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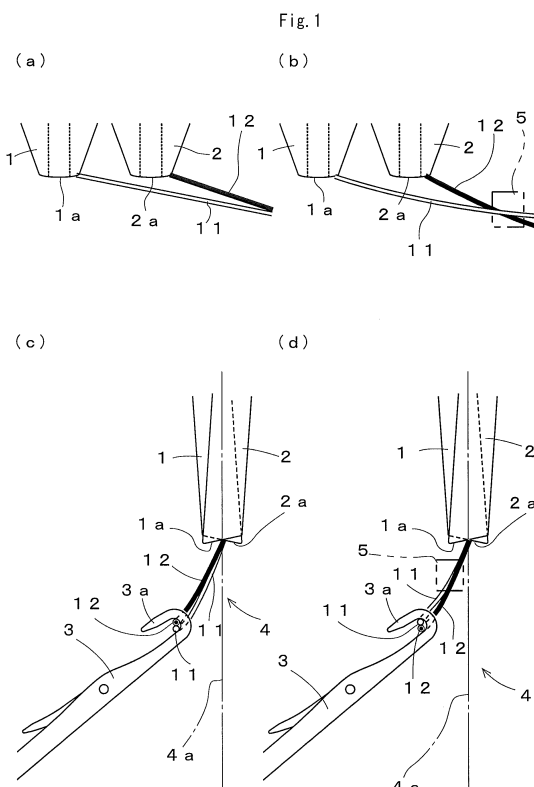
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(54) **PLATING KNITTING METHOD USED IN FLAT KNITTING MACHINE**

(57) There is provided a method of knitting for plating stitch by a flatbed knitting machine in which there is no need to change the running order of two yarn feeding ports, only a single route of pull-in by the knitting needle is sufficient, and a main yarn and a plating yarn can be inverted even during mid-course of one knitting course.

In ordinary plating shown in (a) and (c), a main yarn 11 and a plating yarn 12 are respectively fed from preceding and following yarn feeding ports 1a, 2a. The main yarn 11 and the plating yarn 12 are fed to a hook 3a of the same knitting needle 3 while being kept at vertical positions. When a fabric is knitted, the main yarn 11 on the lower side of the plating yarn 12 appears on the front surface, and the plating yarn 12 is hidden on the back surface. In the inverse plating, as shown in (b) and (d), an operating member 5 provided with in correspondence with each knitting needle 3 is operated such that an operating part formed near a leading end moves forward and backward above a needle bed gap 4, whereby the vertical positions of the main yarn 11 and the plating yarn 12 to be pulled in by the hook 3a of the knitting needle 3 are inverted.



Description

[Technical Field]

[0001] The present invention relates to a method of knitting for plating stitch to use two types of knitting yarns by a flatbed knitting machine, which makes it possible to switch from ordinary plating in which one knitting yarn as a main yarn covers the other knitting yarn as a plating yarn, to inverse plating in which the plating yarn and the main yarn are inverted in the mid-course of the ordinary plating.

[Background Art]

[0002] Knitting needles for knitting a fabric by a flatbed knitting machine are aligned with a constant pitch in the longitudinal direction of needle beds. At least two needle beds are used facing each other. The space between the needle beds facing each other is called needle bed gap. The fabric is knitted with a knitting yarn fed from a yarn feeding port running above the needle bed gap in the longitudinal direction of the needle beds to a hook of a knitting needle. Knitting for plating stitch by a flatbed knitting machine is performed by feeding two types of knitting yarns different in appearance from two yarn feeding ports which run above a needle bed gap in a longitudinal direction of needle beds to each hook of needle. The feeding of the knitting yarns is performed by using two yarn feeders each of which has a single yarn feeding port or by using one yarn feeder dedicated for plating to have a double yarn feeding port. The knitting yarns fed from the preceding and the following yarn feeding ports are respectively placed on the lower side and the upper side on the hook as far as knitting conditions such as tensile force are appropriately kept, and constitute a main yarn exposed to the surface of the knitted fabric and a plating yarn covered with the main yarn. The two types of knitting yarn can form patterns in the knitted fabric by changing the running order to switch between the main yarn and the plating yarn.

[0003] The change of the running order of the two yarn feeding ports is possible during one course of knitting but cannot be done instantaneously. Changing the running order while continuing to knit, causes the switching between the main yarn and the plating yarn over in a section of a plurality of stitches to make unclear a boundary between patterns. If knitting would be stopped once at a boundary between patterns and resumed after changing the running order of the yarn feeding ports, the boundary between the patterns could be clarified. However, the change of the running order of the yarn feeding ports would require an operation including an inversion of the running direction of a carriage equipped with a cam for driving the knitting needles, thereby leading to deterioration in knitting efficiency.

[0004] Purl stitch enables the inversion of the plating yarn and the main yarn without changing the running or-

der of the two yarn feeding ports, but the stitches of the inverse section get into back stitches (for example, refer to Patent Citation 1, paragraph 0002). Patent Citation 1 proposes a method of switching between the ordinary plating and the inverse plating by using a swing-type movable sinker (refer to paragraphs 0016 and 0017, although the ordinary plating and the inverse plating are respectively described as standard plating and yarn-replaced plating). The movable sinker according to this proposition has a convex portion and a concave groove which are formed on the upper side of the part for making a stitch (refer to Patent Citation 1, Fig. 3 and others). To invert the main yarn and the plating yarn in the inverse plating, the movable sinker is swung such that the main yarn to start to be pulled in by the hook of the knitting needle contacts the convex portion. The main yarn is raised toward the concave groove to exchange the vertical positions of the main yarn and the plating yarn, and then the main yarn and the plating yarn exchanged in vertical position are pulled in by the hook (refer to Patent Citation 1, paragraph 0034). For the ordinary plating in which the main yarn and the plating yarn are not exchanged in vertical position, the pull-in operation of the knitting needle is delayed such that, even when the movable sinker is swung, the main yarn and the plating yarn are not pulled in by the hook (refer to Patent Citation 1, paragraphs 0023 and 0024). The switching between the ordinary plating and the inverse plating is performed by switching between two routes prepared for pull-in stitching operation of the knitting needle while the movable sinker operates in an unchanged manner (refer to Patent Citation 1, Figs. 2 and 11).

[Citation List]

[Patent literature]

[0005] Patent Citation 1: Japanese Patent No. 2016-176159 A

[Summary of Invention]

[Technical Problem]

[0006] According to Patent Citation 1, in response to the operation of the movable sinker, the pull-in by the knitting needle for the inverse plating is performed earlier than the pull-in by the knitting needle for the ordinary plating. Therefore, in the vicinity of a boundary between the section of the pull-in by the knitting needle for the ordinary plating and the section of the pull-in by the knitting needle for the inverse plating, the size of the stitch in the following inverse plating is determined earlier during the formation of the stitch of the preceding ordinary plating. The ordinary plating stitch, the size of which is determined later, is formed with feeding of the knitting yarn through the inverse plating stitch, the size of which has been already determined, and thus excessive tensile

force is applied to the knitting yarn that may become broken accordingly. In addition, in the section of the inverse plating, the movable sinker swings even during the pull-in of the knitting yarn by the hook of the knitting needle (refer to Patent Citation 1, Figs. 14 to 17), and it is thus presumed that some adverse effect might be exerted on the stability of the stitches and the quality of the knitted fabric. Further, the need to prepare the two routes for the pull-in stitching operation of the knitting needle may result in complicated needle selection and a wider cam system for driving the knitting needles.

[0007] An object of the present invention is to provide a method of knitting for plating stitch by a flatbed knitting machine, in which there is no need to change the running order of two yarn feeding ports, only a single route of pull-in by the knitting needle is sufficient, and switching is allowed between the ordinary plating and the inverse plating even in the mid-course of knitting.

[Solution to Problem]

[0008] The present invention is a method of knitting for plating stitch by a flatbed knitting machine that is switchable between ordinary plating and inverse plating to knit plating stitch, in which the ordinary plating is performed such that a main yarn and a plating yarn are fed from preceding and following yarn feeding ports to the same knitting needle while being kept at vertical lower and upper positions so that the main yarn is on a front side, and the inverse plating is performed such that vertical positions of the main yarn and the plating yarn to be fed to the knitting needle are inverted and the plating yarn is on the front side,

characterized in that

providing with an operating member having an operating part at a leading end for inverse operation to be switchable whether the operating part at a leading end is allowed or disallowed to move forward and backward with respect to a needle bed gap in correspondence with adjacent sides in a proceeding direction of knitting with respect to each knitting needle, and

in the inverse plating, the operating part of the operating member is moved forward to an upper side of the needle bed gap and caused to operate on the main yarn and the plating yarn to be fed to the knitting needle in such a manner as to invert the vertical positions of the main yarn and the plating yarn to be pulled into a hook of the knitting needle, and a fabric is knitted such that the plating yarn is on the front side.

[0009] In the present invention, for knitting said inverse plating,

utilizing a local member, disposed on a needle bed to which said knitting needle belongs in the vicinity of a side to said proceeding direction of knitting with respect to each knitting needle, for an inverse wall to invert said vertical positions in cooperation with said operating member, and

making said operating part of the operating member, provided at an upper portion of the operating member to operate on said main yarn and the plating yarn from below, to guide said main yarn and the plating yarn placed thereon to the inverse wall, to cause the yarns to be pulled into the hook in cooperation with the inverse wall such that the plating yarn is on the lower side and the main yarn is on the upper side, and to invert the vertical positions of the main yarn and the plating yarn.

[0010] In the present invention, said operating member and said local member are arranged in this order toward said proceeding direction of knitting with respect to said knitting needle, and for said inverse plating,

making said operating part, which guides said main yarn preceding said plating yarn to said inverse wall and retains them there, to constitute a downward wall against the main yarn and the plating yarn, and to form a region surrounding and restricting the main yarn and the plating yarn together with an upper portion of the hook as an upward wall, and inverting the positions of the main yarn and the plating yarn such that the plating yarn comes around a lower side of the main yarn, by pulling them into the hook from a state in which the yarns are surrounded by the region and aligned with each other.

[0011] In the present invention, said inverse wall has an upward inclination which is lower on said needle bed gap side and is higher on a side leaving from the needle bed gap, and

for knitting said inverse plating, while the yarns are guided from said operating part to the inverse wall such that said main yarn precedes on the upper side and said plating yarn follows on the lower side, pulling the yarns into said hook such that the main yarn is on the upper side and the plating yarn is on the lower side so that the vertical positions are inverted.

[0012] In the present invention, said operating part of said operating member is provided at the lower portion of the operating member, and

operating on said main yarn and said plating yarn from above in the inverse plating to press the plating yarn into a lower side of the main yarn so that the vertical positions are inverted.

[0013] In the present invention, said following yarn feeding port is run at a position separated from said preceding yarn feeding port, with respect to said needle bed to which said knitting needle belongs, in a direction of leaving from the needle bed gap.

[Advantageous Effects of Invention]

[0014] According to the present invention, an operating member is provided in correspondence with each of knit-

ting needle so as to be switchable on whether an operating part at the leading end is allowed or disallowed to move forward and backward with respect to the needle bed gap. The operating member, during mid-course of an ordinary plating in which knitting for plating stitch is performed with knitting yarns pulled into a hook of a knitting needle such that a main yarn is on a lower side and a plating yarn is on an upper side, is capable of moving the operating part forward to the needle bed gap. The moved operating part inverts vertical positions of the main yarn and the plating yarn to be pulled into the hook of the knitting needle, which makes it possible to switch to inverse plating in which the plating yarn is on the front surface side of the knitted fabric even during the ordinary plating. There is no need to change a running order of two yarn feeding ports and only a single route for pull-in by the knitting needle is sufficient.

