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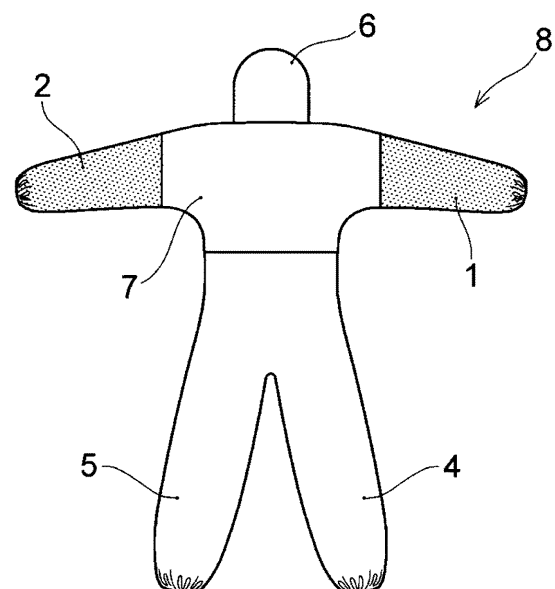
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(54) **PROTECTIVE CLOTHING**

(57) Provided is a protective garment comprising a pair of sleeve parts and a body part, wherein the protective garment has a first fabric and a second fabric and comprises one or more joint covering parts covering at least one of a wearer's elbow joint or knee joint, wherein the first fabric has a water vapor permeability of 200 g/m²/hr or more, a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 60 mm or more and 110 mm or less, wherein the second fabric is arranged on the joint covering part and has a virus barrier property of class 4 or higher, a blood barrier property of class 4 or more, and a bending resistance of 20 mm or more and 50 mm or less, and wherein a surface area of the first fabric with respect to a total surface area of the protective garment is 15% or more and 70% or less.

FIG. 2



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a protective garment.

BACKGROUND ART

10 **[0002]** Some protective products have various forms and functions depending on their purposes and uses. Among them, there are protective products that have excellent performances aimed at protection from harmful substances that may have an adverse effect on a human body, such as a blood and a virus, that is, excellent blood barrier property and virus barrier property. However, this protective product is excellent in blood barrier property and virus barrier property, though it has a poor water vapor permeability, inside of which becomes highly humid due to sweating generated from the body, leading to a problem for improvement in comfortability of clothing such as feelings of heat and stuffiness.

15 **[0003]** Here, a protective garment using a functional fabric, which has excellent virus barrier property and blood barrier property (which, hereinafter, may be collectively referred to as a barrier property) and an excellent water vapor permeability, is known (see Patent Document 1). This functional fabric has a laminated structure of a microporous film having a large number of fine through holes with a non-woven fabric.

20 PRIOR ART DOCUMENT

Patent Document

25 **[0004]** Patent Document 1: WO 2017/119355

SUMMARY OF THE INVENTION

30 **[0005]** Meanwhile, at the time of wearing the protective garment, a movement of a wearer's elbow is large. However, the microporous film comprising the functional fabric of Patent Document 1 has a high bending resistance. Therefore, bending resistance of the functional fabric is also high. As a result, the protective garment using the functional fabric having a high bending resistance easily causes resistance to the movement of the elbow when the wearer moves the elbow, easily reducing workability.

[0006] In view of the circumstances described above, it is an object of the present invention to provide a protective garment having excellent water vapor permeability, barrier property, and also workability.

35 **[0007]** The protective garment of the present invention for solving the above-described problems is a protective garment comprising a pair of sleeve parts and a body part, wherein the protective garment has a first fabric and a second fabric and comprises one or more joint covering parts covering at least one of wearer's elbow joint or knee joint, wherein the first fabric has a water vapor permeability of 200 g/m²/hr or more, a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 60 mm or more and 110 mm or less, wherein the second
40 fabric is arranged on the joint covering part and has a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 20 mm or more and 50 mm or less, and wherein a surface area of the first fabric with respect to a total surface area of the protective garment is 15% or more and 70% or less.

BRIEF DESCRIPTION OF THE DRAWINGS

45 **[0008]**

FIG. 1 is a conceptual diagram of a front surface of the protective garment in Example 1 which is one embodiment of the present invention.

50 FIG. 2 is a conceptual diagram of a back surface of the protective garment in Example 1 which is one embodiment of the present invention.

FIG. 3 is a conceptual diagram of a front surface of the protective garment in Example 5 which is one embodiment of the present invention.

FIG. 4 is a conceptual diagram of a back surface of the protective garment in Example 5 which is one embodiment of the present invention.

55 FIG. 5 is a conceptual diagram of a front surface of the protective garment in Example 6 which is one embodiment of the present invention.

FIG. 6 is a conceptual diagram of a back surface of the protective garment in Example 6 which is one embodiment

of the present invention.

FIG. 7 is a conceptual diagram of a front surface of the protective garment in Comparative example 4 which is one embodiment of the conventional protective garment.

FIG. 8 is a conceptual diagram of a back surface of the protective garment in Comparative example 4 which is one embodiment of the conventional protective garment.

FIG. 9 is a conceptual diagram of a front surface of the protective garment in Comparative example 5 which is one embodiment of the conventional protective garment.

FIG. 10 is a conceptual diagram of a back surface of the protective garment in Comparative example 5 which is one embodiment of the conventional protective garment.

FIG. 11 is a conceptual diagram of a front surface of the protective garment in Example 7 which is one embodiment of the present invention.

FIG. 12 is a conceptual diagram of a back surface of the protective garment in Example 7 which is one embodiment of the present invention.

FIG. 13 is a conceptual diagram of a front surface of the protective garment in Example 8 which is one embodiment of the present invention.

FIG. 14 is a conceptual diagram of a back surface of the protective garment in Example 8 which is one embodiment of the present invention.

EMBODIMENT FOR CARRYING OUT THE INVENTION

<First Embodiment>

[0009] The protective garment according to one embodiment of the present invention comprises a pair of sleeve parts and a body part. The protective garment has a first fabric and a second fabric. The protective garment comprises one or more joint covering parts covering at least one of a wearer's elbow joint or knee joint. The first fabric has a water vapor permeability of 200 g/m²/hr or more, a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 60 mm or more and 110 mm or less. The second fabric is arranged in the joint covering part and has a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 20 mm or more and 50 mm or less. A surface area of the first fabric with respect to a total surface area of the protective garment is 15% or more and 70% or less.

[0010] The first fabric has a high barrier property and also has a high water vapor permeability. Meanwhile, the first fabric having a high barrier property and a high water vapor permeability tends to become hard with a bending resistance of 60 mm or more and 110 mm or less due to composition of the fabric. On the other hand, the second fabric has a high barrier property and is a flexible fabric. Meanwhile, a water vapor permeability of the second fabric, which has a high barrier property and is flexible, is lower than that of the first fabric. This is due to composition of the second fabric. In the protective garment of this embodiment, the first fabric having a high barrier property and a high water vapor permeability occupies 15% or more and 70% or less of the total surface area of the protective garment, and further the second fabric having a high barrier property and is flexible is arranged on one or more joint covering parts. Therefore, the protective garment of this embodiment is excellent in water vapor permeability, barrier property, and also workability.

[0011] In this embodiment, for the sake of clarity, a case is exemplified where the protective garment of this embodiment is worn by a wearer with a height of 171 cm, an upper arm length of 32 cm, a cervical/acromion straight line distance of 15 cm, a fossa jugularis height of 140 cm, a midpoint height of a sternum of 128 cm, an anterior axillary width of 34 cm, a straight line distance between angulus inferior scapulae of 20 cm, a thigh length of 44 cm, and a tibial upper margin height of 43 cm.

[0012] Moreover, in this embodiment (first embodiment), exemplified is an aspect where the joint covering part has a part A that covers an elbow joint of a wearer's right arm and a part B that covers an elbow joint of the wearer's left arm at the time of wearing the protective garment and the second fabric is arranged on the part A and the part B.

[0013] The part A and the part B are parts of the protective garment that cover the wearer's elbow joint when worn. Accordingly, the part A and the part B of the protective garment are parts where, when the wearer bends and stretches the elbow, the fabric of the protective garment bends according to the movement of the bending and stretching of the wearer's elbow. Therefore, by using fabric having an excellent flexibility which is a second fabric for the part A and the part B, the protective garment improves in workability of the wearer when worn. That is, the protective garment is excellent in workability.

[0014] As such, in the protective garment of this embodiment, fabric having a high water vapor permeability is arranged on a part of the protective garment, while fabric having a high flexibility is arranged on another part of the protective garment that covers a part where the wearer moves a lot. Therefore, the protective garment can achieve both comfortability and workability when worn at a high level.

[0015] It is preferable that the protective garment of this embodiment comprises a part C that covers the wearer's

greater pectoral muscle at the time of wearing the protective garment and that the first fabric is arranged on the part C. In a human body, there are many important organs for the human body such as a heart and lungs near a greater pectoral muscle. Accordingly, it is said that the wearer easily feels heat more sensitively in the greater pectoral muscle and parts around the greater pectoral muscle compared with parts other than these parts. Moreover, in the human body, the body temperature decreases due to the temperature being taken from the skin as sweat evaporates. However, it is known that the higher the humidity becomes, the less likely sweat evaporates when the human body sweats, so that the human body feels hot when the temperature is high. Therefore, by using fabric having a high water vapor permeability which is a first fabric for the part C, the protective garment can approximate humidity in the vicinity of the wearer's greater pectoral muscle to humidity of an outside air. As a result, the protective garment of this embodiment is more excellent in comfortability.

[0016] Moreover, it is preferable that the body part comprises a part D that covers the wearer's subscapular muscle at the time of wearing the protective garment and that the first fabric is arranged on the part D. In a human body, there are many important organs for the human body such as a heart and lungs near a subscapular muscle. Accordingly, it is said that the wearer easily feels heat more sensitively in the subscapular muscle and parts around the subscapular muscle compared with parts other than these parts. Therefore, by using fabric having a high water vapor permeability which is a first fabric for the part D, the protective garment can approximate humidity in the vicinity of the wearer's subscapular muscle to humidity of the outside air. As a result, the protective garment of this embodiment is more excellent in water vapor permeability and more excellent in comfortability to be felt by the wearer.

