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(71) Applicant: **Shima Seiki Mfg., Ltd**
Wakayama-shi
Wakayama 641-8511 (JP)

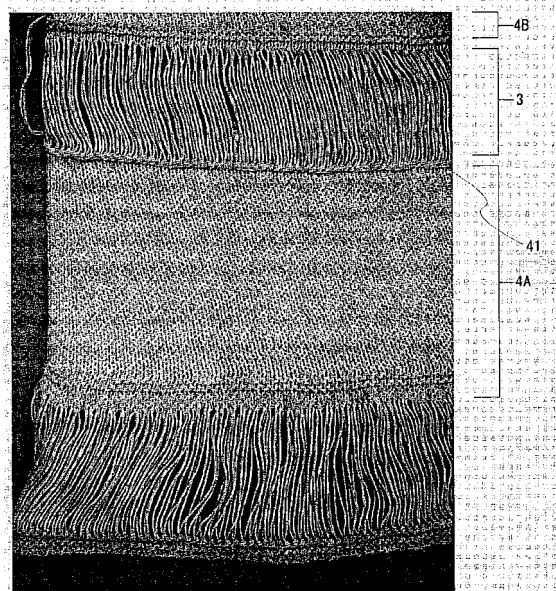
(72) Inventor: **UEMICHI, Kazuya**
Wakayama-shi
Wakayama 641-8511 (JP)

(74) Representative: **Carstens, Dirk Wilhelm et al**
WAGNER & GEYER
Gewürzmühlstrasse 5
80538 München (DE)

(54) **KNITTING METHOD FOR KNITTED FABRIC AND KNITTED FABRIC**

(57) The present invention provides a knitted fabric including a warp pattern section where a knitting yarn is bridged across in a substantially wale direction between base knitted fabric sections spaced apart from each other knitted using a flat knitting machine, and a knitting method of the same. The knitted fabric knitted using the flat knitting machine includes a base knitted fabric section 4A, another base knitted fabric section 4B, a warp pattern section 3 where a knitting yarn is bridged across in a substantially wale direction so as to be turned back from the base knitted fabric section 4A to another base knitted fabric section 4B to connect the base knitted fabric sections 4A, 4B, and a bind-off processing section 41 formed at the last course of the base knitted fabric section. The knitted fabric is obtained by the knitting method of the knitted fabric including the steps of knitting a base knitted fabric section 4A; knitting another base knitted fabric section 4B; and forming a warp pattern section 3 where a knitting yarn is bridged across in a substantially wale direction between the knitted fabric sections 4A, 4B after a knitting of the knitted fabric is finished at between the steps of knitting the base knitted fabric sections.

Fig. 2



Description

TECHNICAL FIELD.

5 **[0001]** The present invention relates to a knitted fabric having a warp pattern section where a knitting yarn is bridged across substantially in a wale direction between base knitted fabric sections spaced apart from each other or a knitted fabric having a textile-like structure section imitating the pattern of a woven fabric between the base knitted fabric sections, and a knitting method of the same.

10 BACKGROUND ART

[0002] A method of knitting a structure pattern such that a plurality of knitting yarns is bridged across long while being lined in parallel in the middle of a knitted fabric using a flat knitting machine includes a knitting method of a knitted fabric described in Patent Document 1. In such a method, if a predetermined zone in knitting the course of the knitted fabric is missed, the knitting yarn fed to the missed zone becomes a bridged yarn and is extended in a horizontal direction. Such knitting is repeated when knitting each course, so that a so-called miss pattern where a plurality of knitting yarns is bridged across long in a course direction (knitting width (horizontal) direction at the time of knitting) forms in the middle of the knitted fabric.

15 **[0003]** A method of knitting an inlay knitted fabric using the flat knitting machine includes a knitting method described in Patent Document 2. In such a method, the inlay knitted fabric in which an inlay yarn (inserting yarn) is inserted between stitches is knitted during the knitting of a base knitted fabric section. Specifically, the loop of the base knitted fabric section and an inlay yarn holding loop are first held by needles of front and back needle beds by split knitting. The inlay yarn is then bridged across on such loops so that the inlay yarn holding loop overlaps the loop of the base knitted fabric section, and then the loops of the next course are formed.

25 **[0004]**

[Patent Document 1] Japanese Laid-Open Patent Publication No. 2006-225776

[Patent Document 2] Japanese Laid-Open Patent Publication No. 2000-96398

30 DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

35 **[0005]** Thus, there has already been proposed a knitted fabric having a miss pattern such that a plurality of knitting yarns is lined in parallel in the wale direction (direction the course increases by knitting) and the knitting yarn is bridged across in the course direction in the middle of the knitted fabric, and a knitted fabric in which the inlay yarn is inserted to the middle of the knitted fabric. However, there has not been proposed a knitted fabric having a structure pattern in which a plurality of knitting yarns is lined in parallel in the course direction and the knitting yarn is bridged across in the wale direction in the middle of the knitted fabric, and a knitted fabric in which a warp and woof cross to form a textile-like structure as in the woven fabric.

40 **[0006]** The present invention has been made in view of the above situations, and an object of the present invention is to provide a knitted fabric including a warp pattern section where the knitting yarns are bridged across in a substantially wale direction between the base knitted fabric sections spaced apart from each other, and a knitting method of the same.

45 **[0007]** Another object of the present invention is to provide a knitted fabric including a textile-like structure section imitating the woven fabric between the base knitted fabric sections spaced apart from each other, and a knitting method of the same.

MEANS FOR SOLVING THE PROBLEMS

50 **[0008]** A knitting method of a knitted fabric including a warp pattern section according to the present invention is a method of knitting a knitted fabric using a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds. The knitting method includes the steps of: knitting a base knitted fabric section; knitting another base knitted fabric section; and forming a warp pattern section where a knitting yarn is bridged across in a substantially wale direction between the knitted fabric sections after the knitting of the knitted fabric is finished at between the steps of knitting the base knitted fabric sections. The step of forming the warp pattern section includes the steps of forming, with a stitch of the last course in the base knitted fabric section as a starting point, a temporarily-held knitting

yarn by bridging across a knitting yarn pulled out from the starting point to a needle spaced apart in at least one direction of either left or right and returning to the starting point side, and reducing the stitches of the last course by bind-off processing the stitch acting as the starting point. The knitting of the another base knitted fabric section is performed on the temporarily-held knitting yarn.

[0009] A knitted fabric including a warp pattern section according to the present invention is a knitted fabric knitted with a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds. The knitted fabric includes a base knitted fabric section; another base knitted fabric section; a warp pattern section where a knitting yarn is bridged across in a substantially wale direction so as to be turned back from the base knitted fabric section towards the another base knitted fabric section to connect the base knitted fabric sections; and a bind-off processing section formed at the last course of the base knitted fabric section.

[0010] A knitting method of a knitted fabric including a textile-like structure section according to the present invention is a method of knitting a knitted fabric using a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds. The knitting method uses the warp pattern section as a warp. That is, the method includes the steps of knitting a base knitted fabric section; knitting another base knitted fabric section; and forming a textile-like structure section where the warp and a woof extending in a knitting width direction cross at between the steps of knitting the base knitted fabric sections. The step of forming the textile-like structure section includes the steps of forming, with a stitch of the last course in the base knitted fabric section as a starting point, a plurality of temporarily-held knitting yarns that become the warps by bridging across a knitting yarn pulled out from the starting point to a needle spaced apart in at least one direction of either left or right and returning to the starting point side, reducing the stitches of the last course by bind-off processing the stitch acting as the starting point, transferring some of the plurality of temporarily-held knitting yarns to the opposing needle bed, feeding a knitting yarn that becomes a woof between the transferred temporarily held knitting yarn and the non-transferred temporarily held knitting yarn, and repeating the step of transferring the temporarily-held knitting yarn and the step of feeding the woof. The knitting of the another base knitted fabric section is performed in continuation to the temporarily-held knitting yarn.

[0011] A knitted fabric including a textile-like structure section according to the present invention is a knitted fabric using a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds. The knitted fabric uses the warp pattern section as a warp. That is, the knitted fabric includes a base knitted fabric section; another base knitted fabric section; a textile-like structure section formed between the base knitted fabric sections; and a bind-off processing section formed at the last course of the base knitted fabric section. The textile-like structure section includes a loop-shaped warp where a knitting yarn is bridged across in a substantially wale direction from the base knitted fabric section to the another base knitted fabric section so as to be turned back to connect the base knitted fabric sections, and a woof that crosses the warp and that appears on a front and a back of the knitted fabric.

EFFECTS OF THE INVENTION

[0012] According to the knitting method of the knitted fabric including the warp pattern section of the present invention, with the stitch of the last course of the base knitted fabric section as a starting point, a temporarily-held knitting yarn is formed on the needle spaced apart in at least one direction of either left or right of the needle bed and a bind-off process is performed on the stitch of the last course of the base knitted fabric section, so that the warp pattern section where the knitting yarn is bridged across in substantially the wale direction is formed following the base knitted fabric section by the flat knitting machine. Furthermore, by knitting another base knitted fabric section on the temporarily-held knitting yarn, the warp pattern section where the knitting yarn is bridged across in substantially the wale direction can be formed between the base knitted fabric sections.

[0013] According to the knitted fabric including the warp pattern section of the present invention, a knitted fabric of a non-conventional and new and different design is obtained by including a warp pattern section where the knitting yarn is bridged across in substantially the wale direction so as to be turned back from the base knitted fabric section to the another base knitted fabric section to connect the base knitted fabric sections, and a bind-off processing section formed at the last course of the base knitted fabric section. In addition, the knitted fabric of the present invention is a light knitted fabric excelling in air permeability by including the warp pattern section.

[0014] According to the knitting method of the knitted fabric including the textile-like structure section of the present invention, with the stitch of the last course of the base knitted fabric section as a starting point, a temporarily-held knitting yarn is formed on the needle spaced apart in at least one direction of either left or right of the needle bed and a bind-off

process is performed on the stitch of the last course of the base knitted fabric section, so that a loop-shaped warp where the knitting yarn is bridged across in substantially the wale direction so as to be turned back to connect the base knitted fabric sections can be formed by the flat knitting machine. Therefore, the textile-like structure section of various patterns can be formed according to the number and the place of the temporarily-held knitting yarn to transfer by transferring some of the temporarily-held knitting yarns to the opposing needle bed, feeding a woof to the needle bed gap in this state and sequentially repeating the transfer of the temporarily-held knitting yarn and the feeding of the woof in a similar manner. Furthermore, by knitting another base knitted fabric section on the temporarily-held knitting yarn, the textile-like structure section can be formed between the base knitted fabric sections.

[0015] According to the knitted fabric including the textile-like structure of the present invention, the textile-like structure section is formed by a loop-shaped warp where the knitting yarn is bridged across in substantially the wale direction so as to be turned back to connect the base knitted fabric sections and a woof crossing the warp and appearing on the front and the back of the knitted fabric, so that a knitted fabric of a novel design with the textile-like structure section imitating a woven fabric can be obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a plan view of one example of a dress including a warp pattern section according to the present invention. Fig. 2 is an enlarged photograph showing a fiber shape of the warp pattern section formed in a body of the dress. Fig. 3 is a plan view of one example of a knitted fabric including a textile-like structure section according to the present invention.

Fig. 4 is an enlarged photograph showing a fiber shape of the textile-like structure section.

Fig. 5 is an enlarged reference photograph showing a fiber shape formed only with a warp without arranging a woof of the textile-like structure section knitted in the knitting method of the present invention.

Fig. 6 is a schematic explanatory view showing one example of a method of knitting a base knitted fabric section and the warp pattern section alternately in plurals.

Fig. 7 is a plan view of a dress formed by applying a knitting method of a first embodiment, where (A) is a view in which the warp pattern section is formed at one part in a peripheral direction of a body and (B) is a view in which the warp pattern section of various shapes is formed.

Fig. 8 is an enlarged photograph showing a fiber shape of one example of the knitted fabric of the present invention with a twisted warp pattern section.

Fig. 9 is a first view of a knitting process for forming a warp pattern section according to a first embodiment.

Fig. 10 is a second view of the knitting process for forming the warp pattern section according to the first embodiment.

Fig. 11 is a third view of the knitting process for forming the warp pattern section according to the first embodiment.

Fig. 12 is a fourth view of the knitting process for forming the warp pattern section according to the first embodiment.

Fig. 13 is a fifth view of the knitting process for forming the warp pattern section according to the first embodiment.

Fig. 14 is a first view of a knitting process for forming a textile-like structure section according to a second embodiment.

Fig. 15 is a second view of a knitting process for forming the textile-like structure section according to the second embodiment.

Description of Symbols

[0017]

1	dress
2	body
21	front body
22	back body
3, 3A, 3a, 3b, 3c, 3d, 31, 32, 33, 34, 35, 36	warp pattern section
4, 4A, 4B, 4a, 4b, 4c, 4d, 4e	base knitted fabric section
41	bind-off processing section
7, 8	yarn feeder
10	knitted fabric
20	waste knitted fabric
5	textile-like structure section
51	warp
52	woof

BEST MODE FOR CARRYING OUT THE INVENTION

(Knitted fabric with warp pattern section)

[0018] A knitted fabric of the present invention with a warp pattern section includes at least one pair of base knitted fabric sections, a warp pattern section, and a bind-off processing section. Fig. 1 is a plan view seen from a front body side of a dress knitted in an embodiment described below, and Fig. 2 is a partially enlarged photograph thereof. As shown in Fig. 1, a dress 1 has a body 2 including a front body 21 and a back body 22, where the front body 21 and the back body 22 are one continued tubular knitted fabric.

[0019] The dress 1 includes the warp pattern section 3 formed with a knitting yarn bridged across in a substantially wale direction at the middle of the body 2. The warp pattern section 3 is formed over the entire periphery of the body between a plurality of base knitted fabric sections 4 arranged spaced apart from each other. As shown in Fig. 2, looking at the knitted fabric of the present invention in more detail, a region formed with the warp pattern section 3 is arranged between one base knitted fabric section 4A and the other (another) base knitted fabric section 4B, where the bind-off processing section 41 is arranged in the last course of the one base knitted fabric section 4A. Such a knitted fabric is obtained by alternately performing the knitting of the base knitted fabric section 4 and the formation of the warp pattern section 3.

(Knitted fabric with textile-like structure section)

[0020] The knitted fabric of the present invention with a textile-like structure section includes at least a pair of base knitted fabric sections, a textile-like structure section, and a bind-off processing section. Fig. 3 is a plan view of a single knitted fabric knitted in a second embodiment described below, and Fig. 4 is a partially enlarged photograph thereof.

