April 16, 1968 L. T. NELSON 3,377,766

LINED CONTAINERS

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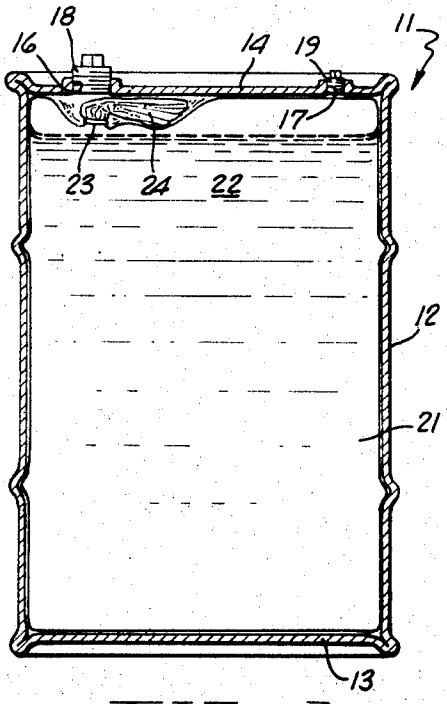


FIG. 1

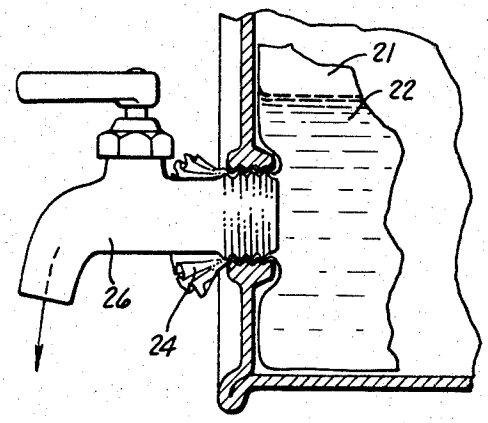


FIG. 2

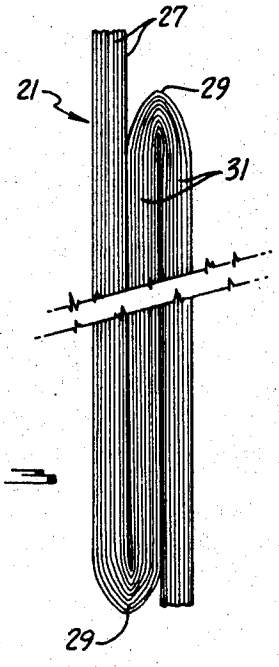


FIG. 3

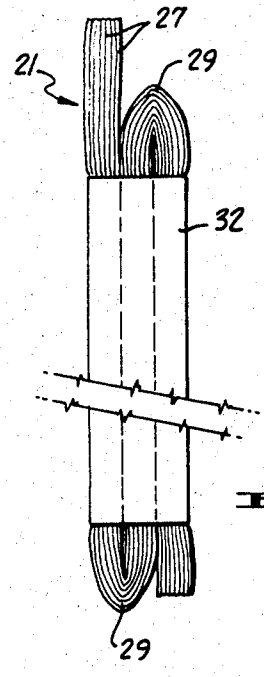


FIG. 4

LAURENCE T. NELSON
INVENTOR.

