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CONTAINER STRUCTURE

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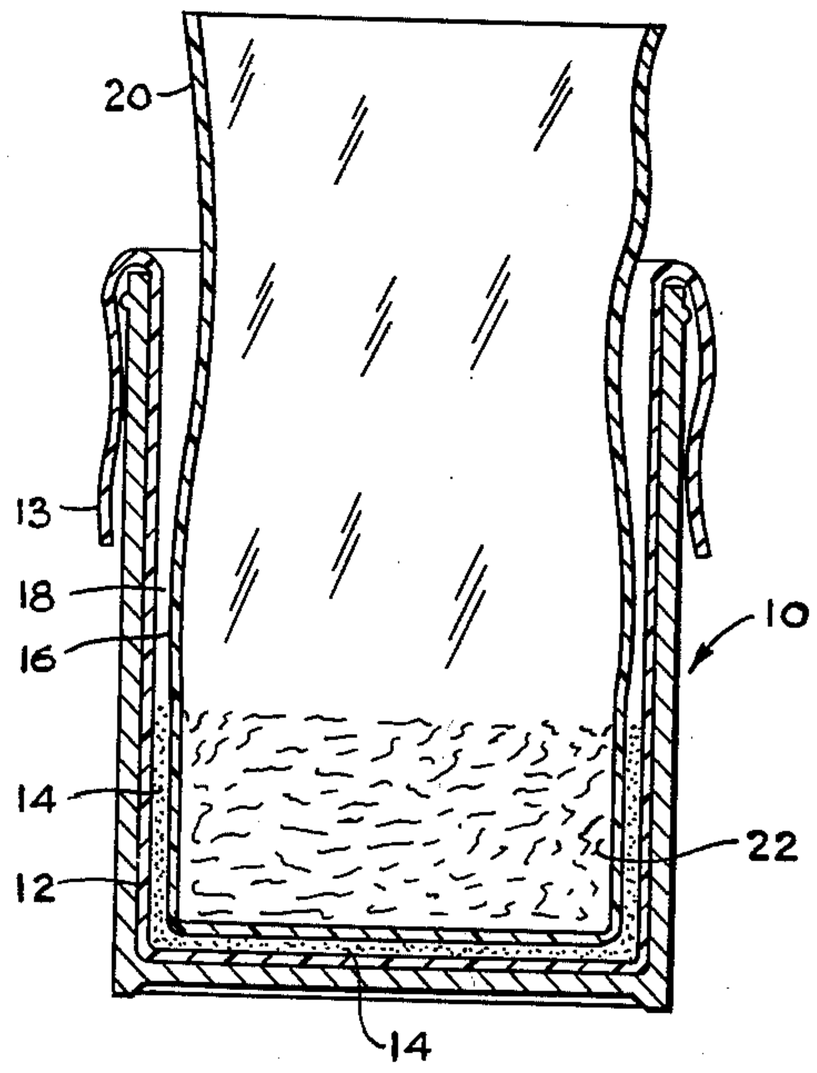

