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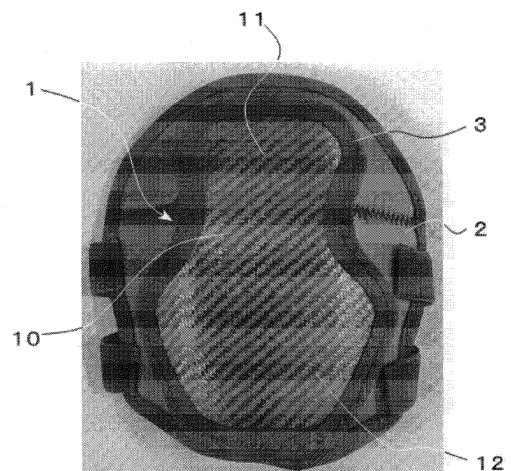
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(54) **PROTECTOR**

(57) An object of a protector according to the present invention is to provide a protector for a knee and a protector for an elbow configured to be light and durable, which is lightweight and has sufficient durability. The object is achieved by including: a protector member 1 comprising a cloth laminate in which a plurality of cloth-like bodies formed from filament bodies made of thermoplastic resin are laminated, the protector member 1 including a dish-like recessed part 10 disposed on a back surface side; a shock absorbing member 2 fixed to the dish-like recessed part 10 of the protector member 1; and a belt-shaped wrapping member 4.

FIG. 1



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Description

TECHNICAL FIELD

- 5 [0001] The present invention relates to a protector, and specifically to a protector configured to be light and durable, which is lightweight and has sufficient durability.

BACKGROUND

- 10 [0002] In the related art, as illustrated in FIG. 10, there has been developed a supporter to be put on a part of a human body such as a knee or an elbow. A supporter for a knee or a supporter for an elbow illustrated herein is a supporter that is used for light work such as gardening work (upper photo in FIG. 10) or DIY work (lower photo in FIG. 10), or for sports such as skateboarding, volleyball, or handball, but is not used for heavy work such as construction work or professional sports such as a motorcycle race or an auto race.
- 15 [0003] For example, Patent Document 1 discloses a supporter (articulation protective equipment) that includes a pad main body including a first buffer disposed on an inner side as an articulation side, and a second buffer that is disposed on an outer side of the first buffer and has higher hardness than that of the first buffer. The supporter has a substantially flat plate shape as a whole, and is put on an articulation of a human body such as a knee or an elbow.

20 PRIOR ART DOCUMENTS

PATENT DOCUMENTS

- 25 [0004] Patent Document 1: JP-A-2020-180385

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

- 30 [0005] A conventional supporter for a knee used for light work is required to be lightweight so that a wearing feeling is light and an articulation such as a knee or an elbow can easily move.
- [0006] However, if weight of the conventional supporter for a knee or supporter for an elbow is excessively reduced, sufficient durability cannot be achieved. To secure sufficient durability, the weight is increased, and lightness is impaired.
- 35 [0007] Thus, the present invention aims at providing a protector configured to be light and durable, which is lightweight and has sufficient durability.
- [0008] Furthermore, other problems of the present invention will be clear in the following description.

MEANS FOR SOLVING PROBLEM

- 40 [0009] The problems described above are solved by the following inventions.
[0010]

1. A protector comprising:

- 45 a protector member (1) comprising a cloth laminate in which a plurality of cloth-like bodies formed from filament bodies made of thermoplastic resin are laminated, the protector member (1) including a dish-like recessed part (10) disposed on a back surface side;
a shock absorbing member (2) fixed to the dish-like recessed part (10) of the protector member (1); and
50 a wrapping member (4) disposed on the protector member (1) and/or the shock absorbing member (2).

2. The protector according to 1 for protecting a movable part.

3. The protector according to 2 for protecting the movable part, the movable part being a knee or an elbow.

- 55 4. The protector according to 3, wherein

the protector member (1) includes an upper bending part (11) on an upper side in a longitudinal direction of the dish-like recessed part (10), and a lower bending part (12) on a lower side in the longitudinal direction of the dish-

like recessed part (10),
the upper bending part (11) bends toward a back surface side from the dish-like recessed part (10) toward the upper side, and the lower bending part (12) bends toward the back surface side from the dish-like recessed part (10) toward the lower side,
the upper bending part (11) and the lower bending part (12) are widened in a width direction as compared with the dish-like recessed part (10), and the lower bending part (12) has a wider shape than the upper bending part (11), and
parts of the upper bending part (11) and the lower bending part (12) close to both sides in the width direction bend toward the back surface side.

5. The protector according to any one of 1 to 4, wherein a thickness of the protector member (1) is 0.4 mm to 1.8 mm.

6. The protector according to any one of 1 to 4, wherein the cloth-like body is formed of the filament bodies that are woven, knitted, or intersected by each other.

7. The protector according to any one of 1 to 4, wherein the filament body made of thermoplastic resin has a structure in which one surface, both surfaces, or a periphery of a core material made of a high melting point thermoplastic resin component is covered by an outer layer made of a low melting point thermoplastic resin component having a melting point lower than a melting point of the core material.

8. The protector according to any one of 1 to 4, wherein an adhesive layer in which a low melting point thermoplastic resin component contains a high melting point thermoplastic resin component is disposed between the cloth-like bodies in the cloth laminate.

9. The protector according to any one of 1 to 4, wherein the shock absorbing member has a substantially elliptic shape when viewed from a front surface side of the protector member, and has a shape wider than the protector member at least in the width direction.

10. The protector according to any one of 1 to 4, wherein the cloth laminate is formed by integrating a plurality of laminated cloth-like bodies by heating and pressure bonding.

11. The protector according to any one of 1 to 4, wherein fracture limit energy in a falling weight test is equal to or larger than 3.0 J.

EFFECT OF THE INVENTION

[0011] The present invention can provide a protector configured to be light and durable, which is lightweight and has sufficient durability.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 is a front view illustrating an embodiment of a protector for a knee according to the present invention.
FIG. 2 is a back view illustrating the embodiment of the protector for a knee according to the present invention.
FIG. 3 is a diagram illustrating the embodiment of the protector for a knee according to the present invention viewed from a left diagonal front side.
FIG. 4 is a plan view illustrating the embodiment of the protector for a knee according to the present invention.
FIG. 5 is an exploded perspective view illustrating the embodiment of the protector for a knee.
FIG. 6 is a diagram illustrating a shape of a protector member, (a) is a perspective view, and (b) is a front view.
FIG. 7 is a perspective view illustrating a use state of the protector for a knee according to the embodiment.
FIG. 8 is a front view illustrating a manufacturing step of the protector for a knee according to the embodiment.
FIG. 9 is a perspective view illustrating tests for the protector for a knee according to an example.
FIG. 10 is a perspective view illustrating use states of a conventional protector for a knee.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The following describes a protector for a knee based on the drawings as an example of a preferred embodiment of

a protector according to the present invention.

[Configuration of protector for knee]

[0014] FIG. 1 is a front view illustrating the embodiment of the protector for a knee according to the present invention, FIG. 2 is a back view illustrating the embodiment of the protector for a knee according to the present invention, FIG. 3 is a diagram illustrating the embodiment of the protector for a knee according to the present invention viewed from a left diagonal front side, and FIG. 4 is a plan view illustrating the embodiment of the protector for a knee according to the present invention. FIG. 5 is an exploded perspective view illustrating the embodiment of the protector for a knee.

[0015] As illustrated in FIG. 1 to FIG. 5, the protector for a knee according to the present embodiment includes a protector member 1, and the protector member 1 has a dish-like shape as a whole when viewed from a back surface side.

[0016] The protector member 1 comprises a cloth laminate obtained by laminating a plurality of cloth-like bodies that are formed from filament bodies made of thermoplastic resin, and the cloth laminate is preferably formed such that the laminated cloth-like bodies are integrated with each other by heating and pressure bonding.

[0017] The cloth-like body is preferably formed by filament bodies made of thermoplastic resin that are woven, knitted, or intersect each other.

[0018] As illustrated in FIG. 1 to FIG. 5, the protector member 1 includes, at a part opposed to a knee of a human body, a recessed part 10 having a dish shape when viewed from the back surface side. The dish-like recessed part 10 is formed to have a projecting shape from a back surface toward a front surface when viewed from the front surface side. The dish-like recessed part 10 includes an upper bending part 11 on an upper side in a longitudinal direction, and includes a lower bending part 12 on a lower side in the longitudinal direction.

[0019] The upper bending part 11 bends toward the back surface side from the dish-like recessed part 10 toward the upper side, and the lower bending part 12 bends toward the back surface side from the dish-like recessed part 10 toward the lower side.

[0020] The upper bending part 11 and the lower bending part 12 are widened in a width direction as compared with the dish-like recessed part 10, and the lower bending part 12 has a wider shape in the width direction than the upper bending part 11.

[0021] Parts of the upper bending part 11 and the lower bending part 12 close to both sides in the width direction bend toward the back surface side.

[0022] Specifically, the protector member 1 has a daruma shape as an external appearance, the daruma shape being formed such that an upper part in an upper and lower direction (longitudinal direction) is small and a lower part is large.

[0023] In the present embodiment, a shock absorbing member 2 is fixed to the back surface side of the protector member 1.

[0024] Due to a structure of the protector member 1 the outer side of which has high rigidity, the structure in which the flexible shock absorbing member 2 is disposed between the protector member 1 and a knee of a human body, even when a hard angular object (such as a corner part of a concrete block, an edge of stairs, or an angular stone) hits the protector member 1 from the outer side, the protector member 1 is less deformed and the shock absorbing member 2 absorbs a shock, so that a pressure and shock transmitted to the knee of the human body is extremely small, and the knee is protected. It is effective in protecting the knee against a high-speed collision, or in a case in which a high pressure is applied thereto at low speed (case in which an object is slowly and strongly pressed thereagainst).

[0025] The structure in which the shock absorbing member 2 is disposed between the protector member 1 according to the present invention and a movable part of a human body such as an elbow or a shoulder exhibits an effect of protecting the movable part of the human body such as an elbow or a shoulder similarly to the knee of the human body.

[0026] The filament body made of thermoplastic resin constituting the protector member 1 has a structure in which one surface, both surfaces, or a periphery of a core material made of a high melting point thermoplastic resin component is covered by an outer layer made of a low melting point thermoplastic resin component having a melting point lower than that of the core material. In this case, for example, the filament body preferably has a core-sheath structure in which the core material made of the high melting point thermoplastic resin component is covered by an outer layer (sheath material) made of the low melting point thermoplastic resin component, or a laminated structure in which the outer layer made of the low melting point thermoplastic resin component is laminated on one surface or both surfaces of the core material (base layer) made of the high melting point thermoplastic resin component.

