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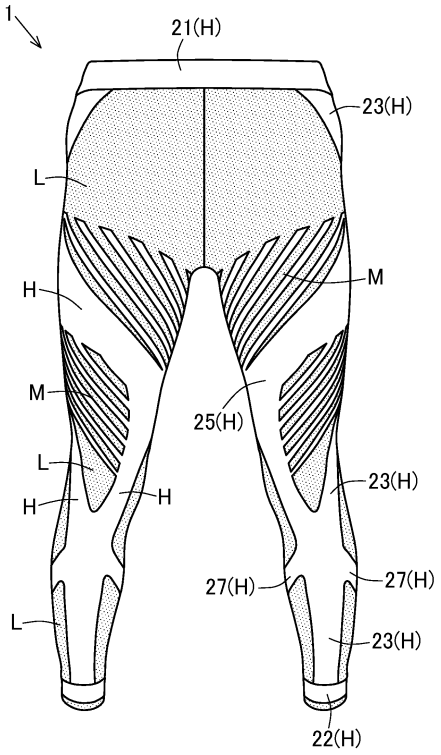
(54) **EXERCISE TIGHTS**

(57) Provided are sports tights formed of a fabric including a high-strength region having a relatively high tensile strength and a low-strength region having a relatively low tensile strength. The high-strength region is located continuously from a waist part to an under knee part of the tights, and located to form a triangular or other polygonal shape having at least a first vertex located to overlap a superior portion of a shinbone of a wearer when the tights are worn, a second vertex located to overlap a vastus lateralis muscle of the wearer, and a third vertex located to overlap a vastus medialis muscle of the wearer and located inferior to the second vertex. A portion of the high-strength region overlapping a patella of the wearer when the tights are worn is located anterior to a bending center of a knee joint of the wearer when the tights are worn. The low-strength region is located within the polygonal region and anterior to the patella of the wearer when the tights are worn, and located to be surrounded by the high-strength region.

Fig.1



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Description

FIELD

[0001] The present invention relates to sports tights, such as running tights, to be worn during exercising.

BACKGROUND

[0002] An example of sports tights can be running tights to be worn by a wearer when he or she runs a relatively long distance for a long period of time during, for example, jogging, running, or the marathon. The running tights are configured to support the wearer's legs with moderate tightness feeling, and thus are popularly worn mainly by, for example, beginners who have yet to become used to running a long distance.

[0003] Running a long distance for a long period of time, such as the marathon, puts a significant load on the runner's body. At the time of the wearer's landing, in particular, force that is three to four times as large as the runner's bodyweight is said to be applied as an impact. This impact frequently causes damage to the runner's knees. Thus, a number of running tights with enhanced support functions for knees have been offered. These running tights typically have such a structure as to impart high compression to the wearer through the application of the "taping fixation" principle, in which areas around the wearer's knee joints are each covered with a high-strength region portion to impart stability. In running, however, high compression imparted to the areas around his or her knee joint would impair his or her comfortable running experience since the runner needs to flex his or her knee joints during a swing period (i.e., period during which the runner's legs are off the ground). The running tights even with a high support force still cause the wearer to easily fatigue if they are configured to impair the wearer's proper running, and thus make it hard for the wearer to run comfortably for a long period of time.

[0004] The applicant of the present application filed an application for a knee wear having a structure to support a wearer's knees while his or her legs are in ground contact, as disclosed in JP 2018-104870 A. The knee wear does not have a conventional support structure configured to fix the wearer's knee joints, but includes a high-strength region for helping the knee joints generate an extension force, and is configured to impart low compression to the wearer without interfering movability of the knee joints while suppressing the vertical movement of the wearer's center of gravity. This knee wear, however, is targeted to sprint races and conceived using a high rigidity fabric having a high support force.

[0005] In long-distance or long-time running, in contrast, there is a demand for tights with a function allowing the wearer to keep running comfortably. This function should not be limited to the function of running tights, but is preferably the function of those tights worn by, for example, walkers or players of a ball game such as tennis or basketball.

CITATION LIST

Patent Literature

[0006] Patent Literature 1: JP 2018-104870 A

SUMMARY

Technical Problem

[0007] It is an object of the present invention to provide sports tights having moderate supporting properties and capable of mitigating a wearer's fatigue.

Solution to Problem

[0008] Provided in the present invention are sports tights formed of a fabric including a high-strength region and a low-strength region, in which the high-strength region has a relatively higher tensile strength than the low-strength region, and the low-strength region has a relatively lower tensile strength than the high-strength region, the high-strength region is located continuously from a superior end to an inferior end of the sports tights, and located to define a polygonal region having a triangular or other polygonal shape by at least a first vertex, a second vertex, and a third vertex, in which the first vertex is located at a position overlapping a superior portion of a shinbone of a wearer of the sports tights when the sports tights are worn, the second vertex is located at a position corresponding to a lateral side of a leg of the wearer and overlapping a vastus lateralis muscle of the wearer, and the third vertex is located at a position corresponding to a medial side of the leg of the wearer and overlapping a vastus medialis muscle of the wearer, the position being located inferior to the second vertex, a portion of the high-strength region coinciding in a vertical direction with a patella of the wearer when the sports tights are worn is located anterior to a bending center of a knee joint based on the wearer when the sports tights are worn, and the low-strength region is located within the polygonal region and anterior to the patella of the wearer when the sports tights are worn, and located to be surrounded by the high-strength region.

[0009] Further provided in the present invention are sports tights formed of a fabric including a high-strength region and a low-strength region, in which the high-strength region has a relatively higher tensile strength than the low-strength region, and the low-strength region has a relatively lower tensile strength than the high-strength region, and the high-strength region and the low-strength regions are located to meet positional relationships set forth in (1) to (4) below in a reference state where any one of a right part and a left part of the sports tights with their seams located to correspond to a medial side of legs of a wearer is laid flat without being sewn:

(1) The high-strength region is located continuously from an end part on a waist side to an end part on a bottom hem side in the reference state;
(2) The high-strength region defines a triangular or other polygonal region having at least three vertices including: a first vertex located closest to the bottom hem side in the reference state; a second vertex located on a posterior part side and closer to the waist side than the first vertex; and a third vertex located on an anterior part side and closer to the waist side than the first vertex and closer to the bottom hem side than the second vertex;
(3) In the case of the sports tights being long tights with the end parts on the bottom hem side located respectively at ankles of the wearer when the sports tights are worn, when the any one of the right part and the left part of the sports tights is divided into four regions by a first straight line connecting a waist half point at a half point in length of the end part on the waist side and a bottom hem half point at a half point in length of the end part on the bottom hem side and a second straight line substantially parallel to an end edge of the end part on the bottom hem side and crossing the first straight line at a half point in length thereof, the majority of the polygonal region is located in one of the four regions located on the anterior part side and on the waist side, and
in the case of the sports tights being short tights with the end parts on the bottom hem side located directly under respective knees of the wearer when the sports tights are worn, when the any one of the right part and the left part of the sports tights is divided into four regions by a first straight line connecting a waist half point at a half point in length of the end part on the waist side and a bottom hem half point at a half point in length of the end part on the bottom hem side and a second straight line substantially parallel to an end edge on the bottom hem side end and crossing the first straight line at a quarter point in length thereof from the bottom hem, the majority of the polygonal region is located in one of the four regions located on the anterior part side and on the waist side; and
(4) The first vertex is located in proximity to a third straight line connecting a waist quarter point at a quarter point in length on the anterior part side of the end part on the waist side and a bottom hem quarter point at a quarter point in length on the anterior part side of the end part on the bottom hem side, in the case of the sports tights being both the long tights and the short tights.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is a front view of sports tights (specifically running tights) according to one embodiment of the present invention, showing its anterior side when worn.
Fig. 2 is a rear view of the running tights, showing its posterior side when worn.
Fig. 3 is a right-side view of the running tights, showing its lateral side when worn.
Fig. 4 is a development view showing a state where a fabric piece of a left part of the running tights is placed in an expansion state with its waist side on an upper side and its bottom hem on a lower side.
Fig. 5 is the development view of Fig. 4 to which how a triangular region is specified is added.
Fig. 6 is the development view of Fig. 4 to which how the position of the triangular region is defined on the fabric piece is added.
Fig. 7 is a development view showing a state where a fabric piece of a left part of sports tights (specifically short running tights) according to another embodiment of the present invention, the view showing how the position of a triangular region is specified on the fabric piece.
Fig. 8 is an enlarged front view of a required portion of a left leg part of the running tights when worn, with a portion corresponding to a lateral side of a thigh of the wearer placed on a right side and a portion corresponding to a medial side of the thigh placed on a left side, the view further showing the arrangement of a high-strength region, a low-strength region, and a middle-strength region.
Fig. 9 is a schematic side view of an example of bones around a knee of the wearer of the running tights.
Fig. 10 is a schematic front view of an example of muscle arrangement around the knee of the wearer of the running tights.
Fig. 11 is a simplified view showing a relationship between the high-strength region and a portion around the knee of the wearer of the running tights.
Fig. 12A is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12B is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12C is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12D is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12E is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12F is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 12G is a view showing an example of a pattern of the middle-strength region of the running tights.
Fig. 13 is a view for explaining a vertical change of the center of gravity of a runner in his or her running motion.
Fig. 14 is a schematic view including a graph on running efficiency (the values for a vertical axis and a horizontal axis of the graph are not limited thereto).

Fig. 15 is a view for explaining a thigh vibration suppressing action of the running tights.

Fig. 16 is a view for explaining a buttocks supporting action of the running tights.

DESCRIPTION OF EMBODIMENTS

[0011] A description will be hereinafter given on long-type running tights (hereinafter referred to also as "tights") as one embodiment of sports tights of the present invention, with reference to the drawings. Directions and positional relationships of parts in the following description correspond to the respective directions and positional relationships of parts of running tights 1 when worn (used). The correspondence of these positional relationships refers to the correspondence when the parts of the running tights coincide with the respective anatomical portions of a wearer in an ideal manner (i.e., refers to the correspondence as designed), but when the running tights are actually worn, any possible displacement therebetween due to the wearer's physical constitution needs to be taken into consideration. The tights to which the present invention is applicable are not limited to long-type, elongated tights having their end parts on a bottom hem side located at the wearer's respective ankles, but include short, Capri tights having their end parts on the bottom hem side located directly under the wearer's respective knees.

[0012] In this embodiment, a fabric that forms the tights 1 and covers hips and legs of the wearer when the tights 1 are worn includes a high-strength region H, a low-strength region L, and a middle-strength region M at positions of the fabric different from each other (i.e., positions not overlapping each other) in plan view. In Fig. 1 to Fig. 4, the high-strength region H is a region in white, the low-strength region L is a dotted region, and the middle-strength region M is a striped region.

[0013] The "wearer" is herein assumed to be a person with a general body shape, such as a person with a standard body shape as defined by the Research Institute of Human Engineering for Quality Life (HQL), Japan, or an athlete participating in a running race or playing other sport.

[0014] The high-strength region H (i.e., a fabric forming the region; the same applies below) has a relatively higher tensile strength than the low-strength region L (that is, hardly stretches), and the low-strength region L has a relatively lower tensile strength than the fabric forming the high-strength region H (that is, easily stretches). The middle-strength region M has a tensile strength relatively lower than the high strength region H and relatively higher than the low-strength region L. In the present invention, forming the middle-strength region M is not essential, and the configuration can be such that the fabric that forms the tights 1 includes only the high-strength region H and the low-strength region L. The tensile strength of the high-strength region His 1.1 times or more, preferably 1.3 to 10 times as large as the tensile strength of the low-strength region L.

[0015] The tights 1 of this embodiment are formed of, for example, a combination of a plurality of fabric pieces sewn together to have the high-strength region H, the low-strength region L, and the middle-strength region M. The tights 1 can also be formed by partially melting the fabric pieces. This configuration can reduce seams that come into contact with the wearer's skin to advantageously give comfortable wearing feeling to the wearer. Alternatively, for the high-strength region H and the middle-strength region M, a portion of the fabric forming the high-strength region H can be formed by applying a resin thereto, using print processing or rubber processing.

[0016] The middle-strength region M is formed of the fabric for forming the high-strength region H and the fabric for forming the low-strength region L that are present in a mixed manner within the same plane. This configuration can form the middle-strength region M using two kinds of fabric in terms of their tensile strengths, thus eliminating the necessity of preparing three or more kinds of fabric. This can possibly reduce material costs (e.g., stock costs). When the tights 1 are formed by the cut-and-sew method, the middle-strength region M can also be formed using a "third kind of fabric", which is different from both the fabric having a relatively high tensile strength for forming the high-strength region H and the fabric having a relatively low tensile strength for forming the low-strength region L.

