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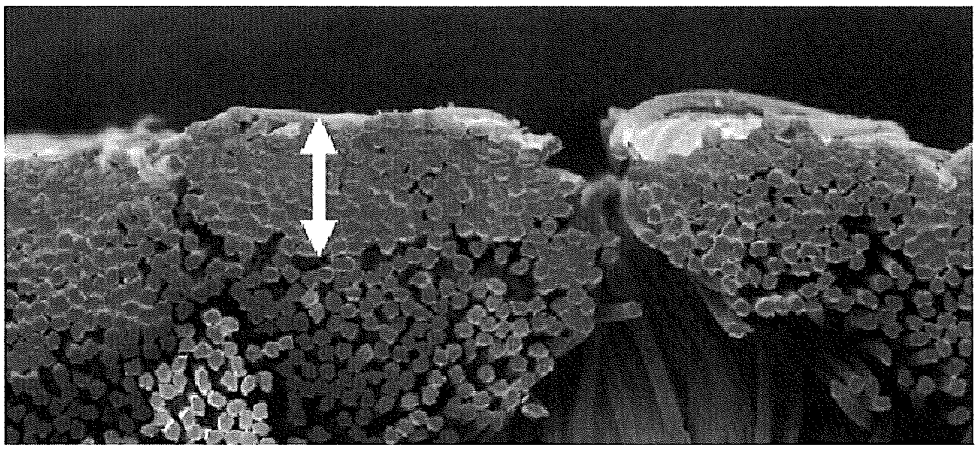
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(54) FABRIC HAVING UNEVEN-SURFACE DESIGN, AND METHOD FOR PRODUCING SAME

(57) Provided is a fabric to which an uneven-surface design which is fine and has flexibility and wear resistance is imparted. The fabric has a polyurethane resin applied portion on at least a portion of a surface side of the fabric, and an uneven-surface design shaped on the polyurethane resin applied portion. The polyurethane resin applied portion is a region in which a polyurethane resin which is applied is present, and the polyurethane resin permeates between the fibers at least in a surface portion of the fabric such that a surface of the fabric is formed by the polyurethane resin and the fibers. In the polyurethane resin applied portion, an application depth of the polyurethane resin is 50 to 200 μm, a filling ratio of the polyurethane resin is 15% to 45%, and a filling ratio of the fibers of the fabric is 50% to 80%.

FIG. 3



EP 3 235 946 A1

Description

Technical Field

[0001] The present invention relates to a fabric having an uneven-surface design, and a method for producing the same.

Background Art

[0002] Nowadays, in the field of clothing, interior materials, vehicle interior materials, and the like, there is a demand for products with high design properties, and products with uneven patterns on the surface have been developed. For example, in order to impart an uneven-surface design to a fabric, the surface of the fabric is subjected to embossing. However, fibers constituting the fabric have elasticity. Therefore, there is a problem that a sufficient shaping effect cannot be obtained due to the compression resilience caused by the elasticity of the fibers in a case where the design is a fine uneven-surface shape even when heat pressing is performed through the embossing.

[0003] As a method for solving the problem described above, it is conceivable to use fibers having a small fineness as the fibers constituting the fabric in order to reduce the compression resilience caused by the elasticity of the fabric. However, in this case, although a fine uneven-surface shape can be imparted by embossing, there is a problem that the uneven-surface shape has no durability and the uneven-surface shape disappears due to wear.

[0004] In addition, when a resin film (resin layer) is formed on the surface of a fabric as in PTL 1 or PTL 2, the resin has better shaping properties than fiber and thus a fine uneven-surface shape can be imparted. However, this causes a state in which the film is spread on the surface like a synthetic leather or plastic film. Therefore, there are problems that the soft feel or appearance of the fibers is impaired and cracking may occur during bending.

Citation List

Patent Literature

[0005]

[PTL 1] JP-A-55-132784
[PTL 2] JP-A-2002-242085

Summary of Invention

Technical Problem

[0006] An object of the present invention is to provide a fabric to which an uneven-surface design which is fine and has flexibility and wear resistance is imparted.

Solution to Problem

[0007] First, the present invention relates to a fabric including: a polyurethane resin applied portion on at least a portion of a surface side of the fabric constituted by fibers; and an uneven-surface design shaped on the polyurethane resin applied portion. The polyurethane resin applied portion is a region in which a polyurethane resin which is applied is present, and the polyurethane resin permeates between the fibers at least in a surface portion of the fabric such that a surface of the fabric is formed by the polyurethane resin and the fibers. The polyurethane resin applied portion satisfies the following requirements.

[0008] An application depth of the polyurethane resin is 50 to 200 μm.

[0009] A filling ratio of the polyurethane resin is 15% to 45%.

[0010] A filling ratio of the fibers of the fabric is 50% to 80%.

[0011] Second, the present invention relates to a method for producing the fabric having an uneven-surface design, including: applying a polyurethane resin to at least a portion of a surface side of the fabric and thereafter shaping the uneven-surface design on a polyurethane resin applied portion by embossing.

Advantageous Effects of Invention

[0012] According to the present invention, a fabric to which an uneven-surface design that is fine and has flexibility and wear resistance is imparted can be provided by a polyurethane resin which suppresses compression resilience

caused by the elasticity of fibers.

Brief Description of Drawings

[0013]

Fig. 1 is a photograph of the surface of a fabric according to an example.
Fig. 2 is a photograph of the cross-section of the fabric according to the example.
Fig. 3 is an enlarged photograph of the cross-section of a polyurethane resin applied portion of the fabric according to the example.
Fig. 4 is a weave diagram of a fabric used in Example 5.

Description of Embodiments

[0014] A fabric having an uneven-surface design according to this embodiment has a polyurethane resin applied portion on at least a portion of the surface side of the fabric, and has an uneven-surface design shaped on the polyurethane resin applied portion. The polyurethane resin applied portion is a region in which a polyurethane resin which is applied is present, the polyurethane resin permeates between fibers at least in the surface portion of the fabric such that the surface of the fabric is formed by the polyurethane resin and the fibers, and the following requirements (1) to (3) are satisfied.

(1) The application depth of the polyurethane resin is 50 to 200 μm.
(2) The filling ratio of the polyurethane resin is 15% to 45%.
(3) The filling ratio of the fibers of the fabric is 50% to 80%.

[0015] By satisfying the requirements (1) to (3) and by causing the polyurethane resin to be present between the fibers in the vicinity of the surface of the fabric, a fine uneven-surface design having flexibility and wear resistance can be obtained while suppressing the compression resilience caused by the elasticity of the fibers.

[0016] Fig. 1 is a photograph (magnification of ×25) of the surface of a fabric having an uneven-surface design according to an example, and Fig. 2 is a photograph (magnification of ×100) of the cross-section of the fabric. On the surface of the fabric, a fine uneven-surface design formed by embossing, that is, an embossed pattern is formed.

[0017] The photograph of the cross-section of the fabric of Fig. 3 is a photograph of the cross-section in a vertical direction of a polyurethane resin applied portion of the fabric having an uneven-surface design according to the example, and shows an example of a state in which a polyurethane resin is applied in the polyurethane resin applied portion. The polyurethane resin is not in the form of a film covering the surface of the fabric, but permeates between the fibers at least in the surface portion of the fabric to form a lump state with the fibers, and is present between the fibers in the vicinity of the surface of the fabric to fix the fibers to each other. Therefore, a fine uneven-surface design having flexibility and wear resistance can be obtained while suppressing the compression resilience caused by the elasticity of the fibers. In this embodiment, the polyurethane resin applied portion is a part to which the polyurethane resin is applied, and refers to a region in which the applied polyurethane resin is present.

[0018] A fabric as a processing object used in this embodiment, that is, a fabric as an object to which the polyurethane resin is applied is also called a base fabric or raw fabric. The fabric is not particularly limited, and for example, well-known fabrics such as a woven fabric, knitted fabric, and nonwoven fabric may be employed. The weave of the woven fabric is not particularly limited, and examples thereof include three foundation weaves: plain weave, twill weave, and satin weave, derivative weaves of the three foundation weaves, special weaves such as a crape weave, and furthermore, a mixed weave having two or more times thereof in combination. The knitted fabric is not particularly limited, and examples thereof include tricot, double raschel and circular knit.

[0019] The material of the fibers constituting the fabric in this embodiment is not particularly limited, and natural fibers, regenerated fibers, semi-synthetic fibers, synthetic fibers, and the like which are well known in the related art may be used. These can be used singly or in combination of two or more kinds. Among these, from the viewpoints of durability, particularly mechanical strength, heat resistance, and light fastness, the material of the fiber is preferably a synthetic fiber, more preferably polyester, and particularly preferably polyethylene terephthalate. Furthermore, from the viewpoint of flame retardancy, it is preferable to use flame retardant fibers.

