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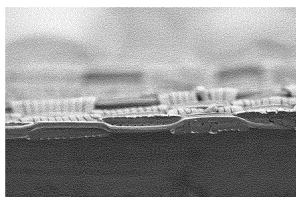
(54) **THIN LIGHTWEIGHT WOVEN FABRIC**

(57) Provided is thin lightweight woven fabric which is suitable for use as covering fabric for down wear, down jackets, futons, sleeping bags, etc. and which, even when subjected to bias deformation, can retain low air permeability. The present invention relates to thin lightweight woven fabric constituted of synthetic fiber multifilaments, characterized in that in a cross section of the warp or

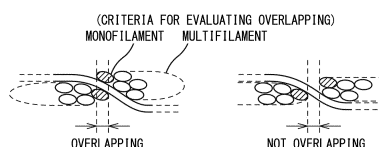
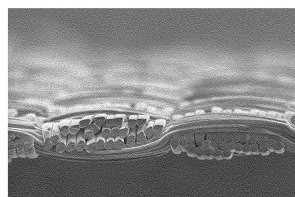
weft constituting the woven fabric, the degree of overlapping between adjacent groups of monofilaments is 0.6 or greater for either the warp or the weft and that the woven fabric has a basis weight of 15-50 g/m². The invention further relates to sports clothing, ticking, and inner-bag woven fabric which are each obtained using the thin lightweight woven fabric.

FIG. 2

(1) EXAMPLE OF ENDS OF ADJACENT MONOFILAMENTS OVERLAPPING



(2) EXAMPLE OF ENDS OF ADJACENT MONOFILAMENTS NOT OVERLAPPING



DescriptionTECHNICAL FIELD

5 **[0001]** The present invention relates to a thin lightweight woven fabric. More particularly, the present invention relates to a thin lightweight woven fabric that retains low air permeability even during bias deformation despite being lightweight and thin.

BACKGROUND ART

10 **[0002]** The following Patent Document 1 discloses a rip-stop fabric for use as wing cloth that has undergone water repellency processing and calendering, has a low basis weight, is resistant to deformation in the bias direction, and has hardly any air permeability. However, since deformation in the bias direction is small as a result of coating with a synthetic resin such as a polyurethane-based or acrylate-based resin, the fabric becomes thick, heavy and demonstrates inferior texture, thereby making application to clothing fabric difficult.

15 **[0003]** In addition, the following Patent Document 2 discloses that fabric air permeability can be reduced and exacerbation of air permeability attributable to laundering can be inhibited by having multifilaments present that are composed of synthetic fibers of 28 dtex or less and arranging monofilaments in two layers. However, there was the problem of having to limit the number of single yarns and single yarn fineness in order to reduce air permeability.

20 **[0004]** Moreover, the following Patent Document 3 discloses a waterproof polyester fabric having total warp fineness of 30 decitex or less, water pressure resistance of 800 mmH₂O or more and water resistance retention rate after laundering of 50% or more. However, there are no provisions regarding air permeability, and air permeability during bias deformation in particular is unable to be satisfied.

25 Prior Art Documents

Patent Documents

[0005]

30 Patent Document 1: Japanese Unexamined Patent Publication No. H05-245983
 Patent Document 2: Japanese Unexamined Patent Publication No. 2012-57265
 Patent Document 3: Japanese Patent No. 4399717

35 SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

40 **[0006]** With the foregoing in view, an object of the present invention is to provide a thin lightweight woven fabric that can be preferably used as down wear, down jackets, covering fabric for futons or sleeping bags, and the like, and which is able to retain low air permeability even during bias deformation.

Means for Solving the Problems

45 **[0007]** As a result of conducting extensive experimentation to achieve the aforementioned object, the inventors of the present invention found that deformation in the bias direction can be reduced even in the case of a thin lightweight woven fabric by making the degree of overlapping of adjacent single yarns (filaments) in the cross-sections of the warp and/or weft to be within a prescribed range without coating with a synthetic resin, thereby leading to completion of the present invention on the basis of this finding.

50 **[0008]** Namely, the present invention is as described below.

[0009]

55 [1] A thin lightweight woven fabric composed of synthetic fiber multifilaments as warp and weft, wherein the degree of overlapping of adjacent monofilaments in the cross-sections of the warp and weft that compose the fabric is 0.6 or more for either the warp or weft, and the basis weight of the fabric is 15 g/m² to 50 g/m².

[2] The thin lightweight woven fabric described in [1] above, which is not coated with a synthetic resin.

[3] The thin lightweight woven fabric described in [1] or [2] above, wherein air permeability after bias deformation is 1.5 cc/m²·sec or less.

