Sept. 10, 1963 R. L. ALLEN 3,103,089

METHOD OF FILLING CONTAINERS

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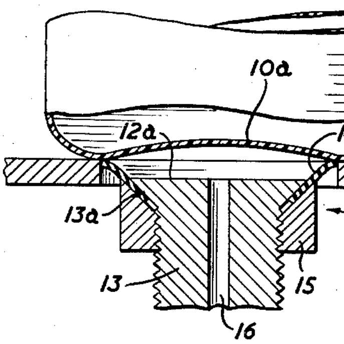

FIG. 1

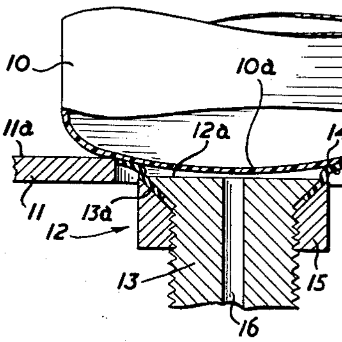

FIG. 2

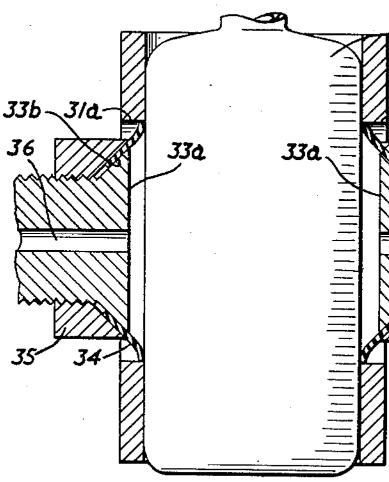

FIG. 3

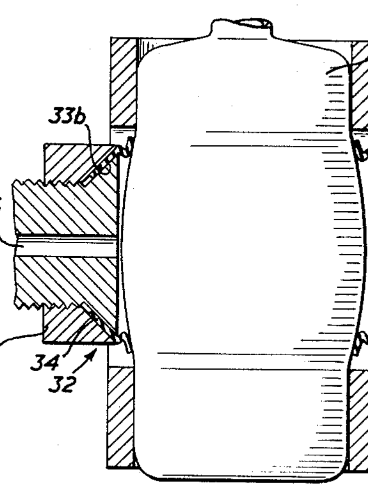

FIG. 4

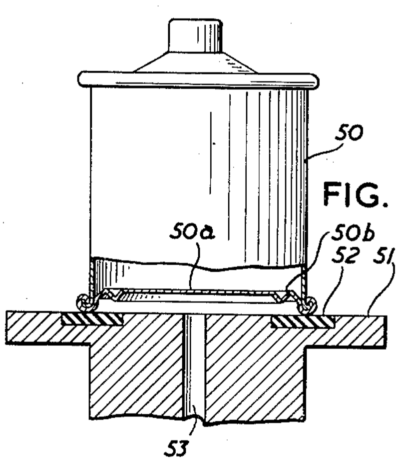

FIG. 5

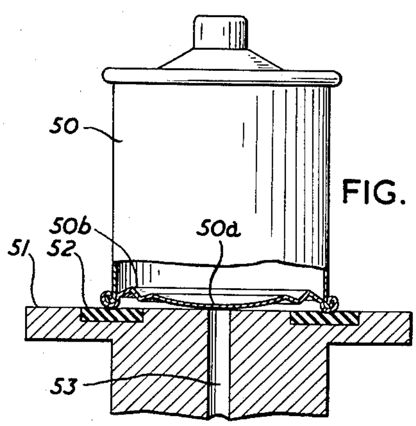

FIG. 6

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METHOD OF FILLING CONTAINERS

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This invention relates to containers, and to a method of filling same, and has particular application in the packaging of materials which tend to absorb air, oxygen or other gaseous elements occupying the free space within the container, or in which the material packaged is susceptible to an appreciable reduction in volume due to temperature change such as is encountered where the material is packaged in a heated condition and subsequently allowed to cool.

A particularly vexatious problem which occurs in the packaging art is the panelling or cockling of walls in an air-impervious rigid container due to a drop in pressure within the container after the material has been packaged.