[0015] According to the present invention, when the operating part of the operating members is brought into operation, the main yarn fed to the lower side and the plating yarn fed to the upper side are placed on a local member in the vicinity of the knitting needle and are guided to an inverse wall, and the operating part can invert vertical positions of the main yarn and the plating yarn to be pulled into the hook in cooperation with the wall.

[0016] According to the present invention, the main yarn and the plating yarn are restricted in an aligned state within a region surrounded by the upper portions of the operating part and the hook as well as the inverse wall. Since the plating yarn is pulled from the region into the hook in such a manner as to come around the lower side of the main yarn, the main yarn and the plating yarn to be pulled into the hook can be inverted in vertical position from the state of yarn feeding.

[0017] According to the present invention, the inverse wall has an upward inclination which is lower on the needle bed gap side and becomes higher on the side distant from the needle bed gap. Guided to the inverse wall, the main yarn precedes and becomes on the upper side and the plating yarn follows and becomes on the lower side. The pulling of the knitting yarns into the hook is performed a state in which the main yarn guided by the inverse wall is on the upper side and the plating yarn guided by the inverse wall is on the lower side, and thus the main yarn and the plating yarn to be pulled into the hook can be inverted in vertical position from the state of yarn feeding.

[0018] According to the present invention, the operating part of the operating member can press the plating yarn fed to the upper side into the lower side of the main yarn so that the main yarn and the plating yarn can be fed in the vertically inverted positions into the hook of the knitting needle.

[0019] According to the present invention, the following yarn feeding port runs at a position separated from the preceding yarn feeding port in the direction of leaving from the needle bed gap. Since the front-back difference between the needle beds is added to the main yarn and the plating yarn, it is possible to stably invert the vertical

position of the main yarn and the plating yarn by the operating part of the operating member, and it is also possible to stably cancel the inverse of the vertical position after the operating member stops operation.

[Brief Description of Drawings]

[0020]

[Fig. 1] Fig. 1 is a partial front view and side view showing a switching operation of a main yarn and a plating yarn in knitting for plating stitch according to the present invention.

[Fig. 2] Fig. 2 is a side view showing stepwise the switching operation of the main yarn and the plating yarn according to example 1 of the present invention.

[Fig. 3] Fig. 3 is a side view showing stepwise the switching operation of the main yarn and the plating yarn continued from Fig. 2 according to the example 1 of the present invention.

[Fig. 4] Fig. 4 is a plan view showing a knitting operation near a needle bed gap including the switching operation shown in Fig. 2 and Fig. 3.

[Fig. 5] Fig. 5 is a side view showing stepwise a switching operation of a main yarn and a plating yarn according to example 2 of the present invention.

[Fig. 6] Fig. 6 is a side view showing stepwise the switching operation of the main yarn and the plating yarn continued from Fig. 5 according to the example 2 of the present invention.

[Fig. 7] Fig. 7 is a plan view showing a knitting operation near a needle bed gap including the switching operation shown in Fig. 5 and Fig. 6.

[Fig. 8] Fig. 8 is a side view showing stepwise a switching operation of a main yarn and a plating yarn according to example 3 of the present invention.

[Fig. 9] Fig. 9 is a plan view showing a knitting operation near a needle bed gap including the switching operation shown in Fig. 8.

[Fig. 10] Fig. 10 is a plan view and side view that showing a comparison between a case in which a yarn feeding port of a plating yarn and a yarn feeding port of a main yarn are run almost at the same position with respect to a needle bed and a case in which the yarn feeding port of the plating yarn is run at a position separated from the needle bed.

[Description of Embodiments]

[0021] Hereinafter, Fig. 1 describes a basic concept of the present invention. Figs. 2 to 5 describe an example 1 of the present invention. Figs. 6 to 8 describe an example 2 of the present invention. Figs. 9 and 10 describe an example 3 of the present invention. For the convenience of description, some components not shown in a drawing being described will be mentioned with reference numerals shown in other drawings. Corresponding components will be given the same reference numerals and

duplicated descriptions thereof may be omitted. Further, as for knitting stitches, old loops are omitted to be shown in the drawings.

[0022] Fig. 1 shows operations of knitting for plating stitch by a flatbed knitting machine in a simplified manner as a basic concept of the present invention. Figs. 1(a) and 1(c) show operations of ordinary plating as a basic of knitting for plating stitch by a flatbed knitting machine. In the ordinary plating, for example in the case of knitting with leftward movement as shown in Fig. 1(a), a main yarn 11 and a plating yarn 12 are respectively fed from yarn feeding ports 1a, 2a of a preceding yarn feeder 1 and a following yarn feeder 2. The main yarn 11 and the plating yarn 12 are discriminated according to the running order of the yarn feeding ports 1a, 2a. The knitting yarns can be fed by using not only the two yarn feeders 1, 2 each having a single yarn feeding port but also one yarn feeder dedicated for knitting for plating stitch having a double yarn feeding port. The main yarn 11 and the plating yarn 12 are fed to a same hook 3a of a knitting needle 3 while the vertical lower and upper positions are kept by a needle bed gap 4 as shown in Fig. 1(c). The knitting needle 3 returns backward to a needle bed while moving obliquely downward from a needle bed gap center 4a. After a fabric is knitted, the main yarn 11 pulled into the lower side than the plating yarn 12 by the hook 3a appears on the front surface and the plating yarn 12 is hidden on the back surface.

[0023] An operating member 5 as shown in Figs. 1(b) and 1(d) is prepared in correspondence with each of the knitting needles 3 to enable switching to the inverse plating according to the present invention. The operating member 5 is made switchable on whether an operating part formed at the leading end is allowed or disallowed to move forward and backward with respect to the needle bed gap 4 as in the example 1, the example 2, and the example 3 of the present invention. As shown in Fig. 1(d), by moving the operating member 5 to the side above the needle bed gap 4 in mid-course of a knitting cause, the operating member 5 can be operated on the main yarn 11 and the plating yarn 12 before being fed to the corresponding knitting needle 3. The operation of the operating member 5 is to invert vertical positions of the main yarn 11 and the plating yarn 12 to be pulled in by the hook 3a of the knitting needle 3 such that the main yarn 11 is on the upper side and the plating yarn 12 is on the lower side. When a fabric is knitted, the plating yarn 12 pulled by the hook 3a to the side below the main yarn 11 appears on the front surface and the main yarn 11 is hidden on the back surface. For the convenience of the description, cross-sections of the main yarn 11 and the plating yarn 12 might be shown in the drawing such as the parts being pulled in by the hook 3a, but the main yarn 11 and the plating yarn 12 are not actually sectioned but are continuous up to the front side of the plane of the drawing.

[0024] According to the present invention, during mid-course of one knitting course in the ordinary plating with

the main yarn 11 and the plating yarn 12, the main yarn 11 and the plating yarn 12 to be pulled in by the knitting needle 3 can be inverted in vertical positions before being fed to the hook 3a, thereby switching to the inverse plating such that the plating yarn 12 is on the front surface side of the knitted fabric. The efficiency of knitting does not decrease even if the main yarn 11 and the plating yarn 12 are switched more frequently, so that it is possible to knit a fabric in a variety of patterns by the knitting for plating stitch. The switching of the main yarn 11 and the plating yarn 12 does not require change of the running order of the two yarn feeding ports 1a, 2a and a single route for pull-in by the knitting needle 3 is sufficient.

[Example 1]

[0025] Fig. 2 and Fig.3 show stepwise an operation of switching from the main yarn 11 to the plating yarn 12 as the knitting yarn to appear on the front surface of the knitted fabric in the inverse plating according to the example 1 of the present invention. In the inverse plating as well, the feeding of the main yarn 11 and the plating yarn 12 by the yarn feeders 1, 2 and the forward and backward movement of the knitting needle 3 with respect to the needle bed gap 4 are carried out in the same manner as in the ordinary plating. The switching operation is performed during mid-course of one knitting course, and the main yarn 11 and the plating yarn 12 are connected to a loop, which is held by the hook 3a of the knitting needle 3 after knitted completely. The knitting needle 3 is housed in a needle groove of the needle bed 6, and at least one pair of needle beds 6 are provided so as to be opposed to each other and to interleave the needle bed gap 4, but the knitting needle on the opposed side is omitted to show in the drawings.

[0026] The knitting needles 3 are provided in parallel with a constant pitch in a direction perpendicular to the plane of the drawing such that the hooks 3a face the needle bed gaps 4. A yarn guide 7 and a movable sinker 8 or the like are provided around each knitting needle 3. A loop presser 15 corresponding to the operating member 5 is arranged above each knitting needle 3. The loop presser 15 is housed in an auxiliary bed as disclosed in Japanese Patent No. 4102430, for example. The auxiliary bed is provided above a needle bed 6 opposed to a needle bed 6 in which the knitting needle 3 is housed, alternatively the auxiliary bed can be provided above the needle bed 6 in which the knitting needle 3 is housed, as disclosed in Japanese Patent No. 3044373, for example.

[0027] The knitting needle 3, the movable sinker 8, and the loop presser 15 operate by receiving actions of a drive control unit mounted on a carriage running along the needle bed in a direction perpendicular to the plane of the drawing. In the present example 1, the loop presser 15 is provided with an operating part 15a on the upper side near the leading end so that the loop presser 15 has not only the original function is to press the loop but also has a function of the operating member 5. Alternatively,

a dedicated member to operate as the operating member 5 may be provided. Instead of the movable sinker 8, a fixed sinker may be used. In Figs. 2 and 3, knitting operation proceeds along a direction from the front side to back side of the drawings. With respect to this direction, the yarn guide 7 and the movable sinker 8 are arranged adjacent to the knitting needle 3 on the needle bed 6. The operating part 15a of the loop presser 15 can move forward and backward from the opposed needle bed side between the yarn guide 7 and the knitting needle 3. Therefore, toward the knitting direction, the knitting needle 3, the operating member 5 such as the loop presser 15, the yarn guide 7, the movable sinker 8, and the next knitting needle 3 are arranged in this order.

[0028] As shown in Fig. 2(a), before the formation of a loop by the knitting needle 3, the hook 3a is raised up to a clear position and then is lowered to a position where to wait for yarn feeding. By raising the hook 3a to the clear position, an old loop formed in the hook 3a moves to a needle shank of the knitting needle 3. As shown at positions 3A, 3B, and 3C, when the pull-in by the hook 3a is started, the operating part 15a of the loop presser 15 moves forward to below the main yarn 11 and the plating yarn 12 as shown at positions 15A, 15B, and 15C. The operating part 15a having moved forward to the position 15C operates the main yarn 11 and the plating yarn 12 from below. The main yarn 11 comes into a state to be aligned at a position nearer the yarn guide 7 than the plating yarn 12, on the operating part 15a,

[0029] As shown in Fig. 2(b), when the pull-in by the hook 3a is continued, the operating part 15a having moved forward to the position 15D guides the main yarn 11 and the plating yarn 12 placed thereon to a side of the front edge 7a of the yarn guide 7. In the space near the hook 3a of the knitting needle 3 pulled to the position 3D, for the main yarn 11 and the plating yarn 12, the front edge 7a constitutes an inverse wall which stops the movement of the main yarn 11 and the plating yarn 12 in the direction toward the needle bed 6 and inverts the vertical positions of the main yarn 11 and the plating yarn 12 as described later, the operating part 15a constitutes a downward wall, and the upper part of the hook 3a constitutes an upward wall. The front edge 7a, as a wall to stop movement, by setting an angle with respect to the direction of the forward and backward movement of the knitting needle 3 with in a range close to the vertical angle shown in the drawing or the like, may constitute a part of a wall of a region, which surrounds the main yarn 11 and the plating yarn 12, and stops the movement from within toward the needle bed 6.

