COMBINED PRESSURE FILLING AND DISPENSING CONTROL VALVE FOR AEROSOL CONTAINERS

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3,158,297 11/1964 Ferry et al. ...................... 222/402.16
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ABSTRACT

A valve for an aerosol dispensing container which functions not only to control normal fluid dispensing from the container but also facilitates pressure filling where the valve is sealed in the mouth of the container prior to loading. The valve employs a tailpiece and plastic dip tubing mounted on the tailpiece, in conjunction with a coaxial integral sleeve on the valve housing, to form a resilient seal which is effective against fluid bypassing the dip tube at normal internal operating pressures of the aerosol dispenser, but which permits such bypassing to occur when filling pressures are introduced into the valve housing. Preferably the valve also incorporates special sealing grommets surrounding the neck of the valve stem which act as a one-way check valve providing increased flow rate of fluid product around the valve stem during pressure filling.

9 Claims, 10 Drawing Figures
This invention relates to valves for aerosol or self-presurized dispensing containers, and more particularly to valves of this type which facilitate the pressure filling or charging of fluid product into the container after the valve has been permanently sealed in the mouth of the container.

The method of pressure filling aerosol containers after the valve assembly has been fixed in the mouth of the container, thereby closing the container, is well-known and provides certain advantages over the alternative "cold-filling" method. The latter involves chilling the fluid product and particularly the pressure-producing gas component thereof to a point where the vapor pressure of the fluid is sufficiently low to avoid excessive evaporation losses during filling and capping operations. Some of the arrangements heretofore proposed for valves having capability for pressure filling of aerosol containers are shown in United States patents such as St. Germain, U.S. Pat. No. 2,746,796; Rheinstrom, U.S. Pat. No. 2,890,817; Bradbury, U.S. Pat. No. 2,961,131; Rhodes et al., U.S. Pat. No. 3,036,743 and 3,081,916; Nesin, U.S. Pat. No. 3,096,003; Beard, U.S. Pat. No. 3,104,785; Briecheil, U.S. Pat. No. 3,158,298; Yovus, U.S. Pat. No. 3,185,356; and Kuffer, U.S. Pat. No. 3,375,557. Since the specific question are of the disposable type, in that they are not reclinable or replaceable but are simply thrown away with the empty container, and since they are employed in very large quantities, even small economies in valve design play an extremely significant part in the commercial suitability and success of any particular valve.

The stem of this invention is accordingly designed with this in mind and through dual use of certain essential components of the valve assembly, a valve of the desired type is afforded having fewer parts and/or effecting more economical use of the same parts than valves provided heretofore for the same purpose.

To this end, valves incorporating this invention are characterized by employing the conventional dip tube at its point of attachment to a molded plastic valve housing in such manner that these member coact to form as a one-way bypass valve. While the dip tubing employed can be quite rigid, it is preferable that it have the resiliency of the order provided by conventional dip tubes of polyethylene, polypropylene, etc. The plastic of which the valve housing is made must be not be of the highly rigid type, such as the acrylic resins usually provide. Rather, linear polyethylene or polypropylene, for example, having good physical stability with reasonable resiliency for the housing. This resiliency is supplemented by the particular configuration in which the valve housing inlet is molded, as hereinafter discussed. The purpose is to provide an auxiliary fluid or bypass fluid passageway at the inner end of the dip tube, supplementing the normal path of fluid flow through the dip tube, in order to increase the capacity of the valve assembly for higher rates of fluid product flow during charging or pressure filling operations. Preferably, valves of the invention also include a special design of grommet for sealing the neck of the valve stem at the discharge or outlet side of the valve housing, which cooperates with the dip tube bypassing arrangement mentioned above.

Further details of the invention will be apparent from the following description of specific embodiments shown in the accompanying drawings, in which:

FIG. 1 is an enlarged fragmentary view in cross-sectional elevation of an aerosol container incorporating a valve embodying the invention, certain parts being broken away for clarity of illustration, the valve being shown in pressure filling mode of operation;

FIG. 2 is a similar cross-sectional view on still larger scale showing the valve in normal closed condition;

FIG. 3 is a cross-sectional view taken on line 3-3 of FIG. 2 looking in the direction of the arrows;

FIG. 4 is a cross-sectional view taken on line 4-4 of FIG. 2, looking in the direction of the arrows;

FIG. 5 is a fragmentary view of the lower end of a valve assembly similar to that seen in FIG. 2 but showing a modification thereof; and

FIGS. 6 through 10 are plan views of various valve stem sealing grommets adapted to be used in the valve assembly.

