

PATENT SPECIFICATION

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DRAWINGS ATTACHED



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(54) IMPROVED PRESSURIZED AEROSOL DISPENSER CONTAINER VALVE STRUCTURE

(71) We, UNION CARBIDE CORPORATION, a Corporation organised and existing under the laws of the State of New York, 10017, United States of America, Park Avenue, New York, State of New York 10017, United States of America, (assignee of GILBERT STEVE JORDAN and NORMAN USEN), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to pressurized aerosol dispensers, and more particularly to the structure and arrangement of the valve assembly provided in the container of an aerosol dispensing system.

Aerosol dispensing systems normally comprise a container or can within which is stored under pressure the aerosol formulation to be dispensed. A valve assembly is mounted in the container, usually at the top thereof, for the purpose of controllably effecting dispensing of the aerosol formulation from within the can to the exterior thereof. The valve assembly usually comprises a stem which is cylindrical in shape and which extends from interiorly of the container to the exterior thereof. Actuation of the stem, normally by axial movement thereof, operates to effect passage of aerosol formulation through the stem for dispensing. An actuator assembly which normally comprises an actuator button engaging the valve stem is mounted over the top of the container and when the actuator button is manipulated by a user, it effects movement of the valve stem thereby causing aerosol formulation to flow from within the container through the stem and through the actuator assembly to the point of ultimate use or application.

The valve assembly is usually fixedly mounted upon the container. However, due to the fact that the valve stem must be moved relative to the container, there is usually involved a sliding engagement between the outer surface of the valve stem and other structural elements of the valve

assembly. Normally, the valve stem is surrounded by a gasket or similar means which tightly engages the stem to effect a seal but which enables sliding movement of the stem relative thereto. Because of this necessity for relative motion between the stem and other fixed components of the valve and container structure, a potential exists for the occurrence of unwanted leakage of aerosol formulation from the container. Additionally, clogging of the valve mechanism or jamming of the valve stem preventing necessary unrestricted movement thereof can occur due to unwanted deposits of aerosol formulation or for other reasons thereby rendering the aerosol dispenser inoperative. Problems of leakage, clogging and jamming are among the most important and significant obstacles which must be overcome in producing an operationally successful aerosol dispenser.

An important factor to be considered in resolving these obstacles is the nature of the aerosol formulation to be stored and dispensed. Certain valve structural arrangement will be appropriate for some types of aerosol formulations, e.g., liquid systems, while being inappropriate for other systems such as dry powder systems. Furthermore, any structural expedient which is utilized to overcome these problems must be adaptive to existing manufacturing techniques and apparatus and capable of being produced at an economically competitive cost.

It is an object of the present invention to provide an improved aerosol dispensing valve structure which is especially adaptable for use with dry powder aerosol systems which will enable effective valve stem operation while exhibiting improved performance with regard to leakage, clogging and jamming.

Another object of the present invention is to provide such an improved valve structure which may be simply produced and manufactured at an economically competitive cost.

According to the present invention a

valve assembly for an aerosol dispensing system comprises a valve housing defining an opening through which a valve stem extends for axial movement therein between a dispensing position, wherein a conduit within the stem provides a connecting passage between upstream and downstream sides of the valve assembly, and a nondispensing position wherein no such passage exists, a gasket mounted in the valve assembly to encircle the valve stem in tight sliding engagement therewith and provide a seal for said opening, and a lubricating washer mounted to closely surround the valve stem in sliding engagement therewith on the side of the gasket remote from the valve housing, an annular protuberance being provided in the valve assembly closely adjacent the valve stem and projecting against the gasket to deform it from its normal shape and compress it about the valve stem thereby to enhance the sealing action.

The annular protruberance may be formed by a part of the valve housing and may comprise a narrow edge projecting against the gasket to cause said deformation.

A lubricator cap may be provided to overlie the lubricating washer and firmly engage a mounting cup of the assembly thereby retaining the lubricator washer in position.

The invention will now be further described by way of example with reference to the following detailed description of a preferred embodiment thereof taken in connection with the accompanying drawing, in which:—

Figure 1 is a vertical cross-sectional and elevational view of a valve assembly according to the present invention, and

Figure 1a is an enlarged detail of part of Figure 1.

In referring now to the drawing, there is shown a valve assembly mounted within a mounting cup 10 of an aerosol dispensing container. The mounting cup 10 includes a mounting curl 12 which extends circumferentially around the outer portion of the mounting cup 10 adapting the structure for mounting to the body of an aerosol dispensing container (not shown) which stores the aerosol formulation to be dispensed. The mounting curl 12 is suitably shaped and structured to permit leakproof attachment to a container in any appropriate manner which would be apparent to those skilled in the art. The portion of the mounting cup 10 located radially inwardly from the mounting curl 12 engages and supports the aerosol dispensing valve assembly in a manner to be described hereinafter.

