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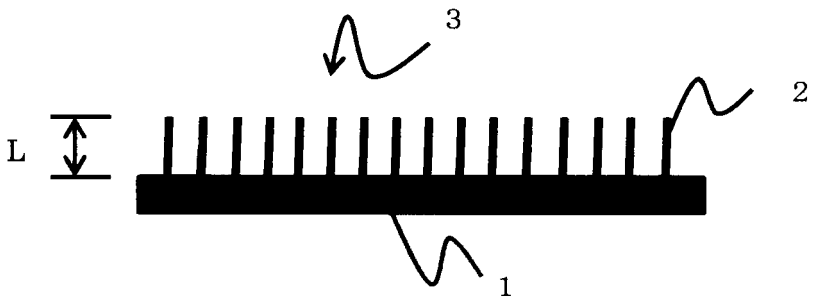
(54) **HOOK AND LOOP FASTENER AND TEXTILE PRODUCTS**

(57) The present invention addresses the problem of providing a hook and loop fastener that not only has excellent engaging properties but is also flexible, generates little ripping noise when the male part and female part are separated, is excellent for sewing to fabric or the like, and is very durable, and a textile product comprising the hook and loop fastener. A hook and loop fastener comprises a fabric A that has a resin layer and a napped fabric B that has a resin layer containing a napped portion and a ground structure portion.

FIG. 1



EP 3 391 768 A1

Description

FIELD

[0001] The present invention relates to a hook and loop fastener composed of a female part and a male part, that not only has excellent engaging properties, but is also flexible, generates little ripping noise when the female part and male part are separated, is excellent for sewing to fabric or the like, and is very durable, and textile products comprising the hook and loop fastener.

BACKGROUND

[0002] Hook and loop fasteners usually are composed of a female part having looped or arched engaging elements and a male part having key- or mushroom-shaped hook sections. Hook and loop fasteners are widely used as fasteners for clothing, shoes, bags, gloves and the like since they engage with products bearing the hook and loop fasteners to allow easy attachment and detachment (see PTL 1, PTL 2 and PTL 3, for example).

[0003] However, while hook and loop fasteners have such an engaging function, one problem associated with them is loud ripping noise generated when the female part and male part of a hook and loop fastener are separated. In addition, because the hook sections of the base fabric portion of a hook and loop fastener are hard, they can be difficult to sew onto clothing, or can damage skin.

[0004] In order to improve these problems, flexible hook and loop fasteners have been proposed wherein a fabric containing superfine fibers is used as the female part while a napped fabric is used as the male part, thereby minimizing the ripping noise when the female part and male part are separated (see PTL 4, for example).

[0005] However, this has not led to satisfactory elimination of the problem, and there has been room for improvement in the durability of the engaging properties with repeated attachment and detachment, or washing.

CITATION LIST

PATENT LITERATURE

[0006]

[PTL 1] Japanese Unexamined Patent Publication No. 2004-173819
[PTL 2] Japanese Patent Publication No. 4354232
[PTL 3] Japanese Unexamined Patent Publication No. 2007-7124
[PTL 4] Japanese Patent Publication No. 5692958

SUMMARY

TECHNICAL PROBLEM

[0007] The present invention has been devised in light of the background described above, and its object it to provide a hook and loop fastener that not only has excellent engaging properties, but is also flexible, generates little ripping noise when the female part and male part are separated, is excellent for sewing to fabric or the like, and is very durable, as well as textile products comprising the hook and loop fastener.

SOLUTION TO PROBLEM

[0008] The present inventors have conducted much diligent research with the aim of achieving the object stated above, and as a result we have found that, for a hook and loop fastener composed of a female part and a male part, the durability of the bonding force is increased by laminating a resin layer on the back sides of the female part and male part (the opposite sides from their bonding surfaces) to increase the rigidity, and upon still further diligent research we have completed this invention.

[0009] Thus, according to the invention there is provided "a hook and loop fastener composed of a fabric A and a napped fabric B containing a napped portion and a ground structure portion, wherein both the fabric A and the napped fabric B have resin layers".

[0010] The resin layers are preferably resin coating layers or laminated layers. Also, fabric A preferably has a knitted fabric texture. In addition, the fabric A preferably includes filament yarn with a monofilament diameter of no greater than 1000 nm. Preferably, the filament yarn is made of polyester, and consists of multifilaments with a number of filaments

of 1000 or more. In the fabric A, preferably the filament yarn is exposed on the fabric surface in the form of loops. The thickness of the fabric A is preferably in the range of 0.3 to 3.0 mm. The elongation percentage in either the warp direction or the weft direction of the fabric A is preferably in the range of 1 to 20%. The bending resistance in either the warp direction or the weft direction of the fabric A is preferably 25 mm or greater. Also, in the napped fabric B, preferably the napped portion is made of polyester and consists of napped yarn with single fiber fineness of 2.5 dtex or greater. The napping length of the napped portion of the napped fabric B is preferably in the range of 0.1 to 3.0 mm. The elongation percentage in either the warp direction or the weft direction of the napped fabric B is preferably in the range of 1 to 20%. The bending resistance in either the warp direction or the weft direction of the fabric B is preferably 25 mm or greater. The tensile shear strength as defined below is preferably 50 cN/cm^2 or greater.

[0011] For both the fabric A and the napped fabric B, two samples cut to 12 cm length and 3 cm width in the horizontal direction are layered 5 cm in the lengthwise direction and across the full width parallel in the lengthwise direction, the two samples are bonded by 2 passes under a load of 9.8 N/cm^2 (1 kg/cm^2) with a contact pressure roller and then loaded into a tensile tester and subjected to tension parallel to the lengthwise direction of the sample with a pull rate of 300 mm/min and an initial load of 19.6 cN (0.2 kg), and after measuring the maximum tensile shear strength until separation of the two samples, the tensile shear strength per unit area is calculated by the following formula, and the average value is calculated for n = 5.

$$F1 = S/(L \times W)$$

[0012] Here, F1 is the tensile shear strength (cN/cm^2), S is the maximum tensile shear load (cN), L is the layering length (cm) and W is the sample width (cm).

