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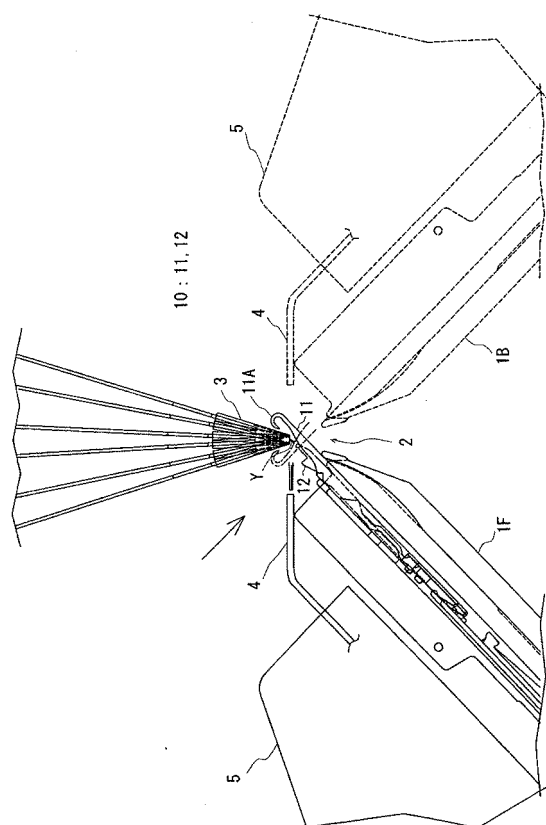
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(54) **FABRIC KNITTING METHOD, AND WEFT KNITTING MACHINE**

(57) Provided are a method of knitting a knitted fabric and a flat knitting machine capable of preventing a decorative portion of a fancy yarn from being caught at a slider of a compound needle. The flat knitting machine includes a plurality of compound needles 10, each including a needle main body 11 and a slider 12; a needle bed 1F in which the compound needles 10 are arranged in a line; and a yarn feeding member 3 for feeding a fancy yarn Y to a needle bed gap portion 2 of the needle bed by reciprocating in a longitudinal direction of the needle bed; wherein the operation of hooking the fancy yarn Y fed to the needle bed gap portion 2 to a hook 11A, and pulling the needle main body into the needle bed 1F is performed. The flat knitting machine includes an air nozzle 4 for pushing the decorative portion in a direction of separating from the slider 12 by injecting air at an elevation of higher than or equal to horizontal so that the decorative portion projecting out at the outer periphery of the fed fancy yarn Y is not caught at the slider 12 when the needle main body is pulled into the needle bed 1F, and a nozzle movement mechanism (carriage 5) for reciprocating the air nozzle 4 along the longitudinal direction of the needle bed.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a method of knitting a knitted fabric and a flat knitting machine capable of preventing a decorative portion of a fancy yarn from being caught at a slider of a compound needle.

BACKGROUND ART

[0002] A flat knitting machine that uses a compound needle, which includes a needle main body with a hook and a slider for opening and closing the hook, is conventionally known (e.g., Patent Document 1). With such a flat knitting machine, a knitted fabric is knitted by advancing the compound needle from needle beds, which oppose each other with a needle bed gap portion in between, to the needle bed gap portion, and hooking a knitting yarn fed by a yarn feeding member from above the needle bed gap portion to the hook of the compound needle and pulling the yarn into the needle bed. In this case, the slider closes the hook with the retreating of the needle main body.

[0003]

[Patent Document 1] International Publication WO 2007/037285 pamphlet

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] A fancy yarn such as a loop yarn or a knot yarn is sometimes used for the knitting yarn in the flat knitting machine. The fancy yarn has a decorative portion, which configures the loop or the knot, projecting out in a raised form at the outer periphery. When knitting with the compound needle using such a fancy yarn for the knitting yarn, the decorative portion may be caught at the slider when the needle main body is retreated with the fancy yarn positioned on the inner side of the hook.

[0005] If the decorative portion is caught at the slider, the fancy yarn at the caught area becomes damaged, and the knitted fabric to be knitted may become damaged. The extent of advancement to the needle bed gap portion side differs for the compound needle (open needle) that attempts to close the hook with the decorative portion caught, and the preceding compound needle (close needle), adjacent to the former compound needle, that has already closed the hook and pulled the fancy yarn to the needle bed side. Thus, if knitting is continued with the decorative portion caught, the slider of the open needle is pulled towards the close needle side through the fancy yarn, and the slider of the open needle may bend or break.

