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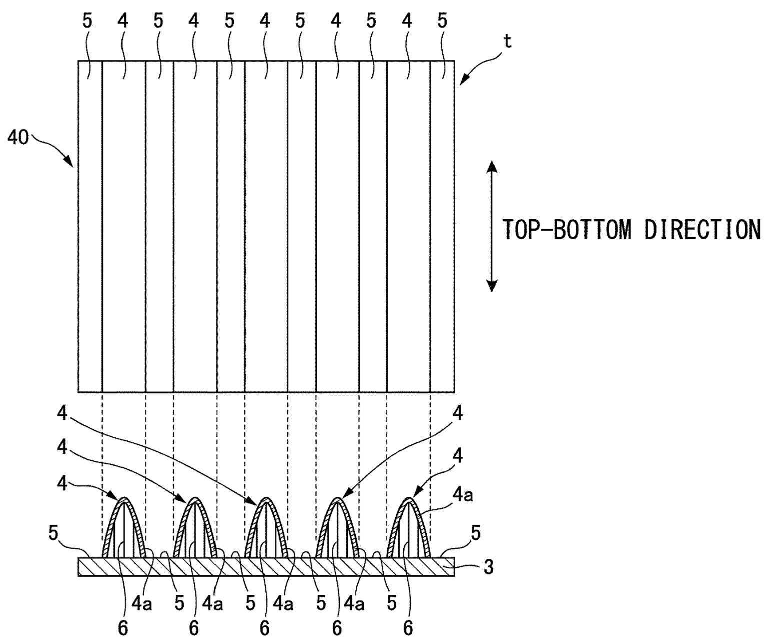
(54) SHIRT

(57) The present teaching provides a shirt that reduces adherence of a fabric to skin even when sweating and does not provide cause discomfort of a wearer.

A shirt (100) includes a section body , the section body (10) including a front section (1) covering a front side of a wearer and a back section (2) covering a back side of the wearer, at least one of the front section or the back section includes a low tack region (t) composed of a knitted fabric (40) including ridge-shaped projections (4), and the low tack region is disposed such that the ridge-shaped projections are located on a side to contact skin of the wearer and extends in top-bottom directions of the section body.

FIG. 3



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Description

BACKGROUND

Technical field

[0001] The present teaching relates to a shirt.

[0002] In sports such as marathon, the fabric of a shirt tends to come into intimate contact with the skin of a wearer when sweating. In such a situation, adherence and separation of the skin and the fabric repeatedly occur. This causes discomfort of the wearer.

[0003] It is therefore desired to place, in an appropriate area of a shirt, a fabric having low adherence with skin even when sweating.

[0004] Conventionally, shirts used for sports such as marathon are subjected to a chemical treatment such as a water repellent treatment on the fabric surface and/or having air vents for promoting permeability.

[0005] However, in a shirt made of a fabric subjected to a chemical treatment such as a water repellent treatment on the fabric surface and/or having air vents for promoting permeability, in the case of reaching a perspiration amount over maximum water retention of the shirt, a contact interface between the skin of a wearer and the fabric is filled with water (sweat) to thereby generate a large adherence. Accordingly, the fabric sticks to the skin, which causes discomfort of the wearer.

[0006] A garment incorporating a double raschel knit fabric in all or part of its fabric is also proposed (see Patent Literature 1). Patent Literature 1 describes that an upper garment or pants entirely or partially incorporate a double raschel knit fabric in which a surface mesh fabric knitted into a coarse mesh and a backside mesh fabric knitted into a fine mesh are united such that monofilament connecting fibers are moved back and forth between the surface mesh fabric and the backside mesh fabric to thereby form a buffer clearance for obtaining permeability between the surface mesh fabric and the backside mesh fabric. The backside mesh fabric is designed to obtain a water absorption function of quickly absorbing sweat of a wearer or supplied moisture by a capillary action and retaining water. The buffer clearance in the surface material is designed to block water moving from the backside mesh fabric to the surface mesh fabric.

Background Information

[0007] Patent Literature: Japanese Patent Application Laid-Open No. 2015-78450

SUMMARY

[0008] The technique described in Patent Literature 1 is intended to absorb and retain water in sweating. Thus, also in Patent Literature 1, in the case of reaching a perspiration amount over maximum water retention, the fabric sticks to the skin of a wearer, which also causes discomfort of the wearer.

[0009] It is therefore an object of the present teaching to provide a shirt that reduces adherence of fabric to skin when sweating and does not cause discomfort of a wearer.

[0010] Inventors of the present teaching studied a surface shape of a fabric that can reduce adherence even in a case where water is present at the interface between skin and the fabric. Through an intensive study, the inventors have reached the following configurations.

[0011] A shirt according to one embodiment of the present teaching is a shirt including a section body, and the section body includes a front section covering a front side of a wearer and a back section covering a back side of the wearer, wherein at least one of the front section or the back section includes a low tack region composed of a knitted fabric including ridge-shaped projections, and the low tack region is disposed such that the ridge-shaped projections are located on a side to contact skin of the wearer and extends in top-bottom direction of the section body.

[0012] In the following description, numerous specific examples are set forth in order to provide a thorough understanding of the present teaching. It is obvious that those skilled in the art, however, would be able to carry out the present teaching without these specific examples.

[0013] The following disclosure is to be, therefore, considered as an exemplification of the present teaching, and is not intended to limit the present teaching to the specific embodiments illustrated by the figures or description below.

[0014] According to one embodiment of the present teaching, since the ridge-shaped projections are present on the front side of the body, only the ridge-shaped projections substantially contact the skin so that the contact area with the skin is small, and adherence to the fabric when sweating can be reduced. In addition, since the ridge-shaped projections are arranged in the top-bottom direction of the section body, sweat in perspiration tends to easily flow in the gravity direction, and accumulation of sweat is reduced. This can reduce adherence to the fabric.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

[FIG. 1] FIG. 1 is a plan view of a shirt according to an embodiment of the present teaching when seen from a front section side.

[FIG. 2] FIG. 2 is a plan view of the shirt according to the embodiment of the present teaching when seen from a back section side.

[FIG. 3] FIG. 3 is a schematic view of a ridge-shaped knitted fabric used for a low tack region of the shirt according to the embodiment of the present teaching.

[FIG. 4] FIG. 4 is a schematic view illustrating a state of the low tack region of the shirt according to the embodiment of the present teaching and skin.

[FIG. 5] FIG. 5 is a human body thermomapping diagram, (a) shows a front side, and (b) shows a back side.

[FIG. 6] FIG. 6 is a human body perspiration rate distribution diagram, (a) shows the front side, and (b) shows the back side.

[FIG. 7] FIG. 7 is a schematic view of a knitted fabric combining low tack regions with different surface shapes.

[FIG. 8] FIG. 8 is a plan view of a shirt according to a variation of the embodiment of the present teaching when seen from a front section side.

[FIG. 9] FIG. 9 is a plan view of the shirt according to the variation of the embodiment of the present teaching when seen from a back section side.

[FIG. 10] FIG. 10 shows plan views illustrating examples of knitted fabrics each having ridge-shaped projections used in the present teaching on one side, and (a) to (d) show four different surface shapes.

[FIG. 11] FIG. 11 is a schematic view showing a relationship between projections and a base fabric when the knitted fabric is taken along the top-bottom directions.

[FIG. 12] FIG. 12 is a schematic view illustrating a state of a low tack region of the shirt according to the embodiment of the present teaching and skin.

[FIG. 13] FIG. 13 is an enlarged view of a portion enclosed by a rectangle a in FIG. 12.

[FIG. 14] FIG. 14 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric which applies to the present teaching.

[FIG. 15] FIG. 15 shows height distributions as results obtained by measuring the fabric surface shown in FIG. 14 with a three-dimensional measuring machine, (a) shows recesses, (b) shows projections, and (c) shows a frequency distribution histogram.

[FIG. 16] FIG. 16 is a bird's-eye view of a sample of a double raschel knit fabric according to Comparative Example 1.

[FIG. 17] FIG. 17 is a bird's-eye view of a sample of a double raschel knit fabric according to Comparative Example 2.

[FIG. 18] FIG. 18 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 1 of the present teaching.

[FIG. 19] FIG. 19 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 2 of the present teaching.

[FIG. 20] FIG. 20 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 3 of the present teaching.

[FIG. 21] FIG. 21 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 4 of the present teaching.

[FIG. 22] FIG. 22 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 5 of the present teaching.

[FIG. 23] FIG. 23 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 6 of the present teaching.

[FIG. 24] FIG. 24 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 7 of the present teaching.

[FIG. 25] FIG. 25 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 8 of the present teaching.

[FIG. 26] FIG. 26 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 9 of the present teaching.

[FIG. 27] FIG. 27 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 10 of the present teaching.

[FIG. 28] FIG. 28 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 11 of the present teaching.

[FIG. 29] FIG. 29 is a bird's-eye view of a sample of a ridge-shaped double raschel knit fabric according to Example 12 of the present teaching.

[FIG. 30] FIG. 30 is a schematic view of a device used for conducting a sensory test of the present teaching.
[FIG. 31] FIG. 31 is a graph showing a relationship between an asperity area ratio and a sensory value.
[FIG. 32] FIG. 32 is a graph showing a relationship between a root mean square height and a water retention.
[FIG. 33] FIG. 33 is a plan view of a shirt according to Specific Example 1 of the present teaching when seen from a front section side.
[FIG. 34] FIG. 34 is a plan view of the shirt according to Specific Example 1 of the present teaching when seen from a back section side.
[FIG. 35] FIG. 35 is a plan view of a shirt according to Specific Example 2 of the present teaching when seen from a front section side.
[FIG. 36] FIG. 36 is a plan view of the shirt according to Specific Example 2 of the present teaching when seen from a back section side.

DETAILED DESCRIPTION

[0016] A shirt according to an embodiment of the present teaching will now be described in detail. The shirt according to the present teaching is not limited to that described in the following embodiment, and can be carried out with an appropriate change without departing from the gist of the teaching.

[0017] FIG. 1 is a plan view of the shirt according to the embodiment of the present teaching when seen from a front section side. FIG. 2 is a plan view of the shirt according to the embodiment of the present teaching when seen from a back section side. A shirt 100 according to an embodiment of the present teaching is suitably used for sports with heavy perspiration amount, such as marathon. The shirt 100 includes a section body 10 including a front section 1 covering the front side of a wearer and a back section 2 covering the back side of the wearer. When sweating, the fabric of the shirt 100 tends to come into intimate contact with the skin of a wearer. In such a situation, the shirt 100 according to the embodiment of the present teaching reduces adherence of the fabric to the skin.

[0018] Conventional shirts take measures such as a chemical treatment such as a water repellent treatment on the surface of the fabric or having air vents penetrating the fabric from the front surface to the back surface in order to promote permeability. Since air vents promote permeability more greatly than a mesh fabric, a known shirt has air vents formed by cutting warp or weft treads of the fabric.

[0019] From a viewpoint different from the water repellent treatment and permeability, the inventors of the present application studied reduction of adherence of the shirt 100 to skin even in a state where water is present at the interface between the skin and the fabric. Consequently, the inventors found that adherence of the fabric to the skin can be reduced even in a state where water is present at the interface between the skin and the fabric by optimizing the surface shape of the fabric. This adherence reduction can suppress movement of moisture due to sweating into the fabric. This eliminates the necessity for increasing maximum water retention of the fabric. Conventionally, moisture generated by perspiration is moved into the fabric and vaporized to be released to the outside. Thus, in the case of exceeding the maximum water retention, the fabric adheres to the skin. To prevent this, the maximum water retention needs to be as large as possible.

[0020] As described above, the shirt 100 does not need to have large maximum water retention of the fabric, and thus, the maximum water retention directly related to a wet shirt weight can be reduced so that the weight of the wet shirt can be reduced.

[0021] In the shirt 100, a low tack region having obtained low tackiness by optimizing the surface shape of the fabric is disposed in at least one of the front section 1 or the back section 2.

[0022] The tackiness herein refers to adherence of the fabric to the skin of a wearer. The low tack region refers to a region where adherence of the fabric to the skin is reduced.

[0023] As illustrated in FIGS. 1 and 2, in this embodiment, a low tack region t is disposed in a front center region 11 extending in the top-bottom direction in a center portion of the front section 1, and a low tack region t is disposed in a back center region 21 extending in the top-bottom direction in a center portion of the back section 2.

[0024] As illustrated in FIG. 3, in a knit fabric 40 constituting the low tack region t, ridge-shaped projections 4 and recesses 5 are alternately arranged. As illustrated in FIG. 4, the ridge-shaped projections 4 are located on a side to contact with a skin 10s. The ridge-shaped projections 4 in the low tack region t are arranged in the top-bottom direction of the section body 10.

[0025] The knit fabric 40 used in the low tack region t of the shirt 100 can be, for example, a ridge-shaped double raschel knit fabric 40 as illustrated in FIG. 3. The ridge-shaped double raschel knit fabric 40is configured such that the ridge-shaped projections 4 shaped by coupling a back-side fabric 4a to contact the skin 10s and a front-side base fabric 3 and the recesses 5 composed of the base fabric 3 are alternately arranged. In this embodiment, the base fabric 3 is a mesh fabric to have high permeability.

[0026] As illustrated in FIGS. 3 and 4, the ridge-shaped double raschel knit fabric 40 including the ridge-shaped projections 4 is mainly composed of the back-side fabric 4a, the base fabric 3, and connecting threads 6. The back-side fabric 4a is formed by knitting threads constituting the back surface. The back-side fabric 4a is on the skin side of the garment. The base fabric 3 is formed by knitting threads constituting the front surface. The connecting threads 6 run substantially in the longitudinal direction (thickness direction) between the back-side fabric 4a and the base fabric 3 to fill a gap between the back-side fabric 4a and the base fabric 3 and connects the back-side fabric 4a and the base fabric 3 together. The connecting threads 6 provide thickness of the double raschel knit fabric 40.

[0027] The ridge-shaped projections 4 and the recesses 5 of the ridge-shaped double raschel knit fabric 40 according to this embodiment function such that the surface shape constituted by the ridge-shaped projections 4 and the recesses 5 reduces adherence. To achieve this function, the ridge-shaped double raschel knit fabric 40 in which the asperity area ratio and the root mean square height of the projections in the fabric are set is used. Accordingly, the height of the ridge-shaped projections 4 of the ridge-shaped double raschel knit fabric 40 according to this embodiment is different from heights of ridge-shaped projections of conventional ridge-shaped double raschel knit fabrics in which the heights of ridge-shaped projections were set to cause the region of the recesses to function as a ventilation region. The surface shape, the asperity area ratio, and the root mean square height of the projections for reducing adherence will be described later.

[0028] As illustrated in FIG. 4, in this embodiment, since the ridge-shaped projections 4 are located on the front side of the body, only the ridge-shaped projections 4 substantially contact the skin 10s. Accordingly, the contact area with the skin 10s is small so that adherence to the fabric when sweating can be reduced. In addition, since the ridge-shaped projections 4 are arranged in the top-bottom direction of the section body, sweat due to perspiration easily flows in the gravity direction. This suppresses accumulation of sweat to thereby reduce adherence to the fabric.

[0029] The low tack region t provided in the shirt 100 is preferably located in an area of the body with a large perspiration amount. FIG. 5 shows a human body thermomapping diagram. FIG. 6 shows a human body perspiration rate distribution diagram. From FIGS. 5 and 6, thermal stress is supposed to be highest in an upper portion of a front center portion and a back center portion of the human body. As shown in FIG. 6, the perspiration amount is large in the front center portion and the back center portion of the human body. Accordingly, the presence of the low tack region t in a region with a large perspiration amount can reduce adherence of the fabric to the skin when sweating.

[0030] The section body 10 includes the front center region 11 extending in the top-bottom direction in a center portion of the front section 1 and the back center region 21 extending in the top-bottom direction in a center portion of the back section 2. The low tack region t is preferably located in at least one of the upper portion of the front center region 11 or the back center region 21 where thermal stress is supposed to be highest. In FIGS. 1 and 2, the low tack region t is located in each of the upper portion of the front center region 11 and the back center region 21. Although the low tack region t is located in the upper portion of the front center region 11 in FIG. 1, the low tack region t may be provided in the entire front center region 11. The upper portion of the front center region 11 refers to a region of an upper half of the front center region 11 when the front center region 11 is divided into an upper portion and a lower portion.

[0031] In this embodiment, in the ridge-shaped double raschel knit fabric 40 used in the low tack region t, the base fabric 3 is composed of a mesh fabric. The base fabric 3 of the double raschel knit fabric 40 is composed of a mesh fabric with high permeability to have high permeability so that air in the shirt 100 can be easily released to the outside. Accordingly, heat dissipation in the shirt 100 is enhanced, and sweat in a gas phase is released to the outside through the mesh fabric with high permeability so that the fabric can be thereby easily dried.

