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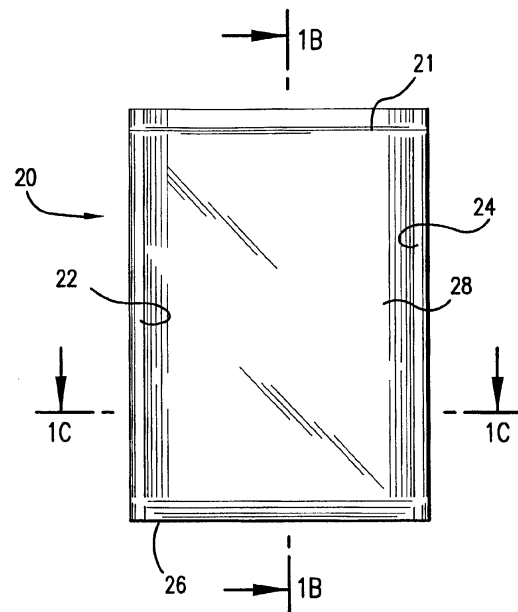
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(54) **Easy open package**

(57) An easy-open package has at least one permanent seal and at least one peelable (i.e., easy-open) seal. In one embodiment, an easy-open package having a peelable heat seal and a permanent heat seal is made from a multilayer film having a first outer layer comprising a first composition which is heat sealable to form a peelable heat seal, and a second outer layer comprising a second composition heat sealable to form a permanent heat seal. The multilayer film is folded inward at one or more seal regions, so that the package has at least one peelable seal and at least one permanent seal. In another embodiment, an inside component film is laminated to an outside component film, with the inside component film providing a majority of the inside surface of the package. The outside component film provides a remainder of the inside surface of the package. The inside film has an inside layer which comprises a composition heat sealed to itself to form a permanent heat seal. The outside film has an inside layer heat sealed to itself or the inside layer of the inside film to form a peelable heat seal.



**FIG. 1A**

**Description**Field of the Invention

**[0001]** The present invention relates to an easy-open package for any one or more of a variety of products, and is especially related to a strong, tough, impact-resistant package which has at least one peelable heat seal.

Background of the Invention

**[0002]** For some time various products have been packaged in easy-open film-based packages utilizing a variety of compositions to produce one or more easy-open (i.e., peelable) heat seals. These packages have utilized an additional strip film, or a strip of coating, to provide the easy-open feature. It would be desirable to provide a package, and method of making same, which does not require an additional strip of film, or the application of a strip of coating, to produce the easy-open feature.

Summary of the Invention

**[0003]** The present invention provides an easy-open package which can be made from a multilayer film which does not require the presence of an additional strip of film, or a strip of coating, to impart the easy-open feature. Moreover, the present invention provides a package having both a permanent heat seal and a peelable heat seal, without the need for an additional strip of film or a strip of coating. The present invention provides a means for having both permanent and peelable seals in the same package using a multilayer film having a first outer layer made from a first composition capable of making a peelable seal, and a second outer layer made from a second composition capable of forming a permanent seal. The multilayer film can be folded in one or more seal regions to control whether the first composition is involved in the seal. Alternatively, the multilayer film can be a lamination of a first component film to a second component film, with the films having one or more offset edge regions to control which composition is present in the seal area, thereby controlling whether the seal is a peelable seal or a permanent seal. Control over the nature of the seal is obtained using folding or offset laminations, rather than using an additional strip of film or a strip of a coating formulation designed to produce a peelable seal.

**[0004]** As a first aspect, the present invention is directed to an easy-open package comprising a peelable heat seal and a permanent heat seal. The package is made from a multilayer film having: (A) a first outer layer comprising a first composition which is heat sealable to form the peelable heat seal, and (B) a second outer layer comprising a second composition which is heat sealable to itself to make a permanent heat seal. The multilayer film is folded inward at one or more seal regions, so that the package has at least one peelable seal and at least one permanent seal.

**[0005]** In an alternative embodiment, the multilayer film is a first film and the package comprises the first film sealed to a second film, with an inside layer of the first film comprising the first composition and an outside layer of the first film comprising the second composition, the easy-open package comprising a pair of permanent side seals and a top having the peelable seal. The permanent side seals are formed by folding the film inward at each of the side seal regions. The bottom of the package can have a permanent heat seal, or be folded inward to form a peelable heat seal. Although the first film can be identical to the second film, it may also be different from the second film.

**[0006]** In a preferred package, the multilayer film has: (A) an outside layer comprising the first composition; and (B) an inside layer comprising the second composition. In this embodiment, the multilayer film is folded inward only at the peelable heat seal so that the outside layer comprising the first composition is present as the inside layer of the package only at the peelable heat seal, with the second composition being present as the inside layer of the package at the permanent heat seal. Preferably, the first composition is sealed to the second composition at the peelable heat seal. Preferably, the first composition is sealed to itself at the peelable heat seal. Preferably, the multilayer film is sealed to itself, with the packaging article comprising a pair of permanent side seals, a seamless folded bottom, and a top having the peelable seal.

**[0007]** Alternatively, the multilayer film is sealed to itself, and the easy-open package comprises a top having a peelable heat seal, sides having first and second permanent heat seals, and a bottom having a third permanent heat seal.

**[0008]** In the package, the first composition preferably comprises a member selected from the group consisting of: (A) a blend comprising polybutylene and low density polyethylene; (B) a blend comprising ionomer resin and polyethylene; (C) a blend comprising polyethylene based wax and polypropylene; (D) a blend comprising ionomer and polypropylene and polystyrene; (E) a blend comprising ethylene/acrylic acid copolymer and ionomer and polystyrene; (F) a blend comprising ethylene/acrylic acid and polystyrene and ethylene/vinyl acetate and polypropylene and polybutylene; and (G) a blend comprising linear low density polyethylene and ionomer and ethylene/vinyl acetate and polypropylene and polybutylene. More preferably, the first composition comprises a blend of polypropylene, ethylene/vinyl

acetate copolymer, polybutylene, and low density polyethylene.

**[0009]** Preferably, the second composition comprises at least one member selected from the group consisting of high density polyethylene, linear low density polyethylene, low density polyethylene, very low density polyethylene, polypropylene homopolymer, propylene/ethylene copolymer, homogeneous ethylene/alpha-olefin copolymer, ethylene/vinyl acetate copolymer, ionomer, ethylene acrylic acid copolymer, ethylene methacrylate copolymer. More preferably, the second composition comprises at least one member selected from the group consisting of linear low density polyethylene and homogeneous ethylene/alpha-olefin copolymer.

**[0010]** Preferably, at least one layer of the multilayer film comprises a pigment.

**[0011]** Preferably, the permanent seal has a strength of greater than 5 pounds per inch measured using ASTM F904 measured at 20 feet per minute. Preferably, the peelable seal has a strength of from about 0.5 to 5 pounds per inch, measured using ASTM F904 measured at 20 feet per minute; more preferably, from about 1.5 to 2.5 pounds per inch.

**[0012]** Preferably, the multilayer film further comprises an O<sub>2</sub>-barrier layer comprising at least one member selected from the group consisting of polyvinylidene chloride, ethylene/vinyl alcohol copolymer, polyamide, polyacrylonitrile.

**[0013]** Preferably, the multilayer film comprises: (A) a first layer which is the outside layer and comprises the first composition; (B) a second layer which is a moisture-barrier layer comprising high density polyethylene; (C) a third layer which is an O<sub>2</sub>-barrier layer; and (D) a fourth layer which is the inside layer and comprises the second composition.

**[0014]** Preferably, at least 85 percent of the film, based on total film volume, consists of at least one member selected from the group consisting of polyolefin homopolymer, polyolefin copolymer, ethylene/ester copolymer, polystyrene, styrene/butadiene copolymer, EVOH, PVDC, and polyacrylonitrile. Preferably, the film has a total thickness of at least 2 mils, and an impact strength of at least about 1.5 ft-lbs, and a total free shrink, at 185°F, of from about 0 to 50 percent.

**[0015]** Preferably, the multilayer film is a laminate of a melt-oriented first component film to a solid-state biaxially-oriented second component film. Preferably, the melt-oriented first component film is a multilayer film comprising the first composition in a peelable-seal layer, and the solid-state biaxially-oriented second component film is a multilayer film comprising the second composition in a permanent-seal layer.

**[0016]** Preferably, the first component film has a total free shrink at 185°F of less than 10 percent (preferably less than 5 percent), and the second component film has a total free shrink at 185°F of from about 10 percent to 150 percent; more preferably, from about 15 to 100 percent; still more preferably, from about 20 to 75 percent. Preferably, the first component film has at least one layer comprising high density polyethylene, and the second component film has at least two layers comprising linear low density polyethylene and/or homogeneous ethylene/alpha-olefin copolymer.

**[0017]** Preferably, each of the at least two layers comprising linear low density polyethylene further comprises carbon black.

**[0018]** As a second aspect, the present invention is directed to a packaged product comprising a product in an easy-open package comprising a peelable heat seal and a permanent heat seal, the package comprising a multilayer film having: (A) a first outer layer comprising a first composition which is heat sealable to form the peelable heat seal, and (B) a second outer layer comprising a second composition which is heat sealable to itself to make a permanent heat seal. The multilayer film is folded inward at one or more seal regions, so that the package has at least one peelable seal and at least one permanent seal. Preferably, the packaged product comprises at least one member selected from the group consisting of photographic film, photographic paper, cheese, pet food, livestock feed, sugar, coffee, cookies, cereal, cake mix, crackers, chips, powdered milk, vitamins, pharmaceutical products, pesticides, and herbicides.

**[0019]** As a third aspect, the present invention pertains to an easy-open package comprising at least one peelable heat seal and at least one permanent heat seal. The package is made from a multilayer film having an inside film laminated to an outside film. The inside film provides a majority of the inside surface of the package, and the outside film provides a remainder of the inside surface of the package, with the inside film having an inside layer which comprises a first member selected from the group consisting of: (a) a first composition which can be heat sealed to itself to form a peelable heat seal; and (b) a second composition which can be heat sealed to itself to form a permanent heat seal. The outside film having an inside layer which comprises a second member which is different from the first member, the second member being selected from the group consisting of: (a) the first composition; (b) the second composition. The multilayer film is sealed to itself or another film to form the easy-open package. Preferably, the inside layer of the inside film comprises the second composition, and the inside layer of the outside film comprises the first composition.

**[0020]** Preferably, the easy-open package comprises a pair of permanent side seals in which the inside layer of the inside film is sealed to itself, a seamless folded bottom, and a peelable top seal in which the inside layer of the outside film is sealed to itself or the second composition.

**[0021]** As a fourth aspect, the present invention comprises a packaged product in an easy-open package comprising at least one peelable heat seal and at least one permanent heat seal, the package being made from a multilayer film having an inside film laminated to an outside film, wherein the inside film provides a majority of the inside surface of the package, and the outside film provides a remainder of the inside surface of the package, with the inside film having an inside layer which comprises a first member which is selected from the group consisting of: (a) a first composition

which can be heat sealed to itself to form a peelable heat seal; and (b) a second composition which can be heat sealed to itself to form a permanent heat seal. The outside film has an inside layer which comprises a second member which is different from the first member, the second member being selected from the group consisting of: (a) the first composition; and (b) the second composition. The multilayer film is sealed to itself or another film to form the easy-open package.

#### Brief Description of the Drawings

[0022] Figure 1A illustrates a lay-flat view of a preferred easy-open package in accordance with the present invention.  
 [0023] Figure 1B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 1A.  
 [0024] Figure 1C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 1A.  
 [0025] Figure 1D is a schematic of a process for producing the bag of Figures 1A-1C.  
 [0026] Figure 1E is a schematic view of a cross-section of the film used in the package of Figures 1A-1D.  
 [0027] Figure 2A illustrates a perspective view of an alternative preferred easy-open package in accordance with the present invention.  
 [0028] Figure 2B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 2A.  
 [0029] Figure 2C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 2A.  
 [0030] Figure 3A illustrates a perspective view of an alternative preferred easy-open package in accordance with the present invention.  
 [0031] Figure 3B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 3A.  
 [0032] Figure 3C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 3A.  
 [0033] Figure 4A illustrates a perspective view of an alternative preferred easy-open package in accordance with the present invention.  
 [0034] Figure 4B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 4A.  
 [0035] Figure 4C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 4A.  
 [0036] Figure 5A illustrates a perspective view of an alternative preferred easy-open package in accordance with the present invention.  
 [0037] Figure 5B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 5A.  
 [0038] Figure 5C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 5A.  
 [0039] Figure 6A illustrates a lay-flat view of an offset-type easy-open package in accordance with the present invention.  
 [0040] Figure 6B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 6A.  
 [0041] Figure 6C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 6A.  
 [0042] Figure 7A illustrates a lay-flat view of an alternative offset-type easy-open package in accordance with the present invention.  
 [0043] Figure 7B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 7A.  
 [0044] Figure 7C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 7A.  
 [0045] Figure 8A illustrates a lay-flat view of an alternative offset-type easy-open package in accordance with the present invention.  
 [0046] Figure 8B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 8A.  
 [0047] Figure 8C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 8A.  
 [0048] Figure 9A illustrates a lay-flat view of an alternative offset-type easy-open package in accordance with the present invention.  
 [0049] Figure 9B illustrates a longitudinal cross-sectional view of the easy-open package illustrated in Figure 9A.  
 [0050] Figure 9C illustrates a transverse cross-sectional view of the easy-open package illustrated in Figure 9A.  
 [0051] Figure 10 illustrates a schematic view of a process for making a melt-oriented film component suitable for use in a preferred laminated film for use in the easy-open package of the present invention.  
 [0052] Figure 11 illustrates a schematic view of a process for making a solid-state oriented film component suitable for use in a preferred laminated film for use in the easy-open package of the present invention.  
 [0053] Figure 12 illustrates a perspective view of a preferred packaged product in accordance with the present invention.

#### Detailed Description of the Invention

[0054] As used herein, the term "film" is used in a generic sense to include plastic web, regardless of whether it is film or sheet. Preferably, films used in the present invention have a thickness of 0.25 mm or less. As used herein, the term "package" refers to packaging materials to be configured around a product being packaged. The phrase "packaged product," as used herein, refers to the combination of a product which is surrounded by a packaging material.

**[0055]** As used herein, the term "seal" refers to any seal of a first region of an outer film surface to a second region of an outer film surface, wherein the seal is formed by heating the regions to at least their respective seal initiation temperatures. The sealing can be performed by any one or more of a wide variety of manners, such as using a heat seal technique (e.g., melt-bead sealing, thermal sealing, impulse sealing, dielectric sealing, radio frequency sealing, ultrasonic sealing, hot air, hot wire, infrared radiation, etc.). As used herein, the phrase "heat seal" refers to a seal of a film and another object, preferably another film, via any one or more of a number of means for sealing through the use of heat, including thermal sealing, melt bead sealing, impulse sealing, dielectric sealing, ultrasonic sealing, etc.

**[0056]** As used herein, the phrases "seal layer," "sealing layer," "heat seal layer," and "sealant layer," refer to an outer film layer, or layers, involved in the sealing of the film to itself, another film layer of the same or another film, and/or another article which is not a film. In general, sealant layers employed in the packaging art have included thermoplastic polymers, such as polyolefin (e.g., linear low density polyethylene, very low density polyethylene, homogeneous polymers such as metallocene catalyzed ethylene/alpha-olefin copolymer, etc), polyamide, polyester (e.g., polyethylene terephthalate glycol), ethylene/ester copolymer (e.g., ethylene/vinyl acetate copolymer), ionomer, etc.

**[0057]** As used herein, the phrase "peelable seal" refers to a seal which undergoes manual separation using no more than 5 pounds per inch of force to cause the separation (measured using ASTM F904 measured at 20 feet per minute). Peelable seals can undergo separation, i.e., failure, in a variety of manners. For example, the layer with the first composition can fail cohesively, i.e., internally, to cause the separation. On the other hand, the layer comprising the first composition can fail adhesively with respect to the layer to which it has been sealed, or even with respect to a layer to which it is directly adhered via coextrusion. Finally, the failure can be of the so-called "interlaminar" variety, in which there is a combination of both cohesive and adhesive failure. Preferably, the failure is cohesive or interlaminar in nature.

