June 28, 1966 J. E. AYRES ETAL 3,258,170

HEATING DEVICE FOR AEROSOL DISPENSER

Filed April 13, 1964 3 Sheets-Sheet 1

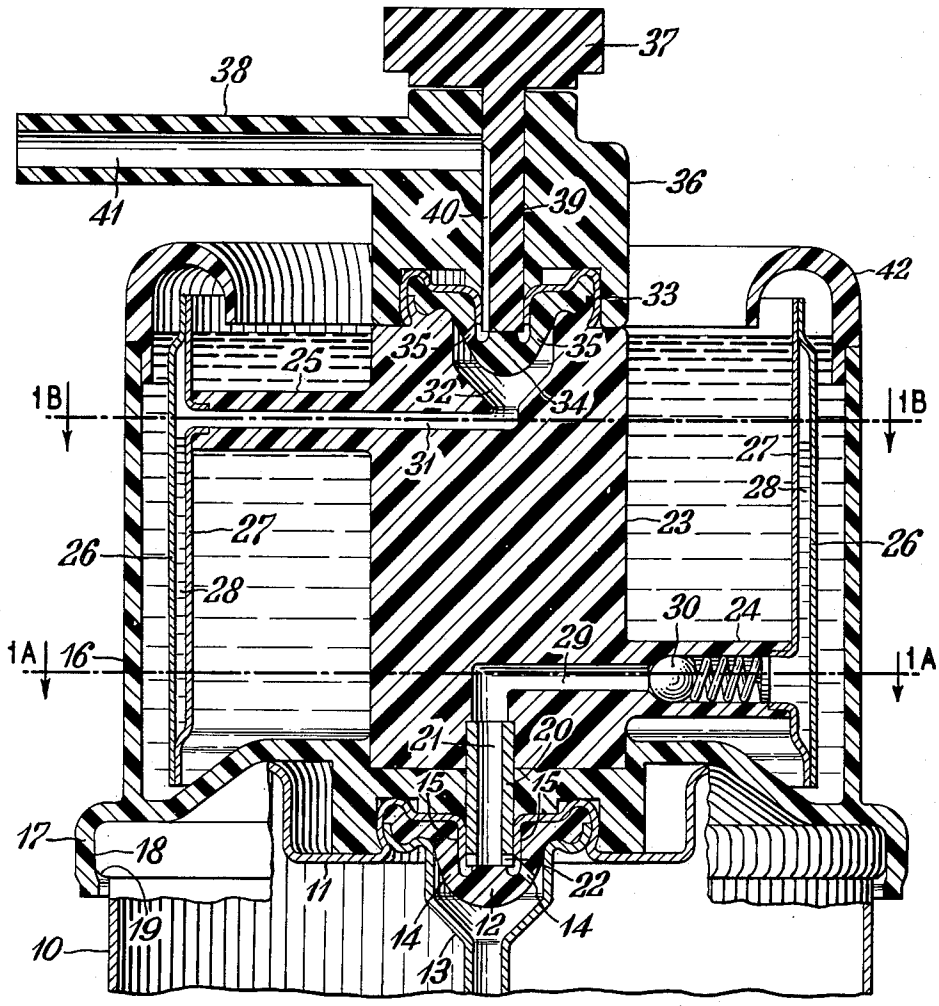

Fig. 1.

