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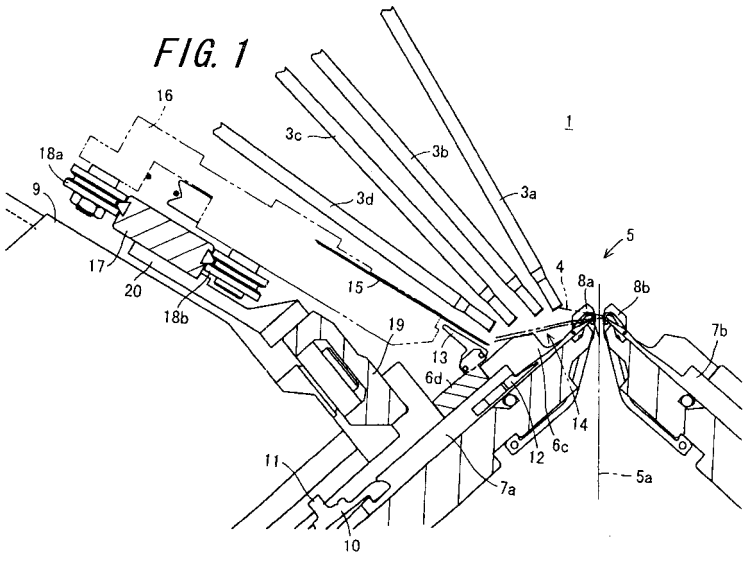
(54) METHOD AND DEVICE FOR CUTTING/HOLDING WARP OF WEFT KNITTING MACHINE

(57) The invention relates to a method and an apparatus for cutting and holding a warp in a weft knitting machine that can appropriately cut even a knitted fabric knitted with a warp fed from a warp insertion mechanism, and can hold the end yarn after the cutting. In a weft knitting machine (1) in which a warp (4) can be inserted, a cut target portion (14) is formed to intersect the warp (4) while reciprocating at an interval to a needle bed (6) in a longitudinal direction thereof by swing operation perpendicular to the longitudinal direction of the needle bed (6) and lapping operation parallel with the longitudinal direction by a warp insertion mechanism (2). The warp (4) in which the cut target portion (14) is formed is hooked to one or a plurality of knitting needles (7b) and held in place. The warp (4) is then cut by causing a blade (15) moving in the longitudinal direction to act on the cut target portion (14) thus held. The warp (4) existing on the warp insertion mechanism (2) side from a cutting position of the cut target portion (14) is hooked to the knitting needle (7b) and held in place. Next knitting with the warp can be started with the warp end kept held.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a method and an apparatus for cutting and holding a warp in a weft knitting machine in which a warp can be inserted into a knitting needle while course knitting is repeated by feeding a weft to knitting needles arranged side by side on a needle bed.

Background Art

[0002] Conventionally, in order to enable a structure similar to a warp knitted fabric to be knitted in weft knitting machines that knit a weft knitted fabric, the weft knitting machines have been provided with a knitting yarn feeding apparatus for a warp (see Japanese Examined Patent Publication JP-B2 3452639, for example). In a warp insertion mechanism as in this sort of knitting yarn feeding apparatus, a plurality of yarn feeding tubes are detachably attached to a lace bar in the shape of a plate, and a knitting yarn functioning as a warp is fed from each yarn feeding tube with lapping in which the lace bar is moved in the longitudinal direction of a needle bed and swing in which the lace bar is swung in a direction perpendicular to the longitudinal direction. The swing is performed between two positions, namely a position above and a position below knitting needles in a needle bed gap. It is possible to partially knit a weft knitted fabric, by feeding a warps to a plurality of knitting needles with lapping of the lace bar and performing knitting with the knitting needles. Since the plurality of yarn feeding tubes can be attached to the lace bar, it is also possible to knit a knitted fabric separately in many sections in the knitting width direction, with this warp insertion mechanism.

[0003] A weft knitting machine includes a cutter that cuts a knitting yarn functioning as a weft after knitting of a knitted fabric in the unit of a garment, and a gripper that grips an end portion (see Japanese Examined Patent publication JP-B2 2547683, for example). Herein, it is possible to use, when necessary, a known fraying prevention method that prevents a leading end and a trailing end of a knitted fabric from fraying when cutting a knitted fabric in the unit of a garment (see Japanese Examined Patent Publication JP-B2 3099304, for example). Furthermore, a set up method for smoothly starting knitting of a new knitted fabric is also disclosed (see Japanese Examined Patent Publication JP-B2 3-77298 (1991), for example).

