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[Solution] A sock as a tubular knitting fabric 5 is formed while a preceding tubular knitting area 1 corresponds to an ankle portion, a one side C-letter knitting area 2 corresponds to an instep portion, an other side C letter knitting area 4 corresponds to a sole portion and a heel portion, and a tubular knitting area 3 is interposed between the instep portion and the sole portion. The one side C-letter knitting area 2 is knitted by repeatedly knitting stitch rows on subsequent courses and forming stitches for joining to the tubular knitting area 3 on vacant knitting needles while moving positions of knitting needles which retain stitch rows to the left side and providing a vacant knitting needle on a right end. The other side C-letter knitting area 4 is knitted by repeatedly moving stitch rows to be knitted on each course to the left side and joining the stitch row to the tubular knitting area 3. A knitting width on the other side C-letter knitting area 4 is increased on the middle of the course so as to be adapted to a shape as a heel portion. A last opening section 4c is closed by binding off process so as to form a tiptoe portion of the sock.

Description

[Technical Field]

[0001] The present invention relates to a tubular knitting fabric which is seamlessly formed by a flatbed knitting machine including front and back needle beds, and a knitting method thereof.

[Background Art]

[0002] Conventionally, in a flatbed knitting machine including front and back needle beds, by yarn feeding to knitting needles on the front needle bed in one direction and by yarn feeding to knitting needles on the back needle bed in the other direction, fabrics are knitted with the front and back needle beds respectively and connected to each other at both ends so as to form seamless tubular knitting fabrics (for example, see Patent Literature 1). In such a tubular knitting fabric, stitch rows circulating in a course direction are continuous in a wale direction. In Patent Literature 1, a first tubular knitting portion and a second tubular knitting portion, which are formed by tubular knitting, correspond to portions which cover a foot and an ankle respectively so that a sock is seamlessly knitted as a whole. A heel portion is knitted between the first tubular knitting portion and the second tubular knitting portion by C-letter knitting in which yarn feeding directions are alternately inversed between the front needle bed and the back needle bed and knitting yarns are folded back in a C-letter form.

[Citation List]

[Patent Literature]

[0003]

[Patent Literature 1] WO 2008/078623 A1

[Summary of Invention]

[Technical Problem]

[0004] In the sock as disclosed in Patent Literature 1, the foot portion and the ankle portion are formed by similar tubular knitting. However, as for a human foot, a shape and a motion of a foot are complicated in comparison with those of an ankle. For example, a shape and a bending manner are different between an instep and a sole on the foot while the ankle roughly has a columnar shape and shapes of front and back sides thereof are similar to each other. A tubular knitting fabric for knitting a foot portion of a sock is desired, not only knitted by simple tubular knitting, but also knitted so as to be adapted to the instep and the sole. Further, only a tubular knitting fabric of which wale directions and course directions are constant is obtained if the tubular knitting fabric is

formed by single tubular knitting only, it is therefore desired that a tubular knitting fabric is capable of getting various shapes and patterns.

[0005] It is an object of the present invention is to provide a tubular knitting fabric which is capable of expressing novel shapes and patterns, and a knitting method thereof.

[Solution to Problem]

[0006] The present invention is a tubular knitting fabric, which is seamlessly made with a flatbed knitting machine, provided with at least a pair of front and back needle beds, and includes a portion in which a tubular knitting area, formed by knitting stitch rows in a course direction with the front and back needle beds and by connecting both ends of the stitch rows between the front and back needle beds, so as to be sandwiched between C-letter knitting areas in which stitch rows are folded back and reciprocate in the course direction repeatedly from one side and the other side of a wale direction, characterized in that:

a stitch row on an end portion course of the other side in the wale direction of the one side C-letter knitting area, and a stitch row on an end portion course of the one side in the wale direction of the tubular knitting area, are continuous to each other with respect to their wale directions;

with respect to a stitch row of an opening portion formed with end stitches, which are folded back in courses except for the end portion course of the other side in the wale direction of the one side C-letter knitting area, and to a stitch row of the end portion course of the one side in the tubular knitting area, the course direction of the one side C-letter knitting area and the wale direction of the tubular knitting area are continuous to each other;

a stitch row on an end portion course of the one side in the wale direction of the other side C-letter knitting area, and a stitch row of an end portion course of the other side in the wale direction of the tubular knitting area, are continuous to each other with respect to their wale directions;

with respect to a stitch row of an opening portion formed with end stitches, which are folded back in courses except for the end portion course of the one side in the wale direction of the other side C-letter knitting area, and to a stitch row of the end portion course of the other side in the tubular knitting area, the course direction of the other side C-letter knitting area and the wale direction of the tubular knitting area are continuous to each other; and the opening portions of the one side and the other side C-letter knitting areas, are joined so as to have a positional relationship of being opposed to each other sandwiching the tubular knitting area.

[0007] In the tubular knitting fabric of the present invention, a sock is formed in such a manner that said one side C-letter knitting area corresponds to an instep portion, said other side C-letter knitting area corresponds to a sole portion, said tubular knitting area connects the instep portion and the sole portion, and in the one side C-letter knitting area, said end portion course of the other side in the wale direction is joined to a knitting area which becomes a tiptoe side, and said end portion course of the one side in the wale direction is joined to a knitting area which becomes an ankle portion, respectively.

[0008] Further, the present invention is a method of knitting a tubular knitting fabric, which is seamlessly made with a flatbed knitting machine, provided with at least a pair of front and back needle beds, and includes a portion in which a tubular knitting area, formed by knitting stitch rows in a course direction with the front and back needle beds and by connecting both ends of the stitch rows between the front and back needle beds, so as to be sandwiched between C-letter knitting areas in which stitch rows are folded back and reciprocate in the course direction repeatedly from one side and the other side of a wale direction,

characterized in that the method comprises:

knitting the C-letter knitting area of the one side, preceding to knitting the tubular knitting area, by repeating to form stitch rows in the course direction and to form stitches for joining by use of vacant needles which are provided by stitch moving towards outward of the knitting width;

knitting the tubular knitting area in a manner that, for its first course in the one side of the wale direction, feeding yarn to needles, which include needles retaining the stitch row of the last course in the C-letter knitting area of the one side and retaining the stitch row for joining, so as to form a stitch row, and for other courses of the wale direction, repeating to form stitch rows until the last course is knitted as the other side; and

knitting the C-letter knitting area of the other side in a manner that,

with the stitch row of the last course which becomes the other side of the tubular knitting area, forming a stitch row of a first course with respect to a section being preset from the other side of the knitting width to the inside of the knitting width, and forming stitch rows of new courses by repeating, to move a stitch row of a preceding course toward inside so that an inside end stitch of the knitting width overlaps on a stitch of the last course in the tubular knitting area, and to fold back the yarn feeding direction so that a new stitch row is formed on the overlapped stitch and on the moved stitch row.

