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(71) Applicant *(for all designated States except US)*: **KRAFT FOODS GLOBAL BRANDS LLC** [US/US]; Three Lakes Drive, Northfield, Illinois 60093 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **POKUSA, Kenneth C.** [US/US]; 11029 West 72nd Street, Indian Head Park, Illinois 60525 (US). **ZERFAS, Paul** [US/US]; 608 East View Court, Verona, Wisconsin 53593 (US).

(74) Agents: **KRATZ, Rudy** et al.; Fitch, Even, Tabin & Flannery, 120 South LaSalle Street, Suite 1600, Chicago, Illinois 60603 (US).

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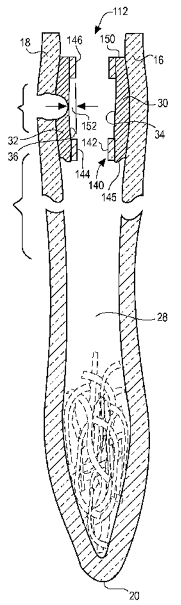
Fig. 4



(57) Abstract: A flexible package having a reclosable fastener with opposing front and back panels joined together to form a cavity. The reclosable fastener including opposing cohesive layers supplied from a solvent dispersion of a thermoplastic elastomer and diluent disposed on each of the front and back panels effective to form a reclosable fastener having a cohesive peel strength less than the bond strength to the front and back panels.

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COHESIVE RECLOSABLE FASTENERS FOR FLEXIBLE PACKAGES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit of United States Provisional Application Number 61/093,901, filed September 3, 2008, United States Provisional Application Number 61/052,021, filed May 9, 2008 and is a continuation and claims benefit of United States Application Number 12/435,768, filed May 5, 2009, all of which are hereby incorporated herein by reference in their entirety.

FIELD

[0002] This disclosure relates generally to reclosable fasteners for flexible packages and, in particular, to cohesive-based reclosable fasteners for flexible packages.

BACKGROUND

[0003] Several types of closures or fasteners are available for reclosing a previously opened flexible package. For example, it is common to use mechanical reclosable fasteners, such as slider zippers, clips, tabs, interlocking strips, and the like. These mechanical closures can be bulky, complexly shaped structures that require separate molding and fabrication steps prior to being joined to the flexible film used to form the package. As the closure itself can be bulky, film rolls incorporating such structures can be difficult to handle. While mechanical closures can be applied in form-fill-seal operations, it often requires complex manufacturing steps to apply, interconnect, and align the mechanical fastening features of each structure. Therefore, mechanical reclosable fasteners often add undue complexity, cost, and expense into the flexible packaging manufacture.

[0004] Adhesive-based reclosable fasteners can be an alternative to the mechanical fastener, but adhesive-based fasteners present separate challenges in both manufacturing and forming a reclosable-type fastener. For example, pressure-sensitive adhesives (PSA) have been used to form resealable fasteners; however, common PSA reclosable fasteners have the shortcoming that these types of adhesives generally have high tack levels. Tack is a property of an adhesive material that generally enables the material to form a bond with the surface of another material upon brief or light pressure. Tack is often considered as a quick stick, an initial adhesion, or a quick grab characteristic of a material. PSA materials generally result in a less-desired reclosable fastener because the adhesive quickly adheres to most surfaces to which it comes into contact with. As a result, the PSA fastener can adhere to machine components during package formation, unintended portions of the packaging film, and even the product (or crumbs thereof) contained in the package.

[0005] During forming of flexible packaging using PSA, the adhesive may come into contact with machine components, such as rollers, cutting blades, folding devices, and the like. Due to the high tack level of the PSA, contact with these machine parts may result in transfer or picking of the PSA to these machine components. The transferred adhesive can then re-transfer from the machine component to other undesired portions of the packaging film, which can in some cases result in web tracking problems and other undesired shortcomings.

[0006] In existing packaging formation machines, the film is often wound up into large rolls of several hundred or several thousand yards of material, sometimes called jumbo rolls or jumbos. In these wound jumbo rolls, the high tack levels of PSAs can result in adjacently wound film layers sticking to each other, commonly known in the industry as "blocking." A blocked jumbo roll is difficult and sometime impossible to unwind, which typically renders the blocked roll unusable.

[0007] Once formed into the package, the reclosable fasteners using PSA may also present problems to the consumer using the package. If the package is used to contain a crumbly or shredded product (*i.e.*, shredded cheese and the like), the crumbs or shreds may also stick to the PSA, which reduces the effectiveness of the adhesive to form a sufficient closure. An adhesive-based closure that is sufficiently fouled with product will generally not form an adequate closure seal because the adhesive is sticking to the crumbs and not the other side of the package.

[0008] Thermoplastic elastomers (TPE), which are sometimes called thermoplastic rubber, are another type of adhesive that has been investigated as a reclosable fastener. Some types of TPE copolymers (especially certain styrenic block polymers) demonstrate high cohesive properties, but low tack levels that can be effective at forming reclosable fasteners; however, such TPEs tend to have undesirably high cohesive properties that render them difficult for use as a reclosable fastener in flexible packaging applications because the TPE can delaminate from the film substrate rather than peel at the cohesive interface. TPEs also have the shortcoming that these materials are thermoplastic and, therefore, generally limited to processing methods using heat (*i.e.*, hot melt extrusion coating). When processing TPE using heat as a hot melt adhesive, the material is generally extrusion coated on the web in a machine direction and in a continuous fashion, which renders the application method unsuitable for use on some exiting packaging equipment where the closure needs to be added in a cross-web direction or transverse to the machine direction. Hot melt adhesives generally can not be intermittently applied as a strip in the cross-web direction in an efficient or cost effective manner.

[0009] Dissolving the TPEs in solvents so that the material may be printed in a cross-web direction also results in shortcomings when the packaging material will be used to form food products. In some cases, organic solvents suitable for use as a carrier with TPE's may not be acceptable for contact with food items. Dissolving TPEs in an aqueous carrier can be difficult and presents further problems in drying the coated product and removing the water carrier. However, in some cases, even the lower tack levels of the TPE fastener can result in processing problems on packaging equipment, such as transfer to machine components and material blocking as described above with PSA closures.

SUMMARY

[0010] A cohesive-based reclosable fastener and a flexible package utilizing the cohesive-based reclosable fastener are disclosed. In one embodiment, the flexible package may include front and back flexible panels joined together to form a cavity therebetween for containing an item, such as a food item or other comestible, for example. Preferably, the cohesive-based reclosable fastener extends between side edges of the front and back flexible panels about an opening of the package and is configured to permit the package to be repeatedly opened and resealed.

[0011] In one aspect, the cohesive-based reclosable fastener may be supplied in the form of a thermoplastic elastomer (TPE) diluted with a secondary or diluting compatible resin, such as for example an ethylene vinyl acetate copolymer (EVA) having a melt flow index of about 600 or above, dissolved in an organic solvent (or a mixture of organic solvents). In some cases, TPE, by itself, generally does not form a suitable reclosable fastener for flexible packages that can be easily and repeatedly opened and reclosed because it has too high of a cohesive bond strength, which will not be peelable or tend to delaminate from the film forming the flexible substrate of the package before peeling apart at a cohesive interface. However, by diluting the TPE with effective, but small amounts of the secondary or diluting resin, such as the EVA copolymer resin, a desired cohesive peel strength can be obtained that is suitable for use in flexible packaging application.

[0012] In one approach, stable solutions of TPE and the secondary resin of EVA have a sufficiently low viscosity (i.e., about 50 to about 1200 centipoise at about 23°C) and high solids content (i.e., about 20 to about 60 percent) so that they may be printed or roll coated. Suitable solvents include ethyl acetate, normal propyl acetate, isopropyl acetate, methyl ethyl ketone, methyl isobutyl ketone, ethyl alcohol, normal propyl alcohol, propylene glycol, normal propyl ether, butyl acetate, toluene, xylene, cyclohexane, cyclohexanol and mixtures thereof. The TPE solution may be pattern-applied to a flexible film via a flexographic or rotogravure printing process and subsequently dried to remove the solvent.

[0013] The pattern-applied cohesive polymer coating may be configured and registered such that opposing cohesive layers are disposed on the front and back panels of the package. The cohesive-based reclosable fastener generally has a configuration effective so that the fastener can be repeatedly opened and closed without substantially delaminating, picking, or transferring from the front and back panels forming the package. In one aspect, such configuration may be achieved by the cohesive layers having an enhanced cohesive bond strength to form a seal as the opposing cohesive layers are engaged together, but also exhibit a greater bond strength to the front and back panels than the cohesive peel force needed to open the reclosable fastener.

[0014] In another aspect, the cohesive-based reclosable fastener may also be configured to enhance adhesion of the fastener to desired surfaces and at the same time to minimize and, preferably, to eliminate adhesion and/or transfer of the cohesive fastener to undesired surfaces. By one approach, the cohesive-based reclosable fastener may have a relatively low tack level to generally minimize adhesion to undesired surfaces and, at the same time, also have the enhanced cohesive bond strength to form the reclosable seal and still have a relatively high bond strength to the front and back panels. In one particular form, the cohesive-based reclosable fastener includes a solvent-based thermoplastic elastomer (TPE) such as a styrenic block copolymer diluted with a secondary resin that exhibits low tack and good cohesive bond strength, but a relatively higher bond strength to the front and back panels than its cohesive bond strength. To this end, the cohesive-based reclosable fastener may include a blend of a styrenic block copolymer and a secondary polymer such as ethylene vinyl acetate. By one approach, the fastener solution includes a major amount of the TPE and a minor amount of the EVA.

[0015] In an alternative form, the cohesive-based reclosable fastener may include a solvent-based cohesive layer of a TPE material and a secondary resin that has an exposed cohesive surface in combination with one or more non-adhesive spacer layers adjacent to the cohesive layer. In this form, an outer surface of the non-adhesive spacer layer may be configured to protrude outwardly beyond the cohesive surface of the cohesive layer so that it is recessed inwardly from the non-adhesive spacer layer outer surface. Such configuration of the cohesive-based reclosable fastener generally forms a gap between the cohesive surface and outer surface of the non-adhesive layer that is effective to allow the fastener to form bonds to desired surfaces (such as when the fastener is squeezed closed) and also minimize and, preferably, eliminate bonds to undesired surfaces (such as when the spacer layers inhibit contact with the cohesive layer as described in more detail below).

[0016] For example, the non-adhesive spacer layer generally functions to limit the contact of the cohesive layer with adjacent surfaces (such as equipment parts or adjacent package panels) by maintaining the gap between the cohesive surface and the adjacent surface because the adjacent surface will first contact the outer surface of the spacer layer rather than the cohesive surface. To close the fastener or otherwise engage the cohesive layer, the adjacent surface will have to span the gap formed by the recessed cohesive layer. As the substrate film as well as the fastener materials are typically flexible, the package may be closed by flexing the package film to traverse the gap to form a bond with a facing cohesive surface of a matching closure on the opposite panel of a package. Such engagement may occur when a user pressed together or squeezes the film with finger pressure or the like.

