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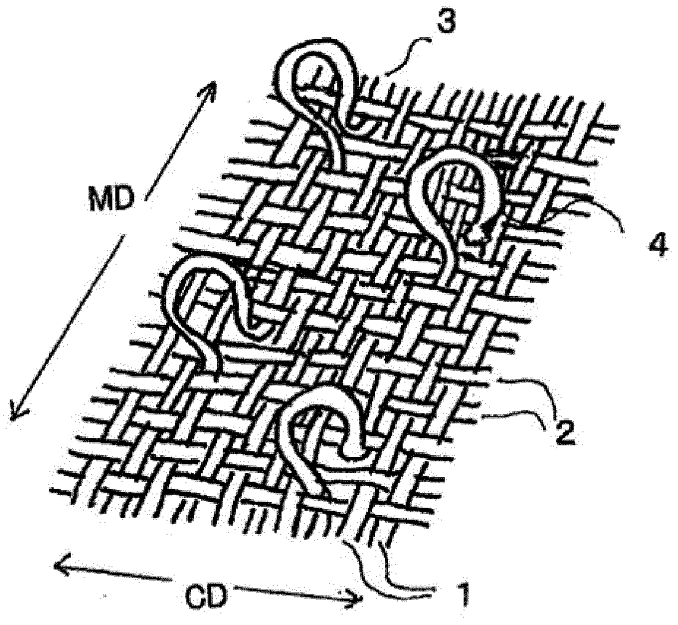
(54) TOUCH FASTENER HAVING LOOP-SHAPED ENGAGEMENT ELEMENTS AND PRODUCTION METHOD FOR TOUCH FASTENER HAVING LOOP-SHAPED ENGAGEMENT ELEMENTS

(57) The present invention relates to a hook-and-loop fastener including a base fabric having existing on a surface thereof plural loop engagement elements, wherein fibers constituting the loop engagement elements are formed of a polybutylene terephthalate-based polyester containing 1 to 8% by mass of polytrimethylene terephthalate.

[Fig. 1]



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Description

Technical Field

[0001] The present invention relates to a hook-and-loop fastener with a loop engagement element (touch fastener having loop-shaped engagement elements), especially a loop type hook-and-loop fastener with excellent peeling durability of the loop engagement element, or a hook-and-loop coexistence type fastener where both a loop engagement element and a hook engagement element coexist on the same surface of a base fabric.

Background Art

[0002] Conventionally, as a hook-and-loop fastener having a woven base fabric formed of cloth, a combination of a hook type hook-and-loop fastener having a hook engagement element formed of a monofilament yarn on the surface of a base fabric and a loop type hook-and-loop fastener having a loop engagement element formed of a multifilament yarn engageable with the hook engagement element on the surface of a base fabric has been widely used.

[0003] In a known loop type hook-and-loop fastener having such a loop engagement element on the surface of a base fabric, the base fabric is composed of a warp yarn, a weft yarn and a yarn for engagement elements, and the warp yarn, the weft yarn and the yarn for engagement elements are all polyethylene terephthalate-based multifilament yarns, the weft yarn is a heat fusible multifilament yarn, and the yarn for engagement elements is fixed to the base fabric by the heat fusible multifilament yarn (PTL 1).

[0004] It is known that this polyester-based loop type hook-and-loop fastener does not require an adhesive layer (so-called back coating layer) for fixing the engagement element on the back surface unlike the conventional nylon-based or polyolefin-based loop type hook-and-loop fastener because the yarn for loop engagement elements is fixed to the base fabric by melting of the yarn constituting the base fabric of the hook-and-loop fastener, and as a result, it is excellent in process simplicity and flexibility, and the obtained hook-and-loop fastener is also excellent in dimensional stability and dyeability because it is formed of polyester-based fibers.

[0005] However, when a multifilament yarn formed of a polyethylene terephthalate-based polyester is used as a yarn for loop engagement elements of a loop type hook-and-loop fastener, the multifilament yarn constituting the loop is less divided (loosening) and the loop is liable to be deformed (settling) due to repeated peeling, resulting in a decrease in engagement force and peeling durability. In addition, when the hook-and-loop fastener is sewn, when the engagement element is tilted by the sewing thread, the engagement element does not rise even if the tilted engagement element portion is rubbed.

[0006] Further, there are problems that the engagement element has high rigidity and hard skin touch, and is not necessarily suitable for applications requiring a flexible skin touch feeling such as clothing and daily goods.

[0007] As a method for solving the problems of such a polyethylene terephthalate-based loop engagement element, a loop type hook-and-loop fastener has been proposed in which a multifilament yarn for loop engagement elements constituting the loop type hook-and-loop fastener is changed from a polyethylene terephthalate-based polyester to a polybutylene terephthalate-based polyester (PTL 2).

[0008] Indeed, a loop type hook-and-loop fastener having a loop engagement element formed of a polybutylene terephthalate-based multifilament yarn has a feature that the multifilament yarn constituting the loop engagement element is easily divided (easily loosened) at the loop portion, as compared with a loop type hook-and-loop fastener having a loop engagement element formed of a polyethylene terephthalate-based multifilament yarn, and as a result, the engagement force and the peeling durability are improved, and the engagement element is flexible, so that the skin touch is excellent.

[0009] However, it has been found that a hook-and-loop fastener having a polybutylene terephthalate-based loop engagement element having such excellent flexibility and peeling durability has a problem that when engagement and peeling are repeated 5000 times or more, individual filaments constituting a multifilament yarn constituting the loop engagement element are gradually damaged and eventually cut, resulting in poor peeling durability.

[0010] In particular, in the case of a hook-and-loop fastener having a polybutylene terephthalate-based loop engagement element, it has been found that when the multifilament yarn constituting the loop engagement element is divided (loosened), the individual filaments forming the multifilament yarn constituting the loop engagement element are divided (loosened) at the loop portion, but are not sufficiently divided (loosened), and as a result, the improvement of the engagement force due to the division (loosening) is insufficient. It has also been found that a part of the individual filaments forming the multifilament yarn constituting the loop engagement element is cut by the further dividing (loosening) treatment, and as a result, the improvement of the engagement strength is insufficient.

Citation List

Patent Literature

[0011]

PTL 1: WO 2007/074791 A
PTL 2: JP 2014-27988 A

Summary of Invention

Technical Problem

[0012] It is an object of the present invention to provide a hook-and-loop fastener which has more excellent peeling durability than a hook-and-loop fastener having a loop engagement element formed of a polybutylene terephthalate-based multifilament yarn, in which the degree of dividing (loosening) is much higher than that of a hook-and-loop fastener having a loop engagement element formed of a polybutylene terephthalate-based multifilament yarn when the multifilament yarn constituting the loop engagement element is divided (loosened), and in which the filaments constituting the multifilament yarn are less likely to be cut by the dividing (loosening) treatment, and as a result, the engagement strength is improved.

Solution to Problem

[0013] That is, the present invention relates to a hook-and-loop fastener comprising a base fabric having existing on a surface thereof plural loop engagement elements, wherein fibers constituting the loop engagement elements are formed of a polybutylene terephthalate-based polyester containing 1 to 8% by mass of polytrimethylene terephthalate.

