

AEROSOL VALVE UNIT

This invention relates to a valve unit for pressurised packages commonly referred to as aerosol packages.

5 Aerosol packages usually comprise a valve unit situated in the neck of the container which is opened by finger pressure against an actuator disposed at one terminus of a valve stem. The valve unit has a moveable valve body and associated hollow valve stem which unseats from a gasket, thereby permitting flow of product into a hollow valve
10 stem (product conduit).

 With certain products, e.g. paints, it is desirable that the valve stem be separable from the valve body in order to clean the product conduit should drying and resultant clogging occur. To provide the aforementioned valve stem removal capability, the valve stem, at
15 one end, is moulded integral to the valve actuator to thereby permit its separation from the valve body by pulling on the actuator. At the other end the valve stem mates with a moveable valve body situated beneath a resilient gasket, the valve stem being passed through a central opening in the resilient gasket. The gasket seals the product
20 discharge orifice in the valve stem when the valve is in a closed position. By depressing the valve stem, the product orifice in the stem is open to flow of product from the container.

 Additionally, such aerosol valve units usually comprise a container closure, commonly called a mounting cup, which is clinched to
25 the container bead. Within and crimped to an upstanding central portion of the mounting cup, commonly called a pedestal, is a valve housing having a resilient gasket disposed atop thereof, which gasket forms a seal between the valve housing and the mounting cup. Disposed within the housing is a reciprocable valve closing/opening member
30 comprising a valve body and valve stem, which body and stem have communicating passages for egress of the pressurised product to a discharge orifice situated in a finger depressible actuator.

 The aerosol valve described above is commonly referred to in the aerosol industry as a "female" valve, in contrast to the so-called
35 "male" valve wherein the valve stem is integral with the valve body. United States Patent Nos. 3,033,473, 3,061,203, 3,074,601 and 3,209,960 describe aerosol valves of the "female" type and United States Patent

No. 2,631,814 describes an aerosol valve of the "male" type.

Furthermore, in prior aerosol valves, the product orifice in the valve stem is formed by a radial pin extending laterally through the wall of the valve stem, a so-called "side action" moulding operation.

5 The presence of the "side action" pin necessitates the removal of the pin before ejection of the moulded part, with a consequent time delay in the moulding operation. Moreover, with orifice sizes commonly used in aerosol valves, the "side action" pin often breaks with consequent shutdown of the moulding operation.

10 Additionally, in prior aerosol valves, the central opening of the gasket seals radially against the product orifice in the valve stem. This sealing of the valve stem orifice upon closure of the valve forecloses gravitational return of the product in the hollow valve stem from moving past the valve stem orifice with the often consequent
15 result that residual product in the hollow valve stem dries and clogs the passage in the valve stem.

In a previous application, GB-A-2198189, a "female" aerosol valve is disclosed having a moveable, gasketed valve body-valve stem located within a valve housing. The valve body has at least one upstanding
20 wall defining a recess in the valve body with a slot extending from the top shoulder of the upstanding wall. The slot provides communication with the interior of the container when the valve is actuated. The valve stem has a longitudinal opening therethrough and a member that frictionally and releasably engages within the valve body recess. The
25 valve stem also has an orifice aligned with the longitudinal opening of the valve stem and which communicates at one end with the slot in the recess of the valve body and at the other end with the orifice in the valve stem. The central opening of the gasket seals the slot defined by the upstanding wall of the valve body when the valve is in a closed
30 position.

