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AUTOMATIC VENT STOPPER

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Fig. 1.

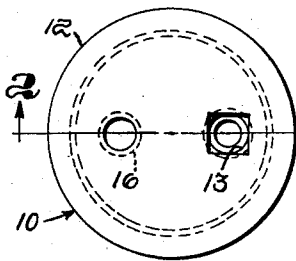


Fig. 2.

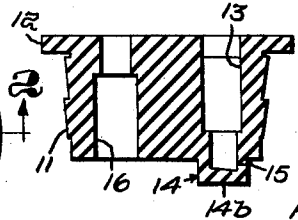


Fig. 3.

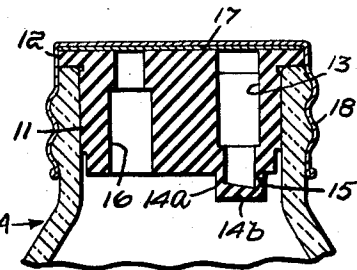


Fig. 4.

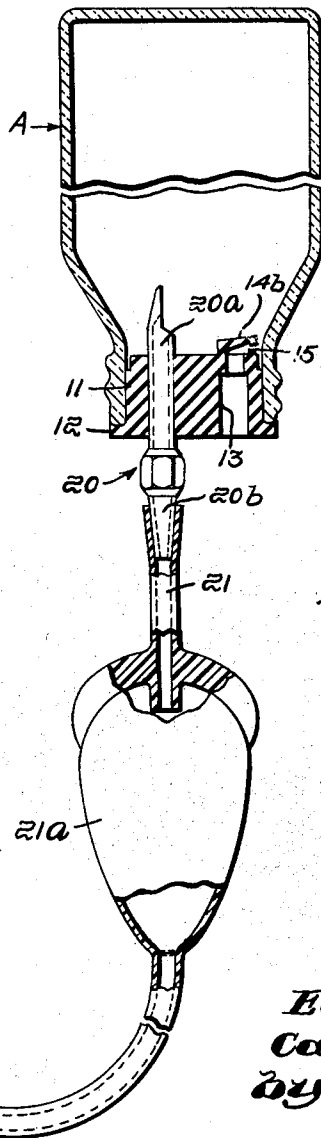


Fig. 5.

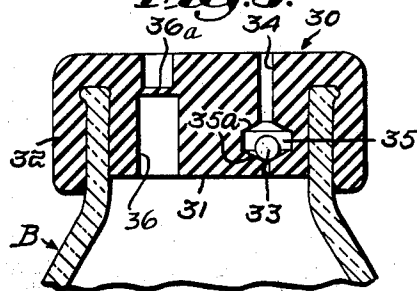
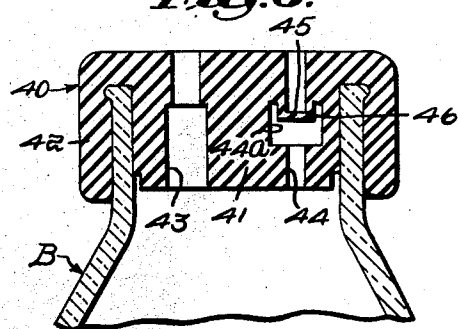


Fig. 6.



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AUTOMATIC VENT STOPPER

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12 Claims. (Cl. 222—481)

This invention relates generally to apparatus for plugging or stoppering fluid containers and more particularly to stopper devices such as adapted to the dispensing as well as to the sealing of fluid from and in such containers. The invention apparatus is particularly advantageous for use with flasks which may be hermetically sealed in storage but must be vented for dispensing, and also with parenteral and the like medical fluids and solutions such as are importantly required to be kept sterile in storage, and preserved against waste or spillage during such dispensing. It aims to provide new and improved means for stoppering and sealing the openings or outlets of such containers or flasks, and for coupling and venting the same in dispensing. The invention aims further to provide in a dispensing stopper a new and improved unitary bushing assembly providing fluid dispensing and container venting openings and self-contained, automatic operating means for valving the vent opening. The further and more particular object of the invention is the provision of a stopper bushing normally closing and sealing a container opening against fluid egress and novelly formed with self-contained means operating automatically upon and subject to negative container pressure to vent said opening for dispensing.

The invention will be better understood from a consideration of the following specification taken in conjunction with the accompanying drawing in which:

Fig. 1 is a top plan of a stopper bushing of the invention;

Fig. 2 is a vertical section of the bushing of Fig. 1;

Fig. 3 is a section of a stopper incorporating the bushing of Figs. 1 and 2, and as applied to a fluid container;

Fig. 4 is an elevation, partly in section, of a dispensing assembly fitted with and incorporating the novel automatic vent stopper; and

Figs. 5 and 6 are vertical sections of modified forms and constructions of the stopper bushing.