[0017] It is preferable that the protective garment further comprises a hood, the body part and the hood are integrated, and at least a part of the hood is composed of a first fabric. The hood is a part that covers the wearer's head at the time of wearing the protective garment. Since a brain is present in the wearer's head, it is said that the wearer's head feels heat more sensitively compared with sites other than the wearer's head. Therefore, by using fabric having a high water vapor permeability which is a first fabric for the hood, the protective garment can approximate humidity in the wearer's protective garment to humidity of the outside air. As a result, the protective garment of this embodiment is more excellent in comfortability to be felt by the wearer.

[0018] When the protective garment comprises a hood, it is preferable that the protective garment has the body part and the hood integrated. When the body part and the hood are separated, the protective garment easily forms a gap between the body part and the hood. In this case, in order to prevent the occurrence of the gap described above, it is necessary to provide a large number of parts where the body part and the hood overlap with each other to prevent the gap in the protective garment. On the parts where the body part and the hood overlap with each other, the water vapor permeability easily decreases, and also the flexibility easily decreases. On the other hand, in the protective garment in which the body part and the hood are integrated, there is no gap between the body part and the hood, and there is no part where the body part and the hood overlap with each other. Therefore, the protective garment is more excellent in comfortability and workability when worn.

[0019] The protective garment of this embodiment may further comprise a lower part of the garment. In this case, it is preferable that the protective garment has, as joint covering parts, a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg at the time of wearing the protective garment and that the second fabric is arranged on the part E and the part F.

[0020] The part E and the part F are parts where the fabric of the protective garment bends when the wearer bends and stretches the knee. Therefore, by using a flexible fabric which is a second fabric for the part E and the part F, the protective garment further improves in workability of the wearer at the time of wearing the protective garment.

[0021] When the protective garment comprises a lower part of the garment, it is preferable that an upper part of the garment and the lower part of the garment are integrated in the protective garment. A protective garment, in which the upper part of the garment and the lower part of the garment are separated, easily forms a gap between the upper part of the garment and the lower part of the garment when the upper part of the garment and the lower part of the garment are worn. In this case, in order to prevent the occurrence of the gap described above, it is necessary to provide a large number of parts where the upper part of the garment and the lower part of the garment overlap with each other to prevent the gap in the protective garment. On the parts where the upper part of the garment and the lower part of the garment overlap with each other, the water vapor permeability easily decreases, and also the flexibility easily decreases. On the other hand, in the protective garment in which the upper part of the garment and the lower part of the garment are integrated, there is no gap between the upper part of the garment and the lower part of the garment, and there is no part where the upper part of the garment and the lower part of the garment overlap with each other. Therefore, the protective garment is more excellent in comfortability and workability when worn.

(First fabric)

[0022] Next, each fabric constituting the protective garment of this embodiment will be described. The first fabric has a water vapor permeability of 200 g/m²/hr or more. The water vapor permeability of the first fabric is preferably 350

g/m²/hr or more, more preferably 450 g/m²/hr or more. Moreover, the water vapor permeability of the first fabric is preferably 600 g/m²/hr or less, more preferably 500 g/m²/hr or less. When the water vapor permeability of the first fabric is 200 g/m²/hr or more, humidity inside the protective garment can be kept low at the time of wearing the protective garment. As a result, the protective garment is excellent in comfortability.

[0023] A method of adjusting the water vapor permeability of the first fabric within the above-described ranges is not particularly limited. By way of an example, the water vapor permeability of the first fabric can be adjusted by varying thickness, porosity, etc. of a microporous film constituting the first fabric.

[0024] The first fabric has a virus barrier property of class 4 or higher. The virus barrier property is preferably class 5 or higher, more preferably class 6.

[0025] A method of adjusting the virus barrier property of the first fabric within the above-described ranges is not particularly limited. By way of an example, the virus barrier property of the first fabric can be adjusted by increasing thickness of or decreasing porosity of a microporous film constituting the first fabric.

[0026] The first fabric has a blood barrier property of class 4 or higher. The blood barrier property is preferably class 5 or higher, more preferably class 6. When the blood barrier property is class 4 or higher, the protective garment is excellent in barrier property.

[0027] A method of adjusting the blood barrier property of the first fabric within the above-described ranges is not particularly limited. By way of an example, the blood barrier property of the first fabric can be adjusted by increasing thickness of or decreasing porosity of a microporous film constituting the first fabric.

[0028] In this embodiment, the virus barrier property is defined by the following method. First, a test is performed by the D method defined by JIS T8061 (2010) (corresponding to ISO16604:2004) to obtain a pressure value to be the maximum (maximum pressure) among pressures by which a virus does not permeate. Next, the obtained maximum pressure value is classified using the criteria for resistance-to-bacteriophage permeability shown in JIS T8122 (2007) (corresponding to EN14126:2003). This defines virus barrier properties (classes 1-6). Moreover, in this embodiment, the blood barrier property is defined by the following method. First, a test is performed by the D method defined by JIS T8060 (2007) (corresponding to ISO16603:2004) to obtain a pressure value to be the maximum (maximum pressure value) among pressures by which a blood does not permeate. Next, the obtained maximum pressure value is classified using the criteria for resistance-to-artificial blood permeability shown in JIS T8122 (2007) (corresponding to EN14126:2003). This defines blood barrier properties (classes 1-6).

[0029] The first fabric has a bending resistance of 60 mm or more. The bending resistance is preferably 80 mm or more, more preferably 90 mm or more. Moreover, the bending resistance is 110 mm or less. The bending resistance is preferably 105 mm or less, more preferably 100 mm or less. When the bending resistance is within the above-described ranges, the protective garment becomes soft and improves in workability.

[0030] A method of adjusting the bending resistance of the first fabric within the above-described ranges is not particularly limited. For the first fabric of the protective garment of this embodiment, a microporous film having a porosity of 30% or more and 60% or less and a thickness of 5 μm or more and 50 μm or less is preferably used as described later in order to realize a high barrier property and a high water vapor permeability. Here, the first fabric using such a microporous film tends to become hard. Therefore, the bending resistance of the first fabric is easily adjusted to 60 mm or more. Besides, the bending resistance of the first fabric can be adjusted to become as desired to some extent by a method of adjusting porosity, thickness, etc. of the microporous film, or by a method of adjusting composition of an adhesive layer between layers when the microporous film is a laminated body of a plurality of microporous film layers. In order for the first fabric to realize a water vapor permeability of 200 g/m²/hr or more, a virus barrier property of class 4 or higher, and a blood barrier property of class 4 or higher, the bending resistance of the first fabric is easily adjusted to 60 mm or more. On the other hand, the smaller the bending resistance of the first fabric is, the more flexible the protective garment becomes. Therefore, an upper limit of the bending resistance of the first fabric is preferably 110 mm or less.

[0031] In this embodiment, the microporous film refers to a film having a large number of pores and having a porosity of 5% or more. Moreover, a nonporous film refers to a nonporous film having no pores as those the microporous film has and a film having substantially no pores. The film having substantially no pores refers to a film having a porosity of less than 5%.

[0032] Resin constituting the microporous film is not particularly limited. By way of an example, resin is a polyolefin resin, polycarbonate, polyamide, polyimide, polyamideimide, aromatic polyamide, a fluorine-based resin, or the like. Among them, resin is preferably a polyolefin resin from the viewpoints of heat resistance, moldability, reduction of production cost, chemical resistance, oxidation resistance/reduction resistance, and the like.

[0033] A monomer component constituting the polyolefin resin is not particularly limited. By way of an example, the monomer component is a compound having a carbon-carbon double bond such as ethylene, propylene, 1-butene, 1-pentene, 3-methylpentene-1, 3-methyl-1-butene, 1-hexene, 4-methyl-1-pentene, 5-ethyl-1-hexene, 1-heptene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, 1-heptadecene, 1-octadecene, 1-eicosene, vinylcyclohexene, styrene, allylbenzene, cyclopentene, norbornene, and 5-methyl-2-norbornene, or the like. The polyolefin resin may be

a homopolymer of the above-described monomer component, may be a copolymer composed of at least two kinds selected from the group consisting of the above-described monomer components, or may be a composition, etc. blended with a homopolymer or a copolymer.

[0034] In addition to the above-described monomer components, the polyolefin resin may be copolymerized and/or graft-polymerized with, for example, vinyl alcohol, maleic anhydride, and the like.

[0035] The polyolefin resin is preferably polyethylene or polypropylene. The polyolefin resin is preferably polypropylene from the viewpoints of heat resistance, air permeability, porosity, and the like. In this case, it is preferable that a main component of the constituent resin of the microporous film is polypropylene. Besides, in this embodiment, the "main component" means that a ratio of a specific component to all components is 50% by mass or more. In this embodiment, the microporous film has polypropylene in an amount of preferably 80% by mass or more, more preferably 90% by mass or more, further preferably 95% by mass or more.

[0036] A method of forming through holes, which are pores, in the microporous film is not particularly limited. By way of an example, the method of forming through holes may be either by a wet process or a dry process.

[0037] In the first fabric, the porosity of the microporous film is preferably 30% or more, more preferably 40% or more. Moreover, in the first fabric, the porosity of the microporous film is preferably 60% or less, more preferably 50% or less. When the porosity is within the above-described ranges, the first fabric is more excellent in both barrier property and water vapor permeability.

[0038] The first fabric may have a fiber layer in addition to the microporous film, since the fiber layer provides other necessary physical properties such as, for example, puncture strength, tensile strength, and water pressure resistance.

[0039] Examples of the fiber layer include a fiber structure such as a woven fabric, a knitted fabric, a non-woven fabric, and paper. Among them, the fiber layer is preferably a non-woven fabric from the viewpoints of excellent cost efficiency, tensile strength, etc. The non-woven fabric is not particularly limited. By way of an example, examples of the non-woven fabric appropriately include a wet non-woven fabric, a resin bond type dry non-woven fabric, a thermal bond type dry non-woven fabric, a spunbond type dry non-woven fabric, a needle punch type dry non-woven fabric, a water jet punch type dry non-woven fabric, a flash spinning type dry non-woven fabric, as well as a non-woven fabric produced by a paper-making method capable of making basis weight and thickness uniform. Among them, as the non-woven fabric, a spunbond type dry non-woven fabric is preferable from the viewpoints of cost, tensile strength, etc.

