United States Patent [19]

Reynolds

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[54] **VALVED STOPPER**

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[51] **Int. Cl.** **A61b 17/36**

[58] **Field of Search** 222/396, 397, 481, 222/505, 509, 511; 128/303.1; 137/210; 251/77; 62/293

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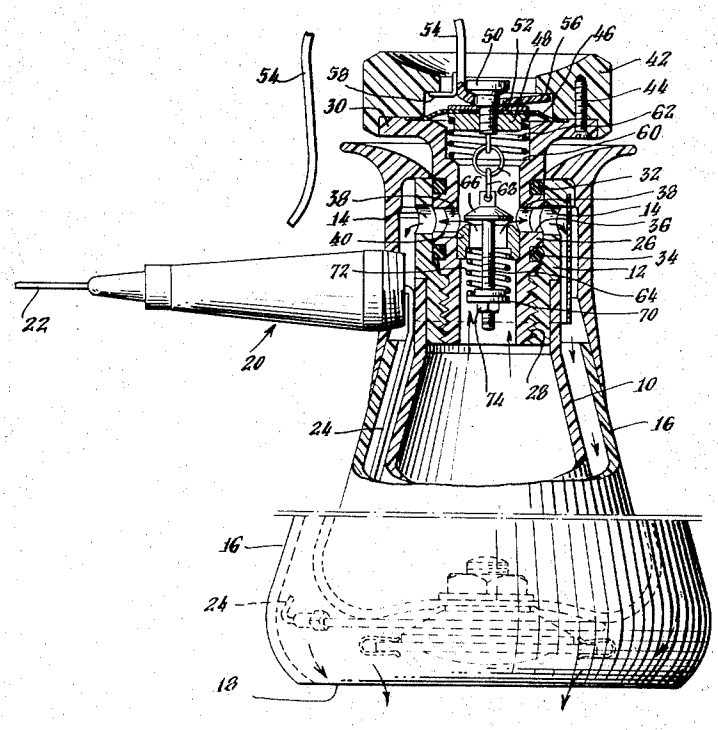
[57] **ABSTRACT**

There is disclosed a valved stopper for use with a self-pressurizing liquid refrigerant dispenser such as used in dermatologic cryosurgery. An operating lever is urged normally outwardly by a spring within the stopper and is loosely linked to a spring loaded vent valve which is normally open. When the lever is manually depressed, the vent valve is closed by its own spring with a force independent of finger pressure. The vent valve then acts as a regulator to prevent excessive pressure build-up within the container.

The foregoing abstract is not to be taken either as a complete exposition or as a limitation of the present invention, and in order to understand the full nature and extent of the technical disclosure of this application, reference must be had to the following detailed description and the accompanying drawings as well as to the claims.