**[0058]** As used herein, the phrase "permanent seal" refers to a seal which does not undergo easy manual separation. Rather, a permanent seal undergoes separation only in conjunction with destruction of one or more of the films, e.g., via tearing of the film, delamination of the film, or disintegration of one or more layers of the film. Preferably, permanent seals have a seal strength of at least 5 pounds per inch (measured using ASTM F904 measured at 20 feet per minute), more preferably at least 7 pounds per inch, and still more preferably at least 10 pounds per inch.

**[0059]** In the package of the present invention, both the permanent seals and the peelable seals are preferably hermetic seals.

**[0060]** As used herein, the term "barrier", and the phrase "barrier layer", as applied to films and/or film layers, are used with reference to the ability of a film or film layer to serve as a barrier to one or more gases. In the packaging art, oxygen (i.e., gaseous O<sub>2</sub>) barrier layers have included, for example, hydrolyzed ethylene/vinyl acetate copolymer (designated by the abbreviations "EVOH" and "HEVA", and also referred to as "ethylene/vinyl alcohol copolymer"), polyvinylidene chloride, polyamide, polyester, polyalkylene carbonate, polyacrylonitrile, etc., as known to those of skill in the art.

**[0061]** As used herein, "EVOH" refers to ethylene vinyl alcohol copolymer. EVOH includes saponified or hydrolyzed ethylene vinyl acetate copolymers, and refers to a vinyl alcohol copolymer having an ethylene comonomer, and prepared by, for example, hydrolysis of vinyl acetate copolymers, or by chemical reactions with polyvinyl alcohol. The degree of hydrolysis is preferably from about 50 to 100 mole percent; more preferably, from about 85 to 100 mole percent.

**[0062]** As used herein, the terms "lamination," "laminar," as well as the phrase "laminated film," refer to the process, and resulting product, made by bonding together two or more layers of film or other materials. Lamination can be accomplished by joining layers with adhesives, joining with heat and pressure, with corona treatment, and even spread coating and extrusion coating. Lamination is described in U.S. Patent No. 5,374,459, to Mumpower et al. Lamination can be carried out by the application of polyurethane or other conventional lamination adhesive to either or both of the substrate films. Bonding is accomplished by techniques well known in the lamination art.

**[0063]** As used herein, the phrase "solid state oriented" refers to a polymer-containing material which has been elongated (generally at an elevated temperature which is below the melt temperature), followed by being "set" in the elongated configuration by cooling the material while substantially retaining the elongated dimensions. This combination of elongation at elevated temperature followed by cooling causes an alignment of the polymer chains to a more parallel configuration, thereby improving the mechanical properties of the film. Upon subsequently heating the unrestrained, unannealed, solid-state oriented polymer-containing material to its orientation temperature, heat shrinkage is produced almost to the original dimensions, i.e., pre-elongation dimensions.

**[0064]** Films which shrink upon being heated are generally referred to as heat-shrinkable films. As used herein, the phrases "heat-shrinkable," "heat-shrink" and the like refer to the tendency of a film, generally a solid-state oriented film, to shrink upon the application of heat, i.e., to contract upon being heated, such that the size (area) of the film decreases while the film is in an unrestrained state. Likewise, the tension of a heat-shrinkable film increases upon the application of heat if the film is restrained from shrinking. As a corollary, the phrase "heat-contracted" refers to a heat-shrinkable film, or a portion thereof, which has been exposed to heat such that the film or portion thereof is in a heat-

shrunken state, i.e., reduced in size (unrestrained) or under increased tension (restrained).

**[0065]** As used herein, the phrase "free shrink" refers to the percent dimensional change in a 10 cm x 10 cm specimen of film, when shrunk at 185°F, with the quantitative determination being carried out according to ASTM D 2732, as set forth in the 1990 Annual Book of ASTM Standards, Vol. 08.02, pp. 368-371, which is hereby incorporated, in its entirety, by reference thereto.

**[0066]** In contrast to solid-state oriented films, a "melt blown" film is generally produced by upwardly extruding a film from an annular die. The annular extrudate immediately upon emergence from the die. The polymer is oriented in this manner, but the orientation is free of stress because it occurs at or above the melting point of the polymer. As a result, the film exhibits very low total free shrink at 185°F (less than 10 percent, often less than 5 percent).

**[0067]** Orienting in one direction is referred to herein as "uniaxial orientation," while orienting in two directions is referred to herein as "biaxial orientation." As used herein, the phrase "orientation ratio" refers to the multiplication product of the extent to which the plastic film material is oriented in the machine direction and the transverse direction. Orientation in the machine direction is herein referred to as "drawing", whereas orientation in the transverse direction is herein referred to as "stretching".

**[0068]** As used herein, the phrase "heterogeneous polymer" refers to polymerization reaction products of relatively wide variation in molecular weight and relatively wide variation in composition distribution, i.e., polymers made, for example, using conventional Ziegler-Natta catalysts. Heterogeneous polymers are useful in various layers of the film used in the present invention. Such polymers typically contain a relatively wide variety of chain lengths and comonomer percentages.

**[0069]** As used herein, the phrase "homogeneous polymer" refers to polymerization reaction products of relatively narrow molecular weight distribution and relatively narrow composition distribution. Homogeneous polymers are structurally different from heterogeneous polymers, in that homogeneous polymers exhibit a more even sequencing of comonomers within a chain, a mirroring of sequence distribution in all chains, and a similarity of length of all chains, i.e., a narrower molecular weight distribution. Furthermore, homogeneous polymers are typically prepared using metallocene, or other single-site type catalysis, rather than the Ziegler Natta catalysts used to produce many heterogeneous polymers.

**[0070]** More particularly, homogeneous ethylene/alpha-olefin copolymers may be characterized by one or more methods known to those of skill in the art, such as molecular weight distribution (Mw/Mn), composition distribution breadth index (CDBI), narrow melting point range, and single melt point behavior. The molecular weight distribution (Mw/Mn), also known as "polydispersity," may be determined by gel permeation chromatography. Homogeneous ethylene/alpha-olefin copolymers which can be used in the present invention preferably have an Mw/Mn of less than 2.7; more preferably from about 1.9 to 2.5; still more preferably, from about 1.9 to 2.3. The composition distribution breadth index (CDBI) of such homogeneous ethylene/alpha-olefin copolymers will generally be greater than about 70 percent. The CDBI is defined as the weight percent of the copolymer molecules having a comonomer content within 50 percent (i.e., plus or minus 50%) of the median total molar comonomer content. The CDBI of linear polyethylene, which does not contain a comonomer, is defined to be 100%. The Composition Distribution Breadth Index (CDBI) is determined via the technique of Temperature Rising Elution Fractionation (TREF). CDBI determination clearly distinguishes homogeneous copolymers (i.e., narrow composition distribution as assessed by CDBI values generally above 70%) from VLDPEs available commercially which generally have a broad composition distribution as assessed by CDBI values generally less than 55%. TREF data and calculations therefrom for determination of CDBI of a copolymer is readily calculated from data obtained from techniques known in the art, such as, for example, temperature rising elution fractionation as described, for example, in Wild et. al., J. Poly. Sci. Poly. Phys. Ed., Vol. 20, p.441 (1982). Preferably, the homogeneous ethylene/alpha-olefin copolymers have a CDBI greater than about 70%, i.e., a CDBI of from about 70% to 99%. In general, the homogeneous ethylene/alpha-olefin copolymers useful in the present invention also exhibit a relatively narrow melting point range, in comparison with "heterogeneous copolymers", i.e., polymers having a CDBI of less than 55%. Preferably, the homogeneous ethylene/alphaolefin copolymers exhibit an essentially singular melting point characteristic, with a peak melting point (T<sub>m</sub>), as determined by Differential Scanning Colorimetry (DSC), of from about 60°C to 105°C. Preferably the homogeneous copolymer has a DSC peak T<sub>m</sub> of from about 80°C to 100°C. As used herein, the phrase "essentially single melting point" means that at least about 80%, by weight, of the material corresponds to a single T<sub>m</sub> peak at a temperature within the range of from about 60°C to 105°C, and essentially no substantial fraction of the material has a peak melting point in excess of about 115°C., as determined by DSC analysis. DSC measurements are made on a Perkin Elmer System 7 Thermal Analysis System. Melting information reported are second melting data, i.e., the sample is heated at a programmed rate of 10°C./min. to a temperature below its critical range. The sample is then reheated (2nd melting) at a programmed rate of 10°C/min.

**[0071]** A homogeneous ethylene/alpha-olefin copolymer can, in general, be prepared by the copolymerization of ethylene and any one or more alpha-olefin. Preferably, the alpha-olefin is a C<sub>3</sub>-C<sub>20</sub> alpha-monoolefin, more preferably, a C<sub>4</sub>-C<sub>12</sub> alpha-monoolefin, still more preferably, a C<sub>4</sub>-C<sub>8</sub> alphamonoolefin. Still more preferably, the alpha-olefin comprises at least one member selected from the group consisting of butene-1, hexene-1, and octene-1, i.e., 1-butene,

1-hexene, and 1-octene, respectively; more preferably, the alpha-olefin comprises octene-1, and/or a blend of hexene-1 and butene-1.

**[0072]** Processes for preparing and using homogeneous linear ethylene/alpha-olefin copolymers are disclosed in U.S. Patent No. 5,206,075, to HODGSON, Jr., U.S. Patent No. 5,241,031, to MEHTA, and PCT International Application WO 93/03093, each of which is hereby incorporated by reference thereto, in its entirety. Further details regarding the production and use of homogeneous linear ethylene/alpha-olefin copolymers are disclosed in PCT International Publication Number WO 90/03414, and PCT International Publication Number WO 93/03093, both of which designate Exxon Chemical Patents, Inc. as the Applicant, and both of which are hereby incorporated by reference thereto, in their respective entireties.

**[0073]** Still another species of homogeneous ethylene/alpha-olefin copolymers is disclosed in U.S. Patent No. 5,272,236, to LAI, et. al., and U.S. Patent No. 5,278,272, to LAI, et. al., both of which are hereby incorporated by reference thereto, in their respective entireties. These polymers are recognized as being homogeneous long-chain-branched ethylene/alpha-olefin copolymers.

**[0074]** As used herein, the phrases "ethylene alpha-olefin copolymer", and "ethylene/alpha-olefin copolymer", refer to such heterogeneous materials as low density polyethylene (LDPE), medium density polyethylene (MDPE), linear low density polyethylene (LLDPE), and very low and ultra low density polyethylene (VLDPE and ULDPE); as well as to such homogeneous ethylene/alpha olefin copolymers as: metallocene-catalyzed EXACT (TM) linear homogeneous ethylene/alpha olefin copolymer resins obtainable from the Exxon Chemical Company, of Baytown, Texas, homogeneous substantially linear ethylene/alpha-olefin copolymers having long chain branching (e.g., copolymers known as AFFINITY® resins, and ENGAGE® resins, available from the Dow Chemical Company, of Midland, Michigan), as well as TAFMER (TM) linear homogeneous ethylene/alpha-olefin copolymer resins obtainable from the Mitsui Petrochemical Corporation. The phrase ethylene/alpha-olefin copolymer is also inclusive of ethylene/alpha-olefin copolymers produced from mixed catalysts, e.g. using a combination of Ziegler Natta catalysis and single site catalysis such as metallocene catalysis. Exemplary of such resins are, for example, the line of resins known as Elite® enhanced polyethylene resins, available from The Dow Chemical Company, of Bayport, Texas. These resins are known to contain interpenetrating polymer networks ("IPN's"). Both the heterogeneous polymers and homogeneous polymers referred to above generally include copolymers of ethylene with one or more comonomers selected from C<sub>4</sub> to C<sub>10</sub> alpha-olefin such as butene-1 (i.e., 1-butene), hexene-1, octene-1, etc. While LDPE and MDPE are more highly branched than LLDPE, VLDPE, ULDPE, EXACT® resin, and TAFMER® resin, this latter group of resins has a relatively large number of short branches rather than the longer branches present in LDPE and MDPE. AFFINITY® resins and ENGAGE® resins have a relatively large number of short branches in combination with a relatively small number of long-chain branches.

**[0075]** As used herein, the phrases "inner layer" and "internal layer" refer to any layer, of a multilayer film, having both of its principal surfaces directly adhered to another layer of the film.

**[0076]** As used herein, the phrase "inside layer" refers to an outer film layer, of a multilayer film packaging a product, which is closest to the product, relative to the other layers of the multilayer film. "Inside layer" also is used with reference to the innermost layer of a plurality of concentrically arranged layers simultaneously coextruded through an annular die.

**[0077]** As used herein, the phrase "outer layer" refers to any film layer of film having less than two of its principal surfaces directly adhered to another layer of the film. The phrase is inclusive of monolayer and multilayer films. All multilayer films have two, and only two, outer layers, each of which has a principal surface adhered to only one other layer of the multilayer film. In monolayer films, there is only one layer, which, of course, is an outer layer in that neither of its two principal surfaces are adhered to another layer of the film.

**[0078]** As used herein, the phrase "outside layer" refers to the outer layer, of a multilayer film packaging a product, which is furthest from the product relative to the other layers of the multilayer film. "Outside layer" also is used with reference to the outermost layer of a plurality of concentrically arranged layers simultaneously coextruded through an annular die. Moreover, an outside layer has an "inside surface" and an "outside surface," the inside surface being that surface of the outside layer which is adhered to another film layer, and the outside surface of the outside layer being that surface which is not adhered to another film layer.

**[0079]** As used herein, the phrase "tie layer" refers to any inner film layer having the primary purpose of adhering two layers to one another. Tie layers can comprise any polymer having a polar group thereon, or any other polymer which provides sufficient interlayer adhesion to adjacent layers comprising otherwise nonadhering polymers.

**[0080]** As used herein, the phrase "skin layer" refers to an outside layer of a multilayer film in packaging a product, this skin layer being subject to abuse.

**[0081]** As used herein, the phrase "bulk layer" refers to any layer of a film which is present for the purpose of increasing the abuse-resistance, toughness, modulus, etc., of a multilayer film. Bulk layers generally comprise polymers which are inexpensive relative to other polymers in the film which provide some specific purpose unrelated to abuse-resistance, modulus, etc.

**[0082]** The multilayer films useful in the article and process of the present invention has at least 2 layers; more

preferably from 4 to 30 layers; still more preferably from 6 to 20 layers; yet still more preferably, from 8 to 15 layers. However, so long as the multilayer film has at least 2 layers, the multilayer film can have any further number of additional layers desired, so long as the film provides the desired properties for the particular packaging operation in which the film is used.

**[0083]** A variety of multilayer film structures are useful in the easy-open package of the present invention. For example, the multilayer film can be selected from the following arrangements of film layers:

- (a) peelable/permanent;
- (b) peelable/impact /permanent;
- (c) peelable/impact/self-weld/impact/permanent;
- (d) peelable/H<sub>2</sub>O-barrier/permanent;
- (e) peelable/H<sub>2</sub>O-barrier/impact/permanent;
- (d) peelable/tie/O<sub>2</sub>-barrier/tie/permanent;
- (e) peelable/tie/O<sub>2</sub>-barrier/tie/adhesive/permanent;
- (f) peelable/H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/permanent;
- (g) peelable/H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/adhesive/permanent;
- (h) peelable/tie/H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/permanent;
- (i) peelable/tie/H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/adhesive/permanent;
- (j) peelable/tie/ H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/opacity and impact/permanent;
- (k) peelable/tie/ H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/adhesive/opacity and impact/permanent;
- (l) peelable/tie/ H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/opacity and impact/self-weld/opacity and impact/permanent;
- (m) peelable/tie/ H<sub>2</sub>O-barrier/tie/O<sub>2</sub>-barrier/tie/adhesive/opacity and impact/self-weld/opacity and impact/permanent;
- (n) peelable/tie/O<sub>2</sub>-barrier/tie/ H<sub>2</sub>O-barrier/adhesive/opacity/self-weld/opacity/permanent;
- (o) peelable/tie/O<sub>2</sub>-barrier/tie/ H<sub>2</sub>O-barrier/adhesive/opacity/self-weld/opacity/permanent; and
- (p) peelable/tie and H<sub>2</sub>O-barrier /O<sub>2</sub>-barrier/tie and H<sub>2</sub>O-barrier / H<sub>2</sub>O-barrier/adhesive/outer/opacity/self-weld/opacity/permanent

**[0084]** In the above multilayer structures which have an adhesive layer, preferably the multilayer film is made by laminating a first component film with a second component film, with the adhesive layer containing the adhesive used to laminate the first component film to the second component film. In such multilayer films, preferably the multilayer structure listed before the adhesive layer is a melt-oriented multilayer component film, while the multilayer structure listed after the adhesive layer is a solid-state oriented multilayer component film.