[0030] In this region, the main yarn 11 is retained at the front edge 7a, and the plating yarn 12 aligns with the main yarn 11 on the needle bed gap 4 side. If the operating part 15a in this region would be too high, it might become hard to feed the yarn to the hook 3a, and the vertical drop from the upper edge of the operating part 15a to the inside of the hook 3a might become large, thereby to increase a load on the knitting yarns. If the

operating part 15a would be too low, the yarn feeding might be possible but the knitting yarns might likely be caught in the hook 3a such that the main yarn 11 might be on the lower side and the plating yarn 12 might be on the upper side as in the case of the ordinary plating. The height of the operating part 15a is decided to avoid these problems. The upper part of the hook 3a is restricted such that the plating yarn 12 does not run on the main yarn 11 retained at the front edge 7a.

[0031] As shown in Fig. 3(c), the operating part 15a moves forward to the position 15E and crosses the front edge 7a such that the operating part 15a is used as a lower wall. The main yarn 11 and the plating yarn 12, when they are caught in the hook 3a from the state of being surrounded by the walls and aligned with each other, are inverted in vertical positions by causing the plating yarn 12 to come around the lower side of the main yarn 11. The front edge 7a constitutes the inverse wall when the vertical positions of the main yarn 11 and the plating yarn 12 is inverted by retaining the main yarn 11. The inverse of the main yarn 11 and the plating yarn 12 is established by being caught on the outer edge of the movable sinker 8. Until the establishment, the loop presser 15 needs to be kept in the moved state at least as the lower wall.

[0032] As shown in Fig. 3(d), when the pull-in by the hook 3a is continued, the old loop having moved to the needle shank of the knitting needle 3 is knocked over. The loop presser 15 needs to be moved backward to a position such as the position 15F, in a range not interfering with the old loop, which is knocked-over. The pull-in is continued until a needle loop by the hook 3a and a sinker loop by the movable sinker 8 are formed, thereby completing the determination of the stitch size. The series of actions of moving forward and backward the loop presser 15 may be not only the linear movement as in the present example 1 but also the vertical movement by swinging as in the present example 3.

[0033] Fig. 4 shows a knitting operation near the needle bed gap 4 including a switching operation illustrated in Figs. 2 and 3. The drive control unit, which is mounted on the carriage running in a direction from the lower side to the upper side of the drawing, drives the knitting needle 3 and the loop presser 15. The knitting needle 3, which is selected for knitting, is driven such that the leading end of the hook 3a draws a trajectory 3t. In the inverse plating, the loop presser 15 is driven such that the leading end draws a trajectory 15t. If the loop presser 15 would not be caused to operate, the loop presser 15 would wait at a position similar to the flat portion of the trajectory 15t, whereby the ordinary plating is performed such that the main yarn 11 appears on the front surface. In all examples including the present example 1, the switching by operation or non-operation of the operating member 5 such as the loop presser 15 is always possible in the sections of the plurality of continuous knitting needles. For example, course knitting can be terminated by switching from the section of the ordinary plating to the section of the

inverse plating, or after the switching to the inverse plating further switching can be made to the section of the ordinary plating.

[0034] Fig. 4 shows positions 3A, 3B, 3C, 3D, 3E, 3F ; 15A, 15B, 15D, 15E, and 15F corresponding to the operations of the knitting needle 3 and the loop presser 15 shown in Fig. 2 and Fig.3. The loop presser 15 in the present example 1 inverts the vertical position of the main yarn 11 and the plating yarn 12 by cooperation with the front edge 7a of the yarn guide 7. When the main yarn 11 and the plating yarn 12, those vertical position are inverted, are fed to the hook 3a of the knitting needle 3, the loop presser 15 moves backward from the needle bed gap 4 to the positions 15E and 15F as shown in Fig. 3(c) and Fig. 3(d).

[0035] In the present example 1, the front edge 7a of the yarn guide 7 is used as a part of the wall of the region which cooperates with the loop presser 15 to retain the main yarn 11 and restricts the main yarn 11 and the plating yarn 12. The inverse wall formed with the front edge 7a of the yarn guide 7 might be substituted for another member such as the movable sinker 8, a fixed sinker, or a dedicated member. It may be preferable that the member constitutes the inverse wall is arranged in proximity to the knitting needle 3 in the proceeding direction of knitting, and that the operating part 15a of the loop presser 15 arranged between the knitting needle 3 and the inverse wall so as to move forward and backward. The arrangement order of the knitting needle 3, the loop presser 15, the yarn guide 7, the movable sinker 8, and the next knitting needle 3 shown in Fig. 4 enables stable switching in the knitting for plating stitch in case of knitting proceeds leftward. In case of knitting proceeds rightward, however, the inverse wall and the loop presser 15 are arranged in this order toward the proceeding direction of knitting with respect to the knitting needle 3. In this arrangement, there no longer exists the downward wall between the inverse wall and the knitting needle 3, and the operation to invert the vertical positions of the main yarn 11 and the plating yarn 12 may lack of stability. Therefore, in the case of knitting rightward, the position of the loop presser 15 with respect to the knitting needle 3 is shifted by racking such that the loop presser 15 is arranged between the knitting needle 3 and the movable sinker 8 adjacent to the knitting needle 3 toward the proceeding direction of knitting. In case of knitting proceeds rightward, the knitting needle 3, the loop presser 15, the movable sinker 8, the yarn guide 7, and the next knitting needle 3 are arranged in this order. In not only the present example 1 but also all the examples, at the time of changing the direction of knitting, the knitting needle 3 and the operating member 5 such as the loop presser 15 are shifted in position by racking such that the three members, that is, the knitting needle 3, the operating member 5, and the inverse wall formed by the yarn guide 7 or the movable sinker 8 are equally arranged. The loop presser 15 can be provided not only on the needle bed side opposed to the needle bed 6 but also on the needle bed 6

itself side. In the case of providing the loop pressers 15 on the both needle bed sides, the loop pressers 15 are used for different purposes such that the loop presser 15 on the opposed needle bed side is used for the leftward knitting, and the loop presser 15 on the needle bed 6 itself side is used for the rightward knitting, thereby eliminating the need for racking to equalize the arrangement.

[Example 2]

[0036] Fig. 5 and Fig.6 show stepwise a switching operation of a main yarn 11 and a plating yarn 12 according to an example 2 of the present invention. In the present example 2, a loop presser 25 corresponding to the operating member 5 is provided with an operating part 25a at an upper portion near a leading end. The loop presser 25 is provided with a loop pressing part 25b similar to the loop pressing part 15b of the loop presser 15 shown in Fig. 2 and Fig. 3. In the present example 2, the yarn guide 7, the movable sinker 8, and the loop presser 25 are arranged adjacent to each other in this order toward the proceeding direction of knitting with respect to the knitting needle 3. That is, the operating part 25a of the loop presser 25 moves forward and backward in the proceeding direction of knitting with respect to the yarn guide 7. However, the arrangement is not limited to this but the loop presser 25 and the yarn guide 7 may be arranged in this order in the proceeding direction of knitting with respect to the knitting needle 3 and the operating part 25a may move forward and backward between the knitting needle 3 and the yarn guide 7.

[0037] In the present example 2, an inclination part 7b formed in the yarn guide 7 to be continuous from the upper end of the front edge 7a is used as a inverse wall. The inclination part 7b has an upward inclination such that the needle bed gap 4 side, which is the right side in the drawing, is lower and the side distant from the needle bed gap 4, which is the left side in the drawing, is higher. The upward inclination of the inclination part 7b guides the knitting yarns to move such that the main yarn 11 is on the upper side and the plating yarn 12 is on the lower side. The upper portion of the operating part 25a preferably has an upward inclination similar to that of the inclination part 7b such that the main yarn 11 and the plating yarn 12 can smoothly move. The operating part 25a may be flat but needs to be shaped to cross at least the inclination part 7b at an obtuse angle in such a manner as not to hinder the movement of the main yarn 11 and the plating yarn 12.

[0038] As shown in Fig. 5(a), the knitting needle 3 is raised to a clear position before the formation of a loop and then is lowered to a position 3A where to wait for yarn feeding. The loop presser 25 is placed in standby at a position 25A. As shown in Fig. 5(b), when the pull-in by a hook 3a is started to lower the knitting needle 3 to a position 3B, the operating part 25a of the loop presser 25 is moved forward to the lower side of the main yarn 11 and the plating yarn 12 as shown at a position 25B.

[0039] Fig. 6(c) shows a state in which the pull-in by the hook 3a is continued so that the knitting needle 3 is lowered to a position 3C just before to catch the main yarn 11 and the plating yarn 12. The main yarn 11 and the plating yarn 12 are being lowered with an inclination from the yarn feeding ports 1a, 2a toward the hook 3a of the preceding knitting needle 3 where the main yarn 11 and the plating yarn 12 have been caught, on the front side of the drawing where the knitting is already done. Although a position 25C of the loop presser 25 is the same as the position 25B, the positions of the main yarn 11 and the plating yarn 12 are lowered relative to the operating part 25a. The operating part 25a operates from the lower side of the main yarn 11 and the plating yarn 12, and aligns the main yarn 11 and the plating yarn 12 thereon such that the main yarn 11 precedes the plating yarn 12 to the inclination part 7b side.

[0040] As shown in Fig. 6(d), while the pull-in by the knitting needle 3 is continued to a position 3D, the main yarn 11 and the plating yarn 12 are pulled by the hook 3a and moved to run on the inclination part 7b. On the inclination part 7b, the main yarn 11 and the plating yarn 12 are aligned in the vertically inverted positions such that the main yarn 11 guided earlier by the operating part 25a is on the upper side and the plating yarn 12 is on the lower side. When the main yarn 11 and the plating yarn 12 are pulled into the hook 3a with the vertically inverted positions, the stitches are formed by the inverse plating with needle loops by the hook 3a and sinker loops by the movable sinker 8. A position 25D of the loop presser 25 is the same as the positions 25C and 25B.

[0041] Fig. 7 shows a knitting operation near the needle bed gap 4 including the switching operation shown in Fig. 5 and Fig. 6 as like as Fig. 4. In the case of the inverse plating, the loop presser 25 is driven such that the leading end draws a trajectory 25t. The positions 3A, 3B, 3C, 3D, 25A, 25B, 25C, and 25D correspond to the operations of the knitting needle 3 and the loop presser 25 shown in Fig. 5 and Fig. 6. In the present example 2, the inclination part 7b of the yarn guide 7 near the knitting needle 3 can be used as an inverse wall that cooperates with the operating part 25a of the loop presser 25 to catch the main yarn 11 and the plating yarn 12 on the hook 3a in such a manner as to be vertically inverted. The front edge 7a continued from the inclination part 7b of the yarn guide 7 is used as a wall that guides the knitting yarns downward to the needle bed gap 4. For the inverse wall to cooperate with the operating part 25a, another member such as the movable sinker 8, a fixed sinker, or a dedicated member may be used.

[Example 3]

[0042] Fig. 8 shows stepwise a switching operation of a main yarn 11 and a plating yarn 12 according to an example 3 of the present invention. In the present example 3, a loop presser 35 corresponding to the operating member 5 is provided with an operating part 35a at a

lower portion near a leading end. The operating part 35a has an inclination rising toward the leading end side. The loop presser 35 is provided with a loop pressing part 35b similar to the loop pressing parts 15b, 25b of the loop pressers 15, 25 according to the other examples. In the present example 3, as in the present example 2, a yarn guide 7 and a movable sinker 8 are arranged adjacent to each other, toward the proceeding direction of knitting with respect to the knitting needle 3, and the operating part 35a of the loop presser 35 moves forward and backward on the adjacent sides from the movable sinker 8 in the proceeding direction of knitting. However, the arrangement is not limited to this but the loop presser 35, the yarn guide 7, and the movable sinker 8 may be arranged adjacent to each other in this order toward the proceeding direction of knitting with respect to the knitting needle 3.