[0009] In the method of the present invention, preceding said C-letter knitting area of the one side, by use of wider section of knitting needles as a knitting width than the section of the knitting needles used to knit said stitch row of the first course, knitting a preceding tubular knitting area in which stitch rows are formed so as to circulate in the course direction.

[0010] In the method of the present invention, knitting said C-letter knitting area of the one side, after adding a C-letter knitting area, in which knitting width of a fold-back section varies, to said preceding tubular knitting area..

[0011] In the method of the present invention, after adding said C-letter knitting area in which the knitting width of the fold-back section varies, further knitting a tubular knitting area for adjusting, and then knitting said C-letter knitting area of the one side.

[0012] In the method of the present invention, with at least one of said C-letter knitting area of the one side or said C-letter knitting area of the other side, performing said stitch moving by an amount of one knitted stitch for each course.

[Advantageous Effects of Invention]

[0013] According to the present invention, as for the C-letter knitting area of the one side and as for the C-letter knitting area of the other side, which are sandwiching a tubular knitting area by circulating knitting and have a positional relationship in which opening portions made from stitch rows for joining are opposed to each other, the circumferential direction of a tubular knitting fabric, as a combination state of them, corresponds to their course directions. Into a middle of the circumferential direction of the tubular knitting fabric, a tubular knitting area in which a course direction is different from those of the C-letter knitting areas is inserted so that novel shapes, patterns, and so on as tubular knitting fabrics in combined states are capable of being expressed by making structures, patterns, knitting yarns or the like different among the knitting areas

[0014] Further, according to the present invention, a novel sock can be obtained as a tubular knitting fabric which can be adapted to a shape and a moving state of an instep and a sole by forming the instep portion and the sole portion by different C-letter knitting areas.

[0015] Furthermore, according to the present invention, knitting areas are continuously knitted from the C-letter knitting area of the one side to the C-letter knitting area of the other side through the tubular knitting area, so that a tubular knitting fabric in which the C-letter knitting area of the one side and the C-letter knitting area of the other side have a positional relationship that opening portions formed by stitch rows for joining are opposed to each other can be obtained. A novel shape and a novel pattern can be expressed by changing patterns or changing knitting yarns to be used for knitting among the knitting areas, in which stitch directions are different.

[0016] Further, according to the present invention, a novel shape and a novel pattern as tubular knitting fabric can be expressed by combining tubular knitting fabric formed as a preceding tubular knitting area and a tubular knitting fabric formed by sandwiching the tubular knitting area between the C-letter knitting area of the one side and the C-letter knitting area of the other side.

[0017] Further, according to the present invention, to a tubular knitting fabric in a preceding tubular knitting area, a C-letter knitting area of which knitting width of a fold-back section changes is added so that the C-letter knitting area of the one side can be connected in a state easy to be folded.

[0018] Further, according to the present invention, a tubular knitting area for adjusting is provided on a portion on which the tubular knitting fabric formed as the preceding tubular knitting area and the C-letter knitting area of the one side are connected in a bending shape, so that the knitting areas can be smoothly joined to each other.

[0019] Further, according to the present invention, either the C-letter knitting area of the one side or the C-letter knitting area of the other side, and the intermediate tubular knitting area, have boundaries on which directions of stitches are orthogonal to each other, so that various tubular knitting fabrics can be knitted as a whole by changing a stretchy direction as a knitting area, patterns, and the like.

[Brief Description of Drawings]

[0020]

[Fig. 1] Figs. 1 are a simplified knitting process drawing showing a schematic procedure of a knitting method according to one example of the present invention and a simplified side view showing a schematic structure of a tubular knitting fabric 5 to be knitted.

[Fig. 2] Figs. 2 are a simplified knitting process drawing showing a schematic procedure of a knitting method according to another example of the present invention and a simplified side view showing a schematic structure of a tubular knitting fabric 10 to be knitted.

[Fig. 3] Fig. 3 is a side view showing an example of the tubular knitting fabric 10 in Figs. 2.

[Fig. 4] Figs. 4 are simplified knitting process drawings showing schematic procedures of knitting method according to still other examples of the present invention.

[Description of Embodiments]

[0021] Hereinafter, a knitting method and a structure of a tubular knitting fabric 5 as one example of the present invention are described with Figs. 1. With Figs. 2 and Fig. 3, a knitting method and a structure of a tubular knitting fabric 10 as another example of the present invention are

described. With Figs. 4, knitting methods as still other examples of the present invention are described. In description of each drawing, description is made by using reference signs as shown in drawings which have been previously described even if the reference signs are not shown in the corresponding drawing in some case. Furthermore, the same reference signs denote parts corresponding to parts as shown in the drawings which have been previously described and redundant description is omitted in some case. As for matters which are applied to a plurality of examples, even if the matters are described in only one example, the matters are also applied to other examples as long as reference signs are identical. Further, arrows in knitting areas are expressed by adding C or W to the end of reference signs, indicate a course direction in which stitch rows are formed so as to be continuous in a direction of knitting yarns to be fed, or a wale direction in which stitch rows are continuous so as to be orthogonal to the course direction, respectively. Note that portions to be knitted on a front needle bed and a back needle bed are indicated by full lines and broken lines respectively in the course direction, and in case for knitting areas denoted by the same reference signs in a preceding drawing, are omitted in subsequent drawings.