[4] The thin lightweight woven fabric described in any one of [1] to [3] above, wherein the fineness of the synthetic fiber multifilaments is 5 dtex to 40 dtex and single yarn fineness is 0.8 dtex to 2.0 dtex.

[5] The thin lightweight woven fabric described in any one of [1] to [4] above, wherein the structure of the fabric is a taffeta or rip-stop taffeta structure, tear strength of the fabric is 7 N or more for both the warp and weft directions, cover factor of the fabric is 1300 to 2000, and air permeability of the fabric is 1.5 cc/m²-sec or less.

[6] The thin lightweight woven fabric described in any one of [1] to [5] above, which has been subjected to silicone resin processing.

[7] The thin lightweight woven fabric described in any one of [1] to [6] above, wherein the synthetic fiber multifilaments are polyester yarn or polyamide yarn.

[8] A sports clothing comprising the thin lightweight woven fabric described in any one of [1] to [7] above.

[9] A ticking comprising the thin lightweight woven fabric described in any one of [1] to [7] above.

[10] An inner bag woven fabric comprising the thin lightweight woven fabric described in any one of [1] to [7] above.

Effects of the Invention

[0010] The thin lightweight woven fabric according to the present invention can be preferably used in sports clothing, ticking or inner bag woven fabric and the like since it has low air permeability during bias deformation and demonstrates superior down-proof properties despite being a thin lightweight woven fabric having a basis weight of 15 g/m² to 50 g/m² as a result of making the degree of overlapping of adjacent single yarns (monofilaments) in cross-sections of the warp and weft that compose the woven fabric to be 0.6 or more, or in other words, by making the degree of overlapping of adjacent single yarns (filaments) to be within a prescribed range.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a schematic diagram for explaining a method for measuring air permeability following bias deformation.

FIG. 2 is an explanatory diagram indicating examples of cross-sectional photographs of a woven fabric that indicate overlapped states of adjacent monofilaments in cross-sections of the woven fabric along with criteria for evaluating that overlapping.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0012] The following provides a detailed explanation of embodiments of the present invention.

[0013] The thin lightweight woven fabric of the present embodiment is composed of synthetic fiber multifilaments. There are no particular limitations on the material of the synthetic fibers, and polyester-based fibers, such as polyethylene terephthalate, polytrimethylene terephthalate, polyethylene naphthalate or copolymers thereof, polyamide-based fibers such as Nylon 6, Nylon 66, Nylon 610, Nylon 612 or polymers or blends thereof, and polyolefin-based fibers such as polyethylene or polypropylene are used preferably.

[0014] There are no particular limitations on the shape of the synthetic fiber monofilaments, and they may have an irregularly shaped cross-section in addition to a round cross-section. Although examples of shapes having an irregularly shaped cross-section include Y-shaped, cross-shaped, W-shaped and V-shaped cross-sections, a round cross-section is used preferably from the viewpoint of strength.

[0015] The fineness of the synthetic fiber multifilaments is preferably 5 dtex to 40 dtex, more preferably 10 dtex to 33 dtex and even more preferably 10 dtex to 25 dtex. If fineness exceeds 40 dtex, the multifilaments become excessively thick causing the woven fabric to become thick and hard and preventing the obtaining of a thin lightweight woven fabric. In addition, in the case fineness is less than 5 dtex, the multifilaments become difficult to weave and adjacent single yarns (filaments) do not overlap even if the cover factor is increased, thereby resulting in an increase in air permeability during bias deformation.

[0016] Single yarn filament fineness is preferably 0.8 dtex to 2.0 dtex and more preferably 0.8 dtex to 1.5 dtex. In the case single yarn filament fineness is less than 0.8 dtex, the single yarns become multifilaments, and although the degree (coefficient) of overlapping of adjacent monofilaments increases in cross-sections of the warp and weft, there is concern over a decrease in tear strength. In the case single yarn filament fineness is greater than 2.0 dtex, since this results in a decrease in the number of single yarn filaments, the degree of crosslinking of adjacent monofilaments in cross-sections of the warp and weft decreases and there is concern over the texture becoming hard.

[0017] There are no particular limitations on the woven structure of the thin lightweight woven fabric of the present embodiment, and taffeta, rip-stop taffeta, twill, satin or other arbitrary structure can be used. Among these, taffeta or rip-stop taffeta is used preferably since it has a large number of intersections and undergoes little change in air permeability

since it is resistant to decreases in the degree of overlapping of adjacent yarns for both the warp and weft following bias deformation.

[0018] The basis weight of the thin lightweight woven fabric of the present embodiment is 15 g/m² to 50 g/m² and preferably 20 g/m² to 40 g/m². The basis weight is 50 g/m² or less in order to perceive the sense of being light weight when the woven fabric is used as sports clothing or a covering fabric for futon, and particularly when used as a down jacket or a covering fabric for down futon. If the basis weight is 15 g/m² or more, tear strength can be made to be 8 N or more by adjusting the woven structure and subjecting the woven fabric to resin processing.

