Aug. 16, 1966 E. H. GREEN 3,266,678

SPRAY VALVE FOR PROTRUDING STEM

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Fig. 1

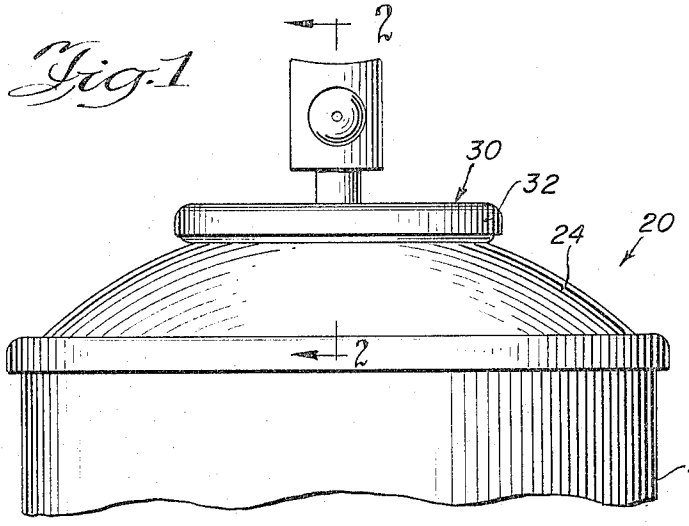



Fig. 2a

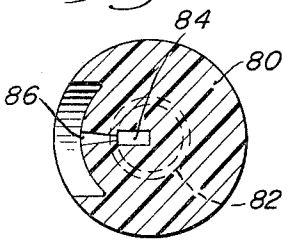



Fig. 9

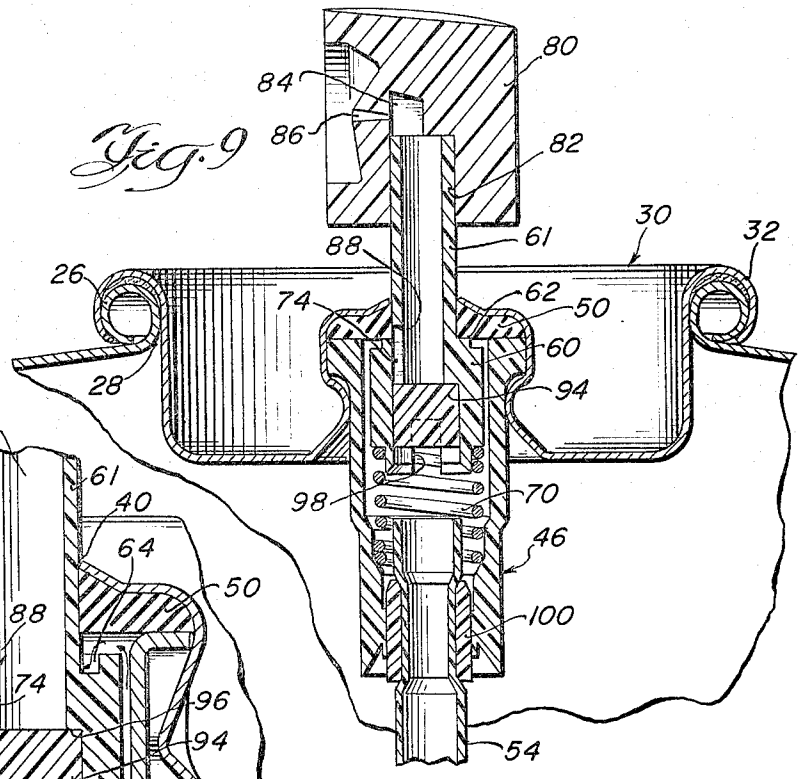
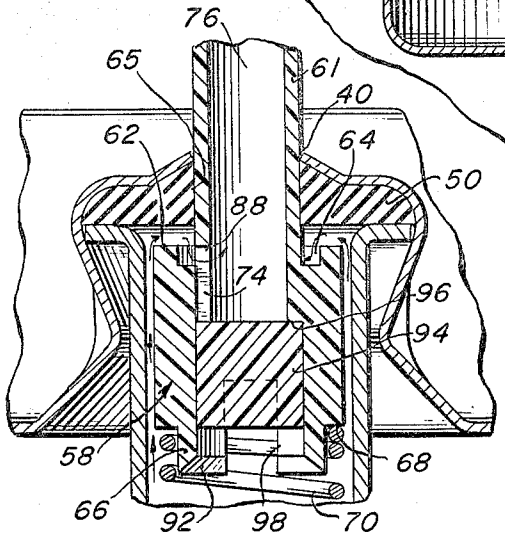