[Example 1]

[0022] Fig. 1(a) shows a schematic procedure of a method to knit a tubular knitting fabric 5 as one example of the present invention, and Fig. 1(b) shows a schematic structure of the tubular knitting fabric 5 to be knitted. The tubular knitting fabric 5 is knitted in a state, where a preceding tubular knitting area 1, a one side C-letter knitting area 2, a tubular knitting area 3, and the other side C-letter knitting area 4 are knitted so as to be sequentially combined in accordance with wale directions 1W, 2W, 3W, and 4W. In the tubular knitting fabric 5, the tubular knitting area 3 has a stitch row of the first course as the one side of the wale direction 3W and a stitch row of the last course as the other side of the wale direction 3W, which are joined to the one side C-letter knitting area 2 and the other side C-letter knitting area 4, respectively.

[0023] The knitting procedure as shown in Fig. 1(a) is realized by using a flatbed knitting machine provided with at least a pair of needle beds which are opposed to each other sandwiching a needle bed gap. The wale direction, in each knitting area when stitches are formed, comes out a direction towards upward from below. Note that in the one side C-letter knitting area 2 and in the other side knitting area 4, since knitted stitch rows of the course directions 2C, 4C, are moved in the lateral direction in the drawing, the wale directions 2W, 4W on the respective areas are seemed to be inclined as shown in Fig. 1(b).

[0024] At first, the preceding tubular knitting area 1 is knitted while forming stitch rows in a circulating course direction 1C. Such tubular knitting is performed in a manner that yarns are fed to the knitting needles on the front

and back needle beds while alternately inverting a yarn feeding direction, for example, the yarns are fed such that the yarn feeding direction is a rightward direction on the front needle bed and is a leftward direction on the back needle bed. Next in the one side C-letter knitting area 2, a first stitch row is formed as a first continuous section 2a on a section which is previously set from an end of a previously set knitting width to an inner side on the front and back needle beds at one end side of the knitting width. The first continuous section 2a is formed by continuously feeding knitting yarns to a knitting needle which retains a stitch row on a last continuous section 1a provided at a left end side of a stitch row on a last course of the preceding tubular knitting area 1, for example. The stitch row on the last continuous section 1a and the stitch row on the first continuous section 2a are continuous to each other in the wale directions 1W, 2W. Yarn feeding is continued till it reaches to one end of the first continuous section 2a at the inner side of the knitting width of the front needle bed or the back needle bed. After the formed stitch rows are moved to the left side as an outer side of the knitting width, the knitting needle at an inner end of the knitting width becomes a vacant needle. On a subsequent course, the yarn feeding direction is folded back to form a stitch for joining on the vacant needle by hanging-over or split knitting, and then, a stitch row, subsequent to the stitch row which has been previously formed, is formed and a stitch for joining is formed on a vacant needle at the other end. Thereafter, stitch row on each course in the one side C-letter knitting area 2 is knitted by repeating to move and forming a stitch joining while folding back the yarn feeding direction, and an opening portion 2b is formed with a stitch row for joining at the inner side of the knitting width.

[0025] Next, the knitting yarns are fed to knitting needles on a section including a knitting needle on a last continuous section 2c, which retains a stitch row on a last course of the one side C-letter knitting area 2, and to knitting needles which retain the stitch row for joining formed as the opening portion 2b so as to form a stitch row on a first course of the tubular knitting area 3 in a circulating course direction 3C. A stitch row on a first continuous section 3a which is joined to the stitch row on the last continuous section 2c of the one side C-letter knitting area 2 and a stitch row on a first joining section 3b are included in the stitch row of the tubular knitting area 3 on the first course at one side in the wale direction. The first joining section 3b is joined to the stitch row for joining which has been formed as the opening portion 2b of the one side C-letter knitting area 2 and a stitch row left as a last joining section 1b of the preceding tubular knitting area 1 by forming a stitch row which is continuous in the wale direction 3W. Thereafter, knitting yarns are fed to a knitting needle which retains the stitch row formed on the first course and a stitch row on a subsequent course is repeatedly formed in the circulating course direction 3C so that the tubular knitting area 3 is knitted.

[0026] Next, at a right end side on the knitting width of

the other end course, which is the last course, in the tubular knitting area 3, a stitch row on a first continuous section 4a is formed as a first course of the other side C-letter knitting area 4. The first continuous section 4a is previously set from a right end of the knitting width to the inner side of the knitting width on the front and back needle beds, and knitting needles on the section retain a stitch row on a last continuous section 3c out of the stitch row on the last course of the tubular knitting area 3. On a subsequent course, the formed stitch row is moved to the left side, which is the inner side of the knitting width, so as to overlap a stitch at a left end side, which corresponds to a stitch at an inner end of the knitting width, on a stitch at a right end side on a stitch row of a last joining section 3d within a stitch row on the last course of the tubular knitting area 3. Thereafter, as a stitch row on each course of the other side C-letter knitting area 4, a new stitch row is repeatedly formed for the stitch rows which have been moved to the left side at one end side of the knitting width, including the overlapped stitch at the left end side while folding back the yarn feeding direction on different courses. If the stitch rows are knitted to the last course, a stitch row on the last course is left on a last opening section 4c of the other side C-letter knitting area 4, and a stitch row on a halfway opening portion 4b comes into a joined state with the stitch row on the last joining section 3d of the tubular knitting area 3.

[0027] Fig. 1(b) shows the tubular knitting fabric 5 in a state where a sock is formed, while the preceding tubular knitting area 1 corresponds to an ankle portion, the one side C-letter knitting area 2 corresponds to an instep portion, the other side C-letter knitting area 4 corresponds to a sole portion and to a heel portion, and the tubular knitting area 3 corresponds to a portion interposed between the instep portion and the sole portion. As shown in Fig. 1(a), the one side C-letter knitting area 2 corresponding to the instep portion is knitted so as to have the same knitting width from the first continuous section 2a to the last continuous section 2c while moving positions of the knitting needles, which retain the stitch row, to the left side. On the other hand, the other side C-letter knitting area 4 corresponding to the sole portion, having a last opening section 4c which is knitted while increasing the knitting width of the first continuous section 4a on the halfway courses than the stitch row on the first course, so that can be made to be adapted to a bulging shape as a heel portion. The last opening section 4c is closed by a binding off process so as to form a portion covering a tiptoe as a tip end of a foot. In a finishing process after the knitting, a processing of closing the opening may be performed. If a part of the last opening section 4c is left in an opened state, the part covering the tiptoe can be made open.