[0019] The thin lightweight woven fabric of the present embodiment preferably has considerable tear strength despite being thin and lightweight. Tear strength is measured in compliance with JIS-L-1096:8.15.5 Method D (pendulum method), and tear strength is preferably about 7 N to 20 N to enable the woven fabric to withstand practical use as sports clothing or a covering fabric for futon and the like. If the tear strength is 7 N or more, there is no risk of tearing during use, while if the tear strength is 20 N or less, a thin lightweight woven fabric using fine yarn as previously described can be used practically.

[0020] The sum of the cover factor of the warp and the cover factor of the weft (cover factor represented by the equation below) in the thin lightweight woven fabric of the present embodiment is preferably 1300 to 2200 and more preferably 1500 to 2000.

$$\text{Cover factor} = \text{warp density (yarns/2.54 cm)} \times \sqrt{\text{warp fineness (dtex)}} + \text{weft density (yarns/2.54 cm)} \times \sqrt{\text{weft fineness (dtex)}}$$

[0021] Here, the units of warp density and weft density are (yarns/2.54 cm).

[0022] Although the resulting woven fabric is lightweight if the cover factor is less than 1300, since overlapping of the warp and/or weft decreases, air permeability following bias deformation increases thereby making this undesirable, while if the cover factor exceeds 2200, density becomes excessively high, and although changes in air permeability following bias deformation become smaller, basis weight becomes excessively high, thereby making this undesirable.

[0023] The degree (coefficient) of overlapping of adjacent monofilaments in cross-sections of the warp and weft that compose the thin lightweight woven fabric is required to be 0.6 to 1 when calculated from cross-sectional photographs to be subsequently described, and is preferably 0.8 to 1. The degree of overlapping for either the warp or weft is within this range, overlapping of the warp is more preferably within this range, and overlapping of both the warp and weft is particularly preferably within this range. Here, the degree of overlapping in the present invention refers to the ratio of those locations where adjacent monofilaments are overlapping when the presence or absence of overlapping of adjacent warp or weft are observed for 50 locations. If the overlapping for the warp and weft is less than 0.6 in all cases, gaps easily form between the warp and/or weft which tend to cause an increase in initial air permeability and air permeability following bias deformation.

[0024] In the case of using the thin lightweight woven fabric for a down jacket or a covering fabric for down futon in particular, air permeability is preferably 0.3 cc/cm²-sec to 1.5 cc/cm²-sec and more preferably 0.3 cc/cm²-sec to 1.0 cc/cm²-sec.

[0025] In addition, following bias deformation, air permeability is also 0.3 cc/cm²-sec to 1.5 cc/cm²-sec and more preferably 0.3 cc/cm²-sec to 1.0 cc/cm²-sec. If air permeability of the woven fabric is within these ranges, batting and the like does not come out of the woven fabric, thereby making this preferable.

[0026] In the case of using silicone resin processing to allow the woven fabric to demonstrate slipping effects, the coated amount thereof is preferably 0.1% by weight to 10.0% by weight based on the weight of the fabric. In particular, the coated amount of silicone resin is more preferably 0.5% by weight to 3.0% by weight based on the weight of the fabric from the viewpoint of reduced susceptibility of the occurrence of other defects such as stitch bunching. If the coated amount of silicone resin is within these ranges, tear strength increases by 10% to 50% in comparison with the absence of silicone resin. In the case the coated amount of silicone resin is 10% or more, although tear strength improves, since bias deformation becomes large, air permeability following bias deformation increases thereby preventing the demonstration of down performance.

[0027] Although there are no particular limitations on the method used for resin processing, examples of methods that are used preferably include processing using the dip-nip method following dyeing, methods using processing by the uptake method, and methods consisting of processing the resin by mixing into a coating agent. A method consisting of processing the resin using the dip-nip method is used particularly preferably from the viewpoint of allowing the processing agent to securely adhere to the fabric surface at the final stage of the processing step. There are no particular problems with using an ordinary woven fabric finishing temperature for the drying temperature. Subjecting the woven fabric to silicone-based resin processing makes it possible to simultaneously achieve the effect of making the texture smooth

and soft in addition to the effect of improving tear strength. As a result of this effect, the woven fabric does not produce a rustling sensation and has a favorable feel on the skin in the case of using as sports clothing or a covering fabric for futon.