10 Claims, 3 Drawing Figures



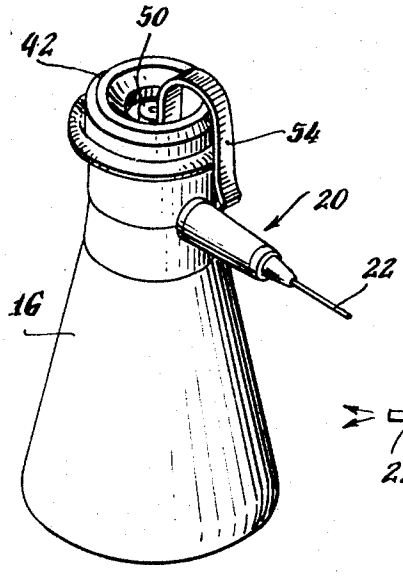


Fig. 1

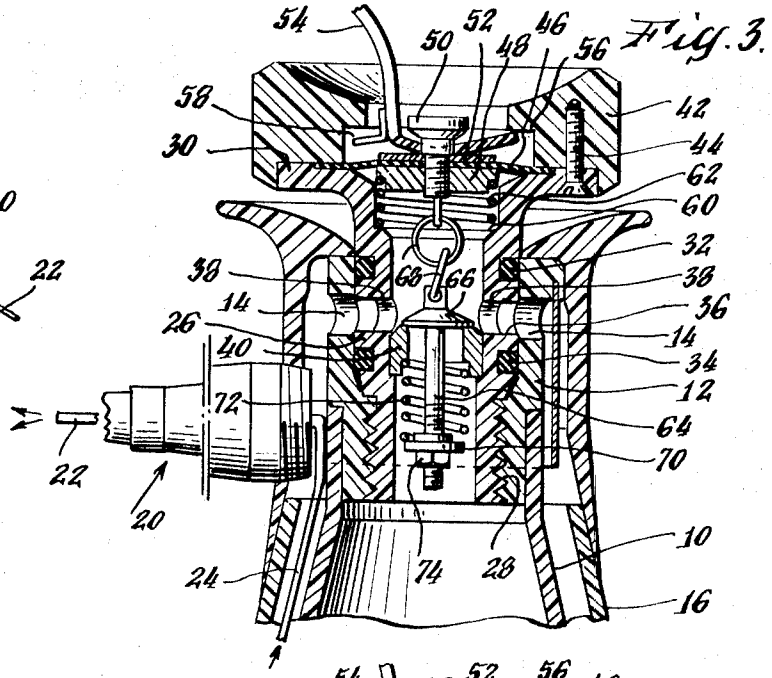


Fig. 3.

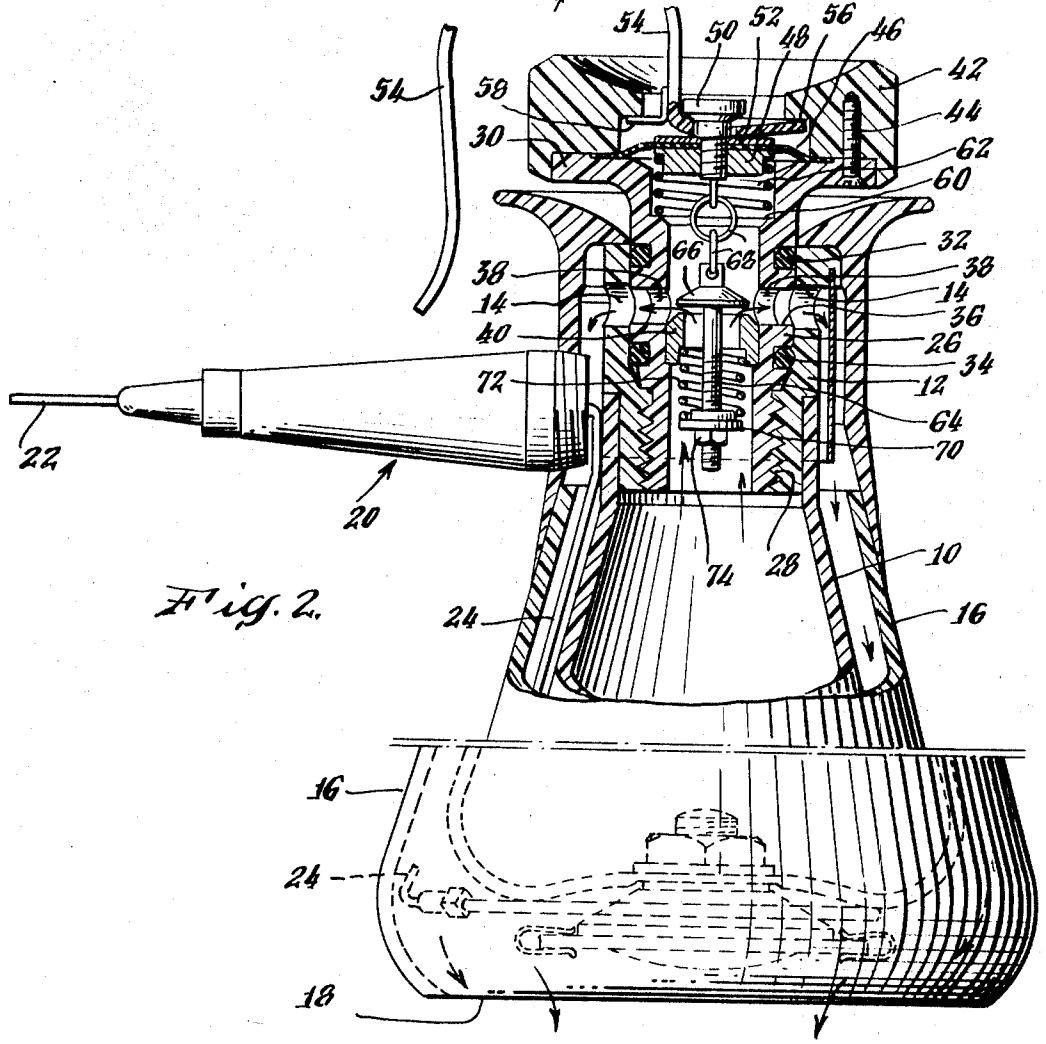


Fig. 2.

