

[54] AEROSOL VALVE AND SPRAYHEAD

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[58] Field of Search..... 222/402.24, 402.1, 402.21, 222/402.23, 398, 402; 251/353, 354

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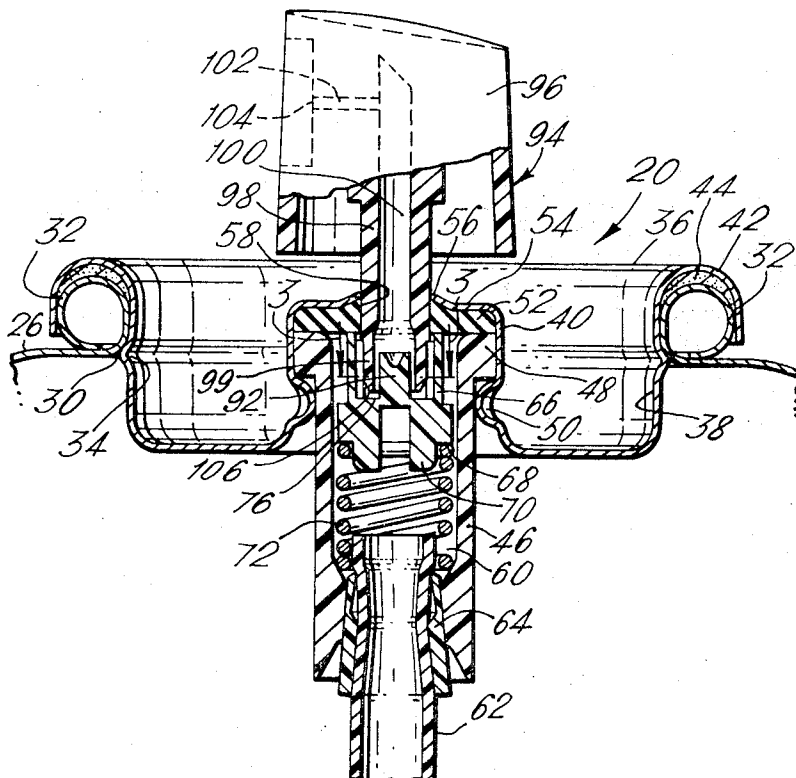
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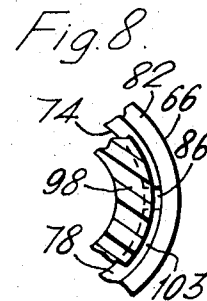
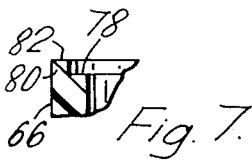
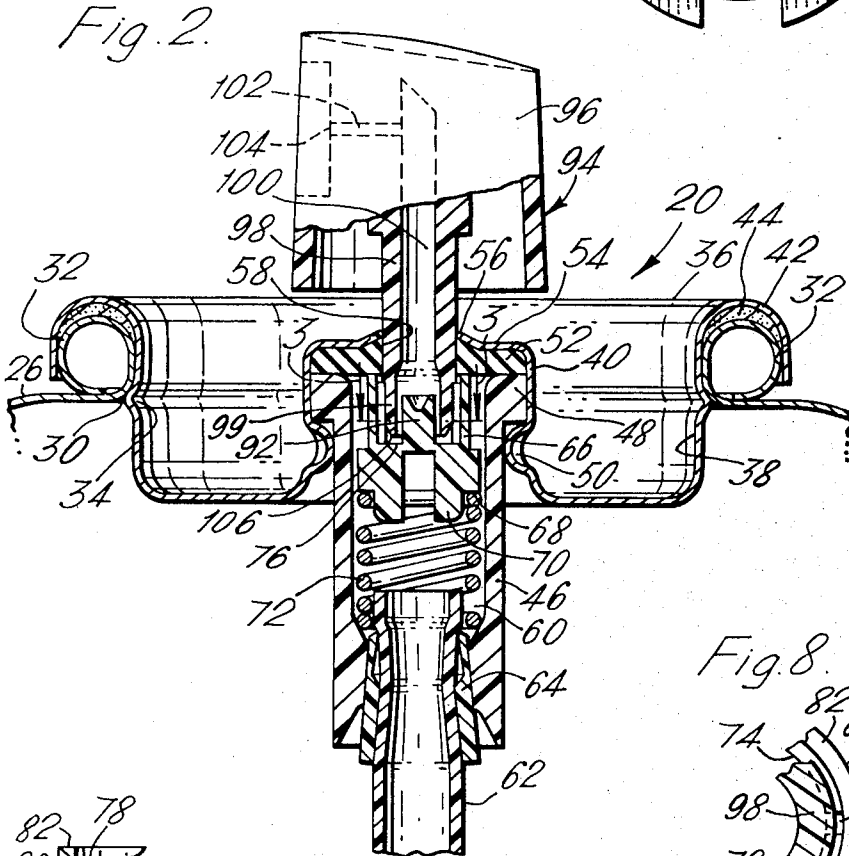
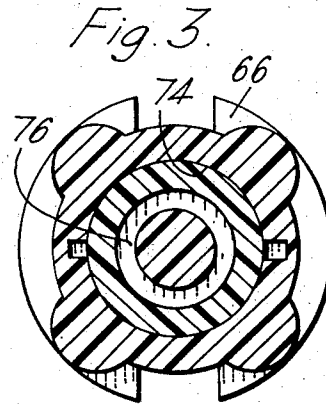
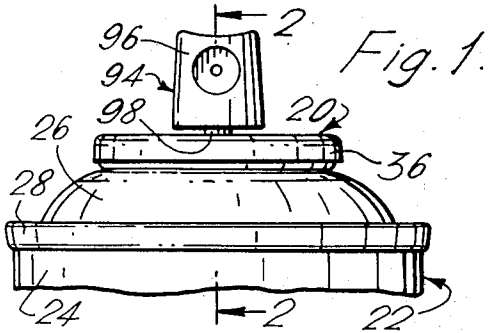
[57] **ABSTRACT**