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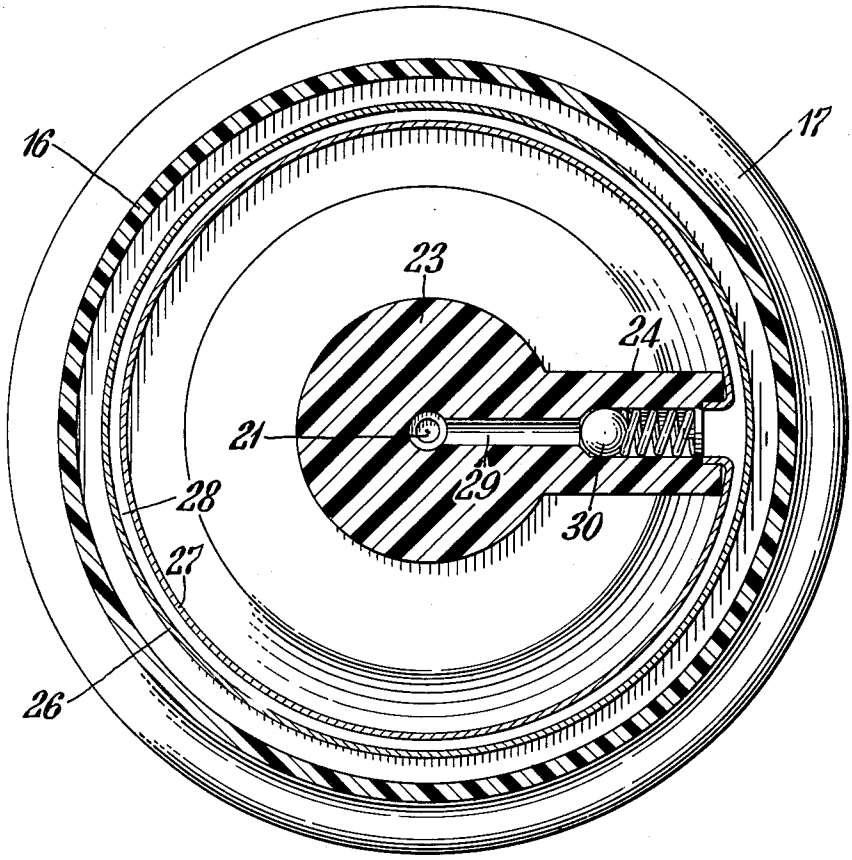

Fig. 1A.

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Filed April 13, 1964 3 Sheets-Sheet 3

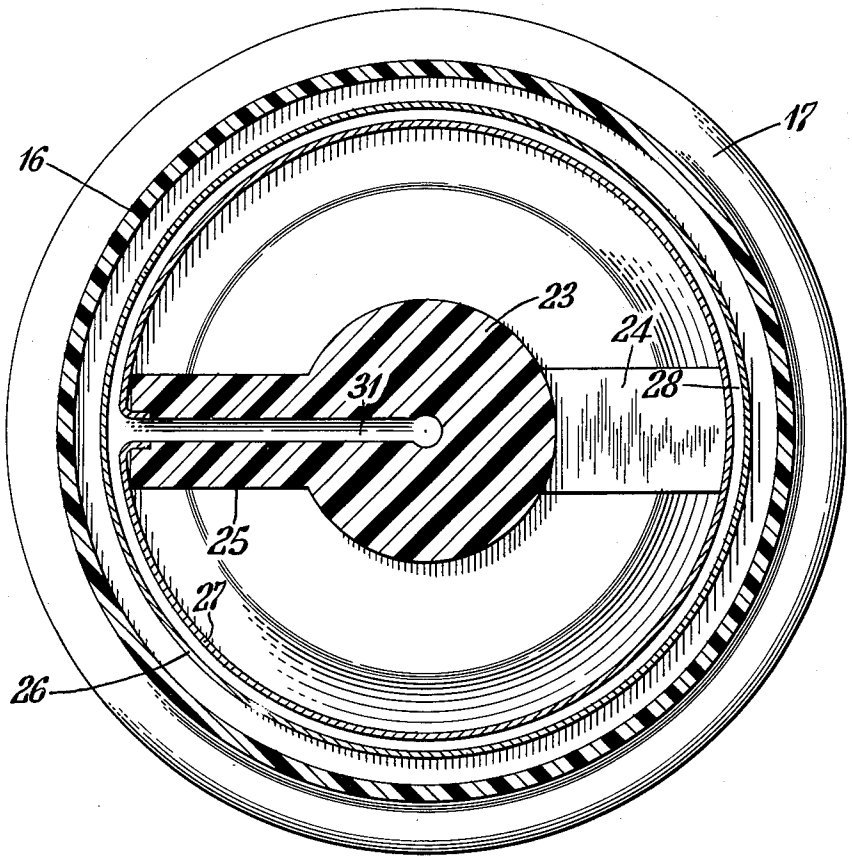

Fig. 1B.

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United States Patent Office 3,258,170 Patented June 28, 1966

3,258,170

HEATING DEVICE FOR AEROSOL DISPENSER

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Filed Apr. 13, 1964, Ser. No. 358,989
8 Claims. (Cl. 222—146)

The present invention relates in general to devices for preparing and dispensing aerosol lathers in heated condition. More particularly, this invention relates to improved devices which are capable of heating such lathers with high efficiency.

In recent years, pressurized aerosol products, such as shaving cream lathers, shampoo lathers, and the like, have been gaining widespread recognition. More recently, a number of devices which permit the dispensing of such products in a heated condition have been described.