Fig. 8

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SPRAY VALVE FOR PROTRUDING STEM

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Fig. 2

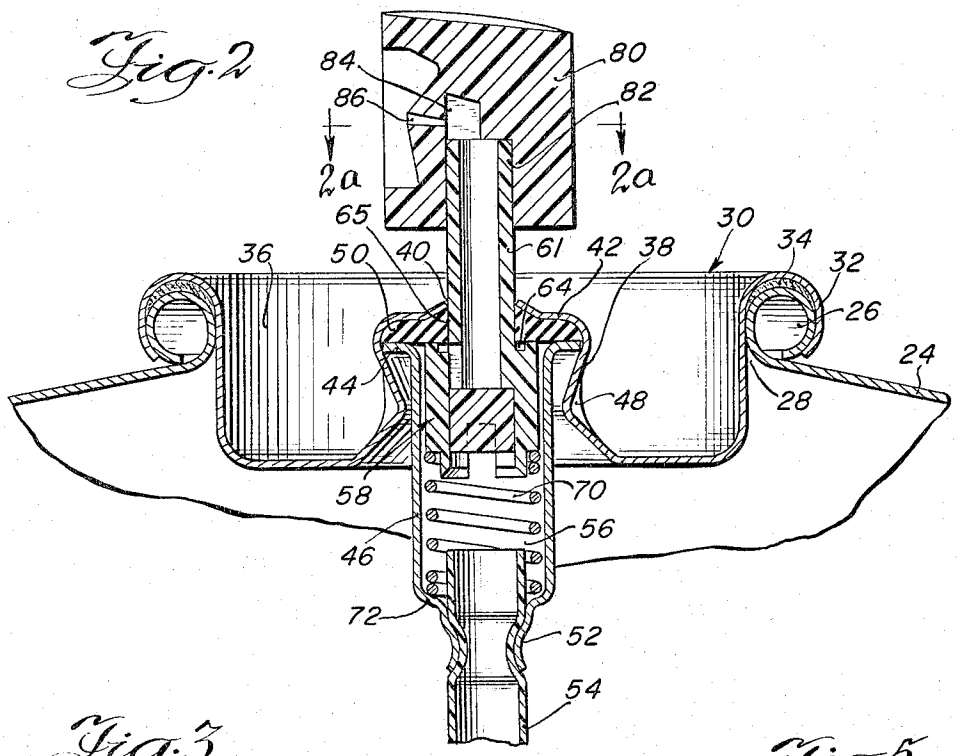



Fig. 3

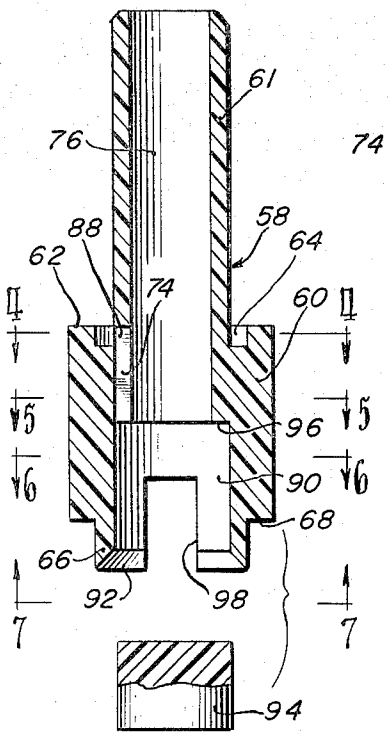



Fig. 4

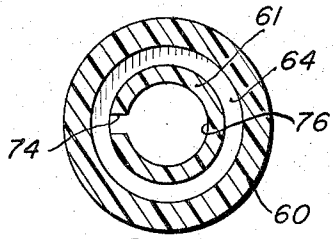



Fig. 5

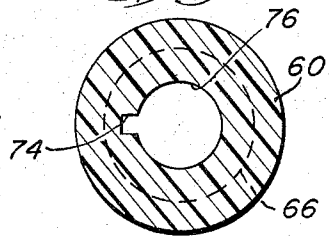



Fig. 6

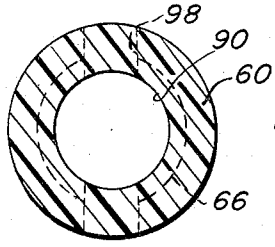
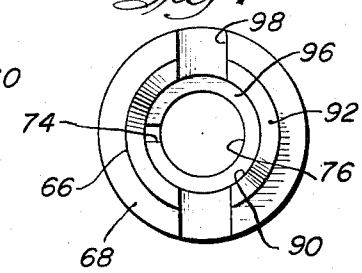



