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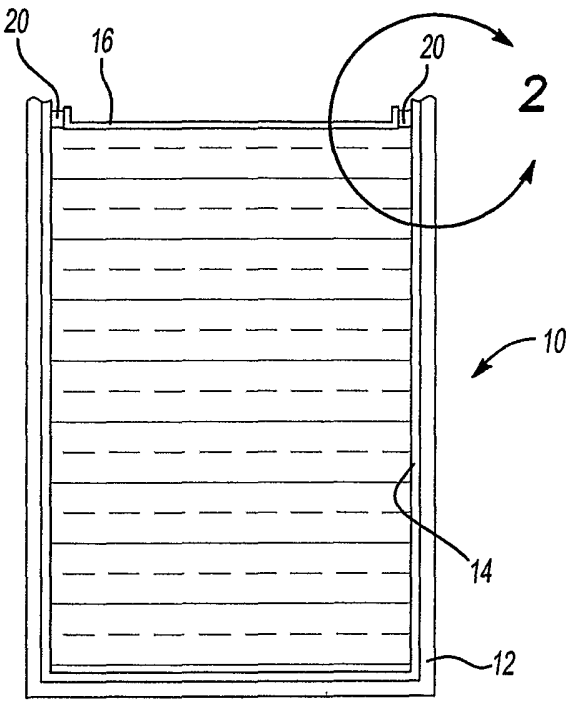
(54) Title: LINED CONTAINER FOR CURABLE LIQUID MATERIALS



(57) Abstract: A container (10) for transporting and storing a curable composition comprising a container (12) and a liner (14) of a surface-treated plastic. The liner is bonded to a cover (16) about the periphery of the cover, with the material contained within the container.

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LINED CONTAINER FOR CURABLE LIQUID MATERIALS

Claim of Priority

[0001] This invention claims the benefit of U.S. Provisional Application 60/531,051 filed on December 19, 2003.

Technical Field

[0002] This invention relates to a container, particularly a container for shipping liquids, and to a method for protecting a liquid from the environment during shipping.

Background of the Invention

[0003] Many liquid resin or adhesive systems such as moisture-curable polyurethane polymers (e.g., sealant primers) or polyurethane prepolymers solidify or cure upon exposure to air or moisture. Therefore, it is desirable to minimize contact between these liquids and the environment prior to their end-use application. While exposure to the environment is more or less of a problem depending on the liquid resin or adhesive system employed, the problems associated with premature contact with the environment are aggravated by long periods between preparation of the liquid resin or adhesive and its actual use. This is particularly acute when the liquid resin or adhesive is shipped over long distances or is maintained in the shipping container for long periods of time prior to use.

[0004] In a conventional operation, the liquid resin or adhesive is placed in a metal drum, commonly a 55 gallon or larger drum, often lined with a plastic film to prevent corrosion and contamination of both the drum and the liquid. The drum is covered with a metal or plastic-coated metal top having approximately the same size as the drum body which is locked to the drum using a locking collar or bung. In various environments, the means for securing the metal lid or top to the drum body is not particularly effective in preventing the contact of the environment with

the drum contents. As such, portions of the liquid resin or adhesive solidify or cure and, upon removal, the solid or cured material is removed with the liquid; thereby introducing impurities into the finished article. It may also be necessary to clean the drum after each use. Further, drum disposal presents a possible waste management issue.

[0005] U.S. Patent No. 5,507,409, herein incorporated by reference, discloses one improved approach to the manufacturing of containers suitable for storing and transporting moisture curable liquids. To help prevent leakage, or curing of the liquids, the inner liner and top closure include a multi-layered liner structure that preferably employs a metal foil layer. It would be desirable to employ a liner that performs at least as effectively as the liner of the above patent, but which also has an attractive structure for reducing overall cost of materials and manufacturing.