**[0085]** The tie layers used in the film preferably comprise at least one member selected from the group consisting of ethylene/unsaturated ester copolymer, anhydride-modified ethylene/alpha-olefin copolymer, anhydride-modified ethylene/ester copolymer, acid-modified ethylene/alpha-olefin copolymer, and acid-modified ethylene/acid copolymer.

**[0086]** The moisture barrier layer used in the film preferably comprises at least one member selected from the group consisting of high density polyethylene, polypropylene, and metallized films and foils.

**[0087]** The adhesive layer is used to laminate two substrate films to one another, in order to form a laminate structure for use in the easy-open package of the present invention. Although the adhesive layer can comprise any suitable adhesive for laminating films together, preferably it comprises a polyurethane adhesive.

**[0088]** The opacity layer used in the film preferably contains carbon black pigment mixed with a suitable thermoplastic polymer. Preferred polymers include polyolefins, polyesters, polyamides, polyvinylchloride, polyvinylidene chloride, polycarbonate, etc. Preferred polymers include linear low density polyethylene, homogeneous ethylene/alpha-olefin copolymer, very low density polyethylene, and low density polyethylene. Layers which provide high impact strength preferably include at least one member selected from the group consisting of linear low density polyethylene, and homogeneous ethylene/alpha-olefin copolymer.

**[0089]** The opacity layer further comprises pigment. Preferably, the film contains at least two opacity layers. The pigment preferably shields the package contents from visible, infrared, and ultraviolet light. Exemplary materials include carbon black, graphite, iron oxide, zinc white, titanium oxide, clay, aluminum powder, aluminum paste, calcium carbonate, mica, barium sulfate, talc, cadmium pigments, red iron oxide, cobalt blue, copper-phthalocyanine pigments, monoazo and polyazo pigments and aniline black. Various carbon black, aluminum powder and aluminum paste from which volatile components are removed are preferred in view of light-shielding ability, quality, cost and the like. Among these, oil furnace carbon black having a mean particle size of smaller than 200 millimicrons is preferred in terms of light-shielding ability, quality, and improvement of physical strength. On the other hand, since acetylene carbon black, Ketschen carbon black and graphite have antistatic character, they are also preferred, though they are expensive.

**[0090]** The self-weld layer used in the film can comprise any polymer capable of self welding upon extrusion. Preferred polymers include ethylene/vinyl acetate copolymers, homogeneous ethylene/alpha-olefin copolymers, and eth-



ylene/methyl acrylate copolymer.

**[0091]** The multilayer film used in the present invention can have any total thickness desired, so long as the film provides the desired properties for the particular packaging operation in which the film is used. Preferably, the film has a total thickness of less than about 20 mils, more preferably the film has a total thickness of from about 2 to 15 mils, still more preferably from about 2 to 10 mils, and yet still more preferably, from about 3 to 7 mils.

**[0092]** In the package of the present invention, preferably the multilayer film has an impact strength of from about 1.5 to 20 ft-lb; more preferably, from about 2 to 5 ft-lb. Preferably, the film has a tensile strength at break of at least 4000 psi.; more preferably, from about 4000 to 50,000 psi; still more preferably, from about 4500 to 35,000 psi; yet still more preferably, from about 5,000 to 25,000 psi; even yet still more preferably, from about 4,000 to 14,000 psi. Preferably, the film has a tear propagation of from about 50 to 800 grams; more preferably, from about 60 to 700 grams; still more preferably, from about 100 to 600 grams.

**[0093]** Preferably, the multilayer film has a modulus of at least about 20,000 psi.; more preferably, from about 25,000 to 300,000 psi; still more preferably, from about 30,000 to 200,000 psi.

**[0094]** The multilayer film can be heat-shrinkable. If heat-shrinkable, the multilayer film preferably has a total free shrink (i.e., machine direction plus transverse direction), of from about 2 to 100 percent, at 185°F, as measured by ASTM D 2732; more preferably, from about 5 to 100 percent; still more preferably, from about 5 to 50 percent. Preferably, the multilayer film is a laminate made from a melt blown first component and a solid-state oriented second component.

**[0095]** Preferably, at least a portion of the film is irradiated to induce crosslinking. In the irradiation process, the film is subjected to an energetic radiation treatment, such as corona discharge, plasma, flame, ultraviolet, X-ray, gamma ray, beta ray, and high energy electron treatment, which induce cross-linking between molecules of the irradiated material. The irradiation of polymeric films is disclosed in U.S. Patent No. 4,064,296, to BORNSTEIN, et. al., which is hereby incorporated in its entirety, by reference thereto. BORNSTEIN, et. al. discloses the use of ionizing radiation for crosslinking the polymer present in the film.

**[0096]** Ionizing radiation can be used to crosslink the polymers in the film. Preferably, the film is irradiated at a level of from 0.5 to 15 MR (5 to 150 kGy), more preferably 1 to 8 MR (10 to 80 kGy), still more preferably, about 3 to 5 MR (30 to 50 kGy). The most preferred amount of radiation is dependent upon the film composition, thickness, etc., and its end use. Chemical crosslinking can also be utilized, together with electronic crosslinking, or in place of electronic crosslinking.

**[0097]** Preferably, the solid-state oriented component film (used in the multilayer film) comprises a crosslinked polymer network. Preferably, the crosslinked polymer network is produced by irradiation, preferably irradiation at a level of from about 0.5 to 15 MR (i.e., 5 to 150 kGy); more preferably, from about 1 to 8 MR (i.e., 10 to 80 kGy); still more preferably, from about 3 to 5 MR (i.e., 30 to 50 kGy).

**[0098]** Preferably, the multilayer film used in the package of the present invention has a moisture vapor transmission rate of from about 0.01 to 50g/100in<sup>2</sup>/day at 100°F and 100% relative humidity; more preferably, from about 0.02 to 35g/100in<sup>2</sup>/day at 100°F; still more preferably, less than about 0.04g/100in<sup>2</sup>/day at 100°F.

**[0099]** Although the package according to the present invention can be printed or unprinted, in one preferred embodiment the article has trap printing between the first component film and the second component film. The printing can be surface printing or reverse printed. Alternatively, printing can be present on an outside surface of the multilayer film.

**[0100]** In the packaged product according to the present invention, the product is preferably light-sensitive and/or moisture-sensitive and/or oxygen-sensitive. Preferred products include photographic film, photographic paper, cheese, and hard, flowable, particulates such as pet food, livestock feed, sugar, coffee, cookies, cereal, cake mix, crackers, chips, powdered milk, and plant food, as well as vitamins, pharmaceutical products, pesticides, and herbicides.

**[0101]** As is known to those of skill in the art, various polymer modifiers may be incorporated for the purpose of improving toughness and/or orientability or extensibility of the film. Other modifiers which may be added include: modifiers which improve low temperature toughness or impact strength, and modifiers which reduce modulus or stiffness. Exemplary modifiers include: styrene-butadiene, styrene-isoprene, and ethylene-propylene.

**[0102]** Figures 1A through 1C illustrate a first preferred package in accordance with the present invention. Figure 1A illustrates a front, lay-flat view of package 20 comprising peelable top heat seal 21, permanent side heat seals 22 and 24, and seamless folded bottom edge 26. Figures 1B and 1C illustrate cross-sectional views showing front side 28 and back side 30 of package 20. Back side 30 has folded top edge 32 and folded-over portion 34 which is heat sealed to the inside surface of front side 28.

**[0103]** Figure 1D is a schematic illustration of a process for making the package of Figures 1A-1C. In Figure 1D, a small upper portion of flat film 36 (i) is folded over (ii). Then the resulting folded film is folded again (iii) at a line across the midpoint along the length of the film. The result is a folded structure (iv), which is thereafter heat sealed on three sides to produce a preferred package (v) in accordance with the present invention.

**[0104]** Figure 1E illustrates a cross-sectional view of a simplified schematic multilayer film for use in package 20 illustrated in Figures 1A-1C. In Figure 1E, film 36 is a laminate of first component film 38 made from a composition

which forms a peelable seal when sealed to itself or another composition. In contrast, component film 40 is made from a composition which forms a permanent seal when sealed to itself. In the package of Figures 1A through 1D, component film 38 forms the outside component film of the laminate, while component film 40 serves as the inside component film. Folded-over portion 34 presents component film 38 for heat sealing to component film 40, to produce peelable top seal 21. In contrast, the sealing of component film 40 to itself forms permanent side seals 22 and 24.

**[0105]** Figures 2A, 2B, and 2C illustrate an alternative package 42. Package 42 is analogous to Package 20, and is made using the same multilayer laminate 36 illustrated in Figure 1E. Package 42 has permanent side seals 22 and 24 and seamless folded bottom edge 26. Top seal 44 is a peelable seal. However, peelable seal 44 is made by sealing layer 38 to itself, by folding over top portions of both sides of the folded film used to make the package. See Figure 2B.

**[0106]** Figures 3A, 3B, and 3C illustrate another preferred package in accordance with the present invention. Figure 3A illustrates a front, lay-flat view of package 50 comprising peelable top heat seal 52, permanent side heat seals 22 and 24, and permanent bottom seal 54. Figures 3B and 3C are cross-sectional views illustrating front side 28 and back side 30 of package 50. Back side 30 has folded top edge 32 and folded-over portion 34 which is heat sealed to the inside layer of the film front side 28.

**[0107]** Figure 3D is a schematic illustration of a process for making the package of Figures 3A-3C. In Figure 3D, a small upper portion 34 of flat film 30 (i) is folded over (ii). Then the resulting folded film is matched up with flat film 28 which forms the front side of the package (iii) and (iv). Then side, bottom, and top heat seals 22, 24, 54, and 52 are made, resulting in package 50. The package of Figures 3A through 3C is made using film such as the film illustrated in Figure 1E, described above.

**[0108]** Figures 4A, 4B, and 4C illustrate an alternative package 60. Package 60 is analogous to Package 50, and is preferably made using two pieces of the multilayer laminate 36 illustrated in Figure 1E. Package 60 has permanent side seals 22 and 24 and permanent bottom seal 54. Top seal 62 is a peelable seal. However, peelable seal 62 is made by heat sealing layer 38 to itself, i.e., by folding-over top portions of both sides of the folded film used to make the package. See Figure 4B.

**[0109]** Figures 5A, 5B, and 5C illustrate yet another embodiment of the package of the present invention. In these figures, package 70 is made by sealing two separate pieces of film 28 and 30 together with permanent side seals 76 and 78, and with peelable top and bottom seals 72 and 74, respectively. In package 70, the film schematically illustrated in Figure 1E is used for both front sheet 28 and rear sheet 30, except that peelable seal layer 38 forms the inside layer of package 70, with permanent seal layer 40 forming the outside layer.

**[0110]** Figures 6A, 6B, and 6C illustrate another preferred package in accordance with the present invention. Figure 6A illustrates a front, lay-flat view of package 80 comprising peelable top heat seal 82, permanent side heat seals 22 and 24, and seamless folded bottom edge 26. Figures 6B and 6C are cross-sectional views illustrating front side 28 and back side 30 of package 80.

**[0111]** Back side 30 has an offset lamination of component films which is illustrated in Figure 6E. Although not illustrated as such, each of component films 86 and 88 is preferably a multilayer film. In Figure 6E, laminated multilayer film 90 has an offset lamination which leaves an inside layer of outer component film 88 exposed for sealing. As can be seen in Figure 6B, the layer having surface 84 is sealed to the inside layer of inside component film 86. Outside component film 88 has an inside layer which is made from a composition which can be sealed to form a peelable seal. Inside component film 86 has an inside layer which is made from a composition which, when sealed to itself, forms a permanent seal. As a result, side seals 22 and 24 are permanent seals, while top seal 82 is a peelable seal.

**[0112]** Figure 6D illustrates schematically a process for folding a piece of offset laminate film to form package 80. That is, the offset laminate film is folded across its middle, and thereafter heat sealed to form permanent side seals 22 and 24, as well as peelable top seal 82.

**[0113]** Figures 7A, 7B, and 7C illustrate an alternative package 100. Package 100 is analogous to Package 80 of Figure 6A, and is made using the same multilayer film 90 illustrated in Figure 6E. Package 100 has permanent side seals 22 and 24 and seamless folded bottom edge 26. Top seal 102 is a peelable seal. However, peelable seal 102 is made by sealing the layer containing surface 84 to itself, by allowing component film 88 to extend outward at both ends (not illustrated in Figure 6E) of the flat film which is folded across its center in the formation of package 100. See Figure 7B.

**[0114]** Figures 8A, 8B, and 8C illustrate yet another preferred package in accordance with the present invention. Figure 8A illustrates a front, lay-flat view of package 110 comprising peelable top heat seal 112, permanent side heat seals 22 and 24, and permanent bottom heat seal 114. Figures 8B and 8C are cross-sectional views illustrating front side 28 and back side 30 of package 110. Back side 30 has an offset lamination on the top end, leaving outer component film 88 available for making the peelable top seal. The multilayer film used to make the package of Figure 8A is as illustrated in Figure 6E.

**[0115]** Figure 8D is a schematic illustration of a process for making the package of Figures 8A-8C. In Figure 8D, a portion of outer component film 84 extends from inner component film 86, allowing outer component film 84 to be used to make peelable top seal 112, while the remainder of the seals are of inner component film 86 to itself, as the two

pieces of film are identical in structure and composition. As can be seen in the process illustrated in Figure 8D, the two separate flat films are brought together and sealed along four edges to result in package 110.

[0116] Figures 9A, 9B, and 9C illustrate yet another embodiment of the package of the present invention. In these figures, package 120 is made by sealing two separate pieces of film together with permanent side seals 126 and 128, and with peelable top and bottom seals 122 and 124, respectively. In package 120, the film schematically illustrated in Figure 6E is used for both the front sheet 28 and the rear sheet 30, except that the compositions in the outer component film and the inner component film are reversed. That is, outer component film 88 contains the composition which seals to itself to form a permanent seal, while the inner component film 86 contains the composition which seals to itself to form the peelable seal.

[0117] Figure 10 illustrates a schematic of a preferred process for producing the solid-state oriented component multilayer film for use in multilayer film used in the package of the present invention. In the process illustrated in Figure 10, solid polymer beads (not illustrated) are fed to a plurality of extruders 132[52] (for simplicity, only one extruder is illustrated). Inside extruders 132[52], the polymer beads are forwarded, melted, and degassed, following which the resulting bubble-free melt is forwarded into die head 134[54], and extruded through annular die, resulting in tubing 136 [56] which is 5-40 mils thick, more preferably 20-30 mils thick, still more preferably, about 25 mils thick.

[0118] After cooling or quenching by water spray from cooling ring 138, tubing 136 is collapsed by pinch rolls 140, and is thereafter fed through irradiation vault 142 surrounded by shielding 144, where tubing 136 is irradiated with high energy electrons (i.e., ionizing radiation) from iron core transformer accelerator 146. Tubing 136 is guided through irradiation vault 132 on rolls 138. Preferably, the irradiation of tubing 136 is at a level of from about 2 to 10 megarads (hereinafter "MR").

[0119] After irradiation, irradiated tubing 150 is directed over guide roll 152, after which irradiated tubing 150 passes into hot water bath tank 154 containing water 156. The now collapsed irradiated tubing 150 is submersed in the hot water for a retention time of at least about 5 seconds, i.e., for a time period in order to bring the film up to the desired temperature, following which supplemental heating means (not illustrated) including a plurality of steam rolls around which irradiated tubing 150 is partially wound, and optional hot air blowers, elevate the temperature of irradiated tubing 150 to a desired orientation temperature of from about 240°F-250°F. Thereafter, irradiated film 150 is directed through nip rolls 158, and bubble 160 is blown, thereby transversely stretching irradiated tubing 150. Furthermore, while being blown, i.e., transversely stretched, irradiated film 150 is drawn (i.e., in the longitudinal direction) between nip rolls 158 and nip rolls 166, as nip rolls 166 have a higher surface speed than the surface speed of nip rolls 158. As a result of the transverse stretching and longitudinal drawing, irradiated, biaxially-oriented, blown tubing film 162 is produced, this blown tubing preferably having been both stretched at a ratio of from about 1:1.5 - 1:6, and drawn at a ratio of from about 1:1.5-1:6. More preferably, the stretching and drawing are each performed at a ratio of from about 1:2 - 1:4. The result is a biaxial orientation of from about 1:2.25 - 1:36, more preferably, 1:4 - 1:16.

