March 28, 1967 E. H. GREEN 3,311,274

VALVE HOUSING AND DIP TUBE ASSEMBLY

Filed Oct. 20, 1965 2 Sheets-Sheet 1

Fig. 2

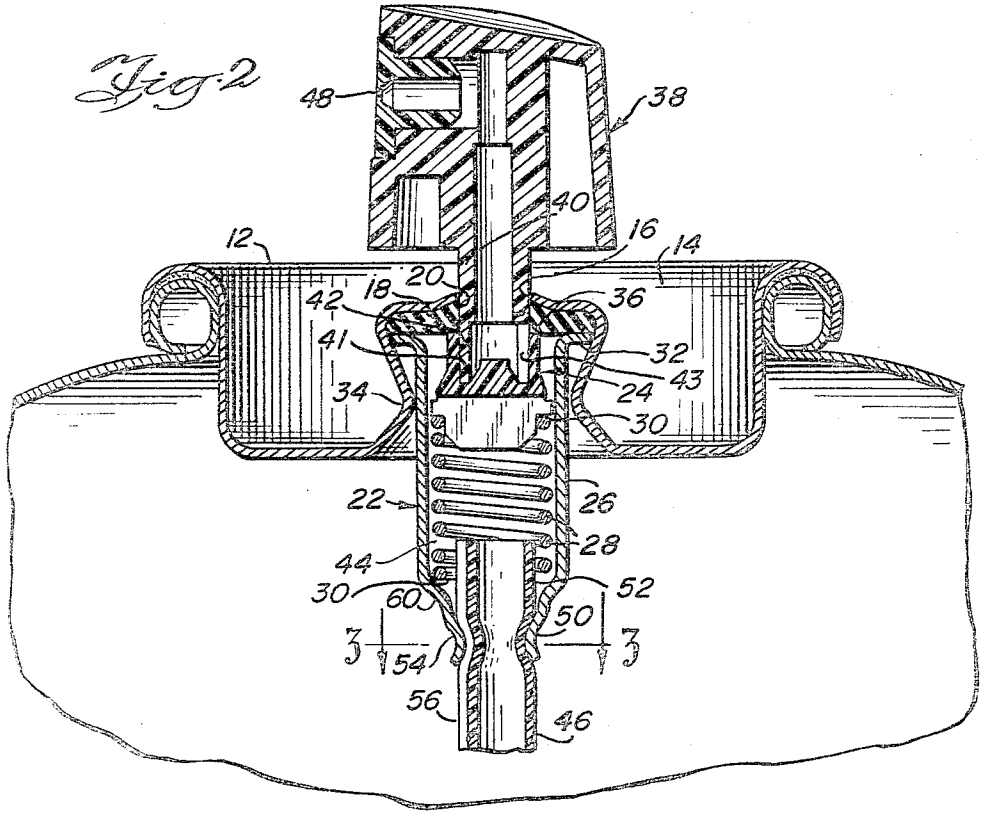


Fig. 3

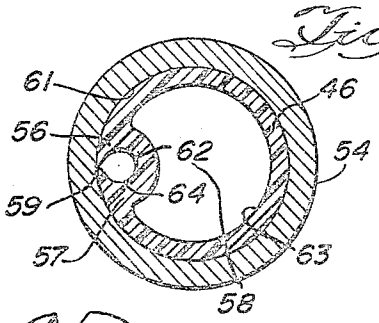
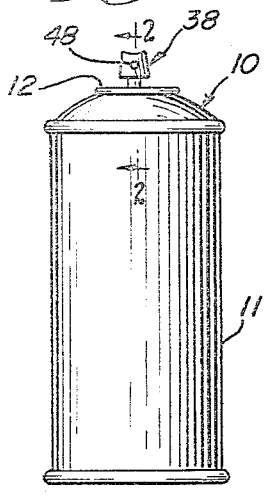