[0017] Possible combinations of a fabric M1 having a relatively high tensile strength and a fabric M2 having a relatively low tensile strength for forming the middle-strength region M can be, for example, patterns shown in Fig. 12A to Fig. 12G. In these figures, the light-shaded region corresponds to the fabric M1 having a relatively high tensile strength, and the dark-shaded region corresponds to the fabric M2 having a relatively low tensile strength. In Fig. 12A, a plurality of pieces of the fabric M1 having a relatively high tensile strength are formed into a geometric shape (circular shape in the illustrated example) and located at intervals from each other relative to the fabric having a relatively low tensile strength. The intervals are uniform in the illustrated example, but can be non-uniform. In Fig. 12B and Fig. 12C, pieces of the fabric M1 having a relatively high tensile strength are located in a grid pattern relative to the fabric having a relatively low tensile strength. The grid size is uniform in the illustrated examples, but can be non-uniform. The pieces of the fabric M1 having a relatively high tensile strength have a linear shape and extend orthogonal to each other in the illustrated examples, but can cross at an acute angle or at an obtuse angle. In Fig. 12D and Fig. 12E, the pieces of the fabric M1 having a relatively high tensile strength are located in a stripe form relative to the fabric having a relatively low tensile strength. In Fig. 12F, the pieces of the fabric M1 having a relatively high tensile strength are located in a hexagonal grid form relative to the fabric having a relatively low tensile strength. Fig. 12G shows the reverse pattern of Fig. 12F,

in which a plurality of pieces of the fabric M1 having a relatively high tensile strength are each formed into a hexagonal shape and located at intervals from each other relative to the fabric having a relatively low tensile strength. As illustrated, the pieces of the fabric M1 having a relatively high tensile strength are located intermittently relative to the fabric having a relatively low tensile strength to form the middle-strength region M.

[0018] The middle-strength region M of this embodiment is formed of pieces of the fabric M1 for forming the high-strength region H and pieces of the fabric M2 for having the low-strength region L that are located alternately with each other into a stripe form. This configuration enables the middle-strength region M to be formed of two kinds of fabric in terms of their tensile strengths, and enables strip-shaped portions of the kinds of fabric (in particular fabric M1) to have a tensile force acting between both ends of the fabric. In this embodiment, the strip-shaped portions of the fabric extend from a lateral side toward a medial side of each leg in a direction diagonally descending from a superior side, on each of an anterior side and a posterior side with reference to the body of the wearer. For a thigh, for example, this configuration enables the strips of the fabric having a relatively high tensile strength to be arranged to have their longitudinal directions extending along a direction inclined relative a circumferential direction of the thigh, and thus enables the tension of the fabric to effectively act on the thigh. The "strip-shaped portions of the fabric" are not limited to the portions of the fabric independent of other portions, and can each be, for example, an aggregate of dotted portions formed by resin printing into a strip shape.

[0019] The tensile strength of each of the regions can be evaluated with the strength measured according to, for example, JIS L 1096. In the case of this embodiment, a test piece of the fabric used for the test is set to have a width of 5 cm and a length of 20 cm. The test piece is prepared to have its longitudinal direction corresponding to the longitudinal direction of the tights 1 when in use. The dimension between the chucks of the tensile tester is set to 10 cm. The test is performed at a tensile speed of 200 mm/min and a sampling frequency of 5 fps or more, and the preset maximum extension in the test is 100% (dimension between the chucks of 20 cm). Under these conditions, the fabric of which the test piece has a tensile force of 0.7 N/cm or more and 4.0 N/cm or less at 50% extension (dimension between the chucks of 15 cm) is specified as having "high-strength", and the fabric of which the test piece has a tensile force of 0.6 N/cm or less (no lower limit is set) is specified as having "low-strength". The "middle-strength" is not herein specified by any numerical value since the fabric having "middle-strength" is formed of a combination of the fabric with "high-strength" and the fabric with "low-strength". The measurement method described herein is a mere example, and the tensile strength of each of the regions can be evaluated by other measurement methods. In particular, since "high-strength" and "low-strength" are evaluated in a comparative manner, it is sufficient to comparatively evaluate which one of the tensile strengths is higher or lower based on the result obtained by a certain measurement method.

[0020] As shown in Fig. 1 to Fig. 4 (Fig. 4 shows a tights fabric piece 1a, which is a half part (specifically left part) of the tights in an expansion state before, for example, being sewn, and shows a reference state to be described later), the high-strength region H is located at: a waist round part 21 at a superior end of a body part of the tights 1; an ankle round part 22 at an inferior end (strictly at a position slightly superior to the inferior end) of a leg part of the tights 1; and a vertically extending part 23 extending vertically for connection between both the waist round part 21 and the ankle round part 22. The high-strength region H is also located at an upper buttocks corresponding part 24 extending inferiorly from a posterior-side portion of the waist round part 21. The high-strength region H is further located at an anterior medial thigh extension part 25 and a posterior medial thigh extension part 26 that are branched from a superior part of the vertically extending part 23, and at a lower leg round part 27 that is branched from an inferior part of the vertically extending part 23. In the tights 1 of this embodiment, the waist round part 21 (including the superior part of the vertically extending part 23 and a superior part of the upper buttocks corresponding part 24) functions as a superior end fixing portion configured to allow the tights 1 to be fixed at a superior position relative to the wearer, and the ankle round part 22 (including the inferior part of the vertically extending part 23) functions as an inferior end fixing portion configured to allow the tights 1 to be fixed at an inferior position relative to the wearer.

[0021] The ankle round part 22 has a back side (i.e., portion in contact with the skin) with non-slip properties. As shown in Fig. 3, the vertically extending part 23 is configured to descend to pass through the lateral side of the wearer's leg from the waist toward the thigh, extend to be directed from the lateral side to the anterior side of the wearer's leg between the thigh and the knee, and extend to pass through the anterior part of the leg in the lower leg to be connected to the ankle round part 22. The superior part of the anterior medial thigh extension part 25, and the posterior medial thigh extension part 26 are configured to correspond to the substantial center of the wearer's thighbone and extend along a portion of the thigh having the maximum circumference.

[0022] The high-strength region H is continuously located as the vertically extending part 23 from a portion corresponding to the wearer's waist to a portion corresponding to an under knee part of the wearer when the tights 1 are worn by the wearer. When the tights 1 are Capri tights, the inferior end of the high-strength region H is located at a position corresponding to a superior part of a shinbone X2. This arrangement allows the tensile force of the high-strength region H to be transmitted to the portion of the wearer extending from the waist to the under knee part. This configuration reliably achieves an

action of the high-strength region H on a bending center JC of the knee joint, which will be described later. In order not to block the transmission of the tensile force, it is preferable that the back side (i.e., portion in contact with the skin) of the continuously located high-strength region H have no non-slip properties.

[0023] Around the wearer's shin when the tights 1 are worn, the high-strength region H forms a triangular region T defined by a first vertex 31, a second vertex 32 (the second vertex 32 is located on the lateral side of the wearer's leg when the tights 1 are worn, and Fig. 8 shows its position), and a third vertex 33 to cover the anterior portion of the wearer's thigh, as shown in Fig. 8. The triangular region T is defined to include and cover a part of the thigh, a part of the lower leg, and the knee of the anterior side of the wearer's leg. The triangular region T is a region having a triangular shape and having virtual sides 34 to 36 (shown by broken lines in Fig. 5 to Fig. 8) that respectively pass through the substantial centers in a width direction of the vertically extending part 23 and the anterior medial thigh extension part 25. As shown in Fig. 5 to Fig. 8, the sides 34 to 36 are located within the high-strength region H located on the anterior side of the wearer's leg. Thus, the high-strength region H functioning to enhance running efficiency as will be described later extends beyond the triangular region T. The outer edge (including the vertices 31 to 33 and the sides 34 to 36) of the triangular region T does not have to be strictly determined, and it is sufficient that the outer edge is roughly defined based on the ranges in which the high-strength region H, the middle-strength region M, and the low-strength region L are respectively formed. When the tights 1 are worn, the first vertex 31 is located at a position overlapping the superior part of the wearer's shinbone X2 (see Fig .9), the second vertex 32 is located at a position overlapping the vastus lateralis muscle Y1 (see Fig. 10), and the third vertex 33 is located at a position overlapping the vastus medialis muscle Y2 (see Fig. 10) and inferior to the second vertex 32. The shape of the region defined by the vertices is not limited to a triangular shape, and can be a quadrangular or other polygonal shape defined by including four or more vertices. Each of the sides forming the polygon (triangle in this embodiment) can be formed into a straight shape or a curved shape. That is, any shape that visually looks like a polygon corresponds to a polygon (substantial polygon). Each of the vertices of the polygon does not have to be formed by being clearly flexed, and a portion inflected to draw a curve can correspond to the vertex.

[0024] Since the tights 1 when worn by the wearer are subjected to the surface shape of the wearer's body, the triangular region T will be specified not in the state where the tights 1 are worn but using the tights fabric piece 1a that is laid flat before being sewn (see Fig. 4). Fig. 4 shows the tights fabric piece 1a that forms a left part of the tights with their seams located on the medial side of each of the legs of the wearer (so called "inseam") and is laid flat on a plane without being sewn (or after the seam is unstitched). Seams 11, 12 of the inseam (corresponding to the anterior and posterior edges of the fabric pieces (i.e., left and right edges of Fig. 4)) are configured to correspond to a position extending from the inner thigh to the medial malleolus of the wearer. The state shown in Fig. 4 is defined as a reference state for specifying the triangular region T in this embodiment. In this embodiment, each of the high-strength region H, the middle-strength region M, and the low-strength region L is arranged to meet first to fourth positional relationships below.

[0025] As the first positional relationship, the high-strength region H is located continuously from the end part on the waist side (upper end in Fig. 4) to the end part on the bottom hem side (lower end in Fig. 4) in the reference state.

[0026] As the second positional relationship, the high-strength region H defines the triangular region T having at least three vertices including: the first vertex 31 located closest to the bottom hem side in the reference state; the second vertex 32 located on the posterior part side and closer to the waist side than the first vertex 31; and the third vertex 33 located on the anterior part side and closer to the waist side than the first vertex 31, and closer to the bottom hem side than the second vertex 32.

[0027] The first vertex 31, the second vertex 32, and the third vertex 33 are determined as follows. First, in the tights fabric piece 1a shown in Fig. 5, a virtual line passes through a substantial center in the width direction of the vertically extending part 23 that is located at a posterior part of the fabric piece and adjacent to a substantially triangular region formed by a combination of the middle-strength region M and the low-strength region L. This virtual line is defined as the first side 34. The intersection at which the first side 34 crosses a perpendicular line 42 passing through a most inferior point 41 of the substantially triangular region formed by the combination of the middle-strength region M and the low-strength region L, the most inferior point 41 being located closest to the bottom hem side, is defined as the first vertex 31. The perpendicular line 42 is a virtual line orthogonal to an end edge 13 in the end part on the bottom hem side of the tights fabric piece 1a.

[0028] A point 45 located closer by 5 cm to the waist side is determined along a perpendicular line 44 passing through a vertex 43 located at the posterior portion of the fabric piece in the substantially triangular region formed by the combination of the middle-strength region M and the low-strength region L. The perpendicular line 44 is a virtual line orthogonal to the end edge 13 in the end part on the bottom hem side of the tights fabric piece 1a. The intersection at which the first side 34 crosses a horizontal line 46 (i.e., virtual line orthogonal to the perpendicular line 44) passing through the point 45 is defined as the second vertex 32.

[0029] Among a plurality of portions at which the high-strength region H is located at the anterior end edge 13 (i.e., left end edge in Fig. 5) of the tights fabric piece 1a,

a point located closest to the waist side is defined as the third vertex 33. A virtual line connecting the first vertex 31 and the third vertex 33 is defined as the second side 35, and a virtual line connecting the second vertex 32 and the third vertex 33 is defined as the third side 36.

[0030] The first vertex 31, the second vertex 32, and the third vertex 33, as well as the first side 34, the second side 35, and the third side 36, which are respectively the virtual lines connecting the vertices, are defined as described above to specify the triangular region T.

[0031] The description above has been given by taking the tights fabric piece 1a of long tights of which the end parts on bottom hem side are located at the ankles of the wearer when the tights are worn (see Fig. 4 to Fig. 6), but the first vertex 31, the second vertex 32, and the third vertex 33 can be defined in the same manner for a tights fabric piece 1b of short tights (Capri tights) of which the end parts on bottom hem side are located directly under the knees of the wearer when the tights are worn (see Fig. 7). In this embodiment, the triangular region T has been specified using the left part of the tights fabric piece 1a, 1b, but the right part of the tights fabric piece can also be used to specify the triangular region T by applying the aforementioned steps in a bilaterally symmetrical manner. Further, even for outseam tights with the seams located at positions corresponding to the lateral sides of the legs of the wearer, the triangular region T can be specified by assuming where the seams for the inseam tights are supposed to be located.

[0032] Next, as the third positional relationship, in the tights fabric piece 1a of the long tights of which the end parts on the bottom hem side are located respectively at the ankles of the wearer when the tights are worn, as shown in Fig. 6, the tights fabric piece 1a can be divided into four regions by a first straight line C1 connecting a waist half point 51 at a half point in length of the end edge 14 of the end part on the waist side and a bottom hem half point 52 at a half point in length of the end edge 13 of the end part on the bottom hem side, and a second straight line C2 substantially parallel to the end edge 13 of the end part on the bottom hem side and crossing the first straight line C1 at a half point in length thereof; and the majority of the triangular region T is located in one of the four regions located on the anterior part side and on the waist side.