[0028] Calendering conditions in the processing step are extremely important for attaining a degree of overlapping of adjacent monofilaments in cross-sections of the warp and weft that compose the woven fabric of 0.6 or more for either the warp or weft. In the case of a thin woven fabric, and particularly in applications using wadding such as down, etc., there are many cases in which calendering processing is used to prevent the down from coming out, and air permeability can be suppressed and down can be prevented from coming out by applying pressure to surface fibers by heat calendering. However, if calendering processing is excessive, although monofilaments present in multifilaments are compressed excessively or the degree of overlapping of the warp and/or weft becomes large, there is the risk of a considerable decrease in tear strength of the woven fabric. Air permeability can be maintained at a low level even following bias deformation by carrying out calendering processing under special conditions to control the state of the fabric surface.

[0029] More specifically, the type, pressure, temperature and speed of the calender rollers are controlled to make the degree of overlapping of adjacent monofilaments in cross-sections of the warp and weft that compose the woven fabric to be 0.6 or more. The proper calender temperature varies according to the material that composes the woven fabric, and when the glass transition temperature of the material is defined as TG (°C) and the melting point is defined as TM (°C), then the calender temperature is preferably (TG+TM)/2-30°C to (TG+TM)/2+30°C, and more preferably (TG+TM)/2-20°C to (TG+TM)/2+20°C, and even more preferably (TG+TM)/2-15°C to (TG+TM)/2+15°C. In the case the woven fabric is a blend of a plurality of materials, the lowest glass transition temperature and melting point of the fiber material on the side contacted by the metal surface of the calender are used. If the calender temperature is excessively high, the surface of the woven fabric becomes hard and air permeability during bias deformation is not maintained, thereby making this undesirable. If the calender temperature is excessively low, ventilation increases and the degree of overlapping of adjacent monofilaments in cross-sections of warp and weft that compose the woven fabric decreases, thereby making this undesirable.

[0030] Calender pressure is preferably 100 kgf/cm to 800 kgf/cm (value per roller width of 160 cm, and corresponding to pressure of 16 t (tons) to 128 t/150 cm of width in the case of a fabric width of 150 cm) and more preferably 200 kgf/cm to 600 kgf/cm (32 t to 96 t). If pressure is excessively high, the fabric becomes hard, and although the degree of overlapping of adjacent monofilaments in cross-sections of the warp and weft that compose the woven fabric increases, air permeability during bias deformation decreases, thereby making this undesirable. In addition, if pressure is excessively low, initial air permeability of the fabric increases and the degree of overlapping of adjacent monofilaments in cross-sections of the warp and weft that compose the woven fabric decreases, thereby making this undesirable. Calender speed is also important, and calendering processing at 5 m/min to 30 m/min is preferable, while that at 10 m/min to 20 m/min is particularly preferable.

[0031] When the calender roller temperature is defined at T (°C), the pressure is defined as P (t/150 cm of fabric width) and the speed is defined as S (m/min), then the calendering index as calculated by $\{T-(TG+TM)/2\}/2+(P-25)+(10-S)$ is preferably 10 to 50 and more preferably 15 to 40. Processing two to three times at this calendering index is more preferable. The use of these conditions makes it possible to maintain low air permeability during bias deformation.

[0032] In addition, although there are no particular limitations thereon, the material of the calender is preferably such that one of the rollers is made of metal. A metal roller enables the temperature of the roller per se to be controlled while also being able to apply pressure equally to the fabric surface. There are no particular limitations on the other roller and an elastic roller such as a paper roller, cotton roller or resin roller may be used in addition to a metal roller. In the case of using a resin roller, a roller having nylon for the surface material thereof is used preferably.

[0033] Since nylon yarn is susceptible to the effects of moisture and swells easily causing this to have an effect on air permeability, promptly cooling to lower the fabric temperature to 50°C or lower makes it possible to immobilize the yarn and in turn inhibit increases in layer misalignment, or in other words, increases in air permeability, during bias deformation.

[0034] There are no particular limitations on the loom used to weave the woven fabric, and a water jet loom or rapier loom can be used. Following weaving, the woven fabric can be scoured, relaxed, preset and dyed in accordance with ordinary methods, and subjected to added function processing or coating processing such as water repellency processing, antimicrobial processing or deodorizing processing as necessary followed by calendering processing or other post-processing.

[0035] A woven fabric obtained in this manner is lighter in weight than conventional woven fabric for sports clothing or covering fabric for futon, demonstrates high levels of tear strength and abrasion strength, has a smooth and soft texture, and demonstrates low air permeability, enabling it to also demonstrate down-proof properties.

Examples

[0036] The following provides a detailed explanation of the present invention through examples and the like.

[0037] The following measurements, evaluation methods, devices and the like were used in the following examples.

(1) Air Permeability

[0038] Air permeability was measured according to JIS-L-1096 8.27.1 Method A (Frazier method). Units are cc/cm²·sec.

