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Holbrook

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[54] **VALVE AND RELATED STRUCTURE FOR VACUUM OPERATED LIQUID-FILL BOTTLES**

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[51] **Int. Cl.** **A61m 1/00,** A61c 17/04

[58] **Field of Search** ..... 141/59, 60, 64, 65; 128/297, 275; 32/33; 137/202, 204, 205, 549, 550, 430; 23/258.5; 210/117, 119, 121, 123, 124, 125, 126, 127, 128, 129; 4/27, 57 R

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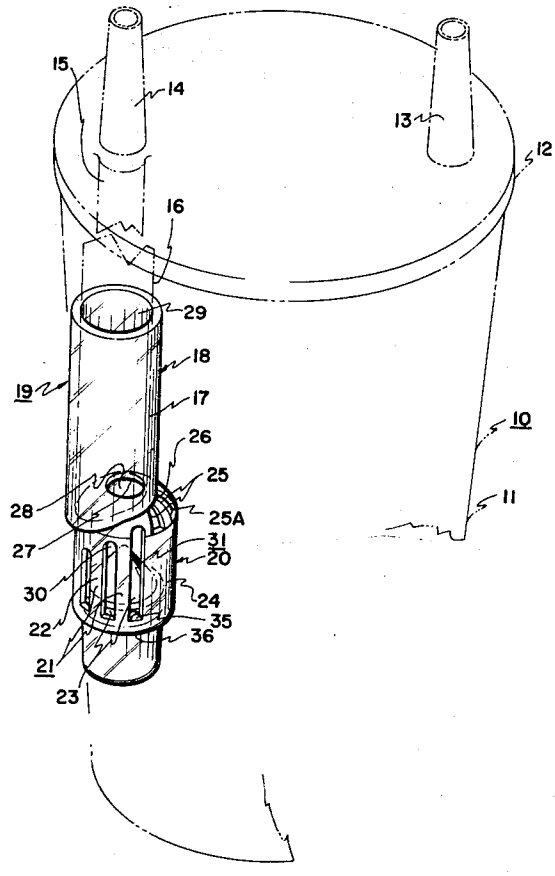
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Primary Examiner—Leon G. Machlin

[57] **ABSTRACT**

Valve structure for vacuum operated liquid-fill bottles, comprising a float valve having peripherally located air passage-way vents in addition to shield means. The shield means is designed and positioned such that solid matter as might be contained within a liquid will not tend to flow into and hence clog the valve structure. To insure proper operation of the float valve such that the same will not be "sucked" to either side of the included valve cage or upwardly, air vents are provided essentially completely around the valve body portion of the structure and above the shield or partition used.

