March 19, 1968 A. B. LOWRY 3,373,904

HEATER FOR MATERIAL DISPENSED FROM A CONTAINER

Filed May 5, 1966 2 Sheets-Sheet 1

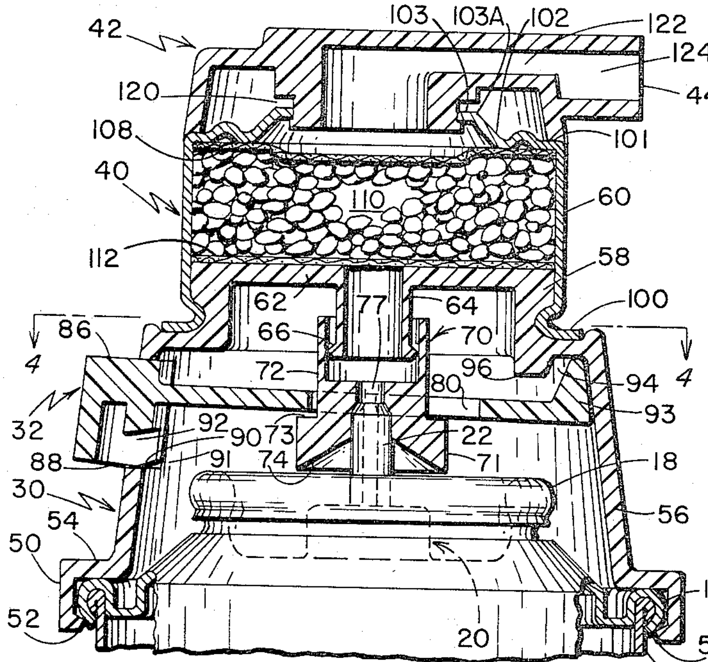

FIG 2

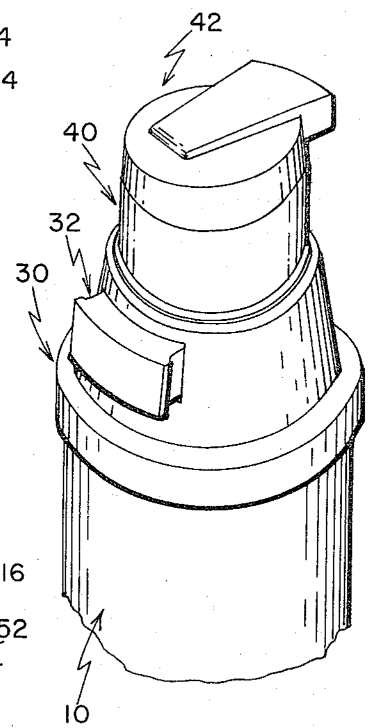

FIG 1

