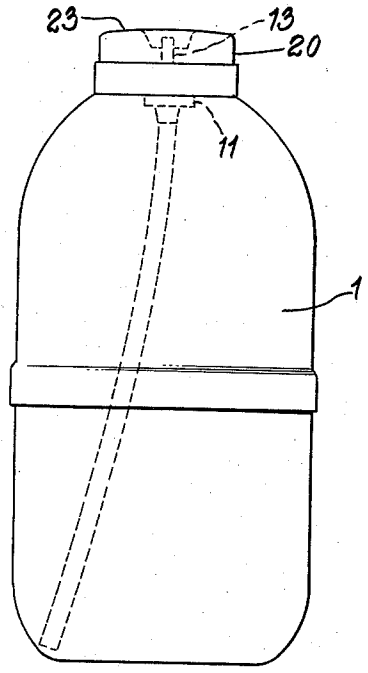
Aug. 7, 1956 T. A. C. BOTH ET AL 2,757,964

HIGH PRESSURE FLUID DISPENSING DEVICE

Filed July 16, 1953 2 Sheets-Sheet 1

Fig. 1.



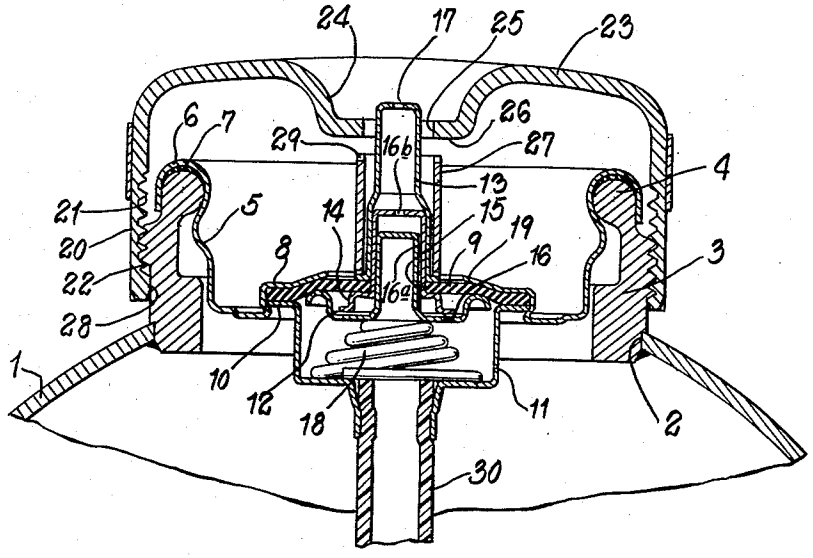


Fig. 2.

INVENTORS
TONJES A.C. BOTH &
BY LESTER CLIFFORD MORTON
Kenyon & Kenyon
ATTORNEYS

Aug. 7, 1956 T. A. C. BOTH ET AL 2,757,964

HIGH PRESSURE FLUID DISPENSING DEVICE

Filed July 16, 1953 2 Sheets-Sheet 2

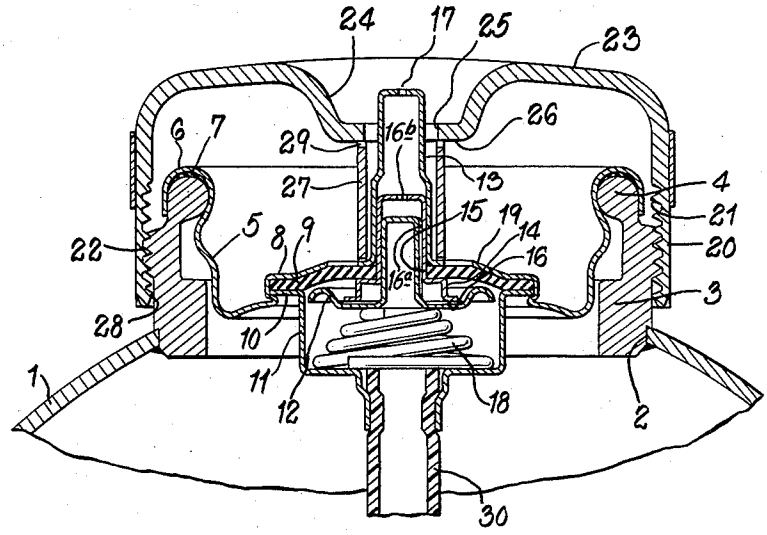


Fig. 3.

