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Maierson

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[54] **METHOD OF MAKING CONTAINER OPENING STRUCTURE COMPRISING FLEXIBLE TAPE AND PRESSURE-RUPTURABLE CAPSULES**

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Related U.S. Application Data

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[52] **U.S. Cl.**..... **156/178,** 156/250, 156/279, 161/DIG. 1

[51] **Int. Cl.**..... **B32b 5/00,** B32b 31/00

[58] **Field of Search**..... 156/176, 178, 250, 156/279; 161/DIG. 1

[56] **References Cited**

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[57] **ABSTRACT**

This disclosure is directed to container opening structures comprising a container wall member, such as a closure, e.g., a lid, to which there is attached at least one flexible closure tearing means accessible from the exterior of the container and a plurality of pressure-rupturable capsules, each of which contains a volatilizable core material, e.g., perfume or other fragrance, located between the container wall or lid and the tearing means. Preferably, the tearing means is a flexible tape composed of a plurality of parallelly arranged monofilaments. The operation of the tearing means serves to rupture at least some of the capsules during opening of the container.

4 Claims, 3 Drawing Figures

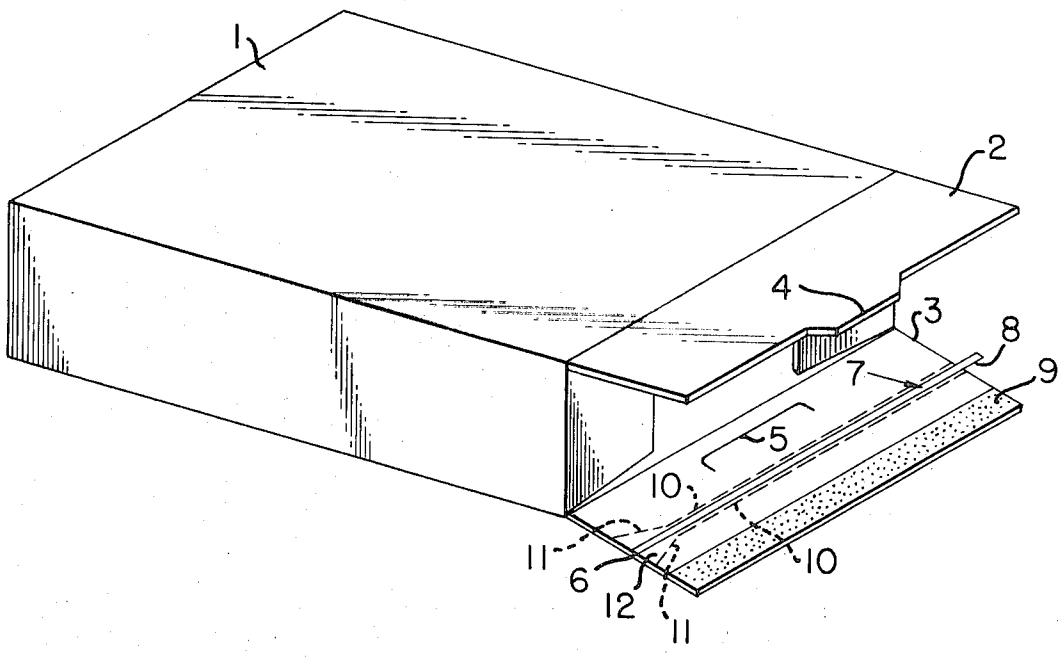


FIG. 1

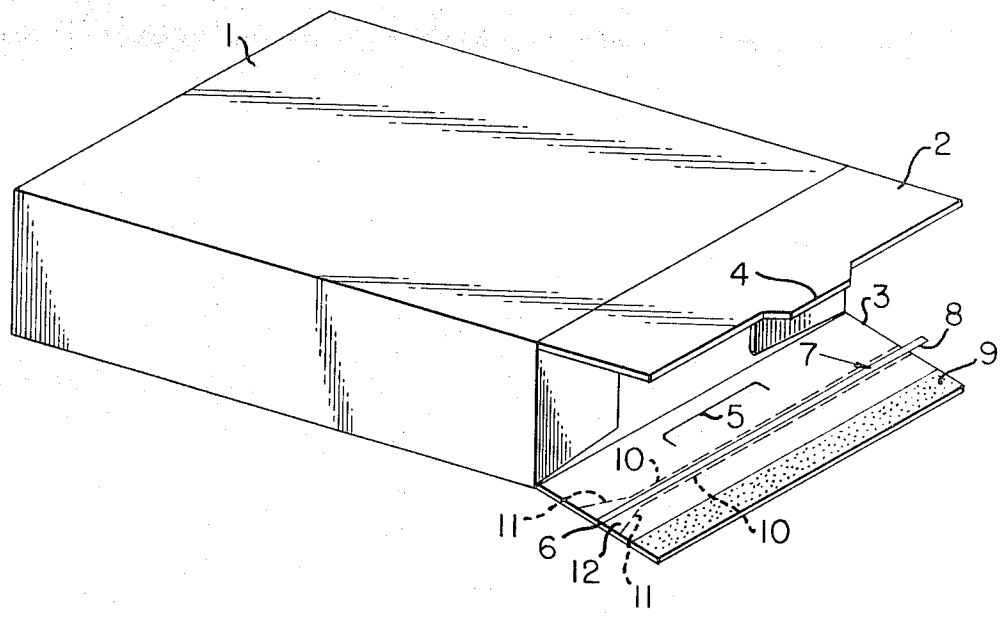


FIG. 2

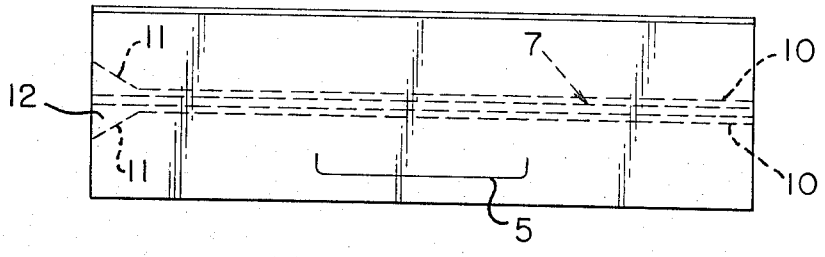
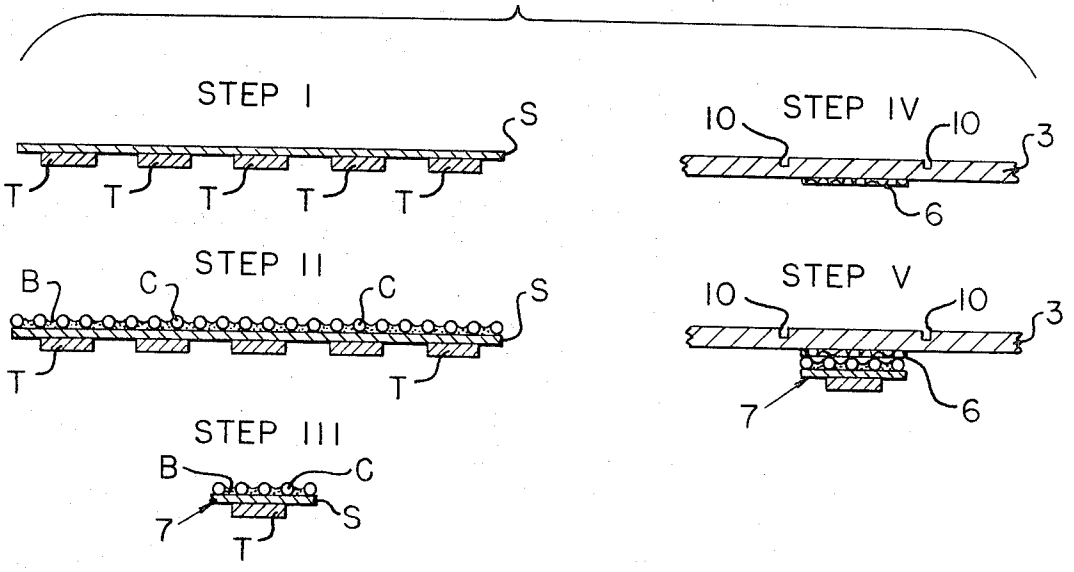


FIG. 3



METHOD OF MAKING CONTAINER OPENING STRUCTURE COMPRISING FLEXIBLE TAPE AND PRESSURE-RUPTURABLE CAPSULES

This is a division of application Ser. No. 879,039, filed Nov. 24, 1969 now U.S. Pat. No. 3,599,859.

One major object of the present invention is the provision of a container opening structure and method for the preparation thereof which, upon opening of the container, will release a desired fragrance or other volatilizable material capable of functioning in the vapor state to accomplish a desired objective. The present invention enables the fragrance or other encapsulated core material to be stored without undergoing any significant change prior to the desired moment of use, viz., the time when the container is to be opened.