[0006] In view of the above situation, it is one object of the present invention to provide a method of knitting

a knitted fabric and a flat knitting machine capable of preventing a decorative portion of a fancy yarn from being caught at a slider of a compound needle.

5 MEANS FOR SOLVING THE PROBLEMS

[0007] A method of knitting a knitted fabric of the present invention is a method of knitting a knitted fabric using a flat knitting machine including a plurality of compound needles, each including a needle main body with a hook and a slider for opening and closing the hook; a needle bed, in which the compound needles are arranged in a line, for holding each compound needle to freely advance and retreat in a longitudinal direction of the needle; and a yarn feeding member for feeding a fancy yarn, which has a decorative portion projecting out at an outer periphery of a core yarn, to a needle bed gap portion of the needle bed by reciprocating in a longitudinal direction of the needle bed, the knitting being performed by hooking the fancy yarn fed from the yarn feeding member to the needle bed gap portion to the hook of the needle main body advanced to the needle bed gap portion, and pulling the needle main body into the needle bed. In the method of knitting a knitted fabric, the knitting is performed with the decorative portion pushed in a direction of separating from the slider by injecting air so that the decorative portion of the fed fancy yarn is not caught at the slider when the needle main body is pulled into the needle bed and the hook is closed by the slider.

[0008] A flat knitting machine of the present invention is a flat knitting machine including a plurality of compound needles, each including a needle main body with a hook and a slider for opening and closing the hook; a needle bed, in which the compound needles are arranged in a line, for holding each compound needle to freely advance and retreat in a longitudinal direction of the needle; and a yarn feeding member for feeding a fancy yarn, which has a decorative portion projecting out at an outer periphery of a core yarn, to a needle bed gap portion of the needle bed by reciprocating in a longitudinal direction of the needle bed, the flat knitting machine performing the operation of hooking the fancy yarn fed from the yarn feeding member to the needle bed gap portion to the hook of the needle main body advanced to the needle bed gap portion, and pulling the needle main body into the needle bed. The flat knitting machine includes an air nozzle for pushing the decorative portion in a direction of separating from the slider by injecting air at an elevation of higher than or equal to a horizontal so that the decorative portion of the fed fancy yarn is not caught at the slider when the needle main body is pulled into the needle bed and the hook is closed by the slider. The flat knitting machine also includes a nozzle movement mechanism for reciprocating the air nozzle along the longitudinal direction of the needle bed.

[0009] In one aspect of the flat knitting machine of the present invention, the nozzle movement mechanism is a carriage for advancing and retreating the compound

needle by reciprocating in the longitudinal direction of the needle bed.

[0010] In one aspect of the flat knitting machine of the present invention, the nozzle movement mechanism is a nozzle carrier that moves along a rail supporting the yarn feeding member.

EFFECTS OF THE INVENTION

[0011] According to the method of knitting the knitted fabric of the present invention, the decorative portion is effectively prevented from being caught at the slider since the decorative portion of the fancy yarn is pushed in the direction of separating from the slider by air injection. The damaging of the knitted fabric and the damaging of the slider that occurred when the yarn is caught in the related art thus can be avoided.

[0012] According to the flat knitting machine of the present invention, the decorative portion is effectively prevented from being caught at the slider for reasons similar to the method of knitting the knitted fabric of the present invention.

[0013] Furthermore, in the flat knitting machine of the present invention, the air can be easily injected to areas where the decorative portion is likely to be caught in accordance with the knitting operation of the compound needle arranged in the needle bed by having the nozzle movement mechanism as the carriage.

[0014] Moreover, in the flat knitting machine of the present invention, the nozzle can be easily moved in conjunction with the yarn feeding member by having the nozzle movement mechanism as the nozzle carrier that moves along a rail supporting the yarn feeding member and the air can be easily injected to areas where the decorative portion is likely to be caught in accordance with the knitting operation of the compound needle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a schematic configuration diagram showing an arrangement of an air nozzle in a flat knitting machine according to a first embodiment.

Fig. 2 is a schematic configuration diagram showing an arrangement state of a needle bed, a fancy yarn, and the air nozzle when seen from the direction of the arrow in Fig. 1.

Fig. 3 is a schematic configuration diagram showing an arrangement of an air nozzle in a flat knitting machine according to a second embodiment.

Description of symbols

[0016]

1F, 1B needle bed
2 needle bed gap portion

3 yarn feeding member
4 air nozzle
41 ejection hole
5 carriage
5 6 nozzle carrier
10 compound needle
10A to 10E open needle
10F close needle
11 needle main body
10 11A hook
12 slider
Y fancy yarn
Y1 decorative portion

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] Embodiments of the present invention will now be described.

