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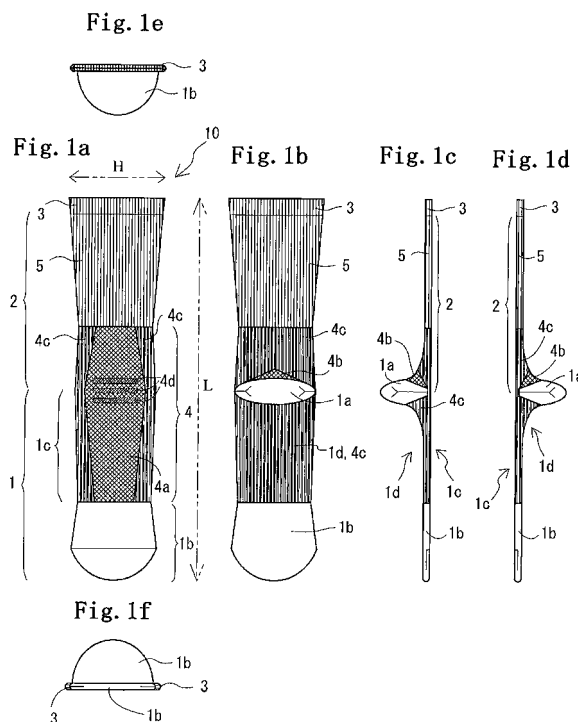
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(54) **FOOT WEAR**

(57) Provided are socks which regulate a tremor of the wearer's ankle, prevent varus sprain and support wearer's stabilized walking to thereby reduce wearer's foot fatigue. A sock (10), which comprises a tiptoe section (1b) that is a tiptoe-shaped part of a cylindrical knitted fabric covering the wearer's tiptoe, a heel section (1a) that is a heel-shaped part of the cylindrical knitted fabric covering the wearer's heel, a body section (2) excluding a flexible section (5), and a foot section (1) excluding the tiptoe section (1b) and the heel section (1a), provided with a figure eight section (4) supporting the wearer's talocrural joint, a holding section (4a) in the figure eight section (4), that is joined at one end to the tiptoe section (1b) and at the other end to the flexible section (5) and extends toward the front side of the cylindrical knitted fabric, and a supporting section (4c) that is a part of the knitted fabric in the figure eight section (4), excluding the holding section (4a), being continuous between the holding section (4a) and the heel section (1a) from the body section (2) to the feet section (1) wherein the stretch resistance, in the lengthwise direction of the cylindrical knitted fabric, of the supporting section (4c) is larger than the stretch resistance, in the length width direction of the cylindrical knitted fabric, of the holding section (4a).



Description

Technical Field

5 **[0001]** The present invention relates to foot wear having a protection, heat-retention, or decorative function on the foot of a wearer, and particularly, to foot wear which enhances the walking performance of a wearer.

Background Art

10 **[0002]** A sock in the related art includes knitted areas which are different in stretch strength from each other, and is provided with a hardly stretchable area knitted in a structure having a high stretch strength, at the area covering a calcaneal tuberosity section when worn, and quasi-inelastic areas which are provided so as to surround the malleolus side and the tiptoe side adjacent to the area and knitted in a structure having a stretch strength lower than the stretch strength of the hardly stretchable area are connected to each other at an upper portion of the talus (refer to PTL 1, for example).

15 **[0003]** Further, a sock or a tubular supporter for lower limb in the related art is a sock or a tubular supporter for lower limb, which covers a foot section, an ankle section, and a calf section, and has a stretchable reinforcing section integrally provided at a section covering from a sole section corresponding to the calcaneal bone and/or the cuboid bone to the side surface of the ankle section, and compression pressure distribution in which compression pressure is gradually reduced from the ankle section to the calf section when worn is provided (refer to PTL 2, for example).

Citation List

Patent Literature

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[0004]

[PTL 1] JP-A-2009-41162

[PTL 2] JP-A-2007-332469

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Summary of Invention

Technical Problem

35 **[0005]** In the sock in the related art, since the area covering the calcaneal tuberosity section is a hardly stretchable area, an impact when a wearer lands by the heel during walking cannot be absorbed by the hardly stretchable area, so that there is a problem in that a burden is applied to the foot of the wearer.

[0006] Further, in the sock or the tubular supporter for lower limb in the related art, a foot arch reinforcing section is provided at a position where the periphery of the foot section is covered so as to be able to press the foot arch. However, 40 this foot arch is the tarsal arch and the foot arch reinforcing section is not provided at a position where the periphery of the foot section is covered so as to be able to press the metatarsal bone arch. That is, the sock or the tubular supporter for lower limb in the related art is for use for improvement in performance in sports or fatigue reduction such as the prevention or reduction of an edema of the lower limb and is not for supporting the formation of the outer longitudinal arch and the medial longitudinal arch which are important for the support of the body weight in an ideal weight shift (three-point walking) in which the centroid of a wearer moves from the heel to the big toe of the wearer.

45 **[0007]** The invention has been made to solve the problems as described above and has an object to provide foot wear which can support stable walking by reducing deflection of the ankle and an impact on the ankle in walking.

Solution to Problem

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[0008] Foot wear according to the invention includes: a tiptoe section which is a tiptoe shaping section corresponding to the tiptoe of a wearer in a tubular knitted fabric; a heel section which is a heel shaping section corresponding to the heel of the wearer in the tubular knitted fabric; a figure eight section which is knitted as a portion of a body section and a foot section excluding the tiptoe section and the heel section and supports the talocrural joint of the wearer; a holding section which is connected at one end to the tiptoe section in the figure eight section and at the other end to the body section excluding the figure eight section and extends on the front face side of the tubular knitted fabric; and a supporting section which is a knitted fabric excluding the holding section in the figure eight section and is continuous between the holding section and the heel section over the body section and the foot section, wherein the stretch resistance of the 55

supporting section in a length direction of the tubular knitted fabric is larger than the stretch resistance of the holding section in the length direction of the tubular knitted fabric.

Advantageous Effects of Invention

[0009] In the foot wear according to the invention, it is possible to prevent varus sprain by suppressing deflection of the ankle of a wearer in walking and also reduce the fatigue of the foot of the wearer by supporting the stable walking of the wearer. Further, in the foot wear according to the invention, it is possible to enhance the walking performance of a wearer by supporting the formation of a medial longitudinal arch and a rearward kicking force by a toe (the big toe) by pushing up the plantar arch of the wearer.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1(a) is a front view showing the schematic configuration of a sock related to the first embodiment, Fig. 1(b) is a back view of the sock shown in Fig. 1(a), Fig. 1(c) is a left side view of the sock shown in Fig. 1(a), Fig. 1(d) is a right side view of the sock shown in Fig. 1(a), Fig. 1(e) is a plan view of the sock shown in Fig. 1(a), and Fig. 1(f) is a bottom view of the sock shown in Fig. 1(a).

[Fig. 2] Fig. 2(a) is a front view of the sock shown in Fig. 1 when viewed from a different direction, Fig. 2(b) is a back view of the sock shown in Fig. 2(a), Fig. 2(c) is a left side view of the sock shown in Fig. 2(a), Fig. 2(d) is a right side view of the sock shown in Fig. 2(a), Fig. 2(e) is a plan view of the sock shown in Fig. 2(a), and Fig. 2(f) is a bottom view of the sock shown in Fig. 2(a).

[Fig. 3] Fig. 3(a) is a right side view showing a wearing state of the sock shown in Figs. 1 and 2, Fig. 3(b) is a front view showing a wearing state of the sock shown in Figs. 1 and 2, and Fig. 3(c) is a perspective view showing a wearing state of the sock shown in Figs. 1 and 2 when viewed from the right rear side.

[Fig. 4] Fig. 4(a) is an explanatory diagram for describing an impact absorption action by the gastrocnemius in an initial stage of a stance phase, Fig. 4(b) is an explanatory diagram for describing the braking of the front side of a lower thigh by the triceps surae muscle in an intermediate stage of the stance phase, and Fig. 4(c) is an explanatory diagram for describing a propulsive force action by the triceps surae muscle in a late stage of the stance phase.

[Fig. 5] Fig. 5 is an explanatory diagram for describing sites for measuring an elongation rate in the sock shown in Fig. 2(d).

[Fig. 6] Fig. 6(a) is a front view showing the schematic configuration of a sock related to the second embodiment, Fig. 6(b) is a back view of the sock shown in Fig. 6(a), Fig. 6(c) is a left side view of the sock shown in Fig. 6(a), Fig. 6(d) is a right side view of the sock shown in Fig. 6(a), Fig. 6(e) is a plan view of the sock shown in Fig. 6(a), and Fig. 6(f) is a bottom view of the sock shown in Fig. 6(a).