Fig. 1

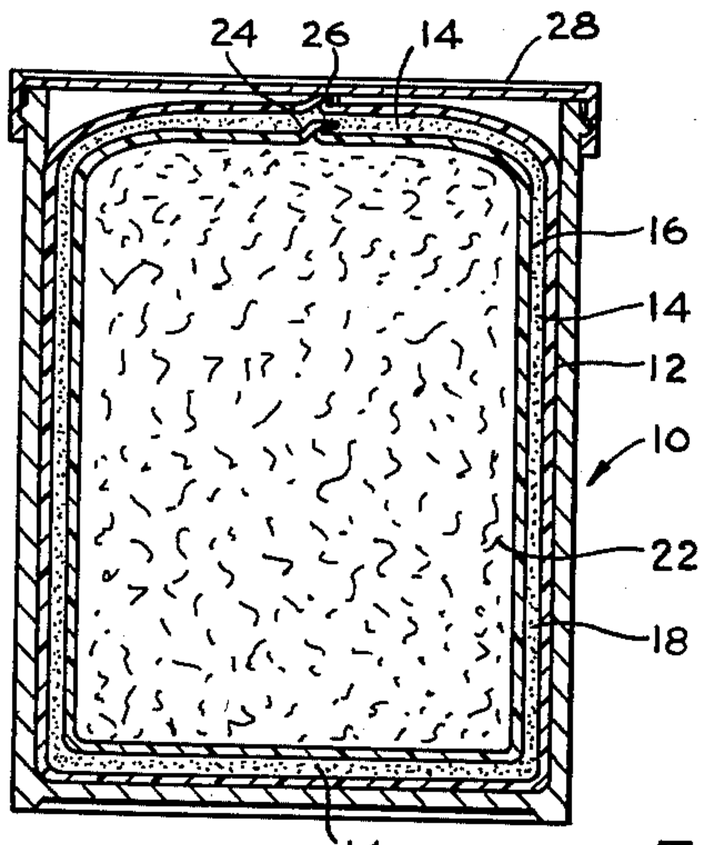

Fig. 2

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CONTAINER STRUCTURE

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This invention relates to the packaging of chemicals, and is particularly concerned with a container structure embodying novel means to prevent corrosive vapors emanating from chemicals packaged in the container from coming into contact with, and corroding or deteriorating the container wall.

In the packaging of corrosive chemicals it is customary practice to insert thin plastic liners into steel or fiber packing drums. These liners isolate the corrosive contents from direct physical contact with the corrodible outer container. One of the most popular and widely used types of plastic liners for this purpose is the polyethylene liner which has an exemplary film thickness of about 0.002". For many applications the use of such a polyethylene liner has provided adequate protection in commercial practice. However, it has been known that the polyethylene liner can "breathe" and that it is permeable to water vapor. It has also been found that this type of liner is permeable to vapors of the halogen acids such as HCl, HBr and HF, and in addition to vapors of ammonia. It also appears to be permeable to other acid and alkaline vapors of comparable molecular size, or smaller.

Due to the vapor permeability of such polyethylene liners, it has been found in commercial practice that rapid deterioration to complete failure of fiber and also of steel drums often occurs when such drums are charged with certain chemicals or chemical compositions emitting the above mentioned corrosive vapors, and the drums stored in an otherwise favorable environment. Chemicals such as ammonium bifluoride emit corrosive HF vapors, and mixtures of sodium bisulfate, sulfamic, oxalic, tartaric, and/or citric acid, and sodium chloride, are notorious for emitting corrosive HCl vapors. Such corrosive vapors pass through the polyethylene liners and attack the fiber or metal wall of the drum. Chemicals such as ammonium bicarbonate, and compositions including ammonium salts such as ammonium sulfate or chloride, mixed with alkalies, release ammonia vapors which are irritating and objectionable particularly from the odor standpoint. To use liners fabricated of polymers having low vapor permeability, and which may include, for example, neoprene, and those marketed as Mylar, Thiokol or Hypalon, is prohibitively expensive for use on a disposable basis.

It is an object of this invention to provide means in containers lined with vapor permeable plastic materials, for preventing corrosive or noxious vapors discharged from chemicals packed in such containers from coming into contact with and corroding or deteriorating the walls of the container, and from escaping into the atmosphere.

Another object of the invention is the provision of a container, for example, a steel or fiber drum, having a polyethylene or like vapor permeable plastic liner, and embodying means for reacting with corrosive or noxious vapors emitted from the contents of the container and passing through such liner, so as to inactivate such vapors and prevent them from contacting the walls of said container, or from passing externally therefrom.

Still another object is the provision of a novel article generally in the form of a container or drum lined with a vapor permeable, particularly polyethylene, liner.

Other objects and advantages of the invention will appear hereinafter.