[0043] Fig. 8(a) shows a state in which the vertical positions of the main yarn 11 and the plating yarn 12 are inverted by the operating part 35a of the loop presser 35 when these yarns get caught on the hook 3a. Before the formation of a loop by the hook 3a of the knitting needle 3, the hook 3a is raised to the clear position and then lowered to the position where to wait for yarn feeding. Before the knitting needle 3 is lowered to the position 3C and the pulling of the main yarn 11 and the plating yarn 12 into the hook 3a is started, the operating part 35a of the loop presser 35 is moved forward to the upper side of the main yarn 11 and the plating yarn 12 as shown at 35A, 35B, and 35C. The operating part 35a operates to press the main yarn 11 and the plating yarn 12 from above in such a manner that the operating part 35a operates earlier at least on the plating yarn 12 fed to the upper side and presses the plating yarn 12 into the lower side of the main yarn 11 so as to invert vertical positions.

[0044] As shown in Fig. 8(b), when the pulling into the hook 3a is continued, the plating yarn 12 pressed into the lower side by the operating part 35a having moved forward to a position 35D is placed also on the inclination part 7b of the yarn guide 7 and pressed into the lower side of the main yarn 11. The plating yarn 12 becomes caught under the main yarn 11 in the hook 3a of the knitting needle 3 having descended to a position 3D, and the vertical positions of the main yarn 11 and the plating yarn 12 are inverted. The main yarn 11 and the plating yarn 12 may not be placed on the inclination part 7b of the yarn guide 7 as far as the main yarn 11 and the plating yarn 12 are caught in the hook 3a in the state where they are pressed by the operating part 35a and inverted in vertical positions.

[0045] Fig. 9 shows a knitting operation near the needle bed gap 4 including the switching operation shown in Fig. 8 as like as Fig. 4 and Fig. 7. In the case of the inverse plating, the loop presser 35 is driven such that the leading end draws a trajectory 35t. The positions 3C, 3D, 35A, 35B, 35C, and 35D indicate the positions corresponding to the operations of the knitting needle 3 and the loop presser 35 shown in Fig. 8. When the loop press-

er 35 is not caused to operate, the loop presser 35 is retained at the position 35A similar to the flat portion on the upper side of the trajectory 35t, thereby performing the ordinary plating in which the main yarn 11 appears on the front surface.

[0046] Even when the loop presser 35 is caused to operate, while the loop presser 35 is placed in standby at the position 35A, the hook 3a of the knitting needle 3 is raised to the clear position once, and then lowered to the position where to wait for yarn feeding. When the loop presser 35 starts to operate and moves forward to the needle bed gap 4 at the position 35B, the hook 3a further starts to descend. The loop presser 35 moves forward in the needle bed gap 4 as shown at the positions 35C and 35D along with the pull-in of the knitting needle 3 by a stitch cam.

[0047] Fig. 10 shows a comparison between the case (a), (b) where the yarn feeding port 2a of the plating yarn 12 and the yarn feeding port 1a of the main yarn 11 are run at positions where the distance to the needle bed gap 4 with respect to the needle bed 6 to which the knitting needle 3 belongs are almost the same, and the case (c), (d) where the yarn feeding port 2a of the plating yarn 12 is run at a separated position closer to the opposed needle bed side with the needle bed gap 4 therebetween. As shown in Fig. 10(a), the yarn feeding ports 1a, 2a are generally set to be capable of feeding the yarns at near the needle bed gap center 4a to knitting needles 3 equally from the needle beds on the both sides. As shown in Fig. 10(b), a plurality of running routes are provided above the needle bed gap 4, and the yarn feeders 1, 2 running in the different running routes are inclined such that the yarn feeding ports 1a, 2a are near the needle bed gap center 4a.

[0048] As shown in Fig. 10(c), the following yarn feeding port 2a is preferably run at a position separated from the preceding yarn feeding port 1a to the opposed needle bed side by a front-back difference ΔD of the needle bed gap 4 with respect to the needle bed 6 to which the knitting needle 3 belongs to be fed with the yarn. As shown in Fig. 10(d), the front-back difference ΔD constitutes the spacing between the needle bed gap center 4a and a center 4b of the yarn feeding port 2a of the plating yarn 12. Since the front-back difference ΔD is added to the spacing between the main yarn 11 and the plating yarn 12, the inverse plating causes the operating part 35a to operate in the state in which the main yarn 11 and the plating yarn 12 are separated by the front-back difference ΔD . The plating yarn 12 becomes easy to press earlier and can be stably caught when the vertical positions are inverted in the hook 3a. The front-back difference ΔD also makes it possible to stably return to the ordinary plating by causing the loop presser 35 to stop operation. The front-back difference ΔD may be provided such that the preceding yarn feeding port 1a is made closer to the needle bed 6 side than the needle bed gap center 4a. That is, the front-back difference ΔD may be provided in the direction of spacing of the needle bed gaps 4.

[0049] Such front-back difference ΔD is preferably provided in both the example 1 and the example 2. In either of the examples, with the front-back difference ΔD , the main yarn 11 and the plating yarn 12 placed on the operating part 15a, 25a of the loop presser 15, 25 are easy to stably align in order without exchange.

[0050] In each of the examples, when the loop pressor 15, 25, 35 as the operating member 5 is caused to operate as the original yarn guide loop pressor, the loop pressor 15, 25, 35 needs to be driven to draw a trajectory different from the trajectories 15t, 25t, 35t shown in Fig. 4, Fig. 8 and Fig. 10. When the carriage is provided with a needle selection mechanism for the loop pressor 15, 25, 35 to make selectable the trajectory 15t, 25t, 35t and a trajectory for yarn guidance, the yarn guidance loop presser to press the loop can also serve as the operating member.

[0051] In addition, the operating member 5 can serve as any knitting member different from the loop presser 15, 25, 35 or can be a dedicated member.

[Explanation of Reference]

[0052]

1, 2	Yarn feeder
1a, 2a	Yarn feeding port
3	Knitting needle
3a	Hook
4	Needle bed gap
4a	Needle bed gap center
5	Operating member
7	Yarn guide
7a	Front edge
7b	Inclination part
11	Main yarn
12	Plating yarn
15, 25, 35	Loop presser
15a, 25a, 35a	Operating part

Claims

1. A method of knitting for plating stitch by a flatbed knitting machine that is switchable between ordinary plating and inverse plating to knit plating stitch, in which the ordinary plating is performed such that a main yarn (11) and a plating yarn (12) are fed from preceding and following yarn feeding ports (1a, 2a) to the same knitting needle (3) while being kept at vertical lower and upper positions so that the main yarn (11) is on a front side, and the inverse plating is performed such that vertical positions of the main yarn (11) and the plating yarn (12) to be fed to the knitting needle (3) are inverted and the plating yarn (12) is on the front side,
characterized in that
providing with an operating member (5; 15, 25, 35) having an operating part (15a, 25a, 35a) at a leading

end for inverse operation to be switchable whether the operating part (15a, 25a, 35a) is allowed or dis-
 allowed to move forward and backward with respect
 to a needle bed gap (4) in correspondence with ad-
 jacent sides in a proceeding direction of knitting with
 respect to each knitting needle (3), and
 for the inverse plating, the operating part (15a, 25a,
 35a) of the operating member (15, 25, 35) is moved
 forward to an upper side of the needle bed gap (4)
 and caused to operate on the main yarn (11) and the
 plating yarn (12) to be fed to the knitting needle (3)
 in such a manner as to invert the vertical positions
 of the main yarn (11) and the plating yarn (12) to be
 pulled into a hook (3a) of the knitting needle (3), and
 a fabric is knitted such that the plating yarn (12) is
 on the front side.

2. The method of knitting for plating stitch by a flatbed
 knitting machine according to claim 1,
 wherein for knitting said inverse plating,

utilizing a local member (7), disposed on a needle
 bed (6) to which said knitting needle (3) be-
 longs in the vicinity of a side to said proceeding
 direction of knitting with respect to each knitting
 needle (3), for an inverse wall (7a, 7b) to invert
 said vertical positions in cooperation with said
 operating member (5; 15, 25, 35), and
 making said operating part (15a, 25a) of the op-
 erating member (15, 25), provided at an upper
 portion of the operating member (15, 25) to op-
 erate on said main yarn (11) and the plating yarn
 (12) from below, to guide said main yarn (11)
 and the plating yarn (12) placed thereon to the
 inverse wall (7a, 7b), to cause the yarns to be
 pulled into the hook (3a) in cooperation with the
 inverse wall (7a, 7b) such that the plating yarn
 (12) is on the lower side and the main yarn (11)
 is on the upper side, and to invert the vertical
 positions of the main yarn (11) and the plating
 yarn (12).

3. The method of knitting for plating stitch by a flatbed
 knitting machine according to claim 2,
 wherein said operating member (15) and said local
 member (7) are arranged in this order toward said
 proceeding direction of knitting with respect to said
 knitting needle (3), and
 for said inverse plating,

making said operating part (15a), which guides
 said main yarn (11) preceding said plating yarn
 (12) to said inverse wall (7a) and retains them
 there, to constitute a downward wall against the
 main yarn (11) and the plating yarn (12), and to
 form a region surrounding and restricting the
 main yarn (11) and the plating yarn (12) together
 with an upper portion of the hook (3a) as an up-

ward wall, and

inverting the positions of the main yarn (11) and
 the plating yarn (12) such that the plating yarn
 (12) comes around a lower side of the main yarn
 (11), by pulling them into the hook (3a) from a
 state in which the yarns are surrounded by the
 region and aligned with each other.

4. The method of knitting for plating stitch by a flatbed
 knitting machine according to claim 2,
 wherein said inverse wall (7b) has an upward incli-
 nation which is lower on said needle bed gap (4) side
 and is higher on a side leaving from the needle bed
 gap (4), and
 for knitting said inverse plating, while the yarns are
 guided from said operating part (25a) to the inverse
 wall (7b) such that said main yarn (11) precedes on
 the upper side and said plating yarn (12) follows on
 the lower side, pulling the yarns into said hook (3a)
 such that the main yarn (11) is on the upper side and
 the plating yarn (12) is on the lower side so that the
 vertical positions are inverted.
5. The method of knitting for plating stitch by a flatbed
 knitting machine according to claim 1,
 wherein said operating part (35a) of said operating
 member (35) is provided at the lower portion of the
 operating member (35), and
 operating on said main yarn (11) and said plating
 yarn (12) from above in the inverse plating to press
 the plating yarn (12) into a lower side of the main
 yarn (11) so that the vertical positions are inverted.
6. The method of knitting for plating stitch by a flatbed
 knitting machine according to any one of claims 1 to
 5,
 wherein said following yarn feeding port (2a) is run
 at a position separated from said preceding yarn
 feeding port (1a), with respect to said needle bed (6)
 to which said knitting needle (3) belongs, in a direc-
 tion of leaving from the needle bed gap (4).