[0120] While bubble 160 is maintained between pinch rolls 158 and 166, blown tubing 162 is collapsed by rolls 164, and thereafter conveyed through pinch rolls 166 and across guide roll 168, and then rolled onto wind-up roller 170. Idler roll 172 assures a good wind-up.

[0121] Figure 11 illustrates a schematic view of another process for making multilayer film for use in the article according to the present invention. Although for the sake of simplicity only one extruder 174 is illustrated in Figure 7, there are preferably at least 2 extruders, and more preferably, at least three extruders. That is, preferably at least one extruder, and more preferably two extruders, supply molten polymer to coextrusion die. Each of the extruders is supplied with polymer pellets suitable for the formation of the respective layer it is extruding. The extruders subject the polymer pellets to sufficient pressure and heat to melt the polymer and thereby prepare it for extrusion through a die.

[0122] Taking extruder 174 as an example, each of the extruders is preferably equipped with a screen pack 178, a breaker plate 180, and a plurality of heaters 182. Each of the coextruded film layers is extruded between mandrel 184 and die 176, and the extrudate is cooled by cool air flowing from air ring 186. The resulting blown bubble is thereafter guided into a collapsed configuration by nip rolls 192, via guide rolls 190. The collapsed tube is optionally passed over treater bar 194, and is thereafter passed over idler rolls 196, and around dancer roll 198 which imparts tension control to collapsed tube 200, after which the collapsed tube is wound into roll 202 via winding mechanism 204.

[0123] Figure 12 illustrates a perspective view of packaged product 206 in accordance with the present invention. Packaged product 206 has end seals 208 and side seals 210.

[0124] The package of the present invention can further comprise means for reclosing the package, such as a zipper. Preferably, the zipper parallel to the peelable heat seal, a short distance inside the package relative to the peelable heat seal. Suitable zipper structures are well known to those of skill in the art, and can be, for example, as disclosed in U.S. Patent No. 5,725, 312, to May, the entirety of which is hereby incorporated by reference thereto.

#### Example 1

[0125] The first substrate was prepared by casting a multilayer tape. The tape outer layer was composed of a major

proportion of linear low density polyethylene and a minor proportion of concentrates with antistatic and antiblock additives. The second layer was composed of linear low density polyethylene with carbon black concentrate. The inner layer was composed of ethylene vinyl acetate with 28% vinyl acetate. In order to prevent the inner layers of tape from self adhering, the interior of the tape was coated with cornstarch powder (from 50 to 150 mg/100 in<sup>2</sup>). The tape was irradiated at 4 megarads. The flattened tubing was reheated at 115°C in an oven and blown into a bubble. The bubble was expanded to about 3.6 times its original dimensions in both the machine and transverse directions. The collapsed and flattened tubing adhered to itself, as the concentration of the corn starch was diminished by the expansion of the tape. Hence, it did not require a ply separation. A single wound film roll was produced.

**[0126]** The second substrate was produced by downwardly casting a coextruded film through an annular die. The melt extrudate was water-quenched, with the quenched film tubing thereafter being edge-ripped and ply-separated to produce single wound rolls. The composition of the second substrate is set forth in Table 1. It was an eight layer film with an outer skin layer on one side, an outer peelable sealant layer on the other side, an oxygen barrier inner layer, and two sets of tie layers between the oxygen barrier layer and the outer layers. Finally, the film contained a bulk layer between the tie layers and the outer peelable sealant layer.

Table I

## Laminate Structure

| Layer Composition                                                                 | Layer Function       | Layer Thickness (mil) |
|-----------------------------------------------------------------------------------|----------------------|-----------------------|
| <b>First Substrate</b>                                                            |                      |                       |
| Blend of 88/8/4 LLDPE #1, Antiblock concentrate #1, and Antistatic concentrate #1 | Permanent Seal Layer | 0.58                  |
| Blend of 75/25 LLDPE #1 and Carbon black concentrate #1                           | Opacity Layer        | 1.35                  |
| EVA #1                                                                            | Self-weld            | 0.675                 |
| Blend of 75/25 LLDPE #1 and carbon black concentrate #1                           | Opacity Layer        | 1.35                  |
| Blend of 88/8/4 LLDPE #1, Antiblock concentrate #1, and Antistatic concentrate #1 | Outer Sealant Layer  | 0.54                  |
| <b>Laminating Layer</b>                                                           |                      |                       |
| Polyurethane adhesive #1                                                          | Laminating Adhesive  | 0.20                  |
| <b>Second Substrate</b>                                                           |                      |                       |
| 94/6 Blend of Nylon 6 #1 and copolyamide #1                                       | Skin Layer           | 0.30                  |
| Anhydride grafted EVA #1                                                          | Tie layer            | 0.84                  |
| 85/15 blend on of nylon 6 #1 and Amorphous nylon #1                               | Moisture Barrier     | 0.195                 |
| EVOH #1                                                                           | Barrier              | 0.24                  |
| 85/15 Blend of nylon 6 #1 and Amorphous nylon #1                                  | Moisture Barrier     | 0.195                 |
| Anhydride grafted LDPE #1                                                         | Tie Layer            | 0.24                  |
| 90/10 blend of LLDPE #2 and LDPE #1                                               | Bulk Layer           | 0.75                  |
| 15/35/50 Blend of PP #1, compounded EVA #1, LDPE #1                               | Peelable Seal Layer  | 0.24                  |

[0127] LLDPE #1 was Dowlex 2045 linear low density polyethylene, having a density of about 0.920 g/cc, and was obtained from Dow Plastics of Freeport, TX. LLDPE #2 was Dowlex 2244A linear low density polyethylene, having a density of 0.916 g/cc, also obtained from the Dow Chemical Company.

[0128] LDPE #1 was Escorene LD 200.48 low density polyethylene, having a density of 0.917 g/cc, obtained from Exxon Chemical Company, of Baytown, Texas.

[0129] Anhydride grafted LDPE #1 was Tymor 1228B anhydride grafted low density polyethylene having a density of 0.921 g/cc, obtained from Morton International, of Chicago, Illinois.

[0130] PP homopolymer #1 was Escorene PP 4292.E1 polypropylene homopolymer, having a density of 0.90 g/cc, also obtained from Exxon.

[0131] EVA #1 was Escorene LD-761.36 ethylene/vinyl acetate copolymer having vinyl acetate level of 28% and density of 0.95 g/cc, also obtained from Exxon.

[0132] Compounded EVA #1 was SPS -33C, which is a proprietary ethylene/vinyl acetate copolymer compound,

having a density of 0.916 g/cc, obtained from MSI Technology, of Arlington Heights, Illinois.

**[0133]** Anhydride grafted EVA #1 was Bynel CXA 3095 anhydride grafted EVA, having a density of 0.925 g/cc, and was obtained from E.I. DuPont de Nemours, of Wilmington, Delaware.

**[0134]** Nylon 6 #1 was Ultramid B 35 polyamide having a density of 1.13 g/cc, obtained from BASF Corporation, of Mount Olive, New Jersey.

**[0135]** Copolyamide #1 was Grilon XE3361 polyamide, comprising of 5% talcum, 5% calcium carbonate, 5% N, N' bis-stearamide in nylon 6, and having a density of 1.14 g/cc, and was obtained from EMS-American Grilon Inc., of Sumter, S.C.

**[0136]** Amorphous nylon #1 was Grivory G21 amorphous nylon having a density of 1.18 g/cc, also obtained from EMS-American Grilon Inc.

**[0137]** Antiblock Concentrate #1 was L-7106-AB antiblock concentrate containing 4.5% Syloid in a low density polyethylene carrier, and was obtained from Bayshore Industrial, Inc., of LaPorte, Texas.

**[0138]** Carbon Black Concentrate #1 was Ampacet 19153 Black PE MB carbon black concentrate, having carbon black loading of 30 weight percent, and was obtained from Ampacet Corporation, of Tarrytown, New York.

**[0139]** Antistat Concentrate #1 was Ampacet 101140 antistat concentrate, also obtained from Ampacet Corporation.

**[0140]** Laminating polyurethane adhesive #1 was a blend of 46.7% Adcote 532A polyester urethane, 9.4% Adcote 532B catalyst for two-part adhesive, and 43.9% ethyl acetate solvent, obtained from Morton International, Inc., of Chicago, Illinois.

**[0141]** The two substrates were laminated using Laminating Polyurethane Adhesive #1, identified above. Side seal bags were prepared with the peelable seal layer on the outside. To make the bags, the laminated substrates were first cut into pieces 20 inches wide by 41 inches long. A first fold was then made across the 20-inch width of the laminate. The first fold was parallel to the ends, and one inch from one of the ends. The first fold was in a direction so that the permanent seal layer doubled back upon itself. The first fold was held in place by heat sealing the permanent seal layer to itself. Then a second fold was made across the width of the laminate, the second fold being parallel to the ends of the laminate and at the midpoint along the length of the laminate. The second fold was made in a direction so that the permanent seal layer doubled back upon itself. The resulting folded laminate was 20 inches long and 20 inches wide. Heat seals were made along each of the 20-inch long side edges, leaving an open top. The result was a side-seal bag with a top having a folded-over edge portion. Figures 1A, 1B, and 1C illustrate the folded structure. The open end of the bag was available for filling the bag with a product, after which a heat seal was applied across the top. While the side seals were permanent seals, the heat seal across the top provided a hermetic, peelable (i.e., easy-open) seal. The resulting package was easy to open by merely peeling apart the peelable seal made across the top.

**[0142]** Figures 2A, 2B, and 2C illustrate an alternative preferred package according to the present invention, in which the laminate was cut to a size of 20 inches by 42 inches. A first fold was then made across the 20-inch width of the laminate. The first fold was parallel to the ends, and one inch from one of the ends. The first fold was in a direction so that the permanent seal layer doubled back upon itself. The first fold was held in place by heat sealing the permanent seal layer to itself. Then a second fold was made at the other end of the laminate, the second fold corresponding with the first fold. Then a third fold was made in the laminate, the third fold being across the width of the laminate, and parallel to the ends of the laminate and at the midpoint along the length of the laminate. The third fold was also made in a direction so that the permanent seal layer doubled back upon itself. The resulting folded laminate was 20 inches long and 20 inches wide. Heat seals were made along each of the 20-inch long side edges, leaving an open top. The result was a side-seal bag with a top with both sides having folded over edge portions. The open end of the bag was available for filling the bag with a product, after which a heat seal was applied across the top. While the side seals were permanent seals, the heat seal across the top provided a hermetic, peelable (i.e., easy-open) seal. The resulting package was easy to open by merely peeling apart the peelable seal made across the top. The pouch could be easily peeled open, without using any tools.

## Example 2

**[0143]** In Example 1, the first substrate was irradiated at a level of 4 megarads. In Example 2, the same first substrate was prepared in the same manner, but the irradiation level was about 7 megarads. As in Example 1, the first substrate was then laminated to the second substrate. Side seal bags were then prepared in the same manner as described in Example 1. As in Example 1, the top of the bag was heat sealed to provide an easy peel openability.

**[0144]** For the pouches of both Examples 1 and 2, a one-inch section was cut from the easy-peel seal to evaluate peel strength. A 180-degree peel strength test (i.e., pulling transversely relative to the peelable seal, the cut section being pulled in a straight line). The peel strength test was carried out on a tensile tester at 20 inch per minute, using ASTM F904, which is hereby incorporated in its entirety, by reference thereto.

**[0145]** The peel strength of easy peel pouches of both Example 1 and Example 2 is provided in Table II, below. As shown in Table II, the peelable seals of both examples exhibited relatively easy peel. Only one end of pouch has such

easy-open peel. The two side seals had a permanent bond so strong that the film tore or delaminated before the seal itself failed.

Table II

Strength of Peelable Seal: Peel Force of Substrate No. 1 to Substrate No.  
2

Not Affected by Irradiation Level of Substrate No. 1

| Example No. | Film Type/Crosslinking Dosage of Substrate No. 1                                              | Peel Force (Lbf) |
|-------------|-----------------------------------------------------------------------------------------------|------------------|
| 1           | Laminate of Substrate No. 1 to Substrate No. 2, with Substrate No. 1 irradiated at 4 megarads | 0.61             |
| 2           | Laminate of Substrate No. 1 to Substrate No. 2, with Substrate No. 1 irradiated at 7 megarads | 0.60             |

#### Examples 3-7

**[0146]** A peelable seal layer of a first film, i.e., an "A" film, was heat-sealed to a non-peelable layer of a group of second films, i.e., "B-films". The films were heat sealed on a Vertrod sealing machine, which produced an impulse seal. The use of impulse sealing, as opposed to other heat sealing means, minimized film shrinkage due to heat from the sealing process. The results obtained in Examples 3-7 demonstrated that seal strength could be controlled by the polymeric composition of the peelable seal layer. The test results demonstrated a peel strength force from as low as 1.74 lbf to as high as 3.45 lbf, using the polymeric compositions provided in Table III.

Table III  
Various Peel Forces Obtained with Various Layer Compositions and  
Irradiation Levels

| Example Number | Composition of Peelable Seal Layers of Film A            | Composition of Non-Peelable Seal Layers of Film B                                  | Film Type/<br>Cross-linking Dosage of B Film | Peel Force (Lbf/inch) |
|----------------|----------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------|-----------------------|
| 3              | Blend of 5% PP #1, 35% Compounded EVA #1, and 60% EVA #2 | Blend of 92.5% LLDPE#1 And 7.5% Antiblock concentrate # 4                          | Black Oriented film<br>6 megarads            | 1.74                  |
| 4              | Same as Example 3                                        | Blend of 88% LLDPE #1, 8% Antiblock concentrate #1, and 4% Antistat concentrate #1 | Black Oriented film<br>6 megarads            | 2.84                  |
| 5              | Same as Example 3                                        | Blend of 88% LLDPE #1, 8% Antiblock concentrate #1, and 4% Antistat concentrate #1 | Black Oriented film<br>4 megarads            | 3.16                  |
| 6              | Same as Example 3                                        | Blend of 80% LLDPE #1, and 20% White color concentrate masterbatch #1              | White Oriented film<br>4 megarads            | 2.72                  |
| 7              | Same as Example 3                                        | Blend of 78% Homogeneous ethylene/alpha-olefin #1, 20% LDPE, and 2%                | Blown Film<br>Not crosslinked                | 3.45                  |

|  |  |                          |  |  |
|--|--|--------------------------|--|--|
|  |  | antiblock concentrate #3 |  |  |
|--|--|--------------------------|--|--|

[0147] Homogeneous ethylene/alpha-olefin #1 was Exceed 363C32 metallocene-catalyzed ethylene/alpha-olefin copolymer, having a density of 0.917 g/cc and a melt index of 2.5, also obtained from Exxon.

[0148] LDPE # 3 was Escorene LD-134.09 low density polyethylene, having density of 0.922 and melt index of 2.0, also obtained from Exxon.

[0149] EVA #2 was Escorene LD 409.09 ethylene/vinyl acetate copolymer, having vinyl acetate of content of 9.9%, also obtained from Exxon.

[0150] Antiblock concentrate # 3 was 10853 concentrate containing having 19.4% diatomaceous silica in a linear low density polyethylene, also obtained from Ampacet.

[0151] Antiblock Concentrate # 4 was L-7118-AB concentrate, having 20% talc in a metallocene-catalyzed linear low density polyethylene, also obtained from Bayshore Industrial, Inc.

[0152] White Color Concentrate #1 was EPE 10214-C color concentrate having 50% titanium dioxide in low density polyethylene, obtained from Teknor Color, of Pawtucket, Rhode Island.

Comparative Examples 8 and 9

[0153] In contrast to the easy-open, peelable seals of Examples 1-7, above, permanent seals were made by sealing a non-peelable composition to itself. The strength of the resulting seal was measured in the same manner as the strength of the peelable seals was measured in Examples 1-7. Table IV, below, provides the seal strength data for two films, each of which was sealed to itself. Since the films failed before the seals failed, these comparative examples indicate that the strength of the seal was greater than the strength of the film. The test results provided a seal strength



higher than 15 lbf/inch. (Example 8) and higher than 12 lbf/inch (Example 9).

