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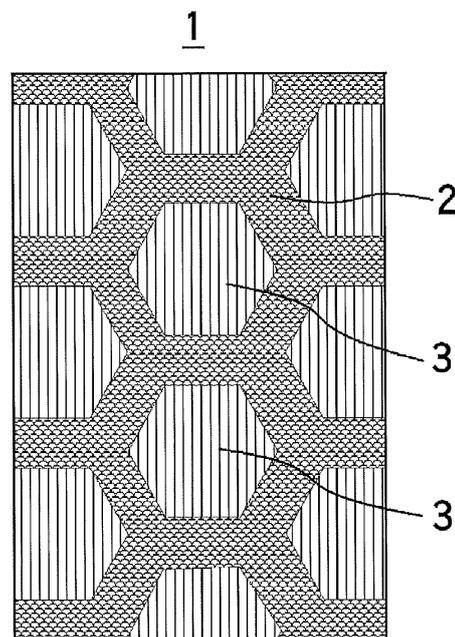
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(54) **FABRIC BEARING DESIGN AND PROCESS FOR PRODUCING SAME**

(57) Provided is a fabric having a novel design in which an uneven-surface design is partially formed by embossing. A polyurethane resin is applied to the surface of the fabric having, on the surface, a low fineness portion and a high fineness portion having a higher single fiber fineness than that of the low fineness portion, the fabric is dried; and embossing is performed on the surface of the fabric. By performing the embossing, while an uneven-surface design is not imparted to the high fineness portion by the embossing and a non-uneven-surface design portion 3 is formed, the uneven-surface design is imparted to the low fineness portion by the embossing and an uneven-surface design portion 2 is formed.

FIG. 1



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Description

Technical Field

5 **[0001]** The present invention relates to a fabric partially having an uneven-surface design and a process for producing the same.

Background Art

10 **[0002]** As a method for imparting an uneven-surface design to a fabric, embossing is known. Embossing is to form an uneven-surface design by pressing a heated mold (referred to as an embossing mold) having an uneven-surface pattern reverse to a desired uneven-surface design (uneven-surface pattern) against the surface of a fabric, and in the related art, various methods have been proposed (for example, PTLs 1 and 2 below). When the uneven-surface design is imparted by the embossing in the related art, the uneven-surface design is uniformly imparted to the entire surface of
15 the fabric, and the uneven-surface design is not partially formed by the embossing.

Citation List

Patent Literature

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[0003]

[PTL 1] JP-A-2010-7211

[PTL 2] JP-A-2010-248668

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Summary of Invention

Technical Problem

30 **[0004]** An object of the present invention is to provide a fabric having a novel design in which an uneven-surface design is partially formed by embossing.

Solution to Problem

35 **[0005]** First, the present invention provides a process for producing a fabric bearing a design partially having an uneven-surface design by embossing, the process including: applying a polyurethane resin to a surface of a fabric having, on the surface, a low fineness portion and a high fineness portion having a higher single fiber fineness than that of the low fineness portion; drying the fabric; and performing embossing on the surface of the fabric.

40 **[0006]** Second, the present invention provides a fabric bearing a design including: a polyurethane resin which is present on a surface portion of the fabric; an uneven-surface design portion and a non-uneven-surface design portion on the surface portion, in which the uneven-surface design portion is constituted by threads having a lower single fiber fineness than that of the non-uneven-surface design portion, and an uneven-surface design is imparted to a surface of the uneven-surface design portion by embossing, and the non-uneven-surface design portion is constituted by threads having a higher single fiber fineness than that of the uneven-surface design portion, and the uneven-surface design is not imparted
45 to a surface of the non-uneven-surface design portion by the embossing.

Advantageous Effects of Invention

50 **[0007]** According to the present invention, a fabric having a novel design in which an uneven-surface design is partially formed can be produced without complex processes.

Brief Description of Drawings

[0008]

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Fig. 1 is a plan view schematically illustrating an example of a surface design of a fabric according to an embodiment.
Fig. 2 is a photograph of the cross-section in an uneven-surface design portion of the fabric according to the embodiment.

Fig. 3 is a photograph of the cross-section in a non-uneven-surface design portion of the fabric according to the embodiment.

Fig. 4 is a photograph of the surface in the uneven-surface design portion of the fabric according to the embodiment.

Fig. 5 is a photograph of the surface of the uneven-surface design portion before resin processing.

Fig. 6 is a photograph of the surface in the non-uneven-surface design portion of the fabric according to the embodiment.

Fig. 7 is a photograph of the surface of the non-uneven-surface design portion before the resin processing.

Fig. 8 is an explanatory view showing a knitted weave according to Example 14.

Description of Embodiments

[0009] Hereinafter, embodiments of the present invention will be described in detail.

[0010] In a process for producing a fabric bearing a design according to the present invention, a polyurethane resin is applied to the surface of the fabric having a low fineness portion and a high fineness portion on the surface, and the resultant is dried and is thereafter subjected to embossing on the surface. In the low fineness portion having a low single fiber fineness, the voids between fibers are small, the fibers are fixed together by the polyurethane resin, and thus shaping properties are improved. Therefore, an uneven-surface design can be imparted by embossing. On the other hand, in the high fineness portion having a high single fiber fineness, the voids between fibers are large, and the fibers are brought into a state close to spot joining rather than being fixed together by the polyurethane resin. Therefore, in the high fineness portion, even when embossing is performed thereon, the uneven-surface design is not imparted thereto, and the design of the fabric itself can remain. That is, by performing the embossing, the uneven-surface design is imparted to the low fineness portion by the embossing and thereby an uneven-surface design portion can be formed, while the uneven-surface design is not imparted to the high fineness portion by the embossing and thereby a non-uneven-surface design portion is formed. Therefore, the fabric partially having the uneven-surface design formed by the embossing can be produced without complex processes.

[0011] As the fabric as a processing object (that is, a raw fabric or base fabric), a fabric having a low fineness portion and a high fineness portion on the surface thereof is used. A part in which the single fiber fineness of threads exposed to the surface of the fabric is low is referred to as the low fineness portion, and a part in which the single fiber fineness of threads exposed to the surface of the fabric is high is referred to as the high fineness portion. A single fiber fineness is the fineness of a single fiber or filament included in a thread and is also referred to as a filament fineness. The single fiber fineness of the portions other than the surface portion, such as the rear face of the fabric is not particularly limited, and the low fineness portion and the high fineness portion are concepts used for the surface portion (that is, surface layer portion) of the fabric. Here, "high" and "low" in the high fineness portion and the low fineness portion are intended to express the relationship between relative finenesses of the two fineness portions. That is, this means that the high fineness portion has a higher single fiber fineness than that of the low fineness portion (conversely, the low fineness portion has a lower single fiber fineness than that of the high fineness portion).

[0012] The low fineness portion is a part constituted by threads having a lower single fiber fineness than that of the high fineness portion in the surface portion of the fabric, and this part becomes the uneven-surface design portion by the embossing. In the present invention, it is not necessary that all of the threads constituting the low fineness portion have a lower single fiber fineness than that of the threads constituting the high fineness portion, and the threads mainly constituting the low fineness portion may have a lower single fiber fineness than that of the threads mainly constituting the high fineness portion. Here, "mainly constituting" means constituting 70% or more (volume ratio) of the threads exposed on the surface of the fabric, and more preferably constituting 80% or more. It is preferable that the low fineness portion includes threads having a single fiber fineness of 1.5 dtex or lower, that is, the single fiber fineness of the threads constituting the low fineness portion is 1.5 dtex or lower. In other words, it is desirable that the threads mainly exposed to the surface in the low fineness portion have a single fiber fineness of 1.5 dtex or lower. By causing the single fiber fineness of the threads constituting the low fineness portion to be 1.5 dtex or lower, the voids between the fibers constituting the low fineness portion can be reduced, and the effect of fixing the fibers together by the polyurethane resin can be enhanced. Accordingly, the shaping properties of the uneven-surface design formed by the embossing can be enhanced. The single fiber fineness of the threads constituting the low fineness portion is preferably 1.0 dtex or lower, and more preferably 0.7 dtex or lower. The lower limit of the single fiber fineness is not particularly limited, and is preferably 0.1 dtex or higher.

