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(54) **COMPOSITE CLOSURE FOR REMOVABLE  
INSERTION INTO WINE OR SIMILAR  
STYLE BOTTLE**

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(57) **ABSTRACT**

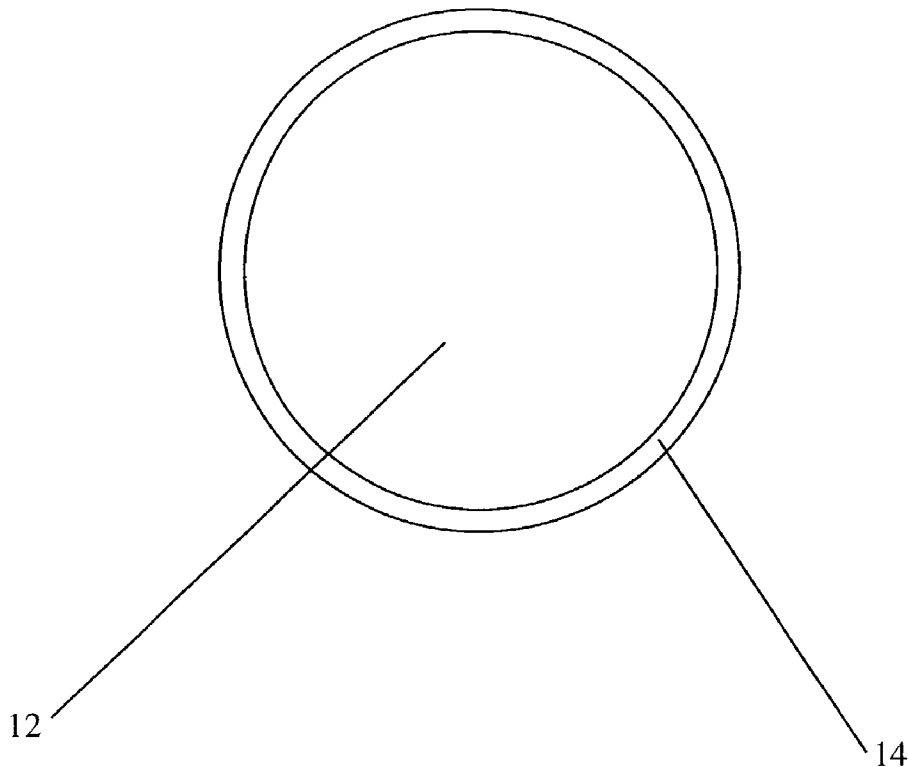
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A closure for a container provides a secure closure for liquid containers while eliminating the disadvantages of traditional cork closures. The closure includes a reduced density core encapsulated by an agglomerated cork layer to which a cork veneer or printed paper or plastic layer is attached. This composite structure provides uniform pressure against the sides of the bottle finish while eliminating the problems normally associated with real cork closures, such as leakage of oxygen in and product out caused by lenticels.