BY Ralph S. Arnold
AGENT

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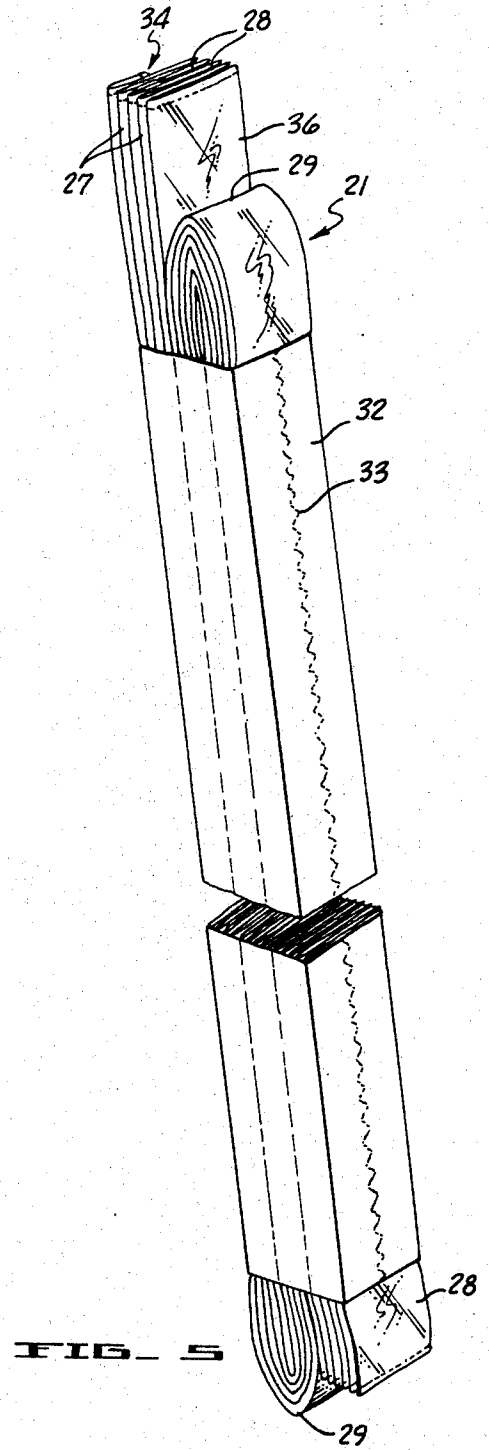


FIG_5

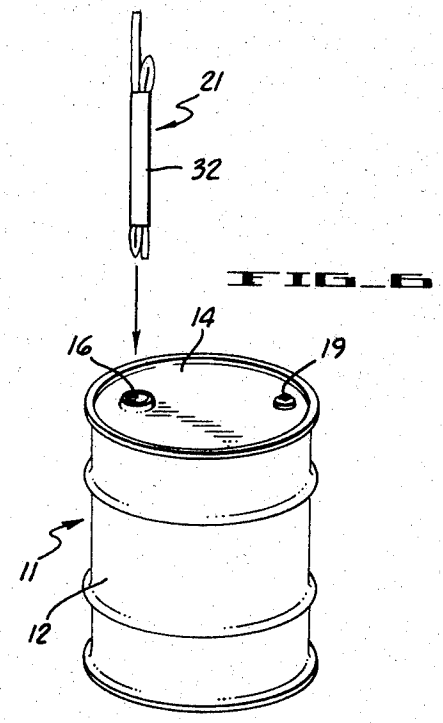


FIG_6

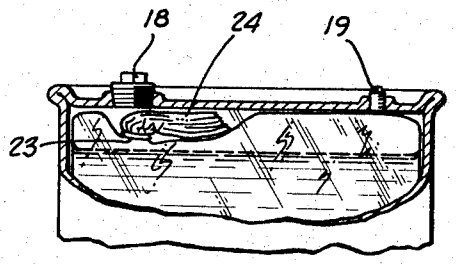


FIG_10

LAURENCE T. NELSON
INVENTOR.

BY Ralph S. Arnold
AGENT

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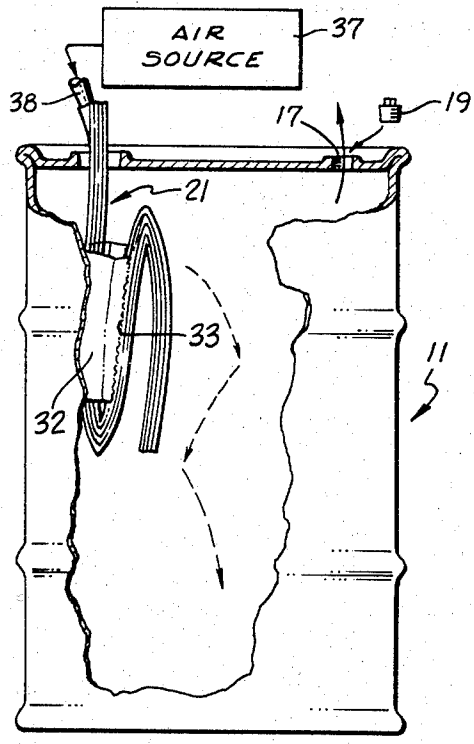