An aerosol spray valve of the type which utilizes a reciprocable plunger moving within a valve housing that is in turn mounted to a cover member. The cover member is adapted to be crimped to a canister and has

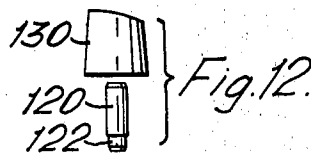
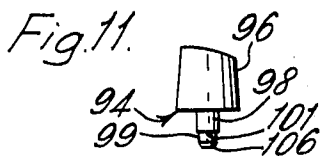
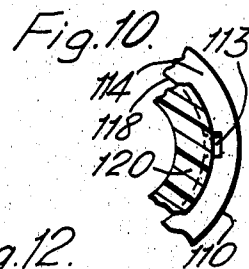
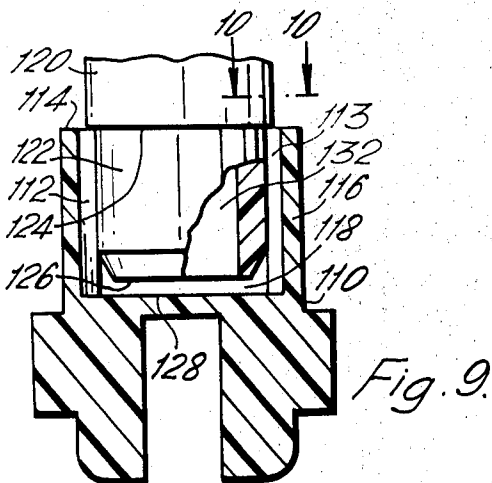
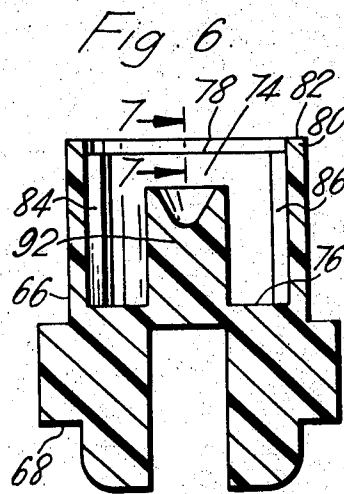
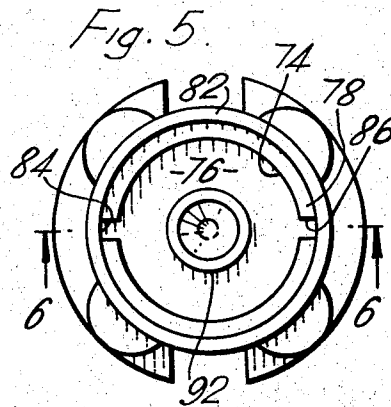
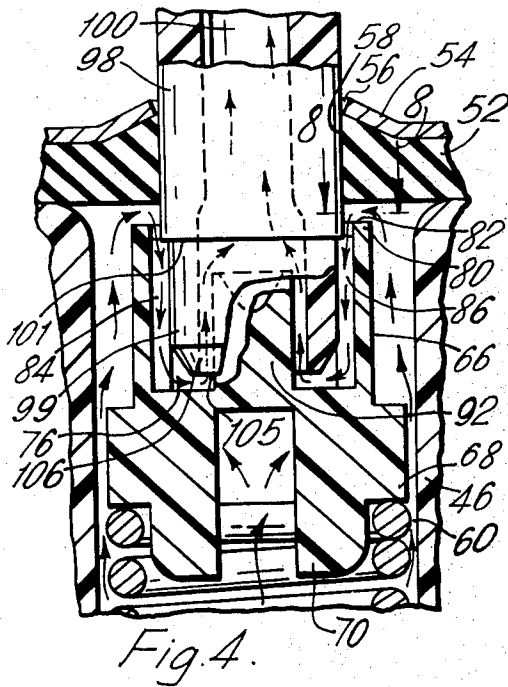
a dip tube extending from the interior of the valve housing to the bottom of the canister. Pressurized product is forced from the interior of the canister through the dip tube into the valve housing and out of the cover member through a central hole into a sprayhead that is mounted in the hole. An annular elastomeric gasket surrounds the hole and the upper end of the reciprocable plunger forms a valve seat that is spring-biased against the underside of the gasket to prevent pressurized product from emerging. The sprayhead has an associated stem that enters a socket formed in the plunger, the stem being slidably and sealingly engaged through the hole and the passageway in the elastomeric gasket. The stem is imperforate. The socket of the plunger has channel means formed in its interior wall along the vertical length thereof so that there are one or more passageways formed between the outer surface of the stem and the socket to transport the pressurized product. The pressurized product enters at the top of the plunger when the valve seat is unseated from the elastomeric gasket, passing through the passageways to the bottom of the plunger on the interior thereof, and then into the hollow bore of the stem from whence it is conveyed to the button of the sprayhead and out to the atmosphere when the button is depressed. The bottom end of the stem is spaced above the bottom floor of the socket by reason of a shoulder formed on the stem where it enters the socket. The stem may be separable from the button of the sprayhead or may be integral therewith. If separable, the stem is substantially permanently engaged in the socket. The resulting structure provides accurate metering of the pressurized product.