Fig. 1

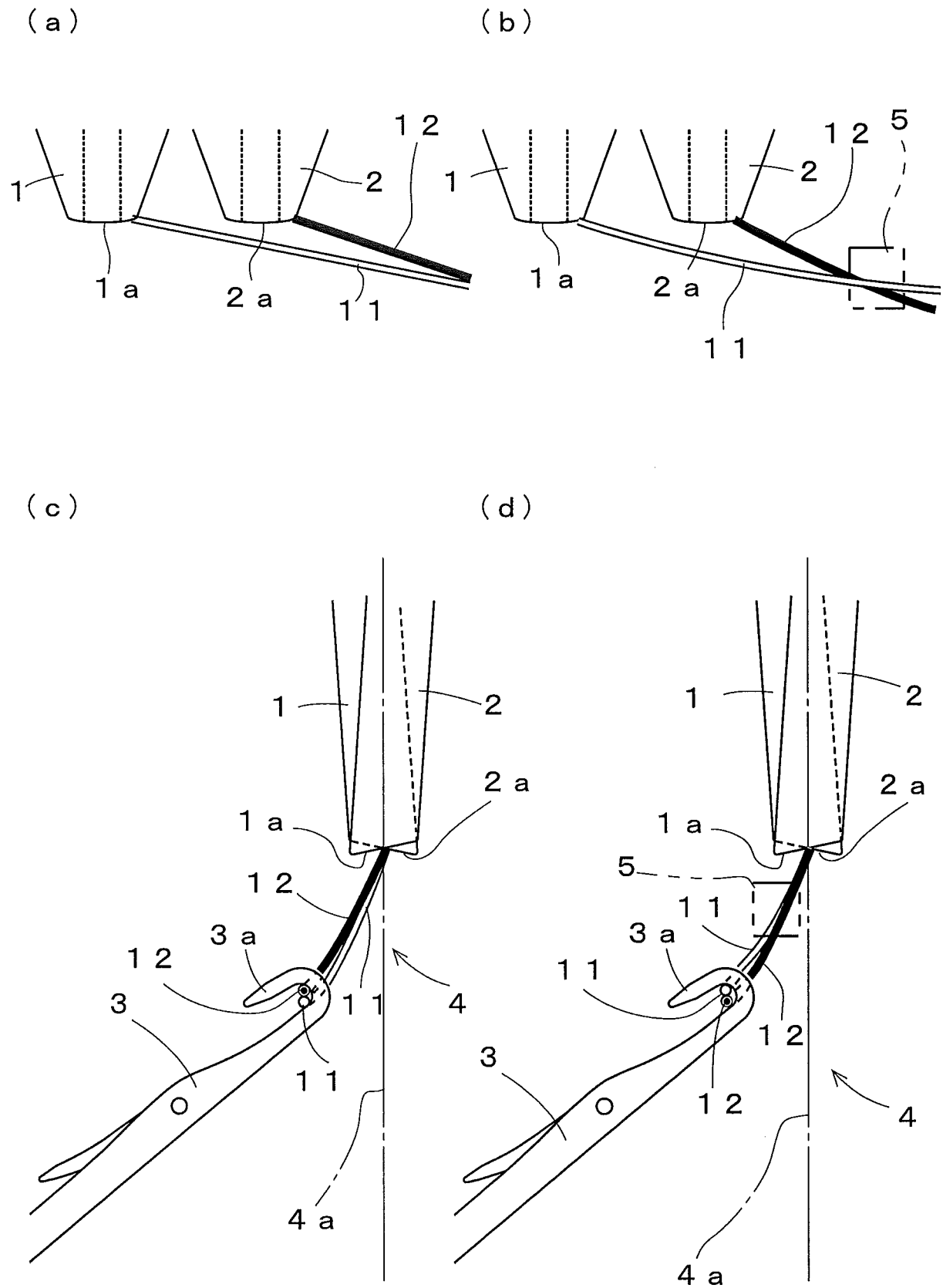
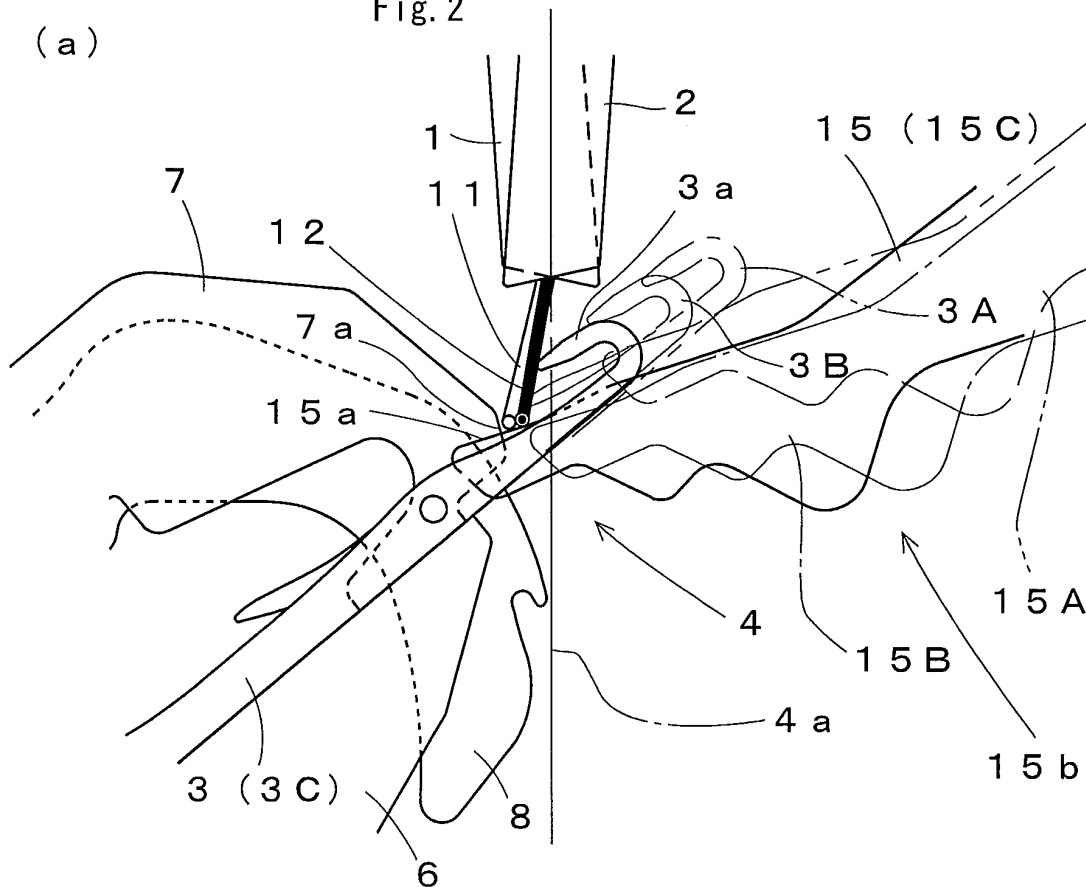
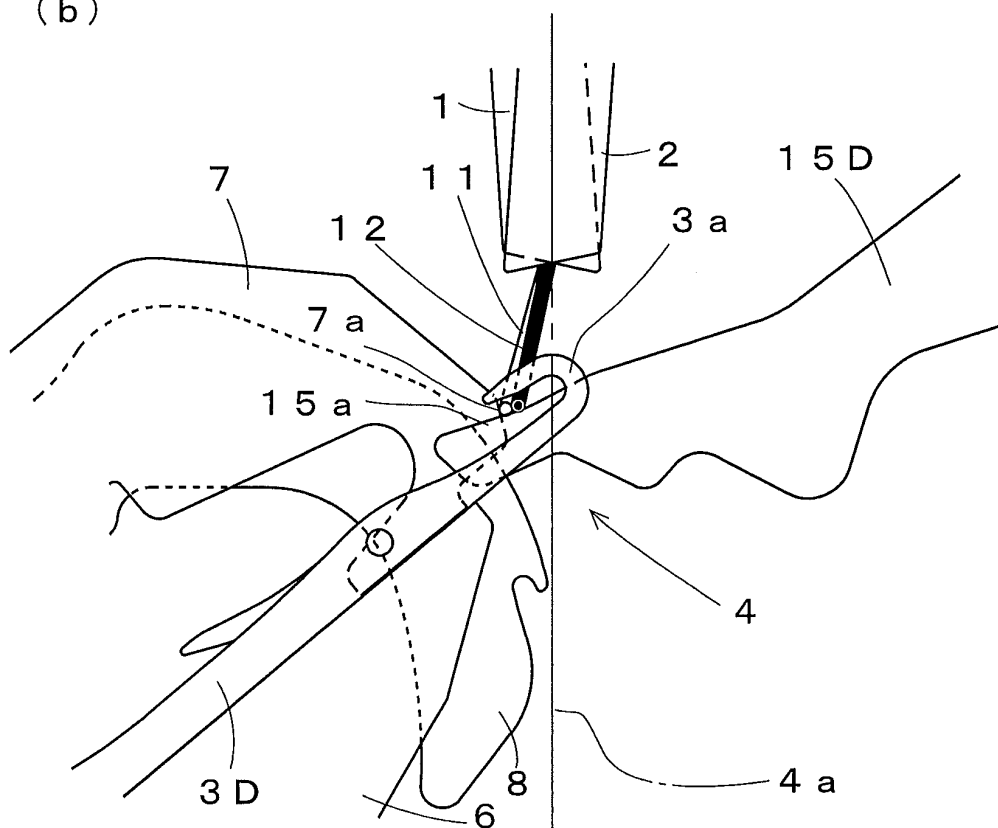


Fig. 2

(a)



(b)