[0032] As shown in the human body perspiration rate distribution diagrams of FIG. 6, the perspiration amount of the human body varies among areas. The surface shape of the fabric of the double raschel knit fabric 40 on the skin side is preferably caused to vary depending on the perspiration amount. For example, in side portions of the human body, since the skin and the fabric less contact each other, an importance is placed on permeability, and an interval x between the ridge-shaped projections 4 and 4 is made wide to increase permeability from the mesh fabric of the base fabric 3. Accordingly, in this embodiment, as shown in FIG. 7, the low tack region t is composed of a combination of knitted fabrics with different skin-side surface shapes such that at least one of a width a of the ridge-shaped projections 4 or an interval x between the ridge-shaped projections 4 and 4 varies.

[0033] With a combination of knitted fabrics in which at least one of the width a of the ridge-shaped projections 4 that provided to be orthogonal to the top-bottom directions of the section body 10 or the interval between the ridge-shaped projections 4 and 4 varies, distortion and shrink of the knitted fabrics easily occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents, and ventilation in the shirt 100 is promoted so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0034] As illustrated in FIG. 1, the front section 1 of the section body 10 includes, as regions other than the front center region 11, side regions 13 covering side portions of the wearer and front intermediate regions 12 between the front center region 11 and the side regions 13. In the shirt 100, all the front center region 11, the front intermediate regions 12, and the side regions 13 are composed of low tack regions t, but each interval between adjacent ridge-shaped projections 4 and 4 varies among the regions. Specifically, the shirt 100 satisfies $x_1 < x_2 < x_3$, where x_1 is an interval between adjacent ones of the ridge-shaped projections 4 and 4 in the low tack region t in the front center region 11, x_2 is an interval between adjacent ones of the ridge-shaped projections 4 and 4 in the low tack region t in the front intermediate regions 12, and x_3 is an interval between adjacent ones of the ridge-shaped projections 4 and 4 in the low tack region t in the side regions 13.

[0035] In this configuration, the intervals between the ridge-shaped projections 4 of the ridge-shaped double raschel knit fabric 40 in the low tack region t are made smaller in an area of the body with a larger perspiration amount so that adherence of the fabric to the body when sweating can be thereby reduced.

[0036] In addition, the front center region 11, the front intermediate regions 12, and the side regions 13 are configured with different knitted fabrics being arranged side by side so that distortion and shrinkage of the fabrics thereby tend to occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents, and ventilation in the shirt 100 is promoted so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0037] As illustrated in FIG. 2, the back section 2 of the section body 10 includes, as regions other than the back center region 21 and side regions 23, back intermediate regions 22 between the back center region 21 and the side regions 23. In the shirt 100, all the back center region 21, the back intermediate regions 22, and the side regions 23 are composed of low tack regions t, but each interval between adjacent ridge-shaped projections 4 and 4 varies among the regions. Specifically, the shirt 100 satisfies $x_4 < x_5 < x_3$, where x_3 is an interval between adjacent ridge-shaped projections 4 and 4 in the low tack region t in the side regions 23, x_4 is an interval between adjacent ridge-shaped projections 4 and 4 in the low tack region t in the back center region 21, and x_5 is an interval between adjacent ridge-shaped projections 4 and 4 in the low tack region t in the back intermediate regions 22.

[0038] In this configuration, the intervals between the ridge-shaped projections 4 of the ridge-shaped double raschel knit fabric 40 in the low tack region t are made smaller in an area of the body with a larger perspiration amount so that adherence of the fabric to the body when sweating can be thereby reduced.

[0039] In addition, the back center region 21, the back intermediate regions 22, and the side regions 23 are configured with different knitted fabrics being arranged side by side so that distortion and shrinkage of the fabrics thereby tend to occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents, and ventilation in the shirt 100 is promoted so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0040] A variation of this embodiment will now be described. FIG. 8 is a plan view of a shirt according to a variation of the embodiment of the present teaching when seen from a front section side. FIG. 9 is a plan view of the shirt according to the variation of the embodiment of the present teaching when seen from a back section side. In this variation, each of the front intermediate regions 12 is divided into three regions: a first intermediate region 12a located near the front center region 11; a third intermediate region 12c located near the side region 13; and a second intermediate region 12b located between the first intermediate region 12a and the third intermediate region 12c, and the first intermediate region 12a, the second intermediate region 12b, and the third intermediate region 12c have different surface shapes of the low tack region t. Similarly, each of the back intermediate regions 22 is divided into three regions: a first intermediate region 22a located near the back center region 21; a third intermediate region 22c located near the side region 23; and a second intermediate region 22b located between the first intermediate region 22a and the third intermediate region 22c, and the first intermediate region 22a, the second intermediate region 22b, and the third intermediate region 22c have different surface shapes of the low tack region t.

[0041] Then, the surface shape of the double raschel knit fabric 40 used in the shirt 100 according to this embodiment will be described. FIG. 10 shows plan views each showing an example of a knitted fabric having ridge-shaped projections on one side, and FIGS. 10(a) through 10(d) show four types of the surface shapes. These knitted fabrics 40 can use ridge-shaped double raschel knit fabrics in each of which the ridge-shaped projections 4 shaped by coupling the back-side fabric to contact with the skin and the base fabric to each other and the recesses 5 composed of the base fabric are alternately arranged. In FIGS. 10(a) through 10(d), the ridge-shaped projections 4 are hatched for discrimination from the recesses 5.

[0042] The ridge-shaped projections 4 and the recesses 5 of the double raschel knit fabric 40 shown in FIG. 10(a) have a substantially straight stripe pattern. The ridge-shaped projections 4 of the double raschel knit fabric 40 shown in FIG. 10(b) have a wave pattern, and adjacent ones of the ridge-shaped projections 4 are line symmetric with respect to the top-bottom directions of the section body 10. A width of the ridge-shaped projections 4 in FIG. 10(b) is larger than that of the ridge-shaped projections 4 in FIG. 10(a). Adjacent ones of the ridge-shaped projections 4 are in contact with each other in portions where the ridge-shaped projections 4 are close to each other. The ridge-shaped projections 4 of the double raschel knit fabric 40 shown in FIG. 10(c) have a wave pattern similar to FIG. 10(b). The interval between adjacent ones of the ridge-shaped projections 4 in FIG. 10(c) is larger than that in FIG. 10(b), and a wave span in FIG. 10(c) is wider than that in FIG. 10(b). A width of the ridge-shaped projections 4 in FIG. 10(c) is larger than that of the ridge-shaped projections 4 in FIG. 10(b). The ridge-shaped projections 4 of the double raschel knit fabric 40 shown in FIG. 10(d) have a wave pattern similar to those in FIGS. 10(b) and 10(c). The interval between the adjacent ridge-shaped projections 4 in FIG. 10(d) is larger than that in FIG. 10(c), and a wave span in FIG. 10(d) is wider than that in FIG. 10(c). A width of the ridge-shaped projections 4 in FIG. 10(d) is larger than that of ridge-shaped projections 4 in FIG. 10(c).

[0043] In the knitted fabrics of FIGS. 10(a) through 10(d), the knitted fabric shown in FIG. 10(a) is used in the low tack region t disposed in a region with a largest perspiration amount, and the knitted fabrics of FIGS. 10(b) through 10(d) whose wave patterns gradually become larger in this order are sequentially used as the perspiration amount decreases. With this configuration, the low tack regions t are disposed in accordance with the perspiration amount of the human body so that reduction of adherence to the skin by the ridge-shaped projections 4 and permeability by the base fabric 3 can be obtained in accordance with the perspiration amount.

[0044] FIG. 11 shows a relationship between the ridge-shaped projections 4 and the base fabric 3 when the knit fabric 40 is taken along the top-bottom directions. As illustrated in FIG. 11, the surface of the ridge-shaped projections 4 on the side of the body have different heights such that the surface of the ridge-shaped projections 4 becomes wavelike in the top-bottom direction with respect to the body of the wearer in an upright posture. That is, a gap is provided between the ridge-shaped projections 4 and the base fabric 3. In this manner, the knit fabric 40 in which the ridge-shaped projections 4 have different heights so as to from wavelike surface in the top-bottom direction with respect to the body of the wearer may be used. For example, the knit fabric 40 shown in FIG. 10(d) may have the ridge-shaped projections 4 as illustrated in FIG. 11. The use of such a knit fabric 40 for the sides of the human body enhances air permeability. This can promote ventilation inside the shirt 100.

[0045] In FIG. 10, the ridge-shaped projections 4 are continuous in the longitudinal direction thereof, but may not be continuous and the ridge-shaped projections 4 may have small slits in a relatively small area ratio. That is, the ridge may have slits as long as the ridge does not have a spotted uneven pattern and has a substantially ridge shape.

[0046] The orientation of the ridge herein is an orientation of the ridge in the longitudinal directions, and is the top-bottom directions in the drawing sheet in the case of FIG. 10(a). Even in the case where the ridge-shaped projections have a wave pattern, as in FIGS. 10(b) through 10(d), the orientation of the ridge refers to the longitudinal directions when seen from a macroscopic overall point of view, and thus, the orientation of the ridge is also the top-bottom directions in the drawing sheet in this case.

[0047] The top-bottom directions of the section body 10 herein include the lengthwise directions (perpendicular direction of the shirt and also includes a case where the directions tilt within an angle range of ±45 degrees from the lengthwise directions of the shirt. However, the angle of the top-bottom directions to the direction along the perpendicular directions of the shirt is preferably as small as possible.

[0048] Each region of the shirt 100 according to the variation illustrated in FIGS. 8 and 9 uses the knit fabric 40 having the surface shape shown in one of FIGS. 10(a) through 10(d). The section body 10 on the front section side shown in FIG. 8 is constituted by the front center region 11, the first intermediate regions 12a, the second intermediate regions 12b, the third intermediate regions 12c, and the side regions 13. The perspiration amount is large in the front center region 11 and the first intermediate regions 12a, and thus, the low tack region t with the surface shape of FIG. 10(a) is disposed in these regions. The perspiration amount in the second intermediate regions 12b is smaller than that in the front center region 11, and thus, the low tack region t with the surface shape of FIG. 10(b) is disposed in the second intermediate regions 12b. The perspiration amount in the third intermediate regions 12c adjacent to the side regions 13 is smaller than that in the first intermediate regions 12a, and thus, the low tack region t of FIG. 10(c) is disposed in the third intermediate regions 12c. Since the side regions 13 do not frequently contact the skin, the low tack region t with the surface shape of FIG. 10(d) having a maximum permeability is disposed.

[0049] Similarly, the section body 10 on the back section side shown in FIG. 9 is constituted by the back center region 21, the first intermediate regions 22a, the second intermediate regions 22b, the third intermediate regions 22c, and the side regions 23. In this variation, the perspiration amount is large in the back center region 21, and thus, the low tack region t with the surface shape of FIG. 10(a) is disposed in the back center region 21. The perspiration amount in the first intermediate regions 22a is smaller than that in the back center region 21, and thus, the low tack region t with the surface shape of FIG. 10(b) is disposed in the first intermediate regions 22a. The perspiration amount in the second intermediate regions 22b is smaller than that in the first intermediate regions 22a, and thus, the low tack region t with the surface shape of FIG. 10(c) is disposed in the second intermediate regions 22b. Although the perspiration amount in the third intermediate regions 22c adjacent to the side regions 23 is smaller than that in the second intermediate regions 22b, in this variation, the low tack region t of FIG. 10(c) is disposed in the third intermediate regions 22c. Since the side regions 23 do not frequently contact the skin, the low tack region t with the surface shape of FIG. 10(d) having a maximum permeability is disposed.

[0050] In this manner, the low tack regions t having different surface shapes are disposed in accordance with the perspiration distribution of the human body so that reduction of adherence of the fabric when sweating and high permeability can be thereby obtained.

[0051] In addition, the regions are configured with different knitted fabrics arranged side by side so that distortion and shrinkage of the knitted fabrics thereby tend to occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents and promote ventilation in the shirt 100 so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0052] Next, the present teaching will be further described based on specific examples.

[0053] In general, a fabric has unevenness on the surface thereof, and thus, in contact between the fabric and skin, projections on the fabric surface are mainly in contact with skin. As illustrated in FIG. 12, the fabric is modeled as a complex of the base fabric 3 and the ridge-shaped projections 4. Consider a case where the fabric and skin are repeatedly separated with motion of a wearer while the contact interface is filled with water 50 by sweating or the like.

[0054] In this case, as illustrated in FIGS. 12 and 13, a certain amount of air 51 is supplied to the contact interface, and water is supposed to be locally present in a columnar shape near the contact portion of the ridge-shaped projections 4 and the skin 10s. A meniscus occurring in a portion where the skin 10s, the water 50, and the air 51 contact causes a water pressure to be negative. Consequently, adherence is generated between the fabric and the skin. The phenomenon that the water pressure becomes negative is a state where water is trying to swallow everything in contact with the water. Accordingly, the fabric and the skin that are in contact with intervention of water are attracted to each other. This suggests that minimization of a projected area (cross-sectional area) of a region surrounded by the frame a in FIG. 12 (see FIG. 13) leads to minimization of adherence. Thus, this is inferred that when the total number of ridge-shaped projections 4 in contact with the skin 10s and the total cross-sectional area are minimized, the cross-sectional area of the columnar water 50 is minimized.

[0055] In view of this, the inventors of the present teaching focused on a total cross-sectional area of projections of the fabric in contact with skin as a design parameter of a low tackiness fabric. Here, an area ratio of projections occupying a fabric projected area is defined as an asperity area ratio. A sample shown in the bird's-eye view of FIG. 14 was prepared to measure an asperity area ratio.

[0056] As the sample shown in FIG. 14, a knitted fabric including ridge-shaped projections in which warp knitting was double raschel jacquard and braid knitting was a rib structure was formed using a material of 100% polyester yarn with a fineness: 56T/36F, 33T/12F with a double raschel machine with piezo jacquard technology.

[0057] As shown in the bird's-eye view of FIG. 14, in the double raschel knit fabric, the base fabric includes ridge-shaped projections. As shown in FIG. 14, a fabric surface of 10 mm square was measured with a three-dimensional shape measuring machine, and a height distribution (frequency distribution, histogram) was derived. The three-dimensional shape measuring machine herein was VR3000 manufactured by KEYENCE CORPORATION. The sample of FIG. 14 was measured, thereby obtaining FIGS. 15(a) and 15(b). White regions in FIG. 15(a) are recesses, and a total area of the recesses is a left side of the histogram in FIG. 15(c). White regions in FIG. 15(b) are projections, and a total area of the projections corresponds to a right side of the histogram in FIG. 15(c).

[0058] Thereafter, samples shown in the bird's-eye views of FIGS. 16 through 29 were formed by using the same material with the same machine as those of the sample shown in the bird's-eye view of FIG. 14. Comparative Example 1 is a mesh structure. In Comparative Example 2 and Examples 1 through 12, braid knitting is a rib structure.

[0059] Five different fabrics shown in Table 1 were measured as fabric samples. In many fabric samples, peaks individually corresponding to projections and the base surface (recesses) were observed. Here, an area ratio of a region (projection region supposed to contact skin) higher than a median of peaks corresponding to projections is defined as an asperity area ratio.

[0060] A sensory test was conducted on tackiness (adherence) to the five fabric samples prepared in the manner as described above.

[0061] Subjects were six healthy adults aged to 30 to 60 years, four males and two females, and a process of placing each fabric sample on the skins of the subjects and detaching the fabric sample was performed, and at each time, the stickiness was sensuously evaluated in five stages of 1 to 5. As the number increases, tackiness decreases, that is, stickiness decreases.

[0062] A sensory test was conducted with a device shown in a schematic view of FIG. 30. A fabric sample cut into 100 mm × 30 mm was placed on the inner side of the left upper arm of each subject, and as shown in FIG. 30, a fabric sample 100S was connected to a weight 104 of 100 g using a clip 101, nylon yarn (No. 0.1) 102, and pulleys 103. Then, the fabric sample was detached from the skin by a free fall of the weight 104. The tackiness at this time was evaluated by the subjects on a 5-point scale (minimum tackiness: 5 points, maximum tackiness: 1 point).

[0063] Each fabric sample 100S was allowed to stand in ion-exchanged water for 10 seconds or more immediately before the sensory test, and then was placed on the inner side of the left upper arm of each subject.

[Table 1]

	Asperity area ratio, %	Tackiness sensory value Minimum tackiness : 5 point Maximum tackiness: 1 point
Comparative Example 1	50.0	1.50
Comparative Example 2	25.3	2.00

(continued)

	Asperity area ratio, %	Tackiness sensory value Minimum tackiness : 5 point Maximum tackiness: 1 point
Example 1	12.9	4.67
Example 2	14.9	4.17
Example 3	22.3	3.33

[0064] Table 1 and FIG. 31 show an asperity area ratio of each fabric sample and sensory test results.