In FIG. 1 the illustration depicts a portion of the upper part of an aerosol dispenser equipped with a valve of the present invention, the valve being shown in pressure filling or charging mode of operation. Valve assembly 10 is mounted in the open mouth 12 of a container 14, assembly 10 including a mounting cup 16 whose peripheral flange 18 is rolled over lip 20 at the mouth of the container thus closing the container. Mounting cup 16 is formed centrally with an upstanding cylindrical boss 22 having a central aperture 24 in its top wall. A tubular valve housing 30 of molded plastic is formed with an external shoulder 32 at its upper end which is received internally of boss 22, and the sidewall of boss 22 is crimped or staked beneath this shoulder at several points 34 about its circumference to securely grip and retain the valve housing in the mounting cup. Housing 30 cooperates with the upper wall of boss 22 to grip the periphery of superimposed resilient annular grommets 36, 38, providing a fluid seal between shoulder 32 and the top wall of boss 22.

A tubular valve core 40 is telescopingly received in valve housing 30, core 40 having a radially enlarged shoulder 42 and an integral neck portion or stem 44 of lesser diameter extending axially outward of the shoulder and projecting through aperture 24 in the top wall of boss 22. Stem 44 is sufficiently smaller in diameter than the aperture to provide appreciable clearance between the stem and margin of the aperture. For example, in actual commercial practice, the diameter of the stem portion of a typical valve core may vary from the order of 0.125 inch while that of the aperture in boss 22 may be approximately 0.145 inch. The purpose of course is to allow clearance for the introduction of aerosol product around the valve core, as well as through it, in the pressure filling process.

Each of grommets 36, 38 is apertured centrally to receive and make a sliding seal with the periphery of stem 44. During pressure filling, as seen in FIG. 1, the body portions of the grommets surrounding their apertures are flexed inwardly of the valve housing, and the housing is formed with an annular recess 46 at its upper end to permit such flexure to occur more easily. In the normal closed position of valve core 40 (FIG. 2), its shoulder 42 abuts the margin of the aperture in the lower grommet 38 to compress both it and superimposed grommet 36 against the top wall of boss 22, thus sealing the outlet of housing 30. An axial compression spring 48 confined between shoulder 42 of valve core 40 and a peripheral shelf or step 50 within housing 30, normally biases the core to the valve-closed position. In this position, discharge through the lower end of the valve core is maintained out of communication with the interior of the valve housing 30. When the valve core is depressed, however, as when normal dispensing from the aerosol container is desired, port 52 is moved below gaskets 36, 38, into communication with the interior of the housing. In such position, fluid under pressure within housing 30 passes through port 52 and out through the hollow interior of stem 44 for dispensing. Usually an actuator button (not shown) incorporating a discharge nozzle is mounted on the projecting end of stem 44.

The open position of valve core 40 just described is also utilized during pressure filling, as shown in FIG. 1, where a filling head 54 is applied over the projecting stem 44 and held in temporary sealing contact against the upper face of boss 22 while aerosol fluid product under substantial pressure is pumped through the head and into container 14, passing both through and around valve core 40 in the process, as mentioned above.

Valve housing 30 is also provided with the usual dip tube 60 which is received on tailpiece 62, the latter having a central bore 64 leading from the interior of the valve housing to the inlet end of the tailpiece.

The valve construction thus far described is generally similar to established commercial aerosol valve design. Without the incorporation of the further features constituting the present invention, the rate of fluid product flow into a container during pressure filling will be limited by the resistance
imposed at the outlet, i.e., upper end, of valve housing 30 and by the substantial resistance imposed by bore 64 in tailpiece 62 and especially by the relatively small bore and great length of dip tubing 60. Such resistance is reduced and the pressure filling rate substantially increased by employing valves incorporating the present invention.

According to the present invention, a fluid bypass is provided to permit fluid to be pumped into the interior of the housing independently of bore 64 and dip tubing 60 in filling the container. To this end, housing 30 is formed with an integral sleeve 70 coaxial of and at least partially coextensive with tailpiece 62 but which is in radially spaced relation to it, forming an annular well 72 in which the upper end of dip tubing 60 is received. The lower or free end of sleeve 70 is molded to provide an internal peripheral lip or bead 74 proportioned to make resilient engagement circumferentially of the outer surface of the dip tubing within the axially coextensive limits of the sleeve and tailpiece. Preferably the wall of sleeve 70 is tapered in the region of lip 74 so as to reduce the wall thickness and increase the radial flexibility of the sleeve at this point. Annular well 72 communicates with the interior of valve housing 30 through one or more axial slots or grooves in 76 formed in the inner wall of the housing, such grooves terminating short of the lip 74 of sleeve 70.