[0021] A textile-like structure section 5 of a knitted fabric 10 is formed by a warp 51 bridged across in a substantially wale direction, and a woof 52 crossing the warp 51. The warp 51 forms stitches of a long loop length compared to the stitches constituting the base knitted fabric sections 4A, 4B, and couples the both base knitted fabric sections between the two base knitted fabric sections 4A, 4B arranged spaced apart from each other. On the other hand, the woof 52 extends substantially in the course direction, and crosses the warp 52 so as to be weaved between the warps 51 lined in parallel. That is, the woof 52 of the present invention is sandwiched by the warps 51 adjacent in the course direction, as opposed to Patent Document 2 in which the inlay yarn is sandwiched between overlapping stitches. As shown in Fig. 4, looking at the knitted fabric 10 of the present invention in more detail, the textile-like structure section 5 is formed between one base knitted fabric section 4A and the other (another) base knitted fabric section 4B, and the bind-off processing section 41 is arranged at the last course of the one base knitted fabric section 4A.

[0022] The knitted fabric with the warp pattern section and the knitted fabric with the textile-like structure section described above greatly differ in outer appearance. However, the textile-like structure section has a structure in which the woof is arranged between the knitting yarns constituting the warp pattern section, and thus both knitting methods have a number of common areas. Hereinafter, the common portion will be summarized and the uncommon portion will be specifically described individually for the knitted fabric and the knitting method of the present invention.

<Base knitted fabric section>

[0023] The base knitted fabric section (another base knitted fabric section) is a knitted fabric section including a knitting structure other than the warp pattern section (textile-like structure section) described below. That is, the knitted fabric of the present invention includes at least one pair of base knitted fabric sections spaced apart in the wale direction with respect to each other by way of the warp pattern section (textile-like structure section). The pair of base knitted fabric sections may be separated and made independent in the wale direction by the warp pattern section (textile-like structure section), or may be extended to the side (course direction) of the warp pattern section (textile-like structure section) and joined to each other. The knitting of the base knitted fabric section may be performed singularly or in combination of various types of knitting patterns such as plain knitting, rib, and purl knitting. Each base knitted fabric section that exists in plurals may have the same color, pattern, or knitting structure, or may have a different color, pattern, or knitting structure.

<Warp pattern section>

[0024] The warp pattern section is a region connecting the pair of base knitted fabric sections spaced apart in the wale direction and constituted by a knitting yarn extending from the last course of one bind-off processed base knitted fabric section and bridged across to a first course of the other base knitted fabric. The knitting yarn is formed in a loop-shape with the one base knitted fabric section side as a basal end and the other base knitted fabric section side as a turn-back end. In this case, the loop-shaped knitting yarn is a turn-back unit. The turn-back unit (temporarily-held knitting

yarn in knitting) is normally formed longer than the length of the stitches of the base knitted fabric section, and the length of the turn-back unit can be arbitrarily selected. If various lengths of the stitches of the base knitted fabric section exist, the length of the turn-back unit may be made longer than the average length or the maximum length of the stitches of the base knitted fabric section. At least one turn-back unit needs to be provided, and the number of turn-back units may be the same number as or a different number from the number of stitches of the last course of the one base knitted fabric section. The knitting yarn in an outward path and the knitting yarn in a homeward path configuring the turn-back unit may cross or may not cross. The warp pattern section may be constituted with the knitting yarn same as the base knitted fabric section or may be constituted with a yarn of a different color or material.

<Textile-like structure section>

[0025] The textile-like structure section is a region formed with a pattern imitating the woven fabric, and connecting the pair of base knitted fabric sections spaced apart in the wale direction. The textile-like structure section includes a warp extending from the last course of one bind-off processed base knitted fabric section and bridged across to the first course of the other base knitted fabric section. The warp uses the warp pattern section described above. That is, as shown in Fig. 5, the photograph of the knitted fabric in which the woof is not arranged and the base knitted fabric sections are connected with only the warp is similar to Fig. 2. As shown in Fig. 5, the warp 51 is formed in a loop-shape with one base knitted fabric section 4A side as the basal end and the other base knitted fabric section 4B side as the turn-back end. In this case, the loop-shaped warp 51 is the turn-back unit. The turn-back unit (temporarily-held knitting yarn in knitting) is normally formed longer than the length of the stitches of the base knitted fabric section, and the length of the turn-back unit can be arbitrarily selected. If various lengths of the stitches of the base knitted fabric section exist, the length of the turn-back unit may be made longer than the average length or the maximum length of the stitches of the base knitted fabric section. The length of the turn-back unit is normally a length of greater than or equal to 2 cm, and more preferably, greater than or equal to 3 cm. At least one turn-back unit needs to be provided, and the number of turn-back units may be the same number as or a different number from the number of stitches of the last course of the one base knitted fabric section. The knitting yarn in the outward path and the knitting yarn in the homeward path constituting the turn-back unit may cross or may not cross. The warp may be constituted with the knitting yarn same as the base knitted fabric section or may be configured with a yarn of a different color or material.

[0026] The woof of the textile-like structure section is a knitting yarn extending in a direction of crossing the warp bridged across in substantially the wale direction. The woof crosses the warp so as to appear at the front and the back of the warp at least one time each. That is, the warp and the woof of the textile-like structure section are in an crossing state similar to the crossing state of a vertical weaving yarn and a horizontal weaving yarn of the woven fabric. In theory, the woof may be at least one, but is preferably in plurals so that the design of the textile-like structure section can be variously changed. The woof can also adopt a yarn of the same type (same color) as or a different type (different color) from the warp.

[0027] The woof is preferably fixed so as not to detach from the warp as it is not knitted at the area crossing the warp. For instance, as shown in an embodiment described below, the woof 52 is knitted and fixed to a waste knitted fabric 20 that is independently knitted at a position spaced apart in the knitting width direction from the knitted fabric 10 to be knitted (see Fig. 3). If the woof 52 is knitted to the waste knitted fabric 20, the woof 52 is cut so as to be longer than the knitting width of the knitted fabric when the knitting of the knitting fabric is finished, and the woof 52 is tied to the warp 51 or the base knitted fabric section at the end in the knitting width direction of the knitted fabric or the woofs 52 are tied to each other so that the woof 52 does not detach from the warp 51. In addition, as illustrated in the embodiment, the number of crossings of the warp and the woof may be made greater at the end in the course direction of the base knitted fabric section than at the intermediate part in the course direction so that the woof does not easily detach from the warp.

<Bind-off processing section>

[0028] The bind-off processing section is formed at the last course of one base knitted fabric section, that is, at the basal end side of the turn-back unit. The stitches are suppressed from loosening from the last course side of the one base knitted fabric section and an appropriate shape of the base knitted fabric section and the warp pattern section (textile-like structure section) can be maintained by performing the bind-off process.

<Formation process of warp pattern section or warp of textile-like structure section>

[0029] The formation process of the warp pattern section includes a "step of forming temporarily-held knitting yarn" and a "step of performing a bind-off process". In forming the textile-like structure section as well, the warp is first connected to the base knitted fabric section, and then the woof is arranged to be filled between the warps. The warp of the textile-like structure section is connected to the base knitted fabric section using the "step of forming temporarily-held knitting

yarn" and the "step of performing a bind-off process", similar to the warp pattern section.

(Step of forming temporarily-held knitting yarn)

[0030] The step of forming the temporarily-held knitting yarn is performed, with the stitch of the last course at the base knitted fabric section as the starting point, by bridging across the knitting yarn to the needle spaced apart in at least one direction of left or right from the starting point and returning to the starting point. That is, at the time of knitting, the knitting yarn is pulled out to at least one side in the transverse direction (course direction) of the needle bed from the starting point to form the temporarily-held knitting yarn, but after the knitting of the knitted fabric is finished, the turn-back unit (temporarily-held knitting yarn in knitting) is pulled to the lower side by the weight of one base knitted fabric section since one base knitted fabric section is on the bottom and the other base knitted fabric section is on the top, whereby the warp pattern section (warp) where the knitting yarn is bridged across in substantially the wale direction between the pair of base knitted fabric sections is formed.

[0031] The length in the wale direction of the warp pattern section (warp) is defined by a distance (hereinafter referred to as spaced distance) between the needle that becomes the starting point, and the needle spaced apart from the starting point when forming the temporarily-held knitting yarn with the knitting yarn. The needle spaced apart from the starting point may be a needle adjacent to the needle that becomes the starting point, but a long temporarily-held knitting yarn can be easily formed by bridging across the knitting yarn to the needle spaced apart from the starting point by a plurality of needles.

[0032] In handling the knitting yarn pulled out from the starting point, the knitting yarn may be hooked directly to the needle spaced apart from the starting point, or a temporary knitting, which is resolved after the knitting of the knitted fabric is finished, may be performed while hooking the pulled knitting yarn to the needle spaced apart from the starting point. In the latter case, the stitch that becomes the starting point is transferred to the needle of the opposing needle bed, and temporary knitting is performed for a few wale in the wale direction with only one needle that is now an empty needle, on which needle the starting point was held. Meanwhile, knitting is not performed with the other needles. After the temporary knitting, the knitting yarn is hooked to the needle spaced apart in the transverse direction from the distal end (end on the side spaced apart from the starting point) of the temporary knitted portion, and turned back towards the starting point side. The temporary knitted portion is resolved by pulling the pair of base knitted fabric sections sandwiching the warp pattern section after the knitting of the knitted fabric is finished, and becomes part of the loop-shaped turn-back unit formed so as to be bridged across both the knitted fabric sections. According to such a method, the length of the temporarily-held knitting yarn can be obtained with the temporary knitted portion even if the spaced distance is relatively short, and thus the turn-back unit longer than the spaced distance can be formed. Obviously, the knitting yarn pulled out from the starting point does not perform knitting (does not include temporary knitting) until being hooked to the needle spaced apart from the starting point. This is because if the knitting is performed with the knitting yarn pulled out from the starting point by other needles, the knitted stitch becomes a new starting point.

[0033] The transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point may be to the left or to the right, or may be both to the left and the right. When forming a temporarily-held knitting yarn at the needles spaced apart in both to the left and the right from the starting point, for example, the knitting yarn is hooked to the needle spaced apart to the right side from the starting point, and then the knitting yarn is hooked to the needle spaced apart to the left side from the starting point, and then the knitting yarn is turned back to the starting point side. In this case, only the knitting yarn held on the needle with which another base knitted fabric section is continuously knitted of the bridged across knitting yarns remains at the needle bed as the temporarily-held knitting yarn, and the knitting yarn held on the needle other than the temporarily-held knitting yarn is removed from the needle bed before starting the knitting of another base knitted fabric section and becomes a temporary temporarily-held knitting yarn for obtaining the length of the turn-back unit.

[0034] In addition, when the knitted fabric to be knitted includes a knitted fabric section held on each front and back needle beds and continued to each other, where performing the process of knitting the base knitted fabric section and the process of forming the warp pattern section are performed (textile-like structure section) in knitting each knitted fabric section held on the front and back needle beds, the transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point is preferably the same direction for one knitted fabric section and the other knitted fabric section held on the front and back needle beds in the step of forming the temporarily-held knitting yarn of when forming the warp pattern section (textile-like structure section).

[0035] When knitting the knitted fabric to a tubular shape, a C-shape, and the like, the knitted fabric section held on each front and back needle beds and continued to each other are knitted. When forming the warp pattern section (textile-like structure section) in both the knitted fabric section held on the front needle bed and the knitted fabric section held on the back needle bed, the transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point is set as the same direction for one knitted fabric section and the other knitted fabric section held on the front and back needle beds, so that the position in the transverse direction of the needle beds of the temporarily-

held knitting yarn correspond in the front and back knitted fabric sections when starting the knitting of another base knitted fabric section following the temporarily-held knitting yarn. Thus, when knitting another base knitted fabric section in continuation to each temporarily-held knitting yarn held on the front and back needle beds, knitting can be performed without each base knitted fabric section shifting and separating in the width direction of the needle bed from each other.

[0036] Obviously, the temporarily-held knitting yarn may be formed at the needle spaced apart to the right (left) side from the starting point in the knitted fabric section held on the front needle bed, and the temporarily-held knitting yarn may be formed at the needle spaced apart to the left (right) side from the starting point in the knitted fabric section held on the back needle bed. In such a case, the temporarily-held knitting yarns held on the front and back needle beds are preferably moved to positions opposing each other by racking and transferring before the knitting of another base knitted fabric section following the temporarily-held knitting yarn.

[0037] When alternately repeating the knitting of the base knitted fabric section and the formation of the warp pattern section (textile-like structure section), that is, when further sequentially performing the formation process of the warp pattern section (textile-like structure section) with respect to the last course of the another knitted fabric section following the knitting of the another base knitted fabric section and the knitting process of yet another base knitted fabric section following such warp pattern section (textile-like structure section) in an alternately repeating manner, the transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point is preferably reversed for every process of forming the warp pattern section (textile-like structure section) in the step of forming the temporarily-held knitting yarn of when forming each warp pattern section (textile-like structure section).

[0038] Using the knitting of the warp pattern section by way of example, assume a case of knitting the knitted fabric in the steps of knitting of first base knitted fabric section 4a → formation of first warp pattern section 3a → knitting of second base knitted fabric section 4b → formation of second warp pattern section 3b → knitting of third base knitted fabric section 4c → formation of third warp pattern section 3c ..., as shown in Fig. 6. In this case, the yarn is bridged across to the needle spaced apart to the left side from the starting point when forming the temporarily-held knitting yarn in the first warp pattern section 3a. The yarn is bridged across to the needle spaced apart to the right side from the starting point when forming the temporarily-held knitting yarn in the second warp pattern section 3b. Hereinafter, the transverse direction of bridging across the knitting yarn to the needle from the starting point is alternately changed for every formation process of the warp pattern sections 3c, 3d in order. If the knitted fabric is knitted with such a method, all base knitted fabric sections 4a to 4e can be knitted in a constant width region on the needle bed, and thus the region required for the knitting at the needle bed can be suppressed to a minimum.

[0039] Obviously, the transverse direction of bridging across the knitting yarn to the needle from the starting point may be the same in the formation process of each warp pattern section (textile-like structure section) if there is extra width in the needle bed.

[0040] The step of forming the temporarily-held knitting yarn is preferably performed from the side edge in the knitting width direction of the knitted fabric section held on the front and back needle beds. Since empty needles are normally lined in parallel on the outer side of the side edge of the knitted fabric section, such empty needles can be used as needles spaced apart from the starting point to bridge the knitting yarn. When forming the temporarily-held knitting yarn with the stitch at the intermediate of the knitting width direction in the knitted fabric section held on the front and back needle beds as the starting point, since the stitches of the base knitted fabric section are held on the needle in the transverse direction of the starting point, such stitches are to be transferred to a different needle bed in advance to obtain an empty needle state.

(Step of performing bind-off process)

[0041] The stitches of the last course held on the needle bed of the base knitted fabric section can be reduced by the step of bind-off processing the stitches acting as the starting point of the temporarily-held knitting yarn. That is, a state in which only the temporarily-held knitting yarn is held on the needle bed is ultimately obtained by reducing the stitches of the last course of the base knitted fabric section by sequentially performing the bind-off process, in addition to forming the temporarily-held knitting yarn. Another base knitted fabric section can thus be knitted in continuation to the temporarily-held knitting yarn. It has been described above that the stitches of the base knitted fabric section are prevented from becoming loose from the last course side by the bind-off process, but the bind-off process also suppresses the adjacent knitting yarn of the turn-back unit from being pulled close even if a certain knitting yarn of turn-back unit is pulled after the knitting is finished and stabilizes the length of the knitting yarn of each turn-back unit.

