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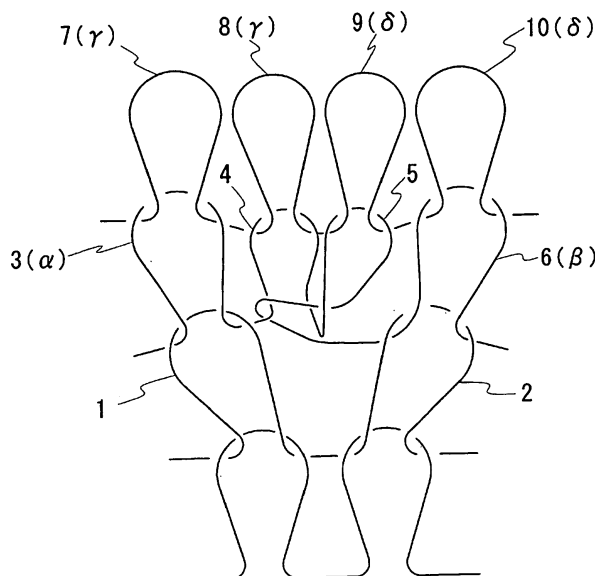
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(54) **Outside widening method of tubular knitted fabric, and tubular knitted fabric**

(57) To provide an outside widening method of a tubular knitted fabric capable of preventing a hole from standing out more effectively than the related art. A first pick-up stitch 4 is formed on an empty needle B of an FB on an outward side of a stitch at an end of a front side knitted fabric portion while moving a yarn feeder outward after knitting a stitch row α following a back side knitted fabric portion (S1). A second pick-up stitch 5 is formed on an empty needle A of the FB on an outward side of the first pick-up stitch 4 while moving the yarn feeder

inward, and then knitting a new stitch row β following the front side knitted fabric portion (S3). A new stitch row γ following the stitch row α and the first pick-up stitch 4 is knitted (S4), and a new stitch row δ following the stitch row β and the second pick-up stitch 5 is knitted (S5). In the series of processes, the first pick-up stitch 4 is transferred to an empty needle B of a BB on the outward side of a stitch 3 at a termination of the stitch row α after forming a stitch 6 at a starting end of the stitch row β and before forming a new stitch 8 following the first pick-up stitch 4 (S3).

Fig. 2



Description

TECHNICAL FIELD

[0001] The present invention relates to an outside widening method of a tubular knitted fabric for forming a widening stitch on an outer side of an end in a longitudinal direction of a needle bed of the tubular knitted fabric held on the needle bed when knitting a knitted fabric using a flat knitting machine, and a tubular knitted fabric knitted by applying such method. The tubular knitted fabric of the present invention includes a knitted fabric in which a part of its tubular portion is not connected as with the torso portion of a cardigan.

BACKGROUND ART

[0002] Conventionally, there are cases of forming a widening stitch to knit a tubular knitted fabric to a desired shape in the process of knitting the tubular knitted fabric with a flat knitting machine. For the method for forming such widening stitch, an outside widening method of a tubular knitted fabric for forming a pick-up stitch on an empty needle on the outer side of the end in the longitudinal direction of the needle bed of the tubular knitted fabric held on the needle bed to increase the knitting width is known.

[0003] However, in the conventional outside widening method of a tubular knitted fabric, the widening stitch formed of the pick-up stitch is formed by feeding yarn to the empty needle, and hence a hole tends to be easily formed at the formed area of the widening stitch. The applicant proposed a method shown in patent document 1 as an outside widening method of a tubular knitted fabric for preventing the hole at the formed area of the widening stitch from standing out.

[0004] Fig. 3 is a knitting process diagram for performing an outside widening method of a tubular knitted fabric described in patent document 1 using a two-bed flat knitting machine having a pair of front and back needle beds disposed opposite to each other. In the knitting process diagram of Fig. 3, alphabet + number on the left side of the figure indicates the process number, the arrow in the left and right direction indicates the moving direction of a yarn feeder, and the arrow in the up and down direction indicates the direction of transfer. A to N in the figure indicate the positions of knitting needles (black points in the figure) of the front needle bed (hereinafter referred to as FB) and the back needle bed (hereinafter referred to as BB), ▼ indicates the yarn feeder, Ω mark indicates a stitch, V mark indicates a pick-up stitch, and the thick line indicates an operation actually carried out in each knitting process. Furthermore, in the figure, reference numerals 11 to 19 are denoted in the formed order for the pick-up stitches to become the widening stitches and some of the stitches in the vicinity thereof. In Fig. 3, the number of knitting needles is less than the number used in the actual knitting, and all the knitting is assumed to be carried out in plain knitting for the sake of convenience of explanation.