**5 Claims, 12 Drawing Figures**





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## AEROSOL VALVE AND SPRAYHEAD

## CROSS-REFERENCE TO RELATED APPLICATION

The invention herein is a modification of the invention disclosed and claimed in a copending application having the same title as the application herein, Ser. No. 128,404, filed on or about Mar. 26, 1971, now U.S. Pat. No. 3,715,081.

## BACKGROUND OF THE INVENTION

The invention herein relates to aerosol valves and more particularly is concerned with a novel valve construction for a pressurized package in which the metering of the pressurized product remains constant for the life of the package and may be accurately established at the time of the manufacture of the valve.

The background of the invention herein is substantially the same as that of the copending application, and reference may be had to said copending application for the total details thereof. For the purposes of this application, however, so much of the background as needed to appreciate and understand the invention will be repeated to some extent.

The invention herein is applicable to two principal types of aerosol valve constructions, namely, those in which the sprayhead which comprises a stem and button are integral and are removable from the package, and those in which the stem is substantially permanently secured to the valve assembly and the button is removable from the stem. The basic structure of the removable integral sprayhead is taught in U.S. Pat. No. 2,777,735. Stem valves are disclosed in U.S. Pat. Nos. 3,266,678 and 3,348,743 although the invention herein and that of the copending application teach stem valve structures which are much simpler than those of the patents.