Fig. 1



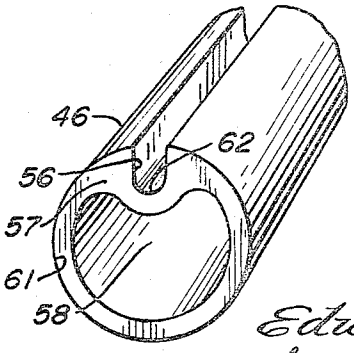


Fig. 4

INVENTOR

Edward H. Green

BY Sherman & Cass

ATTORNEYS

March 28, 1967 E. H. GREEN 3,311,274

VALVE HOUSING AND DIP TUBE ASSEMBLY

Filed Oct. 20, 1965 2 Sheets-Sheet 2

Fig. 5

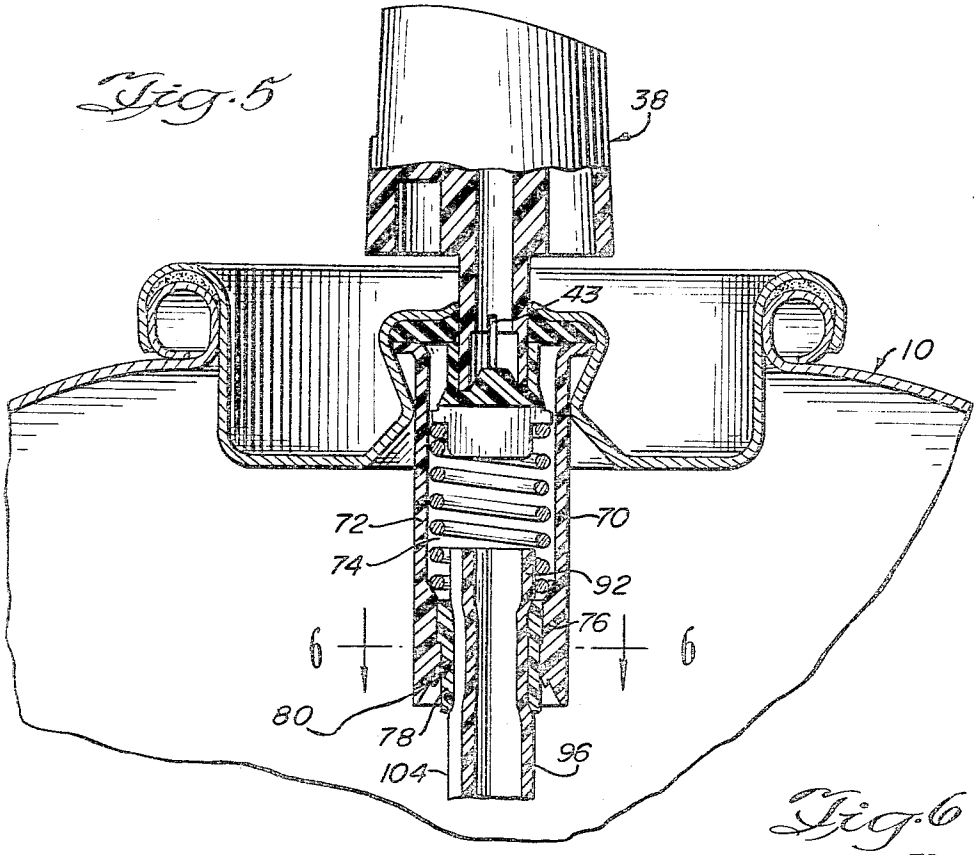


Fig. 6

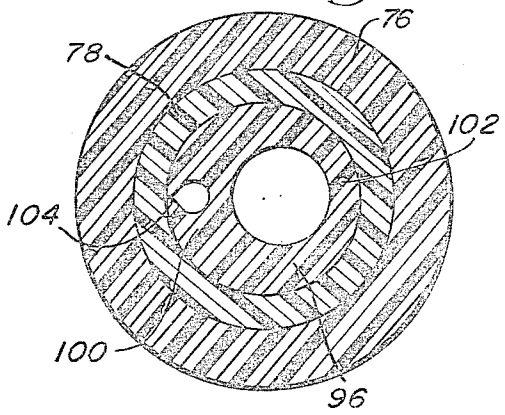
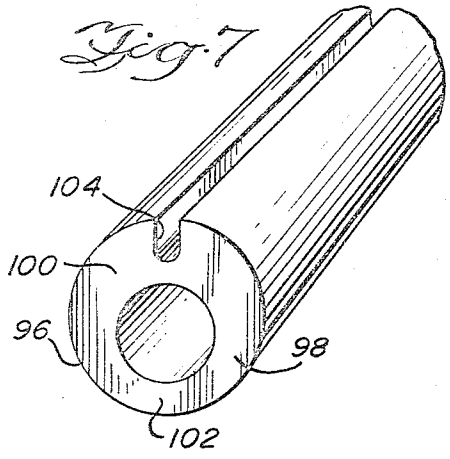


Fig. 7



INVENTOR
Edward H. Green

BY Silverman & Cass
ATTORNEYS

United States Patent Office 3,311,274 Patented Mar. 28, 1967

3,311,274

VALVE HOUSING AND DIP TUBE ASSEMBLY

Edward Howard Green, 11 Army Trail Road, Addison, Ill. 60101

Filed Oct. 20, 1965, Ser. No. 498,626
6 Claims. (Cl. 222—402.18)

This invention relates generally to pressurized product containers and more particularly, relates to an improved valve housing and dip tube assembly for dispensing pressurized or aerosol products from such containers.

Pressurized or aerosol products are conveniently packaged in a metal canister or glass container at the upper end of which is mounted a valve mechanism including an exposed actuator or spray head through which the pressurized product is dispensed to ambient atmosphere. Such valve mechanisms generally include a hollow housing or eyelet on the inside of the container in which a valve assembly is operable in conjunction with said spray head. To the bottom end of the housing is attached an elongate dip tube which normally provides the sole connection of the housing with the canister and hence the only avenue for escape of the pressurized product from the interior of the housing. The packaged product is propelled out of the canister through the valve mechanism by means of a suitable propellant in gas or vapor phase, such as Freon, for instance. The body of propellant is located above the product in the container, but outside of the housing, so that normally, there will be a quantity of the pressurized product in the dip tube at a level approximately the same as the level of said product in the container outside of the housing at the time of filling of the container. The remainder of the space in the dip tube and housing immediately after filling also contains propellant. If the valve mecahnism was sealed perfectly in its normally closed condition and there was no leakage of the pressurized product or propellant to ambient atmosphere through other parts of the container, there would be no concern with shelf life of the pressurized product package.

