United States Patent [19]

Green

[11] **3,741,445**

[45] **June 26, 1973**

[54] **SAFETY VALVE FOR AEROSOL PACKAGE**

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[22] Filed: **Apr. 21, 1971**

[21] Appl. No.: **135,943**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 876,746, Nov. 14, 1969, abandoned.

[52] **U.S. Cl.** **222/397,** 222/402.24
[51] **Int. Cl.** **B65d 83/14**
[58] **Field of Search** 222/397, 396, 402.24

[56] **References Cited**

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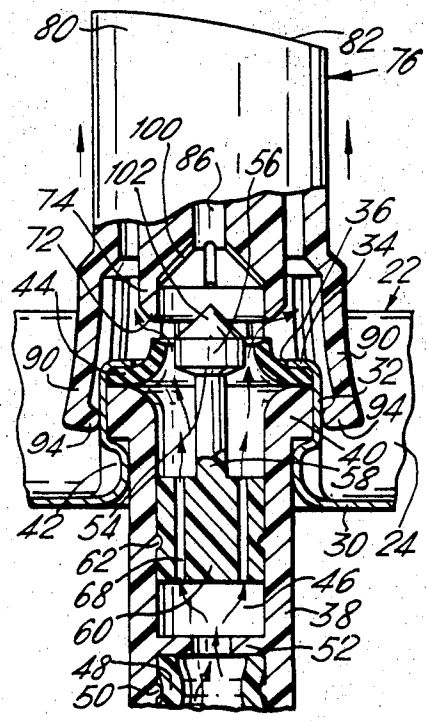
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Attorney—Perry Carvellas, Esq.

[57] **ABSTRACT**

A valve assembly for securement to a container for dispensing pressurized product has a cover member with a central upstanding boss, a perforated diaphragm held in the top of the boss and capable of invagination inwardly of the package and outwardly of the package. A housing depending from the interior of the boss carries an upstanding post providing a valve seat on the outside of the diaphragm, the post extending through the perforation of the diaphragm. Pressure from the interior of the package holds the diaphragm against the valve seat, normally preventing invagination outwardly of the package. An actuator member engages over the boss and has an external metering orifice and connection to a clearance chamber on its interior, the clearance chamber being formed by a skirt engaging the top of the diaphragm and aiding in preventing outward invagination of the diaphragm. The exterior of the actuator member has elongate axially extending fingers with enlarged bottom ends that engage the crimps on the exterior of the boss and are adapted to ride up and down in the crimps. To operate the valve mechanism, pressing down on the actuator member causes the skirt to press the diaphragm downward away from the valve seat, invaginating the same inward, enabling the pressurized product to emerge through the passageways in the actuator member. Releasing of the actuator member causes the internal pressure to reseat the diaphragm on the valve seat. Unusual pressure on the interior of the package will force the diaphragm to invaginate outward of the package into the clearance chamber and forcing the actuator member off the boss to permit the pressurized product wholly to be expelled.

19 Claims, 9 Drawing Figures



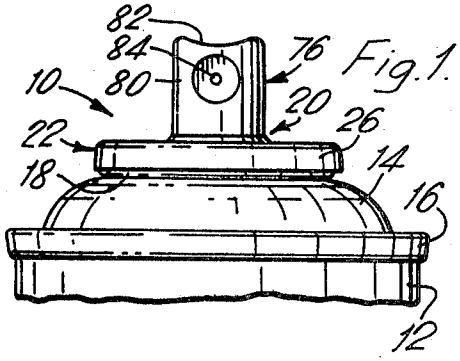


Fig. 1.

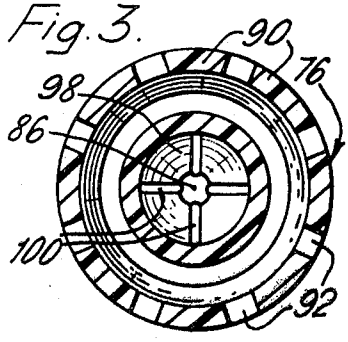


Fig. 3.

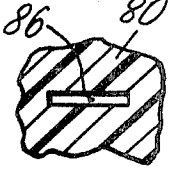


Fig. 4.

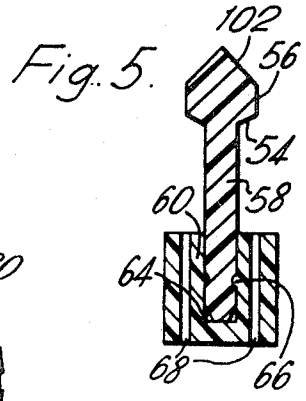


Fig. 5.

