

[54] **PRESSURE-RESPONSIVE SAFETY
DEVICE FOR AEROSOL DISPENSER
AND CONTAINERS EQUIPPED
THEREWITH**

[75] Inventors: **Bruno P. Morane**, Paris; **Charles Paoletti**, Aulnay sous Bois; **Manlio Maurelli**, Vaujours; **Louis Merrien**, Fontenay sous Bois; **Robert Sathicq**, Villepinte, all of France

[73] Assignee: **L'Oreal**

[22] Filed: **June 5, 1970**

[21] Appl. No.: **43,696**

[30] **Foreign Application Priority Data**

June 10, 1968 France.....6919182
Sept. 1, 1969 France.....6929795

[52] U.S. Cl.**220/85 R, 137/525**

[51] Int. Cl.**B54d 25/00**

[58] Field of Search.....220/89 A, 89 B, 44, 85 R;
215/56, 11.2; 137/513, 512, 525.1, 525

[56]

References Cited

UNITED STATES PATENTS

2,702,046 2/1955 Zimmer et al.137/525
3,405,838 10/1968 Preisendanz.....220/44 R

Primary Examiner—Joseph R. Leclair

Assistant Examiner—James R. Garrett

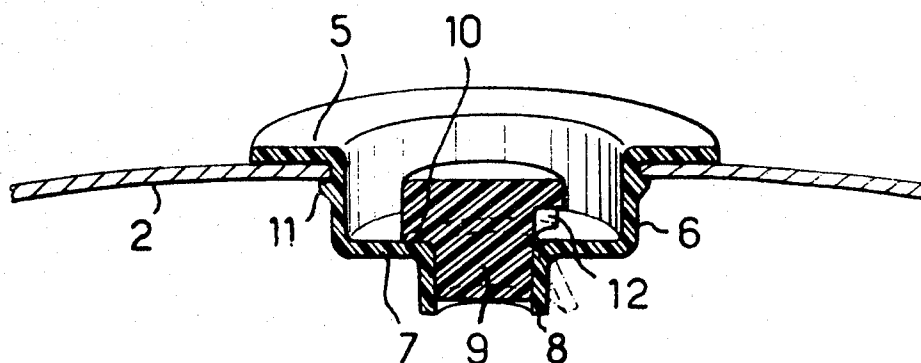
Attorney—Holcombe, Wetherill & Brisebois

[57]

ABSTRACT

A safety device for a container under pressure comprises a resilient member to be positioned in the container wall and formed with a valve opening. A plug is positioned in the opening to normally close it, but the resilient member will flex to permit the release of fluid through the valve opening past the plug in response to excess pressure.

