United States Patent

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[54] **CONTAINER WITH VENTING GASKET**
12 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **222/321,** 222/385, 137/525
[51] **Int. Cl.** **G01f 11/00**
[50] **Field of Search** 222/209, 332, 321, 385, 542, 402.16, 402.18; 137/525

[56] **References Cited**

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ABSTRACT: A dispensing container in which a reciprocating dispensing pump extends into the container through its filling and dispensing opening. A combined gasket and diaphragm valve encircles and cooperates with the pump cylinder and has a flexible substantially elastic inner peripheral valving portion snugly encircling and sealing radially against the cylinder and an outer peripheral gasket portion which is compressed between the neck of the container and the supporting flange of the pump barrel. Air is admitted from the atmosphere between the pump-supporting flange and the gasket portion to a location above the valving portion while the lower surface of that portion is exposed to the internal pressure within the container. The valving portion is of downward converging frustoconical shape to admit air into the container while preventing the outflow of fluid from the container. The valving portion may seat against the pump cylinder either at a location beneath the air vent of the latter, thus to admit an inflow only of air through the vent and to prevent outflow therethrough or, if desired, the valving portion may seat around the pump cylinder at a location above the vent to avoid interference with the usual functions of the latter.

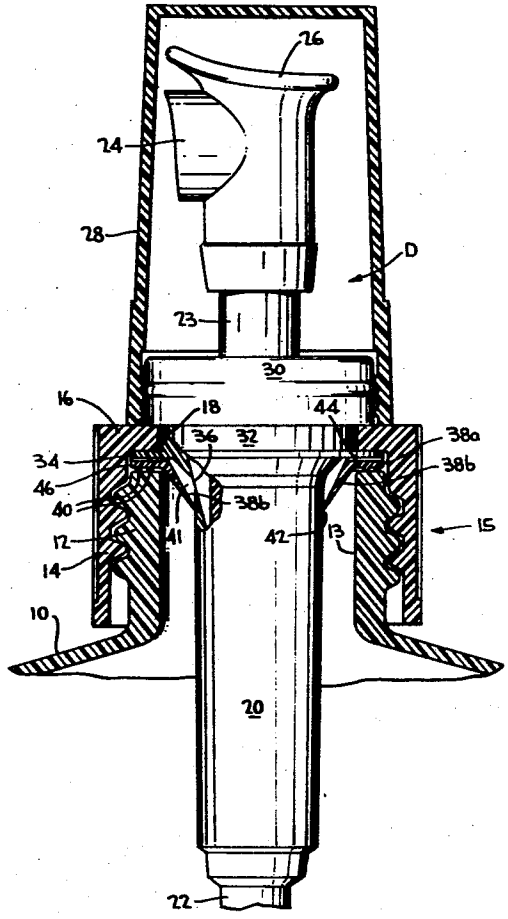


FIG. 1

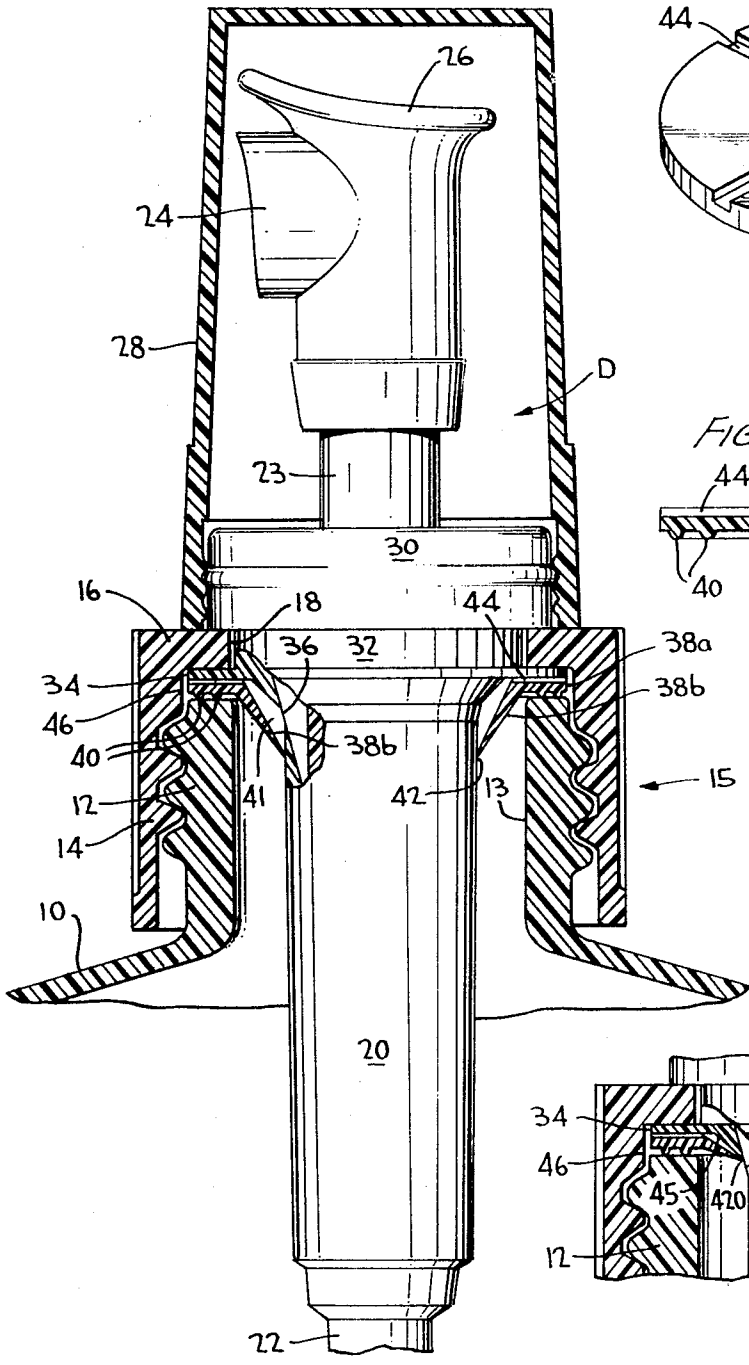


FIG. 2

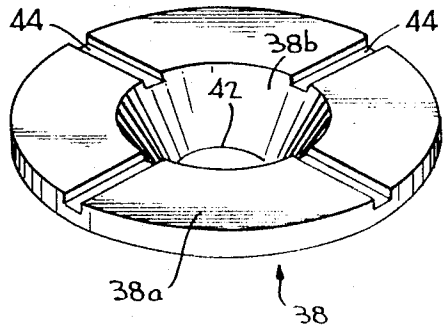


FIG. 3

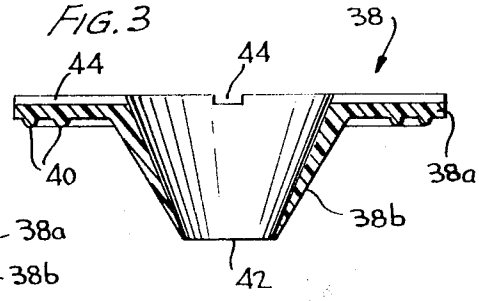
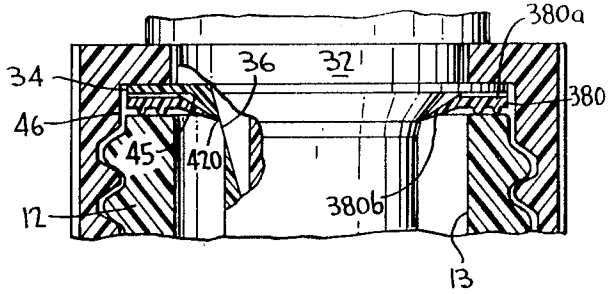


FIG. 4



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CONTAINER WITH VENTING GASKET

This invention relates to improvements in liquid-dispensing containers, or in other words, to containers of the type in which the container is equipped with a dispensing unit such as a pump supported by the container closure and having a tubular portion such as a pump cylinder extending into the container interior for withdrawal of the product contained therein.