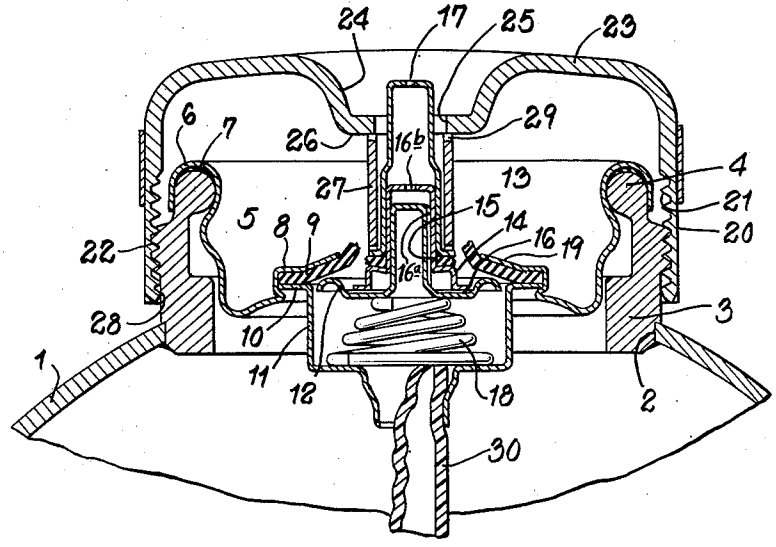


Fig. 4.

INVENTORS
TONJES A.C. BOTH &
BY LESTER CLIFFORD MORTON
Kenyon & Kenyon
ATTORNEYS

United States Patent Office

2,757,964

Patented Aug. 7, 1956

2,757,964

HIGH PRESSURE FLUID DISPENSING DEVICE

Tonjes A. C. Both, Stratford, and Lester C. Morton, Danbury, Conn., assignors to Bridgeport Brass Company, Bridgeport, Conn., a corporation of Connecticut

Application July 16, 1953, Serial No. 368,422

8 Claims. (Cl. 299—95)

This invention relates to a high pressure fluid dispensing device of the package type including a container enclosing a charge of liquefied gas and provided with a fluid dispensing valve. The gas remains liquid because confined under pressure. When the valve is opened this pressure is released so that the gas discharges through the valve. The gas charge in the container includes an active ingredient which may be of many types, a good insecticide providing an example.

Such devices must be shipped by the manufacturer to distributors and merchandisers and, therefore, the packages must comply with Interstate Commerce Commission regulations. The devices are commonly classified industrially as being of either the low pressure of high pressure types, devices having internal fluid pressures of over 50 p. s. i. gage being considered high pressure. Such high pressure devices use a relatively thick walled container and may involve working pressures, internally, of around 200 p. s. i. For protection, in the event of fire, for example, such a high pressure device is required to incorporate some means for providing automatic venting when the internal pressure exceeds the normal value, whereby to prevent explosion of the container.

One of the objects of the present invention is to provide a fluid dispensing device which will provide for such venting at a relatively low manufacturing cost. Another object is to provide for the use of a well known and reliable prior art valve in such a fashion that the valve functions both in its usual fashion and also as a safety vent which operates when the pressure in the container, of the described kind of package, exceeds a safe value.

The accompanying drawings illustrate an example of a device incorporating the invention, the various figures being as follows:

Fig. 1 is a side elevation of the complete package;

Fig. 2 is a vertical section of the upper portion of the package shown by Fig. 1 and illustrates the details of the fluid dispensing valve which also acts as a safety vent;

Fig. 3 is the same as Fig. 2 excepting that it shows the venting action; and

Fig. 4 is the same as Fig. 2 excepting that it shows an extreme venting condition such as occurs in the event the package is heated to extremely high temperatures.

This illustrated device incorporates the relatively thick walled container **1** made of two deep drawn sheet steel parts which are fitted together and brazed. The container is adapted to operate under working pressure of around 200 p. s. i. The top of the container is formed to provide a hole **2** in which a relatively thick walled, annular neck **3** is brazed so as to provide the container with an upstanding neck. The upper rim **4** of this neck is transversely rounded.

The dispensing valve used with the illustrated package is the one shown by Fig. 9 of the N. O. Loven et al. Patent 2,582,262, issued January 15, 1952. This valve has proven to be relatively inexpensive to manufacture, thoroughly reliable as to both shelf and service life, and it provides for an aerosol dispersion of the sprayed charge

in the container. It is to be understood that the container **1** is more or less filled with liquefied Freon or the like which includes an active ingredient such as an insecticide.

As shown by Fig. 2, the dispensing valve is an assembly including a closure **5** in the form of an upright cup having its rim **6** formed around the neck's rim **4** so as to clamp the latter, interposed sealing material **7** forming a gas-tight joint. The bottom of the cup is formed to provide an anular groove **8** within which is clamped the periphery of a flexible diaphragm **9** and the flange **10** of a spring cup **11** which depends below the diaphragm. The groove **8** clamps these parts tightly enough to form a gas-tight seal.