[0027] An adhesive film in which the low melting point thermoplastic resin component contains the high melting point thermoplastic resin component may be disposed between the cloth-like bodies constituting the protector member 1.

[0028] The thickness of the protector member 1 is preferably 0.4 mm to 1.8 mm, and more preferably 0.5 mm to 1.3 mm. Such a thickness of the protector member 1 is preferable for balancing weight reduction with high rigidity.

[0029] The shock absorbing member 2 having elasticity that is fixed to the back surface of the protector member 1 is constituted of a fabric material or a rubber material in a bag shape, houses a shock absorbing material having a shock absorbing property inside, and is configured to have a substantially elliptic shape (or a disc shape, or an oval plate shape)

as a whole.

[0030] To fix the shock absorbing member 2 to the protector member 1, as illustrated in FIG. 3, it is preferable that bias tape 3 is attached to a peripheral edge portion of the protector member 1, and the protector member 1 is sewn to the shock absorbing member 2 via the bias tape 3. Due to this, the protector member 1 and the shock absorbing member 2 can be prevented from being disassembled.

[0031] As illustrated in FIG. 5, the peripheral edge portion of the protector member 1 is sewn to the shock absorbing member 2, so that an outer shape of the shock absorbing member 2 is preferably formed to be larger than the protector member 1.

[0032] The fact that the outer shape of the shock absorbing member 2 is larger than the protector member 1 exhibits an effect of preventing the protector member 1 from shifting and projecting from the shock absorbing member 2 in a lateral direction or an upper and lower direction when a shock or pressure is applied thereto, and preventing an edge portion of the protector member 1 from being brought into contact with a human body. This is a useful effect because the protector member 1 has high rigidity, and pain may be caused if the edge portion is brought into contact with a human body.

[0033] In examples of FIG. 1 to FIG. 5, two belt-shaped wrapping members 4 are disposed on both sides of the shock absorbing member 2. The wrapping member may be disposed on the protector member 1. The shape of the wrapping member is not limited to a belt shape, but may be a string shape or a plate shape. The wrapping member preferably has a belt shape from a viewpoint of ease of fixing. The number of the wrapping members may be three or more.

[0034] It is preferable that the wrapping member 4 is constituted of a fabric material, a rubber material, or a resin material in a belt shape, and a length thereof can be adjusted. In the example illustrated in the drawing, the wrapping member 4 is sewn to the shock absorbing member 2, but the embodiment is not limited thereto. The wrapping member 4 may be attached to the shock absorbing member 2 or the protector member 1 by passing through the inside of the shock absorbing member 2 or the protector member 1.

[0035] The length of the wrapping member 4 is adjusted to match an outer circumference length of the vicinity of a knee of a leg of a user of the protector for a knee, and the wrapping member 4 holds the shock absorbing member 2 on a knee by being wrapped around the vicinity of the knee.

[0036] In a case in which the protector according to the present invention is used for a movable part other than the knee such as an elbow or a shoulder, the length of the wrapping member 4 is adjusted to match an outer circumference length of the movable part such as an elbow or a shoulder for which the protector is used, and the shock absorbing member 2 can be held on the movable part by the wrapping member 4 wrapped around the movable part.

[0037] An attachment position of the wrapping member 4 for the protector member 1 or the shock absorbing member 2 is not limited so long as performance is not impaired.

[Shape of protector member]

[0038] FIG. 6 is a diagram illustrating the shape of the protector member 1, FIG. 6(a) is a perspective view, and FIG. 6(b) is a front view.

[0039] Regarding the shape of the protector member 1, more specifically, as illustrated in FIG. 6(a), a radius of curvature RV of a vertical section from the upper bending part 11 to the lower bending part 12 centered on a center point C is about 200 mm to 300 mm.

[0040] Radii of curvature RH_{11} and RH_{12} of a front surface and a back surface in transverse sections of the upper bending part 11 and the lower bending part 12 are about 200 mm to 300 mm, and it is preferable that the radii of curvature RH_{11} and RH_{12} are the same, or RH_{12} is larger (gentle curvature).

[0041] The upper bending part 11 is present on an upper side of the dish-like recessed part 10 including the center point C corresponding to an apex part of a kneecap, and corresponds to both front sides of a lower part of a femur. Thus, to favorably hold the round kneecap and the lower part of the femur, the radius of curvature RH_{11} is preferably small (strong curvature).

[0042] The lower bending part 12 is present on a lower side of the dish-like recessed part 10 including the center point C, and corresponds to both front sides of upper parts of a neckbone and a fibula. Thus, to run along the upper parts of the neckbone and the fibula having a substantially linear shape, the radius of curvature RH_{12} is preferably large (gentle curvature).

[0043] Next, as illustrated in FIG. 6(b), the protector member 1 is formed in a vertically long shape with a vertical length L1 larger than a width W1. The vertical length L1 is preferably about 150 mm to 200 mm, and the width W1 (of a portion having a maximum width) is preferably about 100 mm to 150 mm.

[0044] The upper bending part 11 and the lower bending part 12 viewed from the front surface side are widened in a width direction as compared with the dish-like recessed part 10. A peripheral edge is configured by a continuous smooth curve over the entire circumference, and a symmetric shape is achieved. The upper bending part 11 and the lower bending part 12 may be formed to bend more inward than the center part by causing the radii of curvature RH_{11} and RH_{12} of the front surface and the back surface in the transverse section to be slightly smaller than those described above.

[0045] As illustrated in FIG. 6(a), the dish-like recessed part 10 including the center point C corresponds to the apex part of the kneecap, the upper bending part 11 corresponds to both front sides of the lower part of the femur, and the lower bending part 12 corresponds to both front sides of the upper parts of the fibula and the neckbone, and a neckbone tuberosity. The upper bending part 11 covers both front sides of the lower part of the femur. The lower bending part 12 covers both front sides of the upper parts of the neckbone and the fibula, and the neckbone tuberosity. By forming the upper and the lower bending parts 12 to bend more inward than the center part, the lower part of the femur and the upper parts of the neckbone and the fibula can be more strongly held.

[0046] Regarding positions and sizes of the upper bending part 11 and the lower bending part 12, as illustrated in FIG. 6(b), a length L2 from a lower end to a lateral apex A of the upper bending part 11 is about 130 mm to 170 mm, a length L3 from the lower end to a narrowest part B of the dish-like recessed part 10 is about 100 mm to 140 mm, a length L4 from the lower end to a lateral apex D (portion having the maximum width) of the lower bending part 12 is about 50 mm to 70 mm, a width (portion having the maximum width) W1 between both lateral apexes D-D of the lower bending part 12 is about 100 mm to 150 mm, a width W2 between both lateral apexes AA of the upper bending part 11 is about 70 mm to 110 mm, and a width W3 of the narrowest part B-B in the width direction of the dish-like recessed part 10 between the upper bending part 11 and the lower bending part 12 is about 50 mm to 90 mm.

[Shape of shock absorbing member]

[0047] The shape of the shock absorbing member 2 may be the same as that of the protector member 1, but is preferably larger than the peripheral edge of the protector member 1 over the entire circumference, for example, about 5 mm to 25 mm larger outward as illustrated in FIG. 1 so that, when a shock or pressure is applied thereto, the protector member 1 is prevented from shifting and projecting in the lateral direction or the upper and lower direction.

[0048] The thickness of the shock absorbing member 2 is preferably about 15 mm to 25 mm.

[0049] The shock absorbing member 2 may be configured in a substantially elliptic shape (or a disk shape, or an oval plate shape) as a whole. The substantially elliptic shape is preferable because it can be easily made.

[Use state]

[0050] FIG. 7 is a perspective view illustrating a use state of the protector for a knee according to the embodiment, FIG. 7(a) is a front view of the knee in a stretched state, FIG. 7(b) is a side view of the knee in a stretched state, and FIG. 7(c) is a side view of the knee in a bent state.

[0051] As illustrated in FIG. 7(a), FIG. 7(b), and FIG. 7(c), the protector for a knee can be used by adjusting the length of the wrapping member 4 to match the outer circumference length of the vicinity of the knee of the leg of the user of the protector for a knee, wrapping it around the vicinity of the knee, and holding the shock absorbing member 2 on the knee.

[0052] The protector member according to the present invention is not only used for the protector for a knee described in the embodiment, but can also be used for a protector for protecting a movable part such as a protector for an elbow and a protector for a shoulder.

[Manufacturing method for protector member]

[0053] The following describes a manufacturing method for the protector member 1 according to the present embodiment.

[0054] FIG. 8 is a diagram illustrating a product manufactured by a manufacturing step for the protector for a knee according to the embodiment, FIG. 8(a) is a diagram illustrating a cloth laminate 1a, FIG. 8(b) is a diagram illustrating the protector member 1 obtained by cutting out and molding the cloth laminate 1a, and FIG. 8(c) is a diagram illustrating the protector for a knee according to the present embodiment.

[0055] The cloth laminate 1a constituting the protector member 1 is formed by forming a cloth-like body having a sheet shape with a filament body obtained by stretching thermoplastic resin (cloth-like body forming step), laminating a plurality of the cloth-like bodies (laminating step), heating and compressing them (heating and pressure bonding step), and cooling and compressing them (cooling and compressing step) to be integrated with each other. At the heating and pressure bonding step, heating and pressure bonding is preferably performed so that part of the filament body is melted.

[0056] In the following, the manufacturing method for the protector for a knee is described while exemplifying a case in which the cloth-like body is formed by weaving the filament body.

[0057] The cloth laminate 1a is called self reinforced plastics (SRP), which is fiber reinforced plastics (FRP) in which an adhesive component and a reinforced fiber are formed from the same type of thermoplastic resin. The same type of thermoplastic resin indicates resin constituted of the same type of component such as polyolefin, polyamide, and polyester.

(1) Cloth-like body forming step

[0058] As illustrated in FIG. 8(a), the cloth-like body constituting the cloth laminate 1a is formed.

[0059] The cloth-like body is formed by weaving the filament body made of thermoplastic resin. This filament body is a portion to be a reinforced fiber when a laminate is formed.

[0060] As thermoplastic resin constituting the filament body made of thermoplastic resin, resin having a large stretching effect, typically crystalline resin, is used. Specifically, an olefin-based polymer such as high-density polyethylene, high-pressure low-density polyethylene, polypropylene, and an ethylene-propylene block copolymer, polyester such as polyethylene terephthalate and polybutylene terephthalate, polyamide such as nylon 6 and nylon 66, and the like can be used. Among them, in view of processability, economic efficiency, and smallness of specific gravity, an olefin-based polymer such as high-density polyethylene, high-pressure low-density polyethylene, and polypropylene is preferred.