As a practical matter, however, there are shelf life problems with pressurized product containers. One of the reasons for this is the nature of the gasket material used. In practically all valve mechanisms for pressurized product package, a rubber-like sealing gasket is used which in some measure is not entirely resistant to the gas propellant or the solvents used with pressurized materials so that some leakage around the gasket area is encountered. Consequently, the aerosol packaging industry has established a product standard which permits leakage through the gasket at a rate of approximately two grams per year. All commercially available valving mechanisms for pressurized product packages permit some gasket leakage, the best structures possibly passing material at the rate of at least one gram per year, this material being practically all gaseous or volatile.

When it is realized that pressurized product packages of such heavy materials as paints, for instance, usually have a shelf life of approximately one year or slightly more, even under such industry standards, additional phenomena is manifest. During leakage through the rubber gasket, the gaseous and other volatile ingredients, such as the solvents and propellant, will pass through gaskets easily. However, the solid particles, such as paint pigments and oils and carriers will not pass so that after a sufficient length of time, the solvent and propellant in the dip tube and housing will leak off. Solids and suspension materials will then load or fill the dip tube and the interior chamber of the valve housing or eyelet, forming a viscous, concentrated and often solid mass which resists being discharged from the container when the valve mechanism is opened. This can prevent operation

of the valve mechanisms by freezing springs and other movable parts or clogging internal valve passageways or openings. Under other circumstances, the valve mechanism may remain operable but such operation will not be reliable.