FIG_7

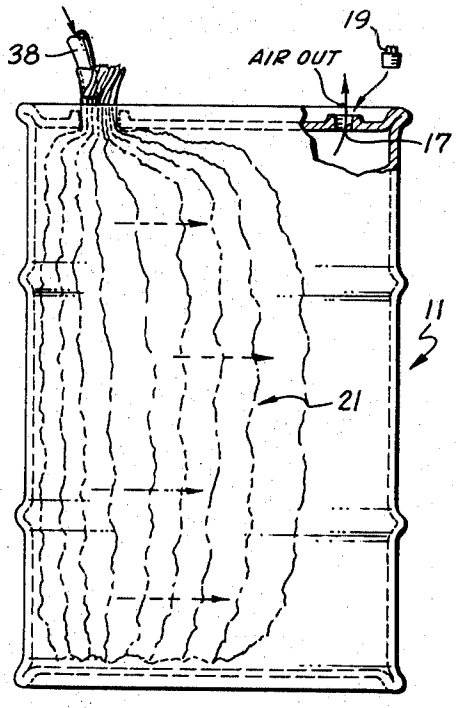


FIG_8

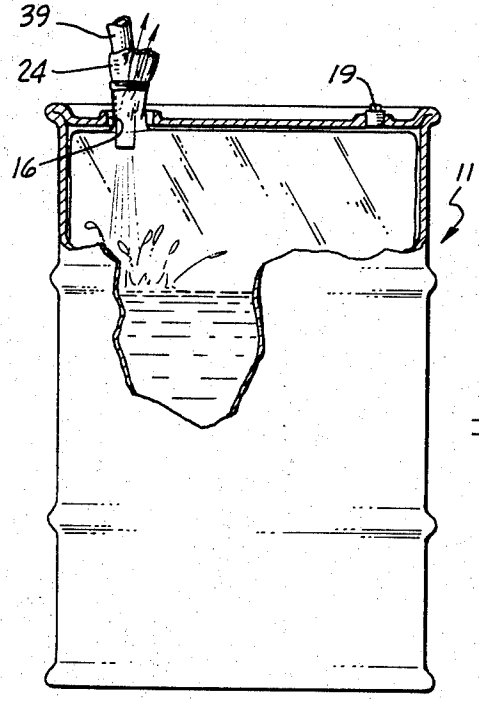


FIG_9

LAURENCE T. NELSON
INVENTOR.

BY Ralph S. Arnold
AGENT

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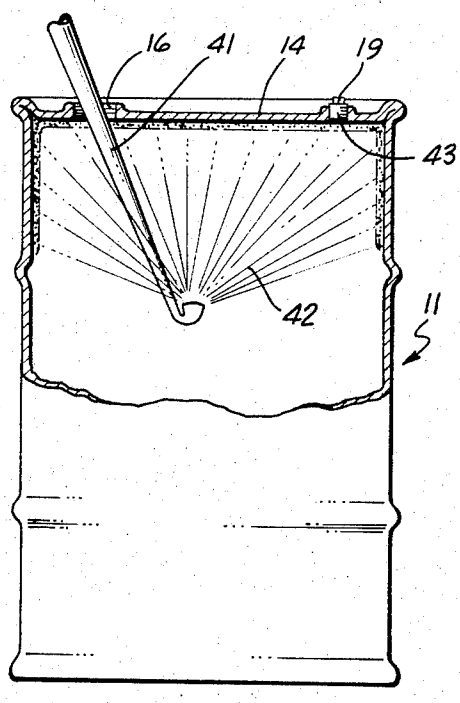