Brief Description Of The Drawings

[0017] FIG. 1 is a perspective view of an exemplary package having a cohesive-based reclosable fastener thereon illustrated in an open condition;

[0018] FIG. 2 is a perspective view of the exemplary package of FIG. 1 illustrated in a closed condition;

[0019] FIG. 3 is a cross-sectional view of an exemplary cohesive-based reclosable fastener;

[0020] FIG. 4 is a cross-sectional view of another example of a cohesive-based reclosable fastener illustrated in an open condition;

[0021] FIG. 5 is a cross-sectional view of the cohesive-based reclosable fastener of FIG. 4 illustrated in a closed condition;

[0022] FIG. 6 is a cross-sectional view of another example of a cohesive-based reclosable fastener illustrated in a partially closed or unsealed condition;

[0023] FIG. 7 is a cross-sectional view of the cohesive-based reclosable fastener of FIG. 6 illustrated in a closed or sealed condition;

[0024] FIG. 8 is a cross-sectional view of another example of a cohesive-based reclosable fastener;

[0025] FIG. 9 is a schematical view of an exemplary method of forming a flexible package having a cohesive-based reclosable fastener thereon;

[0026] FIG. 10 is a cross-sectional view of an exemplary arrangement of a flexible package showing a cohesive-based reclosable fastener relative to an adjacent, exemplary machine component;

[0027] FIG. 11 is a partial, cross-sectional view of an exemplary film substrate roll showing a cohesive-based reclosable fastener relative to adjacent film substrate layers in a wound film roll;

[0028] FIG. 12 is an exemplary process to apply the cohesive based reclosable fastener to a film substrate;

[0029] FIG. 13 is an exemplary process to form a flexible package using a cohesive-based reclosable fastener;

[0030] FIG. 14 is a cross-sectional view of another exemplary cohesive based reclosable fastener.

DETAILED DESCRIPTION OF THE DRAWINGS

[0031] A package 10 having a cohesive-based reclosable fastener 12 is disclosed herein and is generally illustrated in FIGS. 1 to 8. FIG. 1 generally illustrates an open package 10, and FIG. 2 generally illustrates a sealed or closed package 10. In one exemplary form, the package 10 is formed from flexible sheet material or film 14 (sometimes referred herein as a substrate or film substrate) into opposed front and back flexible panels 16 and 18, respectively. In this exemplary form, the package 10 may also include a dead fold 20 along a bottom edge 22 thereof and transverse or side seals 24 along side edges 26 thereof so that the package 10 forms a cavity 28 between the front panel 16 and back panel 18 for containing an item, such as a food item, comestible, or other material. It will be appreciated that the form of package 10 is only an example of but one type of a package suitable for use with the cohesive-based reclosable fastener 12, and other shapes, configurations, materials, and container/package types may also be combined with the cohesive-based reclosable fastener 12. The package 10 may further include other folds, seals, gussets, and/or flaps as generally needed for a particular application. Optionally, the package 10 may also include peel seals 11 either above or below the reclosable fastener 12 as generally provided in Application Serial Number 11/267,174, which is hereby incorporated herein by reference in its entirety.

[0032] In one aspect, the cohesive-based reclosable fastener 12 and package 10 are generally constructed or have a composition to minimize the adhesion of the fastener 12 to undesired surfaces and still function at the same time as an effective reclosable fastener. That is, the fastener 12 can be opened and closed multiple times to seal the contents in the cavity 28 during use by a consumer, but at the same time not delaminate from the film substrate forming the front and back panels 16 and 16. To this end, the cohesive-based reclosable fastener 12 generally includes an adhesive with relatively low tack levels to minimize adhesion to the unwanted surfaces, but has a selected bonding or opening peel strength sufficient to enable sealing or reclosure of the package 10 and also enable unbonding to allow opening and/or re-opening of the package. At the same time, the fastener 12 has a strong bond to the film substrate. By one approach, the fastener may include a blend of styrenic block copolymers and an ethylene vinyl acetate copolymer.

[0033] As generally understood, a cohesive-based material typically adheres more readily to like materials rather than to non-like materials (that is, self-adhesion). Suitable cohesive materials used herein generally exhibit a relatively low tack to undesired surfaces, a good bond strength to desired surfaces (such as no delaminating from the flexible front and back panels), and relatively good cohesive or self adhesion bond strength to hold a flexible package or pouch closed, but still openable or peelable by hand. It will be appreciated that the selected cohesive-based materials used herein may, in some cases, exhibit properties of a pressure sensitive adhesive in that a bond may be formed with the application of pressure rather than through the application of heat, solvent, radiation, or the like. The selected cohesive-based materials also permit debonding or peeling from such like materials so that the cohesive layers may be repeatedly peeled apart without substantial damage to the cohesive material and/or any underlying substrate. When the cohesive material is debonded or peeled apart, the selected cohesive materials has sufficient internal integrity and generally peels apart at a cohesive bonding interface substantially cleanly without substantial material picking, stringiness, delamination from the substrate, and/or other substantial disfigurations of the material (*i.e.*, globbing, pilling, etc.).

[0034] As further discussed below, the cohesive-based material include blends of a major amount of a thermoplastic elastomer diluted with minor amounts of a secondary or diluent resin, such as a relatively low molecular weight (i.e., melt index of about 600 or greater) ethylene vinyl acetate copolymer (EVA). Diluting the TPE with an EVA copolymer or the like having a melt index of about 600 or greater, forms an effective reclosable fastener that can still form an adequate bond with the flexible film forming the front and back panels. Other diluents are also expected to be functional so long as they are dissolvable in the target solvent and miscible with the TPE to form a stable dispersion or solution to be roll coated or printed.

[0035] In another aspect, the package 10 and fastener formulation 12 are also constructed so that the bond or peel strength of the cohesive-based reclosable fastener 12 to the package film substrate 14, 16, and 18 is generally greater than the opening peel strength between the cohesive layers of the fastener 12 itself (layers 32 and 34). In this manner, the reclosable fastener 12 generally remains adhered to the film substrate 14 and does not substantially pick, string, or delaminate from the substrate 14, 16, 18 when the package 10 is opened by a consumer as the fastener 12 is peeled open. It is believed that the blend of TPE and diluent together with the construction of the film substrate is effective to form the desired bonding and peel strengths.

[0036] Referring to FIG. 3, one form of the reclosable fastener 12 is illustrated that includes opposing cohesive layers 30 and 32 with one of the layers disposed on the front panel 16 and the other layer disposed on the back panel 18. The fastener layers 30 and 32 are generally aligned with each other such that facing outer surfaces 34 and 36 of each fastener layer 30 and 32, respectively, oppose each other and are positioned to substantially contact each other in a closed or sealed condition as the cohesive layers are engaged together.

[0037] Preferably, the opposing cohesive layers 30 and 32 are each supplied in the form of a solution consisting of a thermoplastic elastomer (TPE) diluted with an ethylene vinyl acetate copolymer (EVA) in an organic solvent or mixture of organic solvents. As further described below, the use of a solvent-based solution is advantageous because it permits roll-coating of a dissolved TPE into intermittent and transverse strips via a web printing or coating of the cohesive layers 30 and 32 on the film substrate 14 in a manner that simplifies formation of the package 10 in traditional form, fill, and seal (FFS) machines. As also described more below, such transverse and intermediate roll-coating or printing generally can not be achieved using the more traditional hot melt extrusion coating processes.

[0038] In one form, the fastener includes a major amount of the thermoplastic elastomer, which may be a styrenic block copolymer including TPEs such as Kraton ® D SIS block copolymers based on styrene and isoprene, Kraton ® D SBS block copolymers based on styrene and butadiene, Kraton ® G SEBS block copolymers with a hydrogenated midblock of styrene-ethylene/butylenes-styrene, or Kraton ® SEPS block copolymers with a hydrogenated midblock of styrene-ethylene/propylene-styrene, or mixtures thereof. In some cases, additional additives such as plasticizers, fillers, antioxidants, or other polymers may be necessary in the formulation of the TPE compound in order to tailor the processing and performance attributes of the coating.

[0039] By one approach, the fastener may also include a minor amount of the ethylene vinyl acetate copolymer used to dilute the TPE. As mentioned, without the use of the EVA, the fastener generally does not function as a reclosable fastener because the self-adhesion of the TPE alone is greater that about 700 grams per inch and, in some cases, even greater than about 1500 grams per inch, which is undesired for forming a reclosable fastener on flexible substrates because it tends to delaminate before peeling apart at the cohesive interface. By one approach, the EVA is a random copolymer that generally has a melt flow index of about 600 or greater and about 19 percent vinyl acetate and about 81 percent ethylene. EVA with less vinyl acetate and/or a melt flow index less than about 500 did not form a stable solution in toluene.

[0040] By one approach, a suitable blend of the fastener includes may range from about 7 to about 9 parts of the TPE and about 0.5 to about 2 parts of the EVA, and in a preferred approach, about 8 parts of the TPE and about 1 part of the EVA. However, it is expected that the EVA diluent may range from about 5 to about 50 percent of the solution. One form of the solution is about 20 to about 60 percent solids (polymer content) in a compatible solvent such as methyl ethyl ketone, cyclohexane or toluene, having a viscosity between 50 and 1200 centipoise at about 23°C, which is a composition effective so that the solution can be printed or roll coated to the flexible substrate. When this solution is coated onto the film substrate 14 and dried to remove the solvent, the dried TPE layer 30 or 32 has a coating thickness of about 0.0001 to about 0.0030 inches. Once dried, the TPE layer may have a residual amount of the solvent carrier of about 50 ppm or less. However, other thicknesses and coating weights may be appropriate depending on the particular application. Depending on the particular product characteristics desired, suitable TPEs or TPE-based compounds may be obtained from companies such as GLS Corporation (a Division of PolyOne) (McHenry, Illinois), Dow Chemical (Midland, Michigan), or Kraton Polymers (Houston, Texas). Other suppliers may also provide similar products.

[0041] As mentioned above, the cohesive-based reclosable fastener generally has a cohesive bond strength to permit the opposing cohesive layers 30 and 32 to be bonded together in order to close or seal the package 10. For example, a consumer may press the two opposing layers into engagement to seal or close the package as illustrated by the arrows 33 in FIG. 3. By one approach, the bond between cohesive layers 30 and 32 is generally sufficient to seal the layers 30 and 32 together and, in some cases, form a hermetic seal. As used herein, hermetic is understood to mean a generally air tight seal. In one example, the selected TPE forming the cohesive layers 30 and 32 may exhibit a cohesive or peel bond strength of about 100 to about 700 g/inch, and in some cases, between about 100 to about 400 g/inch as measured by the ASTM peel test D 3395; however, the reclosable fastener may have other peel strength values dependent on the particular application or particular measurement test. Cohesive peel strengths greater than this level are generally too high when used with flexible packages to be useful for a peelable and resealable package.

[0042] The cohesive-based materials also preferably have a relatively low tack level that enables the fastener to minimize and, preferably, limit the adhesion of the fastener 12 to unwanted materials and surfaces, such as food particles, forming equipment surfaces, rollers, and the like. By one approach, the selected TPE may have a tack level to undesired surfaces of not exceeding about 5 psi when preloaded with about 4.5 pounds and generally not exceeding about 15 psi when preloaded with about 10 pounds using the ASTM probe tack test D 2979; however, the tack level may also vary depending on the particular TPE and application thereof and measurement test used.

[0043] Even with such relatively low tack levels to undesired surfaces, the cohesive layers 30 and 32 still form a sufficiently strong bond with the film substrate forming the front and back panels 16 and 18 so that the cohesive layers 30 and 32 are not substantially delaminated therefrom when the package 10 is opened. By one approach, the bonding strength of the cohesive layers 30 and 32 to the film substrate at an interface 38 thereof is generally greater than the peel strength of the cohesive material itself. For example, the peel strength of the selected cohesive material to the film substrate forming the front and back panels is generally greater than about 700 g/inch, preferably, greater than about 1000 g/inch and, more preferably, greater than about 1200 g/inch. However, the peel strength may also vary depending on the film substrate 14, the TPE, and other factors.