[0014] Preferably, in the above-described hook-and-loop fastener, the base fabric is a woven fabric composed of a warp yarn, a weft yarn, and a yarn for loop engagement elements, the warp yarn, the weft yarn, and the yarn for loop engagement elements are all multifilament yarns, the weft yarn has heat fusibility, the yarn for loop engagement elements is inwoven into the woven fabric in parallel to the warp yarn, the loop engagement elements are formed at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn, and roots of the loop engagement elements are fixed to the base fabric through fusion of the weft yarn, the loop engagement elements are arranged on the woven fabric in a row in a warp direction with a loop surface facing in the warp direction, and the row exists in parallel to a weft direction in multiple rows, and the weft yarn over which the loop engagement element existing in the row crosses is different from the weft yarn over which a loop engagement element of a row adjacent to the row is crossing.

[0015] More preferably, in the above-described hook-and-loop fastener, the base fabric has a plain weave structure, the yarn for loop engagement elements is inwoven into the woven base fabric every four warp yarns in parallel to the warp yarn, and a loop for engagement element is formed by allowing the five weft yarns to float and sink, then forming the loop for engagement element at a position floated on the weft yarn.

[0016] Preferably, in the above-described hook-and-loop fastener, the yarn for loop engagement elements is a multifilament yarn in which 6 to 12 filaments of 32 to 45 dtex are bundled.

[0017] In addition, according to the present invention, in the above-described hook-and-loop fastener, a part of the yarn for loop engagement elements is replaced with a polyethylene terephthalate-based monofilament yarn for hook engagement elements, the polyethylene terephthalate-based monofilament yarn for hook engagement elements being inwoven into the woven fabric in parallel to the warp yarn, the hook engagement elements are formed at a position crossing over the warp yarn and the weft yarn, and the loop engagement element and the hook engagement element coexist on the surface of the base fabric.

[0018] Preferably, in the hook-and-loop fastener, the multifilament yarns constituting the loop engagement elements are divided at a loop portion, and each of the multifilament yarns is not cut at the loop portion.

[0019] The present invention also relates to a method for manufacturing a hook-and-loop fastener, the method comprising: weaving a woven fabric composed of a warp yarn, a heat fusible weft yarn, and a yarn for loop engagement elements,

wherein,
the warp yarn, the heat fusible weft yarn, and the yarn for engagement elements are all multifilament yarns,
the yarn for loop engagement elements is inwoven in parallel to the warp yarn and forms a loop at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn,

the loop is arranged on a woven fabric in a row in a warp direction, and the row exists in parallel to a weft direction in multiple rows, and
the weft yarn over which the loop existing in the row crosses is different from the weft yarn over which a loop of a row adjacent to the row is crossing; and
then heating and fusing the heat fusible weft yarn to fix the yarn for loop engagement elements to the woven fabric to form a loop engagement element,
wherein the multifilament yarn for loop engagement elements is a multifilament yarn formed of a polybutylene terephthalate-based polyester containing 1 to 8% by mass of polytrimethylene terephthalate.

[0020] Preferably, in the above-described method for manufacturing a hook-and-loop fastener, the yarn for loop engagement elements is a multifilament yarn having an elongation at break of 25 to 45%.

[0021] More preferably, in the above-described method for manufacturing a hook-and-loop fastener, a part of the yarn for loop engagement elements is replaced with a monofilament yarn for hook engagement elements, the monofilament yarn for hook engagement elements is inwoven into a woven fabric in parallel to the warp yarn, a loop is formed at a position where the monofilament yarn for hook engagement elements crosses over the warp yarn and the heat fusible weft yarn, the heat fusible weft yarn is heated and fused, the yarn for loop engagement elements and the monofilament yarn for hook engagement elements are fixed to the woven fabric, and then one leg of the loop formed by the monofilament yarn for hook engagement elements is cut to form a hook engagement element.

Advantageous Effects of Invention

[0022] In the present invention, as the fiber constituting the loop engagement element, preferably as the multifilament yarn constituting the loop engagement element, a multifilament yarn formed of a polybutylene terephthalate-based polyester blended with 1 to 8% by mass of polytrimethylene terephthalate is used. In general, when a polymer constituting a fiber is blended with another polymer, fibrous physical properties are often largely deteriorated due to compatibility between the two polymers. However, when the polybutylene terephthalate-based polyester is blended with polytrimethylene terephthalate, in the case of being used as a multifilament yarn for loop engagement elements, even if engagement and peeling are repeated, individual filaments constituting the multifilament yarn are less likely to be damaged and cut, and the matching element is less likely to fall down, as compared with the case of a multifilament yarn formed of polybutylene terephthalate alone. As a result, the peeling durability is greatly improved.

[0023] In addition, even when the treatment of rubbing the loop engagement element with a card clothing or the like to divide (loosen) the multifilament yarn constituting the loop engagement element into individual filaments is performed, the filaments constituting the multifilament yarn are less likely to be cut and can be more completely divided (loosened) into individual filaments by the treatment, thereby improving the engagement strength.

Brief Description of Drawings

[0024]

Fig. 1 is a perspective view schematically showing one preferred example of a hook-and-loop fastener of the present invention.
Fig. 2 is a photograph showing a cross section in a weft direction of the hook-and-loop fastener of the present invention.
Fig. 3 is a photograph showing a cross section in the weft direction of a conventional hook-and-loop fastener having a loop engagement element composed of a multifilament yarn formed of polybutylene terephthalate alone.

Description of Embodiments

[0025] Hereinafter, the present invention will be described in detail.
A hook-and-loop fastener according to the present invention is a hook-and-loop fastener in which plural loop engagement elements, preferably a large number of loop engagement elements (about 30 elements/cm^2 to 120 elements/cm^2) exist on the surface of a base fabric.

[0026] The base fabric may be any of a woven fabric, a knitted fabric, and a nonwoven fabric, but is preferably a woven fabric woven from a warp yarn, a weft yarn, and a yarn for engagement elements.
In the case of a woven fabric, the features of the present invention are remarkable.

[0027] In the case of a non-woven fabric or a knitted fabric, the surface of the non-woven fabric or the knitted fabric is scraped with a card clothing or the like, and fibers constituting the non-woven fabric or the knitted fabric are drawn out in a loop shape from the surface of the base fabric, thereby obtaining a fabric hook-and-loop fastener having loop engagement elements on the surface thereof.

[0028] The base fabric is preferably a woven fabric. It is particularly preferable that the warp yarn, the weft yarn, and the yarn for loop engagement elements are all multifilament yarns, the weft yarn has heat fusibility, the yarn for loop engagement elements is inwoven into the woven fabric in parallel to the warp yarn, the loop engagement element is formed at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn, and the root of the loop engagement element is fixed to the base fabric through fusion of the weft yarn.

[0029] In the present invention, the term "heat fusibility" refers to a property of being softened by heating, and more specifically, means that when a heat fusible fiber is heated to a certain temperature or higher, it is softened and can be fused to a fiber formed of the same material or a different material, which is in close contact with the fiber.