[0042] The step of performing the bind-off process is normally performed while performing the step of forming the temporarily-held knitting yarn. For instance, the knitting yarn is fed to the needle spaced apart in the transverse direction of the needle bed from the starting point, and meanwhile, the bind-off process is performed on the stitch that becomes the basal end of the turn-back unit of the base knitted fabric section. Thereafter, the knitting yarn fed to the needle spaced apart is returned to the starting point.

<Formation process of woof of textile-like structure section>

[0043] The woof of the textile-like structure section is weaved between the warps described above using a "step of transferring temporarily-held knitting yarn" and a "step of feeding yarn between temporarily-held knitting yarns divided to the front and back needle beds".

(Step of transferring temporarily-held knitting yarn)

[0044] After the step of forming a plurality of temporarily-held knitting yarns is finished, some of the temporarily-held knitting yarns are transferred to the opposing needle bed. Through such transfer, the transferred temporarily-held knitting yarns are held on one needle bed and the non-transferred temporarily-held knitting yarns are held on the other needle bed, whereby the temporarily-held knitting yarns are held by being divided to the front and back needle beds.

(Step of feeding yarn between temporarily-held knitting yarns divided to front and back needle beds)

[0045] According to such a step, the knitting yarn (woof) is fed between the temporarily-held knitting yarns held divided to the front and back needle beds, and such a woof is crossed with a plurality of warps lined in parallel in the course direction and sandwiched with the warps from the front side and the back side of the knitted fabric.

[0046] In the formation of such woofs, the number of temporarily-held knitting yarns to transfer and which temporarily-held knitting yarn to transfer can be arbitrarily selected. Furthermore, the number of woofs to be fed so as to be sandwiched by the warps may also be arbitrarily selected. The textile-like structure section including the three primary structures of the woven fabric, or plain weaving, twilled weaving, and sateen weaving, and the weaving structure combining the same can be formed in the knitted fabric by combining the selectable parameters.

[0047] Thereafter, the transfer of the temporarily-held knitting yarns and the yarn feeding of the woof are similarly repeated to form the textile-like structure section. In the repeating step, the temporarily-held knitting yarns to be transferred may be the same or may be different for every repetition, and an arbitrary temporarily-held knitting yarn can be selected. The woof is pushed down at the area where the temporarily-held knitting yarn held on one needle bed and the temporarily-held knitting yarn held on the other needle bed cross by repeating the transfer of the temporarily-held knitting yarns and the yarn feeding of the woof, and the textile-like structure section in which the woof is weaved between the warps is formed.

<Formation mode of warp pattern section or textile-like structure section>

[0048] The knitted fabric of the present invention includes the following formation mode of the warp pattern section (textile-like structure section) in addition to the knitted fabric formed with the warp pattern section (textile-like structure section) extending in the horizontal direction in the turn-back unit of a uniform length over the width direction of a single knitted fabric.

[0049] (1) The warp pattern section (textile-like structure section) extending in the horizontal direction in the turn-back unit of a uniform length is formed over the entire periphery of a tubular knitted fabric. The tubular knitted fabric also can be knitted with the knitting method similar to when knitting the warp pattern section (textile-like structure section) in a single knitted fabric. A four-bed flat knitting machine or a two-bed flat knitting machine with a transfer jack are preferably used to knit the tubular knitted fabric with the warp pattern section (textile-like structure section). With such flat knitting machines, the front and back knitted fabric sections of the tubular knitted fabric are knitted with the front and back needle beds arranged at the lower part, and the front and back needle beds (or transfer jack) arranged at the upper part can be used to transfer the stitches of the knitted fabric section, and thus the tubular knitted fabric with the warp pattern section (textile-like structure section) can be knitted in an every needle state.

[0050] (2) A single or a plurality of warp pattern sections (textile-like structure section) is formed at one part in the width direction of the base knitted fabric section in the knitted fabric. Using the warp pattern section by way of example, a single or a plurality of warp pattern sections 31, 32 is formed at one part in the width direction of the base knitted fabric section at a body 2 of a dress 1, as shown in (A) of Fig. 7. Such a warp pattern section or a textile-like structure section may be arranged on both front and back bodies, or may be arranged on one body. The warp pattern section (textile-like structure section) may be formed across the front and back bodies 21, 22. Forming a single or a plurality of warp pattern sections (textile-like structure section) at one part of the knitted fabric can also be applied to a C-shaped knitted fabric or the like having an opening such as a cardigan other than a single knitted fabric or a tubular knitted fabric.

[0051] (3) The warp pattern section (textile-like structure section) may be formed so as to extend in a manner obliquely inclined with respect to the course direction of the knitted fabric. In the case of the warp pattern section, the warp pattern sections 33 to 36 formed across the entire length in the width direction of the base knitted fabric section at the body 2 of the dress 1 can be knitted, as shown in Fig. 7(B). This includes the warp pattern section 33 extending in a diagonal direction of the body 2 and the warp pattern section 34 formed in a V-shape with the length of the temporarily-held

knitting yarn of when forming the warp pattern section as a constant.

[0052] The warp pattern section that spreads from one side to the other side of the body 2 can also be formed by changing the length of the temporarily-held knitting yarn of when forming the warp pattern section. This includes the warp pattern section 35 in which the basal end side of the turn-back unit is lined horizontally and the turn-back end side is lined in an inclined manner, and the warp pattern section 36 in which both the basal end side and the turn-back end side of the turn-back unit are lined in an inclined manner.

[0053] In the case of the textile-like structure section, the textile-like structure section is formed so that the woof extends obliquely inclined with respect to the course direction of the knitted fabric. To form the woof so as to be slanted with respect to the course direction of the knitted fabric, the upper end edge of the base knitted fabric section that becomes the basal end side of the turn-back unit is formed so as to be slanted with respect to the course direction. In this case, a state in which the stitches of different courses are lined on the basal end side of the turn-back unit at the base knitted fabric section such that the knitting width of the base knitted fabric section sequentially becomes smaller is obtained before forming the textile-like structure section, and thereafter, the temporarily-held knitting yarn is formed. The basal end side of the turn-back unit of the base knitted fabric section is thereby in a state slanted with respect to the course direction of the knitted fabric, and as a result, the woof is formed inclined with respect to the course direction of the knitted fabric when the woof is bridged across so as to cross the warp, whereby the textile-like structure section formed in continuation to the base knitted fabric section is also slanted. The textile-like structure section formed slanted with respect to the course direction of the knitted fabric includes the textile-like structure section extending in a band-shape in an oblique direction of the knitted fabric and the textile-like structure section formed in a V-shape with the length of the temporarily-held knitting yarn of when forming the textile-like structure section as a constant.

[0054] The textile-like structure section that spreads from one end to the other end in the course direction of the knitted fabric may be formed by changing the length of the temporarily-held knitting yarn of when forming the textile-like structure section. In this case, if the stitches of the same course are lined on the basal end side of the turn-back unit of the base knitted fabric section, the textile-like structure section in which the basal end side of the turn-back unit is lined horizontally and the turn-back end is lined in an inclined manner is obtained, whereas if the stitches of different courses are lined on the basal end side of the turn-back unit of the base knitted fabric section, the textile-like structure section in which both the basal end side and the turn-back end of the turn-back unit are lined in an inclined manner is obtained.

[0055] When forming the warp pattern section (textile-like structure section) in which the length of each turn-back unit continuously changes, the temporarily-held knitting yarn is preferably formed with the direction of bridging across the knitting yarn to the needle spaced apart from the starting point as the side that becomes a long turn-back unit of the transverse direction of the base knitted fabric section. For instance, since longer turn-back unit is realized towards the right side in the warp pattern section 36 of Fig. 7(B), the temporarily-held knitting yarns of when forming the turn-back unit is formed by bridging across the knitting yarn to the needle spaced apart towards the right side from the starting point. Longer temporarily-held knitting yarns are bridged across to the needle more on the right side, and the shorter temporarily-held knitting yarns are bridged across to the needle more on the left side, sequentially, and thus a plurality of temporarily-held knitting yarns is suppressed from being bridged across to one needle even if the length of the knitting yarn constituting each temporarily-held knitting yarn is different.

<Twisted warp pattern section>

[0056] A twist may be formed in the warp pattern section including a plurality of turn-back units. That is, in the knitted fabric of the present invention, with the knitting yarn bridged across from the base knitted fabric section to another base knitted fabric section so as to be turned back to form a loop-shape as the turn-back unit, the base knitted fabric section side of the turn-back unit as the basal end, and the another base knitted fabric section side as the turn-back end, the lined order in the course direction of the plurality of turn-back units is preferably reversed for the basal end side and the turn-back end side. In such a knitted fabric, the bind-off processing section 41 is formed at the last course of the base knitted fabric section 4A, and the warp pattern section 3A, in which twist is formed every group of turn-back units, is formed between the base knitted fabric section 4A and the another base knitted fabric section 4B, as shown in Fig. 8.

[0057] According to the knitted fabric of such a configuration, a knitted fabric of a novel design in which a twist is added to a plurality of turn-back unit groups constituting the warp pattern section can be obtained.

[0058] To form such a twisted warp pattern section, a step of reversing the lined order of the basal end and the lined order of the turn-back end in the knitting width direction of a plurality of temporarily-held knitting yarns is suitably provided prior to knitting another base knitted fabric section with respect to the plurality of temporarily-held knitting yarns, where the starting point side of the temporarily-held knitting yarn is the basal end and the end on the opposite side of the basal end is the turn-back end. A more specific method for reversing the lined order of the basal end and the lined order of the turn-back end in the knitting width direction of the temporarily-held knitting yarns includes a method of reversing the lined order when forming the temporarily-held knitting yarn and a method of reversing the lined order after forming the temporarily-held knitting yarn.

[0059] In the former case, if the lined order of the starting point is A to E from left to right on the needle bed, the temporarily-held knitting yarn from the starting point A is formed on the needle on the left side close to the starting point A, and the temporarily-held knitting yarns from the starting points B ... E are sequentially formed on the needles farther to the left side than the temporarily-held knitting yarn corresponding to the starting point A. According to such a method,

the length of each temporarily-held knitting yarn will not be even, but the lined order on the turn-back end side of the temporarily-held knitting yarn becomes E to A from left to right, whereby the warp pattern section with a twist can be formed.

[0060] In the latter case, after the temporarily-held knitting yarns are formed, the lined order in the knitting width direction of such temporarily-held knitting yarns is reversed through the transfer of the temporarily-held knitting yarns to the opposing needle bed and the racking of the needle bed. For instance, if the lined order on the turn-back end side of the temporarily-held knitting yarns is A to E from left to right on the front needle bed, such temporarily-held knitting yarn group is once transferred to the back needle bed. The back needle bed is then racked towards the right side by a pitch one needle less than the number of temporarily-held knitting yarns in the right direction. The temporarily-held knitting yarn A is then transferred to be returned to the opposing needle bed, and thereafter, each temporarily-held knitting yarn B, C, ... is transferred to be returned to the front needle bed by sequentially racking the back needle bed to the left for two needles for the temporarily-held knitting yarn B, four needles for the temporarily-held knitting yarn C, In this manner, the lined order on the turn-back end side of the temporarily-held knitting yarns is E to A in order from the left side to the right side of the front needle bed, whereby the warp pattern section with a twist can be formed.

<Flat knitting machine>

[0061] The knitting method of the present invention may be performed with a two-bed flat knitting machine including a front needle bed and a back needle bed, in addition to being performed with a four-bed flat knitting machine. When knitting the knitted fabric with the two-bed flat knitting machine, the knitted fabric may be knitted with an empty needle provided alternately. Furthermore, when using the two-bed flat knitting machine, the knitted fabric may be knitted with a transfer jack bed, in which transfer jacks are arranged in columns, arranged at an upper level of one or both of the front and back needle beds.

Embodiment 1

[0062] The embodiments of the present invention related to the knitting of the warp pattern section will be described in detail with reference to the drawings. In the present embodiment, the knitted fabric is knitted using a four-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, the back needle bed capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds.

[0063] The four-bed flat knitting machine includes, on a lower front needle bed and a lower back needle bed, an upper front needle bed and an upper back needle bed arranged in columns with a great number of knitting needles at the same pitch as the lower needle bed. The lower front needle bed is hereinafter simply referred to as FD, the lower back needle bed as BD, the upper front needle bed as FU, and the upper back needle bed as BU.

[0064] The needles of the BU are used to transfer stitches held on the needles of the FD, and the needles of the FU are used to transfer stitches held on the BD. Through the use of the FU and the BU used to transfer stitches, structure patterns of mixed front-and-back stitches, such as links, purls, and ribs can be knitted, stitches can be rotated, and the stitches can be overlapped.

[0065] The flat knitting machine used in the present embodiment includes a yarn feeder arranged to be slidable in the knitting width direction of the knitting machine. The flat knitting machine includes a carriage of so-called 3-cam system mounted with a cam system S2 which moves on the needle beds and is used for knitting, and a cam system S1 and a cam system S3 which are used for transferring stitches. The cam system S1, the cam system S2, and the cam system S3, are hereinafter simply referred to as S1, S2, and S3. In the knitting process, the cam system from the preceding side of the traveling direction of the carriage is always S1, S2, and S3. While the carriage makes one forward movement or backward movement by such cam systems, the knitting with the knitting yarn fed from the yarn feeder is performed.

[0066] In the present embodiment, a sleeveless dress shown in Fig. 1 is knitted to a tubular shape using such a flat knitting machine.

[0067] In the dress 1, the knitted fabric section of a back body 22 is knitted principally with the BD in an every needle state without having an empty needle. The knitted fabric section of a front body 21 is knitted principally with the FD in an every needle state without having an empty needle.

[0068] One example of a knitting method for forming the warp pattern section in the body will be described with reference to the knitting process diagrams of Figs. 9 to 13.

[0069] Figs. 9 to 13 show the knitting process of forming the warp pattern section in continuation to the base knitted fabric section knitted to a tubular shape in a form of a plain stitch at a certain portion of the body 2.

[0070] In the knitting process diagrams of Figs. 9 to 13, the number of stitches of the body is shown to be less than the number used in the actual knitting for the sake of convenience of illustration. The alphabets A to R shown in the figures indicate the needles of FD, BD, FU, BU disposed opposite to each other in the cross direction. In each knitting block of the figures, the numbers at the left end indicate the knitting block number, and the symbol in the parenthesis next thereto indicates the cam used in the knitting process. The arrows at the right end column of the figures indicate the racking direction and the racking pitch of the back needle bed, and the column adjacent to the left thereof indicates the knitting direction. The white circle in the figure indicates the old loop, the black circle indicates the stitch knitted in the relevant knitting block, and the hill-shaped mark indicates the temporarily-held knitting yarn.