[0028] The knitting direction can be inverted, that is, knitting is performed from top to bottom in the drawings. Note that the other side C-letter knitting area 4 is knitted by repeating to form stitch rows in the course direction, and to form stitches for joining by using vacant needles

provided by moving of stitch rows to the outer side of the knitting width. Then, the tubular knitting area 3 is knitted, in the one side C-letter knitting area 2, by forming stitch rows in the course direction and by moving the stitch rows to the inner side, stitches at an inner end of the knitting width on the stitch rows are joined to stitches on an end course of the tubular knitting area 3. The preceding tubular knitting area 1 is knitted last, and on the first course thereof, the stitch row corresponding to the last continuous section 1a and the last joining section 1b is made to be joined to the stitch row corresponding to the first continuous section 2a of the one side C-letter knitting area 2 and the first joining section 3b of the tubular knitting area 3.

[0029] Further, in the present example, the preceding tubular knitting area 1 which covers an ankle is knitted, and then, the one side C-letter knitting area 2 is knitted, however, in a state without the preceding tubular knitting area 1, the one side C-letter knitting area 2 may be knitted. Continuing to the one side C-letter knitting area 2, the tubular knitting area 3 and the other side C-letter knitting area 4 are knitted, so that overshoes, mitten socks or the like can be formed as in combined state of tubular knitting fabrics. Further, the direction of stitches in each knitting area is shown as the wale direction only, however, is not necessarily uniform in each knitting area, and varies depending on connecting state between the knitting areas or the like. In addition, the tubular knitting area 3 and the preceding tubular knitting area 1 are formed by circulating-knitting that the stitch rows in the course direction circulate, but can be also formed by folding-back knitting in which stitch rows are coupled to each other with a tuck after the stitch rows make a circuit..

[Example 2]

[0030] Fig. 2(a) shows a schematic procedure of a method to knit the tubular knitting fabric 10 according to another example of the present invention, and Fig. 2(b) shows a schematic structure of the tubular knitting fabric 10 to be knitted. The tubular knitting fabric 10 is formed in a state where a preceding tubular knitting area 11, an inclined C-letter knitting area 12, an adjusting tubular knitting area 13, the one side C-letter knitting area 2, the tubular knitting area 3, and the other side C-letter knitting area 4 are combined in accordance with the knitting procedures. The preceding tubular knitting area 11 is divided into a rib knitting portion 11a by rib knitting and a plain knitting portion 11b by plain knitting, but a course direction 11C and a wale direction 11W are in common. The inclined C-letter knitting area 12 which is knitted by C-letter knitting in which a knitting width is decreased and of which a stitch row as an opening portion 12a is inclined is added subsequent to the plain knitting portion 11b. End portions of the inclined C-letter knitting area 12, in which the course directions 12C are alternately folded back, are opened, and tuck stitches for joining are formed in order to eliminate steps of stitches on the opening portion

12a. The inclined C-letter knitting area 12 is knitted for connecting an instep portion formed by the one side C-letter knitting area 2 in a smoothly bending manner without generating wrinkles, as shown in Fig. 2(b). If the one side C-letter knitting area 2 is directly connected to the inclined C-letter knitting area 12, displacement for moving becomes difficult when the one side C-letter knitting area 2 is knitted. If the adjusting tubular knitting area 13 is added to the inclined C-letter knitting area 12, the tuck stitches formed on the opening portion 12a of the inclined C-letter knitting area 12 are not required to be moved, so that stable moving can be made when the one side C-letter knitting area 2 is knitted.

[0031] The tubular knitting fabric 10 is formed as a sock like the tubular knitting fabric 5 as shown in Figs. 1(a) and 1(b), and an instep portion and a sole portion are formed by the one side C-letter knitting area 2 and the other side C-letter knitting area 4, to cover a foot, the tubular knitting area 3 can be interposed between the instep portion and the sole portion. The sock is formed by adding the inclined C-letter knitting area 12 to the preceding tubular knitting area 11, so that a tubular knitting fabric formed by the preceding tubular knitting area 11 at an ankle side, and a tubular knitting fabric at a foot side, which is formed by sandwiching the tubular knitting area 3 between the one side C-letter knitting area 2 and the other side C-letter knitting area 4, can be connected to each other in a smoothly bending manner without generating wrinkles. It is to be noted that in the present example, the preceding tubular knitting area 11 which covers the ankle is knitted, and then, the inclined C-letter knitting area 12 is knitted, however, they can be knitted in an inversed direction as in the same manner as the tubular knitting fabric 5 in Figs. 1. In the knitting for the inversed direction, the other side C-letter knitting area 4, the tubular knitting area 3, the one side C-letter knitting area 2, and the inclined C-letter knitting area 12 are knitted in this order.

[0032] Fig. 3 shows a structure of an example for the tubular knitting fabric 10 knitted as a sock. A heel portion as a sock is formed, by combining a lower portion of the inclined C-letter knitting area 12 to be added to the preceding tubular knitting area 11, a back portion of the adjusting tubular knitting area 13, a back portion of the tubular knitting area 3, and a back portion of the other side C-letter knitting area 4.