[0061] The filament body made of thermoplastic resin may be optional so long as the cloth-like body can be formed. For example, tape, yarn, split yarn, a monofilament, a multifilament, and the like can be used. These filament bodies made of thermoplastic resin are thrown as needed, but flat filament bodies such as tape or yarn are preferable. Particularly, flat yarn as a tape-like filament body is preferably used.

[0062] The filament body made of thermoplastic resin preferably contains a low melting point thermoplastic resin component and a high melting point thermoplastic resin component. At the time of heating at the heating and pressure bonding step, by performing heating at a heating temperature at which the low melting point thermoplastic resin component is melted and the high melting point thermoplastic resin component is not melted, the low melting point thermoplastic resin component is melted to be an adhesive component, and the high melting point thermoplastic resin component is not melted and becomes a reinforced fiber.

[0063] It is preferable that the filament body made of thermoplastic resin is configured by the high melting point thermoplastic resin component the melting point of which is higher than a temperature of heating and pressure bonding as the core material, and one surface, both surfaces, or a periphery of the core material is covered by the outer layer made of the low melting point thermoplastic resin component the melting point of which is lower than the heating temperature. In a case in which the outer layer is formed on one surface or both surfaces of the core material, the filament body having a laminated structure is obtained. In a case in which the outer layer is formed on the periphery of the core material, the filament body having a core-sheath structure is obtained.

[0064] For example, as means for manufacturing the filament body having the laminated structure made of stretched thermoplastic resin, for example, uniaxial stretching can be employed. In this case, after a film to be the core material is stretched in a uniaxial direction, the low melting point thermoplastic resin component to be an outer layer film may be laminated on one surface or both surfaces, and this may be slit in a tape shape. Alternatively, before a laminated film in which the core material and the outer layer are laminated is slit, or after the laminated film is slit, this may be stretched in the uniaxial direction to obtain the filament body. The stretching method is not particularly limited, and stretching can be performed by one-step or multi-step stretching using a known heating method such as a heat roll, a hot plate, a hot-blast stove, hot water, hot oil, steam, and infrared radiation.

[0065] When the laminated structure in which the outer layer is formed on one surface or both surfaces of the core material is used as the filament body, means for molding a lamination film as a molding material thereof can be appropriately selected from known means such as (1) means for previously forming a film to be the core material and a film to be the outer layer, and causing them to be multilayered using a dry laminating method or a heat laminating method, (2) a method of coating a surface of the film to be the core material with thermoplastic resin to be the outer layer, (3) a method of extrusion laminating thermoplastic resin to be the outer layer on the previously formed film to be the core material, and (4) a method of performing extrusion forming as a lamination film using a multilayer coextrusion method.

[0066] The thickness of the filament body can be appropriately selected. Typically, the thickness preferably falls within a range from 1 to 10000 dtex (dt).

[0067] To the filament body made of thermoplastic resin, for example, various kinds of additives including an organic antibacterial agent, an inorganic antibacterial agent such as a metal ion-based agent, and the like can be added.

[0068] The cloth-like body is a sheet-like body formed by using the filament body made of thermoplastic resin. Examples of the cloth-like body include woven fabric that is woven by using the filament body made of thermoplastic resin as warp and weft.

[0069] Alternatively, cross-bonded cloth (soft cloth) may be made by arranging a large number of filament bodies made of thermoplastic resin side by side in one direction, arranging a large number of filament bodies made of thermoplastic resin side by side thereon to intersect them in an optional angle direction, and bonding intersection points thereof by using an adhesive agent such as a hot melt agent or by heat sealing. Alternatively, a multi-axial fiber base material may be made by arranging a large number of filament bodies made of thermoplastic resin side by side in one direction, and arranging a large number of filament bodies made of thermoplastic resin side by side thereon to intersect them in an optional angle direction to be coupled with each other by stitching yarn. Furthermore, the cloth-like body may be knit obtained by knitting the filament bodies.

(2) Laminating step

[0070] The obtained cloth-like bodies are laminated to form a laminated product. The laminated product is a cloth laminate before being heated and compressed. The number of the cloth-like bodies laminated to be the laminated product is not limited so long as it is multiple.

[0071] At the laminating step, an adhesive film made of thermoplastic resin is preferably interposed between the cloth-like bodies for adhesion between the cloth-like bodies.

[0072] The adhesive film is disposed between the cloth-like bodies to make the laminated product together with the laminated cloth-like bodies, and becomes an adhesive layer of the cloth laminate when the laminated product is subjected to heating and pressure bonding at the "heating and pressure bonding step" (described later).

[0073] The adhesive film is constituted of thermoplastic resin. It is preferable to use the low melting point thermoplastic resin component containing the high melting point thermoplastic resin component as the thermoplastic resin in causing the adhesive layer of the cloth laminate after being heated and compressed to function as a rigidity improving layer. In the present specification, the "melting point" means a temperature that is measured by differential scanning calorimetry (DSC measurement) as a melting peak temperature. Thus, it can be said that the melting peak temperature of the high melting point thermoplastic resin component is higher than that of the low melting point thermoplastic resin component. The adhesive film exhibits two melting peak temperatures derived from these resins.

[0074] In the present embodiment, in the thermoplastic resin constituting the adhesive film, the low melting point thermoplastic resin component does not necessarily contain the high melting point thermoplastic resin component.

[0075] Examples of the low melting point thermoplastic resin component of the thermoplastic resin used for the adhesive film preferably include polyolefin such as polypropylene and polyethylene, polyester such as polyethylene terephthalate, and the like. Among them, polyolefin is preferred, and polypropylene is more preferred. In a case in which the low melting point thermoplastic resin component does not contain the high melting point thermoplastic resin component in the adhesive film, and the low melting point thermoplastic resin component is selected from polypropylene, the melting point thereof is preferably lower than the melting point of the filament body constituted of the thermoplastic resin component. In a case in which the filament body contains the high melting point thermoplastic resin component and the low melting point thermoplastic resin component, the melting point is preferably substantially the same as or lower than the melting point of the low melting point thermoplastic resin component of the filament body.

[0076] In a case in which the low melting point thermoplastic resin component of the thermoplastic resin used for the adhesive film contains the high melting point thermoplastic resin component of the thermoplastic resin, the high melting point thermoplastic resin component may have a higher melting point than that of the low melting point thermoplastic resin component. Examples thereof preferably include polyolefin such as polypropylene and polyethylene, polyester such as polyethylene terephthalate, and the like. Among them, polypropylene is particularly preferred.

[0077] In a case in which each of the low melting point thermoplastic resin component and the high melting point thermoplastic resin component of the thermoplastic resin used for the adhesive film is selected from polypropylene, for example, random polypropylene can be used as the low melting point thermoplastic resin component, and homopolypropylene can be used as the high melting point thermoplastic resin component.

[0078] The random polypropylene is obtained when propylene as a monomer component and α -olefin (for example, α -olefin other than propylene such as ethylene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene, 1-heptene, and 1-octene) are randomly copolymerized. The α -olefin can be used at a ratio preferably equal to or lower than 20% by weight, more preferably equal to or lower than 10% by weight with respect to all monomer components, for example. The ratio of the α -olefin can be adjusted to exhibit a desired melting point.

[0079] As another aspect of the case in which each of the low melting point thermoplastic resin component and the high melting point thermoplastic resin component of the thermoplastic resin used for the adhesive film is selected from polypropylene, random polypropylene having a relatively low melting point can be used as the low melting point thermoplastic resin component, and random polypropylene having a relatively high melting point can be used as the high melting point thermoplastic resin component.

[0080] As described above, the melting point of the random polypropylene can be set by adjusting the ratio of the α -olefin, for example. Specifically, for example, random polypropylene containing a smaller ratio of α -olefin than the random polypropylene used as the low melting point thermoplastic resin component can be used as the high melting point thermoplastic resin component.

[0081] The adhesive film can be formed by kneading pellets of the low melting point thermoplastic resin component and pellets of the high melting point thermoplastic resin component at a temperature equal to or higher than melting points of both thermoplastic resins, and performing inflation molding thereon.

[0082] In the adhesive film, the content of the high melting point thermoplastic resin component preferably falls within a range from 5% by weight to 50% by weight, and more preferably falls within a range from 10% by weight to 30% by weight, for example.

[0083] Furthermore, in the adhesive film, a weight ratio between the low melting point thermoplastic resin component

and the high melting point thermoplastic resin component preferably falls within a range from 5:95 to 50:50, and more preferably falls within a range from 10:90 to 30:70.

[0084] The thickness of the adhesive film is not limited because it can be appropriately set corresponding to the thickness of the cloth-like body, the thickness of the filament body constituting the cloth-like body, and the like, but preferably falls within a range from 10 μm to 100 μm , and more preferably falls within a range from 20 μm to 60 μm .

[0085] Various kinds of additives can be added to the filament body or the adhesive film depending on purposes. Specifically, examples of additives include: an antioxidant such as organophosphorus-based or thioether-based antioxidant; a light stabilizer such as a hindered amine-based light stabilizer; an ultraviolet absorber such as a benzophenone-based, benzotriazole-based, or benzoate-based ultraviolet absorber; an antistatic agent; a dispersant such as a bisamide-based, wax-based, or organometallic salt-based dispersant; a lubricant such as an amide-based or organometallic salt-based lubricant; a flame retardant such as a bromine-containing organic, phosphoric acid-based, or melamine cyanurate-based flame retardant, or antimony trioxide; a stretching aid such as low-density polyethylene and linear low-density polyethylene; an organic pigment; an inorganic pigment; an inorganic filler; an organic filler; and an inorganic antibacterial agent such as a metal ion-based antibacterial agent or an organic antibacterial agent.

[0086] In the present embodiment, nonwoven fabric can be used instead of the adhesive film described above. The nonwoven fabric can be formed by kneading pellets of the low melting point thermoplastic resin component and pellets of the high melting point thermoplastic resin component at a temperature equal to or higher than the melting points of both thermoplastic resins, and using a method for forming fleece such as spunbonding or melt-blowing, or using thermal bonding, chemical bonding, needle punching, a spun-lace fleece bonding method, and the like. An adhesive agent may also be used. The nonwoven fabric and the adhesive agent used for bonding the cloth-like bodies become an adhesive layer through the heating and pressure bonding step (described later).

[0087] In the cloth laminate according to the present embodiment, part of the laminated cloth-like bodies may be replaced with resin sheets. In this case, it is preferable that the cloth-like bodies are laminated on the front surface side, and the resin sheets are laminated on portions other than the front surface side.

[0088] The resin sheet is constituted of thermoplastic resin. The thermoplastic resin constituting the resin sheet is preferably polyolefin-based resin such as polypropylene and polyethylene, for example, but polyester such as polyethylene terephthalate can also be used.

[0089] In the present embodiment, in a case of using two resin sheets, for example, it is preferable that the laminated structure may be made in order of "the cloth-like body/the resin sheet/the resin sheet/the cloth-like body" so that the cloth-like body is disposed on the outer layer. In this case, the resin sheets are laminated to be adjacent to each other, so that the adhesive film is preferably used between the resin sheets.