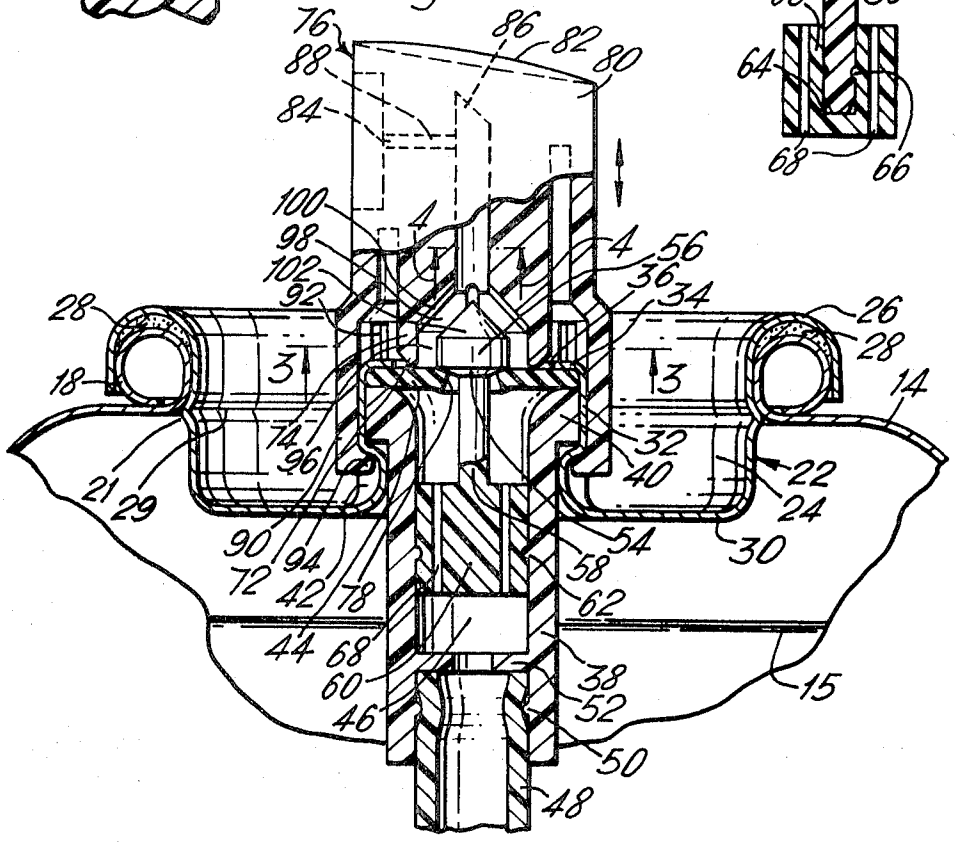


Fig. 2.

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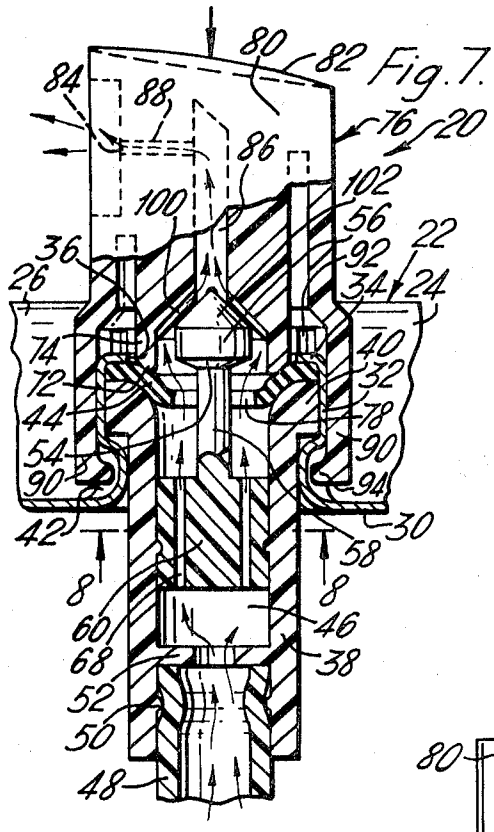
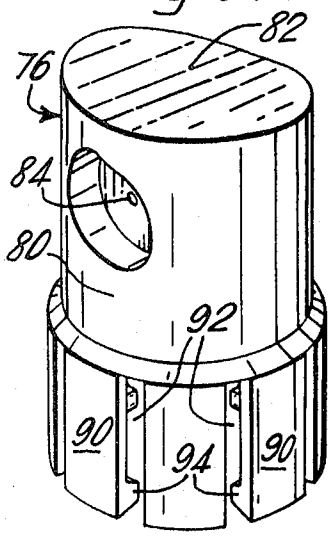


Fig. 7.

Fig. 6.



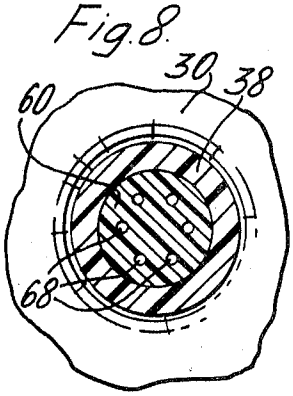


Fig. 8.