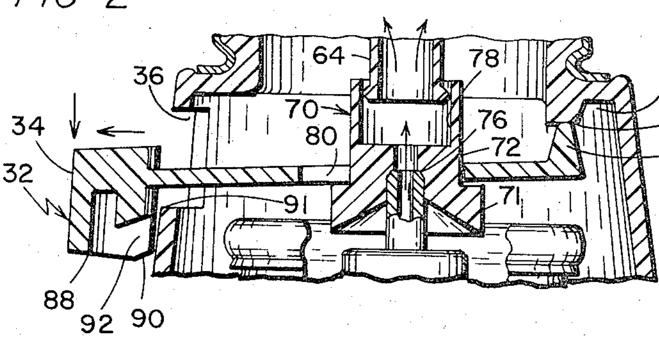

FIG 3

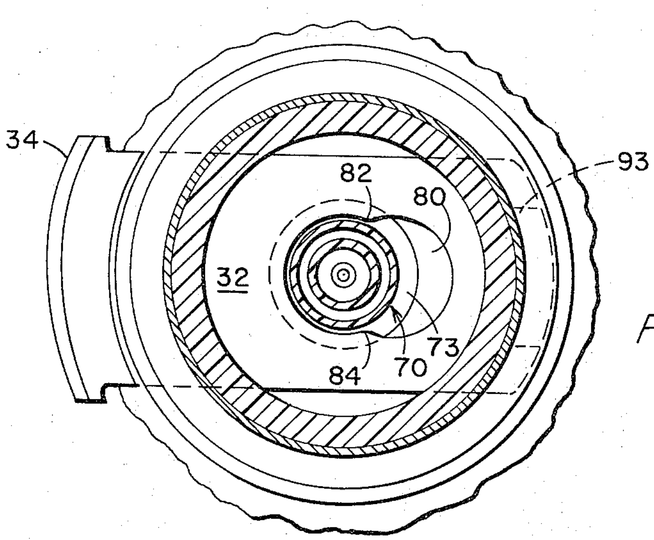

FIG 4

HEATER FOR MATERIAL DISPENSED FROM A CONTAINER

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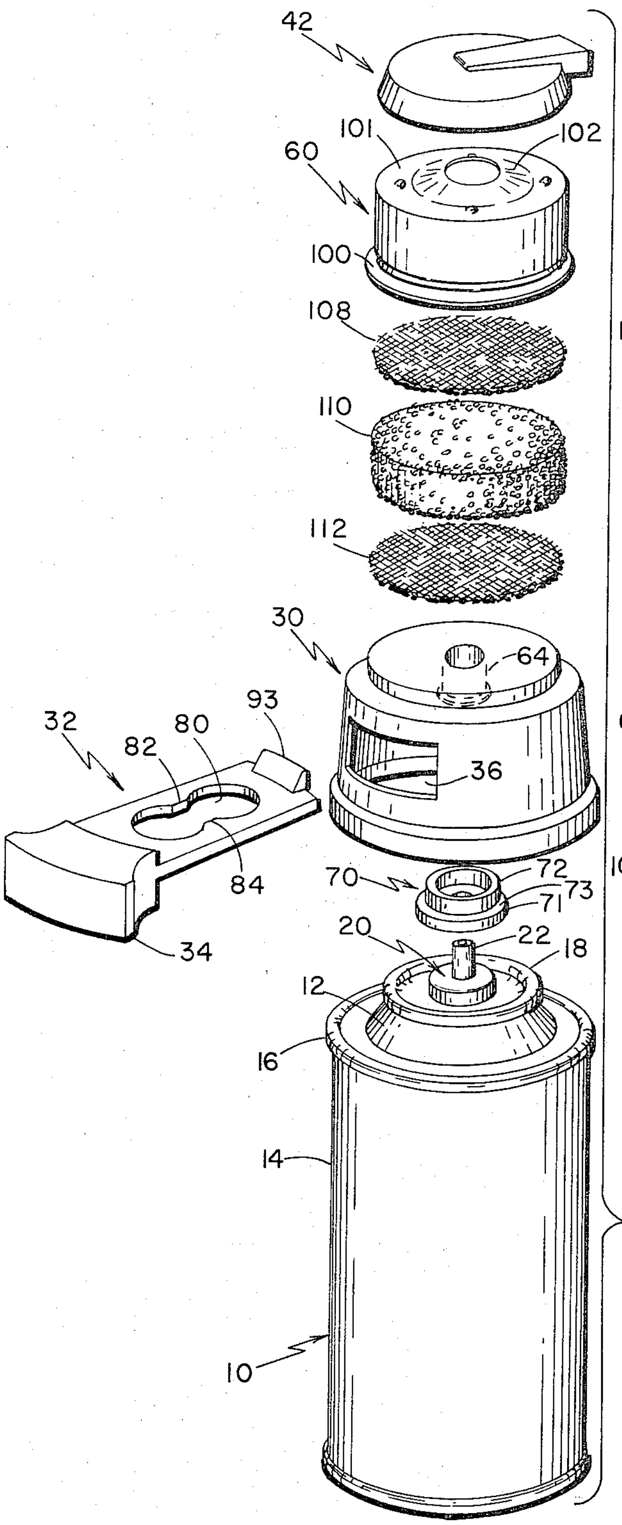