[0013] The high fineness portion is a part constituted by threads having a higher single fiber fineness than that of the low fineness portion in the surface portion of the fabric, and this part becomes the non-uneven-surface design portion. It is preferable that the high fineness portion includes threads having a single fiber fineness of higher than 1.5 dtex, that is, the single fiber fineness of the threads constituting the high fineness portion is higher than 1.5 dtex. In other words, it is desirable that the threads mainly exposed to the surface in the high fineness portion have a single fiber fineness of higher than 1.5 dtex. By causing the single fiber fineness of the threads constituting the high fineness portion to be higher

than 1.5 dtex, the voids between the fibers constituting the high fineness portion can be enlarged, and the effect of fixing the fibers together by the polyurethane resin can be reduced. Accordingly, the uneven-surface design cannot be easily shaped by the embossing. In order to more effectively suppress the shaping of the uneven-surface design in the high fineness portion, the single fiber fineness of the threads constituting the high fineness portion is preferably 2.3 dtex or higher, and more preferably 2.5 dtex or higher. Although the upper limit of the single fiber fineness thereof is not particularly limited, when the threads are monofilaments, the upper limit is preferably 2000 dtex or lower, and when the threads are multifilaments, the upper limit is preferably 10 dtex or lower.

[0014] The difference in single fiber fineness between the low fineness portion and the high fineness portion is preferably 0.4 dtex or higher, more preferably 0.5 dtex or higher, further preferably 1.0 dtex or higher, and even more preferably 2.0 dtex or higher. Accordingly, a more clear change in design can be clearly provided between the uneven-surface design portion and the non-uneven-surface design portion.

[0015] It is preferable that the fineness of the threads constituting the low fineness portion (that is, the total fineness, also called the yarn fineness) is set to be equal to or more than the total fineness of the threads constituting the high fineness portion. Accordingly, the low fineness portion is densely filled with fine fibers having a low single fiber fineness, and thus the voids between the fibers can be reduced.

[0016] The fabric having the low fineness portion and the high fineness portion on the surface portion as described above may be a woven fabric or a knitted fabric and may be selected appropriately depending on applications. In addition, a method for forming the low fineness portion and the high fineness portion is also not particularly limited.

[0017] For example, in the case of the woven fabric, by using a thread having a low single fiber fineness as one of the warp and the weft and a thread having a high single fiber fineness as the other, these may be woven into a weave of a warp satin and a weft satin. Accordingly, the low fineness portion in which the threads having a low single fiber fineness are mainly exposed to the surface and the high fineness portion in which the threads having a high single fiber fineness are mainly exposed to the surface can be provided by the warp satin portion and the weft satin portion.

[0018] In other weaves, similarly, the low fineness portion in which the threads having a low single fiber fineness are mainly exposed to the surface and the high fineness portion in which the threads having a high single fiber fineness are mainly exposed to the surface can be provided by a yarn structure of threads having a low single fiber fineness and threads having a high single fiber fineness using the warp and the weft.

[0019] In the case of the knitted fabric, like the woven fabric, by knitting the configuration of the low fineness portion and the high fineness portion by combining a knitted weave and a yarn structure using threads having a low single fiber fineness and threads having a high single fiber fineness, the low fineness portion in which the threads having a low single fiber fineness are mainly exposed to the surface and the high fineness portion in which the threads having a high single fiber fineness are mainly exposed to the surface can be provided.

[0020] In the fabric as the processing object, in the case of the woven fabric, the total fineness per unit volume 1 mm³ is preferably 2500 to 5800 dtex, more preferably 3000 to 5800 dtex, and even more preferably 3500 to 5800 dtex. By causing this value to be 2500 dtex or higher, the voids between the fibers can be reduced, and the shaping properties of the uneven-surface design formed by embossing can be improved. Furthermore, by causing this value to be 5800 dtex or lower, good weaving properties can be secured.

[0021] The total fineness per unit volume 1 mm³ is calculated as follows. By the product of a warp density (pieces/25.4 mm), a warp fineness (thread fineness) (dtex), and 25.4 mm, the total 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 multiplying, assuming that the warp extends straight in the gray fabric longitudinal direction, 25.4 mm is multiplied. 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 mm³. The above expression is appropriately changed in consideration of yarn drawing or a weave. For example, when the yarn drawing is 1 in 3 out (that is, a structure of one yarn in and three yarns out), 1/4 is further multiplied.

[0022] Specifically, this is calculated by the following expression.

$$\begin{aligned} & \text{Total fineness per unit volume 1 mm}^3 \\ &= (\text{warp density} \times \text{warp fineness (thread fineness)} \times 25.4 + \text{weft density} \times \text{weft} \\ & \text{fineness (thread fineness)} \times 25.4) / (25.4 \times 25.4 \times \text{fabric thickness (mm)}) \end{aligned}$$

[0023] In the fabric as the processing object, in the case of the knitted fabric, the total fineness per unit volume 1 mm³ is preferably 1000 to 5800 dtex, more preferably 1200 to 5800 dtex, and even more preferably 1500 to 5800 dtex. By causing this value to be 1000 dtex or higher, the voids between the fibers can be reduced, and the shaping properties

of the uneven-surface design formed by embossing can be improved. Furthermore, by causing this value to be 5800 dtex or lower, good knitting properties can be secured.

[0024] 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 thread 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 \times the longitudinal direction (25.4 mm) \times the fabric thickness (mm) is calculated. Since two cross-sections are shown in one loop in a cross-section perpendicular to the gray fabric longitudinal direction, the warp density is doubled in the calculation. In addition, it is assumed that a horizontal cross-section continues for 25.4 mm in the width direction. The quotient of the calculated value divided by the volume (width direction \times longitudinal direction \times fabric thickness) is calculated to be used as the total fineness per 1 mm^3 . 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) \times the gray fabric longitudinal direction (25.4 mm) \times 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 mm^3 . The above expression is appropriately changed in consideration of yarn drawing or a weave. For example, when the yarn drawing is 1 in 3 out, $1/4$ is further multiplied.

[0025] Specifically, this is calculated by the following expressions.

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

$$= (\text{total fineness}^{*1} \text{ for each yarn} \times \text{course density} \times 2 \times 25.4) / (25.4 \times 25.4 \times \text{fabric thickness (mm)})$$

*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)

$$= \{(\text{total fineness for each ground yarn} + \text{total fineness for each pile yarn}) \times \text{course density} \times 2 \times 25.4\} / (25.4 \times 25.4 \times \text{fabric thickness (mm)})$$

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

$$= \{(\text{total fineness for each ground yarn} + \text{total yarn fineness for each connecting yarn} \times 2) \times \text{course density} \times 2 \times 25.4\} / (25.4 \times 25.4 \times \text{fabric thickness (mm)})$$

[0026] The material of the fibers constituting the fabric as the processing object is not particularly limited, and well-known fibers such as natural fibers, regenerated fibers, semi-synthetic fibers, and synthetic fibers may be used, and these fibers may be used in combination of two or more types by techniques such as blending, combining, twisting, mixed weaving, and mixed knitting. A thermoplastic fiber is preferable from the viewpoints of the shaping properties and durability of the uneven-surface design. As the thermoplastic fiber, synthetic fibers such as polyester, polypropylene, and nylon, and semi-synthetic fibers such as acetate and triacetate may be employed. These may be used singly or in combination of two or more types. Among these, polyester is more preferable, and polyethylene terephthalate is particularly preferable for excellent physical properties.

[0027] The form of the threads constituting the fabric may be any of a spun yarn (short fiber yarn), a multifilament yarn, and a monofilament yarn (both are long fiber yarns), and may be a long and short fiber composite spun yarn which

is a combination of a long fiber and a short fiber. The multifilament yarn may be subjected to twisting if necessary, or may be subjected to processing such as false twisting or a fluid disturbance treatment.

5 [0028] In addition, the fabric may be subjected to a pre-treatment such as raising, dyeing, presetting, or scouring, if necessary. In the case of raising, it is preferable to cut and raise the threads which are exposed to the surface of the low fineness portion and have a low single fiber fineness because the uneven-surface design can be more easily shaped by the embossing.

10 [0029] The polyurethane resin used in the present invention 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.

15 [0030] 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, an embossing roll does not need to be set to an excessively high temperature when the uneven-surface design is shaped, 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.

20 [0031] The application of the polyurethane resin is performed on the entire surface of the fabric having the low fineness portion and the high fineness portion on the surface. The application amount of the polyurethane resin 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/m² with respect to the fabric, more preferably 5 to 150 g/m², and even more preferably 10 to 100 g/m². In the fabric bearing a design according to this embodiment, the polyurethane resin permeates between the fibers at least in the surface portion (surface layer portion) of the fabric to form the surface 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 weight of a solid content after being dried.