Fig. 7

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SPRAY VALVE FOR PROTRUDING STEM

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Fig. 10

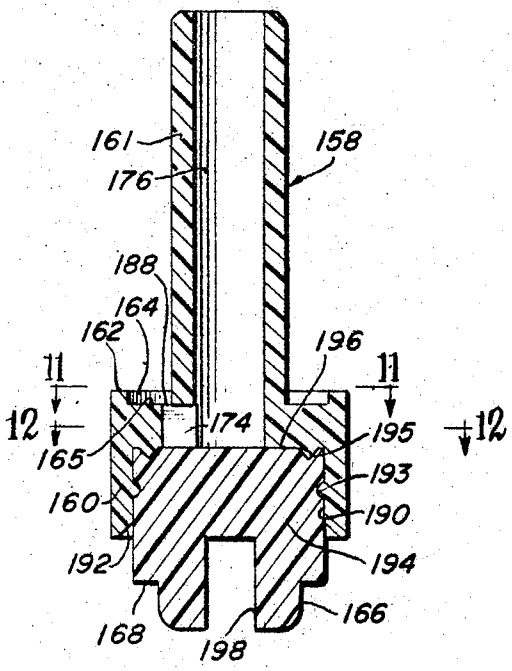



Fig. 11

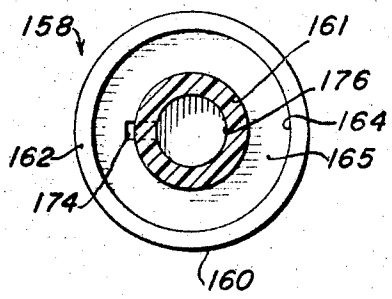



Fig. 12

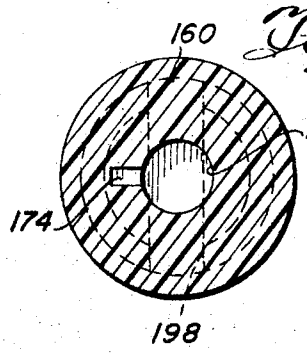



Fig. 13

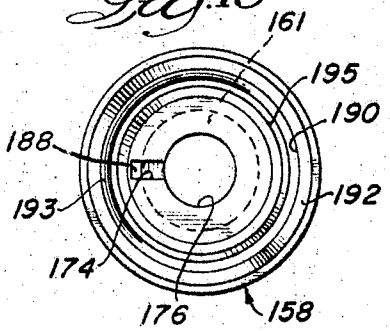



Fig. 14

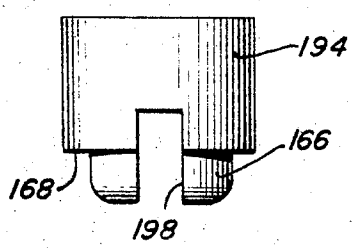
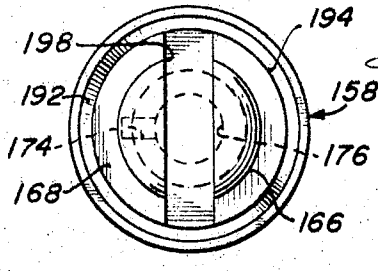



Fig. 15

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United States Patent Office 3,266,678 Patented August 16, 1966



3,266,678

# SPRAY VALVE FOR PROTRUDING STEM

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Filed Oct. 13, 1964, Ser. No. 403,469
16 Claims. (Cl. 222—394)

This invention relates generally to pressurized packages and more particularly is concerned with a valve mechanism for use with a pressurized package.

The modern pressurized package with which the valve structure of the invention is associated is more popularly known as an aerosol spray package. The phrase "pressurized packages" is more apt since many of the pressurized products which are dispensed through the use of containers of this type do not really produce aerosol but produce atomization in the form of minute droplets or particles.

The pressurized package normally consists of a steel canister which is constructed in such a manner as to contain the pressure to which the same normally will be subjected, this canister having a top opening with an outwardly curled lip. The filler who will normally complete the package, purchases the canister from one source and the valve mechanism that goes into the canister from another.