3 Claims, 8 Drawing Figures



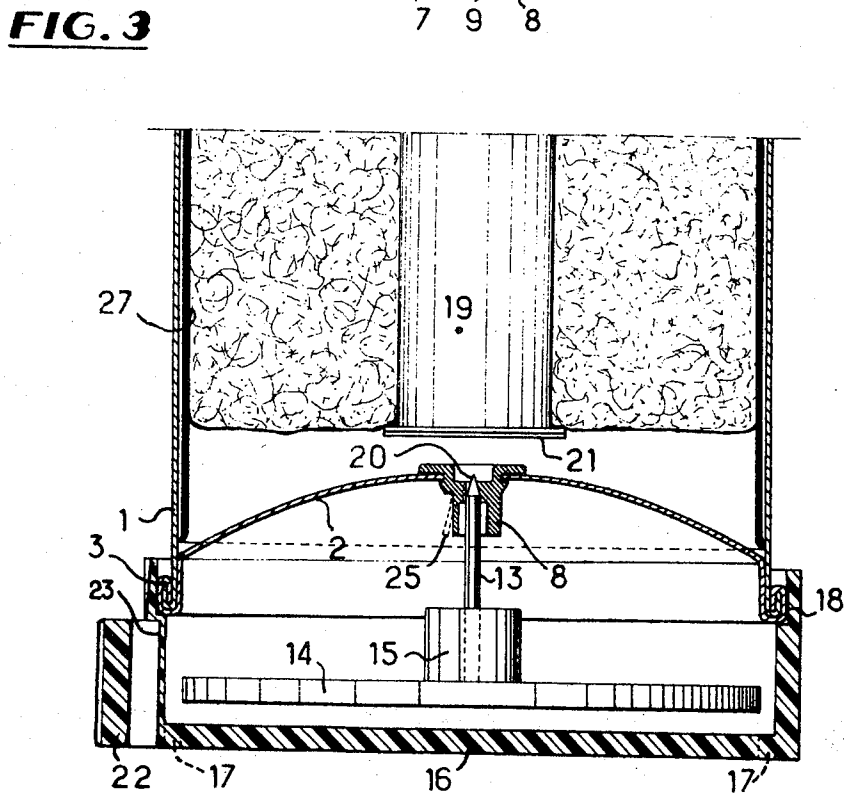
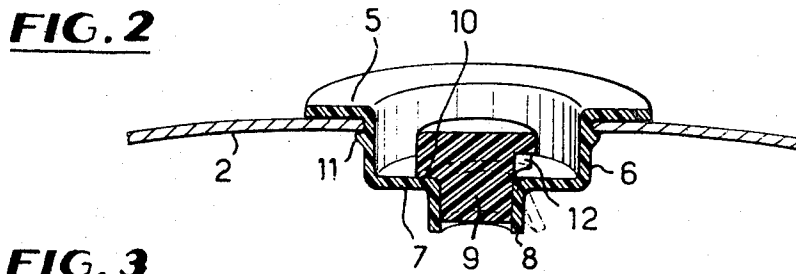
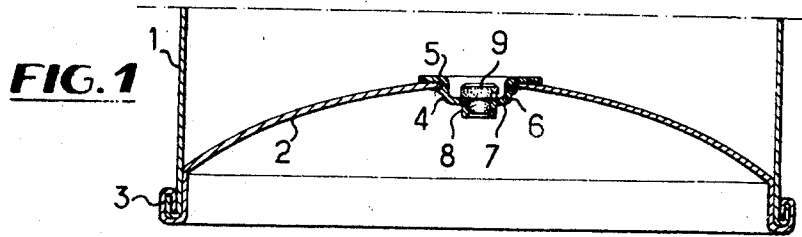


