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R. A. FULTON ET AL

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DISPENSER FOR PRESSURIZED PRODUCTS

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FIG. 1

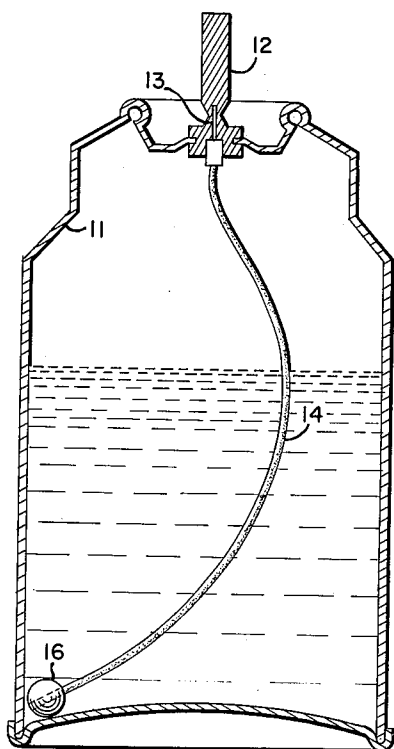


FIG. 2

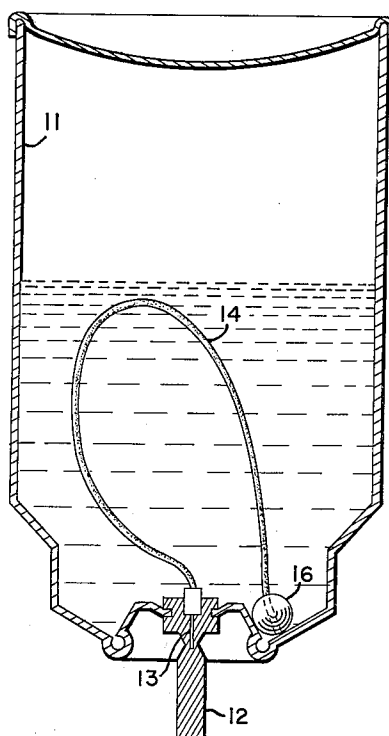


FIG. 3

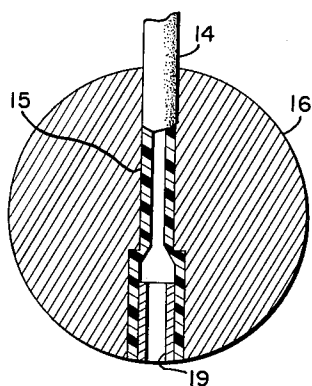
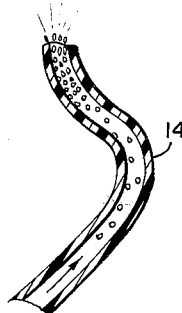


FIG. 4



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DISPENSER FOR PRESSURIZED PRODUCTS

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4 Claims. (Cl. 239-337)

(Granted under Title 35, U.S. Code (1952), sec. 266)

A non-exclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the United States Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

This application is a continuation-in-part of application bearing Serial No. 769,516, filed October 24, 1958, now abandoned.

This invention relates to a dispenser comprising a container and an internal dispensing device adapted to selectively discharge a desired phase of its contents by a propellant gas under pressure, also contained therein, regardless of the position of the container.

The invention has as among its objects the provision of such a dispenser for dispensing contents such as decontaminants for clothing, plastic gear, mobile equipment, aircraft, or any type of decontaminant where the use of steam under pressure is impractical, insecticides to horizontal or low vertical surfaces, and other materials such as shaving creams, liquid hair nets, paints, and lubricating oils.

A further object of the invention is to provide a dispenser of the above character which will not discharge the propellant gas alone when the dispenser is improperly positioned, as for example, inverted.

A further object is the provision of a dispenser of the above character which obviates the need of a nozzle having expansion chambers.

Other objects will be apparent from the description of the invention.

To discharge contents of a conventional pressurized container by internal pressure, a propellant gas, such as air, nitrous oxide, carbon dioxide, a low-boiling hydrocarbon, a chlorofluorohydrocarbon, or CH_3Cl , or any mixture of these is used. The gas may be soluble or insoluble in the other contents and may be lighter or heavier than the other contents. The contents are conventionally forced through a dispensing device, such as a rigid tube, a dispensing valve, and a dispensing nozzle having expansion chambers, in that order to produce the desired type of product, such as an aerosol of fine particles, a medium or fine mist, a coarse spray, a foam type product like shaving lather, whipped cream or hand lotion, a dust, or a gas. With such ordinary dispensers, if the container is held in the wrong position, as, for example, in an inverted position, so that the dispensing nozzle points downwardly, the wrong phase of the contents will escape with resultant waste of product. In some instances, the propellant gas will escape and since the pressure is no longer present, the remaining contents will become useless since they will not be expelled. The dispenser provided by the instant invention obviates these deficiencies in that it dispenses the proper phase of the contents of the container regardless of the position of the container. The dispenser of the invention, furthermore, obviates the need of using a dispensing nozzle having expansion chambers.