[0040] A material of the fiber layer is not particularly limited. By way of an example, examples of the material of the fiber layer include polyolefin such as polyethylene and polypropylene, polyester such as polyethylene terephthalate and polylactic acid, polycarbonate, polystyrene, polyphenylene sulfide, a fluorine-based resin, and a mixture thereof, etc. Moreover, examples of forms of fibers using a mixture of two or more components may include fibers using a copolymer of two or more kinds of resin, mixed fibers in which a fiber composed of a plurality of single components is present as a non-woven fabric, and fibers having a plurality of components per fiber such as core-sheath type, sea-island type, and side-by-side type fibers.

[0041] A method of partially joining a microporous film and a fiber layer is not particularly limited. By way of an example, examples of the joining method include an embossing process of pressing with a roll carved with concave and convex and a pair of rolls and applying heat to these rolls by heating, ultrasonic waves, or high frequency to perform a partial adhesion, a sinter process of spraying with a powder having an adhesive component of a low melting point and conducting a heat treatment to perform a partial adhesion, a hot melt process of spraying with a hot melt adhesive or the like to partially make a water-vapor permeable film and a fiber layer to adhere to each other, and the like. Moreover, a method of applying an adhesive or the like to the entire surface of the microporous film or the fiber layer by coating or the like and laminating it is not preferable because the water vapor permeability is impaired.

[0042] A total area of the first fabric is 15% or more, preferably 20% or more, more preferably 30% or more, with respect to a total area of the protective garment. Moreover, the total area of the first fabric is 70% or less, preferably 60% or less, more preferably 40% or less, with respect to the total area of the protective garment. The protective garment may provide a wearer with a more excellent comfortability when the total area of the first fabric is equal to or greater than the above-described lower limit value. On the other hand, the protective garment may provide the wearer with a more excellent workability when the total area of the first fabric is equal to or lower than the above-described upper limit value.

(Second fabric)

[0043] The second fabric has a bending resistance of 20 mm or more. The bending resistance is preferably 30 mm or more. Moreover, the bending resistance is 50 mm or less. The bending resistance is preferably 40 mm or less.

[0044] A method of adjusting the bending resistance of the second fabric within the above-described ranges is not particularly limited. In the second fabric of the protective garment of this embodiment, the bending resistance can be adjusted to 20 mm or more and 50 mm or less by setting porosity of a nonporous film to less than 5% and setting thickness of the nonporous film to 50 μm or more and 300 μm or less when the second fabric is a nonporous film.

[0045] Moreover, the bending resistance of the second fabric can be increased by increasing the thickness of the second fabric and can be decreased by decreasing the thickness of the second fabric. Furthermore, the bending resistance can also be adjusted by adjusting flexibility of a material by a known means.

[0046] When the bending resistance of the second fabric is equal to or lower than the above-described upper limit value, the protective garment easily follows movement of a wearer's body, easily improving workability. Moreover, when the bending resistance of the second fabric is equal to or greater than the above-described lower limit value, in the protective garment, when the wearer sweats while working, the second fabric is less likely to cling to the wearer's body, which easily suppresses a decrease in workability.

[0047] The second fabric has a virus barrier property of class 4 or higher. The virus barrier property is preferably class 5 or higher, more preferably class 6. When the virus barrier property is class 4 or higher, the protective garment is excellent in barrier property.

[0048] A method of adjusting the virus barrier property of the second fabric within the above-described ranges is not particularly limited. By way of an example, when the second fabric is a nonporous film, the barrier property can be improved by increasing thickness of the nonporous film or decreasing porosity of the nonporous film.

[0049] The second fabric has a blood barrier property of class 4 or higher. The blood barrier property is preferably class 5 or higher, more preferably class 6. When the blood barrier property is class 4 or higher, the protective garment is excellent in barrier property.

[0050] A method of adjusting the blood barrier property of the second fabric within the above-described ranges is not particularly limited. By way of an example, the blood barrier property of the second fabric can be adjusted by increasing thickness of or decreasing porosity of a microporous film constituting the second fabric.

[0051] In this embodiment, the virus barrier property is defined by the following method. First, a test is performed by the D method defined by JIS T8061 (2010) (corresponding to ISO16604:2004) to obtain a pressure value to be the maximum (maximum pressure) among pressures by which a virus does not permeate. Next, the obtained maximum pressure value is classified using the criteria for resistance-to-bacteriophage permeability shown in JIS T8122

[0052] (2007) (corresponding to EN14126:2003). This defines virus barrier properties (classes 1-6). Moreover, in this embodiment, the blood barrier property is defined by the following method. First, a test is performed by the D method defined by JIS T8060 (2007) (corresponding to ISO16603:2004) to obtain a pressure value to be the maximum (maximum pressure value) among pressures by which a blood does not permeate. Next, the obtained maximum pressure value is classified using the criteria for resistance-to-artificial blood permeability shown in JIS T8122 (2007) (corresponding to EN14126:2003). This defines blood barrier properties (classes 1-6).

[0053] A material of the second fabric is not particularly limited. By way of an example, as the material of the second fabric, a material used as a known waterproof fabric such as polyvinyl chloride (PVC), polyurethane, polyethylene, and ethylene vinyl acetate copolymer can be used. By using a nonporous film made of these materials as the second fabric, a second fabric having an excellent blood barrier property and an excellent virus barrier property becomes easily obtained. Besides, when the second fabric is a nonporous film, in the second fabric, the above-described barrier property becomes easily obtained by setting the porosity of the nonporous film to less than 5% and setting the thickness of the nonporous film to 50 μm or more.

[0054] The porosity of the second fabric is preferably less than 5%, and it is more preferable that the second fabric is substantially nonporous. When the porosity is within such a range, the second fabric easily improves in bending resistance, blood barrier property, and virus barrier property at the same time.

[0055] The water vapor permeability of the second fabric is preferably lower than that of the first fabric. That is, when the second fabric is made of a nonporous film in order to obtain excellent barrier property and flexibility, the water vapor permeability of the second fabric becomes lower than that of the first fabric. The water vapor permeability of the second fabric is preferably 0 $\text{g}/\text{m}^2/\text{hr}$ or more, more preferably 5 $\text{g}/\text{m}^2/\text{hr}$ or more. Moreover, the water vapor permeability of the second fabric is preferably 100 $\text{g}/\text{m}^2/\text{hr}$ or less, more preferably 10 $\text{g}/\text{m}^2/\text{hr}$ or less. Even if the water vapor permeability of the second fabric is 0 $\text{g}/\text{m}^2/\text{hr}$, the protective garment of this embodiment comprises a first fabric having an excellent water vapor permeability, so that the humidity inside the protective garment during wearing can be kept low. As a result, the protective garment improves in comfortability. Besides, a method of adjusting a water vapor permeability of a second fabric is not particularly limited. By way of an example, the water vapor permeability of the second fabric can be adjusted by varying the porosity and thickness of the nonporous film when the second fabric is a nonporous film.

[0056] A total area of the second fabric is preferably 30% or more, more preferably 40% or more, further preferably 60% or more, with respect to a total area of the protective garment. Moreover, the total area of the second fabric is preferably 85% or less, more preferably 80% or less, further preferably 70% or less, with respect to the total area of the protective garment. The protective garment may provide a wearer with a more excellent workability when the total area of the second fabric is equal to or greater than the above-described lower limit value. On the other hand, the protective garment may provide the wearer with a more excellent comfortability when the total area of the second fabric is equal to or lower than the above-described upper limit value.

<Second embodiment>

[0057] In the above-described first embodiment, the protective garment was exemplified which has the part A that covers the elbow joint of the wearer's right arm and the part B that covers the elbow joint of the wearer's left arm and has the part E that covers the knee joint of the wearer's right leg and the part F that covers the knee joint of the wearer's left leg, at the time of wearing the protective garment, as the joint covering parts. Instead, the protective garment of the present invention may have a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg as joint covering parts and may not have a part A that covers an elbow joint of the wearer's right arm and a part B that covers an elbow joint of the wearer's left arm.

[0058] In the protective garment of this embodiment, the part E and the part F are composed of a second fabric having an excellent flexibility. Therefore, the protective garment can achieve both comfortability and workability (particularly of a lower body) when worn at a high level.

[0059] One embodiment of the present invention has been described above. The present invention is not particularly limited to the above-described embodiment. Besides, the above-described embodiment mainly describes an invention having the following configurations.

(1) A protective garment comprising a pair of sleeve parts and a body part, wherein the protective garment has a first fabric and a second fabric and comprises one or more joint covering parts covering at least one of a wearer's elbow joint or knee joint, wherein the first fabric has a water vapor permeability of 200 g/m²/hr or more, a virus barrier property of class 4 or higher, a blood barrier property of class 4 or higher, and a bending resistance of 60 mm or more and 110 mm or less, wherein the second fabric is arranged on the joint covering part and has a virus barrier property of class 4 or higher, a blood barrier property of class 4 or more, and a bending resistance of 20 mm or more and 50 mm or less, and wherein a surface area of the first fabric with respect to a total surface area of the protective garment is 15% or more and 70% or less.

(2) The protective garment of (1), wherein the joint covering part has a part A that covers an elbow joint of the wearer's right arm and a part B that covers an elbow joint of the wearer's left arm at the time of wearing the protective garment, and wherein the second fabric is arranged on the part A and the part B.

(3) The protective garment of (1) or (2), wherein the joint covering part has a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg at the time of wearing the protective garment, and wherein the second fabric is arranged on the part E and the part F.

(4) The protective garment of any one of (1) to (3), wherein the first fabric has a microporous film, wherein a porosity of the microporous film is 30% or more and 60% or less, wherein the second fabric has a nonporous film, and wherein a porosity of the nonporous film is less than 5%.

(5) The protective garment of any one of (1) to (4), wherein the protective garment comprises a part C that covers the wearer's greater pectoral muscle at the time of wearing the protective garment, and wherein the first fabric is arranged on the part C.

(6) The protective garment of any one of (1) to (5), further comprising a hood, wherein the body part and the hood are integrated, and wherein at least a part of the hood is composed of the first fabric.

