

FLEXIBLE PINCH FITTING FOR CONTAINERS

Cross-Reference Related Applications

The application claims the benefit of U.S. Provisional Patent Application No. 61/341,169, filed on March 26, 2010, the entire contents of which are incorporated by reference herein.

The present invention relates to a fitting for containers. More particularly, it relates to a flexible fitting capable of being pinched closed with little or no dead volume.

Background of the Invention

Bag style flexible containers are used in a variety of industries today including food, beverage, medical, chemical and the pharmaceutical and biopharmaceutical industries. They offer a number of advantages over more conventional rigid containers for processing and storage of products and intermediates in that they are single use, thereby eliminating the need for cleaning, allow for a more flexible and changeable production line in that they can be connected to different components as needed unlike traditional dedicated stainless steel lines and can be presterilized such as with radiation (gamma or beta) or gases such as ethylene oxide (ETO).

The connections between containers are typically done with a rigid plastic barb fitting 2 as shown in Figure 1. These are generally molded of plastics such as polyethylene and polypropylene and are designed to be rigid and inflexible so as to support the functions described below.

The fitting 2 has a flange 4 adjacent the bag 12, a substantially straight neck portion 6 and a barb portion 8 which is furthest from the flange. A through bore 5 runs through the fitting 2 from the flange to the barb 8. The fitting 2 is attached to an opening 10 of the bag 12, generally by heat sealing, sonic welding or adhesives such that the opening of the 10 of the bag 12 is in fluid communication with the bore 5 of the fitting 2 which in turn is in fluid communication with the bore 16 of a tubing 14. The tubing 14 is slipped over the barb 8 and rests on at least a portion of the neck 6 and is generally secured to the fitting 2 by a device such as a tie wrap 20 to ensure that it doesn't inadvertently slip off such as due to pressure within the system.

The bag 12 and fitting 2 are selectively closed off from the rest of the system generally by a device such as a pinch valve 18 or a clamp (not shown) which may be manually or automatically controlled.

The use of such fittings has shown deficiencies for dynamic processes such as mixing and bioreactors and others where the issue of dead volume may occur. As can be seen from Figure 1, the valve 18 that is used to close off the system is located on the flexible tubing 14 some distance in front of the barb 8. Therefore, fluid can be contained within the bore 5 of the fitting 2 and the bore 16 of the tubing up to the point at which the valve is located. Issues of dead volume have been noticed where the volume of fluid is trapped in the fitting 2 and portion of the tubing 14 before the valve. They have been demonstrated to be stagnant to mixing and an entrapment point for materials such as solid powders that are used in vessels for mixing and bioreactors.

What is needed is a device that allows for the reduction and/or elimination of this dead space between the fitting 2 and the closing device 18.

Summary of the Invention

This invention reduces or eliminates the dead space in the fitting and tubing before the valve by using a flexible elastic fitting that can accommodate a pinch valve or a clamp or the like closer to the flange portion of the fitting.

One aspect of the present invention is to provide a fitting for a disposable plastic container having a flange portion capable of being sealed in a liquid tight manner to an opening in the bag and a neck portion extending outwardly from the flange portion and the opening of the bag and the fitting being formed of a flexible compressible, resilient plastic material. A device such as a pinch valve or clamp can be used on the fitting to compress the fitting to seal off the container.

A further embodiment of the present invention is to provide the neck with either a tubular end portion or a hose barb.

An additional embodiment is to provide a fitting formed of a thermoplastic elastomer, a thermoset such as a urethane or a rubber, natural or synthetic.

Another embodiment of the present invention is to provide a flexible disposable container comprising a closed plastic bag having at least one port, at least one fitting formed of a flange portion sealed in a liquid tight manner to the at least one opening in the bag and a neck portion extending outwardly from the flange portion and the opening of the bag, the fitting

being formed of a flexible compressible, resilient plastic material and a device capable of compressing the neck portion of the fitting so as to seal it off from the bag.

A further embodiment of the present invention is to provide the neck with either a tubular end portion or a hose barb.

An additional embodiment is to provide a fitting formed of a thermoplastic elastomer, a thermoset such as a urethane or a rubber, natural or synthetic.