According to the invention, there is provided a dispenser comprising a pressure-resistant container, having a dispensing nozzle provided with an orifice adapted to be opened to the atmosphere, for dispensing fluid contents,

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e.g., a liquid under pressure, as for example, under pressure of a propellant gas as described above. These is also provided a flexible, non-kinking capillary tube which functions as an eduction tube and has one end communicating with the nozzle orifice and its other end communicating with the fluid contents to be dispensed, preferably under the surface thereof if the contents to be dispensed is a liquid.

An essential feature of the invention relates to the eduction tube whose internal diameter and corresponding length are so selected as to be capable of producing a capillary effect in the tube whereby boiling of the contents in the tube occurs when the nozzle orifice is opened to the atmosphere. In effect, under these circumstances, the pressurized solution, as it flows through the tube, boils or forms a consecutive series of bubbles of gas. These bubbles are essentially a series of expansion chambers that eliminate the need for expansion chambers in the nozzle which otherwise are necessary to atomize and control the size of the particles as they emerge from the discharge outlet.

For this reason, the nozzle and valve structure can now be made exceedingly simple since all that is necessary is for the eduction tube to be connected to the nozzle orifice and the need for an expansion chamber is eliminated. Any size orifice can be used in the nozzle as long as its diameter is not smaller than the internal diameter of the eduction tube.

Means are also provided for continuously maintaining communication between the said other end of the eduction tube and the fluid contents to be dispensed regardless of the position of the container. Such means are exemplified by a weight of the proper specific gravity secured to the end of said other end of the eduction tube, and which, when the fluid contents to be dispersed is a liquid, is submerged below the surface of the liquid.

To produce an aerosol of the proper particle size with liquefied gas formulations of the type described above, a suitable boiling of the formulation must occur as it is being released. This is effected in prior art devices by orifices and expansion chambers in the nozzle.

In the present invention, there has been incorporated a capillary tube effect in the eduction tube so that no constricting orifices or expansion chambers are needed in the nozzle to produce the proper boiling of the formulation. As explained above, the pressurized solution, as it flows through the eduction tube, boils or forms a series of bubbles of gas which are essentially a series of expansion chambers. In addition, this action in the eduction tube has been coupled with flexibility in the tube to enable the said weight at the end to seek the lowest point in the container as the position of the container changes thereby permitting the proper contents of the container to be dispensed at all times regardless of the position of the container.

The capillary effect causes boiling of the formulation in the eduction tube and is a result of pressure drop due to friction. This effect is a function of the internal diameter size, the roughness of the inner surface, and the length of the tube, as well as the ingredients in the formulation. These factors must be balanced to obtain the desired particle size and output of the formulation as it is emitted. For proper operation, it is necessary that the outlet orifice of the nozzle be not smaller, that is, equal to or larger than, the internal diameter of the eduction tube. The inside diameter of the eduction tube may vary from 0.010 to 0.100 inch and the length may vary from 1/2 inch to several feet depending on the size of the container and other factors involved.

The following internal diameters and corresponding lengths of the eduction tube have been found to be effective in producing a particle size in the aerosol range

with standard formulations of 85 percent propellant and 15 percent active ingredient:

Internal diameter of eduction tube (inches):	Length of eduction tube (inches)
0.0135-----	0.5 to 1.0
0.017-----	0.75 to 2.0
0.024-----	1.0 to 4.0
0.029-----	4.0 to 6.0
0.040-----	4.0 to 8.0

The tube lengths listed above may be increased depending on the size can that is used.

In the accompanying drawing
FIG. 1 is a view of a dispenser of the invention in a normal upright position and partly in cross-section;

FIG. 2 is a view of the dispenser of FIG. 1 in an inverted position and also partially in cross-section;

FIG. 3 is a cross section of a weight hung from the eduction tube, exemplifying a means for continuously maintaining communication between the said other end of the eduction tube and the fluid to be dispensed; and

FIG. 4 is a detail showing the bubbling effect in the capillary tube.

Referring to the drawing, the dispenser comprises a conventional container 11 adapted to hold contents under pressure of a propellant gas and to release said contents to the atmosphere through a conventional dispensing valve, such as breakoff valve 12, and a communicating dispensing nozzle 13. Means for permitting the release of the contents to the atmosphere through the orifice of the nozzle regardless of the position of the container is provided in the form of a dispensing device comprising a flexible, non-kinking eduction tube 14, preferably made of polyethylene and of an internal diameter of capillary dimensions and a corresponding length sufficient to produce the boiling effect described above when the orifice of the nozzle is opened to the atmosphere. The diameter of the orifice of the nozzle is not smaller than the internal diameter of the eduction tube. One end of the eduction tube is fixed to, and communicates with, the said dispensing valve 12 while its other end passes through a longitudinal hole 15 in the center of a weight 16. The hole 15 comprises a narrow entrance end and a wider exit end coaxial therewith. An expansion tube 19, coaxial with said entrance and exit ends of hole 15, tightly fitted within the said wider exit end, firmly wedges the said other end of said eduction tube and compresses it against the walls of said exit end. As a result of this structure, the weight 16 is firmly hung to the said other end of the eduction tube, which, in thus, extending through the full length of hole 15, communicates directly with the contents of the container.