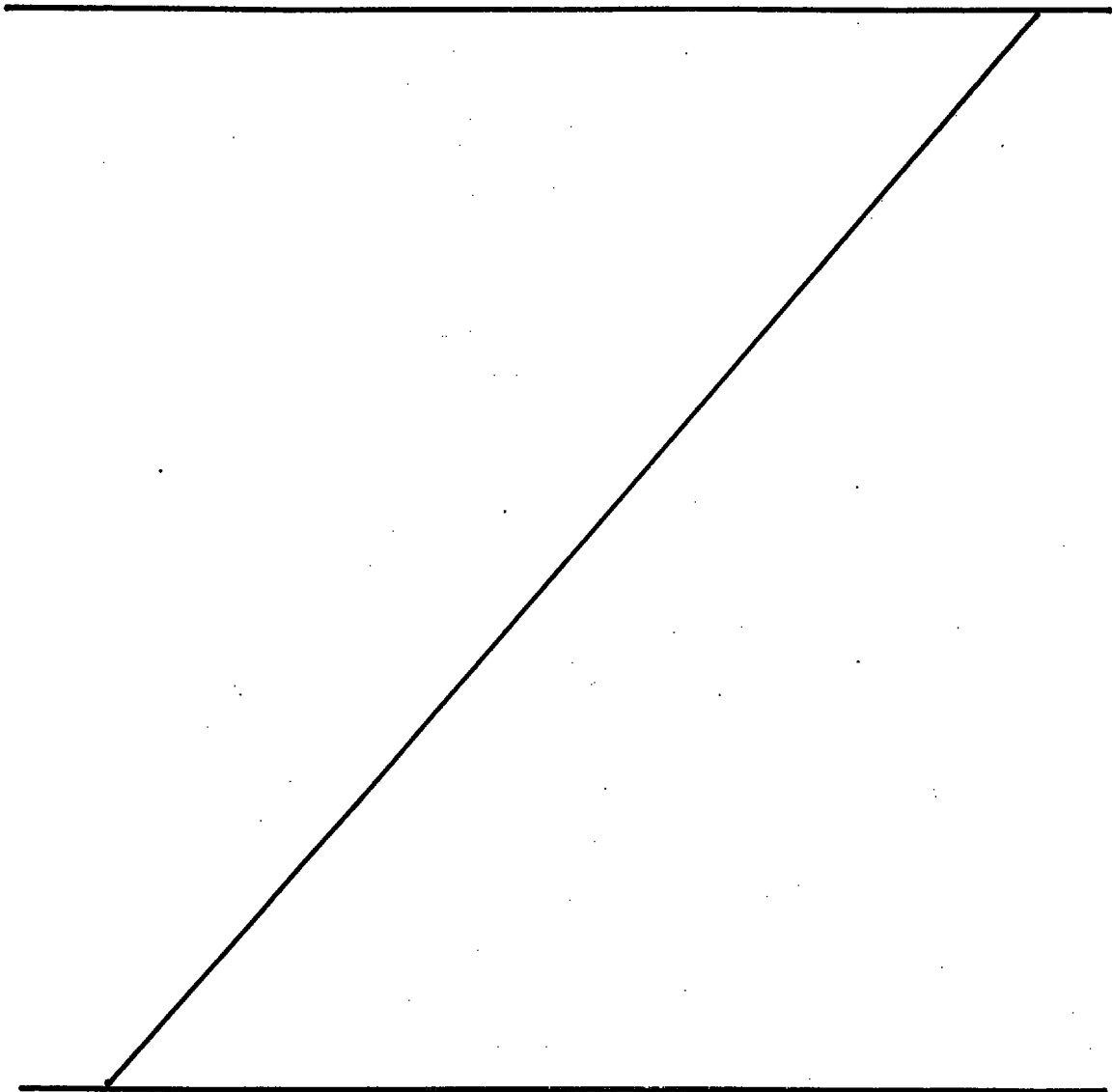
It has been found, however, that this configuration has disadvantages as a tilt action valve because the stresses inherent in tilt actuation can open the slot in the wall, loosening the valve stem. The valve stem and valve body could then become separated.

35 In one aspect the present invention therefore seeks to provide an improved configuration for a tilt action valve which does not suffer from that problem.

However, the principles disclosed herein are also applicable to aerosol valve units operated by axial pressure, and axial movement of the valve stem, as well as to tilt action valves.

