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(54) **PRESSURE-SENSITIVE ADHESIVE COATED LINERLESS NON-WOVEN LOOP**

MIT EINEM HAFTKLEBEMITTEL BESCHICHTETES SCHLINGENMATERIAL OHNE TRENNSCHICHT

BANDE NON TISSEE A BOUCLES SANS SUPPORT RECOUVERTE D'UN ADHESIF SENSIBLE A LA PRESSION

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- **PATENT ABSTRACTS OF JAPAN vol. 097, no. 003, 31 March 1997 & JP 08 296165 A (KANEBO LTD;NISSAN MOTOR CO LTD), 12 November 1996,**

EP 1 043 944 B1

Description

[0001] The present invention relates to a non-woven fibrous loop fastening material specifically adapted to be releasably engaged with a mating male mechanical fastener element which loop fastening material is coated on one face with a pressure-sensitive adhesive and arranged over a like adhesive coated loop fastening material without an intervening release element.

[0002] U.S. Pat. No. 5,605,729 describes a storage/dispensing assembly of a loop fastening material used in a hook and loop fastening system which comprises one or more multiple layered sheets of loop tape fastening material with a pressure-sensitive adhesive layer on one face of the loop tape fastening material. The loop tape fastening material is stored in a dispensable condition on an underlying loop tape fastening material such as to be in direct contact with the loop layer of the underlying loop tape fastening material. When the overlying loop tape fastening material is separated from the underlying loop tape fastening material, the loops of the underlying loop tape fastening material are presented in an engageable state. The loop tape fastening material generally comprises a loop layer comprising a multiplicity of flexible loops and an underlying base layer in which the loops are anchored and a pressure-sensitive adhesive layer on an opposite surface of the base layer. A wide variety of loop materials are described as suitable including knitted materials, woven materials, stitch bonded materials or non-woven materials. Exemplified is a roll of texturized polyester knitted loop fabric extrusion coated with polypropylene and subsequently coated with a pressure-sensitive adhesive of a tackified styrene-butadiene block copolymer. Also exemplified is a spun bond polypropylene loop fabric thermally bonded to a cast film of a ethylene- propylene impact copolymer resin, which film is adhesive coated on the opposite face with a tackified "KRATON" 1111 adhesive (a styrene-isoprene-styrene block copolymer based adhesive). This loop tape construction has been found to be quite advantageous in terms of its manufacturability, roll stability, ease of use, and performance. However, with non-woven fibrous loop tape materials, there is a tendency for the fibers of an underlying loop tape material to become disengaged with the backing material or base layer when the overlying loop tape fastening material is removed. This fiber disengagement can decrease the level of adhesion of the overlying loop tape pressure-sensitive adhesive layer when subsequently attached to a substrate and/or decrease the loop to hook adhesion with the underlying loop tape material. Generally, it is desirable to minimize this level of fiber disengagement.

[0003] Non-woven loop fastening materials are generally known in the art, and are the focus of much attention due to their low cost, ease of manufacture and aesthetic qualities. For example, U.S. Pat. No. 5,256,231 describes forming a non-woven or fibrous loop material by corrugating either a non-woven web or a series of substantially non-parallel yarns in a corrugating nip and subsequently extrusion bonding a thermoplastic film onto specific anchor portions of the sheet of corrugated fibrous material. The individual fibers in the loop material generally are less than 25 denier, preferably from 1 to 10 denier in size with the loop material having a basis weight of from 5 to 300 grams per square meter. This provides a low cost, highly effective non-woven loop structure. U.S. Pat. No. 5,032,122 and PCT Appln. No. WO 95/33390 describe forming a loop fastening material with a non-woven fibrous material intermittently bonded to a backing such that the non-woven material is puckered or projects from the backing between the fixed regions. In both cases, the non-woven loop material is fastened to the backing while it is in a dimensionally unstable condition and then subsequently causing the backing material to contract to a stable condition such as by the application of heat or by release of tension in the case of an elastomeric backing material. The non-woven fibrous material forming the loop generally can be filaments or non-wovens which in the case of the U.S. patent are described as 8 to 9 denier spunbond polypropylene fibers for the specific example. The PCT application describes the filaments as generally spun or blown fibers which preferably are polypropylene fibers of between 2 and 15 denier.

[0004] U.S. Pat. Nos. 5,326,612 and 5,407,439 and PCT Appln. WO 96/04812 describe forming loop fastening material from non-woven materials such as spun bond webs which generally are described as preferably being formed from 0.5 to 15 denier filaments, with a basis weight of the spun bond web being from about 5 to 40 g/yard^2.

[0005] UK Pat. Appln. 2285093 describes a loop material formed by joining a fibrous loop material to a compression resilient backing, generally formed of a woven type material but which also could be a foam. The backing is mechanically joined to a non-woven or stitch bonded loop material by needle punching, stitch bonding or adhesives. The fibrous loop material can be formed of fibers of various diameters ranging from spun bond fibers having diameter of from 10 to 15 μm to staple fibers having a diameter of from 10 to 100 μm.

[0006] This loop material would be dimensionally unstable and not suitable for most industrial uses.

[0007] PCT Appln. No. WO 95/12702 is similar to that described in UK 2285093, however, it is described that the loop materials are deposited in a way to form a plurality of intertwined looped springs, each having a diameter from 0.5 to 3 mm by using filaments having diameters of from 25 to 100 μm.

[0008] Japanese Pat. Publ. No. 7-313213 describes a loop fastening material formed by fusing one face of a non-woven loop fabric, formed from sheath-core composite fibers having a polyethylene sheath and a polypropylene core. Generally, the fibers are described as having a diameter of from 0.5 to 10 denier with the non-woven web having a basis weight of from 20 to 200 g/m^2.

[0009] The loop fastening materials of the invention provide an improvement over that described in U.S. Pat. No. 5,605,729 with relation to loop tape fastening materials formed from non-woven loop fastening layers. Specifically, the invention is directed at addressing the problems relating to providing improved loop integrity and reduced fiber contamination of the adhesive layer on the overlying loop tape fastening material when it is removed from the underlying loop tape fastening material.

[0010] A loop tape fastener material assembly is provided comprising one or more multilayer sheets of loop tape fastener material usable as the loop portion of a hook and loop fastener, said non-woven loop tape fastener material comprising in order: (1) a non-woven loop layer forming its first major surface, said non-woven loop layer comprising (a) a multiplicity of flexible fibrous loops adapted to be releasably engaged by the complementary hook portion of the hook and loop fastener, and (b) a base and/or backing layer in which said non-woven loops are anchored; and (2) a pressure-sensitive adhesive layer forming its second major surface.