The manufacturer of the valve mechanism sells the filler a cover member which can be sealed upon the opening of the canister and which carries the entire valve mechanism thereon. The filler, therefore, fills the package with the pressurized product, such as paint in a carrier of some kind and a suitable propellant such as a low boiling point gas. This material may be introduced into the canister before attaching the cover of the valve mechanism or afterwards.

Two general types of valves are used in pressurized packages. One type of valve mechanism is that shown and described in U.S. Patent 2,777,735 characterized by a valve plunger wholly within the boss formed in the cover member and presenting a socket to an opening in the cover member. The sprayhead in this type of construction has a depending stem with a slot in the stem, and the stem must be inserted through the hole in the cover member past the rubber gasket into the socket formed in the valve plunger. Depressing the sprayhead therefore pushes the stem down and exposes the slot to the inside of the housing secured on the interior of the boss and connected with the bottom end of the canister by means of a dip tube.

The second type of valve mechanism is one in which the valve plunger has an integral stem protruding from the hole of the boss permanently so that the sprayhead is merely a button having a socket fitted over the protruding stem. In this type of structure, the bottom end of the stem being secured to the valve plunger, there had to be a hole drilled in the stem to be exposed when the stem was pressed downwardly.

Each of the valve mechanisms discussed above has its disadvantages. The first is expensive to manufacture and assemble and difficulties have been experienced in attempting to lead the stem into the hole of the boss during assembly. The second type of valve plunger is cheaper to manufacture, but is limited in its commercial applications to pressurized products that leave little, if any, residue after discharge. This significant disadvantage is attributable to the fact that the hole drilled in the stem during manufacture is easily clogged by residue and hence was unsuitable for the dispensing of heavy materials, such as, paint, starch, wax and similar suspended solids. The structure with the depending stem having a slot has become known world-wide as the best valve for the dispensing of such solids, especially paint, because of



the slot. Furthermore, adjustable spray rates can be obtained by changing the internal metering.

The prime object of the invention herein is to combine the best attributes of both types of valves in providing not only a valve structure which includes the protruding stem, but in addition, one in which there is a slot which controls the internal metering.

Still a further object of the invention is to provide a valve structure having a protruding stem in which the internal metering is readily capable of being changed merely by changing the dimensions of the slot.

Still a further object is to provide a valve structure with a slot of sufficient length so that internal metering takes place at the upper end thereof and the remainder of the slot functions as a reservoir to accumulate any trapped particles without interfering with the internal metering at the upper end of the slot.

Still a further object of the invention is to provide a spray valve with a protruding stem in which there is a gallery formed around the stem to give instantaneous spraying the moment that the valve seal is broken during the operation of the valve.

Still a further object of the invention is to provide a novel valve with protruding stem for use in the spray package in which the valve plunger is constructed in a simple, effective and economical way in order to achieve the advantages above enumerated and those which will become apparent from the description which follows.

The preferred embodiments are illustrated in the accompanying drawings in which:

FIG. 1 is a fragmentary side elevational view of a pressurized package showing the environment in which the valve structure of the invention may be used.

FIG. 2 is a median sectional view taken generally along the line 2—2 of FIG. 1 and in the direction indicated.

FIG. 2*a* is a transverse sectional view taken through the sprayhead of FIG. 2 and in the direction indicated.

FIG. 3 is an exploded median sectional view of the valve plunger and stem of FIG. 2 prior to the assembly thereof.

FIGS. 4, 5 and 6 are sectional views taken generally along the lines 4—4, 5—5 and 6—6 of FIG. 3 in the direction indicated.

FIG. 7 is a bottom plan view of the stem of FIG. 3 taken generally from the plane 7—7 and looking upward.

FIG. 8 is a fragmentary enlarged sectional view of the valve mechanism of FIG. 2 but showing the same in a depressed condition, whereby to permit the escape of the pressurized product from the canister.

FIG. 9 is a view similar to that of FIG. 2 but showing a modified form of the invention.

FIG. 10 is a view similar to that of FIG. 3 but of another modified form of the invention and with the valve plunger and stem having its plug in position.

FIG. 11 is a sectional view similar to that of FIG. 4 but taken generally along the line 11—11 of FIG. 10 and in the direction indicated from above the valve seat.

FIG. 12 is a sectional view taken along the line 12—12 of FIG. 10 and in the direction indicated.

FIG. 13 is a bottom plan view of the assembled valve plunger and stem of FIG. 10, but with the plug omitted.

FIG. 14 is a side elevational view of the plug of FIG. 10.

FIG. 15 is a bottom plan view similar to that of FIG. 13 but with the plug in place.