[0071] The knitting block S shown in Fig. 9 shows a state before the warp pattern section is knitted at the stage in the middle of knitting the body. The knitting block S shows a state where the stitches are held on the needles L to Q of the FD and the BD, and the body is knitted. The stitches held on the FD are stitches of the knitted fabric of the front body, and the stitches held on the BD are stitches of the knitted fabric of the back body. The stitches held on the needles of FD and BD are connected, and the body 2 is knitted to a tubular shape.

[0072] In the knitting block 1 of Fig. 9, the carriage is first moved in the right direction, and the knitting yarn is fed from the yarn feeder 7 to the BD to knit one part (needles L, M of BD) of the knitted fabric of the back body by S2.

[0073] In the next knitting block 2, the carriage is moved in the left direction, and the stitch held on the needle M of the BD knitted in the knitting block 1 is transferred to the needle M of the FU by S1.

[0074] In the knitting block 2, the knitting yarn is bridged across to the needle C of the BD to form a temporarily-held knitting yarn by the S2 traveling on the backside of the S1. The knitting yarn bridged across to the needle C is continued to the stitch transferred to the needle M of the FU. Since the length from the needle M to the needle C is the formation length of the warp pattern section, to which needle of the BD to bridge the knitting yarn extending from the needle M is determined depending on the design of the body.

[0075] Furthermore, in the knitting block 2, the stitch held on the needle L of the BD is transferred to the needle L of the FU by the S3 traveling on the back side of the S2.

[0076] In the next knitting block 3, the back needle bed is first racked to the left by one pitch. With this racking, the stitch transferred from the needle L of the BD to the needle L of the FU is at the position facing the needle M of the BD.

[0077] In the knitting block 3, the carriage is moved in the right direction after the racking, and the stitch held on the needle L of the FU is transferred to the needle M of the BD by the S1. According to such transfer, the stitch originally held on the needle L of the BD moves to the adjacent needle M.

[0078] In the next knitting block 4, the back needle bed is first racked to the right by one pitch, and the opposing state of the front and back needle beds is returned to the state of the knitting block S.

[0079] Similarly, in the knitting block 4, the carriage is moved in the left direction after the racking to return the stitch held on the needle M of the FU to the needle M of the BD by the S1. According to such transfer, a double stitch forms on the needle M of the BD. The double stitch is in a so-called slide state in which the overlapped stitch (stitch moved from the needle L of the BD to the needle M of the BD in the knitting blocks 2 and 3) appears on the front side of the body thereby forming a projecting shape. The stitch held on the needle N of the BD is transferred to the needle N of the FU by the S1, and a pre-process of forming the next temporarily-held knitting yarn is simultaneously carried out.

[0080] In the next knitting block 5, the carriage is moved in the right direction, and the yarn is fed from the yarn feeder 7 to the BD to form a stitch on the double stitch (stitch of needle M of the BD) by the S2. In this case, the formation step of the temporarily-held knitting yarn in which the knitting yarn is bridged across to the needle C with the stitch of the needle M of the BU as the starting point and returned to the starting point is performed once. The transfer and the knitting of the stitches in the blocks 2 to 5 are a so-called bind-off process and a known bind-off processing method other than the above may also be used. For instance, when forming the double stitch, there may be realized a so-called non-slide state in which the stitch held on the needle L of the BD is overlapped on the back side of the stitch of the needle M so that the projecting shape does not stand out.

[0081] In the knitting block 6 shown in Fig. 10, the carriage is moved in the left direction, the yarn is fed from the yarn feeder 7, and the knitting yarn is bridged across to the needle D of the BD to form a temporarily-held knitting yarn by the S2.

[0082] In the knitting block 6, the stitch held on the needle M of the BD is transferred to the needle M of the FU by the S3 traveling on the backside of the S2.

[0083] In the knitting after the knitting block 7 in Fig. 10, the formation of the temporarily-held knitting yarn and the bind-off process are repeated. Specifically, in the knitting block 7, the stitch originally held on the needle M of the BD and then held on the needle M of the FU is transferred to the needle N of the BD after racking the back needle bed to the left by one pitch.

[0084] In the knitting block 8, the racking pitch of the back needle bed is then returned to the original position (racked in the right direction by one pitch), and the stitch held on the needle N of the FU in the knitting block 4 (see Fig. 9) is returned to the needle N of the BD to form a slide-double stitch. In the relevant knitting block, the stitch held on the needle O of the BD is transferred to the needle O of the FU as a preparation of the next double stitch.

[0085] Furthermore, in the knitting block 9, a new stitch is formed on the double stitch of the needle N of the BD. At

this time point, the formation step of the temporarily-held knitting yarn in which the knitting yarn is bridged across to the needle D with the stitch of the needle N of the BD as the starting point and returned to the starting point is performed once. The second bind-off process is performed according to the transfer and the knitting from the knitting blocks 6 to 9.

[0086] In the knitting block 10, the knitting yarn is extended from the new stitch formed on the needle N of the BD to form a temporarily-held knitting yarn on the needle E of the BD, and the new stitch is transferred to the needle N of the FU. The state of the stitches at the time point the knitting block 10 is finished is the state in which the number of temporarily-held knitting yarns is increased by one and the number of stitches of the back body held on the BD is reduced by one compared to the state of the stitches at the time point the knitting block 6 is finished. Thereafter, the knitting blocks 7 to 10 are repeated.

[0087] The knitting block 11 of Fig. 11 shows a state where a fifth temporarily-held knitting yarn corresponding to the stitch of the back body is formed by repeating the knitting blocks 7 to 10. After the knitting block 11 is finished, the fifth temporarily-held knitting yarn is formed on the needle G of the BD, so that the stitches of the back body held on the needles P, Q of the BD are held on the needles P, Q of the FU, respectively.

[0088] After the fifth temporarily-held knitting yarn is formed, the back needle bed is racked to the left by one pitch, and then the carriage is moved in the right direction to transfer the stitch held on the needle P of the FU to the needle Q of the BD, as shown in the knitting block 12.

[0089] In the knitting block 13, the racking of the back needle bed is returned to the original position, and the carriage is moved in the left direction to overlap the stitch of the needle Q of the FU (stitch originally held on the needle Q of the BD) on the stitch transferred to the needle Q of the BD in the knitting block 12 (stitch originally held on the needle P of the BD) thereby forming a double stitch.

[0090] In the knitting block 14, the carriage is moved in the right direction, and knitting is performed on the double stitch formed in the knitting block 13.

[0091] In the knitting block 15, the carriage is moved in the left direction to form a sixth temporarily-held knitting yarn on the needle H of the BD.

[0092] In the knitting block 16, the carriage is moved in the right direction, the stitch held on the needle Q of the BD is overlapped on the needle Q of the FD, and knitting is performed on the double stitch. According to the above knitting processes, the temporarily-held knitting yarns corresponding to the stitches of the back body knitted with the needles L to Q of the BD are formed on the needles C to H of the BD.

[0093] After the formation of the temporarily-held knitting yarns corresponding to the back body is finished, the formation of the temporarily-held knitting yarns corresponding to the front body is performed, as shown in Fig. 12. The formation of the temporarily-held knitting yarns corresponding to the front body is basically the same as the knitting method described with reference to Figs. 9 to 11. Similar to forming the temporarily-held knitting yarns corresponding to the base knitted fabric section of the front body on the needle spaced apart to the left side from the starting point, the base knitted fabric section continuing to the warp pattern section is easily knitted by also forming the temporarily-held knitting yarns corresponding to the base knitted fabric section of the back body on the needle spaced apart to the left side from the starting point in the following knitting blocks.

[0094] First, in the knitting block 17, the carriage is moved in the left direction, and the knitted fabric of the front body held on the FD is knitted for one course. Subsequently, the carriage is moved in the right direction, and the knitting is performed on the needles L, M of the FD to form the stitches.

[0095] In the knitting block 18, the stitch of the needle M of the FD is transferred to the needle M of the BU, and then a temporarily-held knitting yarn is formed on the needle C of the FD with the knitting yarn extended from the transferred stitch, similar to the knitting block 2 described with reference to Fig. 9. The stitch of the needle L of the FD is transferred to the needle L of the BU.

[0096] In the knitting block 19, the back needle bed is first racked in the right direction by one pitch, and thereafter, the stitch held on the needle L of the BU is transferred to the needle M of the FD.

[0097] In the next knitting block 20, the back needle bed is first racked to be returned to the original position, and the stitch held on the needle M of the BU is transferred to the needle M of the FD to form a double stitch. At the same time, the stitch of the needle N of the FD is transferred to the needle N of the BU.

[0098] In the knitting block 21, knitting is performed on the double stitch formed in the knitting block 20. The bind-off is formed by the knitting block 21, and the stitch of the front body is reduced by one.

[0099] In the knitting block 22 of after forming the bind-off, the temporarily-held knitting yarn is formed on the needle D of the FD, and then the stitch held on the needle M of the FD (stitch formed in the knitting block 21) is transferred to the needle M of the BU. According to the knitting block 22, a state in which the temporarily-held knitting yarns corresponding to the stitches reduced by the bind-off is formed is obtained.

[0100] In the knitting block 23, the back needle bed is racked in the right direction by one pitch, and the stitch of the needle M of the BU is transferred to the needle N of the FD. At the time point where such knitting is finished, the stitches of the front body held on the FD are reduced by one from the state in which the knitting block 19 described above is finished, and the temporarily-held knitting yarns corresponding to the reduced stitches are formed on the FD.

[0101] Thereafter, the knitting similar to the knitting blocks 20 to 23 is repeated, so that the temporarily-held knitting yarns corresponding to the reduced stitches are formed while bind-off processing the stitches of the front body, and the state of the knitting block 24 of Fig. 13 is obtained. As shown in the knitting block 24, the temporarily-held knitting yarns formed in continuation to the stitches held on the needles L to Q of the BD and the FD knitted by plain knitting are held on the needles C to H of the BD and the FD.

[0102] Although not shown in the knitting block 24, the last stitch that is bind-off processed is performed with the knitting for preventing raveling by a known bind-off processing method, and thus the knitted fabric does not ravel even if the stitch is removed from the needle bed.

[0103] Lastly, the knitting is performed on the temporarily-held knitting yarns by the knitting blocks 25, 26 to form stitches continuing to the temporarily-held knitting yarns, thereby knitting the next base knitted fabric section in continuation to the warp pattern section. After the base knitted fabric section is knitted for a predetermined course, the warp pattern section can be knitted by again performing the knitting processes of Figs. 9 to 13. That is, the desired number of warp pattern sections can be formed in the length direction of the body by repeating the knitting of the base knitted fabric section and the warp pattern section.

[0104] In the process of forming each warp pattern section, the region width necessary for knitting on the needle bed can be reduced as much as possible by alternating the transverse direction of the needle bed for bridging across the knitting yarn to the needle spaced apart from the starting point.

[0105] Therefore, a warp pattern section, which is a novel structure pattern, can be formed in the body, and a knitted fabric excelling in design can be formed by knitting the knitted fabric in the above manner. Furthermore, the knitted fabric can be finished light and air permeability of the knitted fabric can be enhanced by including the warp pattern section, and thus the knitted fabric is comfortable to wear.

Embodiment 2

[0106] An embodiment of the present invention related to the knitting of the textile-like structure section will now be described in detail with reference to the drawings. In the present embodiment, a single knitted fabric shown in Fig. 3 is knitted using a two-bed flat knitting machine having a pair of front and back needle beds (front needle bed FB and back needle bed BB) extending in a transverse direction and disposed opposite to each other in a cross direction, the back needle bed capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds.

[0107] The flat knitting machine used in the present embodiment also has a yarn feeder slidably arranged in the knitting width direction of the flat knitting machine. In the flat knitting machine, a cam system for having the knitting needles provided in columns on the needle bed perform the knitting operation, where the knitting is performed with the knitting yarn fed from the yarn feeder by the carriage that reciprocates on the needle bed.

[0108] The knitted fabric 10 knitted with the flat knitting machine is mainly knitted using the FB in an every needle state without having an empty needle. As shown in Fig. 3, a waste knitted fabric 20 for fixing the woof 52 of the textile-like structure section 5 is arranged on both sides of the knitted fabric 10 separate from the knitted fabric 10.

[0109] One example of a knitting method of forming a textile-like structure in the knitted fabric will be described with reference to the knitting process diagram of Figs. 14 and 15. In Figs. 14 and 15, the knitting step of forming the textile-like structure section in continuation to the base knitted fabric section knitted by plain knitting at a certain portion of the knitted fabric is shown.

[0110] In the knitting process diagram of Figs. 14 and 15, the number of stitches of the knitted fabric is shown to be less than the number used in the actual knitting for the sake of convenience of illustration. The alphabets A to Z shown in the figures indicate the needles of the FB, and a to z indicate the needles of the BB disposed opposing the FB. The meanings of the numbers at the left end column, the white circle, the black circle, and the hill-shaped mark, and the arrow in each knitting block in the figures are similar to the first embodiment.

[0111] The knitting block S shown in Fig. 14 shows a state before the textile-like structure section is knitted at the stage in the middle of knitting the knitted fabric. The knitting block S shows a state where the stitches are held on the needles K to Y of the FB, and the base knitted fabric section is knitted. In the present embodiment, knitting is performed with the knitting width of the base knitted fabric section constant, but the knitting width may be sequentially reduced immediately before knitting the textile-like structure section. In this case, the stitches of different courses are lined at the portion coupled to the textile-like structure section of the base knitted fabric section. Therefore, the woof of the textile-like structure section formed in continuation to the base knitted fabric section is formed inclined with respect to the course direction of the knitted fabric, and as a result, the knitted fabric having the textile-like structure section inclined with respect to the course direction of the knitted fabric can be knitted.

[0112] In the knitting block 1 of Fig. 14, the yarn is first fed from the yarn feeder 7 to the FB to knit one part of the knitted fabric (needles K, L of FB).

[0113] In the next knitting block 2, the stitch held on the needle L of the FB knitted in the knitting block 1 is transferred

to the needle 1 of the BB. Then, the knitting yarn is bridged across from the stitch transferred to the needle 1 of the BB to the needle C of the FB to form a temporarily-held knitting yarn. The length from the needle 1 to the needle C becomes the length in the wale direction of the textile-like structure section, and thus to which needle of the FB to bridge the knitting yarn extending from the needle 1 can be determined according to the design of the knitted fabric.

[0114] In the knitting block 3, the stitch held on the needle K of the FB is transferred to the needle k of the BB.

[0115] In the next knitting block 4, the BB is racked to the right by one pitch. According to such racking, the stitch transferred from the needle K of the FB to the needle k of the BB in the knitting block 3 is at a position opposing the needle L of the FB. Then, the stitch held on the needle k of the BB is transferred to the needle L of the FB. According to such transfer, the stitch originally held on the needle K of the FB moves to the adjacent needle L. Furthermore, in the knitting block 4, the BB is racked to the left by one pitch, the opposing state of the front and back needle beds is returned to the state of the knitting block S, and the stitch held on the needle 1 of the BB is returned to the needle L of the FB. According to such transfer, a double stitch forms on the needle L of the FB. This double stitch is in a so-called slide state in which the overlapped stitch (stitch moved from the needle K of the FB to the needle L of the FB) appear on the front side of the body thereby forming a projecting shape.