Another embodiment of the present invention is to provide a neck portion in the form of a tubular extension with a bore running through the flange and neck portions and further comprising a connector having a first end with a hose barb and a second end with a hose barb and a planar portion between the two barb portions, the neck portion of the fitting farthest from the flange portion having the first barb of the connector and a planar portion of the connector attached to it in a liquid tight manner and a tubing attached to the second barb of the connector and a planar portion of the connector in a liquid tight manner.

An additional embodiment of the present invention is to provide a rigid insert at the portion of the fitting furthest from the bag.

Another embodiment of the present invention is to provide a rigid insert at the portion of the fitting furthest from the bag where the rigid insert is made of metal or plastic.

A further embodiment of the present invention is to provide a rigid insert at the portion of the fitting furthest from the bag wherein the insert is either molded into that portion or attached to a surface (inner or outer) of that portion of the fitting.

A further embodiment of the present invention is to provide a device for attaching the end of the neck to the tubing via tie wraps.

In the Figures

Figure 1 shows a fitting assembled to a bag and tubing with a pinch valve as is known in the prior art in cross-sectional view.

Figure 2 shows a fitting assembled to a bag and tubing with a pinch valve according a first embodiment of the present invention in cross-sectional view.

Figure 3 shows a fitting assembled to a bag and tubing with a pinch valve according a second embodiment of the present invention in cross-sectional view.

Figure 4 shows a fitting assembled to a bag and tubing with a pinch valve according Figure 3 in the closed portion in cross-sectional view.

Figure 5 shows a fitting assembled to a bag and tubing with a pinch valve according another embodiment of the present invention in cross-sectional view.

Figure 6 shows a fitting assembled to a bag and tubing with a pinch valve according another embodiment of the present invention in cross-sectional view.

Figure 7 shows a fitting assembled to a bag and tubing with a pinch valve according a further embodiment of the present invention in cross-sectional view.

Figure 8 shows a cross-sectional view of an alternative insert of Figure 6.

Figure 9 shows a cross-sectional view of an alternative insert of Figure 7.

Figure 10 shows a cross-sectional view of an alternative insert of the present invention.

Figure 11 shows a cross-sectional view of an alternative insert of the present invention.

Figure 12 shows a cross-sectional view of an alternative insert of the present invention.

Detailed Description of the Invention

Figure 2 shows a first embodiment of the present invention. To the extent that the same features are used in the drawings the same element number has been used. The fitting 30 of the present invention is made from a flexible compressible, resilient plastic material. Preferably, the fitting 30 is made from a plastic material that is capable of being bonded to the bag 12 in the same manner as is done with the traditional rigid plastic fittings of Figure 1. Alternatively for this embodiment and all other embodiments in the present invention the fitting may be formed of another material and retained in a liquid tight sealed manner to the bag by other means such as adhesives or mechanical means such as a threaded portion and a nut. As shown the pinch valve 18 is located on the neck 6 of the fitting between bag 12 and the barb portion 8. In this embodiment, the fitting has a flange 4 which is sealed to the bag 12. As shown the fitting 30 has a flange 4 that is in the interior of the bag 12. It can equally be attached to the outer surface of the bag 12 if desired. The neck 6 is formed as a tubular portion which extends outward from the bag 12 and flange 4. In this embodiment, a hose connector 7 is formed with two barbs 7A and B each formed at opposite ends of the connector 7 with a planar portion 9 in between the barbs 7A and B. the first end of the tube or hose connector 7 is inserted into the end of the neck 6 farthest from the flange 4 and a second hose 14 is attached to the other end of the connector 7 over barb 7B. A hose attachment device 20 such as a tie wrap is used on the neck 6 of the fitting 30 and the hose or tube 14 to secure them together in a liquid tight manner.

Figure 3 shows a second embodiment of the present invention. The fitting 30 of the present invention is made from a flexible compressible, resilient plastic material. Preferably, the fitting 30 is made from a plastic material that is capable of being bonded to the bag 12 in the same manner as is done with the traditional rigid plastic fittings of Figure 1. As shown, the

pinch valve 18 is located on the neck 6 of the fitting 30 between the bag 12 and the hose barb 8.

As shown in Figure 4, being of an elastomeric material the pinch valve 18 can be actuated adjacent the opening 10 in the bag over the fitting 30 so as to reduce or eliminate the dead space volume present in the prior art.