Summary of the Invention

[0006] The present invention fulfills the above need by providing a container having a liner of improved structure, which need not employ a metal foil layer. Thus, one preferred aspect the present invention contemplates a lined container that includes a container for at least one curable composition derived from phenolic and amino resins, acrylics, polyurethanes or epoxies and an interior wall surface having at least one opening defining an enclosed cavity. The container includes a removable liner adjacent to at least a portion of the interior wall surface, which includes (and in one particular embodiment consists essentially of) a surface treated plastic layer generally conformable to the shape of the cavity. The container further includes a top closure cover, which includes at least one plastic layer and an impermeable layer. The cover has a size such that when placed above liquid in the container a portion of the plastic layer of the top closure and a portion of the liner are disposed adjacent to one another at a juncture so as to form a closed structure above the contained liquid. As such, the cover is sealed by bonding the liner to the cover with the curable composition and forming a moisture and air impermeable seal at the juncture.

Brief Description of the Drawings

[0007] Fig. 1 is a cross-sectional representation of one illustrative embodiment of the present invention.

[0008] Fig. 2 is an enlarged view of a portion of the embodiment shown in Fig. 1.

[0009] Fig. 3 is a cross-sectional view of another embodiment of the present invention.

Detailed Description of the Preferred Embodiment

[0010] With reference to FIGS. 1-3, in general, the present invention is predicated upon the discovery of an improved structure for a lined container assembly 10, particularly on that employs a container 12 lined with surface treated plastic liner 14 that is bonded to a cover 16 (such as a laminate top disk that optionally includes a contents filling hole that is ultimately covered by a patch 18), by using the material being packaged (in at least a partially cured state) as a bonding agent 20 within a bonding region 22. In one embodiment, the resultant bond strength from use of the bonding agent is sufficient so that cohesive failure would occur in the liner prior to delamination of the liner from the bonding agent.

[0011] By use of the present invention, a resulting container assembly including a liner can be realized in which sufficient moisture barrier protection for the contained product is made possible throughout its shelf life. Cured material remains a part of the liner and is thus substantially prevented from being drawn into drum emptying equipment, and is also potentially free of a metal layer.

[0012] The liners of the present invention offer the potential to realize one or more of a number of advantages over liners that employ a metal layer. For example, the omission of a metal layer could help to reduce the cost of materials to make the liner. The omission of a metal layer offers the ability to reduce film density and thus lighten liner weight. The avoidance of metals also helps reduce

manufacturing waste and also potentially affords an advantage in enabling reclamation of the plastic of the liner without the need to treat the metal. Other possible advantages will be recognizable from the following description.

[0013] In general, the preference is for the liner to be made of thermoplastic film, examples of which are selected from polyesters, polyolefins, cellulose, vinyls (e.g., polyvinyl chlorides, polyvinyl acetates, combinations thereof, or otherwise), thermoplastic elastomers, polyamides, polyimides, polycarbonates, or any combination thereof. Specific examples of films are selected from polyethylene, polypropylene, or a combination thereof, and may be high density type, medium density type, low density type or any combination thereof. By way of example, as desired, films may be at least partially oriented, crystalline, linear, branched, copolymerized, blended, transparent, opaque, colored, coated (e.g., with a heat sealable coating around peripheral edges), include an embedment, or any combination thereof. The films may include a printed layer. The films may be a monolayer or may include multiple layers, for example, as a co-extrudate. In another aspect of the invention, it is contemplated that a metal layer is employed as well, which layer might be sandwiched between opposing plastic layers, or applied over an external plastic surface.

[0014] One particularly preferred liner of the present invention is characterized as having at least one or both of the following properties:

1) a bonding region that has a surface energy (throughout substantially the entire storage life of a stored liquid) on the side of the film that is to be in contact with the stored liquid of at least about 38 dynes (e.g., at least about 40 dynes, at least about 42 dynes, or at least about 44 dynes), or higher; or

2) a water vapor transmission rate (per ASTM-1434) up to about 0.05 g/100 in^2/24 hours at 30° C/80% relative humidity; and more preferably less than about 0.03 g/100 in^2/24 hours at 30° C/80% relative humidity (e.g., less than

about 0.02 or even 0.01 g/100 in^2/24 hours at 30° C/80% relative humidity).

