

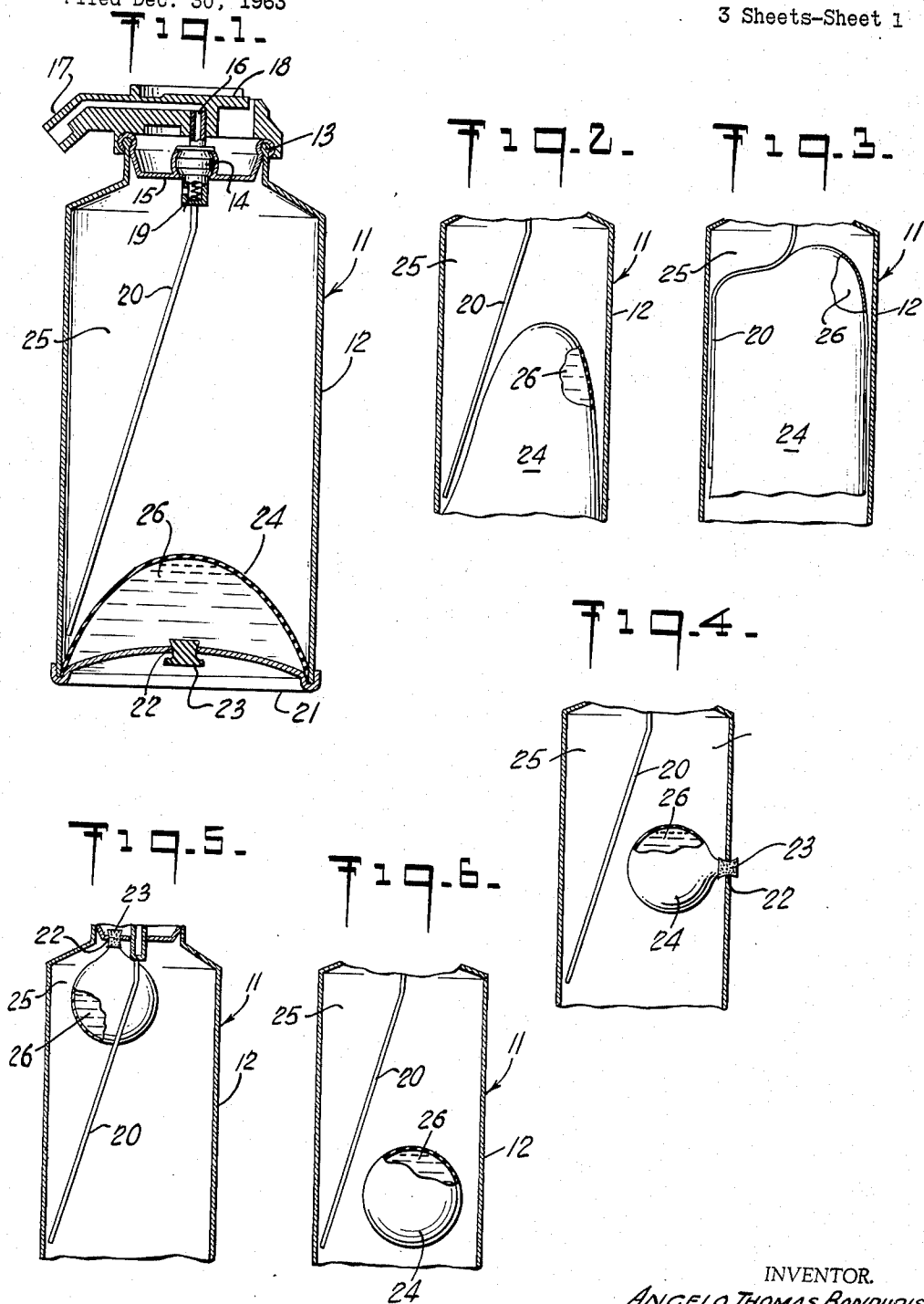
Feb. 15, 1966

A. T. BONDURIS
PRESSURIZED DISPENSING CONTAINER

3,235,137

Filed Dec. 30, 1963