The advantages which can be derived by the use of such latter devices are especially obvious when such devices are used in conjunction with aerosol shaving lathers; therefore, the present invention will be described with particular reference to containers for preparing and dispensing aerosol shaving lathers, but it should be evident from the following description that the devices of the present invention are suitable for use in conjunction with a number of aerosol products, such as lather shampoos, and like.

Aerosol shaving lathers are usually produced from liquid compositions comprising a mixture of an aqueous soap or detergent solution and a liquefield normally-gaseous propellant. Such compositions, when released from a valve-controlled aerosol type container yield a stable lather which can be directly applied to the skin of the user prior to shaving. Due to the cooling effect exerted by the expansion and evaporation of the liquefied propellant the temperature of such lather is usually below room temperature and the body temperature of the user. The application of such cool lather to the body of the user is not entirely pleasant. Furthermore the softening effect of such lather on the beard or hair of the user is reduced by the lower temperature thereof.

The desirability of providing a heated aerosol shaving lather has been recently recognized and a number of devices have been proposed in the art to perform such function. Such prior devices, however, have been generally inefficient and cumbersome and have failed to provide a simple, practical and economical way to solve the proposed probelm.

Some of the proposed devices utilize electrical means for heating a long tube through which the lather product passes after release from the aerosol container. Such use of electrical heating means introduces the hazards and inconvenience of fires and electric cords.

Other similar devices which have been proposed utilize a heating jacket around a lather discharge tube, said heating jacket being connected to a hot water tap and being supplied with a continuous flow of hot water therefrom. Due to the low heat transfer coefficients inherent to such lathers, such devices are ineffective in raising the product to temperatures substantially close to the hot water tap temperature unless a lather discharge tube of substantial length is used. The use of such long tubes results in a breakdown of the lather due to the considerable flow resistance offered by such tubes and to the long residence time. Furthermore, a substantial volume of lather is left within the tube after the user discontinues the operation. This residual lather, in a compressed state due to the high flow resistance of the device, will expand and ooze

out of the tube outlet causing prolonged and copious afterflow.

More recently, a device has been proposed in an attempt to eliminate some of the disadvantages of the prior art devices. Such proposed device comprises a cylindrical heat-conductive chamber of sheet metal projecting in exposed position from a standard aerosol-type container and containing therein a supply of heat-conductive material, such as steel wool. The proposed mode of operation involves heating the cylindrical chamber, and any liquid lather-forming material contained therein, by holding said chamber in contact with hot water and thereafter discharging the heated liquid as a warm lather. The proposed device solves to a certain extent one of the prior art problems, namely the necessity of heating rather large volumes of lather after extrusion, by heating instead the relatively smaller volume of corresponding liquid prior to extrusion. In practice, however, a number of shortcomings, which shall hereinafter become apparent in the light of the instant invention, are inherent to the proposed device.

It is an object of the present invention to provide a device for preparing and dispensing heated aerosol foams. It is a further object of the invention to provide an improved device for preparing and dispensing heated shaving lathers, said device eliminating one or more of the disadvantages of the prior art. These and other objects will become apparent to those skilled in the art in the light of the instant specification.

In a broad aspect, the present invention relates to a device for preparing and dispensing heated aerosol foams from an aerosol-type container provided with an outlet member and containing therein a mixture of an aqueous soap solution and a liquefied normally-gaseous propellant, said device comprising a heat-conductive chamber having an inlet member interconnected with the outlet member of said container; means mounted within said chamber for preventing fluid flow from said chamber to said container; an outlet member having a manually-operated discharge valve for dispensing the contents for use; and heating means on said heat-conductive chamber for heating the contents thereof.

An essential feature of the device of the present invention is the introduction of means within the heat-conductive chamber for preventing fluid flow from said chamber to the container. Such means serve to prevent the return of any portion of the liquid soap solution, upon its expansion due to heating, from the heat-conductive chamber to the container. This back-flow, which is inherent to previously-proposed devices which operate by heating the soap solution in its liquid form, and its undesirable effects, will be discussed in detail in conjunction with the description of the devices of the present invention.

These and other objects will be best understood from the following description of preferred devices of the invention, selected for the purpose of illustration and not of limitation, and shown in the accompanying drawings.

Referring to the drawings:

FIG. 1 is a side elevational view of a preferred device, partly in longitudinal section;

FIG. 1A is a sectional view taken along the line 1A—1A of FIG. 1.

FIG. 1B is a sectional view taken along the line 1B—1B of FIG. 1.

