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Dawson et al.

(54) IMPACT RESISTANT CONTAINER

(75) Inventors: **Kevin W. Dawson**, Charleroi, PA (US); **Peter Hess**, Venetia, PA (US); **Mathias L. Weinzen, JR.**, Coal Center, PA (US)

Correspondence Address:
COHEN & GRIGSBY, P.C.
625 LIBERTY AVENUE
PITTSBURGH, PA 15222-3152 (US)

(73) Assignee: **Rose Plastic USA, L.P.**, California, PA (US)

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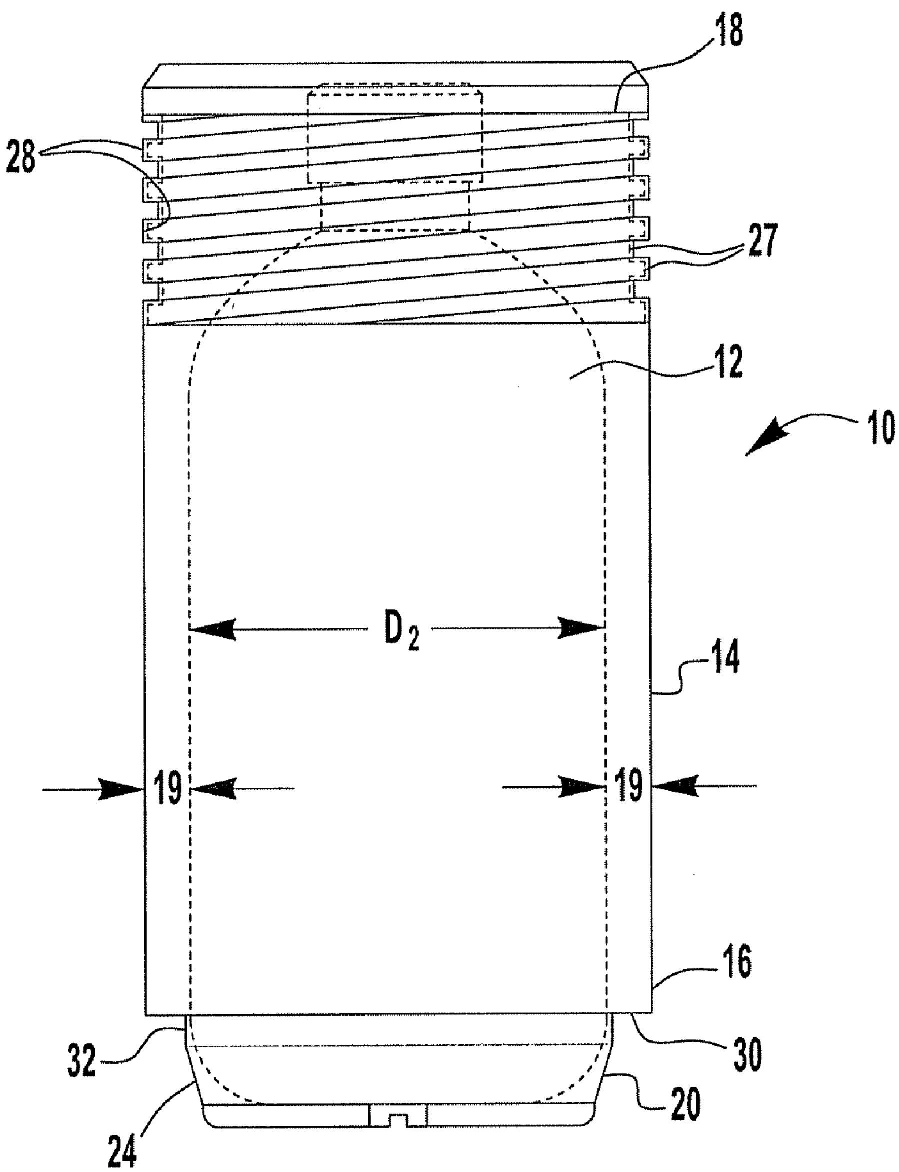
(57) **ABSTRACT**

A protective container (**10**) wherein a flexible wall (**14**) is connected to a base (**20**) and a cap (**26**). Deflection of the flexible wall (**14**) buffers the contents of the container (**10**) against impacts and is limited by the rate of air flow between one end of the flexible wall (**14**) and a cap (**26**) that closes container (**10**).