In anticipation of alleviating the adverse effects of this phenomena, it has been known to supply a second connection between the valve housing or eyelet and the interior of the container so that a vapor phase of propellant could be maintained positively in the valve housing. Where the valve housing was formed of metal, in many types of packages it was known to drill a hole in the housing of the order of 0.020 inch in diameter spaced a short distance above the juncture of the dip tube with the valve housing. Recognizably, the diameter of this drilled hole was considerably smaller than the inside diameter of the dip tube so that when the valve mechanism was opened, the pressurized material was moved preferentially up the dip tube into the valve housing for subsequent dispensing thereof. However, the drilled hole did permit propellant to pass therethrough into the valve housing for carburetion, i.e., aiding in atomization. More important, during standing periods of the package on the shelf, leakage past the gasket and valve parts on the interior of the valve housing caused additional propellant to be drawn into the valve housing through said drilled opening so that there was always propellant in the housing, and the pressurized material was not drawn up the dip tube into the valve housing. Since the propellant preferably leaked, the solvents in the product remained so that settling out or separation of the solid ingredients from the pressurized fluid product was prevented. Accumulation of viscous masses in the housing was avoided and the product remained liquid, ready for spraying at all times. The cross-sectional area of such a hole dictates that it be drilled using special techniques and fixtures so that the cost of drilling one is estimated to be very substantial. Consequently, it is a common commercial practice to avoid using such holes, if possible.

This problem also arises in connection with valving mechanisms using plastic valve housings which cannot easily and economically be drilled either, and I have, in part, considered alleviation of the problem in my U.S. Patent No. 3,159,318 issued Dec. 1, 1964 for "Aerosol Valve Housing Construction and Method of Making Same." There is disclosed in said patent an aerosol valve housing preferably molded from a suitable plastic which utilizes a unique plastic clamping sleeve or collar arrangement for attaching the dip tube to the valve housing. One of the features of this arrangement was the inclusion of a second conduit connection between the interior of the valve housing and container by means of an axially extending groove on the exterior surface of the clamping sleeve or collar which remained open after the dip tube was attached by means of said collar or sleeve. Notably, however, said clamping sleeve arrangement was relegated to use with plastic valve housings. Even such an arrangement was not completely fool-proof because of cold flow of the plastic. In any event molds to accomplish this would be expensive.

Therefore, it is a primary object of the invention to provide a novel valve housing and dip tube assembly which will automatically provide a by-pass or second conduit connection of the character described having equal advantage both with plastic molded and sheet metal valve housings.

An important object of the invention is to provide a novel valve housing and dip tube assembly of the character described which will obviate the need for drilling of special holes in sheet metal valve housings for the general purposes heretofore discussed.

An important object of the invention is to provide an

assembly of the character described which does not require modification in the manufacture of component parts of existing valve mechanisms but which enables the advantages of the invention to be realized by only relatively minor modification in the manner of manufacturing the dip tube of the assembly.

Another object of the invention is to provide an assembly of the character described in which said dip tube is provided with an axially extending groove in a circumferential wall thereof which positively will remain open through the juncture of the dip tube with the valve housing without interfering in any way with the assembly of the tube to the housing, or adversely affecting the juncture in any way.

Still a further object of the invention is to provide a novel valve housing and dip tube assembly of the character described wherein the dip tube has means to assure that an axially extending passageway on the exterior circumferential surface thereof will remain free and clear to allow the passage of a pressurized mixture therethrough despite the relatively small thickness of the cylindrical wall of the dip tube and the constriction around the said tube in order positively to secure the same to the valve housing.