The invention will be illustrated in more detail in the drawings. FIG. 1 of the drawings is a perspective view illustrating one embodiment of a container opening structure utilizing the present invention. FIG. 2 is a top view of the container opening arrangement of FIG. 1 with alternate means to gain access to the tape. FIG. 3 is a series of five sectional views labeled Steps I through V, showing a preferred sequential procedure for formation of a container opening structure(s) in accordance with this invention.

As shown in FIG. 1, container 1 has a closure formed from inner flap 2 and outer flap 3. One longitudinal extremity of inner flap 2 constitutes a reseal truck flap 4, which, after opening of the container, serves to reseal it by insertion into opening 5 on flap 3, which opening serves to seat the reseal tuck flap. Tuck flap 4 actually becomes the outer flap once the original closure is opened and then resealed. Flap 3 has two glue lines applied thereto, one lid sealing glue line area being shown at 9 and a capsule tape adhering glue line area being shown at 6. Glue is applied to the inner surface of flap 3 along glue line 6 to adhere container tearing means assembly 7, which contains the encapsulated fragrance or other core material to the interior surface of flap 3. According to one embodiment of this invention, the tearing means is located within a region or area of the container wherein the container wall material is preweakened, e.g., by perforations 10, as shown in FIGS. 1, 2 and Steps IV and V of FIG. 3, to aid in the tearing thereof.

The container tearing means can be provided with a tab or extension 8 which in effect extends the container tearing means past the lid of the box to provide access from the exterior. The lid sealing glue line 9 adheres the inner surface of flap 3 to the outer surface of flap 2 to achieve the initial container closure. In addition to or in place of access tab 8, a V-shaped (or other shape) preweakened region can be employed in flap 3 to provide access to the tearing tape from the exterior of the container. The perforated access tab 12 shown in FIGS. 1 and 2 as having a "V" shape can be employed to initiate tearing of the container closure. The exterior view one obtains of the preweakened container wall is shown in FIG. 2. To initiate opening the container, the opener merely grips the initiator tab 12 and applies upward pressure which causes the perforated portion of the lid to yield engaging the closure tearing means assembly 7 which opens the container within a region defined by perforations such as one or more perforated lines 10 as shown in FIG. 2. Alternatively, access to the tearing means assembly 7 can be secured by lifting tab 8 in the region between perforated lines 10 and pulling upward.

The container tearing means assembly 7 containing encapsulated fragrance or other capsule core material can be produced readily by fixing a plurality of thin strips of nylon reinforced tape T to a substrate S, e. g., of coating grade paper, at regular intervals shown in Step I of FIG. 3. Any conventional binder, glue, adhesive, etc., can be used for this purpose although a pressure sensitive adhesive is preferable. The tape T constitutes the tearing portion of the closure tearing means in accordance with this invention. According to a preferred embodiment of this invention, the tearing means is a flexible pressure-sensitive plastic tape having a plurality of parallelly arranged nylon monofilaments incorporated therein, said monofilaments being strong enough to pressure rupture the capsules and tear the boxboard or other container material from which the container is made.

On the opposite side of fibrous substrate S there are deposited a plurality and more usually a multitude of capsules C usually in a formulation containing a binder B. The completed laminated assembly containing the capsules, substrate and tape is shown in Step II of FIG. 3. Subsequent to the assembly formation, the substrate is slit or otherwise severed (and any capsules) along the cutting lines between the generally parallelly arranged respective adhered lengths of tape T to result in the individual capsule-containing tearing means assemblies 7 as shown in Step III of FIG. 3. The individual lengths of tape containing the encapsulated fragrance is then applied to outer flap 3 along capsule tape glue line 6 as shown in FIG. 1, the application of the glue to flap 3 being shown in Step IV and the final adhesion of the composite capsule-containing container closure tearing means 7 to flap 3 being illustrated in Step V of FIG. 3.

In accordance with this invention, the substrate S, which can have a width greater than that of said tearing means, can be any fibrous web, e. g., coating grade paper, such as paper having a basis weight ranging from about 8 to about 20 pounds per ream. A ream is defined for reference herein as 500 sheets of paper, each sheet having a length of 22 inches and a width of 17 inches, viz., an area of 1298.6 ft.^{2} regardless of individual sheet size. Characteristically, substrate S has a thickness of 1 to 8 mils and more usually from 2 to 5 mils. As shown in Steps III and V of FIG. 3 substrate S can be wider than tape T, but this is not necessary. Usually the capsules C are coated on the entire surface of the substrate.