(7) The protective garment of any one of (1) to (6), wherein the body part comprises a part D that covers the wearer's subscapular muscle at the time of wearing the protective garment, and wherein the first fabric is arranged on the part D.

EXAMPLE

[0060] Hereinafter, the present invention will be described in detail with reference to Examples. The present invention is not limited to these Examples. First, various measuring methods, comfortability test methods, and workability test methods used in Examples and Comparative examples will be described.

[Measuring method]

(1) Thickness

[0061] A dial gauge-type thickness gauge (JIS B7503 (1997), UPRIGHT DIAL GAUGE (0.001 × 2 mm) manufactured by PEACOCK, No.25, a probe 10 mm φ flat type, 50 gf load) was used to measure a thickness.

(2) Porosity

[0062] Fabric was cut in a thickness direction using a microtome, and the cross section of the obtained sample was imaged at three points at a magnification of 3000 times using a field emission scanning electron microscope (FE-SEM)

S-800 manufactured by Hitachi, Ltd. to calculate a porosity from an average value of the images at three points according to the following equation.

[0063] Porosity = area of porosity in field of view/area of film in field of view (3) Virus barrier property of fabric

[0064] A test was performed by the D method defined by JIS T8061 (2010) (corresponding to ISO16604:2004) to obtain a pressure value to be the maximum (maximum pressure) among pressures by which a virus does not permeate. Next, the obtained maximum pressure value was classified using the criteria for resistance-to-bacteriophage permeability shown in JIS T8122 (2007) (corresponding to EN14126:2003).

(4) Blood barrier property of fabric

[0065] A test was performed by the D method defined by JIS T8060 (2007) (corresponding to ISO16603:2004) to obtain a pressure value to be the maximum (maximum pressure value) among pressures by which a blood does not permeate. Next, the obtained maximum pressure value was classified using the criteria for resistance-to-artificial blood permeability shown in JIS T8122 (2007) (corresponding to EN14126:2003).

(5) Water vapor permeability

[0066] A water vapor permeability was measured based on the JIS L1099 (2012) A-1 method, and the unit was expressed in g/m²/hr.

(6) Bending resistance

[0067] A bending resistance was measured based on A method (a 45° cantilever method) defined by JIS L1096 (1999), high values in a vertical direction and a horizontal direction were defined as values of the bending resistance, and the unit was expressed in mm.

(7) Comfortability test method

[0068] A monitor wore a protective garment (medium size), and then the monitor evaluated humidity and comfortability (for sultriness) in the clothing after step aerobics. The above-described comfortability test was performed by three monitors for the same protective garment, and the most common test result among the evaluations by the three monitors was adopted as a final test result. Three monitors who participated in the comfortability test were male with 58-64 kg weight and 168-174 cm tall.

<Test method>

[0069] Each monitor was subjected to a comfortability test in the following order of S1, S2, S3, S4, and S5.

[0070] S1: Wear pants (88% polyester, 12% polyurethane) and cotton ankle socks only.

[0071] S2: Attach a temperature/humidity sensor (temperature/humidity sensor: SHA-3151 manufactured by T&D Corporation, data logger: Ondotori TR-72wf manufactured by T&D Corporation) to the back of the neck, wear a protective garment, and wear sneakers.

[0072] S3: Sit for 30 minutes in a room under an atmosphere at 20°C and 50% RH and stand still.

[0073] S4: Move to a room in an atmosphere at 30°C and 50% RH and perform step aerobics (interval of step aerobics: 15 steps/10 seconds, step height: 20 cm) in the same atmosphere for 20 minutes.

[0074] S5: Measure temperature and humidity inside the clothing after 20 minutes to evaluate comfortability according to the following evaluation criteria.

<Evaluation criteria>

[0075]

A: The protective garment had no stuffiness with a much excellent comfortability.

B: The protective garment had little stuffiness with an excellent comfortability.

C: The protective garment had much stuffiness with an inferior comfortability.

(8) Workability test method

[0076] A monitor evaluated workability (easiness of walking) when performing step aerobics and workability (easiness

of evaluation) when evaluating bending resistance after wearing a protective garment (medium size). The above-described workability tests were performed by three monitors for the same protective garment, and the most common test result among the evaluations by the three monitors was adopted as a final test result. Three monitors who participated in the comfortability test were male with 58-64 kg weight and 168-174 cm tall.

<Test method>

[0077] Each monitor was subjected to the following workability tests of M1 and M2.

[0078] M1: Evaluate workability (easiness of walking) when performing step aerobics in (7) Comfortability test method.

[0079] M2: Evaluate a sample cut in (6) Bending resistance, and workability (easiness of evaluation) at the time of evaluation, according to the following evaluation criteria.

<Evaluation criteria>

[0080]

A: The protective garment was easy for walking and easy for evaluating with a much excellent workability.

B: The protective garment was a little easier for walking and a little easier for evaluating with an excellent workability.

C: The protective garment was difficult for walking and difficult for evaluating with an inferior workability.

(9) Body size of wearer

[0081] As body sizes, the following items were measured using a tape measure.

Height: Vertical distance from a floor surface to a head top point

Upper arm length: Straight line distance from an acromial point to a radial point

Cervical/acromial straight line distance: Straight line distance from a cervical point to an acromial point

Fossa jugularis height: Vertical distance from the floor surface to a fossa jugularis point

Sternum midpoint height: Vertical distance from the floor surface to a sternum midpoint

Anterior axilla width: Straight line distance between left and right anterior axilla points

Straight line distance between angulus inferior scapulae: Straight line distance between left and right angulus inferior scapulae points

Thigh length: Vertical distance from a trochanteric point to a tibial point

Tibial upper margin height: Vertical distance from the floor surface to a tibial point

(10) Virus barrier property of protective garment

[0082] The first fabric and the second fabric were sewn, and for the obtained protective garment, a total of 3 to 5 parts including a part of the protective garment that covers a wearer's right elbow joint (and/or a part of the protective garment that covers the right knee joint) when worn, a part of the protective garment that covers the wearer's left elbow joint (and/or a part of the protective garment that covers the left knee joint) when worn, and a part of the protective garment that covers the wearer's greater pectoral muscle when worn were evaluated on virus barrier property by the similar method as described in the section "(3) Virus barrier property of fabric", and the lowest virus barrier property at each site was defined as a virus barrier property of the protective garment.

(11) Blood barrier property of protective garment

[0083] The first fabric and the second fabric were sewn, and for the obtained protective garment, a total of 3 to 5 parts including a part of the protective garment that covers a wearer's right elbow joint (and/or a part of the protective garment that covers the right knee joint) when worn, a part of the protective garment that covers the wearer's left elbow joint (and/or a part of the protective garment that covers the left knee joint) when worn, and a part of the protective garment that covers the wearer's greater pectoral muscle when worn were evaluated on blood barrier property by the similar method as described in the section "(4) Blood barrier property of fabric", and the lowest blood barrier property at each site was defined as a blood barrier property of the protective garment.

(Example 1)

[0084] As a first fabric, two polypropylene spunbonded non-woven fabrics (basis weight: 20 g/m²) and one polyethylene

microporous film (thickness: 12 μm , porosity: 45%) were prepared. Next, a first fabric 1-1 was prepared in which a spunbonded non-woven fabric, a microporous film, and a spunbonded non-woven fabric were laminated in this order and the respective layers were bonded to each other. Here, the bonding between the respective layers of the first fabric 1-1 was performed by arranging a hot melt adhesive comprising polyethylene as a main component between the respective layers using a spray. A content of the hot melt adhesive between the respective layers of the first fabric was 2.0 g/m² per between the respective layers. Further, as a second fabric 2-1, a polyethylene nonporous film (thickness: 200 μm , porosity: less than 1%) was prepared. Characteristics of the first fabric 1-1 and the second fabric 2-1 are as shown in Table 1.

[0085] Then, from the obtained first fabric 1-1 and the obtained second fabric 2-1, a plurality of parts corresponding to a plurality of regions constituting the protective garment were cut out. Next, these parts were sewn together with a sewing machine in order to form an overall type protective garment with a hood. The obtained protective garment was used as a protective garment in Example 1.

[0086] A conceptual diagram of the obtained protective garment is shown in FIGS. 1 and 2. FIG. 1 is a conceptual diagram of a front surface of a protective garment 8 in Example 1 which is one embodiment of the protective garment of the present invention, and FIG. 2 is a conceptual diagram of a back surface of the protective garment 8 in Example 1 which is one embodiment of the present invention. The protective garment 8 comprises a pair of sleeve parts, a body part, a lower part of the garment, and a hood 6. The front body part comprises a part C that covers a wearer's greater pectoral muscle and a part D that covers the wearer's subscapular muscle. The part C is indicated by reference numeral 3 and the part D is indicated by reference numeral 7. One of the pair of sleeve parts comprises a part A that covers an elbow joint of the wearer's right arm. The other one of the pair of sleeve parts comprises a part B that covers an elbow joint of the wearer's left arm. The part A is indicated by reference numeral 1 and the part B is indicated by reference numeral 2. Moreover, the lower part of the garment comprises a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg. The part E is indicated by reference numeral 4 and the part F is indicated by reference numeral 5. The hood, the part C, the part D, the part E, and the part F are composed of a first fabric, and the part A and the part B are composed of a second fabric. Moreover, other parts of the protective garment except the hood and the parts A to F are composed of a second fabric. That is, parts of the protective garment corresponding to areas indicated by white blanks in the figures are composed of a first fabric, and parts of the protective garment corresponding to areas indicated by dots in the figures are composed of a second fabric.

[0087] An area ratio of a total area of the first fabric to a total area of the protective garment and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0088] Using the protective garment in Example 1, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 2)

[0089] A first fabric was prepared as follows. Two spunbonded nonwoven fabrics used in Example 1 were prepared, and two polyethylene microporous films used in Example 1 (thickness: 12 μm , porosity: 45%) were prepared. Next, a first fabric 1-2 was prepared in which a spunbonded non-woven fabric, a polyethylene microporous film, a polyethylene microporous film, and a spunbonded non-woven fabric were laminated in this order and the respective layers were bonded to each other. Characteristics of the polyethylene microporous film used for the first fabric and the obtained first fabric 1-2 are as shown in Table 1.