FIG_11

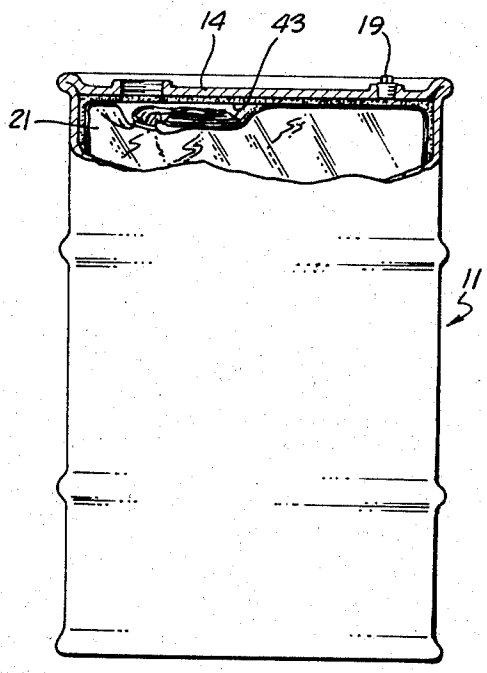


FIG_12

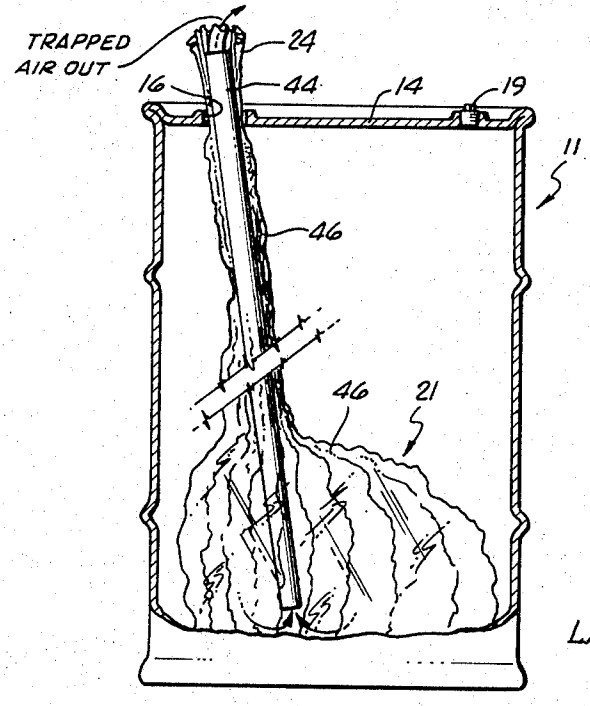


FIG_13

LAURENCE T. NELSON
INVENTOR.

BY Ralph S. Arnold
AGENT

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3,377,766

LINED CONTAINERS

Laurence T. Nelson, Danville, Calif., assignor to Strecton Industries Incorporated, Millbrae, Calif.

Filed June 8, 1965, Ser. No. 462,211
8 Claims. (Cl. 53—27)

ABSTRACT OF THE DISCLOSURE

A closed substantially permanent container such as a metallic drum, storage tank, etc., of the type employed for the bulk storage and shipment of petroleum, chemical, and food products, or the like, which is characterized by an interiorly disposed plastic film disposable liner to facilitate extended reuse of the container with the same or other products without contamination and/or leakage. A method is disclosed for the introduction of a liner to, and its removal from the interior of a closed container through a limited access opening thereof.

This invention relates to closed drums, tanks, and equivalent closed containers, and is more particularly directed to closed containers of this type having an interior plastic liner and to a method of disposing the liner within the container for filling of the resulting lined container with a product.

Considerable difficulties are encountered with containers such as drums, tanks, and the like, from the standpoint of leakage and contamination of the product contained therein. For example, it is not uncommon for drums of the type employed for the storage and shipment of petroleum, chemical, and food products, or the like, to initially have, or subsequently develop, cracks which result in the leakage of the product. What's more, the container material frequently contaminates the contents. As an example, the interior walls of steel drums often rust, and the rust flakes off and mixes with the oil or other contained product. Furthermore, drums and similar containers are generally not reusable. The remnants of previous contents in many instances will contaminate another product when the container is resued. Larger containers, such as storage tanks, suffer from many of the same disadvantages.