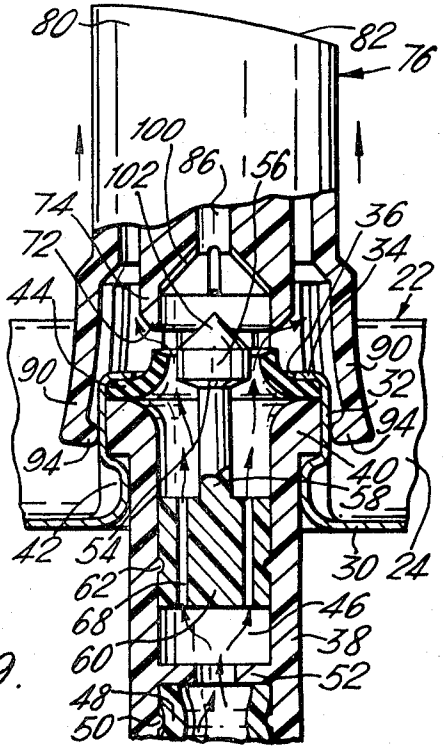


Fig. 9.

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SAFETY VALVE FOR AEROSOL PACKAGE

CROSS-REFERENCE TO COPENDING APPLICATION

This application is a continuation-in-part of a copending application by the same applicant, entitled VALVE ARRANGEMENT FOR A PRESSURIZED DISPENSER, Ser. No. 876,746, filed Nov. 14, 1969, now abandoned.

BACKGROUND OF THE INVENTION

The invention herein relates to aerosol packages and is specifically concerned with a valve construction which will provide a large measure of safety for the user.

The valve mechanisms of known aerosol packages are constructed to resist internal pressure of the pressurized product and propellant within the package. This resistance, so far as is known, has been built into the valve mechanism without regard to limitation, by the very nature of the requirement of containing the pressure. Thus, a valve mechanism which is constructed to resist the normal internal pressure of the package of several atmospheres will also resist pressures running into tens of atmospheres.

The emphasis placed on consumer safety by public-minded private agencies and by governmental agencies has brought into focus a difficult problem with the modern pressurized package. Explosion of an aerosol package produces dire results. As a general rule this will occur when the temperature rises to the vicinity of 200°F. and the interior pressure of the package is in the vicinity of several hundred pounds per square inch.

An exploding aerosol package is lethal. The solvents which are used in most cases are low flash-point hydrocarbons, and these flash into flames immediately so that the package becomes in effect a fire bomb. A canister of insecticide left on a stove by error can cause a holocaust. The breaking up of the package adds shrapnel-like pieces to the explosion. The ordinary valve mechanisms known today will not provide relief for high internal pressures to obviate explosion. On the contrary, they just become more efficient bombs as the internal pressure increases.

Typical of these valves are those which utilize spring-pressed mechanisms of the type disclosed in U.S. Pat. No. 2,777,735. There is a sprayhead having a depending stem with a slot that engages in a boss in the cover member of a pressurized product. A valve housing in the boss and depending from the interior thereof carries a valve plunger arranged for vertical reciprocation, the plunger being biased upward against a gasket secured to the underside of the top wall of the boss. The stem of the sprayhead extends through the gasket and presses the valve plunger off the gasket against which its upper end is seated, the pressurized product thereafter rising from the interior of the package into the valve housing over the valve seat and into the hollow of the stem by way of a slot and out through the external metering orifice of the sprayhead.

The upward pressure of the spring-pressed valve plunger is contained by the upper wall of the boss. The pressure against the bottom of the gasket radially outward of the part engaged by the valve seat is also resisted by the upper wall of the boss. There is thus no relief for internal pressures of greater than the normal

amount. This is true of all known valves, including those of other constructions.

The primary consideration of the invention herein is to provide a valve construction which would act as a safety valve in the event of unusual interior pressures so that the contents of the package could be expelled before building up to values which would cause fire explosions. This has been accomplished as will be detailed hereinafter. In addition, other advantages have flowed from the invention.

The valve mechanism of the invention is such that most of the machinery used to manufacture and assemble known valves may be used. Likewise the machinery used to assemble the eventual package can be used with little modification. As known, the manufacturer of the valve mechanisms normally does not manufacture the canisters nor fill the packages. The manufacturer provides the valve mechanism complete with sprayhead mounted on a cover member. The filler, as the assembler of the package is known, purchases the valve assemblies from one source and the canisters or other containers from another source. He fills the canister with the product but without the propellant, crimps the cover member to the container, then gasses the package by injecting the propellant through the valve mechanism, either with or without the sprayhead in place, depending upon the construction of the valve assembly and the nature of the filler's machinery. Some techniques provide for filling the canister with the propellant cooled to liquid form, but this is not the usual case today.

The valve mechanism of the invention is simple and economical to manufacture and assemble. There is only one moving part in addition to the flexible diaphragm and the internal construction is such that there is little likelihood of clogging during use. There is no spring, since the interior pressure of the pressurized product keeps the valve seated and holds the actuator member in normal condition. In filling, there is no interior movable plunger which could become misaligned. The invention also provides a wide latitude for different kinds of metering at different locations in the path of the pressurized product.

Another feature of the invention is that it is adaptable to a wide variety of products including those which have solids in suspension and those which do not.

SUMMARY OF THE INVENTION

The invention is characterized by the provision of a valve mechanism which includes a perforated diaphragm capable of invagination inward of the package during use and during filling, but which is also capable of invagination outward of the package to provide a blow-off feature in the event that the package is subjected to dangerously high internal pressures.