[0015] As indicated, in one example of the present invention, the liner is also used in combination with a cover (e.g., top disk), a patch or a combination thereof, such as disclosed in U.S. Patent No. 5,507,409, hereby incorporated by reference. In such instances, one very specific example contemplates that the cover, the patch or both further exhibit a water vapor transmission rate (per ASTM-1434) up to about 0.03 g/100 in^2/24 hours at 30° C/80% relative humidity; and more preferably less than about 0.01 g/100 in^2/24 hours at 30° C/80% relative humidity (e.g., less than about 0.005 or even 0.001 g/100 in^2/24 hours at 30° C/80% relative humidity.

[0016] It has been found in particular that advantages of the present invention may be realized by the employment as the liner material a film that is surface treated over at least the bonding region 22 for achieving a surface energy (enduring throughout substantially the entire expected storage life of a stored liquid) on the side of the film that is to be in contact with the stored liquid of at least about 38 dynes (e.g., at least about 40 dynes, at least about 42 dynes, or at least about 44 dynes), or higher. Any of a number of techniques may be employed, particularly a technique selected from a technique that alters the molecular state of a polymer in the film, a technique that bonds a material having the desired surface characteristic to the film, or a combination thereof. By way of specific example, one or any combination of a suitable corona treatment, flame spray treatment, or surface coating treatment may be employed.

[0017] In another aspect of the invention, a lid 24 may be employed to enclose the contents of the container. In one particular application in which a lid is employed (though possible also without employment of a lid), it is contemplated further that there is employed a mechanism or device for absorbing or redirecting humidity away from the packaged contents. By way of example, one or a plurality of desiccant packs 26 (e.g., a desiccant package including an approximately 82 gram molecular sieve) may be contained in a headspace region 28 of the container.

[0018] The container itself may be any suitable material capable of supporting the weight of the contents, and also preferably being substantially corrosion resistant and substantially resistant to degradation caused by contents of the container. Any suitable size or shape may be employed. Examples of a common container suitable for use in the present invention include typical 55 gallon (200 l) cylindrical drums, e.g., plastic drums, metal drums such as chimed steel drums, or otherwise. The containers may include any suitable lid, such as a container lid comprising a Standard 200-liter steel drum lid with a suitable seal, such as an approximately 12 mm diameter (½") diameter sponge rubber gasket. The lid 24 may be any suitable material, such as metal, plastic, ceramic, plastic, coated metal or otherwise. Any suitable hardware may be used to secure the lid to the container, such as using an art disclosed locking collar or bung.

[0019] One specific example of an assembly herein includes providing a liner that includes an approximately 0.08 mil Corona-treated low density polyethylene film, which is surface treated to approximately 50 Dynes. The cover and the patch each are preferably tri-laminates, including at least one gas impermeable layer such as a metal layer. For example, a preferred approach is to employ a polyethylene film and a polyester film and a layer of aluminum foil sandwiched therebetween.

[0020] According to one method of the present invention, a liner is inserted into a container to be filled with at least one curable liquid composition derived from phenolic and amino resins, acrylics, polyurethanes or epoxies. The liquid composition is introduced into the liner through an opening (if employed) in the cover, and the cover is placed over the liquid. Though depicted in the drawings and taught in Patent No. 5,507,409 as having a portion of the liner that extends beyond the liquid level in the container, when filling the liquid level can be brought to substantially the same height as the topmost part of the liner.

[0021] Moisture from ambient air cures the liquid where exposed in a bonding region to cause the liquid to bond the cover to the liner. The patch is likewise attached over the opening in the cover and sealed by exposure of the liquid to ambient moisture in the vicinity of the patch periphery. A desiccant pack

optionally may be removably or securingly attached to the patch, the cover, the container, a container lid or any combination thereof. The container lid is secured to the container, with a suitable seal therebetween. As desired, at any point in the filling operation, the cover of the liner may be smoothed or flattened using a suitable secondary device or gas pockets evacuated, and optionally packaged liquid is pushed into the contact area between the cover and the liner to help aid in achieving suitable bonding in the bond region. Any means of pushing or forcing a portion of the bonding agent, such as use of an automated, appropriately shaped structure wherein air or hydraulic pressure is used to apply the pressure to form a seal of desired thickness.