FIG 5

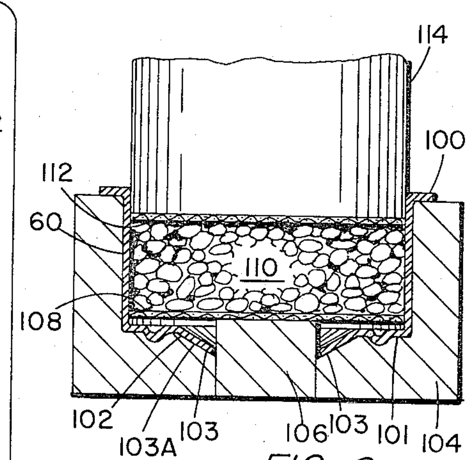

FIG 6

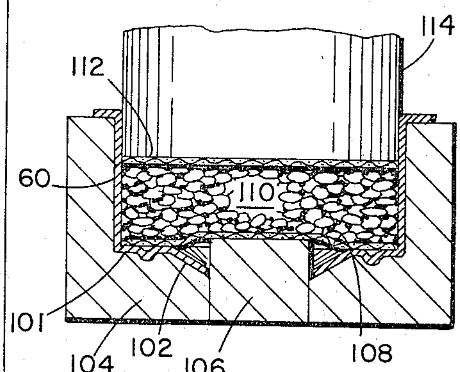

FIG 7

3,373,904

HEATER FOR MATERIAL DISPENSED FROM A CONTAINER

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ABSTRACT OF THE DISCLOSURE

A heat exchanger for an aerosol soap dispensing package includes an aluminum chamber 1.35 inch in diameter, of 0.025 inch wall thickness in which is disposed a mass of aluminum shot at least 0.050 inch in diameter which is compressed to a density of 85% of solid aluminum and a resulting height of 0.42 inch. Discs of expanded aluminum are positioned above and below the compressed mass of shot. The inlet of the chamber is connected via a sleeve coupling to the valved outlet of the pressurized dispensing package and the 0.100 inch diameter outlet of the chamber opens into a larger rectangular discharge nozzle. The sleeve coupling has a flange which is engaged by a fulcrumed actuator lever which, when moved down, opens the package's valve. In latched position the enlarged end of the actuator lever fits tightly into the heat exchanger support shroud to minimize entry of and accumulation of moisture within the shroud.

This invention relates to dispensing packages and to actuator arrangements and to heat exchangers for use with such packages.

In recent years there has been widespread consumer acceptance of pressurized dispensing packages of the aerosol type in which a product held within a container is dispensed in a controlled manner under the pressure of a propellant gas. An example of such a product is foam type shaving cream which is produced from an aqueous colloidal dispersion of soap that is stored with a propellant gas in a valve controlled, pressure type container. That product as it is dispensed from the container is converted into foam condition and applied to the skin directly. Upon discharge of the product, the propellant expands to generate the foam and such expansion, frequently supplemented by an evaporation of the propellant, produces a cooling effect on the product. In the case of a shaving cream product the temperature of the shaving cream has an effect on the comfort and efficiency of shaving. Accordingly, an object of this invention is to provide novel and improved apparatus for heating shaving cream as it is dispensed from a pressurized package.

A number of devices have been proposed for heating such products as they are dispensed from pressurized packages including devices for heating pressurized shaving cream. Such devices, however, have, in general, either imparted insufficient heat to the product being dispensed due to an inefficient heat transfer relationship, or have not been completely satisfactory from a commercial standpoint due to such factors as cost of manufacture and/or unreliability in operation. A number of attempts have been made to improve the heat transfer characteristics such as by increasing the length of the dispensing passage (with a view to increasing the amount of heat imparted to the dispensed product, which however, involves the resulting disadvantages of a large storage area in which the dispensed product tends to deteriorate and excessive delay in making the product available for use) and by restricting the passageway size which improves the heat transfer characteristics but which also reduces the product flow rate so that an undue amount of time is

required to dispense an adequate amount of product for its intended use. Accordingly, another and more general object of this invention is to provide improved apparatus for dispensing a product from a pressurized dispensing package in warm condition.

A further object of the invention is to provide a compact and efficient heat exchanger unit for a dispensing package that is economical to manufacture.

Still another object of the invention is to provide an improved aerosol type shaving cream package with a heat exchange structure in a compact and easy to operate unit.

Another object of the invention is to provide a novel and improved actuator arrangement for a pressurized dispensing package.