In general therefore the present invention resides in a valve unit for aerosol packages and which comprises a mounting cup having a central aperture therein, a valve assembly positioned within said cup and comprising a valve housing, a valve body moveably mounted within said housing and defining therein an upwardly open axial recess, a hollow valve stem frictionally engaged in said recess and extending upwardly therefrom through the central aperture in the mounting cup, a spray button mounted on the free end of the valve stem, a valve spring housed in the valve housing and serving to bias the valve cup upwardly against the underside of the mounting cup, an annular gasket positioned in the mounting cup, between a sealing rim on the valve body and the underside of the mounting cup and sealingly engaging around the valve stem which passes through a central aperture therein, downward or sideways pressure on the free end of the valve stem serving either to move the valve body axially away from the sealing gasket or to tilt the valve body, as the case may be, so as, in either case, to permit the pressurised contents of the aerosol package to discharge over the rim of the valve body, through a fluid flow pathway provided interiorly of the valve body and from there through the hollow valve stem for eventual discharge through the spray button, wherein the valve body comprises an annular extension member integral with and extending upwardly from the valve body, said extension member having an axial bore aligned with the recess in the valve body and into which the valve stem is frictionally engaged, said annular extension member having at least one region of reduced wall thickness extending axially of the extension member and at least one aperture formed in the extension member and passing through said at least one region of reduced wall thickness to provide a flow passageway positioned to receive fluid contents discharged from the aerosol package over the rim of the valve body into the interior thereof and to convey those fluids through the thin wall region(s) of the extension member into an internal groove, provided within the valve body and providing a flow path for those fluids from said aperture to an inlet aperture in the distal end of the valve stem for eventual discharge through the bore of the valve stem.

Preferably the region(s) of reduced wall thickness in the annular extension member on the valve body is or are provided by groove(s) formed in the interior wall of the extension member, and preferably two such grooves located on diametrically opposed sides of the extension member, each with its own inlet aperture extending through the region of reduced wall thickness at the bottom of the groove. Preferably also the groove or grooves and the associated region(s) of reduced wall thickness extend the full length of the extension member, with the inlet aperture or apertures being located in those groove(s) at or adjacent the junction between the extension member and the valve body. Other preferred features will be apparent from the detailed description provided hereinafter.



5 Both aspects of this invention, and the various preferred features thereof, are illustrated by the embodiments described with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a valve unit according to the present invention, in its closed position;

10 Figure 2 is a longitudinal sectional view of the valve unit of Figure 1 in an open position;

Figure 3 is a longitudinal sectional view of the valve unit of Figure 1, opened by tilt activation;

15 Figure 4 is a longitudinal partial sectional view of the valve body as used in the valve unit of Figure 1;

Figure 5 is a side view of that valve body;

Figure 6 is a perspective partial sectional view of that valve body;

Figure 7 is a view along line 7-7 of Figure 4;

20 Figure 8 is a partial sectional view of the assembled valve body and valve stem as used in Figure 1;

Figure 9 is a longitudinal sectional view of the valve stem used in the embodiment of Figure 1;

Figure 10 is a view along line 10-10 of Figure 9;

25 Figure 11 is a perspective view of the valve stem of Figure 9; and

Figure 12 is a longitudinal sectional view of another valve body and valve stem assembly according to the present invention.

30 Referring first of all to Figure 1, the mounting cup 10 of an aerosol container is shown partially cut away. Crimped into the mounting cup 10 is a valve housing 12 and a gasket 14. Disposed within the housing 12 is the valve body 16 having an upwardly extending axial recess 22 defined by an upwardly extending annular extension member 26 integral with the valve body, see Figures 4 - 6. Fitting within the
35 recess 22 of the valve body 16 is a valve stem 20. The valve body is biased toward the gasket 14 by a spring 18 which engages the lower portion 16a of the valve body 16. Preferably the outer wall 16b of the

valve body 16 is inwardly tapered toward the lower portion 16a of the valve body 16 whilst the interior wall 12a at the top of the valve housing 12 is flared outwardly. This provides space allowing for the rotation of the valve body 16 during tilt activation, which is discussed further, below. A conventional dip tube 46 is attached to the bottom of the housing 12.