As an example of a satisfactory dispenser, the container 11, having an internal diameter of about 2 1/8 inches and having a conventional dispensing valve and a nozzle provided with an orifice of a diameter not less than 0.040 inch, as, for example, a "Can type III," is preferred. The eduction tube 14 is preferably constructed of polyethylene, has an outer diameter of 0.075 inch, an internal diameter of 0.040 inch, and is 11 1/2 inches long. Its dimensions must be such as to prevent kinking. The length of hole 15 corresponds to the diameter of the weight 16 and is 0.625 inch long. The entrance end of hole 15 is 0.35 inch long and has a diameter of 0.078 inch while the exit end is .275 inch long and has a diameter of 0.094 inch. Expansion tube 19 is 0.15 inch long, has an outer diameter of 0.60 inch, and an inner diameter of 0.030 inch.

If the contents of the container comprise a liquid phase and a lighter gas phase, and if it is desired to empty the liquid phase, the weight is made heavy so that it is always at the lower point no matter what position the container is in, that it, being submerged below the surface of the liquid. If the gas phase is to be released, the weight can be made light so that it will float on the liquid. If there

are several phases in the container, the weight can be made to float in the phase desired to be released by using a weight of the proper specific gravity.

In operating the dispenser, the dispensing nozzle is opened to the atmosphere as for example, by breaking off breakoff valve 12, as a result of which the phase to be released is propelled by the propellant gas into the exit end of hole 15, then passes through the narrower entrance end of hole 15, and then up through the eduction tube and out to the atmosphere through the orifice of the dispensing nozzle.

As an illustration of the use of the dispenser of the invention to decontaminate clothing, contained, for example, in a large bag, the charged dispenser may be dropped into the bag, the bag closed, and the breakoff valve then broken off whereup the contents of the container are released to decontaminate the clothing and will do so regardless of the position of the container in the bag.

We claim:

1. A dispenser comprising a closed, pressure-resistant container, having a dispensing nozzle provided with an orifice adapted to be opened to the atmosphere, for dispensing fluid contents under pressure, a flexible, non-kinking eduction tube having one end communicating with said nozzle orifice and having its other end in communication with said fluid contents to be dispensed, said nozzle orifice having a diameter not smaller than the internal diameter of said eduction tube, said eduction tube having an internal diameter of capillary dimensions ranging about from 0.010 to 0.100 inch and a corresponding length sufficient to produce boiling in said tube when the orifice of the nozzle is opened to the atmosphere, and means for continuously maintaining communication between said other end of the eduction tube and said fluid contents to be dispensed regardless of the position of the container.

2. A dispenser comprising a closed, pressure-resistant container, having a dispensing nozzle provided with an orifice adapted to be opened to the atmosphere, for dispensing fluid contents under pressure, a flexible, non-kinking eduction tube having one end communicate with said nozzle orifice and having its other end in communication with said fluid contents to be dispensed, said nozzle orifice having a diameter not smaller than the internal diameter of said eduction tube, said eduction tube having an internal diameter of capillary dimensions ranging about from 0.010 to 0.100 inch and a corresponding length sufficient to produce boiling in said tube when the orifice of the nozzle is opened to the atmosphere, and means, secured to said other end of the eduction tube, adapted to continuously maintain the said other end of the eduction tube in communication with the fluid contents to be dispensed regardless of the position of the container.

3. A dispenser comprising a closed, pressure-resistant container, having a dispensing nozzle provided with an orifice adapted to be opened to the atmosphere, for dispensing one phase of multi-phase fluid contents under pressure, a flexible, non-kinking eduction tube having one end communicating with said nozzle orifice and having its other end in communication with the phase to be dispensed, said nozzle orifice having a diameter not smaller than the internal diameter of said eduction tube, said eduction tube having an internal diameter of capillary dimensions ranging about from 0.010 to 0.100 inch and a corresponding length sufficient to produce boiling in said tube when the orifice of the nozzle is opened to the atmosphere, and means of such specific gravity secured to said other end of the eduction tube as to continuously maintain said other end in communication with said phase to be dispensed regardless of the position of the container.

4. A dispenser comprising a closed, pressure-resistant container, having a dispensing nozzle provided with an

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orifice adapted to be opened to the atmosphere, for dispensing a liquid under pressure, a flexible, non-kinking eduction tube having one end communicating with said nozzle orifice and having its other end in communication with the liquid to be dispensed, said nozzle orifice having a diameter not smaller than the internal diameter of said eduction tube, said eduction tube having an internal diameter of capillary dimensions ranging about from 0.010 to 0.100 inch and a corresponding length sufficient to produce boiling in said tube when the orifice of the nozzle is opened to the atmosphere, and a weight of such specific gravity secured to said other end of the eduction tube as

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to continuously maintain said other end below the surface of the said liquid regardless of the position of the container.

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