The valve includes a cup-like head **12** positioned on the diaphragm's inside with its rim sealing thereagainst free from the groove **8** and the rim of the spring cup **11**. The valve has a stem assembly **13** connected to the head **12** and firmly clamped to the diaphragm **9** by the flange-like stem parts **14**. The diaphragm **9** has a hole **15** through which the stem assembly projects, the stem assembly extending a substantial distance upwardly beyond the outside of the diaphragm **9**. The stem assembly is constructed to provide a passage having an entrance **16** sealed by the seated head **12**, and this passage extending along the stem upwardly, through the various parts, and having an exit **17** in the top end of the stem assembly. This passage is formed through the entrance **16**, formed by one or more radial grooves in the upper face of the head **12**, up the passage **16*a***, formed by one or more grooves in the inner one of the telescoped valve stem parts, and through the orifice **16*b*** to the exit **17**. A compression spring **18** is positioned in the valve cup **11** to more positively seat the valve head, and the closure **5** is shaped to provide annular support **19** located to support the diaphragm **9** opposite to the valve head's rim, when the diaphragm **9** is fixed upwardly.

The groove **8** and the hole **15** are centrally disposed and in general all of the parts are symmetrical about the axis of the valve assembly. Excepting for the diaphragm **9**, all of the parts are formed from sheet metal. The diaphragm **9** is made from nylon or other flexible, elastic, thermoplastic, non-metallic material which is suitably inert to the action of the charge in the container.

This valve is shown in the Loven et al. patent as applied to a low pressure package. As described so far, the valve is applied to a high pressure package. Downward motion of the valve stem assembly **13** flexes the diaphragm **9** while permitting the rim of the valve head **12** to unseat, the charge then discharging through the passage formed by the valve assembly. Such a package would be unsuitable because it does not provide any venting arrangement as required by shipping regulations for safety reasons.

In accordance with the present invention a cap is screwed on the neck **3**. This cap includes a generally cylindrical skirt or side wall **20** having internal screw threads **21** in screw-threaded engagement with external screw threads **22** formed on the outside of the generally cylindrical container neck **3**. The cap has a generally flat top or roof **23** provided with a central depression **24** in which a central hole **25** is formed. The hole **25** has a diameter somewhat larger than the outside diameter of the upper portion of the stem assembly **13** so that a space is defined between these two parts. The depression **24** is deep enough so that the upper portion of the valve stem assembly **13** projects through the hole **25** and up into the depression **24** without, however, extending high enough, even when the cap is screwed completely down, to project above the top of the top **23** of the cap.

The inside of the cap around the hole **25**, shown at **26**, forms a relatively flat annular surface around the valve stem assembly, and a cylindrical sleeve **27** is installed around the valve stem assembly so as to in effect form a part of this assembly. This sleeve **27** has a large

enough diameter to abut the surface 26 when the cap is screwed downwardly, so that further downward screwing of the cap pushes the sleeve 27 downwardly so that the valve stem and valve head move downwardly with consequent unseating of the valve head 12 so that the charge in the package discharges through the outlet 17 of the valve stem assembly. Upward screwing releases the downward displacement force so that the valve stem assembly and its valve head return, an action which is aided by the spring 18, so as to again result in reseating of the valve head. Thus the device is provided with a screw-acting operator.

The bottom of the skirt 20, of the cap, has inwardly extending projections 28 which lock the cap against complete unscrewing. This locking action is such as to space this cap's surface 26 a predetermined distance above the top of the sleeve 27. As shown, the sleeve 27 may have diametrically opposite passages 29 formed down in its top edge.

With this organization of parts the device may be actuated by screwing down and screwing up the cap. The device is shipped with the cap screwed to its uppermost position. In the event of fire or other conditions causing heating of the device so that its contents attain a pressure approaching that which would explode the container 1, the flexible diaphragm 9 is extending upwardly by the unusual internal fluid pressure, the annular support 19 being made of relatively thin sheet metal and deforming under the pressure so as to puff or distend upwardly with the diaphragm. The support 19 works as though part of the diaphragm in connection with the just-described action. The hole in its center causes the support 19 to deform under the stress, of the internal pressure, while the balance of the closure 5 resists this stress without material deformation. As the diaphragm 9 puffs upwardly it moves the sleeve 27 upwardly until this sleeve's top edge abuts the cap's surface 26, whereupon the sleeve can move no higher. When this occurs further upward distension or puffing of the diaphragm 9, and further deformation of the support 19, causes the diaphragm to leave the rim of the valve head 12 so as to unseat from the latter. This then opens the valve so that it vents and relieves the internal pressure, as shown by Fig. 3.

