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EXPANSIBLE DRUM LINER

Filed April 5, 1963

Fig. 1.

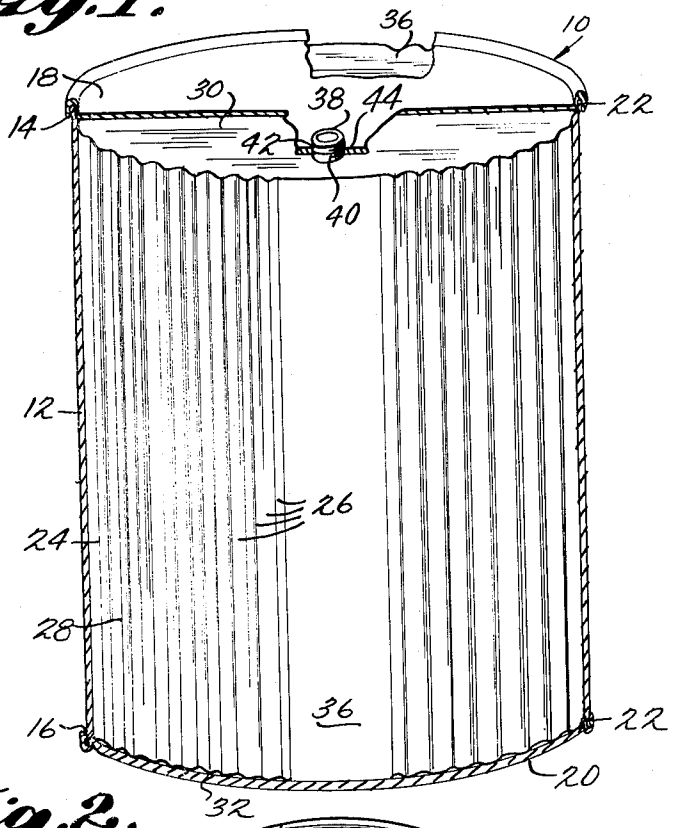
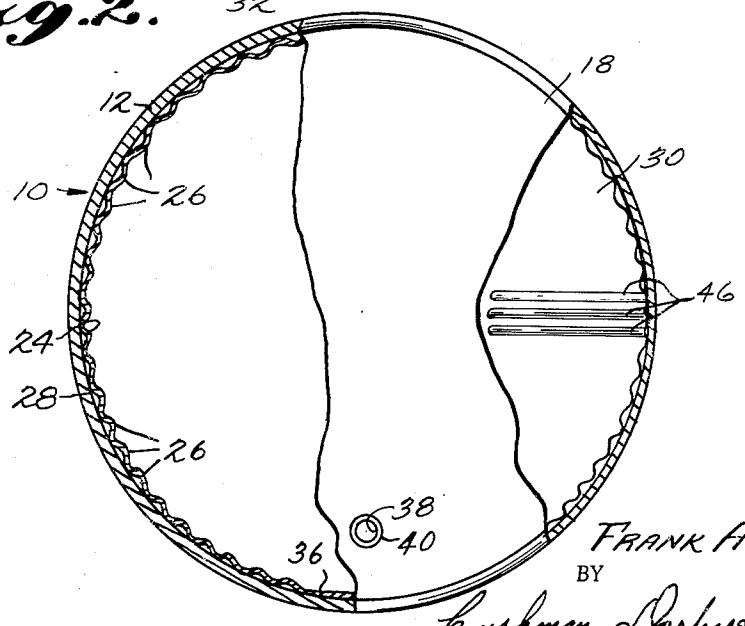


Fig. 2.



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EXPANSIBLE DRUM LINER

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This invention relates to containers and more particularly to an improved drum liner.

It has been a common practice for many years to ship bulk liquids such as fuel oil, tar and other petroleum products in drums or barrels, generally those having 55 gallon capacity. With the advent of postwar chemical development, a much wider range of liquids of both organic and inorganic derivation began to be shipped in barrels. In cases where the prospective barrel contents would damage the barrel or be contaminated by the barrel it has been realized that some inert lining means must be provided in the barrel to separate the liquid contained in the barrel from the barrel itself. In addition, most fiber board drums, having grown in popularity as substitutes for metallic drums, require some type of liquid-proof liner.