The container, including flaps 2 and 3 can be made of any material suitable for forming containers, e.g., conventional paper boxboard material having a basis weight ranging from about 60 to about 100 pounds per thousand square feet with a thickness of about 15 to about 25 mils and more usually from about 75 to 85 pounds per thousand square feet with a thickness of about 18 to about 20 mils.

The glue employed to form glue line areas 6 and 9 can be any conventional paper glue or adhesive, such as dextrin, poly(vinylacetate) aqueous emulsion, gelatin, casein, solutions of elastomeric polymers in organic solvents, such as polybutene dissolved in naphtha.

In addition to utilization of pressure-sensitive tape containing polyamide (nylon) or other fibrous monofilaments as the tearing means, other forms of tearing means can be employed. Suitable tearing means in-

clude, but are not limited to, the following: natural and synthetic fiber monofilaments including those of glass, woven and unwoven fabric tapes, woven and unwoven fabrics and fibers, wire, woven cotton or nylon fiber strings, flexible strips, e. g., strips of metallic foil, plastic, e. g., polyethylene, etc. The tearing means is preferably both flexible and capable of rupturing the capsules and tearing the material from which the container is made at least in a preweakened region thereof.

According to another embodiment of this invention, the container closure tearing means, e. g., woven string, can, itself, contain fragrance capsules adhering to outer circumferential regions thereof. One or more of such capsule-containing strings then constitute the container tearing means, with or without the use of additional capsules located on the interior surface of the container.

Regardless of the specific form of the tearing means, it is essential to this invention to have a structural arrangement where at least some of the capsules are located between the tearing means, i. e., the tape or string, and a container wall portion, e. g., a closure member.

Thus, it is also within the purview of this invention to include the capsules in the glue and apply the capsules along with the glue formulation constituting glue line area **6** on flap **3** followed by application of the tape T with or without substrate S so that the glue in glue line **6** assists in adhering the tape to said flap. In other words, the capsules need not be incorporated in the tearing means prior to adhesion of the tearing means to the interior surface of container flap **3** as shown in Step III of FIG. **3.** Instead, the capsules can be added with the glue of glue line area **6** followed by addition of the tape T.

The capsules are basically generally spherically shaped pressure rupturable cells having an internal core of solid, liquid or gaseous material whose vapor state is functional in respect of a physiologically stimulating or invigorating result or a task to be performed. An example of a physiologically invigorating result is that produced by fragrance or essence, such as food aroma, perfume, etc. Instead of a fragrance or aroma, the capsules can contain liquid or solid insect repellents functioning to repel insects in the vapor state. Thus, the capsule core material can be a fragrance, perfume, food aroma, insect repellent, insecticide, etc.

The capsule layer can be continuous or discontinuous, although the use of continuous capsule layers is preferred. Capsule "payload," viz., concentration of core material can range from about 45 to about 99 weight percent, based upon total capsule weight, viz., core plus cell wall. Usually, the capsule payload ranges from about 70 to about 95 weight percent.

Enclosing the liquid or other core material there is at least one organic polymeric, pressure-rupturable cell wall comprised of a material or combination of materials which is both inert with respect to the core material and capable of retaining it for extended periods of time, which can vary depending upon the desired shelf life and longevity of the article in question. Thus, for example, the capsule cell wall material can be gelatingum arabic hardened with glutaraldehyde. Moreover, mixtures of capsules can be used, some of which release their contents in a short time period and others which retain their contents for longer terms, viz., upon opening the container. Other suitable cell wall materials include, but are not limited to, the following: cellulosic polymers, e. g., ethylcellulose, nitrocellulose, carboxymethylcellulose; shellac; rosin; vinyl polymers, e. g., poly(vinyl alcohol), poly(vinyl chloride), poly(vinylidene chloride), copolymers of vinylchloride and vinylidene chloride (e. g., "Saran"), mixtures of poly (vinyl chloride) and poly(vinylidene chloride); urea-formaldehyde condensates, melamine-foramaldehyde condensates and other aminoplast condensates; polyolefins, e. g., poly(ethylene), poly(propylene); poly(styrene); polyacrylamides; polyethers; polyesters; polyamides; polyolefins, e. g., polybutadiene, polyisoprene; silicones; epoxy resins; polyurethanes; etc. As will be observed from the list of suitable exemplary capsule cell wall materials set forth herein, a wide variety of both thermoplastic and thermosettable capsule cell wall materials can be utilized. Moreover, each capsule or some of them can have a plurality of substantially concentric walls, e. g., a primary cell wall of gelatin-gum arabic with a secondary (outer) cell wall of ethylcellulose, nitrocellulose, or equivalent material. Furthermore, all or a portion of the capsules can have a composite cell wall, viz., one in which a plurality of wall-forming components participate in cell wall formation in one manner or another, e. g., the aforementioned capsules having a hydrophilic cell wall of gelatin-gum arabic hardened with an aldehyde, e.g., glutaraldehyde having a substantial concentration of hydrophobic condensate inclusions formed of in-situ condensates of resorcinol and an aldehyde, e. g., formaldehyde.