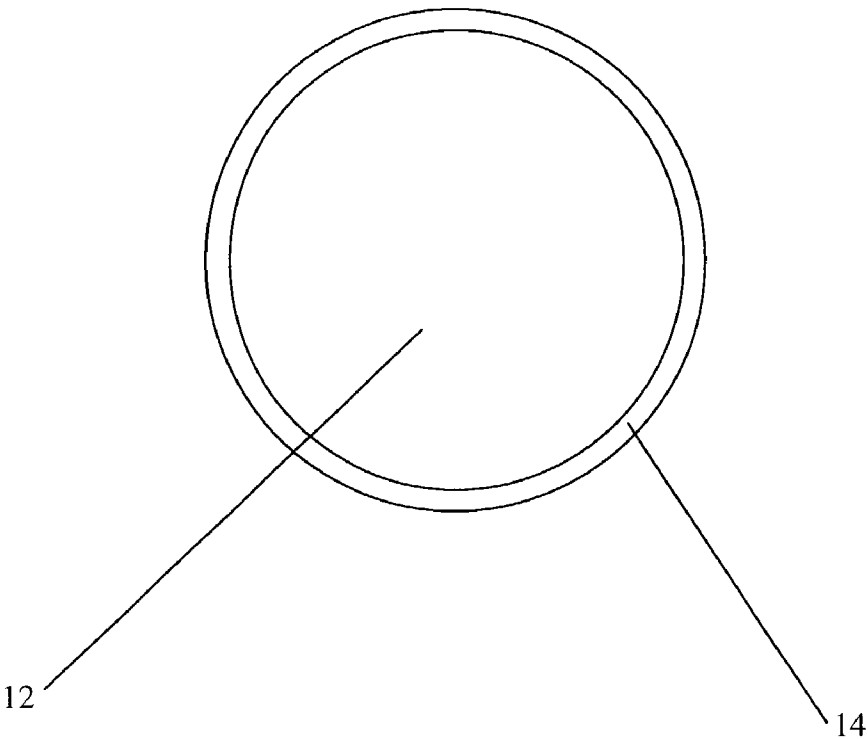
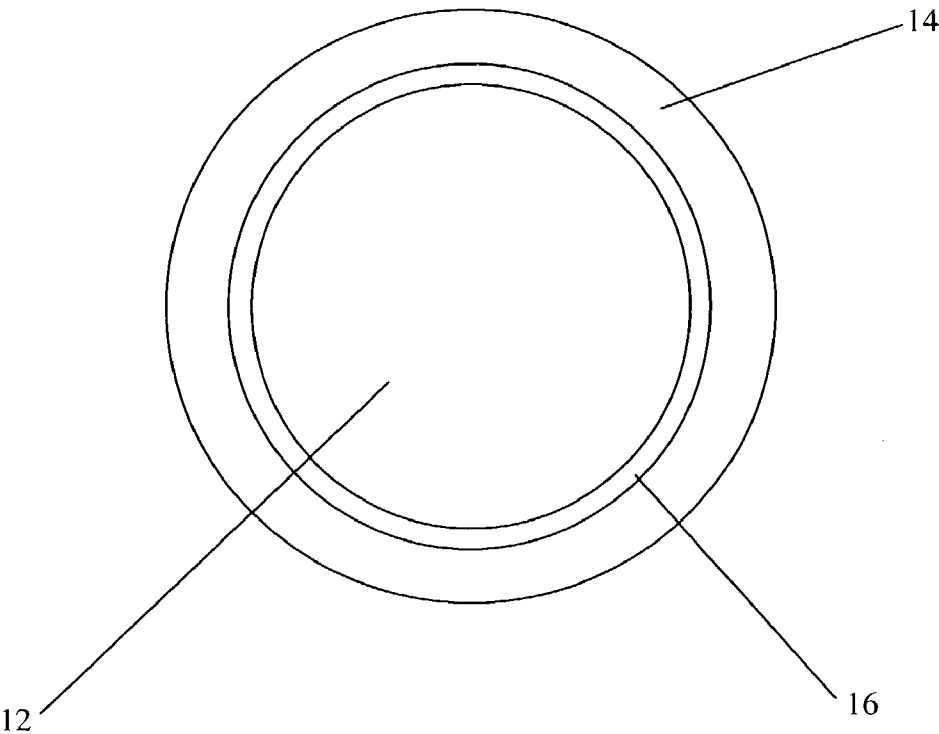