Basically the invention is characterized by the provision of a unitary valve plunger and protruding stem in which there is a slot formed during the molding of the valve plunger and stem so that the benefits of the well-known slotted stem paint valve may be obtained. Thus far, it has been deemed impossible to mold such a structure and

the invention is therefore characterized by the provision of the novel arrangement which results in the desired structure. The necessary internal configuration is molded with the valve plunger and stem having a sufficiently large entrance to enable the introduction of the molding tools, but after molding has been completed the entrance is blocked by a suitable plug tightly fitted and permanently secured.

Referring now to the drawings, FIG. 1 illustrates the upper end of the pressurized package designated generally by the reference character **20** and comprising a cylindrical canister **22** having an upper dome **24** terminating in a curled lip **26** thereby providing an open top **28** which is closed by the cover member **30** that mounts the valve mechanism.

The cover member **30** comprises a sheet metal cuplike structure having an upper curled lip **32** adapted to be crimped over the lip **26** and sealed by means of suitable gasketing material **34** provided in the lip **32** by the valve manufacturer. The cover member has a well **36** in the center of which there is an integral upstanding generally cylindrical boss **38** having a central opening **40** in its top wall **42**. The boss **38** is crimped to the outwardly flared upper end **44** of the valve housing **46** that depends from the interior of the boss **38**, the crimps being shown at **48**.

The housing **46** is sealed on its top end by means of a rubber-like gasket **50** sandwiched between the top wall **42** of the boss **38** and the flared upper end **44** of the housing **46**.

The bottom end of the housing is pinched as at **52** to the upper end of the flexible dip tube **54** which extends downwardly to a corner of the canister **22** so that the pressurized material may flow up the dip tube and into the chamber **56** formed on the interior of the housing.

A valve plunger designated generally **58** is disposed within the chamber **56**, the plunger **58** being best shown in FIGS. 3 through 7. Although the plunger is a unitary structure, it is actually made up of two parts in a manner to be discussed below.

The plunger consists of an enlarged generally cylindrical body portion **60** which is always contained within the housing **46** and an integral protruding hollow stem **61** that extends through a suitable opening **65** provided in the gasket **50** and through the opening **40** in the wall **42**. The gasket **50** is normally in the shape of a flat annular disc when installed but assumes the general configuration somewhat as shown in FIG. 2 during the assembly of the valve mechanism.

It will be seen that the stem **61** is slidably and sealingly engaged within the opening **65** of the gasket **50**.

Continuing with the description of the valve plunger **58**, at its upper end, the body portion **60** has annular valve seat **62**, this valve seat being spaced from the stem **61** by an annular gallery **64** whose purpose will be described. The bottom end of the body portion **60** is of reduced diameter as shown at **66** to provide a shoulder **68** for seating a helical spring **70** disposed in the chamber **56** and having its bottom end engaged at **72**. The spring urges the plunger **58** upward so that seat **62** normally is biased tightly to engage against the bottom surface of the gasket **50**. The pressurized material cannot escape from the chamber **56** while the plunger is in this position.

An internal slot is formed in the body portion **60** at **74**, the slot communicating between the gallery **64** and the bore **76** of the hollow stem. If the stem **61** is pushed downwardly to unseat valve seat **62** from the gasket **50**, the condition will be as illustrated in FIG. 8. Pressurized material will follow the path taken by the arrows into the gallery **64** through the slot **74** and out through the bore **76**. A suitable push button **80**, which may be molded as a unitary member of plastic, has a socket **82** to fit the upper end of the stem **61**, the socket communicating with a small passageway **84** that leads to the external orifice **86**. The pressurized material will be sprayed out of the orifice **86** when the push button **80** is depressed. If desired, external metering or mechanical break-up of the emerging material may be controlled by a suitable insert in the spray head, in a manner well-known in this art.

The only portion of the slot **74** which meters material passing through the slot will be the upper end **88** and by controlling the cross-sectional area of this portion of the slot the manufacturer may control the rate of flow.

The use of the structure in which there is a gallery is advantageous since the moment that the slightest unseating occurs there will be a large area over which the material may enter the gallery and pass through the upper end **88** of the slot **74**. Slot **74** is advantageous since at the spraying of heavy material these materials will tend to continuously drain down to the bottom end of the slot, which functions as a reservoir, thereby leaving the upper end clean.