25 [0032] More specifically, a treatment liquid containing the polyurethane resin is applied to one side of the fabric. The treatment liquid contains at least the polyurethane resin and a medium for dispersing the polyurethane resin, for example, water, and if necessary, may contain additives such as a coloring material (dye, pigment, or metal powder), or a thickener. 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 reverse coater, a comma coater, or the like may also be used.

30 [0033] 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.

35 [0034] 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.

40 [0035] 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.

45 [0036] As described above, the fabric bearing a design, which partially has the uneven-surface design, can be obtained. The polyurethane resin is present on the surface portion of the fabric bearing a design according to the embodiment, and the surface portion has the uneven-surface design portion and the non-uneven-surface design portion. The polyurethane resin is present over the entire surface of the fabric together with the fibers, and the surface of the fabric is formed by the polyurethane resin and the fibers. The polyurethane resin permeates between the fibers at least in the surface portion of the fabric in the thickness direction such that a polyurethane resin permeation portion is formed at least in the surface portion of the fabric.

50 [0037] Fig. 1 schematically shows an example of a surface design of the fabric bearing a design according to the embodiment. A fabric bearing a design 1 has, in its surface portion, an uneven-surface design portion 2 to which an uneven-surface design having an embossed pattern is imparted and a non-uneven-surface design portion 3 to which the uneven-surface design having an embossed pattern is not imparted. The uneven-surface design portion 2 and the non-uneven-surface design portion 3 are repeatedly provided in a predetermined pattern over the entire surface of the fabric 1 to form a repeated pattern. In this example, a hexagonal pattern is formed by the uneven-surface design portion

2 surrounding the periphery of the hexagonal non-uneven-surface design portion 3. The uneven-surface design portion 2 and the non-uneven-surface design portion 3 may be formed in a manner opposite to the configuration shown in Fig. 1. In addition, the shape, number, and arrangement thereof are not particularly limited and various modifications are possible.

5 **[0038]** The uneven-surface design portion is formed by the low fineness portion, and the non-uneven-surface design portion is formed by the high fineness portion. Therefore, the uneven-surface design portion is constituted by the threads having a lower single fiber fineness than that of the non-uneven-surface design portion, and the non-uneven-surface design portion is constituted by the threads having a higher single fiber fineness than that of the uneven-surface design portion.

10 **[0039]** In the uneven-surface design portion, adjacent fibers are more firmly fixed together by the polyurethane resin than in the non-uneven-surface design portion, so that the uneven-surface design is imparted to the surface by the embossing. Specifically, in the low fineness portion, since the fibers constituting the low fineness portion are thin, the spaces between the fibers are small and the spaces are easily filled with the polyurethane resin. Accordingly, the fibers are brought into a state of being fixed together by the polyurethane resin (see Fig. 2). Therefore, the low fineness portion can be easily shaped together with the polyurethane resin when performing embossing, and the uneven-surface design can be imparted thereto by the embossing. The uneven-surface design formed by the embossing is not particularly limited, and a desired uneven-surface shape such as a leather-like grain pattern or a geometric pattern may be imparted.

15 **[0040]** On the other hand, in the non-uneven-surface design portion, adjacent fibers are more loosely fixed together by the polyurethane resin than the uneven-surface design portion, so that the uneven-surface design is not imparted to the surface by the embossing. Specifically, in the high fineness portion, since the fibers constituting the high fineness portion are thick, the spaces between the fibers are large, and in the same amount of the resin, the voids which are not filled with the polyurethane resin are greater than those in the low fineness portion. Therefore, the fibers are brought into a state in which the adjacent fibers are spot-joined by the polyurethane resin rather than being fixed together by the polyurethane resin (see Fig. 3). Therefore, even when the embossing is performed, the uneven-surface design is not imparted, and the design of the fabric itself can be left. That is, the non-uneven-surface design portion is a part to which the uneven-surface design formed by the embossing is not imparted, and may also have an uneven-surface pattern formed by the threads of a weave in a woven fabric or knitted fabric as long as the uneven-surface pattern is an uneven-surface pattern which is not formed by embossing.

20 **[0041]** In this embodiment, it is preferable that the polyurethane resin is imparted so that, in the low fineness portion (that is, the uneven-surface design portion), the permeation thickness of the polyurethane resin is 40 to 400 μm , the filling ratio of the polyurethane resin is 10% to 55%, and the filling ratio of the fibers is 45% to 80%.

25 **[0042]** That is, in the uneven-surface design portion, the permeation thickness of the polyurethane resin is preferably in a range of 40 to 400 μm , more preferably 40 to 330 μm , even more preferably 40 to 260 μm , and particularly preferably 50 to 200 μm . By setting the permeation thickness to be in such a range, the shaping properties by the embossing can be improved. Here, the permeation thickness of the polyurethane resin is obtained by taking a photograph of a vertical section of the polyurethane resin permeation portion with a microscope, measuring the length in a vertical direction from the surface of the fabric to the permeation lower end of the polyurethane resin at arbitrary ten points, and calculating the average value thereof.

30 **[0043]** 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, it is preferable that a non-permeation portion is present below the polyurethane resin permeation portion. Specifically, in the uneven-surface design portion, the ratio of the permeation thickness of the polyurethane resin to the thickness of the fabric bearing a design may be 5% to 25%, or may be 10% to 20%. In the non-uneven-surface design portion, the permeation thickness of the polyurethane resin is not particularly limited. However, typically, since the voids between the fibers therein are large, the permeation thickness thereof is greater than the permeation thickness in the uneven-surface design portion, and may be, for example, 100 to 500 μm , 130 to 400 μm , or 150 to 300 μm . In the non-uneven-surface design portion, the ratio of the permeation thickness of the polyurethane resin to the thickness of the fabric bearing a design is preferably higher than the ratio of the permeation thickness in the uneven-surface design portion, and may be, for example, 21% to 55%, 26% to 55%, or 30% to 55%. Here, the thickness of the fabric bearing a design 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. The numerical ranges of the ratio of the permeation thickness and the thickness of the fabric bearing a design are examples for a fabric excluding double raschel unopened products.

35 **[0044]** In addition, in the uneven-surface design portion, the filling ratio of the polyurethane resin is preferably in a range of 10% to 55%, more preferably 15% to 50%, and even more preferably 20% to 45%. By causing the filling ratio of the polyurethane resin to be 10% or more, the shaping properties by the embossing can be improved. By causing the filling ratio thereof to be 55% or less, flexibility can be improved.

40 **[0045]** The filling ratio of the polyurethane resin is the proportion occupied by the polyurethane resin in the polyurethane

resin permeation portion (a part in which the polyurethane resin permeates between the fibers), 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.

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

[0046] In the uneven-surface design portion, the filling ratio of the fibers is preferably in a range of 45% to 80%, more preferably 50% to 80%, and even more preferably 55% to 80%. By causing the filling ratio of the fibers to be 45% 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 of the fibers to be 80% or less, the flexibility can be improved. The filling ratio of the fibers in the non-uneven-surface design portion is not particularly limited, but is preferably 50% or less, and more preferably 20% to 45%. Typically, since the single fiber fineness of the fibers constituting the non-uneven-surface design portion is high and the voids between the fibers are large, the filling ratio of the fibers therein is lower than that in the uneven-surface design portion.

[0047] The filling ratio of the fibers is the proportion occupied by the fibers in the polyurethane resin permeation portion, and is obtained as follows. That is, the photograph of the vertical section of the polyurethane resin permeation 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 permeation thickness 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 diameters in the vertical and lateral directions of the cross-section of the yarn at arbitrary five points and averaging the measured values. The filling ratio of the fibers is the average value of the filling ratios calculated by the following expression at arbitrary five points.

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

[0048] In this embodiment, it is preferable that the polyurethane resin is applied so that the void ratio in the high fineness portion (that is, the non-uneven-surface design portion) is 10% or more and is higher than the void ratio in the low fineness portion (that is, the uneven-surface design portion). That is, the void ratio in the non-uneven-surface design portion is preferably 10% or more, and more preferably 15% or more. By causing the void ratio to be 10% or more, the uneven-surface shape cannot be easily shaped by the embossing, and a more clear change in design can be provided between the uneven-surface design portions. The upper limit of the void ratio in the non-uneven-surface design portion is not particularly limited, but it is typically 30% or less, and more preferably 20% or less. The void ratio in the uneven-surface design portion is lower than the void ratio in the non-uneven-surface design portion and is not particularly limited, but is preferably less than 10%, and more preferably 7% or less.