The foregoing and other advantages of the invention will become apparent from the disclosure which ensues, the embodiment of the invention being described in detail in consort with the accompanying drawings showing both sheet metal and plastic molded valve housings. It is contemplated, however, that the invention is not necessarily limited to the structural embodiments employed herein as to form, arrangement and construction of the component parts thereof.

In the drawings:

FIG. 1 is a perspective view of a pressurized product containing having the valve housing and dip tube assembly embodying the invention installed therein, said valve housing being of sheet metal.

FIG. 2 is an enlarged fragmentary sectional view taken through the container along the line 2—2 of FIG. 1 and in the direction indicated generally.

FIG. 3 is a sectional view taken through the juncture of the valve housing and dip tube embodying the invention along the line 3—3 of FIG. 2 and in the direction indicated generally.

FIG. 4 is a perspective view of a section of tubing from which the dip tube embodying the invention shown in FIG. 3 is obtained.

FIG. 5 is an enlarged fragmentary sectional view similar to the view of FIG. 2 but employing a valve housing of molded plastic material.

FIG. 6 is a sectional view taken through the juncture of the valve housing and dip tube embodying the invention along the line 6—6 of FIG. 5 and in the direction indicated generally.

FIG. 7 is a perspective view of a section of tubing from which the dip tube embodying the invention shown in FIG. 6 is obtained.

Generally, the invention resides in providing a most reliable juncture between the open bottom end of the valve housing or eyelet and the upper end of the dip tube and which will include a novel conduit connection or by-pass between the interior of the housing and the pressurized container notwithstanding the constrictive nature of said juncture. This connection or by-pass extends through said juncture along the circumference and in the direction of the longitudinal axis of the valve housing and dip tube. This obtains both in the case of sheet metal and molded plastic housings and in either type of valve housing, drilling or otherwise forming special holes or openings in the circumferential wall of the valve housing is avoided.

Referring now to the drawings, the reference character 10 in FIG. 1 identifies a representative pressurized or aerosol product container; the form dimensions and material from which same is made is capable of being varied without limiting the principles of the invention. As illustrated, container 10 includes a sheet metal cylindrical body 11 capped at the top end thereof by the cover 12, also shown as formed of metal. As best seen in FIG. 2, the cover 12 has been stamped and shaped to provide a central, annular boss 14 having a coaxial opening 16 therethrough. The circular gasket 18 having a central opening 20 is clamped inside the boss 14 with the openings 20 and 16 coaxially in registry. Inside the container body 11 is a valve structure designated generally 22. In the illustrated embodiment, the valve structure 22 includes a valve plunger generally shown at 24, reciprocal vertically within the valve housing 26 and parallel with the longitudinal axis of said housing. The valve plunger 24 normally is biased upwardly by means of a coil spring 28 engaged at its ends respectively with a seat 30 provided on bottom end of the plunger 24 and the valve housing on the interior thereof. The upper end 32 of the valve housing is outwardly flanged to engage against the gasket 18 and the valve housing is secured to the interior of the boss 14 by crimping 34 of the cover in a conventional manner.

The valve plunger 24 has its upper end face 36 seated against the bottom face of the gasket 18 about the opening 20 in valve seating engagement therewith and normally is held in this position by the spring 28. To move the plunger 24 linearly inside the housing 26, there is employed an actuator or spray head designated generally 38 having a hollow depending stem 40 which is slidingly and yet sealingly engaged through the aligned openings 16 and 20. The bottom end 41 of the stem 40 is received in socket 42 which opens to the upper end face 36 of plunger 24 for actuating said valve plunger. Said end 41 is provided with an axially extending slot 43 which is open clear through the wall of the stem and which reaches into the gasket opening 20 a short distance in the closed or seated position of the valve plunger. When actuator or spray head 38 is depressed, the valve plunger 24 is unseated from bottom face of the gasket 18 to allow pressurized product to enter the interior chamber 44 of the housing 26 by way of the dip tube 46. This product enters the dip tube 46 from the bottom of the container because of the internal pressure and thereafter, passes through the housing 26, past the seat 30, past the upper end of the plunger 24 into the slot 43 and up the hollow stem 40 to be dispensed through the external orifice 48 in the spray head.