[0011] The non-woven loop layer is formed at least in part of fibers or filaments having a denier of at least 15. The non-woven loop tape fastener material is arranged in said assembly such that the adhesive layer of an overlying non-woven loop tape fastener material is in direct contact with the loop layer of an underlying non-woven loop tape fastener material. The underlying loops are such that, when said overlying non-woven loop tape fastener material is removed from said assembly, said underlying loops are preferably presented in an engagable state. Generally, when the non-woven loop tape fastener material is in a roll form, the underlying loops are compressed by overlying loop tape fastener material arranged in said roll and the compressed underlying loops are restored to an engagable state after removal of the overlying nonwoven loop tape.

[0012] The invention will be further explained with reference to the drawings, wherein:

FIG. 1 is a cross section of a portion of one embodiment of a storage/dispensing assembly of the invention;
FIG. 2 is an edge view of another embodiment of a storage/dispensing assembly of the invention with a portion of dispensed loop fastener material; and
FIG. 3 is a cross-sectional view of the dispensed loop fastener material of FIG. 2.

[0013] These figures, which are idealized, are not to scale and are intended to be merely illustrative and non-limiting.

[0014] An illustrative non-woven loop fastener material assembly of the invention is shown in FIG. 1. Assembly 10 depicted comprises a stack of three multilayer sheets 12a, 12b, 12c of non-woven loop tape fastener materials for the loop portion of a hook and loop fastener. However, the assemblies of the invention can have an indefinite number of layers depending on the width of the non-woven loop tape fastener material and the form of the stack or endless roll. The loop tape fastener material 12 comprises in order: (1) non-woven loop layer 14 forming its first major surface, which non-woven loop layer 14 comprises (a) a multiplicity of fibers 15 adapted to be releasably engaged by the complementary hook portion (not shown) of the hook and loop fastener and (b) a base layer and/or a backing layer 16 in which the loops are anchored; and (2) pressure-sensitive adhesive layer 18 forming the second major surface of the loop fastener material 12. The non-woven loop tape fastener material is arranged in the assembly 10, such that adhesive layer 18a of overlying non-woven loop tape fastener material is in direct contact with the loop layer 14b of an underlying non-woven loop tape fastener material. The loops of loop layer 14b are such that, when the overlying non-woven loop tape fastener material 12a is removed from assembly 10, the loops of the underlying non-woven loop fastening material are presented in an engagable state. In some embodiments, mere removal of the overlying loop tape such that the loops are accessible to be engaged by complementary hook material is sufficient. In other embodiments, where the loops are compressed in the assembly, loops 14b must also recover from their compressed condition, either substantially solely through inherent properties or through assistance with adhesive layer 18a, in order to achieve an engagable state.

[0015] Non-woven loop tape fastener material used in assemblies of the invention may be made with a variety of non-woven loop materials such as spunbond non-wovens, melt blown non-wovens, carded webs, airlaid non-wovens, needlepunched non-wovens, spunlaced non-wovens suitable combination of the above and the like.

[0016] For many applications, non-woven loop tape materials used in assemblies of the invention will have a basis weight between about 3 and 20 ounces/yard^2 (102-678 g/m^2), be made of filaments made of polyolefins (e.g., polypropylene), polyesters, nylons or combinations of such materials. Illustrative examples of non-woven loop materials suitable for use in the present invention are disclosed in U.S. Patent No. 5,032,122 (Noel et al.) and PCT WO 920401 (Gorman et al.) and EP 341993 B1 (Gorman et al.).

[0017] In accordance with the invention, it has been found that when a given percentage of the non-woven loop material is formed from filaments or fibers having an average denier of at least 15 that significantly less fibers are removed from the backing when the overlying loop tape material is removed from the assembly even without added binders or bonding fibers. This results in less contamination of the overlying loop tape adhesive and corresponding better adhesion to substrates to which this loop tape fastening material is subsequently applied. Generally, the loop material should have at least 25 percent by weight (preferably 50 to 100 percent by weight) of fibers from 15 to 50

denier, preferably 15 to 30 denier with the remainder comprising fibers less than 15 denier, preferably from 3 to 9 denier.

[0018] As discussed below, it may be desirable to specifically control the adhesion between the loops of an overlying loop layer 14 and adhesive layer 18 to achieve desired release properties of the overlying loop tape in the assembly. Control of adhesive and release properties of the loop tape in the assembly can be accomplished by a variety of techniques. First, adhesive 18 may be chosen for specific adhesion characteristics to a selected loop layer 14. Second, loop layer 14 may be specially chosen for specific interaction with the selected adhesive. The material of loop layer 14 may inherently exhibit desired release characteristics or the release properties of the loop layer may be modified, e.g., by incorporation of a release control agent (e.g., as an additive in a polymeric composition or via graft polymerization) into the material from which non-woven loops are made and/or application of a release control agent onto the surface of the non-woven loops, prior to arranging the non-woven loop tape fastener material into the assembly. Illustrative examples of incorporated-type release control agents include polymer melt additives or graft polymerization such as the fluorochemical graft polymer disclosed in PCT Appln. No. WO 92/15626 (Rolando et al.), etc. Illustrative examples of surface applied (i.e., topical) release agents include urethanes such as disclosed in U.S. Pat. No. 2,532,011 (Dahlquist et al.), reactive silicones, fluorochemical polymers, epoxysilicones such as are disclosed in U.S. Pat. Nos. 4,313,988 (Bany et al.) and 4,482,687 (Kessel et al.), polyorganosiloxane-polyurea block copolymers such as are disclosed in European Appln. No. 250,248 (Leir et al.), etc.