[0033] The wale direction 3W of the tubular knitting area 3 is nearly orthogonal to the wale directions 2W, 4W at a joining portion between the first joining section 3b and the opening portion 2b of the one side C-letter knitting area 2, and a joining portion between the last joining section 3d and the opening portion 4b of the other side C-letter knitting area 4. On a boundary of these joining portions, the stitch row of the tubular knitting area 3 in the wale direction and the stitch row of the one side C-letter knitting area 2 and the other side C-letter knitting area 4 in the course direction are continuous to each other. To make stitches such orthogonal and such con-

tinuous between the course direction and the wale direction to each other, moving distance of the one side C-letter knitting area 2 or the other side C-letter knitting area 4 might be corresponded to one stitch at every course forming stitch rows. If the relationship between formation of the stitch rows and the moving distance is changed, the corresponding relationship between the stitch row in the course direction and the stitch row in the wale direction is changed so that the stitch row in the course direction can be also inclined. It is to be noted that the wale direction 3W and the wale direction 2W, 4W are continuous to each other on the joining portions between the first continuous section 3a of the tubular knitting area 3 and the last continuous section 2c of the one side C-letter knitting area 2, and between the last continuous section 3c of the tubular knitting area 3 and the first continuous section 4a of the other side C-letter knitting area 4.

[0034] In the tubular knitting area 3, if a stripe pattern extending in the course direction or the like is knitted, it can be easy to form horizontal stripes which are difficult to be knitted when the entire foot portion is formed as one tubular knitting area. In the tubular knitting area 3, if knitting yarns are changed by unit of courses, a stripe pattern can be formed. When the entire foot portion is formed as one tubular knitting area, the course direction corresponds to a longitudinal direction, and knitting yarns used for knitting are required to be changed on the middle of courses in order to form the horizontal stripe pattern as in a case of an intarsia pattern. Further, since the knitting areas are divided, additional values as a stock can be enhanced by including new patterns, shapes, and functions, in such a manner that, for example a decorative pattern is formed or heat-retaining property is enhanced on the one side C-letter knitting area 2 as an instep portion, or for another example, the other side C-letter knitting area 4 as the sole portion is knitted by using knitting yarns having cushioning property, hygroscopic property, or deodorizing property.

[Example 3]

[0035] Figs. 4 show a schematic knitting procedure for a method to knit a tubular knitting fabric as still another example of the present invention. Fig. 4(a) shows a state where an adjusting tubular knitting area 14 is knitted instead of the adjusting tubular knitting area 13 in Figs. 2. A knitting width is enlarged so that a fabric for a heel portion is increased with the adjusting tubular knitting area 14. Fig. 4(b) shows a state where a heel portion C-letter knitting area 15 which further enlarges the heel portion to the lower side is added to the adjusting tubular knitting area 14. The shape of the heel portion can be adjusted by the enlargement of the knitting width with the adjusting tubular knitting area 14 and addition of the heel portion C-letter knitting area 15.

[0036] In each of the above examples, the tubular knitting fabric according to the present invention is applied to a sock, however, the tubular knitting fabric is inter-

posed between the one side C-letter knitting area 2 and the other side C-letter knitting area 4 by changing the wale directions thereof, so that knitting yarns of which raw material are different can be used in a part of knitting areas. For example, if the present invention is applied as a tubular knitting fabric which covers a joint of a human body, such as a supporter, a tubular knitting fabric having new patterns, new shapes, or new functions can be obtained by using knitting yarns having different stretch properties by a unit of knitting area, or using knitting yarns having different hygroscopic properties, strengths, and colors.

[Reference Signs List]

[0037]

1, 11	Preceding tubular knitting area
2	One side C-letter knitting area
2b, 4b, 12a	Opening portion
3	Tubular knitting area
4	Other side C-letter knitting area
5, 10	Tubular knitting fabric
12	Inclined C-letter knitting area
13, 14	Adjusting tubular knitting area
15	Heel portion C-letter knitting area

Claims

1. A tubular knitting fabric (5, 10), which is seamlessly made with a flatbed knitting machine, provided with at least a pair of front and back needle beds, and includes a portion in which a tubular knitting area (3), formed by knitting stitch rows in a course direction (3C) with the front and back needle beds and by connecting both ends of the stitch rows between the front and back needle beds, so as to be sandwiched between C-letter knitting areas (2, 4) in which stitch rows are folded back and reciprocate in the course direction (2C, 4C) repeatedly from one side and the other side of a wale direction (2W, 4W),
characterized in that:

a stitch row on an end portion course of the other side in the wale direction (2W) of the one side C-letter knitting area (2), and a stitch row on an end portion course of the one side in the wale direction (3W) of the tubular knitting area (3), are continuous to each other with respect to their wale directions (2W, 3W);
with respect to a stitch row of an opening portion (2b) formed with end stitches, which are folded back in courses except for the end portion course of the other side in the wale direction (2W) of the one side C-letter knitting area (2), and to a stitch row of the end portion course of the one side in the tubular knitting area (3), the