The valve assembly comprises a vertically movable valve stem 14 mounted within a valve housing 16. The valve stem includes an annular enlargement 18 which is engaged

on the under side thereof by a spring 20 which biases the valve stem 14 in an upward direction. The lower end of the housing 16 comprises an opening defined by a cylindrical wall 22 through which aerosol formulation may flow from the aerosol dispensing container (not shown) to the inner portion of valve housing 16 defined by cylindrical wall 24. It should be noted that the lower portion of the stem 14 is smaller than the diameter of cylindrical wall 22 thereby providing a spacing between the lower end of valve stem 14 and cylindrical wall 22 to permit aerosol formulation to flow to within the chamber defined by wall 24. A step formed by horizontal wall 26 between walls 22 and 24 engages the lower portion of spring 20 and thereby maintains the spring 20 in compression between the step 26 and the enlargement 18.

The valve housing 16 is firmly mounted in the container by mounting cup 10 and held securely in place by means of the particular configuration of mounting cup 10 which includes an indentation 28 engaging the underside of shoulder 30 formed in the upper portion of valve housing 16. The mounting cup 10 extends from the indentation 28 to a vertical cylindrical wall 32 tightly surrounding valve housing 16 and to an upper horizontal wall 34 which includes an opening defined by cylindrical edge 36 extending therethrough, the opening surrounding the upper portion of valve stem 14 but being dimensioned to permit free vertical movement of the valve stem therethrough. A gasket 38, preferably made of Buna N rubber, is positioned between the upper horizontal surface 40 of valve housing 16 and the upper horizontal wall 34 of the mounting cup 10. The gasket 38 has therein an opening defined by wall 42 which is dimensioned to firmly engage the valve stem 14 to seal the interior of the valve housing 16 from the outer atmosphere.

Mounted about the valve stem 14 externally of the container and of the mounting cup 10 is a lubricator felt washer 43 enclosed and held firmly in place by a lubricator cap 44. The lubricator cap 44 comprises an inverted cup shaped arrangement which overlies the central portion of the mounting cup 10 with the inner wall of the lubricator cap 44 lying against the outer surface of walls 32 and 34 of the mounting cup 10. The lubricator cap 44 includes an annular nose 46 which engages the indentation 28 of mounting cup 10 thereby permitting the lubricator cap 44 to be firmly mounted upon the mounting cup 10. A circular opening defined by wall 48 permits passage through the lubricator cap of the valve stem 14 and a recess defined by walls 50 and 52 firmly holds the lubricator felt washer 43 therein.

One of the most significant structural aspects of the present invention is an annular protuberance 54 (Figure 1a) formed in the valve housing 16 at the intersection of the walls 24 and 40 of the valve housing 16. The functional and operational advantages brought about by this particular structural aspect of the present invention may be better appreciated by referring the leakage and clogging problems which may arise in the operation of a valve assembly in an aerosol dispensing system.

In the operation of the valve assembly described herein, dispensing of aerosol formulation is effected by downward depression of the valve stem 14 whereby the valve stem is caused to move against the bias of the spring 20 thereby compressing this spring. As previously noted, the spring 20 is held in compression between the step 26 and the enlargement 18 and thereby tends always to drive the valve stem 14 to its uppermost position depicted in the drawing. With the valve stem 14 depressed against the compression of spring 20, an opening 56 in the valve stem 14 is moved from exteriorly of the aerosol container past the lubricator washer 43 and the gasket 38 to a position interiorly of the valve housing 16. The portion of valve stem 14 above opening 56 is hollow and provides a vertical conduit interiorly of the stem 14 for aerosol formulation to flow through opening 56 and the hollow interior of stem 14 through an exit in the top section 58 of stem 14 which defines the termination of the internal vertical conduit within the stem 14. Accordingly, with the opening 56 positioned below the gasket 38 and interiorly of the valve housing 16, aerosol formulation will be caused to continuously flow through the valve stem 14 to be dispensed therefrom.

It should be noted that although the embodiment of the present invention disclosed herein is described in connection with a continuous flow valve, it need not be limited thereto and may be utilized with other type valves, such as metered flow valves and the like.