Table IV

| Force Required to Separate Typical Permanent Seals, i.e., Seal Strength |                                                                                                 |                          |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------|
| Example Number                                                          | B-to-B Seal: Composition of the Seal Layer of the B-film                                        | Seal Strength (Lbf/inch) |
| 8                                                                       | Blend of 80%LLDPE #1 and 20% White color concentrate masterbatch #1                             | 15**                     |
| 9                                                                       | Blend on 78% homogeneous ethylene/alpha-olefin #1, 20% LDPE #3, and 2% antiblock concentrate #3 | 12**                     |

\*\* No peeling but delamination of portions of sealing layer from remainder of film

**[0154]** Although the present invention has been described in connection with the preferred embodiments, it is to be understood that modifications and variations may be utilized without departing from the principles and scope of the invention, as those skilled in the art will readily understand. Accordingly, such modifications may be practiced within the scope of the following claims.

## Claims

1. An easy-open package comprising a peelable heat seal and a permanent heat seal, the package comprising a multilayer film having:

(A) a first outer layer comprising a first composition which is heat sealable to form the peelable heat seal, and  
(B) a second outer layer comprising a second composition which is heat sealable to itself to make a permanent heat seal; and wherein the multilayer film is folded inward at one or more seal regions, so that the package has at least one peelable seal and at least one permanent seal.

2. The easy-open package according to Claim 1, wherein the multilayer film is a first film and the package comprises the first film sealed to a second film, with an inside layer of the first film comprising the first composition and an outside layer of the first film comprising the second composition, and the easy-open package comprises a pair of permanent side seals and a top having the peelable seal, the permanent side seals being formed by folding the film inward at each of the side seal regions.

3. The easy-open package according to Claim 2, wherein the second film is different from the first film.

4. The easy-open package according to Claim 2, wherein the second film is structurally and compositionally identical to the first film, and the first composition is sealed to itself at the peelable seal.

5. An easy-open package according to Claim 1, wherein the multilayer film has:

(A) an outside layer comprising the first composition; and  
(B) an inside layer comprising a second composition; and

wherein the multilayer film is folded inward only at the peelable heat seal so that the outside layer comprising the first composition is present as the inside layer of the package only at the peelable heat seal, with the second composition being present as the inside layer of the package at the permanent heat seal.

6. The easy-open package according to Claim 5, wherein the first composition is sealed to the second composition at the peelable heat seal.

7. The easy-open package according to Claim 6, wherein the first composition is sealed to itself at the peelable heat seal.

8. The easy-open package according to Claim 6, wherein the multilayer film is sealed to itself, and the packaging article comprises a pair of permanent side seals, a seamless folded bottom, and a top having the peelable seal.

9. The easy-open package according to Claim 5, wherein the multilayer film is sealed to itself, and the easy-open package comprises a top having a peelable heat seal, sides having first and second permanent heat seals, and a bottom having a third permanent heat seal.

10. The easy-open package according to Claim 5, wherein the first composition comprises a member selected from the group consisting of:

- (A) a blend comprising polybutylene and low density polyethylene;
- (B) a blend comprising ionomer resin and polyethylene; and
- (C) a blend comprising polyethylene based wax and polypropylene;
- (D) a blend comprising ionomer and polypropylene and polystyrene;
- (E) a blend comprising ethylene/acrylic acid copolymer and ionomer and polystyrene;
- (F) a blend comprising ethylene/acrylic acid and polystyrene and ethylene/vinyl acetate and polypropylene and polybutylene;
- and
- (G) a blend comprising linear low density polyethylene and ionomer and ethylene/vinyl acetate and polypropylene and polybutylene;

wherein the second composition comprises at least one member selected from the group consisting of high density polyethylene, linear low density polyethylene, low density polyethylene, very low density polyethylene, polypropylene homopolymer, propylene/ethylene copolymer, homogeneous ethylene/alpha-olefin copolymer, ethylene/vinyl acetate copolymer, ionomer, ethylene acrylic acid copolymer, ethylene methacrylate copolymer.

11. The easy-open package according to Claim 5, wherein the multilayer film comprises at least one layer comprising a pigment.

12. The easy-open package according to Claim 5, wherein the permanent seal has a strength of greater than 5 pounds per inch measured using ASTM F904 measured at 20 feet per minute, and the peelable seal has a strength of from about 0.5 to about 5 pounds per inch, measured using ASTM F904 measured at 20 feet per minute.

13. The easy-open package according to Claim 5, wherein the multilayer film further comprises an O<sub>2</sub>-barrier layer comprising at least one member selected from the group consisting of polyvinylidene chloride, ethylene/vinyl alcohol copolymer, polyamide, polyacrylonitrile.

14. The easy-open package according to Claim 5, wherein the multilayer film comprises:

- (A) a first layer which is the outside layer and comprises the first composition;
- (B) a second layer which is a moisture-barrier layer comprising high density polyethylene;
- (C) a third layer which is an O<sub>2</sub>-barrier layer; and
- (D) a fourth layer which is the inside layer and comprises the second composition.

15. The easy-open package according to Claim 5, wherein:

at least 85 percent of the film, based on total film volume, consists of at least one member selected from the group consisting of polyolefin homopolymer, polyolefin copolymer, ethylene/ester copolymer, polystyrene, styrene/butadiene copolymer, EVOH, PVDC, and polyacrylonitrile; and the film has a total thickness of at least 2 mils, and an impact strength of at least about 1.5 ft-lbs, and a total free shrink, at 185°F, of from about 0 to 50 percent.

16. The easy-open package according to Claim 5, wherein the multilayer film is a laminate of a melt-oriented first component film to a solid-state biaxially-oriented second component film.

17. The easy-open package according to Claim 16, wherein the melt-oriented first component film is a multilayer film comprising the first composition in a peelable-seal layer, and the solid-state biaxially-oriented second component film is a multilayer film comprising the second composition in a permanent-seal layer.

18. The easy-open package according to Claim 17, wherein the first component film has a total free shrink at 185°F of less than 10 percent, and the second component film has a total free shrink at 185°F of from about 10 percent

to 150 percent.

19. The easy-open package according to Claim 18, wherein the first component film has at least one layer comprising high density polyethylene, and the second component film has at least two layers comprising linear low density polyethylene or homogeneous ethylene/alpha-olefin copolymer.

20. The easy-open package according to Claim 19, wherein each of the at least two layers comprising linear low density polyethylene further comprises carbon black.

21. The easy-open package according to Claim 5, wherein the multilayer film has a tensile strength at break of at least 4000 psi.

22. A packaged product comprising a product in an easy-open package comprising a peelable heat seal and a permanent heat seal, the package comprising a multilayer film having:

- (A) a first outer layer comprising a first composition which is heat sealable to form the peelable heat seal, and
- (B) a second outer layer comprising a second composition which is heat sealable to itself to make a permanent heat seal; and

wherein the multilayer film is folded inward at one or more seal regions, so that the package has at least one peelable seal and at least one permanent seal.

23. The packaged product according to Claim 22, wherein the product comprises at least one member selected from the group consisting of photographic film, photographic paper, cheese, pet food, livestock feed, sugar, coffee, cookies, cereal, cake mix, crackers, chips, powdered milk, vitamins, pharmaceutical products, pesticides, and herbicides.

24. An easy-open package comprising at least one peelable heat seal and at least one permanent heat seal, the package being made from a multilayer film having an inside film laminated to an outside film, wherein the inside film provides a majority of the inside surface of the package, and the outside film provides a remainder of the inside surface of the package, with the inside film having an inside layer which comprises a first member which is selected from the group consisting of:

- (a) a first composition which can be heat sealed to itself to form a peelable heat seal; and
- (b) a second composition which can be heat sealed to itself to form a permanent heat seal; and

the outside film having an inside layer which comprises a second member which is different from the first member, the second member being selected from the group consisting of:

- (a) the first composition; and
- (b) the second composition; and

wherein the multilayer film is sealed to itself or another film to form the easy-open package.

25. The easy-open package according to Claim 24, wherein the inside layer of the inside film comprises the second composition, and the inside layer of the outside film comprises the first composition.

26. The easy-open package according to Claim 25, comprising a pair of permanent side seals in which the inside layer of the inside film is sealed to itself, a seamless folded bottom, and a peelable top seal in which the inside layer of the outside film is sealed to itself or the second composition.

27. A packaged product in an easy-open package comprising at least one peelable heat seal and at least one permanent heat seal, the package being made from a multilayer film having an inside film laminated to an outside film, wherein the inside film provides a majority of the inside surface of the package, and the outside film provides a remainder of the inside surface of the package, with the inside film having an inside layer which comprises a first member which is selected from the group consisting of:

- (a) a first composition which can be heat sealed to itself to form a peelable heat seal; and

(b) a second composition which can be heat sealed to itself to form a permanent heat seal; and

the outside film having an inside layer which comprises a second member which is different from the first member, the second member being selected from the group consisting of:

- (a) the first composition; and
- (b) the second composition; and

wherein the multilayer film is sealed to itself or another film to form the easy-open package.

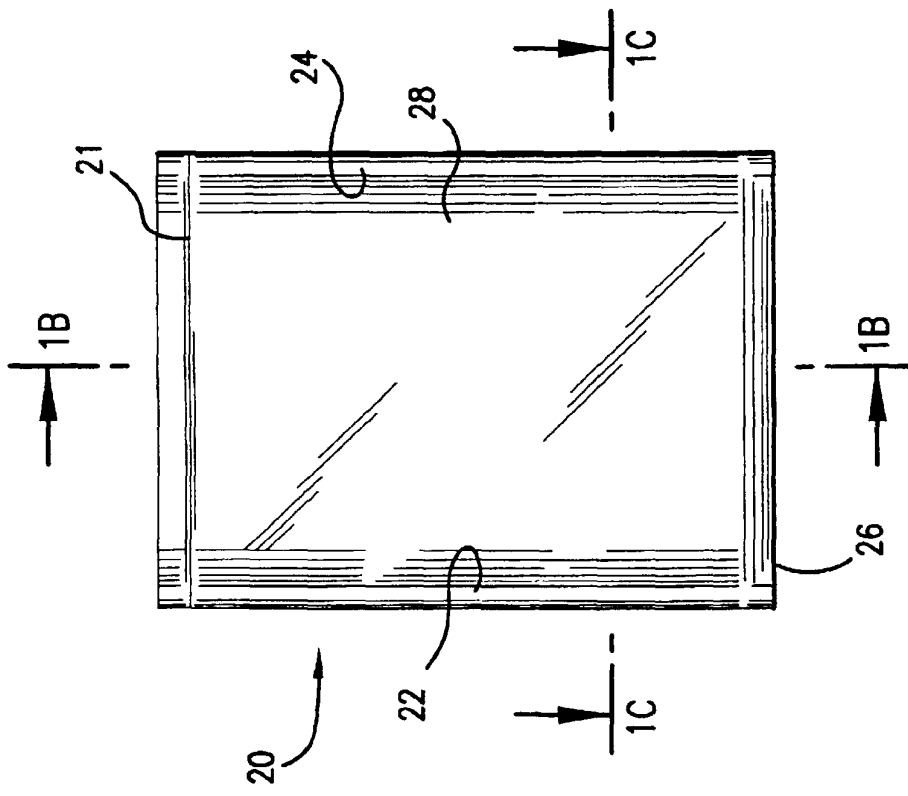


FIG. 1A

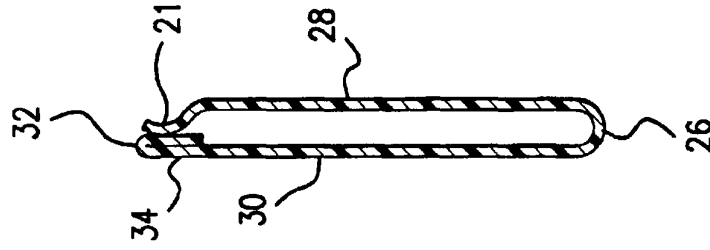


FIG. 1B

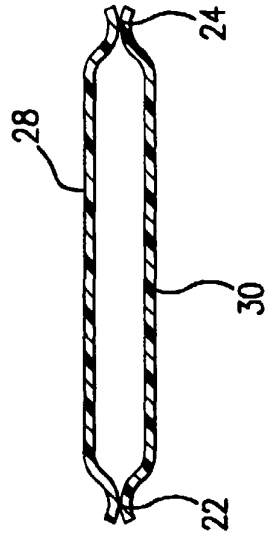
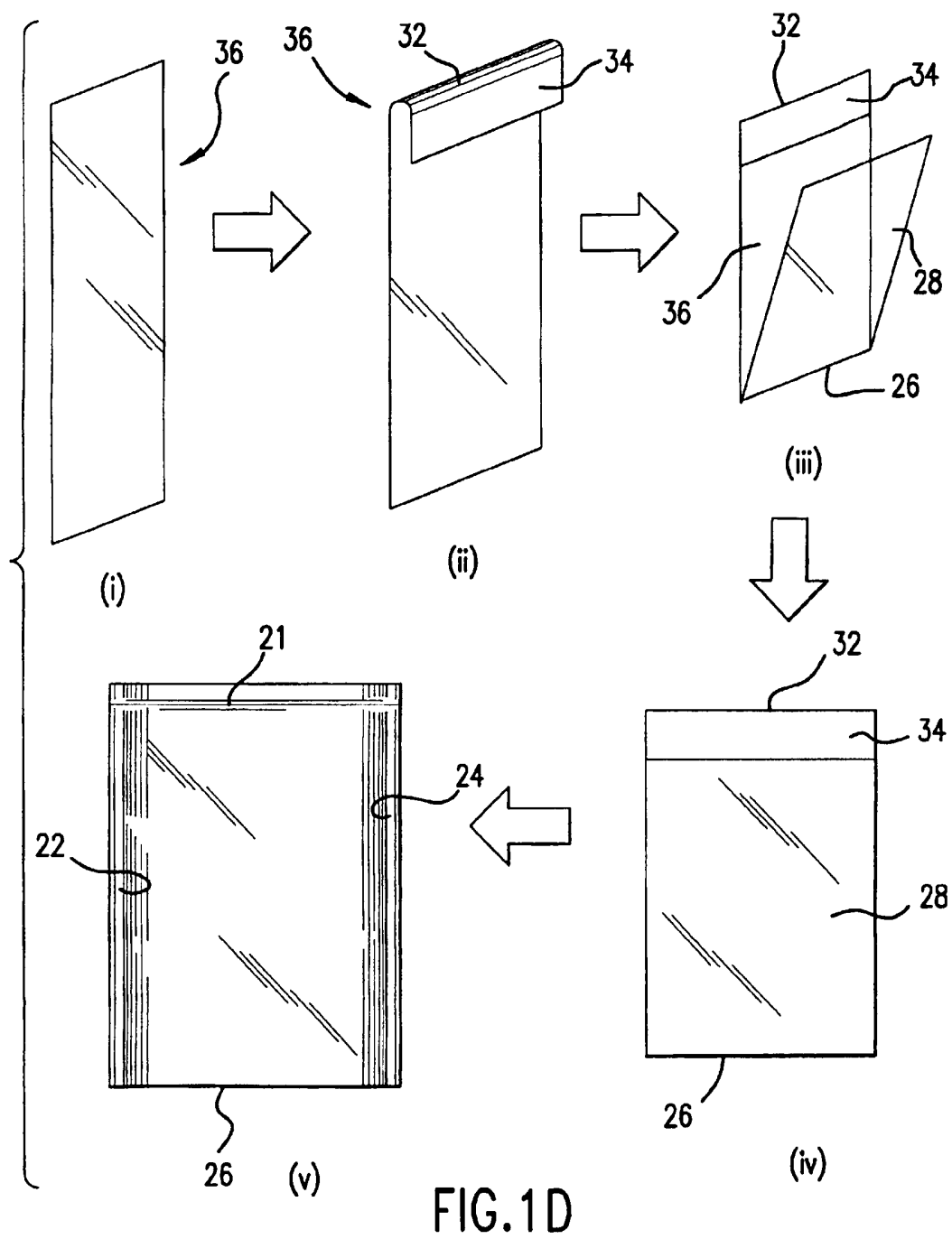