[0065] Table 1 and FIG. 31 confirm that as the asperity area ratio increases, the sensory value decreases. Based on a 2-sample t-test, Comparative Example 1 and Comparative Example 2 do not show a significant difference. On the other hand, it is determined that Comparative Example 2 and Example 3 show a significant difference. That is, it is suggested that tackiness decreases by setting the asperity area ratio less than 25.3%. Accordingly, a low tackiness fabric suitably has an asperity area ratio of 25% or less, preferably 15% or less, in a knitted fabric having ridge-shaped projections.

[0066] Then, a result of consideration on the surface shape of a fabric and a moisture content will be described. Fabric samples were planed using the materials and the knitting machine described above based on Comparative Examples 1 and 2 and Examples 1 through 12 shown in the bird's-eye views of FIGS. 16 through 29.

[0067] For each fabric sample shown in Table 2, a surface shape of 10-mm square was measured with a three-dimensional shape measuring machine of VR3000 manufactured by KEYENCE CORPORATION, and as a parameter of a surface roughness, a root mean square height S_q was calculated.

[0068] From a mass change before and after each fabric sample (25 mm × 60 mm) was immersed in ion-exchanged water for 10 seconds, a water retention per a unit area was calculated.

[Table 2]

	Root mean square height Sq, μm	Water retention, μg/mm^2
Comparative Example 1	56.64	668.67
Comparative Example 2	99.32	66.40
Example 1	276.68	1.60
Example 2	287.26	6.13
Example 3	261.42	3.87
Example 4	373.97	2.93
Example 5	276.38	3.93
Example 6	279.14	2.53
Example 7	310.76	1.20
Example 8	315.19	4.80
Example 9	357.95	4.80
Example 10	357.78	4.13
Example 11	359.73	3.00
Example 12	236.46	3.07

[0069] FIG. 32 and Table 2 show a relationship between the root mean square height S_q and the water retention. As the root mean square height S_q increased, the water retention decreased. From the viewpoint of achieving weight reduction of the shirt when sweating, it is determined to be preferable that the root mean square height S_q is 100 μm or more and 1000 μm or less, preferably 200 μm or more and 1000 μm or less.

[0070] Next, the position of the low tack region with respect to the section body 10 will be further described. From the human body thermomapping shown in FIG. 5 and the human body perspiration rate distribution diagram shown in FIG. 6, it is supposed that thermal stress is highest in a front center upper portion and a back center portion of the human body. A textile with an asperity area ratio of 15% or less is preferably disposed in this region. In addition, in a region between these regions and the sides of the human body, slight adherence between skin and the textile is expected, and thus, a textile with an asperity area ratio of 25% or less is preferably disposed. In the side portions of the human body, the skin and the textile do not contact each other frequently, and thus, arrangement of the textile is not limited to this example.

[0071] Specific examples of the present teaching will now be described. FIG. 33 is a plan view of a shirt according to Specific Example 1 of the present teaching when seen from a front section side. FIG. 34 is a plan view of the shirt according to Specific Example 1 of the present teaching when seen from a back section side.

[0072] In FIGS. 33 and 34, different low tack regions t are disposed in a levee pattern in the front section 1 and the back section 2.

[0073] As illustrated in FIG. 33, the front section 1 includes the front center region 11, the side regions 13, and the front intermediate regions 12 between the front center region 11 and the side regions 13. Each of the front intermediate regions 12 is divided into three regions: the first intermediate region 12a located near the front center region 11; the third intermediate region 12c located near the side region 13; and the second intermediate region 12b located between the first intermediate region 12a and the third intermediate region 12c. Each of the side regions 13 is divided into two regions: a first side region 13a adjacent to the third intermediate region 12c; and the second side region 13b adjacent to the first side region 13a.

[0074] Specific Example 1 uses a double raschel knit fabric constituting low tack regions t with four patterns of surface shapes: the surface shape of Example 1 (see FIG. 18) used as the fabric sample described above; the surface shape of Example 3 (see FIG. 20); the surface shape of Example 7 (see FIG. 24); and the surface shape of Example 10 (see FIG. 27). In FIGS. 33 and 34, Example 1 is indicated as hollow areas, Example 3 is indicated by hatching, Example 7 is indicated by cross hatching, and Example 10 is indicated by hatching with broken lines.

[0075] The low tack regions t are arranged in the following manner. The perspiration amount is large in the front center region 11, the first intermediate regions 12a, and the second intermediate regions 12b. The front section 1 takes into consideration adherence of the fabric to the body. Therefore, the same fabric is used in the front center region 11 and the second intermediate regions 12b, and a different fabric is used in the first intermediate regions 12a. Accordingly, the low tack region t with the surface shape of Example 1 is disposed in the front center region 11 and the second intermediate regions 12b a. The low tack region t with the surface shape of Example 7 which has a small water retention is disposed in the first intermediate regions 12a. The perspiration amount in the third intermediate regions 12c adjacent to the side regions 13 is smaller than that in the front center region 11, and thus, the low tack region t of the surface shape Example 3 is disposed in the third intermediate regions 12c. Since the second side regions 13b do not frequently contact the skin, the low tack region t with the surface shape of Example 10 having a maximum permeability is disposed in the second side regions 13b. In the first side regions 13a, the low tack region t with the surface shape of Example 7 is disposed.

[0076] As illustrated in FIG. 34, the back section 2 is constituted by the back center region 21, the side regions 23, and the back intermediate regions 22 between the back center region 21 and the side regions 23. Each of the back intermediate regions 22 is divided into three regions: the first intermediate region 22a located near the back center region 21; the third intermediate region 22c located near the side region 23; and the second intermediate region 22b located between the first intermediate region 22a and the third intermediate region 22c. Each of the side regions 23 is divided into two regions: the first side region 23a adjacent to the third intermediate region 22c; and the second side region 23b adjacent to the first side region 23a.

[0077] The low tack regions t are arranged in the following manner. The perspiration amount is large in the back center region 21, and thus, the low tack region t with the surface shape of Example 1 is disposed in the back center region 21. The perspiration amount in the second intermediate regions 22b is smaller than that in the back center region 21, and thus, the low tack region t with the surface shape of Example 3 is disposed in the second intermediate regions 22b. Considering adherence of the fabric to the body, the low tack region t with the surface shape of Example 7 is disposed in the first intermediate region 22a and the third intermediate regions 22c. Since the first side regions 23a do not frequently contact the skin, the low tack region t with the surface shape of Example 10 having a maximum permeability is disposed in the first side regions 23a. In the second side regions 23b, the low tack region t with the surface shape of Example 3 is disposed.

[0078] In this manner, the low tack regions t having different surface shapes are disposed in accordance with the perspiration distribution of the human body so that reduction of adherence of the fabric when sweating and high permeability can be thereby obtained.

[0079] In addition, the regions are configured with different knitted fabrics arranged side by side so that distortion and shrinkage of the knitted fabrics thereby tend to occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents and promote ventilation in the shirt 100 so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0080] Wearing evaluation was conducted using Specific Example 1 of the present teaching. The wearing evaluation will be described later.

[0081] FIG. 35 is a plan view of a shirt according to Specific Example 2 of the present teaching when seen from a front section side. FIG. 36 is a plan view of the shirt according to Specific Example 2 of the present teaching when seen from a back section side.

[0082] FIGS. 35 and 36 show mesh-like layouts in which low tack regions t with different diamond shapes are arranged in the front section 1 and the back section 2 in the top-bottom direction and in the left-right directions. In FIGS. 35 and 36, Example 1 is indicated as hollow areas, Example 3 is indicated by hatching, Example 7 is indicated by cross hatching, and Example 10 is indicated by hatching with broken lines.

[0083] The front section 1 of the section body 10 includes the front center region 11, the side regions 13 covering side portions of the wearer, and the front intermediate regions 12 between the front center region 11 and the side regions 13.

[0084] In Specific Example 2, in the front center region 11, a plurality of low tack regions t each with the surface shape of Example 1 having a diamond shape in plan view are arranged, and low tack regions t each with the surface shape of Example 7 having a diamond shape in plan view are arranged to be adjacent to the low tack regions t of Example 1. In the front center region 11, the low tack regions t of Example 1 are occupying the largest total area .

[0085] In each of the front intermediate regions 12, a plurality of low tack regions t each with the surface shape of Example 1 having a diamond shape in plan view are arranged, and low tack regions t each with the surface shape of Example 7 having a diamond shape in plan view are arranged to be adjacent to the low tack regions t of Example 1. In addition, in the front intermediate regions 12 adjacent to the front side regions 13, the low tack regions t each with the surface shape of Example 3 having a diamond shape in plan view and low tack regions t each with the surface shape of Example 7 having a diamond shape in plan view are arranged.

[0086] In the side regions 13, the low tack regions t each with the surface shape of Example 3 having a diamond shape in plan view and low tack regions t each with the surface shape of Example 10 having a diamond shape in plan view are arranged.

[0087] The back section 2 of the section body 10 includes the back center region 21, the side regions 23 covering side portions of the wearer and the back intermediate regions 22 between the back center region 21 and the side regions 23.

[0088] In Specific Example 2, in the back center region 21, a plurality of low tack regions t each with the surface shape of Example 1 having a diamond shape in plan view are arranged, and low tack regions t each with the surface shape of Example 3 having a diamond shape in plan view are arranged to be adjacent to the low tack regions t of Example 1. In the back center region 21, regions occupying the largest total area are the low tack regions t of Example 1.

[0089] In the back intermediate regions 22, a plurality of low tack regions t each with the surface shape of Example 1 having a diamond shape in plan view are arranged, and low tack regions t each with the surface shape of Example 3 having a diamond shape in plan view are arranged to be adjacent to the low tack regions t of Example 1.

[0090] In this manner, the low tack regions t having different surface shapes are disposed in accordance with the perspiration distribution of the human body so that reduction of adherence of the fabric when sweating and high permeability can be thereby obtained.

[0091] In addition, the regions are configured with different knitted fabrics arranged side by side so that distortion and shrinkage of the knitted fabrics thereby tend to occur at the interface between the fabrics. Accordingly, a gap is formed between the body and the shirt 100 to serve as air vents and promote ventilation in the shirt 100 so that adherence of the fabric to the body due to sweating can be thereby reduced.

[0092] Next, results of wearing evaluation tests of Specific Examples 1 and 2 of the present teaching will be described.

[0093] The degree of shirt wetness and the degree of shirt adherence due to sweat were used as measurement parameters, and sensory evaluation was conducted on four test subjects. An experiment was conducted in such a manner that in a phytotron at a temperature of 25°C and a humidity of 50%, test subjects wearing the shirts according to specific examples and a comparative example ran on treadmills for 30 minutes and during the running, evaluation was conducted for the measurement parameters. During the running, air was supplied to the test subjects from the front thereof.

[0094] The shirt prepared as the comparative example was made entirely of a mesh material. The weight of each shirt in a dried state was 53.2 g in the comparative example, 46.1 g in Specific Example 1, and 45.8 g in Specific Example 2.

[0095] A subject A ran for 30 minutes at a running speed of 12.5 Km/hour. The wearing order was Specific Example 2, the comparative example, and Specific Example 1. A subject B ran for 30 minutes at a running speed of 14.3 Km/hour. The wearing order was the comparative example, Specific Example 1, and Specific Example 2. A subject C ran for 30 minutes at a running speed of 10.0 Km/hour. The wearing order was the comparative example, Specific Example 2, and Specific Example 1. A subject D ran for 30 minutes at a running speed of 14.0 Km/hour. The wearing order was Specific Example 2, Specific Example 1, and comparative example.

[0096] Among the measurement parameters, the wetness degree of the shirt was evaluated on a 4-point scale through a questionnaire format rated by the subjects with the following ratings: 4: Wet, 3: Damp, 2: Partially damp, and 1: Dry.

[0097] The degree of adherence of the shirt to the skin, which is another measurement parameter, was evaluated on a 4-point scale through a questionnaire format rated by the subjects with the following ratings: ×: Fully adhered, ▲:

Adhered in two or more places, ◦: Partially adhered or adhered and separated, and None: Wet but no adherence, or the shirt has started to get wet, or the shirt is not wet.

[0098] The evaluation sites were five locations of the chest, abdomen, left armpit, upper back, and lower back. The evaluation was conducted on these sites for 10 minutes later, 20 minutes later, and 30 minutes later.

[0099] Table 3 shows measurement results. In Table 3, the numbers "1" to "4" represent evaluation of the wetness degree of the shirt, while "×," "▲," and "◦" represent evaluation of the degree of adherence of the shirt to the skin. Sections representing none of "×," "A," and "◦," correspond to the aforementioned "None" in evaluation on the degree of adherence of the shirt to the skin.

[Table 3]

	Site	Chest			Abdomen			Left armpit			Upper back			Lower back		
Comparative Example	Elapsed time/min.	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30
	Subject A	1	3▲	4▲	1	3	4▲	1	3	4	1	3	4▲	1	3▲	4▲
	Subject B	1	2○	3▲	1	2	3▲	1	1	3	1	2○	3▲	1	2	3○
	Subject C	2	3○	4○	2	3	4	1	1	4	2	3○	4○	2	3○	4○
	Subject D	1	3▲	4▲	1	3	4	1	1	4	1	3○	4▲	1	3○	4▲
Specific Example 1	Elapsed time/min.	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30
	Subject A	2	3▲	4▲	2	3	4▲	2	3	4	2	3○	4▲	2	3○	4▲
	Subject B	1	2	3○	1	2	3○	1	2	3	1	2	3○	1	2	3○
	Subject C	1	2	4○	1	2	4○	1	2	4	1	2	4▲	1	2○	4○
	Subject D	1	2○	3▲	1	2	3▲	1	2	3	1	2	3▲	1	2	3
Specific Example 2	Elapsed time/min.	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30	0-10	10-20	20-30
	Subject A	1	3○	4▲	1	3	4	1	3	4	1	3○	4▲	1	3	4▲
	Subject B	1	2	3○	1	2	3	1	2	3	1	2	3○	1	2	3○
	Subject C	1	2	4○	1	2	4	1	2	4	1	2	4○	1	2	4○
	Subject D	1	2○	3▲	1	2	3▲	1	2	3	1	2	3▲	1	2	3

[0100] In Table 3, for an evaluation result on the chest area, which relatively frequently sweats, for example, after 10 minutes when sweating starts, the shirts of Specific Examples 1 and 2 tend to show higher results in the degree of adherence than the shirt of the comparative example. This is supposed to be because suitable placement of knitted fabrics constituting low tack regions in body sites where the perspiration amount during exercise is highest and a combination of different low tack regions caused sweat to no longer penetrate the shirt and flow and drip away easily and high perspiration inside the shirt was obtained.

[0101] The embodiment, the variation, and Specific Examples 1 and 2 described above have been applied to sleeveless running shirts, but the present teaching is not limited to these examples, and is also applicable to shirts with sleeves.

[0102] In the present teaching, a knitted fabric in which the fabric surface is subjected to water repellent finish may be used. The surface shape of a knitted fabric that does not contact the skin is not limited. In addition, in the present teaching, chemical compositions of the fabric (monomer types and ratios, polymer types and ratios, molecular weight, straight or branched chains, purity, moisture content, viscoelasticity, and wettability based on chemical composition), single fiber properties (cross-sectional shape, cross-sectional area, fiber length, straight/crimped, and surface roughness of the sides), spinning conditions (single fiber count, short fiber density, twist angle, and friction coefficient between short fibers), and fabric structure (type and ratio of yarns, yarn spatial distribution, fabric thickness, and fabric rigidity) are not limited.

[0103] In the present teaching, air vents penetrating the fabric may be provided. In the present teaching, a fabric dyed with a dye including a supercritical fluid dyeing may be used.

[0104] In addition, a low tack region may be provided in a garment to contact with a human skin, other than the shirt.

For example, a low tack region may be used for short pants, leggings, long pants, skorts, one-piece dresses, and other similar items.

[0105] Optional combinations of the aforementioned embodiment and variations may also be practiced as additional embodiments of the present teaching. Such an additional embodiment made by combination has the effect of each of the combined embodiment and modifications.

[0106] Features disclosed herein include the following:

(1) A shirt comprising a section body, the section body including a front section covering a front side of a wearer and a back section covering a back side of the wearer, wherein at least one of the front section or the back section includes a low tack region composed of a knitted fabric including ridge-shaped projections, and the low tack region is disposed such that the ridge-shaped projections are located on a side to contact skin of the wearer and extends in top-bottom directions of the section body.

(2) The shirt of (1), wherein the section body includes a front center region located in a center portion of the front section and extending in the top-bottom direction and a back center region located in a center portion of the back section and extending in the top-bottom direction, and the low tack region is located in each of an upper portion of the front center region and the back center region.