3 Sheets-Sheet 1



INVENTOR.
ANGELO THOMAS BONDURIS

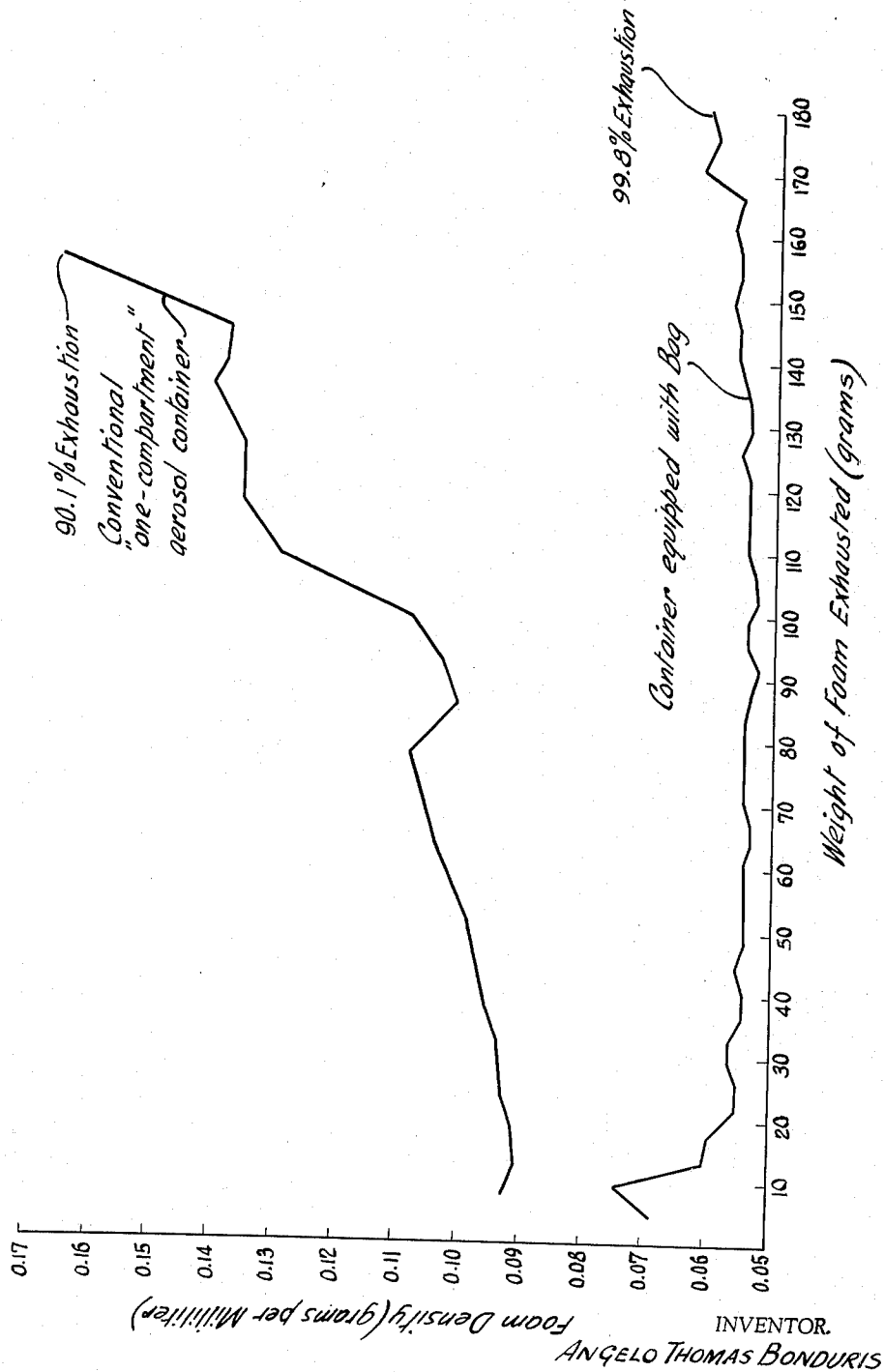
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