Feb. 27, 1973 G. GROTHOFF 3,718,165

REFILLABLE AEROSOL DISPENSER

Filed Dec. 8, 1970

FIG. 1

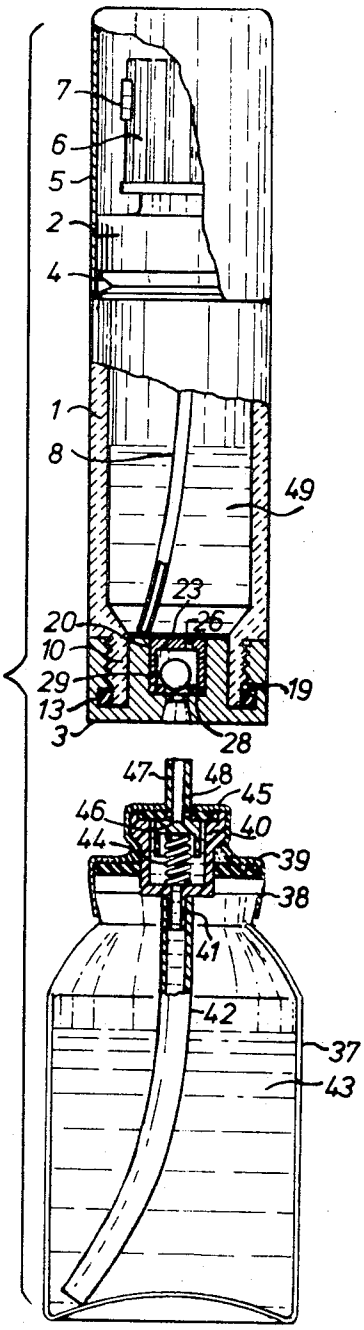


FIG. 2

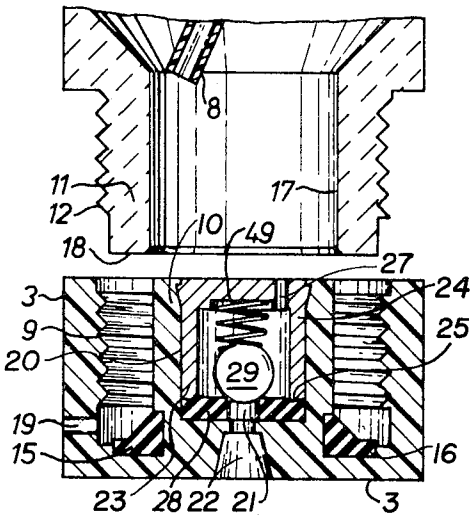
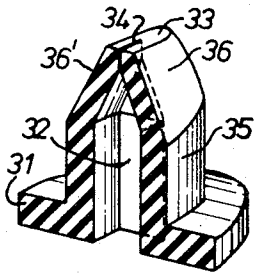


FIG. 3



United States Patent Office 3,718,165
Patented Feb. 27, 1973

3,718,165

REFILLABLE AEROSOL DISPENSER

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Filed Dec. 8, 1970, Ser. No. 97,474
Claims priority, application Germany, Dec. 8, 1969, P 19 61 486.9
Int. Cl. B65b *1/04, 3/04*
U.S. Cl. 141—20 11 Claims

ABSTRACT OF THE DISCLOSURE

A refillable aerosol dispenser comprises a container for a mixture of liquid and a gaseous propellant for dispensing the same. The container has an upper wall and a bottom wall. A dispensing valve is provided in the upper wall for dispensing the mixture when operated, and a separate inlet valve is provided in the bottom wall and operates independently of the dispensing valve for admitting gaseous propellant into the container.

BACKGROUND OF THE INVENTION

The present invention relates generally to aerosol dispensers, and more particularly to refillable aerosol dispensers.