[0049] Here, the void ratio is the proportion of the voids in the polyurethane resin permeation portion, and is obtained as follows. That is, the photograph of the vertical section of the polyurethane resin permeation 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 in the lateral direction and having the permeation thickness of the polyurethane resin in the vertical direction are binarized, and the proportion of the voids in the polyurethane resin permeation portion is calculated. The void ratio in the polyurethane resin permeation portion is the average value of the void ratios calculated at arbitrary five points.

[0050] In this embodiment, the ratio of the fibers to the polyurethane resin (fibers/polyurethane resin) in the uneven-surface design portion is preferably 1.0 or more, and more preferably 1.25 or more. By causing the ratio to be 1.0 or more, the number of fibers per polyurethane resin can be increased, the fixing effect by the polyurethane resin can be increased, the shaping properties of the uneven-surface design formed by the embossing can be improved, and durability can be improved. The ratio is obtained by calculating the respective areas by the product of each of the filling ratios of the fibers and the polyurethane resin calculated above and the measurement area and calculating the quotient of the area of the fibers divided by the area of the polyurethane resin. The ratio of the fibers to the polyurethane resin (fiber/polyurethane resin) in the non-uneven-surface design portion is smaller than the ratio in the uneven-surface design portion, and is preferably less than 1.0, and more preferably less than 0.8.

[0051] In this embodiment, the sum of the outer circumferential lengths of the fiber cross-sections in the uneven-surface design portion is preferably 1500 μm or more per unit area 10,000 μm^2 , and more preferably 2000 μm or more. When the sum of the outer circumferential lengths of the fiber cross-sections 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 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 fiber 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 fiber fineness result 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. It is preferable that the sum of the outer circumferential lengths of the fiber cross-sections in the non-uneven-surface design portion is less than the value in the uneven-surface design portion.

[0052] The sum of the outer circumferential lengths of the fiber cross-sections is obtained as follows. That is, the photograph of the vertical section of the polyurethane resin permeation 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 in the lateral direction and having the permeation thickness 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 diameters in the vertical and lateral directions of the cross-section of the yarn at arbitrary five points and averaging the measured values. The sum of the outer circumferential lengths of the fiber cross-sections is the average value of the sums of the outer circumferential lengths calculated at arbitrary five points.

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

[0053] Fig. 2 shows the cross-section in the uneven-surface design portion of the fabric bearing a design according to this embodiment, and is a photograph of the vertical section of the polyurethane resin permeation portion on the surface side of the fabric, taken with a microscope (Digital HF Microscope VH-8000 manufactured by Keyence Corporation, the same is applied hereinafter). The part surrounded by the rectangular frame in the photograph is the measurement range used when the filling ratio and the void ratio are measured, the measurement width is 100 μm , and the height is the permeation thickness of the polyurethane resin. Fig. 3 is a photograph of the vertical section of the non-uneven-surface design portion of the fabric described above, taken with a microscope. Like Fig. 2, the part surrounded by the rectangular frame in the photograph is the measurement range used when the filling ratio and the void ratio are measured, the measurement width is 100 μm , and the height is the permeation thickness of the polyurethane resin. When the permeation thickness, the filling ratio, the void ratio, and the like are measured using these photographs, in order to reduce variations in the measurement position, the average value of five points or ten points randomly extracted from the thread part in which the fibers form a lump state (that is, excluding the boundary part between the threads) is calculated.

[0054] Fig. 4 is a photograph of the surface of the uneven-surface design portion (single fiber fineness: 0.6 dtex) of the fabric bearing a design according to an embodiment, and Fig. 5 is a photograph of the surface before resin processing, both of which are taken with the microscope at a magnification of 100 times. In the low fineness portion, while a large number of filaments are clearly shown before the resin processing shown in Fig. 5, there is a clear change in the shape of the surface after the resin processing and embossing shown in Fig. 4 and each filament is not clearly shown.

[0055] Fig. 6 is a photograph of the surface of the non-uneven-surface design portion (single fiber fineness: 7.5 dtex) of the fabric described above, and Fig. 7 is a photograph of the surface before the resin processing, both of which are taken with the microscope at a magnification of 100 times. In the high fineness portion, there is hardly any change in the shape of the surface before the resin processing shown in Fig. 7 and after the resin processing and embossing shown in Fig. 6.

[0056] According to this embodiment described above, a fabric which partially has an uneven-surface design formed by embossing without complex processes and has the design of the fabric itself remaining in the other parts can be produced, and thus a fabric having a special design that has not yet been seen can be produced at low costs.

[0057] The application of the fabric bearing a design of the present invention is not particularly limited, and can be used in various fields such as vehicle interior materials, interior materials, clothing, bags, and the like.

Examples

[Evaluation Method]

5 (1) Shaping Properties

[0058] Regarding products subjected to embossing using embossing rolls A, B, and C having the following uneven-surface shapes, uneven-surface design portions and non-uneven-surface design portions were visually checked and evaluated according to the following evaluation criteria. Regarding the following recess shape, the pattern spacing is the distance between the apexes of adjacent protrusions, and the inclination angle is the angle between the straight line connecting the highest position of the protrusion to the lowest position of the recess and a tangent to the highest position of the protrusion.

[0059] 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

[0060] 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

[0061] 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

20 (Evaluation Criteria)

[0062]

- 1: All the uneven-surface shapes of A, B, and 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, and C are unclear.

30 (2) Design Properties

[0063] After evaluating the shaping properties, the uneven-surface design portions and the non-uneven-surface design portions of the products were visually observed and evaluated according to the following evaluation criteria.

(Evaluation Criteria)

[0064]

- 1: The uneven-surface shape is clearly shaped by the embossing in the uneven-surface design portion, and the uneven-surface shape is not seen in the non-uneven-surface design portion, so that two types of designs are clearly obtained.
- 2: Although the uneven-surface shape is clearly shaped by the embossing in the uneven-surface design portion, the uneven-surface shape formed by the embossing is unclearly seen in the non-uneven-surface design portion. Otherwise, the uneven-surface shape is not seen in the non-uneven-surface design portion, but the uneven-surface shape of the uneven-surface design portion is unclear. Therefore, although clarity is degraded, two types of designs are obtained.
- 3: The uneven-surface shape is clearly shaped in both. Otherwise, both are unclear, and two types of designs are not obtained.

[Example 1]

[0065] A polyethylene terephthalate false twisted yarn (single fiber fineness: 7.42 dtex) of 178 dtex/24 f was used as a warp, a polyethylene terephthalate false twisted yarn (single fiber fineness: 1.16 dtex) of 333 dtex/288 f was used as a weft, and these were woven into a weave having a 12-harness weft satin as an uneven-surface design portion and having a 12-harness warp satin as a non-uneven-surface design portion, thereby obtaining a gray fabric.

[0066] Next, by a card cloth raising machine provided with a card cloth roll having 12 pile rollers and 12 counter pile rollers, raising was performed mainly on the weft to form a napped surface by performing raising thereon 3 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 a 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 total fineness per unit volume 1 mm^3 was 4072 dtex.

[0067] Next, a polyurethane resin solution (solid content 28 mass%) was applied to the entire surface at a fabric speed of 8 m/min by a knife coater. Clearance conditions were set so that the application amount of the polyurethane resin was 25 g/m^2 in terms of volume after drying. After applying the polyurethane resin solution, the resultant was dried for 5 minutes in an 80°C dryer. As the polyurethane resin solution, a polyurethane resin "RYUDTE-W BINDER UF6025" (manufactured by DIC Corporation, softening temperature = 120°C) was used.

[0068] Next, embossing was performed thereon with an embossing machine at a roll temperature of 120°C , a roll pressure of 1960 N/cm, and a fabric speed of 3 m/min. As the embossing roll, three types of rollers A to C described above were used. Next, the resultant was subjected to a heat treatment by the heat setter at 130°C for 1 minute and was finished.