FIG. 1C



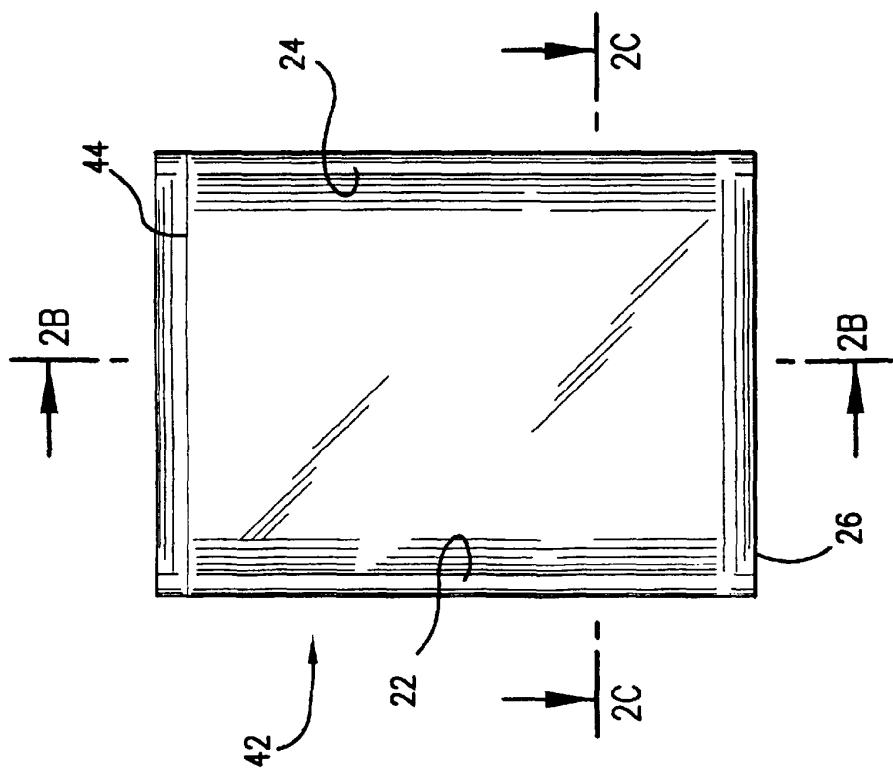


FIG. 2A



FIG. 2B

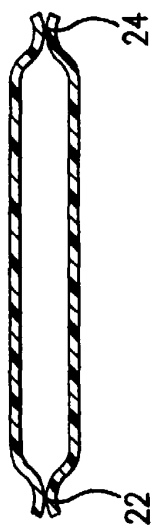


FIG. 2C

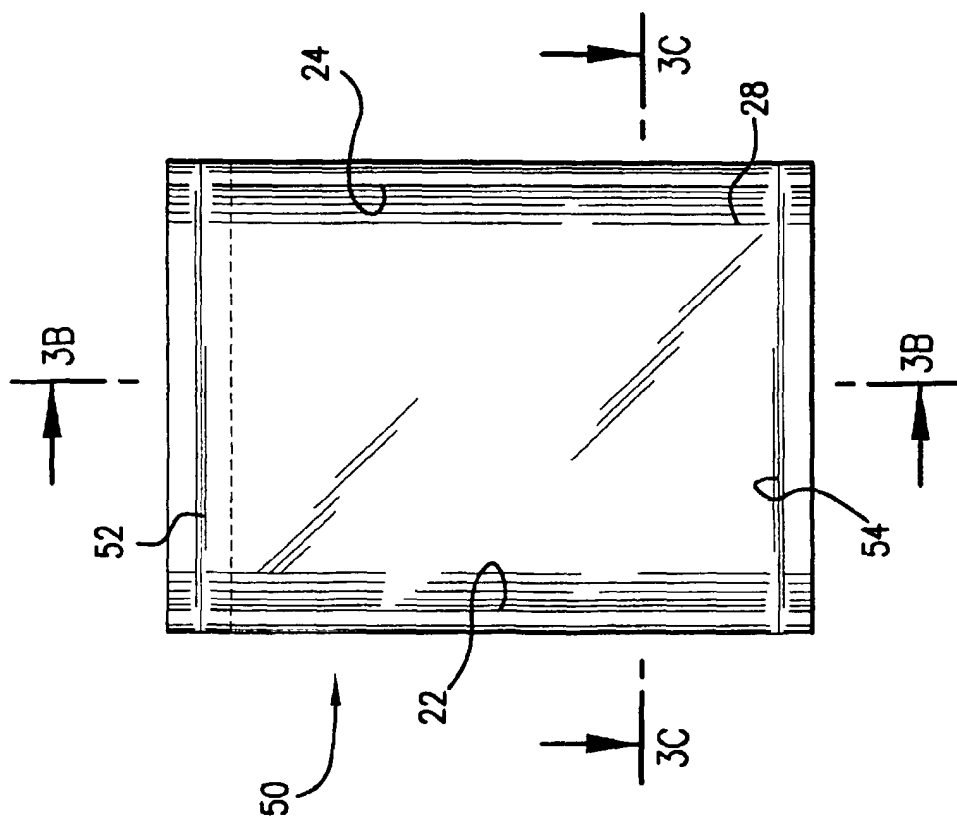


FIG. 3A

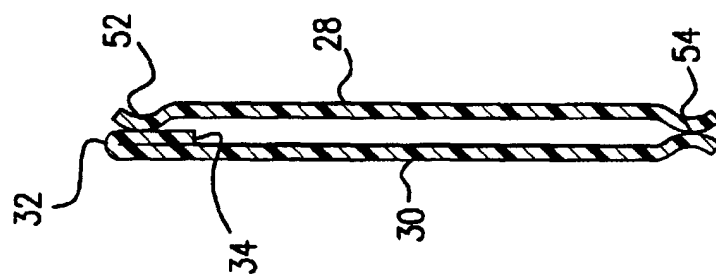


FIG. 3B

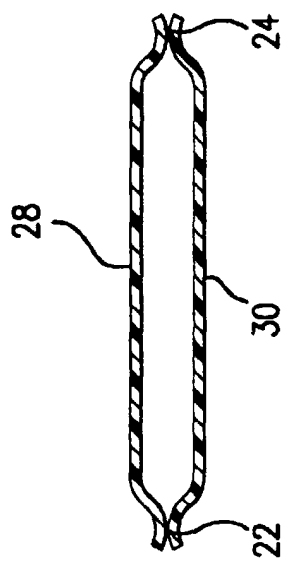


FIG. 3C



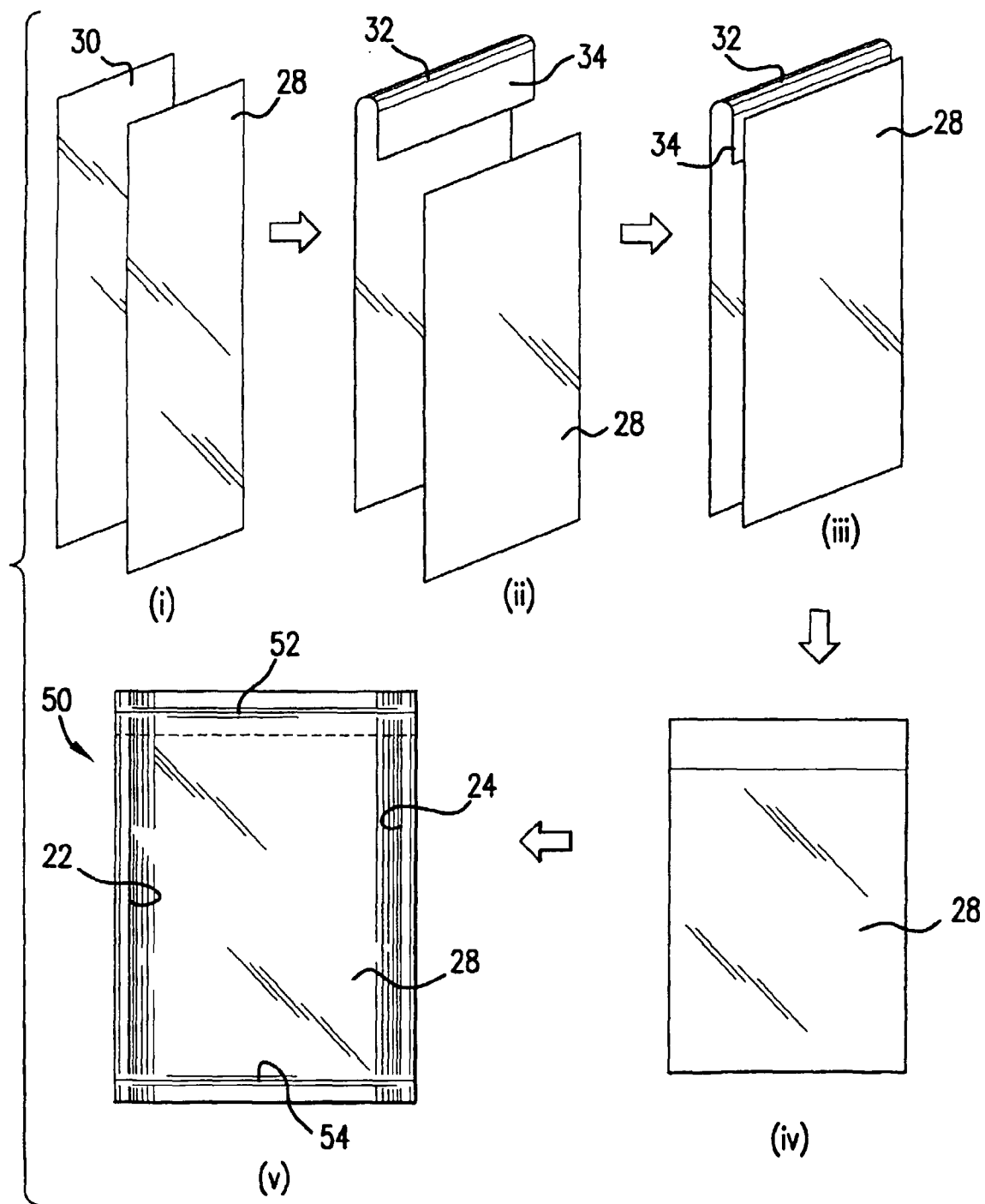


FIG.3D

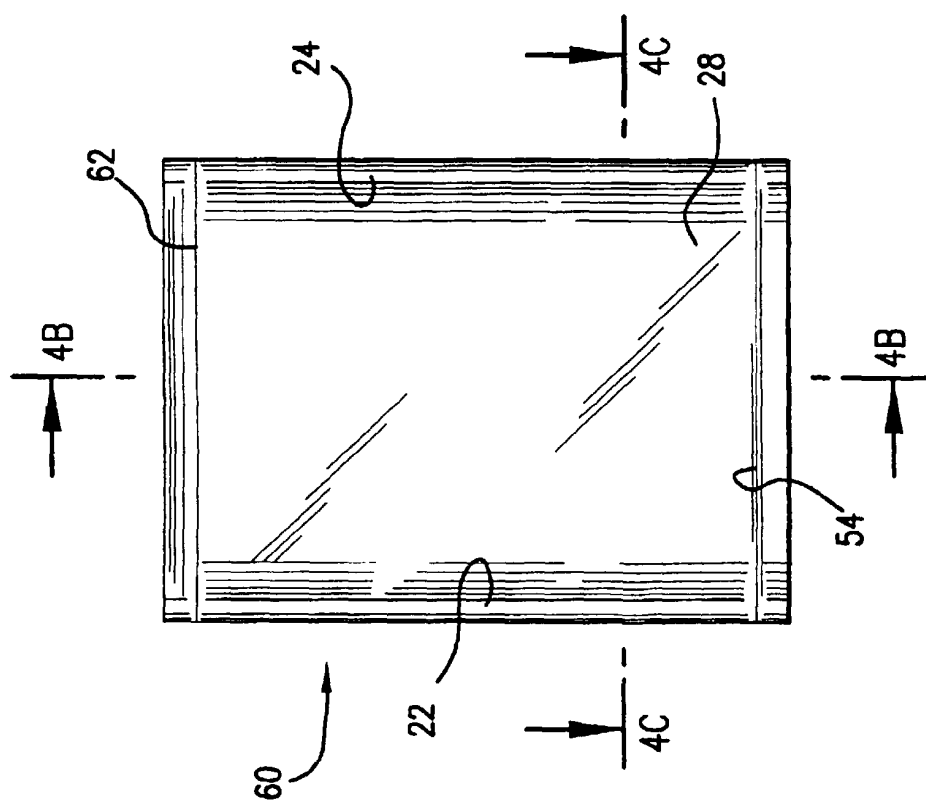


FIG. 4A

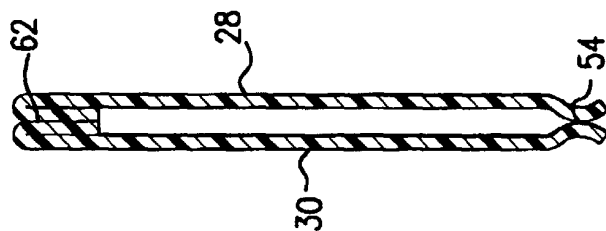


FIG. 4B

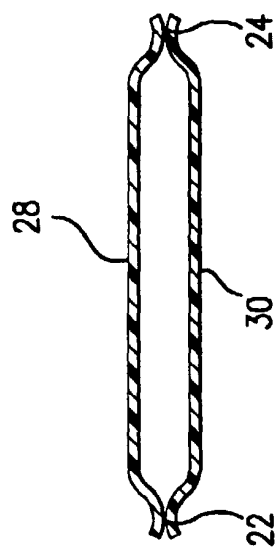
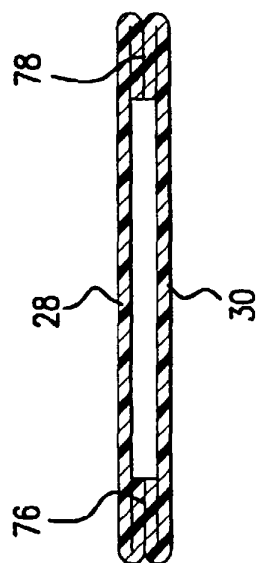
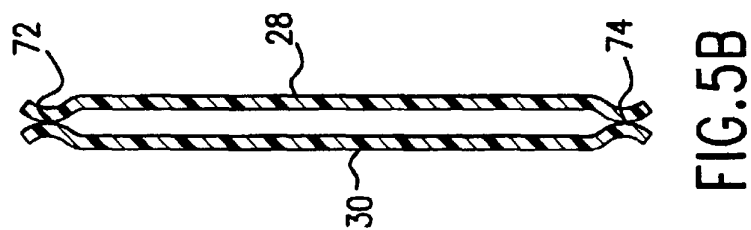
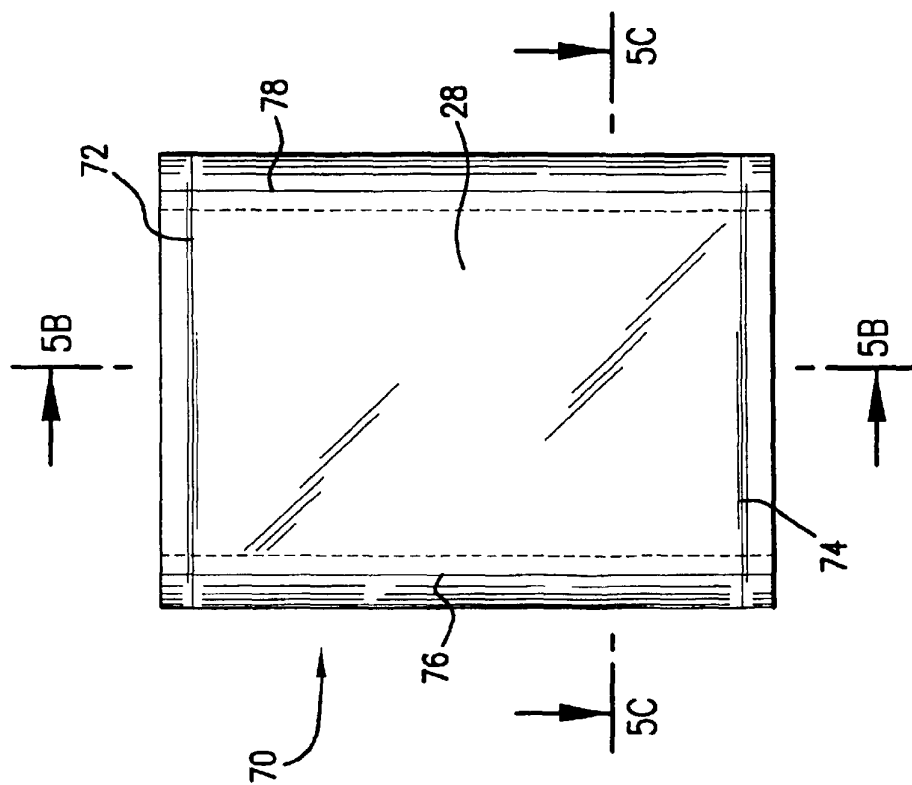