The diaphragm cooperates with a valve seat provided on a head mounted on a post that is coaxial with the housing of the valve mechanism. The housing has the dip tube at the bottom and has its upper end engaged in the top of the boss of a cover member, the edge of the diaphragm being sandwiched between the upper end of the housing and the upper wall of the boss. The post extends through the perforation in the diaphragm. The actuator has a skirt which engages the top of the diaphragm and is spaced from the head to provide a clearance chamber. The clearance chamber leads to the internal expansion chamber of the actuator and

thence to the external metering metering orifice. There is a conical chamber between the clearance chamber and the expansion chamber which has metering grooves so that when the actuator is pressed down so that the head enters into the conical chamber the grooves will permit the pressurized product to pass to the expansion chamber.

The exterior of the actuator has a plurality of footed fingers which engage over the boss and enter the crimps at the base of the boss. In use the feet slide up and down in the crimps.

When high internal pressures are generated, the diaphragm invaginates outward of the package into the clearance chamber pushing the actuator upward and releasing the fingers from the crimps so that the pressurized product blows out of the package without rupturing the package or reaching dangerously high pressures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of the upper end of a pressurized package in which the valve mechanism is constructed in accordance with the invention;

FIG. 2 is a fragmentary median sectional view through the valve mechanism of the invention with portions shown in elevation;

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 sectional view showing a modified form of expansion chamber taken generally along the line 4—4 of FIG. 2 and in the indicated direction;

FIG. 5 is a vertical sectional view taken generally through a plug with post and head of the invention showing a modified form slightly different from that of FIG. 2;

FIG. 6 is a perspective view of the actuator member of the valve mechanism of the invention;

FIG. 7 is a sectional view similar to that of FIG. 2 but showing the valve mechanism in the condition it is placed when the actuator has been depressed and pressurized product is being dispensed;

FIG. 8 is a fragmentary sectional view taken generally along the line 8—8 of FIG. 7 and in the indicated direction; and

FIG. 9 of the invention is a sectional view similar to that of FIGS. 2 and 7 but, in this case, high internal pressures have caused the valve mechanism to operate as a safety valve blowing the actuator member off and expelling the pressurized product.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention herein, as stated above, is characterized by the provision of a valve mechanism which utilizes a single moving actuator member cooperating with a flexible perforated diaphragm to unseat the center portion of the diaphragm from an engaged position relative to a post for dispensing pressurized product, the actuator member being engaged over the upstanding boss of a cover member and having resilient fingers disposed in the crimps of the boss. Under normal conditions, the actuator member rides up and down upon the boss, but when the interior of the pressurized package is subjected to excessive pressure, the diaphragm invaginates outwardly of the valve housing of the pressurized package and the resilient fingers are forced out of the crimps, permitting thereby the blowing of the actuator off the boss. Thus, the contents of the pressurized package are ejected from the pressurized package in the action of a safety valve without building up dangerous interior pressures and exploding.

The reference character **10** designates generally a pressurized container of substantially conventional construction having the valve assembly of the invention incorporated therewith. The container which is illustrated comprises a canister **12** having an upper pressure dome **14** tightly sealed to the body of the canister **12** by means of a conventional rolled lock seam **15** forming the exterior shoulder **16.** The lower end of the canister **12** has a typical inwardly concave pressure closure (not shown) and the upper end of the dome **14** terminates in a rolled formation **18** defining an opening **21.** Although described as a canister, the container with which the valve assembly of the invention is associated can be any other form of vessel capable of retaining pressurized products for dispensing, including glass bottles and the like.

The valve assembly of the invention is designated generally by the reference character **20** and the same includes the cover member **22.** This cover member supports all of the valve mechanism and is constructed not much differently from those which are in wide use today mounting many different types of valve mechanism. As such, the valve assembly of the invention is capable of being manufactured by manufacturers of prior valve assemblies without major modification of fabrication and assembly machinery, and in addition, fillers equipped for filling and gassing pressurized packages need modify their assembly lines and equipment very little, if at all.

The cover member **22** is a dishlike structure having an annular well **24** which is formed on the interior of the cover member **22** and is bordered along the upper entrance thereof by a curled or rolled edge **26** that matingly engages over the rolled formation **18.** A small layer of gasketing material **28** is sandwiched between the rolled edge **26** and the rolled formation **18** to render the resulting joint gastight when the valve assembly **20** is installed on the canister **12.** The assembly **20** is secured in place by installing the mounting cover member **22** in the opening **21** of the dome **14,** this being done by the filler when he assembles and fills the pressurized package with product. The cover member **22** is secured in place by an internal annular crimp **29.** Rising from the center of the floor **30** of the cover member **22** there is a central upstanding boss **32** of generally cylindrical configuration, but having a plurality of circumferentially spaced crimps **42** equally spaced around the same adjacent the bottom thereof. In this invention, as well as in conventional valve assemblies, these crimps serve the purpose of locking the valve housing and an elastomeric gasket within the boss, but according to the invention herein, these crimps serve an additional function as will be seen. At this point, in addition, the construction of the valve assembly departs from what is conventionally known.