[0033] In contrast, in the tights fabric piece 1b of the short tights (Capri tights) shown in Fig. 7 of which the end parts on the bottom hem side are located directly under the respective knees of the wearer when the tights are worn, the tights fabric piece 1b can be divided into four regions by the first straight line C 1 connecting the waist half point 51 at a half point in length of the end edge 14 of the end part on the waist side and the bottom hem half point 52 at a half point in length of the end edge 13 of the end part on the bottom hem side, and a second straight line C4 substantially parallel to the end edge 13 of the end part on the bottom hem side and crossing the first straight line C1 at a quarter point in length thereof from the bottom hem, as shown in Fig. 7; and the majority of the triangular region T is located in one of the four regions located on the anterior side and on the waist side.

[0034] The "majority" refers to 50% or more of the total area of the triangular region T when the triangular region T is evaluated on an area basis.

[0035] As the fourth positional relationship, the first vertex 31 is located in proximity to a third straight line C3 connecting a waist quarter point 53 at a quarter point in length on the anterior part side of the end part on the waist side and a bottom hem quarter point 54 at a quarter point in length on the anterior part side of the end part on the bottom hem side, in the case of both the tights fabric piece 1a of the long tights shown in Fig. 5 and Fig. 6 and the tights fabric piece 1b of the short tights shown in Fig. 7. Specifically, the first vertex 31 is located at a position within 3 cm from the third straight line C3 to the anterior or posterior part side (left or right in the figures) of the tights fabric piece 1a, 1b.

[0036] A distance between the first vertex 31 and the second vertex 32 (i.e., length of the first side 34) is set to be larger than a distance between the first vertex 31 and the third vertex 33 (i.e., length of the second side 35). This is because a vastus lateralis muscle Y1 that overlaps a section between the first vertex 31 and the second vertex 32 is larger as a muscle than a vastus medialis muscle Y2 that overlaps a section between the first vertex 31 and the third vertex 33. This is also for preventing the wearer from feeling uncomfortable by the hardly stretchable high-strength region H brought into contact with his or her crotch. Out of portions of the high-strength region H (see Fig. 1 and Fig. 8) respectively extending the medial and lateral sides on the anterior part of the wearer's thigh, a portion H1 overlapping in side view a patella X1 (see Fig. 9) of the wearer when the tights are worn is, as shown in Fig. 11, configured to be located between a thigh Z1 and a lower leg Z2 and located anterior to the bending center JC (shown in Fig. 8 as a linear axis by a two-dot chain line) of the knee joint of the wearer when the tights are worn.

[0037] The low-strength region L is located within the triangular region T defined by the high-strength region H located into a triangular shape as aforementioned, and is located to cover a portion anterior to the patella X1, that is, the anterior side of the patella X1, of the wearer when the tights are worn. In this embodiment, the low-strength region L in this portion has a triangular shape as shown in Fig. 8, and is located to allow a vertex 41 on the inferior side to substantially coincide with the median line of the patella X1 in front view of the wearer's leg. Two vertices on the superior side are located on a superior side of the vertical center in front view of the wearer's patella X1. Among these, the vertex located to correspond to the lateral side of the thigh is located superior to the vertex located to correspond to the medial side of the thigh. The sides that form a triangle can be straight lines or curved lines. This triangular shape allows stretchability of the low-strength region L to be hardly disturbed.

An inferior part of the low-strength region L has a V shape in this embodiment, but can have a U shape with its vertex portion being curved. Strictly, the "V shape" in this embodiment also refers to such a shape as to be curved at a large curvature. In the low-strength region L, an oblique side of the triangular shape located to correspond to the lateral side of the thigh (i.e., left side in Fig. 8) is set to have a larger length than an oblique side thereof located to correspond to the medial side of the thigh (i.e., right side in Fig. 8).

[0038] The middle-strength region M is located within the triangular region T and superior to the low-strength region L. The middle-strength region M is located also superior to the triangular region T or superior to the anterior medial thigh extension part 25 as shown in Fig. 1, and superior to the posterior medial thigh extension part 26 as shown in Fig. 2, but a description herein will be given on the middle-strength region M located within the triangular region T. In this embodiment, the middle-strength region M in this portion has a substantially rhombus shape as shown in Fig. 8, with a longitudinal direction of the rhombus located along a direction diagonally descending from the superior side. Since the vertically extending part 23 as the high-strength region H is located to correspond to a superior end of the wearer's thighbone (so called greater trochanter X3 (see Fig. 10)), this arrangement is made to correspond to a direction diagonally directed to the greater trochanter X3 from the medial side of the wearer's knee joint. As aforementioned, the middle-strength region M in this portion is formed of the fabric M1 for forming the high-strength region H and the fabric M2 for forming the low-strength region L that are located alternately with each other into a stripe form. As shown in Fig. 8, the arrangement of the fabric M1 and the fabric M2 into a stripe form is made along at least one side of the substantially rhombus shape.

[0039] As shown in Fig. 8, the low-strength region L and the middle-strength region M are located to be surrounded by the high-strength region H. The middle-strength region M located within the triangular region T has a smaller area, and the low-strength region L therewithin has an even smaller area, than the area of the triangular region T defined by the high-strength region H.

[0040] In the triangular region T, the high-strength region H is, as shown in Fig. 11, located anterior to the bending center JC of the wearer's knee joint at the portions H1 located medially and laterally away from the median line of the knee joint when the wearer's leg is viewed from the front, and can thereby impart to the knee joint the extension force resistant to the force of causing the knee joint to be passively flexed at the time of the wearer's landing. When the wearer acquires the propulsion force by kicking out, on the other hand, the high-strength region H shrinks to be thereby capable of imparting the extension force to the knee j oint. The support by the high-strength region H can suppress excessive flexion and extension of the knee joint when the wearer runs, and can thus minimize vertical changes in the wearer's center of gravity while he or she runs. Further, the configuration that the middle-strength region M having an intermediate tensile strength between that of the high-strength region H and that of the low-strength region L is located at a superior portion (close to the center of the wearer's thigh) within the triangular region T can suppress the thigh from vibrating. The low-strength region L located at an inferior portion (close to the wearer's knee joint) within the triangular region T decreases the tensile force superior to the portion corresponding to the patella X1 as compared with the adjacent high-strength region H to thereby permit the knee joint to be flexed during a swing period. The operational effects produced by these portions will be further described below.

[0041] A detailed description will be given on the operational effects produced by the running tights 1 of this embodiment configured as above. In a supporting period (i.e., period for which only a single leg supports the runner's weight) during running, there is a phase during which the runner's weight is applied to the center of the runner's foot (shown in the center of Fig. 13). At that time, the leg is flexed at the knee joint to buffer the impact by landing and to smoothly shift the runner's weight. However, in running during which the runner moves horizontally (i.e., in a direction from left to right in Fig. 13), bending (flexion) and return (extension) of the knee joint facilitates the vertical movement of the runner's body in a direction crossing the direction of movement, which is inefficient in terms of running efficiency. It is therefore important to stably run by minimizing the vertical movement of the center of gravity of the runner's body (portion in Fig. 13 represented as "Center of Gravity"). Since flexion of the knee joint occurs passively by the runner's own weight or by gravity, the muscles of the thigh or the lower leg adhering to the knee joint are pulled in association with the flexion of the knee joint to thereby possibly cause minor muscle damages. These damages trigger a pulled muscle or a delayed muscle pain. Thus, it is effective for the running tights 1 to have support functions to suppress the wearer's knees from being flexed at the time of the wearer's landing.

[0042] In the tights 1 of this embodiment, therefore, the high-strength region H is located as shown in Fig. 11 to overlap the thigh and the lower leg so as to extend over the bending center JC of the knee joint for enhanced running efficiency. The supporting period is divided into two phases by its midpoint as a reference as shown in Fig. 14, the first half of which is the phase where the knee joint is applied with negative force and the second half of which is the phase where the knee joint is made to extend for kicking out, and the running efficiency is derived based on the active force of the runner. In the first half, the tights 1 act to reduce the impact at the time of the runner's landing to thereby enable the runner to reduce his or her negative workload. In the second half, the tights 1 act to suppress the power for acquiring the propulsion force by kicking out to thereby suppress the runner from exerting his or her positive force. These con-

figurations can enhance the running efficiency (in terms of efficiency with reference to the runner). That is, in order to reduce the force (workload) applied to the flexion and extension of the knee j oint, it is important to reduce the flexion and extension of the knee j oint, i.e., the displacement of the angle of the knee joint under the running condition at a constant speed.

[0043] As to the displacement of the angle of the knee joint during the supporting period, the impact at the time of the runner's landing in the phase where negative work develops as shown in Fig. 14 needs to be buffered without relying too much on the flexion of the knee joint (the values for the vertical axis and the horizontal axis of the graph of Fig. 14 are mere examples, without limitation thereto). To achieve this, an extension force needs to be imparted to the knee joint to resist the force of flexing the knee joint. As shown in Fig. 11, the tights 1 of this embodiment have the high-strength region H located from the thigh to the lower leg so as to extend over the knee joint. The high-strength region H applied with a tensile force when the knee joint is passively flexed can suppress the knee joint from being flexed (see the left one of the schematic leg views shown on the top of Fig. 14). The action of suppressing the knee flexion of the fabric also works effectively on the phase where the positive work develops in the right-hand side of the graph in Fig. 14, i.e., works effectively to increase the power required to acquire the propulsion force by kicking. The high-strength region H is applied with a tensile force when the knee joint is passively flexed by the impact at the time of the runner's landing, and the tensile force can in turn impart an extension force to the knee joint in the phase of acquiring the propulsion force where the high-strength region H shrinks. In summary, the high-strength region H is configured to provide part of the power in shaded regions respectively with the "bottom" and the "peak" in the graph of Fig. 14, to suppress the knee joint from being flexed at the time of the runner's landing and to assist the knee joint in extending at the time of kicking out.

[0044] The high-strength region H extends vertically to pass both the medial side and the lateral side of the thigh of the wearer. That is, as shown with a substantially triangular shape in Fig. 16, the high-strength region H is configured to be located around the wearer's thigh so as to cover the anterior part of the thigh. Since the thigh has larger muscles than those at other portions of the leg, the high-strength region H configured to be located around the thigh can suppress the thigh from vibrating that occurs at the time when the wearer lands (see Fig. 15). The high-strength region H suppresses the thigh vibration from propagating (see the right end of Fig. 15) to thereby enable increased stability of the knee joint and contribute to enhanced running efficiency. Further, in this embodiment, the high-strength region H extending to pass the medial side of the wearer's thigh and the high-strength region H extending to pass the lateral side of the thigh are connected to each other at the substantial center in the vertical direction of the thigh. Such a connection can more effectively suppress the thigh vibration at the time of the wearer's landing.

[0045] The high-strength region H extending to pass the medial side of the wearer's thigh and the high-strength region H extending to pass the lateral side of the thigh can be configured to have different tensile forces from each other by, for example, differentiating their width dimensions or the tensile forces of the fabric itself. With such a configuration, a difference in tensile forces can suppress the knee joint from being directed medially or being directed laterally during running.

[0046] The middle-strength region M can be configured such that pieces of the fabric for forming the high-strength region H are located at certain intervals to increase the strength per unit area, or such that a piece of fabric having an intermediate tensile strength between the high-strength region H and the low-strength region L is located by being connected by sewing or attaching a tape thereto. In any case, the high-strength region H if located to cover the entire circumference of the thigh exerts an excellent operational effect, but gives excessive tightness to thereby make it difficult for the wearer to wear the tights 1 and impart poor fitting feeling to the wearer after the tights 1 are worn. It is therefore preferable that the high-strength region H be located at the peripheral edge of the triangular region T, and that the middle-strength region M and the low-strength region L rather than the high-strength region H be located at the portion within the triangular region T surrounded by the high-strength region H.

[0047] The low-strength region L is located so as not to disturb motions including flexion and extension of the knee joint. In particular, in the swing period in which the knee joint needs to be flexed (to increase an angular speed), the low-strength region L is located to correspond to the center of the knee part as shown by a two-dot chain line in Fig. 8 so that the fabric is prevented from being applied with an excessive tensile force in association with an increase in the flexion angle (that is, an excessive tensile force exceeding the action of suppressing the knee flexion exerted by the high-strength region H during the supporting period). In front view of the wearer's leg, the low-strength region L located between portions of the high-strength region H located into a V-shape is to stretch in a circumferential direction of the leg when the knee joint is flexed. This configuration enables the knee joint to be flexed while allowing the action of suppressing the knee flexion to effectively act during the supporting period. The low-strength region L is located superior to the most inferior portion substantially coinciding with the inferior end of the patella X1 or the superior end of the shinbone X2, so as to extend over the bending center JC of the knee joint. Further, the low-strength region L is located into a triangular shape having two oblique sides directed upward so as to respectively extend along the vastus lateralis muscle Y1 and the vastus medialis muscle Y2 (see Fig. 10).