[0005] T0 shows a state in which the tubular knitted fabric is held on the knitting needles C, E, G, I, K of the FB and the knitting needles D, F, H, J, L of the BB. In the subsequent knitting after such state, the widening stitch is formed on the outward side (left side in the plane of drawing) of the knitting width of the tubular knitted fabric while carrying out circling knitting in the clockwise direction.

[0006] First, stitches are formed on the knitting needles K, I, G, E, C of the FB while moving the yarn feeder towards the left side in the plane of drawing to knit a new stitch row ε following in the wale direction of a front side knitted fabric portion of the tubular knitted fabric held on the FB in T0, and thereafter, a pick-up stitch 14 is formed on the knitting needle B of the FB on the outward side of the stitch row ε (T1). Then, stitches are formed on the knitting needles D, F, H, J, L of the BB while moving the yarn feeder towards the right side in the plane of drawing to knit a new stitch row ζ following in the wale direction of a back side knitted fabric portion of the tubular knitted fabric held on the BB in T0 (T2).

[0007] Furthermore, stitches are formed on the knitting needles K, I, G, E, C of the FB while moving the yarn feeder towards the left side in the plane of drawing to knit a new stitch row η following in the wale direction of the stitch row ε formed on the FB in T1, and thereafter, a pick-up stitch 17 is formed on the knitting needle A of the FB on the outward side of the pick-up stitch 14 formed on the knitting needle B of the FB in T2 (T3). The pick-up stitch 14 formed in T1 is then transferred to the knitting needle B of the opposing BB (T4). A new stitch 18 following the pick-up stitch 14 transferred in T4 is formed while moving the yarn feeder towards the right side in the plane of drawing, and thereafter, stitches are formed on the knitting needles D, F, H, J, L of the BB to form a new stitch row θ following in the wale direction of the stitch row ζ formed on the BB in T2.

[0008] A loop diagram seen from the outer side of the tubular portion of the tubular knitted fabric shown in T5 of Fig. 3 obtained through the knitting processes described above is shown in Fig. 4. In Fig. 4, the same reference numerals are denoted for the stitches corresponding to the pick-up stitches and the stitches specified by denoting the reference numerals in Fig. 3.

[0009] In the tubular knitted fabric shown in Fig. 4, the pick-up stitch 14 formed on the knitting needle B of the FB in T1 of Fig. 3 and transferred in T4 has become the widening stitch 14 in a twisted state, and the pick-up stitch 17 formed in T3 has become the widening stitch 17 so as to be hooked to the widening stitch 14, so that the knitting width is increased by two stitches in two courses. One widening stitch 14 of the two widening stitches 14, 17 is a twisted stitch

so that the gap between the two stitches 13, 15 with the twisted stitch 14 interposed therebetween is narrowed, and hence the hole formed at the formed area of the widening stitch 14 does not stand out.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0010]

[Patent document 1] Japanese Patent Publication No. 2896500

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0011] In the method of patent document 1, however, the effect of preventing the hole from standing out may not be sufficient depending on the type of knitting yarn used in the knitting and the knitting pattern in the vicinity of the formed area of the widening stitch, and the development of the outside widening method of the tubular knitted fabric capable of more effectively preventing the hole from standing out is desired.

[0012] The present invention has been made in view of the above situations, and an object thereof is to provide an outside widening method of a tubular knitted fabric capable of preventing the hole from standing out more effectively than the related art, and a tubular knitted fabric knitted by applying the outside widening method thereto.

MEANS FOR SOLVING THE PROBLEMS

[0013] An outside widening method of a tubular knitted fabric according to the present invention is an outside widening method of a tubular knitted fabric for forming a widening stitch on an outer side of an end in a longitudinal direction of a needle bed of a tubular knitted fabric in a process of knitting the tubular knitted fabric including a first side knitted fabric portion held on one of front and back needle beds and a second side knitted fabric portion held on the other needle bed using a flat knitting machine having at least a pair of front and back needle beds and in which stitches are transferrable between the front and back needle beds; the method including the following processes assuming a direction from a position scheduled to form a widening stitch towards the tubular knitted fabric is inward and an opposite direction is outward in a movement direction of a yarn feeder along the longitudinal direction of the needle bed.

