MULTICOMPARTMENT PACKAGE WITH INTERNAL BREAKER STRIP


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10 Claims. (Cl. 206—47)

This invention relates to the packaging of liquid or plastic materials, and particularly to interreactive mate-

rials which, when mixed together, set up or cure to a heat-resistant, hard and tough state. The invention re-
lates to the packaged products and in particular to the novel multicompartment package having an internal "breaker strip" providing for removal at will of the barrier between separate compartments of the package.

Various liquid or plastic components may be enclosed in the separate compartments of the package. Upon breaking of the interior barrier or barriers, these components may then be effectively mixed together by hand manipulation of the outer envelope of the package. While the contents need not be reactive with each other, they may be, and preferably are, interreactive either at room temperature or on the application of heat. A typical and preferred combination of reactive components comprises as a first material a liquid epoxy resin and as a second material a stable mixture of liquid organic polymer and a tertiary amine activator for the epoxy resin. When mixed together, these two materials react exothermically and produce a heat-resistant, hard and tough resinous product which is particularly useful as an electrical insulating material.

The invention will now be more fully described in connection with the accompanying drawing, in which:

Figure 1 is a plan view, and Figure 2 is a cross-sectional view, of a preferred form of our multicompartment package.

Figures 3 and 4 illustrate, in cross-section, modified forms of internal barriers in the package of Figures 1 and 2.

Figure 5 is a sectional view of an alternative type of multicompartment package;

Figures 6, 7 and 8 illustrate in cross-section additional modifications of internal barriers; and

Figure 9 is a plan view of common edge portions of two of the packages of Figure 1 during a typical continuous process of manufacture.

The package 10 of Figures 1 and 2 is made of two sections 11 and 12 of thermoplastic polymeric film, heat sealed at the edges 13 to provide a hermetically sealed envelope. The two sides of the package are also heat sealed to the opposite surfaces of an interior breaker strip 15 along a central area 14, thus separating the package 10 into two compartments, one of which contains, for example, a liquid epoxy resin, the other then containing curing agents and activators for the epoxy resin. The seal at the breaker strip is of sufficient strength to maintain complete separation of the reactive contents of the two segments of the envelope during all normal handling, packaging, shipping and storing operations.

The heat seal between the sections 11 and 12 of thermoplastic film and the breaker strip 15 is conveniently made by a process involving passing one of the two sheet materials in strip form continuously over a roller having a narrow peripheral heated area, passing the breaker strip, also in continuous strip form, over the thus heated area under light tension, similarly affixing the second centrally heated continuous strip of sheet material to the reverse surface of the breaker strip, cooling and hardening the assembly and then separating the same from the second of the partially heated rollers. Such a process is capable of providing a bond between the several surfaces which is as strong as or stronger than the bond produced between the two identical outer sheet materials under heat and pressure, but only if the breaker strip is also identical in physical structure with the outer sheets.

In the present instance, the breaker strip being of dissimilar physical structure is, surprisingly, found to adhere with considerably reduced force to the outer sheets. The continuous strip formed as above indicated is then formed into separate two-compartment packages by sealing under heat and pressure the edges 13 as indicated in Figure 1 and separating the packages along the connecting edge 15. The liquid or plastic reactive materials are metered into the compartments thus provided just prior to completion of the peripheral seal.

In activating and using the package of reactive resin-forming components just described, the two panels 11 and 12 are separately gripped at the central area one of the compartments and are jerked rapidly apart along the central seam 14, thus breaking the seal between one or the other of the panels and the breaker strip 15 without damaging the permanent edge seal 13, and permitting the reactive contents to be combined within the envelope. Combination is effected by hand manipulation of the envelope and is continued until a homogeneous mixture is obtained and the reaction has commenced. One corner of the envelope is then opened, for example by cutting along dotted line A of Figure 1, and the contents flow or are squeezed out into a waiting mold or other cavity as desired, where the reaction continues to completion.

From the application described, it will be apparent that the heat seal between the panels 11 and 12 and the breaker strip 15 must be substantially less strong than the heat seal between the panels themselves at the outer peripheral edge 13.

It has been found that any attempt to produce a differential heat seal by pressing the two panels directly together at temperatures or pressures lower than those required to provide the rupture resistant edge seal 13, invariably results either in a strong seal which cannot readily be broken or in a weak seal which is incapable of maintaining the desired separation between the two compartments of the envelope. Even though accurate control of temperature, pressure and time be achieved, the normal variations in thickness of extruded film, surface irregularities, and other uncontrollable variations preclude the formation of such internal seals on any commercially useful basis.