In medical and hospital practice, parenteral, intravenous and the like fluids and solutions are commonly stored in sterile sealed containers, flasks, or bottles from which they are discharged or dispensed for administering to patients or otherwise. This storing and dispensing of medical fluids is facilitated by dispensing stoppers having a discharge opening or outlet for connection to fluid conducting means, and an opening or portion engageable by such means, and generally by another fluid conducting or auxiliary device, for venting the container, as necessary to the dispensing.

The prevention or minimizing of loss and contamination of the fluid is of primary concern in the dispensing practice just described. The use or manipulation of the prior or conventional stoppers and auxiliary devices, particularly in the inverting of the containers in such dispensing, has, however, been characterized or accompanied by fluid waste or loss. Those skilled in the art will appreciate that the messy, costly fluid loss or drip here concerned has occurred whether the auxiliary device be a needle or tube inserted within the container to a point above the fluid level, or one seated at the vent opening and having

its end without the container held above the fluid level. It will be appreciated further that the auxiliary venting devices heretofore required have hindered also the prevention or minimizing of contamination in such dispensing.

The present invention provides a new and improved dispensing stopper permitting the venting of containers without the use of auxiliary devices and substantially without fluid loss. The stopper means of the invention will be seen to comprise further and in a main feature a unitary bushing assembly providing a self-contained self-operating vent valve, as hereinafter shown and described.

Referring now more particularly to Figs. 1, 2 of the drawing one embodiment of the apparatus is there shown to comprise an elastic bushing 10 which may be fashioned of rubber or other non-toxic, heat-resistant material which retains resiliency and does not become tacky or sticky after sterilization. The bushing is seen further and from Fig. 2 to comprise an annular body having a tapered plug or waist portion 11 depending integrally from a laterally projecting, upper flange portion 12. The bushing 10 is adapted to be received in and more particularly forced into and frictionally held by the mouth of the bottle A, the inner wall of which may have a taper complementary to that of waist portion 11.

In accordance with the invention, the bushing 10 is provided novelly with integral, self-contained, self-operating means for venting a container in dispensing without loss or drip of the container fluid, and without use or coupling of auxiliary devices. Such means comprise in the Fig. 1 embodiment a vertical passage or opening 13 which is seen to extend through the main body of the bushing 10, and which may be dimensioned to permit a desired rate of air ingress. Associated therewith is an annular or other projection 14 depending integrally from the lower or inner face of bushing waist 11 and surrounding and underlying the passage 13. In accordance with the invention a slit 15 is cut in and more particularly laterally through a substantial portion of this projection 14, and preferably at the base or junction thereof with bushing waist 11. The projection 14 is thus formed as a resilient membrane, diaphragm or flap normally yieldably biased to close or seal the opening 13, as shown. The vent closing flap valve 14 is characterized further in the Figs. 1-4 embodiment by recessing which may be axially extensive of bushing passage 13, and defining side and bottom walls 14a, 14b. Further, the recessing at bottom wall 14b may be inclined downwardly toward the slit 15, as shown, whereby the projection side wall 14a is defined as a rim or lip in the region of said slit 15, and whereby desired projection mass or body is retained in the uncut or flexible hinge portion thereof, as shown at the left, Figs. 2, 3.

The stopper of the invention comprises further and in the embodiment of Figs. 1-4 a dispensing passage or vertical opening 16 extending unrestricted through the bushing 10 and adapted as conventional for coupling or connection to tube or the like fluid carrying or conducting means, as hereinafter described.

The automatic vent or valve means of the invention may be comprised in a stopper bushing element such as just described, or variously in a bottle closing or sealing stopper assembly or device. A representative stopper assembly such as here concerned is shown in Fig. 3 to comprise the bushing 10 and a disc or plate 17 proportioned similarly as the bushing flange 12 and adapted to overlie and seal the bushing openings 13, 16 and hence also the bottle A. The plate 17 is seen to be engaged and held in the bushing and bottle sealing position shown by a cap or cup shaped element 18 fashioned or adapted to be applied and secured to the bottle neck in conventional manner.

A container A fitted with the stopper assembly 10,

17, 18 of Figs. 1-3 is readied for fluid discharging or dispensing first by the removal of the cap 18 and plate 17 to expose dispensing passage 16 and vent opening 13. The desired fluid handling, conducting or administering means is then applied to the bushing 10, and the bushing, bottle and said means inverted, Fig. 4. The fluid handling means illustrated, one adapted particularly to the handling and administering of blood or other medical or parenteral solutions, is seen to comprise an adapter or coupler 20 having a stem 20a which is inserted in the dispensing or discharging opening 16 of the bushing, as shown, and an oppositely projecting hub 20b on which is received one end of a fluid carrying or conducting means or tube 21. The tube 21, which may be of flexible plastic construction, is intermediately flattened in right angularly disposed lateral planes to provide a drip-forming enlargement or chamber 21a. It will be understood that the outer or free end of the tube 21 may be variously coupled or connected, as to a phlebotomy needle, for administering or otherwise supplying the fluid, during which the bottle A may be supported in any desired or convenient manner.