The upper wall **34** of the boss **32** has a central opening or passageway **36** which is substantially larger than those of prior structures, such as for example, that illustrated in U.S. Pat. No. 2,777,735. In the latter patent, the opening of the upper wall of the boss is intended to enable sliding passage of a stem while at the same time

confining an elastomeric gasket which is secured to the bottom surface of the wall in face-to-face engagement. In the invention herein, this opening **36** serves other purposes.

As in prior constructions, there is an elongate vertical valve housing **38** having an upper enlarged peripheral flange **40** that is securely clamped in the upper end of the boss **32** by means of the crimps **42**, sandwiching the edge of a disc-like gasket or diaphragm **44**, as it is termed herein, between the flange **40** and the upper wall **34** of the boss. The valve housing **38** is often called an eyelet in the trade, such housing normally providing an interior valve chamber like the hollow chamber **46** and having a dip tube **48** secured to its bottom end by any suitable means. In this case, there is a chamber **46** but the valving action takes place slightly above the housing **38** so that it is not strictly a valve housing. Its construction, however, does not materially differ from prior housings of this general arrangement. The dip tube **48** is frictionally engaged in the bottom end of the housing **38**, being pressed past an annular ridge **50** into engagement with a perforated partition **52**. The dip tube extends down to the bottom of the canister **12**.

The valving action which has been referred to takes place between the diaphragm **44** and a valve seat **54** that is formed on the bottom of an enlarged head **56** that is integral with a central post **58** mounted on the plug **60**. The plug **60** is a cylindrical member which is tightly engaged in the chamber **46** about halfway up the same, for example, by providing internal annular rib **62** on the interior of the housing **38** to bite into the exterior of the plug by "cold flow," as well known in plastics technology. The post **58** and head **56** may be integrally molded with the plug **60**, or may be molded separately as shown by the modified form of FIG. **5**, in which case a socket **64** receives the post **58** in frictional engagement preferably with the aid of the internal annular rib **66**. Through passageways **68** are molded in the plug **60**, these passageways permitting ready passage of pressurized product from the interior of the canister **12** up the dip tube **48** and through the chamber **46** to the top of the housing **38**. The passageways are numerous enough so that clogging of one or more by slugs of the product being moved through the chamber **46** will not materially block flow, and in this respect, the plug serves a filtering function in addition to the function of supporting the post **58**.

The valve seat **54** preferably is beveled as shown to serve a purpose which will be described. The gasket of prior structures was provided with a small central passageway in its center through which the stem of a sprayhead was slidably and yet sealingly engaged. The prior art gasket was fully supported up to the very edge of this central passageway. Valve action took place between the bottom surface of the gasket radially outward of the central passageway and an upwardly biased spring plunger whose peripheral edge tightly engaged against the bottom of the gasket on account of the pressure exerted by a spring which was disposed in the valve housing. The gasket was backed up by the upper wall of the boss, at least directly opposite the location of the valve seat. In the invention herein, the construction and functions of the parts depart quite radically from this prior structure.

The center of the diaphragm **44** under normal conditions shown in FIG. **2** is substantially free of the upper wall **34** of the boss **32** on account of the large opening **36**. Under such normal conditions, the only structure above the diaphragm is the thin tapered edge **72** of a skirt **74** that forms a part of the actuator member **76** to be described. The center of the diaphragm **44** has a relatively large perforation or opening **78** which is preferably slightly larger in diameter than the diameter of the post **58**. The level of the upper surface of the diaphragm **44** is approximately aligned with the valve seat **54** so that under normal conditions the opening **78** is slightly invaginated downward as shown in FIG. **2**. Upward pressure applied by the pressurized product against the lower side of the diaphragm **44** keeps the upper surface of the diaphragm tightly engaged against the valve seat **54**, preventing passage of pressurized product past the diaphragm **44** and the head **56**. In this respect, therefore, the diaphragm **44** serves as a valve for the valve seat **54**.

The actuator member **76** serves the same function as a conventional sprayhead in that it provides at least the external metering orifice and it enables the user to operate the valve mechanism by pressing down upon the same. According to the invention herein, the actuator member provides other functions in cooperation with the valve and valve seat. The actuator member **76** is preferably molded as a single integral member. Like the housing **38** and the plug **60** with its post **58** and head **56**, the actuator member is molded of some rigid synthetic resin that is compatible with the chemicals which will be carried by the pressurized product. There is a body portion **80** which may be substantially hollow in places, having a finger rest **82** to enable the user to press the actuator member **76** downward, an external metering orifice **84**, a central expansion chamber **86** rising from the bottom of the actuator member **76** and a transverse passageway **88** connecting the expansion chamber **86** with the external metering orifice **84**. It should be understood that any form of atomizing means could be used with the actuator member **76**, including mechanical nebulizing structure, swirl inducing devices, and a wide variety of spray pattern forming means. This need not be shown, since the invention is not concerned with this aspect of the structure. The external metering orifice **84** need not perform any metering function, being known as the external metering orifice in the trade. The expansion chamber **86** need not necessarily perform an expansion function, depending upon its construction. It could be larger or smaller proportionally than shown and it may be square, round or bladelike in cross section as shown in the modified form of FIG. **4**. This latter structure could be used for internal metering in addition to or in lieu of other metering means to be described. It may be assumed that the expansion chamber **86** of FIGS. **2**, **3**, **7**, and **9** is circular in cross section.