In such dispensing containers it is customary for the dispensing pump to be provided with an air vent through the sidewall of the pump cylinder above the pump piston so that the interior of the container may communicate through said vent and the upper portion of the cylinder with the atmosphere to maintain the fluid pressure within the container substantially equal to that of the atmosphere.

In such dispensing containers, however, provision is generally made for closing of the vent or of the air passage between the vent and the atmosphere, during shipment and periods of nonuse, at which times there is no provision for equalization of the container interior pressure with the atmosphere. Where the container is of a flexible plastic, if for any reason, as for instance, loss of product by permeability of the container walls, the pressure within the container drops appreciably below that of the atmosphere, unsightly deformation of the container will normally result in the absence of any means for admitting atmospheric air into the container. This, in turn, results in a poor product image to the prospective purchaser when a container filled with a given product is displayed for sale.

Where the pump is of the type in which the vent is automatically sealed by movement of the plunger to its fully raised position at the conclusion of a pumping operation, it has been found that the sealing may be effected before the venting has been completed, that is, before a sufficient volume of atmospheric air has been admitted to the container to replace the product which has been dispensed by the pumping operation. This also may result in partial collapse and unsightly deformation of a flexible walled container.

Further, in such a conventional dispensing container wherein the pump cylinder is equipped with an air vent, tilting of the container during use to cause the product to cover the vent will normally result in undesirable leakage of the product and in addition may result in plugging of the vent by the product. Further, any increase in the internal pressure of a container in which a product or a portion thereof has found its way into the vent will result in causing leakage of the product upwardly through the vent and its associated air passage to the atmosphere.

With these considerations in mind, the present invention contemplates the inclusion in such a conventional dispensing container of a combined diaphragm valve and gasket which may be combined with the container and pump without requirement for modification of either in a manner to admit air from the atmosphere into the container independently of the said pump whenever atmospheric pressure appreciably exceeds the fluid pressure within the container.

Further, in a preferred embodiment of the invention, the said combined diaphragm valve and gasket is associated with the dispensing pump in a manner to permit only the entry of air into the container through the vent while positively preventing outflow of either air or product through the vent. In addition, in such preferred embodiment, the combined diaphragm valve and gasket is associated with the dispensing unit in a manner to maintain the vent at all times isolated from the product whereby to prevent loss of product through the vent as well as plugging of the vent. Also, such an arrangement has the advantage of permitting operation of the pump for dispensing purposes even though the container is tilted sufficiently that in the absence of the invention, the product would cover and tend to leak auto-outwardly through the said vent. Such arrangement, moreover, finds special utility when used with a pump of the type in which the vent is sealed only in the fully depressed position of the plunger, since it prevents leakage of product through the vent in case the container equipped with such a pump is laid on its side, without first securing the plunger in its depressed position.

In addition to its above advantageous features, the combined diaphragm valve and gasket of the invention supplements the function of the vent in admitting atmospheric air into the container to replace the product as the latter is withdrawn by the dispensing unit. If desired for certain types of products. The combined diaphragm valve and gasket of the invention may replace the vent and associated passages to the atmosphere, or in other words permit the elimination of the vent from the pump cylinder.

Alternatively, the invention may be associated with the pump cylinder in a manner such as not to interfere with or modify the action of the conventional air vent, but merely to supplement the action of the latter in admitting air into the container during operation of the dispenser and also to admit air to the dispenser independently of the vent when the latter is sealed off from the atmosphere during shipping and storage.

Although the invention is herein shown and described in its preferred usage with a dispensing container in which the dispensing unit comprises a pump, it is by no means restricted to use with a pump but may also be used to advantage where the dispensing unit is of other type as for instance of the eye-dropper type, so long as the dispensing unit includes a tubular portion extending into the container for withdrawal of the product.

In the accompanying drawing wherein is illustrated the preferred embodiment and one modification thereof simply for purposes of illustration:

FIG. 1 is a vertical section through the upper end portion of a container having a dispensing pump attached thereto, the lower portion of the pump being broken away;

FIG. 2 is a detail perspective view of the combined diaphragm valve and gasket utilized in the preferred embodiment;

FIG. 3 is a cross section on the line 3–3 of FIG. 2; and

FIG. 4 is a fragmentary cross section taken on the same plane as FIG. 1 and showing a modification of the construction illustrated in FIG. 1.