[0013] According to the invention there are also provided textile products selected from the group consisting of nursing clothing, medical clothing, sportswear, outer wear, inner wear, pajamas, men's wear, ladies' wear, bathrobe, working clothes, protective wear, combat wear, hunting wear, footwear, bags, caps, gloves, socks, shoes, bedding, support, connecting members, bandages, safety belts, flooring materials, covers, cushions, base fabrics, supporters, belly bands, aprons, body covers, capes, skin care instruments and cosmetic tools, that comprise the aforementioned hook and loop fastener.

ADVANTAGEOUS EFFECTS OF INVENTION

[0014] According to the invention it is possible to obtain a hook and loop fastener that not only has excellent engaging properties, but is also flexible, generates little ripping noise when the female part and male part are separated, is excellent for sewing to fabric or the like, and is very durable, and also textile products comprising the hook and loop fastener.

BRIEF DESCRIPTION OF DRAWINGS

[0015] Fig. 1 is a diagram illustrating the napping length of napped yarn according to the invention.

DESCRIPTION OF EMBODIMENTS

[0016] Embodiments of the invention will now be explained in detail.

[0017] The hook and loop fastener of the invention is a hook and loop fastener composed of a fabric A (female part) and a napped fabric B (male part) containing a napped portion and a ground structure portion, wherein both the fabric A and the napped fabric B have resin layers on their back sides (i.e. the sides opposite their respective bonding surfaces). The resin layers will also be referred to as "back coatings".

[0018] The resin layers are preferably resin coating layers or film-laminated layers.

[0019] There are no particular restrictions on the resin used to form the resin coating layers, and examples include acrylate ester copolymer resins, urethane resins, vinyl chloride resins, vinyl acetate resins, styrene-butadiene resins, polyester resins, natural rubbers, isoprene rubbers and silicone rubbers. Of these, resins containing acrylate ester copolymer resins are preferred since they do not require other binders for adhesion.

[0020] A film-forming resin is preferably a polyester resin, polyethylene resin, polypropylene resin, nylon resin, polystyrene resin, polyvinyl chloride resin or polyvinylidene chloride resin. For the fabric A and the napped fabric B, it may be the same type or a different type than the resin used to form the resin layer.

[0021] The method of forming the resin layer may be a publicly known method, such as resin coating by a common method using a knife coater or the like, or with appropriate heat treatment or drying treatment after lamination of a film. The viscosity of the resin is preferably in the range of 500 to 1500 cps. The coverage is preferably in the range of 10 to 100 g/m^2, as the solid content. The resin layer is preferably formed over the entire fabric, and it may be formed in a

pattern such as a dotted pattern, lattice pattern, wood-grain pattern, pebble-grain pattern or the patterns of geometric shapes, characters, logos or abstract patterns.

[0022] For fabric A, the texture of the fabric is not particularly restricted, and it may be a woven fabric, knitted fabric or nonwoven fabric obtained by a common method. Woven fabrics and knitted fabrics are preferred, with knitted fabrics being especially preferred for increased stretchability. A knitted fabric is preferred to allow firm engagement with the napped yarn of the male part, by the loops of the knitted fabric. Using the needle surface of the knitted fabric as the surface that engages with the male part (the bonding surface) is particularly preferred, as excellent engaging properties will be obtained.

[0023] In addition, the fabric A preferably includes filament yarn with a monofilament diameter of no greater than 1000 nm, since excellent engaging properties will be obtained.

[0024] For such filament yarn (hereunder also referred to as "nanofibers"), the monofilament diameter (diameter of the single fiber) is more preferably in the range of 100 to 900 nm (even more preferably 550 to 900 nm). In terms of the single fiber fineness, a monofilament diameter of 1000 nm corresponds to 0.01 dtex. With a monofilament diameter of larger than 1000 nm it may not be possible to obtain sufficient engaging properties. When the cross-sectional monofilament shape is an atypical cross-section other than a circular cross-section, the monofilament diameter is the circumscribed circle diameter. The monofilament diameter can be measured by photographing a transection of a fiber with a transmission electron microscope. The variation in the single fiber fineness is preferably within the range of -20% to +20%.

[0025] The number of filaments in the filament yarn is not particularly restricted, but it is preferably 1000 or more (more preferably 2000 to 10,000), in order to obtain excellent engaging properties. Also, the total fineness of the filament yarn (product of the single fiber fineness and the number of filaments) is preferably in the range of 5 to 150 dtex.

[0026] The form of the fibers of the filament yarn is not particularly restricted, but it is preferably in the form of long fiber (multifilament yarn). The cross-sectional shapes of the single fiber are not particularly restricted, and they may be publicly known cross-sectional shapes such as circular, triangular, flat or hollow. Incidentally, common air treatment and/or false-twisting/crimping may also be carried out.

[0027] The type of polymer used to form the filament yarn is not particularly restricted but is preferably a polyester-based polymer. Preferred examples include polyethylene terephthalate, and polytrimethylene terephthalate, polybutylene terephthalate, polylactic acid, stereocomplex polylactic acid, and polyesters copolymerized with third components. Such polyesters may also be material-recycled or chemically recycled polyesters. They may also be polyesters obtained using catalysts containing specific phosphorus compounds and titanium compounds, such as described in Japanese Unexamined Patent Publication No. 2004-270097 or Japanese Unexamined Patent Publication No. 2004-211268.

[0028] If necessary, such polymers may also comprise one or more micropore-forming agents, cationically dyeable agents, coloring prevention agents, heat stabilizers, fluorescent whitening agents, delustering agents, coloring agents, humectants or inorganic fine particles, in amounts that do not interfere with the object of the invention.

[0029] The fabric A serving as the female part in the hook and loop fastener of the invention is preferably composed entirely of such filament yarn, but other yarn may also be included, either alone or in combinations of multiple types. The weight ratio of such other yarn is preferably no greater than 70 wt% with respect to the fabric weight. Such other yarn is preferably polyester yarn or elastic fiber yarn with a monofilament diameter of greater than 1000 nm.

[0030] Such polyester yarn is preferably composed of a polyester type mentioned above. Preferred examples for elastic fiber yarn include water-absorptive polyether ester elastic fiber yarn composed of a polyether ester elastomer with polybutylene terephthalate as a hard segment and polyoxyethylene glycol as a soft segment, non-water-absorptive polyether ester elastic fiber yarn composed of a polyether ester elastomer with polybutylene terephthalate as a hard segment and polytetramethylene oxide glycol as a soft segment, or polyurethane elastic fiber yarn, polytrimethylene terephthalate yarn, synthetic rubber elastic fiber yarn or natural rubber-based elastic fiber yarn.