As explained in the copending application, problems of maintaining the metering of the pressurized product were attempted to be solved by the structures of U.S. Pat. Nos. 3,045,877 and 3,233,792. These problems consisted of a closing of the metering slot in the stem of the sprayhead of the integral type due to constriction by the elastomeric gasket used in the valve assembly, and a closing of said slot because of swelling of the plastic from which the sprayhead was made.

According to the teachings of the copending application, the metering of valve assemblies of the general types involved was established by means of channels formed on the interior of the wall of the socket of the valve plunger into which the stem is engaged. In this manner, many advantages accrue, including

- a. the sprayhead is made with the stem imperforate except for the axial end opening at the bottom of the stem, hence only one sprayhead design is needed for all packages irrespective of the metering desired;
- b. since the sprayhead stem carries no precise slots or side holes (as in the case of most known stem valves) the sprayhead can be made of the so-called soft plastics such as polyethylene instead of the so-called rigid plastics such as nylon, the latter being more expensive than the former; in the case of sprayheads which are formed of permanently mounted stems and removable buttons, at least the

buttons can be made of the economical soft plastic;

- c. the expense of making the sprayheads, whether integral or two-piece is less than formerly because of the elimination of the complex dies needed to make sprayheads whose stems have metering slots or holes;
- d. since the metering channels are in the valve plunger which is a larger piece than the stem, and in addition are fully backed up by the body of the plunger, the channels are not likely to change dimensions from any cause and tend to maintain the accuracy of their metering for the full life of the pressurized package; and
- e. the molds for the molding of the valve plunger with the channels on the interior thereof are simpler and hence more economical to make and maintain than the type of molds used to make the sprayheads whose stems had slots or holes for metering.

In the copending application, the transportation of the pressurized product from the valve chamber to the hollow bore of the stem was accomplished in several manners. In one type of construction, the axial end of the stem bottoms in the socket of the valve plunger and engages against the floor thereof and in order to enable the pressurized product to pass the wall of the stem, grooves are formed in the floor extending from the bottom ends of the channels below the floor to the opening in the axial end of the stem. In such structure, if there is a post, such as for example of the type used for gassing packages having integral sprayheads as taught in U.S. Pat. No. 3,386,479, the diameter of the post is less than the internal diameter of the bottom end of the bore of the stem to permit pressurized product to pass from the grooves up the bore. In the case there is no post, the grooves are only required to carry the pressurized product past the stem wall to the bore directly. In another type of construction, the channels ended at the floor and the stem was supported by ridges or footings in the bottom of the socket to space the stem end above the floor and thereby permit passage of the pressurized product to the bore.

The copending application likewise taught application of the basic invention to valve plungers with and without galleries. In the case of those with galleries, the upper ends of the channels opened to the galleries, while in the case of those without galleries, the upper ends of the channels opened at the valve seat. The invention herein is also applicable to these types of structures.

The invention herein solves the problem of spacing the stem above the floor by means of structure which is an integral part of the stem, but without complicating the manufacture of the stem or giving up common advantages of the invention of said copending application. In addition, since the spacing of the stem above the floor of the socket does not depend upon any engagement of the axial end of the stem with the floor or footings or ridges in the bottom of the socket, the presence of flash occurring on the bottom end of the stem during molding has no effect upon metering or stability of the stem in the socket. In some prior structures, flash on the stem end was intolerable because the perfect seating of the stem end in the socket was required to establish desired metering.