[0030] The warp yarn is preferably substantially composed of a polyethylene terephthalate-based polyester polymer from the viewpoint of not causing waviness (a state in which the base fabric surface of the hook-and-loop fastener irregularly rises and falls and does not become a horizontal surface) due to heat, water absorption, and moisture absorption, and further from the viewpoint of improving the heat fusibility of the weft yarn. More preferably, the warp yarn is formed from a polyethylene terephthalate homopolymer.

[0031] As for the thickness of the multifilament yarn used as the warp yarn, a multifilament yarn composed of 20 to 54 filaments and having a total decitex of 100 to 300 decitex is preferable, and a multifilament yarn composed of 24 to 48 filaments and having a total decitex of 150 to 250 decitex is particularly preferable.

[0032] Preferably, the weft yarn includes a heat-fusible multifilament yarn. As a suitable representative example of the heat fusible multifilament yarn, there can be mentioned a multifilament yarn in which core-sheath type heat fusible filaments having a sheath component as a heat fusible component are bundled.

[0033] Since the weft yarn contains the heat fusible multifilament yarn, the yarn for engagement elements can be firmly fixed to the base fabric, and there is no need to apply a polyurethane-based or acrylic-based back coating resin to the back surface of the base fabric of the hook-and-loop fastener in order to prevent the yarn for engagement elements from being pulled out from the base fabric as in the conventional hook-and-loop fastener. Therefore, the process can be simplified, and the flexibility and air permeability of the hook-and-loop fastener can be obtained because the back surface of the base fabric is not hardened by the back coating resin. Furthermore, the dyeability of the hook-and-loop fastener is prevented from being impaired significantly due to the existence of the back coating resin layer.

[0034] As for the above-mentioned core-sheath type heat fusible multifilament yarn, a suitable example is a multifilament yarn formed by bundling plural core-sheath type filaments, where the sheath component is formed of a polyester-based resin that melts under heat treatment conditions and can firmly fix the root of the multifilament yarn for loop engagement elements to a base fabric, and the core component is formed of a polyester-based resin that does not melt under heat treatment conditions.

[0035] Specifically, a representative example is a core-sheath type polyester-based multifilament yarn having polyethylene terephthalate as the core component and copolymerized polyethylene terephthalate having a melting point or a softening point largely lowered by copolymerizing, for example, 20 to 30 mol% of a copolymerization component represented by isophthalic acid, adipic acid or the like in a large amount as the sheath component. The melting point or softening point of the sheath component is preferably 100 to 200°C, and is preferably 20 to 150°C lower than the melting point of the warp yarn, the core component, or the multifilament yarn for loop engagement elements. The cross-sectional shape of the core-sheath type heat fusible fiber may be a concentric core-sheath type, an eccentric core-sheath type, a single-core core-sheath type, or a multi-core core-sheath type.

[0036] Furthermore, it is preferable that all of the multifilament yarns constituting the weft yarns are the heat fusible multifilament yarns because the yarns for loop engagement elements are firmly fixed to the base fabric. In the case where the multifilament yarn constituting the weft yarn does not have a core-sheath cross-sectional shape but the entire cross-section is formed of a heat fusible polymer, the heat fusible polymer that has melted and solidified again is brittle and easily broken, and in the case of sewing or the like, the base fabric is easily torn from the sewing thread portion. Therefore, the heat fusible multifilament yarn preferably contains a non-heat fusible resin, and more preferably has a core-sheath cross-sectional shape. The mass ratio of the core component to the sheath component is preferably in the range of 20:80 to 80:20, particularly preferably in the range of 75:25 to 55:45.

[0037] The weft yarn is preferably a multifilament yarn, and the thickness of the multifilament yarn constituting the weft yarn is preferably a multifilament yarn composed of 10 to 72 filaments and having a total decitex of 80 to 300 decitex, and particularly preferably a multifilament yarn composed of 18 to 36 filaments and having a total decitex of 100 to 240 decitex.

[0038] What is important in the present invention is that the multifilament yarns for loop engagement elements as the fibers constituting loop engagement elements are formed of a polybutylene terephthalate-based polyester in which 1 to 8% by mass of polytrimethylene terephthalate is blended with respect to the polybutylene terephthalate-based polyester.

[0039] A multifilament yarn formed of a polybutylene terephthalate-based polyester blended with polytrimethylene terephthalate (including polytrimethylene terephthalate and polybutylene terephthalate) can be easily obtained by so-called blend spinning in which polytrimethylene terephthalate chips are blended with polybutylene terephthalate chips and spun.

[0040] Since 1 to 8% by mass of polytrimethylene terephthalate is blended with respect to the polybutylene terephthalate-based polyester, even when engagement and peeling are repeated, individual filaments constituting the multifilament yarn are less likely to be damaged and cut due to repetition of engagement and peeling, as compared with the case of a multifilament yarn formed of polybutylene terephthalate alone (that is, polytrimethylene terephthalate is not blended). As a result, the peeling durability is greatly improved. In the present invention, "1 to 8% by mass of trimethylene terephthalate is blended" refers to a value relative to the polybutylene terephthalate-based polyester. Of course, if the amount of resin other than polybutylene terephthalate and polytrimethylene terephthalate is small, the resin may be blended as other optional component within a range that does not impair the performance, and furthermore, as other optional components, various stabilizers, colorants, and the like may be added within a range that does not impair the performance. The total mass of the two components of polybutylene terephthalate and polytrimethylene terephthalate is preferably 80% by mass or more, more preferably 90% by mass or more, and particularly preferably 100% by mass (only two components of polybutylene terephthalate and polytrimethylene terephthalate) with respect to the mass of the polybutylene terephthalate-based polyester ("polybutylene terephthalate" + "polytrimethylene terephthalate" + "other optional component").

[0041] When the resin to be blended is not polytrimethylene terephthalate but a nylon-based resin, polypropylene, polyethylene terephthalate, polyethylene naphthalate or the like, the peeling durability cannot be improved, and the multifilament yarn constituting the loop engagement element is easily fibrillated by repeating engagement and peeling, so that the peeling durability cannot be improved. Therefore, this is an effect peculiar to polytrimethylene terephthalate.

[0042] When the blending amount of the polytrimethylene terephthalate is less than 1% by mass with respect to the polybutylene terephthalate, the effect of blending the polytrimethylene terephthalate is hardly exhibited. On the other hand, when the blending amount exceeds 8% by mass, it becomes difficult to industrially stably produce a multifilament yarn having a uniform thickness composed of extremely thick filaments suitable for the present invention. Preferably, 2 to 7% by mass, more preferably 2 to 5% by mass, and further preferably 3 to 5% by mass of polytrimethylene terephthalate is blended.

[0043] The thickness of the yarn for loop engagement elements is preferably a multifilament yarn in which 6 to 12 filaments, particularly 6 to 9 filaments of 32 to 45 dtex are bundled. With respect to the thickness, as compared with a multifilament yarn for loop engagement elements generally used for a loop type hook-and-loop fastener, in which 10 to 20 filaments of 15 to 30 dtex are bundled, individual filaments constituting the multifilament yarn are thick and the number of bundled filaments is small. Since the individual filaments constituting the loop engagement element are thick, the loop engagement element is hardly damaged by repetition of engagement and peeling, the peeling durability is improved, and further since the number of bundled filaments of such thick filaments is small, the multifilament yarn is easily divided (easily loosened), thereby improving the engagement strength.