[0116] In the next knitting block 5, the yarn feeder 7 that formed a temporarily-held knitting yarn on the needle C of the FB is moved in the right direction (needle L side), and the yarn is fed to the FB to form a stitch continuing to the double stitch (stitch of needle L of FB). In this case, the formation step of the temporarily-held knitting yarn in which the knitting yarn is bridged across to the needle C with the stitch of the needle L of the FB as the starting point and returned to the starting point is performed once, and the long turn-back unit (warp) extending from the bind-off processing section of the base knitted fabric section is formed.

[0117] The transfer and the knitting of the stitches in the blocks 2 to 5 are the so-called bind-off process and a known bind-off processing method other than the above may also be used. For instance, when forming a double stitch, a so-called non-slide state in which the stitch held on the needle K of the FB is overlapped on the back side of the stitch of the needle L so that the projecting shape does not stand out may be obtained.

[0118] Subsequently, the knitting similar to the knitting blocks 2 to 5 are performed on the remaining stitches held on the needles L to Y on the FB. By repeating the knitting blocks 2 to 5, the stitches held on the needles K to Y of the FB in the knitting block S are removed from the FB by the bind-off process, and the temporarily-held knitting yarns corresponding to the stitches reduced by the bind-off process is formed on the needles C to Q of the FB (see knitting block 6 of Fig. 15). That is, the base knitted fabric section is in a state hanging from the warp (temporarily-held knitting yarns held on the needles C to Q of FB) extending in a long loop-shape from the bind-off processing section. The length of bridging across the temporarily-held knitting yarn can be sequentially differed so that the upper end of the temporarily-held knitting yarns is slanted with respect to the base knitted fabric section.

[0119] Although not shown in the knitting block 6, the last stitch that is bind-off processed is performed with the knitting for preventing raveling by a known bind-off processing method, and thus the knitted fabric does not ravel even if the stitch is removed from the needle bed.

[0120] In the knitting block 7, the temporarily-held knitting yarns held on the needles F, G, H, L, M, N of the FB are transferred to the needles f, g, h, l, m, n of the opposing BB. According to such an operation, the temporarily-held knitting yarns are arranged divided to the front and back needle beds.

[0121] In the knitting block 8, a yarn feeder 8 different from the yarn feeder 7 for knitting the base knitted fabric section is reciprocated to transverse the knitted fabric, and the knitting yarn (woof) is fed between the temporarily-held knitting yarns held divided to the front and back needle beds. According to the knitting block 8, the woof is sandwiched between the long temporarily-held knitting yarns lined in the course direction. In the present embodiment, the operation of the knitting block 8 is performed a plurality of times to form the textile-like structure section of the intended design, but may be performed only once.

[0122] In the knitting block 9, the temporarily-held knitting yarns transferred to the BB in the knitting block 7 is returned to the FB, and the temporarily-held knitting yarn of the FB not transferred in the knitting block 7 (temporarily-held knitting yarns held on the needles C, D, E, I, J, K, O, P, Q of the FB) is transferred to the BB. According to such a transfer operation, the crossing portion of the temporarily-held knitting yarns is pushed down towards the base knitted fabric section side while sandwiching the woof when the positions of the temporarily-held knitting yarns held on the FB and the BB are interchanged.

[0123] The woof is not knitted in the base knitted fabric section nor the warp, but is knitted in the waste knitted fabric 20 arranged on the left and the right with the knitted fabric in between, as shown in Fig. 3, so as not to slip out from the knitted fabric 10. The woof 52 knitted in the waste knitted fabric 20 is cut slightly longer than the knitting width of the base knitted fabric section when all the knitting, to be hereinafter described, are finished, and then can be tied and fixed to the warp and the base knitted fabric section. When the woofs 52 cut slightly longer are tied with each other, the woof is not only prevented from detaching from the warp but the fringe portion hanging from both ends in the course direction of the knitted fabric can be formed.

[0124] In addition, the woof can be knitted without having the waste knitted fabric described above. Specifically, turning

back the woof inserted between the warps so as to be hooked to the warp at the ends in the knitting width direction of the knitted fabric is repeated to knit the woof of the textile-like structure section with the woof of consecutive length. In this case, the crossing number of the warp and the woof becomes greater at both ends in the course direction of the textile-like structure section of the knitted fabric than at the intermediate part. For instance, according to the present embodiment, in the knitting blocks 8 and 9 (knitting blocks 10, 11 described below), a plurality of woofs is collectively inserted between the temporarily-held knitting yarns held divided to the front and the back needle beds to be sandwiched to the warp, but a temporarily-held knitting yarn is transferred every time one woof is inserted to thereby sandwich the woof to the warps at the positions of the needles C and Q (both ends in the course direction of the textile-like structure section). According to the series of knitting, the crossing number of the warp and the woof becomes greater at both ends in the course direction of the textile-like structure section than at the intermediate part, the woof is less likely to shift in the course direction of the knitted fabric, and thus the crossing state of the textile-like structure section is less likely to break. The woof in the knitting is a knitting yarn of consecutive length, and thus the woof is prevented from detaching from the warp by simply fixing one end side to the base knitted fabric section and the other end to another base knitted fabric section. In the knitting process, the number of times to transfer the temporarily-held knitting yarns at both ends in the course direction is great and yarn breakage may occur. Thus, the number of times of transfer of a specific temporarily-held knitting yarn may be reduced by sequentially using two or three temporarily-held knitting yarns (e.g., temporarily-held knitting yarns of needles D and P in Fig. 15) near both ends in addition to the temporarily-held knitting yarns at both ends (temporarily-held knitting yarns of needles C and Q in Fig. 15).

[0125] The method of knitting so as to hook the woof to the warp at the ends in the knitting width direction can be suitably used when forming the textile-like structure section over the entire periphery of the tubular knitted fabric. The tubular knitted fabric has the front and back knitted fabric sections held divided to the front and back needle beds, respectively. The woof is inserted to the front knitted fabric section, and thereafter, the same woof is hooked to at least one of the warp at the end of the front knitted fabric section or the warp at the end of the back knitted fabric section and pulled back and then inserted to the back knitted fabric section. In this case, if the position of the warp where the woof is hooked and pulled back is too close to the center in the knitting width from the ends in the knitting width direction, the woof crosses the front and back knitted fabric sections as if short cutting. In this case, the length of one round of the woof is shorter with respect to the peripheral length of the knitted fabric, and the region of the warp where the woof is not hooked from the area where the woof is hooked to the ends in the knitting width direction cannot be effectively used as a tubular portion. Therefore, the position of the warp to turn-back the woof is preferably four to five yarns worth, at most, from the ends in the knitting width direction.

[0126] In the next knitting block 10, the yarn feeder 8 is reciprocated more than once so as to transverse the knitted fabric to sandwich the woof between the temporarily-held knitting yarns held on the FB and the BB, similar to the knitting block 8.

[0127] The knitting blocks 7 to 10 are repeated for a plurality of times. According to the knitting blocks 7 to 10, the textile-like structure section 5 in which the warp 51 and the woof 52 cross in a lattice form as shown in Figs. 3 and 4 can be formed in the knitted fabric 10.

[0128] Finally, all the temporarily-held knitting yarns are returned to the needle of the FB (knitting block 11), knitting is performed on the returned temporarily-held knitting yarns, and stitches continuing to the temporarily-held knitting yarns are formed, so that the next base knitted fabric section can be formed in continuation to the textile-like structure section (knitting block 12).

[0129] Through the knitting of the knitted fabric in the above manner, the textile-like structure section, a new and non-conventional structure pattern in which the warp and the woof cross each other as a knitted product, can be formed in the knitted fabric section, making a knitted fabric excellent in design.

[0130] After knitting the base knitted fabric section for a predetermined course, the steps of knitting in Figs. 14 and 15 can be again performed to knit the textile-like structure section. That is, the desired number of textile-like structure sections can be formed in the wale direction of the knitted fabric by repeating the knitting of the base knitted fabric section and the textile-like structure section.

INDUSTRIAL APPLICABILITY

[0131] The knitting method of the present invention is suitably used to knit a new structure pattern including a warp pattern section in which the knitting yarn is bridged across in a wale direction of the knitted fabric so as to be turned back to form a long loop-shape. The knitted fabric of the present invention can be used in a knitted product including the warp pattern section in the middle of the base knitted fabric section. Furthermore, the knitting method of the present invention can be suitably used to knit a new structure pattern having the textile-like structure section including a warp of long loop-shape formed by bridging across the knitting yarn in the wale direction of the knitted fabric so as to be turned back and a woof crossing the warp. The knitted fabric of the present invention can be used in a knitted product including the textile-like structure section in the middle of the base knitted fabric section.

Claims

1. A method of knitting a knitted fabric using a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds; the method comprising the steps of:

knitting a base knitted fabric section;
 knitting another base knitted fabric section; and
 forming a warp pattern section where a knitting yarn is bridged across in a substantially wale direction between the knitted fabric sections after the knitting of the knitted fabric is finished at between the steps of knitting the base knitted fabric sections; wherein
 the step of forming the warp pattern section includes the steps of,
 forming, with a stitch of the last course in the base knitted fabric section as a starting point, a temporarily-held knitting yarn by bridging across a knitting yarn pulled out from the starting point to a needle spaced apart in at least one direction of either left or right and returning to the starting point side, and
 reducing the stitches of the last course by bind-off processing the stitch acting as the starting point; and
 the knitting of the another base knitted fabric section is performed on the temporarily-held knitting yarn.

2. The method of knitting the knitted fabric according to claim 1, wherein
 the knitted fabric to be knitted includes a knitted fabric section held on each front and back needle beds and continued to each other;
 the step of knitting the base knitted fabric section and the step of forming the warp pattern section are performed when knitting each knitted fabric section held on the front and back needle beds; and
 the transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point is the same direction for the one knitted fabric section and the other knitted fabric section held on the front and back needle beds in the step of forming the temporarily-held knitting yarn of when forming the warp pattern section.

3. The method of knitting the knitted fabric according to claim 1, wherein
 the step of further forming the warp pattern section with respect to the last course of the knitted fabric section following the knitting of the another base knitted fabric section and the step of knitting yet another base knitted fabric section following the warp pattern section are sequentially performed in an alternately repeating manner; and
 the transverse direction of bridging across the knitting yarn to the needle spaced apart from the starting point is reversed for every step of forming the warp pattern section in the step of forming the temporarily-held knitting yarn of when forming each warp pattern section.

4. The method of knitting the knitted fabric according to claim 1, further comprising the step of, with a starting point side of the temporarily-held knitting yarn as a basal end and an end on an opposite side of the basal end as a turn-back end; reversing a lined order of the basal end and a lined order of the turn-back end in a knitting width direction of a plurality of temporarily-held knitting yarns prior to knitting the another base knitted fabric section with respect to the plurality of temporarily-held knitting yarns.

5. The method of knitting the knitted fabric according to claim 1, further comprising the step of:

forming a textile-like structure section where a warp and a woof extending in a knitting width direction cross, the warp being the temporarily-held knitting yarn; wherein
 the step of forming the textile-like structure section includes the steps of,
 transferring some of the plurality of temporarily-held knitting yarns to an opposing needle bed,
 feeding a knitting yarn that becomes the woof between the transferred temporarily-held knitting yarn and the non-transferred temporarily-held knitting yarn, and
 repeating the step of transferring the temporarily-held knitting yarn and the step of feeding the woof.

6. A knitted fabric knitted with a flat knitting machine having at least a pair of front and back needle beds extending in a transverse direction and disposed opposite to each other in a cross direction, at least one of the front and back needle beds is capable of being racked in the transverse direction so that stitches can be transferred between the front and back needle beds, the knitted fabric comprising:

a base knitted fabric section;

another base knitted fabric section;

a warp pattern section where a knitting yarn is bridged across in a substantially wale direction so as to be turned back from the base knitted fabric section towards the another base knitted fabric section to connect the base knitted fabric sections; and

a bind-off processing section formed at the last course of the base knitted fabric section.

7. The knitted fabric according to claim 6, wherein

the knitting yarn bridged across from the base knitted fabric section to the another base knitted fabric section so as to be turned back and formed in a loop shape is a turn-back unit, the base knitted fabric section side of the turn-back unit being a basal end and the another base knitted fabric section side being a turn-back end; and a lined order in a course direction of a plurality of turn-back units is reversed for the basal end side and the turn-back end side.

8. The knitted fabric according to claim 6, further comprising:

a textile-like structure section formed between the base knitted fabric sections; wherein

the textile-like structure section includes,

a warp constituting a warp pattern section for connecting the base knitted fabric sections, and

a woof crossing the warp and appearing on a front and a back of the knitted fabric.

