the actuator button 14 via a dispensing passage 50 of stem 32.

Interiorly of the valve housing, communication between port 48 and the contents C of the container 10 is provided by a lateral discharge passage 52 and an educator tube 54 connected therein. The remote end 56 of the educator tube 54 is open in the interior of the container and thus fluid entering inlet 56 may enter upper chamber 28, pass through port 48.
and passage 50 to be subsequently discharged from the spray head 14.

In order to provide for recharging of container 10 through valve assembly 12, the valve construction just described includes a venting arrangement which automatically comes into play in the recharging mode of operation. Recharging of the container 10 is accomplished by removing actuator button 14 from the upper end of valve stem 32 and then connecting or coupling the free end of the stem endwise to a recharging nozzle 58 (see FIG. 3), connected to a storage container, (not shown).

Valve assembly 12, to permit recharging of the container, contains a button 74 having an annular shoulder 50 and passage 50 to be subsequently discharged from the spray head 14.

Core 60 extends longitudinally in valve housing 20 and valve stem 32, in telescoping relation with the latter. The outer end 64 of the core is frustoconically formed and recessed within the confines of a counterbore 68 in the upper end of valve stem 32 to be more effectively and securely engaged by the feed or recharging nozzle. The diameter of core 60 is such as to make a free sliding fit within stem 32 so that the core may be axially reciprocated, within limits, relative to the stem. The normal dispensing passage 50 is thus disposed between and longitudinally along the stem and core throughout their common extent. In order to increase the size of the outlet passage without making too loose a fit between the stem and core, one or the other may be rabbeled along the adjacent surfaces or other provision made to get spacing between them.

Core 60 is enlarged adjacent closed end 66 of duct 62 to form a second annular shoulder 70. The core is also provided with a port 72 through its side wall, immediately above shoulder 70 and communicates lower chamber 30 with duct 62 during recharging, as will presently be explained. A second resilient and annular grommet 74 which normally closes port 72, end 66, and makes a seal between the core thereof and also serves to continuously close the inner end of discharge passage 50 between the telescoping stem and core.

Grommet 74 has a cylindrical and inverted cup-shaped structure with a hollow interior open to the interior of lower chamber 30. Its upper end 76 is arranged with a central aperture 79 which frictionally engages core 60 above shoulder 70 and is held in place by a laterally projecting flange 80 which operably cooperates with a second step or stop 82 in the inner wall of the valve housing to provide a more positive seal and also to limit the downward displacement of grommet 74 inside the valve housing under the force of the stem and core when the actuating button is depressed. Projecting downwardly from upper end 76 of the grommet is an annular wall 84 with an annular shoulder 70 which encloses duct 62 and forms with a slightly tapered outer periphery which constitutes a continuous seal with a correspondinglly tapered inner wall section 86 of the valve housing, between second step 82 and a lower third step 88 to block intercommunication between the upper and lower chamber. Third step 88 also functions as a stop and cooperates with the lower edge 90 of the grommet wall to insure a seal and further limit the downward movement thereof.

In the nonrecharging mode of operation, as seen in FIGS. 1 and 2, core 60 is biased by spring 46 to compress shoulder 70 against the undersurface of grommet 74 to effect sealing abutment therewith and also to block port 72. The spring bias imposed on the core is transmitted, in turn, through grommet 74 to valve stem 32, biasing its annular shoulder 64 against the undersurface of resilient grommet 40, as previously described.

With the spray button 14 in position, depression of this button to effect dispensing moves both stem 32 and core 60 so that there is no relative motion between them. The flow of product outwardly through the valve assembly is thus effected via eductor or dip tube 54, discharge passage 52, through port 49 of stem 32 now disposed in upper chamber 28, and via dispensing passage 50 and orifice 16 to the atmosphere.

Annular shoulder 44 of stem 32 is formed with a number of peripherally extending spacers 77 which snugly enclose upper end 76 of grommet 74 to prevent a too extensive outward expansion thereof when under pressure of stem 32 and core 60. Substantial lateral expansion of upper head 76, otherwise, would cause closing of lateral discharge passage 52 and consequent blocking of product flow therefrom into upper chamber 28. The spacers, in the form of fingers, are circumferentially spaced to form small openings between them and project downwardly from shoulder 44 between outer periphery flange 80 of grommet 74 and the inner wall of the valve housing intermediate first step 42 and second step 82.

Peripherally surrounding the recess beneath second step 82 in the inner wall of housing 12 is a lateral annular groove 79 which is in constant communication with the openings between fingers 77 to form a continuous flow passage to upper chamber 28.

Spacers 77 also function to guide valve stem 32 in the upper housing 28 in order to ensure proper longitudinal displacement of the stem relative to the housing and to avoid lateral movement thereof under actuating pressure.