[0031] The total fineness of the elastic fiber yarn is preferably in the range of 5 to 100 dtex (more preferably 10 to 40 dtex).

[0032] The fabric A serving as the female part in the hook and loop fastener of the invention can be produced by the following production method, for example. First, a sea-island composite fiber (for nanofiber) is prepared, which is formed of a sea component and an island component having a diameter of no greater than 1000 nm. The sea-island composite fibers used are preferably the sea-island composite fiber multifilaments disclosed in Japanese Unexamined Patent Publication No. 2007-2364 (100 to 1500 islands).

[0033] The sea component polymer is preferably polyester, polyamide, polystyrene, polyethylene or the like, which have satisfactory fiber-forming properties. For example, preferred polymers that are readily soluble in aqueous alkali solutions are polylactic acid, ultrahigh molecular weight polyalkylene oxide condensed polymers, polyethylene glycol compound-copolymerized polyesters, and polyethylene glycol-based compound/5-sodiumsulfoisophthalic acid-copolymerized polyesters. Preferred among these are polyethylene terephthalate-based copolymerized polyesters with an intrinsic viscosity of 0.4 to 0.6, obtained by copolymerizing 6 to 12 mol% 5-sodiumsulfoisophthalic acid with 3 to 10 wt% polyethylene glycol with a molecular weight of 4000 to 12,000.

[0034] The island component polymer, on the other hand, is preferably a polyester, such as fiber-forming polyethylene terephthalate or polytrimethylene terephthalate, polybutylene terephthalate, polylactic acid, or a polyester obtained by

copolymerization of a third component. If necessary, such polymers may also comprise one or more micropore-forming agents, cationically dyeable agents, coloring prevention agents, heat stabilizers, fluorescent whitening agents, delustering agents, coloring agents, humectants or inorganic fine particles, in amounts that do not interfere with the object of the invention.

[0035] The sea-island composite fiber multifilaments composed of the sea component polymer and island component polymer described above preferably have a sea component with a larger melt viscosity than the melt viscosity of the island component polymer in melt spinning. The diameter of the island component is preferably in the range of 10 to 1000 nm. When the diameters are not circular, the diameters of the circumscribed circles are measured. The sea-island composite weight ratio (sea:island) of the sea-island composite fibers is preferably in the range of 40:60 to 5:95 and more preferably in the range of 30:70 to 10:90.

[0036] The sea-island composite fiber multifilaments can be easily produced by the following method as an example. Specifically, it may be melt spinning using the sea component polymer and the island component polymer. The spinneret used for melt spinning may be any desired one having a group of hollow pins or micropores for formation of the island component. The discharged sea-island cross-section composite fiber multifilaments are solidified with cooling air and wound out after being melt spun at preferably 400 to 6000 m/min. The obtained unstretched filament is either formed into a composite fiber with the desired strength, ductility and heat shrinkage property by a separate stretching step, or instead of being taken up first, it may be first pulled out onto a roller at a fixed speed and then stretched and taken up. The filaments may also be subjected to false-twisting and crimping. For sea-island composite fiber multifilaments, the single yarn fiber fineness, number of filaments and total fineness are preferably in the ranges of single yarn fiber fineness = 0.5 to 10.0 dtex, number of filaments = 5 to 75, total fineness = 30 to 170 dtex (preferably 30 to 100 dtex).

[0037] The sea-island composite fiber multifilaments may be used alone, or if necessary, they may be used together with other yarn (for example, elastic fiber yarn) having a monofilament diameter of greater than 1000 nm for knitting or weaving of fabric A. The texture of the fabric A in this case is not particularly restricted, and it may be a woven fabric, knitted fabric or nonwoven fabric obtained by a common method. Woven fabrics and knitted fabrics are preferred, with knitted fabrics being especially preferred. A knitted fabric is preferred to allow firm engagement with the napped yarn of the male part, by the loops of the knitted fabric. Using the needle surface of the knitted fabric as the surface that engages with the male part is particularly preferred, as excellent engaging properties will be obtained.

[0038] The woven texture of a woven fabric may be, for example, one of the three foundational types of weaves, i.e. a plain weave, twill weave or satin weave, or a derivative weave such as derivative weave or derivative twill weave, a half double weave such as warp backed weave or weft backed weave, a pile weave such as warp velvet, towel or velour, or a weft pile weave such as velveteen, weft velvet, velvet or corduroy. Incidentally, a woven fabric having such a woven texture can be woven by a common method using a common loom such as a rapier loom or air jet loom. The number of layers is also not particularly restricted, and the woven fabric may have a single layer or a multilayer structure of two or more layers.

[0039] The type of knitted fabric may be a weft knitted fabric, or a warp knitted fabric. Preferred examples of weft knitted textures include plain stitch, rib stitch, interlock stitch, purl stitch, tuck stitch, float stitch, rib-and-tuck stitch, lace stitch and plating stitch. A preferred example is a plating plain stitch having composite loops formed of two different types of yarns formed with a plain stitch braid, in which case a bare plain stitch having elastic fiber yarn as one of the yarns is preferred. Preferred examples of warp braids include single denbigh stitch, single atlas stitch, double cord stitch, half stitch, lined stitch and jacquard stitch. Incidentally, the knitting may be knitting by a common method using a common knitting machine such as a circular knitting machine, flat knitting machine, tricot knitting machine or raschel machine. The number of layers is also not particularly restricted, and the knitted fabric may have a single layer or a multilayer structure of two or more layers.

[0040] The fabric is then subjected to aqueous alkali solution treatment, wherein the sea component of the sea-island composite fiber multifilaments is dissolved away with an aqueous alkali solution to convert the sea-island composite fiber multifilaments into filament yarn (nanofibers) having a monofilament diameter of 10 to 1000 nm. The conditions for the aqueous alkali solution treatment may be treatment at a temperature of 55 to 70°C using an aqueous NaOH solution with a concentration of 1 to 4%.

[0041] It may also be subjected to various processing steps in order to impart functionality, such as dyeing, raising treatment, water repellency treatment, water absorption treatment or buffing treatment by common methods, or ultraviolet shielding, or processing using antistatic agents, antimicrobial agents, deodorants, insecticides, luminous agents, retro-reflective agents, minus ion generators and the like.