Referring now in detail to the accompanying drawing, the humeral 10 therein designates a conventional product container such as a flexible walled plastic bottle or a glass bottle having an externally threaded neck 12 for cooperation with the internally threaded skirt 14 of a conventional closure cap 15 having an annular top wall 16 overlying the upper end of the container neck 12. The container neck defines a filling and dispensing opening 13 for the container.

Disposed through the central opening 18 of the closure cap is a conventional dispensing device D which here illustrated as a reciprocating dispensing pump of known type, though in accordance with the broader aspects of the invention it could also constitute a tubular barrel of an eye-dropper-type dispenser or other dispenser having a tubular portion extending into the container.

The pump D includes a conventional pump cylinder 20 depending into the container through its filling and dispensing opening 13 and in spaced relation to the surrounding neck structure. Extending downward from the lower end of the pump barrel 20 is a usual dip tube 22, of which the lower end (not shown) will normally be disposed just above the bottom of the container so that the liquid product may be drawn upward through the tube 22 and cylinder 20 on each operative stroke of the pump plunger 23 to be expelled through the conventional discharge head 24 in well-known manner. It will be appreciated that the plunger 23 is spring projected upward and is actuated by an intermittent downward finger pressure on the fingerpiece 26 at the upper end of its discharge head 24. The upper end portion of the plunger 23 preferably is covered and protected by a removable overcap 28, the downward opening lower end of which is snap-fitted onto an

enlarged collar **30** affixed to a radial enlargement **32** at the upper end of the pump cylinder. The enlargement **32** extends through the cap opening **18** and the annular top wall **16** of the cap is clamped between the collar **30** and the usual supporting flange **34** affixed to the pump cylinder **20** near its upper end. The pump structure is thus supported by the closure cap **15** so that the cap and pump may be applied as a unit to the container in well-known manner.

In accordance with usual practice, the pump cylinder **20** is formed with one or more air vents such as **36** extending through its sidewall within the container, normally at a location above the pump piston (not shown). This vent **36** normally places the interior of the container in communication with the atmosphere, through the upper end of the pump cylinder and the usual clearance space between the collar **30** and the plunger **23** which reciprocates therethrough. The function of the vent **36**, as is well known, is to permit air from the atmosphere to enter the container to replace the product as the latter is withdrawn by operation of the dispensing pump, as well as to provide a means for returning to the container at least a portion of any product that might have become trapped within the cylinder above the pump piston.

It is important in such a dispensing pump to afford some means operative during shipping and storage of its associated product-filled container, for preventing the product from escaping through the vent passage **36** to the atmosphere in the event the container is wholly or partially inverted. Thus, it has been common practice to afford some means for blocking the vent from the atmosphere during shipping and storage. Such means, being well known in the art, is not illustrated in the accompanying drawing.

The structure thus far described is all well known in the art and per se constitutes no part of the present invention but has thus been briefly referred to simply in order to promote a rapid understanding of the invention.

Such an arrangement has had a particular disadvantage where the container **10** is of the flexible plastic walled type inasmuch as where the internal fluid pressure of the container for any reason drops appreciably below atmospheric pressure, the resulting pressure differential tends to produce an unsightly deformation of the container.

In accordance with the invention, there is provided in association with such a container **10** and its dispensing unit D a combined gasket and diaphragm valve **38** which functions independently of the dispensing unit D to admit atmospheric air into the container whenever the fluid pressure within the container drops appreciably below atmospheric pressure. The member **38** is formed of a suitable elastomeric material such as polyethylene, natural or artificial rubber. By reference to FIGS. **1**, **2** and **3**, it will be seen that the said diaphragm valve and gasket **38** is of annular shape such that when assembled with the other parts, its outer peripheral portion **38***a* is compressed between the upper end of the container neck **12** and the supporting flange **34** of the pump cylinder. Both the flange **34** and the gasket portion **38***a* are clamped between the end of the container neck and the closure cap.