FIG. 4

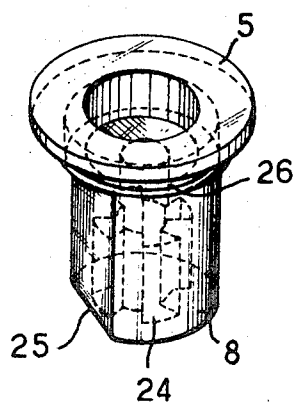


FIG. 5

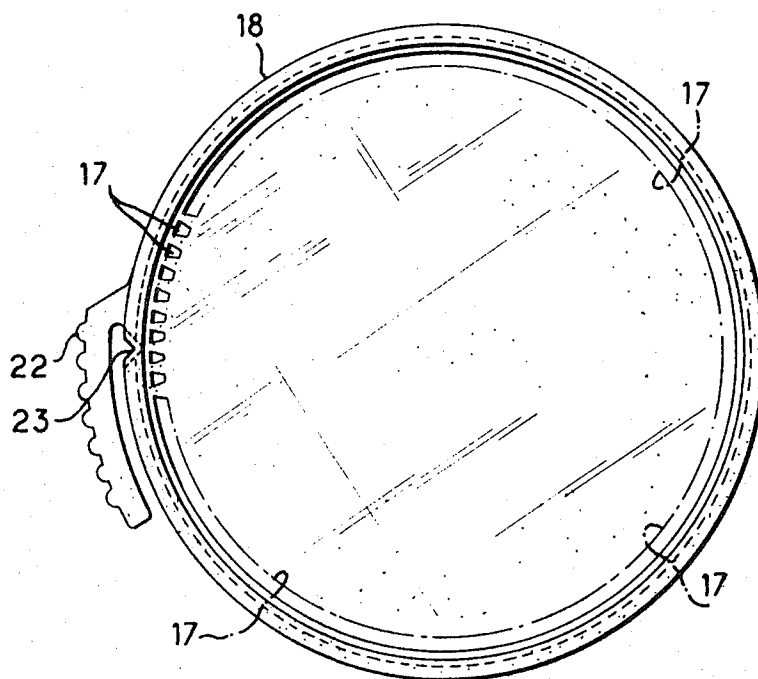


FIG. 6

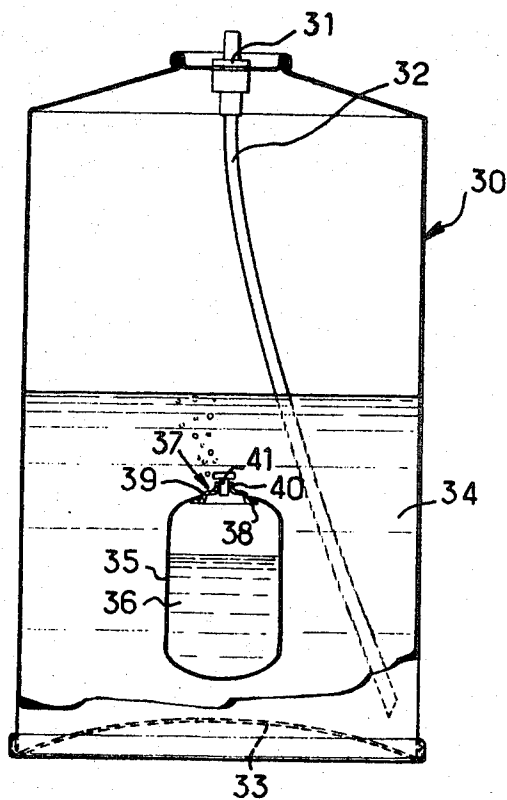
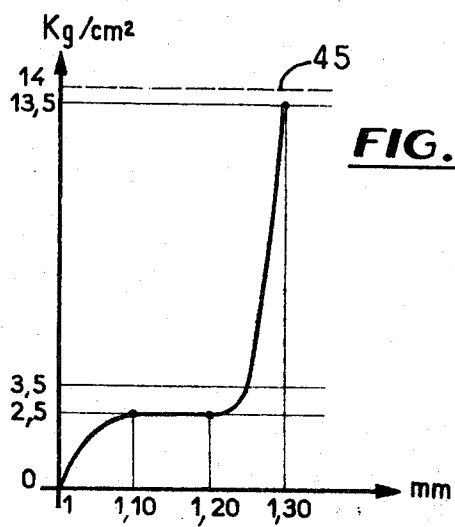
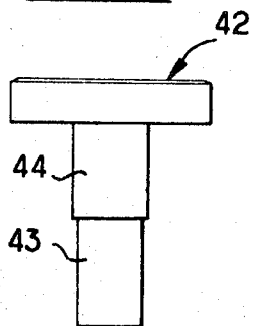


FIG. 7



PRESSURE-RESPONSIVE SAFETY DEVICE FOR AEROSOL DISPENSER AND CONTAINERS EQUIPPED THEREWITH

SUMMARY OF THE INVENTION

This invention relates to improvements in "aerosol bombs" or commercial spray containers adapted to dispense a product in the form of a fog or mist.

As is well known, these devices have a safety problem during both storage and transportation, when in the hands of the seller, and in the hands of the user.