The lower end of the actuator member **76** is hollow and configured to enable the same to embrace the exterior of the boss **32** while certain parts of the interior cooperate with the valve and valve seat. The lower exterior of the actuator member has a slotted skirt thereby forming a plurality of thin resilient fingers **90** circumferentially spaced about the skirt, being separated by slots **92**. The fingers **90** are relatively thin in their radial direction, and, with the slots **92**, are so dimensioned and spaced as to align with the crimps **42** formed in the boss **32** as previously explained. Each finger has an inwardly extending enlarged part or toe **94** so that when the actuator member **76** is introduced to engage upon

the boss 32, the fingers 90 will spread because of the toes 94 riding upon the larger diameter portion of the boss, and as the actuator member is pressed downward to assemble the same to the boss, the toes 94 will all snap into their respective crimps 42 providing the relative association shown in FIG. 2. The usual number of crimps 42 provided in a conventional boss by present crimping machinery is eight, and in such case there will be a total of eight fingers 90 suitably dimensioned to align with the crimps. In FIG. 2, it will be seen that the toes 94 are engaged in the upper ends of the crimps 42, this being their disposition during the normal closed condition of the valve mechanism, but the vertical length of the crimps 42 related to the vertical dimension of the toes and the related overall dimensions of the actuator member 76 leave sufficient room for limited vertical movement of the actuator member 76 without having the toes 94 come out of the crimps. In FIG. 7, for example, it will be obvious that the actuator member has moved downward somewhat and that the toes 94 have accordingly moved to lower positions in their respective crimps 42. It will be obvious that the actuator member 76 is fixed against rotation relative to the boss 32 unless one attempts forcibly to cause such movement against the resilience of the fingers 90 and their engagement with the crimps.

On its interior, as previously explained, the body 80 of the actuator member 76 has an annular skirt 74 whose lower end is chamfered on its outside so that the skirt thins to a tapered edge 72. The interior of the skirt 74 has a diameter which is substantially greater than the diameter of the head 56 thereby providing an annular clearance chamber 96 between the head 56 and the skirt 74. The clearance chamber 96 has its upper end connecting with a conical chamber 98 that connects with the bottom end of the expansion chamber 86. Grooves 100 are provided in the wall that forms the conical chamber 98 so that when the upper conical crown 102 of the head 56 engages against such wall, passage for pressurized product will still be available from the clearance chamber 96 to the expansion chamber 86. These grooves may be of such number and cross-sectional dimensions as to provide metering for pressurized product in lieu of the metering built into the expansion chamber 86. Metering in the grooves 100 is of value in such case that one is assured that the dimensions and construction of the valve mechanism will provide little or no flow into the clearance chamber unless the crown 102 is engaged fully within the conical chamber 98 closing same off but for the grooves 100. This condition is shown in FIG. 7.

The normal operation of the valve assembly 20 is best seen by reference to FIGS. 2 and 7. From FIG. 2 it is seen that no pressurized product can emerge from the pressurized package. The thin edge 72 of the skirt 74 aids the valve seat 54 in holding the diaphragm 44 in the position shown. When it is desired to dispense the product, however, the user applies a finger to the finger rest 82 and pushes the entire actuator down. The bottom edge 72 of the skirt 74 clears the edge of the opening 36 and engages the top of the diaphragm 44. This downward pressure on the diaphragm 44 causes it to invaginate downward, as shown in FIG. 7, its normally smaller passageway 78 opening to a greater extent. This invagination is inward of the package 10. Pressurized product now rises in the dip tube 48 and follows the arrows shown in FIG. 7 into the opening 78, past the head 56, into the grooves 100, the expansion chamber 86 and out to the atmosphere by way of the passageway 88 and the external metering orifice 84. Note that the toes 94 of the fingers 90 have moved to the bottom of the crimps 42.

In the event that the pressurized package 10 is subjected to unusual heat and generates a pressure on its interior which is substantially greater than normal, but nevertheless substantially less than would cause the canister 12 to explode, the pressure of the pressurized product and propellant first forces the diaphragm to invaginate upward as shown in FIG. 9. This invagination is outward of the package 10. The invaginated mouth of the resulting formation enters the clearance chamber 96 exerting considerable upward force on the skirt 74 and causing the toes 94 of the fingers 90 to ride up and out of the crimps 42, spreading the fingers 90 because of their resilience. The internal pressure blows off the actuator member 76 under such circumstances, and with it all of the pressurized product will escape, usually into an overcap that is engaged over the entire top of the package 10, as common with such packages. This overcap (not shown) will normally be engaged upon the shoulder 16. Even if there is no overcap and/or if the pressurized product escapes into the area adjacent the package, it will emerge under much lower pressures than if the package exploded. It thus prevents ignition of the solvents which may be carried by the pressurized product providing a great margin of safety to lives and property than prior valves.

In filling the package 10, the product without propellant is run into the canister 12 after which the valve assembly is installed by crimping the cover member 22 into the opening 20 of the canister. The actuator member 76 may be in place at this time. Thereafter, an adapter of known construction may be introduced over the assembly and down into the well 24 and the gassing accomplished through the slots 92. The propellant will pass the tapered edge 72 and invaginate the diaphragm 44 downward to enter the canister.