[0044] Furthermore, in the present invention, it has been found that when the multifilament yarn for loop engagement elements used for manufacturing a hook-and-loop fastener has an elongation at break of 25 to 45%, the effect of blending polytrimethylene terephthalate is exhibited most effectively. When the value is out of this range, the effect is reduced. The elongation at break of the multifilament yarn for loop engagement elements mainly depends on the draw ratio during the production of the multifilament yarn, and by maintaining the draw ratio at about 2.5 to 3.5 times, a multifilament yarn formed of polybutylene terephthalate blended with polytrimethylene terephthalate having an elongation at break of 25 to 45% can be obtained.

[0045] A woven fabric for a hook-and-loop fastener is woven from the warp yarn, the weft yarn, and the multifilament yarn for loop engagement elements described above. As for a weaving structure of the woven fabric, as shown in Fig. 1, a plain weave in which the multifilament yarn (3) for loop engagement elements is a part of the warp yarn (1) is preferable, and specifically, the weaving structure in which the multifilament yarn for loop engagement elements rises up from the surface of the base fabric in the middle of the structure while existing parallel to the warp yarn and forms a loop (4) without crossing over the warp yarn is preferable.

[0046] The weaving density of the warp yarns is preferably 50 to 90 yarns/cm after heat treatment, and the weaving density of the weft yarns is preferably 15 to 25 yarns/cm after heat treatment. The mass proportion of the weft yarn is preferably 10 to 45% with respect to the total mass of the yarn for loop engagement elements, the warp yarn, and the weft yarn constituting the hook-and-loop fastener.

[0047] The driving number of the multifilament yarns for loop engagement element is preferably about 3 to 6 per 20 warp yarns (including a monofilament yarn for hook engagement elements or a multifilament yarn for loop engagement elements). It is particularly preferable that one multifilament yarn for loop engagement elements per five warp yarns (including a multifilament yarn for loop engagement elements), and preferably the yarn for loop engagement elements is uniformly driven into the warp yarns without being biased. Therefore, it is preferable that the yarns for loop engagement element exist on both sides of four continuous warp yarns.

[0048] In the loop type hook-and-loop fastener of the present invention, as shown in Fig. 1, it is preferable that the loop engagement elements are arranged on the woven fabric in a row in a warp direction (MD direction), and such a row exists in parallel to a weft direction (CD direction) in multiple rows, and the weft yarn over which the loop engagement

element existing in the row crosses is different from the weft yarn over which an engagement element of a row adjacent to the row is crossing, because the force at the time of peeling can be prevented from concentrating on a specific weft yarn, and as a result, the peeling durability can be improved.

[0049] In particular, in the present invention, as shown in Fig. 1, it is preferable that the yarn for engagement elements is inwoven into the woven base fabric every four warp yarns in parallel to the warp yarn (1), and the five weft yarns (2) are floated and sunk to form a loop (4) for engagement element at a position floated on the weft yarn, because both engagement strength and peeling durability can be satisfied.

[0050] The woven fabric for a hook-and-loop fastener thus obtained is then subjected to heat treatment to melt the sheath component of the core-sheath type heat fusible multifilament yarn constituting the weft yarn. This eliminates the need for back coating treatment which has been performed in conventional hook-and-loop fasteners, and can prevent problems such as deterioration of the workplace environment due to evaporation of the solvent of the back coating resin liquid, adhesion of the back coating resin liquid to the apparatus, and deterioration of the flexibility of the hook-and-loop fastener due to the back coating resin layer. As the temperature during the heat treatment, a temperature of 150 to 220°C, which is a temperature at which the sheath component of the heat fusible multifilament yarn melts or softens but the other yarns do not melt, is generally used, and more preferably in the range of 185 to 210°C.

[0051] Further, the loop is naturally twisted by the heat during the heat treatment, and the loop surface is faced in the warp direction. In particular, in the case of a multifilament yarn formed of polybutylene terephthalate containing trimethylene terephthalate, particularly, in the case of a multifilament yarn in which a small number of thick filaments are bundled as described above, and the multifilament yarn rises from the weft yarn without crossing over the warp yarn at the foot of the loop, the loop is easily twisted and the loop surface is easily faced in the warp direction. In particular, as shown in Fig. 1, in the case in which the loop is formed at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn, the loop is easily twisted and the loop surface is easily faced in the warp direction.

[0052] When the loop surface is facing in the warp direction, uniform engagement with the hook engagement element is likely to occur, and when the surface of the loop engagement element is stroked with a card clothing or the like to divide (loosen) the multifilament yarn constituting the loop engagement element, the multifilament yarn is likely to be divided (loosened) into individual filaments, and a part of the individual filaments is hardly cut by the treatment at the time of division (loosening). The term "loop surface is facing in the warp direction" in the present invention includes not only the case where the loop surface is completely facing in the warp direction but also the case where the loop surface is facing in a direction closer to the warp direction than the weft direction.

[0053] Fig. 2 is a photograph of a case where the multifilament yarn constituting the loop engagement element of the hook-and-loop fastener of the present invention is rubbed with a card clothing to divide (loosen) the multifilament yarn, and Fig. 3 is a photograph of a case where the conventional multifilament yarn for loop engagement elements is formed of polybutylene terephthalate alone, and in this case, it can be seen from these photographs that the multifilament yarn constituting the loop engagement element is not divided into individual filaments (not loosened) even when the multifilament yarn is rubbed with a card clothing in the same manner.

[0054] The density of the loop engagement elements in the loop type hook-and-loop fastener is preferably 25 to 125 elements per cm^2 on the basis of the base fabric portion where the engagement elements exist. The height of the loop engagement element is preferably 1.5 to 3.5 mm from the base fabric surface.

[0055] In the loop type hook-and-loop fastener of the present invention, it is more preferable to rub the surface of the loop engagement element with a card clothing or the like to divide (loosen) the multifilament yarn constituting the loop engagement element into individual filaments in order to enhance the peeling durability. As described above, in the hook-and-loop fastener of the present invention, since polytrimethylene terephthalate is added to the multifilament yarn constituting the loop engagement element, the multifilament yarn is easily divided (easily loosened) into individual filaments, and as a result, excellent engagement strength and peeling durability are obtained.

[0056] Although the case of the loop type hook-and-loop fastener has been described in detail above, the present invention is also effective in the case where the loop engagement elements and the hook engagement elements coexist on the surface of the hook-and-loop fastener.

[0057] In this case, the hook engagement element is required to have so-called hook shape retention and rigidity in which the hook shape is not extended by a light force, and for this purpose, a thick monofilament yarn is used. In the present invention, as the monofilament yarn, there is used a monofilament yarn which is formed of polyethylene terephthalate or polybutylene terephthalate particularly excellent in hook shape retention and does not melt at the temperature when the heat fusible fiber is thermally fused. The thickness of the monofilament yarn for hook engagement elements is preferably 0.12 to 0.25 mm in diameter.

