(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 777 169 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.04.2007 Bulletin 2007/17

(51) Int Cl.:
***B65D 51/28** (2006.01)*

(21) Application number: **06021955.7**

(22) Date of filing: **19.10.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **21.10.2005 US 256625**

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(54) **Multicomponent package**

(57) The invention is directed to a multicomponent package having an upper and lower component that are releasably attached to each other and wherein one of either the upper or lower component has high oxygen barrier properties and the other component has low oxygen barrier properties. In one embodiment, one of the components has an oxygen transmission rate of at least 4,000 cc at STP/m^2/24 hr/atm, and the other component has an oxygen transmission rate of less than 1,000 cc at STP/m^2/24 hr/atm. The multicomponent package can be used to package food products that may be incompatible with each other or where it may be desirable to package each food product in differing packaging environment. As a result, two or more dissimilar food products may be stored, shipped, and/or sold in the same package.

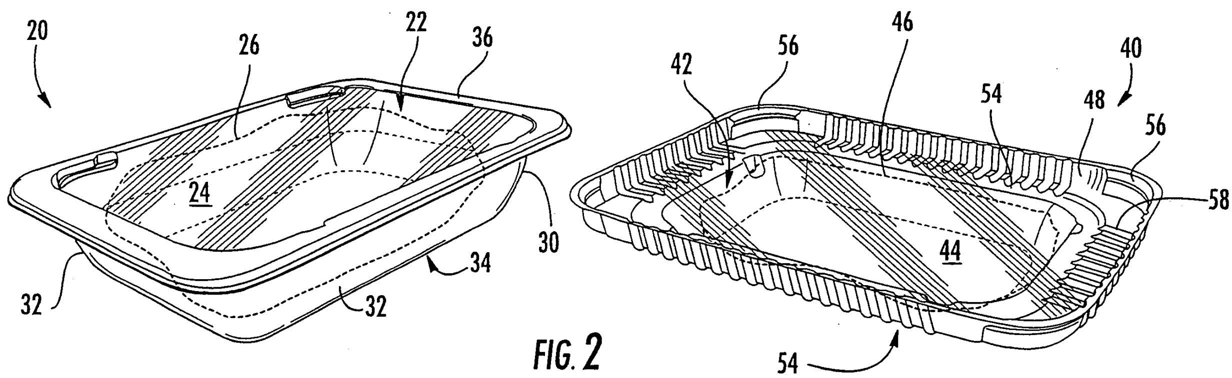

FIG. 2

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Description

BACKGROUND OF THE INVENTION

[0001] The invention relates generally to packaging for food products and more particularly to barrier and non-barrier packaging for food products.

[0002] Various forms of packaging, particularly for food products, use a relatively rigid substrate, such as a foam tray, in which a product is supported. If the product is to be displayed, the packaging may also include a lidding or lidstock that is used to cover and enclose the product within the tray. The lidding may comprise a transparent film or laminate that is bonded to the tray around the product, generally by forming a heat seal between the film and tray, to thereby enclose the product within the package.

[0003] In recent years, consumer demand for fresh naturally preserved food products, such as meat and vegetables, has continued to grow. To meet this demand, it may be desirable to enclose a food product in a package having a low or high oxygen atmosphere. For example, in the packaging of meat products, particularly red meat products, packaging the meat in a low oxygen package having barrier properties may help to extend the shelf-life and improve the overall appearance of meat products. Modified atmosphere packaging (MAP) and/or vacuum packaging are two forms of packaging that can be used to help extend the shelf-life of the packaged product. MAP comprises packaging the food product in an atmosphere that has been modified to extend the shelf-life and/or improve the appearance of the packaged product. The appearance of a meat product is generally very important at the point of purchase. Common gases that may be used in MAP include oxygen, carbon dioxide, carbon monoxide, nitrogen, and noble gases such as argon. In vacuum packaging, a low oxygen atmosphere is obtained by evacuating the atmosphere in the packaging prior to sealing the package.

[0004] In MAP applications, the raw meat is typically packaged in either a high level or low level oxygen (O_2) environment. Packaging systems which provide low levels of oxygen are generally preferable because the fresh quality of meat can be preserved longer under anaerobic conditions than under aerobic conditions. Maintaining low levels of oxygen minimizes the growth and multiplication of aerobic bacteria. One example of a modified atmosphere environment is a mixture of gases consisting of about 30 percent carbon dioxide (CO_2) and about 70 percent nitrogen (N_2). Typically, low oxygen packaging environments may provide an atmosphere that helps prevent or inhibit excessive metmyoglobin (brown) formation. In some low level oxygen environments, the raw meat may a less desirable purple-red color which few consumers would associate with freshness. The deoxymyoglobin (purple-red color) is generally unacceptable to most consumers. Deoxymyoglobin is a precursor protein which when oxygenated forms oxymyoglobin in a normal atmosphere of oxygen. Oxymyoglobin is responsible for the bright red color of meat which most consumers associate with freshness.

[0005] To maintain the desired level of oxygen in the package, the tray and the lidding typically have barrier properties that limit the amount of oxygen that is transmittable through the package.

[0006] In today's fast paced world, consumers are increasingly demanding fresh prepackaged foods that can be cooked and/or heated at home to provide a meal. In some cases it may be desirable to package two or more different food products together to provide a ready to heat or cook meal. However, it may not always be desirable to package some fresh food products together. For example, as discussed above, in packaging meat products it may be desirable to package the meat in a high barrier package that limits the amount of oxygen that can be transmitted into and out of the package. Some food products, such as fresh fruits and vegetables, are respiring products and may require a package having a desired level of permeability (for O_2 and CO_2) that permits the package to breathe. The quality and shelf-life of fresh vegetables and fruits may generally be improved by packaging them in a package that is capable of breathing at a rate that maintains a desired mix of oxygen, carbon dioxide, and water vapor inside the package. The accumulation of water vapor and other gases may adversely affect the shelf-life and quality of the packaged food product. As a result, it may not be desirable to package such food products in a high barrier package, such as those that may be used in the packaging of meat products.

[0007] In some circumstances, it may be desirable to package fresh fruits and vegetables in a Equilibrium Modified Atmosphere Packaging (EMAP). In EMAP, the packaging can be adapted to the respiration of the product so that an equilibrium modified atmosphere may be established in the package. EMAP may be used to slow down the normal respiration of the product so that the shelf-life of the product may be extended and the quality of the product improved.

[0008] Thus, the dissimilar packaging requirements of certain products present a challenge that presently limit what types of fresh food products can be packaged together.

BRIEF SUMMARY OF THE INVENTION

[0009] In one embodiment, the invention is directed to a multicomponent package comprising an upper component and a lower component that are releasably attached to each other, wherein one of either the upper or lower component has high oxygen barrier properties and the other component has low oxygen barrier properties. In one embodiment, one of the components has an oxygen transmission rate of at least 1,200 cc at STP/m^2/24 hr/atm, and the other component has an oxygen transmission rate of less than 1,000 cc at STP/m^2/24 hr/atm. The multicomponent package may be used for packaging items requiring dissimilar packaging environments in a single package.

[0010] The multicomponent package may be particularly useful for packaging food items together that normally cannot be packaged together. For example, in one embodiment, a food product such as fresh vegetables may be packaged in a component having an oxygen transmission rate that is sufficient to permit the food item to breathe. The shelf-life and desirable appearance of the food product may be extended by packaging the food product in a packaging environment that is tailored for the specific food product. A second food product, such as a meat product, may be packaged in a component having barrier properties that substantially limit the amount of oxygen in the component. Similarly, the self-life and desirable appearance of the second food product may be extended by packaging the second food product in a packaging environment that is tailored for the specific food product. The multicomponent package can be used to package food products that may be incompatible with each other or where it may be desirable to package each food product in differing packaging environments. As a result, two or more dissimilar food products may be stored, shipped, and/or sold in the same package.