We have now found that the insertion of a suitable breaker strip 15 between the film sections 11 and 12 overcomes these difficulties and provides a package which is entirely resistant to accidental joining of the several compartments, while being easily activated by hand pulling whenever desired. Surprisingly, we have found that the breaker strip may be identical in chemical composition with the outer films 11 and 12, the only necessary difference being a difference in physical orientation or equivalent property.

As a preferred example, the envelope of Figures 1 and 2 is produced from polyethylene film which has been produced by extrusion from a tubing die, and the barrier strip 15 is produced from a film of chemically identical polyethylene which has been extruded from a flat shooting die, and to approximately the same thickness. The ma-
terials appear to weld together under heat and pressure to substantially the same degree, but it is found that the bond obtained between the two dissimilar films, while being essentially adequate to maintain the two compartments of the package during normal handling, is still readily broken by hand jerking or pulling on the two film walls of the envelope adjacent the center seal. On the other hand, the edge bond 13 is found to be completely resistant to such hand pulling, the film ordinarily breaking at some point removed from such bond when placed under sufficient stress.

Polyethylene film alone is somewhat lower in tensile strength than may be required for certain types of packages. The film is desirably reinforced by laminating another film, such as cellulose or polyurethane film, or metal foil, or paper, which has much higher tensile strength, but is incapable of heat sealing. In such structure, the polyethylene surface of the composite film forms the inner surface of the envelope and the product is therefore identifiable as a tereflex film. The breaker strip 15 is not laminated, but is composed entirely of polyethylene having a different physical orientation from that of the polyethylene layers of the films 11 and 12 forming the container.

The same results are obtained by reversing the two types of films, i.e., by employing for the envelope a film which has been prepared by extrusion from a flat sheeting die, and for the breaker strip a film formed with a tubing die.

Equivalent results are obtained with envelopes and breaker strips which are chemically different while still capable of forming an effective heat seal having less resistance to rupture than a heat seal of either material to itself. One example is an ethylene cellulose film with a breaker strip of a substantially different material.

While the bond between the film and the barrier strip of the package of Figures 1 and 2 will ordinarily break along the plane of the initial juncture between the two, there may be at times some transfer of polymer from the breaker strip to the outer film, or vice versa, when the package is activated. The modified structures illustrated in Figures 3 and 4 provide for deliberate transfer of portions of the breaker strip to the outer films.

In Figure 3, the two films 31 and 32, corresponding with 11 and 12 of Figure 2, are bonded to opposite sides of breaker strip 35 which consists of a central fibrous portion 36 and surface films 37 and 38. The surface films are of the same composition as the envelope, and film with the latter a heat seal which is as strong as the seal formed around the outer edges 13 of the envelope 10 of Figures 1 and 2. The fibrous central layer 36 is sufficiently strong to provide adequate resistance to ordinary handling, and is sufficiently dense to prevent any appreciable transfer of liquid from one compartment of the package to the other. However the section 36 provides a weakened plane at the center of the breaker strip so that, when the sides of the package are jerked apart, the breaker strip splits along this central plane. The resulting two halves of the breaker strip remain attached to the respective sides of the envelope. Mixing of the liquid or plastic components is then accomplished by hand manipulation as in the case of the envelope in Figures 1 and 2.

An example of a structure corresponding to that illustrated in Figure 5 employs as the breaker strip a structure consisting of a thin porous paper coated on both surfaces with a thin continuous layer of polyethylene which is heat sealable to the polyethylene-lined outer envelope. The paper center remains porous, and the slightest penetration by the reactive materials in the package resulting in the formation of an impervious resinous reaction product along one or the other of its exposed edges.

The structure illustrated in Figure 4 employs as the breaker strip 45 a strip of polymeric material which is substantially softer and of lesser internal strength than the thermoplastic inner surface portion of the outer film envelope, to which it is heat sealed. Activation of the package by jerking apart the side walls 41 and 42 then results in a tearing away of a substantial portion of the breaker strip 45, as indicated by the dotted lines 46, the material remaining attached to one or the other of the envelope walls. Materials which have proven highly satisfactory in such a structure include high molecular weight polyethylene film envelopes and low molecular weight, but still solid, polyethylene breaker strips.

The envelope structures thus far illustrated have been indicated as consisting of two separate sections of film, sealed around the entire periphery as well as along the central area. The same results may be obtained by employing a single section of film, forming it along a central line to form an edge, and then completing the envelope by heat sealing the remaining portions as necessary. A still further variation employs extruded tubular film as the envelope, the breaker strip being inserted and sealed in place across a central section and the ends of the tube then being closed by heat sealing. The liquid or plastic contents are obviously introduced into their respective compartments prior to final heat sealing, and are introduced either at the end or at a side of the package, depending on the particular structure employed as well as other factors.