(3) Heating and pressure bonding step

[0090] The laminated cloth-like bodies are integrated by heating and pressure bonding to be the cloth laminate 1a. A specific manufacturing method for heating and compressing is not particularly limited. For example, a hot press machine such as a hydraulic press machine, a roll press machine, or a double-belt press machine can be used.

[0091] In heating and pressure bonding, in a case in which the filament body or the adhesive film contains the high melting point thermoplastic resin component and the low melting point thermoplastic resin component, heating is performed to a temperature equal to or higher than the melting point of the low melting point thermoplastic resin component of the adhesive film and lower than the melting point of the high melting point thermoplastic resin component, and pressure bonding is performed. Subsequently, cooling is performed.

[0092] In a case in which the filament body made of thermoplastic resin contains the low melting point thermoplastic resin component and the high melting point thermoplastic resin component, the adhesive component contains the low melting point thermoplastic resin component and the low melting point thermoplastic resin component of the adhesive film, and the adhesive component can be increased by performing heating and compressing at the heating and pressure bonding step (described later), so that bonding strength can be further enhanced. When the adhesive film is disposed between the cloth-like body and the cloth-like body and subjected to heating and pressure bonding, it becomes the adhesive layer that bonds the cloth-like body and the cloth-like body.

[0093] The adhesive layer has a function as a rigidity improving layer that improves rigidity of the cloth laminate to be obtained.

[0094] Through these steps, the cloth laminate 1a excellent in rigidity can be obtained.

[0095] A pressure of the heating and pressure bonding is not particularly limited, and can be appropriately set corresponding to thicknesses of respective layers and the like. For example, the pressure preferably falls within a range from 0.5 MPa to 20 MPa, and more preferably falls within a range from 2 MPa to 15 MPa.

[0096] Time for the heating and pressure bonding is not particularly limited so long as the heating and pressure bonding can be performed, but preferably falls within a range from 1 minute to 20 minutes, for example.

(4) Cooling and compressing step

[0097] Cooling after the heating and pressure bonding may be natural radiative cooling or forced cooling. In a case of forced cooling, it is possible to employ a method of lowering the temperature to a cooling temperature while maintaining a pressure-bonded state at the time of heating and pressure bonding. In this case, a method of cold pressing can be employed.

[0098] A pressure of the cold pressing is not particularly limited, and can be appropriately set corresponding to thicknesses of respective layers and the like. For example, the pressure preferably falls within a range from 0.5 MPa to 20 MPa, and more preferably falls within a range from 2 MPa to 15 MPa.

[0099] Cooling time is not particularly limited so long as cooling can be performed, but preferably falls within a range from 10 seconds to 20 minutes, for example.

[0100] The cloth laminate 1a subjected to heating and pressure bonding as described above is excellent in rigidity. It has been confirmed, by a test, that higher rigidity can be exhibited due to the high melting point thermoplastic resin component compounded in the adhesive layer. Herein, "rigidity is high" means that, more specifically, a flexural modulus (MPa) that is measured conforming to JIS K 7171:2008 is high, for example.

[0101] As the reason why the cloth laminate 1a is excellent in rigidity, it is estimated that a crystalline state of the resin is improved due to the high melting point thermoplastic resin component that is not melted, or even if it is melted, a very small amount thereof is melted, at the time of heating and pressure bonding.

[0102] More specifically, it is estimated that the unmelted high melting point thermoplastic resin component functions as a crystal nucleating agent when the melted low melting point thermoplastic resin component is recrystallized, and a crystalline state appropriate for giving rigidity to the cloth laminate 1a is formed.

[0103] The present inventors have performed DSC measurement on the resin in which the low melting point thermoplastic resin component contains the high melting point thermoplastic resin component, and confirmed that a crystallization temperature is improved as compared with resin with which the high melting point thermoplastic resin component is not compounded.

[0104] The thickness of the cloth laminate 1a is preferably equal to or smaller than 2.5 mm, more preferably about 0.4 mm to 1.8 mm, and even more preferably about 0.5 mm to 1.3 mm. The thickness of the cloth laminate 1a is a thickness including the adhesive film in a case of using the adhesive film. By causing the cloth laminate 1a to have such a thickness, balance between weight reduction and enhancement of rigidity of the protector member 1 can be further improved.

[0105] In a case of using the resin sheet in forming the cloth laminate 1a, the thickness of the resin sheet may be the same as that of the cloth-like body, or may be thicker than the cloth-like body. In a case of using the resin sheet having a thickness thicker than the cloth-like body, the thickness of the cloth laminate 1a is preferably caused to be equal to or smaller than 2.5 mm, and more preferably caused to be 0.4 mm to 1.8 mm as a whole by reducing the thickness of the cloth-like body. It is possible to obtain the cloth laminate 1a in which the number of the cloth-like bodies, which are more complex to be manufactured than the resin sheet, is reduced while the entire thickness is not changed, the rigidity thereof bears comparison with that of the cloth laminate 1a including only the cloth-like bodies, and the cloth laminate 1a using the resin sheet can be obtained by reducing the thickness of the cloth-like bodies themselves.

(5) Protector member molding step

[0106] As illustrated in FIG. 8(b), the cloth laminate 1a is cut to have a desired size and shape. Cutting may be punching performed by using a die. The cloth laminate 1a having the desired size and shape is molded in a dish shape, by heating and compressing, to be the protector member 1. The heating and compressing can be performed by using a press die.

[0107] The protector member 1 may be formed such that, after forming the cloth laminate 1a, the cloth laminate 1a is subjected to hot press molding with a press die having a desired shape to form a plurality of the protector members 1, and an unnecessary region of each of the protector members 1 is cut. Alternatively, the protector member 1 may be formed such that, after cutting the cloth laminate 1a to have a size corresponding to one protector member 1, hot press processing is performed thereon with a press die having a shape corresponding to one protector member 1, and an unnecessary region is cut thereafter.

[0108] Furthermore, the protector member 1 may be formed such that, after forming the cloth laminate 1a, the cloth laminate 1a is heated to be curved in a desired shape, and cooled in a state of being curved in the desired shape.

[0109] As described above, the protector member 1 is formed in a dish shape along the shape of the vicinity of the knee of the human body, the upper side and the lower side thereof are widened when viewed from a projecting part on the front surface side (dish-like recessed part 10), and the lower side is wider than the upper side.

[0110] The protector according to the present invention can be used for protecting a movable part. Thus, the protector according to the present invention is not limited to the protector for a knee described in the embodiment, but can be used for a movable part of a human body such as an elbow or a shoulder. In this case, the protector can be formed in a dish shape along a shape of the vicinity of the movable part of the human body such as the vicinity of the elbow or the vicinity of the

knee.

[Shock absorbing member fixing step]

[0111] As illustrated in FIG. 8(c), the shock absorbing member 2 is fixed to the protector member 1. Specifically, it is preferable that the bias tape 3 is attached to the peripheral edge portion of the protector member 1 to be sewn to the shock absorbing member 2.

[0112] As described above, the shock absorbing member 2 has a substantially elliptic shape when viewed from the front surface side of the protector member 1, and has a shape wider than the protector member 1.

[0113] As a shock absorbing material constituting the shock absorbing member 2, a foam material (foam) or a plate material made of synthetic resin, an elastomer, rubber, and the like can be used.

[0114] Examples of the synthetic resin include: olefin-based resin such as polyethylene (PE) and ethylene-vinyl acetate copolymer resin (EVA resin); urethane-based resin such as polyurethane; styrene resin such as polystyrene (PS), acrylonitrile-styrene copolymer resin (AS resin), and acrylonitrile-butadiene-styrene copolymer resin (ABS resin); and polyvinyl chloride (PVC).

[0115] As the elastomer, a relatively soft thermoplastic elastomer can be used, and examples thereof include: an ethylene-vinyl acetate copolymer-based elastomer; a styrene-based elastomer such as a styrene ethylene butylene styrene block copolymer (SEBS); an olefin-based elastomer; an urethane-based elastomer; an ester-based elastomer; a fluorine-based elastomer; and a silicone-based elastomer.

[0116] Examples of the rubber include: diene-based rubber such as natural rubber (NR), isoprene rubber (IR), and butadiene rubber (BR); diene-based copolymer rubber such as styrene butadiene copolymer rubber (SBR) and acrylonitrile butadiene rubber (NBR); and non-diene-based rubber such as ethylene propylene diene-based rubber (EPDM), butyl rubber (IIR), and urethane-based rubber.

[0117] One type of these materials can be singly used, or two or more types thereof can be used together.

[0118] The shock absorbing material 2 may further include a front cloth or a back cloth. For example, polyurethane synthetic leather can be used as the front cloth, and polyester can be used as the back cloth. The front cloth and the back cloth included in the shock absorbing material are not limited thereto as long as they do not impair the effect of the shock absorbing material.

[0119] The wrapping member 4 is disposed on the shock absorbing member 2. The wrapping member 4 is configured in a belt shape with a fabric material or a rubber material, and has a structure in which the length can be adjusted. The wrapping member 4 can be attached to the shock absorbing member 2 by being sewn thereto.

[0120] Total weight of the protector according to the present invention is preferably equal to or smaller than 90.0 g, more preferably equal to or smaller than 75.0 g, and even more preferably equal to or smaller than 65.0 g. Due to this, a user hardly feels fatigue when wearing the protector.

[0121] In a falling weight test of the protector constituted of the cloth laminate used for the protector according to the present invention, fracture limit energy is preferably equal to or larger than 3.0 J, and more preferably equal to or larger than 4.5 J. The fracture limit energy per thickness of the protector member is preferably equal to or larger than 5.0 J/mm. Due to this, the knee can be protected against a shock from the outside.

[0122] Herein, to obtain the fracture limit energy, for example, a Du Point (registered trademark) impact tester (conforming to JIS K 5600-5-3) manufactured by TESTER SANGYO CO., LTD. is used. A striker in which R of a front end shape is 4.76 is put onto a sample of 10 cm square, and a weight is freely fallen with an optional load from an optional height to obtain energy with which the striker penetrates the sample (fracture limit energy).

[0123] For example, when the weight with a load of 1 kg is used, and the height for falling is 5 cm to 100 cm (5 cm intervals), the fracture limit energy can be obtained by converting the load and the height at the time of penetration into an energy value. In this case, when the striker does not penetrate the sample even with the load of 1 kg and the height of 100 cm, the fracture limit energy can be obtained by increasing the load to 2 kg (in increments of 1 kg) and changing the height as described above.

[Examples]

[0124] The following describes examples of the present invention, but the present invention is not limited by the examples.