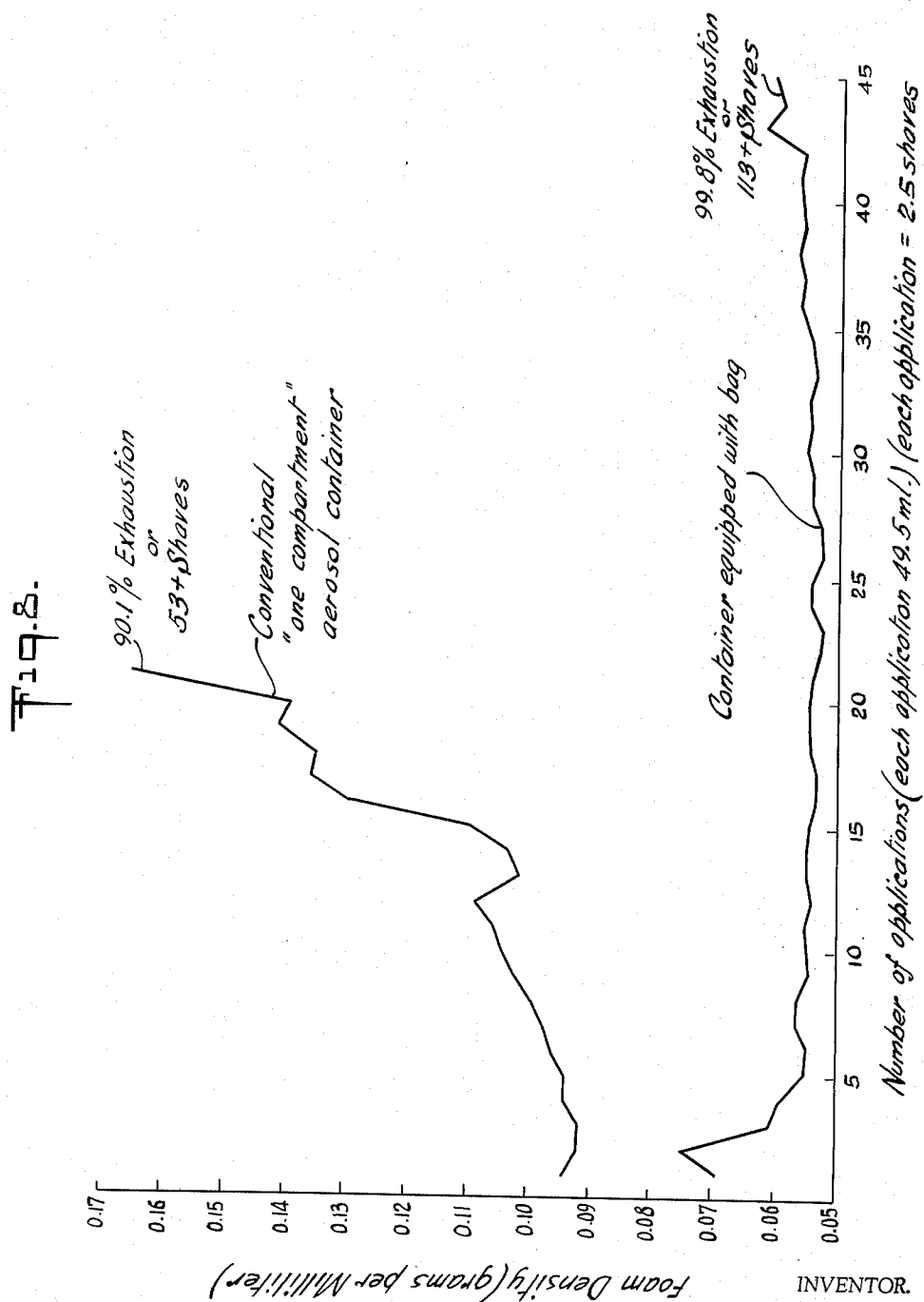
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PRESSURIZED DISPENSING CONTAINER