As shown in Figure 6, the top inner edge 26a of the annular extension 26 of the valve body is chamfered to ease insertion of the valve stem 20 into the recess 22. Additionally the upstanding annular extension 26 has a region 21a of reduced thickness referred to as the thin skin region. The location of the thin skin region 21a is clearly shown in Figures 4 - 6 and runs from the top of the annular extension 26, almost to its bottom where there is an inlet aperture 21 passing through the wall of extension member 26. Preferably, there is a second thin skin region and inlet aperture 21 in the annular extension member 26 diametrically opposed to the first region 21a. See Figure 6. More than two such inlet apertures is not preferred because it can weaken the member 26. The inlet apertures 21 allow for the passage of product into the valve body 16, as will be described below. As shown in Figures 4 and 6 the valve body 16 is provided with internal grooves 32 in its inside surface 22a aligned with the thin wall regions 21a, which in effect provides grooves in the inside wall of the extension member aligned with the grooves 32 in the valve body.

As shown in Figure 1, the upper portion of the tapered valve body ends in an annular shoulder 40 which engages the gasket 14 when the valve is closed. This shoulder 40 is preferably rounded at its top, as shown in Figure 4, to improve the seal with the gasket 14 when the valve is closed. Depending inwardly from the shoulder 40 is an annular wall 40a, preferably tapered toward the centre of the valve body 16, and which intersects an annular shoulder 40b perpendicular to the annular extension member 26, see Figure 7. The inwardly tapered annular wall 40a and the annular shoulder 40b form an annular recess 40c which directs product towards the slots 21, as described below.

The valve stem 20 disposed within the recess 22 of the valve body 16 includes an inner cylindrical portion 60 and an outer cylindrical portion 62, see Figure 9. A longitudinal opening 63 passes through the valve stem 20. Preferably, a lower cylindrical portion 64 depends from

the inner cylindrical portion 60. The lower cylindrical portion 64 of the valve stem 20 has oppositely positioned tangential openings 66, see Figures 10 and 11.

5 The bottom of the recess 22 in the valve body 16 includes a circumferential groove 52, see Figures 4 and 8, which is engaged by the lower cylindrical portion 64 of the valve stem when the two parts are fitted together, thus forming a swirl chamber 68 for the contents of the container as they pass from the valve cup into the valve stem via the tangential openings 66. To this end the lower end of the cylindrical portion 64 of the valve stem and circumferential groove 52 form a tight seal between the valve body 16 and the valve stem 20. Therefore, product can only enter the swirl chamber 68 through the tangential openings 66. The object of the swirl chamber is to provide enhanced spray characteristics, particularly with compressed gas propellant, as is described further below. The tangential openings 66 are preferably about 0.15 mm wide and about 0.25 mm high. These dimensions may be varied dependent on the product and propellant.

20 Above the swirl chamber 68 the valve stem 20 has an orifice 70 which acts as a product flow control orifice. Disposing the orifice 70 above the swirl chamber permits product in the valve stem on the discharge side of orifice 70 to flow back into the swirl chamber and thus product is less likely to clog the product passage in the valve stem. The positioning of the orifice 70 on the discharge side of the swirl chamber 68 also creates a residue of propellant in the swirl chamber upon closing of the aerosol valve. That residue will assist in purging the valve stem and actuator product passages of residual product thereby to avoid or reduce clogging. The diameter of the orifice 70 is about 0.33 mm, but this can be varied dependent on the product and propellant used.

25 Preferably, the recess 22 in the valve body 16 includes an annular indentation 54 which, when the valve unit is assembled is engaged by a pair of annular protrusions 782 on the valve stem 20 thus securing the valve body and valve stem together, as shown in Figure 8.

35 The outer cylindrical portion 62 of the valve stem 20 also preferably includes an annular, tapered, flange 80, see Figure 9, which prevents excessive displacement of the gasket during actuation. The

taper of the annular flange 80 generally conforms to the taper of the annular side wall 40a of the recess 40c, see Figure 8.

Between the inner and outer cylindrical portions 60, 62 of the valve stem 20 is an annular recess 75 terminating at an annular shoulder 77 which abuts the free end of annular extension 26 of the valve body 16 when the two are assembled. The inner rim 82 of the outer cylindrical portion 62 is tapered to ease insertion of the stem into the valve body 16.