[0019] As mentioned above, in some embodiments the loops are substantially not compressed by the overlying adhesive layer when the non-woven loop tape fastener material is arranged in a storage/dispensing assembly of the invention. For many uses, however, it is desired to use non-woven loop tape fastener materials that are very soft and/or made of light weight materials. Such non-woven loops tend to be highly flexible and thus subject to being compressed when arranged in the storage/dispensing assembly of the invention. When the material is arranged in the storage/dispensing assembly, the non-woven loops are compressed by the overlying non-woven loop tape material. After removal, the non-woven loops must recover in order to be readily engagable. In some instances, non-woven loops 14b are such that they will substantially recover (i.e., uncompress so as to substantially reacquire their preassembly loft) following removal of an overlying loop tape portion 12a essentially without any contribution of the adhesive. Typically, however, it is preferred to utilize the action of overlying loop tape adhesive layer 18a to further the recovery of the underlying loops 14b. In such instances, the overlying adhesive layer adheres sufficiently strongly to the non-woven loops that when the overlying non-woven loop tape fastener material is removed from the assembly, the adhesive tends to pull the underlying non-woven loops so as to restore them to an engagable state.

[0020] The adhesion of the adhesive layer to the underlying non-woven loops is preferably low enough that the non-woven loops are not substantially pulled free from the non-woven loop layer when the adhesive layer is separated therefrom. This effect is substantially aided by the use of fibers or filaments having a denier of at least 15 in the above described concentration ranges in the non-woven loop layer. If a substantial number of the loop fibers do not remain anchored to the base layer and are pulled free, dislodged loop fibers may tend to contaminate the overlying adhesive layer and degrade its adhesion properties. This can also reduce the number of intact loops of the underlying loop tape material available for engagement by a complementary hook material, thereby reducing the strength of mechanical bonds which can be obtained in the hook and loop fastener systems formed.

[0021] FIG. 2 illustrates another embodiment of the invention wherein storage/dispensing assembly 20 is a roll comprising one or more multilayer sheets of loop fastener material as described above wound convolutely upon itself around core 22. As shown, the loop tapes are wound concentrically and generally aligned, however, the successive loop tape courses can be wound in any suitable manner such as by levelwinding or the like.

[0022] The overlying adhesive layer typically exhibits a peel force to the underlying loop layer of between about 4 and about 400 g/cm width; preferably between about 8 and 120 g/cm width, and most preferably between about 8 and about 80 g/cm width. As those skilled in the art will appreciate, embodiments of the invention may be made with peel forces outside these ranges if desired.

[0023] Typically, however, the peel force should be less than the internal tear strength of the non-woven loop layer 14 or the loop tape fastener material such that the loop tape fastener material can be readily dispensed from the assembly in usable fashion. The loop tape fastening material on a roll typically exhibits an unwind force of between about 4 and about 250 g/cm width, and preferably between about 8 and about 120 g/cm width.

[0024] Adhesive layer 18 of the loop tape fastener material of the invention is a pressure-sensitive adhesive. Selection of a suitable adhesive will be based in part on such factors as the substrate to which the loop tape fastener material is to be attached, the nature of the backing layer, the nature of the loop layer and its component loops, the desired properties of the loop tape fastener material 12, the conditions of use to which the loop tape fastener material 12 will be exposed, and available converting techniques and equipment for removing loop tape fastener material 12 from the storage/dispensing assembly and conversion, e.g., cutting or slitting, to desired format. The adhesive layer 18 should be tacky at room temperature, adhere as desired to intended substrates to which the loop tape fastener material 12 is to be applied, adhere well to the backing 16 or the loop tape fastening material base layer. Suitable adhesives for particular applications can be readily selected by those skilled in the art. Illustrative examples of suitable adhesives

include: acrylates, tackified natural rubber, tackified synthetic rubber resins, etc. The adhesive layer might be substantially continuous or may be patterned if desired. Suitable adhesives can be readily selected by those skilled in the art.

[0025] The pressure sensitive adhesive is preferably a tackified elastomer where the elastomer is an A-B type block copolymer wherein the A blocks and B blocks are configured in linear, radial or star configurations. The A block is formed of a mono-alkenylarene, preferably a polystyrene block having a molecular weight between 4000 and 50,000, preferably between 7000 and 30,000. The A block content is preferably about 10 to 50 weight percent, preferably about 10 to 30 weight percent of the block copolymer. Other suitable A blocks may be formed from alpha-methylstyrene, t-butyl-styrene and other ring alkylated styrenes, as well as mixtures thereof. The B block is formed of an elastomeric conjugated diene, generally polyisoprene having an average molecular weight from about 5000 to about 500,000, preferably from about 50,000 to about 200,000. The B block content is generally 90 to 50 percent, preferably 90 to 70 percent by weight. The tackifiying components for the elastomer based adhesives generally comprise solid tackifying resin and/or a liquid tackifier or plasticizer. Preferably, the tackifying resins are selected from the group of resins at least partially compatible with the polydiene B block portion of the elastomer. Although not preferred, generally a relatively minor amount of the tackifying resin can include resins compatible with the A block, which when present are generally termed end block reinforcing resins. Generally, end block resins are formed from aromatic monomer species. Suitable liquid tackifiers or plasticizers for use in the fastening tape tab adhesive composition include napthenic oils, paraffin oils, aromatic oils, mineral oils or low molecular weight rosin esters, polyterpenes and C-5 resins. Solid tackifying resins include C-5 resins, resin esters, polyterpenes and the like.

[0026] The tackified portion of the pressure sensitive adhesive generally comprises from 20 to 300 parts per 100 parts of the elastomeric phase. Preferably, this is predominately solid tackifier, however, from 0 to 25 weight percent, preferably 0 to 10 weight percent of the adhesive can be liquid tackifier and/or plasticizer.

[0027] Generally, an additional layer needs to be provided between the non-woven loop layer and the adhesive layer. FIG. 1 shows backing 16.

[0028] Backing 16 provides a more amenable surface for adhesive layer 18 than the non-woven loop layer 14 might otherwise provide, however, the loop layer 14 can be fused to provide a backing 16 as disclosed in Japanese Application No. 7-313213. In most instances, the backing 16 will be a substantially continuous layer, providing a barrier between loop layer 14 and adhesive layer 18. This prevents undesirable blocking of the loops by the adhesive, e.g., during fabrication of the multilayer loop material when the adhesive may be more flowable than when the storage/dispensing assembly is assembled. U.S. Pat. No. 4,994,054 (Pigneul) addresses this issue. Backings may be selected to impart greater tensile and tear strength to the non-woven loop tape fastener material.