Since the diaphragm 9 is made of a material which is not only flexible and elastic, but which is also thermoplastic nylon being commercially used, excessive heating softens the diaphragm 9 so that, under extreme conditions, the entire diaphragm ruptures so as to effect the condition shown by Fig. 4. This provides a large and fully open passage directly through the top of the container and to the inside of the screw cap, the diametrically opposed grooves 29 providing opposed venting up through the space defined around the valve stem by the cap's hole 25. Under such extreme conditions the standpipe 30, which may be made of plastic and crimped into a socket provided in the bottom of the valve cup 11, may also deform inwardly, also as shown by Fig. 4, so as to provide for the rapid venting required under such extreme conditions.

Now it can be seen that by providing the described construction, the well known and reliable valve of the Loven et al patent is made to function not only as a valve that can be opened, but also as a safety venting valve. The venting action is more or less moderate when moderately excessive pressures prevail inside of the container, and in extreme conditions the entire top of the package in effect opens up so as to provide for maximum venting. These features of the invention have been tested and have been accepted as fully complying with the shipping regulations pertinent to packages of the kind described.

It is to be noted that the described package may be returned to the manufacturer, by the user, for refilling should this practice be desired. When the closure is pulled from the neck 3 the latter provides a large opening through which the container may be cleaned and refilled. The valve assembly is adequately inexpensive to permit the substitution of a new assembly. The cap may be removed by the manufacturer by using adequate force to free the anchoring member 28, the cap subsequently being properly replaced after the refilling and revalving procedure.

We claim:

1. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the later to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance.

2. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, the diaphragm being made of elastic material.

3. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and

the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, the diaphragm including material having the characteristic of softening and rupturing when subjected to heat and to the fluid pressure.

4. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, the diaphragm including elastic, thermoplastic, material in its construction.

5. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, said stop being in the form of a cap secured to the mount and having a hole for passing fluid discharged by the valve passage's exit and an inside surface against which the valve abuts after it has moved said predetermined distance.

6. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having

an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, said stop being in the form of a cap secured to the mount and having a hole for passing fluid discharged by the valve passage's exit and an inside surface against which the valve abuts after it has moved said predetermined distance, the cap being secured to the mount by means permitting movement of the cap towards the diaphragm causing the cap's inside surface to engage the valve and move it in the direction unseating its head from the diaphragm's inside, for normal valve operation.

7. A fluid dispensing device including a flexible diaphragm having a hole formed therethrough and having an inside and an outside, a valve having a head positioned on and seating on the inside of the diaphragm and a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, a mount connected to the diaphragm circumferentially around the valve head and spaced therefrom so that motion applied to the stem towards the diaphragm flexes the latter and unseats the head from the diaphragm's inside, the valve being constructed to form a passage with an entrance positioned to be opened on the diaphragm's inside by said unseating of the head and the passage extending longitudinally to the stem and having an exit opening beyond the outside of the diaphragm, whereby fluid pressure, exceeding a predetermined value, applied to the inside of the diaphragm causes the latter to distend in the direction of its outside and moves the valve in said direction therewith, and a stop connected to the mount and positioned to be engaged by the valve after it has moved in said direction a predetermined distance so as to stop the valve's further movement, continued distending of the diaphragm in said direction, after said stoppage of the valve's movement, causing the diaphragm to unseat from the head and thus to open the valve passage's entrance, the diaphragm being made of non-metallic material, and a spring positioned to urge the valve's head towards the diaphragm's inside for more positive seating thereon, and a normally rigid support positioned on the diaphragm's outside opposite to the head and located to support the diaphragm against the spring's pressure, said support being deformable when stressed by said fluid pressure on the inside of the diaphragm.

8. A fluid dispensing package including a container having an opening surrounded by a neck having a mouth, liquefied gas inside of the container, a closure mounted in the neck's mouth and having a substantially central opening, a flexible diaphragm spanning the closure's opening, the diaphragm having a substantially central hole, a valve having a head positioned on the diaphragm's inside and seating thereagainst free from the closure, the

valve having a stem connected to the head and to the diaphragm and projecting through the hole and extending beyond the diaphragm's outside, whereby motion applied to the stem in a direction towards the diaphragm causes flexing of the diaphragm and unseating of the head from the diaphragm's inside, the valve forming a fluid passage with an entrance positioned on the diaphragm's inside so as to be sealed by the seated head and the passage extending along the stem and having an opening substantially at the stem's outer end, a cap in screw-threaded engagement with the container's neck and having a top having a hole formed therein through which the valve stem projects, the stem and cap being constructed to interengage when the cap is screwed down on the neck and to be spaced therefrom when the cap is screwed outwardly from the cap, and means for restraining the cap from being unscrewed beyond a location on the neck where the stem and cap are spaced apart but will interengage when excessive fluid pressure in the container distends the diaphragm outwardly.

References Cited in the file of this patent

UNITED STATES PATENTS

2,577,245	Tuttle et al.	Dec. 4, 1951
2,582,262	Loven et al.	Jan. 15, 1952
2,594,539	Brown	Apr. 29, 1952