CONTAINER WITH FLEXIBLE BOTTOM

FIG. 5

FIG. 6

FIG. 7

FIG. 8

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ABSTRACT OF THE DISCLOSURE
A container constructed to compensate against the effects resulting from a reduction in internal pressure after sealing of the container. The container is provided with a flexible base which flexes inward when the internal pressure of the container is reduced due to chemical reactions, temperature changes and/or other causes. Through the flexure of the container base, deformation or paneling of the sidewalls of the container is prevented. In this manner, the stacking characteristics and appearance of the container are retained.

Description of the preferred embodiments
Referring to the drawings and in particular to FIGURE 1, a container 10 is filled with a fluid, for example, motor oil. After the container has been filled, the fluid attains the level 14 just below the top rim 16 of the container. The container is sealed by an end closure 17 which may be affixed in any suitable manner, for example, by a double-seam, spin weld, or heat seal.

In the normal course of storing the filled container, it has been found that certain constituents of the fluid may react chemically with the air within the container. Such chemical reactions of the fluid result in a reduction of internal pressure in the container in that the reactions use up the oxygen from the residual air space, and the partial pressure, previously created by the oxygen, is no longer present and, consequently, the container will be reduced. A similar result of reduced total internal pressure would prevail for chemical reactions between the fluid and any of the other constituents or gaseous components of the residual space. Further, if the container is initially filled with a heated product (e.g., heated oil to make it less viscous for filling), its subsequent cooling will tend to cause a reduction in the internal pressure.

With reduction of internal pressure, the atmosphere or surrounding environment acts upon the container to cause the wall of the container to buckle or panel. When the sidewall 20 of the container is thus deformed or paneled, various problems arise with respect to the storage of the containers. For example, it is not possible to stack any significant number of containers on top of one another in order to conserve storage space. This is because when the sidewall 20 panels or becomes deformed, as a result of a reduction of the internal pressure, the top and bottom planes of the container are generally not longer parallel, thereby resulting in instability in the container stack. Another problem resulting from the deformed condition of the container is that it gives the container an undesirable appearance. Such deformed appearances of the containers often render the latter unmarketable, even though the contents of the container are...
entirely usable and unaffected by the deformation of the sidewall.

The deformation or paneling of the sidewall of the container is prevented, in accordance with the present invention, through a novel construction of the bottom wall or base of the container wherein flexure means in the bottom wall provide preferential flexure in the latter. FIGURE 3 shows one embodiment of the invention wherein the base or bottom wall 18 includes a flexure means 19 comprising an oval button or convex portion 22 located at the juncture between the sidewall 20 and the base 18. The flexure means 19 further comprises a second bead or convex portion 24 along with the indentation or concave portion 21 disposed therebetween. Adjacent to the bead 24 is an indentation or concave portion 26 which runs into a central bottom portion 30.

FIGURE 3 shows the natural condition of the container while FIGURE 4 shows the container base 18 after the container has been filled and the contents have chemically reacted or other action has taken place to initially reduce the pressure within the container. Because of the irregular configuration of the flexure means 19 and the fact that the thickness T of the flexure means is less than the thickness T of the sidewall 20, such flexure means 19 will bend, in preference to the sidewall 20, to compensate for the pressure reduction. When this bending or flexure occurs, maximum volumetric displacement is effected as the bottom wall 18 flexes from a position starting at the outer annular bead 22. The flexure occurs at the beads 22 and 24, continuing through the intermediate indentation 21. This situation is shown in FIGURE 4, where the container base 18 is shown after the container has been filled and the contents have chemically reacted or other action has taken place to initially reduce the pressure within the container. Because of the irregular configuration of the flexure means 19 and the fact that the thickness T of the flexure means is less than the thickness T of the sidewall 20, such flexure means 19 will bend, in preference to the sidewall 20, to compensate for the pressure reduction. When this bending or flexure occurs, maximum volumetric displacement is effected as the bottom wall 18 flexes from a position starting at the outer annular bead 22. The flexure occurs at the beads 22 and 24, continuing through the intermediate indentation 21. The height of the central portion 30 is shown as 1.25 inches as in FIGURE 4.