The panelling or cockling of the container walls, while it may in no way affect the quality of the material contained within the container, detracts from the appearance of the container and tends to give the impression that the merchandise is "old stock." In the case of a substantially rectangular container the major walls become bowed inwardly in the direction of their width and length, and, in the case of a container which is substantially elliptical in planiform, the major surfaces tend to become bowed inwardly in the direction of their major length. In some cases, particularly where the container is molded from a thermoplastic material, the container may become cockled or distorted in random directions, thus detracting from the visual appeal of the container in that it imparts a squeezed or squashed look to the container.

The object of this invention is to mitigate these disadvantages in a very simple manner.

According to the invention, panelling or cockling of the walls of a preformed container formed of air-impervious material and having at least one wall which is formed of a rigid elastic air-impervious material is mitigated by deforming the elastic wall outwardly of the container prior to an air-impervious closure being applied to the filling opening of the container, and by maintaining said deformation until the container is hermetically sealed. The wall is deformed to an extent which is within the elastic limits of the material from which the wall is formed and in a direction to increase the volume of the cavity within the container, so that the wall will be moved inwardly of the container by the stresses set up in the wall during deformation in a direction to decrease the volume of the cavity and thus to raise the pressure within the cavity to one which is super-atmospheric.

The air which fills the free space within the container is thus raised to a pressure which is slightly super-atmospheric, with the result that a greater amount of air must be absorbed by the packaged material before the pressure within the container drops below the ambient atmospheric pressure. Also, in the event that the packaged material should contract due to a drop in temperature, the contraction is accommodated by expansion of the air occupying the free space within the container and the pressure within the container is maintained above the ambient atmospheric pressure. In this way panelling or cockling of the walls of the container is mitigated.

Preferably the wall of a rigid elastic material is a bottom wall of the container, and preferably that wall is normally bowed inwardly of the container for it to be concave.

The container may be formed from rigid flexible or elastic metal, in which case the deformable wall would

be provided with peripheral undulations enhancing its elasticity, or the container may be formed from a moldable elastic thermoplastics material, such as nylon, polyethylene, polyvinyl chloride, or other suitable material, in which case each of the walls of the container would be inherently rigid and elastic.

Further objects and advantages of the invention will become apparent from a study of the following specification when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a diagrammatic sectional elevation showing the bottom wall of a bottle or container molded from an elastic thermoplastics material prior to the bottom wall being deformed outwardly of the container;

FIGURE 2 is a view corresponding to FIGURE 1, but showing the bottom wall deformed outwardly of the container to increase the volume of the cavity within the container;

FIGURES 3 and 4 are diagrammatic views showing the application of the method of the invention to side walls of a container or bottle molded from an elastic thermoplastic material; and,

FIGURES 5 and 6 are diagrammatic views showing the application of the method of the invention as applied to the filling of a metal can having an elastic bottom wall.

Referring to FIGURES 1 and 2, a container in the form of a bottle is shown at **10**, a support for the bottle while it is being filled is shown at **11**, and a device for subjecting the bottom wall of the container to a source of vacuum is indicated generally at **12**.

The device **12** includes a top surface **12***a* which is spaced beneath a top surface **11***a* of the support **11**, the top surface **12***a* being provided by one end of a threaded block **13** which is formed with a frusto-conical surface **13***a* which provides a seating for a flexible annular washer **14**. The washer **14** is clamped against the frusto-conical surface **13***a* by a nut **15**, and the block **13** is provided with a central bore **16** which selectively may be connected to a source of vacuum.

In use, the bottle **10** is placed on the support **11** and is positioned over the device **12**. The source of vacuum is then established, with the result that the washer **14** seats against the bottom wall **10***a* of the bottle **10**, and the bottom wall is drawn downwardly by the source of vacuum into the position shown in FIGURE 2. This movement of the bottom wall causes an increase in the volume of the cavity within the bottle **10**.

The bottle **10** is then filled by conventional filling appartus, and, while the source of vacuum is maintained, an air-impervious closure is applied to the bottle to provide a hermetic seal.

After the hermetic seal has been established, the source of vacuum is removed, and the bottom wall **10***a* is allowed to return from the position shown in FIGURE 2 towards the position shown in FIGURE 1. The return movement is effected by the stresses which are set up in the material forming the bottom wall as that wall is drawn downwardly.