FIG. 4C



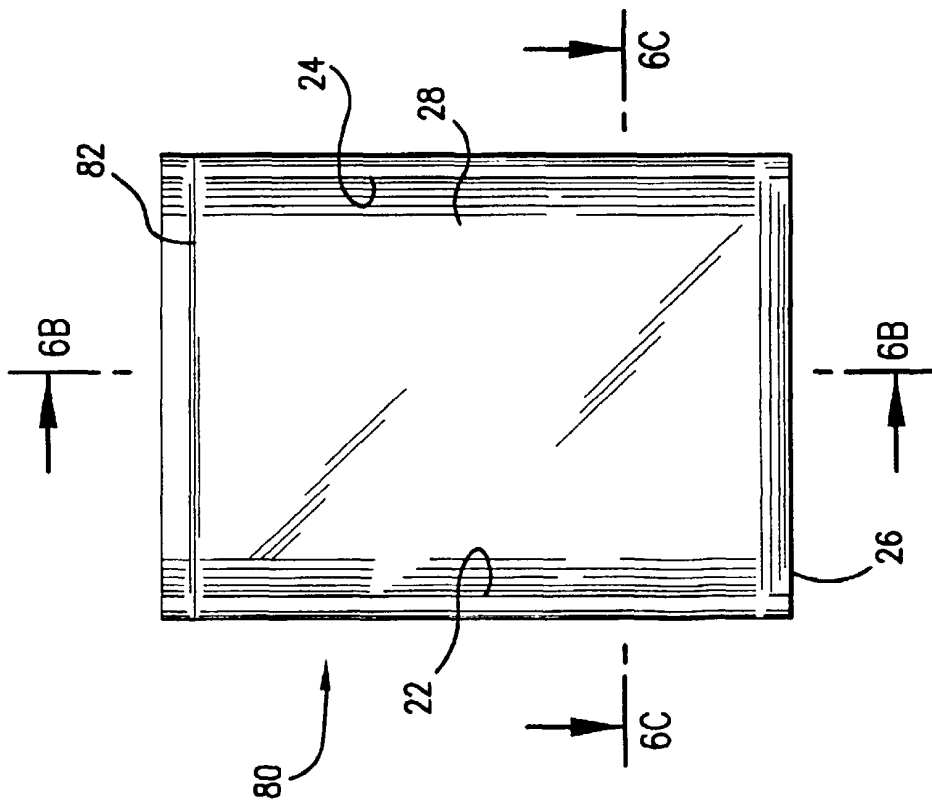


FIG. 6A

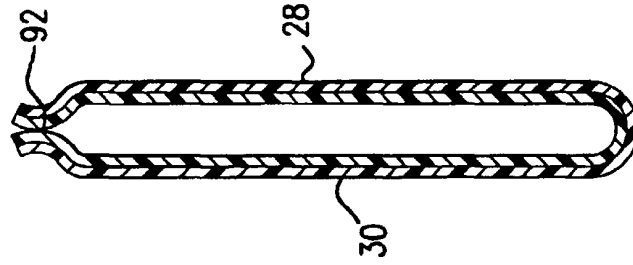


FIG. 6B

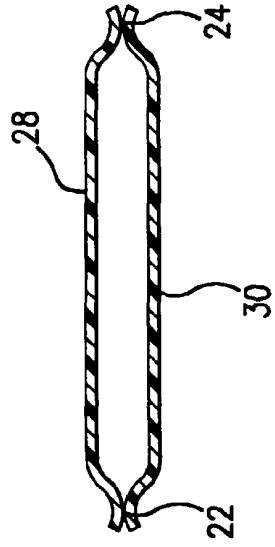
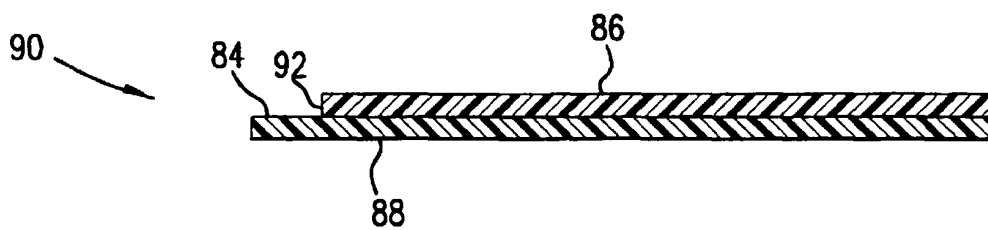
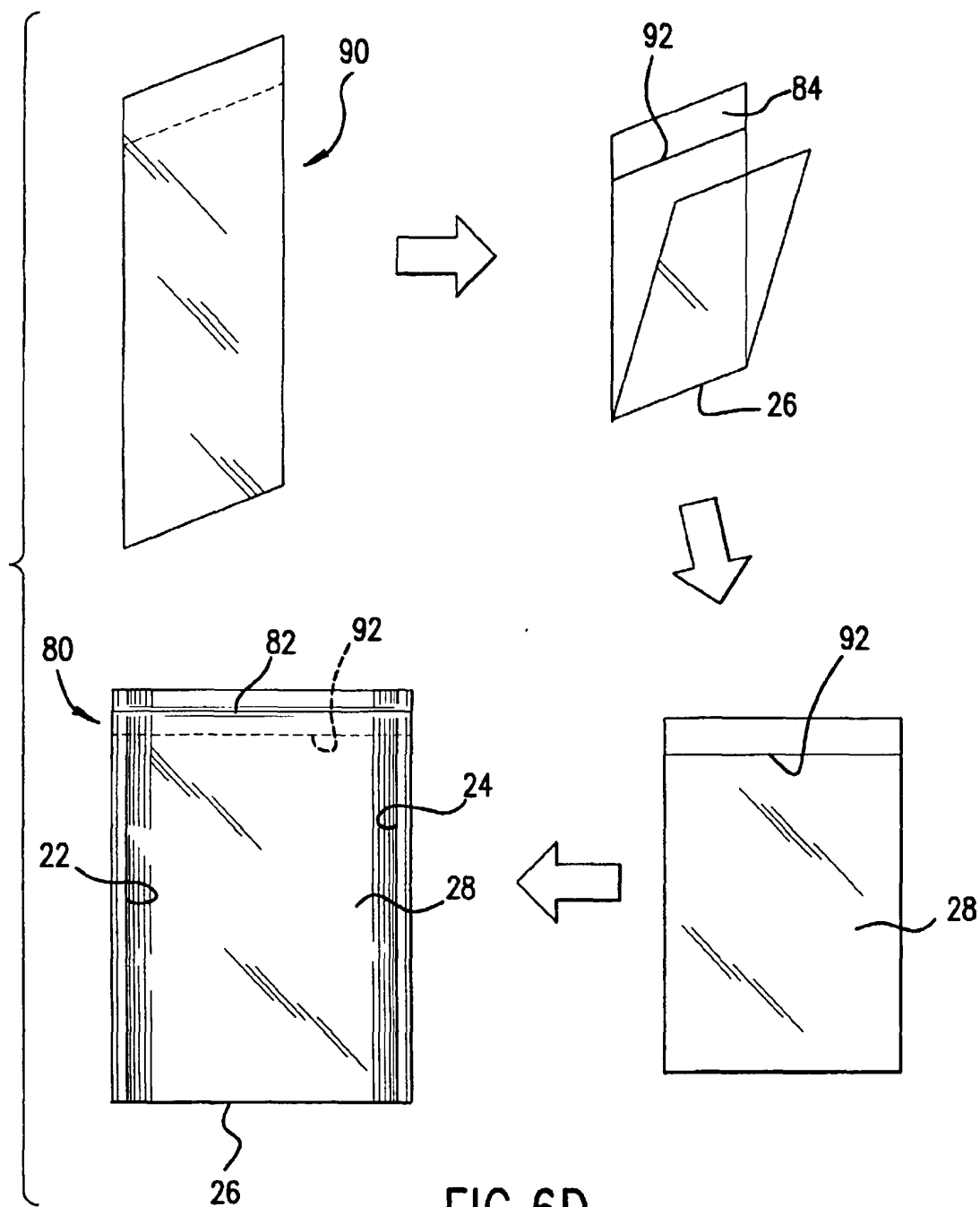