Fig. 1

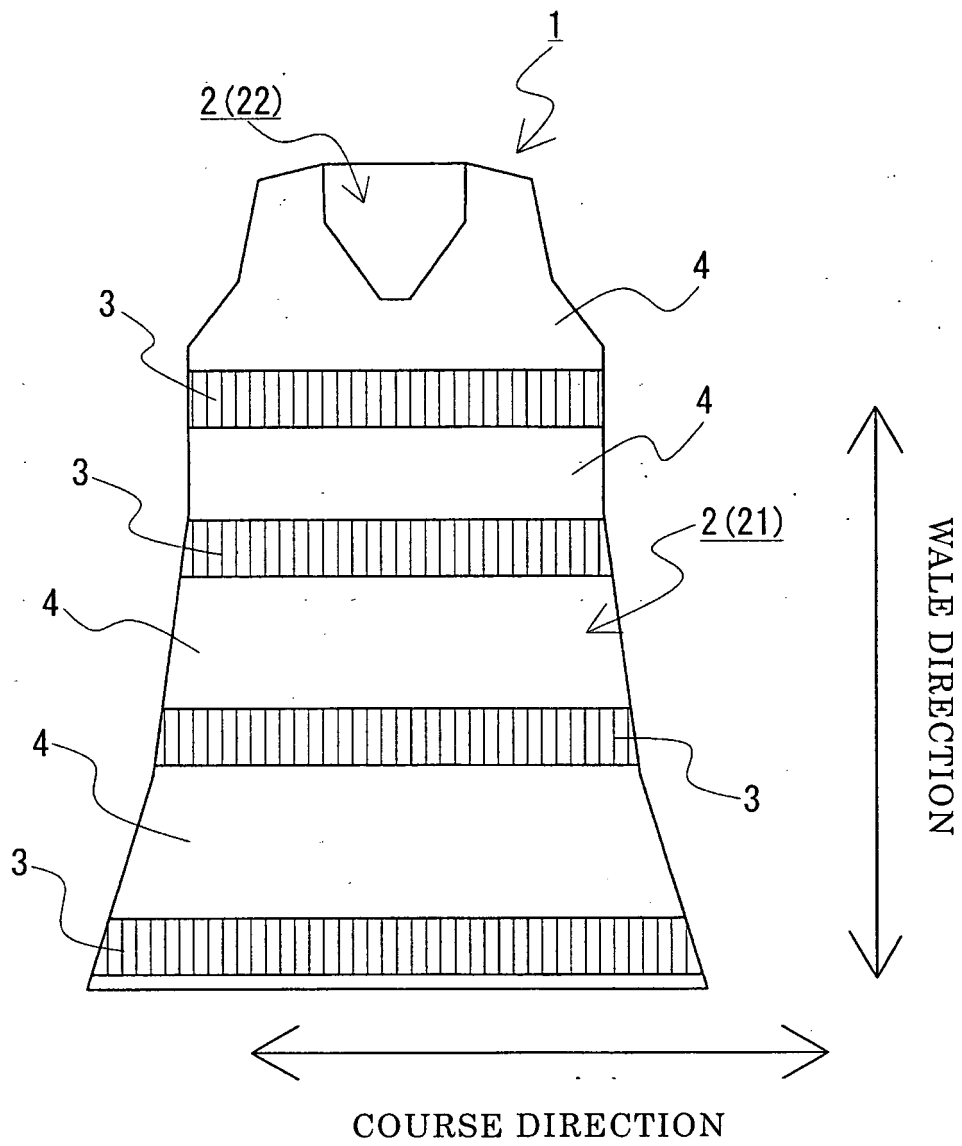


Fig. 2

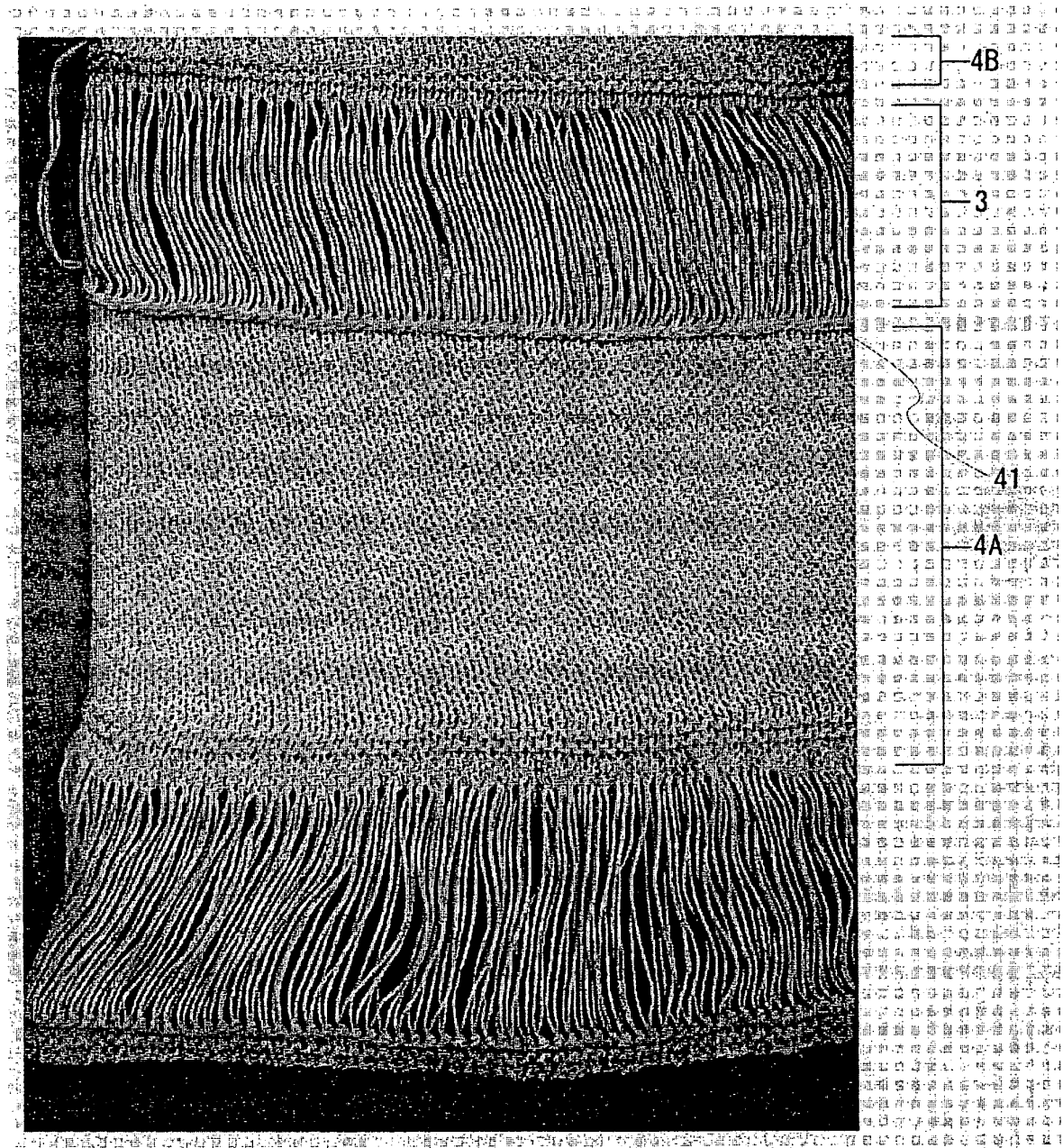


Fig. 3

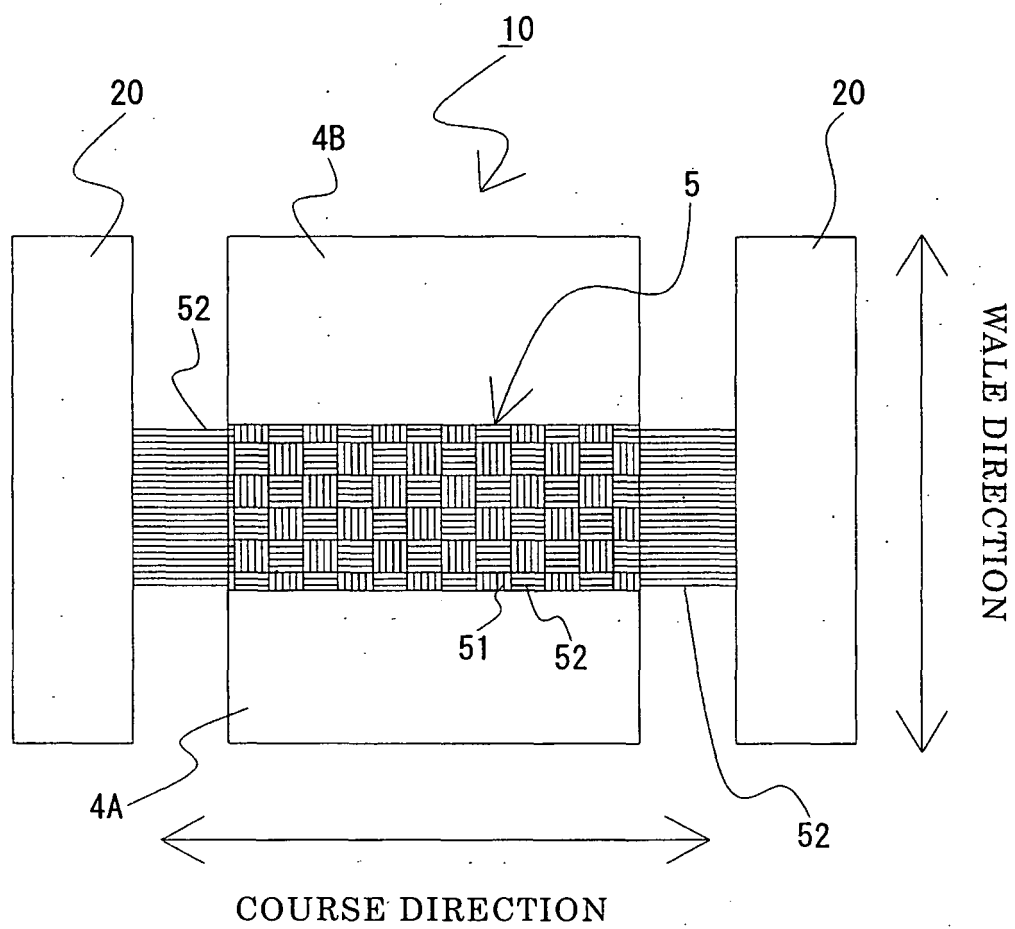


Fig. 4

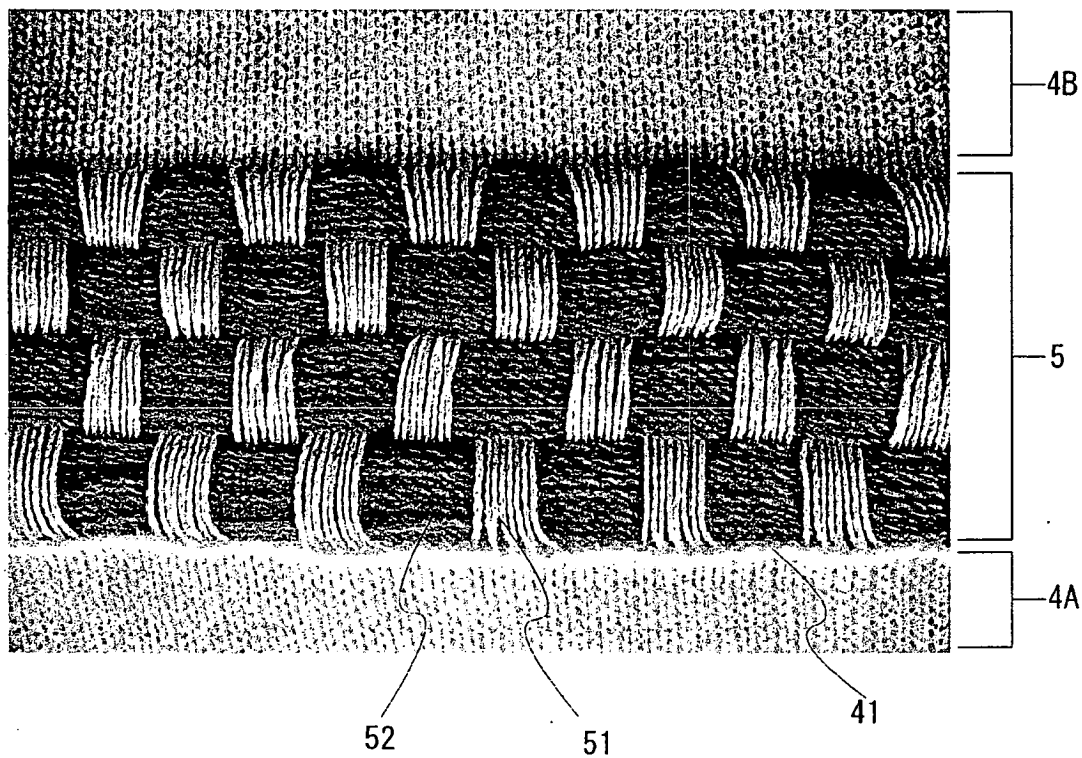


Fig. 5

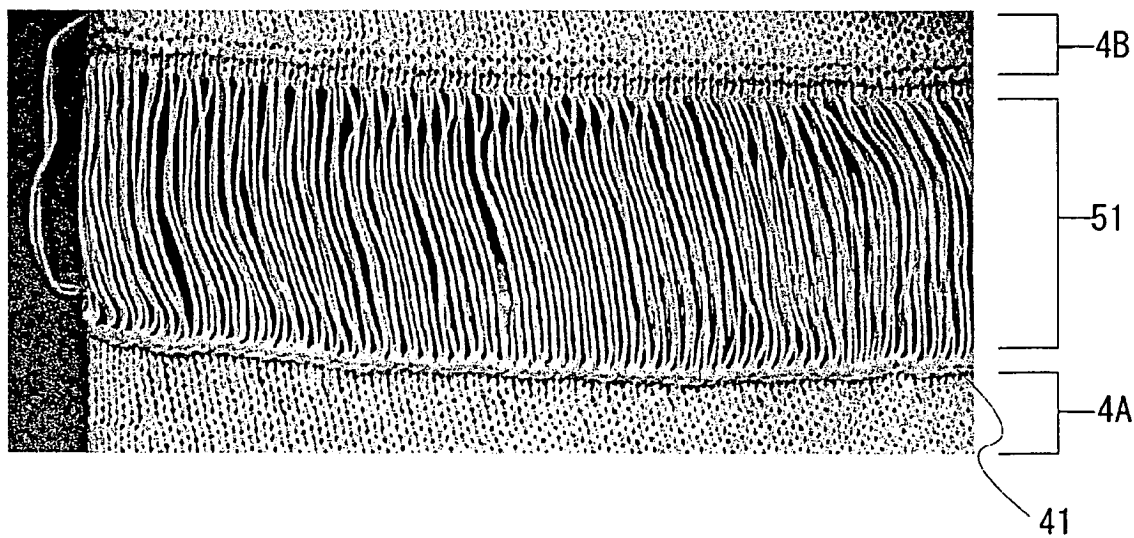


Fig. 6

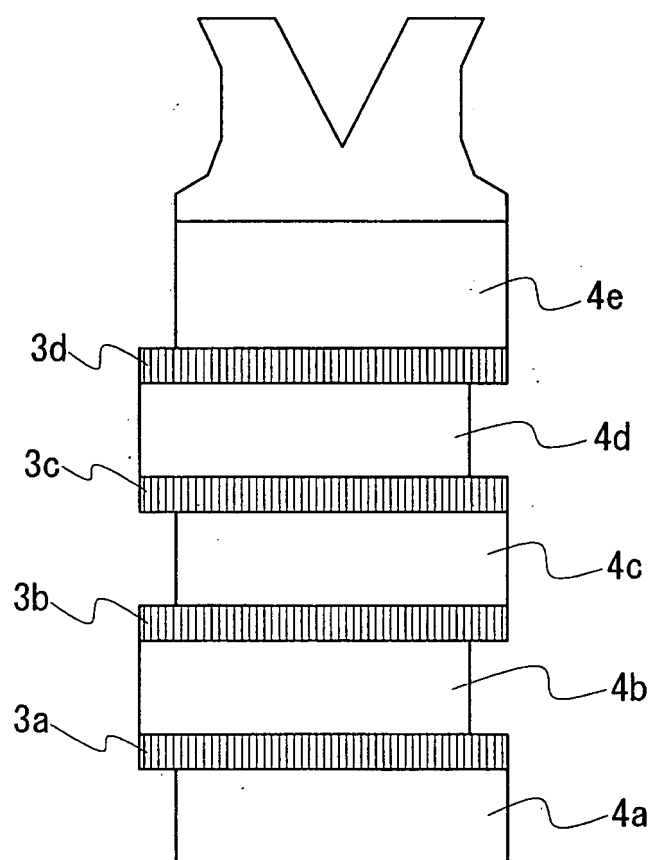


Fig. 7

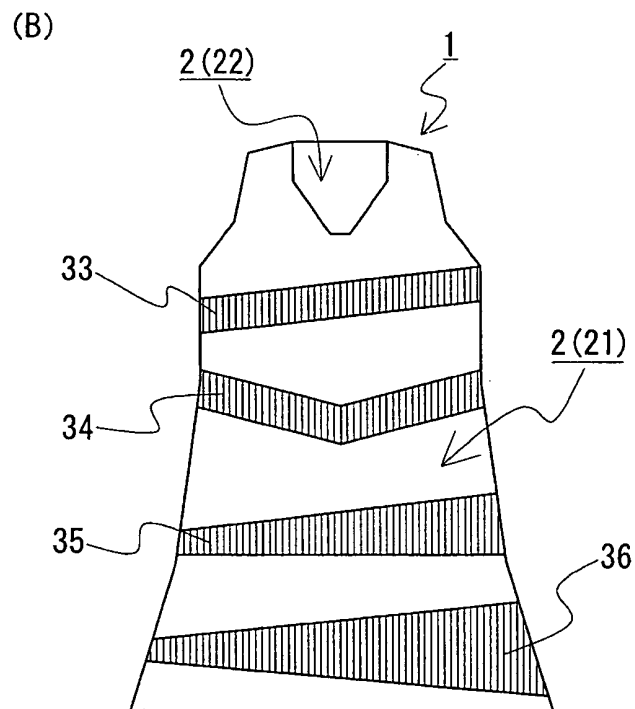
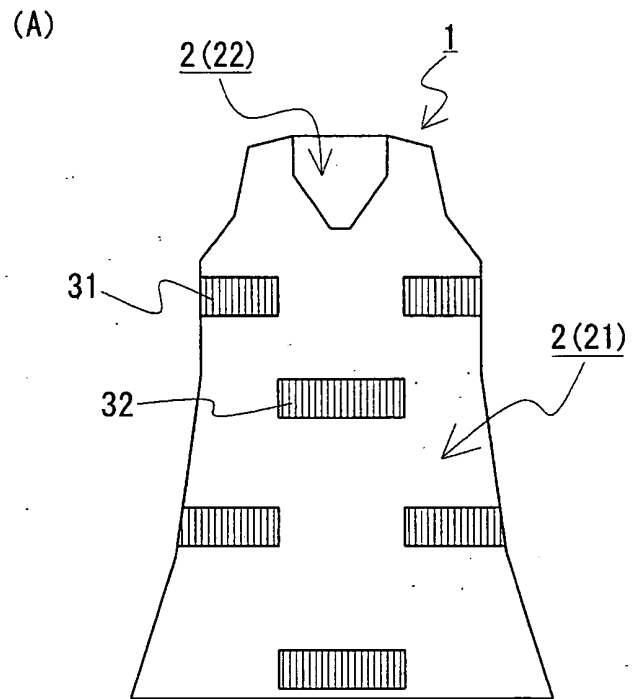