It is already known to provide refillable aerosol dispensers, where the liquid to be dispensed can be refilled when the previous contents are exhausted, and is then pressurized by admitting a gaseous propellant into the container. Conventionally this is done by providing the container with an inlet for the liquid, and when the liquid has been filled into the container and the inlet closed, the spray head of the dispensing valve is removed and the outlet passage of the dispensing valve is brought into communication with the outlet of an aerosol refilling package which contains nothing but pressurized gaseous propellant and from which a requisite quantity of this propellant is admitted via the dispensing valve of the container, into the latter, in order to pressurize the newly-introduced liquid therein. In order to obtain proper sealing between the valve of the aerosol refilling container, and the aerosol dispenser, it is necessary that these valves be precisely positioned with reference to one another. Such positioning is also necessary in order to obtain proper operation of the two valves when the transfer of gaseous propellant into the aerosol dispenser is to take place.

This known approach has certain disadvantages which have been found objectionable. On the one hand, the dispensing valve of the refillable aerosol dispenser is required to perform a dual function, namely to act as a dispensing valve for the mixture as well as to act as an inlet valve for the aerosol charge which pressurizes newly-introduced liquid. That being the case, the dispensing valve obviously cannot be of the type which permits metered dispensing of the container contents, that is dispensing of a predetermined quantity of the mixture whenever the valve is actuated for dispensing purposes. This of course is disadvantageous because, especially where perfumes and similar substances are concerned, a quantity of approximately 30–50 mg. is considered the optimum quantity but cannot be precisely dispensed with the type of valve which does not meter the dispensed

quantity. If the valve is of the type which must be used in accordance with the above-mentioned considerations, that is the type which does not meter the quantity dispensed, then the metering depends upon the period of time for which the user opens the valve. This, however, makes it impossible for the user to dispense quantities as small as 30–50 mg. of mixture because to dispense such a quantity the valve must not be opened for a period longer than at most $\frac{1}{10}$ of 1 second.

Clearly, therefore, if a general-purpose dispensing is used in these refillable aerosol dispensers as is known from the art, more of the contents—especially perfume or the like—will be dispensed with every incident of use than is necessary. This is wasteful. Also, it substantially reduces the period of time for which the aerosol dispenser can be used without refilling.

Additional problems result from the fact that in this general-purpose dispensing valves it is necessary to withdraw the spray-head when the dispensing valve is to be used as the inlet valve for gaseous propellant. Subsequently of course the spray-head must again be put in position and it will frequently occur that the spray-head becomes improperly secured, or that the spray-head or the outlet tube of the dispensing valve become damaged. This, then makes the aerosol dispenser unusable.

Furthermore, with these known constructions it is relatively difficult to introduce a new charge of gaseous propellant into the aerosol dispenser because the dispensing valve of the aerosol dispenser, as well as the dispensing valve of the refilling container containing the gaseous a portion of which is to be transferred into the dispenser, must be opened mechanically, which requires a force of substantially eight pounds or more. In order to discharge as little of the contents as possible per unit of time, the flow through cross-sections of such valves are made as small as possible, which means that the period of time for which the valves must be maintained open during transfer of gaseous propellant from the supply package into the aerosol dispenser is relatively long because the full speed is relatively low. This, in conjunction with the rather long path which must be traversed by the incoming aerosol through the valve of the aerosol dispenser and subsequently through the riser tube therein, results in an inadequate admixing of the propellant with the liquid in the container and therefore in an improper filling of the dispenser. One difficulty in this connection is that a portion of the propellant which enters the dispensing valve of the aerosol dispenser as liquid gas, becomes transformed to gaseous state. This, aided by the increasingly smaller gas space available in the container of the aerosol dispenser as the degree to which the latter progresses, results in the development on the container of the pressure condition in excess of equilibrium pressure so that the entry of gaseous propellant from the supply package into the aerosol dispenser terminates prematurely. Particularly if the entry is rather slow, thermal energy transmitted to the container from the hands of a user may cause the internal pressure in the aerosol dispenser to exceed—due to expansion of the gas being introduced—the pressure in the supply package which may then result in a return flow of the contents of the aerosol dispenser into the supply package and contamination of the content of the latter.