As seen in FIG. 3, before the valve plunger **58** is fully fabricated, it has a cylindrical socket **90** molded in its bottom end, the entrance to which preferably is tapered as at **92**. This gives plenty of space to enable the introduction of molding tools to form the slot **74** and the bore **76** from the bottom end of the piece. The gallery configuration is readily formed by introducing molding tools at the top end of the piece. After the piece has been molded, a cylindrical plug **94** is forced into the socket **90** and is seated at **96**. This fully blocks off the bottom end of the bore **76** and becomes a part of the valve plunger **58**. The recess **98** assists in enabling passage of the materials coming up the dip tube through the chamber **56** past the spring **70**. This is effected because when the spring **70** is compressed its convolutions are engaged one against the other and tend to prevent emergence of the pressurized material, but since the recess **98** extends above the spring seat there is an open path for such material past the spring. As indicated the spring engages upon the reduced diameter portion **66** and seats against shoulder **68**.

FIG. 9 illustrates structure which is quite similar to that described in connection with FIGS. 2 to 8 except in several respects.

In the first place, the valve structure of FIG. 9 uses a plastic housing **46** and the dip tube **54** is locked into the bottom end of the valve housing by means of a split sleeve **100** frictionally engaging the housing.

In the second place, the plunger body **60** does not have a structure like the gallery **64** of FIG. 3, but instead the valve seat **62** is immediately adjacent to the stem **61**.

Because of the construction described involving the elimination of the gallery, it is necessary that the upper end of the slot **74** which is shown at **88** extend above the valve seat **62** and partially enter the gasket **50**. When the spray button **80** is depressed in the structure of FIG. 9, the upper end **88** of the slot **74** will be exposed above the valve seat **62** and the materials passing from the chamber **56** may enter the slot at this point.

In the structure of FIG. 9, uniform maximum spray rate can be obtained only by suddenly depressing the button to the fullest extent. Otherwise, more or less of the upper end **88** of the slot **74** will be exposed varying the metering.

FIGS. 10 to 15 inclusive illustrate another form of the invention which uses the same principles explained above, and which has the same advantages and perhaps additional features which will be mentioned. Since the construction of the plunger is the only part that is varied, these figures show only this part. It is designated generally **158** in order to distinguish it from the other structures of FIGS. 2 through 9. The body portion **160** is substantially shorter in axial length, and the cylindrical bore **190** is substantially larger in diameter. (Note that the reference characters are similar to those previously used for the same parts, but with a prefix "1".) The plunger **158** has a hollow stem **161** having a hollow bore **176** which serves as the usual expansion chamber. The

valve seat is shown at 162, spaced from the bottom end of the stem 161 by an annular gallery 164.

The principal difference between the plunger 158 and those previously shown is in the fact that the metering is controlled by an opening in the floor of the gallery 164 instead of in the side wall of the stem, as in the case of both versions previously described. As noted, the body 160 is provided with a radially extending slot 174, the upper axial end of which slot commences at the floor 165 of the gallery 164, and the lower axial end of which opens to the hollow bore 190 of the body 160. The opening which controls metering is shown at 188.

Another major difference between the structure of the plunger 158 and those previously described is that the body 160 has been simplified by eliminating the need for the spring seating means therefrom and instead, forming the same on the plug. The external surface of the body is simple and cylindrical, and likewise the bore 190 is concentrically cylindrical. The entrance is provided with a pilot taper 192 and, preferably, an annular ridge 193 is provided on the interior surface of bore 190 while another ridge 195 is provided in the surface 196. These ridges are quite small, being a few thousandths of an inch thick. When the plug 194 is forced into the bore 190, these ridges serve to provide a fluid tight and permanent connection. The ridge 193 bites into the side wall of the plug 194 and gradually sinks into a permanently locked position by cold flow. The ridge 195 does the same on the upper end of the plug 194. Thus, the chance of pressurized material getting past the plug 194 is substantially lessened, if not completely eliminated.

The plug 194 has a reduced diameter portion 166, split by the central recess 198 to permit the pressurized product to pass the spring which fits upon the portion 166 and seats upon the shoulder 168 formed by the reduced diameter portion 166.

The molding of the plug 194 has not materially increased in complexity over the simple plug 94 previously described, but the molding of the remainder of the plunger 158 has been simplified over plunger 58.

The structure of FIGS. 10 to 15 is advantageous in other regards. In molding techniques, it is easier to mold small openings where parts of the die come face to face than where these openings are on a plane which is defined by parts moving relative one another. Thus, the structure with the metering opening 188 in the floor of the gallery 164 is more reliably and easily manufactured than the others described. Also, in molding techniques, it is most desirable to have parts as large as feasible to prevent breakage, variations from dimensions caused by bending, and even more important to make the parts easier to manufacture. The structure of FIGS. 10 to 15 uses larger molding parts than the others described.