As previously pointed out, a basic consideration in determining the structural arrangement of a valve best suited to avoid leakage and clogging is the nature and composition of the aerosol formulation to be dispensed. Different types of aerosol formulations will present different problems with regard to adequate sealing of the dispensing mechanism. The present invention is intended for particular utilization with a dry powder aerosol system such as is described and claimed in U.S. Patent Specification No. 3,081,223.

In the operation of an aerosol dispensing valve system as described herein, the reciprocating movement of the valve stem

as it is actuated between a dispensing and a nondispensing position results in frictional engagement between the external surface of the valve stem and the sealing gasket of the aerosol assembly thereby inducing deformation of the gasket. For example, in the specific structure depicted in the drawing, when the valve stem 14 is moved downwardly to effect dispensing, the frictional engagement between the exterior surface of the valve stem 14 and the surface 42 of gasket 38 causes some deflection or downward bending of the gasket 38. Many factors will be pertinent to a determination of whether the amount of gasket deflection will cause operational problems in the valve assembly. Such factors as the type of materials used for the valve stem and the gasket, as well as the particular structural configuration of that portion of the valve housing 16 which supports the gasket 38, will be factors to be considered.

It has been found that in dry powder aerosol systems when the gasket 38 is deflected downwardly, there occurs a separation between the external surface of the valve stem 14 and the surface 42 of the gasket 38. This separation permits particles of aerosol formulation to become entrapped between the valve stem 14 and the gasket 38 thereby causing problems. It has been found that these problems can be very successfully and expediently overcome by a particular structural arrangement of the valve housing 16 in accordance with the principles of the present invention whereby the gasket is afforded sufficient structural support to avoid excessive gasket deformation by movement of the valve stem 14.

The specific structural concept which has been found to effectively overcome in dry powder aerosol systems the problems discussed involves structuring of the portion of the valve housing 16 14 at which surfaces 40 and 24 intersect in the specific configuration comprising the annular protuberance 54. As depicted in the drawing, the protuberance 54 extends completely around the edge of valve housing 16 at the intersection of surfaces 24 and 40. Furthermore, the protuberance 54 should project into the gasket 38 a sufficient amount to effect some deformation thereof from its normal shape and compression of the gasket material about the valve stem 14. As shown in the drawing, the protuberance 54 involves a narrow jutting edge which bites into the gasket 38 to force the material in a more compact arrangement about the valve stem 14. However, depending upon the specific gasket material utilized, as well as other factors, certain variations from the specific shape and configuration of the protuberance 54 depicted and described in the drawing may be tolerated. For example, it may

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not be necessary to form the protuberance 54 with a narrow jutting edge but rather with a more rounded configuration.

It will be clear that the protuberance 54 provides structural support resisting the downward deflection of the surface 42 of gasket 38 when the valve stem 14 is moved downwardly. In providing such support, there are very important limitations which exist regarding the proximity of surface 24 of valve housing 16 to the valve stem 14 and the enlargement 18. If, in attempting to provide maximum support for the gasket 38 the surface 24 is brought too close to the stem 14 and the enlargement 18, there may exist interference between the enlargement 18 and a portion of the valve housing 16 which could impede the free movement of the stem 14 sufficiently to render the valve mechanism inoperative or to at least seriously detract from its effective utilization. Accordingly, in attempting to provide needed support for the gasket 38, an important limitation exists with regard to the clearance which must be present between the enlargement 18 and the surface 24. Because of those limitations, there will always be a portion of the gasket 38 which will overhang or extend beyond the surface 24 of valve housing 16, the amount of this overhanging being dependent upon the clearance which must be provided. In the embodiment depicted in the drawing, the overhang will be the horizontal distance between surface 24 of valve housing 16 and surface 42 of gasket 38. Accordingly, under normal circumstances, the limitations presented by this clearance requirement could create an obstacle to providing sufficient support for the gasket 38 to prevent undue deformation thereof.

By means of the present invention there is provided structural support for the gasket 38 which is greater than the support which could normally be provided within the limitations of the necessity for clearance between the valve stem 14 and the valve housing 16. The protuberance 54 extends into the material of the gasket 38 and thereby effects a compression or firming of the material of the gasket 38. Because of this, the gasket material surrounding the valve stem 14 is caused to be more resistant to downward deflection and less inclined to become deformed in such a manner that particles of aerosol formulation may become entrapped between the surface 42 and the valve stem 14. It has been found that by utilization of the principles of the present invention, structural support for the gasket 38 may be provided in a dry powder aerosol system which is in excess of that which could be provided due to clearance limitations and which is sufficient to overcome and prevent problems of leakage, clogging

and jamming thereby enabling production of a dependable, operative dry powder aerosol dispensing valve assembly.