[0020] On the surface of the fabric as the base fabric, a nap may also be formed by a well-known method such as a woven or knitted weave or a raising process. The nap length in a case where the fabric has the nap is not particularly limited. However, from the viewpoint of wear resistance, for example, in a case of a pile product such as a full-cut pile product or a double raschel opened product, the nap length is preferably 1600 μm or less. By causing the nap length to be 1600 μm or less, the polyurethane resin can be prevented from being fixed in the form of a layer on the surface

of the nap. Therefore, application of a load only to the polyurethane resin applied portion during wear and the deterioration in the wear resistance can be prevented.

[0021] The fabric having an uneven-surface design according to this embodiment (hereinafter, also referred to as designed fabric) has the polyurethane resin applied portion on at least a portion of the surface side of the fabric. It is preferable that the single fiber fineness (hereinafter, also referred to as single fineness) of the fibers constituting the fabric of the polyurethane resin applied portion is mainly a fiber of 1.5 dtex or less. By causing the single fiber fineness to be 1.5 dtex or less, voids between the fibers can be prevented from becoming large, and the shaping properties of a fine uneven-surface shape formed by embossing can be improved. The lower limit of the single fiber fineness is not particularly limited, and may be 0.1 dtex or more, for example.

[0022] In the case of the woven fabric, in the region to which the uneven-surface design is imparted in the fabric as the base fabric, the total fineness per unit volume 1 mm^3 is preferably 2500 to 5800 dtex, more preferably 3000 to 5800 dtex, and even more preferably 3500 to 5800 dtex. By causing the total fineness to be 2500 dtex or more, the voids between the fibers can be reduced, and the shaping properties of the fine uneven-surface shape formed by embossing can be improved. Furthermore, by causing the total fineness to be 5800 dtex or less, good weaving properties can be secured.

[0023] The total fineness per unit volume 1 mm^3 is calculated as follows. That is, by the product of a warp density (pieces/25.4 mm) and a warp fineness (warp yarn fineness) (dtex) and 25.4 mm, the total warp fineness in a volume of 25.4 mm in a width direction with respect to a gray fabric longitudinal direction × 25.4 mm in a longitudinal direction × a fabric thickness (mm) is calculated. In this calculation, the length of the warp in 25.4 mm in the warp direction is 25.4 mm. Strictly speaking, although the warp does not go straight and is bent at a part entangled with the weft, the warp is assumed to go straight in the calculation. The total weft fineness is calculated in the same manner as the warp, and the sum of the total warp fineness and the total weft fineness is calculated. The quotient of the calculated value divided by the volume (width direction × longitudinal direction × fabric thickness) is calculated to be used as the total fineness per 1 mm^3.

[0024] Specifically, this is calculated by the following expression.

$$\text{Total fineness per unit volume 1 mm}^3 = (\text{warp density} \times \text{warp fineness} \times 25.4 + \text{weft density} \times \text{weft fineness} \times 25.4) \div (25.4 \times 25.4 \times \text{fabric thickness (mm)})$$

[0025] In a case where the yarn density is different from the actual density, such as in a case where yarn drawing is present, the calculation is performed using the actual density. For example, when the warp drawing is 1 in 3 out (that is, a structure of one yarn in and three yarns out), the warp density is multiplied by 1/4 in the calculation.

[0026] In the case of the knitted fabric, in the region to which the uneven-surface design is imparted in the fabric as the base fabric, the total fineness per unit volume 1 mm^3 is preferably 1000 to 5800 dtex, more preferably 1200 to 5800 dtex, and even more preferably 1500 to 5800 dtex. By causing the total fineness to be 1000 dtex or more, the voids between the fibers can be reduced, and the shaping properties of the fine uneven-surface shape formed by embossing can be improved. Furthermore, by causing the total fineness to be 5800 dtex or less, good knitting properties can be secured.

[0027] The total fineness per unit volume 1 mm^3 in the case of the knitted fabric is calculated as follows. By the product of twice a course density, the yarn fineness, and 25.4 mm, the total fineness in a volume of the width direction (25.4 mm) with respect to the gray fabric longitudinal direction × the longitudinal direction (25.4 mm) × the fabric thickness (mm) is calculated. Since two cross-sections are shown in one loop in a cross-section in a direction perpendicular to the gray fabric longitudinal direction, the warp density is doubled in the calculation. In addition, in this calculation, the length in 25.4 mm in the width direction in which the cross-sections of the loop are connected is 25.4 mm. Furthermore, strictly speaking, since the knitted yarn does not go straight and forms loops, although the knitted yarn is bent, the knitted yarn is assumed to go straight in the calculation. The quotient of the calculated value divided by the volume (width direction × longitudinal direction × fabric thickness) is calculated to be used as the total fineness per 1 In a case of multiple weaves, for each of yarns constituting each weave, the yarn fineness in a volume of a gray fabric width direction (25.4 mm) × the gray fabric longitudinal direction (25.4 mm) × the fabric thickness (mm) is calculated, and thereafter the calculated values are added. The quotient of the added value divided by the volume is calculated, thereby obtaining the total fineness per unit volume 1

[0028] Specifically, this is calculated by the following expression.

Total fineness per unit volume 1 mm^3 (in a case of tricot knitting and circular knitting)

= (total yarn fineness[*1] for each yarn × course density × 2 × 25.4) ÷ (25.4 × 25.4 × fabric thickness (mm))

*1: The total yarn fineness of a front yarn, a middle yarn, and a back yarn in the tricot knitting, and the total yarn fineness of a face yarn, a bonding yarn, and a rear yarn in the circular knitting.

Total fineness per unit volume 1 mm^3 (in a case of a double raschel opened product)

= {(total yarn fineness for each ground yarn + total yarn fineness for each pile yarn) × course density × 2 × 25.4} ÷ (25.4 × 25.4 × fabric thickness (mm))

Total fineness per unit volume 1 mm^3 (in a case of a double raschel unopened product)

= {(total yarn fineness for each ground yarn + total yarn fineness for each connecting yarn × 2) × course density × 2 × 25.4} ÷ (25.4 × 25.4 × fabric thickness (mm))

[0029] In a case where the yarn density is different from the actual density, such as in a case where yarn drawing is present, the calculation is performed using the actual density. An example is described below. Regarding the connecting yarn of the double raschel unopened product, for example, in a case where the yarn drawing is 1 in 1 out, the following expression is obtained.

Total fineness per unit volume 1 mm^3

= {(total yarn fineness for each ground yarn + total yarn fineness for connecting yarn × 2 × 1/2) × course density × 2 × 25.4} ÷ (25.4 × 25.4 × fabric thickness (mm))

[0030] The polyurethane resin used in this embodiment is not particularly limited, and examples thereof include polyurethane resins based on polyether, polyester, polycarbonate, and the like. Among these, from the viewpoint of texture, a polyester-based polyurethane resin is preferably used, and from the viewpoint of durability, particularly wear resistance, a polycarbonate-based polyurethane resin is preferably used.

[0031] The softening temperature of the polyurethane resin is preferably 100°C to 200°C. By causing the softening temperature to be 100°C or higher, even in a case of being used under conditions in which the fabric is left for a long period of time at a high temperature such as in a vehicle interior material, the resin can be less likely to melt. By causing the softening temperature to be 200°C or lower, the heating temperature of an embossing roll when the uneven-surface design is shaped can be set to be low and the basic fabric in a part to which the polyurethane resin is not applied can be prevented from becoming coarse and hard. The softening temperature is measured by differential scanning calorimetry using a DSC thermal analyzer.

[0032] The application of the polyurethane resin may be performed on the entire fabric, or may be performed only on the periphery of a part to which the fine uneven-surface design is imparted. The application amount of the polyurethane resin in the polyurethane resin applied portion varies depending on the configuration of the fabric as the processing

object, for example, density, fineness, and the like, but is preferably about 1 to 200 g/m^2 with respect to the fabric. By causing the application amount thereof to be 1 g/m^2 or more, the fibers are sufficiently fixed to each other. Therefore, the wear resistance is improved or the shaping properties of the fine uneven-surface shape formed by embossing are improved. By causing the application amount thereof to be 200 g/m^2 or less, the texture can be prevented from becoming hard. Here, the polyurethane resin permeates between the fibers at least in the surface portion (surface layer portion) of the fabric to form the surface portion of the fabric together with the fibers, and unlike a grain face synthetic leather, the skin layer of the polyurethane resin alone is not formed over the entire surface of the fabric. The application amount of the polyurethane resin is obtained by converting the application amount in the part to which the polyurethane resin is applied into the application amount per square meter and is a value in terms of the mass of a solid content after being dried.

[0033] The application depth of the polyurethane resin in the polyurethane resin applied portion of this embodiment is in a range of 50 to 200 μm. By causing the application depth thereof to be 50 μm or more, the fibers are sufficiently fixed to each other. Therefore, the wear resistance is improved or the shaping properties of the fine uneven-surface shape formed by embossing are improved. By causing the application depth thereof to be 200 μm or less, the texture can be prevented from becoming hard. The application depth is preferably 50 to 130 μm, and more preferably 50 to 100 μm.