The above and other objects are achieved, according

to the invention, by providing a confined barrier zone of a vapor phase between the vapor permeable liner containing the packaged chemical contents, and the wall of the container, said vapor phase being of a type such as to react with and inactivate, e.g. by neutralization, the corrosive vapors emanating from the charge of corrosive chemicals within the liner and passing through such liner into the barrier zone, the reaction product of the two reacting vapors preferably depositing as a solid within the barrier zone. Such reaction accordingly inactivates the corrosive vapors entering the barrier zone through the permeable, e.g. polyethylene liner, and thus substantially prevents such vapors from reaching the container wall.

To provide the inactivating or neutralizing vapor phase barrier zone noted above, I incorporate, as a major feature of the invention, a minor amount of a vapor donor substance in the pulverulent solid or liquid form, in the zone between the permeable liner carrying the chemical contents, and the wall of the container. I prefer to use the vapor donor substance in powder or liquid form, and preferably avoid using such substance in coarse granular or lumpy form, since coarse particles inserted between said liner and the container wall may puncture the liner under the load of chemicals packaged within the liner.

In a preferred embodiment I employ two liners of vapor permeable plastic such as polyethylene, one such liner being positioned contiguous to or in substantial contact with the wall of the container, the other such liner being positioned within, or telescoped into, the first mentioned liner. The inner liner is adapted to contain the chemicals or contents to be packaged. The vapor donor substance is introduced into the zone between the inner and outer liners, constituting the above described barrier zone. In this embodiment the corrosive or noxious vapors passing through the pores of the inner liner, and entering the barrier zone between the liners, reacts with, e.g. is neutralized by, the neutralizing vapors given off by the vapor donor substance in the barrier zone, causing deposition of a solid reaction product of the vapors in the confined zone between the two liners.

The present of the additional outer liner adjacent to or in contact with the container wall, although likewise vapor permeable, provides further protection against corrosion of the container wall by any corrosive gases which may not be reacted or neutralized in the barrier zone. However, the main advantage of such outer liner is to prevent contact of the deposited reaction product of the corrosive and neutralizing vapors from coming into direct contact with the container wall, since such reaction product itself may be of a type which is corrosive, such as a chloride or fluoride, e.g. ammonium chloride, as when the corrosive gas is acidic, for example, HCl vapors, and the neutralizing or reacting gas produced by the vapor donor substance in the barrier zone is alkaline, for example, ammonia. Under these circumstances the reaction product, ammonium chloride, has an acidic reaction, and if brought into direct contact with the wall of the container or drum, would produce corrosion thereof in the case of metal, e.g. steel drum. Where the deposited reaction product of the two gases is a completely neutral substance, the danger of attack of the container wall by contact thereof with such substance in the barrier zone is minimized, and the outer liner accordingly may be omitted.

While polyethylene is given as a preferred type of vapor permeable liner employed in the invention system, the use of other types of vapor permeable plastic liners can be employed alternatively. Thus, for example, the newly developed polypropylene sheet plastic, believed to be vapor permeable, can be employed in place of polyethylene. In commercial practice, fiber drums are often provided with a liner of polyethylene sealed or otherwise integrated into the inner surface of the drum. Such liner

may serve as the outer liner of the preferred form of my container structure, the inner liner provided according to the invention serving to form the barrier zone between the two liners.

Although in preferred practice the vapor permeable liners are flexible, vapor permeable rigid liners may be utilized also.

Since the major difficulty in the prior art has been concerned with corrosion or deterioration of the container brought about by acidic gases such as HCl or HF vapors, the vapor donor substance is generally one which emits acid neutralizing or alkaline vapors, e.g. ammonia. A preferred vapor donor substance for this purpose is ammonium bicarbonate, since it liberates a substantial ammonia vapor pressure. Ammonium carbonate also may be employed, except that the lumpy form of the commercial product renders it physically undesirable, due to the danger of such product puncturing the liner between the barrier zone and the packaged contents under load. However, vapor donor substances generating excessive vapor pressures, e.g. of ammonia, should be avoided, as this will cause the neutralizing gas in the barrier zone to permeate the intermediate liner wall and pass into the packaged contents held within said liner, resulting in undesirable rapid spending of the vapor donor substance, and also in simultaneously neutralizing at an undesirable or excessive rate the packaged acidic compound which the liner is intended to preserve. Instead of using ammonia as the neutralizing gas, I may employ amine vapors, e.g. alkyl amines, such as triethylamine, tripropylamine or tributylamine as neutralizing gas, and employing such amines or their compounds such as the corresponding quaternary hydroxide as vapor donor substances.