(2) Measurement of Air Permeability following Bias Deformation

[0039] A sample was cut in the bias direction to a size measuring 15 cm × 15 cm as shown in FIG. 1 followed by deforming the sample under the conditions indicated below using the Tensilon RTC-1210A manufactured by Orientech Inc. and determining air permeability using the same measurement method

Clamping interval (a): 10 cm

Clamping width (b): 6 cm

Fabric load: Load applied up to 2.25 kgf followed by recovery

Tensile speed: 30 mm/min

(3) Basis Weight (weight per unit area)

[0040] Basis weight was determined according to weight per unit surface area in the woven fabric standard state defined in JIS-L-1096 8.4.2.

(4) Tear Strength

[0041] Tear strength was measured according to JIS-L-1096 8.15.5 Method D (Pendulum Method). Units are in N.

(5) Degree (Coefficient) of Overlapping of Adjacent Monofilaments in Cross-Sections of Warp and/or Weft

[0042] Whether or not the ends of adjacent single yarns (filaments) are overlapping in cross-sections in either or both the warp (longitudinal) and weft (lateral) directions were confirmed with cross-sectional photographs. Confirmation was made as to whether or not the end of monofilament of the warp or weft is overlapping with the end of a monofilament of the adjacent warp or weft when viewed along a straight line. Six monofilaments (five adjacent locations) were measured 10 times in cross-sections in the longitudinal direction and lateral direction and indicated as (total number of locations where ends are overlapping)/(total number of adjacent locations (50 locations)). The case in which all of the ends of adjacent single yarns (filaments) are overlapping is designated as 1, while the case in which none are overlapping is designated as 0. Examples of cross-sectional photographs are shown in FIG. 2.

[Example 1]

[0043] 22 decitex, 24 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the warp and 33 decitex, 26 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the weft to weave a taffeta structure fabric with a water jet loom. The resulting woven fabric was scoured and preset in accordance with ordinary methods and then dyed and dried with a jet dyeing machine followed by processing with an emulsion of 1% modified silicone resin in the form of Nikka Silicone DM-100E (Nikka Chemical Co., Ltd.) and 0.5% anionic surfactant using the dip-nip method, drying at 140°C, and carrying out heat calendering twice under conditions of a calendering index of 300 at a calender temperature of 160°C, calender pressure of 300 kgf (=300 × 9.807 N)/cm (P = 48 (t/150 cm of fabric width) since roller width is 160 cm and fabric width is 150 cm) and calender speed of 15 m/min. The coated amount of silicone resin was 0.8% by weight.

[0044] Properties of the resulting woven fabric consisted of a cover factor of 1801, degree of overlapping of 0.80 in the longitudinal direction and 0.50 in the lateral direction, woven fabric basis weight of 40 g/m², tear strength of 15 N for the warp and 13 N for the weft, and air permeability of 0.7 cc/cm²·sec. In addition, air permeability after measuring bias deformation was 0.9 cc/cm²·sec.

[Example 2]

[0045] 22 decitex, 24 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the warp and 33 decitex, 26 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the weft to weave and process a rip-stop taffeta structure fabric in the same manner as Example 1.

[0046] Properties of the resulting woven fabric consisted of a cover factor of 1953, degree of overlapping of 0.85 in the longitudinal direction and 0.60 in the lateral direction, woven fabric basis weight of 45 g/m², tear strength of 16 N for the warp and 16 N for the weft, and air permeability of 0.8 cc/cm²·sec. In addition, air permeability after measuring bias

deformation was 0.9 cc/cm²·sec.

[Example 3]

5 **[0047]** 11 decitex, 8 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the warp and 17 decitex, 16 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the weft to weave and process a rip-stop taffeta structure fabric in the same manner as Example 1.

10 **[0048]** Properties of the resulting woven fabric consisted of a cover factor of 1672, degree of overlapping of 0.80 in the longitudinal direction and 0.15 in the lateral direction, woven fabric basis weight of 29 g/m², tear strength of 13 N for the warp and 10 N for the weft, and air permeability of 0.7 cc/cm²·sec. In addition, air permeability after measuring bias deformation was 1.2 cc/cm²·sec.

[Example 4]

15 **[0049]** 11 decitex, 8 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the warp and 11 decitex, 8 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the weft to weave and process a rip-stop taffeta structure fabric in the same manner as Example 1.

20 **[0050]** Properties of the resulting woven fabric consisted of a cover factor of 1685, degree of overlapping of 0.70 in the longitudinal direction and 0.20 in the lateral direction, woven fabric basis weight of 26 g/m², tear strength of 14 N for the warp and 14 N for the weft, and air permeability of 0.3 cc/cm²·sec. In addition, air permeability after measuring bias deformation was 1.1 cc/cm²·sec.