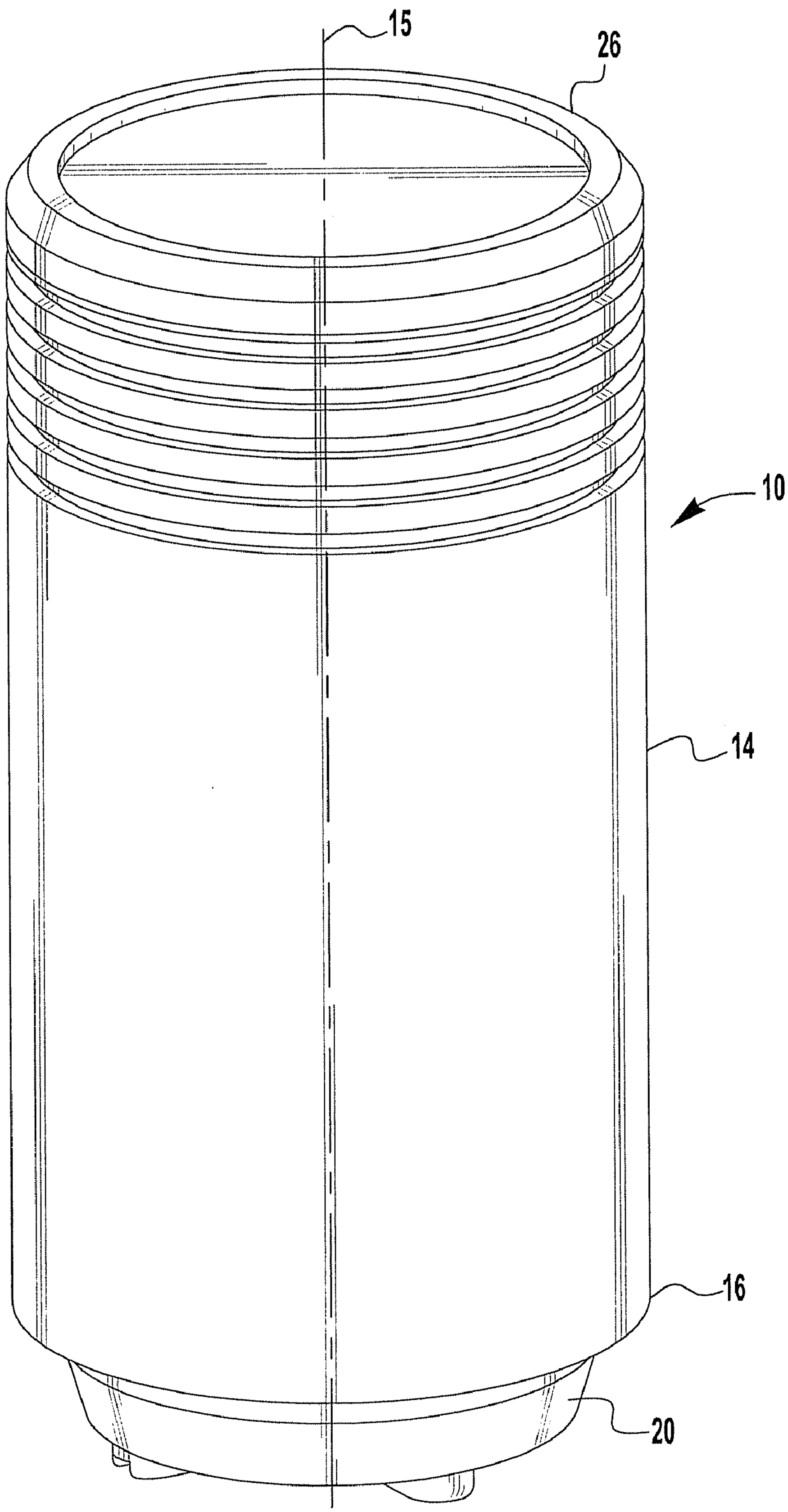


FIG. 1

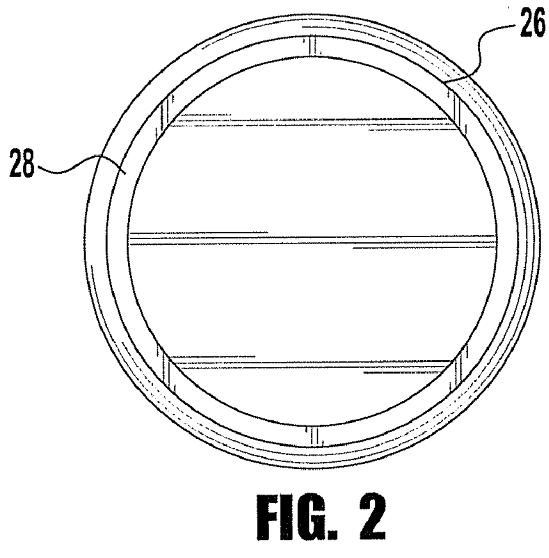


FIG. 2

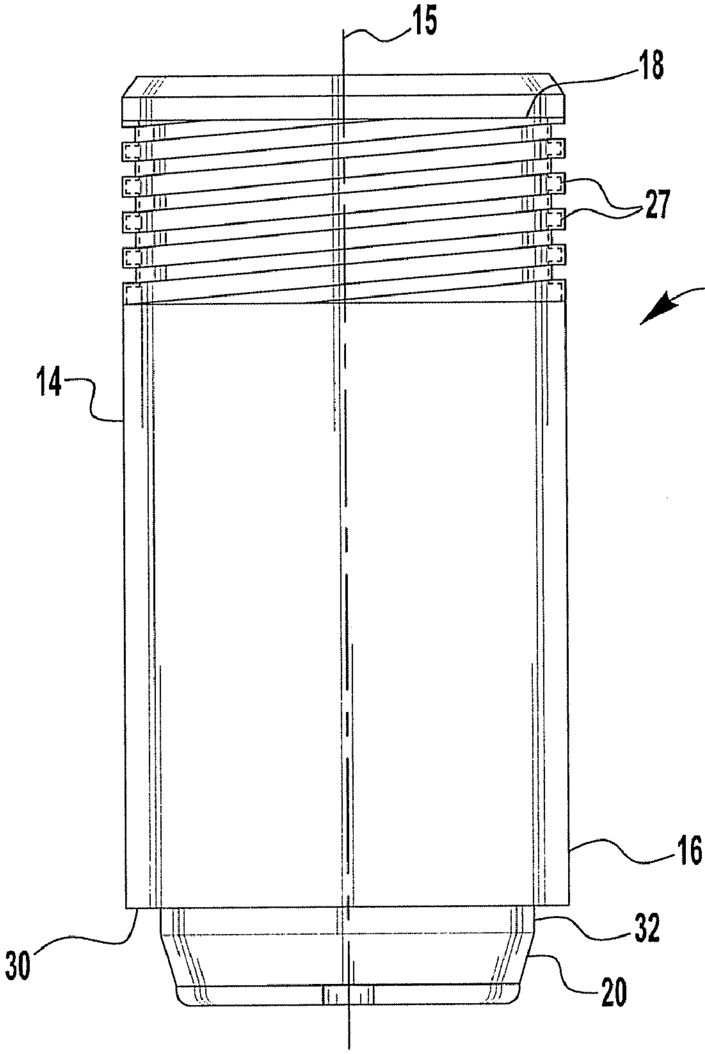


FIG. 3

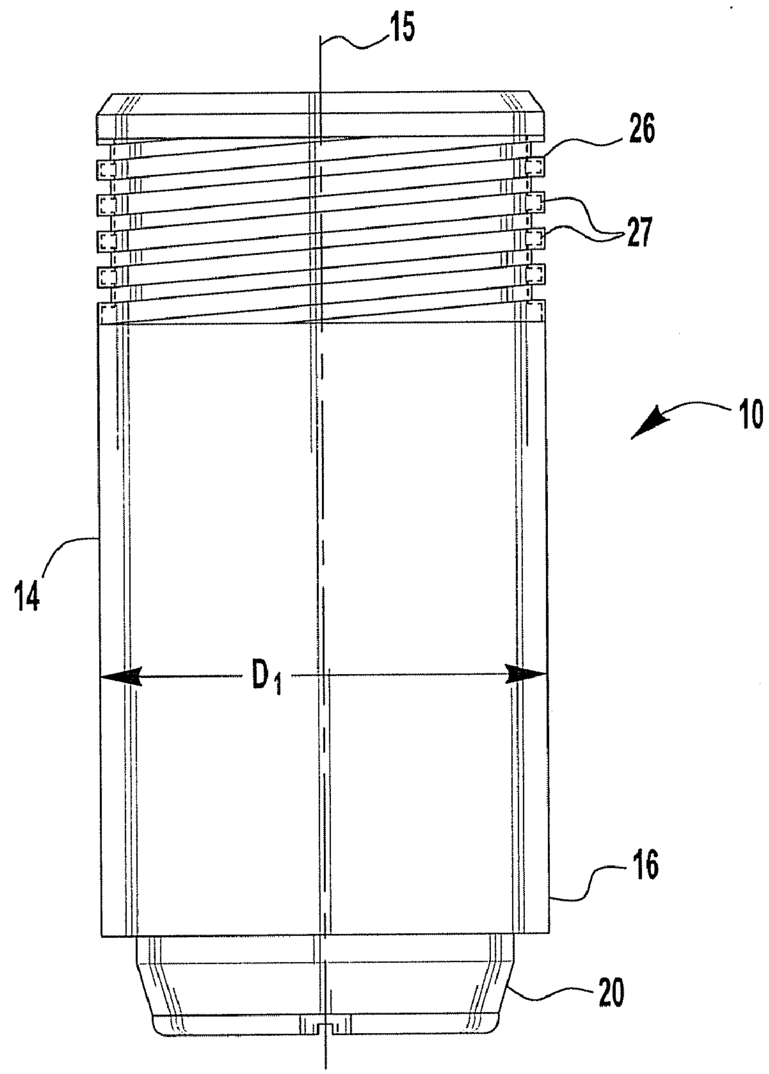


FIG. 4

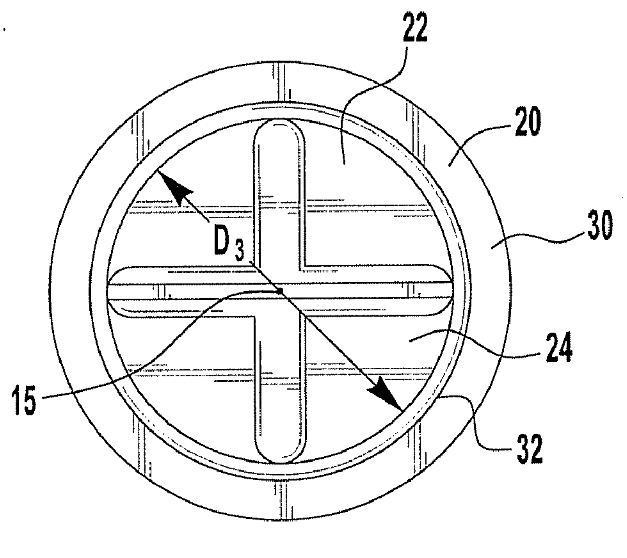


FIG. 5

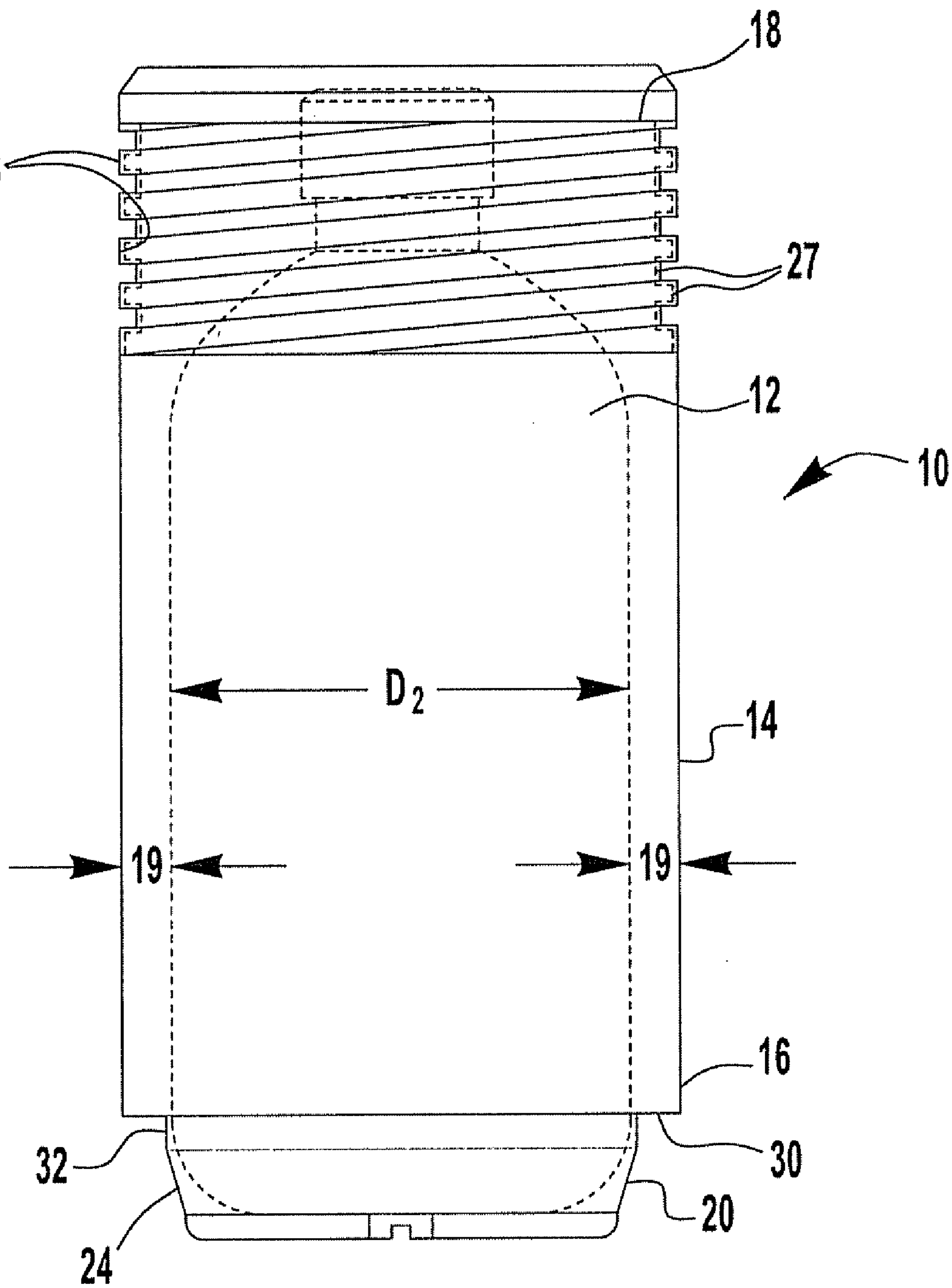


FIG. 6

IMPACT RESISTANT CONTAINER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The presently disclosed invention relates to containers and, more particularly, shipping containers for protecting glass vessels and other fragile objects.

[0003] 2. Description of the Prior Art

[0004] Various types and styles of containers for protecting sensitive or fragile objects are known in the prior art. For example, U.S. Pat. No. 2,493,380 describes a protective enclosure that separates an internal container from an outer container by various ribs between the sides and bottom of the two containers. The protective container is made of upper and lower portions with the upper portion forming a protective cap for the inner container. As another example, U.S. Pat. No. 2,500,786 describes a double wall protective container that includes spacers between the sides and bottom of the inner wall of the protective container and the outer surfaces of the container that is housed therein. The protective container includes upper and lower portions that engage each other to envelop the enclosed container.

[0005] Safety containers have been used to protect breakable containers such as glass bottles that contain flammable or hazardous materials. U.S. Pat. No. 4,245,685 shows a protective container that is integrally closed on the bottom and has a cone-shaped lid at the top. The lid snap-fits into the body and the cone-shaped portion is sized to receive a portion of the neck of the breakable container that is housed therein. The container includes side ribs and bottom ribs that engage the side of the breakable container to hold the breakable container in a relatively fixed position inside the protective container. Other protective containers include a series of ribs that are located at the bottom end to provide increased strength and durability. Examples are shown in U.S. Pat. No. 4,300,612 which has a shatter resistant protective covering that is used to protect glass containers that are housed therein.