[0044] It is anticipated that the increased bond strength of the cohesive materials to the film substrate may be achieved through enhanced interfacial, mechanical or chemical bonding of the cohesive material to the particular substrate, increased surface energy of the substrate obtained from a primer coat, surface treating, and/or combinations of the above. For example, surface treatments may be used to increase the surface energy (such as corona treating, plasma treating, flame treating, and the like) or chemical coatings, such as primers or adhesion promoters may also be used. These primers may be based on acrylates, polyesters, vinyls, and alcohols to name but a few. One example of such a primer coating, described in U.S. Patent No. 4,493,872 A is a copolyester comprised of isophthalic acid and at least one aliphatic dicarboxylic acid, at least one sulfomonomer and an alkylene glycol. If corona treating, ideally the surface energy after treatment should be greater than about 40 dynes.

[0045] In addition, it is further anticipated that enhanced interfacial, mechanical, or chemical bonding of the cohesive materials 30 and 32 to the substrate 14 may be enhanced through particular constructions of the substrate materials 14 to increase bonding surface energy. By one approach, the substrate 14 may be a single layer or a multi-layer film, and it is preferred that an innermost layer of the substrate film 14 forming the front and back panels 16 and 18 may be composed of ethylene vinyl acetate (EVA) and, more preferably, an EVA having low concentrations of additives, such as slip or antiblock (commonly added to packaging film in order to obtain a coefficient of friction suitable to process the film on form, fill, and seal machines). It is believed that such additives may include amounts of fatty acid amides, and it has been discovered that such compounds can affect the bond strength of cohesive materials to the film.

[0046] By one approach, therefore, the film substrate 14 may have less than about 700 ppm of fatty acid amides throughout the innermost layer or, in some cases, throughout the entire substrate 14. While not wishing to be limited by theory, it is believed that fatty acid amides, which are low molecular weight components, can migrate or bloom to the surface of the film affecting the strength of the bond between the film's surface and the cohesive materials. While corona treating or flame treating may initially burn off any fatty acid amides on the surface of the film resulting in an initial good bond strength of the TPE, over time additional fatty acid amides can migrate or bloom to the film surface, which results in a reduced bond strength over an extended shelf life. As a result, it is desired to reduce the fatty acid amide content in the film (either the inner most layers or the entire film substrate) to levels below about 700 ppm, which provides for both good initial bond strength and good long term bond strength because there are such small amounts of these impurities to bloom to the film surface over time. Alternatively, such film substrate formulation may also be combined with use of other surface treatments (corona treating, plasma treating, flame treating, and the like) or other coatings as needed for a particular application.

[0047] In yet another aspect, it is anticipated that the enhanced interfacial, mechanical, or chemical bonding of the cohesive layers to the flexible film substrate may also be enhanced by including fillers (such as inorganic materials, minerals, oxides, and the like) into at least the surface layer(s) of the substrate to enhance the bonding of the TPE fastener 12 to the substrate 14. Examples of suitable fillers include micro- or nano-sized fillers of clay, calcium carbonate, montmorillonite, dolomite, microcrystalline silica, talc, mica, oxides (silicon oxides, aluminum oxides, and the like), other additives, and/or combinations thereof. While not wishing to be limited by theory, it is believed that such additives may increase the bond strength between the coating and substrate in at least two ways. First, on a microscopic level these fillers create a rough surface, increasing the available contact area between the substrate and the coating, thereby providing more sites for chemical and/or mechanical bonding to occur. Secondly, the filler itself, if present at the surface, may increase the surface energy, thereby promoting a stronger bond between the coating and the substrate. By one approach, approximately about 0.5 to about 10 weight percent of the filler in the film (preferably, montmorillonite) is expected to have a beneficial impact on bond strength.

[0048] By one approach, suitable flexible films forming the front and back panels 16 and 18 may be a polyethylene based film about 2 to about 5 mils thick and, in some cases, about 3 mils thick. Turning to FIG. 14 for a moment, one approach of the flexible film 16 or 18 forming the front and back panels is shown as a multi-layer, coextruded blown film including a structural base of one or more layers (two are shown) of a high density polyethylene 702 (HDPE) and an outer or adhesive receiving layer of an EVA heat seal layer 704 filled with the filler 706. By one approach, the outer layer may include blends of EVA, linear low density polyethylene, and the filler. For example, the extruded EVA layer may include about 60 to about 80 percent EVA, about 5 to about 20 percent polyethylene, and about 3 to about 10 percent of the filler. With this approach, the cohesive fastener 12 is applied to the outer EVA heat seal layer 704, which forms the inner surface of the flexible package 10. By another approach, the multi-layered film may include multiple layers such that about two-thirds of the film is about high density polyethylene and about one-third of the film is organoclay filled EVA.

[0049] As shown in FIG. 14, the filler 706 is generally exaggerated in size for illustrative purposes, but is expected to be uniformly dispersed throughout the outer EVA layer 704, and it is expected that at least some of the filler 708, for example, may have at least a portion thereof exposed or protruding slightly at an outer surface 710 of the EVA layer 704. Alternatively, the filler may not be exposed at the surface 708, but it may create a rougher outer surface. While not wishing to be limited by theory, the filler 708 at the surface combined with corona treatment may aid in the bonding of the fastener to the film substrate, which may provide an effective bond to the film that is greater than the cohesive peel strength between the two cohesive layers 32 and 34. In generally, when the cohesive peel force was less than approximately 600 to about 700 grams per inch, no delamination occurred during repeated peel / reseal cycles.

[0050] With the cohesive based fastener and film substrates described herein, an adhesive based reclosable fastener can be repeatedly opened and closed without delamination from the flexible backing, can be achieved in a fastener that is stable over time, and produces generally repeatable results even after fouling or contamination with product, such as food crumbs. Even if the cohesive based fastener is fouled with food crumbs or edible oils, the cohesive based fasteners herein do not exhibit an unusable drop-off in cohesive properties.

[0051] By one approach, the cohesive fasteners herein maintain a cohesive or self-adhesion peel strength when contaminated with product, food crumbs, oils, and the like between about 100 to about 650 g/inch, and exhibit a residual adhesion or residual cohesion after fouling or contamination between about 25 to about 100 percent of the cohesion levels prior to contamination. As used herein, adhesion remaining or residual cohesion is a measurement of the peel strength when fouled or contaminated relative to the peel strength of a clean or uncontaminated fastener exhibited as a percentage. As explained further in the Examples, the cohesive based fasteners herein exhibited a residual cohesion of about 25 percent and about 100 percent, when contaminated with Triscuit and Wheat Thin crumbs, respectively. A comparable pressure-sensitive adhesive exhibited residual adhesive values of about 1.2 and about 8 percent when contaminated with similar levels of Triscuit and Wheat Thin crumbs, respectively.

[0052] Turning back to FIGS. 4 and 5, an alternative form of the reclosable fastener 112 is illustrated that combines cohesive layers 30 and 32 together with an adjacent non-adhesive or buffer spacer layer 140. The adjacent spacer layer 140 is positioned so that it generally protrudes outwardly beyond the outer surfaces 34 and 36 of the cohesive layers 30 and 32 so that the cohesive layers 30 and 32 are generally recessed from an outer surface 142 of the spacer layer 140.

[0053] The non-adhesive spacer layer 140 may be formed from a material that forms a non-sticky or non-adhesive portion of the package 10 such as a material that does not form a bond with other materials. By one approach, the non-adhesive spacer layer 140 may be a polyolefin, a polyamide, or other non-adhesive material. For example, the spacer layer 140 may include polyester, polyethylene, polypropylene, polybutylene, ethylene vinyl acetate, nylon, polyethylene terephthalate, polyvinyl chloride, ethylene vinyl alcohol, polyvinylidene chloride, polyvinyl alcohol, polystyrene, and mixtures thereof. In one embodiment, the spacer layer 140 is a polyolefin. Polyolefins are particularly suitable for use as the spacer layer materials because they are generally non-adhesive when dried and they generally lend themselves well to forming aqueous or solvent dispersions which can be easily pattern coated via flexographic or rotogravure processes. Preferably, the non-adhesive spacer layer 140 is supplied from a solvent or aqueous based dispersion of the non-adhesive material dissolved or dispersed in the solvent. The dispersion is then intermittently coated or printed adjacent to the cohesive layers 32. In general, the thickness of the dried coated layers may range from about 0.1 mils to about 2 mils.

[0054] As illustrated in FIG. 4, the non-adhesive spacer layer 140 preferably includes a pair of non-adhesive spacer layers 144 and 146 positioned adjacent lateral sides 148 or 150 of each cohesive layer 30 and 32. In the particular embodiment of FIGS. 4 and 5, the spacer layers 144 and 146 are positioned on the cohesive layer 32 and spaced at distal ends of the layers 30 and 32 generally adjacent with the lateral side edges 148 and 150 thereof.

[0055] Preferably, the non-adhesive spacer layer 140 forms a gap 152 between the outer surface 142 of the spacer layer 140 and the cohesive surface 34 or 36 of the cohesive material. By one approach, the gap is about 2.5 to about 50 microns. Turning to FIGS. 10

and 11 for a moment, the gap 152 or otherwise recessed cohesive surfaces 34 or 36 enables the fastener 112 to limit the contact of the cohesive layers 30 or 32 with unwanted surfaces. As illustrated in FIG. 10, the spacer layers 140 and gap 152 tends to maintain a space between the cohesive layer 32 and an exemplary machine part, which is illustrated as an exemplary machine roller 154 (but could be any number of machine components, such as rollers, bars, knives, guides, filling tubes to suggest but a few). The recession of the cohesive layer 30 or 32 by the spacer layers 140 reduces and, preferably, eliminates the tendency of the cohesive material to engage with and transfer or pick off adhesive to the machine part because the cohesive layer 30 or 32 is generally spaced from these unwanted surfaces due to the spacer layer 140 contacting the adjacent surface (i.e., machine roller 154) before the cohesive layer 30 or 32 and recession of the cohesive layer therefrom. As generally illustrated in FIG. 11, the spacer layer 140 and gap 152 also tends to reduce and, preferably, eliminate the tendency of the fastener 112 to adhere to other film layers 14 when the film substrate 14 is wound up in a roll or jumbo. The formed gap 152 may keep the cohesive layer 32 spaced from adjacent wound-film layers 14, which generally reduces and, preferably, eliminates the tendency of the wound roll to block because, again, the cohesive layer 32 is spaced from the backside of an adjacent film layer 14 because the spacer 140 engages the adjacent film layer 14 before the cohesive layer 30 or 32.

[0056] Turning back to FIG 5, to close the package 10, a user's fingers (or a machine closing operation during package filing operations) squeezes the front and back panels 16 and 18 between the spacer layers 140 to deflect the panels 16 and 18 inwardly through the gap 152 to intentionally engage the opposing cohesive layers 30 and 32 to form a cohesive bond therebetween to sealably close the package 10. To open the package 10, the user peels back package tabs 156 positioned above the cohesive fastener 112 in opposite directions 157 to peel the cohesive layer 30 from the cohesive layer 32. By one approach, the cohesive layers 30 and 32 are configured to be closed and re-opened multiple times and, in some cases, the cohesive layers 30 and 32 preferably have sufficient structural and bond integrity to be closed and opened about 5 to about 10 times; however, particular cohesive layers and packages can be configured to be opened and closed any number of times depending on the particular configuration, coating weight, and other parameters of the cohesive layers and film substrate.