Two different modes of providing the necessary lining have become established in the art. The first entails applying an adherent coating material to a barrel interior prior to or during the assembly of the barrel. One of the primary disadvantages of the coating method is that leaks often develop through thin spots in the coating, especially at the joints between the barrel ends and side wall. Additionally, when the barrels are reclaimed after a period of use, it is difficult and sometimes impossible to remove the adherent coating for replacement.

The other lining technique in use employs a separate liner for the barrel. In the past these separate liners have been composed of liquid-proofed paper, coated foil, heat welded plastic or the like. These have not met with great acceptance because they generally will not withstand Interstate Commerce Commission standard drop tests that barrels must pass before being used in interstate commerce. Additionally, because of their collapsibility, these liners are usually not susceptible to use in tighthead drums, which are preferred by shippers and users. Therefore, these prior art liners had to be used in open head drums, i.e., drums in which the bottom is secured by crimping or welding and the top is secured in place by use of a metal ring secured by a bolt or locking lever. Experience has shown that open head drums not only will generally not withstand being dropped from a height of four feet when filled with water (the standard ICC drop test), but also are more expensive than comparable tight-head drums because they require a ring and ring retainer as noted above.

Another difficulty arising from the use of prior art liners is that, while standard in gallonage, barrels or drums vary slightly in height and width. Therefore, liners of a single size made to fit all drums of a particular gallon size will not conform to the interior of barrels of large diameter and, having room to move about within the associated drum, a liner of this type will be subject to vibration induced failure during shipment.

These paper, foil and plastic linings also are susceptible to seam failure during use with ensuing damage to both barrels and barrel contents and sometimes danger to lives and property.

Accordingly, it is an object of the present invention to provide a seamless barrel liner capable of safe use in barrels of varying diameter.

It is a further object of the invention to provide a blow molded barrel linear adapted to be used in a tighthead drum and capable of withstanding a drop in a tighthead drum of four feet when filled with water without breaking or leaking.

Yet another object of the present invention is to provide a drum liner having a plurality of longitudinally extending flutes formed in the side walls thereof.

A still further object of the present invention is to provide a flexible, unitary thermoplastic drum liner having closure receiving means integrally mounted therein.

These and other objects of this invention will become more apparent in the following detailed discussion in which reference is made to the attached drawing which depicts an illustrative embodiment of the present invention.

In the drawing:

FIGURE 1 is a perspective view of a drum or barrel, partly broken away to expose the liner contained therein, and

FIGURE 2 is a top plan view of the drum or barrel of FIGURE 1, partly broken away to expose the liner.

The terms "drum" and "barrel" are employed herein as equivalents and as used herein they are not intended to be restrictive, but to denominate any like containers.

A conventional drum or barrel is illustrated at **10** having a generally cylindrical side wall **12**, although conventional encircling stiffening convolutions and other shapes may form an integral part of the side wall. The generally cylindrical volume defined between the upper end **14** and lower end **16** of the side wall **12** is enclosed by a disk-like top **18** and a disk-like bottom **20**, respectively. The peripheries of the top member **18** and bottom member **20** are secured to the side wall ends **14** and **16** as by crimping as at **22**, lip rolling, welding or any conventional means.

Disposed within the barrel or drum **10** is a unitary, seamless liner **24** embodying principles of the present invention. The liner **24** is preferably blow molded according to established techniques although it may be desirable in some cases to form the liner **24** using other methods. The liner **24** is preferably composed of a somewhat flexible, moldable thermoplastic material such as polyethylene; polypropylene; irradiated polyethylene, i.e., irradiated to an extent of 2×10^6 rad. to 20×10^6 rad.; polyvinyl chloride; Saran, e.g., vinylidene chloride—acrylonitrile copolymer (80:20) or vinylidene chloride—vinyl chloride (85:15); rubber hydrochloride; Dacron, e.g., polyethylene terephthalate; nylon, e.g., polymeric hexamethylene adipamide; polymeric epsilon caprolactam; polyvinyl fluoride and like materials.