[0029] A suitable backing for a specific application may be readily selected by one skilled in the art. Selection of a suitable backing is dependent in part upon the desired properties of the loop tape fastener material 12, characteristics of the loop layer 14 and the adhesive layer 18 between which it is to be bonded, the conditions of use to which the loop material will be exposed, available converting techniques and equipment for removing loop fastener material from the storage/dispensing assembly and conversion, e.g., cutting or slitting, to a desired format. Many materials commonly used as tape backings will be useful. Illustrative examples of materials suitable for use as backings herein include: polyalefins, polyesters, vinyls, blends thereof, paper, non-woven web, etc. If desired, multilayer backings can be used. Also, foamed backings may be used. In a particularly preferred embodiment, the loop tape fastening material backing is an extrusion bonded film such as disclosed in U.S. Pat. No. 5,256,231. In this case, the non-woven loop material would be fed into a nip formed between two nested surfaces, such as two correlating intermeshing rolls. Into the nip is fed the non-woven loop material and a thermoplastic backing layer in a molten state from a die, with an optional further backing, or other layer on the opposite face of the molten thermoplastic backing layer. The pressure applied by the nip causes the fibers of the non-woven loop layer to be impregnated into the thermoplastic backing.

[0030] Sometimes, backing 16 is used to impart or define in large part the desired tensile strength of the loop tape fastener material 12. In most embodiments, backing 16 has a basis weight of between about 5.0 and about 400 g/m^2, sometimes between about 10 and about 200 g/m^2, and sometimes between about 20 and about 100 g/m^2.

[0031] In most embodiments, backing 16 has a thickness between about 5 and about 12,500 μm with the larger thicknesses typically being foam type backings. When the backing is, for example, a polyolefin sheet, thicknesses between about 25 and about 500 μm, sometimes between about 50 and 250 μm, will be common. It will be understood that backings of thicknesses outside these ranges may be desired in some instances.

[0032] The method of the invention for dispensing an "engagement-ready" non-woven loop tape fastener material comprises the steps of: (1) providing a storage/dispensing assembly as described above and (2) removing an overlying non-woven loop tape fastener material from the assembly such that the adhesive layer of the overlying non-woven loop tape is separated from the loops of the underlying non-woven loop tape, permitting the loops of the underlying non-woven loop tape fastener material to be releasably engaged by a complementary hook fastener material.

[0033] As mentioned above, in some embodiments the adhesive of the overlying non-woven loop tape adheres sufficiently strongly to the loops of the underlying non-woven loop tape such that when the overlying non-woven loop tape is removed from the assembly the adhesive of this tape tends to pull the underlying loops so as to restore them

to an engagable state.

[0034] In embodiments wherein the assembly is a stack comprising two or more sheets of non-woven loop tape fastener material, the method of removing an overlying portion of the non-woven loop tape fastener material may simply comprise peeling a sheet from the stack.

[0035] In embodiments wherein the assembly is a roll comprising one or more sheets of loop tape fastener material wound convolutely, or otherwise about itself, removing an overlying portion of the non-woven loop tape fastener material may simply comprise unwinding a portion of the non-woven loop tape fastener material from said roll. In some instances, it may be desired that the adhesive exhibits sufficiently strong adhesion to the loops such that when the overlying loop tape is unwound, the adhesive of the overlying loop tape tends to pull upward on the loops of the underlying loop tape so as to restore them to an engagable state. In this regard, it may be desired that the roll exhibit a specified unwind force.

[0036] Typically, following removal of a portion of the ncn-woven loop tape fastener material from the assembly, the loop tape fastener material will be cut as required and then bonded or attached to a substrate with the pressure-sensitive adhesive layer.

[0037] The loop tape fastener material can be used for applications other than as a loop for a hook and loop fastening system if desired. For example, it could be used as a decorative tape, a wall covering, or a fastening tape. However, the loop tape would still be engagable with a hook fastener.

[0038] Storage/dispensing assemblies of the invention can be made in a variety of sizes and embodiments as desired. Due to their surprising stability, roll-type assemblies of the invention using sheets of virtually any desired width can be readily made and handled. For instance, rolls made of sheets 2 inches (5 cm) wide or less are practically handled. Rolls which are wound concentrically will typically be formed of sheets having a width of at least 1 cm. Previously, concentrically wound rolls of sheets of such small widths were very difficult to handle because of the minimal interlayer adhesion that typically results from release liners. Rolls of sheets having greater widths may also be made in accordance with the invention. In addition, large volume rolls may be made, e.g., with a roll radius (i.e., the radius of loop fastener material measured in a radial direction from the center of the roll or core, if any) of 20 inches (0.5 m) or more representing several hundred or thousand overlying layers of loop fastener material. Unlike conventional rolls of loop fastener material, roll-type assemblies of the invention may be made without the familiar side shields usually found attached to one or both ends of a roll core to help prevent telescoping of concentrically wound roll during handling. Similarly, stack-type assemblies of the invention having similar dimensions may be made.

Test Methods

135 Degree Peel Adhesion Test

[0039] The 135 degree peel adhesion test was used to measure the amount of force that was required to peel a strip of a hook fastener material from a sample of the loop fastener material. The test was carried out at constant temperature and humidity in a room set at 23°C and 50% relative humidity.

[0040] A 2 inch x 5 inch (5.08 cm x 12.7 cm) piece of the pressure-sensitive adhesive coated loop fastening material to be tested was securely placed adhesive side down onto a 2 inch x 5 inch (5.08 cm x 12.7 cm) steel panel. The loop fastening material was placed onto the panel with the cross direction of the loop material parallel to the long dimension of the panel. A 0.75 inch x 1 inch (1.90 cm x 2.54 cm) strip of the hook fastener test material (XMH-5145, available from 3M Company) with a paper leader attached was then centrally placed on the loop panel so that the leading edge of the hook strip was along the length of the panel. The sample was rolled by hand, once in each direction, using a 4.5 pound (1000 g) rubber roller. The sample panel was then placed in a 135 degree peel jig and the jig was placed into the bottom jaw of an INSTRON constant rate of extension tensile tester. Without pre-peeling the sample, the end of the paper leader was placed in the upper jaw of the tensile tester so that there was no slack in the leader. At a crosshead speed of 12 inch (30.5 cm) per minute, a chart recorder was used to record the peel which was maintained at 135 degrees. The load required to remove the hook fastener strip from the loop fastening material was recorded. The values reported represent an average of 8-10 tests.

Unwind

[0041] The unwind test provides an estimate of the amount of force required to unwind a roll of the loop fastening tape.