[0048] The high-strength region H is located to extend

along a circumference of the wear's lower leg inferior to a portion overlapping the wearer's patella X1 in front view when the tights 1 are worn. That is, the high-strength region H extending from the portion corresponding to the knee joint is connected to the portion corresponding to the lower leg so as to cover the circumference of the lower leg. This configuration can promote shrinkage of the muscles of the lower leg to thereby promote exertion of the wearer's muscular strength, suppress the muscles of the lower leg from vibrating to thereby mitigate stress on the knee j oint, and allow the tensile force of the high-strength region H to act on the knee j oint to increase the joining force of the knee joint.

[0049] Fig. 16 shows support of the buttocks. A runner swings out his or her legs alternately for running, and therefore the runner's hip joint and pelvis swing in a right and left direction (see an enclosed portion in the center of Fig. 16). When the swing increases, an angular variation of the joints of the entire leg increases, and in particular, an influence on the knee joint increases. Thus, in this embodiment, the high-strength region H is located at a portion corresponding to the lateral side of the wearer's hip joint and pelvis. That is, the high-strength region H located on a part of the vertically extending part 23, the upper buttocks corresponding part 24, the anterior medial thigh extension part 25, and the posterior medial thigh extension part 26 at the buttocks part and around the waist part of the tights 1 is configured to support the muscles of the buttocks (i.e., gluteus maximus muscle and gluteus medius muscle) to suppress the posture of the wearer (runner) from changing in the right and left direction.

[0050] As described above, the running tights 1 of this embodiment are configured to mainly control the knee j oint, and furthermore control the muscles and motions of the lower legs and the hip joint of the wearer to be thereby capable of enhancing running efficiency. The strength, width, and length of the fabric pieces can be designed to conform to various purposes, and the structure of the integrated fabric pieces with different properties achieves appropriate running efficiency.

[0051] Hereinafter, the configurations and operational effects according to the embodiment of the present invention will be summarized. Provided in this embodiment are sports tights 1 formed of a fabric including a high-strength region H and a low-strength region L, in which the high-strength region H has a relatively higher tensile strength than the low-strength region L, and the low-strength region L has a relatively lower tensile strength than the high-strength region H, the high-strength region H is located continuously from a portion corresponding to the wearer's waist to a portion corresponding to an under knee part of the wearer when the tights 1 are worn by the wearer, and located to define a polygonal region having a triangular or other polygonal shape by at least a first vertex, a second vertex, and a third vertex, in which the first vertex is located at a position overlapping a superior portion of a shinbone X2 of a wearer of the sports tights 1 when the sports tights 1 are worn, the second vertex is located at a position overlapping a vastus lateralis muscle Y1 of the wearer, and the third vertex is located at a position overlapping a vastus medialis muscle Y2 of the wearer, the position being located inferior to the second vertex, a portion of the high-strength region H overlapping a patella X1 of the wearer in side view when the sports tights 1 are worn is located anterior to a bending center JC of a knee joint of the wearer when the sports tights 1 are worn, and the low-strength region L is located within the polygonal region and anterior to the patella X1 of the wearer when the sports tights 1 are worn, and located to be surrounded by the high-strength region H.

[0052] This configuration enables the high-strength region H to impart to the knee joint the extension force resistant to the force of causing the knee joint to be passively flexed at the time of the wearer's landing. When the wearer acquires the propulsion force by kicking out, on the other hand, the high-strength region H shrinks to be thereby capable of imparting the extension force to the knee joint. This configuration can suppress excessive flexion and extension of the knee joint when the wearer runs, and can thus minimize vertical changes in the wearer's center of gravity while he or she runs.

[0053] The configuration can be such that the fabric forming the sports tights 1 further includes a middle-strength region M having a tensile strength relatively lower than the high-strength region H and relatively higher than the low-strength region L, and the middle-strength region M is located within the polygonal region and superior to the low-strength region L, and located to be surrounded by the high-strength region H.

[0054] According to such a configuration, the middle-strength region M having an intermediate tensile strength between the tensile strength of the high-strength region H and the tensile strength of the low-strength region L is located within the polygonal region to be thereby capable of suppressing the thigh from vibrating.

[0055] The configuration can be such that the middle-strength region M is formed of a fabric M1 for forming the high-strength region H and a fabric M2 for forming the low-strength region L in a mixed manner.

[0056] This configuration can form the middle-strength region M using two kinds of fabric in terms of their tensile strengths.

[0057] The configuration can be such that the middle-strength region M is formed of strip-shaped pieces of the fabric for forming the high-strength region H and strip-shaped pieces of the fabric for forming the low-strength region L that are located alternately with each other. Further, the configuration can be such that the tensile strength of the high-strength region H is 1.1 times to 10 times as large as the tensile strength of the low-strength region L.

[0058] These configurations can form the middle-strength region M using two kinds of fabric in terms of their tensile strengths, and enable the strip-shaped piec-

es of the fabric to have a tensile force acting between both ends of the pieces of the fabric.

[0059] The configuration can be such that the high-strength region H extends vertically to pass both a medial side and a lateral side of a thigh of the wearer when the sports tights 1 are worn.

[0060] This configuration allows the high-strength region H passing the medial side and the high-strength region H passing the lateral side of the thigh to suppress the thigh from vibrating at the time of the wearer's landing, to thereby enable increased stability of the knee joint.

[0061] The configuration can be such that the high-strength region H extending to pass the medial side of the thigh and the high-strength region H extending to pass the lateral side of the thigh are connected to each other at a substantial center in the vertical direction of the thigh.

[0062] This configuration can effectively suppress the thigh from vibrating at the time of the wearer's landing.

[0063] The configuration can be such that the high-strength region H is located to extend along a circumference of a lower leg of the wearer inferior to a portion of the sports tights 1 overlapping the patella X1 of the wearer when the sports tights 1 are worn.

[0064] This configuration can promote shrinkage of the muscles of the lower leg, suppress the muscles of the lower leg from vibrating, and allow the tensile force of the high-strength region H to act on the knee joint, to increase the joining force of the knee joint.

[0065] The configuration can be such that the high-strength region H is located at a position corresponding to a lateral side of a hip joint and a pelvis of the wearer when the sports tights 1 are worn.

[0066] This configuration suppresses the posture of the hip joint and the pelvis of the wearer from changing in the right and left direction to thereby reduce the angular change of the knee joint.

[0067] As described above, the sports tights 1 of this embodiment have moderate supporting properties and can mitigate the wearer's fatigue.

[0068] The present invention has been described by way of embodiments, but the description is a mere exemplification. The sports tights 1 according to the present invention are not limited to the aforementioned embodiments. Thus, various modifications can be made to the sports tights 1 according to the present invention without departing from the gist of the present invention. The modifications include, for example, a replacement or an omission of a part of a plurality of features forming the aforementioned embodiments, and an appropriate combination of the features of different examples. The modifications further include a combination of matters pertaining to common technical knowledge regarding the sports tights 1.

REFERENCE SIGNS LIST

[0069]

1: Sports tights, running tights, tights
21: Waist round part
22: Ankle round part
23: Vertically extending part
24: Upper buttocks corresponding part
25: Anterior medial thigh extension part
26: Posterior medial thigh extension part
27: Lower leg round part
31: First vertex
32: Second vertex
33: Third vertex
H: High-strength region
H1: Portion configured to overlap wearer's patella in side view
L: Low-strength region
M: Middle-strength region
JC: Bending center of knee joint
M1: Fabric for forming high-strength region, fabric having relatively high tensile strength
M2: Fabric for forming low-strength region, fabric having relatively low tensile strength
T: Polygonal (triangular) region

Claims

1. Sports tights formed of a fabric comprising a high-strength region and a low-strength region, wherein

the high-strength region has a relatively higher tensile strength than the low-strength region, and the low-strength region has a relatively lower tensile strength than the high-strength region,
the high-strength region is located continuously from a superior end to an inferior end of the sports tights, and located to define a polygonal region having a triangular or other polygonal shape by at least a first vertex, a second vertex, and a third vertex, wherein the first vertex is located at a position overlapping a superior portion of a shinbone of a wearer of the sports tights when the sports tights are worn, the second vertex is located at a position corresponding to a lateral side of a leg of the wearer and overlapping a vastus lateralis muscle of the wearer, and the third vertex is located at a position corresponding to a medial side of the leg of the wearer and overlapping a vastus medialis muscle of the wearer, the position being located inferior to the second vertex,
a portion of the high-strength region coinciding in a vertical direction with a patella of the wearer when the sports tights are worn is located anterior to a bending center of a knee joint based on the wearer when the sports tights are worn, and
the low-strength region is located within the polygonal region and anterior to the patella of the wearer when the sports tights are worn, and lo-

cated to be surrounded by the high-strength region.

2. The sports tights according to claim 1, wherein the fabric forming the sports tights further comprises a middle-strength region having a tensile strength relatively lower than the high-strength region and relatively higher than the low-strength region, and
the middle-strength region is located within the polygonal region and superior to the low-strength region, and located to be surrounded by the high-strength region.

3. The sports tights according to claim 2, wherein the middle-strength region is formed of a fabric for forming the high-strength region and a fabric for forming the low-strength region in a mixed manner.

4. The sports tights according to claim 3, wherein the middle-strength region is formed of strip-shaped pieces of the fabric for forming the high-strength region and strip-shaped pieces of the fabric for forming the low-strength region that are located alternately with each other.

5. The sports tights according to any one of claims 1 to 4, wherein the tensile strength of the high-strength region is 1.1 times or more as large as the tensile strength of the low-strength region.

6. The sports tights according to any one of claims 1 to 5, wherein the high-strength region extends vertically to pass both a medial side and a lateral side of a thigh of the wearer when the sports tights are worn.

7. The sports tights according to claim 6, wherein the high-strength region extending to pass the medial side of the thigh and the high-strength region extending to pass the lateral side of the thigh are connected to each other at a substantial center in the vertical direction of the thigh.

8. The sports tights according to any one of claims 1 to 7, wherein the high-strength region is located to extend along a circumference of a lower leg of the wearer inferior to a portion of the sports tights overlapping the patella of the wearer when the sports tights are worn.

9. The sports tights according to any one of claims 1 to 8, wherein the high-strength region is located at a position corresponding to a lateral side of a hip joint and a pelvis of the wearer when the sports tights are worn.

10. Sports tights formed of a fabric comprising a high-strength region and a low-strength region, wherein
the high-strength region has a relatively higher tensile strength than the low-strength region, and the low-strength region has a relatively lower tensile strength than the high-strength region, and
the high-strength region and the low-strength regions are located to meet positional relationships set forth in (1) to (4) below in a reference state where any one of a right part and a left part of the sports tights with their seams located to correspond to a medial side of legs of a wearer is laid flat without being sewn:

(1) The high-strength region is located continuously from an end part on a waist side to an end part on a bottom hem side in the reference state;
(2) The high-strength region defines a triangular or other polygonal region having at least three vertices comprising: a first vertex located closest to the bottom hem side in the reference state; a second vertex located on a posterior part side and closer to the waist side than the first vertex; and a third vertex located on an anterior part side and closer to the waist side than the first vertex and closer to the bottom hem side than the second vertex;
(3) In the case of the sports tights being long tights with the end parts on the bottom hem side located respectively at ankles of the wearer when the sports tights are worn, when the any one of the right part and the left part of the sports tights is divided into four regions by a first straight line connecting a waist half point at a half point in length of the end part on the waist side and a bottom hem half point at a half point in length of the end part on the bottom hem side and a second straight line substantially parallel to an end edge of the end part on the bottom hem side and crossing the first straight line at a half point in length thereof, the majority of the polygonal region is located in one of the four regions located on the anterior part side and on the waist side, and
in the case of the sports tights being short tights with the end parts on the bottom hem side located directly under respective knees of the wearer when the sports tights are worn, when the any one of the right part and the left part of the sports tights is divided into four regions by a first straight line connecting a waist half point at a half point in length of the end part on the waist side and a bottom hem half point at a half point in length of the end part on the bottom hem side and a second straight line substantially

parallel to the end edge on the bottom hem side and crossing the first straight line at a quarter point in length thereof from the bottom hem, the majority of the polygonal region is located in one of the four regions located on the anterior part side and on the waist side; and

(4) The first vertex is located in proximity to a third straight line connecting a waist quarter point at a quarter point in length on the anterior part side of the end part on the waist side and a bottom hem quarter point at a quarter point in length on the anterior part side of the end part on the bottom hem side, in the case of the sports tights being both the long tights and the short tights.