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This invention has to do with a package for dispensing fluent material and, more specifically, has to do with a container for dispensing fluent material such as three-phase systems in an expanded state.

The use of pressurized dispensing containers for a large variety of products has become widely accepted in many fields, including the dispensing of expanded foams and lathers such as shaving preparations and the like. Liquefied gaseous materials (foamants) and propellants are well known for use in such containers. However, the dispensing of foamed products, especially shaving lathers and like preparations, presents problems of foam quality and uniformity, and exhaustion of product from the containers. For example, the initial portions of shaving cream dispensed from the presently available dispensing containers generally are foams which are rather stiff and/or dry. This undesirable characteristic is attributed to an excess of propellant or foamant with product. In the intermediate portions so dispensed, however, are foams of desired quality and excellent consistency, since a suitable balance of foamant and product is maintained. The final portions remaining in the containers are generally too wet and thin when dispensed to form a foam of desirable quality. Thus, insufficient foamant or propellant remains in the final portions to provide suitable foamed product. Consequently, many users do not or cannot exhaust the entire supply in the containers, but on the contrary, dispose of the container when it has been only incompletely exhausted of product. Quite naturally, this has been the reason for some customer dissatisfaction.

In an effort to overcome the disadvantages of the foregoing character, several modifications have been made of the original "aerosol" containers for dispensing fluent products. One-compartment containers, in which product and propellant are in association in the sole compartment, have given way to two-compartment containers for some products. In the latter, product is contained in a first compartment or section defined by the valve or outlet means and by a piston, bag or diaphragm which keeps the products separate from a second compartment or section in which the propellant is located. When a propellant or foamant is used together with product in the first section, product is dispensed as a foam. A higher vapor pressure has been used in the propellant or second section than in the vapor pressure of the product or first section, in order that the bag or diaphragm serve as a piston to urge product from the container or package. However, such containers have not been efficient in that uniformity of dispersed product has not been realized. In particular, the initial portions dispensed from the container continue to have an excess of foamant, and final portions are deficient in foamant. For example, piston containers suffer from leakage of product into the propellant compartment, and leakage of propellant into the product compartment. Additionally, pistons are subject to mechanical failure by virtue of stresses on the containers and pistons, particularly when the container bodies become dented or deformed. And since the product in a piston-type container is compressed, it is difficult to reemulsify product with foamant. The present invention is directed to a modification which overcomes the disadvantageous features of prior bag-type aerosol containers.

It is an object of this invention, therefore, to provide a

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package for dispensing fluent product in an expanded state, such as a foam, stream or mist, of uniform quality whether the package is full, partially full or almost completely exhausted. Another object of the invention is to provide a package which can be substantially completely exhausted of product delivered as fluent product in an expanded state. A particular object is to provide such a package for dispensing shaving preparations. Still other objects will appear from the following description.

The foregoing objects are realized with the present invention which provides a device free from the foregoing disadvantages and permits dispensing of a rich, creamy lather of uniform consistency and quality whether the shaving preparation be the initial, intermediate or final portion dispensed from the container. And the present invention also makes possible substantially complete use of the product in the container, such that substantial exhaustion of product is realized.

Although the device disclosed and claimed herein is readily adaptable to a wide variety of applications, the invention is particularly useful for dispensing shaving lather. For the sake of simplicity at this part of the application, the novel container is described with respect to shaving lather. It is to be understood, however, that the present invention can be employed with a wide variety of products, as explained hereinafter.

The invention is described now with reference to the accompanying drawings in which:

FIGURE 1 is a vertical sectional view of elevation of a preferred embodiment of a pressurized container of shaving preparation in accordance with the invention;

FIGURES 2 and 3 are sectional elevations of the package shown by FIGURE 1, to indicate removal of product from the package;

FIGURES 4 through and inclusive of 6 are sectional elevations of a package of a formed product and a propellant therefor;

FIGURES 7 and 8 are graphical representations showing comparisons made with a container of the present invention and with a conventional container.

Referring more specifically to the drawings, numeral 11 generally designates a dispensing container having a tubular body 12 and a top opening defined by rim 13 adapted to have a normally closed dispensing valve 14 sealed thereto. Valve 14 can be staked directly to the container or can, as illustrated, be fastened to a valve fitment 15 which is staked or rolled into pressure-type engagement with the container at rim 13. Gaskets (not shown) between container 11, valve 14 and fitment 15 are utilized to assure pressure-type joints.