It is also disadvantageous in the known constructions that the closure of the aerosol dispenser, that is the clo-

sure for the inlet opening which is provided in order to admit the liquid of the mixture to be dispensed, acts exclusively in axial direction of the inlet opening. Considering the manufacturing tolerances of the components involved, a thoroughly reliable ceiling under these circumstances is to be obtained only if a high pressure is exerted upon the sealing means provided for this purpose, which means on the other hand that the torque with which the closure for the opening must be pressed against the sealing element must be so great that particularly for feminine uses difficulties as during opening and closing of this closure. It has been proposed to provide the closure itself with external facets for engagement with a tool, such as a wrench. While this certainly facilitates turning of the closure, it brings with it the disadvantage that for opening and closing the closure the utilization of a special tool is necessary, not to mention the fact that the provision of such facets is aesthetically displeasing. Also, the exclusively axially acting sealing elements provide for a proper sealing action only within a relatively narrow range of relative displacement between the closure and the container, meaning that even if the closure performs a rather small movement out of its sealing position, the seal will be broken. The result of all this is that refillable aerosol dispensers have found little popular acceptance until now.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to overcome the disadvantages of the prior art as briefly outlined above.

More particularly it is an object of the present invention to provide an improved refillable aerosol dispenser which is not possessed of the aforementioned disadvantages.

It is an additional object of the invention to provide such an improved aerosol dispenser which makes it possible to rapidly and reliably fill the container of the dispenser with liquid to be dispensed as well as with gaseous propellant for expelling the liquid from the container.

An additional object of the invention is to provide such an improved aerosol dispenser which precludes or at least significantly reduces the possibility of damage to any constituent components including valves of the dispenser, when refilling takes place.

A concomitant object of the invention is to provide such a dispenser which can be readily constructed of commercially available components and which will have a pleasing appearance.

An additional object of the invention is to provide such a dispenser which can be utilized with a dispensing valve of the metering type, and which is inexpensive in its overall construction.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in a refillable aerosol dispenser which, briefly stated, comprises a container adapted to accommodate a mixture of liquid to be dispensed and a gaseous propellant therefor, such container having a first wall and an opposite second wall spaced from the first wall. A dispensing valve is provided in the first wall and operable for dispensing the mixture from the container. A discrete inlet valve is provided in the second wall and is operable independently of the dispensing valve for admitting gaseous propellant into the container.

It is advantageous that the first wall be the normally upper or top wall of the container, and that the second wall be the normally lower or bottom wall of the container. It is also advantageous that the inlet valve be at least substantially accommodated within the confines of second or bottom wall.

The admission of gaseous propellant into the container of my novel aerosol dispenser is made particularly simple, reliable and efficacious by constructing the discrete inlet valve in such a manner that it is a one-way valve

which will automatically open in response to a pressure differential in the direction from its inlet side—which is of course located exteriorly of the container—towards its outlet side—which is located within the container—and which will automatically close when an equilibrium condition of pressure between the inlet and outlet side is achieved to thereby prevent backflow of the contents of the container.

It is also advantageous to have the inlet end of the filling passage of the inlet valve be so constructed that it tapers conically in direction towards the outlet end, whereby a seal is obtained without the necessity for providing additional sealing elements, with the valve of the propellant supply package which valve is usually made of synthetic plastic material, such seal being reliable, not bound for its efficiency to the maintenance of specific manufacturing tolerances and being operable even if there are certain diameter variations between the outlet valve of the supply package and the passage in the inlet valve of the aerosol dispenser.

According to the invention the construction of my novel dispenser will be such that the liquefied gaseous propellant from the supply package is admitted from below in a sharp rapid stream at high flow-rate or speed, into the liquid contained in the container and subsequently to be dispensed, whereby a rapid and complete charging with gaseous propellant, and a proper admixture therewith with the liquid, is assured. This can be further advantageously influenced in that the inlet valve is so constructed that the incoming gaseous propellant will first enter into a compartment of the valve from where it will pass through one or more tangential bores into the interior of the container.

The filling opening provided in the container for admitting the liquid to be dispensed into the same, is sealed by sealing elements which act radially or both radially and axially, and which are either pretensioned or which will become tensioned when the closure for the opening is connected with the container to thereby close the opening. This provides for a particularly reliable but yet readily operable closure. According to a further concept of the invention there is provided at least one relief bore that is so arranged that when the closure is being removed from the container to expose the filling opening, any residual pressure in the interior of the container will first be relieved through this relief bore before the closure can become disconnected from the container. This is a safety factor which is not to be discounted in its importance.