[0022] Many variations of the present invention are possible. For example, the liner can be prepared having a base such as described in U.S. Pat. No. 3,940,052 or having a base portion which is thicker than its side portions such as described in U.S. Pat. No. 4,347,948 (both of which are incorporated herein by reference).

[0023] As indicated, one preferred approach is to cure a portion of the packaged contents of the container to join the cover with the liner. However, another alternative sealant may also be used, as will be discussed. Curing may be by any suitable mechanism, and typically will employ exposure to elevated temperature, radiation (e.g., UV radiation, IR radiation, radio waves, or combinations thereof), moisture, air, any combination thereof or otherwise. In general, it is preferred if the bonding agent will cure within a few seconds to sufficiently bond the liner to the cover, or attach any patch. If necessary, during curing, the liner, the cover, the patch or all of them are physically held in a fixed desired position.

[0024] Preferably, the cured bonding agent will form a seal that is at least about 1 to 2 mils, i.e. 0.001 inches or millimeters, thick and is generally evenly distributed in the juncture between the liner and cover so as to form an air-tight seal.

[0025] The juncture of the liner and the cover might be cured prior to, contemporaneously with or subsequent to filling. In addition to any opening that

might be employed for filling, there may be other openings, such as an opening that can be later exposed for removal of liquid from the container. Thus plural patches may also be employed. Other approaches to filling, such as filling from the bottom are also possible. Further, though the cover is depicted on a top portion of the assembly, it can be located elsewhere, e.g. on the sidewall, on the base or otherwise.

[0026] With regards to the various components employed in the present invention, as indicated the container can take almost any form and size and be made from essentially any material, provided the structure provides a cavity to contain the liquid and the material provides sufficient structural integrity during shipping and storage to prevent damage and loss of the contained liquid. In general, as discussed earlier, the container is advantageously a conventional container for shipping liquids such as a metal, fiber, paperboard, plastic container, e.g., a 40- to 60-gallon drum or smaller pail such as a 5-gallon metal pail or bucket, or a cartridge such as a caulking gun cartridge, although larger as well as smaller capacity containers can be employed depending on the amount of liquid to be shipped, stored or both.

[0027] As also indicated previously, it is preferred in various embodiments to employ one or more films, such as a polyolefin film, and particularly a film made from a polymer or copolymer of ethylene, i.e., a polymer derived solely from ethylene or ethylene and one or more monomers copolymerizable therewith. Such polymers (including raw materials, their proportions, polymerization temperatures, catalysts and other conditions) are well-known in the art and are described, without limitation in U.S. Patent No. 5,507,409 (incorporated by reference).

[0028] Likewise, suitable methods for the preparation of high density polyethylene, low density polyethylene, and linear low density polyethylene polymers are also well-known in the art and are described, without limitation in U.S. Patent No. 5,507,409 (incorporated by reference).

[0029] In general, high density polyethylene (HDPE) has a density of at least about 0.94 grams per cubic centimeter (g/cc) (ASTM Test Method D 1505).

HDPE is commonly produced using techniques similar to the preparation of linear low density polyethylene. When HDPE is employed in the practice of the present invention, it preferably has a density from about 0.96 to about 0.99 g/cc and a melt index from about 0.01 to about 35 grams per 10 minutes as determined by ASTM Test Method D 1238.

[0030] Low density polyethylene ("LDPE") is generally comprised of highly branched chains with a density of less than about 0.94, generally from about 0.91 to about 0.94 grams per cubic centimeter (g/cc) (ASTM D 792). Illustrative of techniques for preparing LDPE are described in U.S. Pat. Nos. 3,756,996 and 3,628,918.