[0042] The resin layer may then be formed as described above to obtain the fabric A.

[0043] Since the fabric A obtained in this manner has a resin layer on the side opposite the bonding surface, it exhibits high rigidity and increased bonding force durability. Including filament yarn A as superfine fibers will allow it to be suitably used as the female part of a hook and loop fastener.

[0044] For fabric A, preferably the filament yarn (nanofibers) are exposed on either one or both of the front side and the back side. If the filament yarn is not exposed on the front side or the back side, it may not be able to engage with

the napped yarn of the male part.

[0045] The thickness of the fabric A is preferably in the range of 0.3 to 3.0 mm. The basis weight of the fabric is preferably in the range of 30 to 500 g/m^2.

[0046] The elongation percentage in either or both the warp direction and the weft direction of the fabric A is preferably in the range of 1 to 20%.

[0047] The bending resistance in either or both the warp direction and the weft direction of the fabric A is preferably 25 mm or greater (preferably 25 to 80 mm).

[0048] According to the invention, the female part may be composed of fabric A that has been appropriately cut, being the fabric A alone, or it may be decoratively stitched so that the periphery of the fabric A does not fray, and appropriate ornamentation may also be added. When the fabric A is cut, because the fabric A has a resin layer and therefore has high rigidity, an excellent effect is exhibited whereby wrinkles are less likely to be generated at the cut locations.

[0049] The hook and loop fastener of the invention also includes the napped fabric B as the male part. The napped fabric B has a ground structure portion with a woven or knitted texture composed of organic fiber yarn, and a napped portion composed of multiple napped yarns entangled or woven with the ground structure portion, and extending outward to at least one side from the ground structure portion. The napped yarn may be in the form of loop piles, but is preferably in the form of cut piles in order to obtain strong engaging properties.

[0050] The napped yarn preferably has a single fiber fineness of 0.5 dtex or greater (preferably 0.5 to 5.0 dtex). If the single fiber fineness is smaller than 0.5 dtex it will be difficult to retain the napped state, and it may not be possible to obtain strong engaging properties when engaging with the female part using the napped fabric B as the male part.

[0051] The napping length of the napped yarn is preferably in the range of 0.1 to 10 mm. If the napping length is less than 0.1 mm, the napping length will be too small and it may not be possible to obtain strong engaging properties when engaging with the female part using the napped fabric B as the male part. Conversely, if the napping length is greater than 10 mm, it will be difficult to retain the napped state, and it may not be possible to obtain strong engaging properties when engaging with the female part using the napped fabric B as the male part. According to the invention, the napping length is the height of L in Fig. 1.

[0052] The napped yarn density of the napped portion formed by the napped yarn is preferably 3000 dtex/cm^2 or greater (more preferably 5000 to 100,000 dtex/cm^2). If the napped yarn density is lower than 3000 dtex/cm^2, the napped yarn will tend to collapse, and therefore it will be difficult to retain the napped state and it may not be possible to obtain strong engaging properties when engaging with the female part using the napped fabric B as the male part.

[0053] Such napped yarn density can be measured by the following method. Specifically, the front side of the napped fabric is photographed (200x magnification) using a microscope (model: VHX-900) by Keyence Corp., and the number of napped yarns per 1 cm^2 (1 cm $\times$ 1 cm) area is measured for calculation by the following formula.

$$\text{Napped yarn density (dtex/cm}^2\text{)} = \text{single fiber fineness (dtex)} \times \text{napped yarn number (number/cm}^2\text{)}$$

[0054] There are no particular restrictions on the type of fibers forming the napped yarn, and they may be common fibers such as cotton, wool, hemp, viscose rayon fiber, polyester fiber, polyether ester fiber, acrylic fiber, nylon fiber, polyolefin fiber, cellulose acetate fiber or aramid fiber. Particularly preferred among these are polyester-based fibers made of polyester, mentioned above, from the viewpoint of recycling properties and rigidity.

[0055] If necessary, the resin forming the fibers may also contain one or more matte agents (titanium dioxide), micro-pore-forming agents (organic sulfonic acid metal salts), coloring prevention agents, heat stabilizers, flame retardants (diantimony trioxide), fluorescent whitening agents, color pigments, antistatic agents (sulfonic acid metal salts), moisture absorbents (polyoxyalkylene glycols) or antimicrobial agents, or other inorganic particles.

[0056] The form of the napped yarn may be uncrimped napped yarn, or crimped napped yarn obtained by further heat treatment of side-by-side latent crimping composite fibers by a false-twisting crimping method or machine-crimping method, and while it is not particularly restricted, it is preferably uncrimped napped yarn in order to obtain strong engaging properties.

[0057] There are no particular restrictions on the single- fiber cross-sectional shapes of the napped yarn, and they may have common circular cross-sections, or alternatively triangular, flat, necked flat, cross-shaped, hexagonal or hollow cross-sectional shapes.

[0058] For the napped fabric B, the ground structure portion has a woven or knitted texture made of organic fiber yarn. The fibers composing the organic fiber yarn may be the same fibers as mentioned for the napped yarn. Particularly preferred are polyester-based fibers, from the viewpoint of recycling properties.

[0059] The form of the organic fiber yarn composing the ground structure portion is not particularly restricted, but it is preferably in the form of long fiber (multifilament yarn). The single fiber fineness and total fineness of the organic fiber

yarn are preferably a single fiber fineness of 0.5 to 5.0 dtex and a total fineness of 30 to 300 dtex, so long as the feel of the fabric is not impaired. Moreover, there are no restrictions on the single-fiber cross-sectional shapes, and they may have common circular cross-sections, or alternatively triangular, flat, necked flat, cross-shaped, hexagonal or hollow cross-sectional shapes. In addition, the organic fiber yarn may be false twisted crimp finished yarn or composite yarn obtained by air intermingling or composite false twisting of two or more types of constituent yarns, or covering yarn having elastic yarn situated as the core and non-elastic yarn situated as the sheath.

[0060] The napped fabric B may be more easily obtained by the following production process, for example.

[0061] First, yarn composed of fibers with a single fiber fineness of 0.5 dtex or greater (preferably 0.5 to 5.0 dtex) as the yarn for the napped yarn, and yarn composed of the aforementioned fibers as the organic fiber yarn for the ground structure portion, are used for knitting or weaving of an ordinary napped fabric (loop pile fabric), after which the tip sections of the loop piles are cut as necessary to form cut piles.