[Process A] Immediately after knitting a new stitch row α following in a wale direction of the first side knitted fabric portion, a first pick-up stitch to become the widening stitch is formed on an empty needle, which is positioned on an outward side of a stitch at an end of the second side knitted fabric portion on a side same as a stitch at a termination of the stitch row α , of knitting needles of the other needle bed on which the other side knitted fabric portion is held while moving the yarn feeder outward.

[Process B] A second pick-up stitch to become the widening stitch is formed on an empty needle, which is positioned on an outward side of the first pick-up stitch, of knitting needles of the other needle bed while moving the yarn feeder inward.

[Process C] A new stitch row β following in a wale direction of the second side knitted fabric portion is knitted after forming the second pick-up stitch.

[Process D] A new stitch row γ following in the wale direction of the stitch row α and the first pick-up stitch is knitted, and a new stitch row δ following in the wale direction of the stitch row β and the second pick-up stitch is knitted.

In the outside widening method of the tubular knitted fabric of the present invention, after forming a stitch at a starting end of the stitch row β in the process C and before forming a new stitch following the first pick-up stitch in the process D, the first pick-up stitch is transferred to an empty needle, which is positioned on an outward side of a stitch at a termination of the stitch row α , of knitting needles of the one needle bed.

[0014] The timing of transferring the first pick-up stitch in the outside widening method of the tubular knitted fabric of the present invention may be any time as long as it is after the stitch at the starting end of the stitch row β is formed and before the new stitch following in the wale direction of the first pick-up stitch is formed. Representatively, it may be carried out after process C and before process D, as described in the embodiment to be described later. In addition, the first pick-up stitch may be transferred in the middle of process C or process D as long as the above-described timing is satisfied.

[0015] Either one of the stitch row γ and the stitch row δ in the process D may be formed first. This aspect will be explained at the end of the embodiment to be described later.

[0016] A tubular knitted fabric of the present invention is a tubular knitted fabric knitted using a flat knitting machine having at least a pair of front and back needle beds and a yarn feeder for feeding a knitting yarn to knitting needles arranged in plurals in each needle bed; the tubular knitted fabric including two widening stitches formed continuously in

a knitting width direction at a boundary portion of front and back knitted fabric portions. One widening stitch of the two widening stitches is a twisted stitch, and one of the sinker loops of the twisted stitch is wound around a root of the other widening stitch.

5 EFFECTS OF THE INVENTION

[0017] According to the outside widening method of the tubular knitted fabric of the present invention, the tubular knitted fabric of the present invention including two widening stitches formed continuously in the knitting width direction can be knitted. In the tubular knitted fabric of the present invention, one widening stitch of the two widening stitches is a twisted stitch, so that the stitches in the vicinity of such widening stitches are tighten. Furthermore, since one of the sinker loops of the twisted stitch is wound around the root of the other widening stitch, the widening stitches are easily moved as a unit so that the gap between the widening stitches is less likely to spread open when the tubular knitted fabric is pulled in the knitting width direction. Therefore, a hole is less likely to be formed at the formed area of the widening stitches in the tubular knitted fabric of the present invention.

15

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

20 Fig. 1 is a knitting process diagram of an outside widening method of a tubular knitted fabric according to the present invention shown in an embodiment.

Fig. 2 is a loop diagram of the vicinity of a formed area of a widening stitch in a tubular knitted fabric knitted according to the knitting process of Fig. 1.

Fig. 3 is a knitting process diagram of an outside widening method of a tubular knitted fabric according to the related art.

25 Fig. 4 is a loop diagram of the vicinity of a formed area of a widening stitch in a tubular knitted fabric knitted according to the knitting process of Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 **[0019]** An embodiment of the present invention using a two-bed flat knitting machine having a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction and in which stitches can be transferred between the front and back needle beds will be described based on Figs. 1 and 2. A flat knitting machine equipped with a transfer jack bed or a four-bed flat knitting machine besides the two-bed flat knitting machine may, of course, be used.

35 **[0020]** The way of looking at the knitting process diagram according to the outside widening method of a tubular knitted fabric of the present invention shown in Fig. 1 is similar to Fig. 3 of the related art diagram described above. However, the pick-up stitch to become the widening stitch and some of the stitches in the vicinity thereof are denoted with reference numerals 1 to 10 in the formed order.