[0011] In one embodiment, the multicomponent package comprises a packaging system wherein the two dissimilar food items are disposed in a ready to heat/cook meal package. For example, the upper and lower components may comprise materials that can withstand temperatures that are normally encountered in microwave and conventional oven cooking. In one embodiment, one of the components may include a meat product that can be cooked/heated while disposed in the component. In another embodiment, one of the components may include a vegetable product that can be cooked/heated while still disposed in the component. As a result, the multicomponent package may comprise a package that permits a consumer to purchase two or more fresh food products, such as meats and vegetables, that can be conveniently heated in their respective component packaging with minimal effort on behalf of the consumer.

[0012] The multicomponent package may include an upper component having an oxygen transmission rate of at least 4,000 cc at STP/m^2/24 hr/atm, and the lower component may have an oxygen transmission rate of less than 1,000 cc at STP/m^2/24 hr/atm. In another embodiment, the upper component may include a vegetable product and the lower component may include a meat product.

[0013] Thus, the invention provides a multicomponent package that allows food products requiring varying packaging environments to be bundled together in the same package.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0014] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 is a cross-sectional perspective view of the multicomponent package where a portion of the package has been cut away for ease of visualization;

FIG. 2 is a perspective view depicting the upper and lower components separated from each other;

FIG. 3 is a cross sectional side view of the multicomponent package wherein the upper component has been vacuum packaged to define a passageway between the upper and lower components through which gases may be transmitted into and out of the upper component;

FIG. 4 is a perspective view of the multicompartment package wherein a tubular sleeve is wrapped about the upper and lower components to thereby releasably attach them together; and

FIG. 5 is partial depiction of the upper and lower component that illustrates a lip on the upper component engaging a corresponding surface on the lower component to thereby releasably attach them together.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The present inventions now will be described more fully hereinafter with reference to the accompanying drawings in which some but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0016] With reference to FIG. 1, a multicomponent package that is in accordance with the invention is illustrated and broadly designated by reference number **10.** In one embodiment, the multicomponent package comprises a lower component **20** and an upper component **40** that can be releasably attached together. The upper and lower components **40, 20** each include an interior space **22, 42** in which an item, such as a food product, may be disposed. Each component may also include a lower and upper lidding **24, 44,** also referred to as a lidstock, that can be used to sealably enclose a food product therein. The multicomponent package provides a packaging system wherein two or more food products can be packaged separately within the same package. The multicomponent package can be used to package food products that may be incompatible with each other or where it may be desirable to package each food product in differing packaging environment. As a result, two or more dissimilar food products may be stored, shipped, and/or sold in the same package.

[0017] In one embodiment, the upper and lower components are arranged so that the interior space and lidding of each component are disposed opposite each other in a face-to-face relationship. In some embodiments, the upper component **40** and the lower and upper liddings **24, 44** of each respective component comprise a visually transparent material through which the items disposed in both components are observable. In this regard, FIG. 1 illustrates an embodiment wherein a vegetable product is disposed in the upper component and a meat product is disposed in the lower component. An individual, such as a retailer or consumer, may then observe both items by looking through the upper component. This may be particularly useful in food products where the visual appearance of the product may be important in making a purchasing decision.

[0018] In one embodiment, the multicomponent package provides a means whereby two or more dissimilar items or two or more items requiring different packaging environments may be packaged and sold in the same package. In one embodiment, this may be accomplished by providing one of the components to have barrier properties that are different than the barrier properties of the other component. For example, one of the upper and lower components may have low barrier properties, such as an oxygen transmission rate of at least 2,500 cc at STP/m^2/24 hr/atm or greater, and the other component may have high barrier properties, such as an oxygen transmission rate of less than 1,000 cc at STP/m^2/24 hr/atm. It should be recognized that the OTR of the upper and lower components may be selected for the type of food product that is disposed in each respective component. For example, some fresh produce food products may have an improved shelf-life and/or appearance under a reduced oxygen concentration that may help slow down the rate at which the product respires, while other food products may have an improved shelf-life and/or appearance in conditions that permit the product to respire at a normal or accelerated rate.

[0019] A multicomponent package wherein one of the components has high barrier properties and the other component has low barrier properties may provide many advantages. For instance, as shown in FIG. 1, a high barrier component may be used to package a food product, such as a meat product, in a packaging environment that may be used to extend the shelf-life of the product and to help the product maintain a desirable appearance during retail display. As discussed above, such environments may include a modified atmosphere package (MAP), vacuum package, and the like. In addition, a low barrier component may be used to package a food product, such as vegetables, where breathability of the interior of the component may be desirable. As a result, two food products requiring different packaging environments may be packaged together in a single package. In one embodiment, the multicomponent package may be useful for packaging fresh vegetables and meat together in a single package. It should be recognized that the multicomponent package can be used to package a variety of food products together including such food products as meats, vegetables, pastas, rice, sauces, desserts, etc. It should also be recognized that products are not limited to any specific location within the multicomponent package provided that the food product can be disposed in a component having the desired barrier properties and packaging atmosphere. For example, in some embodiments, a meat product may be disposed in the upper component and a vegetable product can be disposed in the lower component, and vice versa.

[0020] The multicomponent package may be used in conjunction with a variety of different packaging environments. For example, in one embodiment one of the components may comprise a MAP, vacuum package, breathable package, Equilibrium Modified Atmosphere Packaging (EMAP), or the like. Suitable MAP environments include, without limitation, atmospheres comprising oxygen, nitrogen, carbon dioxide, carbon monoxide, and combinations thereof. In some MAP environments, the interior space of the component may include substantially no oxygen. In other embodiments, the modified atmosphere environment may comprise a mixture of gases comprising about 30 percent carbon dioxide (CO_2) and about 70 percent nitrogen (N_2). In another embodiment, one of the components may include a vacuum package in which substantially the entire atmosphere, including oxygen, has been evacuated from within the interior space of the component. In yet other embodiments, one of the components may comprise a low barrier component wherein gases, such as oxygen, can enter and exit the interior space of the component.

[0021] The multicomponent package may be used to package a variety of food products that are dissimilar from each other and that may have expected shelf-lives that are also dissimilar. For instance, many fresh meat products may have a shelf-life that may be up to about 4 to 6 weeks, depending upon the atmosphere, while fresh vegetables on the other hand may have a shelf-life on the order of 2 to 3 weeks. At first glance, it may not seem desirable to package two items having dissimilar shelf-life together because if one of the products expires before the other product, the entire package may have to be discarded. However, the multicomponent package provides a system wherein the two dissimilar items can be packaged together to provide a ready to heat/cook meal.

[0022] In another embodiment, the multicomponent package may also provide a convenient medium in which a food product may be heated. In this embodiment, each component of the multicomponent package may be selected to provide a means for heating/cooking dissimilar items under different conditions. For example, in one embodiment, a food product disposed in the upper component may require microwaving for a certain period of time, while a food product in the lower component may require oven cooking at a desired temperature for a certain period of time. To meet these requirements, the upper and lower components may each comprise a material that is selected for the particular product being packaged. In one embodiment, one or more of the components may comprise a microwavable material or ovenable material. In another embodiment, one of the components may comprise a microwavable material while the other material comprises an ovenable material.

[0023] In one embodiment, the multicomponent package comprises a microwave oven safe package that permits an item to be heated in a microwave oven while disposed in the interior of the component. In yet another embodiment, the flexible package may be configured to withstand temperatures in excess of 150° F, 200° F, 225° F, 250° F, 280° F, 350° F and 400° F, such as those that may be encountered when cooking/heating a food product in a microwave or conventional oven. In some embodiments, the multicomponent package may be capable of withstanding temperatures in excess of about 450° F. In some embodiments, the multicomponent package may also include one or vents to exhaust steam from the package during cooking. In one embodiment, the vents remains closed tightly until pressure from gas in the interior reaches approximately 3 mbar during microwaving or oven cooking. The vent may then remain open to vent gas from the package. Many suitable vents including gas holes covered by tape or a pressure relief device may be used to vent hot air/steam from within the package. The vents may also be operable to respire gas formed in the package prior to heating from food or during freezing.