[0006] In some cases, such protective containers have used a foam cushion to protect vessels housed therein. For example, U.S. Pat. No. 3,241,209 describes a safety container with a flange that engages the neck of a breakable container housed therein to stabilize the breakable container within the outer container. Cushioning material is inserted into other portions of the interstitial space between the outer container and the breakable container. In addition, an overcap engages the flange to protect the cap of the breakable container. U.S. Pat. No. 6,793,076 describes a protective enclosure for glass bottles in which internal shock absorbers extend between the sides and bottom of the internal surface of the protective enclosure and the external surface of the glass bottle. The enclosure also has a cap that includes shock absorbing protrusions.

[0007] In another design, U.S. Pat. No. 5,704,484 shows a protective jacket for bottles. The protective container has interlocking top and bottom. The bottom includes channeled edges that reinforce the bottom and that cooperate with an insert to space the enclosed bottle from direct contact with the bottom of the container and blunt forces that are applied to the outside of the protective jacket. U.S. Pat. No. 3,900,121 describes a protective container that includes an interior member that is intended to stabilize the bottle within the container.

[0008] Difficulties and disadvantages have attended all of these prior designs. In some cases, these designs have afforded means to buffer a force that was applied to the side of the container such as when the container is accidentally dropped or impacted by another object. When the prior art design has attempted to account for external impacts, they generally have been in the form of a cushion or shock absorber that transfers unabsorbed energy to discrete areas where the cushion or shock absorber. While this design allows the fragile internal container to survive stronger impacts, it still resulted in breakage because the transferred energy was focused on a relatively small area of the vessel.

[0009] Protective container designs that fully cushioned the inner vessel with foam inserts and the like still relied on mechanical means for absorbing the energy from an impact. Due to the mechanical nature of these designs, energy that was not absorbed was transferred to the breakable vessel in an uneven loading that still resulted in frequent destruction of the interior vessel.

[0010] Accordingly, there was a need in the prior art for a more effective way to protect fragile or breakable items such as vessels that contain flammable or hazardous materials.

SUMMARY OF THE INVENTION

[0011] In accordance with the presently disclosed invention, a container for protecting vessels includes a continuous flexible wall that encircles the vessel at times when the vessel is placed in the container. The flexible wall defines an air gap between the outer surface of the vessel and the wall. A base is integrally connected to one end of the flexible wall and a cap is connected to the opposite end of the flexible wall. The base defines a well that receives a portion of the vessel and centers the vessel in the flexible wall. In this way, the air gap between the flexible wall and vessel is substantially the same as all angular locations of the flexible wall. The cap is threadingly engaged with the end of the flexible wall that is opposite from the base.

[0012] The cap and treaded portion of the flexible wall are gaped to allow air flow from the air gap between the flexible wall and vessel to outside the container in response to flexing of the wall toward the vessel. The rate of air flow between the cap and threaded portion of the flexible wall is limited. The rate of flow is selected to be low enough to allow flexure of the wall to absorb energy by developing air pressure within the air gap. The rate of flow is selected to be high enough to limit the pressure that is applied to the surface of the vessel.

[0013] Forces that deflect the flexible wall toward the vessel are transferred to the surface of the vessel by fluid pressure. In this way, the forces are more uniformly transferred to the surface of the vessel than by mechanical means such as mechanical shock absorbers.

[0014] Preferably, a base defines a shoulder between the perimeter of the well and the integral connection between the flexible wall and the base. This structure further strengthens the bottom portions of the container.

[0015] Also preferably, the flexible wall is made of transparent material so that the condition of the vessel and labeling on the vessel can be viewed through the container without removing the vessel from the container.

[0016] Other features, advantages, and objects of the presently disclosed invention will become apparent to those skilled in the art as a description of a presently preferred embodiment thereof proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The presently disclosed invention is shown and described in connection with the accompanying drawings herein:

[0018] FIG. **1** is a perspective view of a presently preferred embodiment of the container disclosed herein.