[0034] The application depth of the polyurethane resin is referred to as the depth of the region in which the polyurethane resin is present between the fibers of the fabric from the surface of the fabric, and hereinafter, this region is also referred to as the application depth region of the polyurethane resin. Here, the application depth of the polyurethane resin is synonymous with the thickness of the polyurethane resin applied portion. The application depth of the polyurethane resin is indicated by a white arrow in Fig. 3. The application depth of the polyurethane resin is determined as follows. A vertical section of the polyurethane resin applied portion is photographed with a microscope, for arbitrary ten points, the length in the vertical direction from the surface of the fabric to the lower end of the permeating polyurethane resin in a part in a state in which the polyurethane resin causes the fibers to be fixed together and form a lump state is measured, and the average thereof is obtained.

[0035] As described above, the polyurethane resin permeates between the fibers at least in the surface portion of the fabric and may permeate throughout the fabric thickness. However, from the viewpoint of texture, it is preferable that the polyurethane resin does not permeate through the entire thickness of the fabric, that is, permeates into a portion in the thickness direction including the surface portion of the fabric. Specifically, a ratio of the application depth of the polyurethane resin to the thickness of the designed fabric may be 3% to 30%, or may be 3% to 10%. Here, the thickness of the designed fabric is not particularly limited, and may be, for example, 0.2 to 3.0 mm (that is, 200 to 3000 μm), or 0.3 to 2.8 mm.

[0036] The filling ratio of the polyurethane resin in the polyurethane resin applied portion of this embodiment is in a range of 15% to 45%. By causing the filling ratio thereof to be 15% or more, the shaping properties of the uneven-surface shape are improved. By causing the filling ratio thereof to be 45% or less, the flexibility is improved. The filling ratio is preferably 15% to 35%, and more preferably 20% to 35%.

[0037] The filling ratio of the polyurethane resin in the polyurethane resin applied portion is the proportion occupied by the polyurethane resin in the application depth region of the polyurethane resin (the part in which the polyurethane resin causes the fibers to be fixed together and form a lump state), and is obtained as follows. That is, this is obtained by the following expression from the filling ratio of the fibers and the void ratio, which will be described later.

$$\text{Filling ratio (\%) of polyurethane resin} = 100 - (\text{filling ratio of fibers} + \text{void ratio})$$

[0038] The filling ratio of the fibers of the fabric in the polyurethane resin applied portion is in a range of 50% to 80%. By causing the filling ratio thereof to be 50% or more, the voids between the fibers can be reduced and thus the adhesion between the fibers can be improved, thereby improving the wear resistance. By causing the filling ratio thereof to be 80% or less, the flexibility can be improved. The filling ratio is preferably 55% to 80%, more preferably 55% to 75%.

[0039] The filling ratio of the fibers in the polyurethane resin applied portion is the proportion occupied by the fibers in the application depth region of the polyurethane resin (the part in which the polyurethane resin causes the fibers to be fixed together and form a lump state), and is obtained as follows. That is, a photograph of the vertical section of the polyurethane resin applied portion taken with the microscope is read by a scanner, and the number (n) of yarn sections in a measurement area having a width of 100 μm as the lateral direction and having the application depth region of the polyurethane resin in the vertical direction is measured, and the filling ratio of the fibers is obtained by the following expression. The diameter R (μm) of the yarn is obtained by measuring the diameter in the vertical and lateral directions of the cross-section of the yarn at arbitrary five points and averaging the measured values.

$$\text{Filling ratio (\%) of fibers} = (78.5 \times R^2 \times n) \div (100 \times \text{application depth } (\mu m) \text{ of polyurethane resin})$$

[0040] The filling ratio of the fibers in the polyurethane resin applied portion is the average value of the filling ratios of the fibers obtained at arbitrary five points.

[0041] The sum of the outer circumferential lengths of the fiber cross-sections in the polyurethane resin applied portion of this embodiment is preferably 1500 μm or more per unit area 10,000 μm^2, more preferably 1800 μm or more, and even more preferably 2700 μm or more. When the sum thereof is 1500 μm or more, the adhesion between the polyurethane resin and the fibers is improved, the compression resilience of the fibers is suppressed, and thus the shaping properties of the fine uneven-surface shape formed by embossing can be improved. It is thought that this is because as the sum of the outer circumferential lengths increases, a large number of fibers (filaments) having a small single fineness are present, the voids between the fibers are small, and the polyurethane resin and the fibers are easily fixed together. Furthermore, it is thought that a large number of fibers having a small single fineness results in an increase in the surface area with respect to the total fineness, and thus the area covered with the polyurethane resin is increased and is easily fixed. The upper limit of the sum of the outer circumferential lengths of the fiber cross-sections is not particularly limited, and may be, for example, 9000 μm or less, or 6000 μm or less.

[0042] The sum of the outer circumferential lengths of the fiber cross-sections in the polyurethane resin applied portion is obtained as follows. That is, the photograph of the vertical section of the polyurethane resin applied portion taken with the microscope is read by the scanner, and the number (n) of yarn sections in the measurement area having a width of 100 μm as the lateral direction and having the application depth region of the polyurethane resin in the vertical direction is measured, and the sum of the outer circumferential lengths of the fiber cross-sections is obtained by the following expression. The diameter R (μm) of the yarn is obtained by measuring the diameter in the vertical and lateral directions of the cross-section of the yarn at arbitrary five points and averaging the measured values.

$$\text{Sum } (\mu m) \text{ of outer circumferential lengths of fiber cross-sections} = (31{,}400 \times R \times n) \div (100 \times \text{application depth of polyurethane resin } (\mu m))$$

[0043] The sum of the outer circumferential lengths of the fiber cross-sections in the polyurethane resin applied portion is the average value of the sums of the outer circumferential lengths of the fiber cross-sections obtained at arbitrary five points.

[0044] The void ratio in the polyurethane resin applied portion is preferably 13% or less, and more preferably 9% or less. By causing the void ratio to be 13% or less, the uneven-surface shape can be easily shaped by embossing. The lower limit of the void ratio is not particularly limited, and for example, may be 0.1% or more, or, 2% or more.

[0045] The void ratio in the polyurethane resin applied portion is the ratio of the void portions in the application depth region of the polyurethane resin (the part in which the polyurethane resin causes the fibers to be fixed together and form a lump state), and is obtained as follows. That is, the photograph of the vertical section of the polyurethane resin applied portion taken with the microscope is read by the scanner, and the voids and the other parts in the measurement area having a width of 100 μm as the lateral direction and having the application depth region of the polyurethane resin in the vertical direction are binarized, and the proportion of the voids in the application depth region of the polyurethane resin of the fabric is calculated. The void ratio in the polyurethane resin applied portion is the average value of the void ratios obtained at arbitrary five points.

[0046] The number of fibers per 100 μm^2 of the cross-sectional area of the polyurethane resin in the polyurethane resin applied portion is preferably 1.5 or more, and more preferably 2.0 or more. By causing the number to be 1.5 or more, the number of fibers per polyurethane resin is increased, and thus a binder effect of the polyurethane resin can be enhanced. Therefore, the shaping properties of the fine uneven-surface shape formed by embossing can be improved, and the wear resistance can be improved. The upper limit of the number of the fibers is not particularly limited, and for example, may be 100 or less, 50 or less, or 20 or less.

[0047] The number of fibers per 100 μm^2 of the polyurethane resin in the polyurethane resin applied portion is obtained by using the photograph of the vertical section of the polyurethane resin applied portion taken with the microscope, similar to the filling ratio of the polyurethane resin. The number of fiber cross-sections in the measurement region is counted. The area of the polyurethane resin is calculated by multiplying the filling ratio of the polyurethane resin by the area of the measurement region. From these values, the number of fibers per 100 μm^2 of the polyurethane resin is calculated.

[0048] The uneven-surface design in this embodiment is preferably a fine uneven-surface design having a recess

shape with a width of 200 to 1500 μm and a maximum depth of 20 to 450 μm. The uneven-surface design preferably has a maximum pattern spacing of 10,000 μm or less. As a preferable embodiment, in the uneven-surface design, the width of the recess may be 200 to 1200 μm, the maximum depth of the recess may be 20 to 250 μm, and the maximum pattern spacing may be 5000 μm or less. As a more preferable embodiment, the width of the recess may be 200 to 800 μm, the maximum depth of the recess may be 20 to 150 μm, and the maximum pattern spacing may be 2000 μm or less. By satisfying these ranges, a fine uneven-surface design that could not be hitherto obtained by embossing, for example, an uneven-surface design which is as fine as the grain of natural leather can be expressed.