(3) The shirt of (1) or (2), wherein the knitted fabric is a ridge-shaped double raschel knit fabric in which ridge-shaped projections and recesses are alternately arranged, the ridge-shaped projections being shaped by coupling a back-side fabric to contact skin and a base fabric to each other, the recesses being composed of the base fabric, and the base fabric is a mesh fabric.

(4) The shirt of any one of (1) to (3), wherein in the low tack region, at least one of a width of the ridge-shaped projections or an interval between the ridge-shaped projections varies.

(5) The shirt of any one of (1) to (4), wherein the front section of the section body includes a side region covering a side portion of the wearer and a front intermediate region located between the front center region and the side region, and the shirt satisfies $x_1 < x_2 < x_3$, where x_1 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the front center region, x_2 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the front intermediate region, and x_3 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the side region.

(6) The shirt of any one of (1) to (5), wherein the back section of the section body includes a back intermediate region between the back center region and the side region, and the shirt satisfies $x_4 < x_5 < x_3$, where x_3 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the side region, x_4 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the back center region, and x_5 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the back intermediate region.

(7) The shirt of any one of (1) to (6), wherein the ridge-shaped projections have unevenness in the top-bottom direction with respect to the body of the wearer in an upright posture.

(8) The shirt of any one of (1) to (7), wherein the low tack region is composed of a double raschel knit fabric having an area ratio of the ridge-shaped projections of 1% or more and 25% or less and a root mean square height of 100 μm or more and 2000 μm or less.

(9) The shirt of (8), wherein the low tack region is disposed in an area of 50% or more of the front section and an area of 50% or more of the back section.

INDUSTRIAL APPLICABILITY

[0107] The present teaching is applicable to sport shirts such as running shirts.

Claims

1. A shirt comprising a section body, the section body including a front section covering a front side of a wearer and a back section covering a back side of the wearer, wherein

   at least one of the front section or the back section includes a low tack region composed of a knitted fabric including ridge-shaped projections, and
   the low tack region is disposed such that the ridge-shaped projections are located on a side to contact skin of the wearer and extends in top-bottom directions of the section body.

2. The shirt according to claim 1, wherein

the section body includes a front center region located in a center portion of the front section and extending in the top-bottom direction and a back center region located in a center portion of the back section and extending in the top-bottom direction, and
the low tack region is located in each of an upper portion of the front center region and the back center region.

3. The shirt according to claim 1 or 2, wherein

the knitted fabric is a ridge-shaped double raschel knit fabric in which ridge-shaped projections and recesses are alternately arranged, the ridge-shaped projections being shaped by coupling a back-side fabric to contact skin and a base fabric to each other, the recesses being composed of the base fabric, and
the base fabric is a mesh fabric.

4. The shirt according to any one of claims 1 to 3, wherein in the low tack region, at least one of a width of the ridge-shaped projections or an interval between the ridge-shaped projections varies.

5. The shirt according to any one of claims 1 to 4, wherein

the front section of the section body includes a side region covering a side portion of the wearer and a front intermediate region located between the front center region and the side region, and
the shirt satisfies $x_1 < x_2 < x_3$,

where x_1 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the front center region, x_2 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the front intermediate region, and x_3 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the side region.

6. The shirt according to any one of claims 1 to 5, wherein

the back section of the section body includes a back intermediate region between the back center region and the side region, and
the shirt satisfies $x_4 < x_5 < x_3$,

where x_3 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the side region, x_4 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the back center region, and x_5 is an interval between adjacent ones of the ridge-shaped projections in the low tack region in the back intermediate region.

7. The shirt according to any one of claims 1 to 6, wherein the ridge-shaped projections have unevenness in the top-bottom direction with respect to the body of the wearer in an upright posture.

8. The shirt according to any one of claims 1 to 7, wherein the low tack region is composed of a double raschel knit fabric having an area ratio of the ridge-shaped projections of 1% or more and 25% or less and a root mean square height of 100 μm or more and 2000 μm or less.

9. The shirt according to claim 8, wherein the low tack region is disposed in an area of 50% or more of the front section and an area of 50% or more of the back section.

FIG. 1

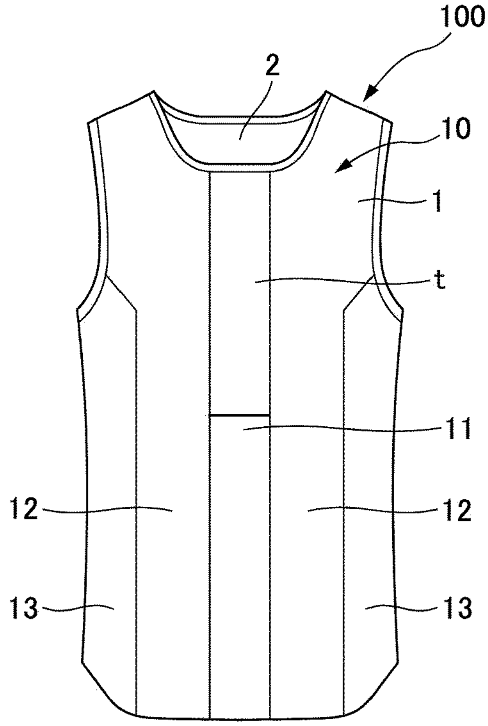


FIG. 2

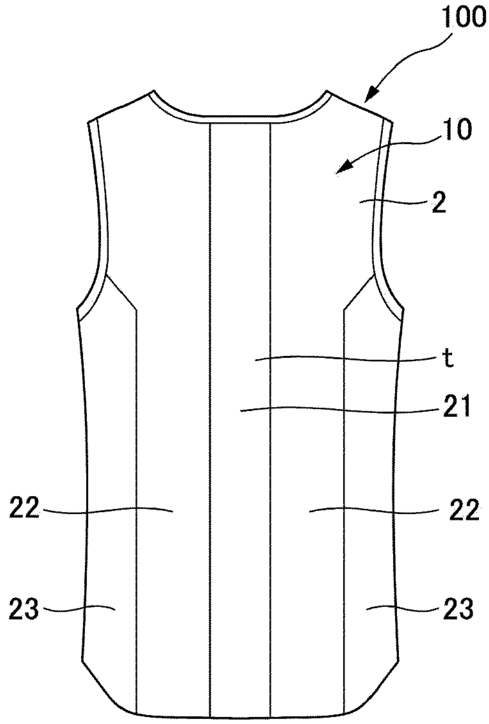
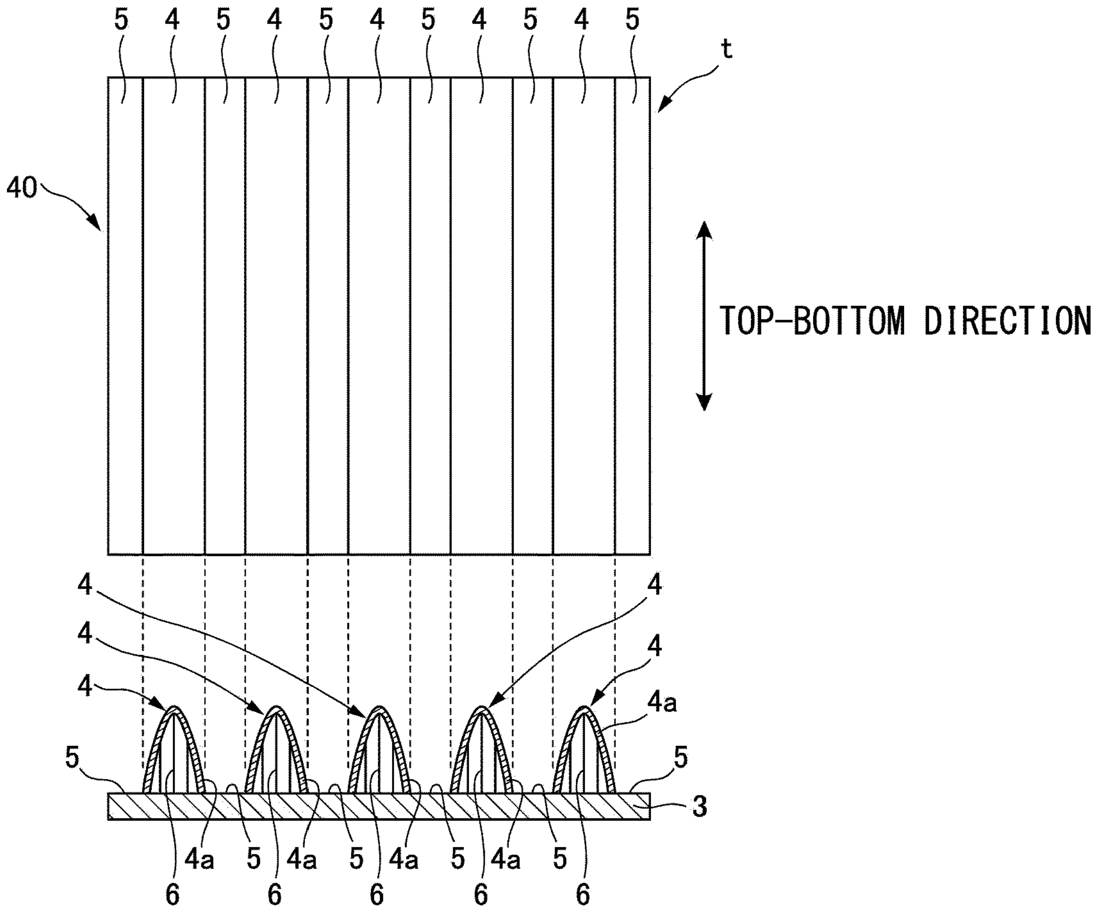


FIG. 3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TOP-BOTTOM DIRECTION
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4a
5
5
3
4a 5 4a 5 4a 5 4a 5
6 6 6 6 6