As previously noted, many aspects of the operation of the valve mechanism of an aerosol system will be affected by the specific materials utilized. The valve stem 14 could be formed of several types of material, among those commonly in use being molded thermoplastic material or stainless steel. As previously mentioned herein, the gasket 38 is preferably formed of Buna N (Registered Trade Mark) rubber. The specific material utilized will affect the amount of friction which is developed between the outer surface of the valve stem 14 and the surface 42 of the gasket 38. Under certain conditions, and with a combination of materials which create increased friction, it may be that compaction of the gasket 38 against the valve stem 14 by means of the protuberance 54 could sufficiently increase the frictional engagement between the outer surface of valve stem 14 and the surfaces 42 of gasket 38 to detract from the smooth movement of the valve stem 14 between the dispensing and the nondispersing positions. In order to avoid the effects of such increased frictional resistance, the lubricator washer 43 is provided about the valve stem 14 exteriorly of the aerosol container and of the mounting cup 10. The purpose of the lubricator washer 43 is to provide a lubricant coating about the exterior surface of valve stem 14 as the valve stem is moved between the dispensing and nondispersing positions thereby to overcome the effect of any additional frictional resistance which might arise between the surface 42 of gasket 38 and the exterior surface of valve stem 14. The washer 43 may be comprised of felt material which is impregnated with alubricant such as Ucon 1145 (Registered Trade Mark). As the valve stem 14, during normal use of the aerosol dispenser, is actuated in the axial direction, movement of the valve stem 14 against the washer 43 will cause application of lubricant to the external surface of the valve stem 14, which surface as it moves across the surface 42 of gasket 38 will effect lessened frictional engagement due to the lubricating action created. Thus, there is created a mechanism overcoming frictional resistance to movement of valve stem 14 without consequently detracting from the deformation-preventing support which is provided to the gasket 38 by protuberance 54.

In accordance with the principles of the present invention, and as a result of the simplified arrangement provided thereby, the washer 43 may be easily mounted upon the aerosol dispenser merely by positioning the washer over the valve stem 14 after assembly of the dispenser. The lubri-

cator cap 44 may be thereafter positioned over the washer 43 and the central hub portion of the mounting cup 10 to hold the washer 43 securely in place about the valve stem 14 in a simple and expedient manner. The lubricator cap 44 may be comprised of molded thermoplastic material and may be easily snapped over the central hub portion of the mounting cup 10 into the position shown. Due to the nature of the material of the lubricator cap 44, some deflection thereof is possible. Therefore, when the nose 46 encounters the wall 32 of mounting cup 10, it will cause some outward deflection of the nose 46 thereby enabling it to slide over the wall 32 into the position shown engaging the indentation 28 thereby holding securely in place both the washer 43 and the lubricator cap 44. It will be clear that the specific structural arrangement of washer 43 and lubricator cap 44 described herein enables optional utilization of these elements of the invention. If it is desired to construct the aerosol dispenser without a lubricator washer 43 and lubricator cap 44, this may be easily accomplished with no affect upon other components of the structure. However, utilization of lubricator washer 43 and lubricator cap 44 may be easily and simply provided, if desired, subsequent to assembly of the aerosol dispensing container and valve structure.

WHAT WE CLAIM IS:—

- 35 1. An improved valve assembly for an aerosol dispensing system comprising a valve housing defining an opening through which a valve stem extends for axial movement therein between a dispensing position,

wherein a conduit within the stem provides a connecting passage between upstream and downstream sides of the valve assembly, and a nondispersing position wherein no such passage exists, a gasket mounted in the valve assembly to encircle the valve stem in tight sliding engagement therewith and provide a seal for said opening, and a lubricating washer mounted to closely surround the valve stem in sliding engagement therewith on the side of the gasket remote from the valve housing, an annular protruberance being provided in the valve assembly closely adjacent the valve stem and projecting against the gasket to deform it from its normal shape and compress it about the valve stem thereby to enhance the sealing action.

2. A valve assembly as claimed in claim 1 wherein the annular protruberance is formed by part of the valve housing.

3. A valve assembly as claimed in claim 1 or 2 wherein the annular protruberance comprises a narrow edge projecting against the gasket to cause said deformation.

4. A valve assembly as claimed in any one of claims 1 to 3 wherein a lubricator cap is provided to overlie the lubricating washer and firmly engage a mounting cup of the assembly to hold the washer in place about the valve stem.

5. A valve assembly for an aerosol dispensing system substantially as herein described with reference to and as illustrated in the accompanying drawing.

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