Various measures have been taken heretofore to overcome the above-noted shortcomings, but without any substantial degree of success. Attempts have been made to spray or otherwise cover the container interior with a protective coating to prevent contact between the material of the container and the contents. However, the coating is susceptible to chipping such that particles of the coating may contaminate the contained product. The coating also cracks when the drum material cracks and is thus ineffective to prevent leakage. The coating does nothing to render the container reusable.

The ideal solution to the problem is to provide a liner of plastic film, or similar inert material, within the container, the walls of the container backing the liner and providing the strength for supporting the contents. This expedient has proven successful with open topped containers, removable top containers, and containers which may be placed about the liner during fabrication. However, with closed drums and similar containers which are provided with integral heads or other end closures, the use of liners has been heretofore precluded for lack of a way of disposing a liner within the closed container for filling with a product.

It is therefore an object of the present invention to provide interiorly lined closed containers.

Another object of the invention is the provision of a drum with integral heads having a disposable plastic film liner or bag therein containing the drum contents.

Still another object of the invention is the provision of a lined closed container of the class described which is effective in preventing contamination of a contained product and leakage of the product through cracks, and the like, which may exist in the container walls.

It is yet another object of the invention to provide a closed container of the class described wherein the liner is disposable and may be replaced by a new liner, thus facilitating reuse of the container.

A very important object of the invention is to provide a method of introducing a plastic film liner into a closed container and into contact with the walls thereof such that the resulting lined container may be filled with a product.

It is a further object of the invention to provide a liner in a form which may be readily inserted into a drum through the large bung hole thereof and thereafter readily inflated into contact with the drum interior.

Further objects and advantages of the invention will become apparent upon consideration of the following detailed description thereof in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a sectional view taken in a diametric plane through a lined closed drum in accordance with the invention;

FIGURE 2 is a fragmentary sectional view similar to FIGURE 1, but illustrating a conventional pouring spout cooperating with the bung hole and liner to facilitate pouring of the contents of the drum;

FIGURE 3 is an elevation view of a plastic film liner folded to facilitate disposition in a closed drum or other closed container in accordance with the method of the present invention;

FIGURE 4 is a view similar to FIGURE 3, but illustrating a modification of the liner in the form of a package;

FIGURE 5 is a perspective view of the packaged liner of FIGURE 4, illustrating further details thereof;

FIGURE 6 is a perspective view illustrating insertion of the folded liner into a closed drum through the large bung hole thereof;

FIGURE 7 is a side elevation with portions broken-away, of the liner inserted into the drum, and illustrating the initial stages of inflation of the liner in accordance with the method;

FIGURE 8 is a side elevation view with portions broken-away, illustrating later stages of liner inflation;

FIGURE 9 is a view similar to FIGURE 8, but with the liner fully inflated within the drum and being filled with a product;

FIGURE 10 is a fragmentary sectional view of the upper portion of FIGURE 9, illustrating the lined drum filled with a product and the liner opening sealed;

FIGURE 11 is an elevational view of a drum with portions broken-away, illustrating a modification of the method;

FIGURE 12 is a view similar to FIGURE 11, further illustrating the modification of the method; and

FIGURE 13 is a side elevation view with portions broken-away of a lined drum, and illustrating a preferred method of removing the liner from the drum for subsequent replacement with a new liner.

Briefly stated, the present invention provides a closed container having an interiorly disposed plastic film liner in contact with the container walls, so as to be rigidly supported thereby. In this regard, the term "closed container" is to be taken as including closed drums as well as larger vessels, such as tanks, having heads or other end closures which are integral with the container body

prior to the disposition of the liner therein. Containers of a type having a removable lid, or other end closure, which would permit the placement of a liner within the container prior to attachment of the lid are excluded from the present invention. The interior liner of the closed container of the present invention may be of substantially any thermoplastic film, such as nylon or polyamide film, polypropylene resin film, or the like, the particular material depending upon the characteristics of the product to be contained by the container. Similarly, the thickness of the film employed depends upon the size of the container, density of the product, strength of the film, etc. The invention is described in detail hereinafter with respect to a closed or integral head drum; however, as noted above, it is intended that closed containers other than drums be also embraced by the invention.