Fig. 8

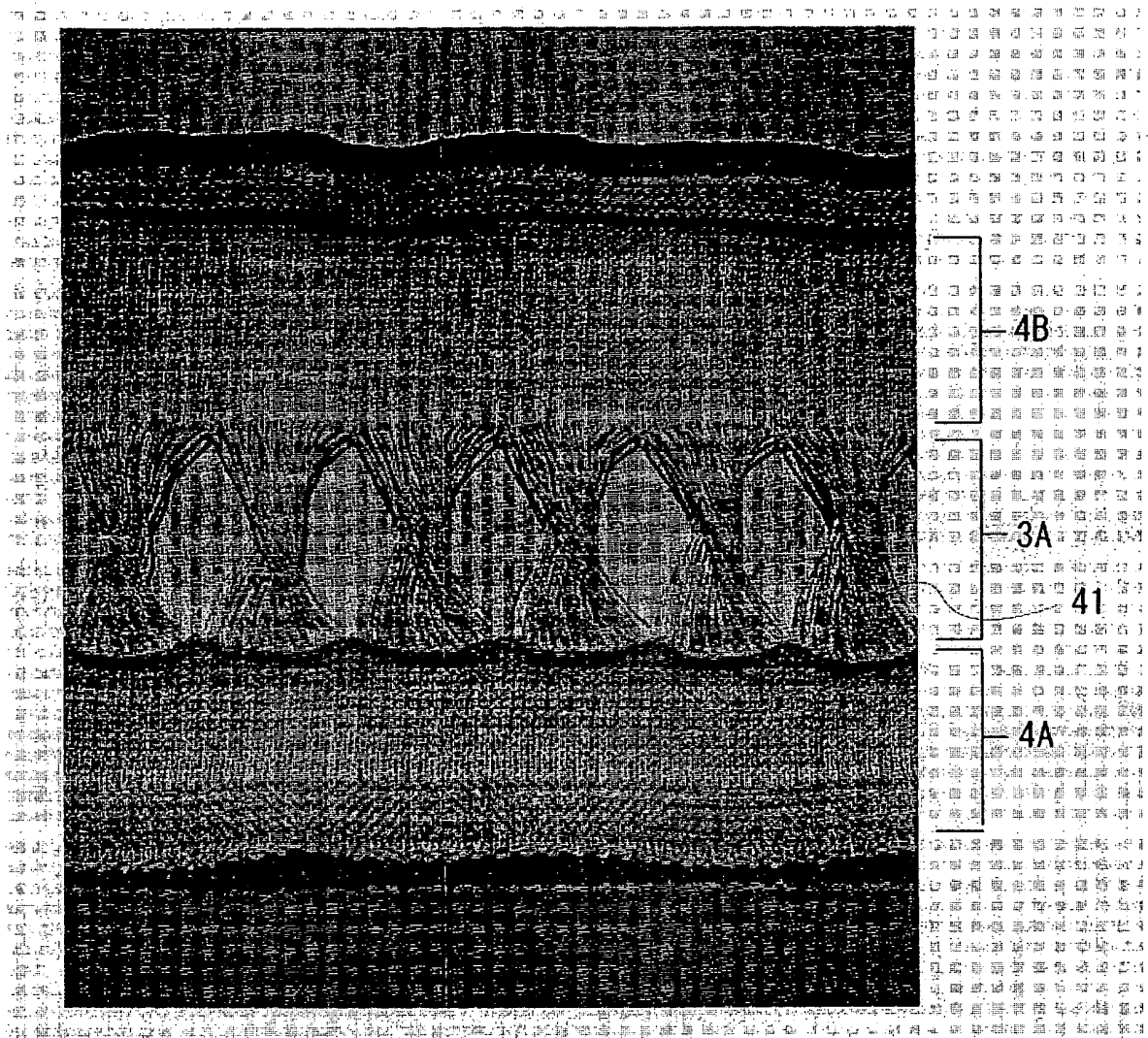


Fig. 9

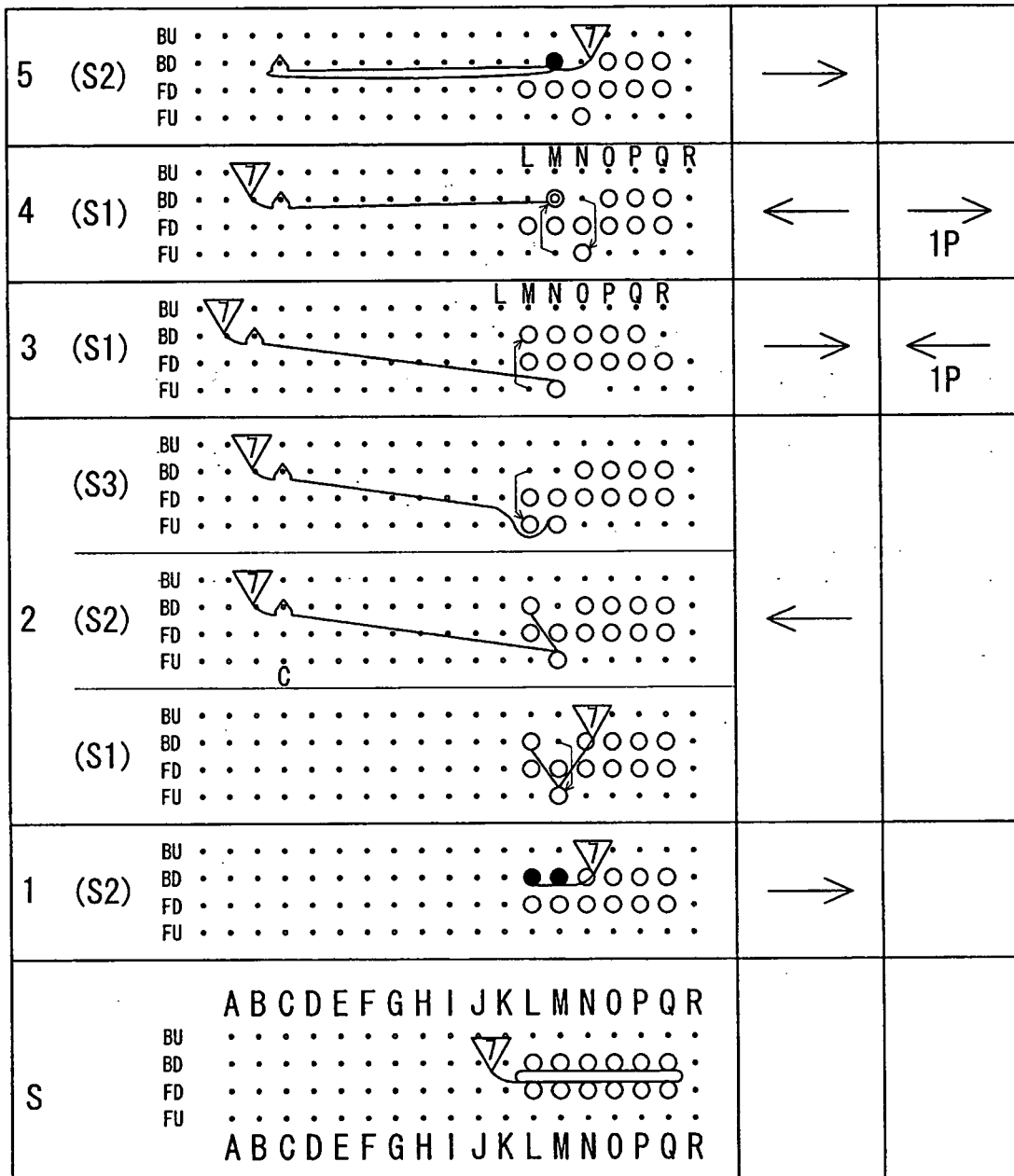


Fig. 10

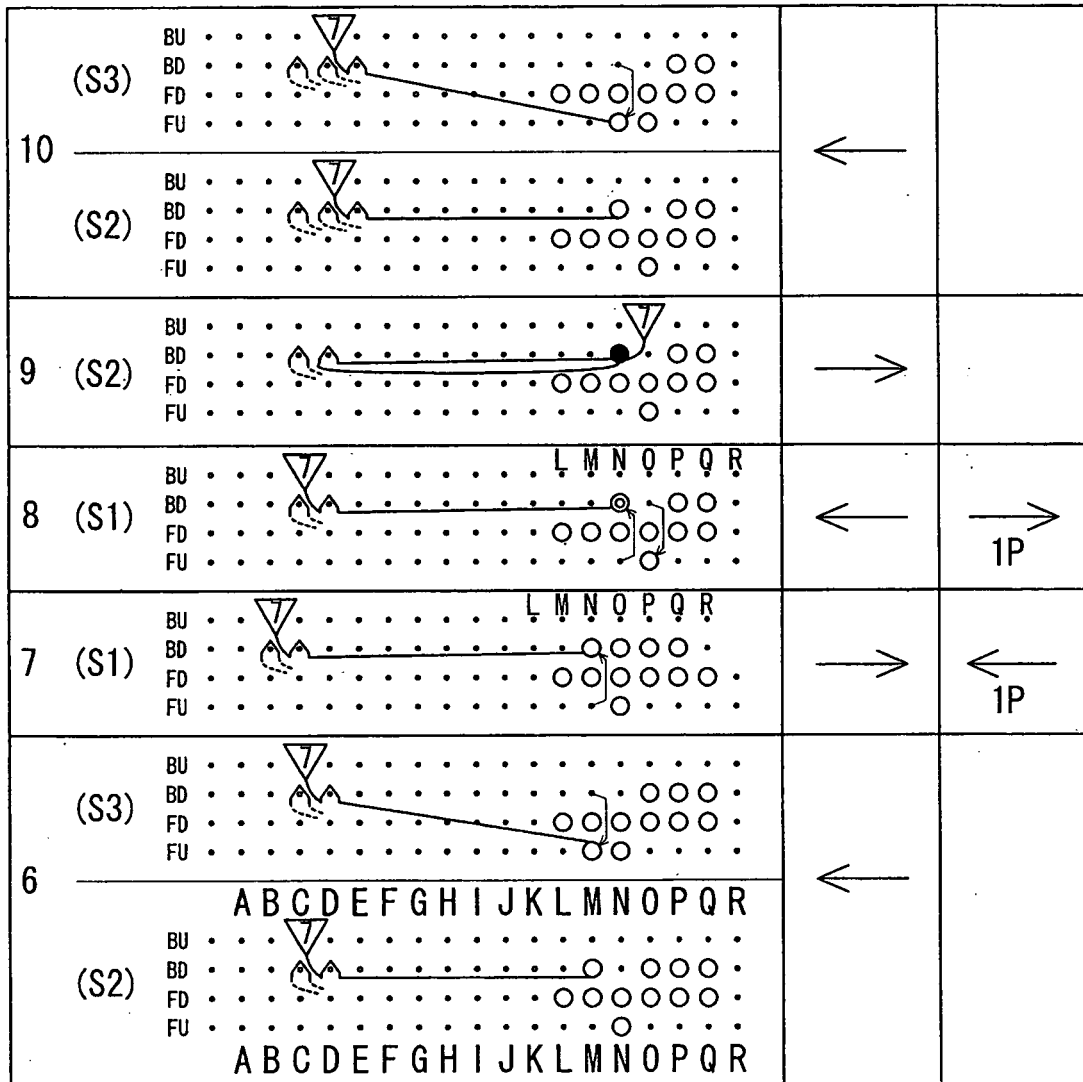


Fig. 11

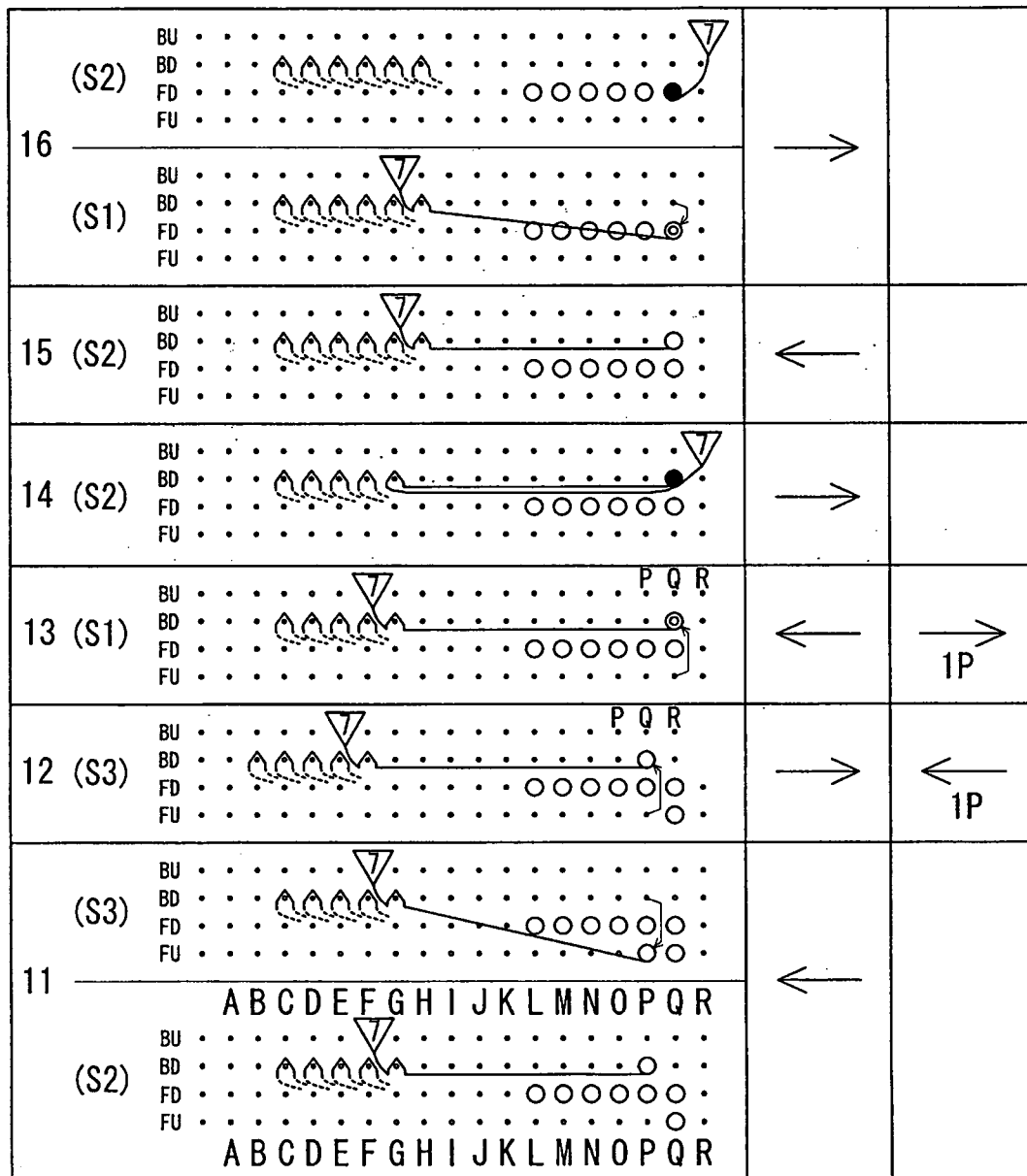


Fig. 12

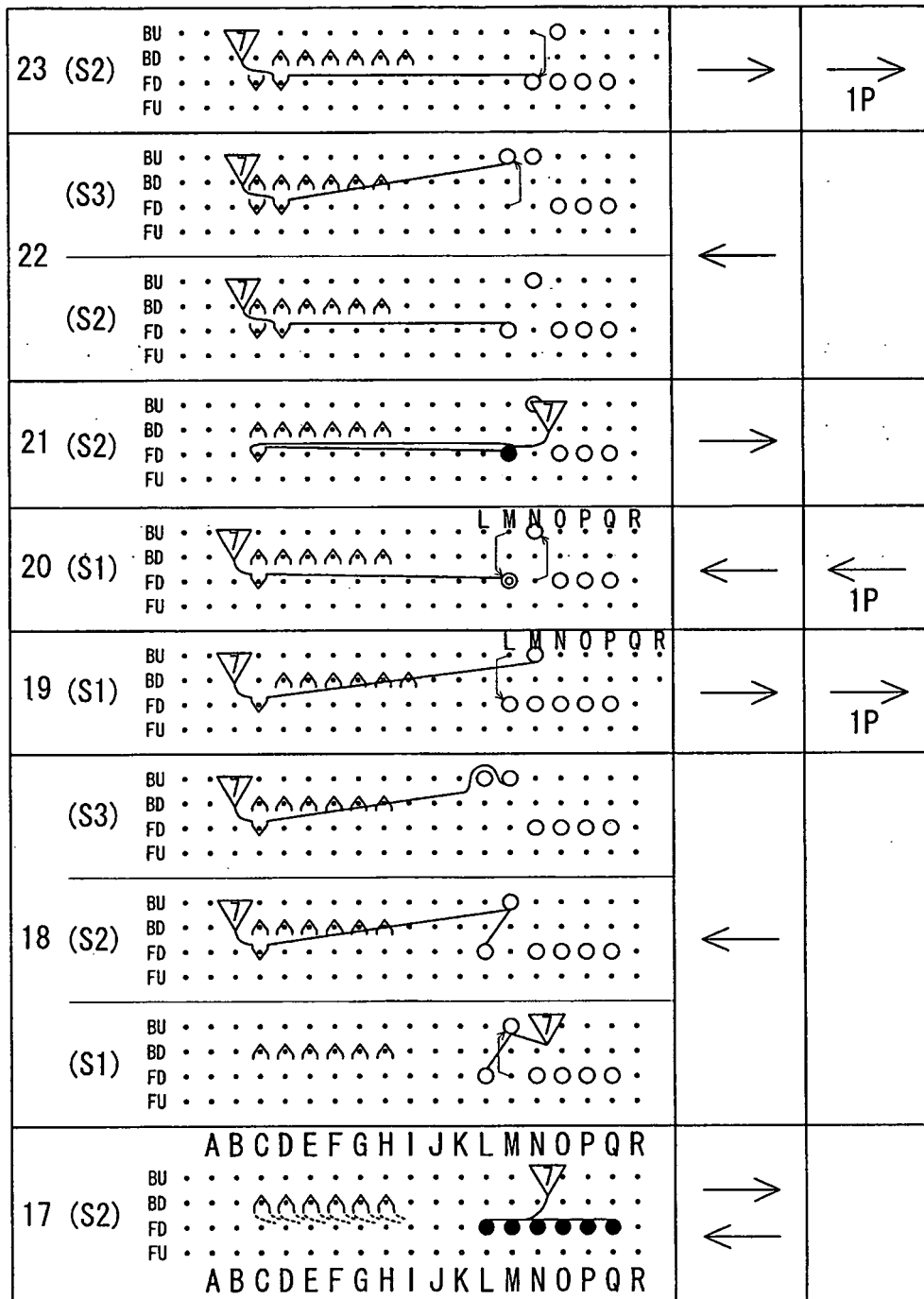


Fig. 13

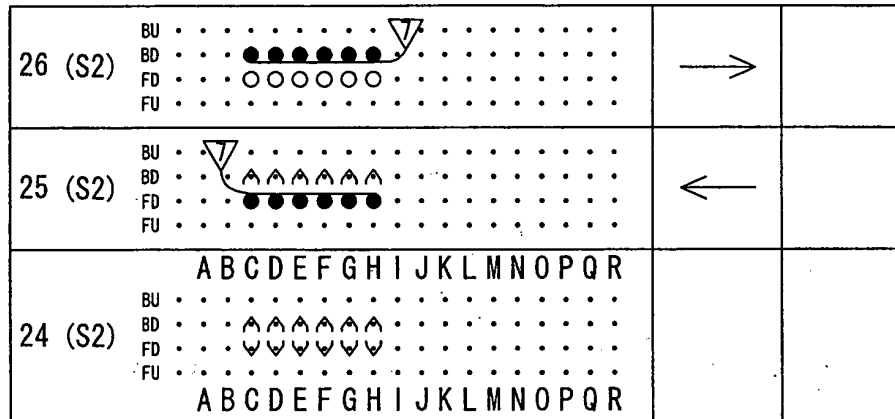


Fig. 14

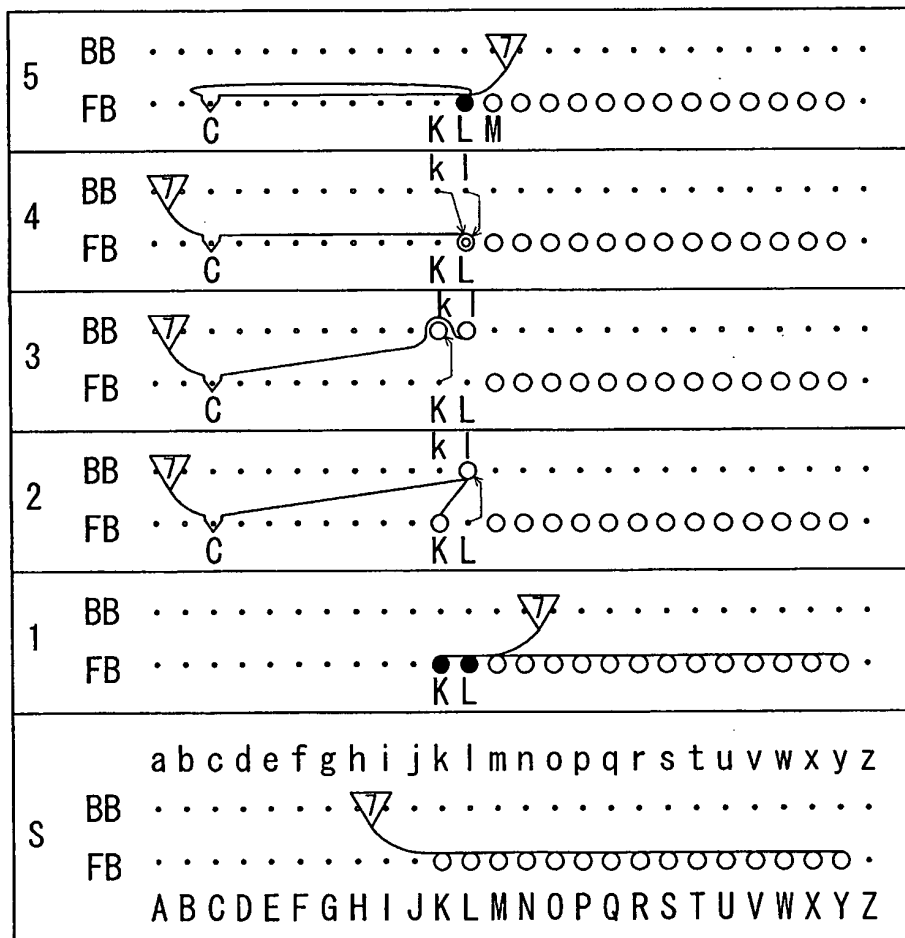
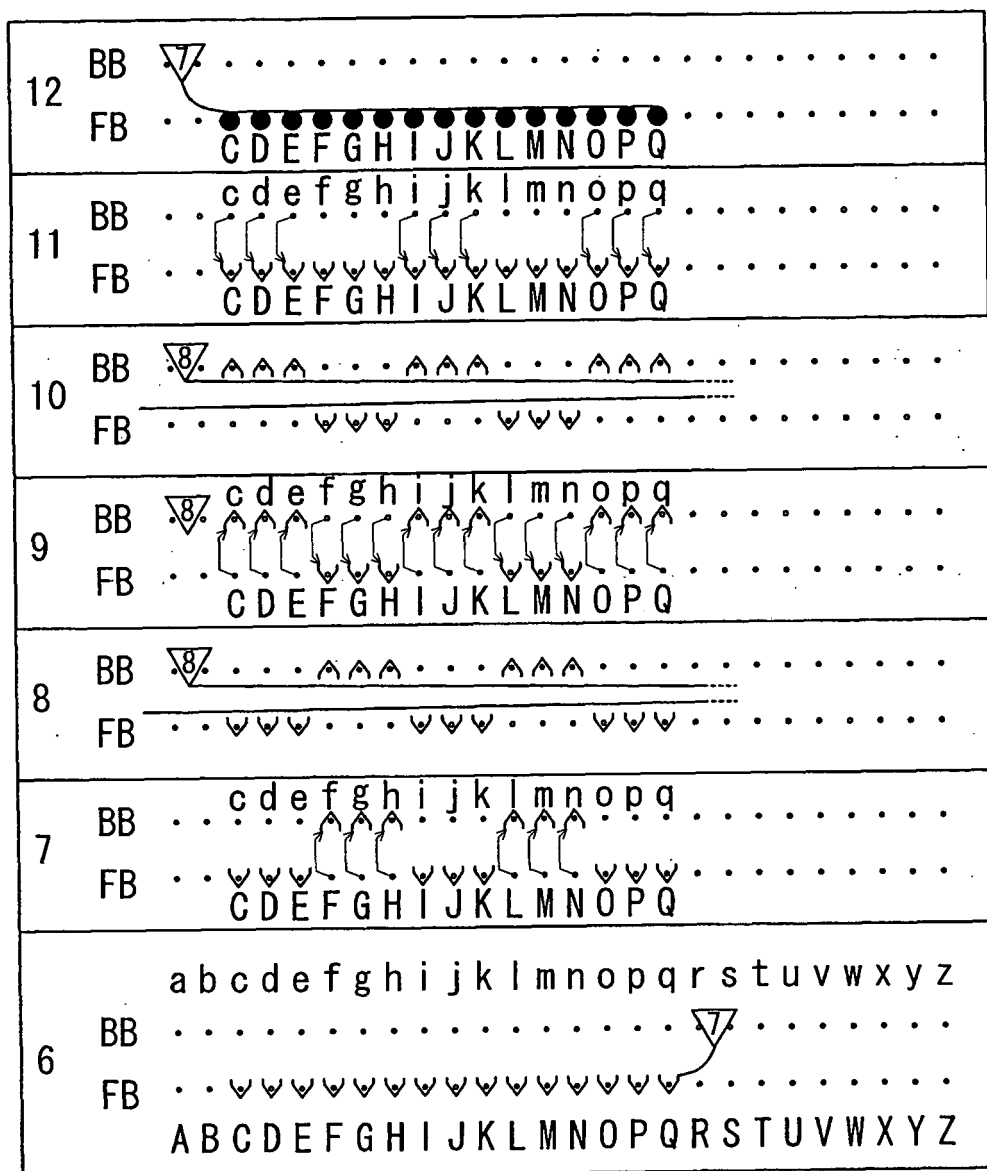


Fig. 15



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/001093

A. CLASSIFICATION OF SUBJECT MATTER

D04B1/22(2006.01)i, D04B1/00(2006.01)i, D04B7/00(2006.01)i, D04B7/22(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)

D04B1/22, D04B1/00, D04B7/00, D04B7/22

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 1996-2008

Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

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	JP 2006-225776 A (Shima Seiki Mfg., Ltd.), 31 August, 2006 (31.08.06), Full text (Family: none)	1-8
A	JP 2002-327303 A (Kimio HIRAI), 15 November, 2002 (15.11.02), Par. No. [0015]; drawings (Family: none)	1-8

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
18 July, 2008 (18.07.08)Date of mailing of the international search report
29 July, 2008 (29.07.08)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006225776 A [0004]
- JP 2000096398 A [0004]