[0090] The obtained first fabric 1-2 and the second fabric 2-1 were used in the combination shown in Table 2 for each site of the protective garment to prepare a protective garment of Example 2 in the similar manner as in Example 1. An area ratio of a total area of the first fabric to a total area of the protective garment of Example 2 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0091] Using the protective garment in Example 2, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 3)

[0092] A first fabric was prepared as follows. A first fabric 1-3 was prepared in the similar manner as in Example 1 except that a polyethylene microporous film (thickness: 12 μm , porosity: 33%) was used instead of the polyethylene microporous film in Example 1 (thickness: 12 μm , porosity: 45%). Characteristics of the polyethylene microporous film used for the first fabric and the obtained first fabric 1-3 are as shown in Table 1.

[0093] The obtained first fabric 1-3 and the second fabric 2-1 were used in the combination shown in Table 2 for each site of the protective garment to prepare a protective garment of Example 3 in the similar manner as in Example 1. An area ratio of a total area of the first fabric to a total area of the protective garment of Example 3 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0094] Using the protective garment in Example 3, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 4)

[0095] A second fabric was prepared as follows. As a second fabric 2-2, a polyethylene nonporous film (thickness: 300 μm , porosity: less than 1%) was prepared. Characteristics of the obtained second fabric 2-2 are as shown in Table 1. The first fabric 1-1 and the obtained second fabric 2-2 were used in the combination shown in Table 2 for each site of the protective garment to prepare a protective garment of Example 4 in the similar manner as in Example 1. An area ratio of a total area of the first fabric to a total area of the protective garment of Example 4 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0096] Using the protective garment in Example 4, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 5)

[0097] The first fabric 1-1 and the second fabric 2-1 used in Example 1 were used in the combination shown in Table 2 for each site of the protective garment. FIG. 3 is a conceptual diagram of a front surface of a protective garment 8a in Example 5 which is one embodiment of the protective garment of the present invention, and FIG. 4 is a conceptual diagram of a back surface of the protective garment 8a in Example 5 which is one embodiment of the present invention. Besides, the similar reference numerals as those in FIGS. 1 and 2 are given to the similar configurations as those in Example 1. Moreover, the lower part of the garment comprises a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg. The part E is indicated by reference numeral 4a and the part F is indicated by reference numeral 5a. The hood, the part C, and the part D are composed of a first fabric, and the part A, the part B, the part E, and the part F are composed of a second fabric. Moreover, other parts of the protective garment except the hood and the parts A to F are composed of a second fabric. That is, parts of the protective garment corresponding to areas indicated by white blanks in the figures are composed of a first fabric, and parts of the protective garment corresponding to areas indicated by dots in the figures are composed of a second fabric.

[0098] An area ratio of a total area of the first fabric to a total area of the protective garment of Example 5 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0099] Using the protective garment in Example 5, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 6)

[0100] The first fabric 1-1 and the second fabric 2-1 used in Example 1 were used in the combination shown in Table 2 for each site of the protective garment. FIG. 5 is a conceptual diagram of a front surface of a protective garment 8b in Example 6 which is one embodiment of the protective garment of the present invention, and FIG. 6 is a conceptual diagram of a back surface of the protective garment 8b in Example 6 which is one embodiment of the present invention. The similar reference numerals as those in FIGS. 1 to 4 are given to the similar configurations as those in Example 1 or 5.

[0101] An area ratio of a total area of the first fabric to a total area of the protective garment of Example 6 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0102] Using the protective garment in Example 6, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Comparative example 1)

[0103] Fabric 1-4 was obtained in the similar manner as in Example 1 except that a polyethylene microporous film (thickness: 60 μm , porosity: 25%) was used instead of the polyethylene microporous film used in Example 1 (thickness: 12 μm , porosity: 45%), as a first fabric. Porosity and thickness of the polyethylene microporous film used for the first fabric are as shown in Table 1. Moreover, characteristics of the first fabric 1-4 are as shown in Table 1. The obtained first fabric 1-4 and the second fabric 2-1 were used in the combination shown in Table 2 for each site of the protective garment to obtain a protective garment of Comparative example 1 in the similar manner as in

Example 1.

[0104] An area ratio of a total area of the first fabric to a total area of the protective garment of Comparative example 1 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0105] Using the protective garment in Comparative example 1, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Comparative example 2)

[0106] Fabric 1-5 was obtained in the similar manner as in Example 1 except that a polyethylene microporous film (thickness: 4 μm , porosity: 45%) was used instead of the polyethylene microporous film used in Example 1 (thickness: 12 μm , porosity: 45%), as a first fabric. Porosity and thickness of the polyethylene microporous film used for the first fabric are as shown in Table 1. Moreover, characteristics of the first fabric 1-5 are as shown in Table 1. The obtained first fabric 1-5 and the second fabric 2-1 were used in the combination shown in Table 2 for each site of the protective garment to obtain a protective garment of Comparative example 2 in the similar manner as in Example 1.

[0107] An area ratio of a total area of the first fabric to a total area of the protective garment of Comparative example 2 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0108] Using the protective garment in Comparative example 2, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Comparative example 3)

[0109] As a second fabric, a polyethylene nonporous film (thickness: 400 μm , porosity: less than 1%) 2-3 was prepared. Characteristics of the obtained second fabric 2-3 are as shown in Table 1. The first fabric 1-1 and the obtained second fabric 2-3 were used in the combination shown in Table 2 for each site of the protective garment to obtain a protective garment of Comparative example 3 in the similar manner as in Example 1.

[0110] An area ratio of a total area of the first fabric to a total area of the protective garment of Comparative example 3 and an area ratio of a total area of the second fabric to the total area of the protective garment are as shown in Table 2.

[0111] Using the protective garment in Comparative example 3, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Comparative example 4)

[0112] All fabric used for each site of the protective garment were used as the second fabric 2-1 to obtain a protective garment of Comparative example 4 in the similar manner as in Example 1. FIG. 7 is a conceptual diagram of a front surface of a protective garment 8c in Comparative example 4, and FIG. 8 is a conceptual diagram of a back surface of the protective garment 8c in Comparative example 4. The similar reference numerals as those in FIGS. 1 to 6 are given to the similar configurations as those in Example 1, 5, or 6.

[0113] An area ratio of a total area of the second fabric to a total area of this protective garment is as shown in Table 2.

[0114] Using the protective garment in Comparative example 4, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Comparative example 5)

[0115] All fabric used for each site of the protective garment were used as the first fabric 1-1 to obtain a protective garment of Comparative example 5 in the similar manner as in Example 1. FIG. 9 is a conceptual diagram of a front surface of a protective garment 8d in Comparative example 5, and FIG. 10 is a conceptual diagram of a back surface of the protective garment 8d in Comparative example 5. The similar reference numerals as those in FIGS. 1 to 8 are given to the similar configurations as those in Example 1, 5, 6, or Comparative example 4.

[0116] An area ratio of a total area of the first fabric to a total area of the protective garment is as shown in Table 2.

[0117] Using the protective garment in Comparative example 5, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 7)

[0118] A protective garment of Example 7 was obtained by the similar method as in Example 5 except that the first fabric 1-1 was used for the part A and the part B. FIG. 11 is a conceptual diagram of a front surface of a protective garment 8e in Example 7 which is one embodiment of the protective garment of the present invention, and FIG. 12 is a conceptual diagram of a back surface of the protective garment 8e in Example 7 which is one embodiment of the present invention. The similar reference numerals as those in FIGS. 1 to 10 are given to the similar configurations as those in Example 1, 5, 6, Comparative example 4, or 5.

[0119] An area ratio of a total area of the second fabric to a total area of this protective garment is as shown in Table 2.

[0120] Using the protective garment in Example 7, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

(Example 8)

[0121] A protective garment of Example 8 was obtained by the similar method as in Example 7 except that, of the lower part of the garment, a site G consisting of the first fabric 1-1 was provided on the upper part of the part E that covers the knee joint of the right leg and the part F that covers the knee joint of the left leg. Reference numeral 9f is given to the site G. FIG. 13 is a conceptual diagram of a front surface of a protective garment 8f in Example 8 which is one embodiment of the protective garment of the present invention, and FIG. 14 is a conceptual diagram of a back surface of the protective garment 8f in Example 8 which is one embodiment of the present invention. The similar reference numerals as those in FIGS. 1 to 12 are given to the similar configurations as those in Example 1, 5-7, Comparative example 4, or 5.

[0122] An area ratio of a total area of the second fabric to a total area of this protective garment is as shown in Table 2.

[0123] Using the protective garment in Example 8, three monitors performed a comfortability test and a workability test. The evaluation results are shown in Table 3.

Table 1

	Water vapor permeability	Virus barrier property	Blood barrier property	Bending resistance	Porosity		Thickness	
					Microporous film	Nonporous film	Microporous film	Nonporous film
Unit	g/m ² /hr	Class	Class	mm	%	%	μm	μm
First fabric								
1-1	450	4	4	80	45	-	12	-
1-2	380	6	6	100	45	-	24	-
1-3	220	5	5	63	33	-	12	-
1-4	160	6	6	125	25	-	60	-
1-5	600	1	1	30	45	-	4	-
Second fabric								
2-1	Less than 10	6	6	28	-	Less than 1%	-	200
2-2	Less than 10	6	6	40	-	Less than 1%	-	300
2-3	Less than 10	6	6	52	-	Less than 1%	-	400

Table 2

	Protective garment									
	Site									Area ratio
	A: Elbow joint of right arm	B: Elbow joint of left arm	C: Greater pectoral muscle	D: Subscapularis muscle	E: Knee joint of right leg	F: Knee joint of left leg	Hood	G: Upper positions of both knee joints	First fabric (%)	Second fabric (%)
Example 1	2-1	2-1	1-1	1-1	1-1	1-1	1-1	1-1	64	36
Example 2	2-1	2-1	1-2	1-2	1-2	1-2	1-2	1-2	64	36
Example 3	2-1	2-1	1-3	1-3	1-3	1-3	1-3	1-3	64	36
Example 4	2-2	2-2	1-1	1-1	1-1	1-1	1-1	1-1	64	36
Example 5	2-1	2-1	1-1	1-1	2-1	2-1	1-1	2-1	38	62
Example 6	2-1	2-1	1-1	2-1	2-1	2-1	2-1	2-1	23	77
Com parative example 1	2-1	2-1	1-4	1-4	1-4	1-4	1-4	1-4	64	36
Com parative example 2	2-1	2-1	1-5	1-5	1-5	1-5	1-5	1-5	64	36
Comparative example 3	2-3	2-3	1-1	1-1	1-1	1-1	1-1	1-1	64	36
Com parative example 4	2-1	2-1	2-1	2-1	2-1	2-1	2-1	2-1	0	100
Com parative example 5	1-1	1-1	1-1	1-1	1-1	1-1	1-1	1-1	100	0
Example 7	1-1	1-1	1-1	1-1	2-1	2-1	1-1	2-1	52	48
Example 8	1-1	1-1	1-1	1-1	2-1	2-1	1-1	1-1	45	55