[0057] Referring to FIGS. 6, 7, and 8, alternative embodiments of the reclosable fastener are illustrated. In FIGS. 6 and 7, a reclosable fastener 212 is illustrated where the spacer layers 240 are adjacent the cohesive layers 30 and 32 and disposed on the film substrate 16 and 18. In FIG. 8, the spacer layers 240 are adjacent the cohesive layers 30 and 32, but spaced thereform as the spacer layers 140 do not necessarily need to contact or engage the cohesive layers 30 or 32 and, in some cases, variability in manufacturing may result in a space between the layers 140 and layers 30 and 32.

[0058] In these alternative embodiments, a similar wet coating weight of both the cohesive layer 30 or 32 and the spacer layer 140 can be applied to the film substrate 14, but the gap 152 and recession of the cohesive surfaces 34 and 36 can be formed by varying the percent solids of the cohesive solvent solution and the spacer layer solvent or aqueous solution used to apply the wet coating. For example, the cohesive material solution may have a lower percent solids than the spacer layer solution so that, when dried and the solvent is substantially removed, the cohesive layers 30 and 32 will form a lower dried coating weight or lower thickness. By one approach, the cohesive material solution may be about 25 to about 45 percent solids and the spacer layer solvent solution may be about 45 to about 65 percent polyolefin solids so that the cohesive layer forms a coating thickness which is substantially thinner than the spacer layer. For example, the cohesive layer may be about 10 to about 20 microns in thickness and the spacer layer may be between about 20 and about 40 microns in thickness.

[0059] Turning to FIG. 9, an exemplary process to form the reclosable fastener 12, 112, or 212 is generally illustrated in schematic form in which an intermittent indexing process is used. For instance, a supply of the film substrate 14 may be supplied in a roll 402 and unwound in a machine direction 404. A first application station 406 intermittently applies a first strip 408 of the cohesive dispersion in a transverse or cross web direction. The first application station 406 may include a flexographic applicator, a gravure applicator, or other suitable applicator to apply a solvent dispersion intermittently across a moving web. The web of film 14 is then indexed or unwound a first distance 410 in the machine direction and the first application station 406 then applies a second strip 412 of the cohesive dispersion in a transverse or cross web direction. The web is then indexed or unwound a second distance 414, which may be shorter than the first distance 410, where the application station 406 then applies a third transverse strip 416 again in a transverse or cross web direction. This application pattern is then repeated between short and long indexing as the web 14 is continuously unwound from the roll 402. Alternatively, the web may be indexed a uniform distance between each application of transverse strips.

[0060] The web having the coatings 408, 412, and 416 thereon is then dried, cured, or set using a drying oven or other drying device 420 to remove the solvent carrier to provide a dried cohesive strip. The film web 14 may also be finished into the package 10 by cutting 422, folding 424, forming side seals 426, and filling 428 an item 430 (such as a foodstuff, for example shredded cheese).

[0061] If the spacer layers 140 are to be utilized, an optional second application station 432 may be utilized. If used, the station 432 will apply a wet coating of the spacer layer dispersion adjacent to the cohesive material dispersion in a similar fashion either subsequently to, concurrently, with or prior to the cohesive layer application using a flexogrpahic applicator, a gravure applicator, or other suitable applicator to apply a solvent dispersion intermittently across a moving web. Preferably, the spacer layers are also applied generally parallel to the cohesive layer.

[0062] Turning to FIGS. 12 and 13, another example of a suitable process 500 that may be used to form a substrate having the reclosable fastener 12, 112, and/or 212 thereon is provided. In this example, a solvent coating, printing, rotogravure, or flexographic process is provided to apply the cohesive and/or spacer layers (if used) to the film substrate. It will be appreciated that other application processes or methods may also be used as needed for a particular application. By this alternative approach, the film substrate having the closure thereon is wound up into a roll that is later transferred to a form, fill, and seal machine to form the flexible package.

[0063] In this exemplary process 500, a supply of the film substrate 14 may be provided in a large jumbo or roll 502 of base film, which may be a single layer or multi-layer film having EVA as the inner layer 504 to which the adhesives will be applied. The film is then unwound and directed to a first application station 506 where the cohesive fastening layer can be applied. By one approach, the first application station 506 may include a cohesive polymer solvent solution applicator 508, such as an extrusion die, solution pan, or other supply of solution. For example, the TPE containing solvent solution may be applied to a first or plate cylinder 510 that transfers to the solution to a second or offset cylinder 512 having an image or impression thereon 514 in the configuration, size, and shape of the cohesive strip to be applied to the film 14. The second cylinder 512 then transfers the solvent solution of the cohesive material to the moving film substrate 14 to form a first strip of the TPE containing material 516 on the web.

[0064] The web 14 then may be directed to a drying oven 520 to dry, cure, or remove any residual solvent in the applied fastening layer. After the fastening layer has been dried to the desired amount, it may be wound up into an intermediate jumbo or roll 522 for storage or transfer to a subsequent package forming station, such as a form, fill, and seal process as generally illustrated in FIG. 13.

[0065] If the fastening layer includes the optional buffer or spacer layers 140 or 240, then the process 500 may also include a second solution application station 530. The second application 530 station may be similar to the first station 506, but configured to apply and register the spacer layer 140 adjacent to the cohesive layer as discussed previously. To this end, the second application station 530 may be configured so that the spacer layer 140 or 240 is either applied on top of or adjacent to the cohesive layer as also discussed previously.

[0066] By one approach, the second application station 530 may also include a solution applicator 532 (solvent or aqueous), a first or plate cylinder 534, a second or offset cylinder 536 having an image or impression 538 thereon of the size, shape, and configuration of the desired spacer layer or layers 140 and/or 240. The second cylinder 536 then transfers the strip or strips of the spacer layer solution to the web in the correct orientation and arrangement relative to the cohesive layer. Both the cohesive and spacer layers are then fed to the drying oven 520 to remove residual solvents prior to being wound up in the intermediate jumbo 522. Alternatively, the second application station 530 may be located downstream of the oven 520 so that the spacer layers are applied adjacent to a dried cohesive layer. In this case, the applied spacer layers will then be fed into a second drying oven similar to the oven 520.

[0067] Referring now to FIG. 13, an exemplary form, fill, and seal machine 600 using the intermediate roll 522 prepared from the process 500 (which may be slit to an appropriate size prior to process 600) is illustrated to form a sealed package 602. In this example, a vertical bagger or flow wrapping process is used that wraps the film 14 around a filling tube 604. A first heat seal assembly 606 forms a first machine-direction heat seal 607. A second transverse-direction heat seal assembly 608 with an integral trim tool then forms second and third transverse-direction heat seals 609 and 611 such that these heat seals are located on either side of the cohesive reclose feature 613. As shown in FIG. 12, seal 609 is below the cohesive closure 613, but seal 609 may also be above or both above and below seal 613. Finally, the integral trim tool within the transverse-direction heat seal assembly cuts the film between the cohesive reclose feature 613 and the bottom seal 611 of an adjacent pouch thereby separating the pouch that was just filled and sealed from the following pouch that is in the process of being filled. It will be appreciated that the exemplary processes of FIGS. 9, 12, and 13 are only but one example of suitable methods of forming and filling the flexible packaging having the cohesive-based reclosable fastener thereon. Other formation methods may also be used as needed for a particular application.

[0068] Advantages and embodiments of the fastener described herein are further illustrated by the following examples; however, the particular conditions, processing schemes, materials, and amounts thereof recited in these examples, as well as other conditions and details, should not be construed to unduly limit this method.
All percentages are by weight unless otherwise indicated.

EXAMPLES

[0069] A cohesive-based reclosable fastener was prepared and compared to a standard pressure-sensitive adhesive fastener (PSA-Control) obtained from a commercial Nabisco Chips Ahoy Snack 'n Seal package using a pressure sensitive adhesive (Fasson, Avery Dennison Corporation).

[0070] The cohesive-based fastener was prepared using about 8 parts of a styrenic block copolymer (TPE, LC347-042B, GLS Corporation) and about 1 part by weight ethylene vinyl acetate (EVA 1980a, AT Plastics, Edmonton, Alberta, Canada) and dissolving in toluene. The EVA had about 19 percent vinyl acetate and a melt flow index of about 600. The blended and diluted solution had about 22 percent solids and a Brookfield viscosity of about 155 cP at about 21°C. It was applied on a 2.7 mil multi-layer substrate using two spaced micrometer controlled notch bars. The coated substrate was dried by making two passes through an oven at about 150°F (total drying time about 2.5 to about 3 minutes) to form about a 3 mil dry coating of the cohesive fastener.

[0071] The substrate film (Pliant Corporation) was a multilayer, co-extruded film having two layers of a high density polyethylene and one outer layer of an organoclay filed, ethylene vinyl acetate (EVA) heat seal layer. The outer EVA heat seal layer of the coextruded film included about 80 percent EVA, about 10 percent polyethylene, and about 6 percent organoclay filler. The EVA layer surface was also corona treated to 40 dynes. The cohesive fastener was applied to the EVA heat seal layer. With this film, the cohesive based fasteners of this example did not delaminate or peel from the film backing so that the bond to the film and the EVA heat seal layer was greater than the cohesive peel strengths as tested below.

[0072] Both the cohesive-based fastener and the PSA control were tested for T-peel in an un-contaminated form, contaminated with Triscuit-Brand Crumbs (Kraft Foods), Wheat Thin Brand Crumbs (Kraft Foods), and Coffee beans. As shown in Tables 1-3 below, the T-peel test results (grams per inch at about 12 inch per minute cross head speed) with and without exposure to food crumbs are shown. Table 3 provides the residual or percent adhesion remaining (residual cohesion) after contamination, which is a ratio of the contaminated peel relative to the un-contaminated peel.

[0073] Each of the cohesive based and control samples were contaminated by covering the adhesive surface completely with the food crumbs, and then lifting up and gently shaking the sample to remove any excess crumbs not adhered to the strip. For the Triscuit and Wheat Thin crumbs, the crumbs were equivalent to the ground crumbs found at the bottom of a commercial product box. For the coffee bean sample, whole coffee beans were placed on the sample and removed. It is believed that oils from the coffee beans contaminated the sample.

[0074] Table 1: PSA Control and Inventive Cohesive Fastener contaminated with Food Crumbs

Factor	Triscuit Crumbs		Wheat Thin Crumbs		Coffee Beans	
	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in
Contaminated	0	281	7	755	151	572
Contaminated	5	24	16	604	138	621
Contaminated	4	137	4	504	186	615
Contaminated	3	82	69	733	186	471
Avg, g/in	3	131	24	649	208	639

[0075] Table 2: PSA Control and Inventive Cohesive Fastener un-contaminated with Food Crumbs

Factor	Triscuit Crumbs		Wheat Thin Crumbs		Coffee Beans	
	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in
Un-contaminated	196	165	259	476	271	652
Un-Contaminated	253	414	248	376	183	642
Un-Contaminated	259	563	330	638	271	820
Un-Contaminated	261	595	-	697	276	715
AVG, g/in	242	524	279	547	250	707

[0076] Table 3: Adhesion remaining after contamination with Food Crumbs

Factor	Triscuit Crumbs		Wheat Thin Crumbs		Coffee Beans	
% adhesion remaining	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in	PSA Control, g/in	Cohesive, g/in
	1.2	25	8.6	118.7	83	90.3

[0077] As shown above, the cohesive fastener was much more resistant to contamination by food particles then the PSA adhesive. The cohesive based fastener exhibited a percent adhesive remaining (i.e., contaminated peel/un-contaminated peel x 100) of at least about 25 percent, and in some cases at least about 100 percent. As a result, the cohesive based fastener did not exhibit any drop off in peel strength and performed just as well contaminated with food crumbs as it did when un-contaminated. The PSA fastener exhibited significant drop-off in peel strength when contaminated.