Valve stem 16 is fitted with a spout 17 and a button 18. When button 18 is manually depressed, it forces the valve 14 to open and permits dispensable material to be expelled through the valve stem 16 and out through the spout 17. The base 19 of valve 14 can have attached thereto a dip tube 20 which can extend to close to the bottom of the container. A closure member 21 is staked and rolled into pressure-type engagement with the tubular body 12 at the end opposite valve 14. Closure member 21 has a hole or orifice 22 in the center thereof. The orifice can be sealed after propellant gas has been charged by any suitable means such as rubber plug 23. Propellant gas can also be charged by other techniques such as sealing rubber plug 14 to the container, the rubber plug having a self-sealing orifice through the center thereof adapted to receive a gas charging needle.

The periphery of a flexible bag or diaphragm 24 is within container 11, being secured to tubular body 12 and closure member 21 in pressure-type engagement. Bag 24 separates the interior of container 11 into a first section 25, at one end of which valve 14 is located, and

a second section 26, opposite thereto. The first section 25 is filled with a shaving preparation having dispersed therein a liquefied gaseous material or foamant capable of expanding upon release to the atmosphere and causing the shaving preparation to foam. The composition of the shaving preparation, including the liquefied gaseous material dispersed therein, as well as its physical and chemical properties, can vary widely and are set forth in greater detail hereinafter. However, regardless of the particular composition of the shaving preparation and of the liquefied gaseous material, it is beneficial for producing excellent foam that the ratio (weight) of the foamant to shaving preparation be from about 1:100 to about 12:100, preferably 2 to 3:100 for a hydrocarbon foamant and preferably 6 to 9:100 for a halogenated foamant. Moreover, a sufficient quantity of the dispensable product is utilized to fill the first section 25 of the container 11 in order that substantially no head space exists therein at any time from initial charging to final dispensing of product. That is, there should be essentially no space unoccupied by product in the first section 25 in order that no liquefied gaseous material can return to the gaseous state within product section 25 of container 11; this insures that the ratio of liquefied gaseous material or foamant to shaving preparation in container 11 remains substantially constant from initial charging to final dispensing. With this ratio remaining so constant, uniformity of dispensed product is realized.

A second section 26 of the container 11 is defined by the bottom of container 11 and the periphery of bag or flexible diaphragm 24. The second section 26 is filled with propellant, the exact composition of which can vary widely and is described in detail hereinbelow. However, propellant utilized is one capable of maintaining a substantially constant pressure in the package from manufacture or assembly until product is exhausted from the package. Diaphragm 24 can be made of any suitable flexible, impervious material such as natural or synthetic rubber; and plastic compositions such as the following: Mylar, a polyester of E. I. du Pont de Nemours and Company; Telsal, a Dupont fluorocarbon; Scotchpark, a polyester with a polyethylene laminate, and an aluminized form thereof, each a product of Minnesota Mining and Manufacturing Company; Aclar and Capran, a fluorocarbon and a polyamide, respectively, of General Chemical; Saran, a vinyl chloride polymer of Dow Chemical; Kodar, a polyester of Eastman Kodak; Azdez, a phenoxy composition of Union Carbide; and Avisco R-18, a vinyl copolymer-coated cellophane of American Viscose.

In the new containers of this invention, the vapor pressure of product section 25 is at least equal to, and is preferably greater than, the vapor pressure of propellant section 26 when container 11 is fully charged and ready for initial dispensing of product therefrom. For example, a shaving preparation containing foamant or propellant can be in product section 25 at about 55 pounds per square inch gauge (p.s.i.g.), and a suitable propellant can be contained in section 26 at a pressure of about 45 p.s.i.g. At this point, diaphragm 24 is restrained from flexing to any substantial amount. As product is released from product section 25 through dip tube 20 and valve 14 to spout 17, product with foamant leaves the container and the pressure within product section 25 becomes approximately 45 p.s.i.g. The vapor pressure decrease of about 10 p.s.i.g. is caused by expelling entrapped or entrained air in the product, as the first portions of product are dispensed from container 11. When approximately one-third to one-half of the product has been so released, the pressure of the product is still at about 45 p.s.i.g., the pressure within propellant section 26 remaining at 45 p.s.i.g. Thus, diaphragm 24 is no longer restrained but flexes to accommodate to space made available by product dispensed and to occupy a different position in container 11 as shown by FIGURE 2. By way of further illustration, when approximately 65 percent of the prod-