Fig.1

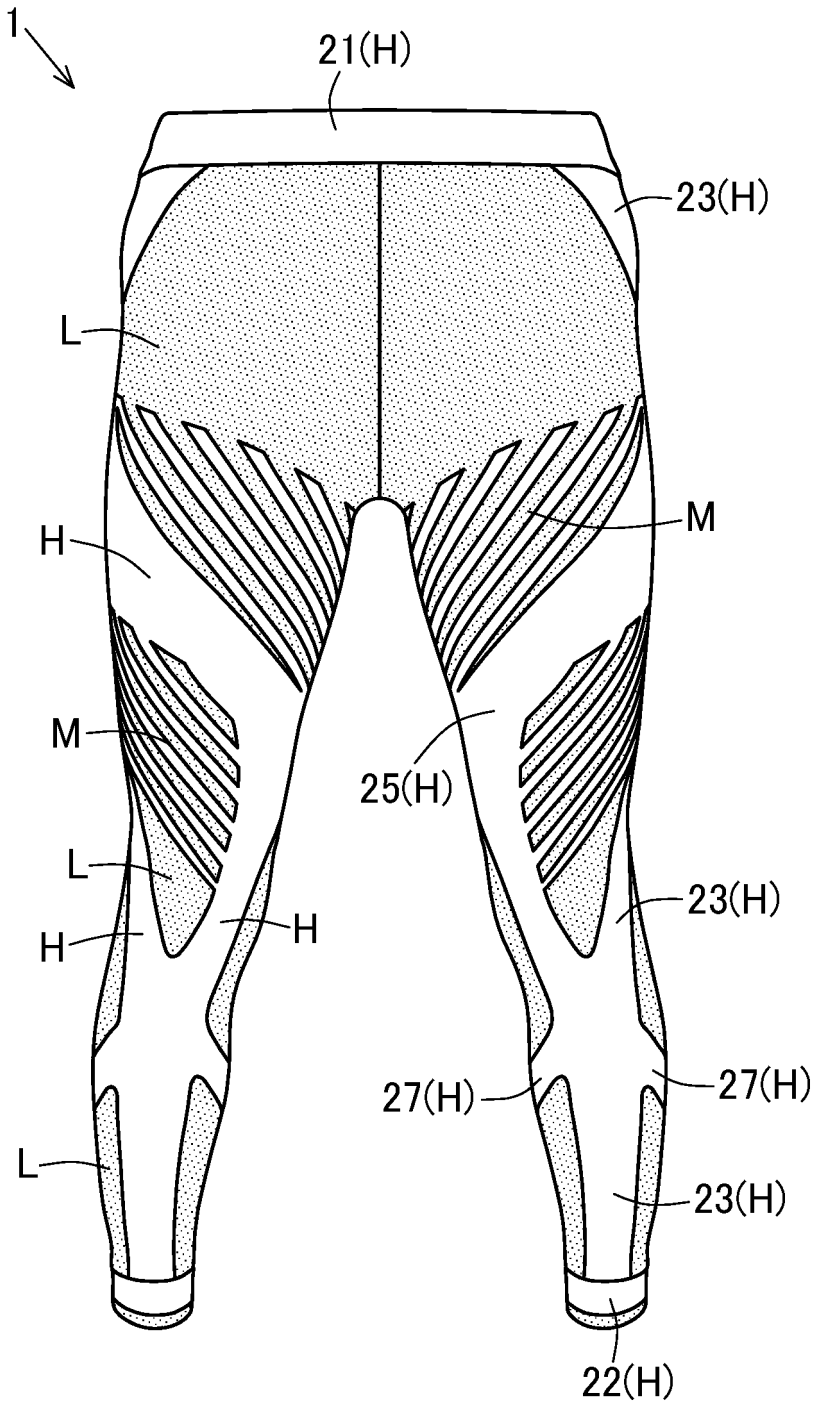


Fig.2

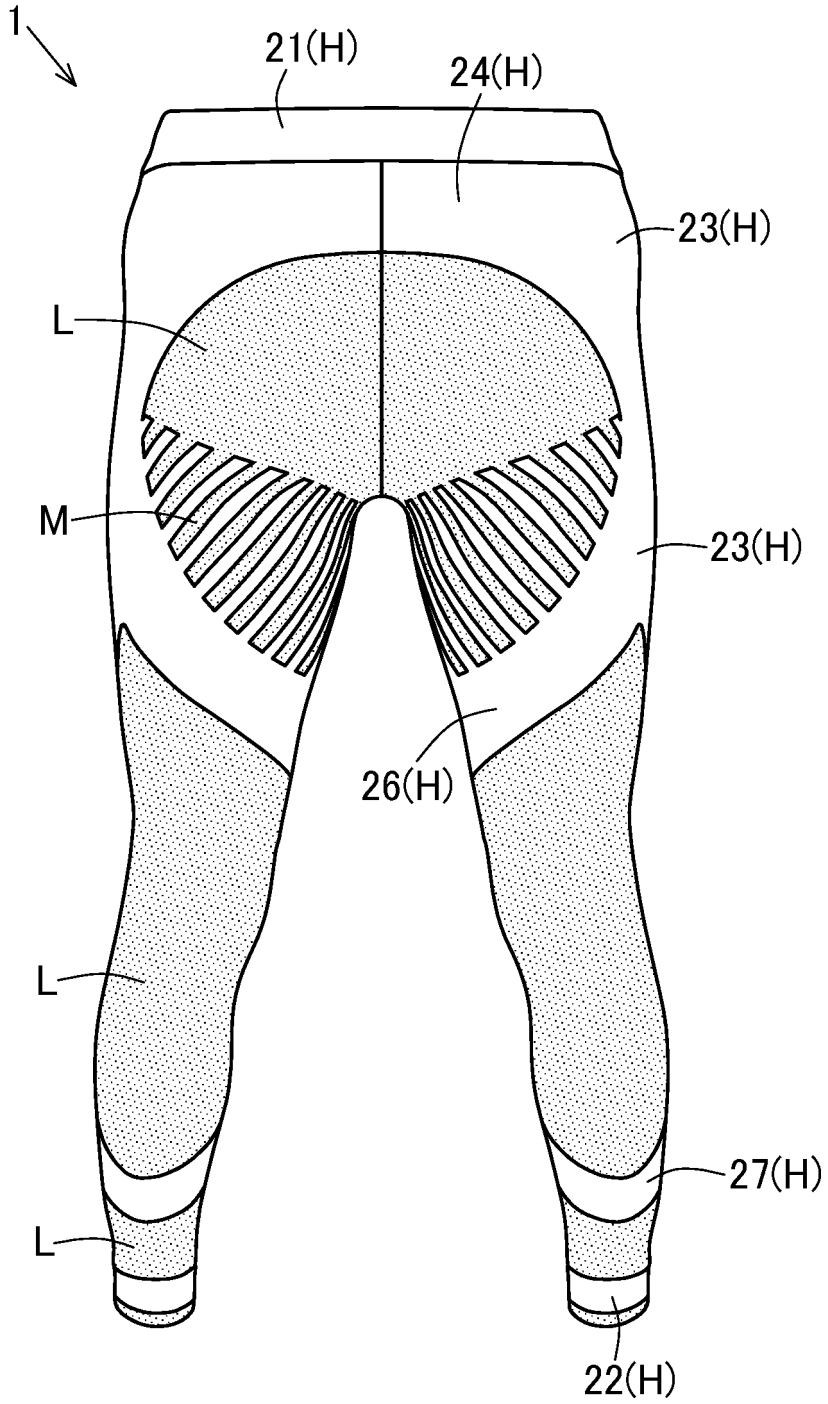


Fig.3

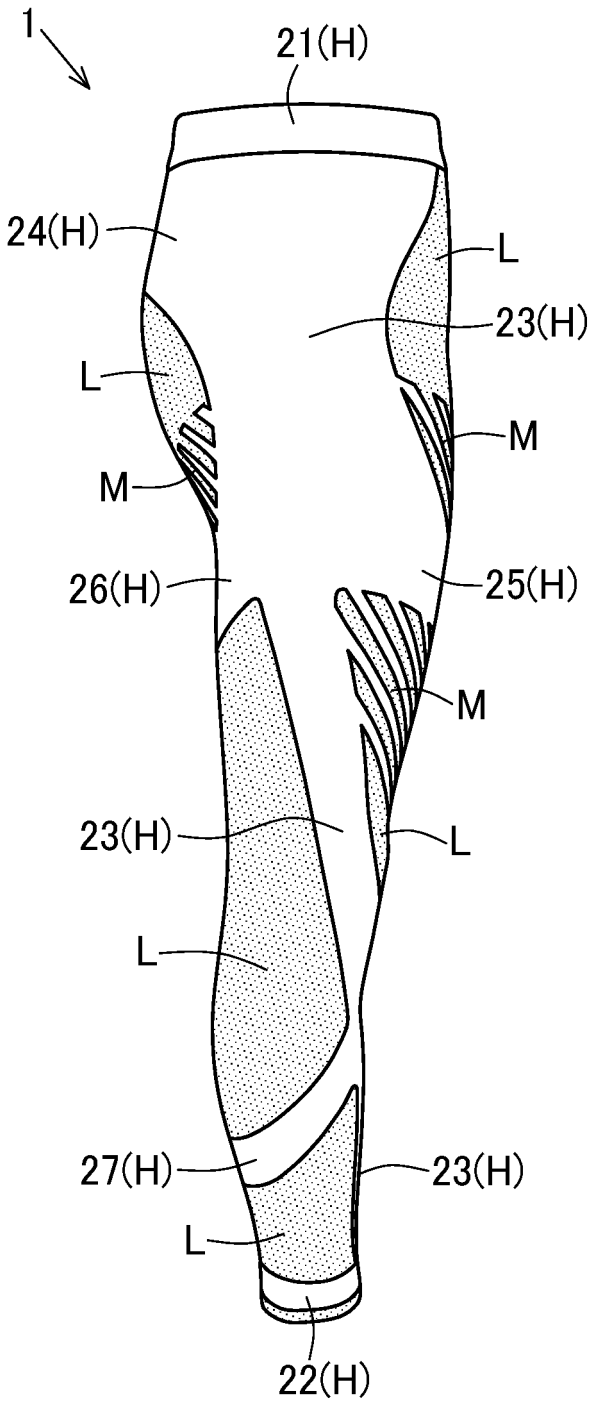


Fig.4

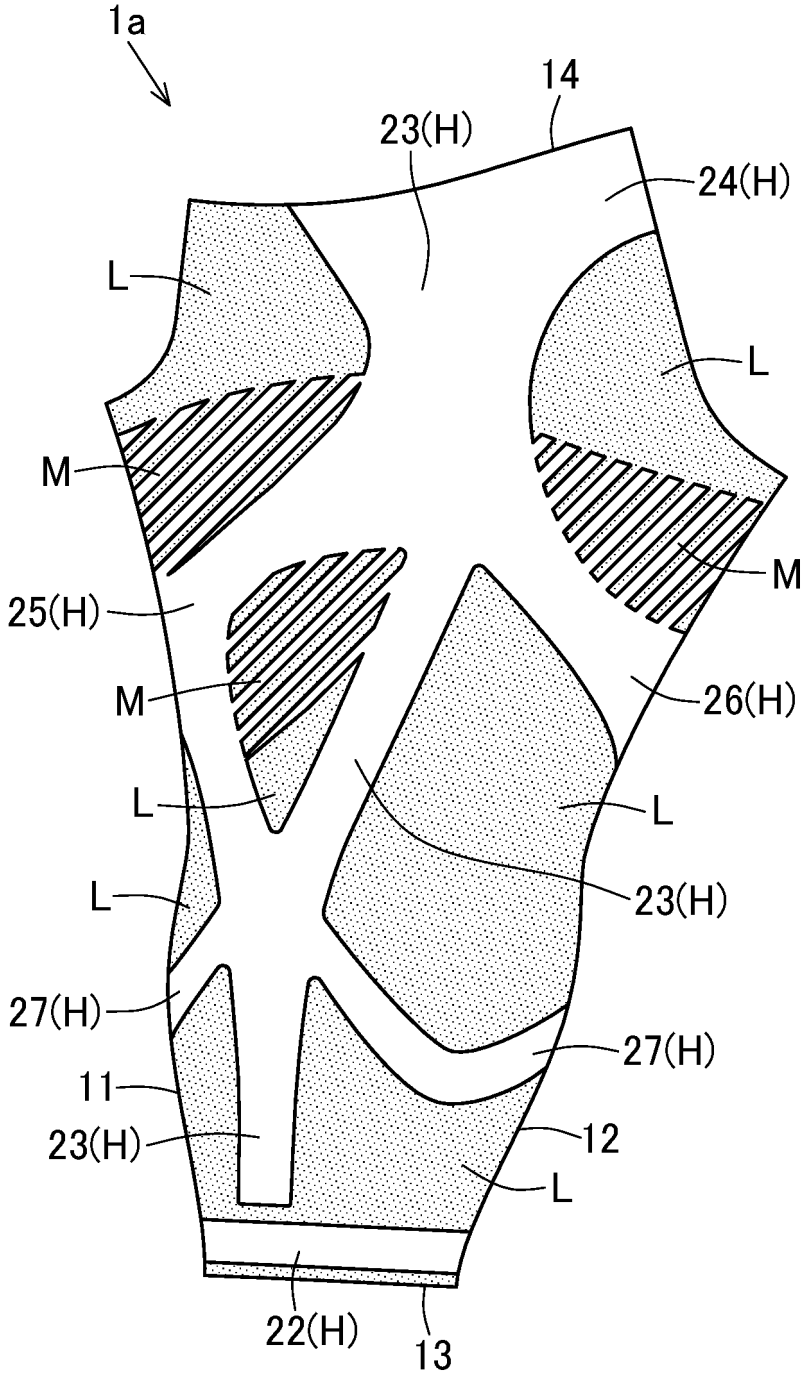


Fig.5

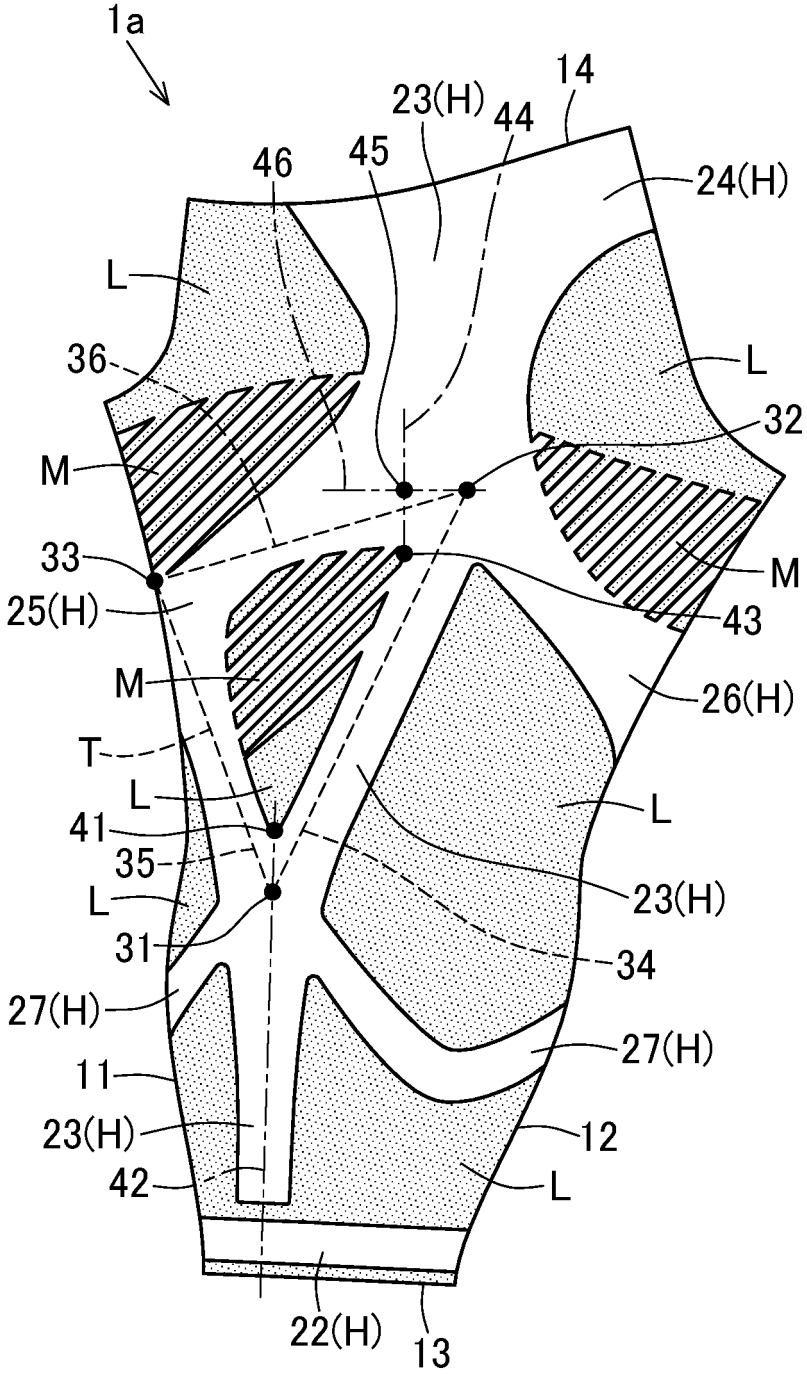

1a
14
23(H)
44
46
45
24(H)
L