[0031] Any polyethylene film employed is preferably heat sealable and is more preferably an essentially pinhole free or pinhole free, low density, heat-sealable polyethylene. In one specific example, the liner is a polyethylene that is low density polyethylene.

[0032] When employed, such as in the cover and any patch, a particular gas impermeable layer will be a film layer prepared from a material which is suitably impermeable to air or the environment for the intended purpose. While the permeability properties of such layer may vary depending on the liquid employed and its susceptibility to moisture or the environment as well as the thickness and specific composition of the polyethylene and polyester film layers, in general, the material employed in preparing the impermeable film layer is a material such that the inner liner and top laminate film have a gas transmission of less than about 0.5 cc, preferably less than 0.2 cc, more preferably less than 0.15 cc per 100 square inches (645.16 square centimeters) in a 24 hour period (ASTM-1434). Most preferably, the gas permeability is less than about 0.1 cc/100in^2 /24 hours. In addition, the barrier layer is prepared from a material which is compatible or which can be made compatible with the polyethylene and polyester layers, i.e., the gas impermeable barrier layer can be prepared as a laminate with the polyethylene and polyester layers, such as using an adhesive between one or more of the layers (e.g., the aluminum foil and low density polyethylene) or by coextruding a polyethylene layer between the polyester and metal foil layer.

While certain polymers such as vinyl chloride polymers can be employed as the barrier layer, in general, a metal foil or metalized polymer film is most advantageously employed as the impermeable layer. A preferred metal for use as the impermeable layer is aluminum, more preferably an essentially pinhole free or pinhole free, dead-soft, aluminum foil.

[0033] When employed, the polyester layer is a film made from a polyester material. Polyesters and methods for their preparation (including the specific monomers employed in their formation, their proportions, polymerization temperatures, catalysts and other conditions are well known in the art and described in U.S. Patent No. 5,507,409 (incorporated by reference).

[0034] Metalized polymer films comprise a plastic film having a thin metal on a surface. The metal layer is generally deposited on the film surface as a metal vapor layer in a vacuum. A preferred metal is aluminum, though other metals may also be employed. Preferred plastic film comprises polyether polycarbonates, nylons and polypropylene. The preferred films comprise polyesters.

[0035] The thickness of the top and inner film layers as well as each layer in a laminate herein are dependent on a number of factors including the liquid being shipped or stored in the container, the length of shipping and storage prior to use, and the specific composition employed in each layer of the laminate.

[0036] In general, the liner will have a total thickness of from about 7 to about 2000 microns, preferably from about 25 to about 500 microns; with the thickness of the polyethylene layer being from about 5 to about 750 microns, preferably from about 10 to about 300 microns; the thickness of the polyester layer being from about 1 to about 250 microns, preferably from about 5 to about 100 microns and the thickness of the barrier layer being from about 1 to about 100 microns, preferably from about 5 to about 50 microns when the barrier layer is a metal foil.

[0037] In general, the top laminate film will have a total thickness of from about 16 to about 1000 microns, preferably from about 20 to about 250 microns, with the thickness of the polyethylene layer being from about 10 to about 500 microns, preferably from about 25 to about 200 microns; the thickness of the

polyester layer being from about 5 to about 200 microns, preferably from about 15 to about 100 microns; and the thickness of the barrier layer being from about 1 to about 100 microns, preferably from about 5 to about 50 microns when the barrier layer is a metal foil.

[0038] The bonding agent employed preferably will be material of the type that is packaged in the container. In general, any material which reduces permeability of the environment and which sufficiently acts to bond the materials to one another can be employed and selection of the material which is most advantageous will be dependent on a variety of factors including the contained liquid and its susceptibility to moisture and/or air, the specific inner and top laminate layers employed, and the expected duration of shipping and storage. Other representative examples of materials which can be employed as the bonding agent include hot melt adhesive such as hot melt adhesives based on polyester, polyamides or block copolymer rubbers; adhesives which are applied from solution or dispersion such as phenolics and amino resins which can be applied from water solution, or acrylics or polyurethanes which can be applied from organic solutions, or epoxies applied from aqueous dispersion. An adhesive which can be applied dry and then activated such as by exposure to water or an organic solvent can also be employed. In addition, pressure sensitive adhesives can also be employed. Preferred sealants are those materials which have good shelf life in the absence of air or moisture but which cure rapidly upon exposure to moisture or air.