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FIRST EMBODIMENT

<General outline of overall configuration of flat knitting machine>

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[0018] A flat knitting machine of the present embodiment includes a pair of needle beds 1F, 1B in which a plurality of compound needles 10 is arranged in a line; a yarn feeding member 3 for feeding a fancy yarn Y to a needle bed gap portion 2; an air nozzle 4 for holding down a decorative portion Y1 projecting out at the outer periphery of the fancy yarn Y by injecting air; and a carriage 5 that reciprocates in a longitudinal direction of the needle beds 1F, 1B. Each configuration of the flat knitting machine of the present embodiment will be described in detail below based on Figs. 1 and 2.

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[0019] As shown in Fig. 1, the compound needle 10 includes a needle main body 11 and a slider 12. The needle main body 11 has a hook 11A at the distal end portion, and the slider 12 is, for example, a thin plate, two of which form a set, fitted into a groove of the needle main body 11. The hook 11A arranged at the distal end portion of the needle main body 11 opens and closes when the needle main body 11 and the slider 12 relatively slide in the longitudinal direction. Specifically, the hook 11A closes when the distal end portion of the slider 12 clamps both sides of the hook 11A of the needle main body 11 by the relative slide of the needle main body 11 and the slider 12. On the contrary, the hook 11A opens when the slider 12 separates from the hook 11A.

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[0020] As shown in Fig. 2, the compound needle 10 is arranged in a line with a predetermined spacing in the longitudinal direction of the needle bed, and knits the knitted fabric by pulling the fancy yarn Y fed to the needle gap portion 2 to the needle bed 1F, 1B side by advancing and retreating to the needle bed gap portion 2 through the action of the knitting cam system of the carriage 5 (Fig. 1). A known configuration can be used for the car-

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riage 5 and a needle selecting mechanism to advance and retreat the compound needle 10.

[0021] Furthermore, as shown in Fig. 1, the yarn feeding member 3 of the flat knitting machine is a member for feeding the fancy yarn Y from a yarn feeder arranged at the distal end portion thereof to the needle bed gap portion 2. Each yarn feeding member 3 is slidably attached to a rail (not shown) extending in a direction perpendicular to the plane of drawing of Fig. 1. The yarn feeding member 3 is configured to be entrained by the carriage 5 to reciprocate in the longitudinal direction of the needle beds 1F, 1B in conjunction with the reciprocating movement of the carriage 5.

<Air nozzle>

(Configuration and arrangement)

[0022] In such a flat knitting machine, the air nozzle 4 is fixed to the carriage 5. As will be described later, the air injected from the air nozzle 4 needs to be supplied to a predetermined region where the compound needle 10 is performing the knitting operation. Thus, the air can be easily injected to the predetermined region where the compound needle 10 is performing the knitting operation if the air nozzle 4 is fixed to the carriage 5 since the air nozzle 4 moves in conjunction with the carriage 5. That is, the carriage 5 serves both as a drive mechanism of the compound needle 10 and as a nozzle movement mechanism of the air nozzle 4. One air nozzle of a pipe-shape is used for the air nozzle 4 in the present embodiment, but that in which a plurality of pipes is lined or that having a flat shape with a slit-shaped opening may be used.

[0023] As shown in Fig. 1, such an air nozzle 4 is horizontally arranged substantially towards the distal end portion of the yarn feeding member 3. More specifically, as shown in Fig. 2, the air nozzle 4 is arranged to inject air to the yarn feeding region of the compound needles 10 (open needles 10A to 10E), which hooks 11A are opened, on the back side (downstream side) with respect to the movement direction of the yarn feeding member 3.

[0024] Fig. 2 shows a state in which the yarn feeding member 3 moves to the right side and the knitting of the knitted fabric proceeds from the left side to the right side, where the decorative portion Y1 of the fancy yarn Y is shown in a loop-form. If the air is not injected, the yarn feeding path from the yarn feeding member 3 to the compound needle 10 (close needle 10F) retreated more than the movement track of the yarn feeding member with the fancy yarn Y hooked to the hook becomes linear, as shown with a chain dashed line. In this case, one of the decorative portions Y1 may face the slider 12 side since the decorative portions Y1 are radially projected at the outer periphery of the fancy yarn Y, and the decorative portion Y1 may be caught at the slider 12 if the hooks of the open needles 10A to 10E are closed in such a state. However, if air is injected with the air nozzle 4 arranged