40 **[0021]** First, in S0 of Fig. 1, a state in which a back side knitted fabric portion (first side knitted fabric portion) of the tubular knitted fabric is held on the knitting needles D, F, H, J, L of the BB (one needle bed), and a front side knitted fabric portion (second side knitted fabric portion) of the tubular knitted fabric is held on the knitting needles C, E, G, I, K of the FB (other needle bed) is shown. In the knitting subsequent to this state, the widening stitch is formed on the outer side (left side in the plane of drawing) of the knitting width of the tubular knitted fabric while carrying out circling knitting in the counterclockwise direction.

45 **[0022]** First, in S1, stitches are formed on the knitting needles L, J, H, F, D of the BB while moving the yarn feeder towards the left side in the plane of drawing, and thereafter, a first pick-up stitch 4 is formed on the knitting needle B of the FB. The yarn feeder is positioned on the outward side of the knitting needle A to prepare for the next S2. According to S1, a new stitch row α following in the wale direction of the back side knitted fabric portion of the tubular knitted fabric held on the BB in S0 is formed. The first pick-up stitch 4 formed in S1 is held on the outer side (outward side distant from the tubular knitted fabric) of the stitch 2 at the end of the front side knitted fabric portion held on the knitting needle C of the FB in S0.

50 **[0023]** In the next S2, a second pick-up stitch 5 is formed on the knitting needle A of the FB while moving the yarn feeder towards the right side in the plane of drawing, that is, the inward side towards the tubular knitted fabric, and thereafter, stitches are formed on the knitting needles C, E, G, I, K of the FB. According to S2, a new stitch row β following in the wale direction of the front side knitted fabric portion of the tubular knitted fabric held on the FB in S0 is formed. The second pick-up stitch 5 formed in S2 is held on the outer side of the first pick-up stitch 4 formed in S1, and a knitting yarn connecting the second pick-up stitch 5 and a stitch 6 at the starting end of the stitch row β is crossed over the first pick-up stitch 4.

[0024] In S3, the first pick-up stitch 4 formed on the knitting needle B of the FB in S1 is transferred to the knitting needle B of the BB on the outward side of the stitch 3 at the termination of the stitch row α . As a result of such transfer, the first pick-up stitch 4 is in a state similar to a stitch pulled out towards the near side from the far side in the plane of drawing with respect to the knitting yarn connecting the second pick-up stitch 5 and the stitch 6 of the stitch row β . The transfer of the first pick-up stitch 4 of S3 may be carried out at any time as long as it is carried out after the stitch 6 at the starting end of the stitch row β is knitted in S2 and before a new stitch 8 following the first pick-up stitch 4 is knitted in the next S4.

[0025] In S4, a new stitch row γ is knitted following in the wale direction of the stitch row α including stitches held on the knitting needles L, J, H, F, D of the BB, and the first pick-up stitch 4 held on the knitting needle B of the BB while moving the yarn feeder towards the left side in the plane of drawing. The yarn feeder is positioned on the outward side of the knitting needle A to prepare for the next S5.

[0026] Lastly, in S5, a new stitch row δ is knitted following in the wale direction of the second pick-up stitch 5 held on the knitting needle A of the FB and the stitch row β including the stitches held on the knitting needles C, E, G, I, K of the FB while moving the yarn feeder towards the right side in the plane of drawing.

[0027] A loop diagram seen from the outer side of the tubular portion of the tubular knitted fabric shown in S5 of Fig. 1 obtained through the knitting processes described above is shown in Fig. 2. In the tubular knitted fabric shown in Fig. 2, two widening stitches 4, 5 are formed continuously in the knitting width direction so that the knitting width is increased by two stitches in two courses. Since one widening stitch 5 of the two widening stitches 4, 5 is a twisted stitch, the stitches 1 to 10 in the vicinity of the widening stitches 4, 5 including the widening stitches 4, 5 are tighten. Furthermore, since one of the sinker loops of the twisted widening stitch 5 is wound around the root of the other widening stitch 4, the widening stitches 4, 5 are easily moved as a unit so that the gap between the widening stitches 4, 5 is less likely to spread open even if the tubular knitted fabric is pulled in the knitting width direction. As a result, a hole is less likely to be formed at the formed area of the widening stitches 4, 5 in the tubular knitted fabric shown in Fig. 2.

[0028] The present invention is not limited to the embodiment described above, and may be appropriately changed in a scope not deviating from the gist of the invention. For instance, all knitted fabric portions are formed by plain knitting in the embodiment described above for the sake of convenience of explanation, but the knitted fabric portions may be structure patterns.