- course direction (2C) of the one side C-letter knitting area (2) and the wale direction (3W) of the tubular knitting area (3) are continuous to each other;
- a stitch row on an end portion course of the one side in the wale direction (4W) of the other side C-letter knitting area (4), and a stitch row of an end portion course of the other side in the wale direction (3W) of the tubular knitting area (3), are continuous to each other with respect to their wale directions (3W, 4W);
- with respect to a stitch row of an opening portion (4b) formed with end stitches, which are folded back in courses except for the end portion course of the one side in the wale direction (4W) of the other side C-letter knitting area (4), and to a stitch row of the end portion course of the other side in the tubular knitting area (3), the course direction (4W) of the other side C-letter knitting area (4) and the wale direction (3W) of the tubular knitting area (3) are continuous to each other; and
- the opening portions (2b, 4b) of the one side and the other side C-letter knitting areas (2, 4), are joined so as to have a positional relationship of being opposed to each other sandwiching the tubular knitting area (3).
2. The tubular knitting fabric (10) according to claim 1, wherein a sock is formed in such a manner that said one side C-letter knitting area (2) corresponds to an instep portion, said other side C-letter knitting area (4) corresponds to a sole portion, said tubular knitting area (3) connects the instep portion and the sole portion, and in the one side C-letter knitting area (2), said end portion course of the other side in the wale direction (2W) is joined to a knitting area which becomes a tiptoe side, and said end portion course of the one side in the wale direction (2W) is joined to a knitting area (12, 13) which becomes an ankle portion, respectively.
3. A method of knitting a tubular knitting fabric (5, 10), which is seamlessly made with a flatbed knitting machine, provided with at least a pair of front and back needle beds, and includes a portion in which a tubular knitting area (3), formed by knitting stitch rows in a course direction with the front and back needle beds and by connecting both ends of the stitch rows between the front and back needle beds, so as to be sandwiched between C-letter knitting areas (2, 4) in which stitch rows are folded back and reciprocate in the course direction (2C, 4C) repeatedly from one side and the other side of a wale direction (2W, 4W), **characterized in that** the method comprises:
- knitting the C-letter knitting area of the one side (2), preceding to knitting the tubular knitting area (3), by repeating to form stitch rows in the course direction (2C) and to form stitches for joining by use of vacant needles which are provided by stitch moving towards outward of the knitting width;
- knitting the tubular knitting area (3) in a manner that,
- for its first course in the one side of the wale direction (3W), feeding yarn to needles, which include needles retaining the stitch row of the last course in the C-letter knitting area of the one side (2) and retaining the stitch row for joining, so as to form a stitch row, and
- for other courses of the wale direction (3W), repeating to form stitch rows until the last course is knitted as the other side; and
- knitting the C-letter knitting area of the other side (4) in a manner that,
- with the stitch row of the last course which becomes the other side of the tubular knitting area (3), forming a stitch row of a first course with respect to a section being preset from the other side of the knitting width to the inside of the knitting width, and
- forming stitch rows of new courses by repeating, to move a stitch row of a preceding course toward inside so that an inside end stitch of the knitting width overlaps on a stitch of the last course in the tubular knitting area (3), and to fold back the yarn feeding direction so that a new stitch row is formed on the overlapped stitch and on the moved stitch row.
4. The method of knitting the tubular knitting fabric (5, 10) according to claim 3, wherein preceding said C-letter knitting area of the one side (2), by use of wider section of knitting needles as a knitting width than the section of the knitting needles used to knit said stitch row of the first course, knitting a preceding tubular knitting area (1, 11) in which stitch rows are formed so as to circulate in the course direction.
5. The method of knitting the tubular knitting fabric (10) according to claim 4, wherein knitting said C-letter knitting area of the one side (2), after adding a C-letter knitting area (12), in which knitting width of a fold-back section varies, to said preceding tubular knitting area (11).
6. The method of knitting the tubular knitting fabric (10) according to claim 5, wherein after adding said C-letter knitting area (12) in which the knitting width of the fold-back section varies, further knitting a tubular knitting area (13) for adjusting, and then knitting said C-letter knitting area

of the one side (2).

7. The method of knitting the tubular knitting fabric (5, 10) according to any one of claims 3 - 6, wherein with at least one of said C-letter knitting area of the one side (2) or said C-letter knitting area of the other side (4), performing said stitch moving by an amount of one knitted stitch for each course.

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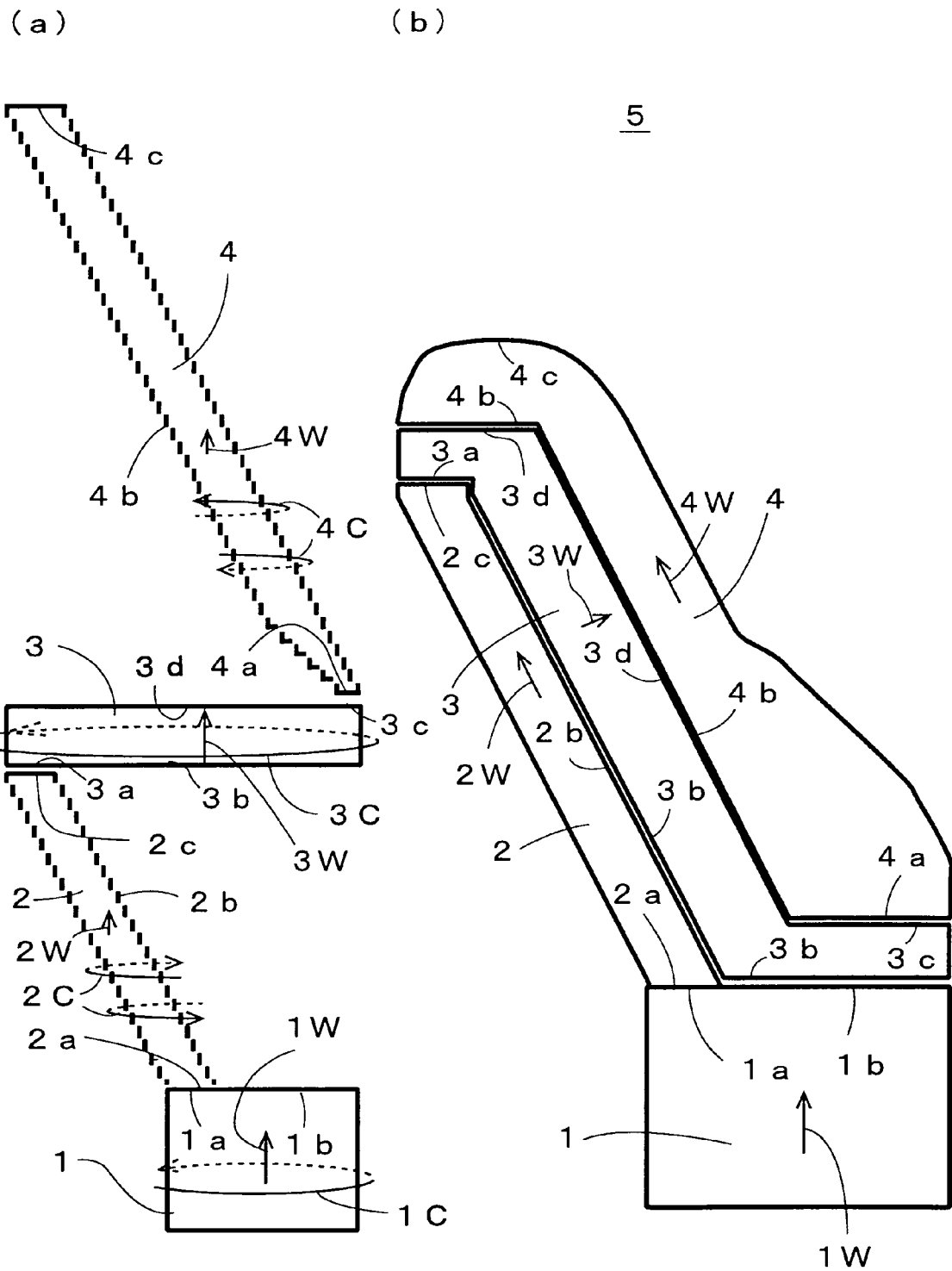
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Fig. 1