As shown in Figure 1, an actuator button 85 is mounted on the upper portion of the valve stem 20 and is anchored thereon by an annular rib or barb 87 enabling the valve stem 20 and the actuator button to be removed from the valve body 16 as a single unit.

A slightly different type of button is shown in Figure 3. This is tilt button 88 with an inclined surface 88a which eases engagement and continued actuation in the tilt position during prolonged use. A recess 89 may be provided at the bottom of the tilt button 88 so that the bottom of the button will not interfere with the pedestal of the mounting cup 10 during use.

Referring now to the operation of the valve unit, in the closed position of the valve, shown in Figure 1, the gasket 14 seals against the annular top shoulder 40 of the valve body 16 and the annular extension 26 to the valve body 16 to prevent passage of product through the aperture 21.

In the open position of the valve, shown in Figure 2, vertical pressure on the actuator button 85 depresses the valve stem 20 and the valve body 16, disengaging the annular shoulder 40 from the gasket 14. The pressurised contents of the container can then pass over the shoulder 40, into the annular recess 40c and through the apertures 21. The product proceeds down the grooves 32 inside the valve cup through the tangential openings 66 in the lower cylindrical portion 64 of the valve stem, into the swirl chamber 68. From the swirl chamber 68 the product proceeds through the orifice 70, up the valve stem to the discharge orifice 84 in the actuator button 85.

The tangential openings 66 into the swirl chamber 68 impart a circular motion to the discharging product, and force the two product streams into each other. This causes a mechanical breakup of the product. Particles within the product stream are broken up and

dissolved and the product stream is energised. This provides for a finer, drier spray. The use of a swirl chamber is preferred to enhance spray characteristics, particularly if the propellant used is compressed gas. It is believed that satisfactory spray characteristics can be maintained with a compressed gas propellant as the product is dispensed in periodic use, without the use of vapour taps. Vapour taps can use up the available propellant before the product is fully dispensed.

Figure 12 shown an alternative form of valve cup and valve stem according to the present invention which do not provide a swirl chamber. In this embodiment the valve body 16 is the same as in the previous embodiment except that there is no groove 52, and the valve stem 20 is the same except there is no lower cylindrical portion 64.

In the embodiment shown in Figure 11, product entering the bottom of the recess 22 of the valve body 16 will enter the valve stem 20 directly through the orifice 70.

In the embodiment of Figure 3, the tilt button 88 is depressed forwardly and downwardly. This disengages the front portion of the shoulder 40 from the gasket 14. Product then passes over the front of the shoulder 40, through the slot 21 to be discharged via the swirl chamber as described above with respect to Figure 2. The tapered flange 80 on the valve body 16 and the flared upper section 12a of the valve housing together provide a space for the rotational movement of the valve body 16 during tilt actuation.

Aerosol packages according to this invention can have either a conventional press button action (Figure 2) or tilt action (Figure 3). An extra button can be included in the packaging to provide for alternative use. The buttons can be easily changed.

It has been found that in tilt actuation, a portion of the valve stem may engage the pedestal of the mounting cup. See region "A" in Figure 3. Excessive pressure exerted on the button 88 could thus be transferred through the valve stem 20 to the valve body 16. Thus if an open slot runs from the top of the cylindrical wall 26, as in GB-A-2198189, this force could separate the wall, loosening the valve stem. Therefore, the design of the '189 patent is not well suited for tilt action valves. The thin skin region 21a is added in the present invention to reinforce the annular extension member in this region to

maintain the tight fit between the valve stem and valve body. Such reinforcement allows for more reliable moulding, as well.

The use of the thin skin region enables moulding of the valve body without the use of "side action" pins. The core pin used in
5 moulding the valve body 16 has a pair of extended sections on opposite sides, which decreases the distance between the core pin and the mould cavity.

Plastic filling in this region forms the thin skin region 21a. Even greater extensions lie beneath the extended sections. These
10 extensions contact the outer wall of the mould cavity, preventing the collection of plastic. The inlet apertures or slots 21 are formed in these regions. The thin skin region is pliable enough after moulding to allow for easy removal of the core pin. Therefore, no "side action" pins are required to form the aperture 21. Whilst the thin wall
15 regions are preferably provided by groove(s) formed interiorly of the extension member, substantially the same moulding advantages are obtained with the groove(s) located externally of the extension member.