[0069] In the obtained fabric, an uneven-surface design was imparted only to the napped weft part by the embossing. In the uneven-surface design portion (weft satin portion), the permeation thickness of the polyurethane resin was $78 \mu\text{m}$, the filling ratio of the fibers was 56.2%, the filling ratio of the polyurethane resin was 40.7%, the void ratio was 3.1%, the ratio between the fibers and the polyurethane resin (fibers/polyurethane resin) was 1.38, the sum of the outer circumferential lengths of the fiber cross-sections per unit area $10,000 \mu\text{m}^2$ was $2196 \mu\text{m}$. In addition, in the non-uneven-surface design portion (warp satin portion), the permeation thickness of the polyurethane resin was $199 \mu\text{m}$, the filling ratio of the fibers was 36.3%, the filling ratio of the polyurethane resin was 46.8%, the void ratio was 16.9%, the ratio between the fibers and the polyurethane resin (fibers/polyurethane resin) was 0.78, the sum of the outer circumferential lengths of the fiber cross-sections per unit area $10,000 \mu\text{m}^2$ was $1682 \mu\text{m}$. The thickness of the fabric bearing a design was $600 \mu\text{m}$.

[0070] Evaluation results are shown in Table 1. According to Example 1, the fabric having a unique design in which the uneven-surface design portion having a leather-like grain pattern and the non-uneven-surface design portion having the design of the woven structure of the fabric itself were repeated in a predetermined pattern over the entire fabric was obtained.

[Examples 2 to 10, Comparative Example 1]

[0071] Fabrics of Examples 2 to 10 and Comparative Example 1 were produced in the same manner as in Example 1 except that the configurations and densities of warps and wefts were changed as shown in Table 1.

[0072] Evaluation results are as shown in Table 1. In Comparative Example 1 in which threads having the same single fiber fineness were used as the warp and the weft, an uneven-surface shape formed by embossing was clearly shaped in both a weft satin portion and a warp satin portion, and thus two types of designs were not obtained, resulting in the deterioration of design properties. Contrary to this, in Examples 1 to 10, fabrics having two types of designs including an uneven-surface design portion to which an uneven-surface design was imparted by the embossing and a non-uneven-surface design portion having the design of the woven structure of the fabric itself, on the surfaces of the fabrics were obtained. Particularly, in the fabrics of Examples 1 and 3, the difference between the uneven-surface design portion and the non-uneven-surface design portion was clear, and the design properties were particularly excellent. Here, in Examples 6 and 8, contrary to the other examples, the warp satin portion became the uneven-surface design portion, and the weft satin portion became the non-uneven-surface design portion.

[0073] In addition, in Example 7, the filling ratio of the fibers in the uneven-surface design portion was low, and the wear resistance was deteriorated compared to Example 1. In Example 8, the filling ratio of the fibers in the uneven-surface design portion was high, and the flexibility was deteriorated compared to Example 1. In Example 10, the void ratio in the non-uneven-surface design portion is low, and the uneven-surface shape formed by the embossing was slightly seen even in the non-uneven-surface design portion. Therefore, the design properties were deteriorated compared to Example 1, and the wear resistance was also deteriorated compared to Example 1.

[0074] Here, the wear resistance was measured according to the wear strength C method (Taber type method) of JIS L 1096 8.19.3 (conditions: abrasive wheel CS-10, load 4.9 N, wear count 1000 times), the specimen after the wear test was observed and evaluated from the viewpoint of whether or not there is a change in outer appearance, and whether or not the uneven-surface design is unclear or disappears.

[0075] Regarding the flexibility, three specimens with a size of 40 mm in width and 70 mm in length were taken from each of the warp and weft directions, each of the specimens was bent into two parts in the longitudinal direction so as to cause the surface thereof to be on the outside, and was subjected to a bending test 30,000 times under conditions of a gripping interval of $30 \pm 0.2 \text{ mm}$, a stroke of 15 mm, and a speed of 100 times/min in an environment of -10°C , using De Mattia flexing tester (manufactured by Ueshima Seisakusho Co., Ltd.). The appearances of the specimens after the bending test were observed and evaluated based on the degree of a change in appearance.

[Table 1]

			Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Example 10	Comparative Example 1		
5	Woven fabric	Warp	Type	Multifilament false twisted yarn	←	←	←	←	←	←	←	←	←		
			Yarn fineness (dtex)	178	192	150	192	192	167	150	168	150	196	333	
			Number of filaments (pieces)	24	96	30	96	96	144	72	144	72	48	288	
			Single fiber fineness (dtex)	7.42	2.00	5.00	2.00	2.00	1.16	2.08	1.17	2.08	4.08	1.16	
	10	Woven fabric	Weft	Type	Multifilament false twisted yarn	←	←	←	←	←	←	←	←	←	
				Yarn fineness (dtex)	333	216	360	275	330	140	330	150	330	330	333
				Number of filaments (pieces)	288	144	2400	172	288	72	288	72	288	288	288
				Single fiber fineness (dtex)	1.16	1.50	0.15	1.60	1.15	1.94	1.15	2.08	1.15	1.15	1.16
				Warp density (pieces/25.4 mm)	184	130	180	130	130	174	130	184	133	133	184
				Weft density (pieces/25.4 mm)	88	94	105	90	76	75	67	75	88	88	88
15	Uneven surface design portion	Fabric thickness (mm)	0.60	0.50	0.80	0.50	0.70	0.50	0.60	0.50	0.50	0.60	0.60		
		Total fineness per unit volume 1 mm ³ (dtex)	4072	3564	3189	3914	2814	3115	2730	3320	3857	3616	5943		
		Permeation thickness of polyurethane resin (μm)	78	82	85	80	74	98	81	118	78	78	78		
		Filling ratio of fibers (%)	56.2	57.7	59.5	53.2	48.2	78.0	42.4	82.4	55.8	55.8	56.2		
		Filling ratio of polyurethane resin (%)	40.7	41.5	38.2	41.6	47.7	19.8	50.7	16.0	40.7	40.7	40.7		
		Void ratio (%)	3.1	0.7	2.3	5.2	4.1	2.3	6.8	1.5	3.5	3.5	3.1		
		Ratio between fibers/urethane resin	1.38	1.39	1.56	1.28	1.01	3.94	0.84	5.15	1.37	1.37	1.38		
		Sum of outer circumferential lengths of fiber cross-sections per unit area 10,000 μm ² (μm)	2196	1862	7082	1808	1901	3078	1676	3254	2201	2201	2196		
		20	Non-uneven surface design portion	Permeation thickness of polyurethane resin (μm)	199	219	204	219	219	263	219	263	204	178	67
				Filling ratio of fibers (%)	36.3	20.1	32.9	28.7	30.2	35.8	31.1	35.8	43.6	39.9	48.5
Filling ratio of polyurethane resin (%)	46.8			42.2	45.3	42.2	42.2	42.2	42.2	42.2	45.4	52.1	48.4		
Void ratio (%)	16.9			37.6	21.8	29.1	27.5	21.9	26.7	21.9	11.0	8.0	3.1		
Ratio between fibers/urethane resin	0.78			0.48	0.73	0.68	0.72	0.85	0.74	0.85	0.96	0.77	1.00		
Sum of outer circumferential lengths of fiber cross-sections per unit area 10,000 μm ² (μm)	1682			1688	1743	1688	1688	1001	1459	1001	1216	1122	3831		
Thickness of fabric bearing design (μm)	600			500	800	500	700	500	600	500	500	600	600		
25	Evaluation items			Shaping properties	1	1	1	2	1	1	1	1	1	1	1
				Design properties	1	1	1	2	1	1	1	1	1	2	3

[Example 11]

[0076] Using each polyethylene terephthalate yarn shown in Table 2 below, a stripe pattern tricot knitted fabric including a part (14 wales) composed of L2 and L3 and a part (12 wales) composed of L4 was prepared according to the weaves shown in Table 3. Next, the polyurethane resin solution (solid content 28 mass%) was applied to sinker loop surfaces (L2, L3, and L4) by a reverse coater at a fabric speed of 5 m/minute 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 25 g/m² in terms of volume after drying. After applying the polyurethane resin solution, the resultant was dried for 5 minutes in the 80°C dryer. As the polyurethane resin solution, the polyurethane resin "RYUDETE-W BINDER UF6025" (manufactured by DIC Corporation) was used.

[0077] 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 embossing roll, three types of rollers A to C described above were used. Next, the resultant was subjected to a heat treatment by the heat setter at 130°C for 1 minute and was finished.

[0078] Evaluation results are shown in Table 4. In the obtained fabric, a part formed of a front yarn became an uneven-surface design portion, and an uneven-surface design formed by the embossing was imparted thereto. In addition, a part formed of a middle yarn became a non-uneven-surface design portion, and the uneven-surface design formed by the embossing was not imparted thereto.