## SUMMARY OF THE INVENTION

According to the invention herein, the stem of the sprayhead is made with the portion that enters the socket of slightly smaller diameter than the remainder of the stem whereby to form a shoulder. The length of the portion which enters the socket is made to have an axial length somewhat less than the depth of the socket from the point at which the shoulder engages the upper end of the socket to its floor so that when fully seated in the socket the axial end of the stem is spaced above the floor. In this way, the channels in the inner surface of the valve plunger wall need not extend below the floor and there is no need for grooves in the floor. The shoulder of the stem rests either on the valve seat in the case of a valve plunger that has no gallery, or on the gallery of a valve seat which has a gallery. The metering is controlled by the total of the smallest cross-sectional areas of the respective channel entrances formed by the stem at the upper ends of the channels.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary elevational view of the upper end of a pressurized package of the type in connection with which the invention is used;

FIG. 2 is a fragmentary median sectional view taken through the package of FIG. 1 along the line 2—2 and in the indicated direction, the valve construction including a removable sprayhead;

FIG. 3 is a sectional view taken generally along the line 3—3 of FIG. 2 and in the indicated direction;

FIG. 4 is a fragmentary view on an enlarged scale of a portion of FIG. 2, illustrating the relationship of the parts during the time that the sprayhead has been depressed and pressurized product is being dispensed;

FIG. 5 is a top plan view of the valve plunger illustrated in FIGS. 2, 3, and 4;

FIG. 6 is a sectional view through the valve plunger of FIG. 5 taken along the line 6—6 and in the indicated direction;

FIG. 7 is a fragmentary sectional view taken along the line 7—7 of FIG. 6 and in the indicated direction;

FIG. 8 is a fragmentary sectional view taken generally along the line 8—8 of FIG. 4 and in the indicated direction;

FIG. 9 is a view similar to that of FIG. 6 but showing the invention as applied to a structure in which the valve plunger does not have a gallery, the bottom of a stem being shown partially in elevation and partially in section;

FIG. 10 is a fragmentary sectional view taken generally along the line 10—10 of FIG. 9 and in the indicated direction;

FIG. 11 is a side elevational view of a sprayhead of the construction for use with the invention in which the button and stem are integral; and

FIG. 12 is an exploded elevational view of a sprayhead of the construction for use with the invention in which the button and stem are separate articles.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention is applicable to either the stem valve type of structure or to the structure in which the entire sprayhead is removable in the manner taught by U.S. Pat. No. 2,777,735. Likewise, it will be seen that the

invention is applicable to structures which use a gallery and those which do not.

In FIGS. 1 through 8 there is illustrated a type of valve construction in which the sprayhead is fully removable, there is a gallery in the upper end of the wall of the valve plunger, and in which there is a plastic valve housing.

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The valve assembly of the invention is designated by the reference character 20. This valve assembly 20 is purchased by the filler who puts it together with a canister 22 to make up the pressurized package, filling it with the propellant either before or after he installs the sprayhead or spray button, depending upon his techniques. FIG. 1 shows a canister 22 which has a cylindrical body 24 that is held to a metal pressure dome 26 by a locked and sealed seam 28. The upper end of the dome 26 provides an opening or mouth 30 that has a rolled or curled formation 32. The valve assembly 20 is adapted to be mounted in the opening 30 and crimped in place as by the crimp 34, the seal being effected by the joint to be described.

The valve assembly 20 includes a metal cover member 36 that has an annular well 38 that surrounds an upstanding central boss 40 that is integral with the floor of the well and is formed from the same integral sheet metal member that constitutes the cover member 36. The upper edge of the cover member 36 is rolled as shown at 42 and this rolled edge engages over the rolled formation 32 surrounding the mouth 30 of the dome 26. A layer of gasketing material 44 between the rolled edges seals the cover member 36 into the opening 30 of the canister 22.

The valve assembly 20 includes a valve housing 46 which is often called an eyelet in the trade, this housing in the structure being described being made out of some suitable plastic and having its upper end flared or enlarged to provide the flange 48 that engages into the boss 40 and is locked in place by means of the crimps 50. A disc-like elastomeric gasket 52 is compressed by the flange 48 against the inside of the upper wall 54 of the boss 40 so that the gasket 52 is sandwiched between the flange 48 and the upper wall 54. The upper wall 54 of the boss 40 has a central opening 56 and the gasket 52 likewise has a central passageway 58 that is aligned with the opening 56.