In order to maintain effective sealing engagement with the container neck, the gasket portion **38***a* is provided with suitably arranged concentric sealing ribs **40** on its undersurface for cooperation with the container neck in the usual manner. If desired, the upper end of the container neck may be provided with concentric grooves (not shown) for cooperative reception of these sealing ribs in the manner such as disclosed, for instance, in the U.S. Pat. No. 3,179,306 to Corsette.

In its preferred form, the central area or valve portion **38***b* of the member **38** is of downward converging frustoconical configuration and its walls are of downward tapering thickness toward its converging end so as to increase its flexibility. The valving portion **38***b* has its inner peripheral end **42** encircling the pump valve and normally in snug radial sealing engagement therewith. Such peripheral edge **42** defines a valve port preferably of slightly smaller diameter than the cooperating portion of the pump cylinder **20** so as to be slightly stretched when applied to the latter and thus resiliently biased toward sealing engagement with the cylinder pump.

With this arrangement, it will be apparent that fluid pressures within the container **10** will act on the undersurface of the diaphragm valve and gasket **38** to urge its downward convergent valving portion **38***b* radially into sealing relation with the pump cylinder **20** and to isolate the vent **36** of the pump cylinder from the container interior, the peripheral lower edge **42** of the valving portion in this instance being disposed below the vent **36**.

The valving portion **38***b* and the pump cylinder **20** jointly define between them an air chamber **41** which communicates with the atmosphere as hereinafter described so that the upper surface of the valving portion **38***b* is exposed to atmospheric pressures in opposition to the internal container pressure operating against the undersurface of the valving portion **38***b*.

It will be seen that the air space or chamber **41** communicates outwardly between the supporting flange **34** and the gasket portion **38***a of the gasket 38 through one or more radial grooves 44 formed in the upper surface of the gasket portion 38a*. The outer end of each such groove or passage **44** communicates with the radial space **46** between the closure cap skirt **14** and the externally threaded neck of the container to communicate with the atmosphere through the clearance space between the coacting threads of the neck **12** and skirt **14**.

Thus, in the construction illustrated in FIG. **1**, it will be apparent that the diaphragm valving portion **38***b* permits entry of air from the atmosphere into the container at any time that atmospheric pressure substantially exceeds the internal pressure of the container. This function is entirely independent of the pump and its vent **36** and may occur during storage and shipping. In addition, such venting function may supplement the venting action of the pump cylinder vent **36** during operation of the pump to admit air into the container for product replacement purposes.

Further, it will be apparent that the disposition of the member **38** with respect to the vent **36** modifies the action of the vent to permit only an influx of air through the vent into the container while barring positively the outflow of any fluid from the container through the vent as well as through the groove or passage **44**.

Thus, the member **38** functions to permit operation of the pump for dispensing purposes even though the container may be tilted to a near horizontal position in which the product, except for the presence of the member **38**, would cover the vent **36** and tend to escape therethrough. Moreover, the fact that the member **38** isolates the vent **36** at all times from the product, ensures against the plugging of the vent by the product.

In the modified arrangement shown in FIG. **4**, the construction of the container and the dispensing pump are identical in all respects with the corresponding elements of the preferred embodiment, but the combined diaphragm valve and gasket member **380** has been somewhat modified to cooperate in slightly different manner with the pump. Thus, in FIG. **4**, it will be apparent that the gasket portion **380***a* is similar in structure and cooperates with the other elements in the same manner as earlier described, but that the diaphragm valve portion **380***b* is so arranged that its convergent lower end edge **420** engages and encircles the pump cylinder at a location above the vent **36**. The member **380** thus does not isolate the vent **36** from the product within the container as in the preferred embodiment and the vent **36** is permitted to achieve its usual functions in well-known manner without interference by the member **380**. The member **380**, however, in addition to functioning as a gasket at its outer portion **380***a*, has its valving portion **380***b* arranged and cooperating with the pump structure to admit air into the container quite independently of the pump when the atmospheric pressure exceeds the fluid pressure within the container. Thus, air will be admitted into the container under suitable conditions even though the communication between the vent **36** and the atmosphere is disrupted

in conventional manner during shipping and storage of the container. Moreover, during operation of the dispensing pump, the valving portion **380***b* will cooperate with the pump in a manner to supplement or even to replace the action of the vent in admitting atmospheric air into the container for replacement of the withdrawn product. Thus, even though the vent **36** is eliminated, the valving portion **380***b* of the gasket member **380** will sever its function of admitting atmospheric air into the container when necessary for pressure equalizing purposes.