Table 3

	Temperature in clothing °C	Relative humidity in clothing % RH	Evaluation on comfortability			Evaluation on workability			Barrier	property
			Monitor No. 1	Monitor No. 2	Monitor No. 3	Monitor No. 1	Monitor No. 2	Monitor No. 3		
Example 1	36.2	74	A	B	A	B	B	A	4	Blood barrier
Example 2	36.7	81	A	B	B	B	B	A	6	6
Example 3	36.4	83	B	B	B	B	B	A	5	5
Example 4	36.2	76	A	B	A	B	B	A	4	4
Example 5	36.6	81	A	B	B	A	B	A	4	4
Example 6	36.7	84	A	B	B	A	A	A	4	4
Com parative example 1	37.0	95	B	C	C	B	B	A	6	6
Comparative example 2	35.9	72	A	A	A	A	B	A	1	1
Com parative example 3	36.0	76	A	B	A	C	B	C	4	4
Com parative example 4	37.1	98	C	C	C	A	A	A	6	6
Com parative example 5	35.5	70	A	A	A	C	C	C	4	4
Example 7	36.3	78	A	B	A	B	B	A	4	4
Example 8	36.4	79	A	B	A	A	B	A	4	4

[0124] As shown in Table 3, all of the protective garments in Examples 1 to 8 of the present invention had no or little stuffiness in the comfortability tests, which were excellent in comfortability. Moreover, all of the protective garments in Examples 1 to 8 of the present invention were easy for walking and easy for evaluating in the workability tests, which were excellent in workability.

[0125] On the other hand, for the protective garment of Comparative example 1, a first fabric, which is outside the scope of the present invention, was used, and therefore, the inside of the clothing became highly humid and much stuffy, which was inferior in comfortability. For the protective garment of Comparative example 2, a first fabric, which is outside the scope of the present invention, was used, and therefore, the virus barrier property and the blood barrier property were low. For the protective garment of Comparative example 3, a second fabric, which is outside the scope of the present invention, was used, and therefore, the protective garment was difficult for walking and difficult for evaluating, which was inferior in workability. For the protective garment of Comparative example 4, only a second fabric was used without using a first fabric and a second fabric of the present invention in combination, and therefore, the inside of the clothing became highly humid and much stuffy, which was inferior in comfortability. For the protective garment of Comparative example 5, only a first fabric was used without using a first fabric and a second fabric of the present invention in combination, and therefore, the protective garment was difficult for walking and difficult for evaluating, which was inferior in workability.

REFERENCE SIGNS LIST

[0126]

- 1, 1d, 1e. Part A that covers elbow joint of wearer's right arm
- 2, 2d, 2e. Part B that covers elbow joint of wearer's left arm
- 3, 3c. Part C that covers wearer's greater pectoral muscle
- 4, 4a, 4c. Part E that covers knee joint of wearer's right leg
- 5, 5a, 5c. Part F that covers knee joint of wearer's left leg
- 6, 6b. hood
- 7, 7b, 7c. Part D that covers wearer's subscapular muscle
- 8, 8a, 8b, 8c, 8d, 8e, 8f. Protective garment
- 9f. Upper part of part E that covers wearer's knee joint

Claims

1. A protective garment comprising a pair of sleeves and a body part,
 - wherein the protective garment has a first fabric and a second fabric,
 - wherein the protective garment comprises one or more joint covering parts covering at least one of a wearer's elbow joint or knee joint,
 - wherein the first fabric has a water vapor permeability of 200 g/m²/hr or more,
 - wherein the first fabric has a virus barrier property of class 4 or higher and a blood barrier property of class 4 or higher,
 - wherein the first fabric has a bending resistance of 60 mm or more and 110 mm or less,
 - wherein the second fabric is arranged on the joint covering part,
 - wherein the second fabric has a virus barrier property of class 4 or higher and a blood barrier property of class 4 or higher,
 - wherein the second fabric has a bending resistance of 20 mm or more and 50 mm or less, and
 - wherein a surface area of the first fabric with respect to a total surface area of the protective garment is 15% or more and 70% or less.
2. The protective garment of claim 1,
 - wherein the joint covering part has a part A that covers an elbow joint of the wearer's right arm and a part B that covers an elbow joint of the wearer's left arm at the time of wearing the protective garment, and
 - wherein the second fabric is arranged on the part A and the part B.
3. The protective garment of claim 1 or 2,

wherein the joint covering part has a part E that covers a knee joint of the wearer's right leg and a part F that covers a knee joint of the wearer's left leg at the time of wearing the protective garment, and wherein the second fabric is arranged on the part E and the part F.

5 **4.** The protective garment of any one of claims 1 to 3,

wherein the first fabric has a microporous film,
wherein a porosity of the microporous film is 30% or more and 60% or less,
10 wherein the second fabric has a nonporous film, and
wherein a porosity of the nonporous film is less than 5%.

5. The protective garment of any one of claims 1 to 4,

15 wherein the protective garment comprises a part C that covers the wearer's greater pectoral muscle at the time of wearing the protective garment, and
wherein the first fabric is arranged on the part C.

6. The protective garment of any one of claims 1 to 5, further comprising a hood,

20 wherein the body part and the hood are integrated, and
wherein at least a part of the hood is composed of the first fabric.

7. The protective garment of any one of claims 1 to 6,

25 wherein the body part comprises a part D that covers the wearer's subscapular muscle at the time of wearing the protective garment, and
wherein the first fabric is arranged on the part D.