Considering now more particularly the operation of a stopper or stopper bushing incorporating the novel automatic vent means of the invention, the normal tendency of the flap valve 14 to engage against the bushing face and seal the vent opening 13, arising from the resiliency and surface tension of the bushing material, is seen to be reinforced upon the described inverting of the bottle A by the weight of the projection 14 and also of the container fluid. The vent passage 13 is thus effectively sealed against any fluid waste, loss, or drip particularly at the instant or moment of inverting of the container for dispensing. The operation of the invention apparatus is characterized further by the venting of the container automatically upon and incident to fluid flow therefrom, as in such dispensing, and without the use of needles, tubes, adaptors or other auxiliary devices. In medical practice, and more particularly in the administering of blood or the like, the ordering of such flow may be first to eject the air from the tube 21, then to establish a fluid level in the drip chamber 21a, and finally to supply the patient. The flow or dispensing of the container fluid as described will be understood to be through a conduit, herein the needle 20 and tube 21, defining a fluid column of a length sufficient to setup or create a negative pressure or vacuum in the container which will serve automatically to retract or withdraw the flap 14 from the vent closing position of Fig. 3 to an upraised venting or flow affording position, as somewhat exaggerated in Fig. 4. It may be noted in this connection that the design of automatic vent valve 14 may readily be adjusted, as by modifying the rubber characteristic or wall thickness thereof, or by varying the extent of the cut 15, to provide for the opening of the vent passage 13 subject to differing container negative pressures or vacuums. Should adherence of material at the slit 15 occasionally tend to delay normal opening of the vent passage, such adherence may be sheared by manipulation of the portion of the bushing adjacent to the valve 14 as by tilting and wobbling the inserted coupler such as 20 to apply stress at the slit 15 via the side and bottom walls 14a, 14b of the valve means.

Further in accordance with the invention, a bushing novelly incorporating the automatic vent may itself be constituted as a bottle closing or stoppering means. In the embodiment of Fig. 5 an automatic vent stopper of the invention is shown as comprising a rubber or the like bushing 30 having a cylindrical waist or plug portion 31 adapted to be received in the similarly formed mouth of a container B and mounting an integral skirt 32 adapted for folding downwardly over and sealingly gripping the same, as shown. A modified form of the automatic vent means of the invention is shown in Fig. 5 as a ball 33

received and confined in an enlargement 35 of a vertical through passage 34, said enlargement dished at its opposite ends to provide opposed valve seats 35a, 35a.

The Fig. 5 stopper 30 is seen further to have an outlet or dispensing passage or opening 36, closed or sealed at or near its upper or outer end by a puncturable or partible membrane or diaphragm 36a. The diaphragm 36a will be understood to constitute the bushing element 30 as a container closing or stoppering means normally effectively sealing the container B but providing also self-contained valve means operating automatically to vent the container upon and for dispensing therefrom. More particularly, the ball valve 33 will close and seal the vent opening 34 normally and also when the bottle B is inverted, wherein it will be seen to shift from one to the other seat 35a, 35a so as substantially to prevent fluid loss through vent opening 34. Further, the ball valve 33 is withdrawn from its seat 35a to vent the opening 34 and the container B upon and incident to a negative pressure or vacuum condition such as obtaining in said container in dispensing. The diaphragm 36a will be understood to be pierceable or puncturable for such dispensing by needle, tube, or adapter means such as conventionally employed in the art.

A further modification of the automatic vent stopper of the invention is shown in Fig. 6 as comprising a bushing 40 having similarly as the Fig. 5 form a waist 41 and a skirt 42, and being formed also with through passages 43, 44. The opening 44 is constituted as an automatic vent by the provision of a bushing portion or projection 45 closing the opening in an interior enlargement 44a thereof, and formed as a flap valve by a lateral slit 46 which is seen to define the projection bottom wall. With the embodiment of Fig. 6 the functions or roles of vent passage 44 and fluid conducting passage 43 may be reversed, and the fluid carrying coupler or adapter applied instead to vent opening 44, and so as to depress or unseat the valve 46, as for example for filling the container. This is seen as facilitated by the described or non-undercut flap construction, by which the free sliding engagement with and thrusting aside of the flap 46 by the point or stem of the coupler or adapter means is assured. The outlet 43 as well as 16 of Fig. 3 may of course be provided with a closing or sealing diaphragm like that of Fig. 5 and partible as thereto described for admitting or supplying fluid to or from the container.