With continuing reference to the accompanying drawings, FIG. 1 shows a preferred form of a heating device of the invention removably mounted on a standard aerosol container of a type commercially used by some manufacturers of aerosol products. It is comprised of can **10** having a suitable attached bottom, not shown in the drawing, and lid **11**. Lid **11** is provided with a container out-

let member consisting of a central opening for discharge of product, said opening being provided with manually-operated valve means.

The valve means include a diaphragm **12**, preferably made of rubber or other resilient material, which is mounted between the lid **11** and the conventional dip tube **13**. The diaphragm **12** includes a plurality of openings **14** which are normally closed by the centrally located depending tubular portion **15** of lid **11**. For normal usage, such aerosol containers are provided with a valve actuator assembly, not shown in the drawing, which consists of a valve button, a dispensing spout, and a tubular valve actuator extending downwardly from said valve button. Customarily, the user manually depresses the valve button, displacing the tubular valve actuator downwardly in actuating contact with the diaphragm **12**. When the diaphragm is thus depressed, the openings **14** are no longer obstructed by the tubular portion **15** and the pressurized product is discharged from the can **10** through said openings and thence through the dispensing spout of said valve actuator assembly. In the practice of the present embodiment of the invention, the valve actuator assembly, which is customarily mounted with a friction fit coaxially with the opening in lid **11**, is removed prior to mounting the heating device of the invention on the aerosol container.

The valve construction described above is conventional and it will be understood, of course, that other and different forms of valve mechanisms may be employed with the present invention. It will also be understood that the use of such different valve mechanism will necessitate some minor changes in the construction of the novel heating device, but the necessity of such changes and the extent thereof will become apparent to one skilled in the art in the light of the instant specification.

The illustrated heating device includes a body **16** capacitated to hold a supply of hot water and having the general configuration of a cup with an open top. It is made of common plastic material having the properties of stiffness, lightness and low rate of heat conduction, such as linear polyethylene, polypropylene, polystyrene, and the like.

The bottom of cup **16** is fashioned with a configuration generally complementary to the top of the aerosol package and includes a depending peripheral annular flange **17** provided with an internal annular channel **18** to firmly engage the upper rim **19** of the package with a friction snap-fit.

Extending downwardly from cup **16** is centrally located tubular valve actuator **20** having an internal passageway **21** extending therethrough. When the heating device is mounted on the package by exerting downward pressure sufficient to snap annular flange **17** over rim **19**, the tubular actuator **20** is similarly displaced downwardly with a friction fit through the tubular opening defined by the depending tubular portion **15** of the lid **11**. The lower end of the actuator, provided with a diametrically disposed slot **22**, engages diaphragm **12**, actuating said diaphragm and thereafter maintaining it in the open position, i.e., in the position wherein openings **14** are no longer obstructed by tubular portion **15**. Diaphragm **12** remains in said open position as long as the heating device is mounted on the aerosol package.

Fixedly mounted within body **16** and extending upwardly into the cup defined by said body is a centrally located cylindrical body **23** having tubular arms **24** and **25** extending radially therefrom and forming an integral part thereof. For optimum efficiency, said tubular arms are positioned on cylindrical body **23** at points substantially removed from each other.

Mounted within body **16** a heat-conductive chamber is provided for holding the desired amount of liquid soap solution. In the illustrative embodiment shown, the heat-conductive chamber is defined by a radiator consisting of two closely spaced upright cylindrical plates **26** and **27**,

telescopically disposed and concentrically positioned. The top and bottom edges of cylindrical metal plates **26** and **27** are sealed to one another by conventional means to provide a pressure-tight upright chamber **28** of annular cross-section. The radiator is formed from a heat-conductive material, preferably metal, and is constructed as to be capable of withstanding pressures in the range of up to 150 p.s.i. which are generated during operation of the present device, which operation will be explained in detail hereinafter.

As best shown in FIG. 1A, the radiator is connectively sealed to tubular arm **24** and the chamber thereof is interconnected with the container outlet member by means of a chamber inlet member comprising passageway **29**, which extends through tubular arm **24** and cylindrical body **23**, and passageway **21**, which extends through valve actuator **20** and is interconnected with said passageway **29**. Located in passageway **29** is check valve **30**, positioned so as to allow the liquid soap solution to flow from the container through passageway **29** and into chamber **28** but as to prevent any fluid from returning from chamber **28** to the container. Such backflow, which would occur because of gravity flow and of the pressure differential which develops between chamber **28** and the interior of container **10** when the chamber is heated, is hereby prevented.