[0062] In order to obtain a napped fabric in which the ground structure portion has a braided texture, a method may be used in which a ground weave is knitted, a loop pile texture such as a sinker pile, pole tricot pile or double raschel pile is formed extending over it, and the loop pile is sheared. A pole tricot pile is obtained by forming the pile knitted portion of the tricot braided texture into a loop pile using a raising machine.

[0063] On the other hand, in order to obtain the napped fabric B wherein the ground structure portion has a woven fabric texture, a method may be used in which a warp pile woven fabric or weft pile woven fabric is woven and the loop piles are cut, or a moquette woven fabric is woven and the pile yarns are center cut.

[0064] The napped fabric B obtained in this manner may also be subjected to various processing steps in order to impart functionality, such as dyeing, water repellency treatment, water absorption treatment or buffing treatment by common methods, or ultraviolet shielding, or processing using antistatic agents, antimicrobial agents, deodorants, insecticides, luminous agents, retroreflective agents, minus ion generators and the like.

[0065] The resin layer may then be formed as described above to obtain the napped fabric B.

[0066] According to the invention, the male part may be composed of the napped fabric B that has been appropriately cut, being the napped fabric B alone, or it may be decoratively stitched so that the periphery of the napped fabric B does not fray, and appropriate ornamentation may also be added. When the fabric B is cut, since the fabric B has a resin layer and therefore has high rigidity, an excellent effect is exhibited whereby wrinkles are less likely to be generated at the cut locations.

[0067] The napping length of the napped portion of the napped fabric B is preferably in the range of 0.1 to 3.0 mm.

[0068] The elongation percentage in either the warp or the weft direction of the napped fabric B is preferably in the range of 1 to 20%.

[0069] The bending resistance in either the warp or the weft direction of the fabric B is preferably 25 mm or greater (preferably 25 to 80 mm).

[0070] The hook and loop fastener of the invention is composed of a female part comprising the fabric A and a male part comprising the napped fabric B, and it has excellent engaging properties when the fabric A engages with the napped portions of the napped fabric B. The tensile shear strength as defined below is preferably 50 cN/cm^2 or greater (preferably 50 to 300 cN/cm^2).

[0071] For both the fabric A and the napped fabric B, two samples cut to 12 cm length and 3 cm width in the horizontal direction are layered 5 cm in the lengthwise direction and across the full width parallel in the lengthwise direction, the two samples are bonded by 2 passes under a load of 9.8 N/cm^2 (1 kg/cm^2) with a contact pressure roller and then loaded into a tensile tester and subjected to tension parallel to the lengthwise direction of the sample with a pull rate of 300 mm/min and an initial load of 19.6 cN (0.2 kg), and after measuring the maximum tensile shear strength until separation of the two samples, the tensile shear strength per unit area is calculated by the following formula, and the average value is calculated for n = 5.

$$F1 = S/(L \times W)$$

[0072] Here, F1 is the tensile shear strength (cN/cm^2), S is the maximum tensile shear load (cN), L is the layering length (cm) and W is the sample width (cm).

[0073] Since the hook and loop fastener of the invention comprises the fabric A and napped fabric B, it is flexible and generates little ripping noise when the female part and the male part are separated. In addition, its ability to be stitched with other fabrics and the like is also excellent. It also has very durable bonding force.

[0074] A textile product according to the invention is a textile product selected from the group consisting of sportswear, outer wear, inner wear, men's wear, ladies' wear, medical clothing, nursing clothing, bathrobes, working clothes, protective wear, footwear, bags, caps, gloves, socks, beddings, support belts, base fabrics, car seats, supporters, wiping utensils, skin care instruments and cosmetic tools, comprising the aforementioned hook and loop fastener. Since such a textile product employs the hook and loop fastener described above, it not only has excellent engaging properties, but is also

flexible, generates little ripping noise when the female part and male part are separated, and is excellent for sewing to fabrics or the like. It also has very durable bonding force.

EXAMPLES

[0075] The present invention will now be explained in greater detail by examples and comparative examples, with the understanding that the invention is not limited only to the examples. The values measured in the examples were obtained by the following methods.

<Melt viscosity>

[0076] After setting in the orifice of an extruder at the melting temperature during spinning of the dried polymer and maintaining a molten state for 5 minutes, several levels of load are applied for extrusion, during which time the shear rate and melt viscosity are plotted. The plots were carefully joined to draw a shear rate-melt viscosity curve, and the melt viscosity at a shear rate of 1000 seconds^{-1} was noted.

<Melting rate>

[0077] Filaments of the sea and island components were taken up each at a spinning speed of 1000 to 2000 m/min from a 0.3ϕ - 0.6 L $\times$ 24 H nozzle, and stretched to a residual elongation in the range of 30 to 60%, to obtain a multifilament with a total fineness of 84 dtex/24 fil. The reducing rate was calculated from the dissolution time and degree of dissolution with a liquor to goods ratio of 100, at a temperature for dissolution in each solvent.

<Monofilament diameter>

[0078] After photographing the fabric with a scanning electron microscope SEM, the monofilament diameter was measured for n = 5 locations, and the average value was calculated.

<Ductility>

[0079] This was measured according to JIS L 1096 8.12.

<Thickness>

[0080] This was measured according to JIS L 1096 8.5.

<Bending resistance>

[0081] This was measured according to JIS L 1096 8.21.1 A.

<Tensile shear strength>

[0082] For both the fabric A and the napped fabric B, two samples cut to 12 cm length and 3 cm width in the horizontal direction were layered 5 cm in the lengthwise direction and across the full width parallel in the lengthwise direction, the two samples were bonded by 2 passes under a load of 9.8 N/cm^2 (1 kg/cm^2) with a contact pressure roller and then loaded into a tensile tester and subjected to tension parallel to the lengthwise direction of the sample with a pull rate of 300 mm/min and an initial load of 19.6 cN (0.2 kg), and after measuring the maximum tensile shear strength until separation of the two samples, the tensile shear strength per unit area was calculated by the following formula, and the average value was calculated for n = 5.

$$F1 = S/(L \times W)$$

[0083] Here, F1 is the tensile shear strength (cN/cm^2), S is the maximum tensile shear load (cN), L is the layering length (cm) and W is the sample width (cm).