The fitting materials include but are not limited to any elastomeric material such as thermoplastic elastomers, thermosets such as urethanes, especially closed cell foamed urethane, and rubber, both natural and synthetic. Preferably, they are thermoplastic elastomers such thermoplastic polyolefin and elastomeric alloys containing polyolefins so as to allow for the fitting to be heat bonded to the bag material directly. One such preferred material is a thermoplastic elastomer Versaflex® CL E85, a styrene block co-polymer blended with polyethylene polymer system available from GLS Corporation. Another material would be RTP 2899X 106530A, a thermoplastic polyolefin available from RTP Company. A further material is Santoprene® elastomers available from Advanced Elastomer Systems of Akron, Ohio.

Alternatively, the fitting may be made from another elastomeric material provided that a suitable means for attachment can be provided. For example one can use an intermediate material that bonds to the bag and to the fitting and have it bond to both so as to secure the fitting in place.

Figure 5 shows a second embodiment of the present invention. A rigid insert 32 is overmolded or insert molded into the fitting 30 so that a portion of the neck 6 downstream of where the valve 18 is and the barb contain the insert 32. This provides a more traditional fitting for the tubing and helps to ensure that it is secured to the fitting and resists the normal actions that might otherwise dislodge it. The rigid insert 32 may be formed of metal such as aluminum, brass or stainless steel or it may be formed of a rigid plastic such as polyethylene or polypropylene or the like.

Figure 6 shows a third embodiment of the present invention. A rigid insert 34 is fit over a portion of the exterior and interior of the fitting 30 so that a portion of the neck 6 downstream of where the valve 18 is and the barb contain the insert 34. This provides a more traditional fitting for the tubing and helps to ensure that it is secured to the fitting and resists the normal actions that might otherwise dislodge it. Preferably as shown the insert 34 has a portion 35 that fits under the barb of the fitting to help retain it in place. This insert 34 can be press fit into the fitting 30 and retained by frictional forces. Optionally it may have one or more retention devices such as barb 40 as shown in Figure 8 or ridges and the like which are angled toward

the end of the fitting 30 farthest from the flange 4 to allow for its insertion into the bore 5 while preventing its removal once inserted. Additionally and alternatively it may be bonded to the fitting such as be heat bonding or adhesives to ensure it is not removed. The rigid insert 34 may be formed of metal such as aluminum, brass or stainless steel or it may be formed of a rigid plastic such as polyethylene or polypropylene or the like.

Figure 7 shows a further embodiment of the present invention. A rigid insert 36 is fit into the bore 5 of the fitting 30 so that a portion of the neck 6 downstream of where the valve is and the barb contain the insert 36. Optionally as shown the insert 36 has a flange portion 38 that rests against the outer surface of the barb portion adjacent the point at which the bore 5 exits the fitting 30 so as to prevent it from being inserted too far into the fitting 30 and interfering with the valve 18. This insert 36 can be press fit into the fitting and retained by friction fitting. Optionally it may have one or more retention devices such as barbs 40 as shown in Figure 9 or ridges and the like which are angled toward the end of the fitting farthest from the flange to prevent its removal once inserted. Additionally and alternatively, it may be bonded to the fitting such as be heat bonding or adhesives to ensure it is not removed. The rigid insert 36 may be formed of metal such as aluminum, brass or stainless steel or it may be formed of a rigid plastic such as polyethylene or polypropylene or the like.

Figures 8 and 9 show a close up the alternative inserts 34 and 36 containing a mechanical retention means such as a barb 40.

Figure 10 shows another embodiment of the present invention. A rigid insert 102 is overmolded or insert molded into the fitting 100 so that a portion of the neck 104 downstream of where the valve will be located contains the insert 102. As shown the portion of the neck 104 is tubular in design rather than a barbed fitting as in the embodiment of Figure 5. The rigid insert 102 like its counterparts above in Figure 6 may be formed of metal such as aluminum, brass or stainless steel or it may be formed of a rigid plastic such as polyethylene or polypropylene or the like.

Figures 11 and 12 show a tubular ended fitting similar to that of Figure 10 with a rigid insert 102 inserted into or placed over the portion of the neck 104 in a manner similar to that taught in the embodiments of Figure 6 -9. In Figure 12, the insert 102 has a barbed end portion 106.