[0019] FIG. **2** is a top plan view of the container that is shown in FIG. **1**.

[0020] FIG. **3** is a side elevation view of the container shown in FIG. **1**.

[0021] FIG. **4** is a side elevation view of the container shown in FIG. **1** from a position orthogonal to the view in FIG. **3**.

[0022] FIG. **5** is a bottom plan view of the container that is shown in FIG. **1**.

[0023] FIG. **6** is an elevation view of the container that is shown in FIGS. **1-5** except that FIG. **6** further depicts an exemplary vessel which is a glass bottle and illustrates the air gap between the container and the bottle.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0024] FIGS. **1-6** show a presently preferred embodiment of the invention wherein a container **10** is a protective container for a fragile vessel such as glass bottle **12** which is contained in container **10**. Container **10** is a molded plastic container that is comprised of clear polyethylene.

[0025] Container **10** includes a flexible wall **14** that is in the form of a circular cylinder that has a longitudinal axis **15**. Flexible wall **14** encircles bottle **12** and defines a first end **16** and a second end **18**. Flexible wall **14** is sized so that the diameter D_1 of the cylinder is larger than the diameter D_2 of the bottle **12** so that a gap **19** is defined between the flexible wall **14** and the surface of bottle **12**. The first end **16** of the flexible wall is integrally connected to a base **20** that supports the container at times when the container is oriented in an upright position.

[0026] Base **20** includes an area **22** that has a longitudinal position along axis **15** in the direction further away from flexible wall **14** than the rest of base **20** so that base **20** defines a well **24** with area **22** at the bottom of the well. Area **22** is generally circular and intersected at the center point by axis **15**. The diameter D_3 of area **22** is selected to be less than D_1 and greater than D_2. In that way, well **24** is large enough to receive one end of bottle **12** and, when bottle **12** is placed in well **24**, bottle **12** tends to be centered with respect to longitudinal axis **15** and flexible wall **14**. Since bottle **12** is centered with respect to flexible wall **14**, the gap **19** between flexible wall **14** and bottle **12** is substantially the same at all angular positions around longitudinal axis **15**.

[0027] The second end **18** of flexible wall **14** is threadingly connected to a cap **26** by threads **27** in the second end **18** of flexible wall **14** and threads **28** in cap **26**. Threads **27** and **28** are constructed so that they secure cap **26** to the second end **18** of flexible wall **14**, but still have an air gap that will allow a limited flow of air between threads **27** and **28** in response to differences in air pressure between the inside and outside of container **10**.

[0028] Flexible wall **14** is made of a clear, resilient material such as polyethylene. Flexible wall **14** has a wall thickness that is large enough to withstand substantial impact forces, but wall **14** is also thin enough that impact forces will cause wall **14** to deflect inwardly toward bottle **12**. Preferably, wall **14** has a thickness in the range of 0.5 mm. to 1.5 mm.

[0029] When wall **14** is impacted by a force sufficient to deflect wall **14** toward bottle **12**, the air pressure in gap **19** tends to increase, applying opposing forces both against wall **14** and the surface of bottle **12**. The increased air pressure tends to absorb energy of the impact force. As the air pressure inside container **10** increases, the pressure differential between the inside and outside of container **10** causes air to flow at a limited rate between threads **27** and **28** from the inside of container **10** to the outside.

[0030] Because the air flow rate between threads **27** and **28** is limited, the flexible wall **14** does not readily deflect to the surface of bottle **12**. Instead, the deflection continues to be slowed by opposing forces of the elevated air pressure in gap **19**. The opposing force in gap **19** is determined by the rate at which air in gap **19** is displaced by the deflection of wall **14** and the rate at which air flows between threads **27** and **28**. In this way, side impacts to container **10** are buffered by air in gap **19** so that bottle **12** is protected. Thus, the opposing force in gap **19** is governed by air flow gap between threads **27** and **28**.

[0031] The mechanical strength of container **10** is increased by structure at the first end **16** and second end **18** of wall **14**. More particularly, because the diameter D_3 of well **24** is less than the diameter D_1 of flexible wall **14**, base **20** forms a shoulder **30** between first end **16** and the perimeter **32** of well **24**. Shoulder **30** provides increased rigidity for container **10** in the region of the first end of flexible wall **14**.