[0078] For the T-peel tests above, a slip/peel tester (Model SP-102B-3M90, Instrumentors, Inc., Strongsville, Ohio) was used. Set-up included using the machine in the T-peel test mode set to run at about 12 inch per minute speed. Adhesive samples were cut into strips about 1 inch wide and about 10 inches long, and two strips were adhered together with adhesive coated sides facing each other. The adhered sampled were rolled twice up and back (4 times total) using a 4.5 pound silicone-coated rubber roller (Chemsultants International Network, HR100, 4.5 pound hand roller). The Peel test included taking about 5 second average readings with about 5-8 readings per strip.

[0079] EXAMPLE 2

[0080] The TPE/EVA cohesive-based fastener of Example 1 in a blend of about 8 parts TPE to 1 part EVA was tested for variation in T-peel strength over time. Results are shown below in Table 4.

[0081] Table 4: T-Peel Aging Results

Time	0 Hour	24 Hours	96 Hours	1 Week
T-Peel, g/inch	211	231	205	294
	282	327	319	316
	270	337	327	362
	215	307	306	290
	200	335	288	249
	250	335	319	290
	250	333	343	290
	130	326	331	317
Average	240	316	305	301

[0082] EXAMPLE 3

[0083] The TPE/EVA blended cohesive-based fastener of Example 1 was tested for drop-off in peel strength upon multiple peel/re-seal cycles in rapid succession using the procedures of Example 1. Each sample was tested consecutively with no waiting between tests except to reseal and roll the samples. Wait time between tests was about 2 minutes or less. Results are shown in Table 5 below. As shown below, the cohesive peel strength maintained about 80 percent of its peel strength after repeated re-seal attempts from its highest level.

[0084] Table 5: Multiple Peel/Re-seal Results

Iteration	1st	2nd	3rd	4th
T-Peel, g/in	177	136	120	119
	255	247	237	231
	283	309	316	249
	280	317	339	283
	297	330	362	266
	323	378	367	293
	310	365	340	303
	275	382	350	310
Average:	275	308	304	257

[0085] COMPARATIVE EXAMPLE 1

[0086] The film substrate of Example 1 was coated in the manner of Example 1, but with only the TPE (LC 347-042B) in toluene without the use of a diluent. In this investigation, the initial peel strength was about 339 grams per inch (on average), but the peel strength after 24 hours was unacceptably high at about 1,500 gram per inch (on average). Results are shown below in Table 6.

[0087] Table 6: Undiluted TPE Peel Strength

Time	Initial	24 Hour
T-Peel, g/in	344	
	366	
	362	
	279	1510
	343	1544
	308	1592
	357	1528
	353	1625
Average	339	1560

[0088] COMPARATIVE EXAMPLE 2

[0089] Other diluents were also tried, but did not result in acceptable products. First, polyvinyl butyral (PVB) (Wacker Chemical) was blended with the TPE in toluene in a manner similar to Example 1 at ratios of about 1:1, about 3:1, and about 7:1 (TPE:PVB). The cohesive peel strength was also tested as in Example 1. No sample produced acceptable results as the cohesive peel was either too high or too low. At a 1:1 ratio, the sample had a low initial peel at about 23 g/in, which then increased to about 293 g/in after about 24 hours, but then dropped off again to less than about 100 g/in after about 96 hours. At a 3:1 ratio, the cohesive peel had an initial self-adhesion of about 294g/in, which increased to greater than 1,100 g/in after 24 hours. Lastly, a 7:1 ratio had an initial cohesion of about 394 g/in, which increased to greater than about 1,700 g/in after 24 hr. Results are provided in Tables 7, 8, and 9 below. These samples were not acceptable with either too low or unacceptable high peel.

[0090] Table 7: Initial Peel values (TPE and PVB blends)

	TPE/PVB ratio		
	1/1	3/1	7/1
T-Peel, g/inch	25	306	361
	23	318	385
	16	328	373
	21	295	357
	31	268	434
	24	277	409
		297	395
		262	438
Average:	23	294	394

[0091] Table 8: 24 Hour Peel values (TPE and PVB blends)

	TPE/PVB ratio		
	1/1	3/1	7/1
T-Peel, g/inch	269	1227	1696
	342	1272	1867
	319	1103	1794
	237	1083	1703
	309	1091	1745
	328	657	1777
	269	678	1090
	272	569	749
Average:	293	1155	1764

[0092] Table 9: 96 Hour Peel values (TPE and PVB blends)

	TPE/PVB ratio		
	1/1	3/1	7/1
T-Peel, g/in	68	557	Would not peel
	90	498	Would not peel
	61	443	Would not peel
	74	481	Would not peel
	86	426	Would not peel
	81	377	Would not peel
	64	357	Would not peel
	79	419	Would not peel
Average:	75	445	Would not peel

[0093] COMPARATIVE EXAMPLE 3

[0094] Different ethylene vinyl acetate copolymers were also evaluated for use as the diluent. An EVA diluent with about 18 percent vinyl acetate and a melt flow index of about 150 (EVA 1850A, AT Plastics) was investigated, but would not dissolve in the toluene or form a stable solution with the TPE. Another EVA having about 18 percent vinyl acetate and a melt flow index of about 500 (EVA 1880A, AT Plastics) was investigated, but also would not dissolve in toluene or form a stable solution with TPE.

[0095] It will be understood that various changes in the details, materials, and arrangements of the package and process of formation thereof, which have been herein described and illustrated in order to explain the nature of the described package, may be made by those skilled in the art within the principle and scope of the embodied method as expressed in the appended claims.

CLAIMS

What is claimed is:

1. A flexible package having a reclosable fastener comprising:

opposing front and back panels joined together to form a cavity;

a reclosable fastener including opposing cohesive layers supplied from a solvent solution of a blend of a thermoplastic elastomer and a diluent resin disposed on each of the front and back panels, the cohesive layers being positioned facing each other on the front and back panels so that the flexible package can be closed when the opposing cohesive layers contact each other; and

a bond strength of the cohesive layers to the panels greater than a cohesive bond strength between opposing cohesive layers so that the front and back panels can be repeatedly peeled open without substantially delaminating the cohesive layers from the front and back panels.

2. The flexible package of claim 1, wherein the cohesive layers include a major amount of the thermoplastic elastomer including a styrenic block copolymer or a mixture of styrenic block copolymers diluted with a minor amount of the diluent resin including ethylene vinyl acetate copolymer to form the cohesive bond strength.

3. The flexible package of claim 2, wherein the cohesive layers include about 7 to about 9 parts of the thermoplastic elastomer and about 0.5 to about 2 parts of the ethylene vinyl acetate copolymer.

4. The flexible package of claim 2, wherein the styrenic block copolymer is selected from the group consisting of SIS block copolymers based on styrene and isoprene, SBS block copolymers based on styrene and butadiene, SEBS block copolymers with a hydrogenated midblock of styrene-ethylene/butylenes-styrene, SEPS block copolymers with a hydrogenated midblock of styrene-ethylene/propylene-styrene, and mixtures thereof.

5. The flexible package of claim 1, wherein the cohesive bond strength is about 100 to about 700 g/inch with a residual cohesion bond strength after contamination about 25 to about 100 percent of the cohesion bond strength before contamination.

6. The flexible package of claim 5, wherein the cohesive layer has a tack level not exceeding about 5 psi when preloaded with about 4.5 pounds and not exceeding about 15 psi when preloaded with about 10 pounds.

7. The flexible package of claim 6, wherein the cohesive layer has a peel strength to the panels of greater than about 700 g/inch.

8. The flexible package of claim 1, wherein the front and back panels are selected from the group consisting of ethylene vinyl acetate, polyethylene, polypropylene, polybutylene, nylon, polyethylene terephthalate, polyvinyl chloride, ethylene vinyl alcohol, polyvinylidene chloride, polyvinyl alcohol, polystyrene, or combinations thereof.

9. The flexible package of claim 8, wherein the front and back panels contain ethylene vinyl acetate in at least their innermost surfaces.

10. The flexible package of claim 1, wherein at least the innermost surfaces of the front and back panels include less than about 10 percent of a filler therein.

11. The flexible package of claim 10, wherein the filler is selected from micro- or nano-sized inorganic materials.

12. The flexible package of claim 11, wherein the filler includes clay, calcium carbonate, montmorillonite, dolomite, talc, mica, and mixtures thereof.

13. The flexible package of claim 1, wherein the front and back panels includes less than about 700 parts per million fatty acid amide or other additives that can migrate to the panel surface and decrease the bond strength to the cohesive layers.

14. The flexible package of claim 1, wherein the solvent is an organic solvent selected from the group consisting of ethyl acetate, normal propyl acetate, isopropyl acetate, methyl ethyl ketone, ethyl alcohol, normal propyl alcohol, propylene glycol, normal propyl ether, butyl acetate, toluene, cyclohexane, cyclohexanol, and mixtures thereof.

15. The flexible package of claim 1, wherein the reclosable fastener has less than about 50 parts per million residual organic solvent.

16. A reclosable fastener suitable for a package, the reclosable fastener comprising:

a cohesive layer applied to a flexible film and having an exposed cohesive surface; and

a non-adhesive spacer layer having an outer surface and disposed adjacent the cohesive layer, the non-adhesive spacer layer protruding outwardly beyond the cohesive surface of the cohesive layer so that the cohesive surface is recessed from the outer surface of the adjacent non-adhesive spacer layer.

17. The reclosable fastener of claim 16, wherein the adjacent non-adhesive spacer layer includes a pair of non-adhesive spacer layers each positioned adjacent a lateral side of the cohesive layer.

18. The reclosable fastener of claim 17, wherein each of the pair of adjacent non-adhesive spacer layers are disposed on the cohesive surface of the cohesive layer.

19. The reclosable fastener of claim 17, wherein each of the pair of adjacent non-adhesive spacer layers are disposed on the flexible film.

20. The reclosable fastener of claim 16, wherein the adjacent non-adhesive spacer layer includes a polyamide, polyester, polyethylene, polypropylene, polybutylene, ethylene vinyl acetate, polyethylene terephthalate, ethylene vinyl alcohol, polyvinyl chloride, polyvinylidene chloride, polyvinyl alcohol, polystyrene, and combinations thereof.

21. The reclosable fastener of claim 16, wherein the cohesive layer includes a thermoplastic elastomer and a diluting resin.

22. The reclosable fastener of claim 21, wherein the thermoplastic elastomer is a compound including a styrenic block copolymer or a mixture of styrenic block copolymers and the diluting resin is ethylene vinyl acetate.

23. The reclosable fastener of claim 22, wherein the compound includes minor amounts of plasticizers, fillers, antioxidants, or mixtures thereof.

24. The reclosable fastener of claim 22, wherein the styrenic block copolymer is selected from the group consisting of SIS block copolymers based on styrene and isoprene, SBS block copolymers based on styrene and butadiene, SEBS block copolymers with a hydrogenated midblock of styrene-ethylene/butylenes-styrene, SEPS block copolymers with a hydrogenated midblock of styrene-ethylene/propylene-styrene, and mixtures thereof.

25. The reclosable fastener of claim 16, wherein the cohesive surface has a cohesive bond strength of about 100 g/inch to about 700 g/inch.

26. The reclosable fastener of claim 25, wherein the cohesive surface has a tack level not exceeding about 5 psi when preloaded with about 4.5 pounds and not exceeding about 15 psi when preloaded with about 10 pounds.

27. The reclosable fastener of claim 16, wherein a gap of about 2.5 to about 50 microns is formed between the outer surface of the adjacent non-adhesive spacer layer and the cohesive surface of the cohesive layer.