12 Claims, 2 Drawing Figures



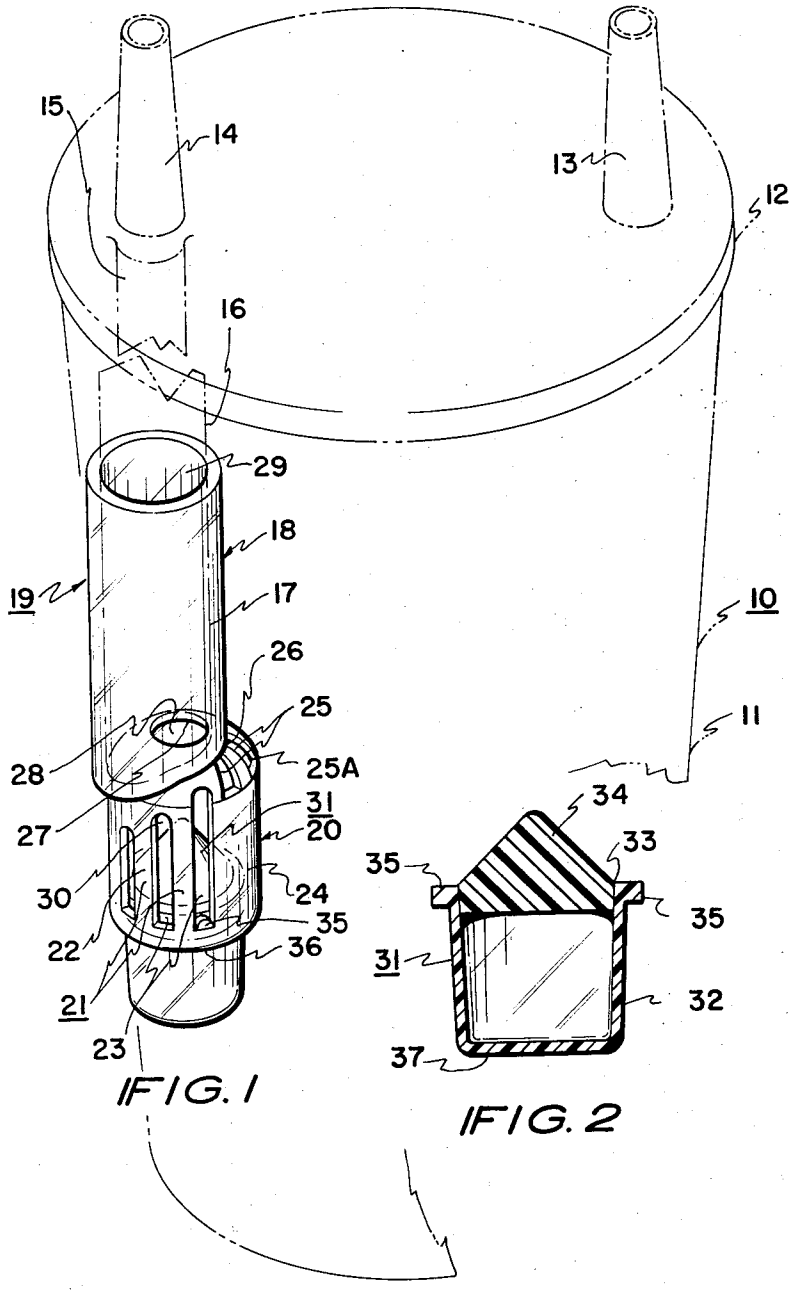

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FIG. 1

FIG. 2

VALVE AND RELATED STRUCTURE FOR VACUUM OPERATED LIQUID-FILL BOTTLES

The present invention relates to valve structures and, more particularly, to new and improved valve structures which can be incorporated with the vacuum port of a liquid-fill bottle operable by a vacuum pump.

Float valves, of course, are not new. This is likewise true of vacuum operated containers. In the past, however, there has been considerable difficulty in designing a suitable float valve and attendant structure for vacuum-operated fill-bottles, such as hospital asperation bottles, so that solid matter such as bone fragments rising within the bottle will not operate to clog the valve as the liquid level rises to actuate the shut-off float valve. Additionally, for cost and other considerations, it is highly desirable to fabricate valve elements from materials such as polyethylene. Such material is very lightweight and can easily be inadvertently drawn upwardly toward valve seat structure simply upon the application of negative pressure (vacuum). What is needed, hence, is a provision for a maximum of air passage-way 360° across the valve and through the tubular mounting thereof, upwardly of the valve seat so that the valve element itself will not be "sucked" upwardly toward the valve seat or to one side or the other.

In the structure of the present invention, maximum air-flow passage-way means is provided completely about the valve and above a shield isolating the interior of the valve cage from the direct flow of bone fragments and other solid material as might be contained within the aspiration fluid entering the bottle. Hence, the valve will be actuated solely upon a float valve principle; this is to say, solely the rising fluid level when contacting the bottom or base of the valve will operate to raise the same so as to shut off the vacuum supply source from the tubular mount of the valve structure. The valve is designed such that its base is co-planar with the valve housing at valve shut-off; thus solid material cannot possibly clog the valve structure, and particularly when the shield or partition, as hereinafter described, is employed.

To keep the valve from sucking upwardly upon the application of negative pressure, air vent means is applied not only around but above the valve element, over the shield, so that air flow to the vacuum does not cause the valve to rise upwardly. Accordingly, there is an equalization of air pressure below the valve and also completely above the valve element of the valve.

Accordingly, the principal object of the present invention is to provide a new and improved float valve structure for use in vacuum operated, liquid-fill bottles.

A further object of the invention is to provide a float valve structure which can be of lightweight plastic design.

An additional object is to provide a shield or partition in a float valve structure such as to prevent solid matter from clogging the valve.

An additional object is to provide for maximum air-flow around and over the valve element of the valve, prior to its rise, so as to preclude a sucking up of the valve element upon the application of negative pressure, thereby leaving the valve operative solely upon rise of fluid level within the bottle thereof.

An additional object of the invention is to provide an offset valve structure wherein the tubular or other elongate hollow mount of the valve is offset relative to the axis of the valve cage within which the valve is positioned to rise.

An additional object is to provide perforate structure above the shield of the valve cage, this so as to insure proper operation of the valve, restricting its movement solely to rising fluid level.

The features of the present invention may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a perspective view of the valve in the present invention used in conjunction with the vacuum operated liquid-fill bottle such as a hospital aspiration bottle; for convenience, the aspiration bottle with which the valve is used is shown simply in phantom lines.