[0024] Referring back to FIG. 1, the lower component 20 may comprise a tray-like structure having a first interior space 22 in which an item 26 may be disposed. The upper component 40 may comprises a lid-like structure having a second interior space 42 that is configured to serve as a lid for lower component 20. In this regard, FIG. 1 illustrates an embodiment wherein the upper component is releasably attached to the lower component in a lid like manner. As shown, the upper and lower components may be arranged so that the interior space and lidding of each respective component are disposed opposite each other in a face-to-face orientation. As discussed above, the orientation of the upper and lower components may provide a package having a visually aesthetic appearance that may help improve the overall appearance of the multicomponent package. Additionally, the visually transparent upper component may permit a consumer to observe the food products disposed in both the upper and lower components. In addition, the lower component may comprise a material that is substantially printed or opaque. The opaque material may be used to mask the accumulation of unsightly liquids that may have pooled on or about the lower component. Such liquids may result from cooking/heating the item in the lower component.

[0025] In some embodiments, the multicomponent package may also be used as a convenient means for displaying and/or storing a packaged item. For example, a food product may be placed into each respective component at a point of processing and then the individual components may be releasably attached together to form the multicomponent package. The multicomponent package and its contents may be stored or shipped to a retailer. Upon reaching the retailer, the multicomponent package and its contents may be displayed and sold.

[0026] With reference to FIG. 2, the lower and upper components **20, 40** are depicted as being separated from each other. In one embodiment, the upper component **40** includes inner sidewalls **52** and a base **54** which define interior space **42.** A food product **46,** represented by the dashed lines, is depicted as being disposed in the interior space **42** of the upper component. A lidstock **44** is attached to the upper component **40** and encloses the food product within the interior space.

[0027] As discussed above, lidstock **44** may have barrier or non-barrier properties. In one embodiment, the lidstock **44** has an oxygen transmission rate of at least 4,000 cc at STP/m^2/24 hr/atm or greater. In some embodiments, the lidding may have an OTR of at least 1,200, 2,500, 4,000, 4500, 5,000, 6,000, cc (at standard temperature and pressure (STP))/m^2/24 hr/atm or greater, as measured according to ASTM D-3985. Unless otherwise indicated, all references to OTR in this application have been determined according to ASTM D-3985 at 23° C and 0% relative humidity.

[0028] The lidstock may be attached to the upper component in a variety of ways including heat seal bonding, ultrasonic bonding, adhesive bonding, and the like. In heat sealing the lidstock to the upper component **40,** the surface layer of the upper component may contact and meld with an inner surface of the lidstock **44** to form a heat seal. To facilitate a strong heat seal, the surface layer of the upper component may comprise one or more thermoplastics that are compatible with the thermoplastic composition of the lidstock **44.**

[0029] In some embodiments, the upper component 40 may also include outer side walls **48** that are arranged and configured to engage a surface on the lower component **20** and thereby releasably attach the lower and upper components together. In another embodiment, the outer side walls **48** may define the interior space of the upper component (not illustrated). It should be recognized that the upper component can have any desired configuration or shape, e.g., rectangular, round, oval, etc. provided that the upper and lower components can be releasably attached to each other.

[0030] In another embodiment, the upper component **40** may also include one or more lips **56** that are disposed on the outer wall **48** and that are configured to engage a flange **36** disposed on the lower component and to thereby releasably attach the upper and lower components together. This is discussed in greater detail below. The upper component may also include a plurality of ribs **58** that may improve the strength of the upper component and may also help facilitate transmission of gases between the upper and lower components.

[0031] The lower component **20** may include product support member **30** having a cavity **22** or interior space formed therein and a product **26,** represented by the dashed lines, disposed within the cavity. Support member **30** may be in the form of a tray having side walls **32** and a base **34** which define the cavity **22,** and further may include a peripheral flange **36** extending outwardly from the cavity. Lidstock **24** forms a lid on the lower component and encloses the product **26** within cavity **22** by being heat-welded or otherwise bonded to flange **36.** In some embodiments, the lidstock **24** may be attached to the support member using other means including adhesive bonding, ultrasonic bonding, etc.

[0032] Support member **30** can have any desired configuration or shape, e.g., rectangular, round, oval, etc. Similarly, flange **36** may have any desired shape or design, including a simple, substantially flat design which presents a single sealing surface as shown, or a more elaborate design which presents two or more sealing surfaces, such as the flange configurations disclosed in U.S. Pat. Nos. 5,348,752 and 5,439,132, the disclosures of which are hereby incorporated herein by reference.

[0033] Suitable materials from which support member **30** can be formed may include, without limitation, polyvinyl chloride, polyethylene terephthalate, polystyrene, polyolefins such as high density polyethylene or polypropylene, paper pulp, nylon, polyurethane, and combinations thereof. The support member may be foamed or non-foamed (e.g., solid or semi-solid) as desired. Support member **30** may have oxygen transmission barrier attributes, particularly when product **26** is an oxygen-sensitive food product. When such oxygen-sensitive products are to be packaged in a modified atmosphere environment to extend either bloom-color life or shelf-life, support member **30** may have a thickness and composition sufficient to provide an oxygen transmission rate of no more than about any of the following values: 1000, 500, 150, 100, 50, 45, 40, 35, 30, 25, 20, 15, 10, and 5 cubic centimeters (at standard temperature and pressure) per square meter per day per 1 atmosphere of oxygen pressure differential measured at 0% relative humidity and 23° C. Unless otherwise stated all references to oxygen transmission rate are measured according to ASTM D-3985.

[0034] To achieve oxygen barrier attributes, support member **30** may comprise one or more oxygen barrier components, such as a substantially oxygen impermeable film or laminate in order to provide oxygen barrier attributes to the support member. Such barrier components may be incorporated within structural sections or aspects of the support member--or optionally incorporated in an inner surface layer or film (not shown) laminated or otherwise bonded to form the inside surface of the support member, as described in U.S. Pat. Nos. 4,847,148 and 4,935,089, and in U.S. Ser. No. 08/326,176, filed Oct. 19, 1994 and entitled "Film/Substrate Composite Material" (published as EP 707 955 A1 on Apr. 24, 1996), each of which is incorporated herein in its entirety by reference.

[0035] In addition to (or as an alternative to) providing oxygen barrier attributes, the inner surface layer or film of the support member may enhance the sealability of the lidstock **24** to the support member **30.** In heat sealing the lidstock to the support member **30,** the surface layer of the support member may contact and meld with an inner surface of the lidstock **24** to form a heat seal. To facilitate a strong heat seal, the surface layer of the support member may comprise one or more thermoplastics that are compatible with the thermoplastic composition of the lidstock **24.** In some embodiments, the inner surface layer may also have antifog properties to help enhance the clarity of the film. Suitable antifog additives may include, without limitation, polyglycerol esters, mono and diglycerides and combinations thereof.

[0036] The height of the product **26** within the tray may be low profile or high profile. "Low profile" refers to packages wherein the product has a maximum height which is below the maximum height of support member **30,** i.e., the level at which flange **36** is located. "High profile" products may also be packaged in accordance with the present invention, i.e., those having a maximum height which is above the level at which flange **36** is located so that the portion of the product which extends above the level of flange **36** will be in contact with lidstock **24.**

[0037] With reference to FIG. 3, a cross-sectional view of the multicomponent package is illustrated. As shown in FIG. 3, a space **60** may exist between the lower lidding **24** and the upper lidding **44.** In one embodiment, space **60** can be created by vacuum sealing either the lower or upper lidding to form a so called "skin-pack." Space **60** may help provide clearance and define a passageway through which gases, such as moisture vapor, carbon dioxide, oxygen, and the like may be transmitted into and out of one of the components having low barrier properties. In the illustrated embodiment, the wavy arrows represent gases being transmitted through the upper component.