[0039] Examples of particularly preferred bonding agents are moisture-curable polyurethanes, such as described in U.S. Pat. Nos. 4,758,648; 4,780,520; and 5,086,151 (all incorporated by reference). These agents comprise a polyurethane prepolymer (an isocyanate terminated reaction product of an organic polyisocyanate with a polyhydroxy compound, preferably having an isocyanate functionality of between 2.3 and 3.0) and a catalyst useful for promoting the reaction of isocyanate groups with water. See also Patent No. 5,507,409 (incorporated by reference).

[0040] Prior to filling the container, the cover film is put in place and the container filled from the bottom. Upon completion of filling, the impermeable bonding agent is cured by its exposure to air, thereby gluing the top laminate and inner liner together to produce an air impermeable seal. Alternatively, the bonding agent is applied to either or both of the cover or liner, at which time the films are bonded together and the bonding agent being exposed to moisture, bonds the films. In one embodiment, once applied from the moisture-free environment onto the inner and/or top laminate film, the sealant will effectively cure within about 30 seconds to about 300 minutes, and more particularly from about 1 to about 30 minutes.

[0041] It will be further appreciated that functions or structures of a plurality of components or steps may be combined into a single component or step, or the functions or structures of one step or component may be split among plural steps or components. Alternatively, functions performed by one of the components might be split among or performed by other components. The present invention contemplates all of these combinations. Unless stated otherwise, quantities, dimensions and geometries of the various structures depicted herein are not intended to be restrictive of the invention, and others are also possible. In addition, while a feature of the present invention may have been described in the context of only one of the illustrated embodiments, such feature may be combined with one or more other features of other embodiments, for any given application.

[0042] The explanations and illustrations presented herein are intended to acquaint others skilled in the art with the invention, its principles, and its practical application. Those skilled in the art may adapt and apply the invention in its numerous forms, as may be best suited to the requirements of a particular use. Accordingly, the specific embodiments of the present invention as set forth are not intended as being exhaustive or limiting of the invention. The scope of the invention should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes.

CLAIMS

What is claimed is:

1. A lined container comprising:

a container for at least one curable composition derived from phenolic and amino resins, acrylics, polyurethanes or epoxies and comprising an interior wall surface having at least one opening and defining an enclosed cavity;

a removable liner adjacent at least a portion of the interior wall surface having a closure region consisting essentially of a surface treated plastic film, which inner liner is conformable generally with the shape of the cavity; and

a top closure comprising at least one plastic layer and an impermeable layer; the top closure film having a size such that when placed above liquid in the container a portion of the plastic layer of the top closure and a portion of the liner are disposed adjacent to one another at a juncture so as to form a closed structure above the contained liquid; and wherein the top closure is sealed by bonding the liner to the closure with the curable composition and forming a moisture and air impermeable seal at the juncture.

2. The container of claim 1, wherein the liner is selected from a corona treated liner, a plasma treated liner, a flame spray treated liner or a combination thereof.

3. The container of claim 1, wherein the liner is a multilayered plastic film.

4. The container of claim 2, wherein the lined container further comprises a desiccant pack.

5. The container of claim 1, wherein the liquid is a composition curable by moisture, UV radiation, heat, air or a combination thereof.

6. The container of claim 5, wherein the liquid is a moisture-curable polyurethane.

7. The container of claim 1, wherein the top closure is a laminate film comprising an impermeable layer between a layer of polyester and a layer of polyethylene.

8. The container of claim 1, wherein the liner is bonded to the interior surface of the container prior to filling with the liquid.