For any of several reasons, such as mechanical shock, an increase in temperature, or an unexpected chemical reaction, the pressure inside the container may increase substantially, which leads to the danger of an explosion. It has accordingly been found that the use of a safety device is desirable. This device must operate automatically and be always ready to function. On the other hand, the inexpensive nature of these dispensers requires a safety device which does not require any expensive parts in order to secure the required degree of safety.

The present invention has as its object to impart to aerosol dispensers a high degree of safety without substantially increasing the cost of the product.

Specifically, the present invention is intended to provide, as a new article of manufacture, a safety device adapted to be inserted in the wall of a container, which is essentially characterized by the fact that it comprises an elastic member force-fitted into an opening in the wall of the container and providing, in succession from the inside of the container to the outside, a sealing ring bearing on the inner surface of the opening, and a deformable cylindrical cup having a deformable bottom equipped with a central flexible valve on the side of the cup remote from the sealing ring. A rigid stopper having an external diameter greater than the internal diameter of the flexible valve is inserted in this valve, and blocks it to form a fluid tight seal when there is a normal difference in pressure between the inside and outside of the container. The cup bottom is, however, adapted to deform, if the difference in pressure increases, thus permitting an escape of fluid toward the outside of the container.

The release of the fluid contained in the container in the case of an abnormal pressure inside it results from the combined effects of the deformation produced by said excess pressure in the deformable cylindrical cup, on the deformable bottom of said cup, and on the flexible valve in contact with the stopper.

It is a further object of the present invention to provide as a new article of manufacture a container of the aerosol bomb type essentially characterized by the fact that it comprises, preferably in a protected zone of its outer wall, at least one safety device such as the one which has just been described.

In the case of a container of the aerosol bomb type, in which the products to be distributed are not placed under pressure until the moment of use, the stopper may consist of the pin intended to perforate the capsule containing the pressurizing fluid. In this case the flexible valve may have, in addition to its inner sealing diameter, an internally fluted zone having a smaller inner diameter than the outer diameter of the pin which is partially force-fitted therein.

It is obvious that, when the bomb has not yet been placed under pressure, the part of the container holding the cartridge of pressurizing fluid is in direct communication with the atmosphere through the opening in the flexible valve and the spaces between the flutes. No excess pressure can then be produced in this part of the container. After perforation, the jacket is pressurized, and if the pressure becomes too high, the elastic safety device deforms as has been described, with the perforating pin then acting as the aforesaid rigid plug.

It will be appreciated that the safety device according to the invention, may be applied to any container holding a product under pressure, which may be of a type other than an aerosol bomb, and that the invention is not limited to this particular application of said safety device. In particular the present invention includes the application of this safety device which permits the packaging of products under a propellant fluid pressure which is constant throughout the course of the operation of the device and different from the vapor pressure of the propellant fluid utilized. It should be noted that, in the case of those containers under pressure presently known, the internal pressure created by the pressurizing fluid is, in general, equal to the vapor pressure of this fluid, at the temperature of the container. Liquefied gases are generally used which have a vapor pressure at room temperature which is of the order of magnitude of 2 to 4 kg/cm².

It is accordingly a further object of the present invention to provide a new article of manufacture which consists of a device which comprises a cup-shaped elastic member and a plug inserted in a flexible valve in the bottom of the cup, which is essentially characterized by the fact that it is positioned at a point on the wall of a container holding a propellant fluid such as a liquefied gas for example, the outer diameter of the plug being so selected with respect to the inner diameter of the flexible valve that the pressure required to open the device by deforming the flexible valve is less than the vapor pressure of the propellant fluid inside the container to which the device is attached. This container, equipped with its cup-shaped safety device and plug is itself positioned inside a jacket closed by a dispensing valve and holding at least one product to be dispensed under pressure.