28. The reclosable fastener of claim 16, further comprising opposing first and second reclosable fasteners, the cohesive surface of the first reclosable fastener opposing the cohesive surface of the second reclosable fastener.

29. A flexible package having a reclosable fastener, the flexible package comprising:

opposing front and back panels; and

a reclosable fastener on each of the front and back panels, each reclosable fastener including a cohesive layer disposed on the panel and having an outer surface spaced a first distance from the panel, a non-adhesive layer adjacent the cohesive layer and having an outer surface spaced a second distance greater than the first distance from the panel so that the cohesive layer is substantially recessed from the outer surface of the non-adhesive layer, and at least a portion of the outer surfaces of the cohesive layers cohesively engaged to each other to form a closed package.

30. The flexible container of claim 29, wherein the first distance the outer surface of the cohesive layer is spaced from the panel is about 2.5 to about 50 microns.

31. The flexible container of claim 29, wherein the second distance the outer surface of the non-adhesive layer is spaced from the panel is about 2.5 to about 100 microns.

32. The reclosable fastener of claim 29, wherein the non-adhesive layer is disposed on the outer surface of the cohesive layer.

33. The reclosable fastener of claim 29, wherein the non-adhesive layer is disposed on the panel.

34. The reclosable fastener of claim 33, wherein the thickness of the cohesive layer is about 2.5 to about 50 microns and the thickness of the non-adhesive layer is about 5 to about 100 microns.

35. The reclosable fastener of claim 29, wherein the non-adhesive layer includes a polyolefin, polyamide, polyester, polyethylene, polypropylene, polybutylene, ethylene vinyl acetate, polyethylene terephthalate, polyvinyl chloride, ethylene vinyl alcohol, polyvinylidene chloride, polyvinyl alcohol, polystyrene, and combinations thereof.

36. The reclosable fastener of claim 29, wherein the cohesive layer includes a thermoplastic elastomer or a mixture of thermoplastic elastomers selected from the group consisting of a styrenic block copolymer or a mixture of styrenic block copolymers.

37. The flexible container of claim 29, wherein the cohesive layer has a cohesive bond strength of about 100 g/inch to about 700 g/inch.

38. The flexible container of claim 37, wherein the cohesive layer has a tack level not exceeding about 5 psi when preloaded with about 4.5 pounds and not exceeding about 15 psi when preloaded with about 10 pounds.

39. A method of forming a flexible package having a reclosable fastener, the method comprising:

moving a flexible film longitudinally in a machine direction;

applying first and second strips of a thermoplastic elastomer containing solution intermittently to the flexible sheet and transverse to the machine direction, the first and second strips being spaced a first gap along the machine direction;

applying a third strip of the thermoplastic elastomer containing solution intermittently to the flexible sheet and parallel to one of the first and second strips, the third strip being spaced a second gap smaller than the first gap from one of the first or second strips;

applying a strip of a polyolefin solution adjacent to each of the intermittent thermoplastic elastomer strips in a manner such that an outer surface of a dried thermoplastic elastomer strip is recessed from an outer surface of a dried polyolefin strip; and

drying the thermoplastic elastomer strips and the polyolefin strips.

40. The method of claim 39, further comprising forming the flexible film into the flexible package such that one of the intermittent thermoplastic elastomer strips faces another of the intermittent thermoplastic elastomer strips to form the reclosable fastener.

41. The method of claim 39, wherein a percent solids of the thermoplastic elastomer containing solution is less than the percent solids of the polyolefin solution so that the dried thermoplastic elastomer strip has a smaller thickness than the dried adjacent polyolefin strip.

42. The method of claim 41, wherein the thermoplastic elastomer containing solution has a percent solids ranging from about 25 to about 45 percent.

43. The method of claim 42, wherein the polyolefin solution has a percent solids ranging from about 45 to about 65 percent.

44. The method of claim 29, wherein the non-adhesive layer is applied to the outer surface of the cohesive layer.

45. The method of claim 29, wherein the non-adhesive layer is applied to the flexible film.

46. A method of forming a flexible package having a reclosable fastener, the method comprising:

moving a flexible film longitudinally in a machine direction;

applying first and second strips of a thermoplastic elastomer containing solution intermittently to the flexible sheet and transverse to the machine direction, the first and second strips being spaced a first gap along the machine direction;

applying a third strip of the thermoplastic elastomer containing solution intermittently to the flexible sheet and parallel to one of the first and second strips; and

drying the thermoplastic elastomer strips to form the reclosable fastener.

47. The method of claim 46, wherein the thermoplastic elastomer containing solution includes about 25 to about 45 percent solids solution of a styrenic block copolymer and a secondary resin in an organic solvent.

Fig. 1

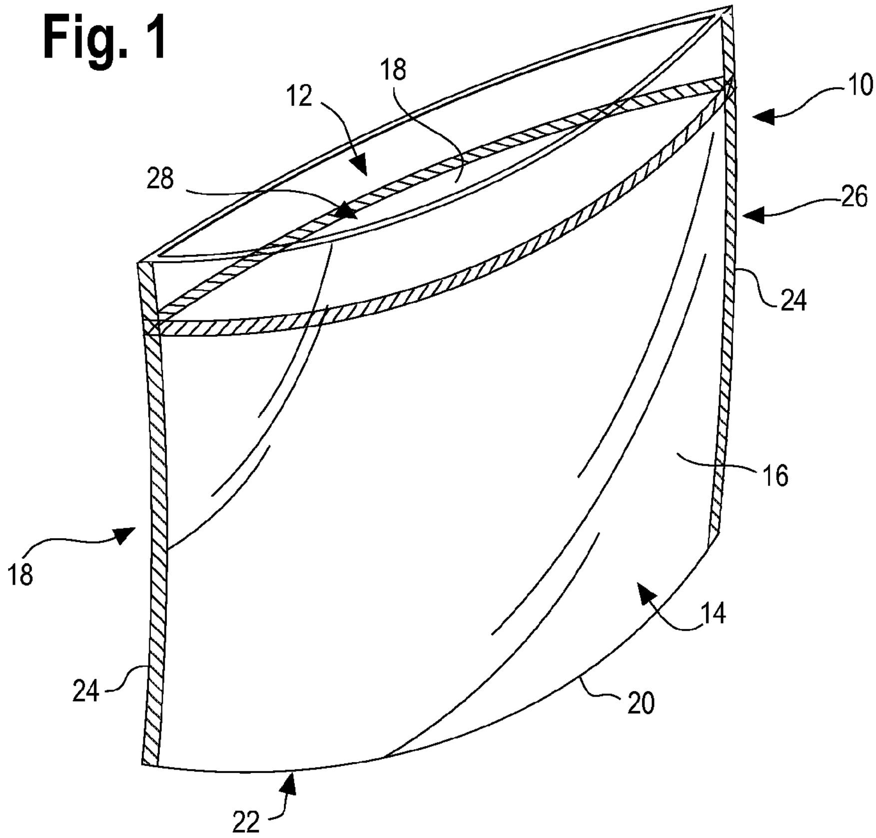
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Fig. 2

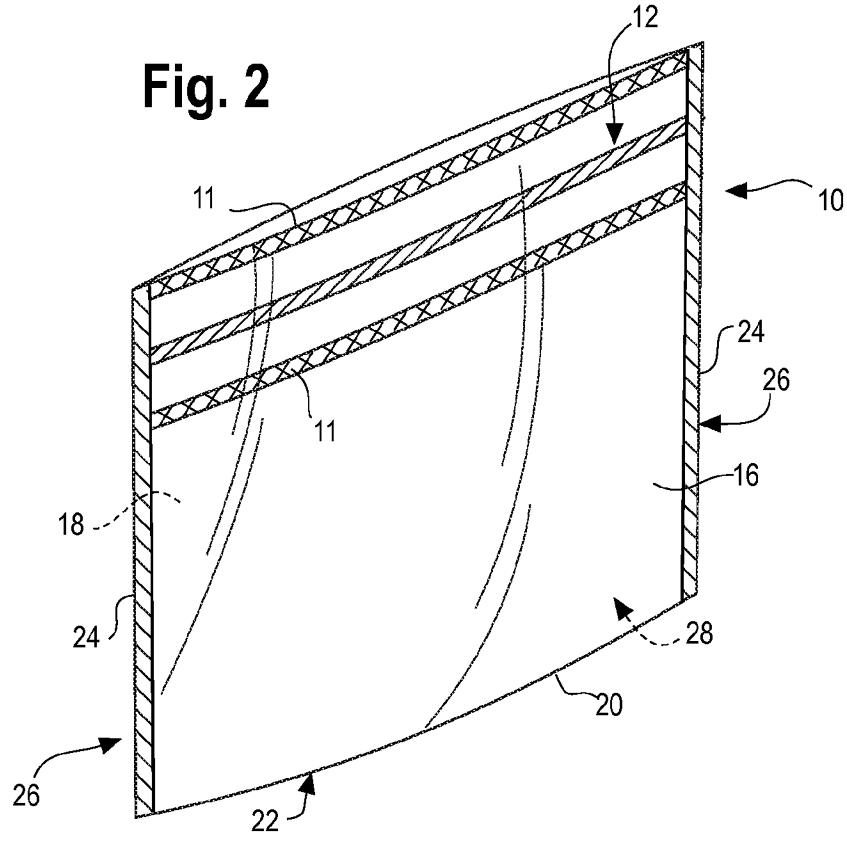
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Fig. 3