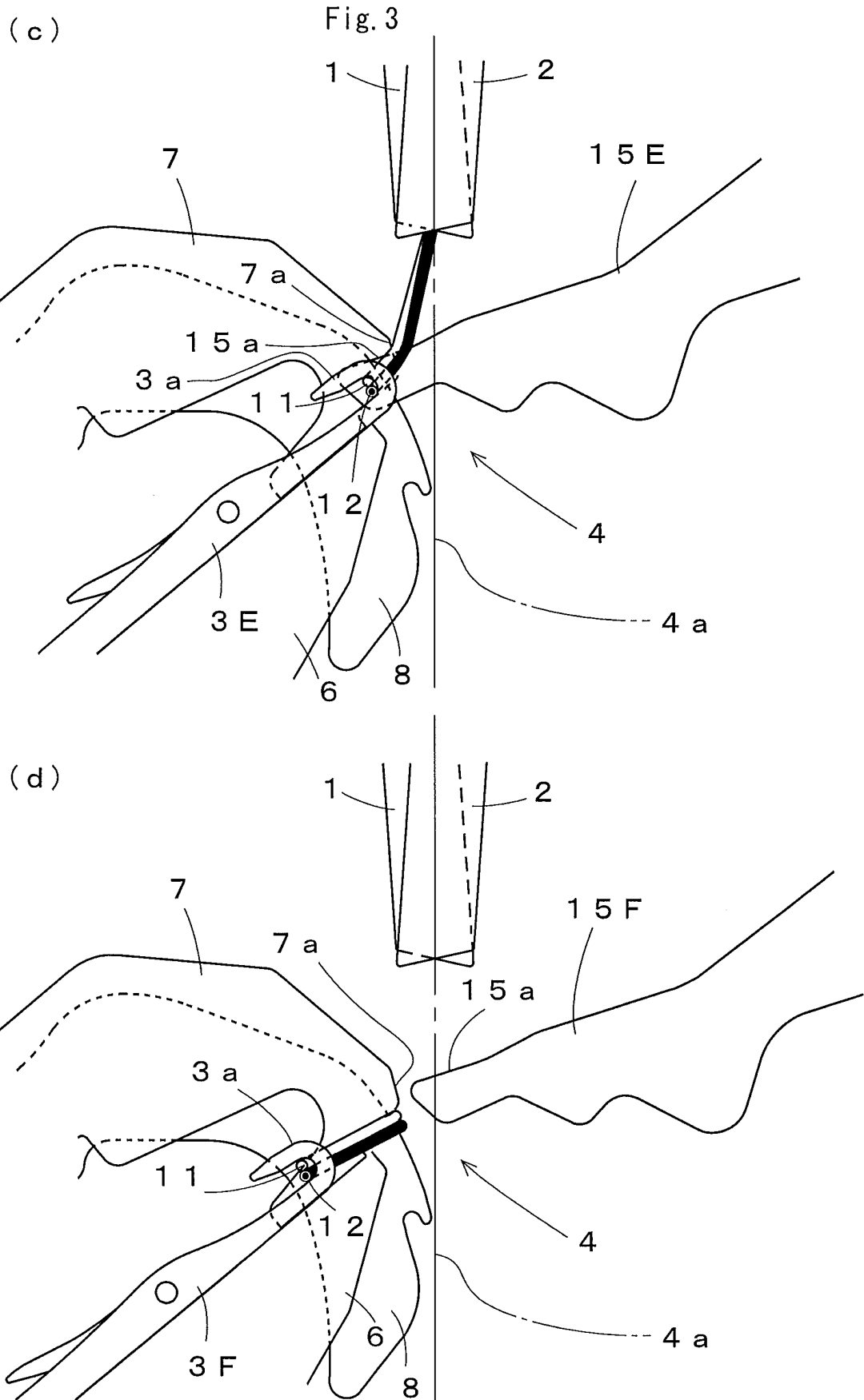
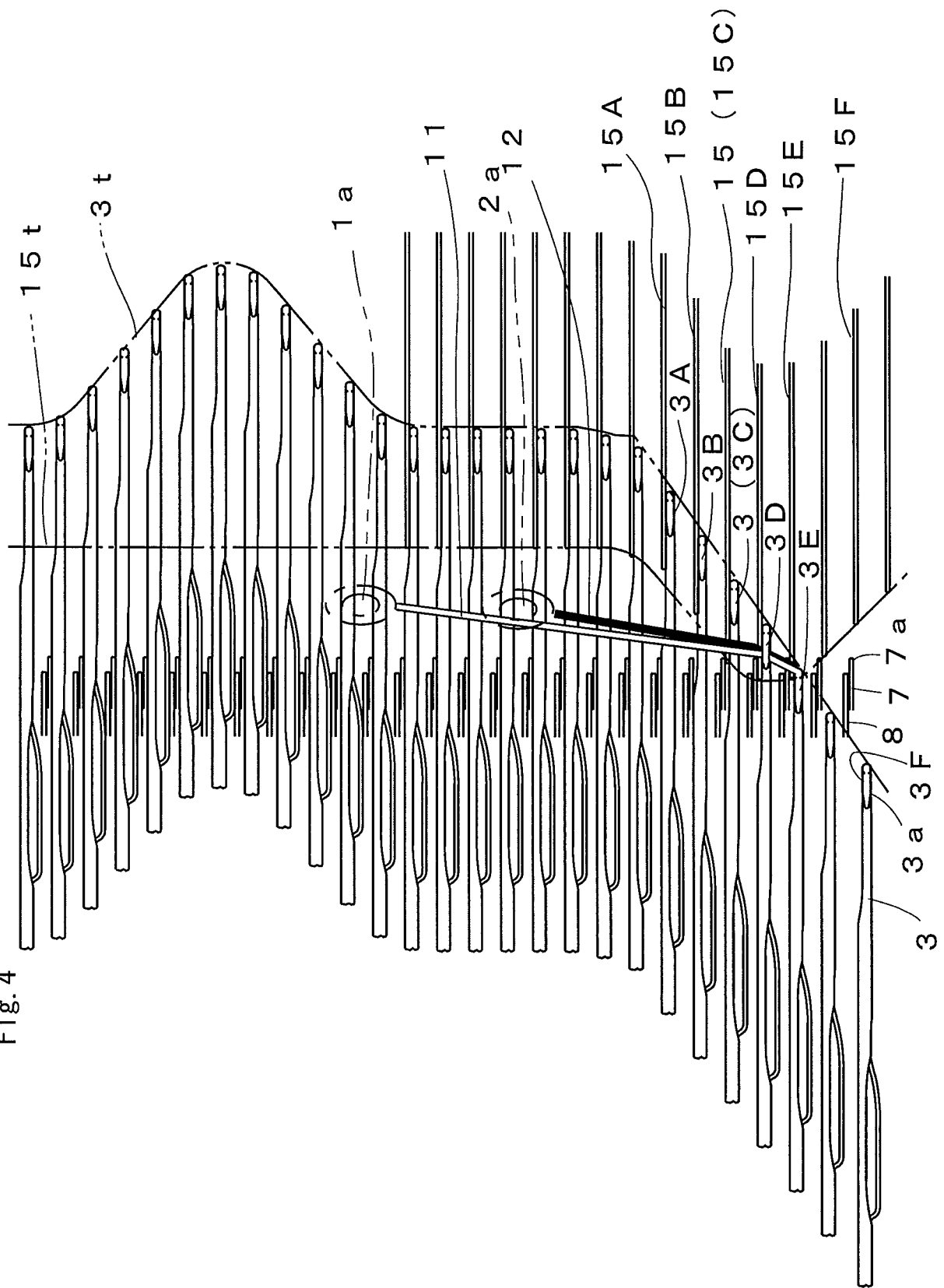
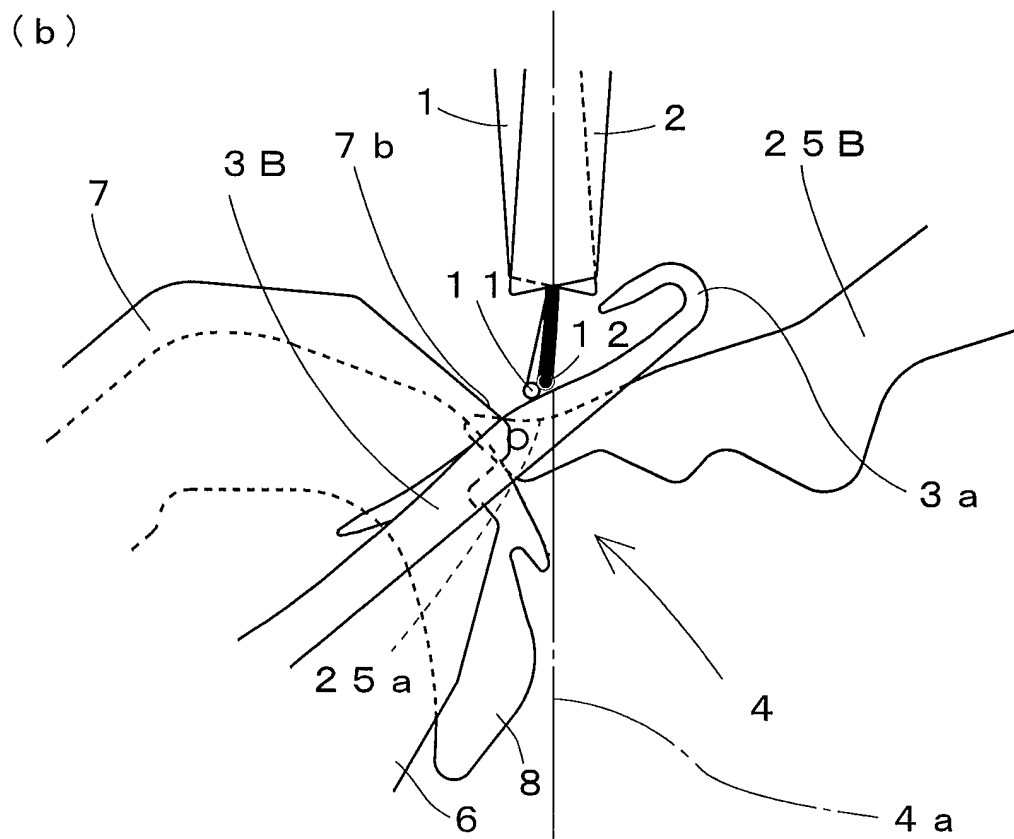
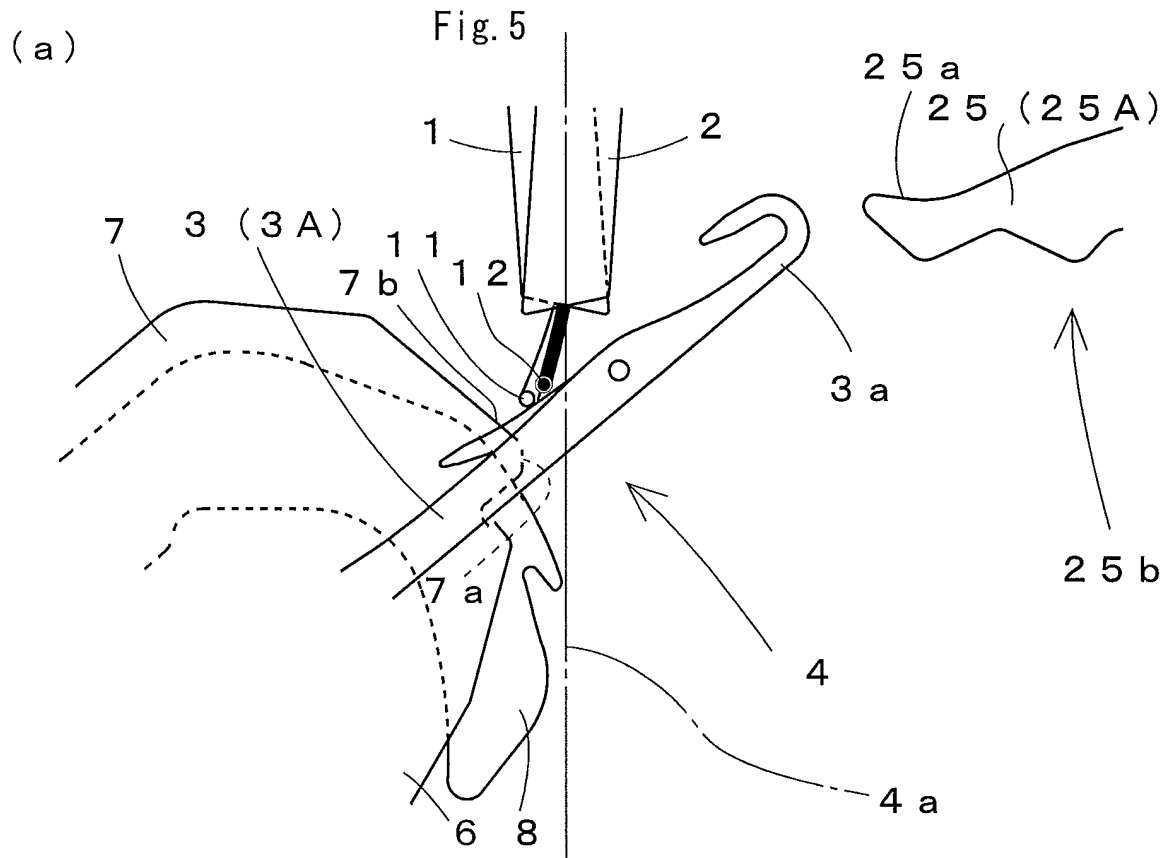