[Fig. 7] Fig. 7(a) is a front view of the sock shown in Fig. 6 when viewed from a different direction, Fig. 7(b) is a back view of the sock shown in Fig. 7(a), Fig. 7(c) is a left side view of the sock shown in Fig. 7(a), Fig. 7(d) is a right side view of the sock shown in Fig. 7(a), Fig. 7(e) is a plan view of the sock shown in Fig. 7(a), and Fig. 7(f) is a bottom view of the sock shown in Fig. 7(a).

Description of Embodiments

[0011] Foot wear is classified into Japanese socks, socks, and leggings, and further, the socks can be broadly divided into foot covers, each of which is composed of only a foot section; socks, each of which is composed of three sections, that is, a cuff section, a body section, and a foot section; stockings in which a body section is significantly longer than that of a sock; and tights and panty stockings where a panty section is joined to an upper portion.

That is, foot wear is appropriately provided with a foot section, and a body section, a cuff section, or a panty section, as needed, thereby becoming foot clothing suited for the respective applications and purposes.

[0012] Hereinafter, in this embodiment, a sock 10 which is provided with a foot section 1, a body section 2, and a cuff section 3 will be described taken as an example. However, the invention is not limited to the sock 10 provided with the three sections, and it is acceptable if it is foot wear provided with at least the foot section 1 and the body section 2.

(First Embodiment of the Invention)

[0013] In Figs. 1 to 3, the sock 10 related to this embodiment has a configuration in which portions corresponding to the heel and the tiptoe of a wearer of a tubular knitted fabric which is knitted in circular knitting by a hosiery knitting machine (for example, a "LAMBDA INFINI (number of needles: 144)" knitting machine, manufactured by Murata Man-

ufacturing Company, Ltd.) by using an upper thread, an under thread, and a rubber thread as knitting yarn, are sewn into the form of a sock.

[0014] The sock 10 is broadly divided into three sections, that is, the foot section 1, the body section 2, and the cuff section 3.

The foot section 1 includes a heel section 1a which is a heel shaping section, a tiptoe section 1b which is a tiptoe shaping section, an instep section 1c which is a section located above a line connecting leading ends of the shaping lines (gore lines) of the heel section 1a and the tiptoe section 1b, and a sole section 1d which is a section located below the line connecting the leading ends of the shaping lines (the gore lines) of the heel section 1a and the tiptoe section 1b.

[0015] In addition, the heel section 1a and the tiptoe section 1b related to this embodiment are knitted in a plain stitch that is a knitted fabric in which loops are continuously arranged and the surface and the back are distinguished from each other.

[0016] Further, the shape of the heel section 1a related to this embodiment is a Y heel, and the end of the gore line is branched out, whereby the gore line is inconspicuous with respect to a large heel, and the heel section 1a is made large with respect to a normal heel, so that a holding feeling with respect to the heel of a wearer is enhanced. In this manner, the heel section 1a functions as an anchor that suppresses the position shift of a figure eight section 4 (described later) by enhancing the holding feeling with respect to the heel of a wearer.

[0017] The figure eight section 4 is knitted as a portion (the body section 2 excluding a flexible section 5 which will be described later) of the body section 2 and the foot section 1 excluding the tiptoe section 1b and the heel section 1a, and is configured by performing knitting in such a manner that the elongation thereof in a length direction L of the sock 10 is small compared to the elongation thereof in a circumferential direction H of the sock 10, so as to support the talocrural joint of a wearer.

[0018] The figure eight section 4 has the operation and effects of stabilizing the foot joint of a wearer and suppressing (heel locking) deflection of the ankle of the wearer in walking, thereby being able to prevent varus sprain and also support stable walking of the wearer. Further, the figure eight section 4 allows a wearer to feel an appropriate support feeling by providing elongation in the circumferential direction H of the sock 10.

[0019] Here, as shown in Fig. 4, the function of the triceps surae muscle is principal over a stage from an intermediate stage (Fig. 4(b)) to a late stage (Fig. 4(c)) of a stance phase (a period where a foot is grounded during walking).

[0020] For this reason, the figure eight section 4 performs the dorsiflexion braking of the foot joint by a taping function from the calcaneus to the Achilles' tendon of a wearer, thereby being able to reduce a burden to the lower thigh over a stage from the intermediate stage to the late stage of the stance phase and also perform assistance of takeoff (a propulsive force in walking) from the late stage of the stance phase.

[0021] Further, the figure eight section 4 assists the dorsiflexion braking of the foot joint, thereby being able to lead the centroid of a wearer in a tiptoe direction and assist walking of the wearer. Further, the figure eight section 4 can stabilize the foot joint of a wearer and perform assistance for absorbing an impact from the ground (a floor) in the initial stage (Fig. 4(a)) of the stance phase.

[0022] In particular, the figure eight section 4 is provided with a holding section 4a which is connected at one end to the tiptoe section 1b and at the other end to the body section 2 (the flexible section 5 which will be described later) excluding the figure eight section 4 and extends to the front face side of the sock 10. The holding section 4a is knitted such that the stretch resistance thereof in the length direction L of the sock 10 is smaller than the stretch resistance of the sole section 1d in the length direction L of the sock 10.

[0023] Further, the figure eight section 4 is provided with a first buffer section 4b which is knitted at the boundary between the body section 2 and the heel section 1a in the sock 10. The first buffer section 4b is knitted such that the stretch resistance thereof in the length direction L of the sock 10 is larger than the stretch resistance of the heel section 1a in the length direction L of the sock 10 and smaller than the stretch resistance of a supporting section 4c (another knitted fabric of the figure eight section 4 adjacent to the first buffer section 4b) in the length direction L of the sock 10.

[0024] In addition, as shown in Figs. 1 to 3, the supporting section 4c related to this embodiment is a knitted fabric excluding the holding section 4a in the figure eight section 4 and is a knitted fabric that is continuous between the holding section 4a and the heel section 1a over the body section 2 and the foot section 1 and is surrounded by the heel section 1a, the tiptoe section 1b, the holding section 4a, the first buffer section 4b, and the flexible section 5 (described later).

[0025] Further, in this embodiment, each of the holding section 4a and the first buffer section 4b is set to be made of a knitted fabric in which a moss stitch and an insert stitch are used in combination (hereinafter referred to as a moss stitch-insert stitch knitted fabric), and the supporting section 4c is set to be made of a knitted fabric in which a rib stitch, a plating stitch, and an insert stitch are used in combination (hereinafter referred to as a rib stitch-plating stitch-insert stitch knitted fabric).

[0026] Here, a moss stitch knitted fabric is a knitted fabric where a plain stitch and a tuck (a structure in which no loop protrudes over a certain course and plural loops protrude over the subsequent course) appear alternately or for every few courses in the course direction and the wale direction. For this reason, in the holding section 4a and the first buffer section 4b, the plain stitch and the tuck are used in combination, whereby it is possible to make protuberances or

openwork stitches on the surface of a knitted fabric and a mesh pattern such as a moss appears.

[0027] In addition, the holding section 4a and the first buffer section 4b (the moss stitch-insert stitch knitted fabrics) related to this embodiment are knitted fabrics, each of which is made in an insert stitch in which no loop is made in a moss stitch knitted fabric and a rubber thread (a power rubber) is knitted therein.

[0028] Further, a rib stitch knitted fabric is a 3x1 knitted fabric in which a face stitch and a back stitch are arranged for every three wales in this embodiment in loops in which a wale of the face stitch and a wale of the back stitch are alternately arranged in a longitudinal direction.

[0029] Further, in a rib stitch-plating stitch knitted fabric, expansion and contraction of the supporting section 4c in the length direction L of the sock 10 is moderately suppressed by additionally feeding another knitting yarn (for example, woolly nylon yarn) in addition to the ground knitting yarn of the rib stitch. That is, in the rib stitch-plating stitch knitted fabric, knitting is performed such that elongation in the length direction L of the sock 10 is small compared to elongation in the circumferential direction H. Further, in the rib stitch-plating stitch knitted fabric, another knitting yarn is cut at the boundary between the supporting section 4c and another knitted fabric (cut-boss).

[0030] In addition, the supporting section 4c (the rib stitch-plating stitch-insert stitch knitted fabric) related to this embodiment is a knitted fabric which is made in an insert stitch in which no loop is made in a rib stitch-plating stitch knitted fabric and a rubber thread (a power rubber) is knitted therein, and is knitted such that the stretch resistances thereof in the length direction L and the circumferential direction H of the sock 10 are small with respect to the holding section 4a and the first buffer section 4b. In particular, in the supporting section 4c, ribs that can become ridges in the wale direction in the rib stitch are formed to be continuous over the body section 2 and the foot section 1 between the holding section 4a and the heel section 1a.