On its interior, the valve housing 46 provides a chamber 60 into which pressurized product is adapted to be introduced by way of the dip tube 62 that is locked to the bottom end of the housing 46 by any suitable means such as the split locking collar 64. The exact construction of this locking means is described in U.S. Pat. No. 3,159,318. Any other method of securing the dip tube 62 may be used. In the chamber 60 there is a valve plunger 66 which provides a shoulder 68 and pilot projections 70 to seat a helical spring 72 that urges the plunger 66 upwardly as viewed, against the bottom surface of the gasket 52. The interior of the plunger 66 provides a socket 74 which has a blind bottom end which forms a floor 76, as best seen in FIGS. 4 to 6.

The upper end of the socket 74 has a gallery 78 that extends around the interior thereof, giving rise to a narrow section 80 that has an end surface 82. This end sur-

face 82 is that which engages tightly against the bottom surface of the elastomeric gasket 52 as best seen in FIG. 2 and comprises the valve seat. When the valve plunger 66 moves off the gasket 52 as by being pushed downwardly, pressurized product from the chamber 60 will pass over the seat 82 and into the gallery 78, as best shown in FIG. 4. The interior of the socket 74 has channels 84 and 86 formed therein, these channels opening at their upper ends into the gallery 78 and extending to the floor 76 at their bottom ends. The channels 84 and 86 extend generally axially of the valve plunger as viewed, for example, in FIGS. 4 and 6. The floor 76 is flat except for the post 92 in its center, this post being integral with the valve plunger 66 and extending upwardly from the floor.

A sprayhead 94 is mounted in association with the valve assembly 20, the sprayhead comprising a button 96 with an integral, hollow bore stem 98 depending from the bottom of the button. The stem has a central expansion chamber 100 which leads to a transverse passageway 102 in the button 96 connecting the external spray orifice 104 with the said chamber 100. The bottom end of the stem 98 has a slight chamfer at 106 as shown in FIG. 4 to assist in guiding the stem through the gasket 52 and into the socket 74 when the sprayhead 94 is assembled to the valve assembly 20. At its bottom end, the interior hollow chamber 100 is of such diameter that it clears the post 92 on the interior of the stem by a substantial amount, as best seen in FIGS. 3 and 4.

As for its exterior dimensions and configuration, therein the structure of this invention differs from that of the copending application thus giving rise to the advantages which are ascribed to this invention. The diameter of the stem 98 above the portion 99 which fits into the socket 74 is slightly larger than the said portion 99 so that the effect is the formation of an annular shoulder 101 on the stem 98. This is best seen in FIGS. 4 and 11. The exterior dimension of the lower end 99 of the stem 98 is such as to provide a relatively tight sliding fit with the socket 74. In this manner, since the stem 98 is imperforate along its entire length including the lower portion 99 except for the opening to the chamber 100 at the bottom axial end, no pressurized product can escape from the valve chamber 60 except by way of the channels 84 and 86 and the bore 100 of the stem 98.

The diameter of the stem 98 above the shoulder 101 is somewhat less than the largest diameter of the gallery 78 so that, although the shoulder overlaps the gallery a slight amount as may be ascertained by examining FIG. 8, it does not extend to the narrow section 80. This leaves a space indicated at 103 in FIG. 8 which slightly narrows the gallery 78. Since the channels 84 and 86 open into the gallery at their upper ends, the entrances to the channels are also slightly narrowed, also as shown in FIG. 8. These entrances are seen to be the smallest cross sections for the flow of pressurized product to the bore 100 from the chamber 60, and hence the cross-sectional dimensions of these entrances control the metering of the valve assembly 20, assuming that none of the remainder of the passageways such as 102 and the orifice 104 has a smaller total cross section. The cross-sectional area of one such entrance multiplied by the number of channels gives the total cross-sectional area controlling metering. Increasing the number of channels to more than two or decreasing

them to one enables the manufacturer to build any desired metering into the structure.

The axial distance from the shoulder 101 to the axial end 105 of the stem 98 is chosen to be somewhat less than the axial distance from the gallery 78 to the floor 76. In this manner, the shoulder 101 serves as stop means when the stem is inserted into the socket 74, preventing the said end 105 from engaging the floor 76. The end 105 is thus spaced above the floor 76 so that pressurized product emerging from the bottom ends of the channels 84 and 86 passes across the floor 76, upwardly alongside the post 92 and into the bore 100 of the stem.