[0038] As discussed above, the upper and lower components may be attached together in a variety of ways. For example, as shown in FIG. 3 the upper component may include and outer wall **48** that is configured and arranged to engage a corresponding surface **38** on the lower component **20.** In some embodiments, the clearance between outer wall **48** and surface **38** may be such that a frictional fitting is formed between the upper and lower components. In some embodiments, the outer wall **48** may also include one or more lips that are configured to engage and "snap" into place over the lower component. Other methods of attaching the upper and lower components together may include, for example, adhesives, tape, labels, etc.

[0039] In another embodiment, the multicomponent package may also include a tubular sleeve that is configured to wrap about the upper and lower components to thereby releasably attach them together. In this regard, FIG. 4 illustrates an embodiment wherein the upper and lower components are disposed in a tubular sleeve **66** that releasably attaches the two components together. Tubular sleeve may comprise a variety of materials including paperboard, thermoplastic or thermoset materials, and the like. In one embodiment, the tubular sleeve comprises a shrinkable material that is wrapped about the upper and lower components. In some embodiments, the tubular sleeve may also include printed indicia **68,** such as alpha or numeric symbology, e.g., a bar code, labeling and branding information, product ingredients and warnings, cooking instructions, and the like.

[0040] With reference to FIG. 5, an embodiment of the multicomponent package is illustrated in which the upper component **40** includes a lip **56** that extends inwardly from an outer wall of the upper component. The lip **56** is configured and arranged to engage and "snap-onto" a corresponding surface of the lower component, such as the flange **36.** The lip provides one method whereby the upper and lower components may be releasably attached together.

[0041] In one alternative embodiment, the lidstocks **24, 34** may comprise a single or multilayer film or laminate which is substantially impermeable to oxygen. In another embodiment, one or more of the lidstocks may comprise a single or multilayer film or laminate having low barrier attributes. In one embodiment, the lidstock may comprise a laminate comprising two or more films. The film(s) may be monolayer, two-layer, or have three or more layers. The lidstock **24** may be laminated to the support member (e.g., a tray) to form sealed lower component **20** in which a food product **26** may be enclosed.

[0042] In embodiments, where either the upper or lower lidstocks **24, 34** have low barrier attributes, the lidstocks **24, 34** may have an OTR of at least 1,200, 2,500, 4,000, 4500, 5,000, 6,000, or 10,000 cc (at standard temperature and pressure (STP))/m^2/24 hr/atm or greater.

[0043] In embodiments, where either the upper or lower lidstocks **24, 34** have barrier attributes, the lidstocks **24, 34** may comprise a film or laminate having one or more barrier layers, which incorporate one or more components ("barrier components") that markedly decrease the oxygen transmission rate through the layer and thus the film incorporating such layer. Accordingly, the barrier layer of the film that is utilized in a lidstock incorporated in a package may either help to exclude oxygen from the interior of the package--or to maintain a modified atmosphere within the package. In one embodiment, the lidstock may have a thickness and composition sufficient to provide an oxygen transmission rate of no more than about any of the following values: 1000, 500, 150, 100, 50, 45, 40, 35, 30, 25, 20, 15, 10, and 5 cubic centimeters (at standard temperature and pressure) per square meter per day per 1 atmosphere of oxygen pressure differential measured at 0% relative humidity and 23° C.

[0044] Useful barrier components may include: ethylene/vinyl alcohol copolymer ("EVOH"), polyvinyl alcohol ("PVOH"), vinylidene chloride polymers ("PVdC"), polyalkylene carbonate, polyester (e.g., PET, PEN), polyacrylonitrile ("PAN"), and polyamide. In some embodiments the lidstock may also include one or more thermoplastic polymers including polyolefins, polystyrenes, polyurethanes, polyvinyl chlorides, polyesters, and ionomers provided that the desired barrier properties of the lidstock may be maintained.

[0045] Suitable polyolefins for use in the lidstock may include LLDPE, low density polyethylene, high density polyethylene, metallocene catalyzed polyethylene, polypropylene, and oriented polypropylene, ethylene homo- and co-polymers and propylene homo- and co-polymers. Ethylene homopolymers include high density polyethylene ("HDPE") and low density polyethylene ("LDPE"). Ethylene copolymers include ethylene/alpha-olefin copolymers ("EAOs"), ethylene/unsaturated ester copolymers, and ethylene/(meth)acrylic acid. ("Copolymer" as used in this application means a polymer derived from two or more types of monomers, and includes terpolymers, etc.).

[0046] EAOs are copolymers of ethylene and one or more alpha-olefins, the copolymer having ethylene as the majority mole-percentage content. In some embodiments, the comonomer includes one or more C_3-C_{20} alpha-olefins, more preferably one or more C_4-C_{12} alpha-olefins, and most preferably one or more C_4-C_8 alpha-olefins. Particularly useful alpha-olefins include 1-butene, 1-hexene, 1-octene, and mixtures thereof.

[0047] EAOs include one or more of the following: 1) medium density polyethylene ("MDPE"), for example having a density of from 0.93 to 0.94 g/cm^3; 2) linear medium density polyethylene ("LMDPE"), for example having a density of from 0.926 to 0.94 g/cm^3; 3) linear low density polyethylene ("LLDPE"), for example having a density of from 0.915 to 0.930 g/cm^3; 4) very-low or ultra-low density polyethylene ("VLDPE" and "ULDPE"), for example having density below 0.915 g/cm^3; and 5) homogeneous EAOs. Useful EAOs include those having a density of less than about any of the following: 0.925, 0.922, 0.92, 0.917, 0.915, 0.912, 0.91, 0.907, 0.905, 0.903, 0.9, and 0.898 grams/cubic centimeter. Unless otherwise indicated, all densities herein are measured according to ASTM D1505.

[0048] The polyethylene polymers may be either heterogeneous or homogeneous. As is known in the art, heterogeneous polymers have a relatively wide variation in molecular weight and composition distribution. Heterogeneous polymers may be prepared with, for example, conventional Ziegler Natta catalysts.

[0049] On the other hand, homogeneous polymers are typically prepared using metallocene or other single site-type catalysts. Such single-site catalysts typically have only one type of catalytic site, which is believed to be the basis for the homogeneity of the polymers resulting from the polymerization. Homogeneous polymers are structurally different from heterogeneous polymers in that homogeneous polymers exhibit a relatively even sequencing of comonomers within a chain, a mirroring of sequence distribution in all chains, and a similarity of length of all chains. As a result, homogeneous polymers have relatively narrow molecular weight and composition distributions. Examples of homogeneous polymers include the metallocene-catalyzed linear homogeneous ethylene/alpha-olefin copolymer resins available from the Exxon Chemical Company (Baytown, Tex.) under the EXACT trademark, linear homogeneous ethylene/alpha-olefin copolymer resins available from the Mitsui Petrochemical Corporation under the TAFMER trademark, and long-chain branched, metallocene-catalyzed homogeneous ethylene/alpha-olefin copolymer resins available from the Dow Chemical Company under the AFFINITY trademark.

[0050] Another useful ethylene copolymer is ethylene/unsaturated ester copolymer, which is the copolymer of ethylene and one or more unsaturated ester monomers. Useful unsaturated esters include: 1) vinyl esters of aliphatic carboxylic acids, where the esters have from 4 to 12 carbon atoms, and 2) alkyl esters of acrylic or methacrylic acid (collectively, "alkyl (meth)acrylate"), where the esters have from 4 to 12 carbon atoms.

[0051] Representative examples of the first ("vinyl ester") group of monomers include vinyl acetate, vinyl propionate, vinyl hexanoate, and vinyl 2-ethylhexanoate. The vinyl ester monomer may have from 4 to 8 carbon atoms, from 4 to 6 carbon atoms, from 4 to 5 carbon atoms, and preferably 4 carbon atoms.

[0052] Representative examples of the second ("alkyl (meth)acrylate") group of monomers include methyl acrylate, ethyl acrylate, isobutyl acrylate, n-butyl acrylate, hexyl acrylate, and 2-ethylhexyl acrylate, methyl methacrylate, ethyl methacrylate, isobutyl methacrylate, n-butyl methacrylate, hexyl methacrylate, and 2-ethylhexyl methacrylate. The alkyl (meth)acrylate monomer may have from 4 to 8 carbon atoms, from 4 to 6 carbon atoms, and preferably from 4 to 5 carbon atoms.