[0058] The monofilament yarn for hook engagement elements is inwoven in parallel to the warp yarn, and a woven structure is used in which one to three warp yarns and one to three weft yarns are skipped over at a position where a loop for forming the hook engagement element is formed, and the monofilament yarn is inserted between the warp yarns.

[0059] The driving number of the monofilament yarns for hook engagement elements is preferably 3 to 6 per 20 warp

yarns in total of the monofilament yarns for hook engagement elements and the multifilament yarns for loop engagement elements (including the monofilament yarns for hook engagement elements and the multifilament yarns for loop engagement elements), and the number ratio of the monofilament yarns for hook engagement elements to the multifilament yarns for loop engagement elements is preferably in the range of 30:70 to 70:30. It is particularly preferable that a row in which plural hook engagement elements are arranged in the warp direction and a row in which plural loop engagement elements are arranged in the warp direction exist alternately on the surface of the woven fabric in units of two rows each.

[0060] In the case of a hook-and-loop coexistence type fastener, one leg side portion of the loop for hook engagement elements protruding from the surface of the woven fabric for the heat-treated hook-and-loop fastener is cut to obtain a hook engagement element. It is preferable that the loop for hook engagement elements is formed at a place crossing over the ground warp yarn as described above because only one leg of the loop can be easily cut.

[0061] The height of the hook engagement element is preferably 1.5 to 2.5 mm from the surface of the base fabric and lower than the height of the loop engagement element by 0.3 to 0.8 mm. In particular, in the present invention, since polytrimethylene terephthalate is blended with polybutylene terephthalate constituting the loop engagement element, flexibility and texture are excellent, and this effect is even more pronounced when the loop engagement element is higher than the hook engagement element.

[0062] The density of each of the hook engagement elements and the loop engagement elements in the hook-and-loop coexistence type fastener is preferably 20 to 40 elements per cm^2 on the basis of the base fabric portion where the engagement elements exist. The ratio of the number of the hook engagement elements to the number of the loop engagement elements is preferably in the range of 30:70 to 70:30.

[0063] Also in the case of the hook-and-loop coexistence type fastener, it is preferable to rub the surface of the loop engagement element with a card clothing or the like to divide (loosen) the multifilament yarn constituting the loop engagement element into individual filaments in order to enhance the peeling durability. In the case where the height of the loop engagement element is higher than the height of the hook engagement element, the hook engagement element is hardly damaged even if rubbed with a card clothing or the like, and engagement strength and peeling durability are hardly impaired.

[0064] The loop type hook-and-loop fastener and the hook-and-loop coexistence fastener of the present invention can be used in application fields in which conventional general hook-and-loop fasteners are used, and are particularly suitable for applications in which engagement and peeling are repeatedly performed, and can be used in a wide range of applications such as shoes, bags, hats, gloves and the like, as well as clothing, blood pressure monitors, supporters, binding bands for packing, binding tapes, various toys, fixing of sheets for civil engineering and construction, storage boxes and packing cases that can be freely assembled and disassembled, small articles, curtains, and the like.

Examples

[0065] Hereinafter, the present invention will be described with reference to Examples. In the Examples, the initial engagement strength was measured in conformity with the method of JIS L3416:2000, and the peeling durability was also measured in conformity with JIS L3416:2000.

[0066] The elongation at break was measured in conformity with JIS L1096:2010 (method A).

[0067] When the hook-and-loop fastener was a loop type hook-and-loop fastener, a woven fabric hook type hook-and-loop fastener A8693Y.71 manufactured by Kuraray Fastening Co., Ltd. was used as the engagement partner, and when the hook-and-loop fastener was a hook-and-loop coexistence type fastener (hook and loop coexistence type fastener F9820Y.12 manufactured by Kuraray Fastening Co., Ltd.), the same hook-and-loop coexistence type fastener was used as the engagement partner.

(Example 1)

[0068] As a warp yarn, a weft yarn and a multifilament yarn for loop engagement elements that constitute a base fabric of a hook-and-loop fastener, the following yarns were prepared.

[Warp Yarn]

[0069]

Multifilament yarn formed of polyethylene terephthalate having a melting point of 260°C
Total decitex and the number of filaments: 167 dtex and 30 filaments

[Weft Yarn (Multifilament Yarn composed of Core-Sheath Type Composite Filaments)]

[0070]

Core component: polyethylene terephthalate (melting point: 260°C)
Sheath component: polyethylene terephthalate copolymerized with 25 mol% of isophthalic acid (softening point: 190°C)
Core/sheath ratio (mass ratio): 70:30 (core component : sheath component)
Total decitex and the number of filaments: 110 dtex and 24 filaments

[Multifilament Yarn for Loop Engagement Elements]

[0071]

Multifilament yarn formed of a polybutylene terephthalate-based polyester blended with 5% by mass of polytrimethylene terephthalate (melting point: 220°C)
Total decitex and the number of filaments: 265 dtex and 7 filaments
Draw ratio: 3.0 times, elongation at break: 34.6% (average value of 10 yarns)

[Manufacturing of Loop Type Hook-and-Loop Fastener]

[0072] Using the warp yarn, the weft yarn, and the multifilament yarn for loop engagement elements, plain weave was used as the weaving structure, and weaving was performed so that the weaving density (after heat shrinkage treatment) was 55 warp yarns/cm and 22 weft yarns/cm. Then, as shown in Fig. 1, a loop was formed on a base fabric in such a manner that the multifilament yarn for loop engagement elements is driven at a ratio of one warp yarn to four warp yarns in parallel to the warp yarn without crossing over the warp yarn and five weft yarns are floated and sunk to form a loop, and the loop is arranged in a row in the warp direction on the woven fabric, and such a row exists in parallel to the weft direction in multiple rows, and the weft yarn over which the loop existing in the row crosses is different from the weft yarn over which a loop of a row adjacent to the row is crossing (specifically, a weft yarn located in the middle of two weft yarns that are crossed over by two loops in front and behind that exist in a row is used as a weft yarn that is crossed over by a loop of an adjacent row).

[0073] A tape for a loop type hook-and-loop fastener woven under the above conditions was subjected to a heat treatment at 200°C, which is a temperature at which only the sheath component of the weft yarn is melted and the warp yarn, the multifilament for loop engagement element, and the core component of the weft yarn are not melted. As a result, the sheath component was melted and the yarn existing in the vicinity was fused to the core component of the weft yarn. The obtained loop type hook-and-loop fastener had a loop engagement element density of 44 elements/cm^2, the height of the loop engagement element from the base fabric surface was 2.4 mm, and the loop engagement element was twisted so that most of the loop surface faced in the warp direction.

[0074] Table 1 below shows the results of the initial engagement strength and the peeling durability after repeating 5000 times of engagement and peeling of the obtained loop type hook-and-loop fastener.

[0075] Further, using the multifilament for loop engagement element, a loop type hook-and-loop fastener having a napped structure in which the yarn for loop engagement element forms a loop after sinking by one weft yarn and having a loop engagement element density of 120 elements/cm^2 was woven, and then the surface was rubbed with a card clothing to divide (loosen) the multifilament yarn constituting the loop engagement element. When the surface of the obtained loop type hook-and-loop fastener was observed with a microscope, as shown in Fig. 2, the multifilament yarn constituting the loop engagement element was almost completely divided into individual filaments (loosened), and no filament broken by the card clothing treatment was found.