A somewhat different but closely analogous structure is illustrated in Figure 5. In this example, the package 50 consists of a relatively rigid but still flexible one-piece envelope 51 having an internal peripheral channel 59 into which is set a closely fitting and somewhat less flexible diaphragm 55 serving as a breaker strip. The package is activated by pressure applied to one end of the package or capsule, causing the diaphragm to be snapped out of its normal retaining channel, thus permitting mixing of the interreactive contents. The reactive mixture is then forced from the capsule through the tip 52 which is opened for this purpose by cutting along dotted line A.

The breaker strip or diaphragm 55 of Figure 5 is not required to be heat sealed to the walls 51 of the capsule 50, but the relative rigidity of the structure, as compared with the structures illustrated in the previous figures, produces substantially the equivalent effect. The liquid or plastic contents are prevented from intermingling prior to activation of the central diaphragm. The breaker strip is effectively removed from its initial position by manipulation of the envelope when required, and by stresses which are insufficient to cause damage to the outer envelope.

The breaker strip 65 of Figure 6 is formed of two layers 66 and 67 of a composition material of the same chemical but different physical structure. The two sections are lightly bonded together, e.g., by techniques herein described, and the composite is bonded to the two outer films 61 and 62 forming the center seal of the package as shown in Figure 1. When the package is opened, the breaker strip fails along the central interface, thus permitting the reactive contents of the two compartments of the package to be intermixed.

The packages of which the breaker strip and adjacent portions are indicated in Figures 7 and 8 provide for the inclusion of a third reactive component within the breaker strip itself. In Figure 7, the breaker strip 75 is in the form of a hollow thin sealed tube or cylinder, sealed along opposite paraxial areas to the outer films 71 and 72. In this case the latter films are indicated as of composite structure, having an inner thermoplastic layer and an outer layer of increased strength. Such a film has already been described in connection with the description of the package in Figure 1. The thin film forming the breaker strip 75 has sufficient thickness or body to permit the formation of a strong bond between it and the thermoplastic surfaces of the outer films, but is much lower in tensile strength than the laminated
films. When the latter are jerked apart, in using the package, the film of the breaker strip fails, thus liberating the reactive component initially contained therein and also permitting mixing of the reactive components of this and the other two chambers of the package.

Another modification, illustrated in Figure 8, employs a tubular breaker strip 86 and 87 of thin thermoplastic polymer film material sealed to the outer laminated films 81 and 82 and to each other along the edges, but sealed along the central areas to form a third compartment for reactive material. It will be apparent that the films 86 and 87 may be sealed to the outer sheets 81 and 82 along areas other than the sealed edge areas of the breaker strip 85. Since the films 86 and 87 are thinner and of lower tensile strength than the outer laminates, the breaker strip fails in the same manner as that of Figure 7, i.e., by tearing of the film material, and hence the several bonds between thermoplastic surfaces may be made as strong as desired.

In all of these packages, it will be observed that the binder strip provides an increased thickness at the outer edge of the package, i.e., at the corner 19 of Figure 1. Under such conditions it would normally be expected that leakage would occur by penetration and by bonding at the juncture between the breaker strip and the outer sheet materials. Surprisingly, the packaging of this invention are found to be completely free of any leakage, even after the package has been activated by tearing the outer panels rapidly apart along the central seam as hereinafter described. It is believed that this result is accomplished in the following manner. As shown in Figure 9, the formation of a seal between the outer sheet materials to form a common edge of adjacent packages in a continuous strip of the film material results in all of the thermoplastic polymer at the corner area 19, as indicated by the extension of the dotted line indicating the boundaries of the breaker strip 15. In the packages of Figures 1 and 2, 4, 6, 7 and 8, the thermoplastic breaker strip is effectively masticated and integrated with the thermoplastic material of the outer film or laminate. In the structure of Figure 3, the thermoplastic material additionally penetrates and impregnates the fibrous polymer layer 38. In all cases, there is produced a peripheral bond 13 which is no thicker at the corner area 19 than at any other point around the entire periphery of the package. The corner area is at least as well bonded as the remainder of the peripheral seal, and in many cases is found to have a superior bond due to the additional slight ridge of polymer along the inner edge of the peripheral seal, as at area "a" of Figure 9. As before indicated, cutting the seal along the central line "c" of Figure 9 sever the completed package from the adjacent package next in line in the continuous method of manufacture described.

This application is a continuation-in-part of the co-pending application Serial No. 385,992 of Emil Wayne Bolinmeier and Leo F. Vokaty, filed October 19, 1953.