[0032] At the second end **18** of wall **14**, threads **27** and **28**, in combination with cap **26**, cooperate to provide additional mechanical strength and rigidity for container **10**.

[0033] While a presently preferred embodiment of the invention, the presently disclosed invention is not limited thereto, but can be otherwise variously embodied within the scope of the following claims.

We claim:

1.) A container for protecting a vessel that has a closed end, said container comprising:

a continuous flexible wall that encircles the vessel at times when the vessel is placed in the container, said flexible wall defining an air gap between the outer surface of the vessel and the wall, said wall having a first end and also having a second end that is oppositely disposed from said first end;

a base that is connected to one end of the flexible wall, said base defining a well for receiving the bottom end of a vessel and locating the bottom end of the vessel at a predetermined position with respect to the flexible wall; and

a cap that engages the second end of the flexible wall, the engagement of said cap and the second end of the flexible wall allowing air to flow from said air gap between said cap and the second end of the flexible wall to the exterior of said container at a limited rate of flow.

2.) The container of claim **1** wherein said cap is threadingly engaged to the second end of the flexible wall.

3.) The container of claim **2** wherein the threads of said cap engage the threads of the second end of said flexible wall to allow the passage of air at a limited flow rate.

4.) The container of claim **1** wherein the flexible wall is comprised of polyethylene or polyurethane.

5.) The container of claim **4** wherein the wall thickness of the flexible wall is in the range of 0.5 mm. to 1.5 mm.

6.) A container for protecting a vessel, said container comprising:

a continuous flexible wall that encircles the vessel at times when the vessel is placed in the container, said wall defining an air gap between the outer surface of the vessel and the wall, said wall also defining a first end and also a second end where the second end is oppositely disposed from said first end;

a base that is integrally connected to the first end of the flexible wall, said base having a portion that is extended in a longitudinal direction and that defines a well for receiving a portion of the vessel and centering the vessel with respect to the flexible wall; and

a cap that engages the second end of the flexible wall, said cap being removeably engagable with the second end of the flexible wall, said cap and the second end of said flexible wall allowing a limited rate of air flow from said air gap to the exterior of said container where said air flows between said cap and the second end of said flexible wall.

7.) The container of claim **6** wherein the well in said base defines a perimeter that is radially offset from the integral connection between said base and the first end of said continuous flexible wall.

8.) The container of claim **7** wherein the perimeter of the well in said base is located radially inward from the radial position of said flexible wall such that said base defines a shoulder between the perimeter of said well and the integral connection between said base and the first end of said flexible wall.

9.) The container of claim **6** wherein the cap is threadingly connected to the second end of the flexible wall and wherein the threads in the second end of the flexible wall and the treads in the cap cooperate to increase the rigidity of the second end of the flexible wall.

10.) The container of claim **6** wherein the air gap between the continuous flexible wall and the vessel is in the shape of a circular cylinder.

11.) A container for fragile vessels, said container having a first end that is closed and a second end that has a removable closure, said container comprising:

a flexible wall that is cylindrically shaped about a longitudinal axis, said flexible wall surrounding a vessel that is received in the container and cooperating with such vessel to define an air gap between the outer surface of the vessel and the flexible wall, said flexible wall defining a first end and also defining second end that is oppositely disposed from said first end;

a base that is integrally connected to the first end of the flexible wall, said base having an extended portion that defines a well for receiving a portion of the vessel and for centering the vessel with respect to the longitudinal axis of the flexible wall; and

a cap that engages the second end of the flexible wall, said cap being rotatable on said longitudinal axis and being threadingly engageable with the second end of the flexible wall, said cap and the second end of said flexible wall allowing the passage of air from said air gap to the exterior of said container through the treaded engagement of said cap and the second end of said container in response to deflections of said flexible wall in a radially inward direction, said cap and the threaded end of said flexible wall limiting the rate of air flow therebetween.

12.) The container of claim **11** wherein the rate at which the flexible wall flexes in response to a force against the side of the flexible wall rate is limited by the rate of air flow between the cap and the second end of the flexible wall limited.

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