In accordance with the invention there is provided a heat exchanger device for transferring heat to or from a product as that product emerges from the outlet of a dispensing package. The device includes a chamber that has an inlet receiving the product from the package, an outlet for discharging the product from the chamber and an annular thermally conductive wall between the inlet and the outlet. A multiplicity of inert, thermally conductive bodies are disposed in the chamber in firm, frictional thermally conducting engagement with one another to form an integrated mass in thermally conducting engagement with the internal surface of the chamber wall. The frictionally engaged bodes define a multiplicity of connected passageways between them that extend between the chamber inlet and the chamber outlet. The chamber and mass of thermally conductive bodies may be rapidly heated or cooled by exposing the chamber to an appropriate temperature source. The product to be dispensed is then released from the package for flow through the chamber. That product contacts a series of temperature conditioned bodies as it flows through the chamber and substantial heat transfer with the product is accomplished in an efficient manner. The lengths of the passages are preferably relatively short so that a minimum delay is imposed on delivery of the product.

In a particular embodiment the thermally conducting bodies are metal spheroids of similar dimensions which are distorted under pressure into firm engagement with one another and with the chamber wall and provide a heat exchanger structure having a multiplicity of random passages extending between the chamber inlet and outlet.

More specifically in a preferred form of heat exchanger structure the spheroids are of substantially pure aluminum and have diameters within the range 0.050–0.100 inch. These spheroids in that embodiment are placed in an aluminum chamber structure and compressed about 30% producing a degree of distortion while forcing them into firm mechanical and thermally conductive engagement with one another. Preferably employed in the chamber on either side of the mass of compressed metal spheres are metal screen members which act as barriers to retain the spheroids in position while acting as flow distributors for the product applied to the chamber.

The chamber, in a particular embodiment, is secured in fixed relation on the pressurized container by a support structure that houses a valve actuator assembly. A tubular inlet of the heat exchanger chamber is disposed in spaced aligned relation with a tubular container outlet and a sleeve bridges the gap between the two tubular members. An actuator cooperates with the sleeve to move it downwardly under manually applied force to open the container outlet while maintaining the bridge between container outlet and chamber inlet. The actuator is movable between a latch position (suitable for shipping for example) and a released position in which it is easily operated (through benefit of mechanical advantage) to release the product to be dispensed from the container. For facility in assembly and reliability in operation, the sleeve in the preferred embodiment includes a conical recess in its base which terminates in a seat for receving the tubular container outlet and a bore in its upper end which receives a sliding relation an enlarged bead formed on the downwardly projecting chamber inlet tube. A restricted passage connects the bore and the seat portions of the sleeve and a shoulder on the sleeve cooperates with the actuator which imparts downward movement to the sleeve to open the container outlet while maintaining the enclosed connection between the container and the chamber.

Other objects, features and advantages will be seen as the following description of a particular embodiment of the invention progresses in conjunction with the drawings, in which:

FIG. 1 is a perspective view of a pressurized dispensing package that incorporates a control arrangement and a heat exchanger structure constructed in accordance with the invention;

FIG. 2 is a sectional view through the upper portion of the dispensing package illustrating details of the control arrangement and the heating structure attached to it;

FIG. 3 is a sectional view similar to FIG. 2 showing the control arrangement in the unlatched (or working) position;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2 showing details of the control arrangement employed in the dispensing package;

FIG. 5 is a view showing components of the dispensing package in spaced relation; and

FIGS. 6 and 7 indicate steps in the process of forming the heat exchanger structure employed in the apparatus shown in FIG. 1.

As indicated in FIGS. 1 and 5, the dispensing package includes a metallic pressure container **10** of conventional configuration having a top wall **12** connected to the cylindrical side wall **14** by means of bead **16**. An annular ridge **18** is provided in the top wall and centrally located in the top wall of the container is a valve structure **20** that includes an upwardly projecting tubular actuator element **22**.

The base of a cylindrical actuator housing **30** is secured on bead **16** and receives an actuator member **32** which is arranged for movement between a locked position (in which actuator handle **34** is positioned in housing aperture **36**) as shown in FIGS. 1 and 2 and a withdrawn (operative) position as shown in FIG. 3. Above the fixed actuator housing **30** is a heat exchanger structure that includes a chamber **40** of thermally conductive material, a preferred material being aluminum. Above the chamber **40** is a nozzle structure **42** that has an outlet orifice **44** (FIG. 2) through which the product to be dispensed from the package is ejected upon operation of the actuator.