It will be noted in this embodiment that the valving portion **380***b* cooperates with an upwardly and outwardly flaring generally conical surface portion **45** of the pump cylinder rather than the cylindrical exterior surface of the pump cylinder as in the preceding embodiment, but that the mode of cooperation between these elements remains essentially unchanged.

This embodiment finds particular utility when employing a pump of the type in which the vent passages are sealed by locking the plunger in its fully depressed position during shipping and storage. In the event of loss of product by permeation through the walls of a plastic container, atmospheric air will be admitted to the container independently of the vent, to prevent container deformation by external pressure, despite the sealing of the vent passages.

What I claim is:

1. In a dispensing container of the class in which a dispensing pump supported by the container has its pump cylinder extending into the container through the dispensing opening thereof, in spaced relation to the container wall which defines said opening, the combination with said container of an annular diaphragm valve of resiliently flexible material secured to the container in sealing relation around said opening, said valve defining a circular valve port which normally snugly receives said cylinder in sealing relation therewith, the lower surface of said valve being exposed to the internal fluid pressure of the container and the upper surface of said valve being exposed to atmospheric pressure.

2. The invention defined in claim **1** in which said cylinder is formed with an air vent and with a downward convergent frustoconical surface above said vent, said valve encircling and seating against frustoconical surface.

3. In a dispensing container as defined in claim **1**, the further feature in accordance with which said valve is of elastomeric material and includes a valving portion immediately surrounding said port and diverging upward therefrom within the container opening.

4. The invention defined in claim **3** in which said cylinder is provided with an air vent through its sidewall to establish communication between its interior and said opening, said valve snugly receiving said cylinder in sealing engagement therewith at a location below said vent.

5. The invention defined in claim **3** in which said valve encircles and seats radially against the cylindrical exterior surface of said pump cylinder.

6. The invention defined in claim **3** in which said cylinder includes a supporting flange secured to the container over said opening, the outer peripheral portion of said valve being disposed between said flange and the container in sealing engagement with the container around the opening.

7. The invention defined in claim **6** in which the container, together with said cylinder and said valve, defined an air chamber between said flange and the valve.

8. The invention defined in claim **7** in which said valve is formed with a groove extending across its upper surface from said air chamber to its outer periphery to place said chamber in communication with the atmosphere.

9. The invention defined in claim **8** in which said container includes a closure cap secured over said opening and clamping said flange and said outer peripheral portion of the valve against each other and the container.

10. In a dispensing container having a neck defining a filling and dispensing opening and a closure secured over the open end of said neck, a reciprocating pump having a pump cylinder extending through said closure and said opening into the container interior in spaced relation to the neck, the pump having a plunger disposed for reciprocation in said cylinder through its upper exterior end, the combination therewith of an annular diaphragm valve having a portion of flexible elastomeric material surrounding said cylinder with the inner periphery of said valve normally snugly encircling and sealing against said cylinder within the said opening, said cylinder having a radial supporting flange near is upper end between said closure and the container neck, the outer peripheral portion of said valve being disposed between said supporting flange and the container neck in sealing engagement with the latter, said cylinder and valve defining an air chamber within the container opening between said flange and the valve, and means for admitting air from the atmosphere into said chamber.

11. The invention defined in claim **10** in which said valve is formed in its upper surface with a groove extending from said air chamber to the outer periphery of the valve, said closure including a skirt encircling said neck, said neck and said closure being mutually conformed to establish communication between said groove and the atmosphere.

12. The invention defined in claim **11** in which said cylinder is formed with an air vent establishing communication between its interior and the said air chamber.