The thickness of the thin skin region 21a is preferably about 0.1 mm, which allows for easy removal of the core pin and provides
20 sufficient reinforcement during tilt actuation. The annular extension member 26 is itself approximately 0.5 mm thick. The dimensions of the slot 21 are preferably about 0.05 x 0.05 mm.

In assembling the several valve components, a sub-assembly comprising the valve stem, valve body, spring and gasket is initially
25 made. Such a sub-assembly properly orients and maintains the position of the gasket relative to the valve body, thereby enabling rapid assembly of the sub-assembly and other valve components without risk of dislodging the orientation of the gasket to the other components prior to permanent positioning of the gasket through crimping of the valve to
30 the mounting cup.

The structure in the valve stem-valve body fitment portions that facilitates disposition and positional stabilisation of the gasket onto the valve body is best shown in Figure 8. In assembling the valve unit the gasket 14 is passed over the outside surface of valve stem 20 and
35 ultimately seated on the annular shoulder 40 of the valve body 16.

Moreover, the height of the annular extension 26 is preferably greater than the gasket thickness, to prevent the top shoulder of the

extension 26 from passing beneath the gasket 14 during pressure filling of the container with propellant.

Whilst the invention has been described herein with reference to particular embodiments, it will be apparent that various modifications
5 may be made in those particular embodiments without departing from the broad principles of the invention herein described and as hereinafter claimed.

It will also be understood that the present invention extends to aerosol packages fitted with a valve unit according to the invention.



CLAIMS

1. An aerosol valve unit for fitting to an aerosol package, said unit comprising a mounting cup having a central aperture therein, a
5 valve assembly positioned within said cup and comprising a valve housing, a valve body moveably mounted within said housing and defining therein an upwardly open axial recess, a hollow valve stem frictionally engaged in said recess and extending upwardly therefrom through the central aperture in the mounting cup, a spray button mounted on the
10 free end of the valve stem, a valve spring housed in the valve housing and serving to bias the valve cup upwardly against the underside of the mounting cup, an annular gasket positioned in the mounting cup, between a sealing rim on the valve body and the underside of the mounting cup and sealingly engaging around the valve stem which passes through a
15 central aperture therein, downward or sideways pressure on the free end of the valve stem serving either to move the valve body axially away from the sealing gasket or to tilt the valve body, as the case may be, so as, in either case, to permit the pressurised contents of the aerosol package to discharge over the rim of the valve body, through a
20 fluid flow pathway provided interiorly of the valve body and from there through the hollow valve stem for eventual discharge through the spray button, wherein the valve body comprises an annular extension member integral with and extending upwardly from the valve body, said extension member having an axial bore aligned with the recess in the
25 valve body and into which the valve stem is frictionally engaged, said annular extension member having at least one region of reduced wall thickness extending axially of the extension member and at least one aperture formed in the extension member and passing through said at least one region of reduced wall thickness to provide a flow passageway
30 positioned to receive fluid contents discharged from the aerosol package over the rim of the valve body into the interior thereof and to convey those fluids through the thin wall region(s) of the extension member into an internal groove provided within the valve body and providing a flow path for those fluids from said aperture to an inlet
35 aperture in the distal end of the valve stem for eventual discharge through the bore of the valve stem.