In the construction of the valve assembly 20, in order to have the safety feature be reliable, one must design the structure to cause a certain internal pressure to force the diaphragm 44 to invaginate outwardly against the resistance of the actuator member in its engagement with the boss 32. Accordingly, the first factor to consider is the flexiblity of the diaphragm and its dimensions. Normally the diaphragm can be made of some elastomer capable of stretching somewhat to enable the invagination to occur. Synthetic resins of some kind have elastomeric properties, hence elastomer will include both. It must not be too thick so that it may enter the clearance chamber 96. The dimensions of the head 56 and the skirt 74 and its edge 72 should be such as to provide a clearance chamber which will accommodate the outwardly invaginated portion of the diaphragm 44 which is seen in FIG. 9. The thickness of the fingers 90 and the dimensions of the toes or enlarged portions 94 will determine the resistance to unseating from the crimps. All factors must be considered. In the structure illustrated, it should be noted that the valve seat 54 is tapered. This provided a good seating for the diaphragm 44, but additionally, it provides a surface which will enable the invagination of FIG. 9 to occur without obstruction. The edge of opening 78 will slide off the valve seat 54 without catching on the edge of the head 56.

Normal pressures on the interior of a pressurized package are in the neighborhood of about 40 pounds per square inch, this being approximately three atmospheres. Temperatures up to about 140°F. will cause the propellants in most packages to increase in pressure to about 150 pounds per square inch, or roughly ten atmospheres. This pressure can be contained by practically all commercial packages at this time. At temperatures above that value, the internal pressure becomes dangerous, probably rupturing the package at about 200 pounds per square inch of internal pressure. The safety feature of the invention could best be brought into play at some pressure between the value which can usually be contained and that which is likely to cause rupture. Such pressure could be of the order of 175 pounds per square inch.

Inasmuch as materials used vary, the blow-off of the actuator member will have to be adjusted by experiment, but such experimenting is well within the ability and knowledge of those skilled in this art.

Variations can 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 an aerosol package, comprising

A. a cover member adapted to be installed in said package and having a central upstanding boss, a plurality of vertically elongate circumferentially arranged indentations in the exterior of the boss, the boss having an upper wall and a central opening in the wall,

B. a hollow housing connected to said boss on the interior thereof and having a bore coaxial with the said central opening in the boss and means in the bore for communication with the interior of the package,

C. a post mounted in the bore between the ends thereof and extending upward to the upper end of the housing and having a head with a downward facing valve seat on the head, the post mounting being provided with means permitting flow of pressurized product through said bore,

D. an elastomeric diaphragm having a central perforation extending across the upper end of the housing with the post extending through the perforation, said diaphragm being held around its edges between the housing and the upper wall of the boss with the central portion of its upper surface around the central perforation engaged against the valve seat and adapted to press against said valve seat in a closed valve relationship due to internal pressure of pressurized product in the bore against the bottom surface of the diaphragm,

E. an actuator member engaged over the exterior of the boss and adapted to be pressed downward to invaginate the central portion of the diaphragm that is engaged against the valve seat inward of the package to permit pressurized product to move upward past the valve seat, said actuator member comprising a plurality of exterior resilient fingers having enlarged bottom ends engaged in said indentations for limited vertically reciprocable movement while so engaged, an exterior orifice in said actuator member, an interior depending annular skirt having its lower edge coaxial with the opening in the boss and clearing the same, said lower edge being in engagement with the upper surface of the diaphragm but spaced from said head to provide an annular clearance chamber between the skirt and head during normal use of the valve structure, internal passageways between the clearance chamber and the external orifice including a vertical expansion chamber whereby any pressurized product entering the clearance chamber will pass through said internal passageways and emerge from said external orifice, downward pressure upon the actuator member serving to move the skirt edge against the upper surface of the diaphragm causing same to invaginate downward in an open valve relationship with the valve seat releasing pressurized product from said bore, release of said actuator member enabling internal pressure to return the invaginated portion of the diaphragm to its closed valve relationship and to stop the flow of pressurized product thereby raising the actuator member, and

abnormal internal pressure of the package short of explosion pressure forcing the central portion of the diaphragm to invaginate upward and outward of the package into the clearance chamber and forcing the actuator member to move off the boss because of its said fingers being forced out of said indentations enabling the contents of the aerosol package to be expelled by way of said clearance chamber.

2. The valve structure as claimed in claim 1 in which the valve seat is beveled.

3. The valve structure as claimed in claim 1 in which the post mounting comprises a plug in said bore having passageways through the same and the post connected therewith.

4. The valve structure as claimed in claim 1 in which said expansion chamber provides internal metering.

5. The valve structure as claimed in claim 4 in which said expansion chamber is blade-shaped in cross section.

6. The valve structure as claimed in claim 1 in which said internal passageways include a wall forming a connecting chamber between the expansion chamber and the clearance chamber, the configuration of said connecting chamber and the upper configuration of said head being complementary, the said wall forming the connecting chamber being spaced from said head a distance accommodating the vertical movement of said actuator member in normal operation whereby the head will come into engagement with the wall to limit downward movement of said actuator member during normal use, there being grooves in one of said head and wall to enable passage of pressurized product when so engaged.