to face the yarn feeding regions of the open needles 10A to 10E, in particular, the yarn feeding region of the open needle 10E adjacent to the close needle 10F, the fancy yarn Y will be pushed away in the direction of separating from the slider 12, and the yarn feeding path from the yarn feeding member 3 to the close needle 10F becomes nonlinear. In this case, the decorative portions Y1 of the fancy yarn positioned before the close needle 10F at the downstream of the yarn feeding member 3 are also pushed away in the direction of separating from the slider 12 since the air injecting region is spread. As a result, the decorative portion Y1 will not be caught at the slider 12 when retreating the needle main body 11 of the open needle 10E from the needle bed gap portion and closing the hook 11A.

[0025] In Fig. 1, only the configuration in which air is injected to the yarn feeding region of the compound needle of one needle bed 1F of the pair of needle beds 1F, 1B is shown with a solid line for the sake of convenience of the explanation, but the air nozzle 4 is also mounted on the carriage 5 of the other needle bed 1B so as to be point symmetric with respect to the intersection of the diagonal lines when both carriages 5 are seen in plane view.

(Air injecting direction)

[0026] The installing direction of the nozzle 4 is determined such that the air injecting direction becomes an elevation including the horizontal direction. More specifically, an angle between the installation angle of the needle bed 1F, 1B (normally, between 40 and 45° with respect to horizontal direction) and the horizontal direction is suitable. With such an angle, the decorative portion Y1 of the fancy yarn can be easily pushed in the direction of separating from the slider 12. If the air is injected in the depression direction, it is difficult to reliably prevent the decorative portion Y1 from being caught at the slider 12 since the decorative portion Y1 of the fancy yarn fed from the yarn feeding member 3 is pushed towards the slider 12 side. In the example shown in Fig. 1, the direction is a horizontal direction.

(Air injecting strength)

[0027] The air injecting strength merely needs to be such that an extent of pushing away the decorative portion Y1 in the direction of separating from the slider 12 is ensured. Even if strongly injected to an extent of changing the yarn feeding path of the fancy yarn Y itself, problems do not arise in proceeding the knitting since the fancy yarn Y is pushed against the inner side of the hook 11A.

(Air injecting timing)

[0028] For the air injecting timing, the air may be, in theory, continuously injected on a steady basis during

the knitting operation. However, since injecting air on a steady basis is a waste of energy, the injection may be stopped during the course, in which the knitting of hooking the fancy yarn Y to the hook 11A is not involved. The air may be discontinued, for example, by extracting the timing the course in which the knitting of hooking the fancy yarn Y to the hook 11A is not involved occurs from the knitting program of the knitted fabric set in advance, and controlling an air discontinuing means such as an electromagnetic valve in synchronization with such a timing. The air is suitably ejected after the air ejection amount stabilizes to a constant.

<Air source>

[0029] An air source (not shown) such as a compressor is used to inject air from the air nozzle 4. Normally in factories installed with the flat knitting machine and the like, a compressor is arranged for a dust cleaner, and air is supplied from the compressor through a hose. Therefore, it is suitable to use the compressor for the air source of the air nozzle 4. Needless to say, other compressors may obviously be used.

<Effects>

[0030] According to the above embodiment, the decorative portion of the fancy yarn fed from the yarn feeding member can be pushed in the direction of separating from the slider, so that the decorative portion is prevented from being caught at the slider when the needle main body is pulled into the needle bed. Thus, the problems that arise when the decorative portion is caught at the slider, that is, the damage of the knitted fabric and the deformation of the slider can be avoided.

SECOND EMBODIMENT

[0031] An embodiment of the present invention in which an air nozzle is arranged in place of some yarn feeding members will now be described based on Fig. 3. This embodiment is similar to the first embodiment in basic configuration and function, but differs from the first embodiment in the configuration and the installing area of the air nozzle. The difference with the first embodiment will be centrally described below.

<Configuration>

[0032] The yarn feeding member 3 is slidably supported by a plurality of rails (not shown) extending in the longitudinal direction of the needle bed at substantially the upper side of the needle bed gap portion 2. The rails are lined in a direction orthogonal to the longitudinal direction of the needle beds 1F, 1B, where a nozzle carrier 6 is held using the rails positioned at the ends in the lined direction, and the yarn feeding members 3 are held by the remaining rails. If the air nozzle 4 is supported using

the rails at the ends in the lined direction, the air can be act on the fancy yarn Y fed from either yarn feeding member 3 (only one is illustrated herein). The nozzle carrier 6 may be configured to be entrained by the carriage, or may be configured to be self-propelled.