36
L
32
M
33
M
25(H)
43
M
26(H)
T
L
L
41
35
23(H)
L
31
34
27(H)
27(H)
11
23(H)
12
42
L
22(H)
13

Fig.6

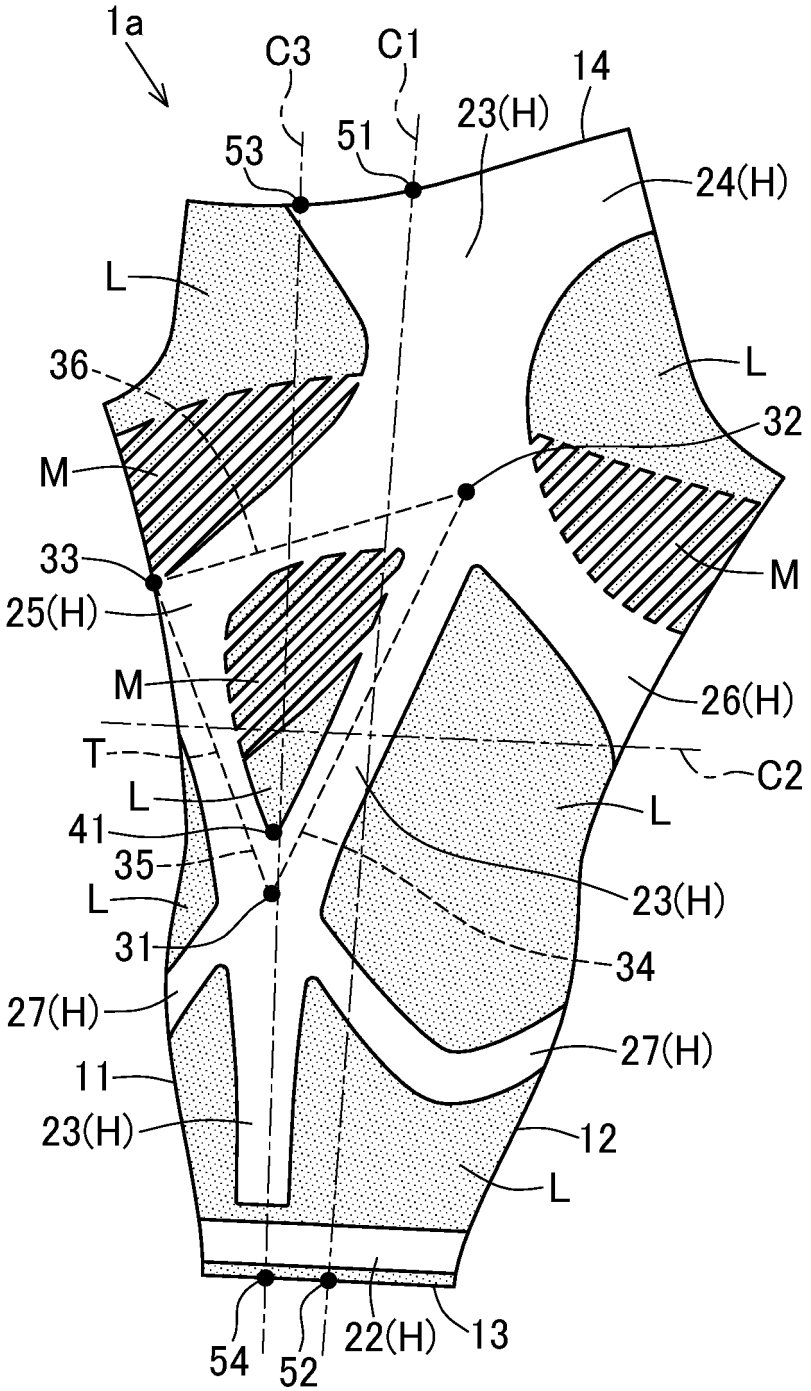

1a
C3
C1
14
23(H)
53
51
24(H)
L
36
L
32
M
M
33
25(H)
M
26(H)
T
C2
L
L
41
35
23(H)
L
31
34
27(H)
27(H)
11
23(H)
12
L
54
52
22(H)
13