1. Manufacture of protector for knee

(Example 1)

<Making cloth-like body>

[0125] By using polypropylene (MFR = 0.4 g/10 min, weight-average molecular weight M_w = 630,000, melting point 164°C) as a high melting point thermoplastic resin component and a propylene-ethylene random copolymer (MFR = 7.0 g/10 min, weight-average molecular weight M_w = 220,000, melting point 125°C) as a low melting point thermoplastic resin component, a three-layer film (layer thickness ratio 1/8/1) having a laminated structure including the low melting point thermoplastic resin component as both outer layers and the high melting point thermoplastic resin component as a core material was obtained by using an inflation molding method.

[0126] The high melting point thermoplastic resin component (polypropylene) and the low melting point thermoplastic resin component (propylene-ethylene random copolymer) are both polyolefin, and are the same type of thermoplastic resin.

[0127] The obtained film was slit by a razor. Subsequently, the film was stretched to be seven times larger on a hot plate at a temperature of 110 to 120°C, and subjected to relaxation heat treatment of 10% in a hot air circulating-type oven at a temperature of 145°C to obtain flat yarn with a yarn width of 4.5 mm and fineness of 1700 dt.

[0128] By weaving the obtained flat yarn to be a twill weave with 15 warps/25.4 mm and 15 wefts/25.4 mm using a Sulzer weaving machine, a cloth-like body with a thickness of 0.3 mm was obtained.

<Making adhesive film>

[0129] On the other hand, by mixing propylene-ethylene random copolymer (MFR = 7.0 g/10 min, weight-average molecular weight M_w = 220,000, melting peak temperature 125°C) as the low melting point resin component and polypropylene (MFR = 1.9 g/10 min, weight-average molecular weight M_w = 500,000, melting peak temperature 161°C) as the high melting point resin component at a weight ratio of "low melting point resin component: high melting point resin component = 80:20", an adhesive film was obtained by the inflation molding method.

<Heating and pressure bonding/cooling>

[0130] Obtained two cloth-like bodies were laminated via the adhesive film. A laminated product in which "the cloth-like body/the adhesive film/the cloth-like body" were alternately laminated in order was obtained.

[0131] The obtained laminated product was integrated by being hot-pressed with a press temperature of 150°C and a pressure of 4 MPa for 2 minutes by a hydraulic press machine, and cold-pressed with a press temperature of 20°C and a pressure of 4 MPa for 2 minutes by the hydraulic press machine to obtain a cloth laminate having a thickness of 0.6 mm and including "the cloth-like body/the adhesive layer/the cloth-like body".

[0132] At the time of hot pressing, when actual temperatures of an upper press surface and a lower press surface of the hydraulic press machine were measured by using "ST-41" manufactured by RKC Instrument Inc., the upper press surface was 150.6°C and the lower press surface was 150.3°C.

[0133] This cloth laminate was cut, heated, and cooled in a state of being set in a dedicated jig to be shaped, and a protector member having a weight of 47.6 g was obtained.

<Attaching parts>

[0134] A shock absorbing member was sewn to the protector member, and a wrapping member was attached to the shock absorbing member to obtain a protector for a knee. The weight of the protector for a knee was 55.1 g.

[0135] A falling weight test (puncture resistance test) and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1.

(Example 2)

[0136] Similarly to Example 1 except that three cloth-like bodies were used and lamination was performed in order of "the cloth-like body/the adhesive film/the cloth-like body/the adhesive film/the cloth-like body", the cloth laminate having a thickness of 0.9 mm was obtained, and the protector member having a weight of 52.8 g was obtained. The shock absorbing member was sewn to the protector member and the wrapping member was attached thereto to obtain the protector for a knee. The weight of the protector for a knee was 60.3 g.

[0137] A falling weight test (puncture resistance test), an abrasion resistance test, and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1 and Table 2.

(Example 3)

[0138] Similarly to Example 1 except that four cloth-like bodies were used and lamination was performed in order of "the cloth-like body/the adhesive film/the cloth-like body/the adhesive film/the cloth-like body/the adhesive film/the cloth-like body", the cloth laminate having a thickness of 1.2 mm was obtained, and the protector member having a weight of 56.1 g was obtained. The shock absorbing member was sewn to the protector member and the wrapping member was attached thereto to obtain the protector for a knee. The weight of the protector for a knee was 63.6 g.

[0139] A falling weight test (puncture resistance test) and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1.

(Comparative example 1)

[0140] By using three PP sheets having a thickness of 250 μm in place of the cloth-like bodies in Example 1, and laminating them in order of "the PP sheet/the adhesive film/the PP sheet/the adhesive film/the PP sheet" with the adhesive film between the PP sheets, laminated PP sheets were obtained.

[0141] By heating and compressing the laminated PP sheets similarly to Example 1, a plate-shaped PP plate including "the PP sheet/the adhesive layer/the PP sheet/the adhesive layer/the PP sheet" was obtained.

[0142] The thickness of the PP plate was 0.9 mm (the thickness of each of the adhesive layers was 55 μm).

[0143] The obtained PP plate was caused to have the same shape (weight 53.4 g) as that of the protector member in Example 1, the same shock absorbing member as that in Example 1 was sewn thereto, and the wrapping member was attached thereto to be the protector for a knee. The weight of the protector for a knee was 60.9 g.

[0144] A falling weight test (puncture resistance test) and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1.

(Comparative example 2)

[0145] Four PP sheets similar to those in Comparative example 1 were used to obtain the PP plate having a thickness of 2.0 mm.

[0146] The obtained PP plate was caused to have the same shape (weight 69.9 g) as that of the protector member in Example 1, the same shock absorbing member as that in Example 1 was sewn thereto, and the wrapping member was attached thereto to be the protector for a knee. The weight of the protector for a knee was 77.4 g.

[0147] A falling weight test (puncture resistance test) and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1.

(Comparative example 3)

[0148] Five PP sheets similar to those in Comparative example 1 were used to obtain the PP plate having a thickness of 3.0 mm.

[0149] The obtained PP plate was caused to have the same shape (weight 84.8 g) as that of the protector member in Example 1, the same shock absorbing member as that in Example 1 was sewn thereto, and the wrapping member was attached thereto to be the protector for a knee. The weight of the protector for a knee was 92.3 g.

[0150] A falling weight test (puncture resistance test) and sensory evaluation were performed for the obtained protector for a knee, and results thereof were indicated in Table 1.

(Product of Company A)

[0151] A falling weight test (puncture resistance test), an abrasion resistance test, and workability evaluation (sensory evaluation) were performed for a protector for a knee manufactured by Company A, and results thereof were indicated in Table 2. The weight of the protector for a knee manufactured by Company A was 53.0 g.

2. Evaluation method

[0152] Test pieces of 10 cm square were created from the cloth laminates in the respective examples and the PP plates in the comparative examples, and the following falling weight test was performed.

[0153] In the falling weight test (puncture resistance test) in Table 1, a dupont impact tester (conforming to JIS K 5600-5-3) manufactured by TESTER SANGYO CO., LTD. was used, and a striker with a predetermined load in which R of a front end shape is 4.76 is freely fallen from a predetermined height to measure fracture limit energy (penetration energy) (J).

[0154] In Table 1, the fracture limit energy per material thickness (J/mm) was calculated.

[0155] The weight in Table 1 includes weights of subsidiary materials (such as the shock absorbing member and the wrapping member).

[0156] In the sensory evaluation in Table 1, mobility means mobility at the time when a user wears the protector for a knee and performs bending motion 10 times. Herein, ◦ indicates "easy to move", Δ indicates "slightly difficult to move", and × indicates "difficult to move". Fatigue resistance means fatigue resistance at the time when the user wears the protector for 1 hour. Herein, ◦ indicates "hardly feel fatigue", Δ indicates "slightly easy to feel fatigue", and × indicates "easy to feel fatigue". Fit feeling is a degree of pain caused by contact between an end part of the protector for a knee and a human body. Herein, ◦ indicates "small pain", Δ indicates "medium pain", and × indicates "large pain". These were represented as scores assuming that ◦:10, Δ:5, and ×:1, and average values of the number of samples $n = 5$ was calculated and summed.

[0157] FIG. 7 is a perspective view illustrating tests for the protector for a knee according to the example.

[0158] In the falling weight test (puncture resistance test) in Table 1, as illustrated in FIG. 7 (a), a 60° conical adapter was attached to a force gauge, force of 5 kgf was applied to the sample, and a degree of deformation (presence/absence of penetration) of the sample was evaluated.

[0159] In the abrasion resistance test in Table 2, as illustrated in FIG. 7 (b), after the sample was scratched by an awl 10 times, a degree of deformation of the sample (presence/absence of a scratch or rip) was evaluated.

[0160] In the workability evaluation (sensory evaluation) in Table 2, whether the workability is good or bad was evaluated in a state in which the user wears the protector for a knee.

[0161] The falling weight test (puncture resistance test) and the sensory evaluation (mobility, fatigue resistance, and fit feeling) were performed for Examples 1 to 3 and Comparative examples 1 to 3, and results thereof were indicated in Table 1.

[0162] The falling weight test (puncture resistance test), the abrasion resistance test, and the workability evaluation (sensory evaluation) were performed for Example 2 and the product of Company A, and results thereof were indicated in Table 2.

<Evaluation>

(1) (Table 1) Falling weight test (puncture resistance test)

[0163] As a result of calculating the fracture limit energy per material thickness, the following is obtained.

(Example 1) 8.2 J/mm

(Example 2) 7.1 J/mm

(Example 3) 5.3 J/mm

(Comparative example 1) 2.2 J/mm

(Comparative example 2) 3.7 J/mm

(Comparative example 3) 5.9 J/mm

[0164] In Example 2, the thickness was 0.9 mm, the fracture limit energy was 6.4 J, and the fracture limit energy per thickness was 7.1 J/mm. On the other hand, in Comparative example 1, the thickness was 0.9 mm, the fracture limit energy was 2.0 J, and the fracture limit energy per thickness was 2.2 J/mm. The fracture limit energy in Example 2 is three or more times that in Comparative example 1 having the same thickness. The weight (60.3 g) in Example 2 is substantially the same as the weight (60.9 g) in Comparative example 1.

[0165] The fracture limit energy per thickness in Example 2 was 7.1 J/mm, and on the other hand, the fracture limit energy per thickness in Comparative example 2 was 3.7 J/mm. The thickness (0.9 mm) in Example 2 is equal to or smaller than a half of the thickness (2.0 mm) in Comparative example 2, but the weight (60.3 g) in Example 2 is smaller than the weight (77.4 g) in Comparative example 2 by about 22%, and the fracture limit energy per thickness is also improved.