FIG. **2** is an enlarged, longitudinal cross-section taken centrally relative to the valve member FIG. **1.**

In the drawings the vacuum operated liquid-fill bottle **10** is shown in phantom lines and its particular design per se forms no part of the present invention. The vacuum bottle **10** will include the usual container **11** and lid **12,** these to be fitted thereover. Lid **12** will be provided with fluid inlet port **13** and vacuum port **14.** A vacuum pump and its conduit will be coupled to and hence communicate with vacuum port **14.** The lower extremity **15** of vacuum port **14** will be tapered at **16** to receive in a press or wedging fit tubular mount **17** of the subject valve **18.** Tubular mount or upper mounting portion **17,** in fact, forms a part of valve housing **19,** and the latter includes, depending from tubular mount **17,** a valve body portion **20** which is offset from tubular mount **17.** Such offset reduces valve length and accommodates close proximity of the vacuum port with the container lid edge.

The valve body portion **20** includes a valve cage **21** provided with upstanding bar portions **22** defining open spaces **23.** A solid portion or shield **24** extends partially around the transverse periphery of valve body portion **20** as indicated. Most importantly, air vents or vent openings **25** are provided above shield **24.** Valve body or lower valve guide portion **20** and tubular mount **17** meet in a common juncture portion **26** at which an upwardly tapered valve seat **27** is provided annularly about communicative opening **28.** Communicative opening **28,** of course, provides communication as between the interior elongate aperture **29** of tubular mount **17** and the interior **30** of the valve body portion **21.** Valve member **31** itself includes a hollow valve cup **32** as shown, and fitted into upper extremity **33** of the latter is an essentially cone-shaped valve element **34.** Valve element **34** is designed to seat against the valve seat **27** which, as seen in the drawing, is disposed between the opposite extremities of said valve housing **19,** the latter including tubular mount **17** and valve body portion **20** (including the valve cage **21**). Valve cup **32** has a cylindrical cross-section, transverse to the longitudinal axis of said valve cup, and is preferably made of polystyrene so as to be lightweight and hence preserve the float valve characteristics of valve member **31.** Ears or tabs **35** are provided the valve **31,** and these ears operate as stops for engagement with the ring shaped base portion **36** of valve body portion **20.** It is noted that the tubular mount **17** is offset relative to the vertical axis of the valve body portion **20.** This is also

for the purpose of providing a peripheral region as at 25A so that the air vents 25 can be provided.

The subject valve is especially suitable for use in the design of body fluid aspiration bottles for hospital use. Where the aspiration bottle **10,** for example, incorporates the subject valve of the present invention, then the same is provided an automatic, fluid-level controlled float valve to automatically shut off or isolate the negative pressure source, i.e., a vacuum pump, from direct communication with the interior of the aspiration or liquid-fill bottle **10,** and hence terminate fluid flow. Thus, the vacuum supply being cut off from the bottle, additional fluid as from the patient's operative area will not continue to pour in through fluid inlet port **13.**

Valve member **31** is ideally seated as a float and is kept from dropping out of the valve housing by virtue of ears **35** and their abutment engagement with ring shaped base portion **36.**

For many types of surgery solid material such as tissue and bone fragments may be found in the incoming body fluid or blood stream coming into the bottle via fluid inlet port **13.** Shield **24** operates to prevent such bone and tissue fragments from clogging the valve. Yet, it has been found through experimentation that air vents about the valve must be supplied both above the shield, as at **25,** and also about the opposite side of the valve area proximate openings **23.** If either of the sets of openings **25** or **23** are eliminated, then negative or vacuum pressure as supplied tubular mount **17** via the operating vacuum pump (not shown) will itself operate to close the valve, i.e., to draw valve **31** upwardly to close against valve seat **27.** It is desirous to mold the valves as lightweight as possible and to use as little material as possible. Polyethylene plastic ideally serves as a material for use here. But when such is the case, a maximum air-flow is needed completely above the valve element **34** prior to its ascent to its valve seat. Accordingly, air vents must be supplied both above the shield **24** and also on the opposite side as at **23.** Such a peripheral vent pattern will insure that valve ascent enclosure will be dependent solely upon rising fluid level and the engagement thereof with base **37** of the valve member **31.** Thus, shield **24** keeps bone fragments and tissue from clogging the valve, and the air vents above the shield **24,** as at **25,** with air vents or openings **23** serve to provide for a maximum air-flow across the valve, thus precluding inadvertent raising of the valve solely upon the application of vacuum pressure. It is known that by virtue of the above design the lower peripheral air vents at **23** may be oriented close to the inside wall of the bottle so as to further tend to eliminate possibilities of clogging the valve by solid material contained within the body fluid.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art the various changes and modifications which may be made without departing from the essential features of the present invention and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a vacuum-operated liquid-fill bottle having a vacuum connection port and a liquid receiving port, said vacuum connection port having a lower extremity, an improvement comprising a molded unitary valve housing having an upper tubular mount secured directly to said lower extremity, a lower valve cage integral with and meeting at a unitarily molded common juncture partition with and at the bottom of said upper tubular mount and depending therebeneath, said common juncture partition being configured to define a downwardly facing apertured valve seat disposed within said valve housing at the bottom of said tubular mount, an upwardly convex, interiorly hollow float-valve member, having a transverse, cylindrical cross-section, disposed within said lower valve cage and constructed for seating against said valve seat when said float-valve member is carried upwardly by a rising liquid level within said bottle, said lower valve cage including plural, mutually spaced apertures, disposed about the periphery of said valve cage.