[0049] The width and the depth of the recess in the uneven-surface design can be obtained by measuring the width and the depth of the recess from the photograph of the vertical section of the polyurethane resin applied portion taken with the microscope. Specifically, as shown in Fig. 2, the width (W) of the recess of the uneven-surface design is obtained by measuring the distance from one end to the other end of arbitrary three recesses and calculating the average value thereof. The depth (D) of the recess of the uneven-surface design is obtained by measuring the distance of a perpendicular drawn to the deepest part of the recess from the straight line connecting one end to the other end of the recess when the width of the recess is measured as described above, and the maximum value for three arbitrary recesses is obtained. The pattern spacing of the uneven-surface design is obtained by measuring the distance between the apexes of adjacent protrusions from a photograph of the surface of the polyurethane resin applied portion taken with the microscope, and the maximum value for arbitrary three sets of protrusions is obtained.

[0050] The cross-sectional shape of the uneven-surface design in the vertical direction is not particularly limited, but is preferably a corrugated shape that can express a finer pattern. In a case of the corrugated shape, it is preferable that the inclination angle of the straight line connecting the highest position of the projection and the lowest position of the recess in the projection and the recess adjacent to each other is 5 to 40 degrees. The inclination angle is more preferably 5 to 30 degrees, and even more preferably 5 to 20 degrees.

[0051] The inclination angle of a corrugated design is measured as follows. The inclination angle is obtained by measuring the angle between the straight line connecting the highest position of the projection to the lowest position of the recess and a tangent to the highest position of the projection from the photograph of the vertical section of the polyurethane resin applied portion taken with the microscope.

[0052] The fabric having an uneven-surface design according to this embodiment can be obtained by applying the polyurethane resin to at least a portion of the surface side of the fabric as the base fabric and thereafter shaping the uneven-surface design on the polyurethane resin applied portion by embossing.

[0053] In a manufacturing method of this embodiment, first, a treatment liquid containing the polyurethane resin is applied to at least a portion of the surface side of the fabric. For example, the treatment liquid may be applied to the entire surface on the surface side of the fabric. Alternatively, the treatment liquid may be applied to a portion of the surface side of the fabric, and in this case, may be applied into a pattern. The treatment liquid contains at least the polyurethane resin and a medium (for example, water) for dispersing the polyurethane resin, and if necessary, may contain additives such as a coloring material (dye, pigment, or metal powder), or a thickener.

[0054] A method for applying the treatment liquid is not particularly limited, and examples thereof include screen printing, rotary printing, ink jet printing, and the like. In a case where the fabric has an uneven surface, a gravure coater, a comma coater, a reverse coater, or the like may also be used.

[0055] Next, the polyurethane resin is dried and solidified. The drying may be performed to the extent that the medium does not remain, and the conditions thereof are not particularly limited, and may be appropriately set in consideration of the boiling point of the medium and production efficiency.

[0056] As described above, after the polyurethane resin is applied to the surface portion of the fabric and dried, the entire surface is subjected to embossing. Specifically, for example, the surface is caused to pass through an embossing roll having a temperature of 100°C to 160°C and a pressure (linear pressure) of 490 to 1960 N/cm to soften and shape the polyurethane resin on the surface of the fabric. On the surface of the embossing roll, an uneven-surface pattern having an uneven surface reverse to a desired fine uneven-surface pattern is carved. The temperature of the embossing roll is set in consideration of the softening temperature of the polyurethane resin, the material of the fibers constituting the fabric, required durability, and the like.

[0057] A heat treatment may be performed on the fabric after the shaping process in order to soften the texture. The heat treatment is preferably performed at 100°C to 150°C for 30 seconds to 3 minutes.

[0058] As described above, the fabric having an uneven-surface design of this embodiment can be obtained. The polyurethane resin permeates between the fibers at least in the surface portion in the thickness direction to form the surface portion of the fabric together with the fibers.

[0059] The application of the fabric having an uneven-surface design according to this embodiment is not particularly limited, and can be used in various fields such as vehicle interior materials, interior materials, clothing, bags, and the like.

Examples

[0060] Hereinafter, the present invention will be described in more detail using examples, but the present invention is not limited to these examples. In addition, the evaluation of the fabric was performed according to the following methods.

(1) Shaping Properties

[0061] Products subjected to embossing using embossing rolls A, B and C having the following uneven-surface shapes were visually checked and evaluated according to the following evaluation criteria.

Embossing roll A: recess width 800 μm, maximum recess depth 150 μm, pattern spacing 2000 μm, uneven-surface cross-sectional shape in vertical direction; corrugated, inclination angle 5 to 20 degrees, leather grain pattern
Embossing roll B: recess width 1200 μm, maximum recess depth 250 μm, pattern spacing 5000 μm, uneven-surface cross-sectional shape in vertical direction; corrugated, inclination angle 10 to 30 degrees, leather grain pattern
Embossing roll C: recess width 1500 μm, maximum recess depth 450 μm, pattern spacing 10,000 μm, uneven-surface cross-sectional shape in vertical direction; trapezoidal, line pattern

(Evaluation Criteria)

[0062]

1: All the uneven-surface shapes of A, B, C are clearly shaped.
2: The uneven-surface shape of A is unclear, but the uneven-surface shapes of B and C are clearly shaped.
3: The uneven-surface shapes of A and B are unclear, but the uneven-surface shape of C is clearly shaped.
4: All the uneven-surface shapes of A, B, C are unclear.

(2) Flexibility

[0063] The specimen after the evaluation of the shaping properties was cut into a width of 25 mm and a length of 150 mm, and then fixed to De Mattia flexing tester (manufactured by Tester Sangyo Co., Ltd.). With a bending stroke of 57 mm, the specimen was bent 300 times per minute, a total of 3000 times. The specimen after being bent was observed and evaluated according to the following criteria.

(Evaluation Criteria)

[0064]

1: Cracking had not occurred.
2: Cracking had occurred.

(3) Wear Resistance

[0065] After cutting the specimen after the evaluation of the shaping properties into a width of 70 mm and a length of 300 mm, a urethane foam having a size of 70 mm in width, 300 mm in length, and 10 mm in thickness was attached to the rear surface thereof, and the resultant was fixed to Plane Abrasion Tester T-TYPE (manufactured by DAIEI KAGAKU SEIKI MFG. co., ltd.). The specimen was worn by applying a load of 9.8 N to a rubbing finger covered with a cotton cloth (cotton canvas). The rubbing finger had worn back and forth 10,000 times at a rate of 60 reciprocations/min between 140 mm on the surface of the specimen. The cotton canvas was replaced every 2500 times of wear reciprocation, and was reciprocated a total of 10,000 times to be worn. The specimen after being worn was observed and evaluated according to the following criteria.

(Evaluation Criteria)

[0066]

1: The uneven-surface shape had not disappeared.
2: The uneven-surface shape had slightly disappeared.
3: The uneven-surface shape had clearly disappeared.

[Example 1]

[0067] A polyethylene terephthalate false twisted yarn of 167 dtex/288 f was used as a warp, a polyethylene terephthalate false twisted yarn of 167 dtex/48 f was used as a weft, and these were woven into a warp-faced 5-harness satin weave, thereby obtaining a gray fabric. Next, a heat treatment was performed at 190°C for 1 minute by a heat setter. The density of the warps of the obtained fabric was 178 pieces/25.4 mm, the density of wefts was 61 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 3928 dtex.

[0068] Next, a polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation, softening temperature = 120°C) solution (solid content 28 mass%) was applied to the entire surface by a screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in a 90°C dryer. Next, embossing was performed thereon with an embossing machine at a roll temperature of 150°C, a roll pressure of 588 N/cm, and a fabric speed of 3 m/min. As the embossing roll, three types of rollers A to C described in Shaping Properties in the above-mentioned evaluation item were used.

[0069] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and fine uneven-surface design (fine embossed pattern) formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 98 μm, the filling ratio of the fibers was 69.1%, the filling ratio of the polyurethane resin was 26.4%, the void ratio was 4.5%, the number of fibers per 100 μm^2 of the polyurethane resin was 6.5, the circumferential length of filament cross-sections was 3863 μm, and the thickness of the fabric was 400 μm. Evaluation results are shown in Table 1.

[Example 2]

[0070] Using a three-reed tricot knitting machine, a polyethylene terephthalate false twisted yarn of 84 dtex/96 f was used for L1 (front yarn) for a 3-needle swing cord stitch (1-0/3-4), a polyethylene terephthalate flame retardant yarn of 84 dtex/36 f was used for L2 (middle yarn) for a denbigh stitch (1-0/1-2), a polyethylene terephthalate flame retardant yarn of 84 dtex/36 f was used for L3 (back yarn) for a 3-needle swing cord stitch (2-1/1-0), these were each knitted by full set threading, thereby obtaining a gray fabric. Next, this was subjected to dyeing by a dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, by a card cloth raising machine provided with a card cloth roll having 12 pile rollers and 12 counter pile rollers, full cut raising was performed by performing raising thereon 13 times alternately in a knitting end direction and in a knitting start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 71 loops/25.4 mm in the course, a density of 38 loops/25.4 mm in the wale, and a fineness of 2310 dtex per 1 mm^3 volume.