Fig. 1



**Fig. 2**

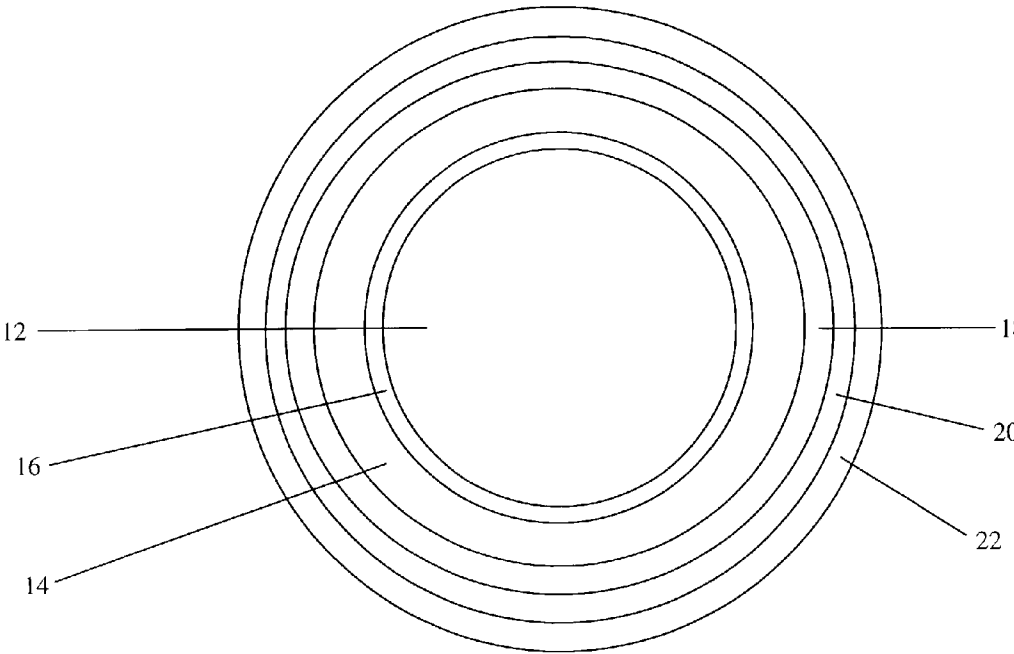


Fig. 3

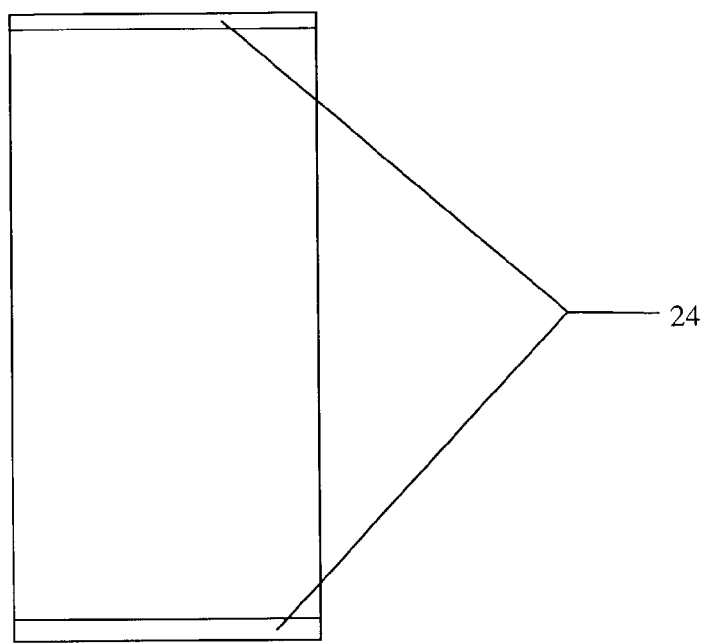


Fig. 4

## COMPOSITE CLOSURE FOR REMOVABLE INSERTION INTO WINE OR SIMILAR STYLE BOTTLE

### BACKGROUND OF THE INVENTION

#### [0001] 1. Field of the Invention

[0002] The present invention relates to closures made from both synthetic and natural materials used in the sealing/stoppering of containers. In particular, the present invention relates to an improved cork for liquid containers.

#### [0003] 2. Description of the Related Art

[0004] The most common material used in the fabrication of wine corks and bottle stoppers is natural cork which is derived from the bark of an oak tree (*Quercus Suber*) which is grown primarily in Portugal and Spain and to lesser degrees in Algeria and California. Natural cork has special properties, which make it uniquely suited for the production of wine corks and bottle or jar stoppers. The superior seal of the natural cork in comparison to recent plastic alternatives is due to the remarkable elastic properties of natural cork. Microscopic inspection of cork cells has shown them to be hexagonal prisms, having 18 edges and 12 vertices on average. Cell walls have also been identified as not being straight but having corrugations, which occupy six of the eight walls in each cell. Each cell has two or three complete corrugations, which give the cells the appearance of a bellows or concertina.