2. The structure of claim **1** wherein said valve cage is provided with a solid shield portion disposed part way about the periphery of said valve cage, said valve cage including aperture means above said valve shield as part of said plural apertures, the remainder of said plural apertures depending beneath said aperture means.

3. In a vacuum-operated liquid-fill bottle having a vacuum connection port and a liquid receiving port, said vacuum connection port having a lower extremity, an improvement comprising a unitary valve housing having an upper tubular mount secured to said lower extremity, a lower valve cage integral with and meeting at a common juncture partition with said upper tubular mount, at the bottom thereof, and depending therebeneath, said common juncture partition being configured to define a downwardly facing apertured valve seat which is disposed within said valve housing, an upwardly convex hollow float-valve member, having a transverse, cylindrical cross-section, disposed within said lower valve cage and constructed for seating against said valve seat when said float-valve member is carried upwardly by a rising liquid level within said bottle, said lower valve cage including plural, mutually spaced apertures disposed about the periphery of said valve cage, and wherein said common juncture partition is inclined relative to the longitudinal axis of said tubular mount.

4. Structure according to claim **3** wherein said valve cage is laterally offset relative to said tubular mount.

5. Structure according to claim **1** wherein said valve member comprises a valve cup having a closed interior and an outwardly convex valve seating element seated within said valve cup to close said interior.

6. Structure according to claim **1** wherein a portion of said plural apertures is elevated relative to the remainder of said apertures, said valve cage including a valve shield disposed beneath said elevated apertures.

7. A float-valve construction including, in combination, a unitary valve housing having an upper tubular mount and constructed for direct connection to a depending vacuum port, a valve cage integral with, depending from, and integrally molded with said upper tubular mount, the common juncture structure between said tubular mount and said valve cage being configured to define a downwardly facing valve seat, a hollow float-valve member disposed within said valve cage and constructed for seating against said valve seat when said float-valve member is carried upwardly by a rise in liquid level, said valve cage including plural, mu-

tually spaced apertures disposed in the aggregate completely about the periphery of said valve cage.

8. Structure according to claim **1** wherein said float-valve member includes laterally extending guide ears slideably registering with selected ones of said apertures.

9. In a vacuum-operated liquid-fill bottle having a fluid inlet port and a vacuum port: an improvement comprising a valve housing having an upper mounting portion directly secured to said vacuum port and a lower valve guide portion integral with said upper mounting portion, and interiorly hollow valve means operably disposed within said lower valve guide portion for terminating air-flow through said vacuum port, said valve means comprising a lower, interiorly hollow valve cup, and an upper sealing valve element sealingly secured to said valve cup, said valve housing being provided with wall aperture means for permitting air-flow there-through, said valve housing and said valve means having mutually engageable reaction structure for retaining said valve means for operation within said valve housing.

10. In a vacuum-operated liquid-fill bottle having a fluid inlet port and a vacuum port: an improvement comprising a valve housing having an upper mounting portion secured to said vacuum port and a lower valve guide portion integral with said upper mounting portion, and interiorly hollow valve means operably disposed within said lower valve guide portion for terminating air-flow through said vacuum port, said valve means comprising a lower, interiorly hollow valve cup, and an upper sealing valve element sealingly secured to said valve cup, said valve housing being provided with wall aperture means for permitting air-flow there-through, said valve housing and said valve means having mutually engageable reaction structure for retaining said valve means for operation within said valve housing, and wherein said aperture means comprise essentially vertically oriented, mutually spaced, lowerly closed-ended slots, said valve means including outwardly extending tab means, constituting in part said reaction structure, positioned in selected slots for engaging the lower ends thereof.

11. Structure according to claim **9** wherein said valve element is upwardly convex and upstanding from said cup.

12. Structure according to claim **9** wherein said valve housing is provided with an apertured transverse partition disposed at the bottom of said upper mounting portion and constructed as a valve seat cooperable with said valve means.

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