[0042] The roll (7.6 cm wide) of the loop fastening tape to be tested was conditioned for 24 hours at 23°C and 50% relative humidity. Three laps of the loop tape were removed from the roll and the tape was folded over at the free end to form a tab. An unwind apparatus having a free turning spindle was placed in the lower jaws of an INSTRON constant rate of extension tensile tester making sure that the spindle turned freely. The tab was then placed in the upper jaw of the tensile tester. At a crosshead speed of 20 inch (50.8 cm) per minute a chart recorder set at a chart speed of 10 inch (25.4 cm) per minute was used to record the average unwind value for unwinding approximately 6 inch (15.24

cm) of loop tape. The unwind values in Table II are reported in g/2.54 cm-width and represent an average of at least two independent measurements.

Fiber Delamination Test: 180 Degree Peel Adhesion and 90 Degree Peel Readhesion

[0043] The fiber delamination test was used to examine fiber disengagement and the subsequent contamination of the pressure-sensitive adhesive of the loop tape.

[0044] A 2 inch x 5 inch (5.08 cm x 12.7 cm) piece of the loop tape to be tested was securely placed adhesive side down onto a 2 inch x 5 inch (5.08 cm x 12.7 cm) steel panel. A 1 inch (2.54 cm) wide strip of pressure-sensitive adhesive test tape with a paper leader attached was then centrally placed on the loop material so that the leading edge of the adhesive test tape was along the length of the panel. The test tape adhesive was a tackified styrene-isoprene type block copolymer pressure-sensitive adhesive (XMF-4065 available from 3M Company). The sample was rolled by hand, once in each direction, using an 11 pound (5.3 kg) roller. The sample panel was then placed into the bottom jaw of an INSTRON constant rate of extension tensile tester. Without pre-peeling the sample, the end of the paper leader was placed in the upper jaw of the tensile tester so that there was no slack in the leader. At a crosshead speed of 12 inches (30.5 cm) per minute, a chart recorder was used to record the peel, which was maintained at 180 degrees. The load required to remove the test tape from the loop fastening material was recorded. The results reported in Table II are in g/2.54 cm-width. The values represent an average of at least two independent measurements.

[0045] To examine the extent that the pressure-sensitive adhesive had been detackified due to fibers transferring from the loop fastening material, the tape which had been adhered to the loop material was tested for 90 degree peel readhesion from a smooth polyethylene film surface. This tape was also tested for 90 degree peel readhesion from a non-woven laminate used as the diaper outer cover on Pampers™ Premium Infant Diapers.

90 Degree Peel Readhesion:

[0046] A 13 mil (330 μm) piece of smooth polyethylene film was securely adhered to a steel panel measuring two inches x five inches (5.1 cm x 12.7 cm) using double-coated adhesive tape. The contaminated adhesive test tape was centrally placed adhesive side down on the surface of the polyethylene film and the tape was rolled down with two passes of a 100 g rubber roller. The panel was placed into a fixture that was then placed into the bottom jaw of an INSTRON constant rate tensile tester while the release tape was held by the upper jaw. The upper jaw was set in motion at a constant crosshead speed of 12 inches (30.5 cm) per minute while the steel panel was moved so as to keep the release tape at a 90 degree angle to the panel. The tests were carried out at a constant temperature of 21°C and 50 percent relative humidity. The force required to remove the contaminated tape from the polyethylene film was recorded as the readhesion value. The test was run in a similar manner when peeling from the non-woven material except that a 4.5 pound (2.2 kg) rubber roller was used for the rolldown. The readhesion data in Table III are reported in grams/2.5 cm-width. The results represent an average of at least two independent measurements.

Examples

Examples 1-5, 9-12 and Comparative Examples 6-8,11

[0047] The loop fastening materials for Examples 1-5 and Comparative Examples 6-8 were prepared substantially in accordance with the method described in Example 3 and illustrated in Figure 6 of U.S. Patent No. 5,256,231, except that a gap was used between rolls 25 and 26 of from 0.002 to 0.003 inches (0.005 to 0.008 cm). The sheet of backing material that was adhered on the side of the thermoplastic backing layer opposite the sheet of fibers was a 1.2 mil (30.5 μm) thick cast polypropylene printed film. The polypropylene resin used to extrude the thermoplastic backing layer was a polyethylene-polypropylene impact copolymer (#7C50 available from Union Carbide). The basis weight of the thermoplastic backing layer for the examples was 45-48 g/m^2. The loop material was a carded web formed of fibers listed in Table 1.

[0048] The fibrous loop side of the loop fastening material was corona treated to have a surface energy of greater than about 33 dynes/cm and was then coated with a release material. The release material used was a polyorganosiloxane-polyurea copolymer type release material similar to those described in U.S. Patent No. 5,290,615. The release coating thickness (or coating weight) was approximately 0.4 - 0.8 g/m^2. A pressure-sensitive adhesive was then hot melt coated onto the backing on the side opposite the fibrous loops. The adhesive used was the same tackified styrene-isoprene type block copolymer pressure-sensitive adhesive that was used on the adhesive test tape in the fiber delamination test described above. The adhesive coating thickness was approximately 38 μm. The loop fastening material was then wound upon itself into roll form without a release liner.

[0049] Examples 9-12 and Comparative Example 13 were identical to Examples 1-4 and Comparative Example 8

except that the corrugating rollers were designed or shaped to provide a sheet of loop material having a hexagonal bonding pattern rather than a linear bonding pattern. The hexagons were approximately 5 mm wide having anchor or bonding portions approximately 1 mm wide.

[0050] The fiber types and sizes that were used to prepare the carded sheets of fibers for all of the loop fastening materials used in the Examples and Comparative Examples are summarized in Table I. Weight ratios are also provided for Examples 4, 5 and 12 which utilized fiber blends. The basis weight of the sheet of fibers (after corrugation) for all the examples was 45-48 g/m^2.

Table I

Examples	Fiber Type & Size
1 and 9	15 denier EC-486[1]
2 and 10	18 denier EC-698[1]
3 and 11	25 denier EC-699[1]
4 and 12	30 denier T-182[2]/9 denier T-196[2] blend (75:25)
5	15 denier EC-486/30 denier T-182/ 9 denier T-196 blend (50:25:25)
C6	3 denier T-196[2]
C7	6 denier T-196[2]
C8 and C13	9 denier T-196[2]

[1] EC-486, EC-698, EC-699 are polypropylene staple fibers having a fiber length of 1 7/8 inch (4.76 cm) and are available from Synthetic Industries.