7. The valve structure as claimed in claim 6 in which the grooves are in said wall forming the connecting chamber.

8. The valve structure as claimed in claim 6 in which said configuration is conical.

9. The valve structure as claimed in claim 6 in which said grooves provide internal metering.

10. The valve structure as claimed in claim 1 in which said lower edge of said skirt is tapered and said fingers are spaced apart whereby to permit gassing of said aerosol package while the actuator member is in normal position, the taper being on the exterior of said skirt to permit passage of gassing materials between

said skirt and said opening in the upper wall of the boss to invaginate the central portion of the diaphragm downward and inward of the package to admit said gassing materials to said bore.

11. The valve structure as claimed in claim **1** in which said indentations comprise crimps and said housing has an upper flange, said crimps engaging beneath the flange on the interior of said boss and clamping said flange to the underside of said upper boss wall with the edges of said diaphragm sandwiched between the flange and boss wall.

12. In a valve structure of the type in which there is a valve assembly adapted to be connected to the open top of a container which is adapted to be filled with pressurized product, said assembly including an actuator member which is pressed downward by the user from a normal nondispensing position to a lower dispensing position to dispense pressurized product through an external orifice in the actuator and released by such user when it is desired to halt the dispensing whereupon the actuator member moves upward to said nondispensing position, in which the valve assembly includes a cover member and a hollow coupling mounted to the cover member and providing a conduit from the interior of the container to the exterior of the cover member, in which there is a valve seat connected to the coupling and a flexible diaphragm type valve engaged with the valve seat, the valve being mounted to the cover member, the actuator having internal passageways leading to said external orifice and having a valve-actuating extension adapted to push the valve off the seat when the actuator member is moved downward to said dispensing position and said extension having a structure guiding pressurized product emerging past the valve seat to the said internal passageways, said extension adapted to be returned to a relation with respect to the valve permitting reseating of the valve when the actuator member is returned to said nondispensing position, said cover member and actuator member having cooperating means limiting normal movement of said actuator member between said dispensing and nondispensing positions, the invention herein which comprises:

said valve having a central perforation and the portion around the perforation being engaged with said valve seat, the valve being disposed between said coupling and valve seat such that engagement between said valve and valve seat is effected by pressure from the bottom of the valve upward, said extension being engaged to the upper surface of the valve spaced from the valve seat, whereby during dispensing movement the extension presses the valve downward invaginating said portion off said seat and during return movement the pressure on the bottom of the valve raises the actuator member to nondispensing position and wherein said valve is capable of invaginating upward by abnormal pressure in the container and moving into the space between the extension and valve seat thereby forcing the actuator member out of engagement with the cover member and permitting expelling of the pressurized product from said containter.

13. The invention as claimed in claim **12** in which the cover member includes a central upstanding boss and the coupling and valve are mounted on the interior of the boss and in which the cooperating means comprise a plurality of vertically oriented indentations on the exterior of the boss and a plurality of resilient fingers on the actuator member engaged in said respective indentations and thereby enabling the actuator member to move up and down while the fingers slide in the indentations.

14. The invention as claimed in claim **12** in which the cover member includes a central upstanding boss having a central opening in the upper wall thereof, the coupling being secured to the interior of the boss and engaged against the inside of the upper wall with the valve clamped around its edges to the upper wall by the coupling and having its center portion extending across said opening and in which mounting means for said valve seat is secured on the interior of the coupling and extends through the perforation of the valve and said central opening with the seat above the valve.

15. The invention as claimed in claim **12,** in which the cover member includes a central upstanding boss and the coupling and valve are mounted on the interior of the boss and in which the cooperating means comprise a plurality of vertically oriented indentations on the exterior of the boss and a plurality of resilient fingers on the actuator member engaged in said respective indentations and thereby enabling the actuator member to move up and down while the fingers slide in the indentations during normal use of the valve structure, but the fingers capable of being forced out of the indentations when said abnormal pressure occurs.

16. The invention as claimed in claim **12** in which there is a head having the valve seat on the bottom thereof and said internal passageways include a wall forming a chamber complementary in configuration to the head, the head adapted to move into said chamber when the actuator member is pressed downward whereby engagement of said head with the wall will limit the downward movement.

17. The invention as claimed in claim **16,** in which there are grooves in one of the chamber-forming wall and the head to enable pressurized product to pass while the head and wall are in engagement.

18. The invention as claimed in claim **17,** in which the grooves are metering grooves.

19. The invention as claimed in claim **15,** in which the internal passageways include a vertical expansion chamber, there is a head having the valve seat on the bottom thereof and said internal passageways include a wall forming an annular chamber connecting the space between the valve seat and extension with said expansion chamber, said annular chamber being complementary in configuration to said head and the head adapted to move into said chamber when the actuator member is pressed downward whereby engagement of the head with said wall will limit such downward movement, there being means to permit flow of pressurized product through said annular chamber while said head is so engaged.

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