[0031] Therefore, by making the sole section 1d (the supporting section 4c) be the rib stitch-plating stitch-insert stitch knitted fabric and making the instep section 1c (the holding section 4a) be the moss stitch-insert stitch knitted fabric, it is possible to make the stretch resistance of the sole section 1d (the supporting section 4c) in the length direction L of the sock 10 large with respect to the instep section 1c (the holding section 4a).

[0032] That is, when tension in a case where certain elongation has been imparted from a state where elongation is not imparted to a material is set to be F, the tension of the sole section 1d in the length direction L of the sock 10 is set to be F_{L1d} , and the tension of the instep section 1c in the length direction L of the sock 10 is set to be F_{L1c} , the sole section 1d has such a magnitude relation of $F_{L1d} > F_{L1c}$ that it has a strong tightening force in the length direction L of the sock 10, compared to the instep section 1c.

[0033] In this manner, the sole section 1d eliminates elongation in the length direction L of the sock 10, thereby supporting the formation of a medial longitudinal arch (an arch including the calcaneus, the talus, the navicular bone, the first cuneiform bone, the first metatarsal bone, and the phalanx as component bones) of a wearer and pushing the plantar arch of the wearer up, and also supports kicking by the toe (the big toe) at the time of rising, thereby being able to kick the ground with a sufficient force, so that it becomes easy for the wearer to walk.

[0034] Further, by making the first buffer section 4b be the moss stitch-insert stitch knitted fabric and making the supporting section 4c be the rib stitch-plating stitch-insert stitch knitted fabric, it is possible to make the stretch resistance of the first buffer section 4b in the length direction L of the sock 10 small with respect to the supporting section 4c.

[0035] That is, when the tension of the first buffer section 4b in the length direction L of the sock 10 is set to be F_{L4b} and the tension of the supporting section 4c in the length direction L of the sock 10 is set to be F_{L4c} , the first buffer section 4b has such a magnitude relation of $F_{L4c} > F_{L4b}$ that it has a weak tightening force in the length direction L of the sock 10, compared to the supporting section 4c.

[0036] Further, by making the first buffer section 4b be the moss stitch-insert stitch knitted fabric and making the heel section 1a be a plain stitch knitted fabric, it is possible to make the stretch resistance of the first buffer section 4b in the length direction L of the sock 10 large with respect to the heel section 1a.

[0037] That is, when the tension of the heel section 1a in the length direction L of the sock 10 is set to be F_{L1a} , the first buffer section 4b has such a magnitude relation of $F_{L4b} > F_{L1a}$ that it has a strong tightening force in the length direction L of the sock 10, compared to the heel section 1a.

[0038] In this manner, the first buffer section 4b is a section corresponding to the Achilles' tendon of a wearer, becomes a knitted fabric that a tightening force by the supporting section 4c on the back side of the body section 2 does not reach, and suppresses tightening on the Achilles' tendon of the wearer while maintaining a tightening force on the ankle by the figure eight section 4, thereby allowing pain to be relieved.

[0039] Further, the figure eight section 4 has a wrinkle suppressing section 4d extending in a circumferential direction at a bent portion on the front face side of the sock 10. The wrinkle suppressing section 4d is knitted such that the stretch resistance thereof in the length direction L of the sock 10 is smaller than the stretch resistance of the holding section 4a in the length direction L of the sock 10.

[0040] Further, in this embodiment, the wrinkle suppressing section 4d is made of a knitted fabric in which a mesh stitch and an insert stitch are used in combination (hereinafter referred to as a mesh stitch-insert stitch knitted fabric). Here, a mesh stitch knitted fabric is a knitted fabric which has a knitting structure having good air permeability and in

which a certain loop is not made temporarily when knitting a fabric and loops are made together when knitting the next course and which stretches well with knitting in the form of a mesh.

[0041] Further, the wrinkle suppressing section 4d (a mesh stitch-insert stitch knitted fabric) related to this embodiment is a knitted fabric which is made in an insert stitch in which no loop is made in a mesh stitch knitted fabric and a rubber thread (a power rubber) is knitted therein.

[0042] In addition, since the figure eight section 4 is a knitted fabric which is composed of the rib stitch-plating stitch-insert stitch knitted fabric and the moss stitch-insert stitch knitted fabric, the knitted fabric becomes thick compared to normal socks, and the figure eight section 4 is not smoothly bent at the bent portion (the front face side of the ankle of a wearer) of the sock 10, thereby causing wrinkles. In order to prevent occurrence of the wrinkles, originally, it is good to make the knitted fabric of the entire bent portion of the sock 10 thin. However, if the knitted fabric of the entire bent portion of the sock 10 is made thin, it does not become possible to maintain the tightening force on the ankle by the figure eight section 4.

[0043] For this reason, by forming the wrinkle suppressing section 4d by a knitted fabric extending in the circumferential direction H of the sock 10 at a portion of the holding section 4a, it is possible to avoid occurrence of the wrinkles in the bent portion of the sock 10 while maintaining the tightening force on the ankle by the figure eight section 4. In addition, in Fig. 1, a case where three wrinkle suppressing sections 4d are arranged in parallel in the length direction L of the sock 10 is shown. However, as long as occurrence of wrinkles in the bent portion of the sock 10 can be prevented, the number thereof is not limited thereto.

[0044] The flexible section 5 is a knitted fabric surrounded by the cuff section 3 and the figure eight section 4 in the body section 2 and is formed of an amerib stitch knitted fabric (described later), along with the cuff section 3. The amerib stitch knitted fabric is a flexible knitted fabric and allows an insertion opening by the body section 2 and the cuff section 3 to spread with respect to the tiptoe of a wearer, so that it is possible to make a wearer to easily wear the sock 10.

[0045] Here, a float stitch knitted fabric is a knitted fabric in which a specific needle is put at an inoperative position during the knitting of a knitted fabric, so that knitting yarn is not fed to the needle and the previous loop is maintained, whereby knitting yarn of this portion floats straight on the back of the knitted fabric. In contrast to this, the amerib stitch knitted fabric is a float stitch knitted fabric in which a rubber thread knitted in a plain stitch knitted fabric is knitted to skip one course for every three courses.

[0046] Therefore, by making the flexible section 5 be the amerib stitch knitted fabric, making the holding section 4a be the moss stitch-insert stitch knitted fabric, and making the supporting section 4c be the rib stitch-plating stitch-insert stitch knitted fabric, it is possible to make the stretch resistance of the flexible section 5 in the circumferential direction H of the sock 10 small with respect to the holding section 4a and the supporting section 4c.

[0047] That is, when the tension of the flexible section 5 in the circumferential direction H of the sock 10 is set to be F_{H5} , the tension of the holding section 4a in the circumferential direction H of the sock 10 is set to be F_{H4a} , and the tension of the supporting section 4c in the circumferential direction H of the sock 10 is set to be F_{H4c} , the flexible section 5 has such a magnitude relation of $F_{H4c} > F_{H4a} > F_{H5}$ that it has a weak tightening force in the circumferential direction H of the sock 10, compared to the holding section 4a and the supporting section 4c.

[0048] In addition, in the sock 10 related to this embodiment, due to the knitted fabric of each site described above, the stretch resistance of the supporting section 4c in the length direction L of the sock 10 is larger than the stretch resistance of the holding section 4a in the length direction L of the sock 10. Further, the stretch resistance of the holding section 4a in the length direction L of the sock 10 is approximately equal to the stretch resistance of the first buffer section 4b in the length direction L of the sock 10. Further, the stretch resistances of the holding section 4a and the first buffer section 4b in the length direction L of the sock 10 are larger than the stretch resistance of the cuff section 3 in the length direction L of the sock 10. Further, the stretch resistance of the cuff section 3 in the length direction L of the sock 10 is larger than the stretch resistance of the flexible section 5 in the length direction L of the sock 10. Further, the stretch resistance of the flexible section 5 in the length direction L of the sock 10 is larger than the stretch resistance of the wrinkle suppressing section 4d in the length direction L of the sock 10. Further, the stretch resistance of the wrinkle suppressing section 4d in the length direction L of the sock 10 is larger than the stretch resistance of the tiptoe section 1b in the length direction L of the sock 10. Further, the stretch resistance of the tiptoe section 1b in the length direction L of the sock 10 is approximately equal to the stretch resistance of the heel section 1a in the length direction L of the sock 10.

[0049] Therefore, the sock 10 related to this embodiment satisfies a magnitude relation shown in the following expression (1) in the tension F in the length direction L of the sock 10. However, in the following expression (1), F_{L4a} is the tension of the holding section 4a in the length direction L of the sock 10, F_{L3} is the tension of the cuff section 3 in the length direction L of the sock 10, F_{L5} is the tension of the flexible section 5 in the length direction L of the sock 10, F_{L4d} is the tension of the wrinkle suppressing section 4d in the length direction L of the sock 10, and F_{L1b} is the tension of the tiptoe section 1b in the length direction L of the sock 10.