The upward movement of the bottom wall results in a reduction of the volume of the cavity within the bottle, and acts to place the air which occupies the free space within the bottle under a pressure which is higher than the ambient atmospheric pressure. This slight overpressure acts to maintain the walls of the bottle in an expanded condition, and, in the event that air within the bottle should be absorbed by the material within the bottle, it is not until sufficient air has been absorbed to cause the pressure within the bottle to drop below that of the ambient atmospheric pressure that there is any possibility of the container walls cockling or panelling. Similarly, in the event that the material within the bottle should decrease in volume due to a drop in temperature, that decrease in volume is accommodated by the expansion of the air contained in the residual space within the bottle, and a far greater amount of shrinkage can be accommodated before panelling or cockling occurs.

Referring now to FIGURES 3 and 4, a container in the form of a bottle molded from an elastic thermoplastics material is shown at **30**, the container being located within a jig **31** having side apertures **31***a*. Mounted within each of the apertures **31***a* is a device indicated generally at **32** which includes a threaded block **33** having a planar end face **33***a* which is surrounded by a frusto-conical seat **33***b*. Positioned on the seat is an annular washer **34** which is held against the seat by a nut **35**. Each of the blocks **33** has a bore **36** which communicates with the face **33***a* and which selectively can be connected to a source of vacuum.

In use, the container **30** is placed within the jig **31** and the source of vacuum is established to the bores **36**. This results in the washers **34** seating on the side walls of the container, and subsequently results in the side walls being drawn towards the blocks 33 by the source of vacuum to expand the walls and thus increase the volume of the cavity of the container, the walls then will be in the position shown in FIGURE 4. The bottle is then filled in the usual manner and is hermetically sealed, after which the source of vacuum is removed and the locally expanded portions of the side walls of the container are allowed to move inwardly under the influence of the stresses set up in those walls during the expansion.

As described with reference to FIGURES 1 and 2, the inward movement of the walls results in the residual air in the container being placed under a slight super-atmospheric pressure.

The bottles or containers referred to with reference to FIGURES 1–4 may be the commonly known bottles formed by molding nylon, polyethylene, polyvinyl chloride or any other suitable moldable thermoplastics material. Such material is both rigid and elastic. Where the container is elliptical or other than circular in cross-section, the required increase of the volume of the container cavity can be accomplished by applying pressure to the outside of the container in a manner such as to cause the walls of the container to move towards a position in which the cross-section of the container is more close to that of circular.

Optionally the jig of FIGURES 3 and 4 may be provided by a hollow cylinder having a pair of annular sealing rings provided at spaced positions along its bore, the sealing rings encircling the container and defining a gallery between the rings into which the container may be expanded by a source of vacuum applied to the gallery.

The invention also has application in the filling of metal cans. Metal cans are commonly made of thin steel sheet material which is both rigid and elastic. Reference is now made to FIGURES 5 and 6 which shows a metal can **50** positioned on a support **51** having an annular seal **52**. The annular seal **52** encircles a bore **53** which may selectively be connected to a source of vacuum. When filling the can, the lower rim of the can is positioned on the annular seal **52**, as is shown in FIGURE 5, and, when the source of vacuum is established, owing to its elasticity the bottom wall **50***a* is drawn downwardly into the position shown in FIGURE **6**. The can is then filled and is hermetically sealed. To enhance the flexibility of the bottom wall, preferably, that wall is provided with peripheral corrugations **50***b*.

On release of the bottom wall from the source of vacuum, that wall will move upwardly under the influence of the stresses set up during the downward deformation, and will act to reduce the volume of the cavity of the can and to place the air occupying the free space within the can under a slight super-atmospheric pressure.

Obviously, when the can is formed from a magnetizable material a suitable magnet or electromagnet could be used in place of the source of vacuum.

It will be understood that the above recited embodiments of the invention are to be taken by way of example only, and that various modifications are possible without departing from the spirit of the invention and the scope of the appended claims.

What I claim as my invention is:

1. A method of mitigating the panelling or cockling of walls of an air-impervious container, the container being preformed and having a filling opening adapted to be hermetically sealed by a closure and having at least one wall which is formed from a rigid elastic air-impervious material, comprising the steps of deforming the already formed rigid elastic wall outwardly of the container to increase the volume of the container, and filling the container at substantially atmospheric pressure prior to applying a closure to the opening in the container and maintaining said deformation until such time as the closure is seated in a manner providing a hermetic seal, said deformation being within the elastic limits of the material forming the wall, the wall then being permitted to move inwardly of the container under the influence of the stresses set up in the elastic material during deformation to substantially resume its original form and thus reduce the volume of the cavity of the container and to cause a super-atmospheric pressure to obtain within the container.