[0053] The unsaturated ester (i.e., vinyl ester or alkyl (meth)acrylate) comonomer content of the ethylene/unsaturated ester copolymer may range from about 3 to about 18 weight %, and from about 8 to about 12 weight %, based on the weight of the copolymer. Useful ethylene contents of the ethylene/unsaturated ester copolymer may include the following amounts: at least about 82 weight %, at least about 85 weight %, at least about 88 weight %, no greater than about 97 weight %, no greater than about 93 weight %, and no greater than about 92 weight %, based on the weight of the copolymer.

[0054] Representative examples of ethylene/unsaturated ester copolymers may include ethylene/methyl acrylate, ethylene/methyl methacrylate, ethylene/ethyl acrylate, ethylene/ethyl methacrylate, ethylene/butyl acrylate, ethylene/2-ethylhexyl methacrylate, and ethylene/vinyl acetate. Another useful ethylene copolymer is ethylene/(meth)acrylic acid, which is the copolymer of ethylene and acrylic acid, methacrylic acid, or both.

[0055] Useful propylene copolymer may include propylene/ethylene copolymers ("EPC"), which are copolymers of propylene and ethylene having a majority weight % content of propylene, such as those having an ethylene comonomer content of less than 10%, preferably less than 6%, and more preferably from about 2% to 6% by weight.

[0056] Ionomer is a copolymer of ethylene and an ethylenically unsaturated monocarboxylic acid having the carboxylic acid groups partially neutralized by a metal ion, such as sodium or zinc, preferably zinc. Useful ionomers may include those in which sufficient metal ion is present to neutralize from about 15% to about 60% of the acid groups in the ionomer. The carboxylic acid is preferably "(meth)acrylic acid"--which means acrylic acid and/or methacrylic acid. Useful ionomers include those having at least 50 weight % and preferably at least 80 weight % ethylene units. Useful ionomers also include those having from 1 to 20 weight percent acid units. Useful ionomers are available, for example, from DuPont Corporation (Wilmington, Del.) under the SURLYN trademark.

[0057] In some embodiments, EVOH may have an ethylene content of between about 20% and 40%, preferably between about 25% and 35%, more preferably about 32% by weight. EVOH may include saponified or hydrolyzed ethylene/vinyl acetate copolymers, such as those having a degree of hydrolysis of at least 50%, preferably of at least 85%.

[0058] Vinylidene chloride polymer ("PVdC") refers to a vinylidene chloride-containing polymer or copolymer--that is, a polymer that includes monomer units derived from vinylidene chloride (CH2=CC12) and also, optionally, monomer units derived from one or more of vinyl chloride, styrene, vinyl acetate, acrylonitrile, and C1-C12 alkyl esters of (meth)acrylic acid (e.g., methyl acrylate, butyl acrylate, methyl methacrylate). As used herein, "(meth)acrylic acid" refers to both acrylic acid and/or methacrylic acid; and "(meth)acrylate" refers to both acrylate and methacrylate. Examples of PVdC include one or more of the following: vinylidene chloride homopolymer, vinylidene chloride/vinyl chloride copolymer ("VDC/VC"), vinylidene chloride/methyl acrylate copolymer, vinylidene chloride/ethyl acrylate copolymer, vinylidene chloride/ethyl methaerylate copolymer, vinylidene chloride/methyl methacrylate copolymer, vinylidene chloride/butyl acrylate copolymer, vinylidene chloride/styrene copolymer, vinylidene chloride/acrylonitrile copolymer, and vinylidene chloride/vinyl acetate copolymer. Useful PVdC may include those having between 75 and 95 weight % vinylidene chloride monomer. Useful PVdC includes that having from about 5 to about 25 weight %, from about 10 to about 22 weight %, and from about 15 to about 20 weight % comonomer with the vinylidene chloride monomer. Useful PVdC includes that having a weight-average molecular weight (Mw) of at least 80,000, such as at least 90,000, at least 100,000, at least 111,000, at least 120,000, at least 150,000, and at least 180,000; and between 80,000 and 180,000, such as between 90,000 and 170,000, between 100,000 and 160,000, between 111,000 and 150,000, and between 120,000 and 140,000. Useful PVdC may also include that having a viscosity-average molecular weight (Mz) of at least 130,000, such as at least 150,000, at least 170,000, at least 200,000, at least 250,000, and at least 300,000;

and between 130,000 and 300,000, such as between 150,000 and 270,000, between 170,000 and 250,000, and between 190,000 and 240,000.

[0059] A barrier layer that includes PVdC may also include a thermal stabilizer (e.g., a hydrogen chloride scavenger such as epoxidized soybean oil) and a lubricating processing aid (e.g., one or more acrylates).

[0060] Useful polyamides may include polyamide 6, polyamide 9, polyamide 10, polyamide 11, polyamide 12, polyamide 66, polyamide 610, polyamide 612, polyamide 6I, polyamide 6T, polyamide 69, copolymers made from any of the monomers used to make two or more of the foregoing homopolymers (e.g., copolyamide 6/12, polyamide 12, copolyamide 66/69/61, copolyamide 66/610, copolyamide 6/66, and copolyamide 6/69), and blends of any of the foregoing homo- and/or copolymers. Polyamide copolymers include: (a) copolyamide 6/12 comprising (i) caprolactammer in an amount of from about 20 to 80 weight percent (preferably 30 to 70 weight percent, more preferably 40 to 60 weight percent), and (ii) laurolactam mer in an amount of from about 80 to 20 weight percent; and (b) copolyamide 66/69/6I comprising 10 to 50 weight percent hexamethylene adipamide mer (preferably from about 20 to 40 weight percent), 10 to 50 weight percent polyamide 69 mer (preferably from about 20 to 40 weight percent), and 10 to 60 weight percent hexamethylene isophthalamide mer (preferably, from about 10 to 40 weight percent).

[0061] In some embodiments, the lidstock may also comprise one or more additional layers or films including one or more sealant layers, tie layers, bulk layers, etc. In some embodiments, the lidstock may comprise a trap-printable laminate having barrier properties. Such laminates are discussed in greater detail in U.S. Patent Nos. 6,627,273 and 6,769,227, the contents of which are hereby incorporated by reference.

[0062] As discussed above, one or more of the upper and lower components may be heatable in a microwave oven, conventional oven, or both. The upper and lower components may comprise materials that can withstand elevated temperatures that may be encountered in heating/cooking application that may be used in conjunction with a conventional or microwave oven. Suitable materials for conventional oven applications may have a heat distortion temperature in excess of at least 250° F, with a heat distortion temperature in excess of 300° F, 350° F, 400° F, and 450° F being more typical. In the context of the invention the term heat distortion temperature (HDT) (also called softening point or heat deflection temperature under load) refers to the maximum temperature at which a polymer can be used as a rigid material. Most HDT's can be defined as a single point on a deflection-temperature curve. The temperature where the deflection at the center reaches 0.010 inch is the heat distortion temperature. For amorphous polymers, the HDT is typically near the glass transition temperature whereas for highly crystalline polymers the HDT is closer to the melting point. Unless otherwise indicated, all heat distortion temperatures herein are measured according to ASTM D648.

[0063] Suitable materials for the cooking/heating applications may include nylons, various olefins such as polypropylene, crystallized polyethylene terephthalate, and poly-4-methyl pentene, polyimides, polyamide imides, polyether imides, polyether ketones, polyether sulfones, polyphenylene sulfides, liquid crystal polymers, and other high heat distortion temperature polymers.