[0071] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 120°C, a roll pressure of 1470 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0072] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and a fine uneven-surface design formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 92 μm, the filling ratio of the fibers was 66.2%, the filling ratio of the polyurethane resin was 25.4%, the void ratio was 8.4%, the number of fibers per 100 μm^2 of the polyurethane resin was 4.0, the circumferential length of filament cross-sections was 2934 μm, and the thickness of the fabric was 610 μm. Evaluation results are shown in Table 1.

[Example 3]

[0073] A polyethylene terephthalate false twisted yarn of 178 dtex/24 f was used as a warp, a polyethylene terephthalate false twisted yarn of 167 dtex/144 f was used as a weft, and these were woven into a warp-faced 8-harness satin weave and a weft-faced 8-harness satin weave to form a border pattern with an interval of 10 mm, thereby obtaining a gray fabric. Next, by the card cloth raising machine provided with the card cloth roll having 12 pile rollers and 12 counter pile rollers, semi-cut raising was performed by performing raising thereon 13 times alternately in a weaving end direction and in a weaving start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 150°C for 1 minute and was finished. The density of the warps

of the obtained fabric was 184 pieces/25.4 mm, the density of wefts was 88 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 3113 dtex.

[0074] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied only to the weft portion by a reverse coater at a fabric speed of 5 m/min and a roll rotation speed of 12 m/min. The roll rotation speed conditions were set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 150°C, a roll pressure of 588 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0075] In the obtained fabric, a fine uneven-surface design formed by the embossing was imparted to the weft portion which was exposed to the surface of the fabric and was provided with the resin applied thereto. The application depth of the polyurethane resin in the polyurethane resin applied portion thereof was 66 μm, the filling ratio of the fibers was 59.6%, the filling ratio of the polyurethane resin was 30.9%, the void ratio was 9.5%, the number of fibers per 100 μm^2 of the polyurethane resin was 2.4, and the circumferential length of filament cross-sections was 2353 μm. The thickness of the designed fabric was 600 μm. Evaluation results are shown in Table 1.

[Example 4]

[0076] Using a 3-reed tricot knitting machine, a polyethylene terephthalate false twisted yarn of 84 dtex/72 f was used for L1 (front yarn) for a 4-needle swing cord stitch (1-0/4-5), a polyethylene terephthalate regular yarn of 84 dtex/36 f was used for L2 (middle yarn) for a denbigh stitch (1-0/1-2), a polyethylene terephthalate regular yarn of 84 dtex/36 f was used for L3 (back yarn) for a 4-needle swing cord stitch (2-1/1-0), these were each knitted by full set threading, thereby obtaining a gray fabric. Next, this was subjected to dyeing by the dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, by the card cloth raising machine provided with the card cloth roll having 12 pile rollers and 12 counter pile rollers, full cut raising was performed by performing raising thereon 13 times alternately in a knitting end direction and in a knitting start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 67 loops/25.4 mm in the course, a density of 28 loops/25.4 mm in the wale, and a fineness of 2179 dtex per 1 mm^3 volume.

[0077] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface at a fabric speed of 10 m/min by a knife coater. The shape and the position of the knife were set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 1 minutes in a 130°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 120°C, a roll pressure of 1470 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0078] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and a fine uneven-surface design formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 53 μm, the filling ratio of the fibers was 50.5%, the filling ratio of the polyurethane resin was 42.1%, the void ratio was 7.4%, the number of fibers per 100 μm^2 of the polyurethane resin was 1.5, the circumferential length of filament cross-sections was 1996 μm, and the thickness of the fabric was 610 μm. Evaluation results are shown in Table 1.

[Example 5]

[0079] Using a 26-gauge double knit circular knitting machine, a polyethylene terephthalate flame retardant yarn of 110 dtex/48 f was used as a rear yarn (3F, 6F), a polyethylene terephthalate flame retardant yarn of 110 dtex/36 f was used as a bonding yarn (2F, 5F), a polyethylene terephthalate false twisted yarn of 84 dtex/94 f was used as a face yarn (1F, 3F), and a double knit gray fabric was knitted according to a weave diagram of Fig. 4. Next, this was subjected to dyeing by the dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, by the card cloth raising machine provided with the card cloth roll having 12 pile rollers and 12 counter pile rollers, semi-cut raising was performed by performing raising thereon 13 times alternately in a knitting end direction and in a knitting start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 73 loops/25.4 mm in the course, a density of 34 loops/25.4 mm in the wale, and a fineness of 2912 dtex per 1 mm^3 volume.

[0080] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying

the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 130°C, a roll pressure of 1470 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0081] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and a fine uneven-surface design formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 84 μm, the filling ratio of the fibers was 66.2%, the filling ratio of the polyurethane resin was 24.8%, the void ratio was 9.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 4.1, the circumferential length of filament cross-sections was 2924 μm, and the thickness of the fabric was 600 μm. Evaluation results are shown in Table 1.

[Example 6]

[0082] Using a 22-gauge double raschel knitting machine with 6 reeds, a polyethylene terephthalate false twisted yarn of 84 dtex/36 f as a ground yarn was fed through reeds L1 and L6 in a full set, a polyethylene terephthalate false twisted yarn of 110 dtex/94 f as a ground yarn was fed through reeds L2 and L5 in a full set, a polyethylene terephthalate false twisted yarn of 84 dtex/216 f as a pile yarn was fed through reeds L3 and L4 in a full set, and a double raschel knitted gray fabric was knitted according to the following weaves.

Reed L1: 1-2/1-1/1-0/1-1
Reed L2: 1-0/1-1/1-2/1-1
Reed L3: 1-0/0-1
Reed L4: 1-0/0-1
Reed L5: 1-0/1-1/1-2/1-1
Reed L6: 1-2/1-1/1-0/1-1

[0083] The gray fabric was center-cut and trimmed. Next, this was subjected to dyeing by the dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 53 loops/25.4 mm in the course, a density of 38 loops/25.4 mm in the wale, and a fineness of 1259 dtex per 1 mm^3 volume.

[0084] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 110°C, a roll pressure of 1960 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0085] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and a fine uneven-surface design formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 96 μm, the filling ratio of the fibers was 63.1%, the filling ratio of the polyurethane resin was 27.9%, the void ratio was 9.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 9.6, the circumferential length of filament cross-sections was 4609 μm, and the thickness of the fabric was 1200 μm. Evaluation results are shown in Table 1.

[Example 7]

[0086] Using a 22-gauge double raschel knitting machine with 6 reeds, a polyethylene terephthalate false twisted yarn of 167 dtex/30 f as a rear ground weave ground yarn was fed through reeds L1 and L2 in a full set, a polyethylene terephthalate false twisted yarn of 33 dtex/1 f as a connecting yarn was fed through a reed L3 in a full set, a polyethylene terephthalate false twisted yarn of 330 dtex/144 f as a connecting yarn was fed through a reed L4 in a full set, a polyethylene terephthalate false twisted yarn of 220 dtex/288 f as a face ground weave ground yarn was fed through a reed L5 in a full set, a polyethylene terephthalate false twisted yarn of 110 dtex/144 f as a face ground weave ground yarn was fed through a reed L6 in 1 in 3 out, and a double raschel knitted gray fabric was knitted according to the following weaves.

Reed L1: 1-0/0-0/2-3/3-3
Reed L2: 0-1/1-1/2-1/1-1
Reed L3: 0-1/0-1/1-0/1-0

Reed L4: 0-0/0-1/0-0/0-1/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/0-0/ 0-0/0-0/0-0/0-0/0-0/0-0/0-0
Reed L5: 0-0/0-1/1-1/1-0
Reed L6: 0-0/4-4/4-4/0-0/0-0/4-4/4-4/0-0/0-0/8-8/8-8/0-0/0-0/8-8/8-8

[0087] Next, this was subjected to dyeing by the dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 43 loops/25.4 mm in the course, a density of 25 loops/25.4 mm in the wale, and a fineness of 1771 dtex per 1 mm^3 volume.

[0088] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 100°C, a roll pressure of 1764 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0089] In the obtained fabric, the polyurethane resin had permeated between the fibers in the surface portion of the fabric, the surface of the fabric was formed by the polyurethane resin and the fibers, and a fine uneven-surface design formed by the embossing was imparted to the entire surface of the fabric. In the polyurethane resin applied portion of this designed fabric, the application depth of the polyurethane resin was 95 μm, the filling ratio of the fibers was 70.1%, the filling ratio of the polyurethane resin was 21.9%, the void ratio was 8.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 5.8, the circumferential length of filament cross-sections was 3329 μm, and the thickness of the fabric was 2500 μm. Evaluation results are shown in Table 1.