In prior structures, the post 92 has served as an assist in guiding and seating the stem in the bottom of the socket, and in such cases, the outer diameter of the post was the same as the inner diameter of the bore of the stem. In this case, since it is required that there be a space to enable the pressurized product to enter the lower end of the expansion chamber 100 and move past the post 92, the outer diameter of the post 92 is substantially less than the inner diameter of the bore 100. The primary purpose for the post in the construction which is illustrated is to enable gassing the pressurized package by the apparatus and method disclosed in U.S. Pat. No. 3,386,479. Otherwise, the post 92 is not essential to the operation of the valve structure.

The operation of the aerosol valve of the invention is best described in connection with FIGS. 2 and 4. In FIG. 2 the valve is closed, with the valve seat 82 tightly pressed against the underside of the gasket 52. Under these circumstances no pressurized product can escape from the valve chamber 60. The entire sprayhead 94 may be removed from the valve assembly 20 if desired without affecting the inoperative condition. This provides certain advantages which are common with the construction of the valve structure of U.S. Pat. No. 2,777,735.

With the sprayhead 94 in place, when it is desired to dispense the pressurized product, the button 96 is pressed downwardly and the shoulder 101 engaging the gallery 78 of the valve plunger 66 forces the plunger downward against the bias of the spring 72 to the position which is illustrated in FIG. 4. When this occurs, pressurized product generally follows the lines of the arrows illustrated in FIG. 4. It rises in the chamber 60 to the top of the plunger 66, passes over the valve seat 82 and into the gallery 78. From the gallery 78, the pressurized product passes down the channels 84 and 86 to the floor 76, across the floor and the axial end 105 of the stem portion 99 and past the post 92, moving into the bore 100 of the stem 98. From the expansion chamber 100 the pressurized product passes to the atmosphere by way of the passageway 102 and the external orifice 104.

To discontinue the spraying of the aerosol product, the button 96 is released by the user and the sprayhead 94 moves upwardly because of the spring 72, thereby closing the valve due to the valve seat 82 once more engaging against the underside of the gasket 52.

While there are advantages in having a gallery as 78 in connection with the apparatus, it is not essential to the operation of the invention and the principal advantages are achieved without the use of the gallery. For example, in FIGS. 9 and 10 the gallery is omitted. In this case the valve plunger 110 is constructed in the same manner as the valve plunger 66 of FIGS. 1

through 8, except that the channels 112 and 113 which are the equivalents of the channels 84 and 86, respectively, of the valve assembly 20 end at the valve seat 114. The valve seat 114 is substantially wider than the valve seat 82, since it is formed by the upper end of the wall 116 which forms the socket 118 of the plunger 110.

In the structure of FIGS. 9 and 10, the stem 120 has the reduced diameter lower portion 122 which provides the shoulder 125 that serves as stop means, engaging the valve seat 114 and partially overlapping the same as seen in FIG. 10. This prevents the bottom axial end 126 of the stem portion 122 from touching the floor 128, the stem and thereby being spaced above the floor 128. The structure of FIG. 9 does not include a central post like the post 92, it being assumed that the post is not needed for gassing. The stem 120 could be a stem which is not integral with a button, as, for example, shown in FIG. 12. In such case, the button 130 could be made out of soft plastic of the polyethylene type while the stem 120 could be made out of rigid plastic of the nylon type since it will be force fitted into the socket 118 to be substantially permanently engaged therein. Thus, without a post, the pressurized product, passes from the bottom ends of the channels 112 and 113 across the floor 128 and directly into the bore 132 of the stem.

In this latter case, the metering is established by the exposed upper entrances of the channels 112 and 113 since these are most likely to be the areas of smallest cross-sectional dimension. The slight overlap of the channel ends is not a disadvantage since the entrances open to relatively larger cross-sectional areas and clogging in the channels is not too likely to occur.

In both of the structures described above, the accumulation of residue at the bottom of the socket 74 or 118 is also not likely to interfere with the operation of the pressurized package.

Separable stem structures could be used in the valve assembly 20 to make the same into a stem valve type of apparatus.