[0005] The corrugations, for the most part, occur along the radial axis of the prism. The parallel axis being defined as a line running from the center of the tree to its closest outer bark surface at a right angle to the ground. These corrugations cause the cells to fold up during compressive deformation such as in the mechanical compression used to insert them into the neck of a bottle.

[0006] Collapse of the cells along the folds of the cell walls is local to the area of compression and does not necessarily carry through the body of the cork. The folding of the cells is not stable, however once it achieves a level of 10% along the area of compressive force an entire layer will collapse. This phenomenon will carry on throughout the cork until the compressive force is lessened or removed or until the cork has suffered a complete collapse.

[0007] Upon removal of the compressive force, recovery of the collapsed cells of the cork are, for the most part, complete as the deformation caused by the compressive force are (non-linear) elastic and as such, recover. Man-made, "plastic cork" replacements for natural cork suffer from non-uniformity of the density of the structure along with irregularity of the cells structures i.e., bubble size and shape as well as wall thickness'. These inconsistency issues of "plastic corks" can be seen to manifest themselves in problems which relate to the all "plastic corks" not being tight enough which can caused leakage to occur or can allow the cork to be pushed out as a result of the pneumatic pressure which develops when the cork is inserted into the neck of the bottle.

[0008] The problems associated with the use of "plastic corks" due to the irregularity or inconsistency issues is further compounded by the tendency of "plastic corks" to take a set after they have been held under compression for

a period of time. This can lead to leakage if the bottle is subjected to a temperature change, which would increase the finish or opening diameter of the bottle without adequate time to allow for expansion of the "plastic cork".

[0009] Natural corks allow oxygen and other gases to permeate through the cork, which may adversely affect the quality or shelf life of the product. Similarly, man made corks allow gases to permeate through the cellular body of the man made closures.

[0010] Therefore, there has been and continues to be a need for an easy-to-use, practical closure for containers which conforms to the container, which can return to its original shape, which prevents the leakage of oxygen and which does not contaminate the product contained in the container.

### SUMMARY OF THE DISCLOSURE

[0011] A closure for containers is described which includes a core element and a sheathing layer. The core element is preferably fabricated from an extruded olefinic material. The core element is foamed and/or filled with pieces of cork and preferably has a density in the range of 0.2 g/cm<sup>3</sup> to 0.8 g/cm<sup>3</sup>. The sheathing layer is extrusion mounted or laminated to the core element. If lamination is used, the preferred method is thermoplastic hot-melt adhesives however other methods which are safe for use with food are also acceptable. The sheathing layer is an aggregate of small pieces of cork in a polymer matrix. The closure may also include a decorative layer adhered to the sheathing layer. The decorative layer may be made from a cork veneer. The closure may further include an outer an outer protective layer, preferably which is extrusion coated to the outer surface of the closure. The protective layer may be formed from an olefinic material. If desired, the outer protective layer consists of a plurality of sublayers such as one or more oxygen barrier sublayer and one ore more protective layers. The oxygen barrier layer is preferably made from ethyl vinyl alcohol, nylon, MDX6 nylon, poly acrylonitrile or polyvinylidene chloride. The closure further includes end caps which are attached to the ends of the closure. The end caps may be attached using hot melt adhesive, ultrasonic welding, hot plate welding or heat sealing and preferably include an oxygen barrier material.

[0012] It is therefore an object of the present invention to provide a closure for containers which conforms to the container.

[0013] It is another object of the present invention to provide a closure for containers which protects leakage of oxygen through the closure.

[0014] It is yet another object of the present invention to provide a closure for containers which resembles currently used closures.

[0015] It is yet a further object of the present invention to provide a closure for containers which does not collapse upon extended use.

[0016] Finally, it is an object of the present invention to accomplish the foregoing objectives in a simple and cost effective manner.

### DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a cross sectional view of a preferred embodiment of the present invention;

[0018] FIG. 2 is a cross sectional view of an alternate embodiment of the present invention;

[0019] FIG. 3 is a cross sectional view of an alternate embodiment of the present invention; and

[0020] FIG. 4 is a side view of the preferred embodiment of the present invention.

[0021] Element List

[0022] 12 core element

[0023] 14 sheathing layer

[0024] 16 adhesive layer

[0025] 18 decorative layer

[0026] 20 oxygen barrier layer

[0027] 22 protective layer

[0028] 24 end caps

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] The following detailed description is of the best presently contemplated modes of carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating general principles of embodiments of the invention.

[0030] The present invention is a fabricated closure for containing liquids, predominately but not exclusively wine. The closure includes a reduced density core encapsulated by an agglomerated cork layer to which a cork veneer or printed paper or plastic layer is attached. The advantage of this composite structure is to provide the uniform pressure against the sides of the bottle finish while eliminating the problems normally associated with real cork closures, such as leakage of oxygen in and product out caused by tubular channels, called lenticels. The lenticels are a natural occurrence in cork and their function is to connect the outer bark with the inner cork material.

[0031] The outer surface of the agglomerated and/or laminated layer is enrobed with an olefinic layer comprised of one or more layers of plastic materials. The purpose of the different plastic layers are to provide a functional barrier between the product and the surface of the agglomerated cork, cork veneer or other surfaces which would benefit from having an indirect contact with the product. Benefits provided include elimination of "cork taint" and the surface in contact with the product would be acceptable by the Food & Drug Administration for direct contact with the product and would be organoleptically neutral

[0032] To provide a barrier to the ingress of oxygen thereby minimizing oxidation and significantly increasing the shelf life and quality of the product, an oxygen barrier layer may be included. The preferred material for this oxygen barrier layer would be ethyl vinyl alcohol (EVOH), but the following materials could also be used, nylon, MDX6-nylon, polyvinylidene chloride (PVDC), or polyacrylonitrile.

[0033] Corks made according to the present invention may be decorated for product or manufacturer's identification by printing in the flat directly onto the cork, paper or plastic veneer that is laminated onto the agglomerated sheathing

and then wound, by way of conventional means, continuously onto the foamed core of the cork. This results in improved print quality due to printing on a flat surface as opposed to a round surface. Furthermore, a wider selection of print colors is available because the inks will not be in direct contact with the product.

[0034] Endcaps, which match the compression and barrier characteristics of the fabricated cork body have the ability to have printed, embossed and/or raised lettering and/or designs. The end caps further provide the ability to control the ingress of oxygen, CO<sub>2</sub> and other gases into and out of the body of the fabricated cork and subsequently into and out of the enclosed headspace area of the container. Further control and modification of the entrapped headspace gas is accomplished by the use of oxygen absorbers or scavengers blended into one or more layers of the end cap. The oxygen absorbers would be located in layers outboard of the primary oxygen barrier layer so as to improve their efficiency relative to the headspace gases.

[0035] The present invention is a fabricated closure for liquid containers comprised of an inner core 12 which is preferably fabricated from an extruded olefinic material, which has been foamed and/or filled with pieces of cork. The density of the olefinic material is preferably in the range from 0.2 to 0.8 g/cm<sup>3</sup>. The foamed and/or filled olefinic core 12 is produced using normal extrusion manufacturing techniques known to those experienced in the art and may include direct injection of a foaming agent (gas) or the use of chemical blowing agents typically used for this type of process or both simultaneously. The preferred type of chemical blowing agents are those in which an endothermic reaction causes the formation of CO<sub>2</sub> gas. In addition, the endothermic reaction allows for improved control of the bubble size over other non-endothermic chemical blowing agents. Bubble size and uniformity throughout the extrudate are important elements in the consistent production of acceptable foamed and/or filled cores 12.