2. A method of mitigating the panelling or cockling of the walls of an air-impervious container, the container being preformed and having a filling opening adapted to be hermetically sealed by a closure and having at least one wall which is formed from a rigid elastic air-impervious material, comprising the steps of applying a source of vacuum to said one already formed rigid elastic wall and filling the container at substantially atmospheric pressure prior to applying a closure to the opening in the container, the source of vacuum being applied to that surface of the wall which is exterior of the container and acting to deform the wall outwardly of the container to increase the volume of the cavity of the container, the deformation being within the elastic limits of the elastic material whereby on release of the vacuum it will tend to resume its original form, maintaining the source of vacuum until after the closure has been applied to the container, and subsequently removing the source of vacuum to permit said one wall to be substantially restored to its initial position by stresses set up in the elastic material during deformation of the wall, whereby the volume of the cavity is reduced to cause a super-atmospheric pressure to obtain within the container.

3. A method of packaging material in a preformed air-impervious container having a filling opening adapted to be hermetically sealed by a closure and having at least one wall formed of a rigid elastic air-impervious material, comprising the steps of filling the preformed container at substantially atmospheric pressure and applying an air-impervious closure thereto whilst said one wall is subjected to an external pulling force acting to deform the wall outwardly of the container to increase the volume of the cavity of the container, the deformation being within the elastic limits of the elastic material, and subsequently removing the external pulling force to permit said one wall to be substantially restored to its initial position by stresses set up during deformation of the rigid elastic material providing the wall, whereby the volume of the cavity is reduced to cause a super-atmospheric pressure to obtain within the filled container, and panelling or cockling of the walls is mitigated.

4. A method of packaging material in a preformed air-impervious container having a filling opening adapted to be hermetically sealed by a closure and having at least one wall formed of a rigid elastic air-impervious material, comprising the steps of subjecting said elastic wall of the container to an external source of vacuum to cause the wall to be deformed outwardly of the container to temporarily increase the volume of the cavity

within the container, the deformation being within the elastic limits of the elastic material, maintaining said source of vacuum and filling at substantially atmospheric pressure and applying an air-impervious closure to the container, and subsequently removing the source of vacuum to permit said elastic wall to be restored towards its initial position by stresses set up during deformation of the rigid elastic material providing said wall, whereby the volume of the cavity of the container is reduced to cause a super-atmospheric pressure to obtain within the filled container, and panelling or cockling of the walls of the container is mitigated.

5. The method of claim 4, in which the wall is a bottom wall of the container.

6. The method of claim 4, in which the wall is a normally concave bottom wall of the container.

7. The method of claim 4, in which the rigid elastic air-impervious material is a molded thermoplastics material.

8. A method of packaging material in a preformed air-impervious container having a filling opening adapted to be hermetically sealed by a closure and having at least one wall formed of a rigid elastic air-impervious material, comprising the steps of anchoring the preformed container to a support by applying a source of vacuum between said rigid elastic wall of the container and said support, permitting said wall to be deformed outwardly of the container by the source of vacuum to temporarily increase the volume of the cavity within the container, the deformation being within the elastic limits of the rigid elastic material, filling at substantially atmospheric pressure and applying an air-impervious closure to the container whilst the source of vacuum is maintained, and subsequently removing the source of vacuum to release the container from the support and to permit said wall to be restored towards its initial position by stresses set up during deformation of the elastic material providing said wall, whereby the volume of the cavity is reduced to cause a super-atmospheric pressure to obtain within the cavity, and panelling or cockling of the walls of the container is mitigated.

9. The method of claim 8, in which the wall is a bottom wall of the container.

10. The method of claim 8, in which the wall is a normally concave bottom wall of the container.

11. The method of claim 8, in which the rigid elastic air-impervious material is a molded thermoplastics material.

12. The method of claim 4, in which the rigid elastic air-impervious material is metal.

13. The method of claim 8 in which the rigid elastic air-impervious material is metal.

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