Fig.7

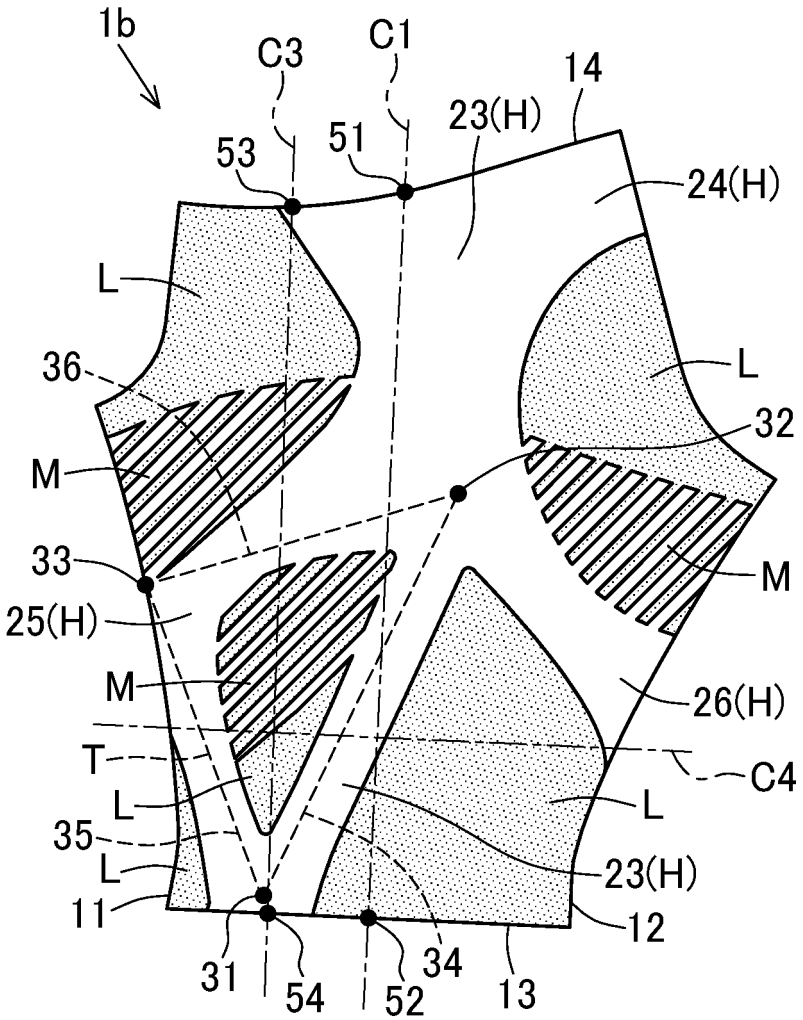

1b
C3
C1
14
23(H)
53
51
24(H)
L
36
L
32
M
33
M
25(H)
M
26(H)
T
C4
L
L
35
L
23(H)
11
12
31
54
52
34
13

Fig.8

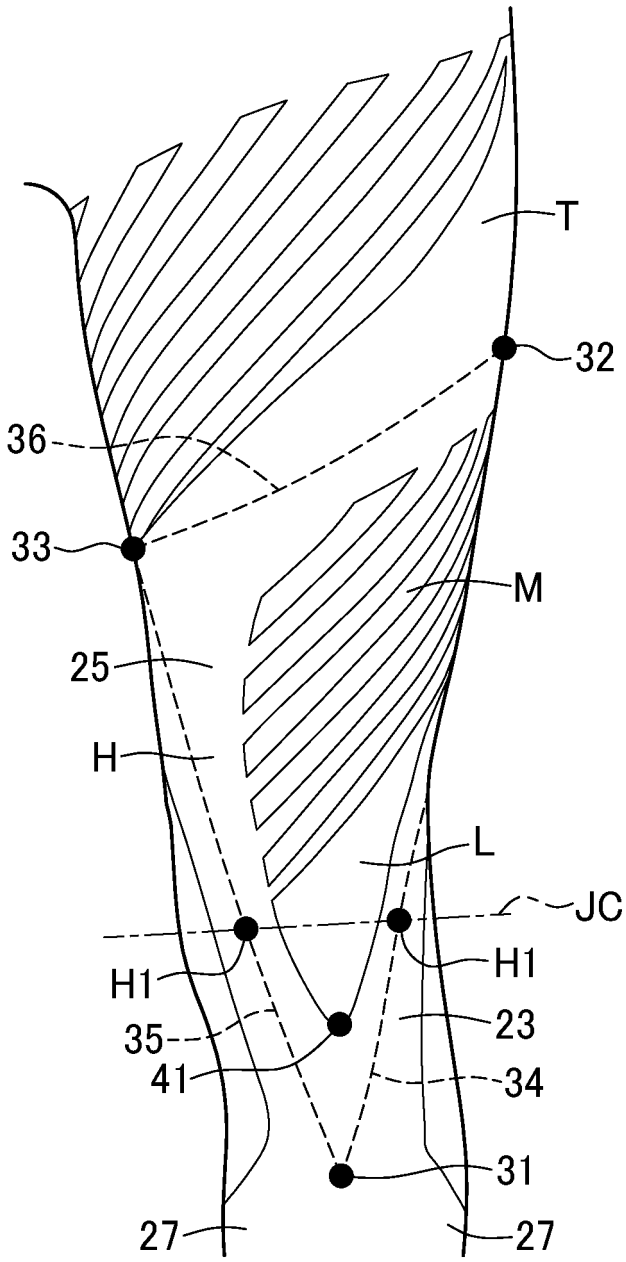


Fig.9

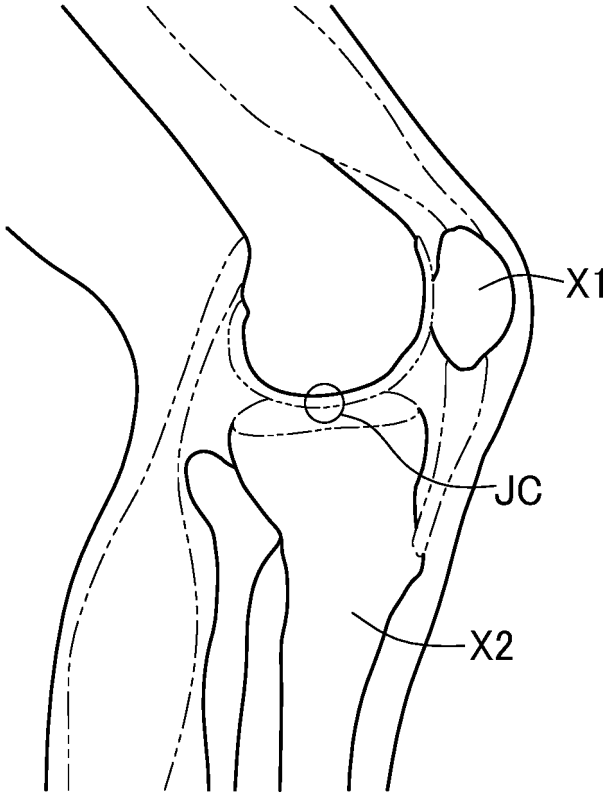


Fig.10

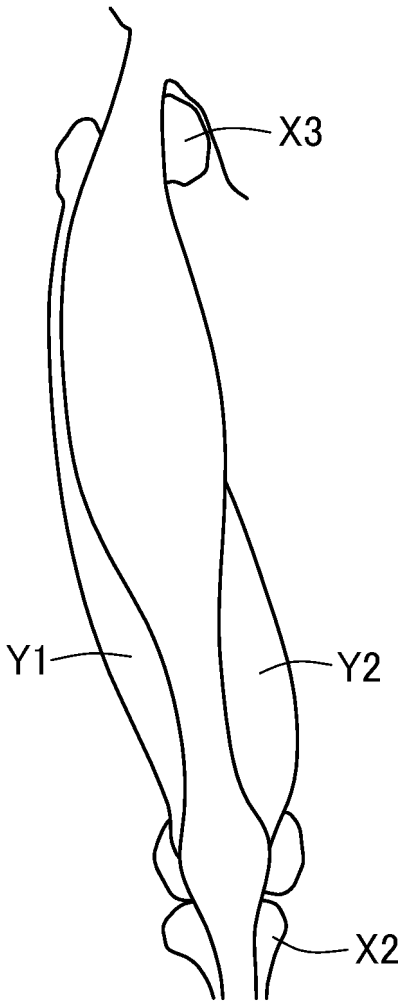


Fig.11

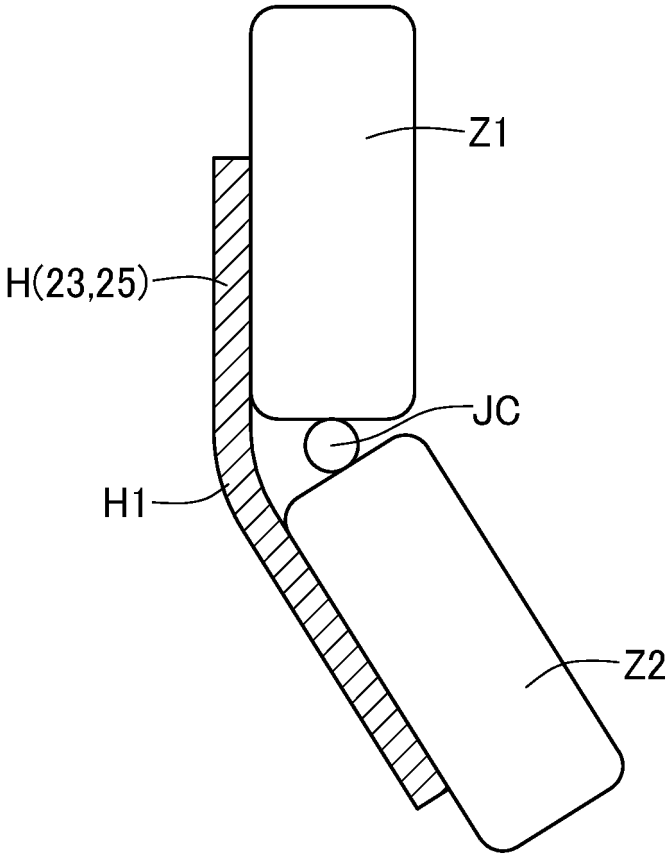


Fig. 12A

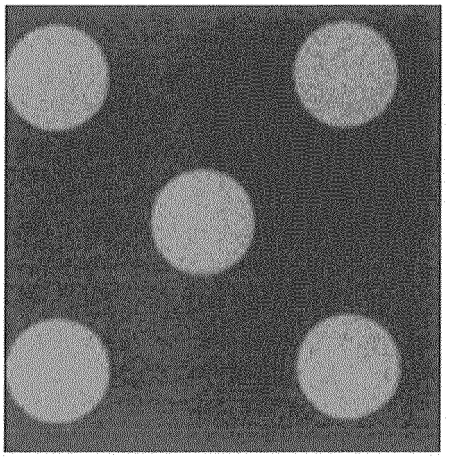


Fig. 12B

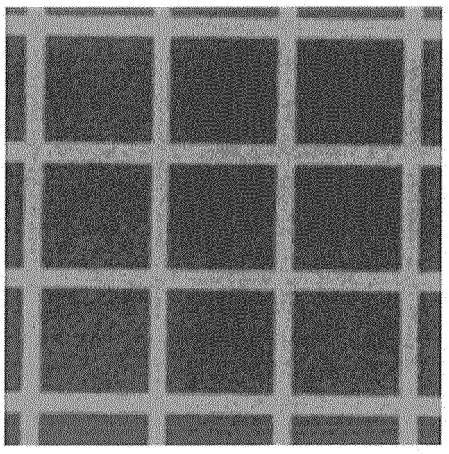


Fig. 12C

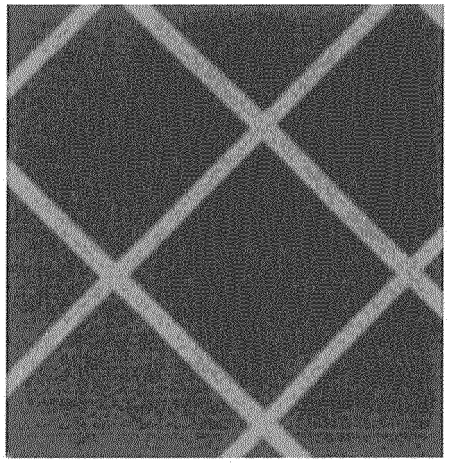


Fig. 12D

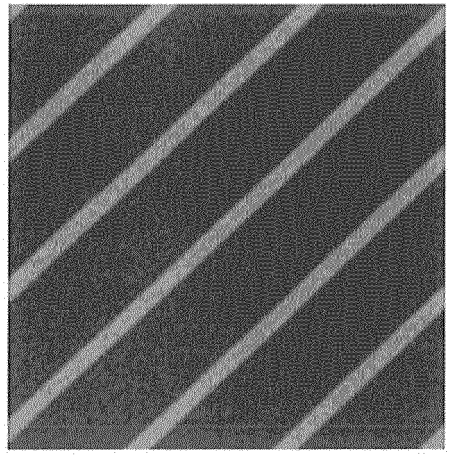


Fig. 12E

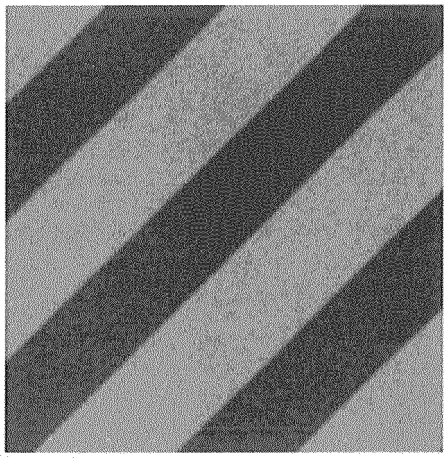


Fig. 12F

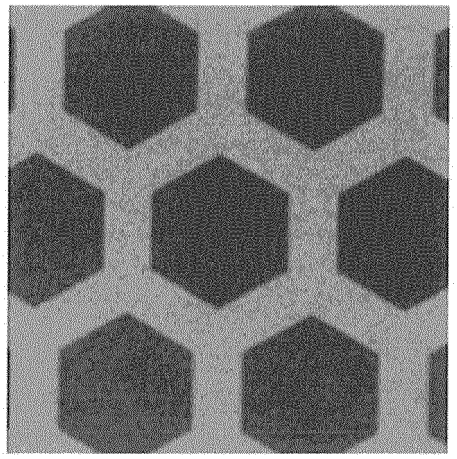


Fig. 12G

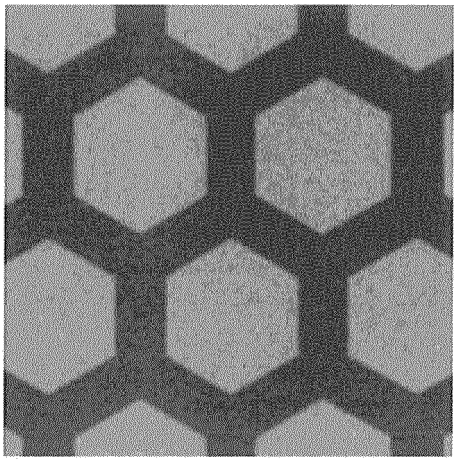


Fig. 13

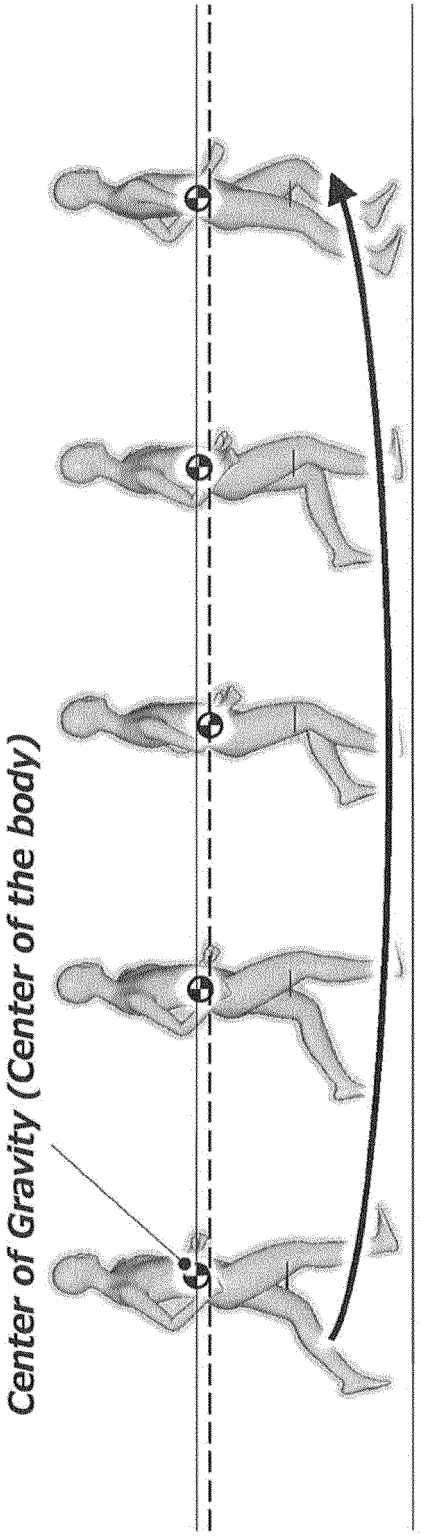


Fig. 14

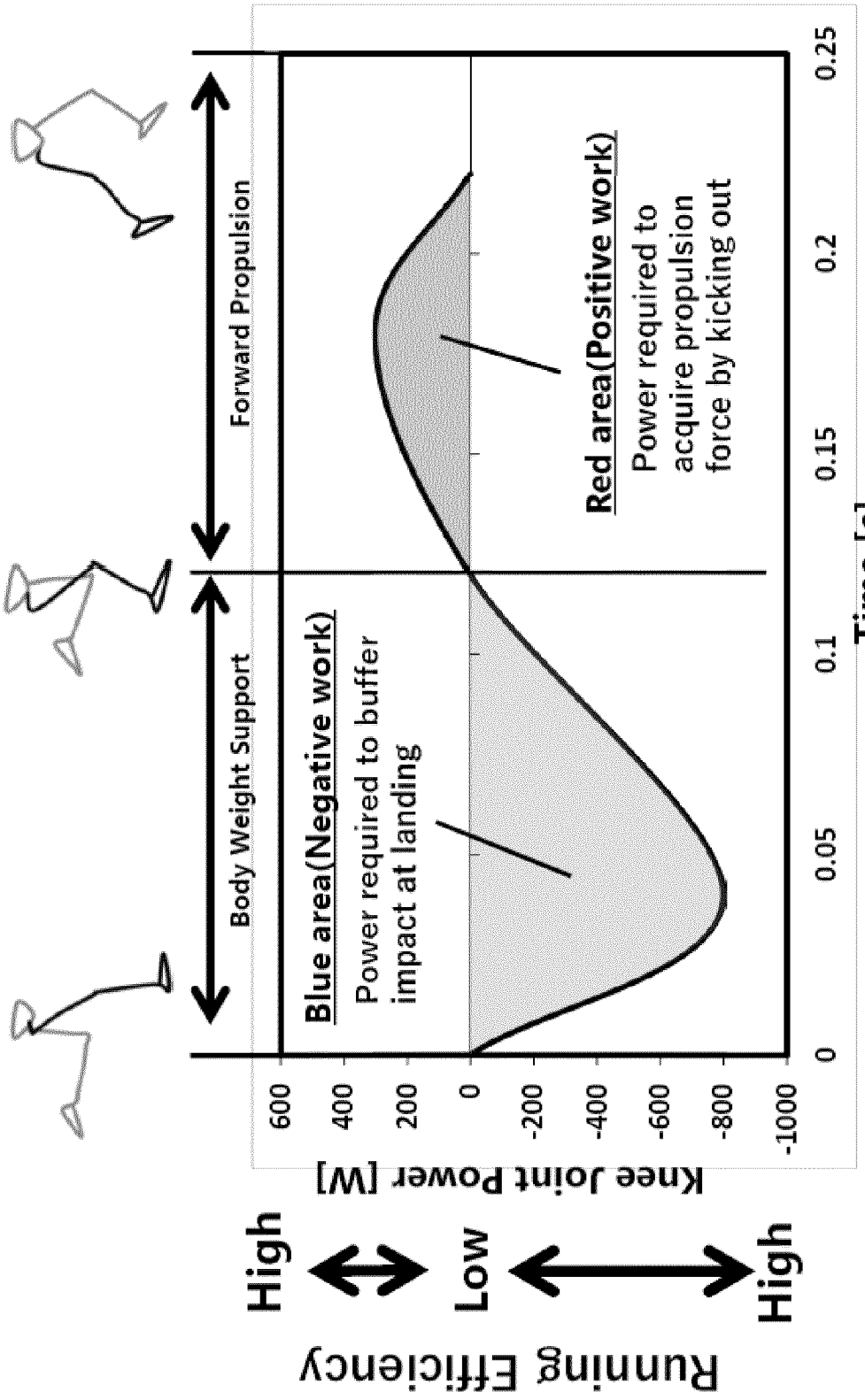

Running Efficiency
High
Low
High
Knee Joint Power [W]
600
400
200
0
-200
-400
-600
-800
-1000
0
0.05
0.1
0.15
0.2
0.25
Time [s]
Body Weight Support
Forward Propulsion
Blue area(Negative work)
Power required to buffer impact at landing
Red area(Positive work)
Power required to acquire propulsion force by kicking out

Fig. 15

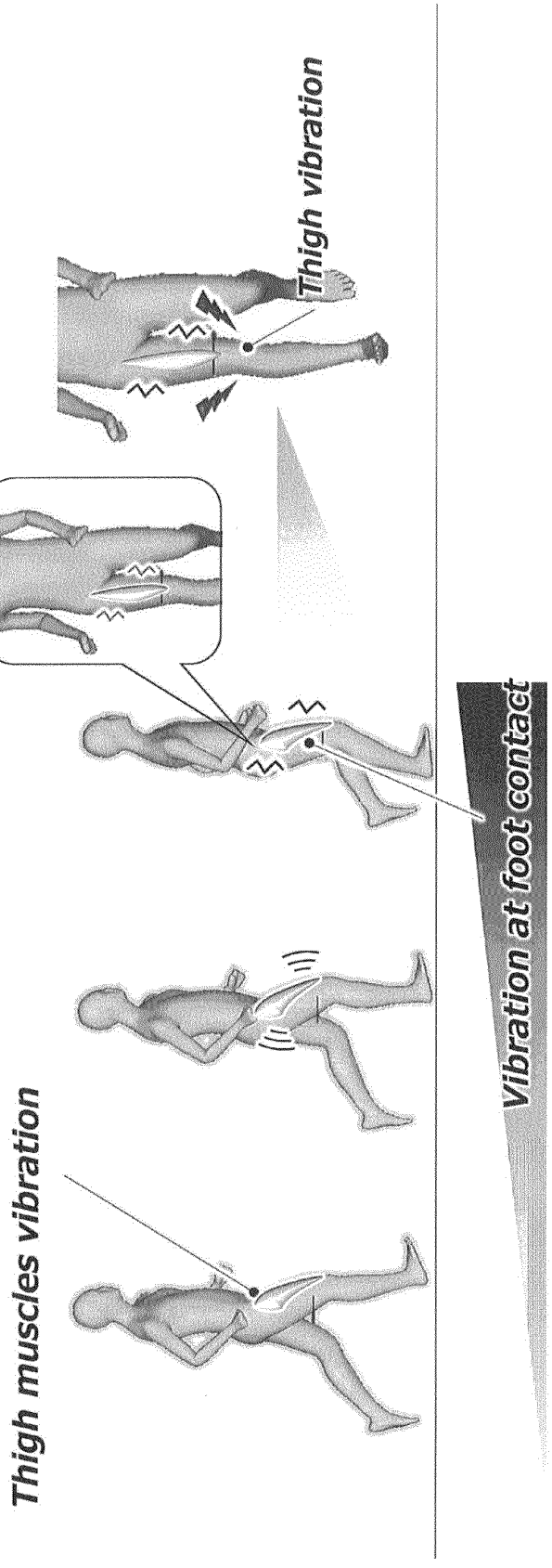
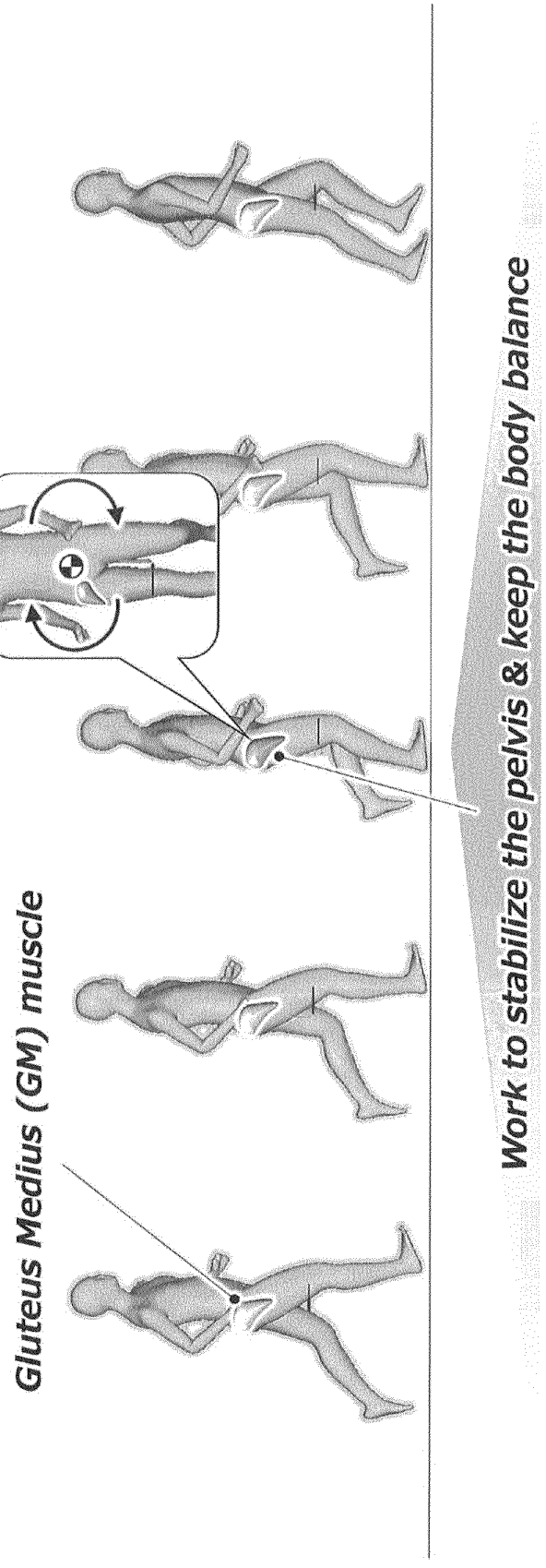

Thigh vibration
Vibration at foot contact
Thigh muscles vibration

Fig. 16


Gluteus Medius (GM) muscle
Work to stabilize the pelvis & keep the body balance

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/000791

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. A41D13/00(2006.01)i, A41B11/14(2006.01)i, A41D13/05(2006.01)i, A41D13/06(2006.01)i
FI: A41D13/00 115, A41B11/14 Z, A41D13/05 143, A41D13/06 105
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)
Int. Cl. A41B9/02, A41B11/14, A41D13/00, A41D13/05, A41D13/06, A61F5/02, A63B71/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

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.
Y A	JP 2018-104870 A (ASICS CORP.) 05 July 2018 (2018-07-05), paragraphs [0036]-[0087], [0094], [0101], [0103], [0105], fig. 1-15, 20	1, 5-10 2-4