[0036] A sheathing layer 14 is extrusion mounted or laminated to the outside of the foamed and/or filled core 12. The sheathing layer 14, if extrusion mounted, is preferably an aggregate of small pieces of cork in a polymer matrix. In a variation of the technology, the sheathing layer 14 may be cork or agglomerated cork particles supplied in roll form.

[0037] If the sheathing 14 is laminated to the core 12, it is preferably affixed to the foamed and/or filled core 12 by means of an adhesive 16 deemed acceptable for direct or indirect food contact by the U.S. Food and Drug Agency. The preferred adhesive 16 materials are thermoplastic hot-melt adhesives although other U.S. Food and Drug Agency compliant adhesive materials may be used.

[0038] The sheathing layer 14 may also have a decorative layer 18 adhesive mounted to it for decorative purposes. Examples of this decorative layer include cork veneers as well as paper or plastic films printed to look like cork. The outer decorative layer 18 of the sheathing layer 14 may also be printed with a logo, design or name of a particular company, manufacturer, customer or product.

[0039] The agglomerated sheathing 14 compensates for the natural tendency of the foamed core 12 to take a permanent set. The unique ability of natural cork to rapidly recover from a radial compressive load along with its ability

to provide a constant and uniform pressure against any irregularities commonly found in the finish of glass bottles eliminates the concern over the propensity for the foamed plastic component to take a set. The decorative layer 18, which may be adhesive laminated to the agglomerated cork-sheathing layer 14, provides an elegant appearance to the shortcomings of plastic corks, providing the present cork with the appearance of natural cork. Corks made according to the present invention are virtually indistinguishable from a hand cut, natural cork. This ability to mimic natural corks applies to the fabricated cork's ability to be inserted into bottle finishes using automatic cork insertion equipment. This ease of use also translates to the consumer's ability to use the traditional corkscrew in the fabricated cork's removal from the bottle.

[0040] In order to protect the wine from contamination from the cork, paper or printing inks, an additional layer or layers may be extrusion coated over the sheathed (14), foamed and/or filled core 12. The process of extrusion coating is well known in the wire and cable business as the preferred method of putting a protective, insulating layer to the outside of a copper or aluminum wire. In fabricated corks the protective layer 22 is normally a single material but it may be produced by means of the coextrusion process to contain multiple layers. Typically, the protective layer 22 will be an olefinic material, preferably Union Carbide's FLEXOMER POLYOLEFIN which has been tested to impart no organoleptic deviation to the product coming in contact with it.

[0041] Another coextruded layer (or layers) 20 which may be included in the present fabricated cork manufacturing process protects the wine or product from the ingress of oxygen, which is normally found within the cellular structure of foamed plastic, as well as within the cellular structure of agglomerated and natural corks. The position of the oxygen barrier layer or layers 20 used to control the ingress of oxygen is typically between the sheathing layer 14 and the protective layer 22.

[0042] If required, the oxygen barrier layer 20 made from a material such as ethyl vinyl alcohol, nylon, MDX6 nylon, poly acrylonitrile or polyvinylidene chloride (PVDC) may be coextruded along with the protective layer 22. Depending upon the oxygen barrier material chosen and one or more of the materials it must come in contact with, an intermediate material may be extruded or applied between the protective layer 22 and the oxygen barrier layer 20 and, if required to improve adhesion between layers, i.e. between the oxygen barrier layer 20 and the sheathing layer 14. The primary purpose of the intermediate material is to provide a functional barrier between the product and the oxygen barrier material 20 as well as to act as a polymer flow compatibilizer, commonly referred to as a tie layer.

[0043] On the opposite side, (inside), of the oxygen barrier layer 20 there may again be a flow compatibilizing polymer which may be coextruded in combination with the outer protective layer 22, an intermediate tie layer (if one was required), and the barrier resin. An alternative to this method of applying the adhesive which allows the oxygen barrier material to adhere to the laminated sheathing 14 is to apply a suitable adhesive directly to the outer surface of sheathing layer 14 or surface which the barrier layer must adhere to.