9. The container of claim 3, further comprising a patch having at least one plastic layer and an impermeable layer, wherein the patch is adapted cover a dispensing port located through the closure and bond to the closure with the curable composition thereby forming a moisture and air impermeable seal at the dispensing port.

10. The container of claim 1, wherein the sealant is a composition including a polyurethane prepolymer.

11. A container filled with liquid comprising:

a container comprising an interior wall surface having at least one opening and defining an enclosed cavity;

a removable liner adjacent at least a portion of the interior wall surface comprising a surface treated plastic film, which inner liner is conformable generally with the shape of the cavity;

at least one curable composition derived from phenolic and amino resins, acrylics, polyurethanes or epoxies filling at least a portion of the lined structure such that a portion of the inner liner extends beyond the liquid contained by the container; and

a top closure film comprising at least one plastic layer and an impermeable layer; the top closure film having a size such that when placed above liquid in the container a portion of the plastic layer of the top closure and a portion of the liner are disposed adjacent to one another at a juncture so as to

form a closed structure above the contained liquid; and wherein the top closure is sealed by bonding the liner to the closure with the curable composition and forming a moisture and air impermeable seal at the juncture.

12. The container of claim 11, wherein the liner is a multilayered film.

13. The container of claim 11, wherein the liner includes a metal layer.

14. The container of claim 13, wherein the top closure is a laminate film comprising an impermeable layer between a layer of polyester and a layer of polyethylene.

15. The container of claim 11, further comprising a patch having at least one plastic layer and an impermeable layer, wherein the patch is adapted cover a dispensing port located through the closure and bond to the closure with the curable composition thereby forming a moisture and air impermeable seal at the dispensing port.

16. The container of claim 15, wherein the sealant is a composition including a polyurethane.

17. A container filled with liquid comprising:

a metal container comprising an interior wall surface having at least one opening and defining an enclosed cavity;

a removable liner adjacent at least a portion of the interior wall surface comprising a surface treated polyolefin film, which inner liner is conformable generally with the shape of the cavity, the liner being selected from a corona treated liner, a plasma treated liner, a flame spray treated liner or a combination thereof;

a moisture curable polyurethane composition filling at least a portion of the lined structure such that a portion of the liner extends beyond the moisture curable polyurethane composition contained in the container; and

a top closure film comprising at least one plastic layer and an impermeable layer; the top closure film having a size such that when placed above liquid in the container a portion of the plastic layer of the top closure and a portion of the liner are disposed adjacent to one another at a juncture so as to form a closed structure above the contained liquid; and wherein the top closure is sealed by bonding the liner to the closure with the curable polyurethane composition and forming a moisture and air impermeable seal at the juncture.

18. The container of claim 17 wherein the container further comprises a desiccant located in a headspace region within the container and above the top closure film.

19. The container of claim 17, wherein the liner is a multilayered film.

20. The container of claim 19, wherein the top closure is a laminate film comprising an impermeable layer between a layer of polyester and a layer of polyethylene.

21. The container of claim 17, further comprising a patch having at least one plastic layer and an impermeable layer, wherein the patch is adapted cover a dispensing port located through the closure and bond to the closure with the curable composition thereby forming a moisture and air impermeable seal at the dispensing port.