[0050]

[Expression 1]

$$F_{L4c} (F_{L1d}) > F_{L4a} (F_{L1c}) \approx F_{L4b} > F_{L3} > F_{L5} > F_{L4d} > F_{L1b} \approx F_{L4a} \quad \dots \quad (1)$$

[0051] In addition, since the tiptoe section 1b related to this embodiment has a plain stitch and does not have a strong tightening force as in the figure eight section 4, the gaps between the toes of a wearer can be fully opened, so that the wearer can be held on the ground by the toes. In particular, in the tiptoe section 1b related to this embodiment, a tip is not divided. However, the tiptoe section 1b may also be made to have a function as an anchor for preventing the twist of the sock 10 caused by walking or a position shift of the supporting section 4c with respect to the plantar arch of a wearer by dividing the tiptoe section 1b into two sections such that the big toe of the foot of a wearer and four toes other than the big toe can be separately received in the tiptoe section 1b.

[0052] Further, the tiptoe section 1b related to this embodiment may also be configured such that the tiptoe section 1b of the foot section 1 is divided into two or more sections, may also be configured to be divided into a section for one toe without being limited to the big toe and a section for the other four toes, and may also be configured to be divided into a section for a plurality of toes and a section for the other plurality of toes.

[0053] In addition, in this embodiment, as the ground knitting yarn which is used in the plain stitch, the rib stitch, the moss stitch, and the mesh stitch, an upper thread that is a cotton blended thread in which 50% cotton and 50% ester are blended with each other and which has a thickness of 32 deniers and that is composed of one piece of twisted yarn and two pieces of knitting yarn, and an under thread that is covering yarn (FTY: filament twisted yarn) in which nylon winding yarn having a thickness of 70 deniers is wound around polyurethane core yarn having a thickness of 30 deniers are used. However, the threads are not limited to these materials.

[0054] For example, as the upper thread, it is preferable to select a natural fiber such as cotton, wool (cashmere, lamb, Angora, or the like), silk, or hemp, a chemical fiber such as acrylic, a material having a sweat absorbing, quick-drying, or body temperature adjusting function, or the like according to the cost of the sock 10 or the needs of a wearer. Further, as the under thread, it is preferable to select an ester, DCY (double covered yarn), or an antibacterial, deodorant, or odor eliminating material according to the cost of the sock 10 or the needs of a wearer.

[0055] Further, the woolly nylon yarn (pattern yarn) in the rib stitch-plating stitch-insert stitch knitted fabric (the supporting section 4c) has a thickness of 100 deniers and is composed of two pieces of twisted yarn and two pieces of knitting yarn.

[0056] Further, the rubber thread in each of the moss stitch-insert stitch knitted fabric (the holding section 4a and the first buffer section 4b), the rib stitch-plating stitch-insert stitch knitted fabric (the supporting section 4c), the mesh stitch-insert stitch knitted fabric (the wrinkle suppressing section 4d), and the amerib stitch knitted fabric (the flexible section 5 and the cuff section 3) is covering yarn (for example, "ST6800" manufactured by OPELONTEX CO., LTD.) in which polyester winding yarn having a thickness of 75 deniers is wound around polyurethane core yarn having a thickness of 360 deniers.

[0057] Here, the results of measurement of an elongation rate (the percentage of a difference between a length when elongated (an elongated dimension) and the original length (the original dimension) to the original length) measured with respect to the respective sites (refer to Fig. 5) of the sock 10 made according to the above-described knitting yarn and knitted fabrics by using a stretch tester (tensile load: 4 kg) are shown in Table 1 below.

[0058]

[Table 1]

Measured site		Original dimension [cm]	Elongated dimension [cm]	Elongation rate [%]
Circled number 1	Circumferential direction H of the cuff section 3	10.5	28.5	171.4
Circled number 2	Circumferential direction H of the flexible section 5	10.0	27.0	170.0

(continued)

Measured site		Original dimension [cm]	Elongated dimension [cm]	Elongation rate [%]
Circled number 3	Circumferential direction H over the holding section 4a and the supporting section 4c in the body section 2	8.0	17.0	112.5
Circled number 4	Circumferential direction H over the holding section 4a and the supporting section 4c in the foot section 1	8.0	17.0	112.5
Circled number 5	Length direction L of the holding section 4a	7.8	16.0	105.1
Circled number 6	Length direction L of the supporting section 4c	7.8	13.0	66.7

[0059] In addition, since the elongation rate in Table 1 represents the fact that the larger the value, the more the knitted fabric is easily elongated and the tension F in the above-described expression (1) represents the fact that the larger the value, the more difficult it is for the knitted fabric to be elongated (the larger the tightening force), an inequality sign showing the magnitude relation of the elongation rate and an inequality sign showing the magnitude relation of the tension F become opposite to each other.

[0060] Further, in the sock 10 related to this embodiment, the knitted fabric of the figure eight section 4 is configured by performing knitting such that elongation in the length direction L of the sock 10 becomes small compared to elongation in the circumferential direction H of the sock 10 by changing the number of loops according to the rib stitch or the moss stitch and reinforcing the knitted fabric according to the plating stitch and/or the insert stitch. In contrast to this, by configuring the knitted fabric of the figure eight section 4 by performing knitting by yarn impregnated with resin of a kind such as a polyester type, a polyamide type, a polyurethane type, a polyethylene type (high density, low density), or an ethylene vinyl acetate type, it is possible to reduce the elongation rate in the length direction L of the sock 10 without using a knitting structure by the rib stitch, the moss stitch, the plating stitch, or the insert stitch, and it is possible to obtain the same operation and effects.

[0061] Further, also by sewing a tape made of a narrow cloth or the like for preventing elongation to the knitted fabric of the figure eight section 4, or by sticking an adhesive tape, in which an adhesive is applied onto a tape made of cellophane, vinyl, or the like, to the knitted fabric of the figure eight section 4, it is possible to reduce the elongation rate in the length direction L of the sock 10 without using a knitting structure by the rib stitch, the moss stitch, the plating stitch, or the insert stitch.

[0062] Further, also by applying liquid resin to the knitted fabric of the figure eight section 4 and then bringing the resin into contact with air, thereby oxidizing and fixing the resin, or by attaching a thin film-shaped resin to the knitted fabric of the figure eight section 4, or by spraying liquid resin onto the knitted fabric of the figure eight section 4 by a sprayer or the like and then bringing the resin into contact with air, thereby oxidizing and fixing the resin, it is possible to reduce the elongation rate in the length direction L of the sock 10 without using a knitting structure by the rib stitch, the moss stitch, the plating stitch, or the insert stitch.

[0063] Further, the knitted fabric of the figure eight section 4 may also be an adhesive interlining cloth which is subjected to resin processing using an adhesive. In this case, the resin can be fixed to the knitted fabric by applying adhesive resin made of resin of a kind such as a polyester type, a polyamide type, a polyurethane type, a polyethylene type (high density, low density), or an ethylene vinyl acetate type to the knitted fabric by a processing method such as dot processing, powder processing, cobweb processing, or film processing and performing heating and pressurization treatments by a flat press, a roller-type press, or the like.

[0064] As described above, in the sock 10 related to this embodiment, by the figure eight section 4, deflection of the ankle of a wearer in walking is suppressed, varus sprain is prevented, and the stable walking of a wearer is also supported, so that the fatigue of the foot of the wearer can be reduced.

[0065] Further, in the sock 10 related to this embodiment, the sole section 1d is provided with the supporting section 4c, whereby a wearer naturally performs three-point walking and can really feel that the foot comes into contact with the ground in the order from the heel to the outer portion of the foot and from the little toe to the big toe, so that the walking posture of the wearer is improved. Accordingly, the muscle of the back of a wearer is stretched and knee pain or waist pain is also relieved.

[0066] Further, in the sock 10 related to this embodiment, the sock 10 is provided with the first buffer section 4b which is knitted at the boundary between the body section 2 and the heel section 1a, whereby it is possible to relieve pain by suppressing tightening on the Achilles' tendon of a wearer while maintaining the tightening force on the ankle by the figure eight section 4.

[0067] In addition, in the sock 10 related to this embodiment, the holding section 4a is provided with the wrinkle suppressing section 4d, whereby it is possible to prevent occurrence of wrinkles in the bent portion, thereby preventing occurrence of pain due to a pinch or the like of the skin of a wearer by wrinkles.

[0068] In particular, in the sock 10 related to this embodiment, the operation and effects are obtained which can contribute to impact absorption in the initial stage of the stance phase and a propulsive force over a stage from the intermediate stage to the late stage of the stance phase and also allows the stability of the foot joint to be obtained by the left and right (varus and valgus) braking. Further, in the sock 10 related to this embodiment, the operation and effects are obtained in which the sock 10 assists the foot joint of a wearer, whereby Achilles' tendon pain, the fatigue and pain of the triceps surae muscle, and the pain of the outside (the ligament) of the foot joint can be relieved.