[0076] The results of the initial engagement strength and the peeling durability after repeating 5000 times of engagement and peeling of the loop type hook-and-loop fastener rubbed with the card clothing are also shown in the same table.

[0077] As is apparent from the results shown in Table 1, the loop type hook-and-loop fasteners of the present Examples, both of those not treated by rubbing with a card clothing and those treated by rubbing with a card clothing, are excellent in initial engagement strength and extremely excellent in engagement strength after repeating 5000 times of engagement and peeling.

[0078] When the state of the loop engagement element of the loop type hook-and-loop fastener after repeating 5000 times of engagement and peeling was observed under a microscope in an enlarged manner, some of the filaments forming the multifilament yarn constituting the loop engagement element were partially broken, but most of them were not broken, and the multifilament yarn was in a state of being divided (loosened) at the loop portion, and no falling loop engagement element was found.

(Example 2 and 3 and Comparative Examples 1, 2 and 3)

[0079] A loop type hook-and-loop fastener was manufactured in the same manner as in Example 1 except that the blending amount of polytrimethylene terephthalate was changed to 2% by mass (Example 2), 7% by mass (Example 3), 0% by mass (Comparative Example 1), or 10% by mass (Comparative Example 2) as the multifilament yarn for loop engagement elements used in Example 1. In addition, as Comparative Example 3, a loop type hook-and-loop fastener was manufactured in the same manner as in Example 1 using a multifilament yarn formed of polytrimethylene terephthalate alone as a multifilament yarn for loop engagement elements.

[0080] When the blending amount was 10% by mass (Comparative Example 2), a multifilament yarn having a uniform thickness that could be used as a loop engagement element of a loop type hook-and-loop fastener could not be manufactured, and therefore could not be used as a loop type hook-and-loop fastener.

[0081] In the case of using polytrimethylene terephthalate alone (Comparative Example 3), the yarn was stretched by the tension applied during weaving, and the loop engagement element could not be stably raised.

[0082] Therefore, it was impossible to form a loop engagement element in which a hook engagement element is hooked, and it was impossible to form a hook-and-loop fastener.

[0083] The draw ratios of the multifilament yarn having a blending amount of 2% by mass (Example 2) and the multifilament yarn having a blending amount of 7% by mass (Example 3) were both 3 times, and as a result, the elongation at break was 25% and 40%, respectively. The loop surfaces of the obtained loop type hook-and-loop fasteners were all faced in the warp direction, but the loop surfaces were faced accurately in the warp direction as the blending amount of the polymethylene terephthalate increased.

[0084] Table 1 below also shows the results of the initial engagement strength and the peeling durability after performing 5000 times of engagement and peeling of the obtained loop type hook-and-loop fasteners.

[0085] Further, the surfaces of the loop type hook-and-loop fasteners were rubbed with a card clothing to divide (loosen) the multifilament yarns constituting the loop engagement elements, and the initial engagement strength and the peeling durability after repeating 5000 times of engagement and peeling of the obtained loop type hook-and-loop fasteners were measured. The results are also shown in the same table.

Table 1

	PTT Blending Amount (mass%)	Initial Engagement Strength		Peeling Durability after 5000 times of Engagement and Peeling	
		No Card Clothing Treatment, Engagement Element Density 44 elements/cm^2	Card Clothing Treatment Product, Engagement Element Density 120 elements/cm^2	No Card Clothing Treatment, Engagement Element Density 44 elements/cm^2	Card Clothing Treatment Product, Engagement Element Density 120 elements/cm^2
Example 1	5	1.40	2.36	1.53	1.91
Example 2	2	1.41	2.35	1.39	1.81
Example 3	7	1.61	2.69	1.42	1.76
Comparative Example 1	0	1.33	2.28	1.29	1.57
Comparative Example 2	10	Unable to spin			
Comparative Example 3	PTT alone	Unable to form a loop engagement element			
PTT: polytrimethylene terephthalate Engagement strength: peeling strength (N/cm^2) measured in conformity with JIS L3416					

[0086] Further, when the state of the multifilament yarns of the loop engagement elements was observed with a microscope for these loop type hook-and-loop fasteners, in the case of Comparative Example 1, as shown in Fig. 3, the individual filaments constituting the multifilament yarn were less in a divided state (a loosened state) and more in a bundled state in a state of being rubbed with a card clothing. In contrast, in both Examples 2 and 3, it was observed that the individual filaments constituting the multifilament yarn were almost completely divided (loosened) as in Example 1. However, in Example 3, some stretching yarns were observed in the divided (loosened) multifilament yarns.

[0087] Furthermore, as a result of observing the state of the loop engagement elements of the loop type hook-and-loop fasteners after repeating 5000 times of engagement and peeling with a microscope, in Example 2 and Example 3, as in Example 1, some of the filaments forming the multifilament yarn constituting the loop engagement element were partially broken, but most of them were not broken, and the multifilament yarn was in a state of being divided (loosened) at the loop portion, and no falling loop engagement element was found.

[0088] However, in Example 3, a partially broken multifilament yarn was observed as a stretching yarn. In contrast, in Comparative Example 1, a considerable amount of the filaments forming the multifilaments constituting the loop engagement elements was broken, and in addition, some of the loop engagement elements fell down and lost their engagement ability. Further, in the case of the multifilament yarn formed of polytrimethylene terephthalate alone, the stability of the loop shape was poor, and the multifilament yarn could not be used as an engagement element of a loop type hook-and-loop fastener.

(Example 4 and Comparative Example 4)

[0089] A woven fabric for a hook-and-loop coexistence type fastener was prepared in the same manner as in Example 1 except that the following monofilament yarn for hook engagement elements was used in place of every two multifilament yarns for loop engagement elements in Example 1, and two rows of loops for hook engagement elements exist adjacent to the two rows of loop engagement elements on the surface of the hook-and-loop fastener, and the multifilament yarn for hook engagement elements was formed so as to cross over three warp yarns and one weft yarn at the position where the loops for hook engagement elements were formed (Example 4). Further, in Example 4, a woven fabric for a hook-and-loop coexistence type fastener was prepared using the polybutylene terephthalate multifilament yarn used in Comparative Example 1, which was not blended with polytrimethylene terephthalate at all, as the multifilament yarn for loop engagement elements (Comparative Example 4).

[Monofilament for Hook Engagement Element]

[0090]

Polyethylene terephthalate monofilament (melting point: 260°C)
Fineness: 390 dtex (diameter: 0.19 mm)

[0091] The obtained two kinds of woven fabrics were heat-treated in the same manner as in Example 1, and the two rows of loops for the hook engagement elements were cut at the leg closer to the central portion to form the loops as the hook engagement elements. The obtained hook-and-loop coexistence type fastener had a loop engagement element density of 30 elements/cm^2 and a hook engagement element density of 30 elements/cm^2, the height of the loop engagement element was 2.5 mm, and the height of the hook engagement element was 2.0 mm. In the hook-and-loop fastener of Example 4, the loop surface was completely faced in the warp direction.