Referring to FIGURE 1, there is shown a conventional closed integral head drum 11 including a cylindrical body 12, integral bottom 13, and integral head 14. The head is provided with the usual large and small bung holes 16 and 17 which are internally threaded to receive externally threaded large and small bungs 18 and 19. Within the drum 11 there is provided a plastic film bag or liner 21 in substantial contact with the interior of drum and containing a liquid or other product 22 having a level near the top of the drum. Adjacent the large bung hole 16, the liner is provided with an opening which is sealably closed as by means of a pinch clamp 23, or the like, with gathers 24 of the liner extending from the clamp. In other instances, a heat seal may be employed to close the opening.

It will be appreciated that by virtue of the liner 21, the product 22 does not contact the interior walls of the drum 11. Thus, the product cannot be contaminated by the material of the drum, rust which frequently forms thereon, the remnants of other products in the event the drum is reused, etc. Furthermore, any cracks, or the like, in the drum are bridged by the liner such that leakage of the product is prevented.

When it is desired to pour the product 22 from the lined container, the large bung 18 is removed and the gathers 24 of the liner are grasped and withdrawn through the bung hole. The pinch clamp 23, or other seal means, is in this manner positioned exteriorly of the drum and is now accessible. The clamp is removed or the seal otherwise broken. A conventional externally threaded pouring spout 26 is inserted into the liner opening and is encompassed by the gathers 24. The spout threads are engaged with the large bung hole threads through the intermediary of the liner material as indicated in FIGURE 2. A seal is thus provided between the liner and spout such that the product 22 within the liner may be poured from the spout. During pouring of the product the small bung 19 may be removed in which case the drum interior is vented to atmosphere and the liner will collapse as the contents are poured. Alternatively, the small bung may be left in place such that a partial vacuum is retained within the drum and the liner will tend to remain adjacent the drum walls during pouring. Subsequent to pouring of the product from the drum, the liner may be withdrawn through the large bung hole and disposed of. Another liner may be placed in the drum in a manner described hereinafter, and the drum may then be reused.

Considering now a method of positioning the liner 21 within the closed drum 11 for filling, it is first to be noted that the liner is in the form of a sealed rectangular plastic film bag. For this reason, the liner is thermoplastic such that fluid tight seals may be readily formed during manufacture by conventional heat sealing techniques. The liner is of a sufficient size to fill the drum upon expanding. In this regard, plastic films are typically quite stretchable such that the liner size is not critical. The liner is initially prepared by folding in the manner illustrated in FIGURES 3 to 5. More particularly, the liner is folded widthwise at a plurality of lengthwise extending fold lines 27 to form a plurality of accordion pleats 28. In other words, a widthwise extending stacks of relatively narrow lengthwise pleats are provided which are extendible in the widthwise direction. In addition, the pleats 28 are folded lengthwise at a plurality of widthwise fold lines 29. The lengthwise folding is preferably such as to provide a plurality of widthwise accordion pleats 31 extendible in the lengthwise direction. However, the lengthwise folding may alternatively be such as to form a flat spiral.

Although the folded liner may be utilized per se in the method, it is frequently desirable that the folded liner be provided as a pre-wrapped package, as shown in FIGURES 4 and 5, to prevent unintentional unfolding during handling. In this regard, an encircling wrapper 32 of paper, or the like, may be placed about the folded liner to retain same in folded condition. The wrapper is secured to itself, but not to the liner. It is of importance to note that the wrapper is perforated, or otherwise formed with a weakened section 33 extending lengthwise thereof, preferably adjacent the outermost lengthwise pleat 28 that is provided with the liner opening. This opening may be provided by diagonally cutting a corner of the liner from one of the outermost pleats 28, as indicated at 34. If desired, a stiffening ring 36 of paper, or the like, may be secured about the opening.

The folded liner, with or without the wrapper 32, is inserted through the large bung hole 16 into the interior of the drum 11, as indicated in FIGURE 6. The liner is oriented with the stack of pleats 28 facing radially inward from the bung hole and from the pleat having the opening 34. In other words, the pleats 28 are oriented for widthwise explanation into the drum interior from the bung hole.