In recharging container 10, actuator button 14 is removed and the container is inverted and its valve stem placed in end-to-end relation with recharging or feed nozzle 58, as seen in FIG. 3. Upon depressing the aerosol package against nozzle 58, core 60 is first moved axially inwardly relative to valve stem 32 until abutment occurs between the tip of nozzle 58 and an inner seat 92 formed in the counterbore 68 in the upper end of valve stem 32. Thereafter, further depression by nozzle 58 moves both the core and stem inwardly relative to valve housing 20 until abutment occurs between flange 80 of grommet 74 and second step 82 and, between the lower edge 90 of grommet wall 84 and third step 88, in which position both port 48 and grommet 74 are substantially open.

At this stage, as will be appreciated from FIG. 3, recharging fluid passes inwardly through duct 62 and port 72 and via lower chamber 30 and aperture 26 into the interior of the container. Simultaneously, gas or air trapped in the container bottom region is vented through eductor tube 54, passage 52, the opened port 48 of stem 32 in upper chamber 28 and via discharge passage 50 and orifice 16 to the atmosphere. As a result, the "daughter" dispenser fills easily and completely with the product supplied under pressure from the supply or "mother" container.

We claim:

1. In a valve assembly for a self-venting and refillable aerosol dispenser, which includes:
   a. a tubular valve housing having a stepped inner side wall, a centrally apertured upper and lower wall and, an upper and lower valve chamber intermediate said walls;
   b. a first discharge passage arranged laterally of said lower chamber and adapted to place said upper chamber in communication with the interior of the dispenser;
   c. a tubular valve stem projecting outwardly from said upper chamber through said centrally apertured upper wall and axially reciprocable therein;
   d. a core extending longitudinally in said valve housing and said valve stem and axially reciprocable therein, said core having a longitudinal duct open at its outer end and closed at its inner end;
   e. a second discharge passage formed axially between said valve stem and core;
   f. a first port through the wall of said valve stem placing said upper chamber in communication with said second discharge passage;
   g. a resilient annular grommet fixedly secured between said upper wall and a first step in said housing about said valve stem and normally closed said first port;
   h. a first annular shoulder formed at the inner end of said valve stem directly below said first port and constituting a sealing abutment with said first grommet in the normally closed position of said first port;
i. a second port through the wall of said core placing the duct in said core in communication with said lower chamber;
j. a second resilient annular grommet about said core and axially reciprocable therewith with respect to said first annular shoulder and a second lower step in said housing, said grommet normally closing said second port;
k. a second annular shoulder on said core directly below said second port and constituting a sealing abutment with said second grommet in the normally closed position of said second port;
l. a spring normally pressing said core axially outward of said stem to cause closure of said first and second ports and sealing abutment of said core and valve stem shoulders with their respective grommets;
m. an actuating button detachably mounted on the outer end of said valve stem and enclosing the outer end of said core whereby upon depression of said button said stem and core are simultaneously moved against said spring in which condition said first port is opened and said second port remains closed;
n. said core having its outer end formed to be securely and depressingly engaged by a feed nozzle upon removal of said button in which condition said core is further moved against said spring whereby said first and second ports are opened; and
'o. the improvement wherein said second resilient annular grommet is in the form of an inverted cup-shaped member having an upper central aperture slidably and sealably engaging said core, a hollow interior open to said lower chamber and enclosing said second annular shoulder on said core and, a downwardly projecting wall the outer periphery of which forms a continuous frictional seal with the inner side wall of said housing between said second lower step and said lower apertured wall, thereby blocking communication between said upper and lower chamber.
2. A valve assembly according to claim 1, wherein said cup-shaped member is an elongated cylindrical member having a centrally apertured upper end with an outwardly projecting flanged portion cooperable with said second lower step in said housing for effecting a seal therewith and for limiting the downward movement of said member in said housing under actuating force of said stem and said core.
3. A valve assembly according to claim 1, and including a third step arranged in the inner side wall of said housing between said second step and said lower wall and adapted to engage the lower end of said downwardly projecting wall for further limiting the downward movement of said member in said housing under actuating force of said stem and said core.
4. A valve assembly according to claim 3, wherein the outer periphery of said downwardly projecting wall and the inner wall of said valve housing between said second and third step, are tapered.
5. A valve assembly according to claim 2, wherein said first shoulder at the inner end of said valve stem is peripherally formed with a number of downwardly projecting slightly spaced fingers snugly and circumferentially enclosing said flanged portion of said cup-shaped member and disposed to prevent substantial outward expansion of said portion and consequent blocking of said first discharge passage under actuating pressure of said valve stem and core, and disposed to longitudinally guide said valve stem to prevent lateral movement thereof under actuating pressure.
6. A valve assembly according to claim 5, and including a peripheral groove surrounding said second step and communicating with said first discharge passage, said groove, in conjunction with said slightly spaced fingers, forming a fluid escape passage adapted to prevent blocking of fluid feed from said first discharge passage.
7. A valve assembly according to claim 1, wherein said outer end of said core is frustoconically formed.
8. A valve assembly according to claim 7, wherein said frustoconical outer end of said core is recessed relative to said outer end of said valve stem.