<Napping length (pile height) of napped yarn>

[0084] A microscope (model VH-6300) by Keyence Corp. was used to photograph the cross-section of the napped fabric (50x magnification), the overall thickness and the ground structure portion thickness were measured, and the napping length of the napped yarn was calculated by the following formula. The overall thickness was measured as the distance from the lowest section of the ground structure portion to the highest section of the napped yarn. The average value for n = 5 was calculated. The pile height was measured in the same manner.

$$L = \text{Overall thickness (mm)} - \text{ground structure portion thickness (mm)}$$

[Example 1]

[0085] Using polyethylene terephthalate (melt viscosity at 280°C: 1200 poise, matte agent content: 0 wt%) as the island component and polyethylene terephthalate copolymerized with 6 mol% 5-sodiumsulfoisophthalic acid and 6 wt% polyethylene glycol with a number-average molecular weight of 4000 (melt viscosity at 280°C: 1750 poise) as the sea component (melting rate ratio (sea/island) = 230), a sea-island composite unstretched fiber with sea:island = 30:70, number of islands = 836, was used for melt spinning at a spinning temperature of 280°C and a spinning speed of 1500 m/min and taken up. The obtained unstretched filament was stretched with a roller at a stretching temperature of 80°C and a draw ratio of 2.5 and then heat set at 150°C and taken up. The obtained sea-island composite fiber multifilaments (fibers for nanofiber, stretched yarn) had a total fineness of 56 dtex/10 fil, and observation of the filament transection with a transmission electron microscope (TEM) revealed round island shapes with an island diameter of 700 nm.

[0086] Next, with sea-island composite fiber multifilaments (fibers for nanofiber) and polyester false twisted crimp finished yarn (product of Teijin, Ltd., 56 dtex/72fil) as yarn for the pile yarn and polyester false twisted crimp finished yarn (product of Teijin, Ltd., 167 dtex/48 fil) as yarn for the ground weave, a 24G, 26-inch diameter circular knitting machine (product of Fukuhara Works, Ltd.) was used for knitting of a circular knit greige with a sinker pile texture (greige for fabric A). Next, in order to remove the sea component of the sea-island composite fiber multifilaments of the obtained circular knit greige, the knitted fabric was subjected to 8.3% alkali reduction treatment at 70°C in a 3.5% NaOH aqueous solution. This was followed by high-pressure dyeing at 130°C and dry heat setting at 170°C, after which a polyacrylate copolymer resin (viscosity: 1000 cps) was back coated on the back side with a knife coater to a coverage of 25 g/m^2 as solid content and then dried to obtain a knitted fabric (fabric A).

[0087] When the front side and cross-section of the obtained knitted fabric (fabric A) were observed with a scanning electron microscope SEM, the knitted fabric was confirmed to have filament yarn with a mean monofilament diameter of 700 nm that was included in loop form in the pile sections on the front side, and uniformly opened. The thickness of the knitted fabric (fabric A) was 0.85 mm, the elongation percentage in the warp direction was 4.5%, and the bending resistance in the warp direction was 50 mm.

[0088] Separately, a warp knitted greige (greige for napped fabric B) with a pile texture (front: 10/56, middle: 10/12, back: 23/10) was knitted with common polyester filament yarn (product of Teijin, Ltd., 33 dtex/12 fil) as yarn for the ground weave and common polyester filament yarn (product of Teijin, Ltd., 84 dtex/24 fil) as yarn for the napped yarn, using a 36G warp knitting machine (product of Carl Mayer KK.). The obtained warp knitted greige was used as preset for dry heat setting at 160°C, and high-pressure dyeing at 130°C. This was followed by shearing and dry heat setting at 170°C, after which a polyacrylate copolymer resin (viscosity: 1000 cps) was back coated on the back side with a knife coater to a coverage of 75 g/m^2 solid content, and then dried to obtain a napped knit fabric (napped fabric B).

[0089] When the fabric front side and cross-section of the obtained napped knit fabric (napped fabric B) were observed with a scanning electron microscope SEM and a microscope, it was found to be composed of a napped portion comprising cut piles and a ground structure portion, the single fiber fineness of the napped yarn was 3.5 dtex, the napping length was 1.2 mm, the elongation percentage in the warp direction was 2.5% and the bending resistance in the warp direction was 48 mm.

[0090] The knitted fabric (fabric A) and napped knit fabric (napped fabric B) were engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the fabric A, and upon measuring the tensile shear strength F1, it was found to exhibit excellent engaging properties, represented by tensile shear strength F1 = 128 cN/cm^2. When the female part (fabric A) and the male part (napped fabric B) were separated, absolutely no ripping noise was generated and the feel was also soft. When the knitted fabric (fabric A) and napped knit fabric (napped fabric B) were sewn into pajamas as a hook and loop fastener, the sewing operation was also satisfactory. The engaging properties were not reduced even with washing.

[Example 2]

[0091] The 56 dtex/10 fil sea-island composite fiber multifilaments obtained in Example 1 (fibers for nanofiber) were used alone to obtain a warp knitted greige (greige for fabric A) having a half texture (front: 10/23, middle: 23/10, back: 10/12), using a 28G warp knitting machine (product of Carl Mayer KK.). Next, in order to remove the sea component of the sea-island composite fiber multifilaments of the obtained warp knitted greige, the knitted fabric was subjected to 31% alkali reduction treatment at 70°C in a 3.5% NaOH aqueous solution. This was followed by high-pressure dyeing at 130°C and dry heat setting at 170°C, after which the back side was coated with an acrylic resin in the same manner as Example 1 and dried to obtain a knitted fabric (fabric A). The thickness of the knitted fabric (fabric A) was 0.40 mm, the elongation percentage in the warp direction was 3.0%, and the bending resistance in the warp direction was 39 mm.

[0092] Next, the knitted fabric (fabric A) and napped knit fabric (napped fabric B) obtained in Example 1 were engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the fabric A, and upon measuring the tensile shear strength F1, it was found to have excellent engaging properties, represented by tensile shear strength F1 = 97 cN/cm^2. When the female part (fabric A) and the male part (napped fabric B) were separated, absolutely no ripping noise was generated and the feel was also soft. When the knitted fabric (fabric A) and napped knit fabric (napped fabric B) were sewn into pajamas as a hook and loop fastener, the sewing operation was also satisfactory. The engaging properties were not reduced even with washing.