It is further advantageous according to the invention to provide the dispensing valve in known form as a metering valve which whenever it is operated, will dispense a predetermined quantity of mixture ranging preferably between substantially 30 and 60 mg. The volumetric contents of the container are preferably so chosen that they range between 2 and 30 ccm., preferably between substantially 4 to 12 ccm.

Finally it is advantageous to make the container at least predominantly of a material which permits visual observation of its contents, such as a glass or a synthetic plastic of requisite type.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view, partly in vertical section, of a refillable aerosol dispenser according to the present invention and a supply package for supplying it with gaseous propellant;

FIG. 2 is a fragmentary detail view, on an enlarged scale, of the aerosol dispenser in FIG. 1; and

FIG. 3 is a sectioned detail view, on an enlarged scale, of an inlet valve according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail it will be seen that in the upper portion of FIG. 1 I have illustrated a refillable aerosol dispenser according to the present invention. In the lower portion of this figure I have illustrated a conventional supply package containing a gaseous propellant which is to be transferred into the interior of the novel aerosol dispenser for pressurizing the contents thereof.

As shown in the drawing, reference numeral **1** identifies the container of my novel refillable aerosol dispenser. This advantageously is at least predominantly composed of a material, such as glass, which permits visual observation of its contents. It has an upper wall illustrated but not separately identified with a reference numeral, which is provided with a dispensing valve **2** of known construction, preferably one of the known metering valves which whenever actuated will dispense a predetermined quantity of the contents of the container. Opposite the upper wall there is provided a lower wall **3** closing an inlet opening through which liquid contents can be introduced into the container **1**.

In the illustrated embodiment the dispensing valve **2** is connected in known manner by an inwardly extending circumferential bead **4** which connects it with the body of the container **1** as shown. This manner of connecting the valve with the container is already known. A protective cap **5** is provided which covers the valve **2** as well as the spray head **6** with the spray nozzle **7** provided on the valve **2**, it being known that the spray head **6** will ordinarily be depressed in downward direction to open the spray valve **2** for discharge of the contents from the container **1**. A riser tube **8** communicates with the dispensing valve **2** in known manner and extends to the region of the bottom wall **3** so as to supply liquid to the dispensing valve **2** when the latter is opened.

The bottom wall **3** is provided with an internal screwthread **9** which meshes with the outer screwthread **12** provided in a cylindrical portion of the container **1** which surrounds the inlet opening **11** for admission of liquid. A further cylindrical portion **10** is provided on the bottom wall **3** and when the latter is connected with the portion **11**, the portion **10** will be located within the confines of the portion **11** as illustrated. In this position the bottom wall **3** will close the opening **11**, spanning the same.

A sealing element is provided between the projection **10** and the internal screwthread **9** and different cross-sectional configurations of the sealing element are illustrated in FIGS. 1 and 2 and are identified with reference numerals **13**, **15** and **16**. If the sealing element is of the type identified with reference numeral **13**, it provides for an exclusively radial sealing effect, whereas the embodiments of reference numerals **15** and **16** provide for axial as well as radial sealing. It is preferable that these sealing elements **13** and **15–16** be made from natural or synthetic elastomers whose characteristics may be so selected as to make them particularly suitable for the intended purpose. It is also advantageous to provide the sealing element at the inner wall **17** and/or the end face **18** of the portion bounding the opening **11**, because here the sealing circumference is the smallest and therefore the sealing the most reliable.

At least one relief bore **19** is provided so as to be located intermediate the sealing element and starting portions of the screwthreads.

Located within a recess in the projection **10** is the inlet valve **20** for admitting gaseous propellant into the interior of the container **1**. It communicates via a bore **21** and a preferably conically outwardly diverging inlet opening **22** with the exterior side of the wall **3**, as shown. Inwardly of the bore **21** there is provided a cupped insert **23** so configurated that its transverse wall is flush with the upper end of the recess in the projection **10** as shown, with the insert being held in place in suitable manner, for instance by beads **24** as shown in FIG. 2.

The insert **23** has an annular inner surface **25** on which a sealing element **28** of the valve **20** is located, with the surface **25** exerting pressure upon the element **28** to provide a sealing effect with the same. A bore **26**, or a tangential bore **27** as shown in FIG. 2, communicates with the interior of the container **1** as well as with the compartment defined by the cupped insert **23**.