[0092] Table 2 below also shows the results of the initial engagement strength and the peeling durability after performing 5000 times of engagement and peeling of the obtained two kinds of hook-and-loop coexistence type fasteners. As the engagement partner, each hook-and-loop coexistence type fastener was used.

Table 2

	PTT Blending Amount (mass%)	Initial Engagement Strength	Peeling Durability after 5000 times of Engagement and Peeling
Example 4	5	1.94	1.85
Comparative Example 4	0	1.83	1.66
PTT: polytrimethylene terephthalate Engagement strength: peeling strength (N/cm^2) measured in conformity with JIS L3416			

[0093] Further, as a result of observing the state of the loop engagement elements after repeating 5000 times of engagement and peeling with a microscope, in Example 4, some of the filaments forming the multifilament yarn constituting the loop engagement element were partially broken, but most of them were not broken, and the multifilament yarn was in a state of being divided (loosened) at the loop portion, and no falling loop engagement element was found. In

contrast, in Comparative Example 4, a considerable amount of the filaments forming the multifilaments constituting the loop engagement elements was broken, and in addition, some of the loop engagement elements fell down and lost their engagement ability.

Reference Signs List

[0094]

1: Warp yarn
2: Weft yarn
3: Yarn for loop engagement elements
4: Loop engagement element
MD: Warp direction
CD: Weft direction

Claims

1. A hook-and-loop fastener comprising a base fabric having existing on a surface thereof plural loop engagement elements, wherein fibers constituting the loop engagement elements are formed of a polybutylene terephthalate-based polyester containing 1 to 8% by mass of polytrimethylene terephthalate.

2. The hook-and-loop fastener according to claim 1, wherein

   the base fabric is a woven fabric composed of a warp yarn, a weft yarn, and a yarn for loop engagement elements,
   the warp yarn, the weft yarn, and the yarn for loop engagement elements are all multifilament yarns,
   the weft yarn has heat fusibility,
   the yarn for loop engagement elements is inwoven into the woven fabric in parallel to the warp yarn,
   the loop engagement elements are formed at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn, and roots of the loop engagement elements are fixed to the base fabric through fusion of the weft yarn,
   the loop engagement elements are arranged on the woven fabric in a row in a warp direction with a loop surface facing in the warp direction, and the row exists in parallel to a weft direction in multiple rows, and
   the weft yarn over which the loop engagement element existing in the row crosses is different from the weft yarn over which a loop engagement element of a row adjacent to the row is crossing.

3. The hook-and-loop fastener according to claim 2, wherein the base fabric has a plain weave structure, the yarn for loop engagement elements is inwoven into the woven base fabric every four warp yarns in parallel to the warp yarn, and a loop for engagement element is formed by allowing the five weft yarns to float and sink, then forming the loop for engagement element at a position floated on the weft yarn.

4. The hook-and-loop fastener according to any one of claims 1 to 3, wherein the yarn for loop engagement elements is a multifilament yarn in which 6 to 12 filaments of 32 to 45 dtex are bundled.

5. The hook-and-loop fastener according to any one of claims 2 to 4, wherein a part of the yarn for loop engagement elements is replaced with a polyethylene terephthalate-based monofilament yarn for hook engagement elements, the polyethylene terephthalate-based monofilament yarn for hook engagement elements being inwoven into the woven fabric in parallel to the warp yarn, the hook engagement elements are formed at a position crossing over the warp yarn and the weft yarn, and the loop engagement element and the hook engagement element coexist on the surface of the base fabric.

6. The hook-and-loop fastener according to any one of claims 2 to 5, wherein the multifilament yarns constituting the loop engagement elements are divided at a loop portion, and each of the multifilament yarns is not cut at the loop portion.

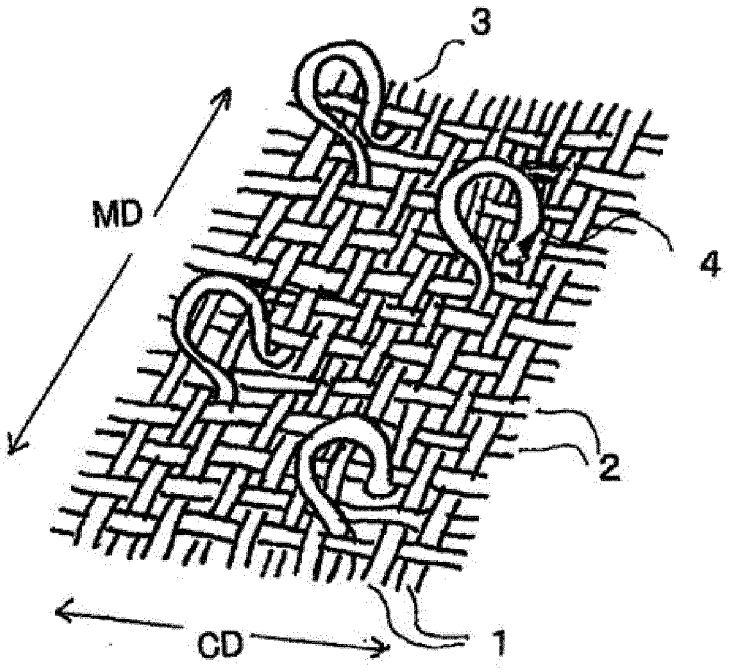
7. A method for manufacturing a hook-and-loop fastener, the method comprising: weaving a woven fabric composed of a warp yarn, a heat fusible weft yarn, and a yarn for loop engagement elements,

wherein,
the warp yarn, the heat fusible weft yarn, and the yarn for engagement elements are all multifilament yarns,
the yarn for loop engagement elements is inwoven in parallel to the warp yarn and forms a loop at a position where the yarn for loop engagement elements crosses over one weft yarn without crossing over the warp yarn, the loop is arranged on a woven fabric in a row in a warp direction, and the row exists in parallel to a weft direction in multiple rows, and
the weft yarn over which the loop existing in the row crosses is different from the weft yarn over which a loop of a row adjacent to the row is crossing; and
then heating and fusing the heat fusible weft yarn to fix the yarn for loop engagement elements to the woven fabric to form a loop engagement element,
wherein the multifilament yarn for loop engagement elements is a multifilament yarn formed of a polybutylene terephthalate-based polyester containing 1 to 8% by mass of polytrimethylene terephthalate.