By properly coordinating the resiliency of the molded plastic of which the valve housing and possibly also the dip tube are formed, as well as proportioning the thickness of the wall of sleeve 70, the engagement between internal lip or bead 74 and dip tubing 60 can be made to form a fluid seal about the tubing which is effective to prevent bypassing of fluid under normal dispensing pressures existing within the container to which the valve is assembled, yet yieldable at fluid pressures significantly greater than normal dispensing pressure to allow fluid to flow between the lip and dip tube in the manner indicated by the arrows in FIG. 1. Obviously fluid will still of course pass through bore 64 and dip tubing 60 so that the flow passages operate in parallel during the filling mode of operation but the greater part of the flow occurs through the bypass. When the filling pressure imposed by head 54 is removed, the seal between lip 74 and dip tube 60 is automatically reestablished.

In commercial practice, the normal pressure maintained in an aerosol dispenser to expel the fluid product when the valve is operated by the user will range from approximately 14 pounds per square inch gauge to 40 or 50 p.s.i.g. On the other hand, filling pressures imposed by pumping the product through filling head 54 are normally on the order of at least 600 p.s.i.g. and higher if the valve will stand it. The bypassing arrangement here disclosed permits such higher pressures to be utilized, thus greatly speeding up the filling process.

While a single outlet sealing grommet can be employed in place of the multiple grommet 36, 38, arrangement specifically illustrated, the arrangement shown is preferred not only because it is possible to get a more effective sliding seal between the margin of the grommet and stem 44 of valve core 40, but because a greater pressure filling flow rate can be achieved by using two or more grommets whose annular body portions are pierced at peripherally spaced points, with the piercing in one grommet being rotatably offset from that of the adjacent grommet or grommets. Additional fluid flow paths through the grommets are thus provided. This piercing can take the form of small holes or apertures 80 in the annular body portion of the grommets, as seen in FIG. 6 wherein holes 80 of the upper grommets are angularly offset from those of the subadjacent grommet. Or the grommets may be slit, as seen in FIGS. 7 and 8, and superimposed so that the slits in one are out of registry with those of the other. The slits may be circumferential as well as radial, or may be a combination of both as seen in FIGS. 9 and 10.

In those instances where the nature of the aerosol product is such that a very small bore dip tube is desirable in the valve assembly, it usually will not be practical to use the outer surface of the dip tube as one element of the bypass sealing arrange-
braces said neck of the valve core to provide a sliding seal therewith,
a spring compressed axially between said valve housing and valve core to urge the latter outwardly of the housing and compress the body portion of said gasket means between said shoulder and mounting cup,
said tubular valve core being closed at its inner end and having a port extending through the wall of said valve core neck adjacent said shoulder, said port being normally closed by said gasket means but movable into communication with the interior of said valve housing by axial depression of said valve core against said spring, and conduit means at the inlet end of said valve housing for communicating the interior of said housing with the interior of the aerosol container, said conduit means including a tubular tailpiece integrally formed on said housing and a length of resilient plastic dip tubing received over said tailpiece,
a sleeve on said valve house integrally joined at one end to said housing coaxially of and at least partially coextensive with said tailpiece and being radially spaced from said tailpiece to provide an annular well within which said dip tubing is received, said sleeve having on its interior surface a peripheral lip which makes contact circumferentially of the surface of said plastic dip tubing to form a seal thereabout within the axially coextensive limits of said sleeve and tailpiece, said contact being effective to prevent bypassing of fluid at normal operating pressures of the aerosol dispenser but sufficiently resilient to permit radial distortion at fluid pressures significantly greater than normal dispensing pressure to break said seal and allow fluid to pass between said lip and dip tubing,
passage means formed in said valve housing communicating said annular well internally of said lip with the interior of said valve housing;
said gasket means at said housing outlet end comprising at least two superimposed resilient grommets, each being axially pierced in its annular body portion at circumferentially spaced points, said grommets being rotatively positioned in said valve housing such that the piercing in each of them is angularly offset from that of adjacent grommets.
7. A combined pressure filling and dispensing control valve as defined in claim 6, wherein said grommets are pierced to provide circumferentially spaced holes.
8. A combined pressure filling and dispensing control valve as defined in claim 6, wherein said grommets are pierced to provide circumferentially spaced slits.
9. A combined pressure filling and dispensing control valve as defined in claim 6, wherein one grommet is pierced to provide holes and the other to provide slits.

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