uct originally charged to product section 25 has been dispensed therefrom, the vapor pressure of section 25 is again at about 45 p.s.i.g. Finally, when substantially all of the material has been dispensed from container 11, as illustrated by FIGURE 3, the vapor pressure of product section 15 remains at about 45 p.s.i.g., with diaphragm 24 expanding extensively throughout container 11. As indicated, substantially all of the product is exhausted from the container. It will be clear, therefore, that the vapor pressures of the product and propellant sections 25 and 26, respectively, remain substantially constant throughout use of container 11.

Since the pressure in propellant section 26 of container 11 is substantially equal to the pressure in product section 25 throughout more than about two-thirds of use thereof, diaphragm 24 is urged toward valve 14 and prevents formation of appreciable head space in section 25 of the container. For example, with a standard six (6) ounce aerosol container, the vapor pressure of product section 25 is sufficient to expel all of the dispensable product (of section 21) in an expanded state. Generally, this will be from about 40 to about 50 p.s.i.g. at 70° F. for shaving preparations. It will be recognized that pressure differentials will vary dependent upon the character, as viscosity, of other dispensable products such as catsup, mustard, etc., with respect to the pressures in sections 25 and 26.

Turning now to liquefied gaseous materials which can be used in product section 25 as foaming agents, these are volatile organic compounds or materials. At ordinary temperatures and pressures, these compounds normally exist in the form of a gas. However, they can liquefy at lower temperatures or under pressure in a container such, for example, as that disclosed and claimed herein. Among suitable liquefied gaseous materials are aliphatic hydrocarbons, and preferably saturated hydrocarbons, such as propane, n-butane, isobutane and cyclobutane. These are particularly desirable for use as foamants of shaving preparations, since they perform a lather-forming function without undesirable burning of human skin. A mixture of propane and isobutane is particularly preferred. One or a mixture of such compounds having a vapor pressure ranging from about 20 to about 100 p.s.i.g., preferably 40 to 50 p.s.i.g., at about 70° F. can be used. Homologs having vapor pressures outside of the stated ranges can also be used, so long as the combined vapor pressure is within the stated ranges. Also suitable as foaming agents are the partially or wholly fluorinated and partially or wholly chlorofluorinated hydrocarbons described below as propellants.

The quantity of liquefied gaseous material used in product section 25 of container 11, can vary considerably with the character and type of dispensable product. With shaving preparations, generally from about 1 to about 5 parts by weight of liquefied hydrocarbon gaseous material or 5-10 parts by weight of liquefied halogen-containing gaseous material are used for 100 parts by weight of product. Such quantities provide excellent dispersions which, when dispensed from container 11, are desirable foamed products. And such quantities are sufficient to remove product in expanded state, e.g., a foam, from container 11. Stable emulsions within product section 25 and foams of desired density from spout 17 are provided by using such quantities.

Propellants useful herein are volatile organic compounds or materials, of which many exist in the form of a gas at ordinary temperatures and pressures. They can liquefy at lower temperatures or when under pressure in a container such as those described and claimed herein. Included among suitable propellants are aliphatic hydrocarbons, partially or wholly fluorinated and partially or wholly chlorofluorinated hydrocarbons which have vapor pressures ranging from about 20 to about 100 p.s.i.g., preferably 40 to 50 p.s.i.g., at about 70° F. Either a

single compound or a mixture of two or more compounds can be used. And other homologs individually having vapor pressures outside the desired ranges set forth, can be used with other homologs, if the combined vapor pressure falls within such desired ranges. By way of illustration, kerosines and light mineral oils can be utilized. Gases such as carbon dioxide, nitrogen and air can be used. Thus, the term "propellant" used herein denotes liquefied gaseous materials, e.g., propane and non-liquefied materials, e.g., carbon dioxide.