The operation of the valve as described generally is well known. Accordingly, as will become apparent, modified constructions of an operating valve can be employed in the container 10 for use with the invention with equal advantage.

The valve housing or eyelet 26 is shown as a conventional sheet metal hollow body but the dip tube 46 joined thereto is not conventional. The housing 26 has a reduced diameter open bottom end portion 50 which is cylindrical in configuration prior to securing the upper end 52 of the dip tube 46 thereto. Initially then, the internal diameter of said portion 50 is greater than the outside diameter of the dip tube 46 so that the upper end 52 may be inserted readily into said open bottom end portion and a sufficient distance so as to extend axially between the convolutions of the adjacent seated end of spring 28. Then the end 50 is crimped severely adjacent the extremity thereof, as indicated at 54, to constrict the end portion 50 around the dip tube. The resulting constriction 54 is circular and the dip tube is compressed thereat a substantial amount as seen from a visual comparison of the interior diameter of the tube 46 at said constricted portion 54 with that of said tube outside of the housing. Actually, the juncture at 54 is a very tight one which is intended to hold the dip tube and housing portion 50 in an otherwise sealed juncture thereat.

However, in accordance with the invention, said dip

tube has an axially extending exterior groove **56** in the circumferential wall thereof. As seen in FIG. 4, the groove **56** is in the form of a trough or keyway of generally rectangualr cross-section with one end thereof opening to the exterior circumference of the tube wall. The groove **56** is located in an enlarged or thickened formation **57** which can be formed during extrusion of the dip tube. The formation **57** protrudes into the bore **58** of the tube so that the groove **56** can be deeper than the thickness of the remainder of the circumferential wall **46**. This is illustrated by the lower end or root of the groove extending inwardly of the inner circumferential surface **63** of the tube. In extruding the tube, the groove **56** can be formed concurrently with the thickened formation **57**. At the constriction **54**, the open end of said groove **56** is crimped closed due to the constrictive force exerted by the end portion **50** of the valve housing. As indicated in FIG. 3 the thickened portion **57** with the deep groove **56** assures that there will be a by-pass conduit when the tube is clamped to the housing. Since the diameter of the tube is reduced considerably by the constriction thereof at the juncture **54**, the deep groove will close at the marginal edges **59** thereof adjacent the circumference **61** but a portion **62** will remain open to provide the axially extending passageway **64** along the length of the tube and through the juncture **54**. Consequently, the groove **56** serves as a conduit connection between the container and the chamber **44** in the housing other than through the interior of the dip tube. The tight conduit connection at **54** obviates the need for drilling an opening in the housing wall in the vicinity of reference character **60**, as heretofore practiced in the art.

Although passageway **64** has been illustrated as being generally circular in cross-section, the passageway can assume other configurations with equal effectiveness.

Referring to FIG. 5, there is partially illustrated a pressurized container **10** mounting a valve assembly for dispensing the aerosol product. Those parts of the valve assembly of FIG. 5 which are identical or substantially similar to corresponding parts of the valve assembly of FIG. 2 are identified by the same reference characters and hence, a specific description of such parts will be unnecessary. The principal difference resides in the valve housing designated **70**. Housing **70** is a molded plastic hollow body having a cylindrical portion **72** which provides the internal mixing chamber **74** and the thickened cylindrical open bottom end portion **76**. The upper end **92** of the dip tube **96** is rigidly clamped in the interior of the bottom end portion **76** by the clamping sleeve or collar **78**. Generally, the clamping sleeve **78** and its function to retain the dip tube **96** secured to the housing **70** is similar to that of the clamping sleeve disclosed in my Patent No. 3,159,318. The juncture of the end **92** of the dip tube and the housing **70** is identified generally at **80** and can extend the full axial length of the clamping sleeve **78**.