In the articles of this invention, substantially all of the capsule contents are usually released by pressure, discounting minor losses of core material by evaporation through the cell wall, transfer, etc. The individual capsule diameters can range very widely in size. Thus, the individual capsule size range can range from about 2 to about 200 microns, more usually from about 5 to about 100 microns, and preferably from about 10 to about 50 microns. While the size of the individual capsules can vary over a wide range, the predominant concentration of capsules and hence the predominant capsule size (on a particle size distribution weight basis) usually ranges from about 25 to about 100 microns and more usually from about 35 to about 50 microns. Individual capsule cell wall thickness can range anywhere from about 0.5 to about 10 microns.

A wide variety of encapsulation procedures can be employed to form the capsules mentioned hereinabove. Thus both mechanical and chemical, e. g., coacervation, encapsulation procedures can be utilized. It should be understood that this invention is not limited by the manner of encapsulating the core material. The specific procedure chosen will depend upon several considerations, including, shelf life requirement, desired capsule size, specific cell wall material used, the specific core material employed, etc. Sutitable encapsulation procedures, both chemical and mechanical, can be found in the treatise entitled "Micro Encapsulation" by Anderson et al published by Management Reports, Boston, Mass. (1963). Chapter 2 (pages 9 through 33 and accompanYing bibliography) of this report is directed to chemical processes of microencapsulation and chapter 3 thereof (pages 35 through 55 and accompanying bibliography) is directed to mechanical processes of microencapsulation. The disclo-

sure of this publication is incorporated herein by reference.

The capsule-containing coating formulation usually applied from aqueous media and containing a binder can be applied directly to the sized or unsized surface of the paper or other substrate S by use of any known coating techniques, e. g., Meyer rod, spraying, air knife, reverse roll, or it can be printed on the paper surface through the use of silk screen, Gravure or Flexographic printing procedures. It is also feasible to deposit the capsules onto the substrate by spraying them as an aqueous slurry containing a flexible binder, viz., one which yields a flexible film upon drying of the coating vehicle, and a filler(s), e.g., talc. Suitable flexible binders which can be employed in conjunction with such a coating procedure include the water-soluble acrylates and methacrylates, e.g., "SR-2"marked by the Rohm and Haas Company; starch and starch derivatives, e.g., Essex Gum (a commercially available hydroxy ethyl ether derivative of potato starch), marketed by the Penick and Ford Corporation; water-dispersible elastomers, such as butadiene-styrene copolymers, butadiene-acrylonitrile copolymers, etc. According to a preferred embodiment of this invention, the capsule coating is deposited so that the capsules are located over substantially the entire area of said substrate on a major surface remote from the tearing means.

In accordance with a preferred method embodiment of this invention, the substrate S (coating grade paper) has a plurality of nylon mono-filament reinforced adhesive tapes or strips T attached to one side thereof at regular spaced intervals in generally parallel arrangement as shown in Step I of FIG. 3. Preferably the widths of the monofilament-reinforced tape strips are in the range of from about 1/32 to one-eighth inch dependent upon how and which portion of a particular container is to be opened and the material from which the container is made. The wider tapes produce a double rupture line allowing for a higher percentage of release of core material from the capsules. Characteristically, the center line of each such tape can vary from about one-fourth to about one-half inch depending upon the specific container geometry and the material employed for the container. Subsequent to the deposition of the capsules C on the opposite side of the same substrate, the substrate is slit to the desired width.

Glue is then interposed between the capsules and the inner part of flap 3 which can be previously perforated as shown at 10 in the region of glue line area 6. The capsule-container tearing assembly 7 is then fixed to the glue. Glue is also applied to lid sealing glue line area 9 and both flaps 2 and 3 are glued together by first folding flap 2 in and then flap 3 upon flap 2. Alternatively the two flaps can be secured by staples, hot melt adhesives, heat sealable thermoplastic coatings, etc. Both flaps are held firmly in place until the glue has set.