Representative propellants are: aliphatic hydrocarbons, preferably saturated hydrocarbons, such as propane, butane, isobutane and cyclobutane; saturated fluorinated, and fluorinated and chlorinated, aliphatic hydrocarbons illustrated by: 1,1-difluoroethane; 1,2-dichloro-1,1,2,2-tetrachloroethane; trichlorotrifluoroethane; dichlorodifluoromethane; monochlorodifluoromethane; monofluoromethane; 1 - monochlorodifluoromethane; monofluoromethane; 1 - monofluoro - 1, 1-difluoroethane; trifluoro ethyl chloride; and octafluorocyclobutane.

Regardless of which of the particular compounds or mixtures thereof are employed herein as propellants, it is not necessary to be concerned about the effect of the propellant on the physical or chemical properties of the dispensable product or their effect upon the surface or area to which the product is applied. This follows from the facts that the propellant or propellants are substantially completely isolated in the propellant section 26 of container 11 and that they do not come into contact with the product to be dispensed. Accordingly, in a pressurized package or container of a shaving preparation manufactured in keeping with this invention, those compounds set forth above as propellants which cause a tingling sensation to the skin or instability of lather can be employed as propellants since they are completely isolated from the dispensable product in section 26.

It is to be understood that container body 12 can be composed of a wide variety of materials, including steel, aluminum, plastic such as polyolefins. Valves—as 14—used herein are those conventionally used; however, they need not have in combination therewith a dip tube such as 20 shown in FIGURES 1-6. It is to be understood, however, that dip tube 20 can be made of any one of a variety of materials such as natural and synthetic rubbers, plastics such as polyethylene, etc.

As indicated above, the base of closure member 21 can have a filling plug or a spot weld therein (the latter not shown), such plug or weld serving as a safety member to avoid explosion under an unusual circumstance. The plug, for example, can be composed of natural or synthetic rubber or plastic, and can be one having a self-filling channel (not shown). Plug 23 can be positioned in closure member 21 as shown in FIGURE 1. It may also be positioned in wall 12 of container 11 as shown in FIGURE 4, or can be in the valve assembly as indicated in FIGURE 5. Diaphragm 24 can also be secured to plug 23 as indicated in FIGURES 4 and 5.

The diaphragm 24 can be in the form of an enclosed bag as indicated in FIGURE 6. In this instance, propellant can be charged to bag 24 when the bag is not within container 11. The bag is then chilled such that it occupies a minimum of space. The chilled bag can be charged to container 11 before the valve assembly is positioned onto walls 12.

By way of illustration, an excellent dispenser for shaving lather is one such as represented by FIGURE 1, containing about 5.5 ounces (avoirdupois) of product and having a capacity when empty of 7 fluid ounces:

Product:	Grams
Soap solution	177
C ₃ -iC ₄ mixture	4.7
Propellant:	Gram
C ₃ -iC ₄ mixture	1

The C₃-iC₄ mixture comprises 87 percent (87%) of isobutane and 13 percent (13%) of propane. The vapor pressure of the product section of the illustrative dispenser is approximately 55 p.s.i.g. and the vapor pressure of the propellant or bag section is approximately 45 p.s.i.g.

Comparable test results are given graphically in FIGURES 7 and 8 to demonstrate substantial advantages achieved with the present invention. A conventional aerosol shaving dispenser containing about 177 grams of product and 4.7 grams of the C₃-iC₄ mixture, identified above, was used. The container comprises "one compartment" since no bag or diaphragm separator is present therein. The container is equipped with a dip tube such as 20 of FIGURE 1. A second container of the same capacity and size, and equipped with a dip tube, but having a bag-type separator such as illustrated in FIGURE 1, was also charged with 177 grams of product and 4.7 grams of the C₃-iC₄ mixture; one gram of the C₃-iC₄ mixture was charged to the bag. Product was dispensed from each container in a regular pattern, that is, 4.5 grams of foam was dispensed with each depression of the valve assembly. The density of each foam so dispensed was determined. It was found that approximately 163 grams of foam was dispensed from the conventional container, equivalent to about 90.1 percent exhaustion of the container. In contrast, approximately 179 grams of foam was dispensed from the bag-equipped container, equivalent to 99.8 percent exhaustion of the container.

FIGURE 7 also makes clear the advantage realized with the new container of a substantially uniform product, from initial to final use of the container. This is opposed to the considerable fluctuation characterizing the product taken from the conventional container.