[Comparative Example 1]

[0090] A polyethylene terephthalate false twisted yarn of 333 dtex/96 f was used as a warp, a polyethylene terephthalate false twisted yarn of 600 dtex/192 f was used as a weft, and these were woven into a weft-faced 8-harness satin weave, thereby obtaining a gray fabric. Next, a heat treatment was performed at 190°C for 1 minute by the heat setter. The density of the warps of the obtained fabric was 78 pieces/25.4 mm, the density of wefts was 36 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 2341 dtex.

[0091] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 150°C, a roll pressure of 588 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0092] In the obtained product, the application depth of the polyurethane resin was 37 μm, the filling ratio of the fibers was 64.9%, the filling ratio of the polyurethane resin was 20.1%, the void ratio was 15.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 1.3, the circumferential length of filament cross-sections was 1480 μm. Evaluation results are shown in Table 1.

[Comparative Example 2]

[0093] Using a 2-reed tricot knitting machine, a polyethylene terephthalate false twisted yarn of 55 dtex/24 f was used for L1 (front yarn) for a 2-needle swing cord stitch (1-0/4-5), a polyethylene terephthalate false twisted yarn of 33 dtex/12 f was used for L2 (back yarn) for a denbigh stitch (1-0/1-2), these were each knitted by full set threading, thereby obtaining a gray fabric. Next, this was subjected to dyeing by the dyeing machine with a gray disperse dye at 130°C for 60 minutes. Next, by the card cloth raising machine provided with the card cloth roll having 12 pile rollers and 12 counter pile rollers, full cut raising was performed by performing raising thereon 13 times alternately in a knitting end direction and in a knitting start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished. The obtained fabric had a density of 66 loops/25.4 mm in the course, a density of 36 loops/25.4 mm in the wale, and a fineness of 915 dtex per 1 mm^3 volume.

[0094] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. After applying the polyurethane resin, the resultant was dried for 10 minutes in the 90°C dryer. The application amount of the polyurethane resin was about 30 g/m^2 in terms of mass after drying. Next, embossing was performed thereon with the embossing machine at a roll temperature of 120°C, a roll pressure of 1470 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0095] In the obtained product, the application depth of the polyurethane resin was 27 μm, the filling ratio of the fibers

was 14.6%, the filling ratio of the polyurethane resin was 62.0%, the void ratio was 23.4%, the number of fibers per 100 μm^2 of the polyurethane resin was 0.1, the circumferential length of filament cross-sections was 409 μm. Evaluation results are shown in Table 1.

[Comparative Example 3]

[0096] A polyethylene terephthalate false twisted yarn of 167 dtex/288 f was used as a warp, a polyethylene terephthalate false twisted yarn of 167 dtex/288 f was used as a weft, and these were woven into a warp-faced 5-harness satin weave, thereby obtaining a gray fabric. Next, a heat treatment was performed at 190°C for 1 minute by the heat setter. The density of the warps of the obtained fabric was 178 pieces/25.4 mm, the density of wefts was 65 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 4204 dtex.

[0097] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 60 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. In the obtained fabric, the fibers were not exposed to the surface, and a polyurethane resin layer was formed thereon. Next, embossing was performed thereon with the embossing machine at a roll temperature of 150°C, a roll pressure of 588 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0098] In the obtained product, the application depth of the polyurethane resin was 35 μm, the filling ratio of the fibers was 70.4%, the filling ratio of the polyurethane resin was 23.6%, the void ratio was 6.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 7.4, the circumferential length of filament cross-sections was 3931 μm. The polyurethane resin was in the form of a film. Evaluation results are shown in Table 1.

[Comparative Example 4]

[0099] A product was obtained in the same manner as in Comparative Example 1 except that the number of applications was changed to cause the application amount of the polyurethane resin to be 15 g/m^2 in terms of mass after drying. In the obtained product, the application depth of the polyurethane resin was 40 μm, the filling ratio of the fibers was 64.9%, the filling ratio of the polyurethane resin was 9.5%, the void ratio was 25.6%, the number of fibers per 100 μm^2 of the polyurethane resin was 2.8, the circumferential length of filament cross-sections was 1480 μm. Evaluation results are shown in Table 1.

[Comparative Example 5]

[0100] A polyethylene terephthalate split yarn of 122 dtex/444 f was used as a warp, a polyethylene terephthalate split yarn of 244 dtex/888 f was used as a weft, and these were woven into a warp-faced 5-harness satin weave, thereby obtaining a gray fabric. Next, a heat treatment was performed at 190°C for 1 minute by the heat setter. The density of the warps of the obtained fabric was 232 pieces/25.4 mm, the density of wefts was 110 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 5713 dtex.

[0101] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire surface by screen printing. The number of applications was set so that the application amount of the polyurethane resin was 60 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 150°C, a roll pressure of 588 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0102] In the obtained product, the application depth of the polyurethane resin was 42 μm, the filling ratio of the fibers was 86.2%, the filling ratio of the polyurethane resin was 10.0%, the void ratio was 3.8%, the number of fibers per 100 μm^2 of the polyurethane resin was 48.2, the circumferential length of filament cross-sections was 7215 μm. The polyurethane resin was in the form of a film. Evaluation results are shown in Table 1.

[Comparative Example 6]

[0103] A polyethylene terephthalate false twisted yarn of 333 dtex/96 f was used as a warp, a polyethylene terephthalate false twisted yarn of 600 dtex/192 f was used as a weft, and these were woven into a warp-faced 5-harness satin weave, thereby obtaining a gray fabric. Next, a heat treatment was performed at 190°C for 1 minute by the heat setter. The density of the warps of the obtained fabric was 78 pieces/25.4 mm, the density of wefts was 36 pieces/25.4 mm, and the fineness per 1 mm^3 volume was 2341 dtex.

[0104] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid

content 28 mass%) was applied to the entire surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 160°C, a roll pressure of 490 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0105] In the obtained product, the application depth of the polyurethane resin was 130 μm, the filling ratio of the fibers was 72.2%, the filling ratio of the polyurethane resin was 12.4%, the void ratio was 15.4%, the number of fibers per 100 μm^2 of the polyurethane resin was 2.4, the circumferential length of filament cross-sections was 1647 μm. Evaluation results are shown in Table 1.

[Comparative Example 7]

[0106] The woven fabric after the heat treatment by the heat setter of Comparative Example 6 was used. By the card cloth raising machine provided with the card cloth roll having 12 pile rollers and 12 counter pile rollers, semi-cut raising was performed by performing raising on the rear surface (weft-faced side) of the woven fabric 13 times alternately in a knitting end direction and in a knitting start direction at a card cloth roller torque of 2.5 MPa and a fabric speed of 12 m/min. Next, the resultant was subjected to a heat treatment by the heat setter at 190°C for 1 minute and was finished.

[0107] Next, the polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation) solution (solid content 28 mass%) was applied to the entire raised surface by the screen printing machine. The number of applications was set so that the application amount of the polyurethane resin was 30 g/m^2 in terms of mass after drying. After applying the polyurethane resin solution, the resultant was dried for 10 minutes in the 90°C dryer. Next, embossing was performed thereon with the embossing machine at a roll temperature of 160°C, a roll pressure of 490 N/cm, and a fabric speed of 3 m/min. As the roll, three types of rollers A to C described above were used.

[0108] In the obtained product, the application depth of the polyurethane resin was 158 μm, the filling ratio of the fibers was 40.0%, the filling ratio of the polyurethane resin was 20.7%, the void ratio was 40.3%, the number of fibers per 100 μm^2 of the polyurethane resin was 0.8, the circumferential length of filament cross-sections was 888 μm. Evaluation results are shown in Table 1.

[Comparative Example 8]

[0109] A product was obtained in the same manner as in Comparative Example 7 except that the application amount of the polyurethane resin was caused to be 50 g/m^2 in terms of mass after drying and the embossing conditions were set to a roll temperature of 130°C. In the obtained product, the application depth of the polyurethane resin was 161 μm, the filling ratio of the fibers was 42.1%, the filling ratio of the polyurethane resin was 12.0%, the void ratio was 45.9%, the number of fibers per 100 μm^2 of the polyurethane resin was 1.4, the circumferential length of filament cross-sections was 959 μm. Evaluation results are shown in Table 1.

[Comparative Example 9]

[0110] A product was obtained in the same manner as in Comparative Example 7 except that the application amount of the polyurethane resin was caused to be 10 g/m^2 in terms of mass after drying and the embossing conditions were set to a roll temperature of 130°C. In the obtained product, the application depth of the polyurethane resin was 31 μm, the filling ratio of the fibers was 42.8%, the filling ratio of the polyurethane resin was 25.7%, the void ratio was 30.0%, the number of fibers per 100 μm^2 of the polyurethane resin was 0.7, the circumferential length of filament cross-sections was 977 μm. Evaluation results are shown in Table 1.