[0064] In one alternative embodiment, the upper and lower components may comprise a layer of air cellular material. Air cellular material comprises two sheets of film or laminate that are adhered to each and include a plurality of air-filled cavities or "bubbles" that are formed between the sheets. Suitable air cellular material may be available from Sealed Air Corporation under the trademark Bubblewrap®. In one embodiment, the air cellular material may be formed from two sheets of film, such as nylon that have been sealed together to enclose a plurality of air cavities between the sheets. The air cavities within the air cellular material provide insulating properties that may effectively limit the amount of heat that is transferred to the outer surface of the support member. The size and quantity of air cavities may be selected so that a desired level of heat insulation is achieved. The rigidity of the support member and the air cellular material may also be selected to provide flexible packages having a desired degree of rigidity.

[0065] The upper and lower components may be formed from any material useful for the expected end use conditions, including polyvinyl chloride, polyethylene terephthalate, polystyrene, polyolefins (e.g., high density polyethylene or polypropylene), nylon, and polyurethane. The support member may be foamed or non-foamed as desired. Support member may have oxygen transmission barrier attributes. In some embodiments, where it may be desirable to expose the product to a high oxygen atmosphere, the support member may have an OTR of at least 4,000 cc at STP/m^2/24 hr/atm. In other embodiments, the support member may have an oxygen transmission rate less than about 4,000 cc at STP/m^2/24 hr/atm.

[0066] The film or laminate forming the lidstock may also be selected to withstand elevated temperatures. In one alternative embodiment, the lidstock comprises a sheet of film or laminate having a heat distortion temperature of at least 200° F. For microwave oven applications, the lidstock may have a heat distortion temperature in excess of at least 200° F. Suitable materials may include those discussed above, such as nylons, polyethylenes, polypropylenes, polyesters and copolymers thereof having a heat distortion temperature in excess of 200° F 225° F, 250° F, 280° F, 350° F and 400° F. In yet another embodiment, the lidstock may comprise a sheet of film or laminate having a heat distortion temperature of at least 450° F. For conventional oven applications, the lidstock should have a heat distortion temperature in excess of at least 250° F and for some applications in excess of

450° F. Suitable materials may include those discussed above, such as nylons, and polyesters, such as poly(ethylene terephthalate).

[0067] In another embodiment, the multicomponent package may also be suitable for use in sterilization conditions, such as are commonly found under retort conditions. Standard retort conditions may range from about 240° to 260° F, at 30 psig overpressure. The multicomponent package may be maintained under these conditions for a sufficient length of time to obtain commercial sterility. Typically, lower retort temperatures require longer cooking times.

[0068] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A two component package comprising:

an upper component and a lower component that are releasably attached together, each comprising a sealed compartment having an interior space for enclosing a food product therein, and wherein at least one of the upper and lower components has an oxygen transmission rate of at least 1,200 cc at STP/m^2/24 hr/atm, and the other component has an oxygen transmission rate of less than 1,000 cc at STP/m^2/24 hr/atm.

2. The two component package of claim 1, wherein the upper component has an oxygen transmission rate of at least 4,000 cc at STP/m^2/24 hr/atm.

3. The two component package of claim 1 or 2, wherein the interior spaces of each of the upper and lower components are disposed opposite each other in a face-to-face orientation.

4. The two component package of any one of the preceding claims, wherein the upper component comprises a thermoplastic material having a heat distortion temperature that is at least 225° F.

5. The two component package of any one of the preceding claims, wherein the lower component comprises a thermoplastic material having a heat distortion temperature that is 250° F or greater and includes a meat product disposed therein.

6. The two component package of any one of the preceding claims, wherein the lower component comprises a tray having a base and sidewalls defining an interior space and a lidding sealably enclosing a first food product therein, the tray having an oxygen transmission rate of less than about 1,000 cc at STP/m^2/24 hr/atm; and wherein the upper component comprises a lid removably attached to the tray and defining a second interior space disposed opposite the first interior space, and comprising a lidding sealably enclosing a second food product therein, the lid having an oxygen transmission rate of at least 1,200 cc at STP/m^2/24 hr/atm.

7. The multicomponent meal package of claim 6, wherein the second food product has a shorter shelf-life than the first food product.

8. The multicomponent package of claim 6 or 7, wherein the lid comprises a visually transparent material so that a food product disposed in the tray is observable through the lid.

9. The multicomponent package of any one of claims 6 to 8, wherein a meat product is disposed in the tray and a vegetable product is disposed in the lid.

10. The multicomponent package of any one of claims 6 to 9, wherein the lid has a heat distortion temperature of at least 280° F and the tray has a heat distortion temperature that is 300° F or greater.

11. The multicomponent package of any one of claims 6 to 10, wherein the interior space of the tray includes a modified oxygen atmosphere having substantially no oxygen.

12. The multicomponent package of any one of claims 6 to 11, wherein the upper and lower components are attached together with a tubular sleeve, label, adhesive, or combinations thereof.

13. The multicomponent package of any one of claims 6 to 12, further comprising a tubular sleeve that wraps about the upper and lower components so they are releasably attached together.

14. The multicomponent package of any one of claims 6 to 13, wherein at least one of the liddings of the upper and lower components are spaced apart as to define a passageway between the liddings through which gases can enter and exit the upper component.

15. The multicomponent package of any one of claims

6 to 14, wherein the tray has an oxygen transmission rate of less than about 10 cc at STP/m^2/24 hr/atm and the lid has an oxygen transmission rate of at least 6,000 cc at STP/m^2/24 hr/atm.

16. The multicompartment package of any one of claims 6 to 15, wherein the tray comprises a visually opaque material and the lid comprises a visually transparent material.

17. The multicompartment package of claim 16, wherein the tray has a heat distortion temperature of at least of 450° F and the lid has a heat distortion temperature of at least 400° F.

18. The multicomponent package of any one of claims 6 to 17, wherein the tray includes at least one lip that is arranged and configured to engage a corresponding surface on the lid so that the tray and lid are releasably attached to each other.

19. A multicomponent meal system comprising:

a substantially oxygen impermeable tray comprising a first interior space and a barrier layer enclosing a meat product therein, the tray having an oxygen transmission rate of less than 100 cc at STP/m^2/24 hr/atm and a heat distortion temperature that is at least 250° F; and
a lid releasably attached to the tray, the lid comprising a second interior space and a non-barrier layer enclosing a vegetable product therein, the lid having an oxygen transmission rate of at least 1,200 cc at STP/m^2/24 hr/atm and a heat distortion temperature of at least 200° F, and wherein the tray and the lid are arranged so that the barrier layer and the non-barrier layer are disposed opposite each other in a face-to-face orientation.

20. The system according to claim 19, wherein the lower component is cookable at a temperature of at least 350° F and the upper component is cookable in a microwave oven at a temperature of at least 225° F.

21. The system according to claim 19 or 20, wherein at least one of components further includes pasta, rice, or a combination thereof.