Additional details of the actuator structure and the heat exchanger structure may be seen with reference to FIG. 2. The actuator housing **30** may be made of a high density polyethylene and includes a depending annular skirt **50** having an inwardly projecting bead **52** at its lower end. Above the skirt is a horizontal annular surface **54** which seats on the upper end of bead **16** and a frustoconical actuator housing body **45** which receives the valve actuator assembly. The upper portion of body **56** forms a cap structure **58** to which is secured the metallic wall member **60** of heat exchange structure **40**. The top wall **62** of the actuator cap is imperforate and its upper surface may include a series of radially extending flow distribution ridges or channels. Depending from wall **62** is tubular member **64** that has an annular ridge or bead portion **66** at its base.

Received on the tubular member **64** is an actuator sleeve **70** which has a larger lower diameter and a smaller upper diameter **72** to provide a horizontal transition shoulder portion **73**. The lower surface includes a conical surface portion **74** and a control recess **76** that forms a seat on which is received the stem **22** of the valve unit. Coaxial with recess **76** is a passage **77** which may be sized for flow control purposes and which opens into an enlarged bore **78** in which the depending tubular member **64** is received.

Resting on shoulder **73** of sleeve **70** is the actuator member **32** which, as indicated in FIG. 4, has a slot in the form of aperture **80** for receiving the sleeve which has a reduced center section formed by projections **82, 84** which cooperate with sleeve **70** to provide two positions of adjustment, a latched position shown in FIGS. 2 and 4 and a second (released) position as indicated in FIG. 3. At one end of actuator an enlarged member is handle **34** which has inclined lower surfaces **88, 90** which cooperate with the lower surface **91** of aperture **36** in the wall of the housing to provide an aperture shield that serves to minimize entry of liquid while allowing circulation of air through vent **92** to minimize accumulation of moisture and condition of high humidity when the actuator is in latched position as shown in FIGS. 1 and 2. At the opposite end of the actuator is an upstanding ridge or web **93** which is received in recess **94** when the actuator is in position shown in FIG. 2. This web **93** cooperates with surface **96** when the actuator is in the position shown in FIG. 3 which acts as a fulcrum about which the actuator is pivoted to operate the valve **22**, as indicated in FIG. 3. Thus it will be seen that this actuator assembly provides an actuator structure which in latched position effectively shields the actuator housing against the entry of water, which is easy and reliable in operation, and which is positively positioned in either latched or released position by the cooperation of slot **80** and sleeve **70**. The actuator sleeve cooperates with the bead **66** on the tubular entrance passageway to the heat exchange chamber to provide an annular line surface of contact which accommodates tilting of sleeve **70** relative to the inlet stem **64** during operation for example. Also the structure facilitates assembly of several components into their intended relationships utilizing mass production manufacturing and assembly techniques. Modifications of this actuator arrangement obviously may be employed, for example, a separate camming device may be employed to move the actuator member between its locked position and its released position or the stub channel **64** may surround sleeve **70**.

The heat exchanger structure **40**, as indicated above, includes an aluminum cup **60** (the wall of which is preferably at least 0.025 inch in thickness) in which is disposed a mass of compressed metallic shot that provides a multiplicity of random flow passages. This cup member **60** is of the configuration indicated in FIG. 6 and includes an upper flange **100** and a lower wall which includes horizontal section **101** and conical section **102** which conforms to a die **104** in which the cup is received. Conical section **102** has an inner portion **103** which, in initial forming, is disposed parallel to horizontal section **101** and then is bent into conical configuration; producing a region of weakness at transition **103***a*. Upwardly projecting post **106** of die **104** passes through the aperture in section **102** when the cup **60** disposed in the die, and in that position a first screen (retainer) **108** in the form of a disc of expanded aluminum 0.035 inch in thickness and of 20 mesh size is positioned on post **106**. Aluminum shot **110** (of 99.5 to 99.9% purity and preferably of substantially uniform particle size) is loaded into the cup **60**. The diameter of these pellets or spheroids **110** should be less than 0.250 inch and preferably less than 0.100 inch. For adequate heat transfer characteristics, flow characteristics and convenience in handling it is preferred that the shot be at least 0.050 inch in diameter. A similar second retainer sheet of expanded aluminum **112** is placed on top of the load of shot and then pressure is applied by suitable means such as plunger **114** to effect about a one-third compression of the shot to a predetermined depth. This compression forces the shot particles into firm frictional engagement and distorts the lower retainer plate **108** to the configuration shown in FIG. 7.