Similarly, at a point in the chamber substantially removed from said inlet conduit means, the radiator has outlet conduit means connectively sealed to tubular arm **25**. Passageway **31** extends through tubular arm **25** and interconnects chamber **28** with valve chamber **32**. Such embodiment is best shown in FIG. 1B.

Located on valve chamber **32** and secured to cylindrical body **23** by crimping the outer edges of the closure member **33** over a bead which surrounds the valve chamber opening in the top of body **23**, is diaphragm **34**. Said diaphragm, which includes a plurality of openings **35** which are normally closed by the depending tubular portion **36** of closure member **33**, is similar in construction and in mode of operation to diaphragm **12** hereinefore described.

Mounted on cylindrical body **23** and secured thereto by a friction fit, is valve actuator assembly **36** comprising valve button **37**, dispensing spout **38** and tubular valve actuator **39**. When the user manually depresses valve button **37**, tubular valve actuator is displaced downwardly into actuating contact with diaphragm **34**. Any pressurized product present in chamber **28** is thus discharged from said chamber through openings **35** and then through a chamber outlet member, i.e., through longitudinal groove **40** and thence to the atmosphere through passageway **41** in dispensing spout **38**.

The illustrated heating device also comprises an annular top portion **42** which is fitted to the top of body **16**.

In operating this device of the invention, the user, after removing the standard valve actuator assembly from a commercial container of aerosol shaving lather, mounts the heater on said container by displacing the unit downwardly as to allow peripheral annular flange **17** to engage the upper rim **19** of the container. Tubular valve actuator **20** comes into actuating contact with diaphragm **12**, allowing the pressurized contents of the package to flow through openings **14** and to fill chamber **28**.

The user then places the device under a hot water faucet and fills body **16** with hot water. The hot water submerges the radiator, heating the radiator walls to substantially the temperature of the water itself. At the same time, the liquid soap solution which is present in chamber **28** is similarly heated by heat conduction through said radiator walls.

Upon heating, due to the increase in vapor pressure of the propellant which is present in chamber **28**, pressures of up to about 150 p.s.i.g. develop in said chamber. Such pressures are substantially higher than the pressures prevailing in container **10**. However, contrary to prior art devices, check valve **30** prevents the heated soap solution

from escaping from chamber **28** back into container **10**, thereby making it possible to maintain said soap solution in heat-exchange relationship with the heated radiator walls for a time sufficient for said solution to reach a temperature substantially approximately the wall temperature.

Having removed the device from under the faucet, the user presses actuator button **37** which in turn opens diaphragm **34** as shown in FIG. 1. The heated product from chamber **28** is propelled through the multiple openings **35** and thence through passageways **40** and **41** and out of spout **38**. In the meantime, due to the pressure decrease in chamber **28**, cold soap solution from container **10** is propelled upwardly through dip tube **13** and thence through passageways **21** and **29**, past check valve **30**, to fill chamber **28**. The new charge of liquid soap solution remains in chamber **28** until such time as the user wishes to use the device again. The check valve serves to segregate the charge and to prevent it from returning to container **10** by gravity flow, as would normally occur on storage.

In a particularly preferred aspect of the invention, such upward surge of the cold soap solution from container **10** into chamber **28** is facilitated by providing, in said container, in addition to the standard liquefied normally-gaseous propellant, which is customarily used in pressurized aerosol products, an inert substantially water-insoluble gas which, due to its physical properties, will exist in the gaseous state under the conditions prevailing in said container. It has been found that the use of such gas which, due to its insolubility in the aqueous soap solution and to its ability to remain in the gaseous phase, makes it possible to fill chamber **28** to its maximum capacity with liquid soap solution, as explained hereinafter.

Such gas, which is preferably nitrogen but which can be any inert gas substantially insoluble in the aqueous soap solution and substantially non-liquefiable under the conditions prevailing in the aerosol container, such as air, oxygen, and the like, is preferably used in an amount sufficient to provide a gaseous phase in said container in which the inert substantially water-insoluble gas has a partial pressure of from about 10 to about 50 p.s.i.g. at 70° F. A total container pressure in the range of from about 25 to about 85 p.s.i.g. at 70° F. is preferred.

In the absence of such inert, insoluble, non-liquefied gas, the liquid in the container does not completely fill the heating chamber. Especially when the heating chamber is warmer than the bulk of the liquid in the container, solution which enters the chamber tends to partially vaporize so that the chamber becomes filled not with the liquid but with a foamy mixture comprising substantial quantities of vaporized propellant suspended in the liquid as bubbles. The presence of such bubbles reduces the amount of liquid soap available in the chamber and at the same time causes the formation of an undesirably soft and somewhat unstable foam upon extrusion.