FIG. 4

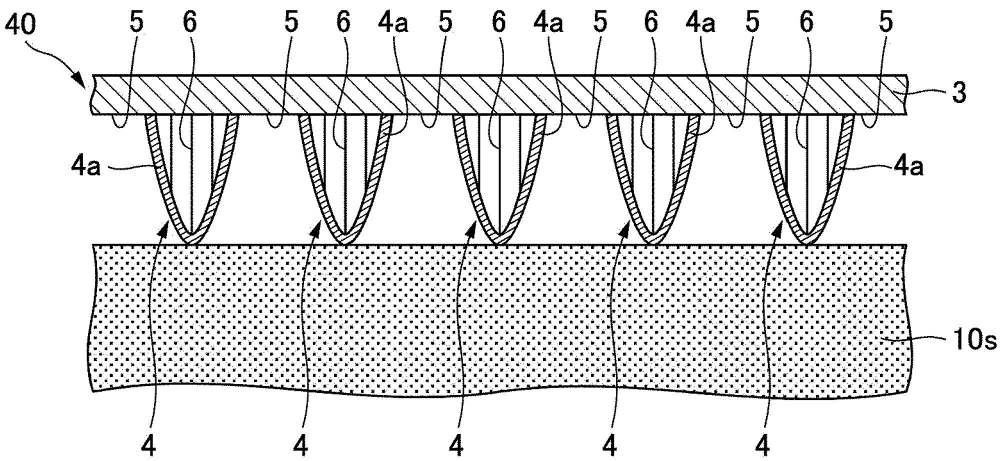

40
5 6 5 6 4a 5 6 4a 5 6 4a 5 6 5
3
4a
4a
10s
4 4 4 4 4

FIG. 5

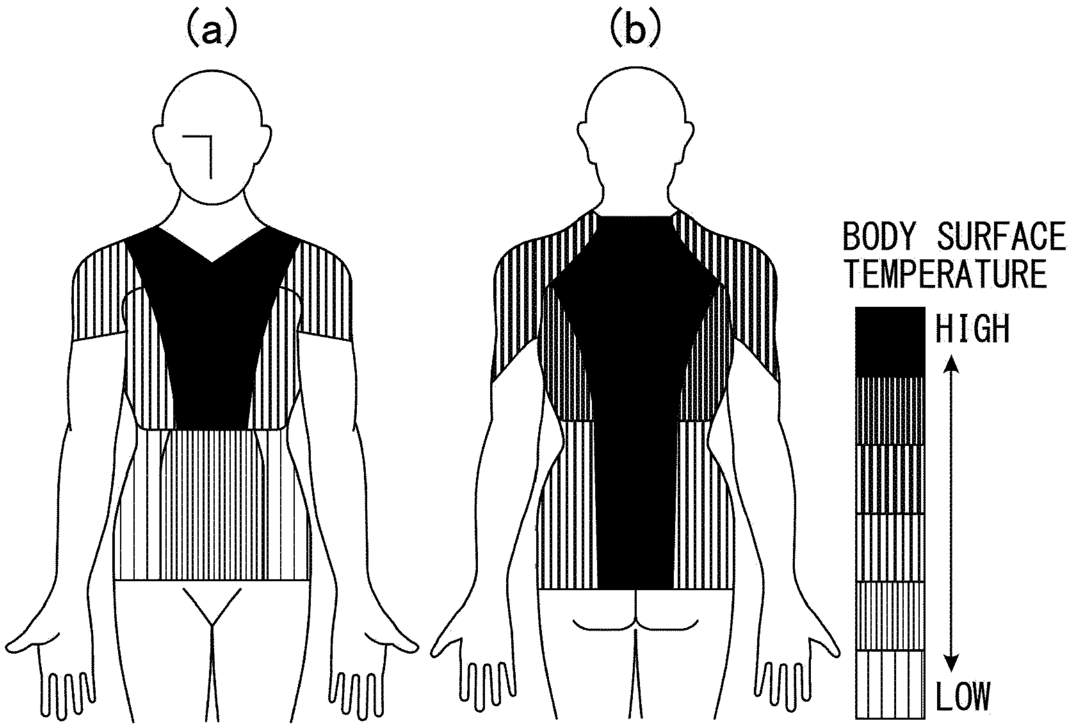


FIG. 6

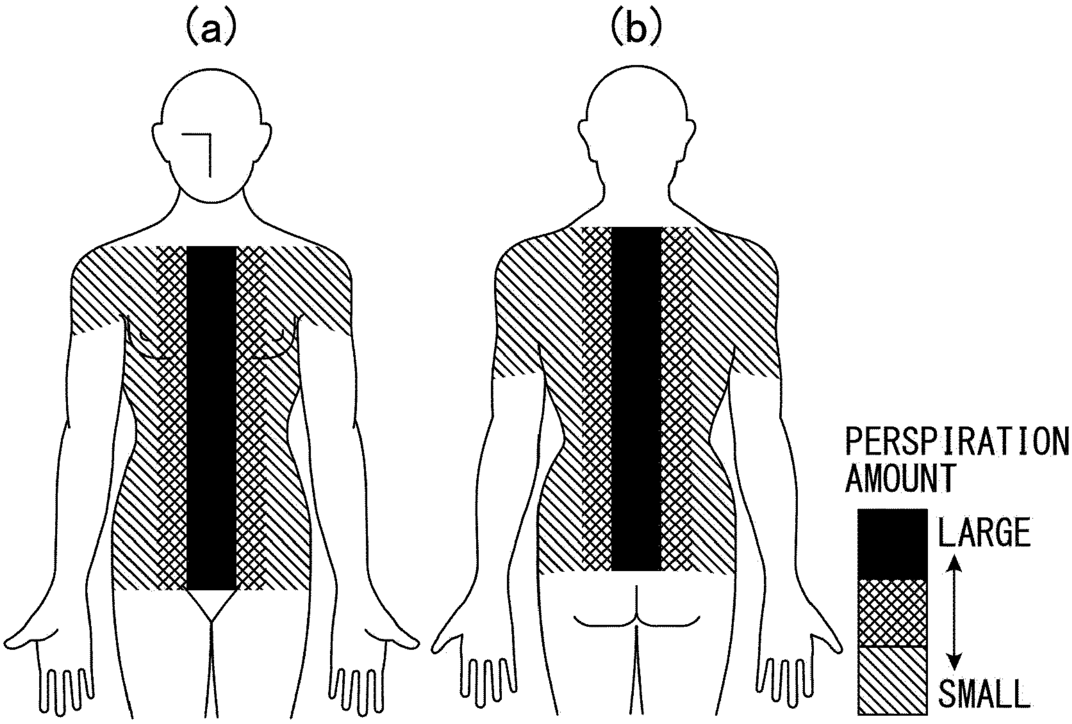


FIG. 7

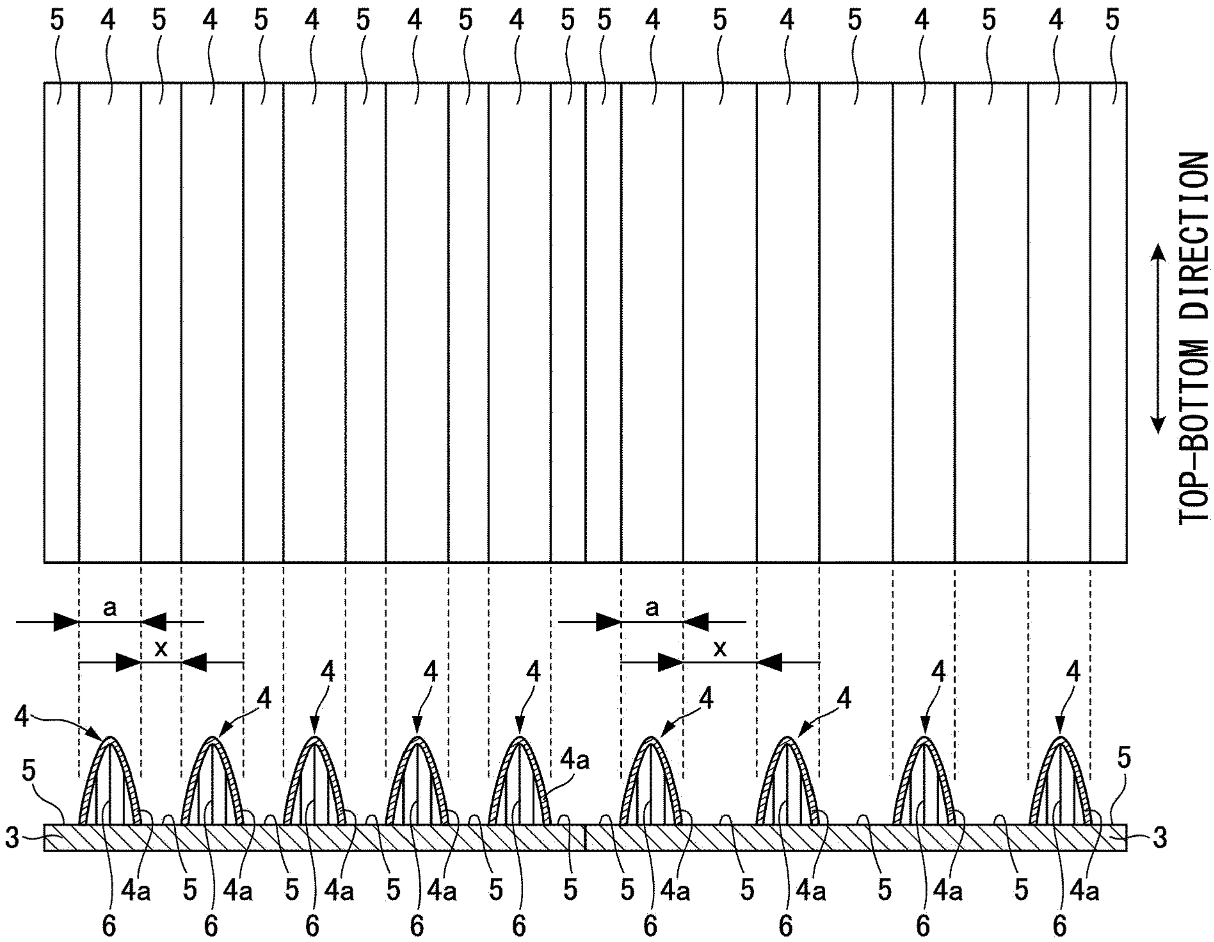


FIG. 8

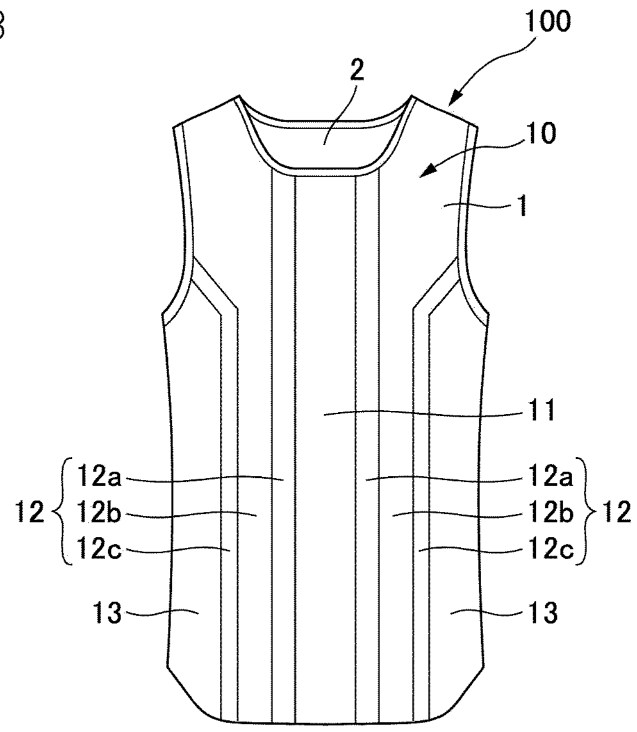

100
2
10
1
11
12a
12b
12c
12
13
12a
12b
12c
12
13

FIG. 9

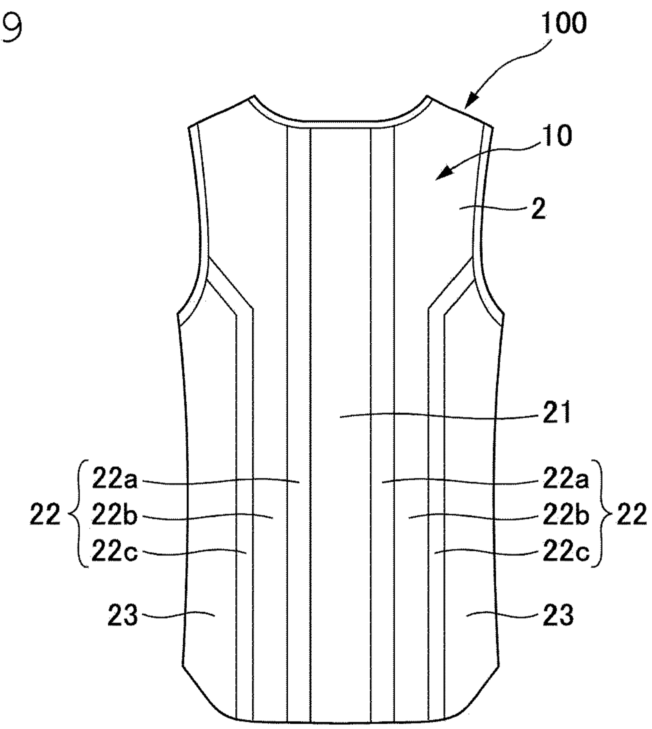
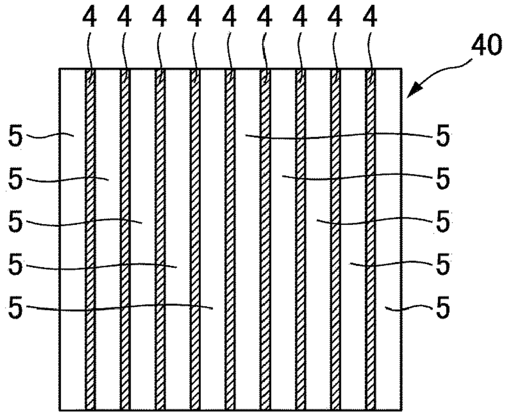
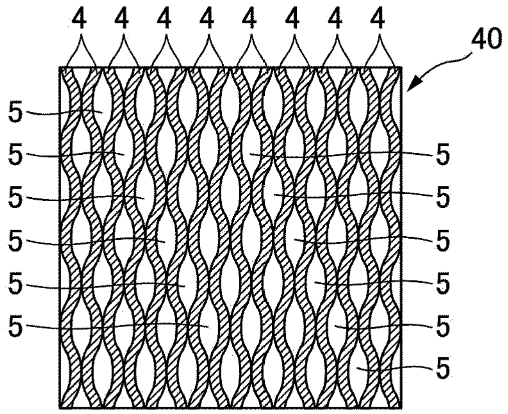

100
10
2
21
22a
22b
22c
22
23
22a
22b
22c
22
23

FIG. 10

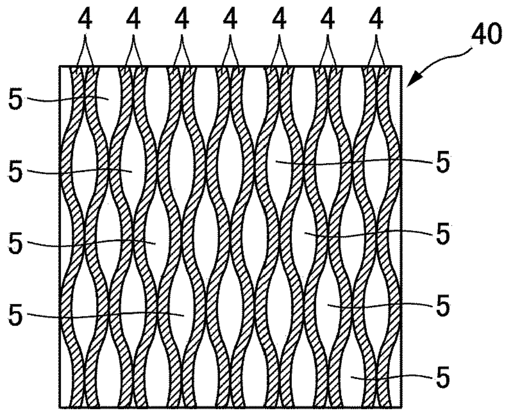
(a)


4 4 4 4 4 4 4 4 4
40
5
5
5
5
5
5
5
5
5
5

(b)


4 4 4 4 4 4 4 4
40
5
5
5
5
5
5
5
5
5
5
5
5
5

(c)


4 4 4 4 4 4 4
40
5
5
5
5
5
5
5
5
5

(d)

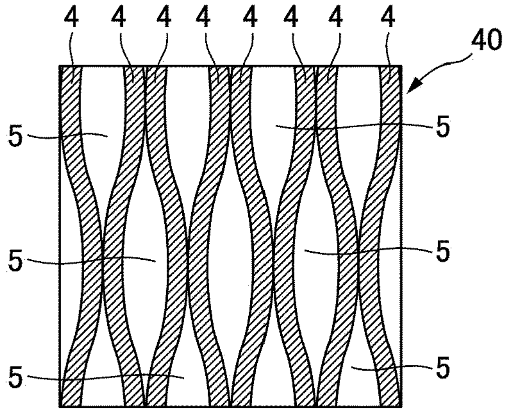

4 4 4 4 4 4 4 4
40
5
5
5
5
5
5

FIG.11

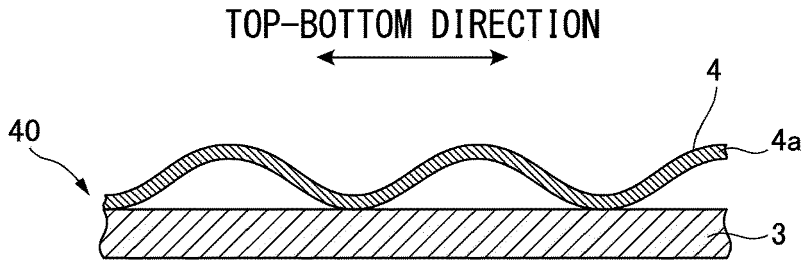


FIG.12

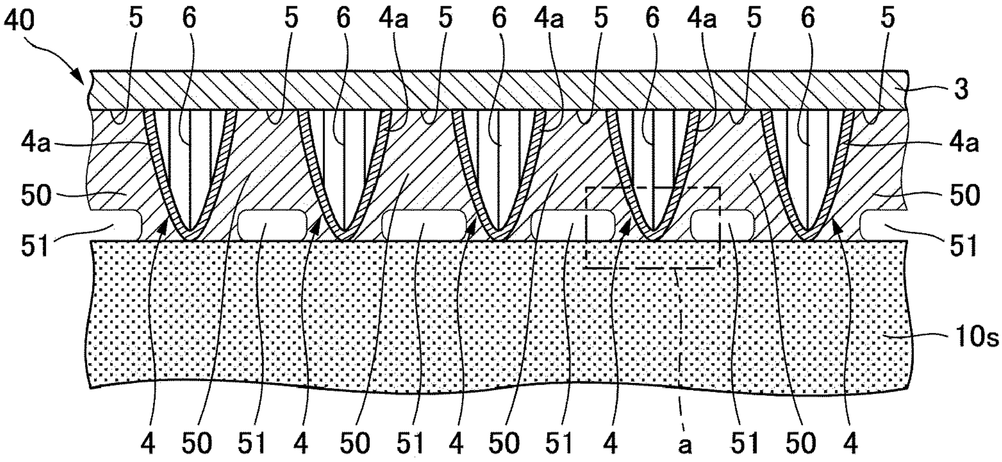


FIG.13

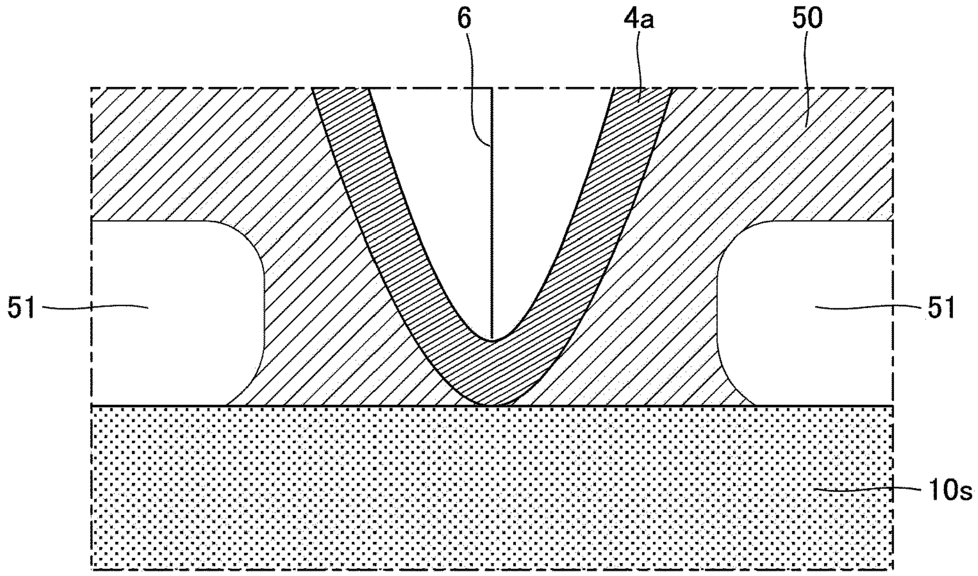


FIG.14

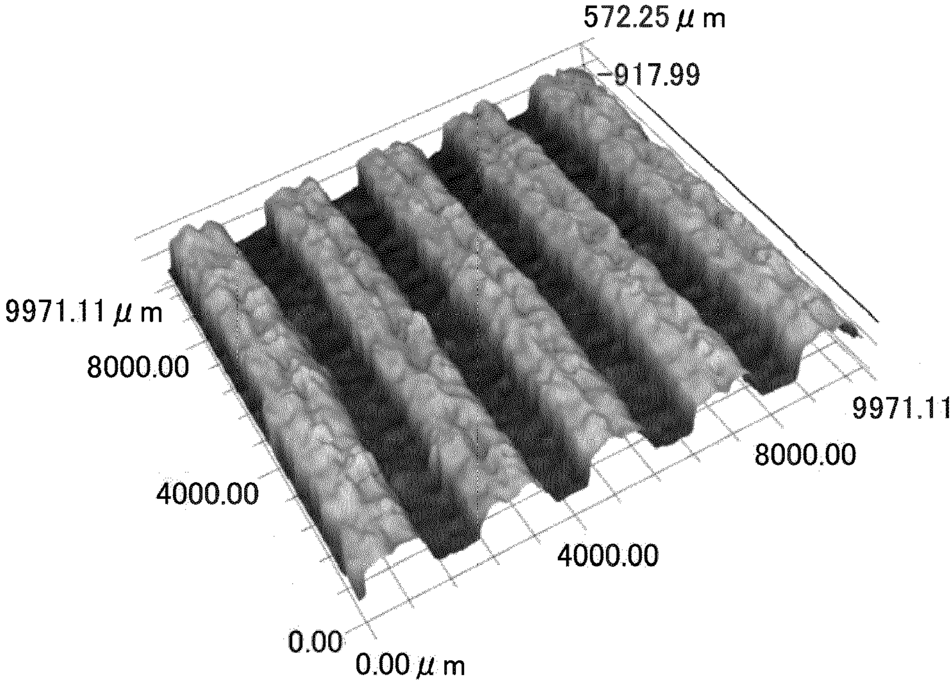

572.25 μm
-917.99
9971.11 μm
8000.00
4000.00
0.00
0.00 μm
4000.00
8000.00
9971.11