[Example 3]

[0093] Sea-island composite fiber multifilaments, 56 dtex/10 fil, (fibers for nanofiber) were obtained in the same manner as Example 1. Next, two stretched yarns were interlaced with multifilaments (33 dtex/12 fil) composed of common polyethylene terephthalate, to obtain composite yarn. The composite yarn was twisted 300 turns/m (S direction) and the total amount distributed as warp yarn, while 2 multifilament false twisted crimp finished yarns (56 dtex/144 fil) composed of common polyethylene terephthalate were combined and doubled at 300 turns/m (S direction) and distributed in the total amount as weft yarn, and a common weaving method was carried out at a woven density with a warp density of 171/2.54 cm and a weft density of 67/2.54 cm, to obtain 5 satin woven fabric greiges (greiges for fabric A). Next, in order to remove the sea component of the sea-island composite fiber multifilaments of the obtained woven fabric greige, it was subjected to 21% alkali reduction treatment at 70°C in a 3.5% NaOH aqueous solution. This was followed by high-pressure dyeing at 130°C and dry heat setting at 170°C, after which the back side was coated with an acrylic resin in the same manner as Example 1 and dried to obtain fabric A. The thickness of the woven fabric (fabric A) was 0.33 mm, the elongation percentage in the warp direction was 1.8%, and the bending resistance in the warp direction was 32 mm.

[0094] Next, the woven fabric (fabric A) and napped knit fabric (napped fabric B) obtained in Example 1 were engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the fabric A, and upon measuring the tensile shear strength F1, it was found to have excellent engaging properties, represented by tensile shear strength F1 = 55 cN/cm^2. When the female part (fabric A) and the male part (napped fabric B) were separated, absolutely no ripping noise was generated and the feel was also soft. When the woven fabric (fabric A) and napped knit fabric (napped fabric B) were sewn into pajamas as a hook and loop fastener, the sewing operation was also satisfactory. The engaging properties were not reduced even with washing.

[Example 4]

[0095] A knitted fabric (fabric A) was obtained in the same manner as Example 1.

[0096] Separately, as yarns for the ground weave, common polyester crimp finished yarn (product of Teijin, Ltd., 44 dtex/48 fil) was distributed as the warp yarn for the ground weave and common polyester false twisted crimp finished yarn (product of Teijin, Ltd., 56 dtex/24 fil) was distributed as the weft yarn for the ground weave, while common polyester filament yarn (product of Teijin, Ltd., 84 dtex/24 fil) was used as the yarn for the napped yarn, with the woven density at a warp density of 165/2.54 cm and a weft density of 200/2.54 cm, to obtain a woven fabric greige with a pile texture (greige for napped fabric B), using a velvet loom. The obtained woven fabric greige was used as preset for dry heat setting at 160°C, and high-pressure dyeing at 130°C. This was followed by shearing and dry heat setting at 170°C, after which the back side was coated with an acrylic resin in the same manner as Example 1 and dried to obtain a napped weave (napped fabric B).

[0097] Next, the knitted fabric (fabric A) and napped weave (napped fabric B) obtained in the same manner as Example 1 were engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the fabric A, and upon measuring the tensile shear strength F1, it was found to have excellent engaging properties, represented by tensile shear strength F1 = 118 cN/cm^2. When the female part (fabric A) and the male part (napped fabric B) were separated, absolutely no ripping noise was generated and the feel was also soft. When the knitted fabric (fabric A) and napped weave (napped fabric B) were sewn into pajamas as a hook and loop fastener, the sewing operation

was also satisfactory. The engaging properties were not reduced even with washing.

[Comparative Example 1]

[0098] After obtaining sea-island composite fiber multifilaments (fiber for nanofibers), 56 dtex/10 fil, in the same manner as Example 1, a circular knit greige with a sinker pile texture (greige for fabric A) was knitted in the same manner as Example 1. Next, in order to remove the sea component of the sea-island composite fibers of the obtained circular knit greige, the knitted fabric was subjected to 8.3% alkali reduction treatment at 70°C in a 3.5% NaOH aqueous solution. This was followed by high-pressure dyeing at 130°C, and dry heat setting at 170°C as the final setting, to obtain fabric A (without a back coating). The thickness of the knitted fabric (fabric A) was 0.83 mm, the warp direction/weft direction elongation percentage was 21.5%/62%, and the warp direction/weft direction bending resistance was 22 mm/18 mm.

[0099] Next, the knitted fabric and napped knit fabric (napped fabric B) obtained in Example 1 were engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the knitted fabric, but upon measuring the tensile shear strength F1, it was found to have inadequate engaging properties, represented by tensile shear strength F1 = 32 cN/cm^2.

[Comparative Example 2]

[0100] A knitted fabric (fabric A) was obtained in the same manner as Example 1.

[0101] Separately, a warp knitted greige (greige for napped fabric B) was knitted in the same manner as Example 1. Next, the obtained warp knitted greige was used as preset for dry heat setting at 160°C, and high-pressure dyeing at 130°C. This was followed by shearing and dry heat setting at 170°C as the final setting, to obtain napped fabric B (without a back coating). The warp direction/weft direction elongation percentage of the napped knit fabric (napped fabric B) was 6.4%/4.0%, and the warp direction/weft direction bending resistance was 20 mm/21 mm.

[0102] The knitted fabric (fabric A) and napped knit fabric (napped fabric B) were then engaged with each other, with the front side of the napped portion of the napped fabric B in contact with the fabric A, but upon measuring the tensile shear strength F1, it was found to have inadequate engaging properties, represented by tensile shear strength F1 = 44 cN/cm^2.

INDUSTRIAL APPLICABILITY

[0103] According to the invention there is provided a hook and loop fastener that not only has excellent engaging properties, but is also flexible, generates little ripping noise when the female part and male part are separated, is excellent for sewing to fabrics and the like, and is very durable, as well as textile products comprising the hook and loop fastener, and therefore the invention has very high industrial value.

Explanation of Symbols

[0104]

1 Ground structure portion
2 Napped yarn
3 Napped portion

Claims

1. A hook and loop fastener composed of a fabric A and a napped fabric B containing a napped portion and a ground structure portion, wherein both the fabric A and the napped fabric B have resin layers.