In place of vapor donors emitting acid neutralizing vapors, I can employ in the barrier zone vapor phase inhibitor substances. These may include, for example, amine salts of carboxylic acids, such as, for example, cyclohexylamine laurate, oleate or benzoate, and suitably volatile nitrites or nitrates.

Where the vapors emanating from the packaged chemicals and passing through the liner into the barrier zone are basic, for example, ammonia, the barrier zone may be charged with a vapor donor substance emitting vapors having a base neutralizing or acid reaction to prevent escape of such oxious alkaline vapors. Thus, for example, where the chemical contents of the container include ammonium bicarbonate which evolves irritating ammonia vapors, such vapors can be confined and inactivated or neutralized in the barrier zone by charging the barrier zone with a small amount of sodium diacetate, which evolves a substantial vapor pressure of acetic acid.

In preferred practice, the vapors evolved by the vapor donor substance in the barrier zone should have a sufficiently large molecular size that the liners employed have minimum permeability to such vapors.

The amount of donor substance introducd into the barrier zone between the inner liner holding the packaged chemical contents and the outer liner or wall of the container, is relatively small. Thus, for example, it has been found that introduction of from about 4 to about 8 ounces of ammonium bicarbonate into the barrier zone of a metal drum having two polyethylene liners according to the invention, and having 125 lbs. of packaged chemical in the inner liner, composed of a mixture of sulfamic acid, sodium bisulfate, ammonium bifluoride and sodium chloride, resulted in a package having a storage life of at least six months without any corrosion or deterioration of the drum. However, in the same package, in the absence of the protective barrier zone containing the ammonium bicarbonate, the metal container will show substantial corrosion within 24 hours storage time.

The invention is further illustrated by the description below of a preferred embodiment, taken in connection with the accompanying drawing wherein:

FIG. 1 illustrates a drum in the process of being charged, embodying the invention principles; and

FIG. 2 shows the drum of FIG. 1 after it has been filled and sealed.

Referring to FIGS. 1 and 2, numeral **10** represents a conventional form of drum, which may be constructed of steel or fiber. An outer liner **12** in the form of a polyethylene bag is placed in the drum around the interior wall thereof, and the upper end **13** of the bag is folded down over the upper edge of the drum, as seen in FIG. 1. A small amount of vapor donor substance, e.g. ammonium bicarbonate, indicated at **14**, is then distributed over the liner **12** at the bottom of the drum, and a second similar liner **16**, in the form of a polyethylene bag is telescoped into the outer bag **12** in the drum, leaving an annular space **18** between the side walls of the two bags or liners. The upper end **20** of the inner bag **16** extends upwardly exteriorly of the upper end of the drum and is connected to a bag filling apparatus (not shown). The inner bag **16** is then partially filled, say about one fourth to one third full, with chemicals to be packaged, e.g. a composition including ammonium bifluoride, as indicated at **22**, and additional vapor donor substance **14** is distributed in the annular space **18** around the contends **22** partially filling bag **16**. This filling process is continued by alternately charging additional quantities of chemical into bag **16** and distributing vapor donor substance **14** into the annulus **18** until the bag **16** is completely filled or filled to the desired amount, with vapor donor substance **14** completely surrounding the sides of bag **16** in the barrier zone **18** between the two bags, up to the top of bag **16**, or to a height coextensive with the height of the charge of packaged material in liner **16**.