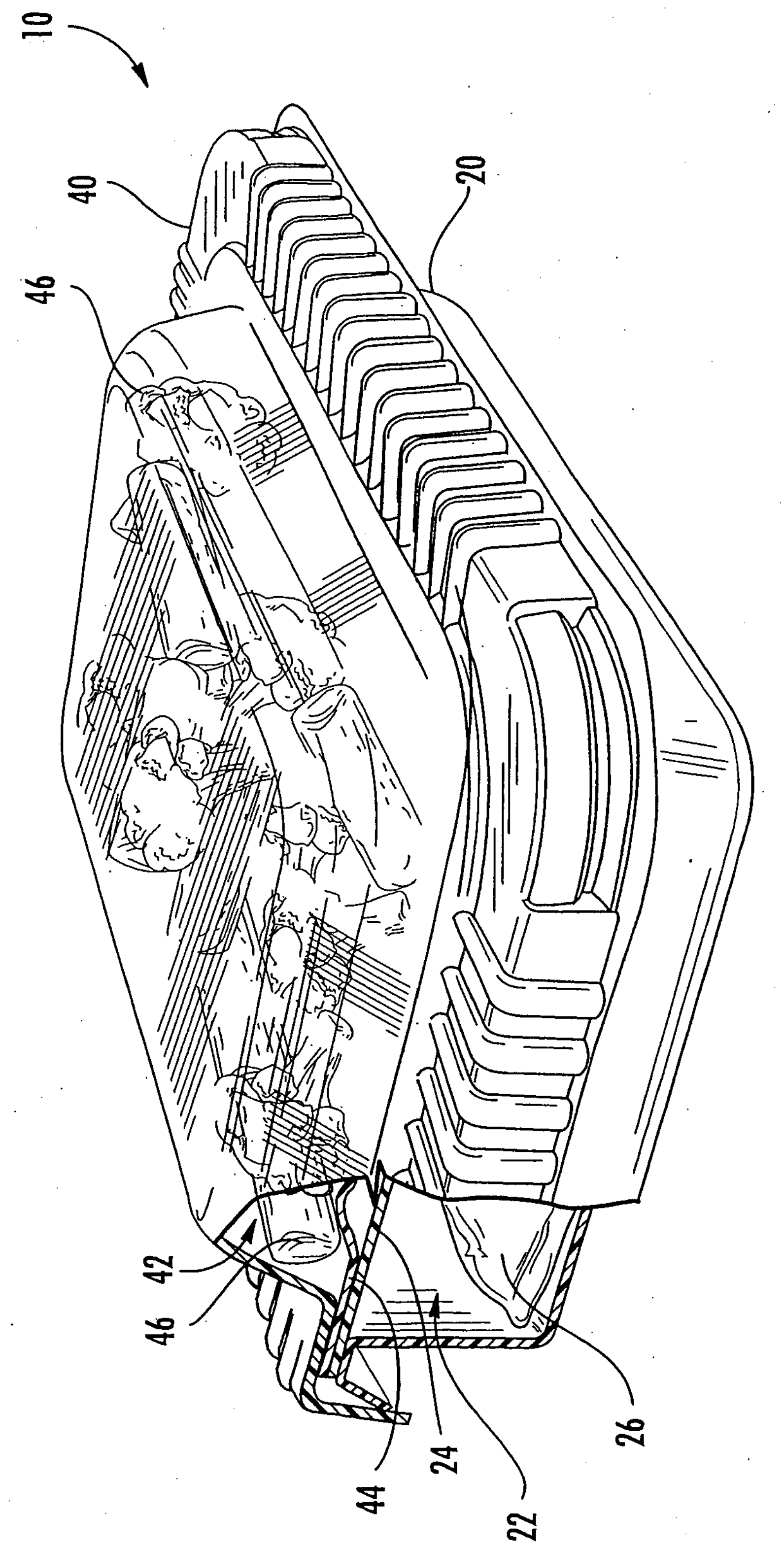

FIG. 1

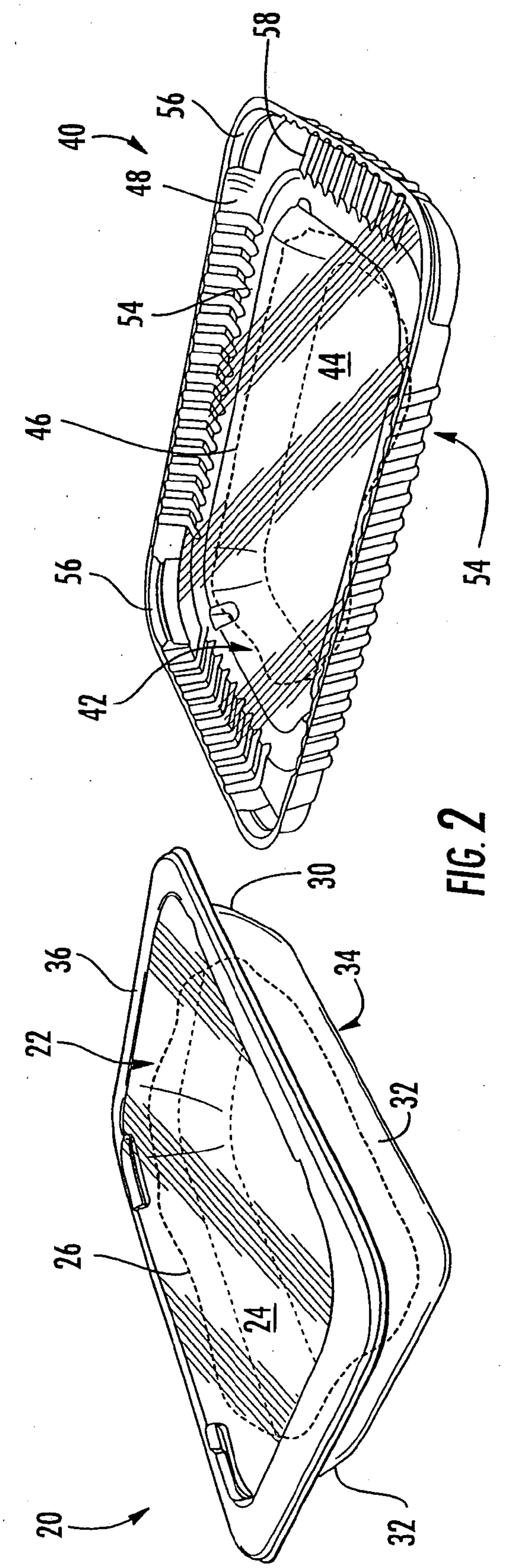

FIG. 2

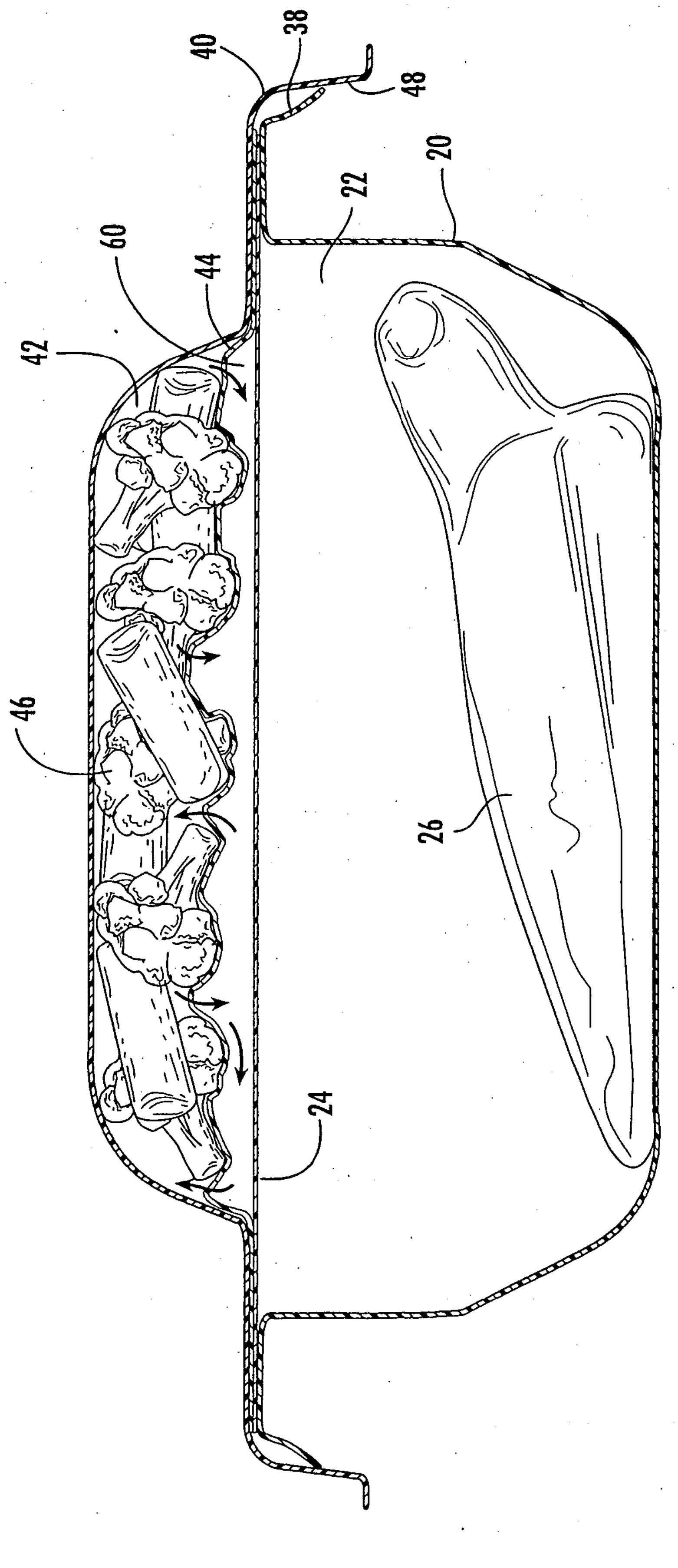

FIG. 3

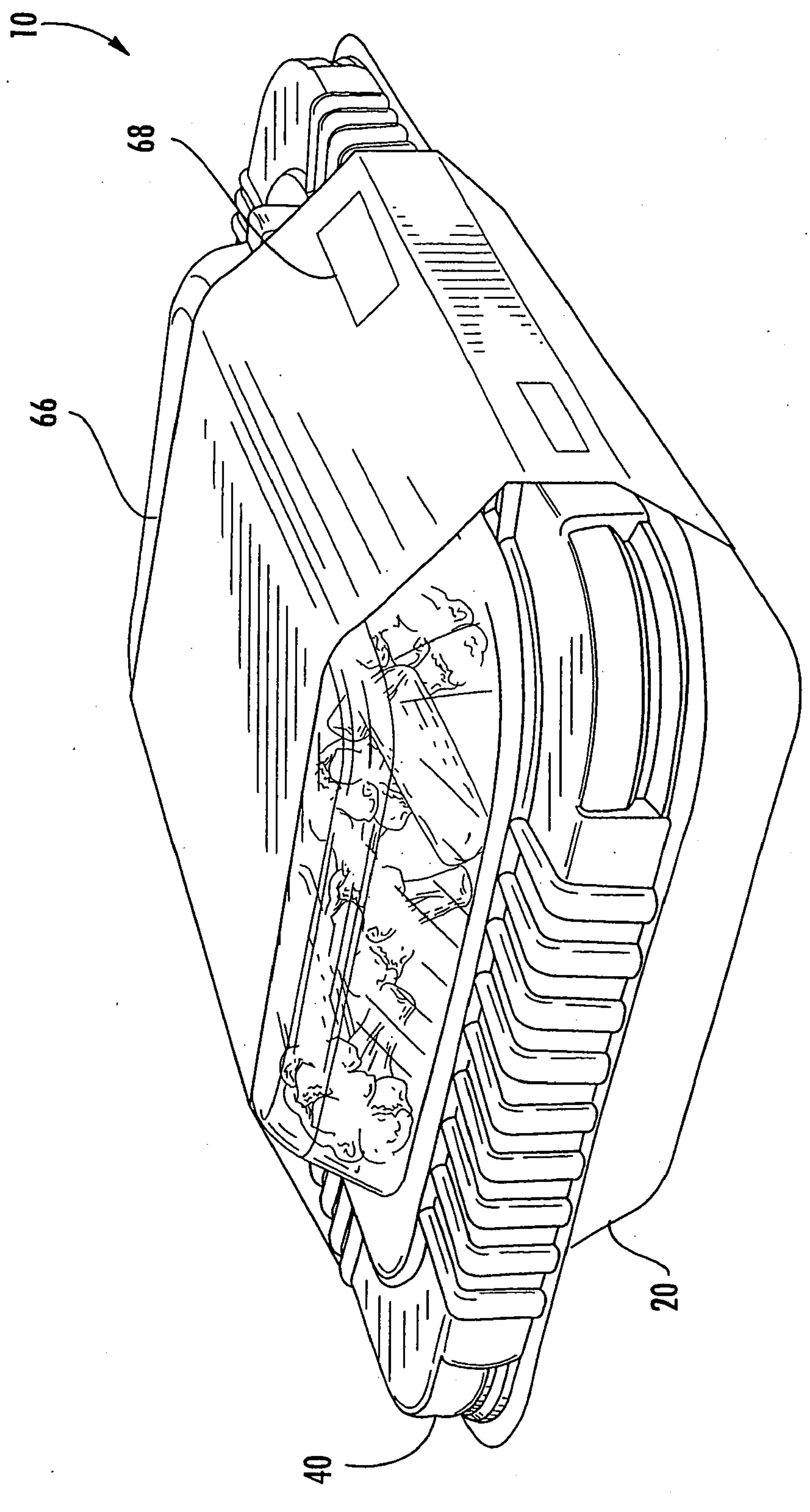