[2] T-196 and T-182 are polypropylene staple fibers having a fiber length of 1 7/8 inch (4.76 cm) and are available from Hercules Inc.

[0051] All of the examples were tested for Unwind and Fiber Delamination according to the test methods described above. The results are summarized in Table II.

Table II

Example	Unwind	180 Degree Peel Adhesion	90 Degree Peel Re-adhesion to polyethylene	90 Degree Peel Re-adhesion to non- woven
1	80	309	683	998
2	68	199	648	1068
3	62	146	699	1216
4	69	210	631	1302
5	64	198	680	1162
C6	193	2428	6	371
C7	164	1823	16	416
C8	124	1858	45	342
9	61	387	665	1053
10	51	181	780	1117
11	41	87	811	1112
12	71	264	678	950
C13	104	1609	29	232

Considerably higher unwind and 180° peel adhesion values were obtained for the examples that were prepared with the lower denier fibers (C6, C7, C8, and C13) as compared to those that were prepared with the higher denier fibers (Examples 1-3 and 9-11), or with blends of the lower denier fibers and the higher denier fibers (Examples 4, 5 and 12). This suggests that the pressure-sensitive adhesive adheres so strongly to the lower denier fibers that fiber contamination of the adhesive layer on the overlying loop tape fastening material occurs when it is removed from the underlying loop tape fastening material. This results in fiber contamination of the overlying loop tape adhesive and a corresponding decrease in the adhesion of the loop tape to the polyethylene and non-woven substrates. This was affirmed by the readhesion data as the 90 degree peel readhesion values were markedly lower (essentially nonfunctional) for the examples that were prepared with the lower denier fibers.

[0052] Examples 1 and 5 were also tested for 135 degree peel adhesion. The results were 639 g/2.54 cm-width and 352 g/2.5 cm-width, respectively. The data demonstrates that the loop material made with the higher denier fibers would function well as the loop fastener portion of a hook and loop fastener.

Examples 14, 15 and Comparative Example 16

[0053] Examples 14, 15 and Comparative Example 16 were prepared in a manner similar to that described for the Examples 1-5 and Comparative Examples 6-8 above except that a preformed backing was thermally bonded to the corrugated fiber sheet instead of extruding a thermoplastic backing layer to the fiber sheet. This type of thermal bonded loop material and the method for making it is generally described in European Patent No. 341 993 B1. The basis weight of the fiber sheet (after corrugation) for these examples was 35 grams/meter^2. The film backing that the loop material was thermally bonded to was a 1.2 mil (38 μm) thick cast polypropylene film. The fiber types and sizes used to prepare the loop fastening materials are given in Table III along with data for 90 degree peel readhesion to polyethylene.

Table III

Example	Fiber Type and Size	90 Degree Peel Re-Adhesion to polyethylene
14	15 denier T-182	548
15	15 denier T-182/9 denier T-196 (75:25)	508
C16	9 denier T-196	265

[0054] As in the previous examples the 90 degree peel readhesion value was considerably lower for Comparative Example C16 (prepared with lower 9 denier fibers) as compared to Examples 14 and 15 that were prepared with a higher denier fiber (15 denier) or a blend having 75 weight percent of a higher denier fiber (30 denier). Again, this indicates contamination of the adhesive occurred due to fiber transfer from the loop material after it has been in contact with the pressure-sensitive adhesive.

Claims

1. A non-woven loop tape material assembly (10) comprising one or more multilayer sheets of non-woven loop tape fastener material (12) usable as the loop portion of a hook and loop fastener, the non-woven loop tape fastener material (12) comprising in order: (1) a non-woven loop layer (14) forming its first major surface, said non-woven loop layer (14) comprising (a) a multiplicity of flexible fibrous loops adapted to be releasably engaged by the complementary hook portion of the hook and loop fastener, and (b) a base and/or backing layer (16) in which said non-woven loops are anchored: and (2) a pressure-sensitive adhesive layer (18) forming its second major surface;

   wherein the non-woven loop layer (14) is formed at least in part of fibers (15) having a denier of at least 15, and said non-woven loop tape fastener material (12) is arranged in said assembly (10) such that the adhesive layer (18a) of an overlying non-woven loop tape fastener material (12a) is in direct contact with the non-woven loop layer (14b) of an underlying non-woven loop tape fastener material (12b) forming underlying loops, said underlying loops being such that, when said overlying non-woven loop tape fastener material (12a) is removed from said assembly (10), said underlying loops are presented in an engagable state.

2. The assembly (10) of claim 1 wherein said underlying loops are compressed by the overlying nonwoven loop tape fastener material (12a) arranged in said assembly (10) and the compressed underlying loops are restored to an engagable state after removal of the overlying non-woven loop tape fastening material (12a).

3. The assembly (10) of claim 1 further wherein said adhesive layer (18a) of the overlying non-woven loop tape fastener material (12a) exhibits a peel force to said underlying loop layer (14b) of between about 4 and about 250 g/cm width.

4. The assembly (10) of claim 1 further wherein said adhesive layer (18a) of the overlying non-woven loop tape fastener material (12a) exhibits a peel force to said underlying loop layer (14b) of between about 8 and about 80 g/cm width, said assembly (10) is a roll comprising one or more said sheets of non-woven loop tape fastener material (12) wound upon itself, and said sheet of non-woven loop tape fastening material (12) on the roll exhibits an unwind force of between about 8 and about 120 g/cm width.

5. The assembly (10) of claim 4 wherein said roll has a roll radius of up to 50 centimeters.

6. The assembly (10) of claim 1 wherein said non-woven loop layer (14) comprises a backing (16) bonded between said loop layer (14) and said adhesive layer (18).

7. The assembly (10) of claim 1 wherein said non-woven loop layer (14) is comprised of;

a) from 25 to 100 weight percent of fibers (15) having a denier of from 15 to 50;
b) from 0 to 75 weight percent of fibers (15) having a denier of less than 25.

8. The assembly (10) of claim 1 wherein said non-woven loop layer (14) is comprised of;

a) from 50 to 100 weight percent of fibers (15) having a denier of from 15 to 30;
b) from 0 to 50 weight percent of fibers (15) having a denier of less than 25.

9. The assembly (10) of claim 1 wherein the pressure sensitive adhesive layer (18) comprises a tackified elastomer adhesive wherein the elastomer is a A-B type block copolymer where the A block is formed of a mono-alkenylarene and the B block is formed of a conjugated diene where the A block content is from 10 to 50 weight percent and the B block content is from 90 to 50 weight percent the tackifier comprising 20-300 parts by weight tackifier to 100 parts elastomer.