(Second Embodiment of the Invention)

[0069] Fig. 6(a) is a front view showing the schematic configuration of a sock related to the second embodiment, Fig. 6(b) is a back view of the sock shown in Fig. 6(a), Fig. 6(c) is a left side view of the sock shown in Fig. 6(a), Fig. 6(d) is a right side view of the sock shown in Fig. 6(a), Fig. 6(e) is a plan view of the sock shown in Fig. 6(a), and Fig. 6(f) is a bottom view of the sock shown in Fig. 6(a). Fig. 7(a) is a front view of the sock shown in Fig. 6 when viewed from a different direction, Fig. 7(b) is a back view of the sock shown in Fig. 7(a), Fig. 7(c) is a left side view of the sock shown in Fig. 7(a), Fig. 7(d) is a right side view of the sock shown in Fig. 7(a), Fig. 7(e) is a plan view of the sock shown in Fig. 7(a), and Fig. 7(f) is a bottom view of the sock shown in Fig. 7(a). In Figs. 6 and 7, the same symbols as those in Figs. 1 to 3 denote the same or equivalent sections, and explanation thereof is omitted.

[0070] The holding section 4a is provided with an approximately trapezoidal second buffer section 4e which is knitted in different knitting on the tiptoe section 1b side of the sock 10 such that the stretch resistance in the length direction L of the sock 10 in an area knitted in the different knitting is smaller than the stretch resistance of the other area in the holding section 4a.

[0071] Further, the holding section 4a is provided with an approximately trapezoidal third buffer section 4f which is knitted in different knitting on the cuff section 3 (the flexible section 5) side of the sock 10 such that the stretch resistance in the length direction L of the sock 10 in an area knitted in the different knitting is smaller than the stretch resistance of the other area in the holding section 4a.

[0072] In addition, in this embodiment, the other area in the holding section 4a is the moss stitch-insert stitch knitted fabric excluding the wrinkle suppressing section 4d, the second buffer section 4e, and the third buffer section 4f. Further, in this embodiment, the second buffer section 4e and the third buffer section 4f are set to be mesh stitch knitted fabrics.

[0073] In this manner, by making the holding section 4a be the moss stitch-insert stitch knitted fabric, making the supporting section 4c be the rib stitch-plating stitch-insert stitch knitted fabric, and making the second buffer section 4e and the third buffer section 4f be the mesh stitch knitted fabrics, it is possible to make the stretch resistances of the second buffer section 4e and the third buffer section 4f in the length direction L of the sock 10 small with respect to the holding section 4a and the supporting section 4c.

[0074] That is, when the tension of the second buffer section 4e in the length direction L of the sock 10 is set to be F_{L4e} and the tension of the third buffer section 4f in the length direction L of the sock 10 is set to be F_{L4f} , the holding section 4a and the supporting section 4c have such a magnitude relation of $F_{L4c} > F_{L4a} > F_{L4e} \approx F_{L4f}$ that they have a strong tightening force in the length direction L of the sock 10, compared to the second buffer section 4e and the third buffer section 4f.

[0075] In addition, the second embodiment is different from the first embodiment only in that the second buffer section 4e and the third buffer section 4f are newly disposed at the holding section 4a, and the same operation and effects as those in the first embodiment except the operation and effects by the second buffer section 4e and the third buffer section 4f, which will be described later, are obtained.

[0076] The second buffer section 4e weakens a tightening force on the tiptoe section 1b side on the holding section 4a in the instep section 1c, thereby making a force of pushing the plantar arch of a wearer up by the sole section 1d act obliquely upward on the tiptoe section 1b side, rather than vertically upward with respect to the sole section 1d, and suppresses landing of the tiptoe of the wearer at an acute angle with respect to the ground, thereby being able to prevent

a misstep during walking of the wearer.

[0077] Further, the third buffer section 4f weakens a tightening force on the holding section 4a on the front face side of the body section 2 and makes the holding section 4a and the supporting section 4c not go around the tubular knitted fabric on the flexible section 5 side, thereby suppressing tightening on the Achilles' tendon of a wearer while maintaining a tightening force on the ankle by the figure eight section 4, so that it is possible to relieve pain.

[0078] Further, the second buffer section 4e and the third buffer section 4f have the operation and effects of emphasizing contrast between the strength and the weakness of the knitted fabrics of the holding section 4a and the supporting section 4c which are adjacent to the second buffer section 4e and the third buffer section 4f, thereby making a wearer further realize a taping effect by the figure eight section 4.

Reference Signs List

[0079]

- 1: foot section
- 1a: heel section
- 1b: tiptoe section
- 1c: instep section
- 1d: sole section
- 2: body section
- 3: cuff section
- 4: figure eight section
- 4a: holding section
- 4b: first buffer section
- 4c: supporting section
- 4d: wrinkle suppressing section
- 4e: second buffer section
- 4f: third buffer section
- 5: flexible section
- 10: sock

Claims

- 1.** Foot wear which is made of a tubular knitted fabric knitted in circular knitting and includes at least a body section and a foot section, the foot wear comprising:

a tiptoe section which is a tiptoe shaping section corresponding to the tiptoe of a wearer in the tubular knitted fabric;
 a heel section which is a heel shaping section corresponding to the heel of the wearer in the tubular knitted fabric;
 a figure eight section which is knitted as a portion of the body section and the foot section excluding the tiptoe section and the heel section and supports the talocrural joint of the wearer;
 a holding section which is connected at one end to the tiptoe section in the figure eight section and at the other end to the body section excluding the figure eight section and extends on the front face side of the tubular knitted fabric; and
 a supporting section which is a knitted fabric excluding the holding section in the figure eight section and is continuous between the holding section and the heel section over the body section and the foot section, wherein the stretch resistance of the supporting section in a length direction of the tubular knitted fabric is larger than the stretch resistance of the holding section in the length direction of the tubular knitted fabric.

- 2.** The foot wear according to Claim 1, further comprising:

a first buffer section which is knitted at a boundary between the body section and the heel section in the tubular knitted fabric,
 wherein the stretch resistance of the first buffer section in the length direction of the tubular knitted fabric is larger than the stretch resistance of the heel section in the length direction of the tubular knitted fabric and smaller than the stretch resistance of the supporting section in the length direction of the tubular knitted fabric.

- 3.** The foot wear according to Claim 1 or 2, further comprising:

a second buffer section which is formed by making the holding section be knitted in different knitting on the
 tiptoe section side such that the stretch resistance in the length direction of the tubular knitted fabric in an area
 knitted in the different knitting is smaller than the stretch resistance of the other area in the holding section; and
 a third buffer section which is formed by making the holding section be knitted in different knitting on a cuff
 section side such that the stretch resistance in the length direction of the tubular knitted fabric in an area knitted
 in the different knitting is smaller than the stretch resistance of the other area in the body section,
 wherein the second buffer section and the third buffer section are mesh stitch knitted fabrics.

4. The foot wear according to any one of Claims 1 to 3, further comprising:

a wrinkle suppressing section which extends in a circumferential direction at a bent portion on the front face
 side of the tubular knitted fabric,
 wherein the stretch resistance of the wrinkle suppressing section in the length direction of the tubular knitted
 fabric is smaller than the stretch resistance of the holding section in the length direction of the tubular knitted fabric.

5. The foot wear according to any one of Claims 1 to 4, wherein the holding section is a knitted fabric in which a moss
 stitch and an insert stitch are used in combination, and
 the supporting section is formed of a knitted fabric in which a rib stitch, a plating stitch, and an insert stitch are used
 in combination, and ribs in a wale direction in the rib stitch are formed to be continuous over the body section and
 the foot section.