[0033] The nozzle carrier 6 has a different distal end shape from the yarn feeding member 3, and reciprocates along the rail while holding the air nozzle 4 at the end. In other words, the nozzle carrier 6 can be operated in conjunction with the yarn feeding member 3. The air nozzle 4 held by the nozzle carrier 6 is also one pipe in the present embodiment. However, this nozzle 4 has a configuration in which the distal ends of the pipe are sealed and an ejection hole 41 of the air is formed at the side of the pipe. With the nozzle 4 of such a configuration, the air can be injected horizontally while extending the nozzle 4 downward from the upper side of the needle beds 1F, 1B through the nozzle carrier 6.

<Effects>

[0034] Similar to the first embodiment, the air nozzle of the present embodiment also ejects air to the yarn feeding region of the compound needles, which hooks are opened, at the downstream of the yarn feeding member. The decorative portion of the fancy yarn is thus pushed in the direction of separating from the slider, thereby preventing the decorative portion from being caught at the slider.

<Variant>

[0035] Each configuring member of the embodiments described above can be replaced as described below.

<<Compound needle>>

[0036] The compound needle used in the present invention merely needs to have a configuration of including the needle main body and the slider, and in which the hook arranged at the distal end of the needle main body is opened and closed by the slider that slides in the longitudinal direction of the needle main body. The compound needle described with reference to the drawings is a so-called slideneedle (registered trademark of Shima Seiki Mfg., Ltd.) in which the hook of the needle main body is clamped with two sliders with respect to one needle main body. In addition, a type in which one slider is provided with respect to one needle main body may be used for the compound needle.

<<Needle bed>>

[0037] The flat knitting machine described in the embodiments is a two-bed flat knitting machine including a pair of needle beds disposed opposite to each other, but may be a flat knitting machine including one needle bed. A four-bed flat knitting machine in which a pair of oppos-

ing needle beds is arranged above a pair of opposing needle beds may also be used.

<<Yarn feeding member>>

[0038] The yarn feeding member described in the embodiment is configured to be entrained by the carriage, but the yarn feeding member itself may be a self-propelling type. Furthermore, the yarn feeding member is in plurals in the embodiments, but may be singular.

<<Fancy yarn>>

[0039] In the present embodiment, a loop yarn in which a loop (decorative portion) is formed by wrapping a decorative yarn around the outer periphery of a core yarn is used for the fancy yarn, but obviously, other fancy yarns may be used. For instance, the fancy yarn other than the loop yarn includes a knot yarn in which a ball-shaped knot (decorative portion) is formed in places by wrapping the decorative yarn around the outer periphery of the core yarn. In any case, according to the configuration of the present invention, the decorative portion is prevented from being caught at the slider for the general fancy yarn having the projecting decorative portion at the outer peripheral side of the core yarn.

«Others»

[0040] The flat knitting machine of the present invention has a configuration of using a carriage for advancing and retreating the compound needle and entraining the yarn feeding member in knitting, but may have a carriageless configuration of driving a plurality of compound needles and a plurality of yarn feeding members with an individual drive mechanism.

INDUSTRIAL APPLICABILITY

[0041] The method of knitting the knitted fabric and the flat knitting machine of the present invention can be suitably used in knitting of a knitted fabric using a fancy yarn.

Claims

1. A method of knitting a knitted fabric using a flat knitting machine including a plurality of compound needles, each including a needle main body with a hook and a slider for opening and closing the hook; a needle bed, in which the compound needles are arranged in a line, for holding each compound needle to freely advance and retreat in a longitudinal direction of the needle; and a yarn feeding member for feeding a fancy yarn, which has a decorative portion projecting out at an outer periphery of a core yarn, to a needle bed gap portion of the needle bed by reciprocating in a longitudinal direction of the needle

bed, the knitting being performed by hooking the fancy yarn fed from the yarn feeding member to the needle bed gap portion to the hook of the needle main body advanced to the needle bed gap portion, and pulling the needle main body into the needle bed; wherein

the knitting is performed with the decorative portion pushed in a direction of separating from the slider by injecting air so that the decorative portion of the fed fancy yarn is not caught at the slider when the needle main body is pulled into the needle bed and the hook is closed by the slider.