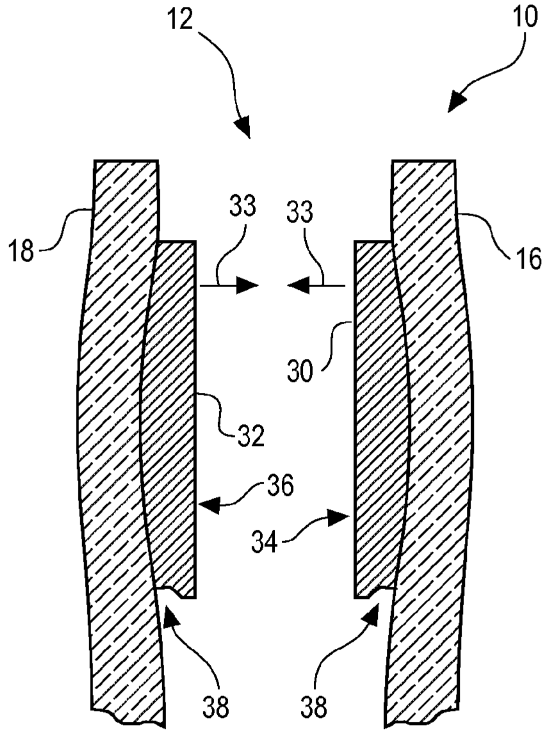


Fig. 4

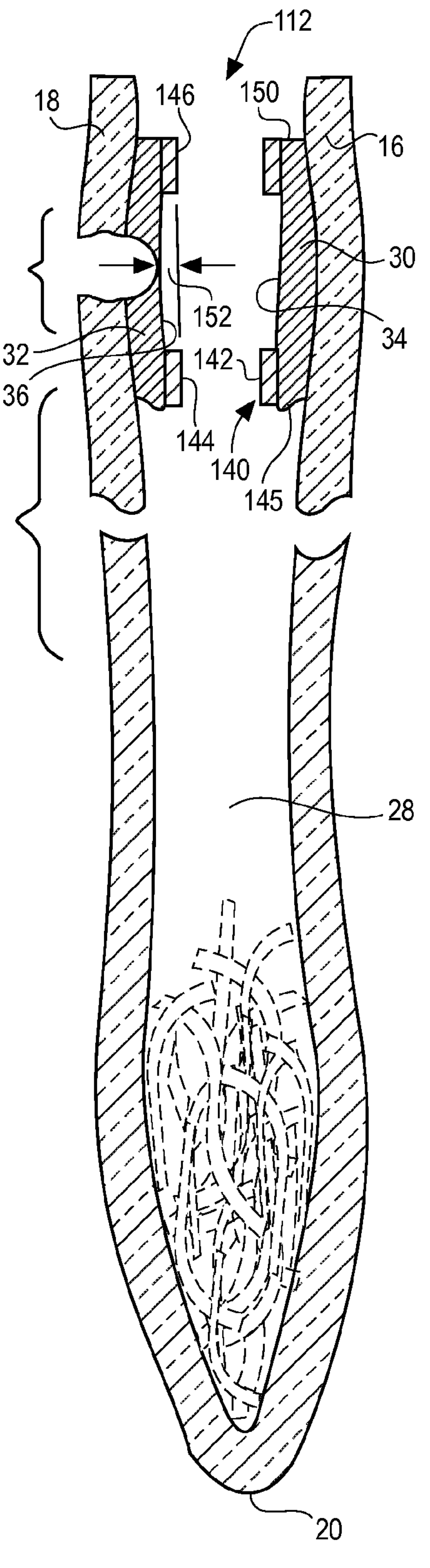
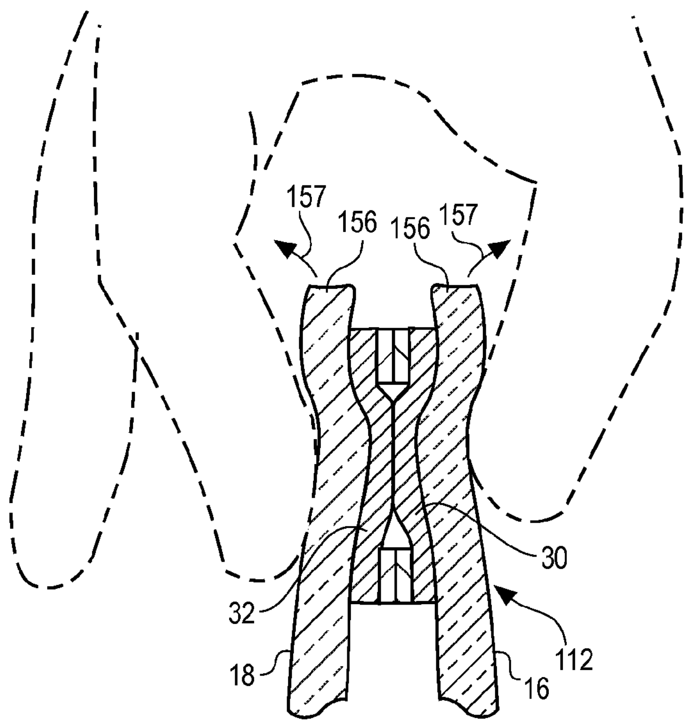


Fig. 5



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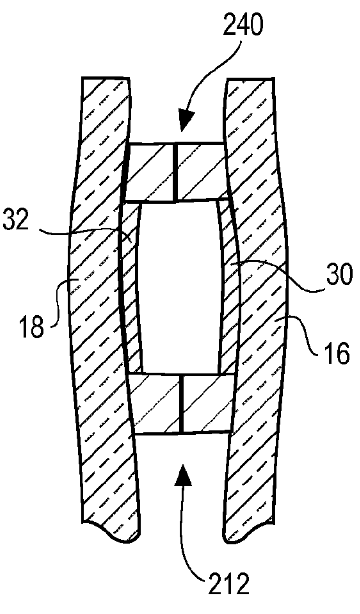

Fig. 7

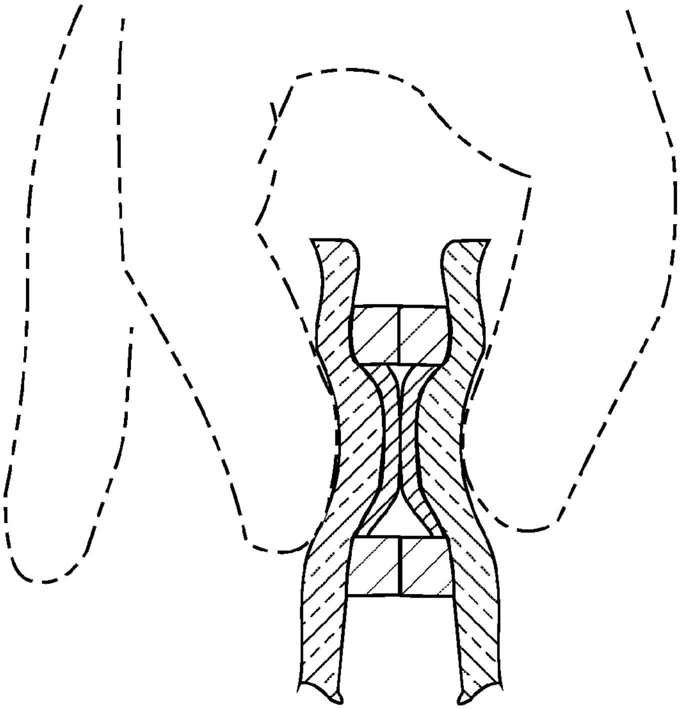

Fig. 8

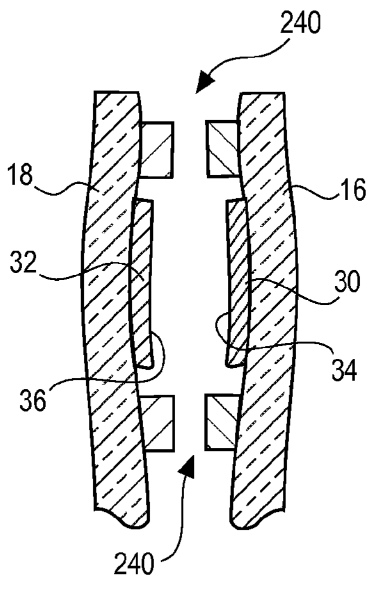

Fig. 9

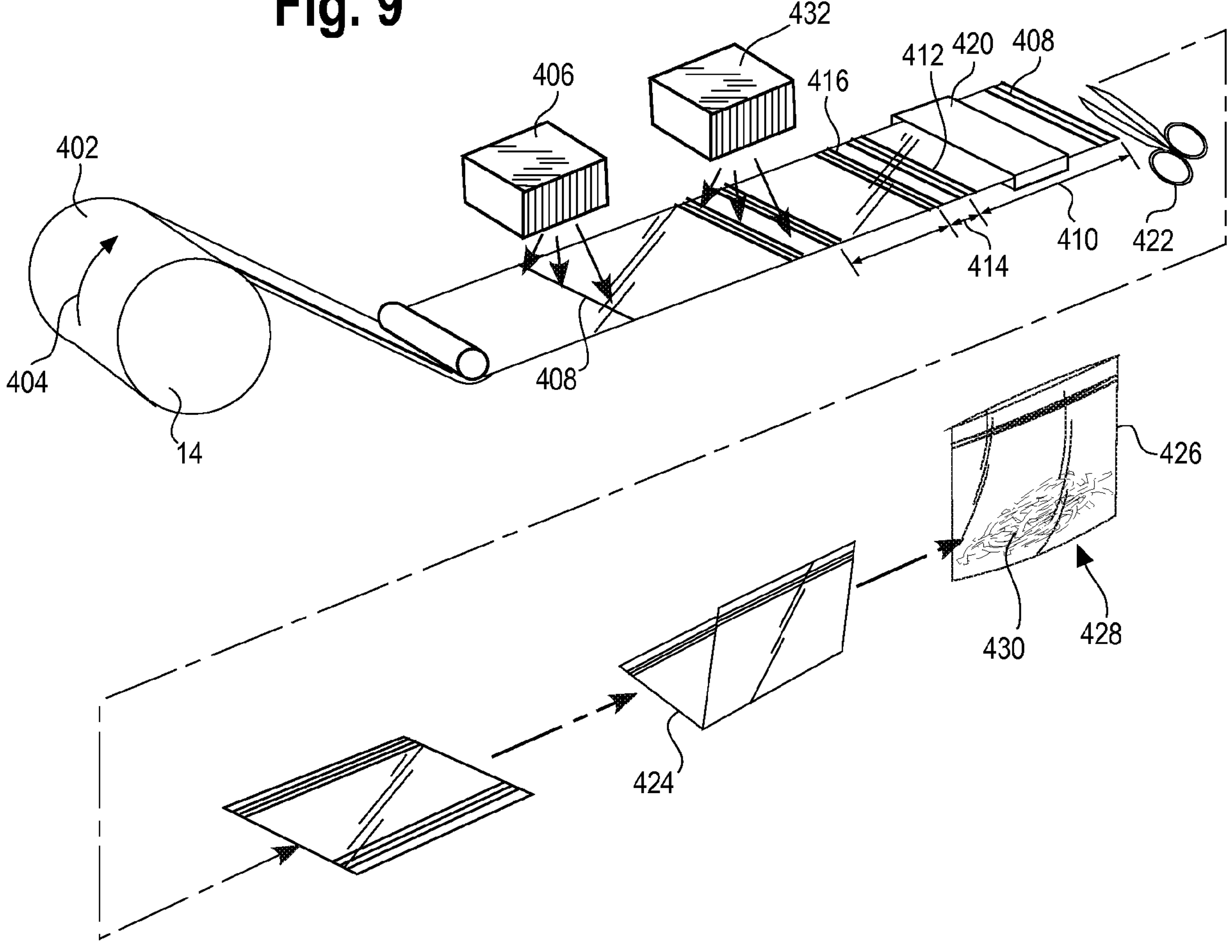
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Fig. 10