In a preferred embodiment the exchanger cup **60** weighs 4.8 grams, the exchanger shot **110** weighs 17 grams and the retainer plates **108**, **112** weigh 0.80 gram each. Thus the total mass or aluminum in the exchanger is 23.4 grams in a cylinder 1.35 inch in diameter and 0.42 inch deep and that mass has a density of about 85% of solid aluminum.

This fabricated heat exchanger component is then removed from die **104**, inverted, and secured to the actuator housing **30** by suitable means such as peening or crimping the surface adjacent flange **100** inwardly in the groove of the upper portion of that housing to the position shown in FIG. 2. A nozzle structure **42** is then snapped over the aperture in the wall **102** of the housing **60** forcing the conical wall **103** down to its initially formed position with the inner edge of section **103** firmly gripping the notch **120** in the nozzle base in the position shown in FIG. 2 to complete the structure. The nozzle includes a restricted passage **122**, 0.100 inch in diameter, which opens into a large rectangular discharge section **124**.

In operation the heat exchanger is immersed in a heat source for a short period of time to warm the chamber and the shot. After removal of the heat exchanger from the heat source, actuator **32** is pulled out from its latched position (FIG. 2) to the position shown in FIG. 3 and pressed downwardly as indicated in FIG. 3. That action moves sleeve **70** down and acts on the valve actuator **22** to open the valve of the pressurized container and allow the shaving cream product to flow up through the sleeve **70** and into the inlet of the heat exchanger for passage through the multiplicity of paths between the shot **110** therein, to the outlet of the structure to the nozzle **42** for discharge in warm foamed condition through the exit orifice **44**. For example, a 25 cc. quantity of shaving cream is increased to an average temperature of 118° to 122° when discharged through 0.018 inch orifice of the container **10** affter the above described particular form of heat exchanger structure has been held under a constant flow of tap water at 140° F. for a period of 10 to 15 seconds.

While a particular embodiment of the invention has been shown and described, various modifications thereof will be apparent to those skilled in the art, and therefore it is not intended that the invention be limited to the disclosed embodiment or to details thereof and departures may be made therefrom within the spirit and scope of the invention as defined in the claims.

What is claimed is:

1. A heat exchanger device for subjecting a product to a heat transfer operation as that product emerges from the outlet of a dispensing package comprising

a chamber having an inlet for receiving the product from said package, an outlet for discharging the product from said chamber, and a thermally conductive wall between said inlet and said outlet,

and a multiplicity of inert, thermally conductive spheroidal elements in firm frictional engagement with one another forming a mass having a multiplicity of passages therethrough, said spheroidal elements having been subjected to compressive distortion to form said mass such that substantial surface areas of each said spheroidal element are in contact with immediately adjacent spheroidal elements, thus providing a multiplicity of thermally conductive paths across the chamber generally perpendicular to said multiplicity of passages, said mass being disposed in said chamber in thermally conductive engagement with said chamber wall with said passages providing flow paths between said chamber inlet and said chamber outlet.

2. The device as claimed in claim **1** wherein said chamber wall and said elements are of essentially the same material.

3. The device as claimed in claim **1** wherein said elements are solid metal bodies which, before compression, were of essentially the same configuration.

4. The device as claimed in claim **3** wherein the elements have a dimensional range between 0.050 inch and 0.250 inch.

5. The device as claimed in claim **1** further including a foraminous flow distributor member disposed between said mass of frictionally engaged elements and said inlet and a second foraminous flow distributor member disposed between said mass and said chamber outlet.

6. The device as claimed in claim **1** and further including a pressurized package having an upstanding element defining an outlet passageway and a separate coupling for connecting said outlet passageway directly to said chamber inlet for applying the contents of said pressurized package immediately on release from said pressurized package to said chamber inlet.

7. The apparatus as claimed in claim **6** and further including an actuator for moving said coupling and said outlet passageway defining element to release the product stored in said package for passage through said chamber.

8. The device as claimed in claim **6** wherein said chamber inlet includes a projecting stub portion which defines an inlet passage and said outlet passageway defining element is also a projecting stub and said coupling is a sleeve that connects said two projecting stubs together, said sleeve being slidable relative to one of said stubs to open said package outlet passageway while maintaining a passageway between said package and said chamber.