FIG. 6C



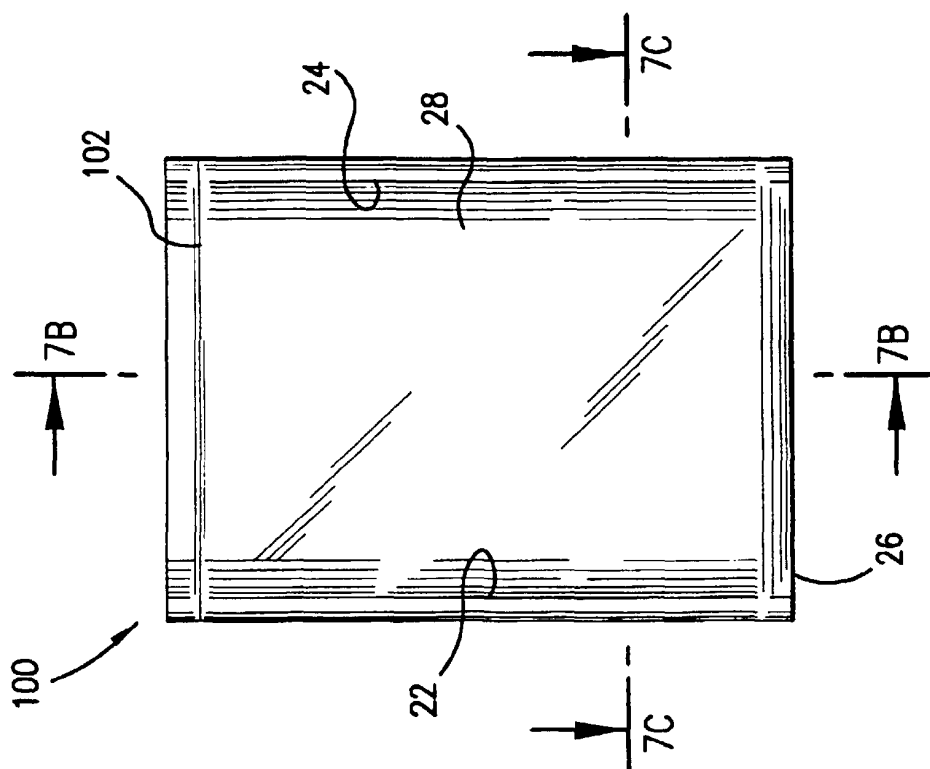


FIG. 7A

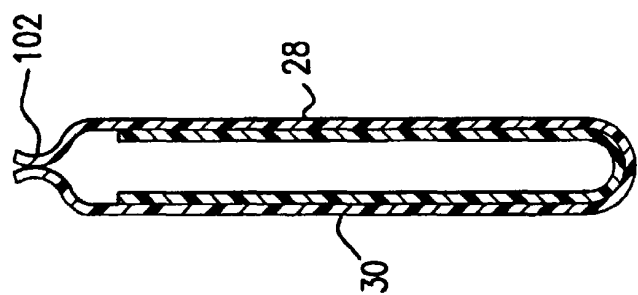


FIG. 7B

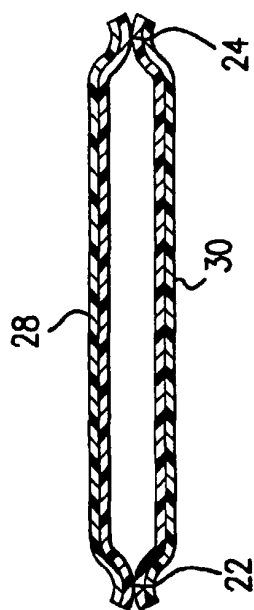


FIG. 7C

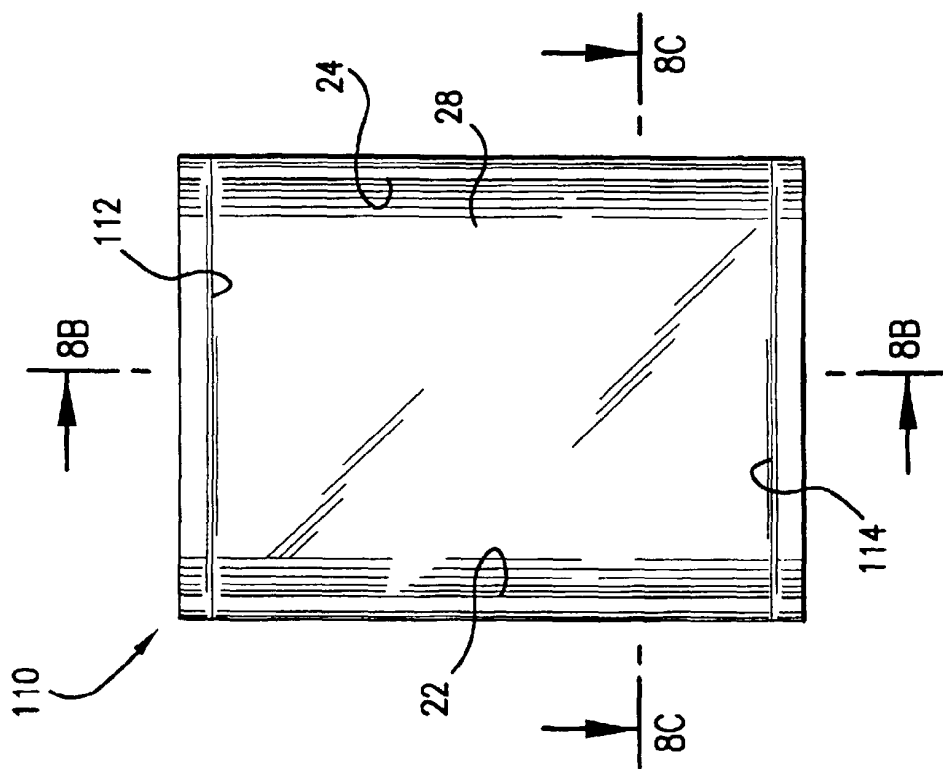


FIG. 8A

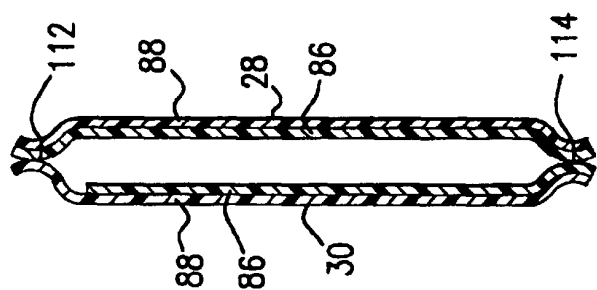


FIG. 8B

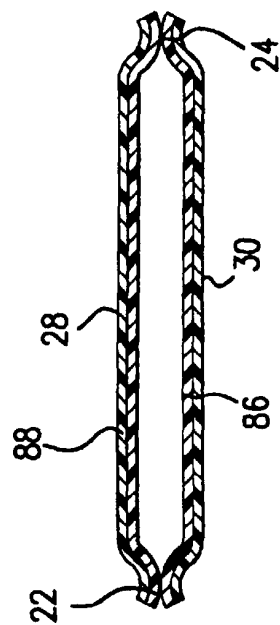


FIG. 8C

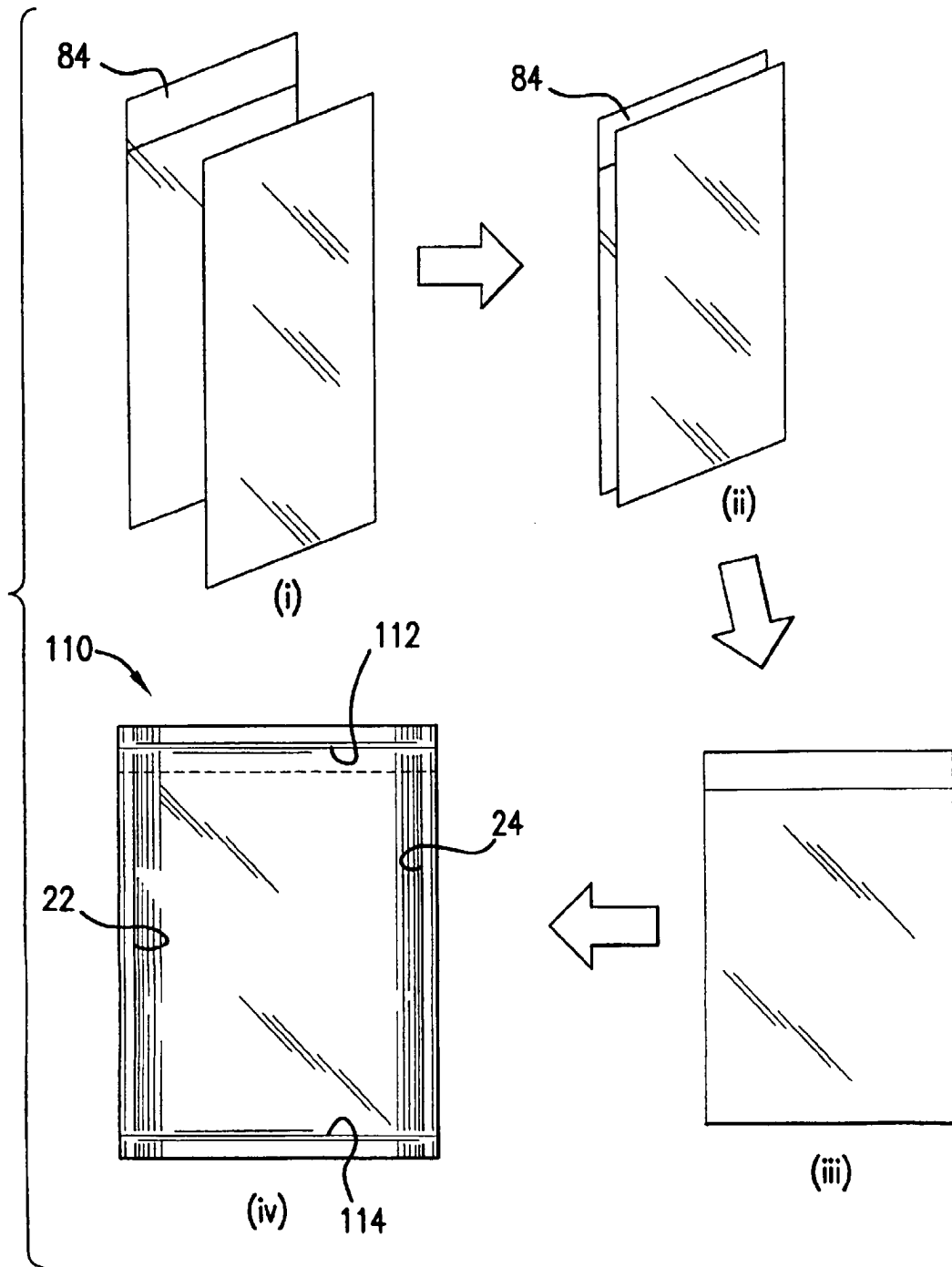


FIG.8D



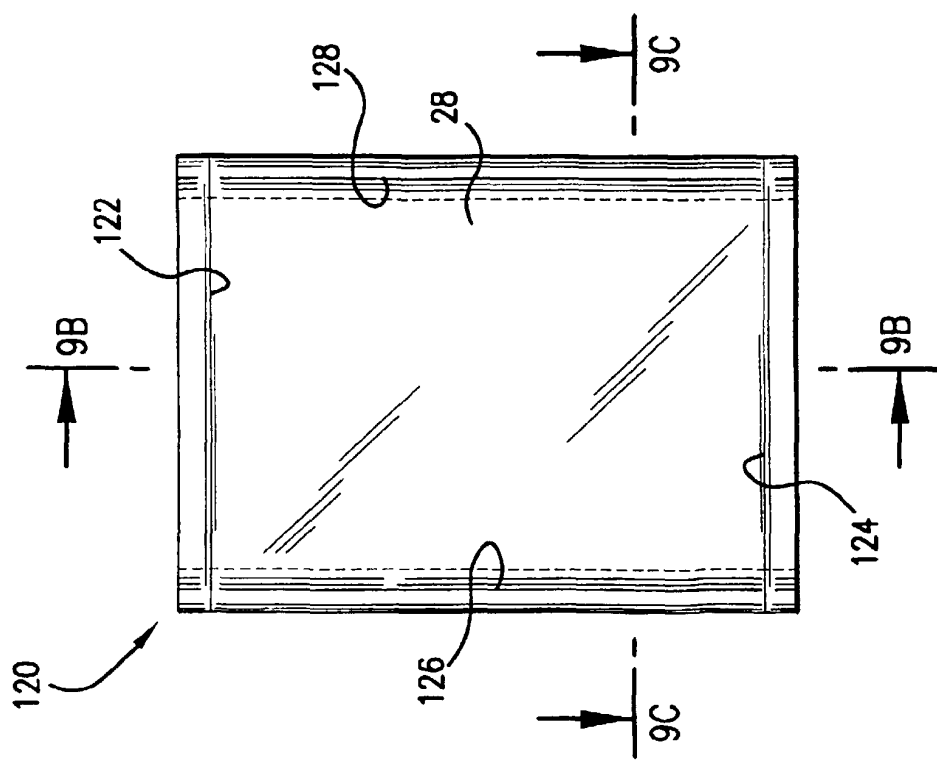


FIG. 9A

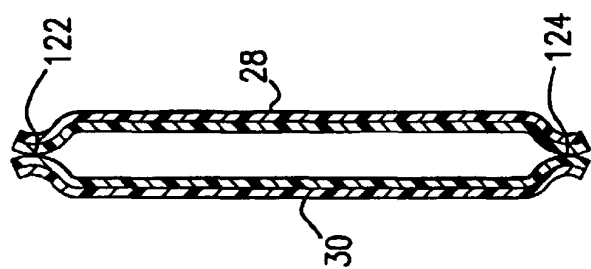


FIG. 9B

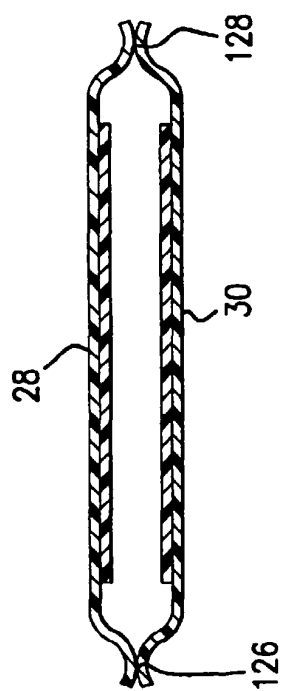


FIG. 9C

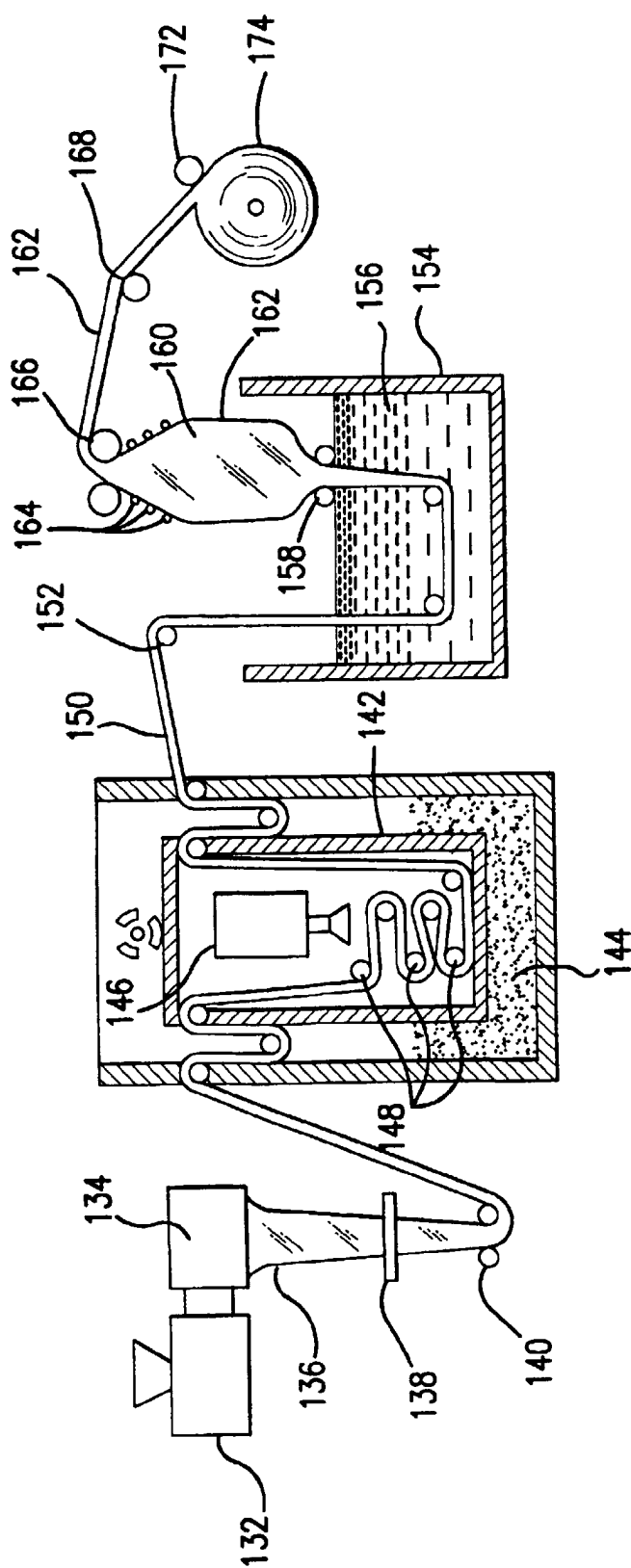


FIG.10

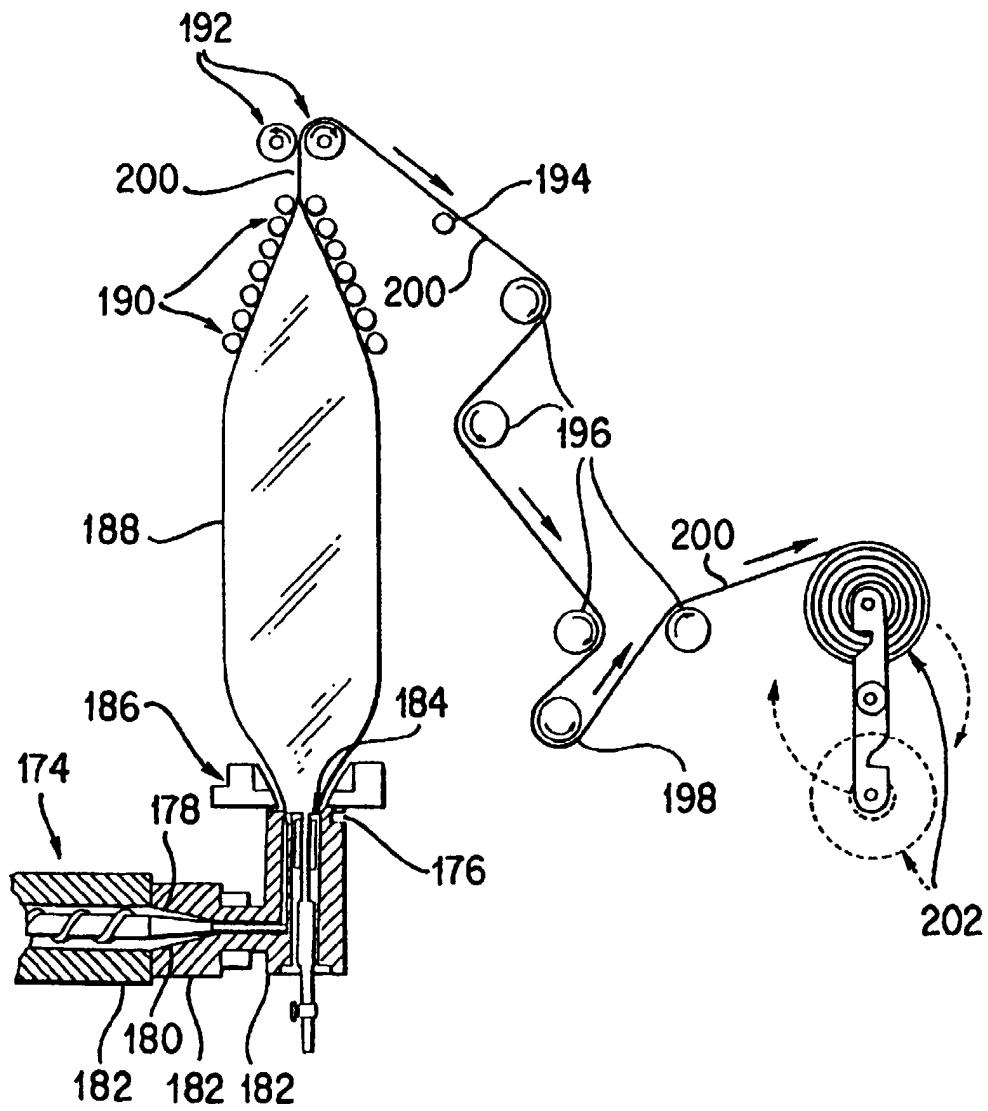


FIG. 11

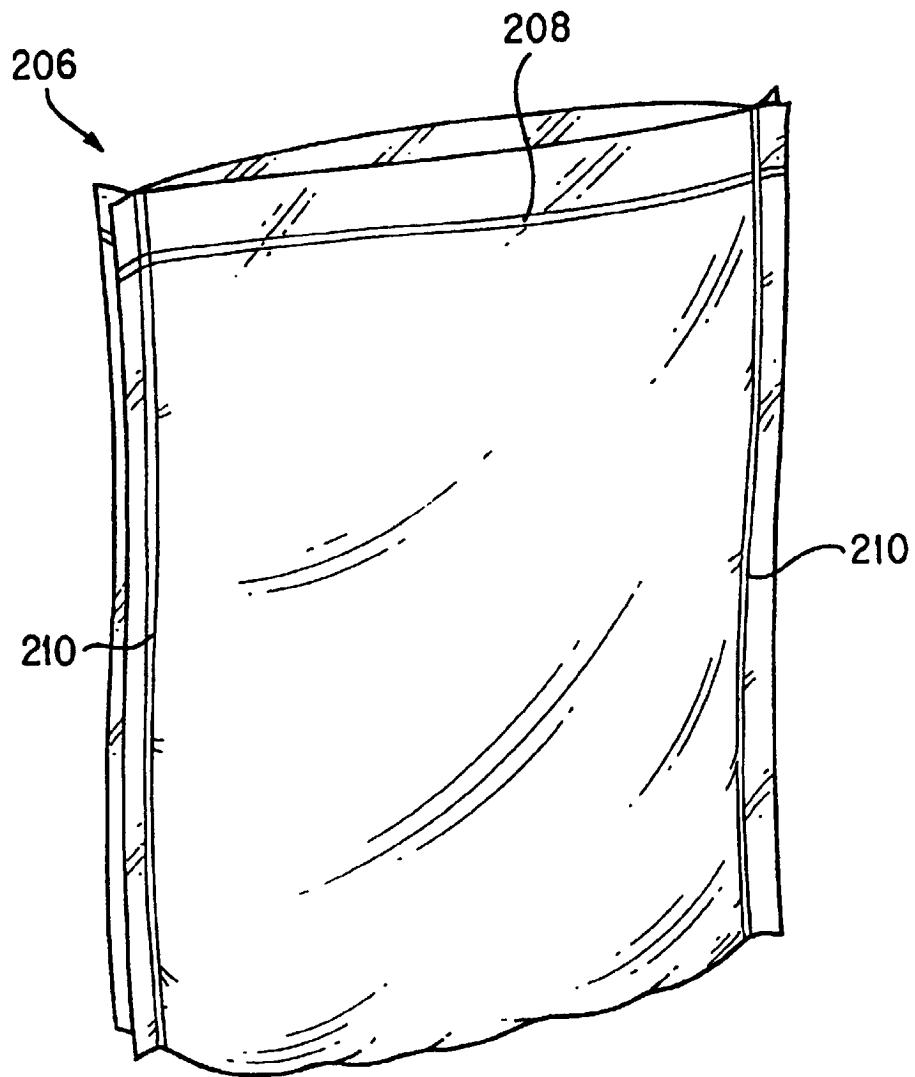


FIG. 12