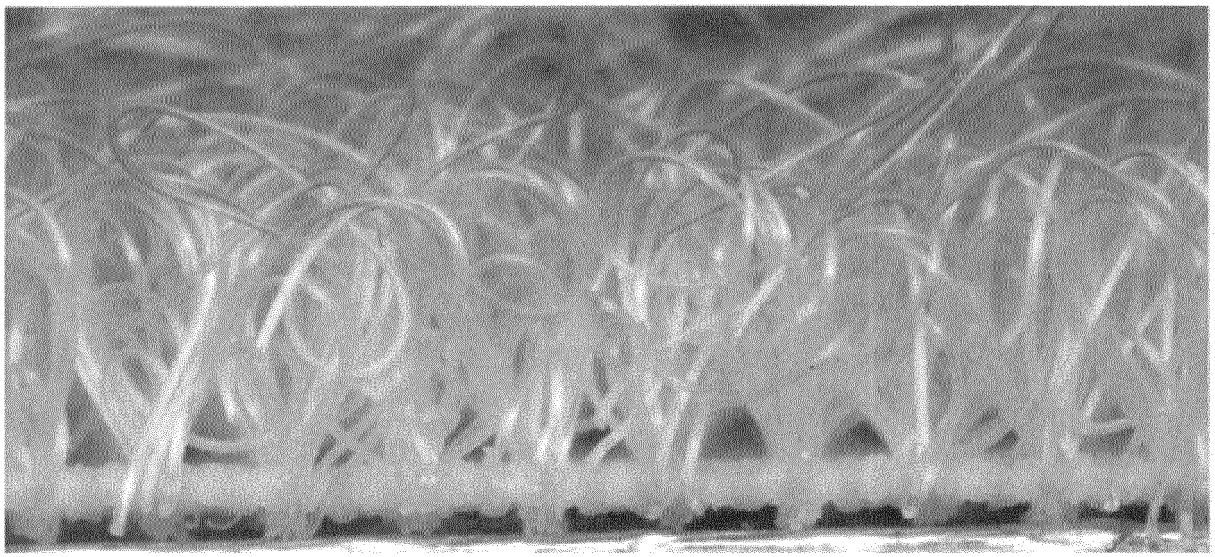
8. The method for manufacturing a hook-and-loop fastener according to claim 7, wherein the yarn for loop engagement elements is a multifilament yarn having an elongation at break of 25 to 45%.

9. The method for manufacturing a hook-and-loop fastener according to claim 7 or 8, wherein a part of the yarn for loop engagement elements is replaced with a monofilament yarn for hook engagement elements, the monofilament yarn for hook engagement elements is inwoven into a woven fabric in parallel to the warp yarn, a loop is formed at a position where the monofilament yarn for hook engagement elements crosses over the warp yarn and the heat fusible weft yarn, the heat fusible weft yarn is heated and fused, the yarn for loop engagement elements and the monofilament yarn for hook engagement elements are fixed to the woven fabric, and then one leg of the loop formed by the monofilament yarn for hook engagement elements is cut to form a hook engagement element.

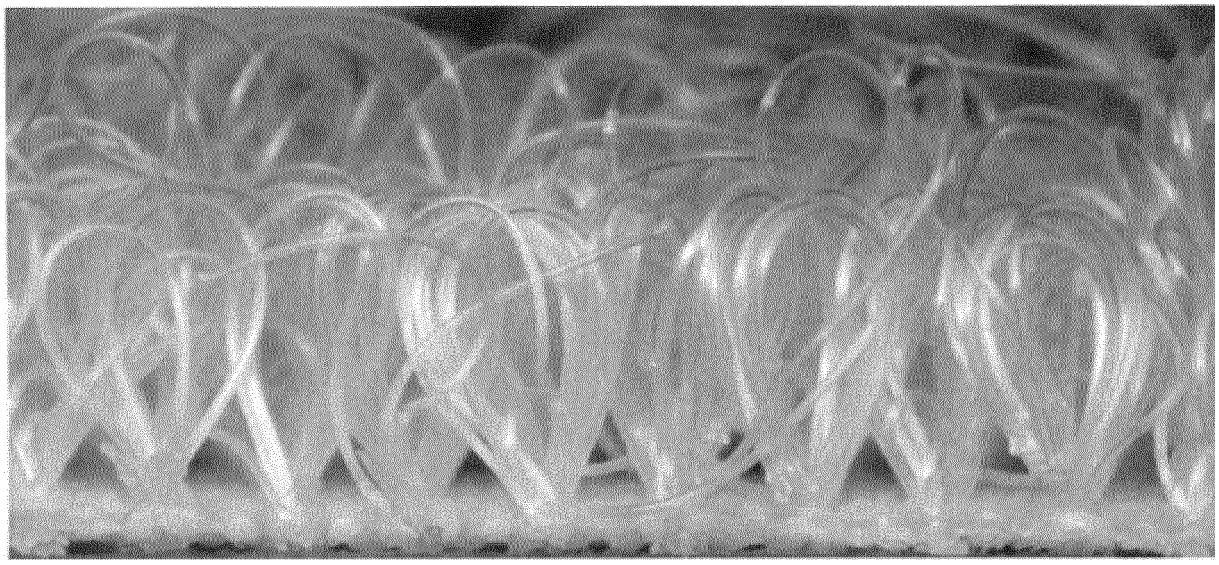
[Fig. 1]



[Fig. 2]



[Fig. 3]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/043144

A. CLASSIFICATION OF SUBJECT MATTER
A44B 18/00(2006.01)i; D03D 1/00(2006.01)i; D03D 15/00(2006.01)i; D03D 27/00(2006.01)i
FI: A44B18/00; D03D1/00 Z; D03D15/00 E; D03D27/00 A; D03D15/00 G
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; D03D1/00; D03D15/00; D03D27/00

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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.
Y	WO 2005/122817 A1 (KURARAY FASTENING CO., LTD.) 29.12.2005 (2005-12-29) paragraphs [0001]-[0099], claims, etc.	1-9
Y	JP 2018-29912 A (KURARAY FASTENING CO., LTD.) 01.03.2018 (2018-03-01) claims, paragraphs [0001]-[0062], fig. 1-4, etc.	1-9
Y	JP 58-104216 A (TEIJIN LTD.) 21.06.1983 (1983-06-21) claims, lower left column, line 14 to page 4, upper right column, lines 13, etc.	1-9
Y	WO 2007/074791 A1 (KURARAY FASTENING CO., LTD.) 05.07.2007 (2007-07-05) paragraphs [0001]-[0034], claims, fig. 1-2, etc.	2-9

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

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/043144

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 11-244010 A (YKK CORP.) 14.09.1999 (1999-09-14) claims, paragraphs [0001]-[0045], fig. 1-4, etc.	5-6, 9
Y	JP 2016-123419 A (KURARAY FASTENING CO., LTD.) 11.07.2016 (2016-07-11) claims, paragraphs [0001]-[0065], fig. 1-2, etc.	6
A	JP 2014-27988 A (KURARAY FASTENING CO., LTD.) 13.02.2014 (2014-02-13) entire text, all drawings	11-9

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2019/043144

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 2005/122817 A1	29 Dec. 2005	US 2008/0289157 A1 paragraphs [0001]-[0120], claims EP 1764009 A1 CA 2567502 A1 KR 10-2007-0024732 A CN 1968616 A TW 200608913 A	
JP 2018-29912 A	01 Mar. 2018	(Family: none)	
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JP 11-244010 A	14 Sep. 1999	US 6202264 B1 fig. 1-7, column 1, line 5 to column 13, line 31, claims DE 19908874 A1 ES 2165753 A1 CA 2567502 A1 CN 1239746 A TW 538691 U KR 10-2007-0024732 A	
JP 2016-123419 A	11 Jul. 2016	(Family: none)	
JP 2014-27988 A	13 Feb. 2014	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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