[Example 5]

25 **[0051]** 14 decitex, 5 filament Nylon 66 processed yarn (TG: 49°C, TM: 267°C) was used for the warp and 14 decitex, 5 filament Nylon 66 processed yarn (TG: 49°C, TM: 267°C) was used for the weft to weave a rip-stop taffeta structure fabric in the same manner as Example 1 followed by processing under calendering conditions (calendering index: 19) at pressure "P", temperature "T" and speed "S".

30 **[0052]** Properties of the resulting woven fabric consisted of a cover factor of 1960, degree of overlapping of 0.82 in the longitudinal direction and 0.20 in the lateral direction, woven fabric basis weight of 30 g/m², tear strength of 11 N for the warp and 11 N for the weft, and air permeability of 0.9 cc/cm²·sec. In addition, air permeability after measuring bias deformation was 1.1 cc/cm²·sec.

[Comparative Example 1]

35 **[0053]** 56 decitex, 48 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the warp and 56 decitex, 48 filament Nylon 6 filaments (TG: 47°C, TM: 225°C) were used for the weft to weave and process a taffeta structure fabric in the same manner as Example 1.

40 **[0054]** Although properties of the resulting woven fabric consisted of a cover factor of 2100, degree of overlapping of 1.00 in the longitudinal direction and 0.90 in the lateral direction, tear strength of 21 N for the warp and 16 N for the weft, air permeability of 0.8 cc/cm²·sec and air permeability after measuring bias deformation was 0.9 cc/cm²·sec, woven fabric basis weight was high at 73 g/m².

[Comparative Example 2]

45 **[0055]** 33 decitex, 26 filament Nylon 66 filaments (TG: 49°C, TM: 267°C) were used for the warp and 33 decitex, 26 filament Nylon 66 filaments (TG: 49°C, TM: 267°C) were used for the weft to weave a rip-stop structure fabric with a water jet loom in the same manner as Example 1. Calendering processing was carried out in the same manner as Example 1 with the exception of making the calendering index to be 9 by changing only the calender temperature to 140°C.

50 **[0056]** Properties of the resulting woven fabric consisted of a cover factor of 1614, degree of overlapping of 0.50 in the longitudinal direction and 0.10 in the lateral direction, woven fabric basis weight of 35 g/m², tear strength of 18 N for the warp and 16 N for the weft, air permeability of 1.6 cc/cm²·sec and air permeability after measuring bias deformation of 3.5 cc/cm²·sec.

55 INDUSTRIAL APPLICABILITY

[0057] Since the thin lightweight woven fabric according to the present invention is a thin, lightweight woven fabric having a basis weight of 15 g/m² to 50 g/m² while having a degree of overlapping of adjacent monofilaments in cross-

sections of the warp and weft that compose the woven fabric of 0.6 or more for either the warp or the weft, or in other words, having a degree of overlapping of adjacent single yarns (filaments) within a prescribed range, thereby reducing air permeability during bias deformation and demonstrating superior down-proof properties, it can be preferably used in applications such as sports clothing, a covering fabric for futon, ticking or inner bag woven fabric.

Claims

1. A thin lightweight woven fabric composed of synthetic fiber multifilaments as warp and weft, wherein the degree of overlapping of adjacent monofilaments in the cross-sections of the warp and weft that compose the fabric is 0.6 or more for either the warp or weft, and the basis weight of the fabric is 15 g/m² to 50 g/m².
2. The thin lightweight woven fabric according to claim 1, which is not coated with a synthetic resin.
3. The thin lightweight woven fabric according to claim 1 or 2, wherein air permeability after bias deformation is 1.5 cc/m²·sec or less.
4. The thin lightweight woven fabric according to any one of claims 1 to 3, wherein the fineness of the synthetic fiber multifilaments is 5 dtex to 40 dtex and single yarn fineness is 0.8 dtex to 2.0 dtex.
5. The thin lightweight woven fabric according to any one of claims 1 to 4, wherein the structure of the fabric is a taffeta or rip-stop taffeta structure, tear strength of the fabric is 7 N or more for both the warp and weft directions, cover factor of the fabric is 1300 to 2000, and air permeability of the fabric is 1.5 cc/m²·sec or less.
6. The thin lightweight woven fabric according to any one of claims 1 to 5, which has been subjected to silicone resin processing.
7. The thin lightweight woven fabric according to any one of claims 1 to 6, wherein the synthetic fiber multifilaments are polyester yarn or polyamide yarn.
8. A sports clothing comprising the thin lightweight woven fabric according to any one of claims 1 to 7.
9. A ticking comprising the thin lightweight woven fabric according to any one of claims 1 to 7.
10. An inner bag woven fabric comprising the thin lightweight woven fabric according to any one of claims 1 to 7.