[0029] In addition, the tubular knitted fabric to knit may be a knitted fabric in which a part of its tubular portion is not connected as with the torso portion of the cardigan. For instance, when knitting the tubular knitted fabric in which the front side knitted fabric portion and the back side knitted fabric portion on the right side in the plane of drawing are not connected in S0 of Fig. 1, the knitting similar to S1 to S3 of Fig. 1 is first carried out. Then, the stitches are formed on the knitting needles K, I, G, E, C, A of the FB while moving the yarn feeder towards the left direction in the plane of drawing in the next process of S3 to form a stitch row δ following in the wale direction of the stitch row β . Then, the stitches are formed on the knitting needles B, D, F, H, J, L of the BB while moving the yarn feeder towards the right direction in the plane of drawing to knit a stitch row γ following in the wale direction of the stitch row α .

DESCRIPTION OF SYMBOLS

[0030]

1, 2, 3, 6, 7, 8, 9, 10	stitch
4	first pick-up stitch (widening stitch)
5	second pick-up stitch (widening stitch)
11, 12, 13, 15, 16, 18, 19	stitch
14	pick-up stitch (widening stitch)
17	pick-up stitch (widening stitch)
$\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta$	stitch row

Claims

1. An outside widening method of a tubular knitted fabric for forming a widening stitch on an outer side of an end in a longitudinal direction of a needle bed of a tubular knitted fabric in a process of knitting the tubular knitted fabric including a first side knitted fabric portion held on one of front and back needle beds and a second side knitted fabric portion held on the other needle bed using a flat knitting machine having at least a pair of front and back needle beds and in which stitches are transferrable between the front and back needle beds wherein the method comprises:

when assuming a direction from a position scheduled to form a widening stitch towards the tubular knitted fabric

is inward and an opposite direction is outward in a movement direction of a yarn feeder along the longitudinal direction of the needle bed,

process A of, immediately after knitting a new stitch row α following in a wale direction of the first side knitted fabric portion, forming a first pick-up stitch (4) to become the widening stitch on an empty needle (B), which is positioned on an outward side of a stitch (2) at an end of the second side knitted fabric portion on a side same as a stitch at a termination of the stitch row α , of knitting needles of the other needle bed (FB) on which the other side knitted fabric portion is held while moving the yarn feeder outward;

process B of forming a second pick-up stitch (5) to become the widening stitch on an empty needle (A), which is positioned on an outward side of the first pick-up stitch (4), of knitting needles of the other needle bed (FB) while moving the yarn feeder inward;

process C of knitting a new stitch row β following in a wale direction of the second side knitted fabric portion after forming the second pick-up stitch (5); and

process D of knitting a new stitch row γ following in the wale direction of the stitch row α and the first pick-up stitch (4), and knitting a new stitch row δ following in the wale direction of the stitch row β and the second pick-up stitch (5); wherein

after forming a stitch at a starting end of the stitch row β in the process C and before forming a new stitch (8) following in the wale direction of the first pick-up stitch (4) in the process D, the first pick-up stitch (4) is transferred to an empty needle (B), which is positioned on an outward side of a stitch (3) at a termination of the stitch row α , of knitting needles of the one needle bed (BB).

2. A tubular knitted fabric knitted using a flat knitting machine having at least a pair of front and back needle beds, and a yarn feeder for feeding a knitting yarn to knitting needles arranged in plurals in each needle bed; the tubular knitted fabric comprising:

two widening stitches (4, 5) formed continuously in a knitting width direction at a boundary portion of front and back knitted fabric portions; and

one widening stitch (5) of the two widening stitches (4, 5) is a twisted stitch, and one of the sinker loops of the twisted stitch is wound around a root of the other widening stitch (4).