As shown, the inlet valve is configurated as a one-way over-pressure valve which will open and close automatically. In FIG. 1 the valve utilizes as a valve element a spherical element **29** which sealingly engages the inner side of the sealing element **28** to close the aperture provided therein. It is pressed into contact with this aperture and the sealing element **28** when the pressure in the interior of the container **1** is greater than the pressure acting in the bore **21**. However, it is also possible to omit the element **28** and to make the spherical element **29**—which in FIG. 1 is for instance of metal—of an elastomer which then can seal directly by engaging the wall of the bore **21**. A weak reinforcing spring **49** can also be provided, acting between the element **29** and the transverse wall of the cupped insert **23**.

As shown in FIG. 3, however, the inlet valve may in particularly advantageous manner be constructed in that it is in form of a component **30** of elastomer material, having a radially outwardly projecting flange **31** which is held in place by the cupped insert **23** and which simultaneously provides the necessary sealing function in conjunction with surface **25**, whereby the necessity for the separate sealing element **28** is avoided. As shown in FIG. 3, the component **30** is provided with an axial passage **32** which tapers inwardly towards the end face **33** at which it has narrowed to a slot **34**. The outer side of the cylindrical portion **35** of the component **30** is provided with inclined flanks **36** and **36'** so that the portion **33** is in effect of lip-like configuration.

In conventional manner the supply package for gaseous propellant is a container **37** provided with a self-closing valve **38** of known construction, which is secured in the container **37** via a seal **39** in known manner. The valve housing **40** is mounted within the valve **38**, provided with a projection **41** which is apertured and with the aperture of which the riser tube **42** communicates which extends to the bottom wall of the container **37** into and through the gaseous propellant accommodated therein. A spring **44** is located within the housing **40** and guides a valve member **46** of substantially conical configuration which seals with reference to the sealing washer **45**. The element **46** is provided with a hollow shaft **47** in which one or more radial bores **48** terminate, with the outer diameter of the shaft being accommodated as to size to the diameter of the opening **22** of the inlet valve in the refillable aerosol dispenser.

The operation of my operation will be evident from what has been set forth thus far. It shall be assumed for purposes of explanation that the container **1** is empty and needs to be refilled both with liquid and with gaseous propellant. For this purpose the bottom wall **3** is unscrewed and as soon as the seal is broken, any residual gas contained in the container **1** can escape through the bore **19**. The bore is so located that the threads **9** and **12** cannot come out of engagement with one another before the bore has been exposed, thus permitting escape of residual gas. Thus, the container **1** can be opened only when it is completely depressurized; in order to be sure that this will happen even if the container **1** is filled still with liquid, the cross-section of the bore **19** is made corre-

spondingly large, or several bores **19** are provided distributed over the circumference of the container **1**.

To fill the container with the liquid **43** to be dispensed, the container is inverted and may rest for instance on the end face of the protective cap **5**. The liquid may either be provided in premeasured pack quantities, or a mark may be provided on the wall of the container **1** indicating to which level it is to be filled. Liquid is then introduced through the opening **11** whereupon the wall **3** is again connected with the container **1** until sealing is established. Now the container **1** is moved to upright position again, that is the position shown in FIG. 1, and the opening **22** is now placed over the shaft **47** of the valve **48** of the supply package **37**. The packages are then pressed towards one another so that the valve member **46** moves oppositely the force of the spring **44** into the valve, and the radial bores **48** move out of the sealing range of the sealing element **45** into the interior of the housing **40**, so that gaseous propellant can now escape from the interior of the container **37**. The pressure of the propellant acts upon the inlet valve of the aerosol dispenser, automatically opening the same in a sense admitting the propellant into the interior of the container **1**.