2. A flat knitting machine including a plurality of compound needles, each including a needle main body with a hook and a slider for opening and closing the hook; a needle bed, in which the compound needles are arranged in a line, for holding each compound needle to freely advance and retreat in a longitudinal direction of the needle; and a yarn feeding member for feeding a fancy yarn, which has a decorative portion projecting out at an outer periphery of a core yarn, to a needle bed gap portion of the needle bed by reciprocating in a longitudinal direction of the needle bed, the flat knitting machine performing the operation of hooking the fancy yarn fed from the yarn feeding member to the needle bed gap portion to the hook of the needle main body advanced to the needle bed gap portion, and pulling the needle main body into the needle bed; the flat knitting machine comprising:

an air nozzle for pushing the decorative portion in a direction of separating from the slider by injecting air at an elevation of higher than or equal to a horizontal so that the decorative portion of the fed fancy yarn is not caught at the slider when the needle main body is pulled into the needle bed and the hook is closed by the slider; and
a nozzle movement mechanism for reciprocating the air nozzle along the longitudinal direction of the needle bed.

3. The flat knitting machine according to claim 2, wherein the nozzle movement mechanism is a carriage for advancing and retreating the compound needle by reciprocating in the longitudinal direction of the needle bed.

4. The flat knitting machine according to claim 2, wherein the nozzle movement mechanism is a nozzle carrier that moves along a rail supporting the yarn feeding member.