FIG.15

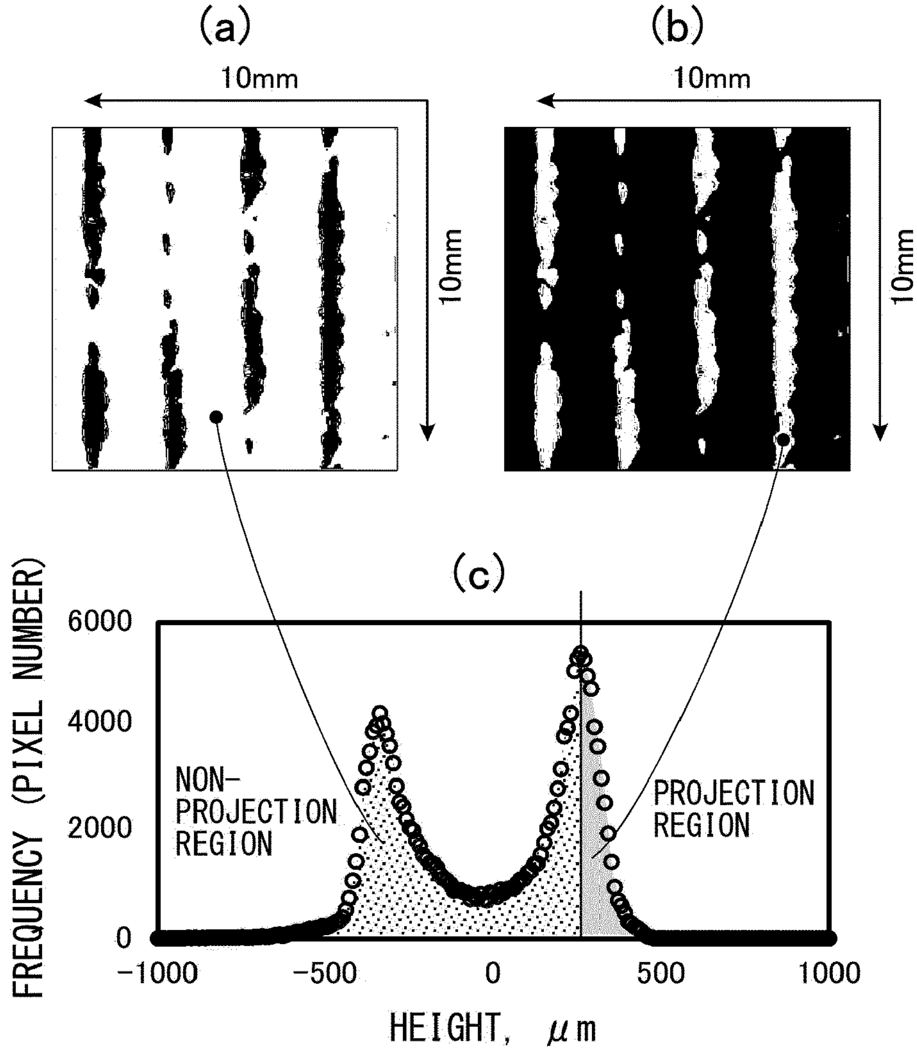
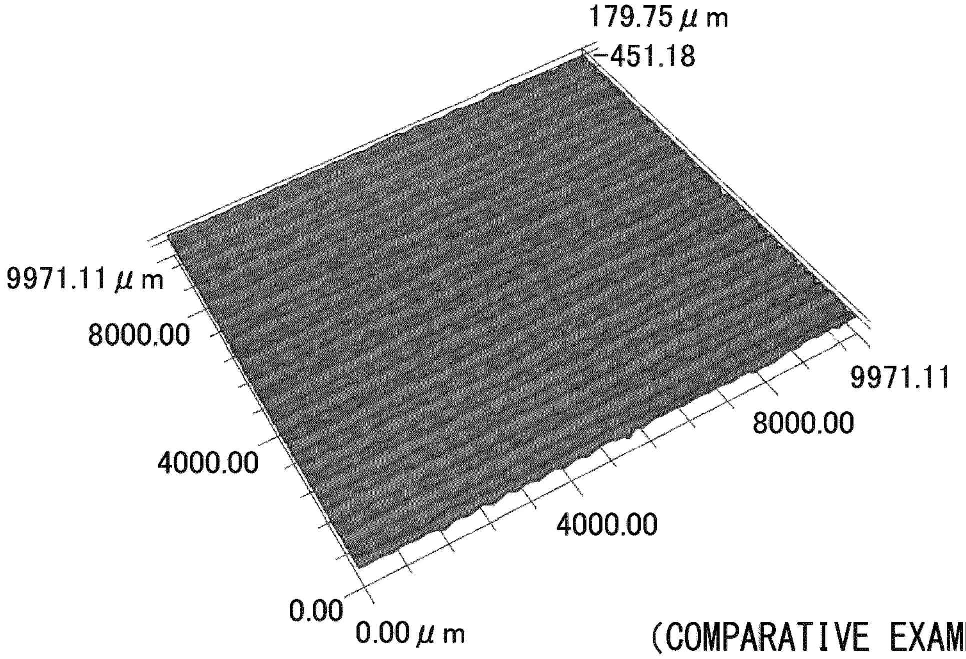
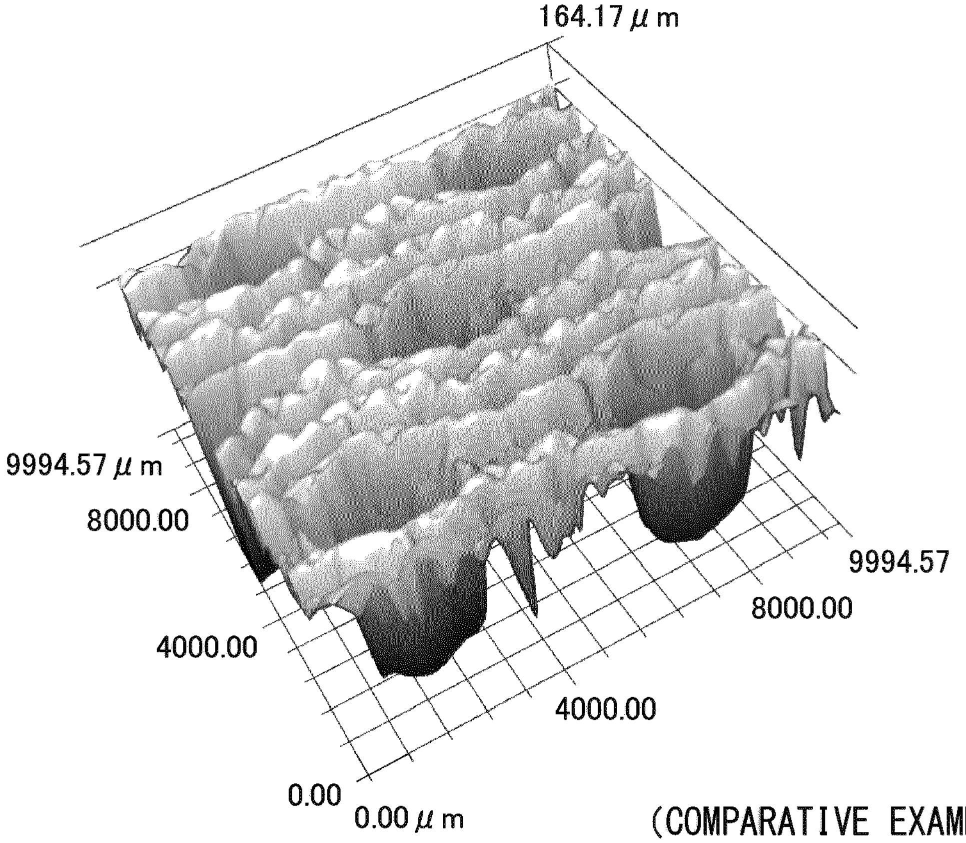

(a)
10mm
10mm
(b)
10mm
10mm
(c)
FREQUENCY (PIXEL NUMBER)
6000
4000
2000
0
NON-
PROJECTION
REGION
PROJECTION
REGION
-1000
-500
0
500
1000
HEIGHT, μm

FIG.16



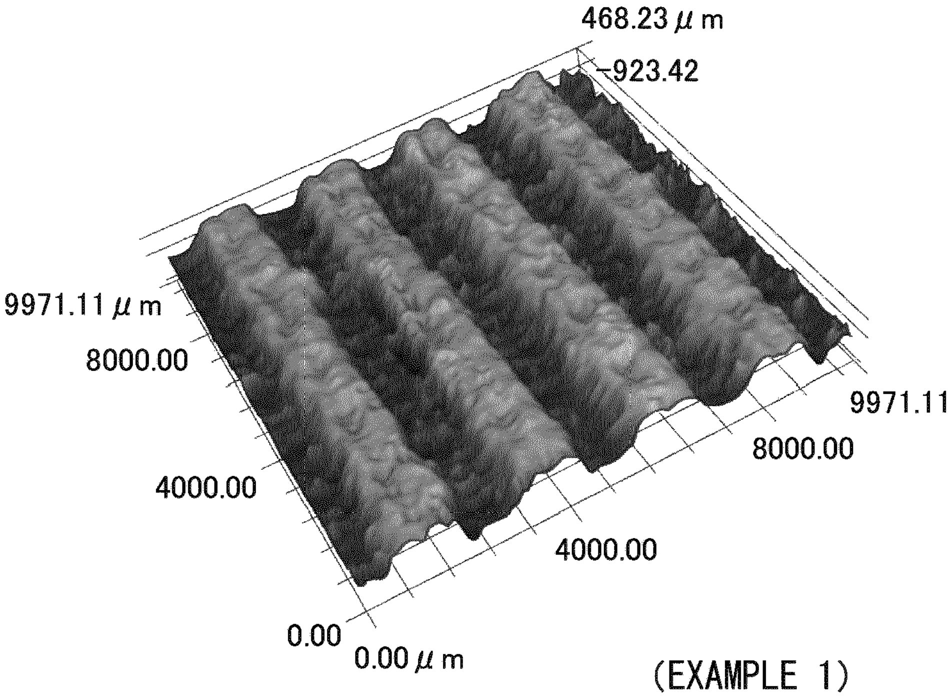
(COMPARATIVE EXAMPLE 1)

FIG.17



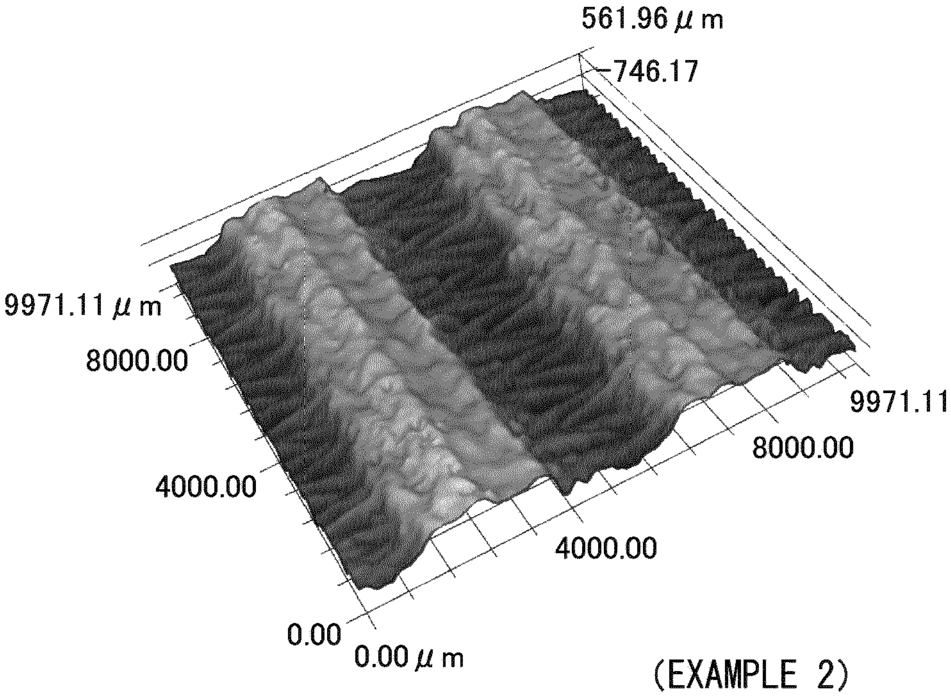
(COMPARATIVE EXAMPLE 2)

FIG.18



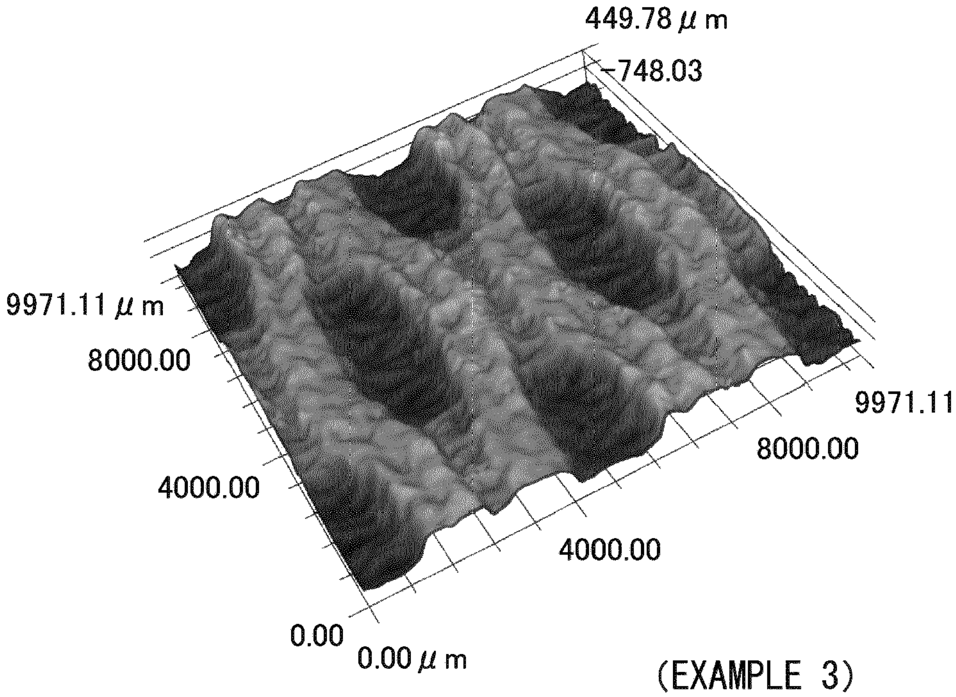
(EXAMPLE 1)

FIG.19



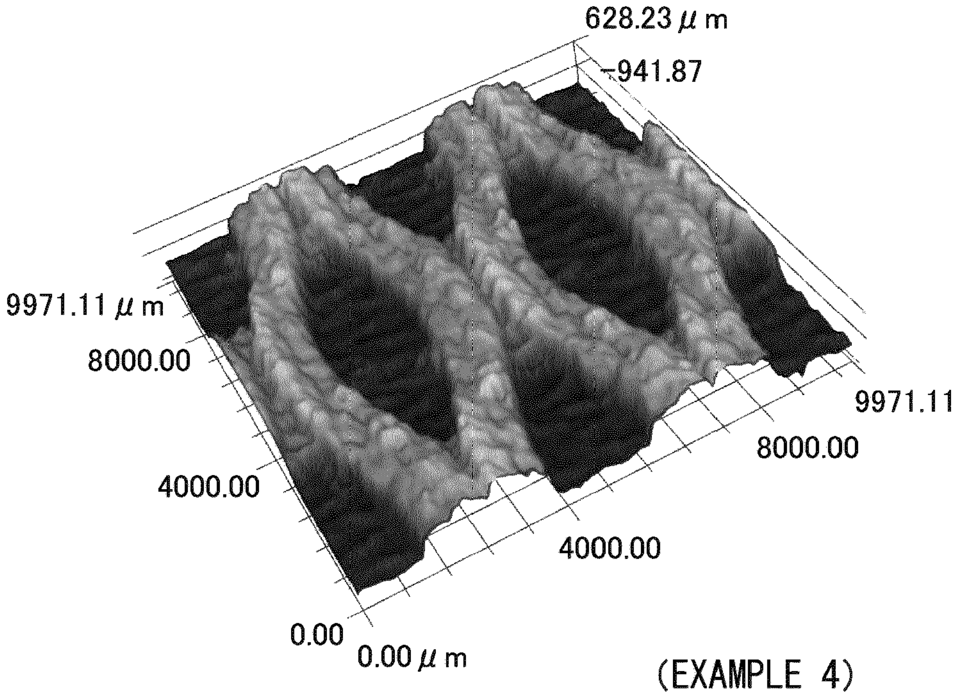
(EXAMPLE 2)