From the foregoing it will be appreciated that the present invention provides new and improved container stopper and stopper bushing devices having novel self-contained automatic operative means for venting the container in dispensing without the use of auxiliary devices, and whereby loss and/or contamination of container fluid in dispensing is prevented or minimized.

Our invention is not limited to the particular embodiments thereof illustrated and described herein, and we set forth its scope in our following claims:

We claim:

1. An automatic vent stopper comprising an elastic bushing adapted to be applied to a container and formed with outlet and inlet openings extending therethrough, self-contained valve means normally closing the inlet opening and automatically operable to vent said inlet opening subject to a negative pressure in said container, and fluid conduit means at said outlet opening and defining a fluid column of a length sufficient to create said negative container pressure.

2. An automatic vent stopper comprising an elastic bushing adapted to be applied to a container and formed with outlet and inlet openings extending therethrough, self-contained valve means normally closing the inlet opening and automatically operable to vent said inlet opening subject to a negative pressure in said container, and communicating fluid conduit means extensive of said outlet opening and defining a fluid column of a length sufficient to create said negative container pressure.

5

3. A stopper comprising an elastic bushing adapted to be seized in a container mouth, said bushing formed with venting and dispensing openings therethrough, an integrally projecting flap yieldably biased to and sealingly engaged across the venting opening and closing said opening against fluid outlet, said flap automatically withdrawing from said venting opening subject to negative pressure in the container, and fluid conduit means at said outlet opening and defining a fluid column of a length sufficient to create said negative container pressure.

4. An automatic vent stopper comprising a bushing adapted to plug a container opening and formed with through passages for dispensing from and venting to the container, a valve element confined in and normally closing one said passage against fluid outlet and shiftable subject to a vacuum condition in said container to open said one passage to air inlet, and fluid conduit means at said outlet opening and defining a fluid column of a length sufficient to set up said container vacuum condition.

5. The apparatus of claim 4 wherein said stopper comprises an elastic bushing and wherein said automatic vent valve element comprises a resilient flap underlying and normally biased to close the venting passage, said flap of the same material as the bushing and for intimate sealing engagement about the periphery of the passage, and said flap integrally supported from the inner face of said bushing whereby lateral stressing of the bushing in the region of said face is transmitted through the flap to shear adherence to said periphery.

6. The apparatus of claim 4 wherein said stopper comprises an elastic bushing and said automatic vent valve comprises an integral projection on said bushing, said projection having a side wall underlying and substantially slit tangential to and an end wall extending across and yieldably biased to an infacing periphery of one said passage, whereby to form a resilient flap normally closing said one passage against fluid outlet and withdrawing from said periphery to open said passage to air inlet subject to negative container pressure set up by said fluid outlet through another said passage.

7. The apparatus of claim 6 wherein said projection is undercut to form a sealing lip on said flap.

8. An automatic vent stopper comprising a bushing adapted to plug a container opening and formed with passages for dispensing from and venting to the container and a valve element confined in and normally closing one said passage against fluid outlet and shiftable subject to a vacuum condition in said container to open said

6

passage to air inlet, said one passage having an intermediate enlargement defining opposed valve seats, and said valve element comprising a ball shiftable from one to the other of said seats in the inverting of said container for dispensing.

9. An automatic vent dispensing stopper comprising an elastic bushing having a waist portion adapted to be seized in and a skirt portion adapted to be turned down over a container mouth, said bushing formed also with dispensing and venting passages, and self-contained valve means projecting integrally of said bushing and normally biased to the venting passage to close it against fluid outlet, said valve means automatically withdrawing from said passage subject to negative pressure set up in the container in dispensing.

10. An automatic vent dispensing stopper comprising a bushing adapted to plug a container opening and having discharge and vent passages, self-contained negative pressure actuated valve means normally closing said vent passage, a plate removably sealing said discharge passage, and a cap received over and releasably clamping said plate and opening.

11. In combination, an elastic bushing adapted to be applied to a container opening and having inlet and outlet passages therethrough, a check valve carried by said bushing and normally closing the inlet passage against fluid outlet, said check valve automatically operable subject to negative container pressure to open said passage to air inlet, and means for removably closing said outlet passage against fluid outlet.

12. An automatic vent stopper comprising an elastic bushing adapted to be applied to a container and formed with outlet and inlet openings, a self-contained negative-pressure-sensitive valve normally closing and automatically operable to vent the inlet opening, and a partible diaphragm closing the outlet opening.

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