The liner **24** is characterizeed by having a plurality of flutes **26** formed in the generally cylindrical side wall **28** thereof which extend longitudinally of the liner in a substantially parallel manner and merge into integrally molded upper and lower liner ends **30** and **32** which correspond in location on the liner **24** to the position of the ends **18** and **20** on the barrel **10**, thereby defining a closed cylindrical volume **34** within the liner **24**. Particularly if the liner **24** is blow molded it may have non-fluted side wall portions **36** which constitute a minor portion of the periphery of the liner side wall. As shown, the two diametrically opposed non-fluted portions **36** conveniently provide for the separation of the halves of the mold employed in forming the liner **24**. It should be realized that fluting may be provided to a greater or lesser extent around the side wall depending on the forming method employed and the amount of radial expansibility desired for the drum as discussed hereinbelow. In any case, the fluted portions **26** generally extend over a major portion of the liner side wall **28**.

Preferably a filling and removal opening **38** is formed in the liner top **30**, being defined by a generally hollow

cylindrical upwardly extending neck portion **40** having closure receiving means such as threads **42** formed thereon. Although the opening **38** is shown at the top of the liner, it should be realized that in certain applications one or a plurality of such or like openings can be conveniently integrally arranged at this and other locations on either liner end or on the side wall **28**. The neck **40** of the opening protrudes through a suitable opening **44** formed in the drum or barrel which may be the conventional bung hole of the barrel. The closure assembly for the barrel preferably includes means for retaining the neck **40** against accidental withdrawal into the barrel; for instance, an assembly such as that provided in the commonly assigned copending application Serial No. 276,807, filed April 30, 1963, now Patent No. 3,167,210, granted January 26, 1965.

The liner **24** is preferably slidably urged longitudinally into the barrel **10** before the barrel top **18** has been put in position, thereafter the top is conventionally secured in place as outlined above, to produce a tight-head drum having an integral, seamless liner of somewhat flexible, relatively inert material.

As noted above, most liquid transportation drums are of the 55 gallon variety; however, these drums do not all have the same physical dimensions. In particular, it is well known that the interior diameters of 55 gallon drums may be anywhere within the approximate range of 22½ to 23 inches, the narrow drums being slightly longer so as to include the same gallonage. For this reason it has not been readily possible with drum liners of the prior art, of other than the previously mentioned coating variety, to form a smooth fit with any drum whether wide or narrow. This deficiency necessitated either being satisfied to form a good fit with one diameter of drum and and a loose or pinched fit with others or else providing prohibitively costly duplication of molding or forming machinery to produce drum liners of various diameters corresponding to the diameters of available drums of the particular volumetric capacity.

In contradistinction to the obvious unattractiveness of each of these alternatives the drum liner provided by this invention is aptly described as "universal" for barrels or drums a particular capacity because the fluting provided on the lining side walls allows the liner to radially expand to conform to the diameter of the particular drum in which it is employed. For instance, it has been found that a liner **24**, embodying the invention, formed from polyethylene and having fluting of ⅛ inch peak-to-trough depth and 1 inch flute width covering approximately 80 percent of the periphery of the liner side wall and having an initial major diameter of 23 inches, was easily accommodated in a drum having a 22½ inch interior diameter. The liner was assembled to the drum by simply longitudinally sliding it into the drum before securing the cover to the drum. Of course, where a substantial radial contraction range is anticipated, means such as concentric fluting can be provided in the top and bottom of the liners to absorb any tendency of the top and bottom members to bow or wrinkle.

Where vibration during transportation is an especially important factor, generally radially extending fluting such as flutes **46** shown in FIGURE 2, may be formed in the liner top **30**. Experimentation has shown that sufficient strengthening and rigidity for resistance to severe vibration will be imparted to a 55 gallon drum liner of the type disclosed herein if fluting is formed in the liner top in the central areas between the parting line of the mold in which the radially extending flutes **46** are generally perpendicular to the parting line. The flutes **46** may be extensions of the vertical side wall flutes **26**, as shown, or may be entirely independent therefrom. In the latter case, the flutes **46** should extend around the corner defined between the liner top **30** and the side wall **28** and should extend down the side wall at least far enough to pass the normal level that liquid will have in the drum during transportation. Particularly, when some or all of the flutes **46** extend independently of the flutings **26** they may be made of different configuration and depth than the flutes **26**, for instance they may have a different spacing and be formed as deeper convolutions than the flutes **26**.

It has been found that, for a 55 gallon drum, two sets of 5 flutes **46** diametrically opposed from one another on the liner top **30** and extending 6 inches down the liner side walls **28** independently of the flutes **26**, in the area generally at right angles to the non-fluted parting line area **36** where, in a blow molded liner the material tends to be somewhat thinner than at other areas, stiffens the liner and thereby increases its resistance to vibration by several orders of magnitude. In addition the flutes **46**, which also aid in adapting the liners **24** to drums of slightly different heights, may be conveniently arranged on the liner bottom **32** in a like manner.