Fig. 1

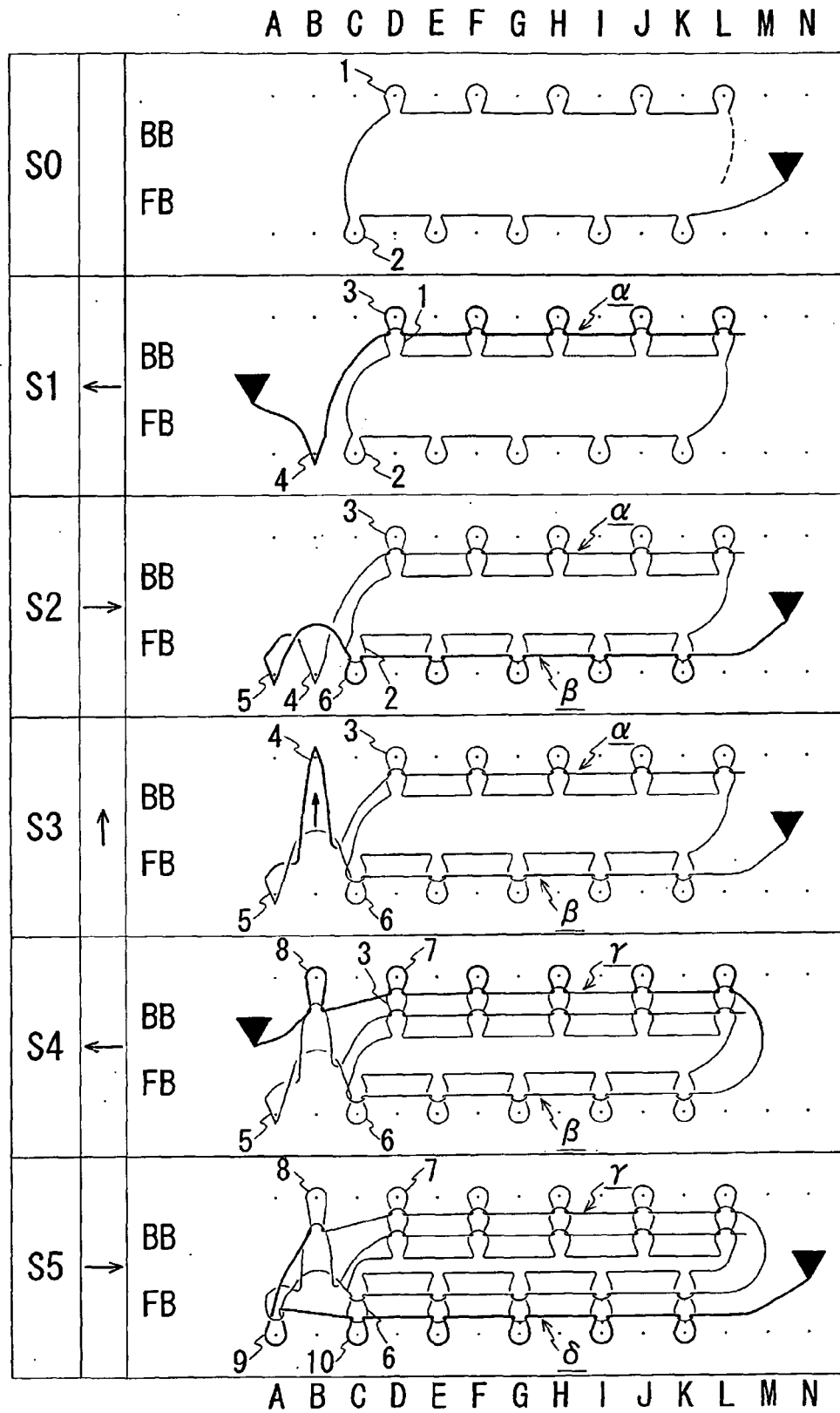


Fig. 2

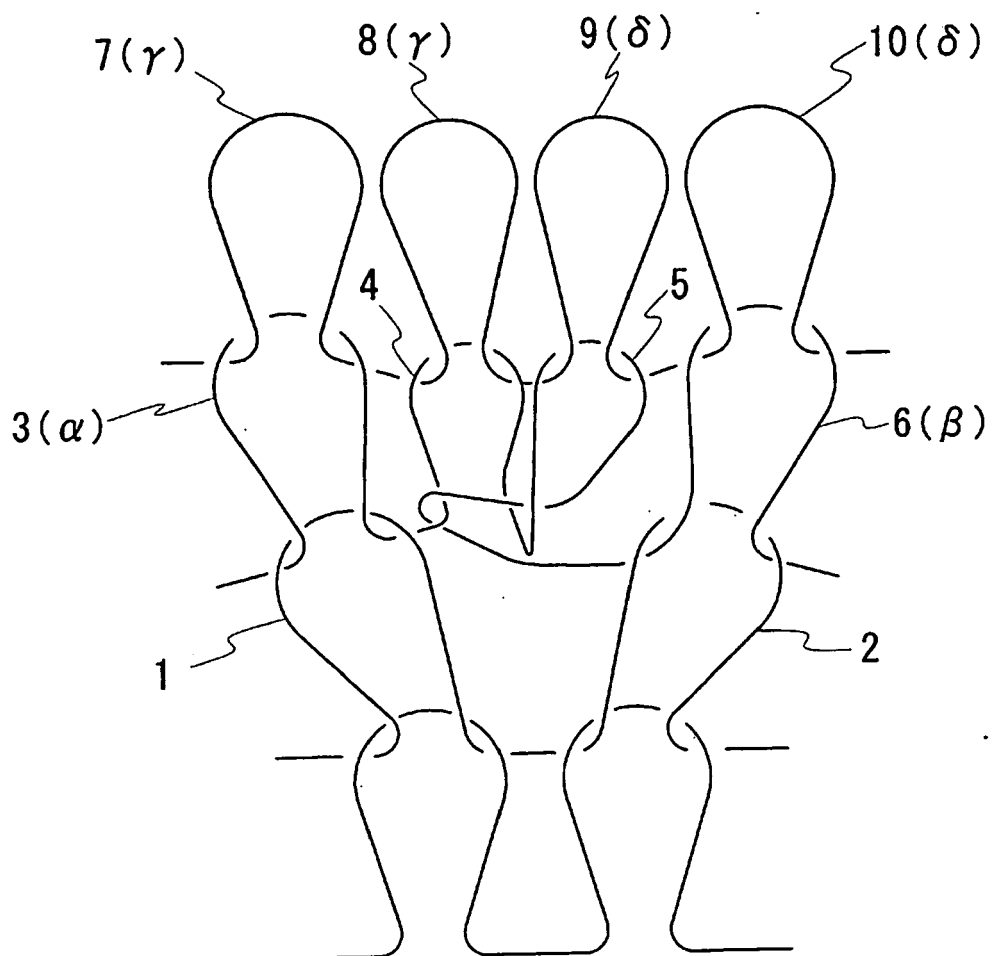