[Examples 12 to 14]

[0079] Fabrics of Examples 12 to 14 were prepared in the same manner as in Example 11 except that the configuration and weave of each polyethylene terephthalate yarn were changed as shown in Tables 2 and 3. Evaluation results are shown in Table 4.

[0080] In Example 12, a double raschel knitted fabric was opened, and the polyurethane resin solution was applied to a stripe pattern pile surface formed by a part (10 wales) constituted by L3 and a part (10 wales) constituted by L4. In the obtained fabric, the part formed by the yarn fed through the reed L3 became an uneven-surface design portion, and an uneven-surface design formed by the embossing was imparted thereto. In addition, the part formed by the yarn fed through the reed L4 becomes a non-uneven-surface design portion, and the uneven-surface design formed by the embossing was not imparted thereto.

[0081] In Example 13, without opening a double raschel knitted fabric, the polyurethane resin solution was applied to stripe pattern face ground weave surfaces (L4 and L5) formed by a part (7 wales) constituted by L4 and a part (7 wales)

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constituted by L5. In the obtained fabric, the part formed by the yarn fed through the reed L4 became an uneven-surface design portion, and an uneven-surface design formed by the embossing was imparted thereto. In addition, the part formed by the yarn fed through the reed L5 becomes a non-uneven-surface design portion, and the uneven-surface design formed by the embossing was not imparted thereto.

[0082] In Example 14, the polyurethane resin solution was applied to the surface of a border pattern formed by a part (14 courses) constituted by a face yarn 1 of a double jersey knitted fabric and a part (14 courses) constituted by a face yarn 2. In the obtained fabric, the part formed by the face yarn 1 became an uneven-surface design portion, and an uneven-surface design formed by the embossing was imparted thereto. In addition, the part formed by the face yarn 2 becomes a non-uneven-surface design portion, and the uneven-surface design formed by the embossing was not imparted thereto.

[Table 2]

		Example 11 tricot	Example 12 double raschel (opened)	Example 13 double raschel (unopened)	Example 14 double jersey
15 20 25	Back yarn L1 face yarn 1	Multifilament yarn	Multifilament yarn	Multifilament yarn	Multifilament false twisted yarn
	Yarn fineness (dtex)	84	84	84	84
	Number of filaments (pieces)	36	36	36	144
	Single fiber fineness (dtex)	2.33	2.33	2.33	0.58
	Yarn structure	Full set	Full set	Full set	Total of 14 yarns
30 35 40	Middle yarn L2 face yarn 2	Multifilament false twisted yarn	Multifilament yarn	Multifilament yarn	Multifilament false twisted yarn
	Yarn fineness (dtex)	167	84	84	84
	Number of filaments (pieces)	48	36	36	36
	Single fiber fineness (dtex)	3.48	2.33	2.33	2.33
	Yarn structure	14in12out	Full set	Full set	Total of 14 yarns
45 50 55	Middle yarn L3 bonding yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament yarn	Multifilament false twisted yarn
	Yarn fineness (dtex)	167	167	33	110
	Number of filaments (pieces)	48	288	6	24
	Single fiber fineness (dtex)	3.48	0.58	5.50	4.58
	Yarn structure	14in12out	10in10out	Full set	Total of 28 yarns

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(continued)

		Example 11 tricot	Example 12 double raschel (opened)	Example 13 double raschel (unopened)	Example 14 double jersey	
5	Front yarn L4 rear yarn	Type	Multifilament false twisted yarn	Multifilament false twisted yarn	Multifilament false twisted yarn	
10		Yarn fineness (dtex)	110	167	220	167
		Number of filaments (pieces)	156	48	288	48
15		Single fiber fineness (dtex)	0.71	3.48	0.78	3.48
		Yarn structure	14out12in	10out10in	7in7out	Total of 28 yarns
20	L5	Type		Multifilament yarn	Multifilament false twisted yarn	
		Yarn fineness (dtex)		84	220	
25		Number of filaments (pieces)		36	96	
		Single fiber fineness (dtex)		2.33	2.29	
30		Yarn structure		Full set	7out7in	
35	L6	Type		Multifilament yarn	Multifilament false twisted yarn	
		Yarn fineness (dtex)		84	167	
40		Number of filaments (pieces)		36	48	
		Single fiber fineness (dtex)		2.33	3.48	
45		Yarn structure		Full set	1in6out	

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[Table 3]

		Example 11 tricot	Example 12 double raschel (opened)	Example 13 double raschel (unopened)	Example 14 double jersey	
5	Weave	Back yarn L1 face yarn 1	1-2/1-0	3-2/2-2/0-1/1-1	4-4/4-4/0-0/0-0	see Fig. 8(a)
		Middle yarn L2 face yarn 2	1-0/3-3/1-0/3-4	0-1/1-1/2-1/1-1	1-2/1-1/1-0/1-1	see Fig. 8(b)
10		Middle yarn L3 bonding yarn	1-0/3-4/1-0/3-3	0-1/0-1	0-1/0-1/1-0/1-0	see Fig. 8(c)
		Front yarn L4 rear yarn	1-0/3-4	0-1/0-1	1-1/0-1/0-0/1-0	see Fig. 8(d)
15		L5		1-1/0-1/1-1/0-1	1-1/0-1/0-0/1-0	
		L6		1-1/3-2/2-2/0-1	0-0/7-7/7-7/0-0	
	Course density (number of courses/25.4 mm)		62.00	48.00	45.00	70.00
20	Wale density (number of wales/25.4 mm)		30.00	32.00	34.00	41.00
	Fabric thickness (mm)		1.00	1.00	11.0	1.10
25	Total fineness per unit volume 1 mm ³ (dtex)		2578	1581	2666	2230

[Table 4]

		Example 11	Example 12	Example 13	Example 14	
30	Uneven-surface design portion	Permeation thickness of polyurethane resin (μm)	88	80	72	79
		Filling ratio of fibers (%)	52.3	55.7	52.5	56.1
35		Filling ratio of polyurethane resin (%)	42.8	40.9	40	40.1
		Void ratio (%)	4.9	3.4	7.5	3.8
		Ratio between fibers/urethane resin	1.22	1.36	1.31	1.40
40		Sum of outer circumferential lengths of fiber cross-sections per unit area 10,000 μm^2 (μm)	2464	2894	2859	2861
45	Non-uneven -surface design portion	Permeation thickness of polyurethane resin (μm)	179	179	184	184
		Filling ratio of fibers (%)	19.6	24.2	2.3	23
		Filling ratio of polyurethane resin (%)	51.6	50.6	50.3	50.3
50		Void ratio (%)	28.8	25.2	47.4	26.7
		Ratio between fibers/urethane resin	0.38	0.48	0.05	0.46
55		Sum of outer circumferential lengths of fiber cross-sections per unit area 10,000 μm^2 (μm)	828	1019	120	1211
	Thickness of fabric bearing design (μm)		600	800	11000	700

(continued)

		Example 11	Example 12	Example 13	Example 14	
5	Evaluation items	Shaping properties	1	1	1	1
		Design properties	1	1	1	1

Reference Signs List

[0083]

- 1 fabric bearing a design
 2 uneven-surface design portion
 15 3 non-uneven-surface design portion

Claims

- 20 1. A process for producing a fabric bearing a design partially having an uneven-surface design by embossing, the process comprising:

25 applying a polyurethane resin to a surface of a fabric having, on the surface, a low fineness portion and a high fineness portion having a higher single fiber fineness than that of the low fineness portion;
 drying the fabric; and
 performing embossing on the surface of the fabric.

- 30 2. The process for producing a fabric bearing a design according to claim 1, wherein, by performing the embossing, while the uneven-surface design is not imparted to the high fineness portion by the embossing and a non-uneven-surface design portion is formed, the uneven-surface design is imparted to the low fineness portion by the embossing and an uneven-surface design portion is formed.

- 35 3. The process for producing a fabric bearing a design according to claim 1 or 2, wherein the low fineness portion includes threads having a single fiber fineness of 1.5 dtex or lower, and the high fineness portion includes threads having a single fiber fineness of higher than 1.5 dtex.

- 40 4. The process for producing a fabric bearing a design according to any one of claims 1 to 3, wherein the polyurethane resin is applied so that, in the low fineness portion, a permeation thickness of the polyurethane resin is 40 to 400 μm , a filling ratio of the polyurethane resin is 10% to 55%, and a filling ratio of fibers is 45% to 80%.