[0111] The products obtained in Examples 1 to 7 were excellent in any of the shaping properties, flexibility, and wear resistance of the uneven-surface design. On the other hand, the products obtained in Comparative Examples 1, 2, 4, 8, and 9 were inferior in the evaluation of the shaping properties and wear resistance. The products obtained in Comparative Examples 3 and 5 were inferior in the evaluation of the flexibility. The product obtained in Comparative Example 6 was inferior in the evaluation of the shaping properties. The product obtained in Comparative Example 7 was inferior in the evaluation of the wear resistance.

[Table 1]

		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Comparative Example 1	Comparative Example 2
Woven fabric used [Table 2]		Woven fabric A		Woven fabric B					Woven fabric C	
Knitted fabric used [Table 3]			Knitted fabric a		Knitted fabric b	Knitted fabric c	Knitted fabric d	Knitted fabric e		Knitted fabric f
Polyurethane resin applied portion	Application depth of polyurethane resin (μm)	98	92	66	53	84	96	95	37	27
	Filling ratio of polyurethane resin (%)	26.4	25.4	30.9	42.1	24.8	27.9	21.9	20.1	62.0
	Filling ratio of fibers (%)	69.1	66.2	59.6	50.5	66.2	63.1	70.1	64.9	14.6
	Void ratio (%)	4.5	8.4	9.5	7.4	9.0	9.0	8.0	15.0	23.4
	Number of fibers per 100 μm^2 of polyurethane resin	6.5	4.0	2.4	1.5	4.1	9.6	5.8	1.3	0.1
	Sum of outer circumferential lengths of fiber cross-section (μm) (per unit area 10,000 μm^2)	3863	2934	2353	1996	2924	4609	3329	1480	409
Evaluation items	Shaping properties	1	1	2	2	1	1	1	4	4
	Wear resistance	1	1	1	1	1	1	1	2	3
	Flexibility	1	1	1	1	1	1	1	1	2

[Table 1 (Cont'd)]

		Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6	Comparative Example 7	Comparative Example 8	Comparative Example 9
Woven fabric used [Table 2]		Woven fabric D	Woven fabric C	Woven fabric E	Woven fabric F	Woven fabric F	Woven fabric F	Woven fabric F
Knitted fabric used [Table 3]								
Polyurethane resin applied portion	Application depth of polyurethane resin (μm)	35	40	42	130	158	161	31
	Filling ratio of polyurethane resin (%)	23.6	9.5	10.0	12.4	20.7	12.0	25.7
	Filling ratio of fibers (%)	70.4	64.9	86.2	72.2	40.0	42.1	42.8
	Void ratio (%)	6.0	25.6	3.8	15.4	40.3	45.9	30.0
	Number of fibers per 100 μm^2 of polyurethane resin	7.4	2.8	48.2	2.4	0.8	1.4	0.7
	Sum of outer circumferential lengths of fiber cross-section (μm) (per unit area 10,000 μm^2)	3931	1480	7215	1647	888	959	977
Evaluation items	Shaping properties	1	4	1	4	2	4	4
	Wear resistance	1	3	1	1	3	3	3
	Flexibility	2	1	2	1	1	1	1

[Table 2]

		Woven fabric A	Woven fabric B	Woven fabric C	Woven fabric D	Woven fabric E	Woven fabric F
Warp	Type	Multifilament false yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament split yarn	Multifilament false twisted yarn
	Yarn fineness (dtex)	167	178	333	167	122	333
	Number of filaments (pieces)	288	24	96	288	444	96
	Single fiber fineness (dtex)	0.58	7.42	3.47	0.58	0.27	3.47
Weft	Type	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament split yarn	Multifilament false twisted yarn
	Yarn fineness (dtex)	167	167	600	167	244	600
	Number of filaments (pieces)	48	144	192	288	888	192
	Single fiber fineness (dtex)	3.48	1.16	3.13	0.58	0.27	3.13
Warp density (pieces/25.4 mm)		178	184	78	178	232	78
Weft density (pieces/25.4 mm)		61	88	36	65	110	36
Fabric thickness (mm)		0.40	0.60	0.80	0.38	0.38	0.80
Fineness per unit volume 1 mm^3 (dtex)		3928	3113	2341	4204	5713	2341
Weave formation		Warp-faced 5-harness satin	Warp-faced 8-harness satin Weft-faced 8-harness satin weave	Weft-faced 8-harness satin	Warp-faced 5-harness satin	Warp-faced 5-harness satin	Warp-faced 5-harness satin

[Table 3]

		Knitted fabric a tricot	Knitted fabric b tricot	Knitted fabric c circular knit	Knitted fabric d double raschel	Knitted fabric e double raschel	Knitted fabric f tricot
L1 or face yarn	Type	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)
	Yarn fineness (dtex)	84	84	84	84	167	55
	Number of filaments (pieces)	96	72	94	36	30	24
	Single fiber fineness (dtex)	0.88	1.17	0.89	2.33	5.57	2.29
L2 or bonding yarn	Type	Multifilament yarn (flame retardant yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (flame retardant yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)
	Yarn fineness (dtex)	84	84	110	110	167	33
	Number of filaments (pieces)	36	36	36	94	30	12
	Single fiber fineness (dtex)	2.33	2.33	3.06	1.17	5.57	2.75

(continued)

		Knitted fabric a tricot	Knitted fabric b tricot	Knitted fabric c circular knit	Knitted fabric d double raschel	Knitted fabric e double raschel	Knitted fabric f tricot
L3 or rear yarn	Type	Multifilament yarn (flame retardant yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (flame retardant yarn)	Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	
	Yarn fineness (dtex)	84	84	110	84	33	
	Number of filaments (pieces)	36	36	48	216	1	
	Single fiber fineness (dtex)	2.33	2.33	2.29	0.39	33.00	
L4	Type				Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yarn)	
	Yarn fineness (dtex)				84	330	
	Number of filaments (pieces)				216	144	
	Single fiber fineness (dtex)				0.39	2.29	

(continued)

		Knitted fabric a tricot	Knitted fabric b tricot	Knitted fabric c circular knit	Knitted fabric d double raschel	Knitted fabric e double raschel	Knitted fabric f tricot
L5	Type				Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yearn)	
	Yarn fineness (dtex)				110	220	
	Number of filaments (pieces)				94	288	
	Single fiber fineness (dtex)				1.17	0.76	
L6	Type				Multifilament yarn (false twisted yarn)	Multifilament yarn (false twisted yearn)	
	Yarn fineness (dtex)				84	110	
	Number of filaments (pieces)				36	144	
	Single fiber fineness (dtex)				2.33	0.76	
Course density (loops/25.4 mm)		71	67	73	53	43	66
Wale density (loops/25.4 mm)		38	28	34	38	25	36
Fabric thickness (mm)		0.61	0.61	0.60	1.20	2.50	0.50
Nap length (μm)		1060	1514	-	900	-	-

(continued)

	Knitted fabric a tricot	Knitted fabric b tricot	Knitted fabric c circular knit	Knitted fabric d double raschel	Knitted fabric e double raschel	Knitted fabric f tricot
Fineness per unit volume 1 mm^3 (dtex)	2310	2179	2912	1259	1771	915

Claims

1. A fabric comprising:

   a polyurethane resin applied portion on at least a portion of a surface side of the fabric constituted by fibers; and an uneven-surface design shaped on the polyurethane resin applied portion,
   wherein the polyurethane resin applied portion is a region in which a polyurethane resin which is applied is present, and the polyurethane resin permeates between the fibers at least in a surface portion of the fabric such that a surface of the fabric is formed by the polyurethane resin and the fibers, and
   in the polyurethane resin applied portion, an application depth of the polyurethane resin is 50 to 200 μm, a filling ratio of the polyurethane resin is 15% to 45%, and a filling ratio of the fibers is 50% to 80%.

2. The fabric according to claim 1,
   wherein a void ratio in the polyurethane resin applied portion is 13% or less.

3. The fabric according to claim 1 or 2,
   wherein the sum of outer circumferential lengths of fiber cross-sections in the polyurethane resin applied portion is 1500 μm or more per unit area 10,000 μm^2.

4. The fabric according to any one of claims 1 to 3,
   wherein the number of fibers per 100 μm^2 of the cross-sectional area of the polyurethane resin in the polyurethane resin applied portion is 1.5 or more.

5. The fabric according to any one of claims 1 to 4,
   wherein, in the polyurethane resin applied portion, the application depth of the polyurethane resin is 50 to 100 μm, the filling ratio of the polyurethane resin is 20% to 35%, and the filling ratio of the fibers is 55% to 75%.