The tube **96** is a modified form of that shown in FIG. 2. As seen in FIG. 7, the dip tube **96** has a circumferential wall **98** of non-uniform thickness. Thus, there is a side wall portion **100** which is thicker in dimension than the thickness of the side wall portion **102** diametrically opposite thereto. The thickened wall portion **100** extends the entire length of the dip tube. The groove **104** is generally of the same rectangular configuration as that of groove **56** shown in FIG. 4, and is positioned along the exterior circumference of the thickened wall portion **100** of the tube. The open end of groove **104** is crimped into a closed configuration by the clamping sleeve **78**, but a portion of the groove still remains open to allow passage of a pressurized mixture therethrough. The depth of groove **104** is longer than the thickness of wall portion **102**. Thus, as a pressurized mixture passes up the tube **96** into the chamber **74** subsequently to be dispensed from the spray head **38**, a vapor phase is introduced into the chamber **74** above said juncture **80**. This

vapor phase moves through the open portion of the groove **104** from the container into said chamber **74**. The crimping of the tube **96** by the clamping sleeve **78** is illustrated by closed external edges of the groove in FIG. 6.

It is to be understood that either form of the dip tube, i.e., tube **46** shown in FIG. 4 or tube **96** shown in FIG. 7, is suitable for use with either a valve housing constructed of metal or of molded plastic, and that the particular combinations described herein are for the purposes of illustration only.

In its broad context, the invention enables the specified by-pass or conduit connection with the interior of a valve housing to be obtained automatically by attaching the dip tube to a valve housing of known construction. Where the dip tube is used with eyelets or valve housing, the special drilling of by-pass or relief holes in the housing is obviated. The desired conduit connection is realized automatically by merely securing the dip tube to the bottom open end of the housing. Further, there is no necessity of modifying any of the procedures for assembling valve parts hereto used.

What it is desired to secure by Letters Patent is:

1. An aerosol dispenser valve construction which includes a hollow valve housing having an internal chamber and a valve assembly reciprocal in said chamber along the longitudinal axis of said housing, said valve housing having a coaxial entrance at the lower end thereof and a dip tube secured to said entrance in an otherwise sealed juncture therewith with the bore of the tube communicating with said internal chamber through said entrance, said tube and lower end of the housing having mating surface portions defining a conduit exterior of the bore of said tube enclosed on all sides thereof through said juncture into said chamber from exterior of said housing, said conduit extending in the same general direction as the axis of said housing and comprising a longitudinally extending groove in a circumferential surface of the tube closed at said surface and said conduit being inwardly spaced from said mating surface portions.

2. A construction as claimed in claim **1** in which said tube has a thicker wall portion and said groove is provided in said portion.

3. A construction as claimed in claim **1** in which the length of said groove is greater than the wall thickness of said tube.

4. An aerosol dispenser valve construction which includes a hollow valve housing having an internal chamber and a valve assembly reciprocal in said chamber along the longitudinal axis of said housing, said valve housing having a coaxial entrance at the lower end thereof and a dip tube secured to said entrance in an otherwise sealed juncture therewith with the bore of the tube communicating with said internal chamber through said entrance, said tube having a thickened wall portion extending along the length thereof, said tube having an axially extending groove on the exterior surface of the thickened wall portion thereof, the depth of said groove being greater than the wall thickness of the said tube, said lower end of the housing and dip tube being constrictively engaged to close said groove, albeit provided said conduit spaced inwardly of said exterior surface of the tube.

5. A construction as claimed in claim **5** in which the open portion of the said groove is generally circular in cross-section.

6. A construction according to claim **4** in which said wall portion extends into the bore of said tube.

References Cited by the Examiner

UNITED STATES PATENTS

3,155,290	11/1964	Venus	239—337 X
3,225,969	12/1965	O'Donnell	222—394

ROBERT B. REEVES, *Primary Examiner.*

H. S. LANE, *Assistant Examiner.*