- 45 5. The process for producing a fabric bearing a design according to any one of claims 1 to 4, wherein the polyurethane resin is applied so that a void ratio in the high fineness portion is 10% or higher and is higher than a void ratio in the low fineness portion.

6. The process for producing a fabric bearing a design according to any one of claims 1 to 5, wherein the polyurethane resin is applied so that the polyurethane resin permeates between the fibers at least in a surface portion of the fabric and the surface of the fabric is formed by the polyurethane resin and the fibers.

- 50 7. A fabric bearing a design comprising:

a polyurethane resin which is present on a surface portion of the fabric; and
 an uneven-surface design portion and a non-uneven-surface design portion on the surface portion,
 55 wherein the uneven-surface design portion is constituted by threads having a lower single fiber fineness than that of the non-uneven-surface design portion, and an uneven-surface design is imparted to a surface of the uneven-surface design portion by embossing, and
 the non-uneven-surface design portion is constituted by threads having a higher single fiber fineness than that

of the uneven-surface design portion, and the uneven-surface design is not imparted to a surface of the non-uneven-surface design portion by the embossing.

- 5
8. The fabric bearing a design according to claim 7,
wherein adjacent fibers in the uneven-surface design portion are fixed together more firmly than in the non-uneven-surface design portion by the polyurethane resin such that the uneven-surface design is imparted to the uneven-surface design portion by the embossing.
- 10
9. The fabric bearing a design according to claim 7 or 8,
wherein the uneven-surface design portion includes threads having a single fiber fineness of 1.5 dtex or lower, and the non-uneven-surface design portion includes threads having a single fiber fineness of higher than 1.5 dtex.
- 15
10. The fabric bearing a design according to any one of claims 7 to 9,
wherein, in the uneven-surface design portion, a permeation thickness of the polyurethane resin is 40 to 400 μm , a filling ratio of the polyurethane resin is 10% to 55%, and a filling ratio of the fibers is 45% to 80%.
- 20
11. The fabric bearing a design according to any one of claims 7 to 10,
wherein a void ratio in the non-uneven-surface design portion is 10% or higher and is higher than a void ratio in the uneven-surface design portion.
- 25
12. The fabric bearing a design according to any one of claims 7 to 11,
wherein the polyurethane resin permeates between the fibers at least in a surface portion of the fabric and a surface of the fabric is formed by the polyurethane resin and the fibers.
- 30
13. The fabric bearing a design according to any one of claims 7 to 12,
wherein a sum of outer circumferential lengths of fiber cross-sections in the uneven-surface design portion is 1500 μm or more per unit area 10,000 μm^2 .
- 35
- 40
- 45
- 50
- 55