Y	JP 2011-32599 A (HAYASHI, Hidesuke) 17 February 2011 (2011-02-17), paragraphs [0037]-[0041], fig. 6, 12	Y1, 5-10
Y	JP 2013-147759 A (OSAKA SANGYO UNIVERSITY) 01 August 2013 (2013-08-01), paragraphs [0001], [0043], [0044], fig. 7	8-9
Y A	JP 2002-220708 A (GRD KK) 09 August 2002 (2002-08-09), paragraph [0014], fig. 1, 2, paragraphs [0017], [0039], fig. 3, 9, 11	10 2-4

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

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16.03.2021	23.03.2021
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/000791

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2016-132839 A (MAKI CREATION KK) 25 July 2016 (2016-07-25)	2
A	JP 2017-115256 A (OKAMOTO CO., LTD.) 29 June 2017 (2017-06-29)	2-4
A	JP 2016-204789 A (MIZUNO INC.) 08 December 2016 (2016-12-08)	1, 10
A	JP 2018-111909 A (MIZUNO INC.) 19 July 2018 (2018-07-19)	1, 10
A	JP 2001-214303 A (WACOAL CORP.) 07 August 2001 (2001-08-07)	1, 10
A	JP 2004-137666 A (WACOAL CORP.) 13 May 2004 (2004-05-13)	1, 10
A	US 2006/0169004 A1 (BELLUYE, Nicolas et al.) 03 August 2006 (2006-08-03)	1, 10

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/000791

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 2018-104870 A	05.07.2018	(Family: none)	
JP 2011-32599 A	17.02.2011	(Family: none)	
JP 2013-147759 A	01.08.2013	(Family: none)	
JP 2002-220708 A	09.08.2002	(Family: none)	
JP 2016-132839 A	25.07.2016	(Family: none)	
JP 2017-115256 A	29.06.2017	(Family: none)	
JP 2016-204789 A	08.12.2016	(Family: none)	
JP 2018-111909 A	19.07.2018	(Family: none)	
JP 2001-214303 A	07.08.2001	(Family: none)	
JP 2004-137666 A	13.05.2004	US 2003/0101506 A1 US 2007/0111868 A1 WO 01/080675 A1 WO 01/080676 A1 EP 1310179 A1 EP 1380219 A2 CA 2482304 A1 CN 1380814 A CN 1839720 A KR 10-0706631 B1	
US 2006/0169004 A1	03.08.2006	EP 1673991 A2 FR 2879901 A1 FR 2879900 A1 CN 1806706 A	

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Patent documents cited in the description

- JP 2018104870 A **[0004] [0006]**