It should be noted that the ease with which a liner of the invention is placed in a drum is provided in part by the fact that thermoplastic material preferably composing the liner is somewhat self lubricating, and that the contact area between the liner side wall and the drum side wall is minimized in that only the flute peaks and unfluted portions engage the drum side walls. This last feature is additionally important during the assembling process because the ducts defined between adjoining flute peaks and the drum side wall allow air trapped between the liner bottom and the drum bottom as the liner is being advanced into the drum, to pass freely out of the drum rather than providing increasing resistance to the positioning of the liner as would be the case if the liner side walls were smooth.

Additionally, it is easy to see that the longitudinally extending flutes or convolutions **26** strongly oppose any tendency of the liner to collapse either longitudinally or radially because they act as ribs or columns longitudinally while acting as radially outwardly biased resilient means or springs in the radial direction.

The seamlessness and rigidity of the liners provided by this invention, even though they are relatively thin walled, make them easily usable with the preferred tight-head drum and hence provide lined drums able to withstand the water filled four foot drop test that enables tight-head drums so lined to be used in interstate commerce.

It should be obvious that although the liner illustrated in the drawing as been included within a metallic drum, that liners embodying the principles of this invention may be used in fiber board and other barrels, dums and like containers and that the particular dimensional configuration of flutes shown can be modified without departing from the purview of this invention.

It should also be realized that other modifications may be made with respect to the specific illustrative embodiment of the present invention as shown, without departing from the principles of this invention as clearly delineated herein and therefore the present invention embraces all modifications within the spirit and scope of the claims appended hereto.

What is claimed is:

1. A radially expansible cylindrical drum liner formed of flexible inert strong thermoplastic selected from the group consisting of polyethylene, polypropylene, irradiated polypropylene, polyvinylchloride, rubber hydrochloride, polyethylene terephthalate, polymeric hexamethylene adipamide and polyvinylfluoride comprising a generally cylindrical side wall having a first end and a second end; a disk like top integrally secured by molding at the periphery thereof to said side wall first end; a disk like bottom integrally secured by molding at the periphery thereof to said side wall second end so as to include a generally cylindrical closed volume within said liner between said top and said bottom; means defining a plurality of generally radially extending convolutions in the disk-like top of said liner; and fluting means in said side wall defining a plurality of generally parallel, longitudinally extending

convolutions located around a major part of the periphery in said side wall, said fluting means merging into the integrally molded top and bottom, means defining an opening through the liner top, a tubular neck secured by molding as an integral extension of said top to form a seamless entity of said liner, said tubular neck extending outwardly of said top surrounding said opening, said liner being adapted to be inserted into a drum of slightly smaller diameter when the liner is unconfined so that the longitudinally directed flutes are resiliently urged into intimate contact with the drum side wall interior thereby eliminating abrasion damage when the loaded drum and liner are shifted, and radially extending flutes at one end of said liner located centrally and alongside of the non-fluted areas of the side wall.

2. The combination comprising a generally cylindrical drum including a generally cylindrical side wall, and a disk like top and a disk like bottom secured to opposite ends of said side wall as to define a closed, generally cylindrical volume within the drum between said bottom and said top; and a generally cylindrical radially expansible drum liner formed of flexible strong inert thermoplastic selected from the group consisting of polyethylene, polypropylene, irradiated polypropylene, polyvinylchloride, rubber hydrochloride, polyethylene terephthalate, polymeric hexamethylene adipamide and polyvinylfluoride within said barrel, said drum liner comprising a unitary blow-molded top, bottom and side walls, a tubular neck integrally secured to said top which surrounds said top and is an extension of a sleeveless entity therewith, said liner walls defining a generally cylindrically closed volume between top and bottom and defining fluting means in the form of a plurality of generally parallel longitudinally extending convolutions located around a major part of the periphery in said liner walls leaving a non-fluted central zone therein, said convolutions resiliently engage said drum side wall as to prevent substantial vibration of said liner with respect to the drum during shipping of said drum, and radially extending flutes at one end of said liner located centrally and alongside of the non-fluted areas of the side wall.

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