In a preferred method of carrying out this invention, the recipient to which the cup-shaped device and plug is attached is a metallic cartridge, made for example of aluminum, which is substantially cylindrical in shape and contains a pressurizing fluid of a conventional type such as one or more of the chlorofluorinated hydrocarbons, or butane. The cup-shaped elastic member is made of a natural or synthetic elastomer having a Shore hardness between 65 and 75. The plug is a simple cylindrical plug force-fitted into the flexible valve of the elastic member. The jacket inside which the container for the pressurizing fluid is placed may be a container of the aerosol bomb type having at its upper end a conventional dispensing valve and a closed bottom.

Surprisingly, it has been found that, for an elastic member having the given Shore hardness and a given interior diameter, the opening pressure according to this embodiment remains substantially constant when the diameter of the cylindrical plug varies within cer-

tain limits. This pressure increases considerably when the diameter of the plug increases above this stated range. It is thus important to emphasize that when, in accordance with the preferred embodiment of the invention, one operates within the range in which the opening pressure remains substantially constant as a function of the diameter of the plug, it is possible, for a flexible valve of a given inner diameter, to use plugs the diameter of which does not have to be determined with great precision. The opening pressure will nevertheless remain substantially the same despite a large tolerance with respect to the diameter of the plug. This possible tolerance as to the diameter of the plug and the flexible valve makes it possible to manufacture the device according to the invention very cheaply.

It will be appreciated that, in the outer jacket, which holds both the product to be dispensed and the cartridge for the pressurizing fluid with its safety device according to the above embodiment, there is a pressure equal to the difference between the vapor pressure of the pressurizing fluid in the cartridge and the pressure required to open the safety device and stopper on said container. In effect, the pressurizing fluid, which has a vapor pressure greater than the opening pressure of the device on the cartridge which holds it, escapes from this cartridge inside the outer jacket. The pressure inside this outer jacket then increases to a value such that the pressure difference between the inside and the outside of the cartridge holding the pressurizing fluid is equal to the opening pressure of the device on the container. At this time no further escape of pressurizing fluid takes place between the cartridge and the outer jacket and the pressure inside the outer jacket therefore remains constant.

When the product to be dispensed is sprayed out through the dispensing valve of the outer jacket in response to the pressure which is produced inside that jacket, the pressure inside the jacket diminishes and this results in a leakage of pressurizing fluid from the cartridge inside the outer jacket. This leakage continues until the pressure inside the outer jacket reaches its previously established value.

It will be appreciated in the light of what has been said that the pressure inside the outer jacket is clearly less than the vapor pressure of the pressurizing fluid used. The pressurizing fluid may, for example, have a vapor pressure of 3.5 kg/cm² and produce inside the outer jacket a pressure of 1 kg/cm², provided that the closure for the cartridge has an opening pressure substantially equal to 2.5 kg/cm².

The two essential parameters which control the opening pressure of the cup-shaped device and stopper mounted on the inner container are, for a given diameter of the flexible valve, the diameter of the plug, and the Shore hardness of the material of which the cup-shaped plastic member is made. Since it is known that it is preferred to use a diameter for the plug which lies in the range in which the opening pressure is substantially constant, as has been hereinbefore set forth, it will be seen that the value of this opening pressure may be selected at will by modifying the Shore hardness of the elastic material of which the cup-shaped elastic member is made.

In one embodiment of the invention the plug may have two different diameters, one corresponding to the

opening pressure used during operation and the other corresponding to an opening pressure which is greater than the vapor pressure of the liquefied gas at room temperature. This arrangement makes it possible to fill the device in the following manner. The cartridge intended to hold the pressurizing fluid is equipped with the elastic cup-shaped member and the desired quantity of liquefied pressurizing fluid is introduced into this cartridge. The plug is then seated in the flexible valve of the elastic member utilizing the maximum diameter of this plug so as to avoid any leakage of pressurizing fluid. The cartridge which has been closed in this manner is then inserted in the outer jacket, which has first been equipped with its dispensing valve and filled with the product to be dispensed. The plug is then moved within the valve so that its portion of smaller diameter is inserted therein instead of its portion of larger diameter. This results in an immediate leakage of pressurizing fluid and the bottom of the outer jacket is promptly sealed so as to completely close it.