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FIG. 1

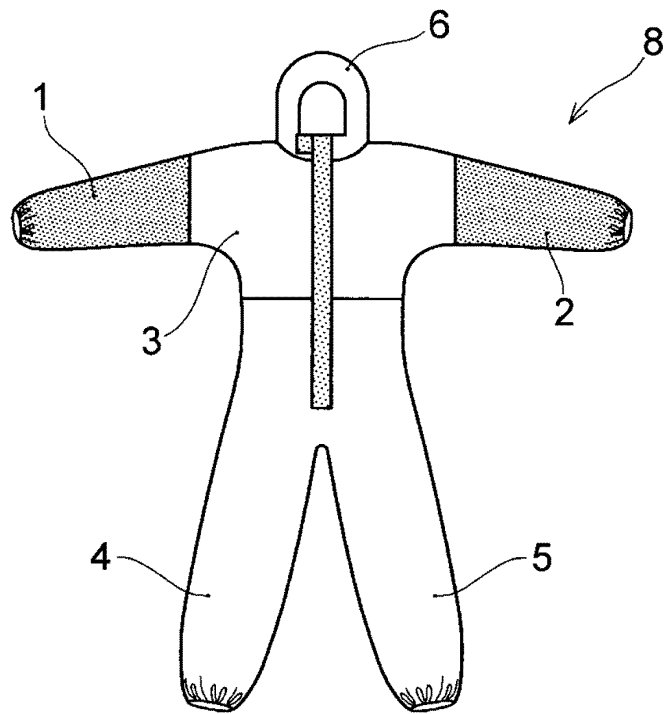


FIG. 2

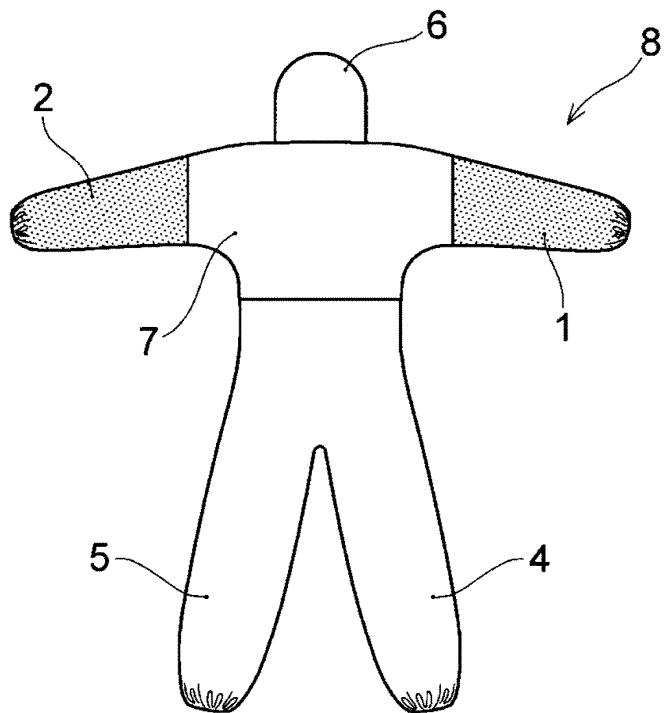


FIG. 3

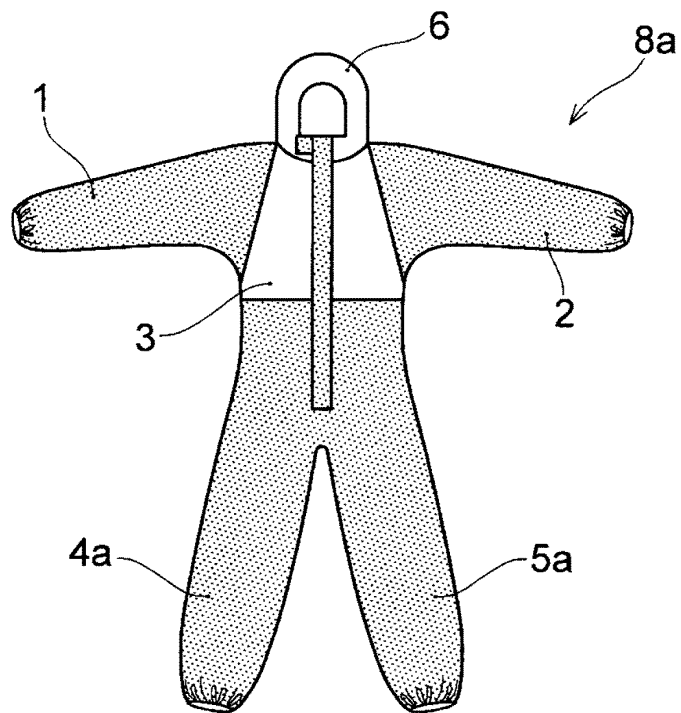


FIG. 4

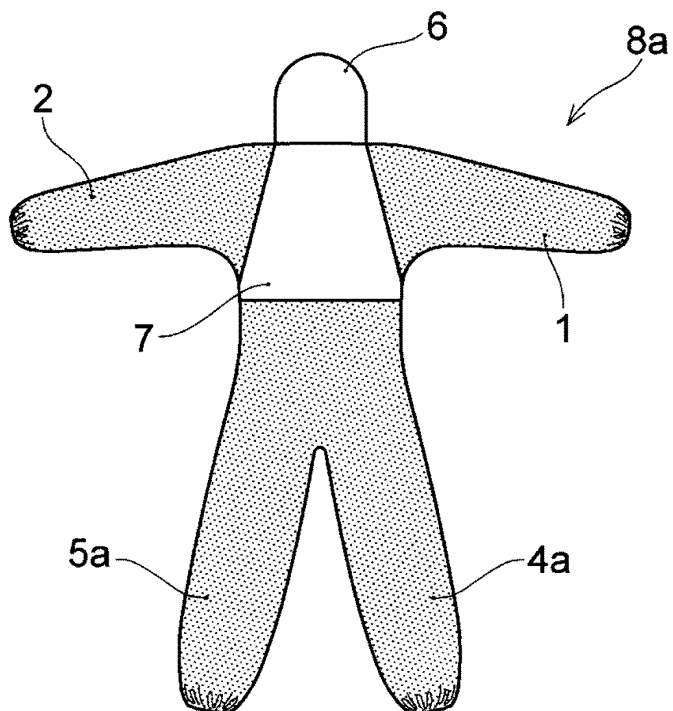


FIG. 5

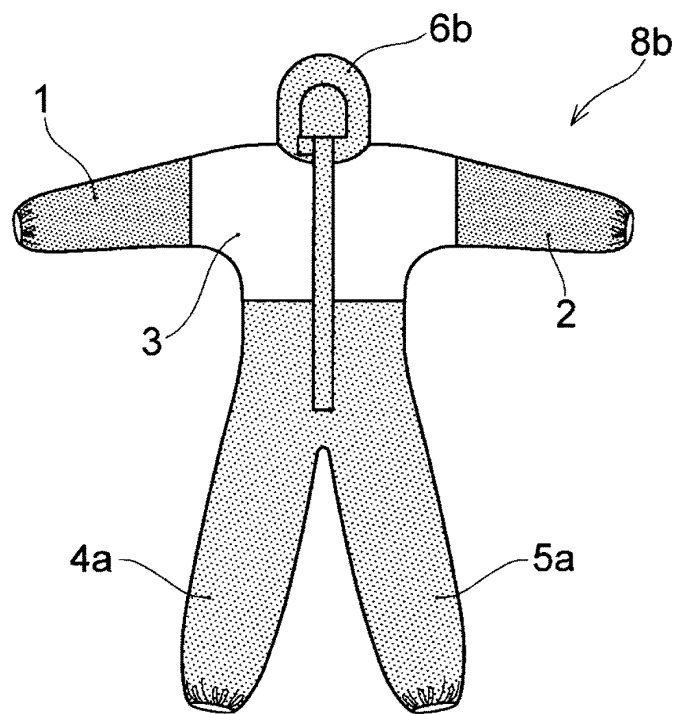


FIG. 6

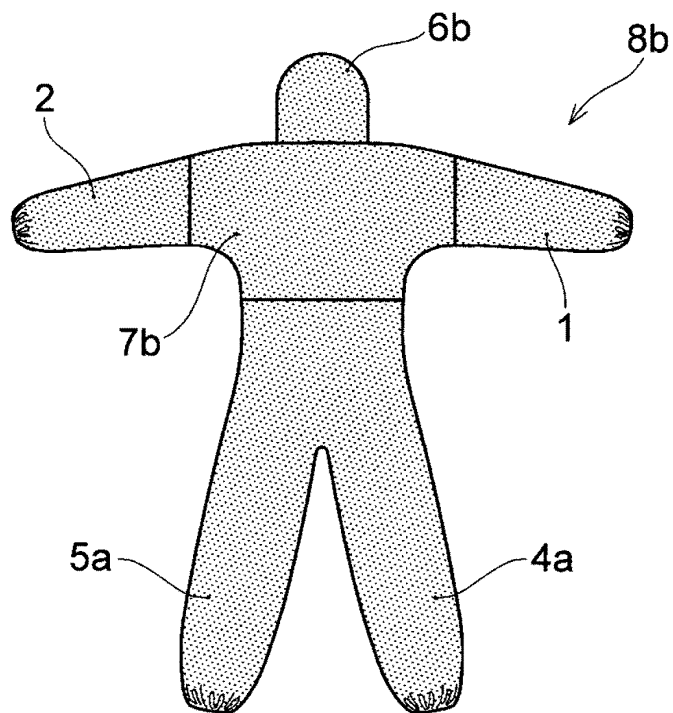


FIG. 7

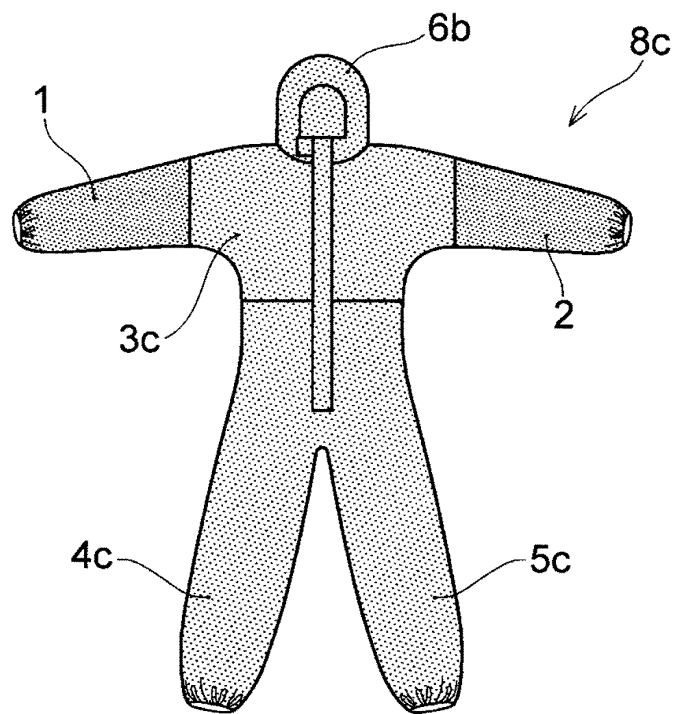


FIG. 8

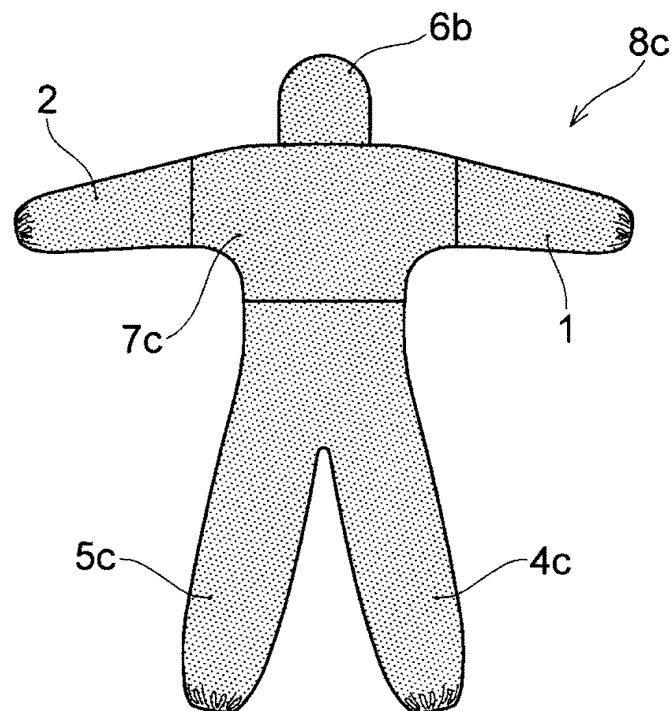


FIG. 9

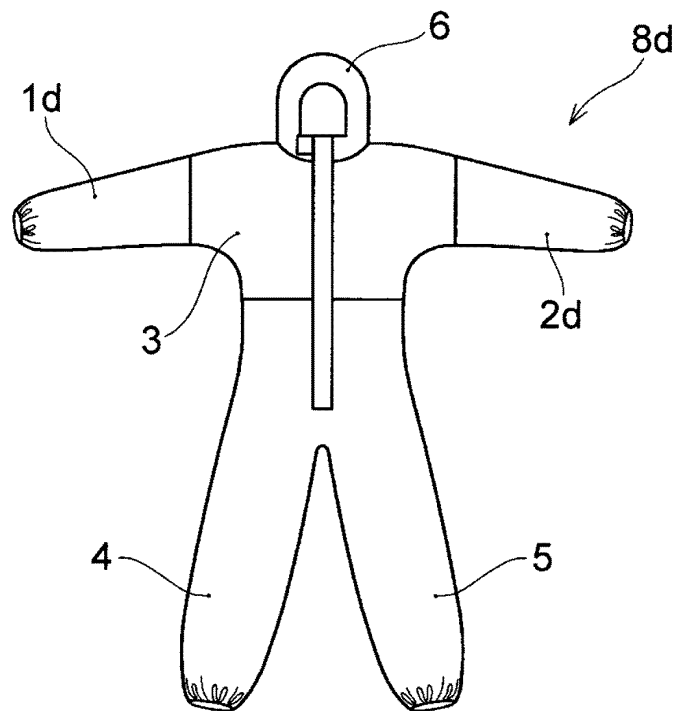


FIG. 10

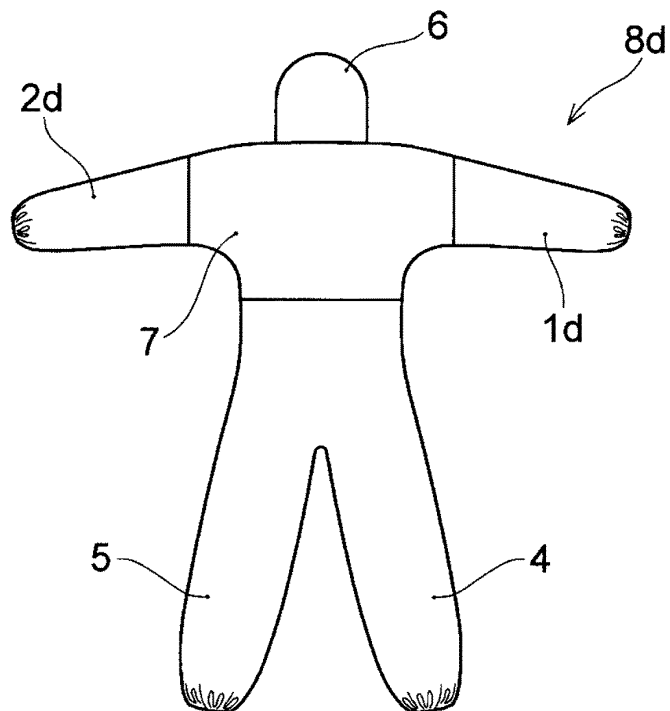


FIG. 11

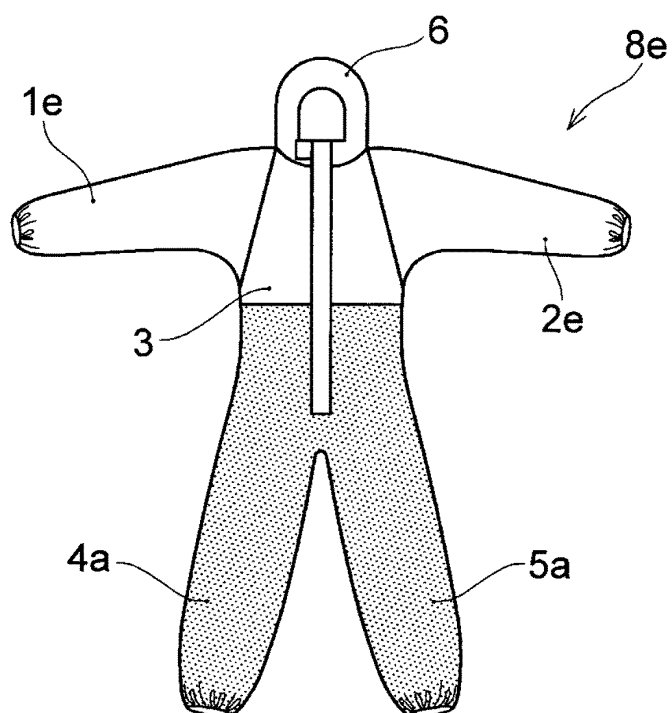


FIG. 12

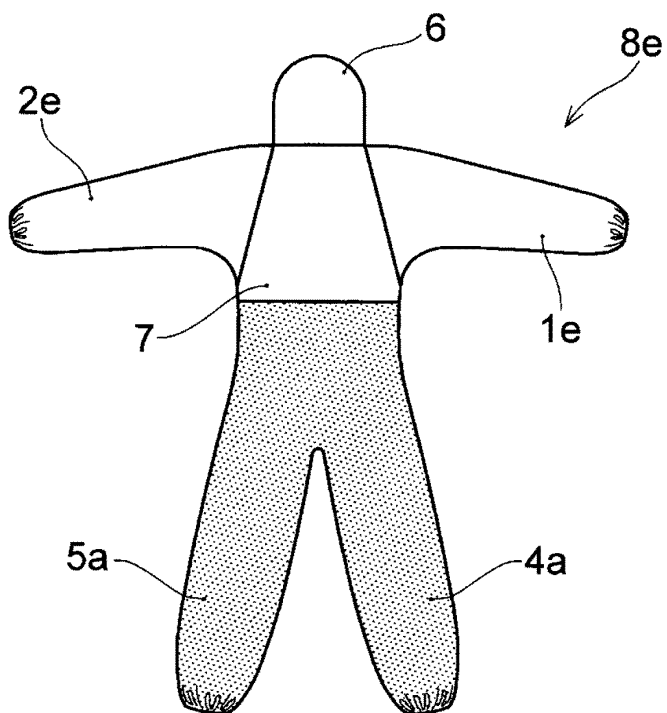


FIG. 13

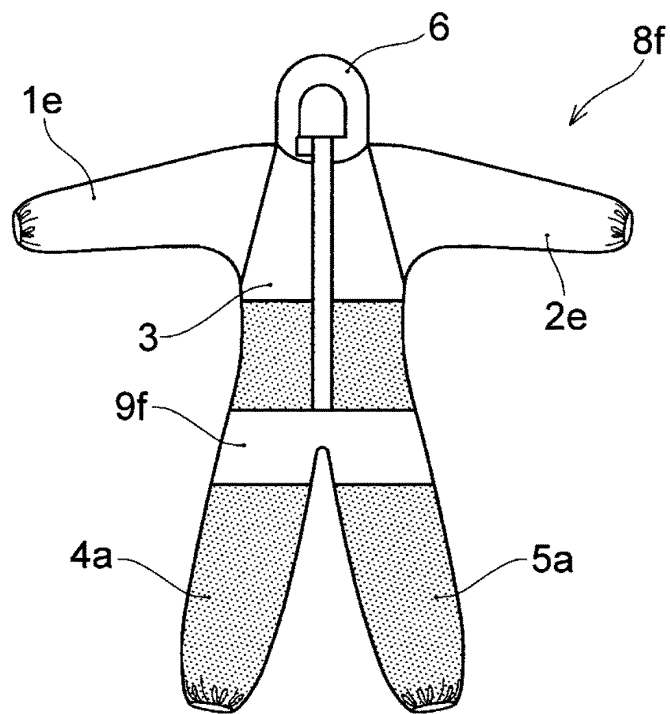
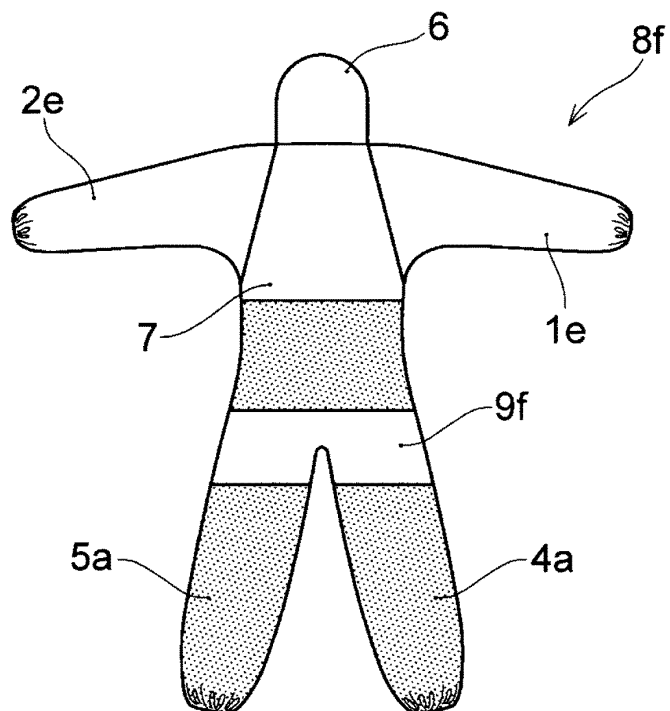


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/033107

A. CLASSIFICATION OF SUBJECT MATTER

A41D 13/00 (2006.01) i; A41D 13/02 (2006.01) i

FI: A41D13/00 102; A41D13/02

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)

A41D13/00; A41D13/02

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.
A	WO 2017/119355 A1 (TORAY INDUSTRIES, INC.) 13 July 2017 (2017-07-13) entire text, all drawings	1-7
A	JP 2018-139899 A (TORAY INDUSTRIES, INC.) 13 September 2018 (2018-09-13) entire text, all drawings	1-7
A	JP 2016-89278 A (SEIREN CO., LTD.) 23 May 2016 (2016-05-23) entire text, all drawings	1-7
A	WO 2016/104492 A1 (TORAY INDUSTRIES, INC.) 30 June 2016 (2016-06-30) entire text, all drawings	1-7
A	JP 2016-129992 A (TOYOBO CO., LTD.) 21 July 2016 (2016-07-21) entire text, all drawings	1-7