In a typical (e.g., one quart) container construction, the preferred thickness T of the sidewall 20 may be within the range of 0.02 to 0.04 inch, the flexure means 19 within the range of 0.012 to 0.035 inch. The following indicates parameters of the construction shown in FIGURE 3.

<table>
<thead>
<tr>
<th>Range Width (W)</th>
<th>Ideal Width (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15-0.25</td>
<td>0.20</td>
</tr>
<tr>
<td>Height of bead (H)</td>
<td>0.005-0.12</td>
</tr>
<tr>
<td>Angle A (degrees)</td>
<td>40-60</td>
</tr>
<tr>
<td>Angle B (degrees)</td>
<td>50-70</td>
</tr>
<tr>
<td>Angle C (degrees)</td>
<td>60-80</td>
</tr>
<tr>
<td>Angle D (degrees)</td>
<td>15-25</td>
</tr>
</tbody>
</table>

FIGURE 5 shows another embodiment for the design and construction of a flexible base for the container. In this design, the flexure means 29 in base 33 comprises an outer bead or annular portion 32 joined to the sidewall 20, the bead 32 joining an inner bead 34 which, in turn, leads to an indentation 36. The latter terminates in the generally flat central portion 38. Prior to being filled and when the container is in the undeformed state, the container is supported on the inner bead 34 and, depending on the thickness and configuration, it might also be supported on the central portion 38. When the internal container pressure is initially reduced, the base 33 flexes, in an inward direction, to the position shown in FIGURE 6.

As in the case of the embodiment of FIGURE 3, the thickness T of the flexure means 29, including the outer bead 32, is less than the sidewall 20 thickness T of the container. Thus, the outer bead 32 allows the entire base 33 to be displaced toward the inside of the container when the aforesaid initial partial vacuum is present therein, thereby to provide maximum volumetric displacement, with flexure occurring at the beads 32 and 34 as the portion therebetween tends to rotate about bead 32. Assuming that the thickness of the sidewall 20 is within the range specified for the first embodiment of FIGURE 3 (i.e., 0.02 to 0.04 inch), the material thickness of the flexure means 29 for the embodiment of FIGURE 5 preferably would reside within the range of 0.012 to 0.035 inch. The internal diameter of the container for both of the embodiments of FIGURES 3 and 5 is nominally 4 inches, when associated with the preceding values.

In the embodiment of FIGURE 7, the base 41 is shaped intermediate the two designs FIGURES 3 and 5. An outer bead 40 of the flexure means 43 is joined to the sidewall 20. In contrast with the outer bead 22 in FIGURE 3, the outer bead 40 does not provide support for the unfilled container (FIGURE 7). The outer bead 40 connects with an inner bead 42 which, in turn, leads to indentation 44, the latter being joined to the central flat portion 48.

In the initial stage of flexure, the central portion 48 is
displaced inward to the position shown in FIGURE 8. In this initial stage of flexure, the filled container is supported by the outer bead 40 and, depending on the thickness and configuration, it may also be supported on the inner bead 42.

Assuming that the thickness of the sidewall 20 is within the range specified in the first embodiment in FIGURE 3 (i.e., 0.02 to 0.04 inch), the material thickness of the flexure means 43 in the embodiment of FIGURE 7 preferably would reside within the range of 0.012 to 0.035 inch. The internal diameter of the container is nominally 4 inches when associated with the preceding value.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing descriptions and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A container body of thermoplastic material or the like having a sidewall and a bottom wall, said bottom wall having flexure means at the outer annular portion thereof comprising a first annular bead disposed at the juncture between the container sidewall and the bottom wall and a second annular bead disposed radially inwardly of the said first bead, said flexure means further comprising an annular concave portion joining said annular beads, said bottom wall having a central portion joined to said second annular bead by a second annular concave portion, said first annular bead being thinner than the adjacent sidewall with the transition in thickness occurring substantially at the juncture between the sidewall and said first annular bead, said central bottom wall portion being displaced inwardly, in preference to the sidewall, upon a relative reduction of pressure in the container, as the flexure means flexes from a position starting at the first annular bead and continuing through said first annular concave portion and said second annular bead.

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