It will be appreciated that because the greater diameter of the plug has been introduced into the flexible valve before the portion of smaller diameter no substantial modification of the opening pressure of the device results, provided that the time during which the zone of larger diameter has been seated in the flexible valve is relatively limited, of the order of a few hours for example.

Finally, the present invention has as its object the new article of manufacture, which consists of a container for dispensing under pressure at least one product, which container is provided with a dispensing valve and is essentially characterized by the fact it comprises an outer jacket holding the product to be dispensed and an inner cartridge holding a pressurizing fluid, which inner cartridge is equipped with a safety device according to the invention. This device comprises an elastic cup-shaped member and a plug which is seated in a flexible valve in the bottom of the cup-shaped member.

One of the essential characteristics of this embodiment of the invention is that it makes it possible to provide pressurized containers the outer jacket of which is made of a plastic material, or even glass, whereas the containers heretofore known are made of aluminum sheet metal. In effect, in the event of accidental breakage of the outer jacket, the explosion which takes place due to the internal pressure therewithin is, in the case of a container according to the invention, extremely small, because the pressure differential between the pressure inside the jacket and the ambient pressure is not very great, since the outer jacket is not subjected to the complete vapor pressure the pressurizing fluid. This characteristic is particularly important from a commercial point of view.

In order that the invention may be better understood three embodiments thereof will now be described, purely by way of illustration and example, with reference to the accompanying drawings, on which:

FIG. 1 is a partial axial sectional view showing the concave bottom of an aerosol bomb with the safety device according to the invention and in which the bomb is placed under pressure when it is filled during manufacture;

FIG. 2 is a section taken through the safety device of FIG. 1 on a larger scale;

FIG. 3 is a partial axial sectional view through the base of a container of the aerosol bomb type equipped with a safety device according to the invention, which container is placed under pressure at the moment of use;

FIG. 4 is a perspective view showing the deformable safety device of FIG. 3;

FIG. 5 is a plan view showing the protective cap of the safety device for a container of the type shown in FIG. 4;

FIG. 6 is a schematic axial sectional view showing a container of the aerosol bomb type holding an inner cartridge provided with a cup-shaped safety device including a plug;

FIG. 7 is a side view showing a plug having two diameters; and

FIG. 8 is a graph showing the variation in the opening pressure of the device attached to the inner cartridge holding the pressurizing fluid, as a function of the diameter of the plug.

Turning now to the drawings, and particularly to FIGS. 1 and 2, it will be seen that reference numeral 1 indicates the cylindrical outer wall of a container of the aerosol bomb type according to the invention. A concave hemi-spherical bottom 2 is sealed at 3 to the bottom of this cylindrical wall. In the center of this concave bottom 2 is a circular opening 4 having rounded edges which is closed by a deformable elastic member comprising a sealing ring 5 which is applied to the inner surface of the bottom 2. A cylindrical zone 6 which is deformable in response to excessive internal pressure is connected to a deformable bottom 7. This bottom 7 is pierced by a flexible cylindrical valve opening 8, which is blocked in a fluid tight manner by the cylindrical body 9 of a rigid plug 10 force-fitted into the valve opening 8. The head 10 of this plug rests on the inner surface of the bottom 7. A circular ridge 11 on the outer wall of the cylindrical zone 6 holds the deformable member in position in the circular hole 4 against the possibility that an external force might tend to force the deformable member into the bomb.

The head 10 of the rigid plug is provided with a notch 12 in the zone of contact between the head and the internal surface of the bottom 7 of the deformable elastic member.

In a second embodiment of the invention adapted to containers of the aerosol bomb type which are not put under pressure until the moment of use, and which is illustrated in FIGS. 3-5, the rigid plug is replaced by a pointed pin 13 attached to a circular head 14 provided with a socket 15 which acts as a stop, and receives the pin 13. A protective cap 16 is provided with weakened areas 17 and attached by a cylindrical lip 18 which externally grips the circular seal 3 of the bomb. The protective cap 16 has a tear strip 22 and an axial scoring 23.