VALVED STOPPER

BACKGROUND OF THE INVENTION

This invention pertains to that class of surgical devices which is used for spraying a low boiling temperature refrigerant, such as liquid nitrogen, onto the skin. Devices of this type which are currently available include a container for the refrigerant and a valved vent passage. The vent passage is normally open, permitting the escape of gas from the continuously boiling liquid. When the surgeon is ready to operate on the affected site, he closes the vent valve. This causes pressure to build rapidly within the container and a spray of liquid refrigerant is ejected from a suitable discharge orifice.

With presently known devices the surgeon has no effective control over the pressure within the container. If, for example, the discharge orifice should become clogged, the container could easily explode from the internal pressure. Furthermore, vent valves of such type are subject to sticking in the closed position. Suppose, for example, that a particle of ice is present on the valve seat. The surgeon could easily force the valve shut by finger pressure, crushing the ice in the process. The ice would then refreeze, causing the vent valve to stick shut with the same potentially disastrous results as previously described.

Accordingly, it is a primary object of the present invention to provide a valved stopper wherein the closing force exerted on the vent valve is independent of the surgeon's finger pressure. Another object is to provide such a stopper which functions as an automatic pressure regulator to prevent excessive pressure build-up within the container. Other objects, features, and advantages will become more apparent from the following description and appended claims.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided a valved stopper for a low boiling temperature liquid container having a top opening. The stopper includes a substantially tubular body which sealingly engages the top opening of the container and defines a vent to atmosphere when so engaged. A first valve member is carried on the interior of the body between the vents and the contents of the container. A second valve member is selectively engageable with the first valve member to form a valve between the interior of the container and the vents. A first spring is provided which normally tends to close the valve. A manually reciprocable valve actuating member is also provided which is loosely linked with the second valve member. A second spring, which is stronger than the first, is operatively connected with the actuating member and tensions the linking means to maintain the valve in a normally open condition.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing

FIG. 1 is an isometric view of a liquid refrigerant dispensing device incorporating a stopper in accordance with this invention;

FIG. 2 is an enlarged partial cross-section through the device of FIG. 1, illustrating the valved stopper portion in detail; and

FIG. 3 is a view similar to FIG. 2 showing the stopper in its actuated condition.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The basic container is double walled and comprises an internal flask 10 for the liquid refrigerant which has secured to its top an internally threaded neck member 12 which defines a plurality of radial vents 14. An outer plastic shell 16 is spaced from flask 10 and has an open bottom 18. Threaded into the top of shell 16 is a nozzle 20 from which protrudes a spray needle 22 which communicates by means of a tubing 24 to a discharge outlet in the bottom of the flask 10.

The stopper of this invention comprises a substantially tubular body 26 having external threads 28 at its lower end for engaging the neck member 12 and a radial flange 30 at its upper end. The tubular body 26 is circumferentially grooved to receive a pair of spaced O-rings 32, 34. A circular channel 36 intermediate the O-rings 32, 34 communicates with the center of body 26 by means of ports 38. Secured within the body 26 and just below the ports 38 is a tubular valve member 40. The top of valve member 40 defines a valve seat and the bottom defines a recess for retaining a spring, as will be hereinafter described.

Mounted on the top of flange 30 is an annular grip 42 secured thereto by means of screws 44. Retained between the flange and grip is a flexible diaphragm 46. A spring retainer 48 is secured to the bottom surface of the diaphragm by means of a screw 50 which also clamps thereto a washer 52. An actuating lever 54 is loosely mounted below the head of screw 50 with one end engaging an annular shoulder 56 formed in grip 42. An L-shaped stop tab 58 mounted on lever 54 also engages a diametrically opposite portion of the shoulder 56. Positioned between spring retainer 48 and the internal shoulder 60 of body 26 is a coil spring 62.

A valve stem 64 is positioned within valve member 40 and includes an enlarged head 66 which cooperates with the upper surface of valve member 40 to form a valve. The valve stem 64 and the screw 50 are interconnected by means of a pair of chain links 68. An adjustment nut 70 on valve stem 64 supports one end of a coil spring 72, the other end being retained in the lower recess formed in valve member 40. A lock nut 74 retains the adjustment nut 70 in its preselected position.