Fig. 1e

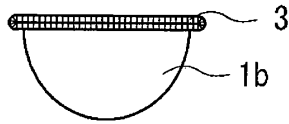


Fig. 1a

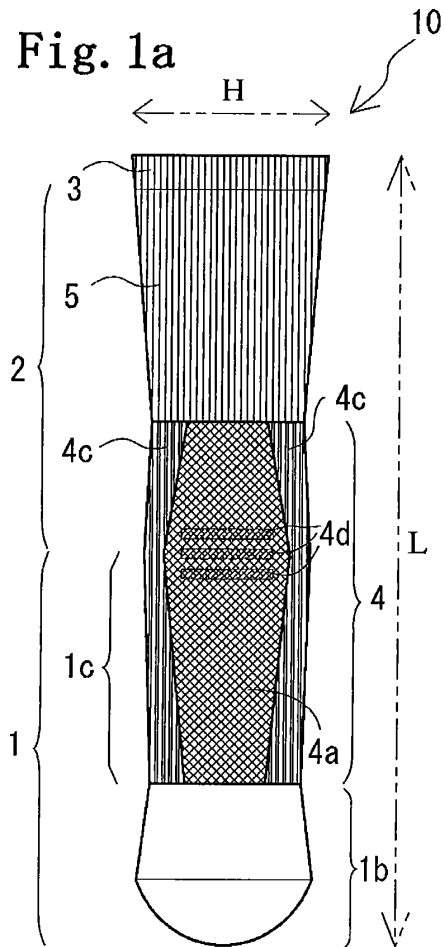


Fig. 1b

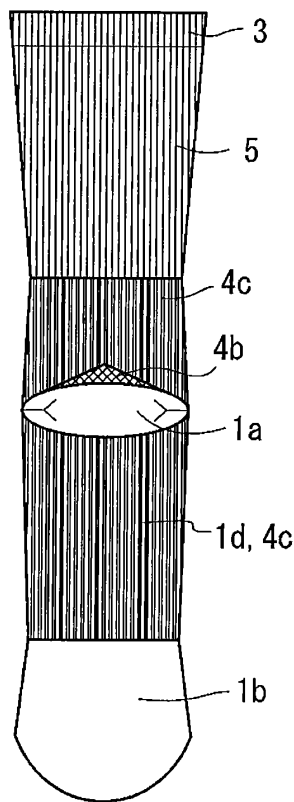


Fig. 1c

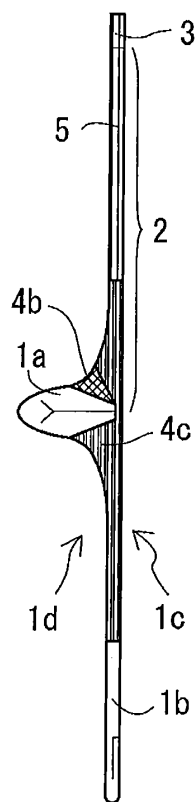


Fig. 1d

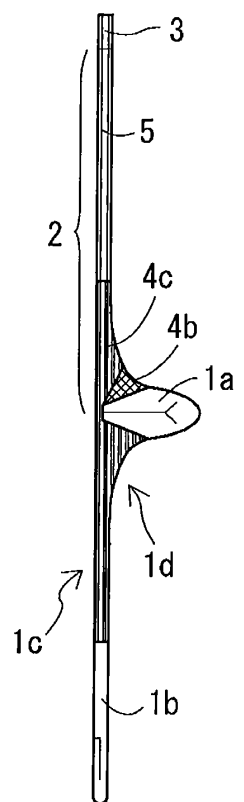


Fig. 1f

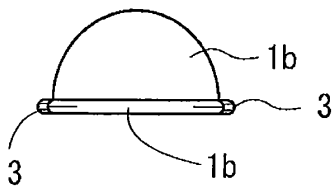


Fig. 2a

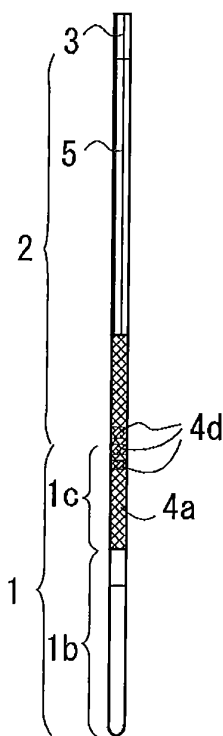


Fig. 2c

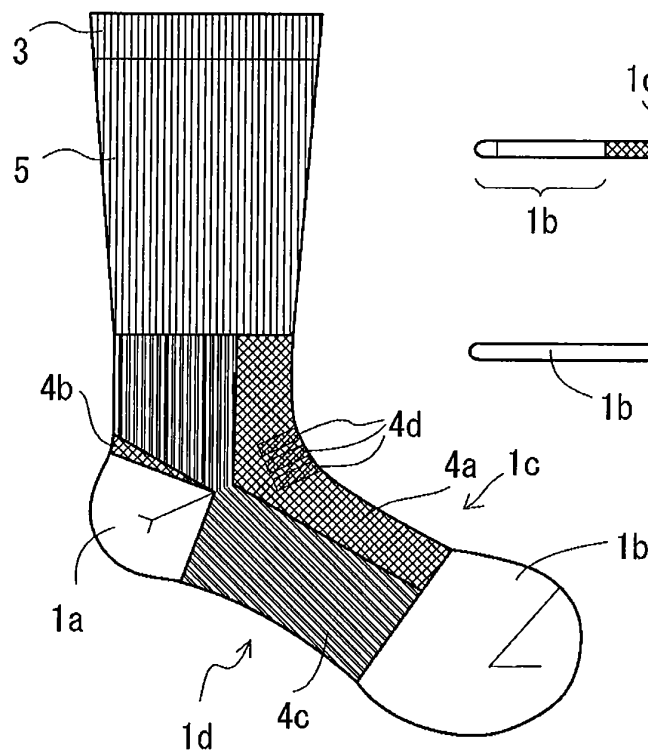


Fig. 2e

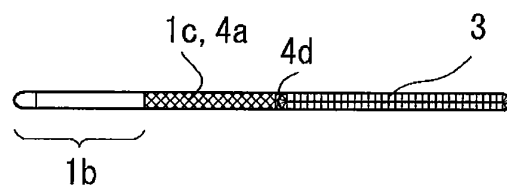


Fig. 2f

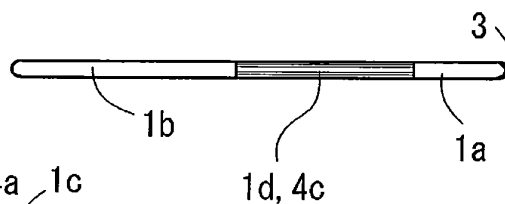


Fig. 2b

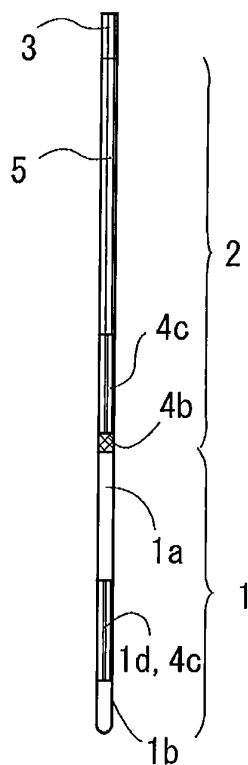


Fig. 2d

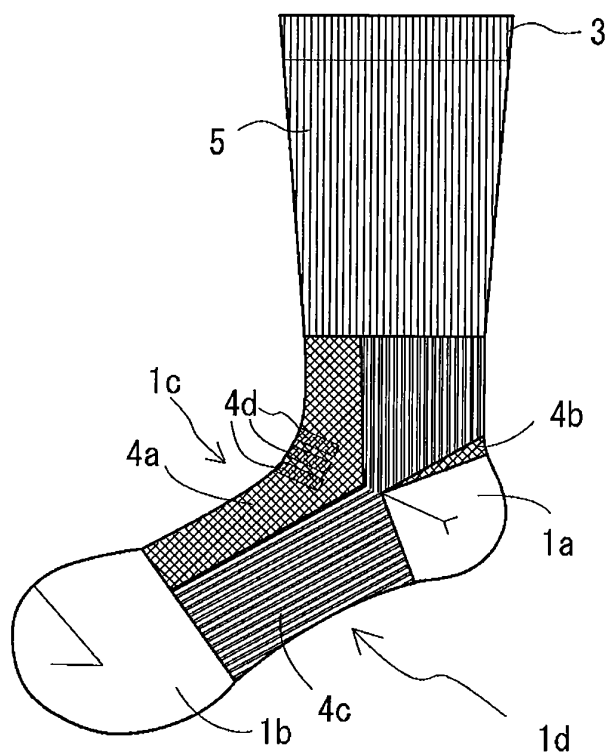


Fig. 3a

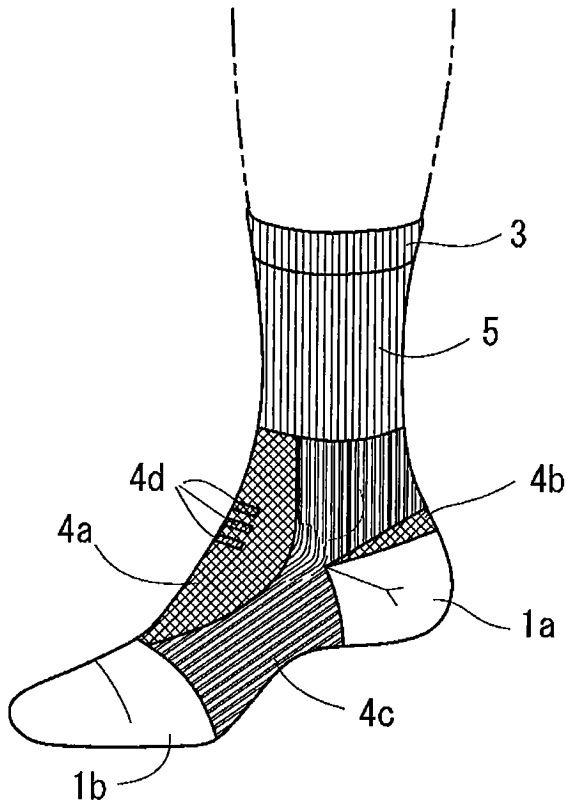


Fig. 3c

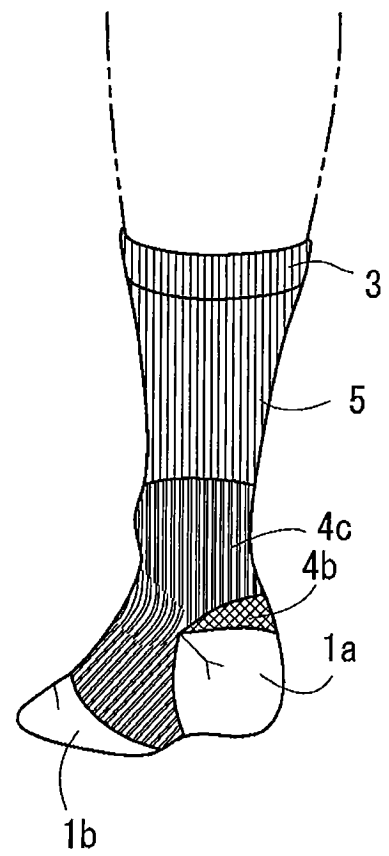


Fig. 3b

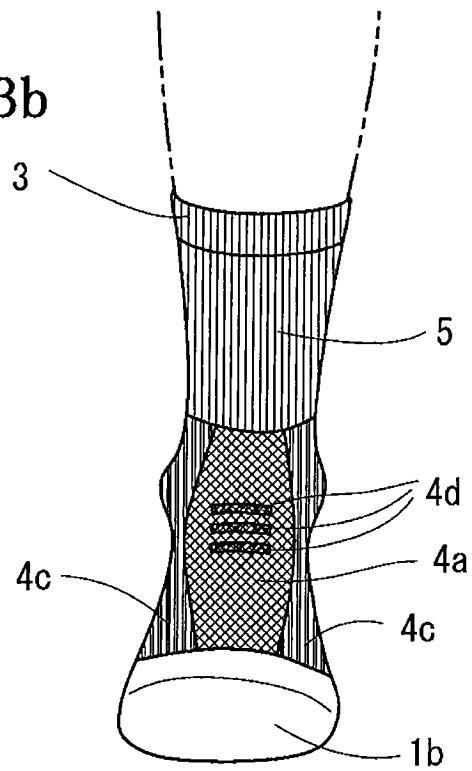


Fig. 4a

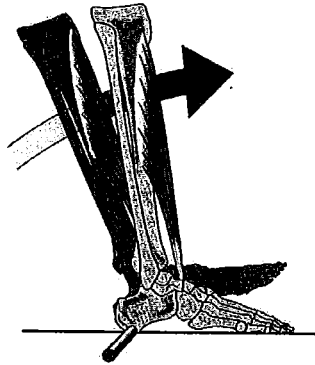


Fig. 4b

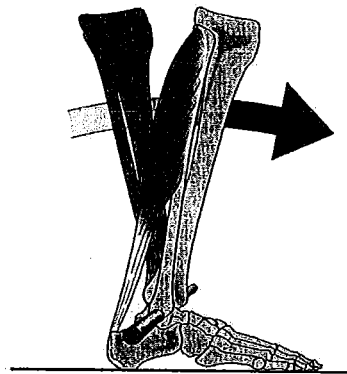


Fig. 4c

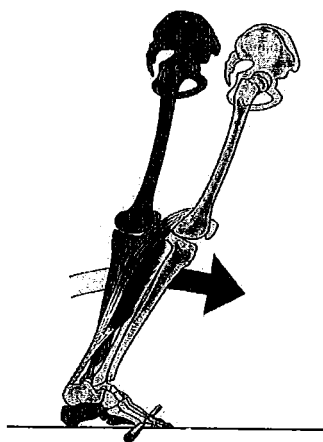


Fig. 5

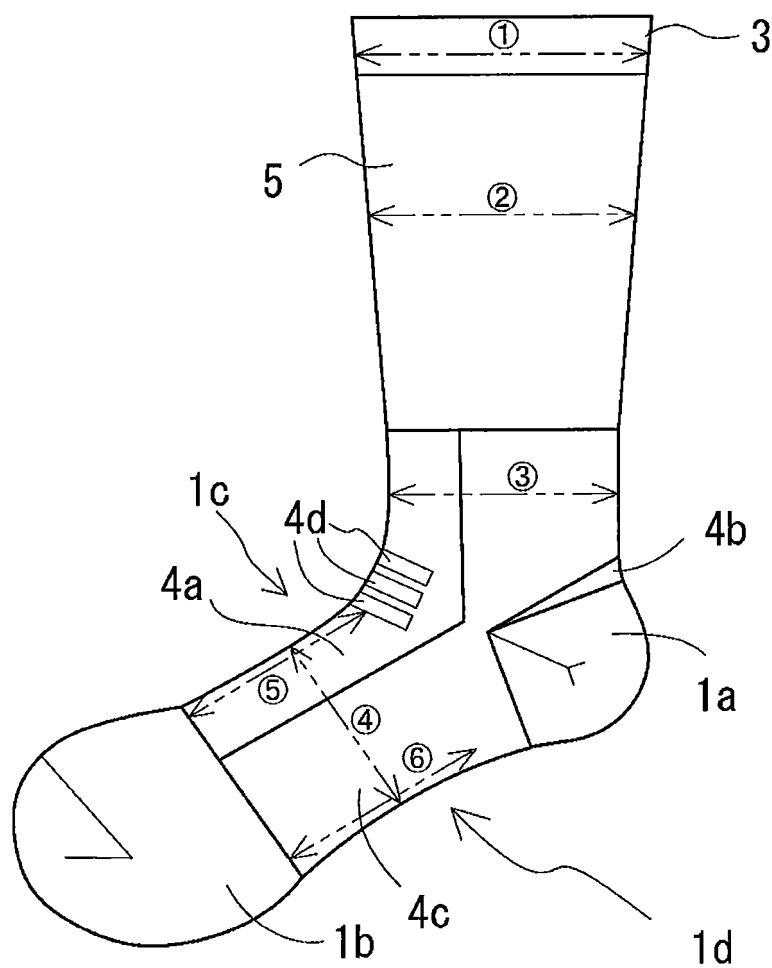


Fig. 6e