9. The device as claimed in claim **8** further including an actuator element mounted on said sleeve and a support structure on said package cooperating with said actuator element enabling said actuator element to be positioned in a latched position and to be moved from said latched position to an operative position in which sliding movement may be imparted to said sleeve to open said package outlet passageway.

10. The apparatus as claimed in claim **9** wherein said support structure includes a rigid housing member on which is mounted said chamber in fixed spaced relation to said package, said housing member having an aperture in its wall for receiving a handle portion of said actuator element, said handle portion, when said actuator element is in said latched position, blocking said housing member wall aperture to minimize entry of liquids into the space defined by said housing member.

11. A pressurized, aerosol-type foam-product dispensing package comprising a container for supply of a liquid colloidal dispersion of a volatile propellant in the product to be dispensed,

a valve in the upper end of said container,

an upstanding tubular valve actuator element projecting above said container,

a tubular stub defining a product discharge passageway, said stub having an annular bead adjacent its lower end,

a stub support structure secured to said container supporting said stub in fixed spaced aligned relation to said valve actuator element,

a coupling sleeve having a conical recess at its lower end terminating in an actuator element seat, an annular surface at its upper end for receiving said stub bead in sealing relation and a restricted control passage between said seat and said bore,

said sleeve bridging the space between said stub and said actuator element with said seat portion disposed on the end of said actuator element and said stub bead in engagement with said sleeve surface,

and a manual operator for moving said sleeve axially towards said container for moving said actuator element to open said valve while said stub bead remains in sealing engagement with said sleeve surface to dispense the product held in said container through said stub.

12. The package as claimed in claim **11** wherein said support structure includes a wall member which defines a housing in which said coupling sleeve is disposed, said wall member having an aperture therein,

and said operator has an enlarged handle portion adapted to be positioned in said aperture, said operator being latched in inoperative position when said handle portion is positioned in said support structure wall aperture.

13. The package as claimed in claim **11** wherein said support structure includes a fulcrum surface,

said sleeve includes a shoulder against which said operator acts, and

said operator is movable between an inoperative position and an operative position in which one end of said operator engages said fulcrum surface and an intermediate portion thereof engages said sleeve shoulder.

14. The package as claimed in claim **11** and further including a heat exchanger structure comprising a chamber having an inlet connected to said tubular stub for receiving the product to be dispensed from said container, an outlet for discharging the foam product from said chamber, and an annular thermally conductive wall between said inlet and said outlet,

and a multiplicity of inert, thermally conductive spheroidal elements in firm frictional engagement with one another forming a mass having a multiplicity of passages therethrough, said mass being disposed in said chamber in thermally conductive engagement with said chamber wall with said passages providing flow paths between said chamber inlet and said chamber outlet for the foam product dispensed from said package.

15. A pressurized, aerosol type shaving cream product dispensing package comprising a container for a supply of a liquid colloidal dispersion of a volatile propellant in a shaving cream product to be dispensed,

a chamber mounted on said container, said chamber having an inlet for receiving the shaving cream product from said container, an outlet for discharging the shaving cream product from said chamber, and a thermally conductive sheet metal wall between said inlet and said outlet,

and a multiplicity of inert, thermally conductive solid metal spheroids in firm mechanical engagement with one another forming a mass having a multiplicity of passages therethrough, said spheroids having been subjected to compressive distortion to form said mass such that substantial surface areas of each said spheroids are in contact with immediately adjacent spheroids, thus providing a multiplicity of thermally conductive paths across the chamber generally perpendicular to said multiplicity of passages, said mass of metal spheroids being disposed in said chamber in thermally conductive engagement with said chamber wall with said passages providing flow paths between said chamber inlet and said chamber outlet for the shaving cream product dispensed from said container.

16. The package as claimed in claim **15** wherein said metal spheroids are aluminum, said spheroids having been subjected to a compressive distortion of about one-third.

17. The package as claimed in claim **16** wherein said spheroids have a minimum diameter of 0.050 inch.

18. The package as claimed in claim **17** and further including a nozzle structure having a passage restriction of cross-sectional area smaller than the cross-sectional area of said flow parts.

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WALTER SOBIN, *Primary Examiner.*