The upper end of bag **16** is then tied in any suitable manner as indicated at **24**, and additional vapor donor substance **14** is then distributed over the top of inner bag **16**, and the upper end of bag **12** is then tied as indicated at **26**. It is thus seen in FIG. 2 that the inner bag **16** containing the packaged chemical contents indicated at **22**, is entirely surrounded by a barrier zone between bags **12** and **16**, containing a relatively minor amount of vapor donor substance **14**. The top **28** is then placed on the drum.

Thus, acid vapors emitted from the chemical **22** contained within bag **16**, and passing through the vapor permeable polyethylene liner or bag **16** into the barrier zone **18**, are caused to react with the ammonia liberated by the ammonium bicarbonate in such zone, forming, for example, ammonium fluoride, which deposits as a solid in the barrier zone between liners **12** and **16**, out of contact with the wall of drum **10**, preventing deterioration of the drum. The resulting package has a storage life of several months without any material deterioration taking place.

From the foregoing, it is seen that the invention provides a container or package designed particularly for packing chemical substances, and incorporating a simple novel means for preventing corrosive and/or noxious vapors emanating from the contents of such package, from attacking the container walls, and preventing leakage of such corrosive and/or noxious vapors from said container to the surrounding atmosphere.

While I have described particular embodiments of my invention for purposes of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. A container adapted for packaging materials normally emitting corrosive vapors, comprising a drum having an outer substantially rigid wall formed of a material normally subject to corrosion by said corrosive vapors, an outer liner positioned in said drum contiguous to said outer wall, an inner liner telescoped within said outer liner but spaced therefrom to form a confined barrier

zone between said inner and outer liners, said inner and outer liners being formed of a flexible chemically resistant synthetic resin permeable to vapors, and a small amount of a powdered solid vapor donor substance distributed in said barrier zone, said substance being capable of emitting, and having a vapor pressure sufficient to emit, vapors of a type to neutralize any corrosive vapors passing through said inner into said barrier zone.

2. A container as defined in claim 1 wherein said liners are composed of polyethylene.

3. A container adapted for packaging materials normally emitting corrosive and/or noxious vapors, comprising a drum having an outer substantially rigid wall, an outer liner positioned in said drum contiguous to said outer wall, an inner liner telescoped within said outer liner but spaced therefrom to form a confined barrier zone between said inner and outer liners, said inner and outer liners being formed of a flexible chemically resistant synthetic resin permeable to vapors, and a small amount of a vapor donor substance distributed in said barrier zone, said substance being in powdered solid form and capable of emitting vapors of a type to inactivate any of said first mentioned vapors passing through said inner liner into said barrier zone, and forming a solid reaction product in said zone.

4. A package comprising a drum having an outer substantially rigid wall, an outer liner positioned in said drum contiguous to said outer wall, an inner liner telescoped within said outer liner but spaced therefrom to form a confined barrier zone between said inner and outer liners, said inner and outer liners being formed of a flexible chemically resistant synthetic resin permeable to vapors, a material contained in said inner liner and normally emitting corrosive and/or noxious vapors, and which pass through said inner liner and into said barrier zone, and a small amount of a substance distributed in

said barrier zone, said substance being in powdered solid form and normally emitting vapors of a type to react with and inactivate said first mentioned vapors passing through said inner liner into said zone.

5. A package comprising a drum having an outer substantially rigid wall formed of a material normally subject to corrosion by acidic vapors, an outer liner positioned in said drum contiguous to said outer wall, an inner liner telescoped within said outer liner but spaced therefrom to form a confined barrier zone between said inner and outer liners, said inner and outer liners being formed of a flexible chemically resistant synthetic resin permeable to vapors, a solid powdered chemical material contained in said inner liner and normally emitting acidic vapors corrosive to said outer wall, and which pass through said inner liner and into said barrier zone, and a small amount of a substance distributed in said barrier zone, said substance being in powdered solid form and normally emitting alkaline vapors of a type to react with and inactivate said corrosive acidic vapors passing through said inner liner into said zone, and forming a solid reaction product in said zone, said substance being present in amount of about 4 to about 8 ounces per 125 lbs. of said material.

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