FIG.20



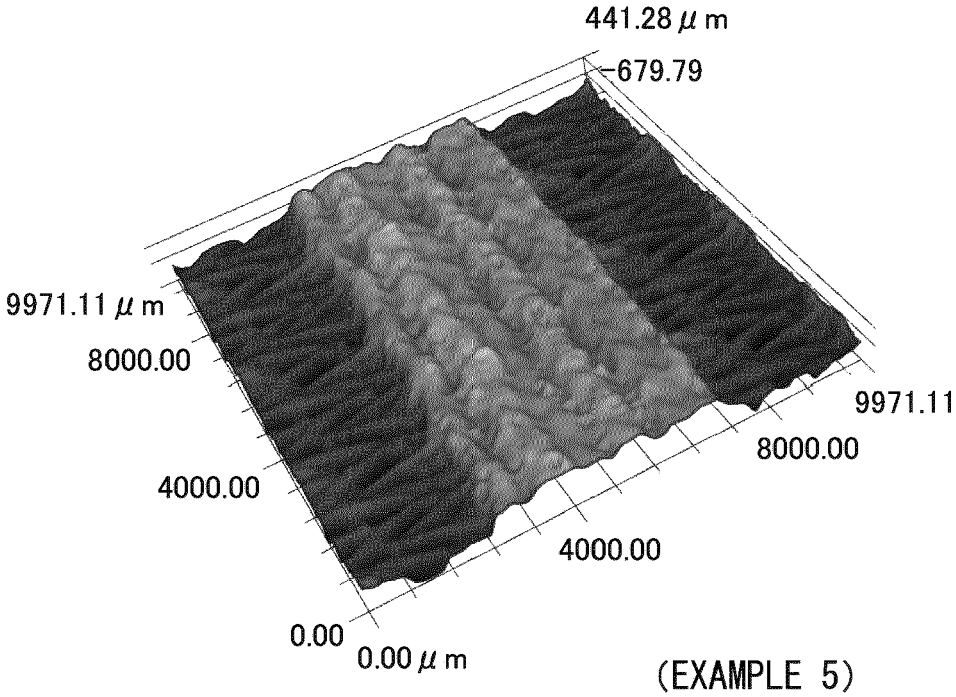
(EXAMPLE 3)

FIG.21



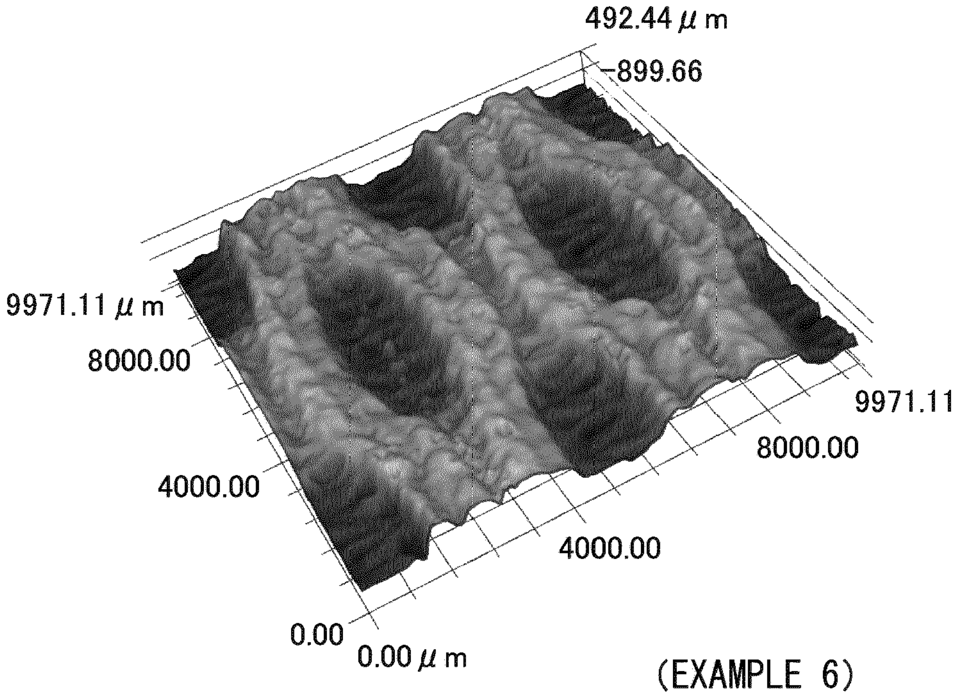
(EXAMPLE 4)

FIG.22



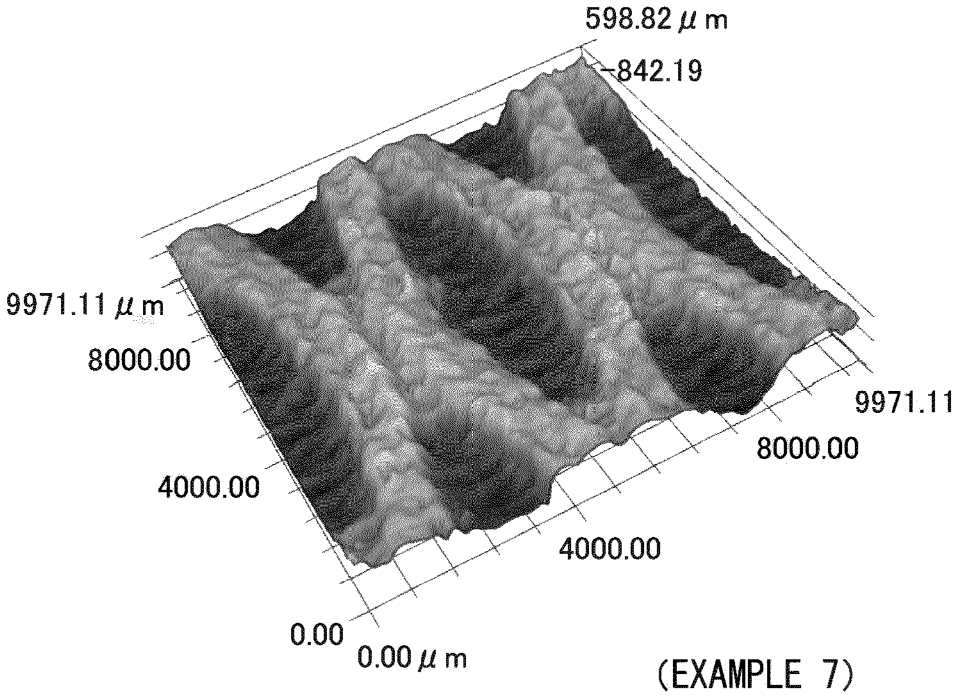
(EXAMPLE 5)

FIG.23



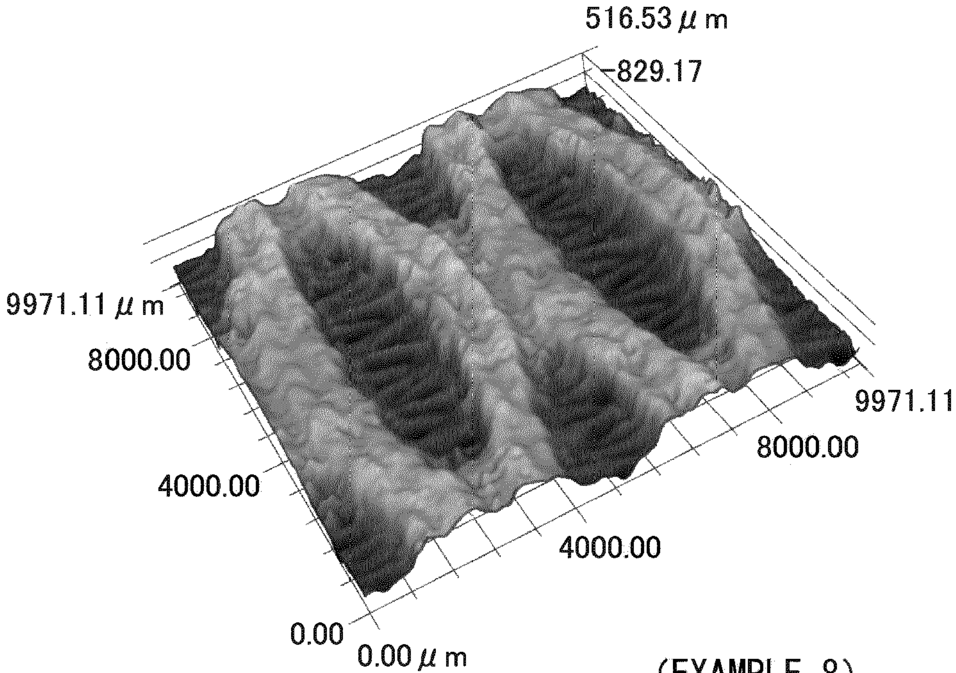
(EXAMPLE 6)

FIG.24



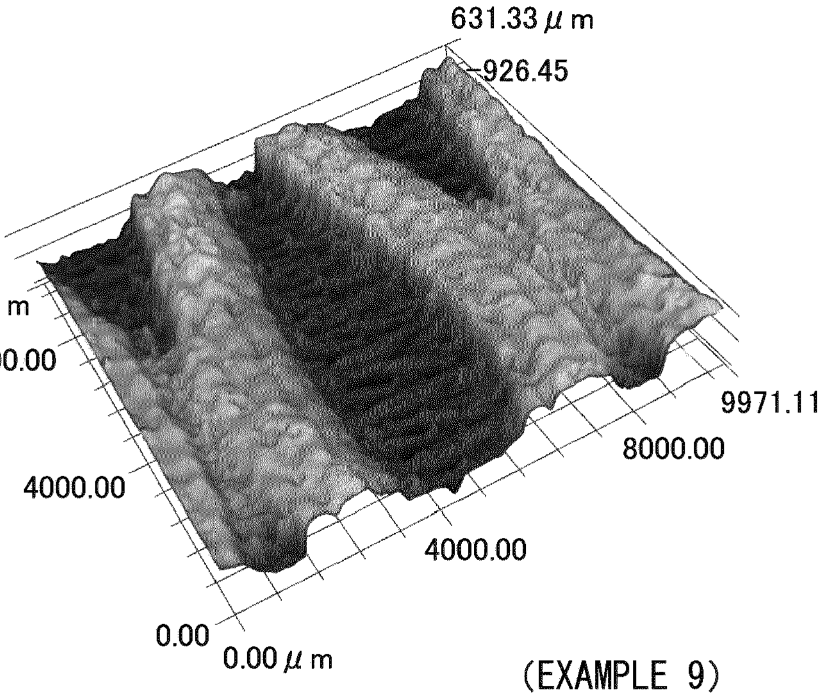
(EXAMPLE 7)

FIG.25



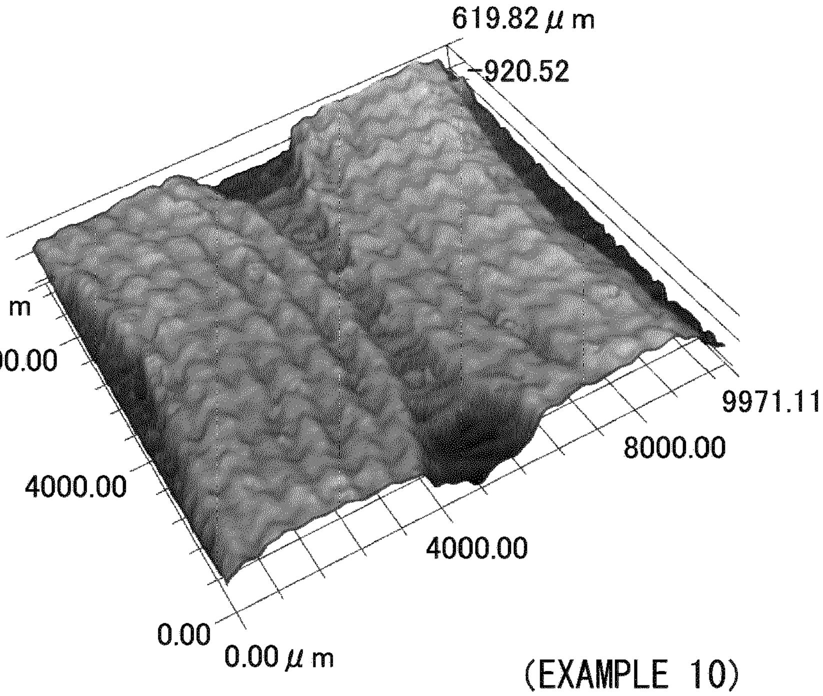
(EXAMPLE 8)

FIG.26



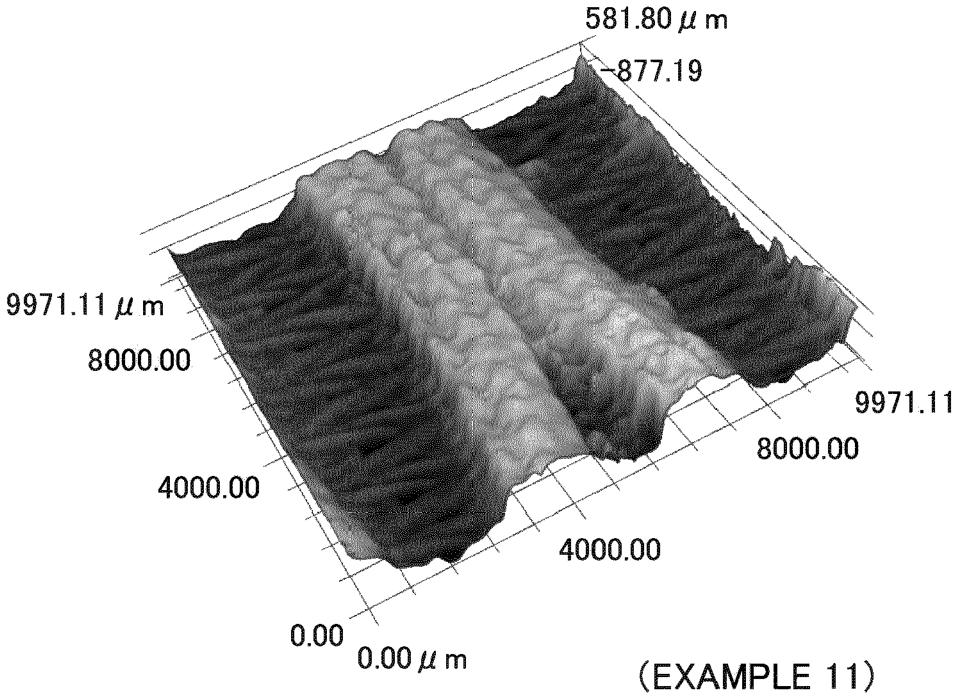
(EXAMPLE 9)

FIG.27



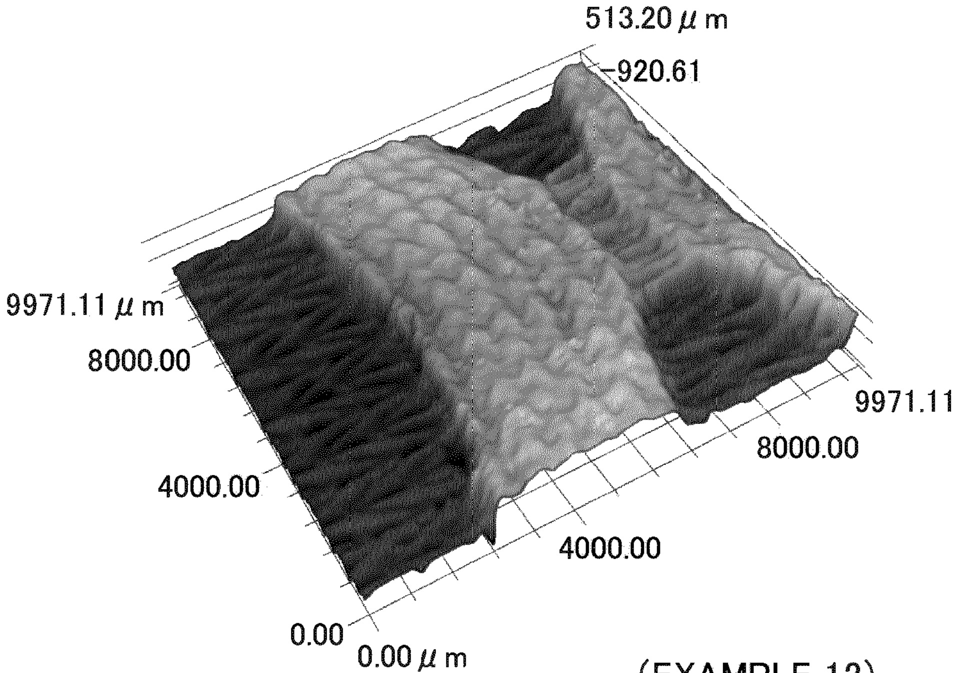
(EXAMPLE 10)

FIG.28



(EXAMPLE 11)

FIG.29



(EXAMPLE 12)