FIG. 1

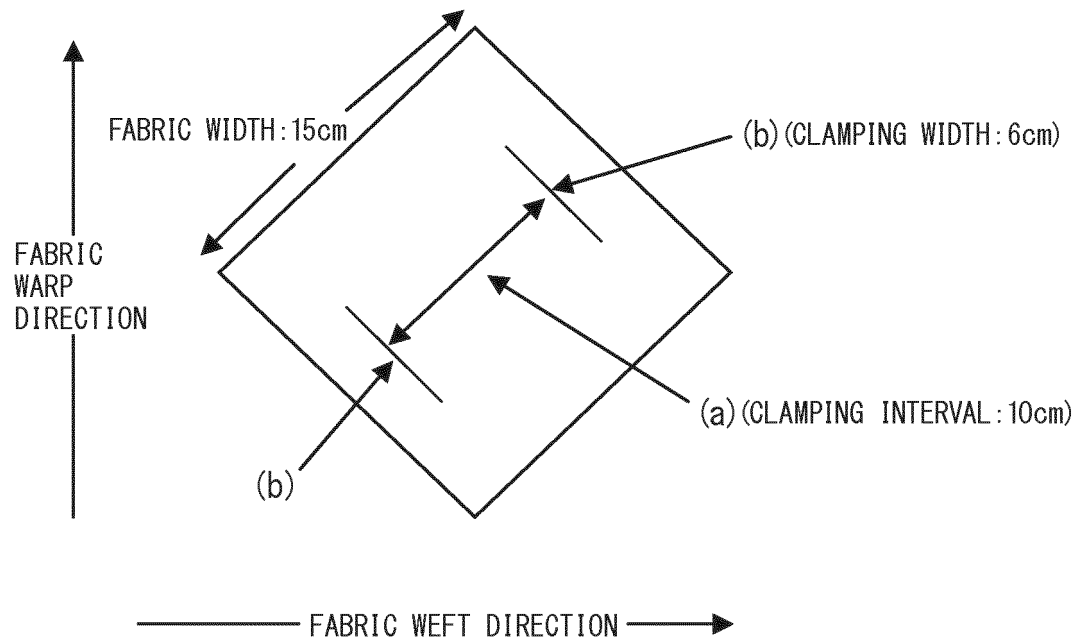
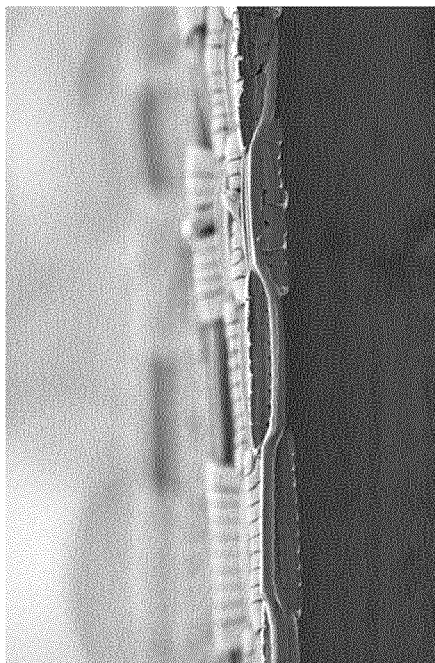
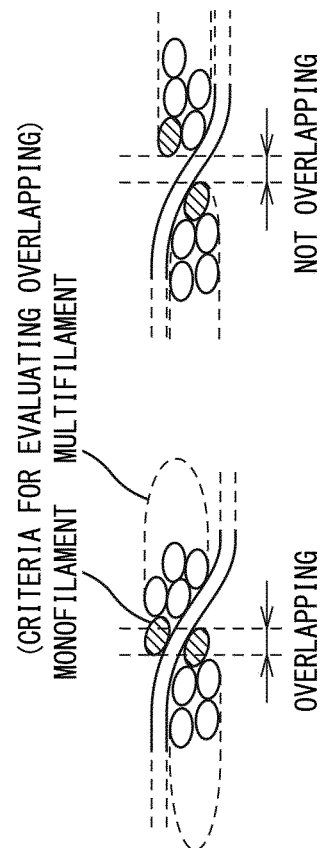
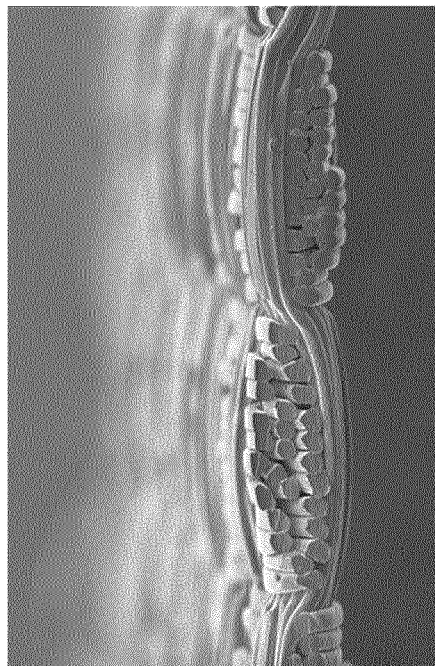