2. The hook and loop fastener according to claim 1, wherein the resin layer is a resin coating layer or laminated layer.

3. The hook and loop fastener according to claim 1 or 2, wherein the fabric A has a knitted fabric texture.

4. The hook and loop fastener according to any one of claims 1 to 3, wherein the fabric A includes filament yarn having a monofilament diameter of no greater than 1000 nm.

5. The hook and loop fastener according to claim 4, wherein the filament yarn is made of polyester and consists of

multifilaments with a number of filaments of 1000 or more.

6. The hook and loop fastener according to claim 4 or 5, wherein in the fabric A, the filament yarn is exposed on the fabric surface in the form of loops.

7. The hook and loop fastener according to any one of claims 1 to 6, wherein the thickness of the fabric A is in the range of 0.3 to 3.0 mm.

8. The hook and loop fastener according to any one of claims 1 to 7, wherein the elongation percentage in either the warp direction or the weft direction of the fabric A is in the range of 1 to 20%.

9. The hook and loop fastener according to any one of claims 1 to 8, wherein the bending resistance in either the warp direction or the weft direction of the fabric A is 25 mm or greater.

10. The hook and loop fastener according to any one of claims 1 to 9, wherein in the napped fabric B, the napped portion is made of polyester and consists of napped yarn with single fiber fineness of 2.5 dtex or greater.

11. The hook and loop fastener according to any one of claims 1 to 10, wherein the napping length of the napped portion in the napped fabric B is in the range of 0.1 to 3.0 mm.

12. The hook and loop fastener according to any one of claims 1 to 11, wherein the elongation percentage in either the warp direction or the weft direction of the napped fabric B is in the range of 1 to 20%.

13. The hook and loop fastener according to any one of claims 1 to 12, wherein the bending resistance in either the warp direction or the weft direction of the fabric B is 25 mm or greater.

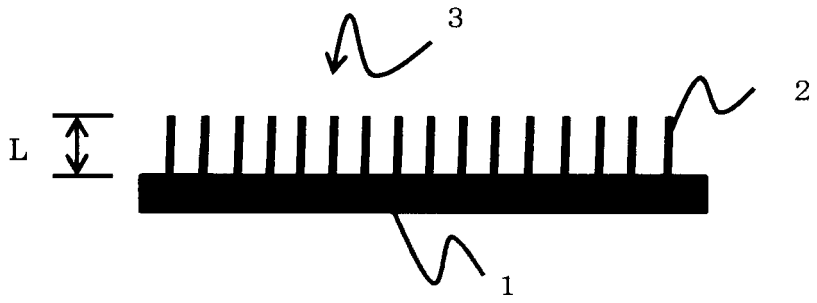
14. The hook and loop fastener according to any one of claims 1 to 13, wherein the tensile shear strength according to the following definition is 50 cN/cm^2 or greater.
For both the fabric A and the napped fabric B, two samples cut to 12 cm length and 3 cm width in the horizontal direction are layered 5 cm in the lengthwise direction and across the full width parallel in the lengthwise direction, the two samples are bonded by 2 passes under a load of 9.8 N/cm^2 (1 kg/cm^2) with a contact pressure roller and then loaded into a tensile tester and subjected to tension parallel to the lengthwise direction of the sample with a pull rate of 300 mm/min and an initial load of 19.6 cN (0.2 kg), and after measuring the maximum tensile shear strength until separation of the two samples, the tensile shear strength per unit area is calculated by the following formula, and the average value is calculated for n = 5.

$$F1 = S/(L \times W)$$

F1 is the tensile shear strength (cN/cm^2), S is the maximum tensile shear load (cN), L is the layering length (cm) and W is the sample width (cm).

15. Textile products selected from the group consisting of nursing clothing, medical clothing, sportswear, outer wear, inner wear, pajamas, men's wear, ladies' wear, bathrobe, working clothes, protective wear, combat wear, hunting wear, footwear, bags, caps, gloves, socks, shoes, bedding, support, connecting members, bandages, safety belts, flooring materials, covers, cushions, base fabrics, supporters, belly bands, aprons, body covers, capes, skin care instruments and cosmetic tools, that comprise a hook and loop fastener according to any one of claims 1 to 14.

FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/083893

A. CLASSIFICATION OF SUBJECT MATTER
A44B18/00(2006.01)i, *D04B1/04*(2006.01)i, *D04B21/04*(2006.01)i, *D06M15/263*(2006.01)i, *D06M101/32*(2006.01)n

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)
A44B18/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 9-224719 A (Haiberuto Kabushiki Kaisha), 02 September 1997 (02.09.1997), paragraphs [0011], [0013], [0015], [0019]; fig. 1, 4 (Family: none)	1,2,15 3-15
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 106938/1972(Laid-open No. 64106/1974) (Kanebo, Ltd.), 05 June 1974 (05.06.1974), specification, page 3, line 18 to page 4, line 3; page 6, line 17 to page 7, line 2 & GB 1438721 A & DE 2345682 A & FR 2198712 A	1,2,15 3-15

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 January 2017 (31.01.17)	07 February 2017 (07.02.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/083893

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 5692958 B2 (Teijin Ltd.), 01 April 2015 (01.04.2015), paragraphs [0011], [0012], [0014], [0022], [0026], [0027], [0029], [0030], [0054], [0055] (Family: none)	3-15
Y	JP 3-215204 A (Zenji INOMATA), 20 September 1991 (20.09.1991), specification, page 2, upper left column, lines 12 to 16 (Family: none)	8-15
Y	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 75391/1993(Laid-open No. 39516/1995) (Tadashi YAMADA), 18 July 1995 (18.07.1995), paragraph [0006] (Family: none)	8-15
Y	JP 2005-160967 A (YKK Corp.), 23 June 2005 (23.06.2005), paragraph [0003] (Family: none)	9-15
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 127251/1988(Laid-open No. 50208/1990) (Tadao YAMAMOTO), 09 April 1990 (09.04.1990), specification, page 6, lines 17 to 20 (Family: none)	9-15
A	US 5231738 A (KURARAY CO., LTD.), 03 August 1993 (03.08.1993), & US 5369852 A & US 5515583 A	1-15

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REFERENCES CITED IN THE DESCRIPTION

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- JP 4354232 B **[0006]**
- JP 2007007124 A **[0006]**
- JP 5692958 B **[0006]**
- JP 2004270097 A **[0027]**
- JP 2004211268 A **[0027]**
- JP 2007002364 A **[0032]**