[0166] Furthermore, the fracture limit energy per thickness in Example 1 was 8.2 J/mm, which is about 4.0 times the fracture limit energy per thickness (2.2 J/mm) in Comparative example 1. The thickness (0.6 mm) in Example 1 was smaller than the thickness (0.9 mm) in Comparative example 1 by about 33%, the weight (55.1 g) in Example 1 is smaller than the weight (60.9 g) in Comparative example 1 by about 9.5%, and the fracture limit energy per thickness was 4 times larger. Example 1 is thinner, stronger, and lighter as compared with Comparative example 1.

[0167] As described above, it was confirmed that the fracture limit energy per thickness in the example was improved by far as compared with the comparative example. The protector according to the example was thin and lightweight, and it was confirmed that the fracture limit energy per thickness was extremely greatly improved if the thickness and the weight of the protector in the comparative example were substantially the same.

(2) (Table 1) Sensory evaluation (mobility, fatigue resistance, fit feeling)

[0168]

- 5 (Example 1) Total score 30
 (Example 2) Total score 30
 (Example 3) Total score 26
 (Comparative example 1) Total score 30
 (Comparative example 2) Total score 23
 10 (Comparative example 3) Total score 17

[0169] The thickness is 0.9 mm and the total score is 30 in Example 2, and the thickness is 0.9 mm and the total score is 30 also in Comparative example 1. The mobility (10), the fatigue resistance (10), and the fit feeling (10) in Example 2 are equal to those in Comparative example 1 having the same thickness.

15 [0170] The fracture limit energy (6.4 J) in Example 2 is substantially the same as the fracture limit energy (7.4 J) in Comparative example 2, but the total score 30 in Example 2 is higher than the total score 23 in Comparative example 2. Example 2 is excellent in the mobility (10:8), the fatigue resistance (10:9), and the fit feeling (10:6) as compared with Comparative example 2, so that the total score thereof is high.

[0171] Example 2 is thinner (0.9 mm: 2.0 mm) and lighter (60.3 g: 77.4 g) than Comparative example 2.

20 [0172] As described above, it was confirmed that the total score of the sensory evaluation in the example was higher than the comparative example if the fracture limit energy was substantially the same.

(3) (Table 2) Falling weight test (puncture resistance test)

25 (Example 2) Not penetrated

(Product of Company A) Penetrated

30 [0173] In the falling weight test, the result was "not penetrated" in Example 2 but "penetrated" in the product of Company A, so that durability of Example 2 is more excellent than the product of Company A. The weight (60.3 g) of Example 2 is substantially the same as the weight (53.0 g) of the product of Company A.

(4) (Table 2) Abrasion resistance test

35 (Example 2) Small scratch

(Product of Company A) Ripped

40 [0174] In the abrasion resistance test, the result was "small scratch" in Example 2 and "ripped" in the product of Company A, so that durability of Example 2 is more excellent than the product of Company A.

(5) (Table 2) Workability evaluation (sensory evaluation)

45 (Example 2) Equal to or higher than product of Company A

[0175] The workability evaluation of Example 2 is equal to or higher than that of the product of Company A, so that workability of Example 2 is more excellent than the product of Company A.

50 [0176] As described above, it was confirmed that the durability (the result of the falling weight test, the result of the abrasion resistance test) and the workability of the example were more excellent than those of the product of Company A if the weight is substantially the same.

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[Table 1]

	Thickness of material	Falling weight test (puncture resistance)	Fracture limit energy per thickness	Weight	Sensory evaluation (n = 5)			
		Fracture limit energy			Evaluation items			
	(mm)	(J)	(J/mm)	(g)	Mobility	Fatigue resistance	Fit feeling	Total
Example 1	0.6	4.9	8.2	55.1	10	10	10	30
Example 2	0.9	6.4	7.1	60.3	10	10	10	30
Example 3	1.2	6.4	5.3	63.6	8	9	9	26
Comparative example 1	0.9	2	2.2	60.9	10	10	10	30
Comparative example 2	2	7.4	3.7	77.4	8	9	6	23
Comparative example 3	3	17.7	5.9	92.3	6	7	4	17

[0177]

[Table 2]

	Durability		Weight (g/number)	Workability
	Falling weight test (puncture resistance)	Abrasion resistance		
Example 2	Not penetrated	Small scratch	60.3	Equal to or higher than product of Company A
Product of Company A	Penetrated	Ripped	53	-

[0178] In the present invention, similarly to the protector for a knee, a protector for an elbow includes the recessed part 10 having a dish shape when viewed from the back surface side at a part opposed to an elbow of the human body, the upper bending part 11 on the upper side in the longitudinal direction of the dish-like recessed part 10, and the lower bending part 12 on the lower side in the longitudinal direction of the dish-like recessed part 10. An external shape thereof may be different from or similar to that of the protector member 1. If a daruma shape arranged in the upper and lower direction is employed, the dish-like recessed part disposed on the back surface can be opposed to the center of the elbow, and can function to protect the elbow.

[0179] Furthermore, in the present invention, a shape of a protector for a shoulder may also be different from or similar to that of the protector member 1 for the protector for a knee. It is estimated that the same effect as that of the protector for an elbow can be obtained with the protector for a shoulder.

[0180] The present invention can provide a protector for protection that protects a movable part of a human body such as a knee, an elbow, or a shoulder.

EXPLANATIONS OF LETTERS OR NUMERALS

[0181]

- 1 PROTECTOR MEMBER
- 1a CLOTH LAMINATE
- 10 DISH-LIKE RECESSED PART
- 11 UPPER BENDING PART

- 12 LOWER BENDING PART
- 2 SHOCK ABSORBING MEMBER
- 3 BIAS TAPE
- 4 WRAPPING MEMBER

Claims

1. A protector comprising:

a protector member (1) comprising a cloth laminate in which a plurality of cloth-like bodies formed from filament bodies made of thermoplastic resin are laminated, the protector member (1) including a dish-like recessed part (10) disposed on a back surface side;
a shock absorbing member (2) fixed to the dish-like recessed part (10) of the protector member (1); and
a wrapping member (4) disposed on the protector member (1) and/or the shock absorbing member (2).

2. The protector according to claim 1 for protecting a movable part.

3. The protector according to claim 2 for protecting the movable part, the movable part being a knee or an elbow.

4. The protector according to claim 3, wherein

the protector member (1) includes an upper bending part (11) on an upper side in a longitudinal direction of the dish-like recessed part (10), and a lower bending part (12) on a lower side in the longitudinal direction of the dish-like recessed part (10),
the upper bending part (11) bends toward a back surface side from the dish-like recessed part (10) toward the upper side, and the lower bending part (12) bends toward the back surface side from the dish-like recessed part (10) toward the lower side,
the upper bending part (11) and the lower bending part (12) are widened in a width direction as compared with the dish-like recessed part (10), and the lower bending part (12) has a wider shape than the upper bending part (11), and
parts of the upper bending part (11) and the lower bending part (12) close to both sides in the width direction bend toward the back surface side.

5. The protector according to any one of claims 1 to 4, wherein a thickness of the protector member (1) is 0.4 mm to 1.8 mm.

6. The protector according to any one of claims 1 to 4, wherein the cloth-like body is formed of the filament bodies that are woven, knitted, or intersected by each other.

7. The protector according to any one of claims 1 to 4, wherein the filament body made of thermoplastic resin has a structure in which one surface, both surfaces, or a periphery of a core material made of a high melting point thermoplastic resin component is covered by an outer layer made of a low melting point thermoplastic resin component having a melting point lower than a melting point of the core material.

8. The protector according to any one of claims 1 to 4, wherein an adhesive layer in which a low melting point thermoplastic resin component contains a high melting point thermoplastic resin component is disposed between the cloth-like bodies in the cloth laminate.

9. The protector according to any one of claims 1 to 4, wherein the shock absorbing member has a substantially elliptic shape when viewed from a front surface side of the protector member, and has a shape wider than the protector member at least in the width direction.

10. The protector according to any one of claims 1 to 4, wherein the cloth laminate is formed by integrating a plurality of laminated cloth-like bodies by heating and pressure bonding.

11. The protector according to any one of claims 1 to 4, wherein fracture limit energy in a falling weight test is equal to or larger than 3.0 J.