The container illustrated contains a movable piston 27 above which the fluids to be dispensed are located. At the lower end of the piston is a cartridge 19 holding a pressurizing fluid. FIG. 3 shows only the lower part of the container and its piston. The point 20 of the pin 13 is located at a distance from the bottom 21 of the cartridge 19 which is less than the distance between the socket 15 and the cylindrical valve 8.

In the elastic deformable member, the cylindrical passage provided at the center thereof for the pin 13

comprises two zones when considered in the direction of penetration of the pin. The first zone, 24 (FIG. 4), is located toward the outer side of the member and is internally fluted, while the second zone 26 is cylindrical.

These two zones have a diameter which is slightly smaller than the external diameter of the pin 13. They are provided with a flat 25 in their outer wall. It should be noted that the protective cap 16 introduces a supplementary safety factor by resisting accidental impacts on the head 14, which impacts could provoke premature perforation of the capsule 19 by the pin 13, thus placing the bomb under the predetermined pressure.

In the first of the above described cases, that is to say when, a bomb placed under pressure during its manufacture and a dangerous excess pressure comes about, this tends to impart a hemi-spherical shape to the safety device. The excess gas penetrates through the notch 12 under the lip 8 of the flexible valve and escapes into the atmosphere. The position of the deformed security device is shown in phantom lines on FIG. 2.

In the case of the bomb placed under pressure at the moment of use, it is operated in the following manner. The user lifts the tear strip 22. The cap 16 tears along the weakened line 23 and the perforation 17 and is easily removed. If pressure is then exerted on the head 14, the point 20 of the pin 13 enters into the passage 26 in the elastic member and perforates the bottom 21 of the cartridge 19. The bomb is then placed under some pressure and the seal between the pin 13 and the wall of the cylindrical zone 26 of the deformable elastic member is sufficient to insure a fluid-tight contact between these members. But if a dangerous excessive pressure is encountered, this tends, as in the previous case, to impart a hemi-spherical shape to the safety member which separates the neck part 25 from the valve 8 and provides an escape channel for the gas to the outside of the jacket until the interior of the jacket has returned to a pressure compatible with the safety required by the nature of the jacket. The position of the deformed safety member is shown in phantom lines on FIG. 3.

Referring now to FIGS. 6-8, it will be seen that reference numeral 30 indicates the container of the aerosol bomb type shown on FIG. 6. The container 30 has at its upper end a dispensing valve 31 provided with a tube 32. It is closed at its lower end by a base 33 seated on the lateral wall. Inside the container 30 is a liquid 34 which is to be dispensed, and a cylindrical cartridge 35 inside which is a pressurizing fluid 36 consisting of a liquefied gas. The vapor pressure of the fluid 36 at ordinary temperatures is about 3.5 kg/cm². The cylindrical cartridge 35 is made of aluminum sheet material. At its upper end the cartridge is provided with an elastic member 37.

The elastic member 37 is made of a synthetic rubber having a Shore hardness of 70. It comprises, from inside the cartridge 35 toward the outside thereof, a sealing ring 38 bearing against the inner surface of the wall of the cartridge 35, then a deformable cylindrical cup 39, and finally, in the central part of the cup 39, a flexible cylindrical valve-hole 40 having an inner diameter of 1 mm. Inside the valve 40 is a plug 41 having a diameter of 1.15 mm.

It will be appreciated that the opening pressure of the device 37-41 is about 2.5 kg/cm² and consequently, the

pressure inside the outer jacket is about 1 kg/cm². This envelope may therefore be made of glass or plastic.

In FIG. 7 there is shown a valuable alternative form of the plug used in combination with the elastic cup-shaped member. This plug 42 comprises two successive zones of different diameter. The zone 43 has a diameter of 1.15 mm whereas the zone 44 has a diameter of 1.30 mm. Such a plug may be used in combination with the elastic member 37 described in connection with the device illustrated in FIG. 6.