The spring 62 is stronger than the spring 72. Therefore, under normal conditions, the assembly will assume the position illustrated in FIG. 2. Namely, the force of spring 62 forces the screw 50 and lever 54 upwardly to the limit formed by the stop tab 58 bearing against shoulder 56. Under these conditions, the chain links 68 pull the valve stem 64 upwardly against the force of spring 72, resulting in the valve being open. Gases evolving from the liquid refrigerant within flask 10 pass upwardly through the valve and out the ports 38 and vents 14, then downwardly between the flask 10 and shell 16 and out the open bottom of the shell.

When it is desired to pressurize the device to spray liquid refrigerant, the surgeon depresses the end of lever 54 toward the device. The lever pivots about its end against the shoulder 56. This applies a downward force against the washer 52 and releases the tension on the chain links as shown in FIG. 3. Under the influence of spring 72, the valve stem 64 is forced downwardly and the head 66 seats on the valve member 40 to prevent the further escape of gas. The resulting pressure build-up within flask 10 forces the liquid refrigerant out

the bottom opening and through the tubing **24** to spray needle **22.**

It is important to note that the surgeon's finger pressure is not applied directly to the valve. Accordingly, if while in the condition shown in FIG. **3,** the pressure within the flask **10** builds to a level above that of spring **72,** the valve will be forced open, permitting the venting of the excess pressure. Accordingly, a regulating action results with the maximum pressure being determined by the setting of the adjustment nut **70** and the resultant effect on the force exerted by spring **72.** It will also be noted that the only force acting to close the valve is that of spring **72.** The surgeon cannot increase this force. If a particle of ice, for example, were to be present between head **66** and valve member **40,** the valve simply would not close and sticking in the closed position would be impossible.

An additional advantage arises from the fact that the actuating lever **54** is loosely coupled to the shank of screw **50** below its head. This permits the lever to be rotated 360° about the vertical axis of the stopper so that it may be positioned by the surgeon for maximum comfort and convenience.

It is believed that the construction and operation of this invention will now be apparent. It will also be apparent that, by means of the foregoing invention, all of the objects hereinbefore set forth have been achieved. It will also be understood that many variations and modifications in this invention may be made without departing from its spirit and scope. Accordingly, the foregoing is to be construed as illustrative only, rather than limiting. The invention is limited only by the following claims.

I claim:

1. A valved stopper for a container having a top opening which comprises: a substantially tubular body sealingly engaging said top opening and defining a vent to atmosphere when so engaged; a first valve member on the interior of said body between said vent and the contents of said container; a second valve member selectively engageable with said first valve member to form a valve between the interior of said container and said vent; first spring means for normally closing said valve; a manually reciprocable valve actuating member; means for loosely linking said actuating member to said second valve member; and second spring means, stronger than said first spring means, operatively connected with said actuating member for tensioning said linking means and maintaining said valve in a normally open condition.

2. The stopper of claim **1** wherein said first valve member comprises an annular valve seat and said second valve member comprises a valve stem passing therethrough and including a substantially disc shaped head engageable with said seat.

3. The stopper of claim **1** wherein said vent is positioned to communicate with a passage to atmosphere formed by said container.

4. The stopper of claim **3** wherein said tubular body includes first and second resilient sealing means spaced on opposite sides of said vent.

5. The stopper of claim **4** wherein said vent comprises a circumferential channel defined by the outer surface of said tubular body and at least one radial port extending from said channel to the interior of said tubular body.

6. The stopper of claim **1** wherein said tubular body comprises an annular grip and said actuating member is positioned therein.

7. The stopper of claim **6** wherein said annular grip defines a circumferential shoulder on its inner surface and said actuating member comprises: a screw having a shank and an enlarged head; and an actuating lever engaging said shank below said head, one end of said lever pivotally engaging said shoulder, and the other end of said lever extending outwardly from said stopper for manual actuation.

8. The stopper of claim **7** wherein said lever loosely engages the shank of said screw and is rotatable thereabout.

9. The stopper of claim **2** wherein said first spring means comprises means for selectively adjusting the force thereof.

10. The stopper of claim **9** wherein said adjusting means comprises a nut threadedly engaging said valve stem, said first spring means being positioned between said nut and said first valve member.

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