FIG.1

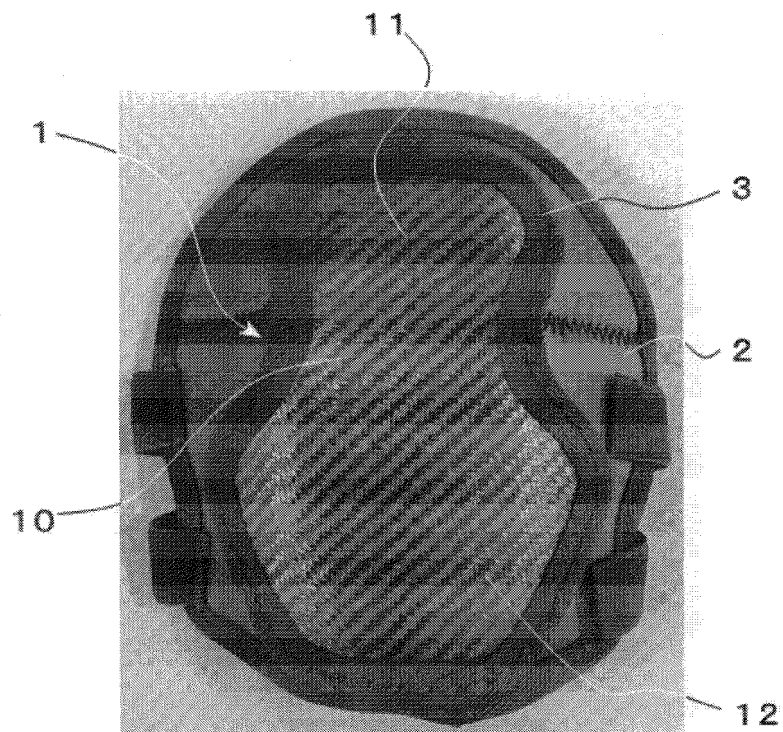


FIG.2

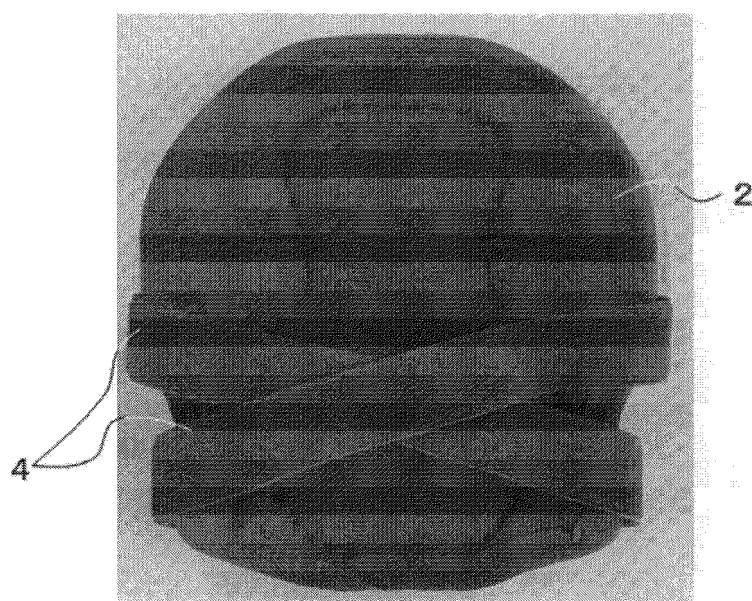


FIG. 3

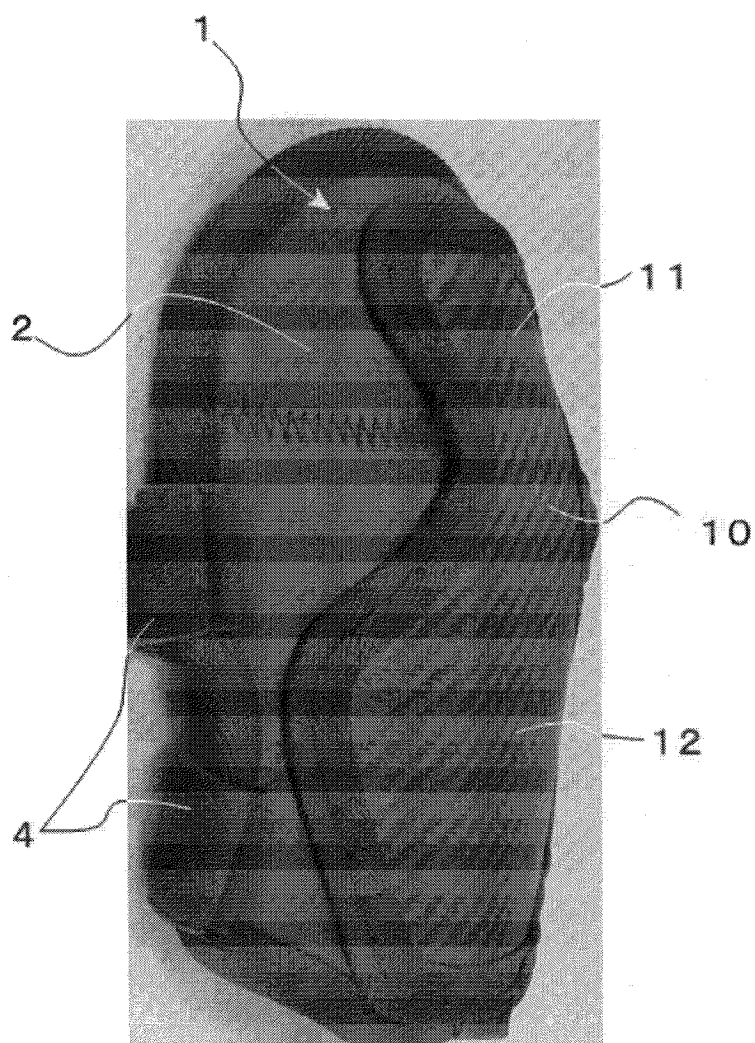


FIG. 4

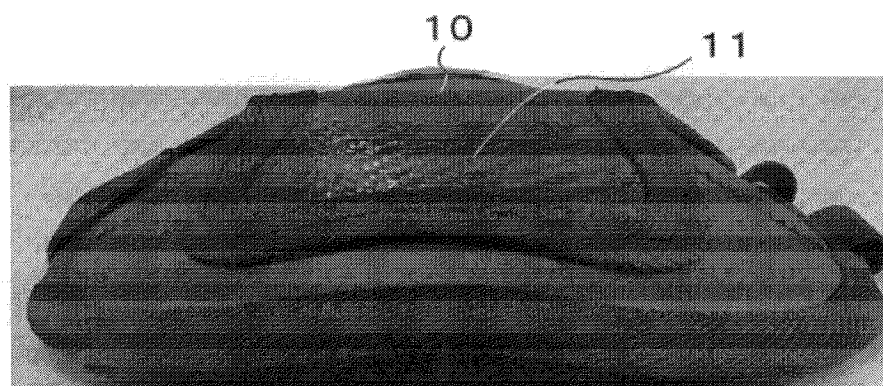


FIG. 5

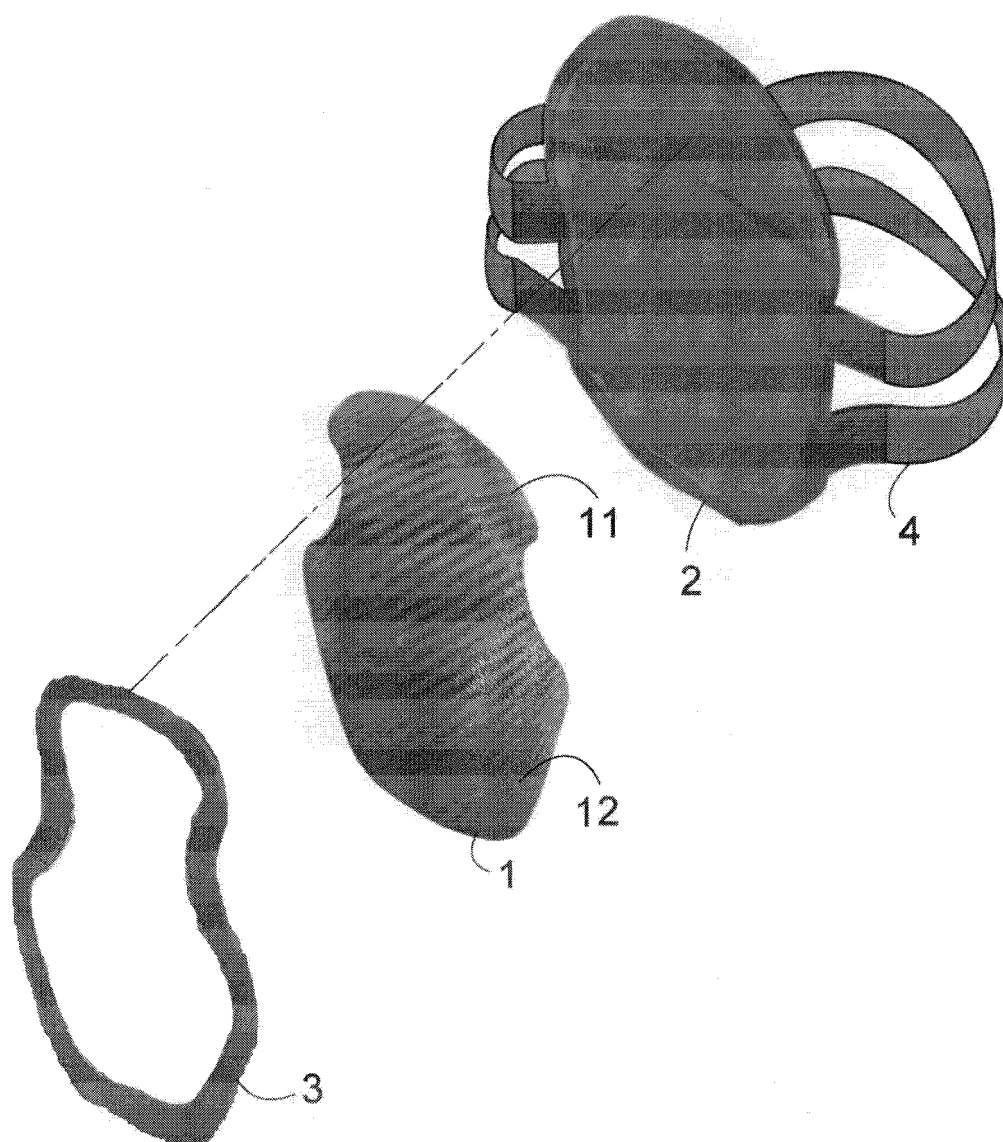


FIG. 6

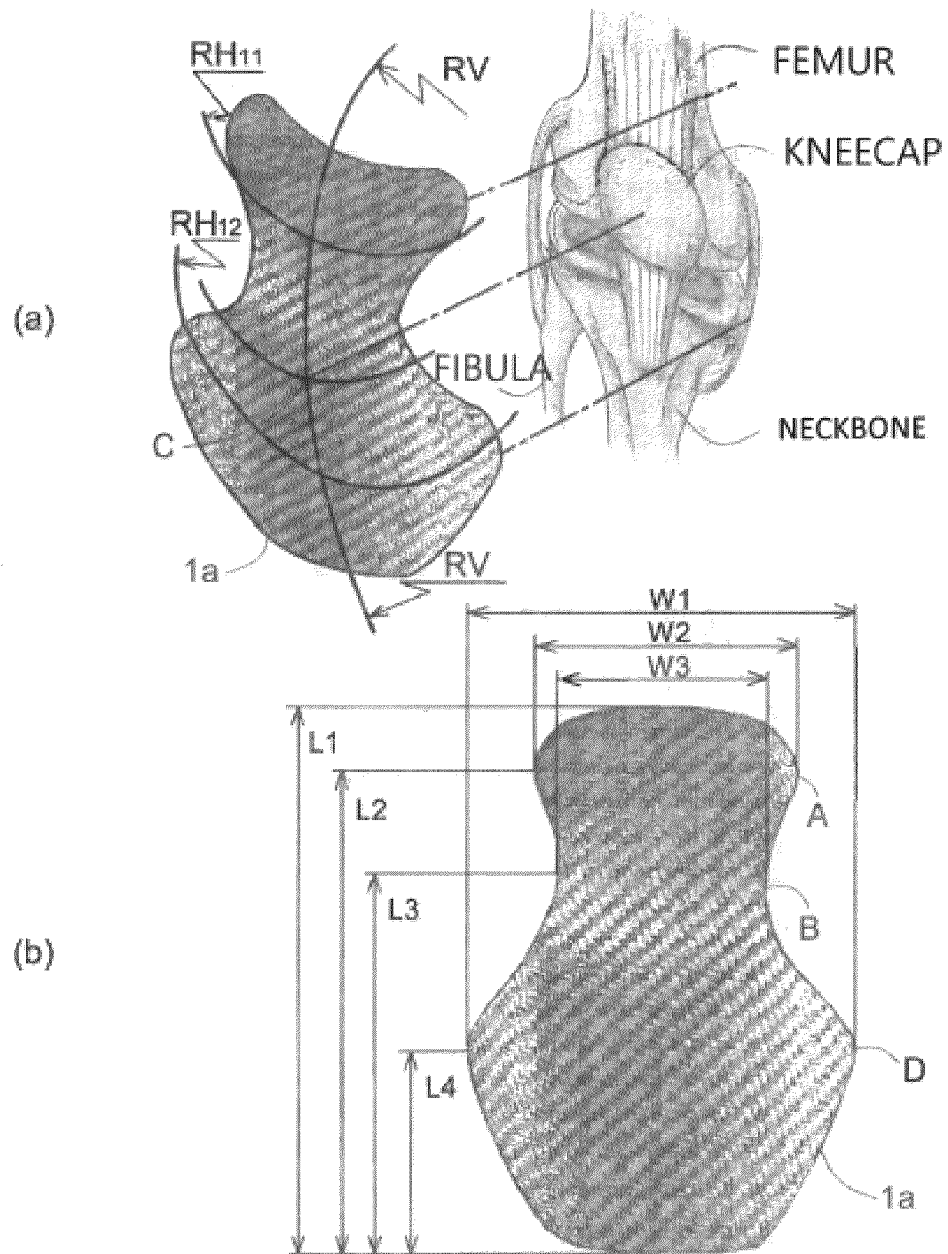


FIG. 7

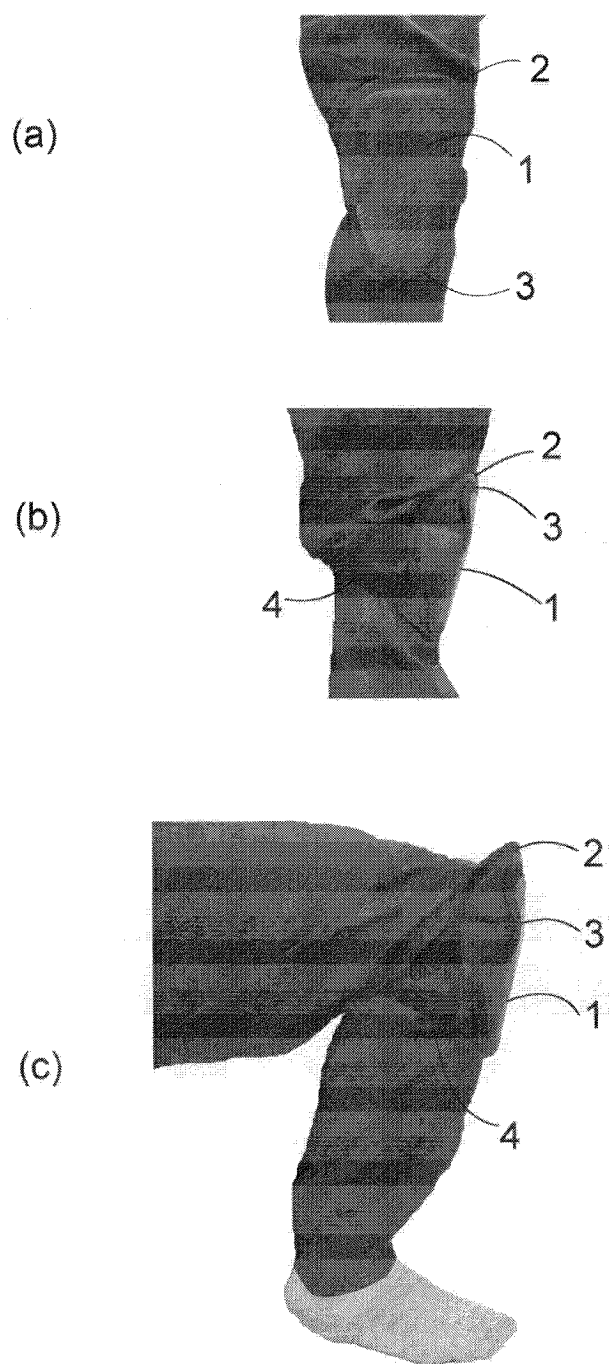


FIG. 8

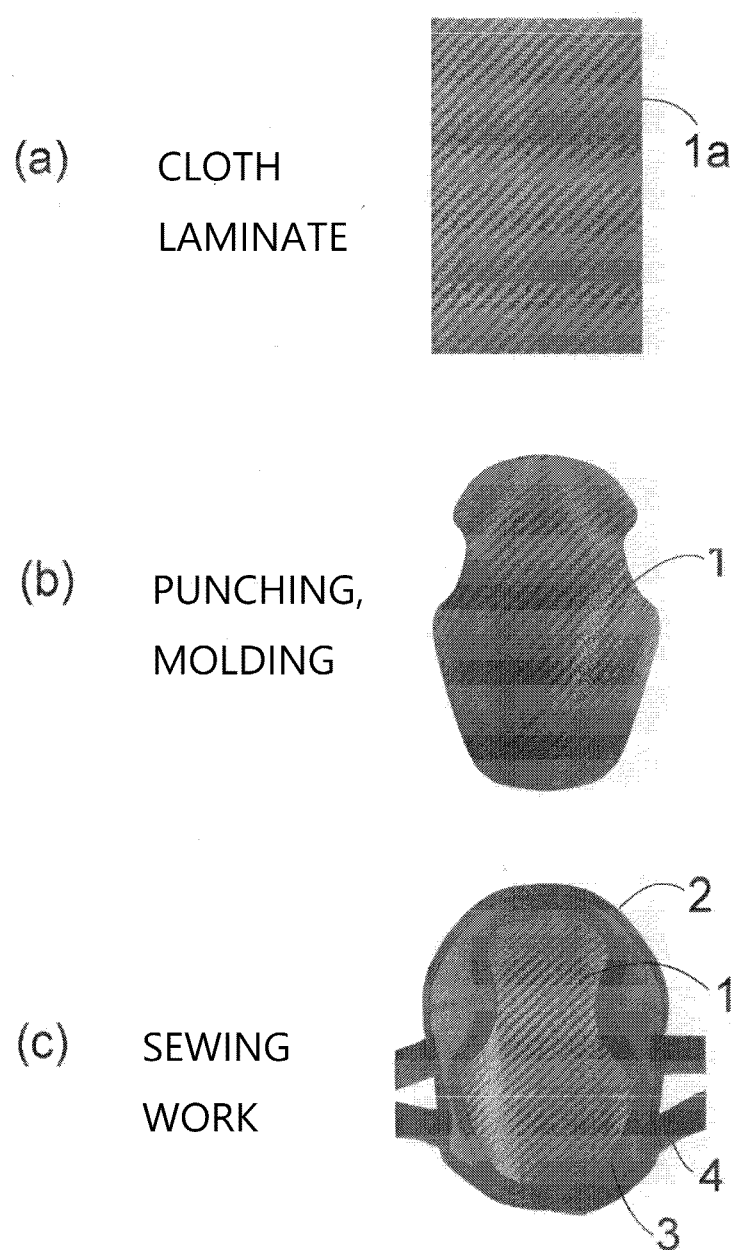
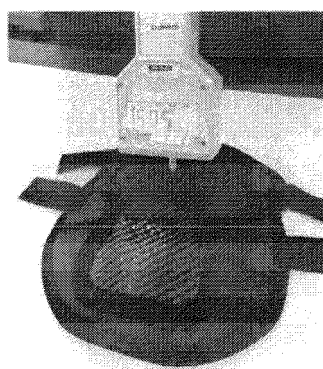


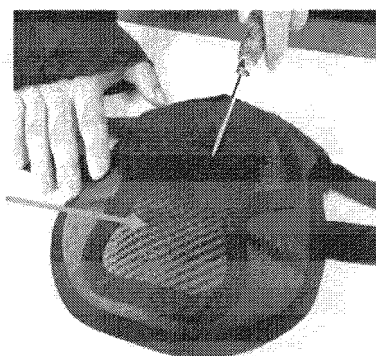
FIG. 9

(a) PUNCTURE
RESISTANCE TEST



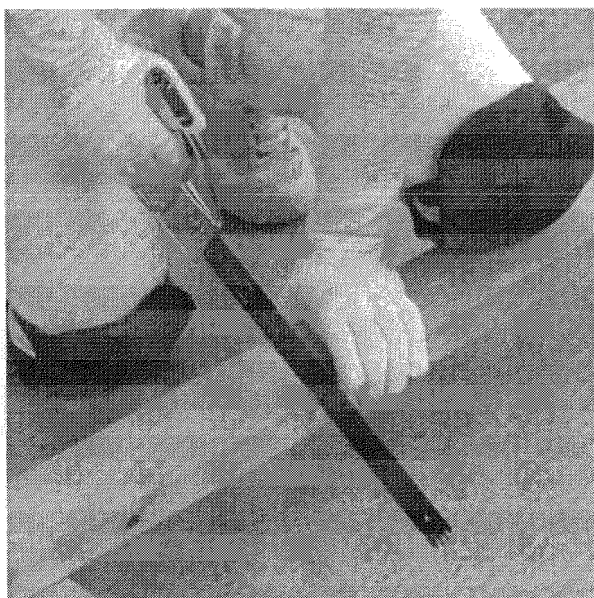
FORCE GAUGE

(b) ABRASION
RESISTANCE TEST



AWL

FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/031764

A. CLASSIFICATION OF SUBJECT MATTER

A41D 13/015(2006.01)i; *A41D 13/06*(2006.01)i; *A41D 13/08*(2006.01)i; *A41D 31/00*(2019.01)i; *A41D 31/28*(2019.01)i
FI: A41D13/06 105; A41D13/08; A41D13/015; A41D31/00 502A; A41D31/28; A41D31/00 504

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)

A41D13/015; A41D13/06; A41D13/08; A41D31/00; A41D31/28

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 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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	JP 2016-150079 A (FUTAGO SHOJI KK) 22 August 2016 (2016-08-22) paragraph [0011], fig. 1-3	1-11
Y	JP 2008-308788 A (FUTAGO SHOJI KK) 25 December 2008 (2008-12-25) paragraph [0013], fig. 1	1-11
Y	JP 2021-11652 A (KRAMER JAPAN KK) 04 February 2021 (2021-02-04) paragraphs [0031]-[0033], fig. 4	1-11
Y	JP 2009-91705 A (TOTTORI PREFECTURE) 30 April 2009 (2009-04-30) fig. 2-3	1-11
A	JP 2021-79060 A (FUTAGO SHOJI KK) 27 May 2021 (2021-05-27)	1-11
A	JP 2003-505173 A (PARKER ATHLETIC PRODUCTS LLC) 12 February 2003 (2003-02-12)	1-11

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

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

07 November 2023

Date of mailing of the international search report

21 November 2023

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
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Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2023/031764

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JP 2021-11652 A	04 February 2021	(Family: none)	
JP 2009-91705 A	30 April 2009	(Family: none)	
JP 2021-79060 A	27 May 2021	(Family: none)	
JP 2003-505173 A	12 February 2003	US 6128777 A	
		WO 2001/008519 A1	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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