What is claimed is as follows:

1. A package comprising a hermetically closed envelope of thermoplastic polymer film enclosing a hollow breaker strip of a thermoplastic polymer material having less internal strength than said film, adhe rently heat sealed to said film along a narrow line area around the entire interior cross-section of said envelope, said breaker strip permanently adherently bonded to said film along a narrow line area around the entire interior cross-section of said envelope, said breaker strip comprising a central fibrous layer having a thermoplastic polymer film layer on each side thereof, the fibrous layer being readily separable along an interior plane under a stress insufficient to break the adhesive bond between the envelope and the surfaces of the breaker strip.

2. The multicompartment package of claim 1 containing in one compartment a liquid resinous component and in another compartment, separated from said one compartment by the separable breaker strip, another reactant material reactive with said liquid resinous material to produce a heat-resistant, hard and tough resinous product.

3. A multi-compartment package for a plurality of separately compartmentalized inter-reactive miscible contents, comprising an upper thermoplastic polymer film wall section, a coinciding lower thermoplastic polymer film wall section, and an intermediate narrow laminar breaker strip across the entire width of said wall sections and intermediate the ends thereof, said breaker strip being sealed along its entire length to corresponding opposing narrow areas of said wall sections to provide a disruptive barrier between the resulting two compartments, and said breaker strip comprising a central disruptive porous fibrous layer having a thermoplastic polymer film layer on each side thereof.

4. A multi-compartment package as defined in claim 3 in which the opposing narrow areas of said coinciding wall sections are permanently sealed together from the outer edges of said package, the fibrous layer of said breaker strip remaining internally substantially free of the thermoplastic polymer film material between said sealed edge areas and being impregnated with said material within said edge areas.

5. A multi-compartment package for a plurality of separately compartmentalized inter-reactive miscible contents, comprising a first thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, a coinciding second thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, said inner films being capable of being permanently sealed together under heat and pressure, and an intermediate narrow breaker strip across the entire width of said wall sections and intermediate the ends thereof and comprising a central thin fibrous layer having an exposed thin thermoplastic polymer film layer on each side thereof, welded along opposite central flat surface areas of said strip to each of said wall sections along the full width of the inner surface of each said wall section.

6. A multi-compartment mixing-package for a plurality of separately compartmentalized miscible contents, comprising a first thin strong flexible thermoplastic polymer film wall section, an opposing coinciding second thin strong flexible thermoplastic polymer film wall section, said sections being capable of being permanently sealed together under heat and pressure, and an intermediate narrow breaker strip across the entire width of said wall sections and intermediate the ends thereof, adherently heat sealed along opposite central flat surface areas of said strip to each of said wall sections along the full width of the inner surface of each said wall section and providing a compartment-separating seal capable of being broken by hand pulling on said opposing wall sections.

7. A multi-compartment mixing-package for a plurality of separately compartmentalized miscible contents, comprising a first thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, a coinciding second thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, said inner films being capable of being permanently sealed together under heat and pressure, and an intermediate narrow breaker strip across the entire width of said wall sections and intermediate the ends thereof, adherently heat sealed along opposite central flat surface areas of said strip to each of said wall sections along the full width of the inner surface of each said wall section.
along the full width of the inner surface of each said wall section; said breaker strip comprising a laminar web material readily separable into two laminae along an interior plane and providing a compartment-separating seal capable of being broken by hand pulling on said opposing wall sections.

9. A multi-compartment mixing-package for a plurality of separately compartmentalized miscible contents, comprising a first thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, a coinciding second thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, said inner films being capable of being permanently sealed together under heat and pressure, and an intermediate narrow breaker strip across the entire width of said wall sections and intermediate the ends thereof, adherently heat sealed along opposite central flat surface areas of said strip to each of said wall sections along the full width of the inner surface of each said wall section; said breaker strip being a strip of thermoplastic polymer material having less internal strength than said wall sections and providing a compartment-separating seal capable of being broken by hand pulling on said opposing wall sections.

10. A multi-compartment mixing-package for a plurality of separately compartmentalized miscible contents, comprising a first thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, a coinciding second thin flexible wall section having an inner exposed-surface thermoplastic polymer film and a reinforcing film laminated thereto, said inner films being capable of being permanently sealed together under heat and pressure, and an intermediate narrow breaker strip across the entire width of said wall sections and intermediate the ends thereof, welded along opposite central flat surface areas of said strip to each of said wall sections along the full width of the inner surface of each said wall section; said breaker strip consisting of two layers of thermoplastic film material lightly bonded together and providing a compartment-separating seal capable of being broken by hand pulling on said opposing wall sections.

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