Depending upon the valve construction, that is that of FIG. 1 or FIG. 2, the incoming gaseous propellant—which of course is always under pressure—flows either through the inlet valve by lifting the spherical element **28** off its seal, or by deflecting the lips bounding the slot **34** of the component **30** shown in FIGS. 2 and 3. It then flows via either the bore **26** or the tangential bore **27** directly into the liquid **46** which is subsequently to be dispensed. In order to guarantee that the propellant enters the liquid in liquid state, and to counteract a flash-over to gaseous phase by partial evaporation of the gaseous propellant prior to its exit from bores **26** or **27**, it is necessary that the flow-through cross-sections in the valve of the supply package **37** as well as in the inlet valve of the novel refillable aerosol dispenser, be larger than the cross-section of the bores **26** or **27** themselves. However, the cross-section of the bores **26** or **27** must still be large enough so that the admission of gaseous propellant into the container **1** is completed within a few seconds so that the necessary high flow speed of the gaseous propellant is obtained which is required for the intimate admixture of liquid and gaseous propellant which is desired.

As soon as a pressure equilibrium between the interior of the container **1** and the interior of the package **37** has been achieved, the one-way overpressure valve—that is the inlet valve of the container **1**—will automatically close by pressing the element **29** against the seal **28**, or by a closure of the lips bounding the slot **34**. In either case return flow—even if for some reason the pressure in the container **1** should rise beyond the pressure in the package **37**—of the contents of the container **1** into the package **37** is reliably precluded. Now the container **1** and the package **37** are separated from one another and the overpressure which now exists in the interior of the container **1** versus the ambient pressure, further increases the reliability of the sealing effect of the inlet valve. The refillable aerosol dispenser is now ready for operation and mixture can be discharged after withdrawing the protective cap **5** and depressing the sprayhead **6**.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a refillable aerosol dispenser, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can be applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. A refillable aerosol dispenser, comprising a container adapted to accommodate a mixture of liquid to be dispensed and a liquefied propellant therefor, said container having an upper portion and a bottom portion provided with an opening; a separate end wall normally extending across and closing said opening; cooperating coupling portions on said bottom portion and said end wall for removably attaching said end wall on said bottom portion in a position closing said opening but for permitting exposure of the same upon removal of said end wall so as to enable admission into said container of liquid to be dispensed; a dispensing valve provided on said upper portion of said container and operable only for dispensing said mixture from said container; and a separate inlet valve provided in said separate end wall and operable only for admitting liquefied propellant into said container when said separate end wall is attached by said coupling means to said bottom portion in a position closing said opening.

2. A dispenser as defined in claim **1**, said inlet valve being a pressure-responsive one-way valve operable for admission of gaseous propellant under pressure only in direction into said container.

3. A dispenser as defined in claim **1**, said second wall having an inner side facing the interior of said container, and an outer side, and said inlet valve being carried by and at least partially located within the confines of said second wall; and wherein said inlet valve has an inlet passage communicating with the interior of said container and being provided with an outer end portion accessible at said outer side of said second wall and converging substantially conically in direction towards said inner side.

4. A dispenser as defined in claim **1**, said second wall having an inner side facing the interior of said container, and an outer side, and said inlet valve being carried by and located within the confines of said second wall; said inlet valve comprising an inlet accessible at said outer side, and a compartment intermediate said inner and outer side and communicating with said inlet; and further comprising at least one tangential passage communicating with said compartment and with said inner side for admission of gaseous propellant from said compartment into the interior of said container.

5. A dispenser as defined in claim **1**, further comprising sealing means for sealing the juncture between said second wall and said second portion so as to prevent undesired escape of fluid through said opening.

6. A dispenser as defined in claim **5**; and further comprising at least one relief bore in one of said second wall and second end portion, said relief bore being normally sealed by said sealing means but becoming open to the ambient atmosphere for venting pressure from the interior of said container in response to but before completion of disconnecting of said second wall from said second end portion.

7. A dispenser as defined in claim **1**, said dispensing valve being a metering valve operative for dispensing, when operated, a predetermined quantity of said mixture.

8. A dispenser as defined in claim **1**, said container surrounding an interior chamber having a volumetric content of between substantially 2 and 30 ccm. of said mixture.

9. A dispenser as defined in claim **8**, wherein said volumetric content is between 4 and 12 ccm.

10. A dispenser as defined in claim 1, said container consisting at least predominantly of a material permitting visual observation of said mixture in said container.

11. A dispenser as defined in claim 1, whereby in the filling position the dispenser will be set upon the valve of a supply package in upright position, so that the propellant enters in a stream of high speed directly in the liquid to be dispensed.

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U.S. Cl. X.R.

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