With the folded liner thus positioned within the drum, the liner is inflated. This is preferably accomplished by means of a high volume, low pressure air source, as indicated at 37, having a tube 38, or the like, inserted in the liner opening 34 and sealed therewith as illustrated in FIGURES 7 and 8. As inflation of the liner commences, and the liner begins to expand, the force exerted on the wrapper 32 at the weakened section 33 severs the wrap. The wrap thus falls free of the liner into the drum to permit unfolding and full inflation of the liner. As the liner is inflated, it expands into the drum as shown in FIGURE 8, the air in the drum displaced by the inflating liner being vented to atmosphere through the small bung hole 19. Upon full inflation of the liner, which may be observed through the small bung hole, the liner is in contact with the drum walls. It will be appreciated that inflation of the liner may be conducted in various other ways such as by drawing a vacuum on the small bung hole either alone or in conjunction with the introduction of air to the liner.

With the liner fully inflated, the small bung 19 is replaced to retain the partial vacuum in the drum. The air tube 38 is removed and the liner is filled directly with a product, or is sealed as by means of the clamp 23 for subsequent filling. Filling of the liner is accomplished merely by inserting a filling pipe 39 into the opening 34 and flowing the product therethrough, as depicted in FIGURE 9.

When the liner is filled, the portion of the liner extending through the large bung hole 16 is gathered (gathers 24) and the pinch clamp 23, or the like, put in place to seal the product therein. A heat seal may be alternatively employed to seal the liner opening. Thereafter, the exterior end of the liner is urged through the large bung hole 16 and the large bung 18 is put in place, as indicated in FIGURE 10.

In some instances, such as when the lined drum is not to be filled for a relatively long time after inflation of the liner, there may be a tendency for the liner to deflate to some extent and fall away from the head of the drum.

This also tends to cause the liner to fall away from the walls of the drum body. These difficulties are readily overcome by slightly modifying the method to provide for adhesion of the inflated liner to the interior surface of the drum head **14**. This may be readily accomplished by applying a suitable adhesive to the interior head surface and upper portions of the interior surface of the body prior to introduction of the liner into the drum and inflation of the liner into contact with the drum walls. The adhesive may be sprayed upon the interior head surface and preferably the upper third of the interior body surface by means of a reverse spray nozzle **41** inserted through the large bung hole and directing a spray **42** of adhesive upwardly upon the interior surfaces of the drum head and upper portion of the drum body, as shown in FIGURE 11. After the adhesive has set sufficiently, the folded liner is introduced into the drum and inflated in the manner previously described. Now, however, when the liner is fully inflated into contact with the drum walls, the liner adheres to the head and upper portion of the body by virtue of the previously applied thin layer **43** of adhesive, as indicated in FIGURE 12. Thus, even if the liner deflates to some extent prior to filling, the liner is retained in place in contact with interior surfaces of the drum head and upper part of the drum body to prevent the liner from falling away therefrom.

In conjunction with reuse of a lined drum, or other container, after the contents are emptied, it is of importance that the old liner be readily removed for replacement with a new liner. Removal of the liner from the drum may be readily accomplished in the manner illustrated in FIGURE 13. With the liner emptied and detached from the head and upper portions of the body, in the event the liner had been adhesively secured thereto, an elongated tube **44** of cardboard, plastic, or the like, is inserted into the liner opening defined within the externally protruding gathers **24**. The tube is urged into the liner to a position adjacent the bottom of the drum. The gathers **24**, with tube **44** encompassing same and protruding externally therefrom, are then grasped and pulled simultaneously from the large bung hole. The liner in encountering the portions of the head about the large bung hole is collapsed, with any air trapped within the portions of the liner inwardly from the large bung hole being vented through the tube **44**, as indicated by the arrows in FIGURE 13. In this manner, the liner is deflated as the liner and tube are withdrawn through the large bung hole. Subsequent to removal of the old liner, a new liner may be inserted in the drum in accordance with the method previously described, and the lined drum again filled with a product.