In FIG. 10, the pin which molds the slot 174 is quite large and robust, because it will extend radially from the bore 176 to the left past the wall of the stem 161. In other cases the pin has always been not greater than the wall thickness of the stem. Note that it is a relatively simple matter to change the metering by increasing the radial size of the pin which is to form the slot 174, exposing more of the opening 188 in the floor 165, or by decreasing the radial dimension of this pin to provide a much smaller opening. In all cases, the pin will be quite sturdy.

The concept of an axially opening metering opening is believed novel in and of itself. Metering is more easily achieved and maintained. Drainage from the gallery is better.

The materials contemplated by the invention are moldable plastics of the thermoplastic variety, principally those of good stability—such as nylon. The plug is advantageously made of polyethylene, since any swelling will lock the plug in tighter.

Many other advantages will occur to those skilled in this art, and likewise variations and modifications may be made 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 aerosol packages in which there is a canister adapted to have a pressurized product therein, and the canister having a top opening, the valve structure adapted to be sealed into the opening, and comprising:

A. a cover member having means for sealingly securing same into said top opening,
  a central valve mounting formation having a passageway therein,

B. a valve housing secured to said formation,

C. a dip tube secured to said housing and adapted to extend downward into said canister when said valve structure is mounted to the canister,

D. an annular gasket having a central opening therein, and the gasket being secured in said formation with its central opening aligned with the passageway and held in place by said housing,

E. a combined valve plunger and stem having
  (1) an annular body portion of diameter substantially greater than that of said central opening reciprocable in said housing,
  (2) a hollow stem portion substantially permanently connected with the body portion, and slidingly but sealingly engaged through said central opening and passageway to have an end protrude from said cover member to present a cylindrical stem thereat,
  (3) a valve seat formed on the body portion surrounding the stem portion at the juncture of said stem portion with the body portion,
  (4) spring means in the housing urging the plunger in a direction to press the valve seat against the bottom surface of the gasket,

F. the stem portion of said combined valve plunger and stem having a hollow bore extending axially from an outer end in that portion of the stem protruding from the cover member to an inner end within the body and beyond said valve seat,

G. a metering orifice formed in the plunger in the vicinity of said juncture and providing communication between said hollow bore and the exterior of said stem portion,

H. a slot in said plunger extending radially outward from said bore and axially downward from said metering orifice to said inner lower end of said bore, said inner end of said bore otherwise being blocked, and

I. a push button with external spray opening and having a socket therein, removably mounted on the protruding end of the stem and adapted to be pressed axially to force the stem portion and hence the plunger into the housing against the pressure of the spring means to give free access for pressurized product past the valve seat from the housing, through the hollow bore and out said spray opening.

2. A structure as claimed in claim 1 in which said valve plunger is formed of two parts, each integrally formed, one of which includes the body and stem and the other of which is a plug substantially permanently sealed within a socket in the axial end of the body opposite the stem, whereby said metering orifice and slot may be formed by means of tools entering through said socket, after which said socket is closed by means of said plug.

3. A valve structure for aerosol packages in which there is a canister adapted to have a pressurized product therein, and the canister having a top opening, the valve structure adapted to be sealed into the opening, and comprising:

A. a cover member having means for sealingly securing same into said top opening,

a central valve mounting formation having a passageway therein,

B. a valve housing secured to said formation,

C. a dip tube secured to said housing and adapted to extend downward into said canister when said valve structure is mounted to the canister,

D. an annular gasket having a central opening therein, and the gasket being secured in said formation with its central opening aligned with the passageway and held in place by said housing,

E. a valve plunger having

(1) a body portion reciprocable in said housing,

(2) a hollow stem portion unitarily connected with the body portion, and slidingly but sealingly engaged through said central opening and passageway to have an end protrude from said cover member,

(3) a valve seat surrounding the stem portion at the juncture of said stem portion with the body portion,

(4) spring means in the housing urging the plunger in a direction to press the valve seat against the bottom surface of the gasket,

F. the stem portion having a hollow bore extending axially from an outer end in that portion of the stem protruding from the cover member to an inner end within the body and beyond said valve seat,

G. a metering orifice formed in the plunger in the vicinity of said juncture and providing communication between said hollow bore and external of said stem portion,

H. a slot in said plunger extending radially outward from said bore and axially from said metering orifice to said inner end of said bore, said inner end of said bore otherwise being blocked,

I. a push button with external spray opening, removably mounted on the protruding end and adapted to be pressed axially to force the stem portion and hence the plunger into the housing against the pressure of the spring means to give free access for pressurized product past the valve seat from the housing, through the hollow bore and out said spray opening and

J. said valve seat being annular in configuration and radially spaced from said juncture by means of a gallery, and said metering orifice opening to said gallery and blocked from communication with said housing only when the valve seat is in engagement with said gasket.