Patentansprüche

1. System aus Vliesschlingenbandmaterial (10), umfassend eine oder mehrere mehrschichtige Lagen von Vliesschlingenbandbefestigungsmaterial (12), verwendbar als Schlingenanteil eines Befestigungsmittels mit Haken und Schlingen, wobei das Vliesschlingenbandbefestigungsmaterial (12) der Reihe nach umfaßt: (1) eine Vliesschlingenschicht (14), die seine erste Hauptoberfläche bildet, wobei die Vliesschlingenschicht (14) (a) eine Mehrzahl von biegsamen Faserschlingen, angepaßt, lösbar mit dem komplementären Hakenanteil des Befestigungsmittels mit Haken und Schlingen verbunden zu sein, und (b) eine Basis- und/oder Trägerschicht (16), in welcher die Vliesschlingen verankert sind, umfaßt; und (2) eine Haftklebeschicht (18), die seine zweite Hauptoberfläche bildet;
wobei die Vliesschlingenschicht (14) zumindest zum Teil aus Fasern (15) mit einem Denier von mindestens 15 gebildet wird und das Vliesschlingenbandbefestigungsmaterial (12) so in dem System (10) angeordnet ist, daß die Klebeschicht (18a) eines darüber liegenden Vliesschlingenbandbefestigungsmaterials (12a) in direktem Kontakt mit der Vliesschlingenschicht (14b) eines darunter liegenden Vliesschlingenbandbefestigungsmaterials (12b), das darunterliegende Schlingen bildet, ist,
wobei die darunter liegenden Schlingen so sind, daß, wenn das darüber liegende Vliesschlingenbandbefestigungsmaterial (12a) aus dem System (10) entfernt wird, die darunter liegenden Schlingen in einem verbindungsfähigen Zustand präsentiert werden.

2. System (10) nach Anspruch 1, wobei die darunter liegenden Schlingen durch das darüber liegende Vliesschlingenbandbefestigungsmaterial (12a), angeordnet in dem System (10), zusammengedrückt werden und die zusammengedrückten darunter liegenden Schlingen nach Entfernung des darüber liegenden Vliesschlingenbandbefestigungsmaterials (12a) in einen verbindungsfähigen Zustand zurückversetzt werden.

3. System (10) nach Anspruch 1, wobei weiterhin die Klebeschicht (18a) des darüber liegenden Vliesschlingenbandbefestigunesmaterials (12a) eine Ablösekraft gegenüber der darunter liegenden Schlingenschicht (14b) von zwischen etwa 4 und etwa 250 g/cm Breite zeigt.

4. System (10) nach Anspruch 1, wobei weiterhin die Klebeschicht (18a) des darüber liegenden Vliesschlingenbandbefestigungsmaterials (12a) eine Ablösekraft gegenüber der darunter liegenden Schlingenschicht (14b) von zwischen etwa 8 und etwa 80 g/cm Breite zeigt, das System (10) eine Rolle ist, umfassend ein oder mehrere der Lagen von Vliesschlingenbandbefestigungsmaterial (12), gewunden auf sich selbst, and die Lage von Vliesschlingenbandbefestigungsmateria[(12) auf der Rolle eine Abrollkraft zwischen etwa 8 und etwa 120 g/cm Breite zeigt.

5. System (10) nach Anspruch 4, wobei die Rolle einen Rollenradius von bis zu 50 cm hat.

6. System (10) nach Anspruch 1, wobei die Vliesschlingenschicht (14) einen Träger (16), gebunden zwischen der

Schlingenschicht (14) und der Klebeschicht (18), umfaßt.

7. System (10) nach Anspruch 1, wobei die Vliesschlingenschicht (14) umfaßt:

a) 25 bis 100 Gewichtsprozent Fasern (15) mit einem Denier von 15 bis 50;
b) 0 bis 75 Gewichtsprozent Fasern (15) mit einem Denier von weniger als 25.

8. System (10) nach Anspruch 1, wobei die Vliesschlingenschicht (14) umfaßt:

a) 50 bis 100 Gewichtsprozent Fasern (15) mit einem Denier von 15 bis 30;
b) 0 bis 50 Gewichtsprozent Fasern (15) mit einem Denier von weniger als 25.

9. System (10) nach Anspruch 1, wobei die Haftklebeschicht (18) einen klebrig gemachten Elastomerklebstoff umfaßt, in dem das Elastomer ein Blockcopolymer vom A-B-Typ ist, wobei der Block A aus einem Monoalkenylaren erzeugt ist und der Block B aus einem konjugierten Dien erzeugt ist, wobei der Gehalt an Block A von 10 bis 50 Gewichtsprozent beträgt und der Gehalt an Block B von 90 bis 50 Gewichtsprozent beträgt,
wobei der Klebrigmacher 20-300 Gewichtsteile Klebrigmacher auf 100 Teile Elastomer umfaßt.

Revendications

1. Ensemble de bande non tissée à boucles (10) comprenant une ou plusieurs feuilles multicouche de matériau de fixation en bande non tissée à boucles (12) pouvant être utilisé comme la partie à boucles d'une fixation à crochets et à boucles, le matériau de fixation en bande non tissée à boucles (12) comprenant dans l'ordre : (1) une couche non tissée à boucles (14) formant sa première surface principale, ladite couche non tissée à boucles (14) comprenant (a) une multitude de boucles fibreuses souples adaptées pour pouvoir s'engager de façon détachable dans la partie à crochets complémentaire de la fixation à crochets et à boucles et (b) une couche de base et/ou de support (16) dans laquelle sont ancrées lesdites boucles non tissées ; et (2) une couche adhésive sensible à la pression (18) formant sa seconde surface principale ;
dans lequel la couche de boucles non tissée (14) est formée au moins en partie de fibres (15) ayant un denier d'au moins 15, et ledit matériau de fixation en bande non tissée à boucles (12) étant agencé dans ledit ensemble (10) de sorte que la couche adhésive (18a) d'un matériau de fixation en bande non tissée à boucles sus-jacent (12a) est en contact direct avec la couche à boucles non tissée (14b) d'un matériau de fixation en bande non tissée à boucles sous-jacent (12b) formant des boucles sous-jacentes, lesdites boucles sous-jacentes étant telles que, lorsque ledit matériau de fixation en bande non tissée à boucles (12a) est retiré dudit ensemble (10), lesdites boucles sous-jacentes sont présentées dans un état engageable.