The embodiments of the invention may have many modifications without departing from the spirit or scope of the invention as defined in the appended claims.

What it is desired to secure by Letters Patent of the United States is:

1. A valve structure for a pressurized package comprising:

A. a cover member adapted to be installed in said package,

B. a housing connected to the bottom of the cover member and being enclosed but for a first opening through the cover member and a second opening adapted to communicate with the interior of the package,

C. an elastomeric gasket between the housing and the cover member and having a passageway aligned with the first opening,

D. a valve plunger in the housing spring-biased against the elastomeric gasket and when so biased blocking passage of pressurized product from the interior of the housing to the exterior of the cover member, said valve plunger comprising;

1. a body having an outer cylindrical wall defining a central bottom floor and an upwardly extending center post,

2. the cylindrical wall having a valve seat at its upper end around the upper entrance of the socket,

3. channel means in the interior of the socket in said wall extending generally axially of the cylindrical wall, opening at the upper end thereof adjacent the valve seat and opening at the bottom end adjacent said floor,

E. a sprayhead including an exterior movable button having an external orifice and a hollow cylindrical stem, said stem having an upper and a lower portion, the upper portion of the stem passing through the passageway of the elastomeric gasket in a sealing and siding engagement, said upper portion having an external diameter slightly greater than the internal diameter of the socket wall, the lower stem portion telescopically and sealingly engaged in said socket, said lower portion being of slightly smaller diameter than the upper stem portion to form a shoulder, said shoulder engaging against the portion of the plunger surrounding the entrance to the socket to define metering entrance means in cooperation with the upper end of said channel means, and the lower stem portion having an axial end opening spaced away from the center post providing the only entrance to the interior of the hollow stem from the bottom end thereof and said lower portion having a length less than the depth of the socket, and

F. whereby the bottom of the upper stem portion engages the internal socket wall to establish a pressurized product flow path from the housing during actuation of the package, said path extending over said valve seat down through the channel means, between the floor and the bottom end of the stem and then up through the axial opening in the stem between the internal wall of the stem and the post.

2. The valve structure as claimed in claim 1 including a gallery at the upper entrance of the socket below said valve seat into which gallery said channel means at the upper end thereof open,

3. A valve assembly adapted to be sealed to the open top of a canister and adapted to have a sprayhead mounted therein, which valve assembly comprises: a sprayhead having a push button and a stem connected together, the stem extending into the valve assembly from the exterior thereof, a cover member having a central passageway for movement of the stem there-through, a gasket, a valve housing secured to the inside of the cover member, a valve plunger in the housing having a valve seat on the upper end thereof and being spring-biased upwardly against the gasket, the valve plunger having an upwardly opening socket confined by the valve seat, the gasket being sandwiched between the valve housing and the cover member and having a central passageway therethrough aligned with the central passageway in the cover member, the socket being axially aligned with the passageways, the stem slidingly and sealingly passing through the central passageways into the socket and engaged therein and having its exterior wall sealingly engaged in said socket, means communicating between the interior of the valve housing over the valve seat and the hollow bore of the stem, the lower end of the stem that is engaged in the socket being imperforate but for an axial end opening, the plunger having axially extending channel means on the

interior of the socket opening at the upper end thereof adjacent the valve seat and extending to the bottom of the socket and the stem having a shoulder cooperating with the valve plunger to space the lower end of the stem above the bottom of the socket, said shoulder having an outer diameter greater than the inner diameter of said socket and that portion of the stem which engages in said socket, the shoulder engaging against the portion of the plunger that surrounds the entrance to the socket to define metering entrance means in cooperation with the upper end of said channel means, the axial length of the portion of the stem which engages in the socket being less than the axial length of the

socket, to provide clear passage for the pressurized product from the bottom end of the channel means to said axial end opening when said stem is engaged in said socket.

4. The valve assembly as claimed in claim 3 in which the plunger has a gallery at the upper entrance of the socket below said valve seat into which gallery said channel means at the upper end thereof open.

5. The valve assembly as claimed in claim 3 in which the shoulder is engaged on said valve seat into which valve seat said channel means at the upper end thereof open.

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