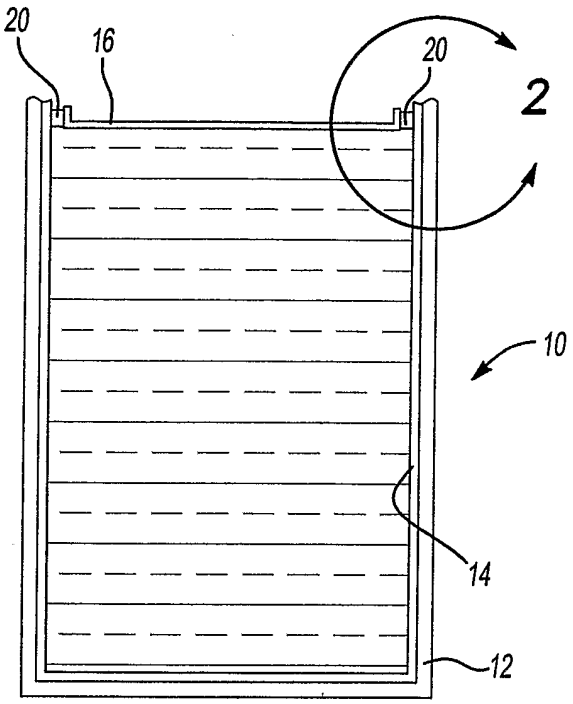

Fig-1

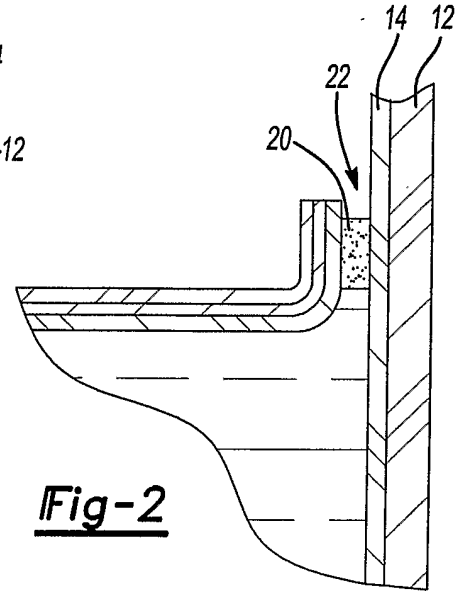

Fig-2

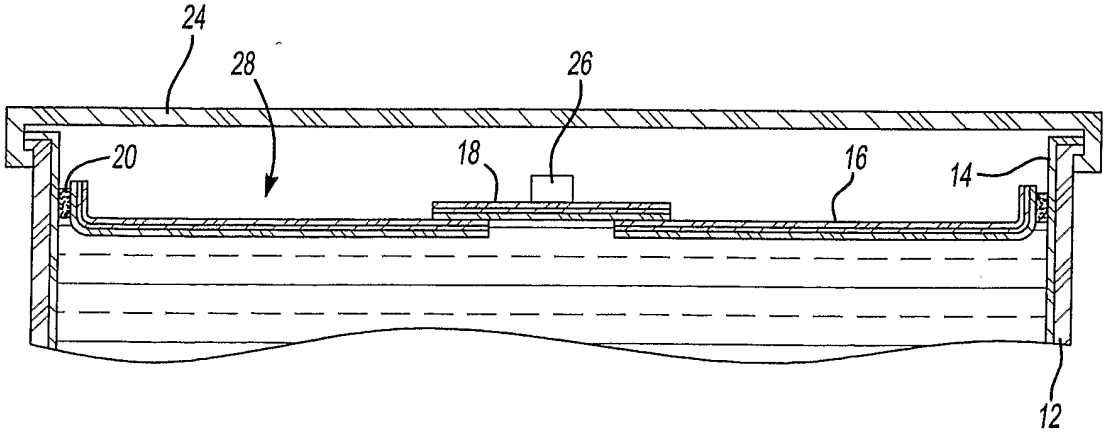

Fig-3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/044062

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D25/16 B65D81/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 507 409 A (PARADINE ET AL) 16 April 1996 (1996-04-16) cited in the application column 1, line 15 - line 18 column 4, line 7 - line 13 column 4, line 63 - line 66 column 5, line 27 - line 30; figures	1-8, 10-14, 16-20
Y	EP 0 127 149 A (IDEMITSU PETROCHEMICAL COMPANY LIMITED; IDEMITSU PETROCHEMICAL CO. LTD) 5 December 1984 (1984-12-05) page 1 - page 5 page 19, paragraph 2	1-8, 10-14, 16-20
Y	GB 397 644 A (MARCEL DUPRET) 31 August 1933 (1933-08-31) page 3, line 15 - line 20	4,18

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 May 2005	20/05/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bridault, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2004/044062

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