Although the invention has been hereinbefore described with particular respect to a preferred embodiment of the product, and specific steps of the method thereof, it will be appreciated that numerous modifications and changes may be made therein without departing from the true spirit and scope of the invention. For example, some drums are provided with bungs at locations other than in the head. In this regard, a side bung may be provided in the body of the drum. In the event it is desired to empty the lined drum contents from such a bung hole, the drum may be manipulated to a position wherein the drum contents are disposed away from the bung hole and the liner in the region thereof is unbulged and hence substantially loose. The loose portion of the liner may then be grasped through the bung hole and withdrawn therethrough. The withdrawn portion may be cut and a spout inserted to facilitate draining of the drum contents. Thus, it is not intended to limit the invention except by the terms of the appended claims.

What is claimed is:

1. A method of interiorly lining a closed container having a small opening in an end thereof comprising folding a flat rectangular plastic film sealed bag-like liner to form a plurality of lengthwise accordion pleats, providing an opening in said liner at a corner thereof included in an exterior one of said pleats, inserting the pleated liner through said opening of said container into the interior thereof with said opening of said liner disposed exteriorly and said pleats disposed to unfold into the container, inflating said liner into contact with the interior walls of said container, and maintaining said liner in inflated condition until a product is introduced through the opening thereof.

2. A method according to claim **1**, further defined by applying an adhesive to the interior surface of said end of the container having an opening therein and adjacent interior portions of said container prior to said step of inserting the pleated liner through said opening in said end.

3. A method according to claim **1**, further defined by placing a wrapper having a weakened section about said pleated liner with the weakened section oriented lengthwise of the pleated liner for severing upon inflation thereof.

4. A method of containing a product in a drum of the type having a body, an integral bottom, and an integral head provided with large and small bung holes receiving large and small bungs comprising the steps of folding a flat rectangular plastic film sealed bag-like liner along a plurality of lengthwise fold lines to form a plurality of widthwise unfoldable accordion pleats, folding said liner along at least one fold line widthwise of said pleats, providing an opening in said liner at a corner thereof contained in an exterior one of said lengthwise pleats, removing said large and small bungs from said large and small bung holes, inserting the folded liner through said large bung hole into the interior of said drum with said opening disposed exteriorly and said pleats oriented to unfold radially inward into said drum from said large bung hole, inflating said liner into contact with the interior surfaces of said drum, securing said small bung in said small bung hole, introducing said product through said opening into said inflated liner and sealing said opening upon filling of the liner with said product, placing the sealed opening interiorly of said drum through said large bung hole, and securing said large bung in said large bung hole.

5. A method according to claim **4**, further defined by said step of inflating said liner comprising introducing air at a high volume and low pressure into said opening of said liner.

6. A method according to claim **4**, further defined by placing a wrapper having a weakened section lengthwise thereof about the folded liner with the weakened section oriented lengthwise of said pleats prior to insertion of the folded liner through said large bung hole.

7. A method according to claim **4**, further defined by applying adhesive to the interior surface of said head and upper interior surfaces of said body prior to said step of inserting the folded liner.

8. A method of reusing a closed drum to contain a product, said drum being of the type having a body, an integral bottom, and an integral head provided with large and small bung holes receiving large and small bungs comprising the steps of folding a flat rectangular plastic film sealed bag-like liner to form a plurality of lengthwise accordion pleats, providing an opening in said liner at a corner thereof included in an exterior one of said pleats, removing said large and small bungs, inserting the pleated liner through said large bung hole into the interior of said drum with said opening disposed exteriorly and said pleats disposed to unfold into the interior of said drum, inflating and filling said liner with a product through said opening, sealing said liner, securing said bungs in said bung holes, removing said large bung, unsealing said liner, emptying said product from said liner, inserting an elongated tube into said liner, withdrawing said tube and liner extending thereabout from said drum

through said large bung hole with air trapped in the liner being exhausted through said tube, and repeating all of the foregoing steps.

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WILLIAM W. DYER, JR., *Primary Examiner.*

ROBERT C. RIORDON, *Examiner.*

N. ABRAMS, *Assistant Examiner.*