A	WO 2017/169718 A1 (TORAY INDUSTRIES, INC.) 05 October 2017 (2017-10-05) entire text, all drawings	1-7



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T"

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

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"Y"

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

"&"

document member of the same patent family

Date of the actual completion of the international search
06 November 2020 (06.11.2020)Date of mailing of the international search report
17 November 2020 (17.11.2020)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/033107

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-133566 A (TORAY INDUSTRIES, INC.) 08 July 2013 (2013-07-08) entire text, all drawings	1-7

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/033107

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 2017/119355 A1	13 Jul. 2017	CN 208972693 U entire text, all drawings	
JP 2018-139899 A	13 Sep. 2018	(Family: none)	
JP 2016-89278 A	23 May 2016	CN 105568563 A entire text, all drawings	
WO 2016/104492 A1	30 Jun. 2016	US 2017/0326485 A1 entire text, all drawings	
		EP 3239394 A1	
		CN 107109781 A	
		KR 10-2017-0098797 A	
JP 2016-129992 A	21 Jul. 2016	(Family: none)	
WO 2017/169718 A1	05 Oct. 2017	EP 3437499 A1 entire text, all drawings	
		CN 108882756 A	
		KR 10-2018-0127318 A	
JP 2013-133566 A	08 Jul. 2013	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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