4. A structure as claimed in claim 3 in which said metering orifice opens to the floor of said gallery.

5. A structure as claimed in claim 4 in which said metering orifice opens in an inside wall of said gallery.

6. A structure as claimed in claim 1 in which said plunger has means on its bottom end for seating said spring means.

7. A structure as claimed in claim 2 in which said plug has means for seating said spring means.

8. A structure as claimed in claim 1 in which said orifice opens through the stem wall between the valve seat and the protruding end, and normally is blocked by the gasket, but adapted to be exposed above said valve seat between it and said gasket when the valve plunger is depressed by said button.

9. A structure as claimed in claim 4 in which a substantial portion of said slot is in said body radially outward of the stem.

10. A valve structure for use with a package for pressurized products, said package including a canister adapted to contain said pressurized product and said valve structure adapted to be sealed into an opening in said canister, said valve structure comprising: a cover member having a rim adapted to be sealed into said opening, a valve housing secured to the inside of said cover member and a gasket mounted inside said cover member, a valve plunger having an inner body and an outer hollow stem connected in a unitary structure, with the stem protruding through said cover and gasket, the body having a valve seat adapted to engage the gasket, spring means in the housing urging the plunger in a direction to bear the valve seat normally against the gasket, but the valve seat adapted to unseat when the plunger is axially moved against the spring means, a spray button secured to the end of the stem outside of the cover member, passage means through the cover member and gasket for the stem to slide in sealing engagement, the valve seat surrounding the passage means in the gasket, a hollow bore in the stem starting from its end outside of the cover member and extending throughout the stem and into the body past the plane of the valve seat, the inner end of the bore being axially blocked but having a lateral slot in the wall forming said bore axially extending from said end to the vicinity of said valve seat, an annular channel around said stem and between the valve seat and the stem, thereby radially spacing the valve seat from the stem and said channel opening axially substantially in the plane of said valve seat and being disposed on the side of said plane opposite the protruding end of the stem, and a metering orifice in the plunger at the end of said slot closest to said plane opening wholly within said channel.

11. A structure as claimed in claim 10 in which the channel includes a floor in a plane axially spaced from said plane of said valve seat, and said metering orifice opens in said floor.

12. A structure as claimed in claim 10 in which a portion of said stem extends into said channel and the metering orifice opens in that portion of said stem.

13. A structure as claimed in claim 10 in which said valve plunger body is formed of two members pre-molded and thereafter assembled, one member comprising said body and having the stem integral therewith and having the channel, hollow bore, lateral slot and metering orifice formed therein, but having an axial socket therein opposite the stem whereby the bore is open throughout said one member, the other member comprising a plug tightly to be engaged in said socket.

14. In a valve structure of the protruding free-ended hollow stem type adapted to be sealed to the open top of a canister and adapted to have a spray button removably mounted on the free stem end so that pushing down on the button will produce a valving action and permit pressurized products in the canister to emerge and be dispensed and said valve structure including a cover member having a central passageway for movement of the stem therethrough, a gasket and valve housing secured to the inside of the cover member, a unitary valve plunger having a valve seat thereon and including an enlarged body portion in the interior of the housing substantially permanently connected to said hollow stem and said hollow stem extending out of the cover member, spring means in the housing urging the valve seat against the gasket, the stem having a central bore, and an internal metering orifice communicating from the bottom of the bore to external of the plunger at a location such that when the seat is against the gasket communication between said orifice and the housing is blocked, but when said plunger is moved to unseat the valve pressurized product may flow from said housing past the seat, into said orifice and bore, the invention herein which comprises: said body portion having an axially elongate interior slot therein in communication with said bore, only a portion of the upper end of the slot forming said orifice and the remainder of the slot extending in a direction from said orifice opposite the direction that the stem extends from the body portion.

15. A structure as claimed in claim 14 in which the bottom end of the bore is blocked but for its communication with said slot, and the slot opens radially along an axially extending side thereof into said bore.

16. A structure as claimed in claim 14 in which said

slot and orifice are located axially of the plane of the valve seat on the same side thereof as the body portion of the plunger.


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