FIG. 2

(1) EXAMPLE OF ENDS OF ADJACENT
MONOFILAMENTS OVERLAPPING



(2) EXAMPLE OF ENDS OF ADJACENT
MONOFILAMENTS NOT OVERLAPPING



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/053265

A. CLASSIFICATION OF SUBJECT MATTER

D03D23/00(2006.01)i, A41D3/00(2006.01)i, A41D3/04(2006.01)i, A41D31/00(2006.01)i, D06M15/643(2006.01)i

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)

D03D1/00-27/18, A41D3/00, A41D3/04, A41D31/00, D06M15/643

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2009-13511 A (Toray Industries, Inc.), 22 January 2009 (22.01.2009), paragraphs [0001] to [0002], [0005] to [0018], [0028], [0044] to [0045], [0059], [0062] to [0065], [0075] to [0095]; paragraph [0130], table 1; paragraph [0131], table 2; fig. 1 (Family: none)	1-3, 5-7 8-10

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

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"&" document member of the same patent family

Date of the actual completion of the international search
18 March 2016 (18.03.16)

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Name and mailing address of the ISA/
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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/053265

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2010-196213 A (Toyobo Specialties Trading Co., Ltd.), 09 September 2010 (09.09.2010), paragraphs [0001], [0008], [0012] to [0013], [0022], [0034] to [0052], [0068] to [0073]; paragraph [0080], table 1; fig. 2, 3 & US 2011/0302689 A1 paragraphs [0001], [0010], [0014] to [0015], [0027], [0039] to [0057], [0089] to [0094]; table 1; fig. 2 to 3 & WO 2010/097970 A1 & CN 102317518 A	1-7, 9 8, 10
X Y	JP 2013-245423 A (Toyobo Specialties Trading Co., Ltd.), 09 December 2013 (09.12.2013), paragraphs [0001] to [0002], [0014], [0032], [0039] to [0043], [0047], [0071] to [0080]; paragraph [0083], table 2; fig. 1 & US 2013/0312155 A1 paragraphs [0001] to [0004], [0022], [0042], [0050] to [0054], [0059], [0099] to [0108]; table 2; fig. 1	1-7, 9 8, 10
X Y	JP 2012-57265 A (Toyobo Specialties Trading Co., Ltd.), 22 March 2012 (22.03.2012), paragraphs [0001] to [0004], [0009], [0015], [0018] to [0024], [0034], [0045], [0051] to [0060], [0064] to [0067], [0085] to [0092]; paragraph [0097], table 1; paragraphs [0099], [0102]; fig. 2 & US 2013/0035014 A1 paragraphs [0001] to [0004], [0015], [0021], [0031] to [0039], [0052], [0070], [0079] to [0092], [0096] to [0102], [0134] to [0141]; table 1; paragraphs [0147], [0150]; fig. 2 & WO 2012/032957 A1 & CN 102859056 A	1-9 10
X Y	WO 2014/021013 A1 (Toray Industries, Inc.), 06 February 2014 (06.02.2014), paragraphs [0001], [0007], [0014], [0025] to [0027], [0044] to [0049], [0070] to [0071], [0083]; paragraph [0096], table 2; paragraph [0097], table 3; paragraph [0099]; fig. 1 & US 2015/0203997 A1 paragraphs [0001], [0006], [0016], [0049] to [0051], [0069] to [0074], [0109] to [0113], [0125]; tables 2, 3; fig. 1 & EP 2881505 A1 & AU 2013297795 A & CN 104520481 A & KR 10-2015-0035530 A & TW 201407013 A	1, 3-8 9, 10

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/053265

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2008-101295 A (Asahi Kasei Fibers Corp.), 01 May 2008 (01.05.2008), paragraphs [0001] to [0004] (Family: none)	8-10
A	JP 2014-148776 A (Suntex Fiber Co., Ltd.), 21 August 2014 (21.08.2014), entire text; all drawings & TW 201430179 A & CN 103966726 A & KR 10-2014-0097948 A	1-10

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2012057265 A [0005]
- JP 4399717 B [0005]