FIG. 1

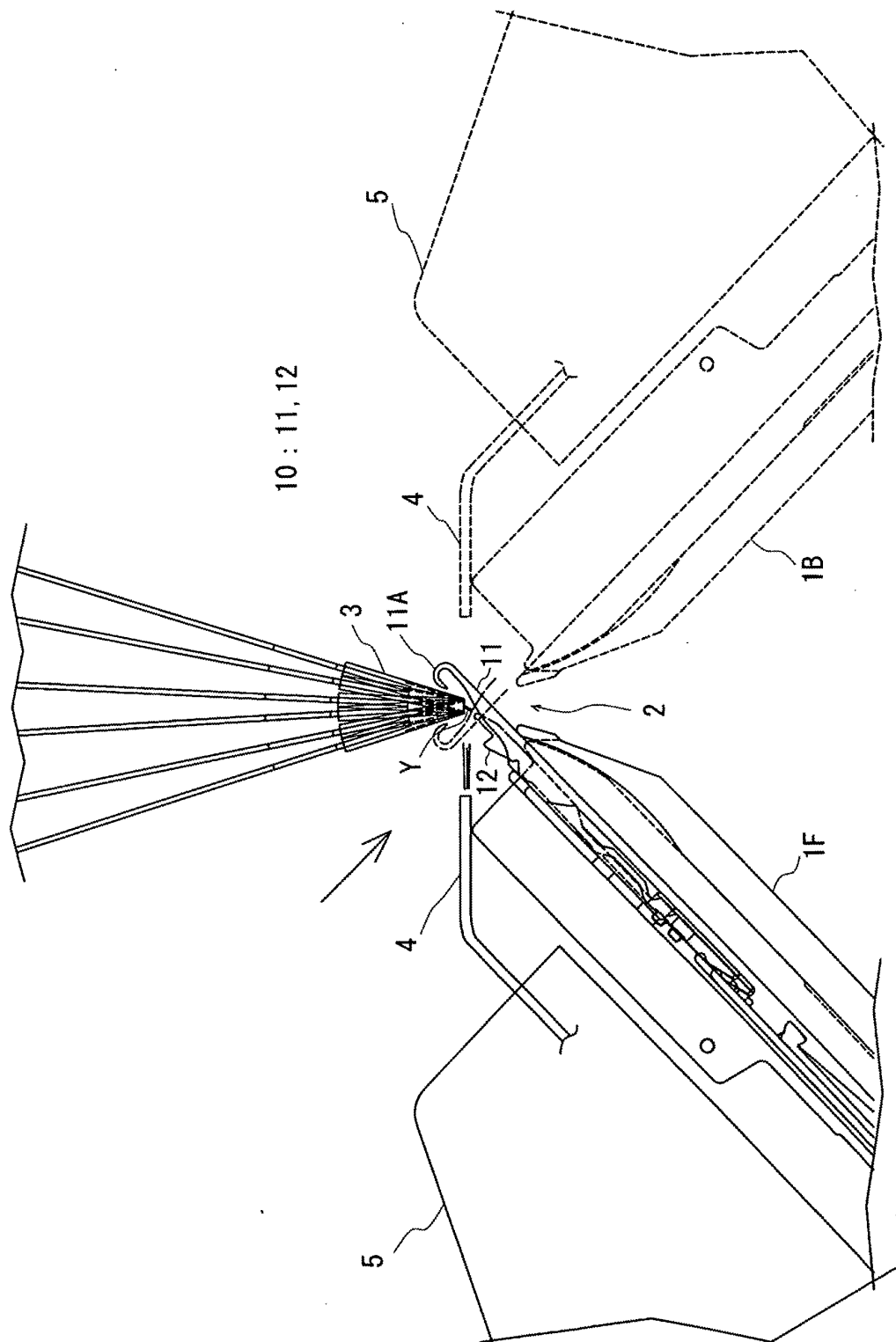


FIG. 2

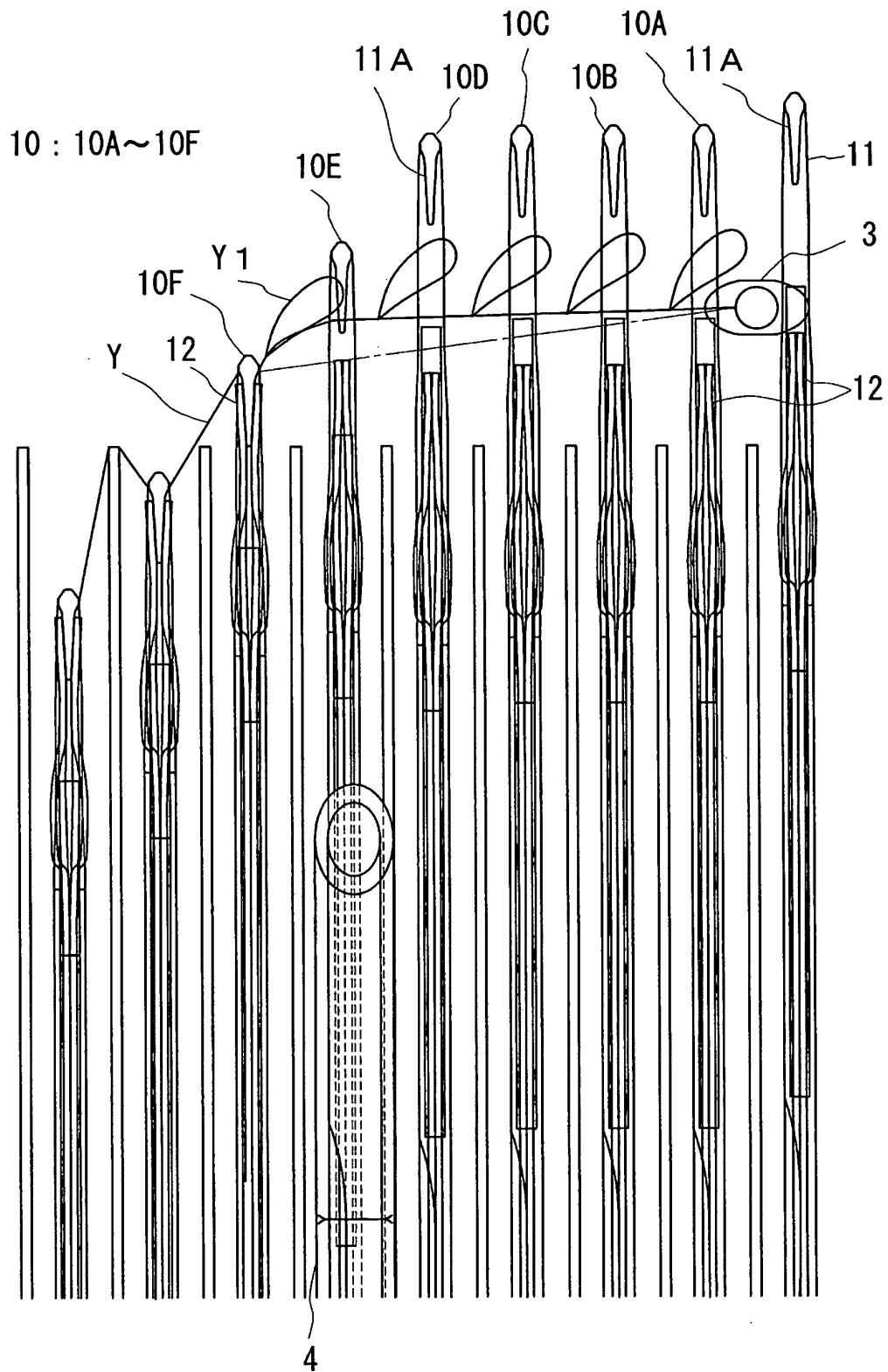
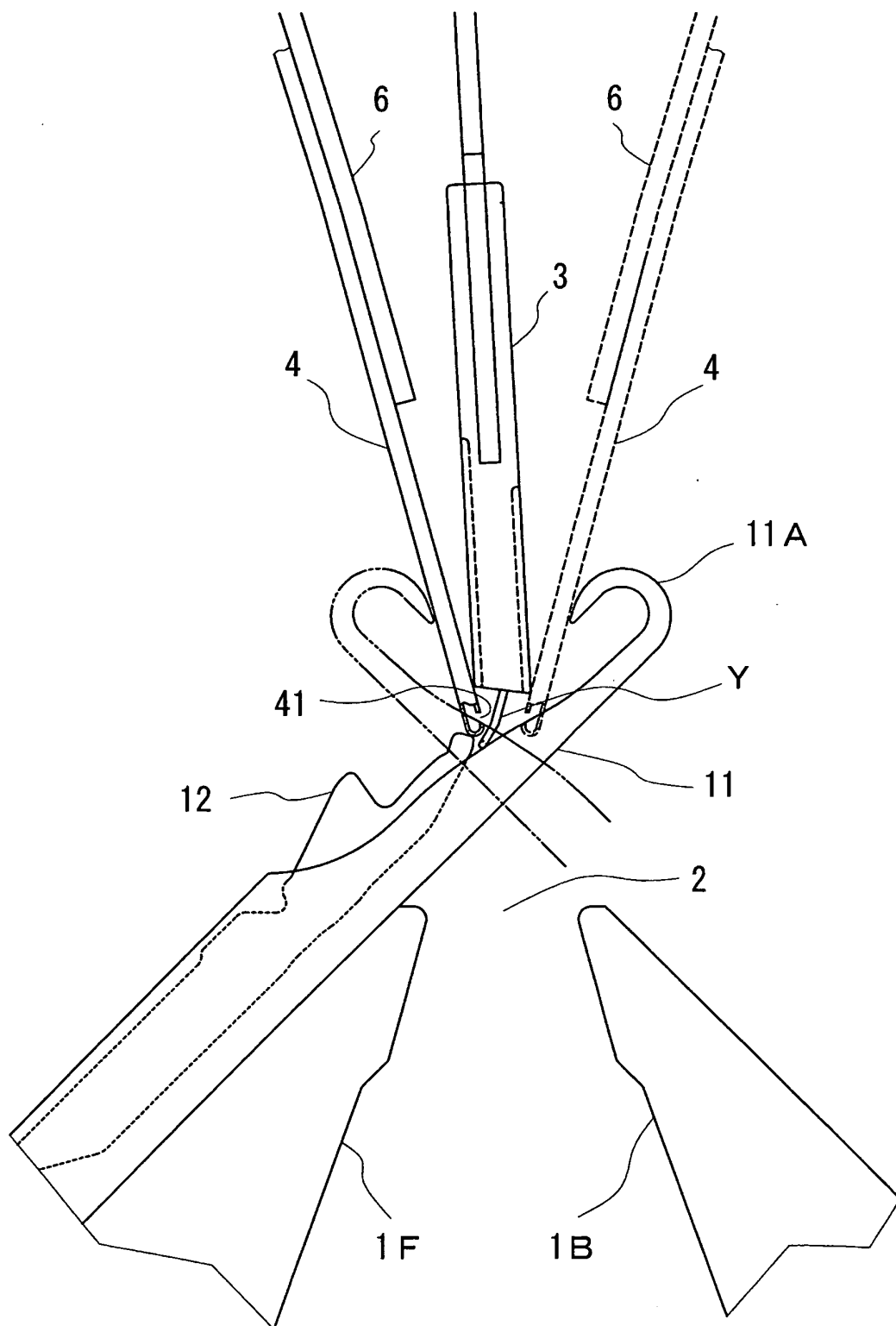


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/001929

A. CLASSIFICATION OF SUBJECT MATTER

D04B15/56(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)

D04B15/54-15/56, 35/32

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	WO 2007/037285 A1 (Shima Seiki Mfg., Ltd.), 05 April, 2007 (05.04.07), (Family: none)	1-4

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

* Special categories of cited documents:

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"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

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Date of the actual completion of the international search
12 September, 2008 (12.09.08)Date of mailing of the international search report
22 September, 2008 (22.09.08)Name and mailing address of the ISA/
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Form PCT/ISA/210 (second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2007037285 A [0003]