2. A valve unit according to claim 1, wherein the extension member comprises two diametrically opposed axial regions of reduced wall thickness each with its own aperture communicating with a corresponding groove formed interiorly of the valve body for the transfer of the fluid contents of the aerosol package as they are discharged over the rim of the valve body following actuation of the valve through said apertures and grooves to the inlet aperture in the distal end of the valve stem.
3. A valve unit according to claim 1 or 2, wherein the or each axial region of reduced wall thickness in the extension member extends the full length of the extension member from its proximal end to the junction with the valve body.
4. A valve unit according to any one of claims 1 to 3, wherein the inlet aperture(s) passing through the wall of the extension member in the region or regions of reduced wall thickness are located at or adjacent the junction of the extension member and the valve body.
5. A valve unit according to any one of claims 1 to 4, wherein the region(s) of reduced wall thickness in said extension member is or are provided by axial groove(s) formed in the interior wall of the extension member, and aligned with a corresponding groove or grooves formed inside the valve body.
6. A valve unit according to any one of claims 1 to 4, wherein the region(s) of reduced wall thickness in said extension member is or are provided by axial groove(s) formed in the external surface of the extension member.
7. A valve unit according to any one of claims 1 to 6, wherein the proximal end of the annular extension member to the valve body is provided with an internal taper to ease engagement of the valve stem with the valve body.
8. A valve unit according to any one of claims 1 to 7, wherein the annular extension member to the valve body is of a sufficient length to



project through the central aperture of the sealing gasket and through the central aperture in the mounting cup.

- 5 9. A valve unit according to claim 8, wherein the valve stem comprises an integral annular skirt surrounding the valve stem adjacent its proximal end and defining with the valve stem an annular blind recess into which is frictionally received the proximal end of the extension member.
- 10 10. A valve unit according to claim 9, wherein said skirt is of sufficient length to extend downwardly through the central aperture of the mounting cup and through and into sealing engagement with the central aperture in the sealing gasket.
- 15 11. A valve unit according to claim 10, wherein the rim of the skirt has an external flange which engages the underside of the sealing gasket.
- 20 12. A valve unit according to any one of claims 1 to 11, wherein the valve body has an annular wall surface tapering inwardly from the sealing rim to provide a shallow recess in the top of the valve body, the said inlet aperture or apertures passing through the region(s) of reduced wall thickness in the extension member opening directly into that recess.
- 25 13. A valve unit according to claim 11 and 12, wherein the flange on the rim of the skirt on the valve stem projects into the said recess, but with a clearance therebetween, the said flange having a tapered external surface matching the inwardly tapering annular wall surface on the valve body which defines that annular recess.
- 30 14. A valve unit according to any one of claims 1 to 13, wherein the valve stem, including said skirt if present, passes through the central aperture of the mounting cup with sufficient clearance to permit the valve unit to be operated by a tilt action.
- 35 15. A valve unit according to any one of claims 1 to 14, wherein a



resilient detent means is provided operating between the internal surface of the valve body and the external surface of the valve stem to retain the valve stem in said recess, but nevertheless permitting the valve stem to be disengaged temporarily from the valve body for cleaning.

16. A valve unit according to any one of claims 1 to 15, wherein the inlet aperture to the valve stem is at its distal end, that end being located a small distance above the bottom of the recess formed in the valve body and which accommodates the distal end of the valve stem, thereby to provide a chamber within the valve body which communicates with the bore of the valve stem and with the groove or grooves formed interiorly of the valve body for the through flow of the fluid contents of the aerosol package from the interior of the valve body into the valve stem.

17. A valve unit according to claim 16, wherein the said chamber serves as a swirl chamber to impart a swirl to the fluid contents of the aerosol package as they pass from the interior of the valve body into the valve stem.

18. A valve unit according to claim 17, wherein the swirl chamber is defined by an annular extension on the distal end of the valve stem which engages against the bottom of the recess defined within the valve body and which is provided with one or more lateral passageways extending tangentially through the wall of that annular extension to impart a swirl to the fluid as it flows through that (those) passageway(s) into the bore of the valve stem.

19. A valve unit according to any one of the preceding claims, wherein the valve housing comprises a cup-shaped member held within the valve mounting cup with its rim sealingly engaged against the annular sealing gasket located in the valve mounting cup between the underside of the valve mounting cup and the rim of the valve housing, and wherein the cup-shaped valve housing member has, adjacent to its rim, a region of enlarged diameter to permit tilting of the valve body within the valve housing, thereby permitting fluids to flow from the aerosol



package over the rim of the valve body into the valve body upon tilt actuation of the valve unit.

20. A valve unit according to claim 1, substantially as hereinbefore
5 described with reference to the accompanying drawings.

21. An aerosol package equipped with a valve unit as claimed in any
one of claims 1 to 20.