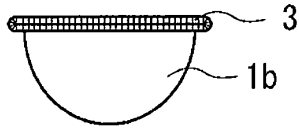


Fig. 6a

Fig. 6b

Fig. 6c Fig. 6d

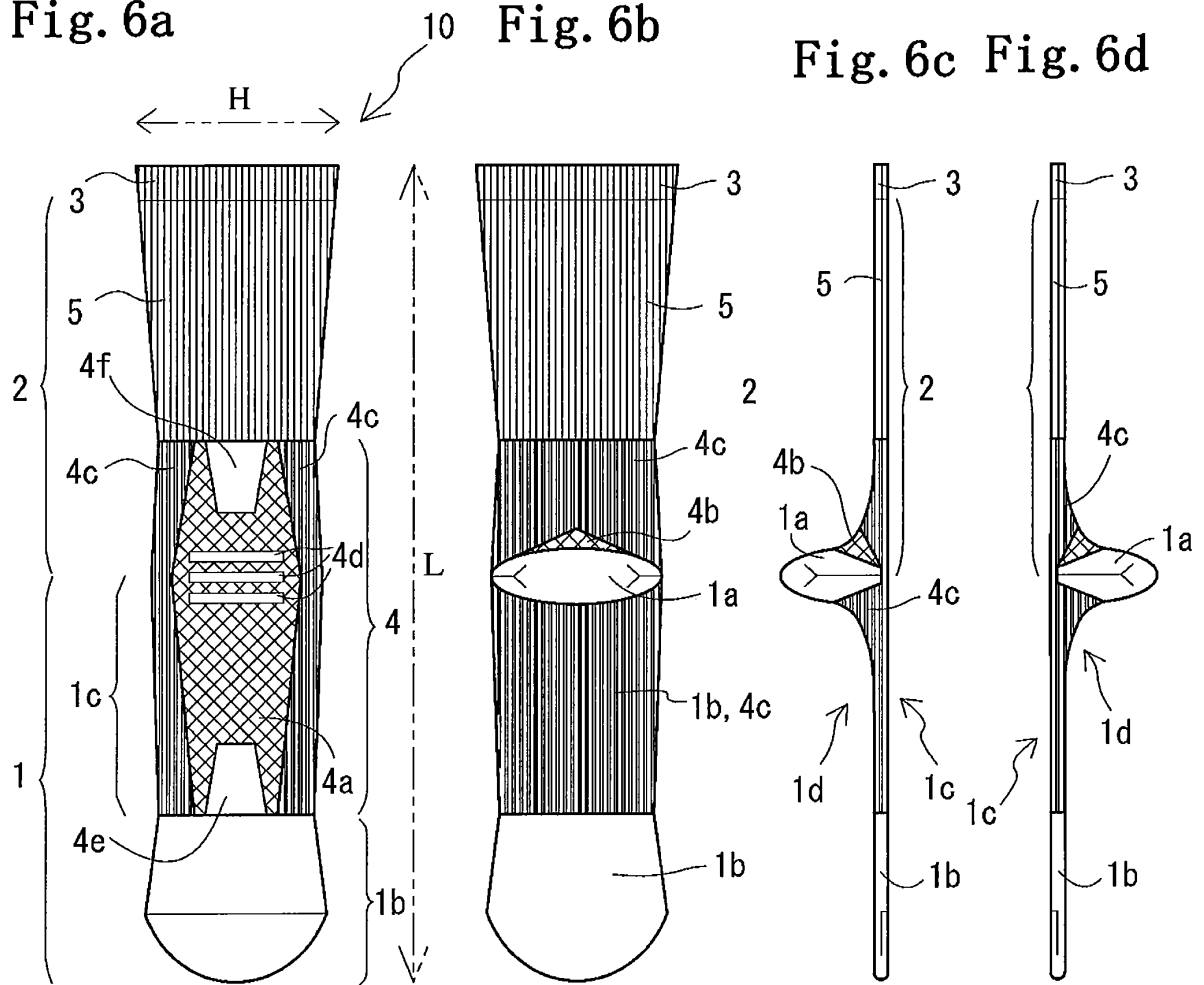


Fig. 6f

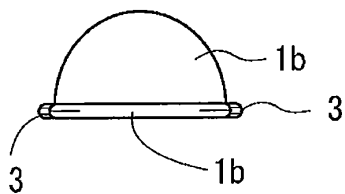


Fig. 7a

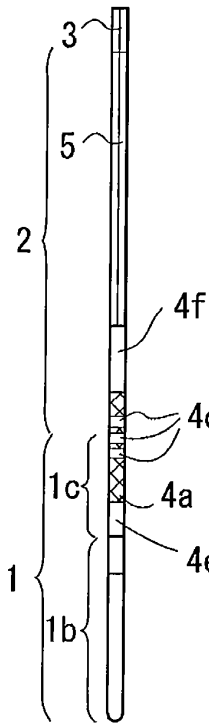


Fig. 7c

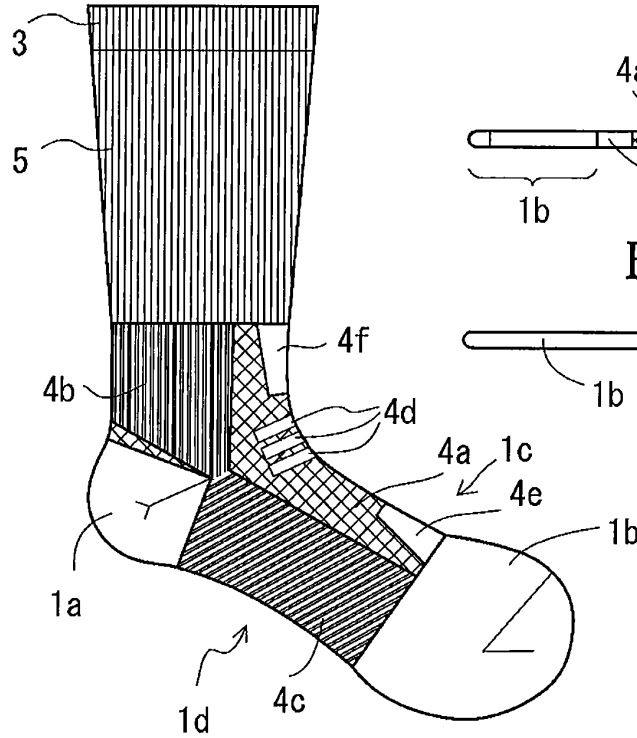


Fig. 7e

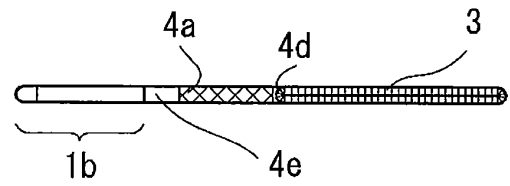


Fig. 7f

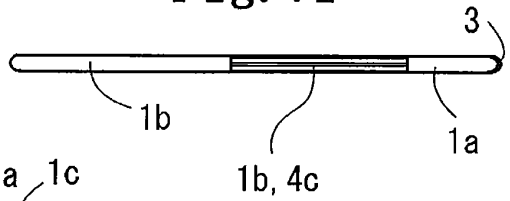


Fig. 7b

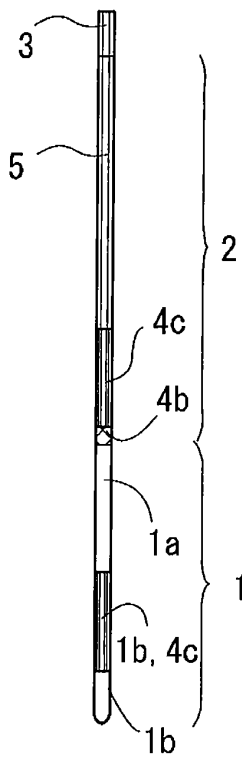
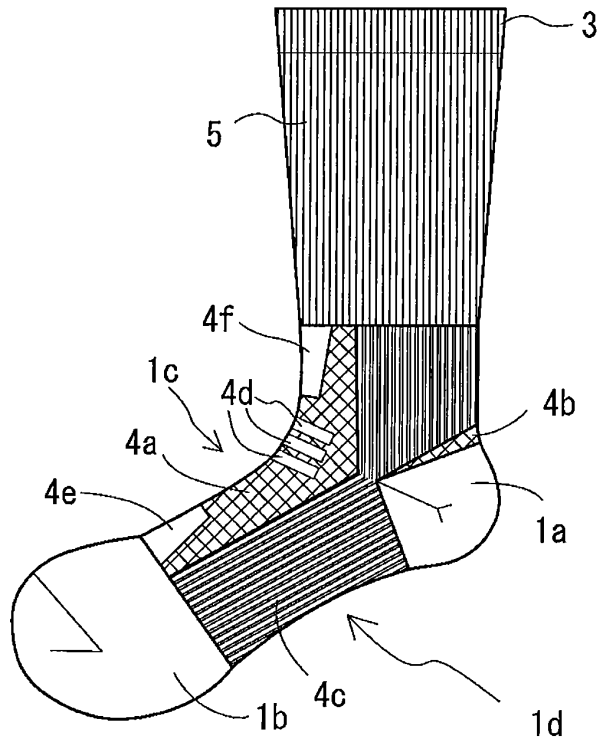


Fig. 7d



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/051217

A. CLASSIFICATION OF SUBJECT MATTER

A41D11/00(2006.01)i, A41B11/00(2006.01)i, D04B1/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A41D11/00, A41B11/00, D04B1/26

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011

Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2007/074735 A1 (Tabio Co., Ltd.), 05 July 2007 (05.07.2007), entire text; all drawings & JP 4040671 B	1-5
A	JP 2006-104599 A (Iida Kutsushita Kabushiki Kaisha), 20 April 2006 (20.04.2006), entire text; all drawings (Family: none)	1-5
A	JP 3113253 U (Washio Kabushiki Kaisha), 02 September 2005 (02.09.2005), entire text; all drawings (Family: none)	1-5

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

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"&" document member of the same patent family

Date of the actual completion of the international search
09 March, 2011 (09.03.11)Date of mailing of the international search report
22 March, 2011 (22.03.11)Name and mailing address of the ISA/
Japanese Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/051217

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 3069736 U (Kabushiki Kaisha Revealle), 30 June 2000 (30.06.2000), entire text; all drawings (Family: none)	1-5
A	US 4732015 A (AMERICAN DOUBLOON CORP.), 22 March 1988 (22.03.1988), entire text; all drawings (Family: none)	1-5
A	JP 2008-31615 A (Kabushiki Kaisha Advancing), 14 February 2008 (14.02.2008), entire text; all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2007332469 A [0004]