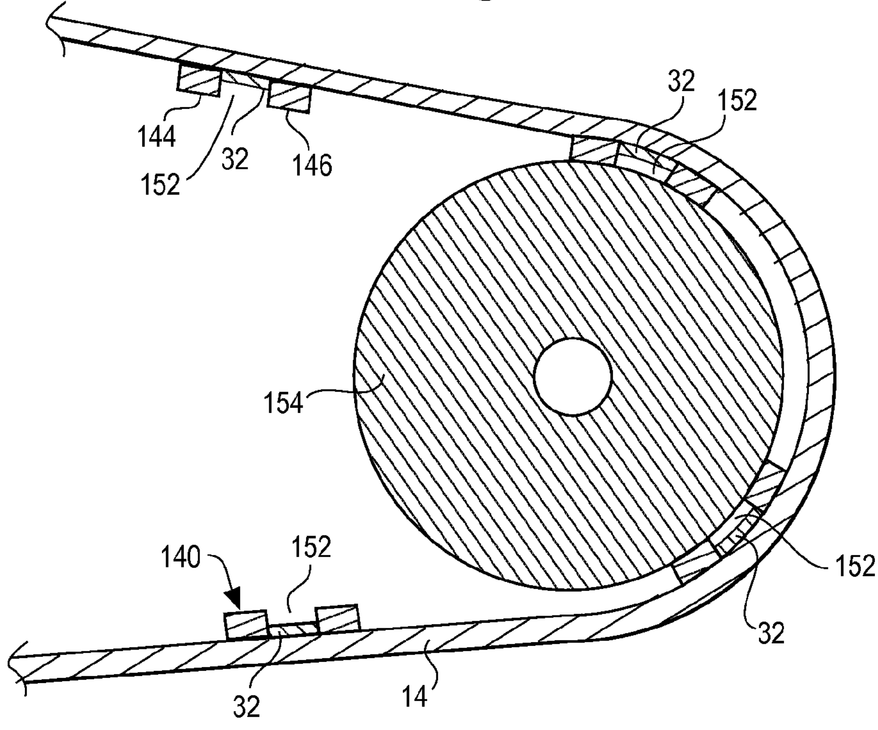
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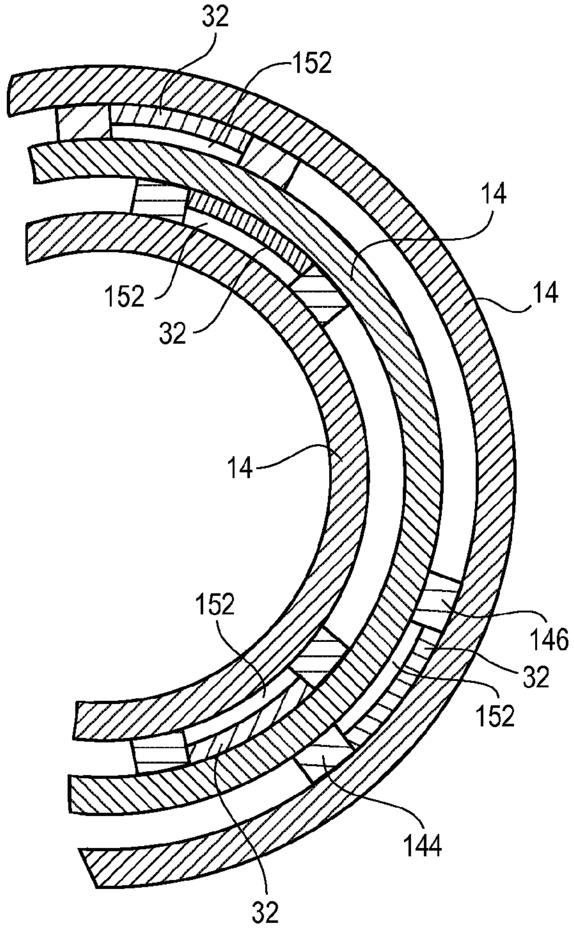
Fig. 11



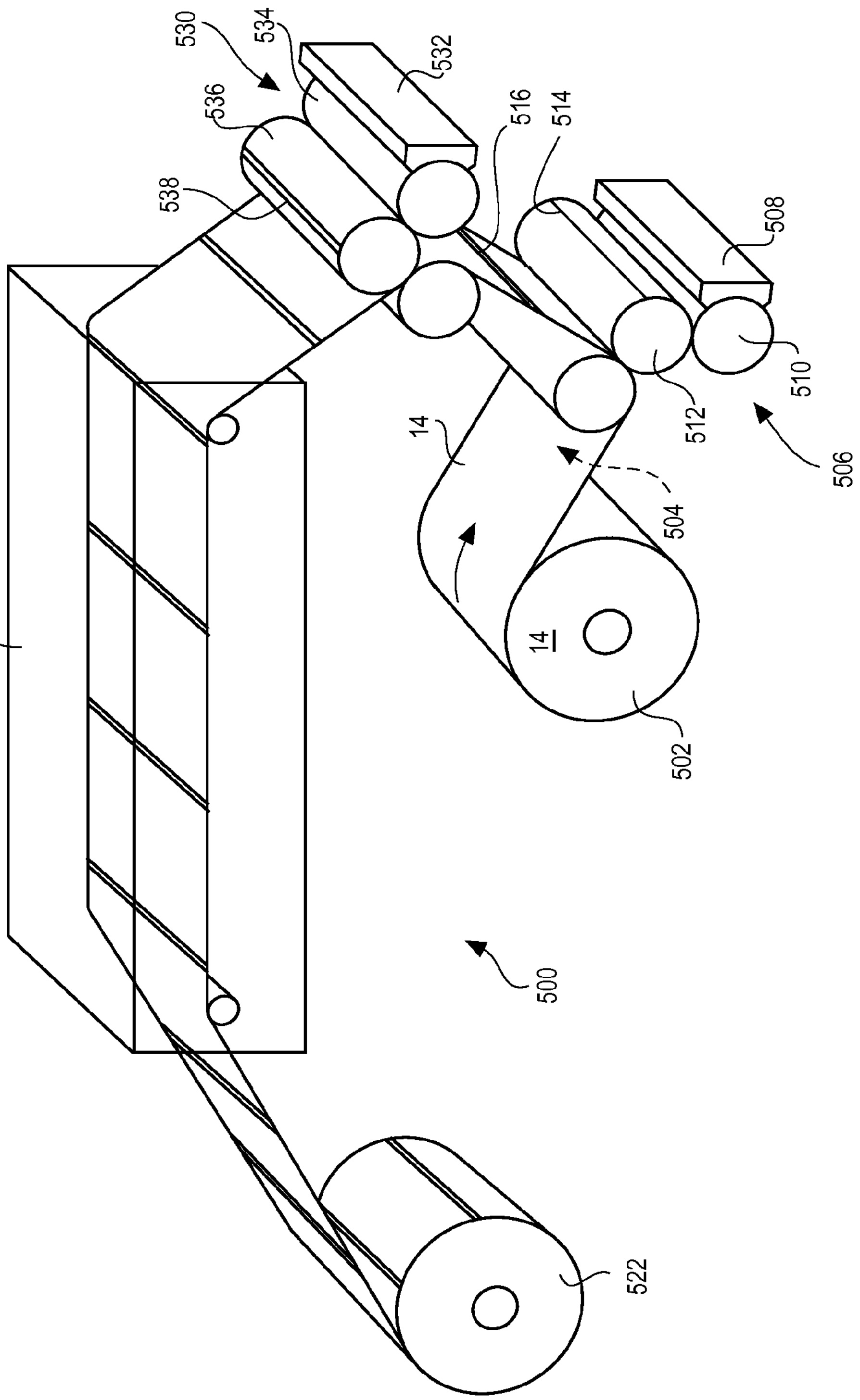

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Fig. 12

Fig. 13

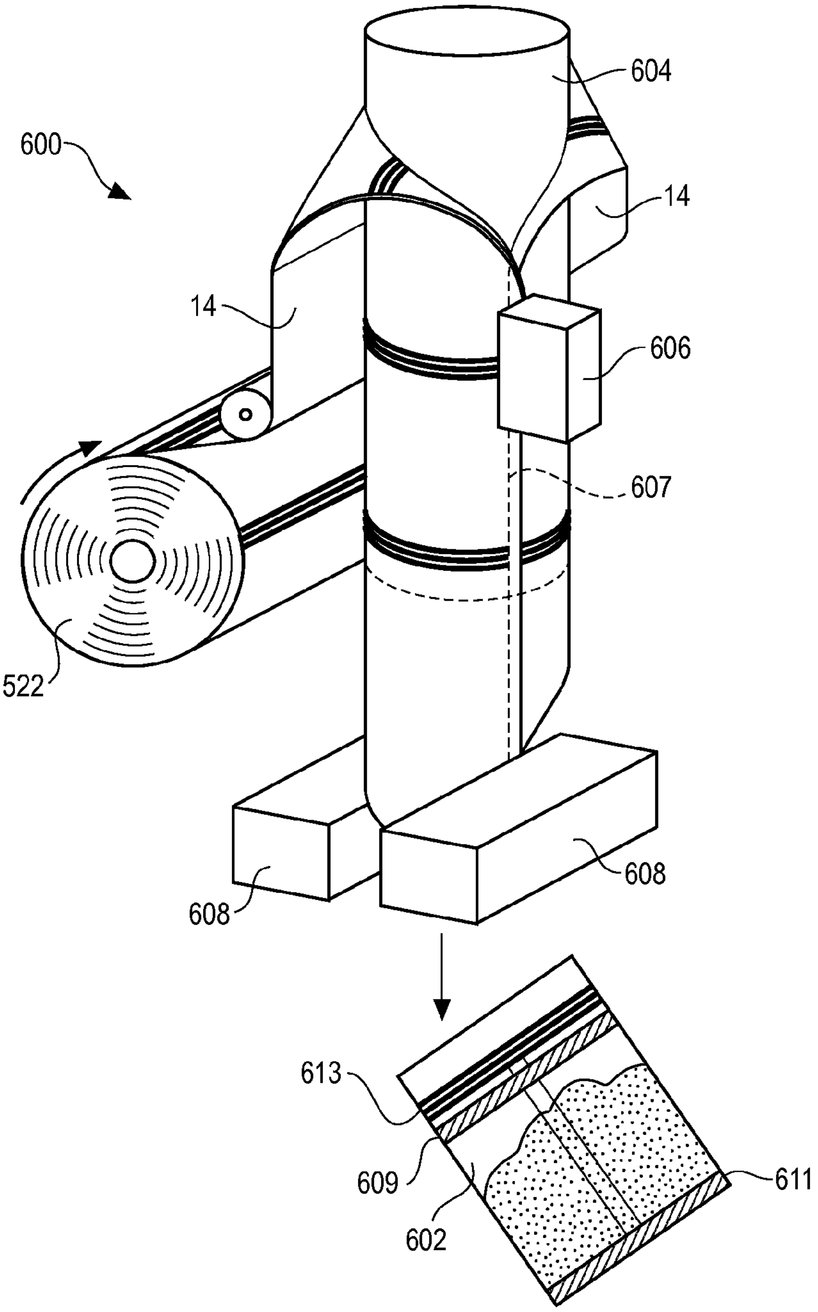
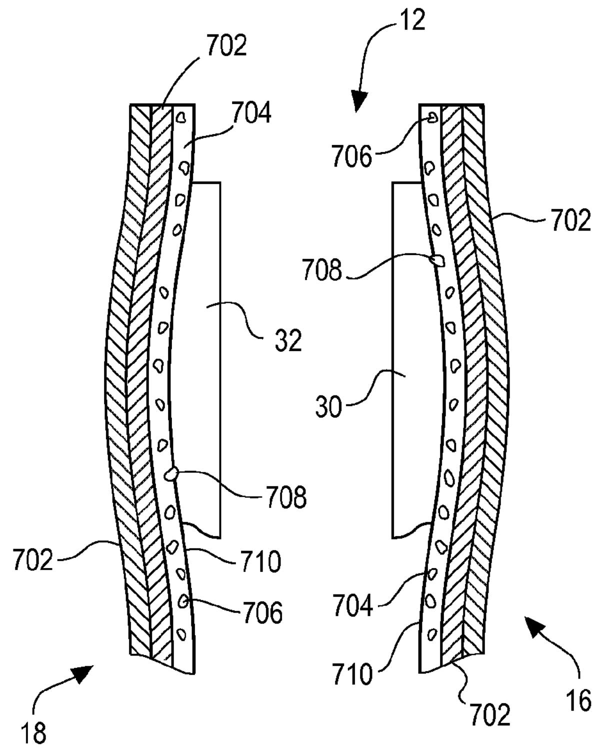


Fig. 14



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/042998

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D33/25

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 739 024 A (ILLINOIS TOOL WORKS [US]) 3 January 2007 (2007-01-03) paragraph [0029]; figure 4	1-15
X	& US 2004/161178 A1 (OLECHOWSKI KEVIN P [US]) 19 August 2004 (2004-08-19) paragraph [0029]; figure 4	1-15
X	US 2006/029300 A1 (YODER RANDALL W [US] YODER RANDALL WAYNE [US]) 9 February 2006 (2006-02-09) paragraph [0027]; figure 2	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search: 24 July 2009

Date of mailing of the international search report: 06/08/2009

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL – 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer
Cazacu, Corneliu

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/042998

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			KR 20070003604	A	05-01-2007
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