On the other hand, when an inert, insoluble, non-liquefied gas is present, it serves to force the liquid up into the heating chamber under a positive head of pressure and to ensure that the liquid in the chamber is maintained under pressure in excess of the vapor pressure of the liquefied propellant, thus causing the chamber to become filled completely with liquid containing no gas spaces or bubbles.

The foregoing description is illustrative of the construction and operation of a preferred embodiment of the present invention. Other embodiments should be evident to those skilled in the art in the light of the instant disclosure, without departing from the spirit and scope of the invention.

For example, it should be evident that the shape of the heating chamber is not critical and that a coiled tube or the like can be substituted for the radiator of the illustrated embodiment. In another aspect of the invention the heating chamber can be externally mounted and heated by contact with hot running water from the faucet, rather than by intimate prolonged contact with a captive body of hot water.

Additionally, it should be evident that the heat-conductive chamber can be constructed as to be permanently affixed to the aerosol container.

What is claimed is:

1. A device for preparing and dispensing heated aerosol foams from an aerosol-type container provided with an outlet member having an open position and a closed position and containing therein a mixture of an aqueous soap solution and a liquefied normally-gaseous propellant, said device comprising a heat-conductive chamber having an inlet member interconnected with the outlet member of said container, means on said inlet member for maintaining said outlet member in the open position, means mounted within said inlet member for preventing fluid flow from said chamber to said container, and an outlet member having a manually-operated discharge valve for dispensing the contents for use; and means whereby said heat-conductive chamber may be heated by immersion in hot water.

2. The device of claim **1** wherein the container contains a gaseous phase comprising an inert substantially water-insoluble gas at a partial pressure of from about 10 to about 50 p.s.i.g. at 70° F.

3. A device for preparing and dispensing heated aerosol foams from an aerosol-type container provided with an outlet member having an open position and a closed position and containing therein a mixture of an aqueous soap solution and a liquefied normally-gaseous propellant, said device comprising a heat-conductive chamber having an inlet member interconnected with the outlet member of said container, means on said inlet member for maintaining said outlet member in the open position, means mounted within said inlet member for preventing fluid flow from said chamber to said container, and an outlet member having a manually-operated discharge valve for dispensing the contents for use; and a body capacitated to hold a supply of hot water in heat exchange relation with said heat-conductive chamber.

4. The device of claim **3** wherein the container contains a gaseous phase comprising an inert substantially water-insoluble gas at a partial pressure of from about 10 to about 50 p.s.i.g. at 70° F.

5. A device for preparing and dispensing heated aerosol foams from an aerosol-type container provided with an outlet member having an open position and a closed position and containing therein a mixture of an aqueous soap solution and a liquefied normally-gaseous propellant, said device comprising a heat-conductive chamber having an inlet member interconnected with the outlet member of said container, means on said inlet member for maintaining said outlet member in the open position, a check valve mounted within said inlet member as to permit fluid flow from said container to said chamber but as to prevent fluid flow from said chamber to said container, and an outlet member having a manually-operated discharge valve for dispensing the contents for use; and means whereby said heat-conductive chamber may be heated by immersion in hot water.

6. The device of claim **5** wherein a container contains a gaseous phase comprising an inert substantially water-insoluble gas at a partial pressure of from about 10 to about 50 p.s.i.g. at 70° F.

7. A device for preparing and dispensing heated aerosol foams from an aerosol-type container provided with an outlet member having an open position and a closed position and containing therein a mixture of an aqueous soap solution and a liquefied normally-gaseous propellant, said device comprising a heat-conductive chamber having an inlet member interconnected with the outlet member of said container, means on said inlet member for maintaining said outlet member in the open position, a check valve mounted within said inlet member as to permit fluid

flow from said container to said chamber but as to prevent fluid flow from said chamber to said container, and an outlet member having a manually-operated discharge valve for dispensing the contents for use; and a body capacitated to hold a supply of hot water in heat exchange relation with said heat-conductive chamber.

8. The device of claim 7 wherein the container contains a gaseous phase comprising an inert substantially water-insoluble gas at a partial pressure of from about 10 to about 50 p.s.i.g. at 70° F.

References Cited by the Examiner

UNITED STATES PATENTS

2,873,351	2/1959	Lannert	219—214
3,043,484	7/1962	Jolly.	

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