Fig. 4





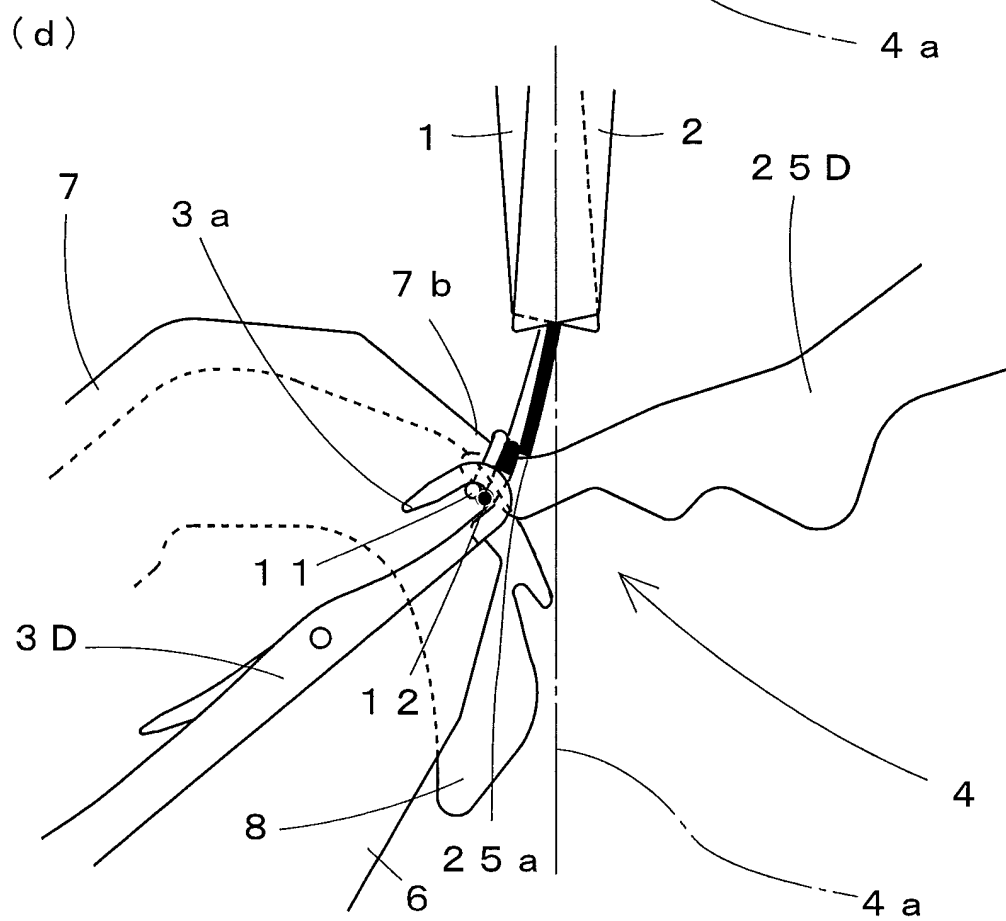
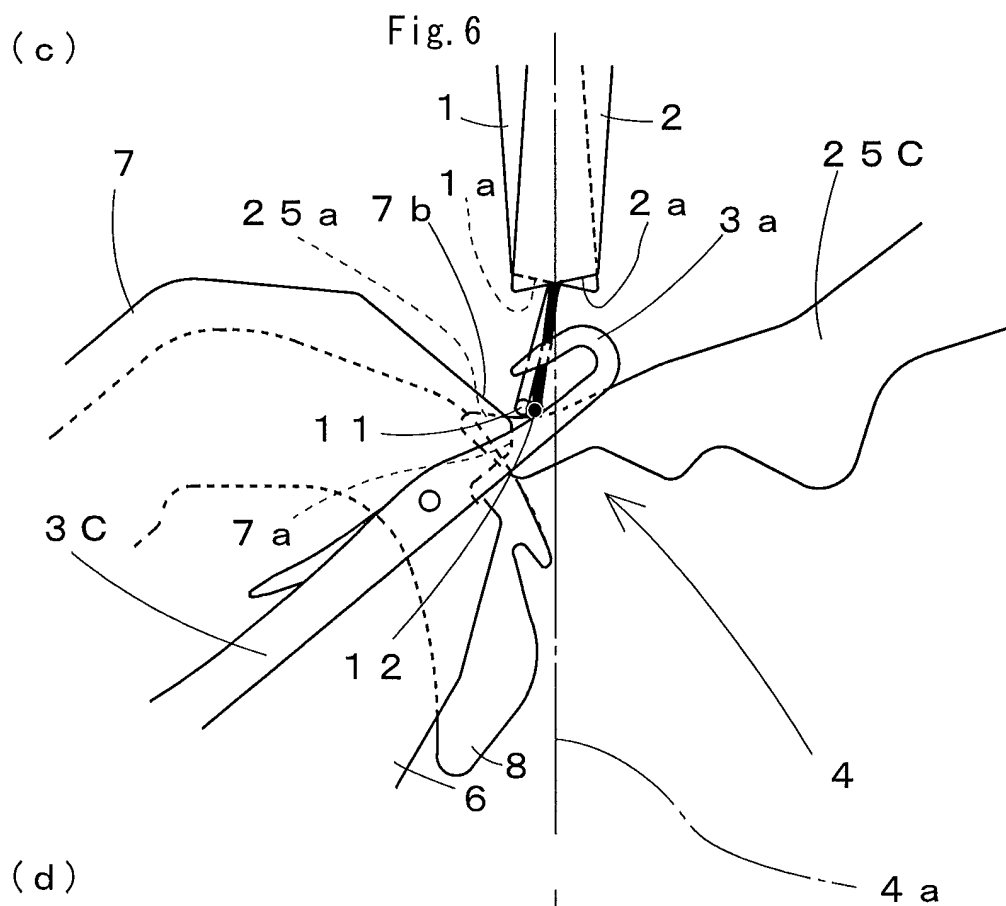