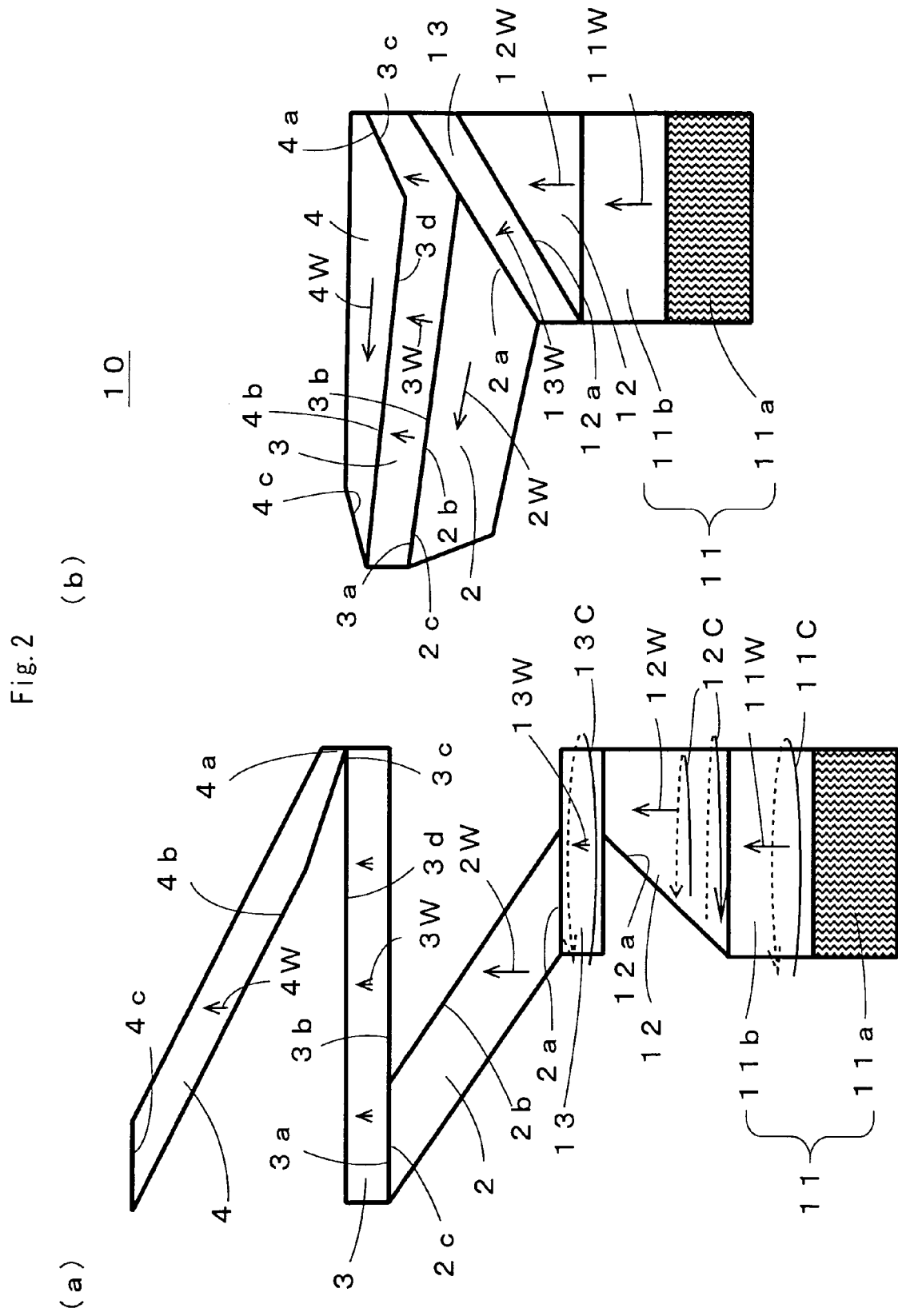


Fig. 3 10

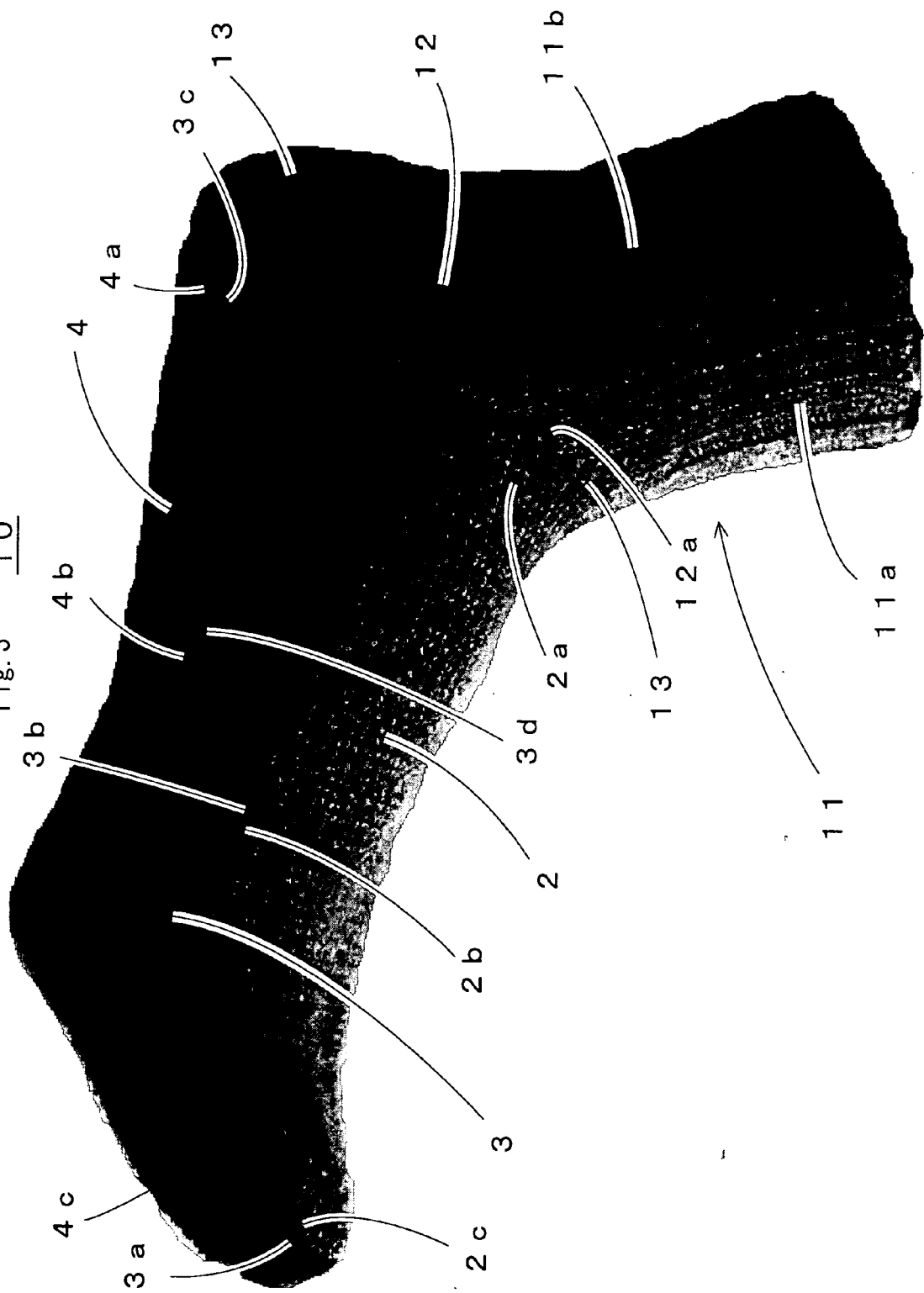
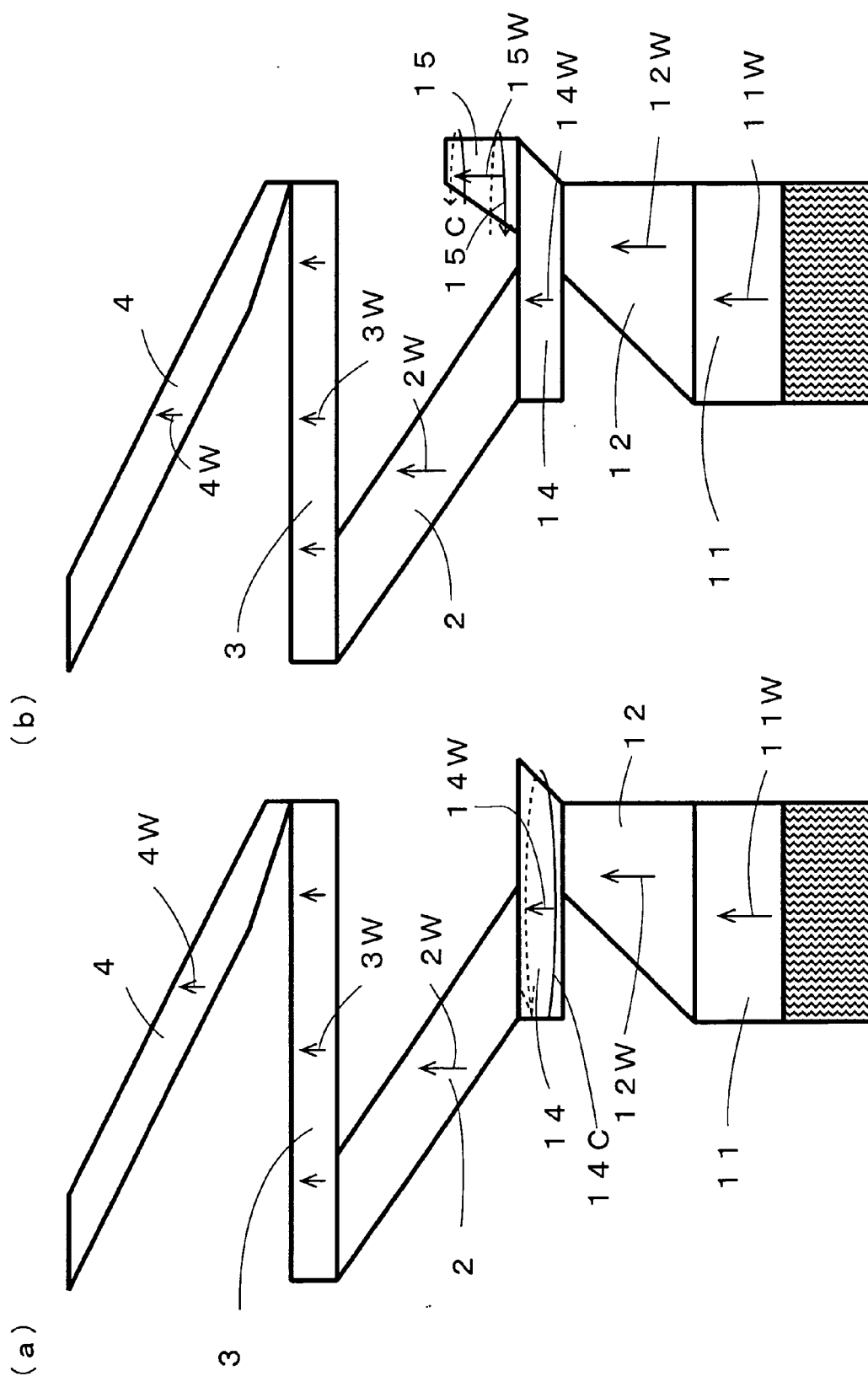


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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