[0044] The end caps 24 of the fabricated present cork are produced separately by manufacturing a coextruded film or

sheet containing an oxygen barrier material layer. The film, once produced, is thermally welded (heat-sealed) to the ends of the cork.

[0045] In a variant of the end manufacturing method, a single material containing a physical blend of polymeric materials, including an oxygen barrier material and a chemical blowing agent, is extruded and formed into end caps by punching the end caps 24 from the sheet. Additionally, end caps 24 can be produced from a monolithic material by means of a compression or injection-molding process in addition to a coextrusion process to produce film or sheet from which the end caps 24 would be cut out.

[0046] End caps 24 produced from monolithic materials can have barrier films laminated by way of insert molding of the films to the end caps 24 or by thermally welding the films to the end caps 24 prior to their being mated to the fabricated cork body. End caps 24 produced by any of the above means may have one or more layers foamed to make the end caps 24 more malleable for the insertion process.

[0047] Once the end caps 24 have been manufactured they are applied to the ends of the cork by adhesive means which would include using a US Food & Drug compliant adhesive system with the preferred method being a hot melt adhesive material. Other methods such as ultrasonic or hot plate welding as well as traditional heat sealing methods may also be used. The end caps 24 can also include an active oxygen scavenger system such as Amasorb ABPA-1000 and ABPA-2000 or a food grade iron powder such as Hoeganaes Corporation's Ancor FG-100. These materials are useful in significantly reducing the concentration of oxygen in the headspace of the filled and sealed (corked) containers.

[0048] While the description above refers to particular embodiments of the present invention, it will be understood that many modifications may be made without departing from the spirit thereof. The accompanying claims are intended to cover such modifications as would fall within the true scope and spirit of the present invention.

What is claimed is:

1. A closure for a container, comprising:

an olefinic core element; and

an agglomerated cork sheathing layer surrounding the core element.

2. The closure for a container as set forth in claim 1 wherein the core element is fabricated from an extruded olefinic material.

3. The closure for a container as set forth in claim 2 wherein the core element is foamed with pieces of cork.

4. The closure for a container as set forth in claim 2 wherein the core element is filled with pieces of cork.

5. The closure for a container as set forth in claim 1 wherein the core element has a density in the range of 0.2 g/cm<sup>3</sup> to 0.8 g/cm<sup>3</sup>.

6. The closure for a container as set forth in claim 1 wherein the sheathing layer is extrusion mounted to the core element.

7. The closure for a container as set forth in claim 1 wherein the sheathing layer is laminated to the core element.

8. The closure for a container as set forth in claim 1 wherein the sheathing layer is laminated to the core element by means of thermoplastic hot-melt adhesives.

9. The closure for a container as set forth in claim 1 wherein the sheathing layer is an aggregate of small pieces of cork in a polymer matrix.

10. The closure for a container as set forth in claim 1 further comprising a decorative layer adhered to the sheathing layer.

11. The closure for a container as set forth in claim 10 wherein the decorative layer is formed from a cork veneer.

12. The closure for a container as set forth in claim 1 further comprising an outer protective layer.

13. The closure for a container as set forth in claim 12 wherein the outer protective layer is extrusion coated.

14. The closure for a container as set forth in claim 12 wherein the outer protective layer is an olefinic material.

15. The closure for a container as set forth in claim 12 wherein the outer protective layer consists of a plurality of sublayers.

16. The closure for a container as set forth in claim 12 wherein the outer protective layer comprises:

at least one oxygen barrier sublayer; and

at least one protective sublayer.

17. The closure for a container as set forth in claim 16 wherein the oxygen barrier layer is selected from the group consisting of ethyl vinyl alcohol, nylon, MDX6 nylon, poly acrylonitrile and polyvinylidene chloride.

18. The closure for a container as set forth in claim 1 further comprising end caps attached to the opposite ends of the closure.

19. The closure for a container as set forth in claim 18 wherein the end caps include an oxygen barrier material.

20. The closure for a container as set forth in claim 1 wherein the end caps are attached using a method selected from the group consisting of hot melt adhesive, ultrasonic welding, hot plate welding and heat sealing.

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