The present invention provides a fitting that allows one to clamp off the fitting closer to the opening of the bag so as to reduce or eliminate any dead space.

Claims

What is claimed:

- 1). A fitting for a disposable plastic container comprising a flange portion capable of being sealed in a liquid tight manner to an opening in the bag and a neck portion extending outwardly from the flange portion and the opening of the bag, wherein the neck portion is a tubular extension with a bore running through the flange and neck portions, and the fitting is being formed of a flexible compressible, or resilient plastic material.
- 2). The fitting for a disposable plastic container of claim 1 wherein the neck portion is a tubular extension with a bore running through the flange and neck portions and ending in a hose barb at a point of the neck farthest from the flange portion.
- 3). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a plastic selected from the group consisting of as thermoplastic elastomers, thermoplastic polyolefins, elastomeric alloys, containing polyolefins, thermosets and rubber.
- 4). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a plastic selected from the group consisting of thermoplastic elastomers, thermoplastic polyolefins and elastomeric alloys containing polyolefins.
- 5). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a plastic selected from the group consisting of thermoplastic elastomers selected from the group consisting of a styrene block co-polymer blended with polyethylene polymer and a thermoplastic polyolefin.
- 6). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a plastic selected from the group consisting of thermosets.
- 7). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a thermoset plastic selected from the group consisting of urethanes.
- 8). The fitting for a disposable plastic container of claim 1 wherein the fitting is made of a plastic selected from the group consisting of natural rubber and synthetic rubber.
- 9). A flexible disposable container comprising a closed plastic bag having at least one port, at least one fitting formed of a flange portion sealed in a liquid tight manner to the at least one opening in the bag and a neck portion extending outwardly from the flange portion and the opening of the bag, wherein the neck portion is a tubular extension with a bore running through the flange and neck portions, and the fitting being formed of a flexible compressible or resilient plastic material and a device capable of compressing the neck portion of the fitting so as to seal it off from the bag and minimize dead space.

10). The flexible disposable container of claim 9 wherein the neck portion is a tubular extension with a bore running through the flange and neck portions and further comprising a connector having a first end with a hose barb and a second end with a hose barb and a planar portion between the two barb portions, the neck portion of the fitting farthest from the flange portion having the first barb of the connector and a planar portion of the connector attached to it in a liquid tight manner and a tubing attached to the second barb of the connector and a planar portion of the connector in a liquid tight manner.

11). The flexible disposable container of claim 9 wherein the neck portion is a tubular extension with a bore running through the flange and neck portions and ending in a hose barb at a point of the neck farthest from the flange portion.

12). The flexible disposable container of claim 9 wherein the fitting is made of a plastic selected from the group consisting of as thermoplastic elastomers, thermoplastic polyolefins, elastomeric alloys containing polyolefins, thermosets and rubber.

13). The flexible disposable container of claim 9 wherein the fitting is made of a plastic selected from the group consisting of thermoplastic elastomers, thermoplastic polyolefins and elastomeric alloys containing polyolefins.

14). The flexible disposable container of claim 9 wherein the fitting is made of a plastic selected from the group consisting of thermoplastic elastomers selected from the group consisting of a styrene block co-polymer blended with polyethylene polymer and a thermoplastic polyolefin.

15). The flexible disposable container of claim 9 wherein the fitting is made of a plastic selected from the group consisting of thermosets.

16). The flexible disposable container of claim 9 wherein the fitting is made of a thermoset plastic selected from the group consisting of urethanes.

17). The flexible disposable container of claim 9 wherein the fitting is made of a plastic selected from the group consisting of natural rubber and synthetic rubber.

18). The flexible disposable container of claim 9 wherein the neck portion is a tubular extension with a bore running through the flange and neck portions and further comprising a connector having a first end with a hose barb and a second end with a hose barb and a planar portion between the two barb portions, the neck portion of the fitting farthest from the flange portion having the first barb of the connector and a planar portion of the connector attached to it in a liquid tight manner and a tubing attached to the second barb of the connector and a planar portion of the connector in a liquid tight manner and wherein the fitting and the tubing are attached to the connector via tie wraps.

19). The flexible disposable container of claim 9 wherein the device is selected from the group consisting of pinch valves and clamps.