Fig. 3

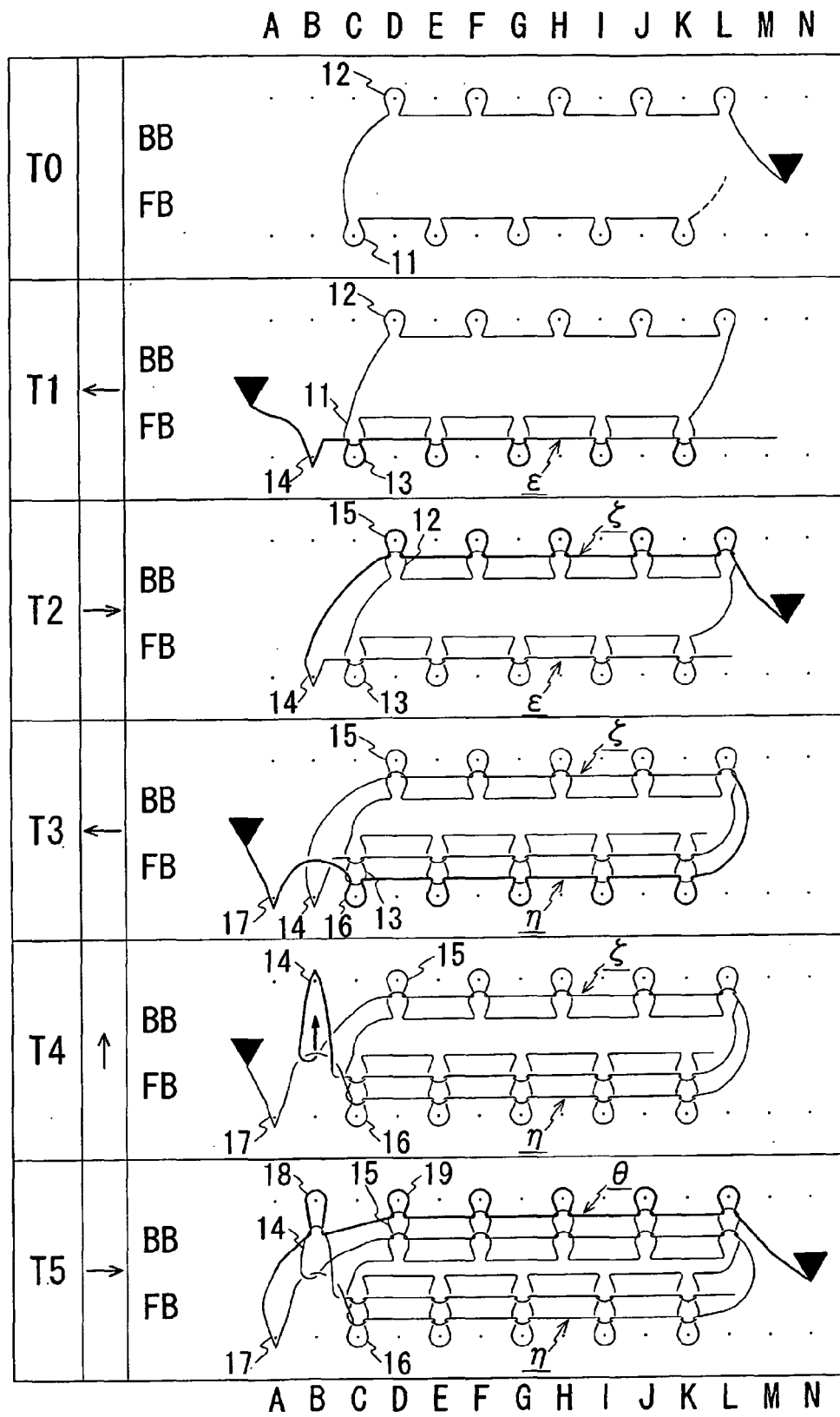
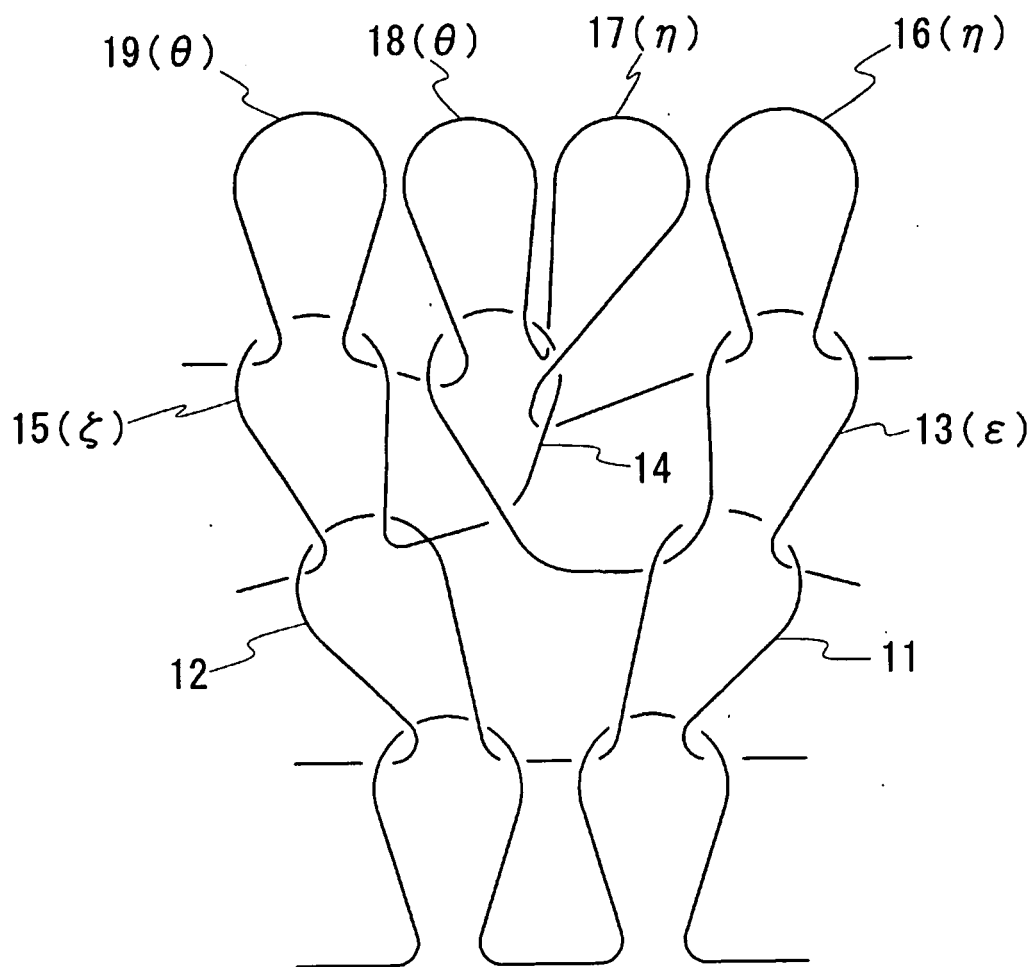


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2896500 B [0010]