Fig. 7

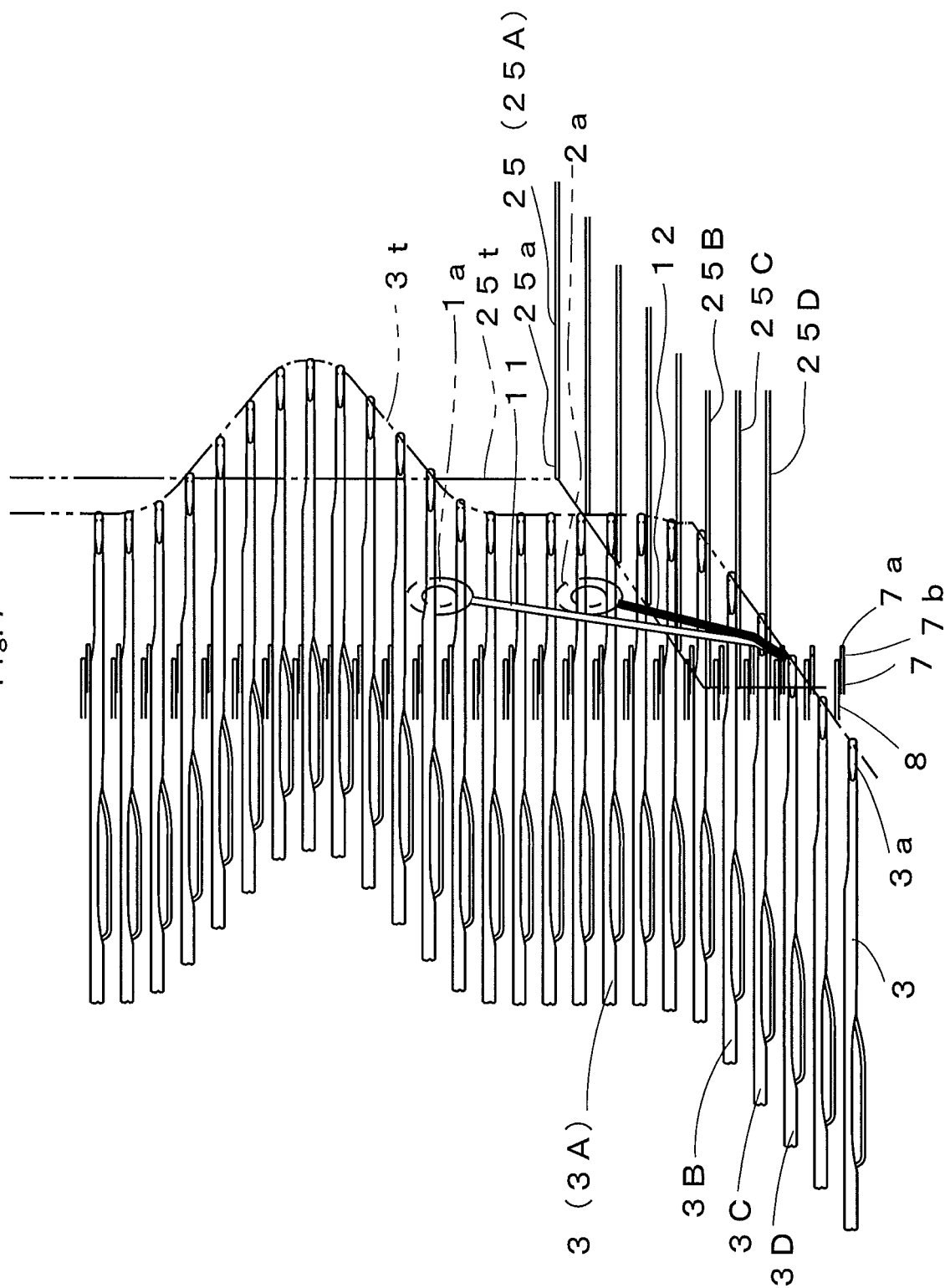


Fig. 8

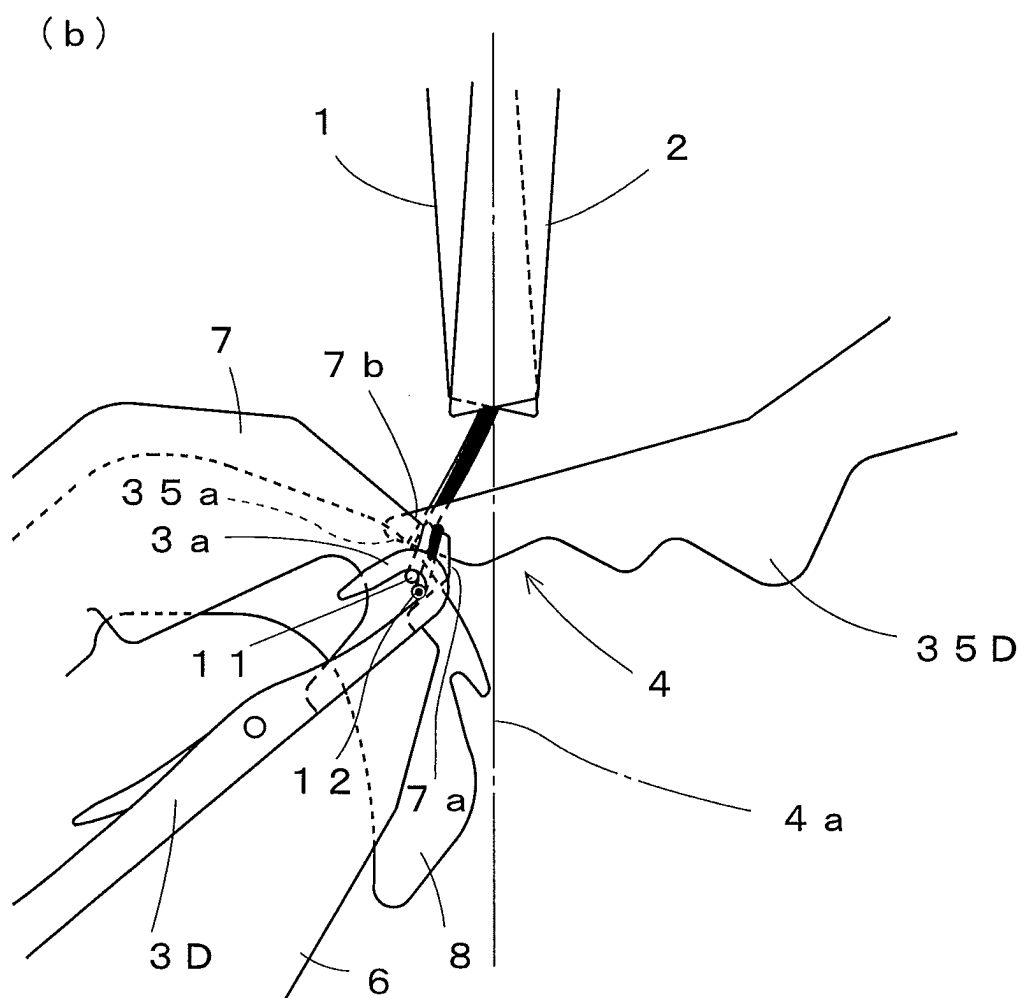
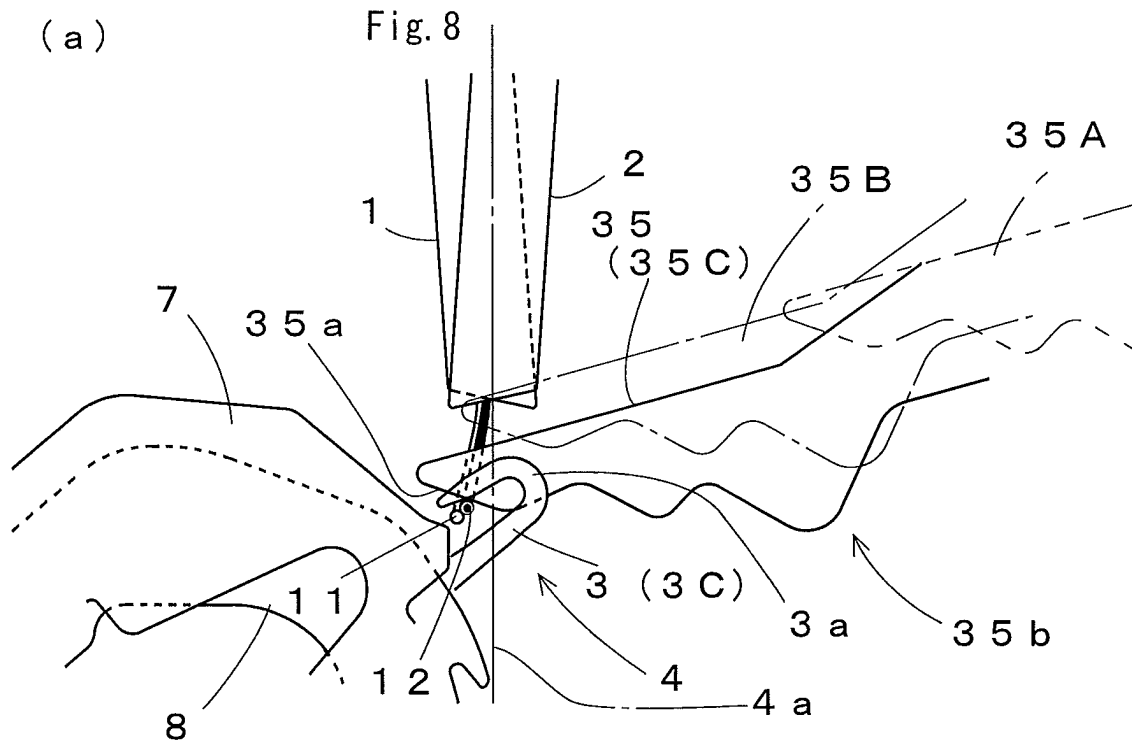
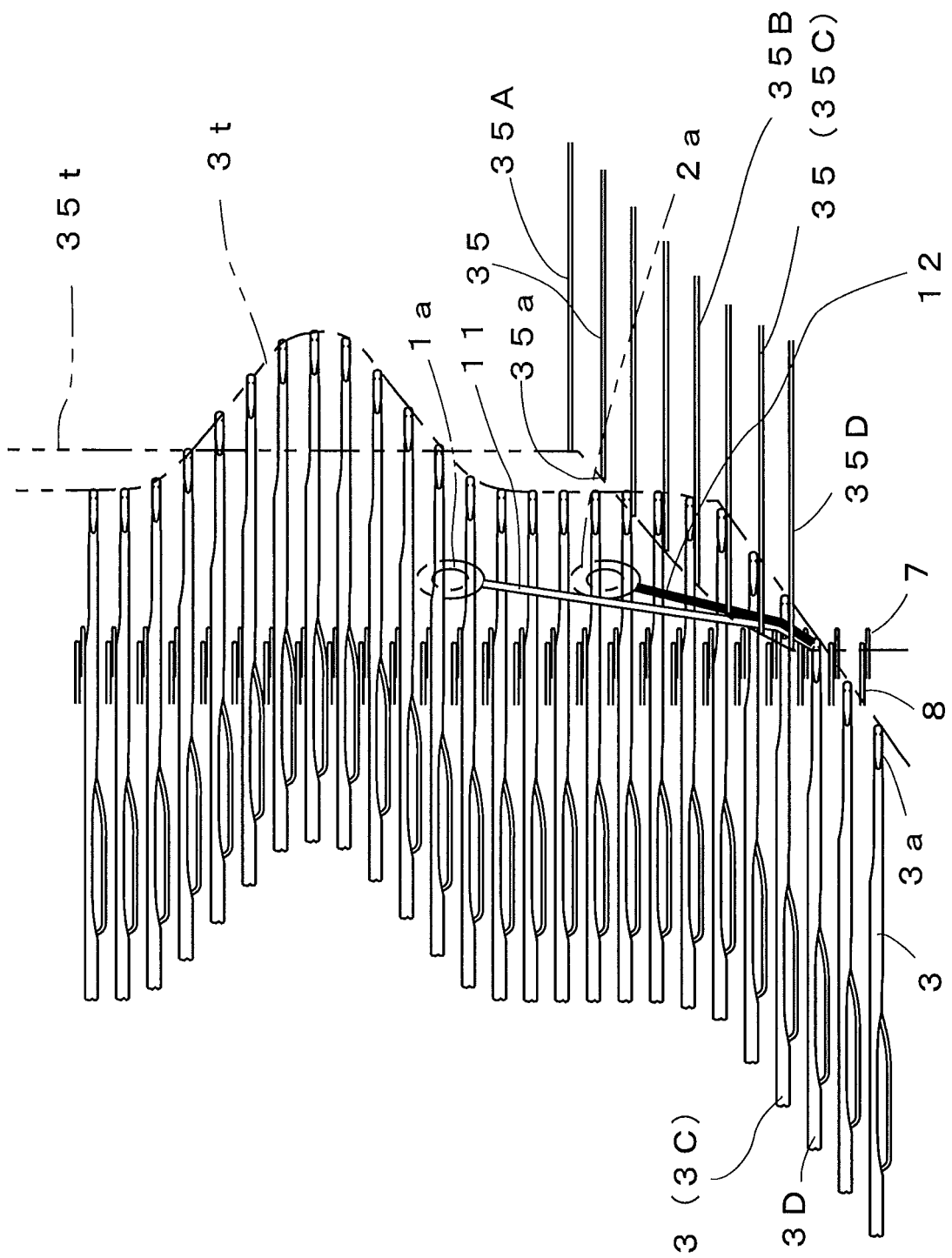
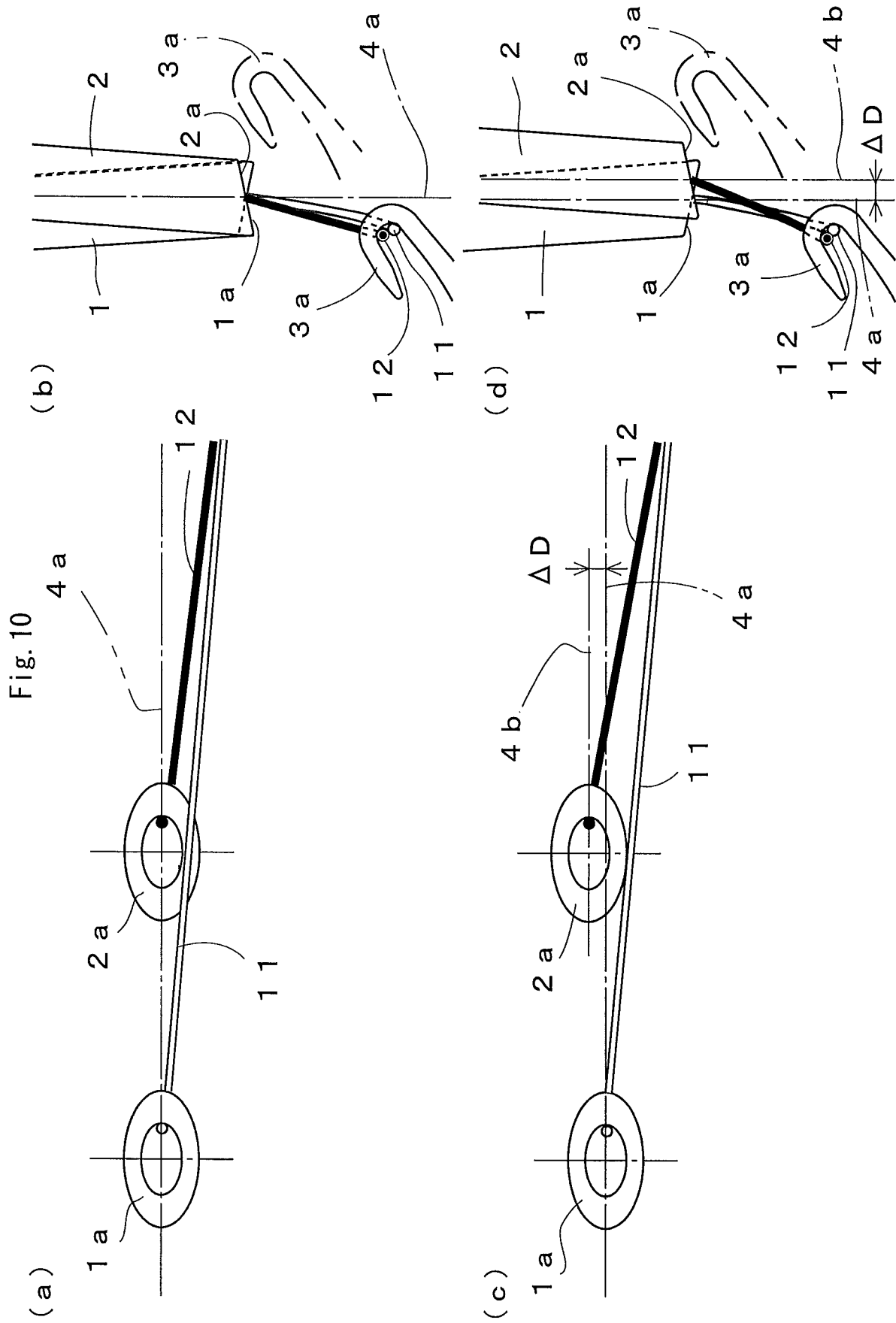


Fig. 9





INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/014814

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. D04B1/00 (2006.01) i, D04B15/00 (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)

Int.Cl. D04B1/00, D04B15/00

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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.
X	JP 2016-176159 A (PAI LUNG MACHINERY MILL CO., LTD.) 06	1, 6
A	October 2016, claims, paragraph [0034], fig. 13-16 (Family: none)	2-5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 149920/1982 (Laid-open No. 54590/1984) (DAITO SEIKI CO., LTD.) 10 April 1984, claims, drawings (Family: none)	1-6
A	WO 2001/064989 A1 (SHIMA SEIKI MFG., LTD.) 07 September 2001, abstract & US 2003/0037575 A1, abstract & EP 1260625 A1 & AU 3418401 A & TW 561210 B & CN 1418271 A	1-6



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search
22 June 2018 (22.06.2018)Date of mailing of the international search report
03 July 2018 (03.07.2018)Name and mailing address of the ISA/
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REFERENCES CITED IN THE DESCRIPTION

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