The box is opened at the desired time by pulling upward on either access tab 8, V-shaped closure access tab 12 or, (in the event that double perforated lines 10 have been imposed on flap 3, e. g., as shown in FIGS. 1 and 2 by pulling upward on either end of the double perforated line. Regardless of how the opening of the box is initiated, the actual opening action to tear the indicated portions of flap 3 and rupture the capsules is accomplished by the tearing means 7 and more specifically by tape T. Tape T shears through the capsules and concurrently slits through the container flap 3 immediately opening the box. The duration of the scent or other released core material will depend in large measure upon its evaporation rate.

The invention will be illustrated in great detail in the following example which is included for illustrative purposes and should not be construed as limiting the invention.

EXAMPLE

Lime fragrance capsules were prepared for coating as follows: 200 grams of oil of lime, 180 grams of an 11 wt. % aqueous gelatin sol, 100 milliliters (ml.) of water and 180 grams of an 11 wt. % aqueous gum arabic solution were added to a mixer (Waring Blendor), all ingredients being maintained at 50° C. Sufficient sustained agitation was applied to reduce the size of the oil droplets to approximately the 20 to 50 micron (μ) range. This batch was then poured into 500 ml. of water maintained at 50° C and stirred continuously as the temperature of the mixture was allowed to descend to room temperature.

This mixture is then chilled to 10° C and 10 ml. of glutaraldehyde are added to achieve capsule hardening. The capsule containing mix is stirred for 12 hours. Then excess supernatant liquid is decanted and replaced with an equal volume of fresh water. Excess supernatent is again decanted. One hundred grams of a 25 wt. % aqueous solution of Essex Gum is mixed with the capsule slurry.

This capsule slurry is then sprayed onto a 13 pound per ream coating grade paper substrate containing one-eighth inch wide Scotch brand Filament tape strips (nylon monofilament-reinforced plastic pressure sensitive tape) affixed to the back surface thereof in generally parallel relation on one-quarter inch centers in the direction of the web of the paper. The capsule coating is applied in a coating weight range of 5 to 10 pounds per ream and thoroughly dried. The resulting laminated assembly is slit between tape lengths and the tapes are wound onto rolls of approximately one-quarter inch width.

A paperboard (82 to 85 pounds per thousand square feet) box blank of the type shown assembled in FIG. 1, but in planar or flat configuration, has two glue lines of poly(vinyl acetate) aqueous emulsion applied thereto in the regions 6 and 9 as illustrated in FIG. 1. The outer flap of the box blank has preweakened perforated access tab and tearing areas (equivalent to the regions defined by perforated lines 10 and 11 of FIG. 1) to aid in grasping the tearing means and opening the box once sealed. The capsule-containing side of the tear tape (as prepared above) premoistened with glue is then pressed lightly on the freshly applied glue line area comparable to 6 in FIG. 1. Additional glue is applied to the inner face of the outer flap in a position comparable to 9 in FIG. 1. The box is then closed by folding the outer flap over the inner flap and maintaining contact until the glue has dried.

The container was then opened by grasping the V-shaped preweakened tab 12 and pulling upwardly. As the container opened by tearing of the wall member or flap 3 a lime fragrance immediately permeated the air in a region approximating the location where opening occurred thus clearly demonstrating the feasibility and desirabilty of this invention.

While in the example above, the container material was paper boxboard, it should be evident that lighter or heavier materials could be used. For example, the container material can be flexible wrapping paper, plastic film, or sheeting, etc. The present invention is not limited by the geometry or form of the container or tearing means shown in the drawings.

What is claimed is:

1. A method of making a container opening structure comprising applying flexible tape means to one major surface of a paper substrate and adhering a plurality of pressure-rupturable capsules containing volatilizable core material on the opposite major surface thereof.

2. A method of making container opening structures comprising adhering a plurality of flexible tape means in generally parallel yet spaced arrangement to one major surface of a paper substrate, adhering a multitude of pressure-rupturable capsules containing volatilizable core material on the opposite major surface of said substrate, and severing the substrate between said parallel tape means.

3. The method of claim **1** wherein the tape means is a plurality of parallelly arranged monofilaments.

4. The method of claim **2** wherein the tape means is a plurality of parallelly arranged monofilaments.

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