FIG.30

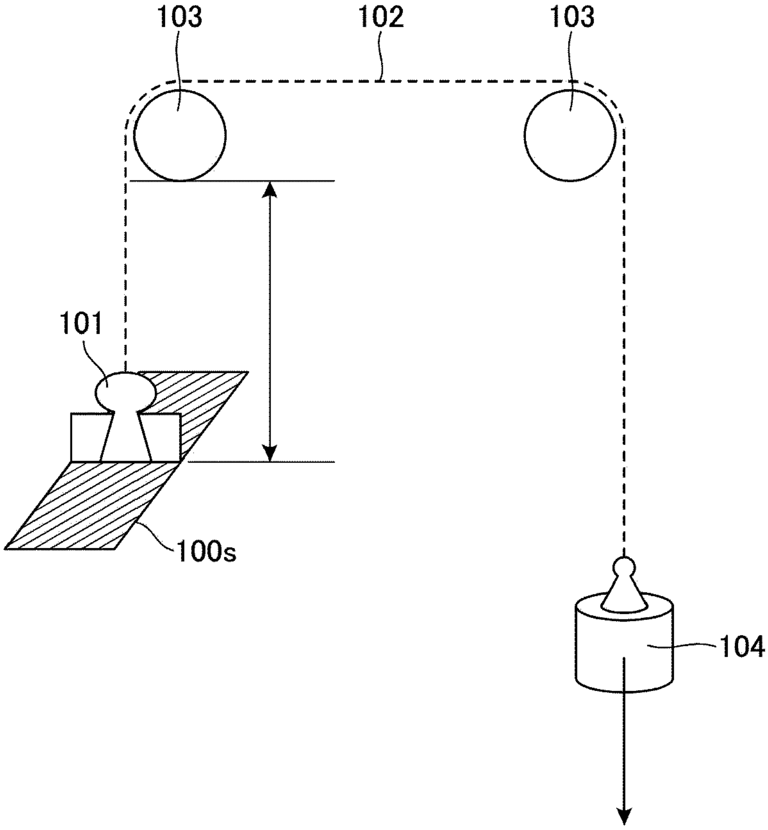


FIG.31

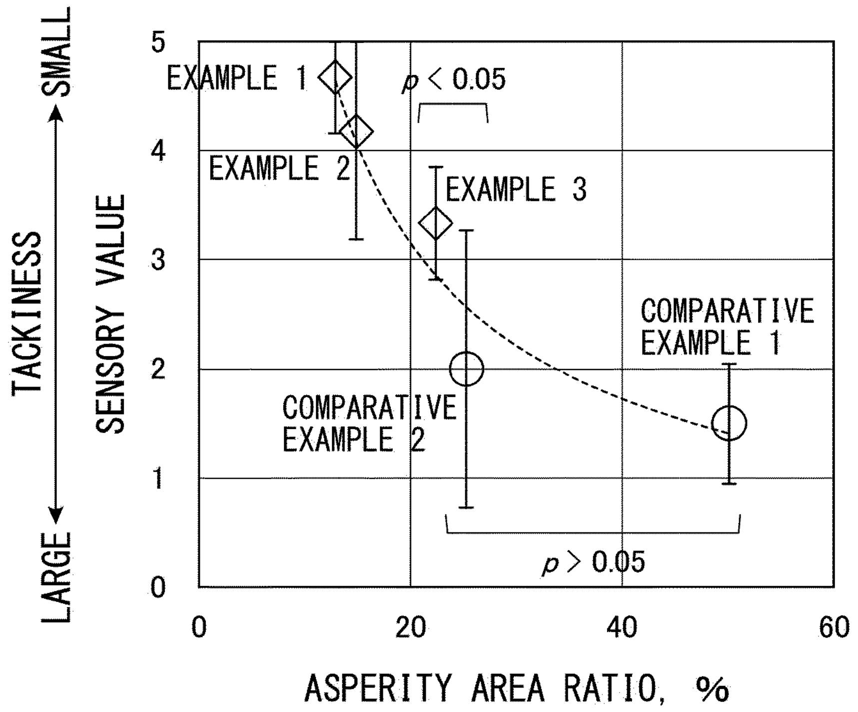

TACKINESS
SMALL
LARGE
SENSORY VALUE
5
4
3
2
1
0
0
20
40
60
ASPERITY AREA RATIO, %
EXAMPLE 1
EXAMPLE 2
EXAMPLE 3
COMPARATIVE EXAMPLE 1
COMPARATIVE EXAMPLE 2
$p < 0.05$
$p > 0.05$

FIG.32

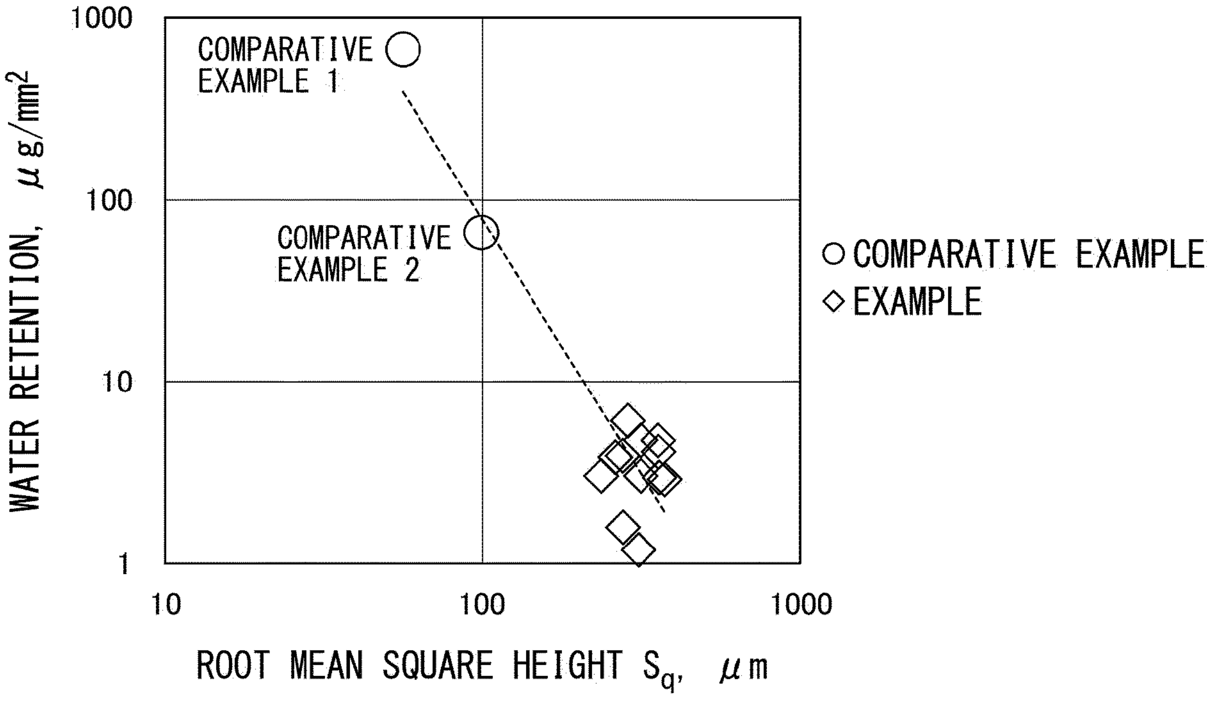

WATER RETENTION, μg/mm²
1000
100
10
1
10
100
1000
ROOT MEAN SQUARE HEIGHT S_q, μm
COMPARATIVE EXAMPLE 1
COMPARATIVE EXAMPLE 2
○ COMPARATIVE EXAMPLE
◇ EXAMPLE

FIG.33

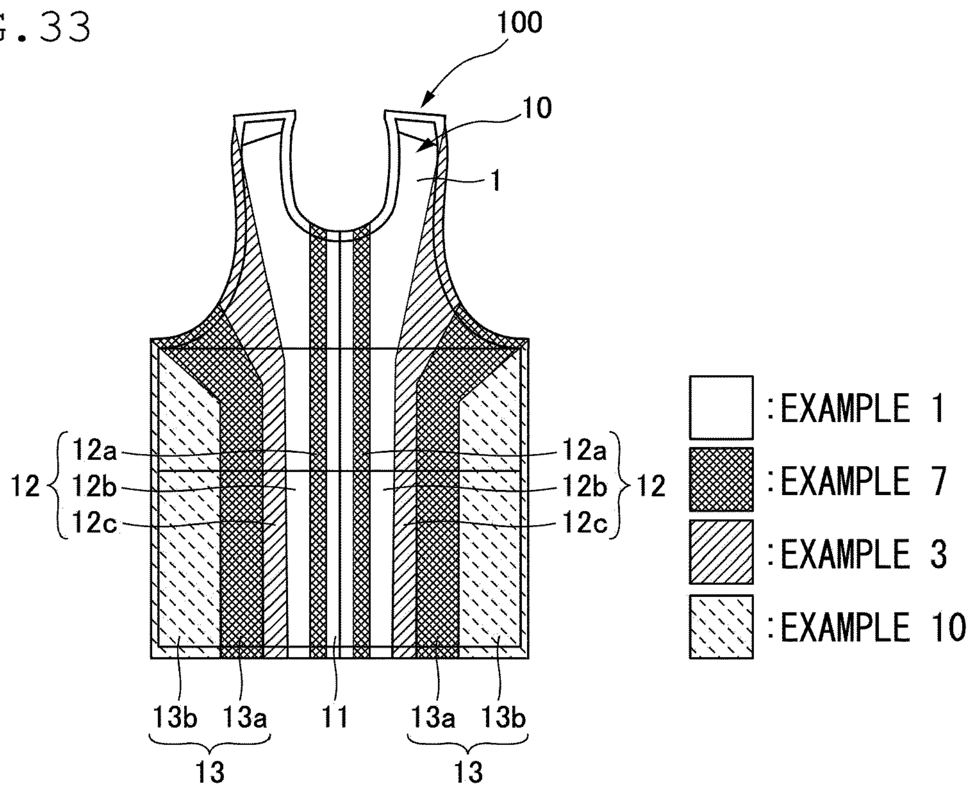

100
10
1
12a
12b
12c
12
11
13a
13b
13
:EXAMPLE 1
:EXAMPLE 7
:EXAMPLE 3
:EXAMPLE 10

FIG.34

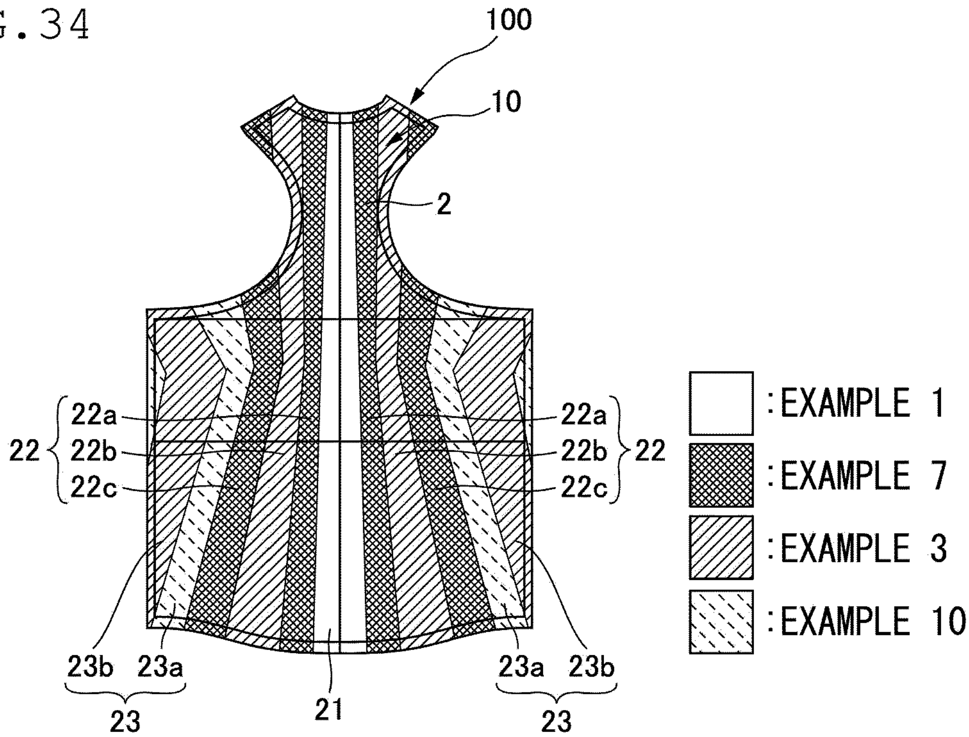

100
10
2
22a
22b
22c
22
21
23a
23b
23
:EXAMPLE 1
:EXAMPLE 7
:EXAMPLE 3
:EXAMPLE 10

FIG.35

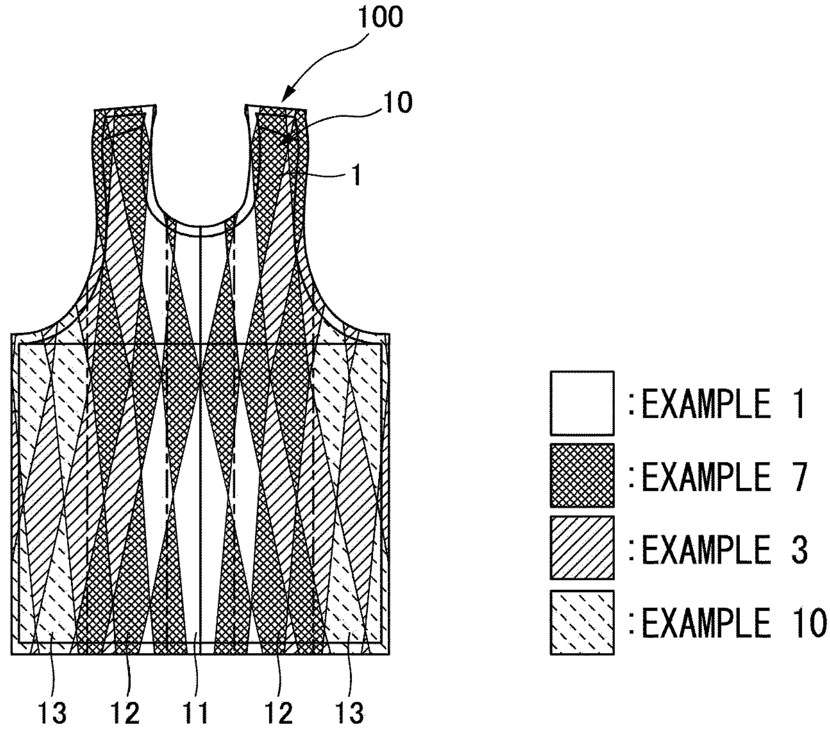
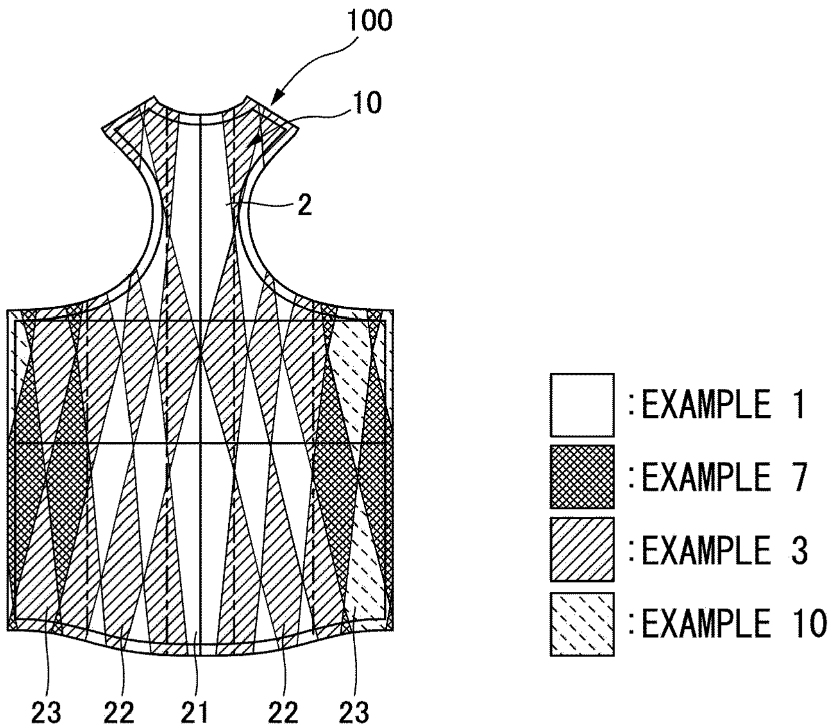

100
10
1
13
12
11
12
13
:EXAMPLE 1
:EXAMPLE 7
:EXAMPLE 3
:EXAMPLE 10

FIG.36


100
10
2
23
22
21
22
23
:EXAMPLE 1
:EXAMPLE 7
:EXAMPLE 3
:EXAMPLE 10

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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 8200

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 520 639 A1 (MIZUNO KK [JP]) 7 August 2019 (2019-08-07)	1-3,7-9	INV. A41B9/06 A41B17/00 A41D13/00
A	* paragraphs [0018], [0023]; figures 3A,10A *	4-6	

TECHNICAL FIELDS SEARCHED (IPC)
A41B
A41D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	23 May 2024	van Voorst, Frank

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23-05-2024

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EP 3520639 A1	07-08-2019	NONE	

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Patent documents cited in the description

- JP 2015078450 A **[0007]**