FIG. 1

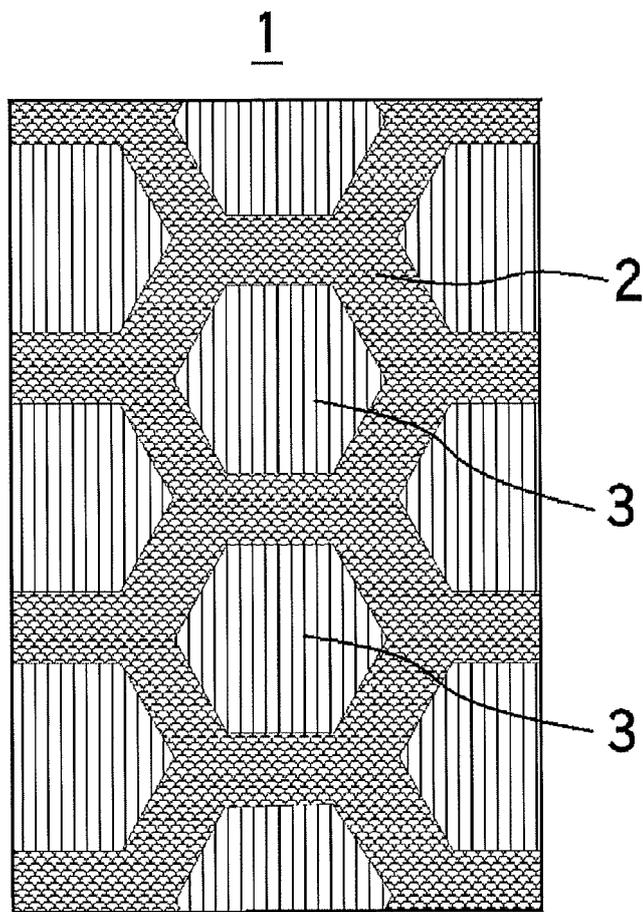


FIG. 2

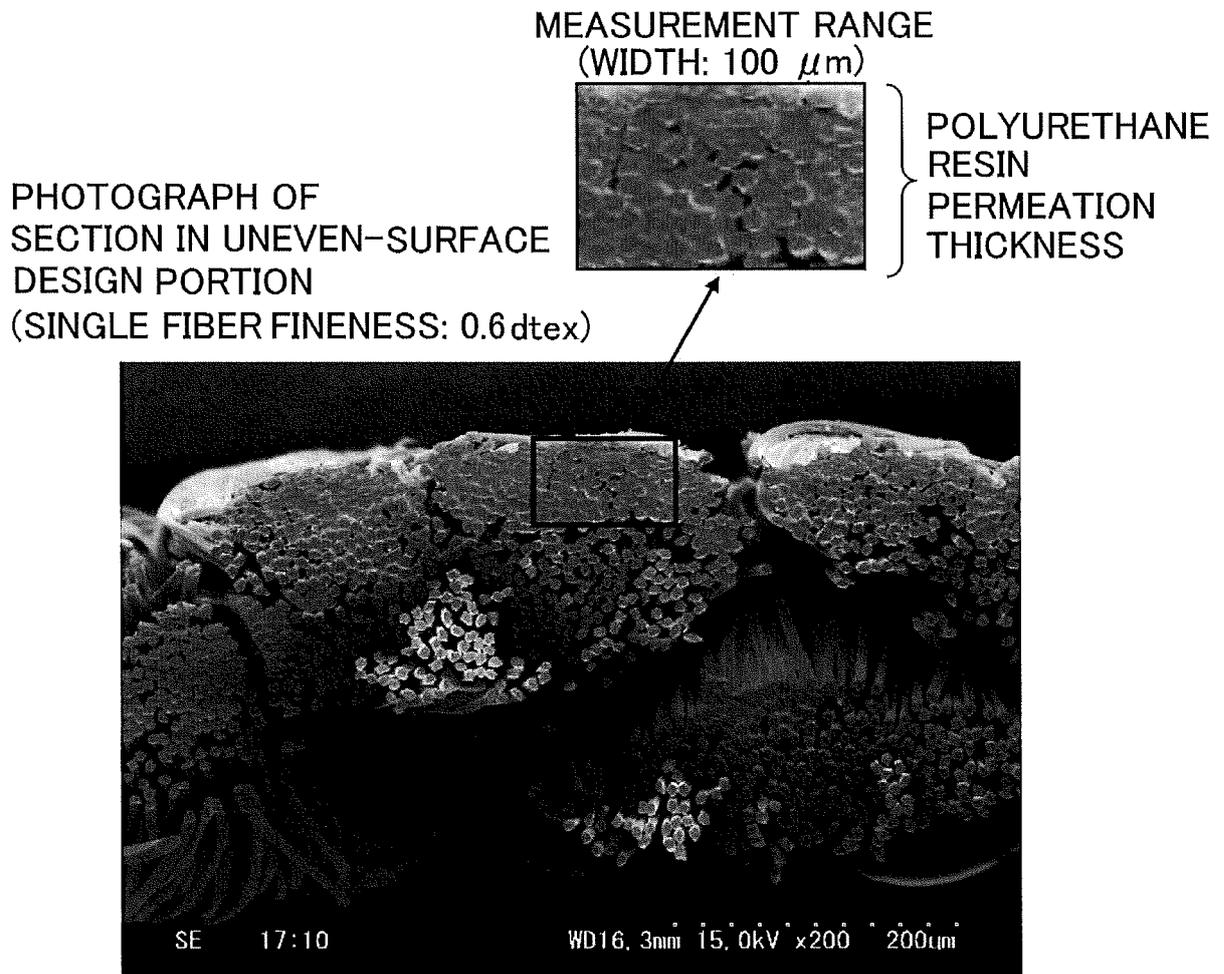


FIG. 3

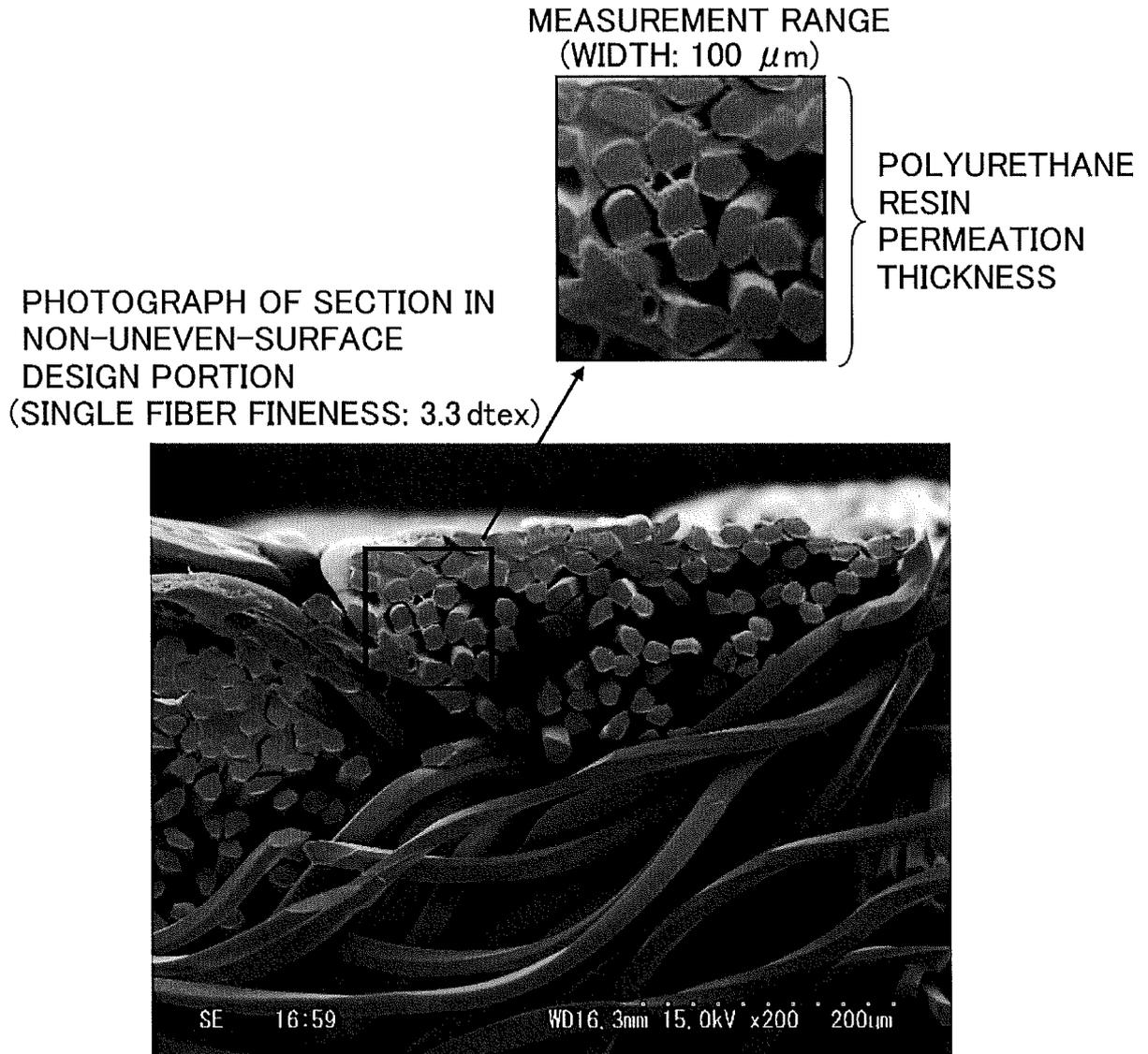


FIG. 4

PHOTOGRAPH OF SURFACE OF
UNEVEN-SURFACE DESIGN PORTION



UNEVEN-SURFACE
DESIGN PORTION

NON-UNEVEN-SURFACE
DESIGN PORTION

FIG. 5

PHOTOGRAPH OF SURFACE OF
LOW FINENESS PORTION
(UNEVEN-SURFACE DESIGN PORTION
BEFORE RESIN PROCESSING)

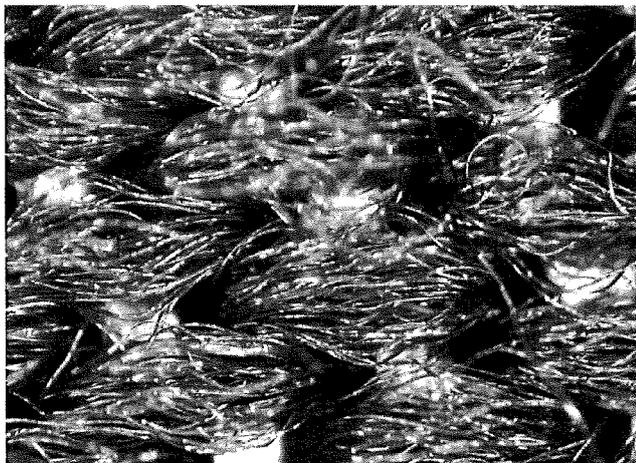


FIG. 6

PHOTOGRAPH OF SURFACE OF
NON-UNEVEN-SURFACE DESIGN PORTION

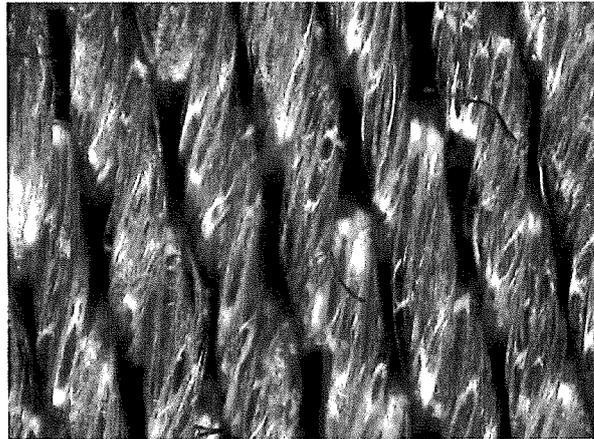


FIG. 7

PHOTOGRAPH OF SURFACE OF
HIGH FINENESS PORTION
(NON-UNEVEN-SURFACE DESIGN
PORTION BEFORE RESIN PROCESSING)

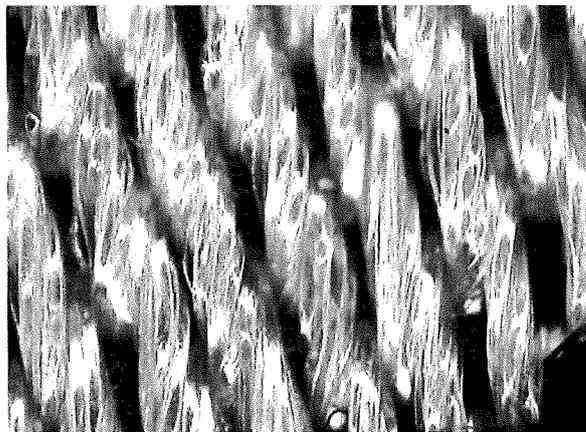
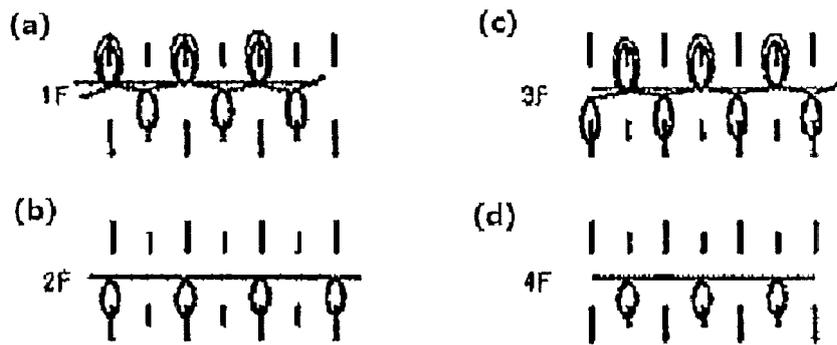


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/006172

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

 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
01 March 2016 (01.03.16)Date of mailing of the international search report
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

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010007211 A [0003]
- JP 2010248668 A [0003]