2. Ensemble (10) selon la revendication 1, dans lequel lesdites boucles sous-jacentes sont comprimées par le matériau de fixation en bande non tissée à boucles sus-jacent (12a) agencé dans ledit ensemble (10) et les boucles sous-jacentes comprimées retrouvent un état engageable lorsque le matériau de fixation en bande non tissée à boucles sus-jacent (12a) est retiré.

3. Ensemble (10) selon la revendication 1, dans lequel en outre, ladite couche adhésive (18a) du matériau de fixation en bande non tissée à boucles sus-jacent (12a) présente une force d'arrachement de ladite couche à boucles sous-jacente (14b) comprise entre environ 4 et 250 g/cm de largeur.

4. Ensemble (10) selon la revendication 1, dans lequel en outre ladite couche adhésive (18a) du matériau de fixation en bande non tissée à boucles (12a) sus-jacent présente une force d'arrachement de ladite couche à boucles sous-jacente (14b) comprise entre environ 8 et 80 g/cm de largeur, ledit ensemble (10) étant un rouleau comprenant une ou plusieurs desdites feuilles de matériau de fixation en bande non tissée à boucles (12), enroulé sur lui-même, et ladite feuille de matériau de fixation en bande non tissée à boucles (12) sur le rouleau présente une force de déroulement comprise entre environ 8 et 120 g/cm de largeur.

5. Ensemble (10) selon la revendication 4, dans lequel ledit rouleau présente un rayon de rouleau pouvant atteindre 50 centimètres.

6. Ensemble (10) selon la revendication 1, dans lequel ladite couche non tissée à boucles (14) comprend un support (16) collé entre ladite couche à boucles (14) et ladite couche adhésive (18).

7. Ensemble (10) selon la revendication 1, dans lequel ladite couche non tissée à boucles(14)est constituée :

a) de 25 à 100 pour cent en poids de fibres (15) ayant un denier compris entre 15 et 50 ;
b) de 0 à 75 pour cent en poids de fibres (15) ayant un denier inférieur à 25.

8. Ensemble (10) selon la revendication 1, dans lequel ladite couche non tissée à boucles (14) est constituée :

a) de 50 à 100 pour cent en poids de fibres (15) ayant un denier compris entre 15 et 30 ;
b) de 0 à 50 pour cent en poids de fibres (15) ayant un denier inférieur à 25.

9. Ensemble (10) selon la revendication 1, dans lequel la couche adhésive sensible à la pression (18) comprend un adhésif élastomère collant dans lequel l'élastomère est un copolymère séquencé de type A-B où le bloc A est formé d'un monoalcénylarène et le bloc B est formé d'un diène conjugué, le contenu du bloc A représentant 10 à 50 pour cent en poids et le contenu du bloc B représentant entre 90 et 50 pour cent en poids, l'agent collant comprenant 20-300 parties en poids d'agent collant pour 100 parties d'élastomère.

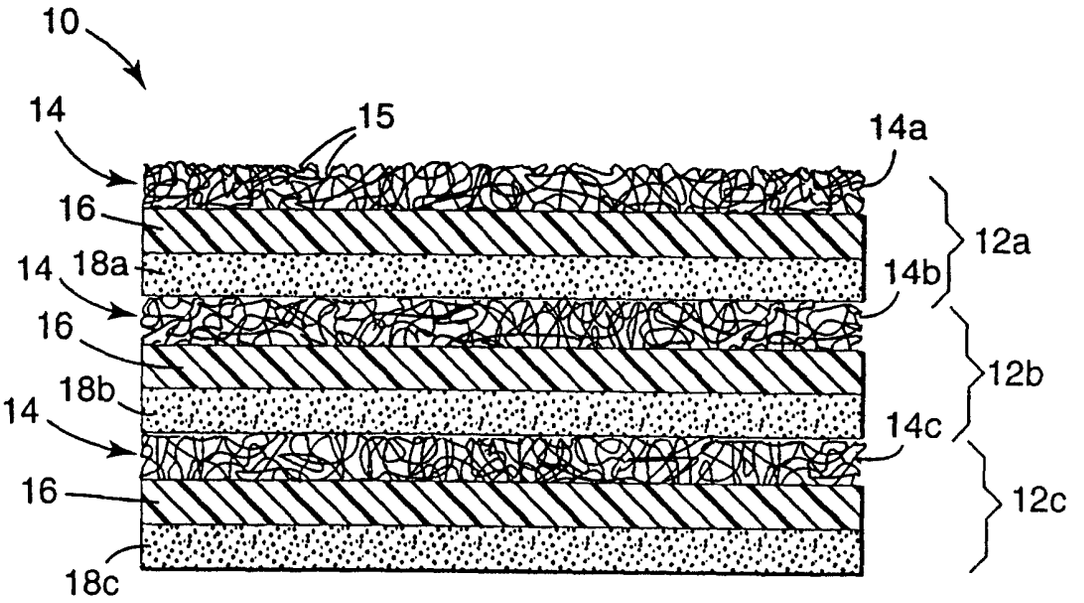

FIG. 1

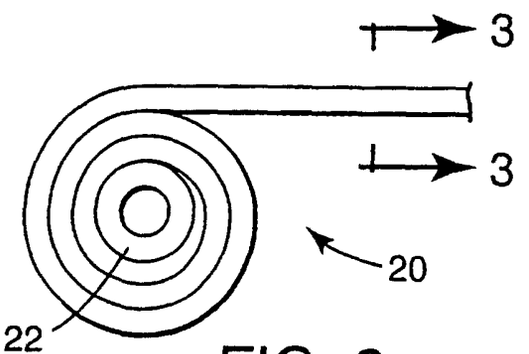

FIG. 2

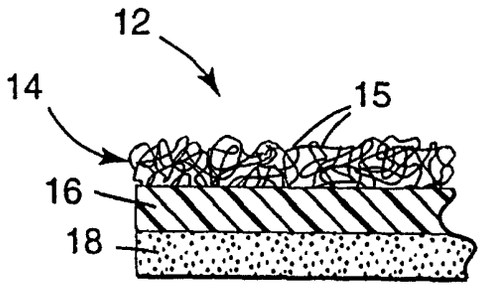

FIG. 3