FIG. 4

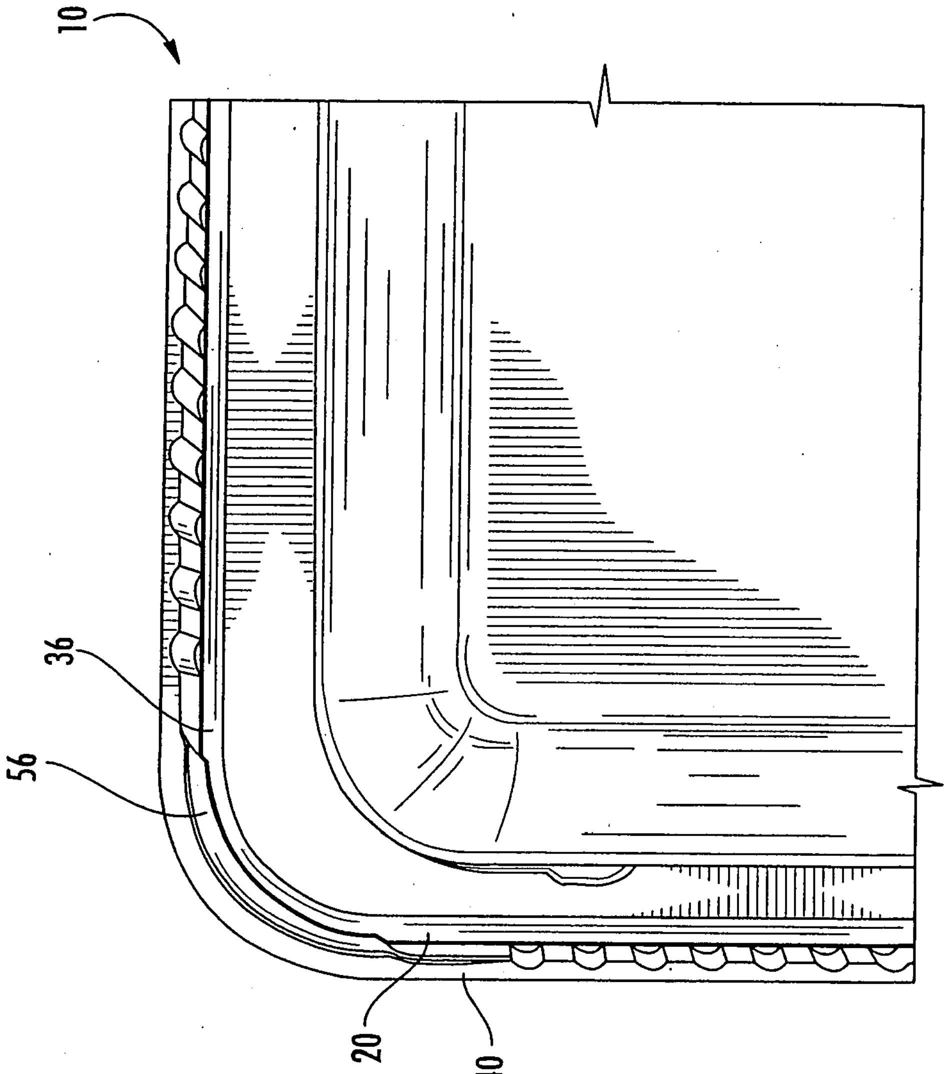

FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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