6. The fabric according to any one of claims 1 to 5,
   wherein a ratio of the application depth of the polyurethane resin to a thickness of the fabric having the uneven-surface design is 3% to 30%.

7. The fabric according to any one of claims 1 to 6,
   wherein a width of a recess forming the uneven-surface design is 200 to 1500 μm and a maximum depth of the recess is 20 to 450 μm.

8. A method for producing a fabric, the method being a method for producing the fabric according to any one of claims 1 to 7, the method comprising:

   applying a polyurethane resin to at least a portion of a surface side of the fabric and thereafter shaping the uneven-surface design on a polyurethane resin applied portion by embossing.

9. The method for producing a fabric according to claim 8,
   wherein the fabric as an object to which the polyurethane resin is applied is a woven fabric, and
   in the woven fabric, in a region to which the uneven-surface design is imparted, a total fineness per unit volume 1 mm^3 is 2500 to 5800 dtex.

10. The method for producing a fabric according to claim 8,
    wherein the fabric as an object to which the polyurethane resin is applied is a knitted fabric, and
    in the knitted fabric, in a region to which the uneven-surface design is imparted, a total fineness per unit volume 1 mm^3 is 1000 to 5800 dtex.

FIG. 1

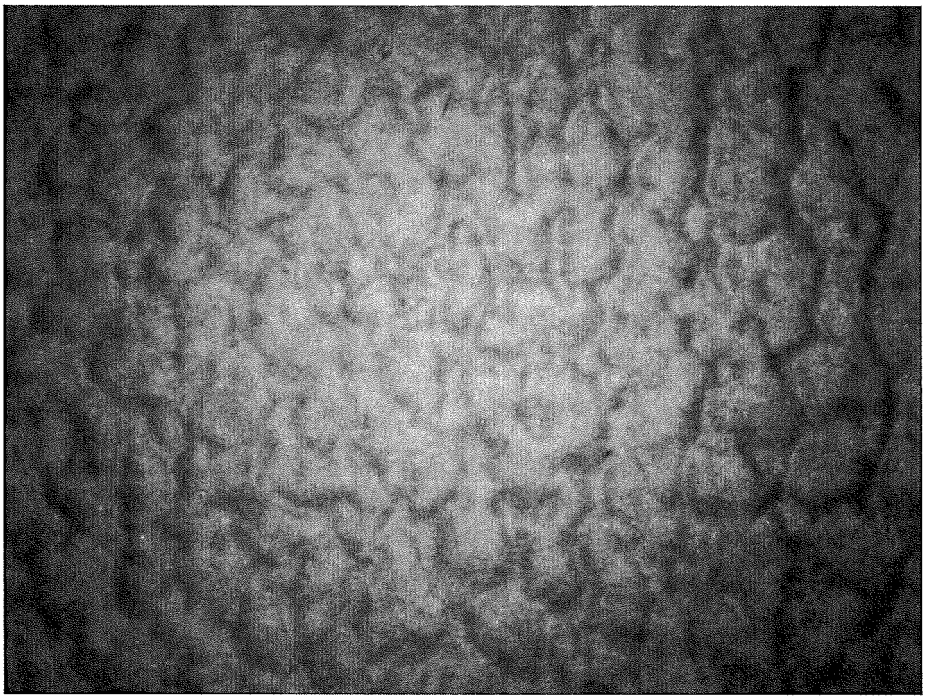


FIG. 2

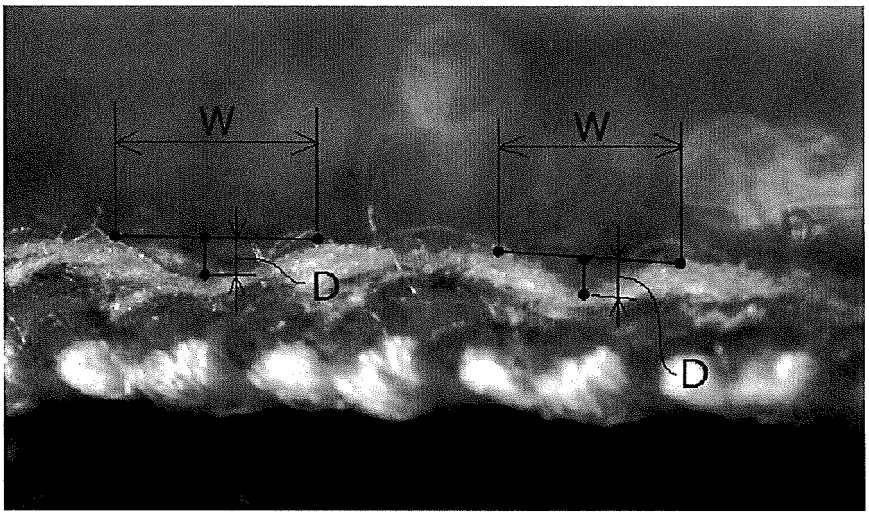


FIG. 3

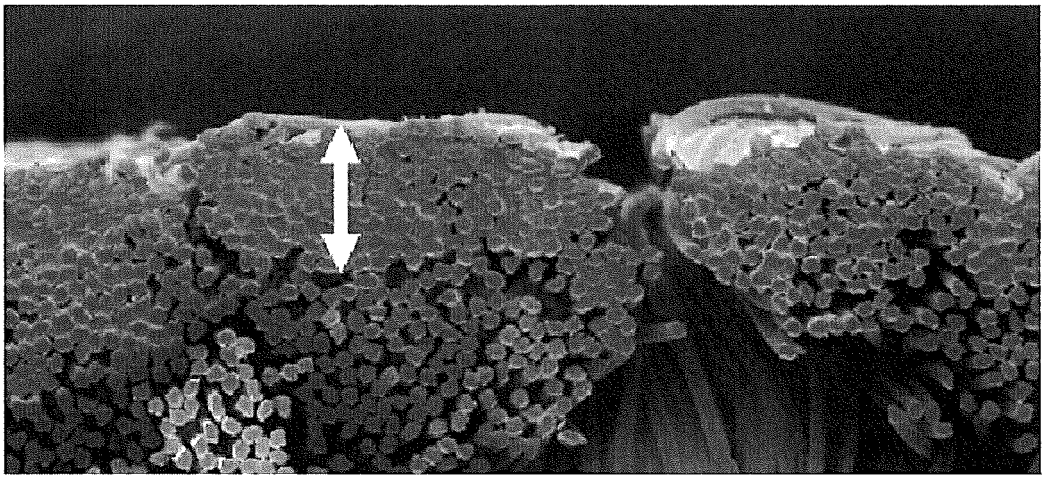
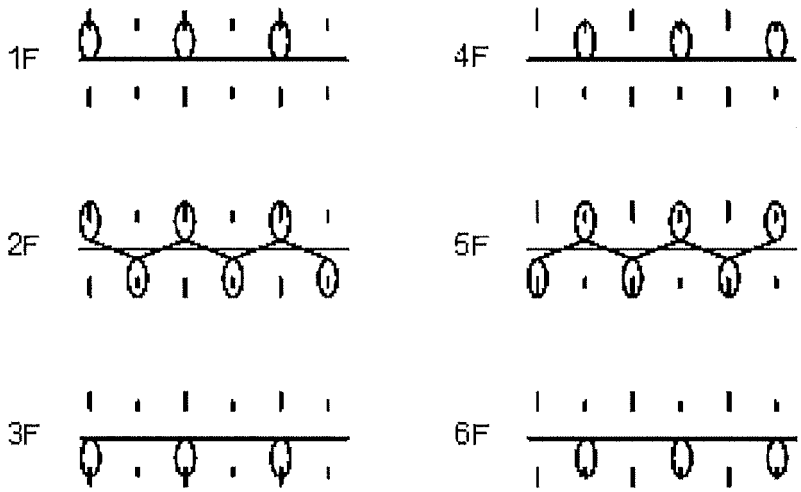


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/006171

A. CLASSIFICATION OF SUBJECT MATTER
D06Q1/08(2006.01)i, *D06C23/04*(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)
D04D1/00-11/00, D06Q1/00-1/14, D06B1/00-23/30, D06C3/00-29/00, D06G1/00-5/00, D06H1/00-7/24, D06J1/00-1/12, B32B1/00-43/00, D06M13/00-15/715, D06N1/00-7/06

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2016
Kokai Jitsuyo Shinan Koho	1971-2016	Toroku Jitsuyo Shinan Koho	1994-2016

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	JP 50-16476 B1 (Daiichi Lace Mfg. Co., Ltd.), 13 June 1975 (13.06.1975), example 1 (Family: none)	1-10
A	JP 2010-248668 A (Teijin Fibers Ltd.), 04 November 2010 (04.11.2010), examples 1, 2 (Family: none)	1-10

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

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
01 March 2016 (01.03.16)	08 March 2016 (08.03.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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Patent documents cited in the description

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- JP 2002242085 A **[0005]**