The graph of FIG. 8 shows, for an elastic member such as the member 37, the variation as a function of the diameter of the plug, of the opening pressure required to produce, by deformation of the cup-shaped member 39 and the valve 40, a leakage between the valve and the plug 41. It will be seen that when the plug has a diameter between 1.10 and 1.20 mm the opening pressure remains substantially constant and is equal to 2.5 kg/cm². For a diameter of 1.30 mm, the opening pressure is of the order of 13.5 kg/cm². The line 45 represents the limit beyond which the outer jacket 30 is deformed by internal pressure. The graph of FIG. 8 utilizes as its ordinate the internal pressure inside the cartridge 35 expressed in kg/cm² and, as abscissa, the diameters of the plug utilized expressed in mm. This graph has been made for an elastic member 37 having the characteristics indicated in the preceding example. To provide a container having a plug 42 the cartridge 35 is equipped with its elastic member 37 and the pressurizing fluid 36 is introduced into this cartridge.

The plug 42 is then inserted in the valve opening 40 so that the zone 44 occupies the valve opening. The vapor pressure of the pressurizing fluid 36, which is less than 13.5 kg/cm², does not cause any leakage of pressurizing fluid outside the cartridge 35 at this time. The valve 31 is mounted on the outer jacket 30 and the product 34 to be dispensed is introduced into it. The zone 44 of the plug 42 is then forced through the valve member 40 until the zone 43 is seated in the valve opening. At this moment a leakage of fluid 36 begins since the opening pressure of the device 37-43 is 2.5 kg/cm². The cartridge 35 is then inserted in the jacket 30 and the base 33 immediately sealed to close it. The pressure inside this jacket increases to 1 kg/cm² and, each time some of the product 34 is dispensed, there is a leakage of fluid 36 which escapes through the valve opening 40 so as to reestablish the pressure inside the jacket 30 at about 1 kg/cm².

It should be noted that the device according to the invention makes it possible to avoid permanent contact

between the pressurizing fluid in the liquid state and the product to be dispensed.

It will of course be appreciated that the various embodiments of the safety device according to the invention which have been hereinbefore described have been given purely by way of example and may be modified as to detail without thereby departing from the basic principles of the invention. In particular the deformable elastic device according to the invention may be applied as a safety device to any part of a container under pressure and to any type of container under pressure, whether it is an aerosol bomb or not.

What is claimed is:

1. Safety device adapted to be inserted in the wall of a container, which device comprises an elastic member force-fitted into an aperture in the container wall, said elastic member having a sealing collar portion bearing on the inner surface of said container and a retaining ridge bearing on the outer surface of said container, said collar portion being connected to a resilient cylindrical cup portion provided with a resilient bottom having a valve opening in its central part, which cup portion projects outwardly of said container, said resilient bottom having a resistance to deformation sufficient to withstand, without deformation, a predetermined difference in the pressures within and without said container, but yielding sufficiently upon application of a pressure difference greater than said predetermined difference to slightly enlarge said valve opening, a rigid plug having a stem portion located in said valve opening and a head portion larger in diameter than said stem portion and seated in said cup with its lower surface against said bottom so long as the pressure inside said container exceeds the ambient pressure, said stem portion filling said valve opening to close it fluid-tight so long as said bottom remains undeformed but being dimensioned to permit the escape of fluid from said container through a space formed between said stem portion and the edge of said valve opening when said valve opening is enlarged by deformation of said resilient bottom and said head portion having a notch in its lower surface to provide access for said fluid to said space.

2. Container of the aerosol bomb type comprising outer jacket having a protected zone and at least one safety device as claimed in claim 1 mounted in said zone.

3. Container as claimed in claim 2 having a concave bottom, in which said elastic member is mounted substantially in the center of said concave bottom.

* * * * *