FIGURE 8 serves to illustrate the tremendous differences in uniformity of product dispensed from the conventional and new containers, and the number of shaves which can be obtained from the products dispensed. As shown, foam density is substantially constant for the foam dispensed from the new container, but is of considerable range from the conventional container. Approximately 53 shaves can be had with the foam emitted from the conventional container, while in excess of 113 shaves can be had from the foam taken from the new container.

In addition to shaving compositions, a wide variety of fluent products can be dispensed in an expanded state, in accordance with this invention. Broadly, three-phase, water-base systems can be dispensed from product sections or compartments such as 25 of FIGURE 1. Shampoos, hair dressings, hand lotions, face creams, dentifrices and other toilet compositions are contemplated. So, too, are edible products typified by whipped creams, icings, catsups, mustard, mayonnaise, etc. Antiseptics, pharmaceutical and medicinal ointments can be used. Still other products are paints, lacquers, chemicals, room sprays, insecticides, etc.

Numerous modifications and variations of the invention can be made without departing from the spirit and scope thereof. Accordingly, it is to be understood that the invention is not to be limited, but is to be construed in the light of the language of the appended claims.

I claim:

1. A pressurized dispensing container for dispensing a fluent product in an expanded state comprising

a first section containing under pressure substantially unexpanded product having liquefied gaseous material dispersed therein said liquefied gaseous material being selected from the group consisting of foamants and propellants and having outlet means for dispensing said product to the atmosphere in an expanded state,

a second section containing propellant under pressure, and

a flexible diaphragm member for separating said first and second sections one from the other, the pressure initially in said first section being at least equal to the pressure of said second section, and the pressures of said first and second sections remaining substantially constant as product is dispensed.

2. A pressurized dispensing container defined by claim 1 wherein the pressure initially in said first section is greater than the pressure of said second section.

3. A pressurized dispensing container defined by claim 1 wherein the pressure in said first section is sufficiently greater than the pressure of said second section until at least about one-third of said product has been dispensed from said package to restrain said flexible member from flexing substantially.

4. A pressurized dispensing container defined by claim 1 wherein the pressure of said first section and the pressure of said second section remains substantially constant as product is dispensed, and wherein said first section contains a free-phase, water-base system and in which the liquefied gaseous materials are volatile organic materials.

5. A pressurized dispensing container defined by claim 1 wherein the periphery of said flexible member is secured to the bottom of said package.

6. A pressurized dispensing container defined by claim 1 wherein a portion of said flexible member is secured to the bottom of said package.

7. A pressurized dispensing container defined by claim 1 wherein a portion of said flexible member is secured to the wall of said package.

8. A pressurized dispensing container defined by claim 1 wherein a portion of said flexible member is secured to the top of said package.

9. A pressurized dispensing container defined in claim 1 wherein said flexible member is disposed within said first section and is completely detached from boundary means defining said package.

10. A pressurized dispensing container defined by claim 1 wherein a discharge tube is secured at one end thereof to said outlet means and extends into said package close to the bottom of said package.

11. A pressurized dispensing container defined by claim 1 wherein said product is shaving cream.

12. A pressurized dispensing container for dispensing shaving lather comprising

a tubular body having closures at each end,

a first section containing under pressure substantially unexpanded dispensible shaving cream having liquefied gaseous hydrocarbon dispersed therein and having a discharge valve for dispensing said shaving cream to the atmosphere in an expanded state in response to repeated openings,

a second section containing propellant under pressure, and

a flexible diaphragm member for separating said first and second sections one from the other,

the pressure initially in said first section being greater than the pressure of said second section, and the pressures of said first and second sections remaining substantially constant as product is dispensed.

13. A package defined by claim 12 wherein the pressure in said first section is sufficiently greater than the pressure of said second section until at least about one-third of said product has been dispensed from said package to restrain said flexible member from flexing substantially.

14. A package defined by claim 12 wherein a discharge tube is secured at one end thereof to said outlet means located at one end of said package and extends into and terminates close to the bottom of said package.

15. A package defined by claim 12 wherein said shaving cream is dispersed in a liquefied gaseous fluorine-containing compound.

16. A package defined by claim 12 wherein said propellant is a fluorine-containing compound.

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