[0004] Also in the weft knitting machine having the warp insertion mechanism, it is possible to knit a knitted fabric in the unit of a garment while cutting a weft, by applying techniques of cutting and holding, set up, and, when necessary, fraying prevention, as disclosed in JP-B2 2547683, JP-B2 3099304 and JP-B2 3-77298, for example. For example, in a knitted fabric for a body portion of a sweater or the like, the knitting width varies. In a knitted fabric for an ordinary body portion, the shoulder width is narrower than the bottom width, and thus it is necessary to perform full-fashioned knitting in which the knitting width is changed. Furthermore, at the time of set up of a knitted fabric, it is necessary to pull down the knitted fabric to the lower portion in the needle bed gap. However, it is not possible to pull down the knitted fabric sufficiently in a portion where the knitting width increases. In particular, in a case where knitting is continuously performed between garments in a portion where knitting of a knitted fabric for a body portion in the unit of a garment ends at the shoulder width and knitting of the next knitted fabric for a body portion starts at the bottom width, many waste courses and the like have to be knitted in order to allow the pulling-down force to smoothly act, and thus efficiency becomes poor. In a case where a knitting yarn is cut in the unit of a garment, a knitted fabric can be knitted efficiently as a whole in spite of necessary processes such as set up of a knitted fabric that is to be newly knitted.

[0005] However, the weft knitting machine having the warp insertion mechanism does not have a function to cut and hold knitting yarns fed as warps respectively from the plurality of yarn feeding tubes attached to the lace bar. Thus, in a knitted fabric that includes a structure knitted with a plurality of warps, even after wefts are cut in the unit of a garment, the warps are still continued. In order to efficiently separate a knitted fabric by cutting in post-treatment, it is necessary to knit a knitted fabric with draw yarns or the like, and after the knitting, to draw the draw yarns from the knitted fabric and separate the knitted fabric by cutting.

Disclosure of Invention

[0006] It is an object of the invention to provide a method and an apparatus for cutting and holding a warp in a weft knitting machine that can appropriately cut even a knitted fabric knitted with a warp fed from a warp insertion mechanism, and can hold the end yarn after the cutting.

[0007] The invention is directed to a method for cutting and holding a warp in a weft knitting machine in which a warp can be inserted, comprising:

forming a cut target portion, which is different from a knitted fabric, with a warp, in a swing operation of a warp insertion mechanism in a direction perpendicular to a longitudinal direction of a needle bed and a lapping operation thereof in a direction parallel to the longitudinal direction;
hooking and holding the warp forming the cut target portion, on a knitting needle; and
thereafter, causing a blade to act to cut the cut target portion.

[0008] Moreover, in the invention, it is preferable that, at least one warp hook portion is disposed at a position away from a needle bed gap in the longitudinal direction

of the needle bed,
the swing operation of the warp insertion mechanism can be performed beyond the warp hook portion, and
the cut target portion is formed by hooking the warp on the warp hook portion.

[0009] Moreover, in the invention, it is preferable that when knitted fabrics for a plurality of garments are continuously knitted, the cut target portion is formed between the garments.

[0010] Moreover, in the invention, it is preferable that before the cut target portion is formed between the garments, the knitted fabric is released from the knitting needle.

[0011] Moreover, in the invention, it is preferable that the cut target portion is formed so as to pass back and forth, the blade is used for cutting one side in the cut target portion that passes back and forth, and the other side in the cut target portion whose tensile force has been reduced after cutting the one side is prevented from being cut with the blade.

[0012] Furthermore, the invention is directed to an apparatus for cutting and holding a warp in a weft knitting machine in which a warp can be inserted, comprising:

a plurality of protrusions that are arranged upright at a position away from a needle bed gap in a longitudinal direction of a needle bed;
a warp insertion mechanism that can perform a swing operation among at least three positions including two positions for hooking a warp on a knitting needle in a vicinity of the needle bed gap and a position for hooking the warp on the protrusion, and a lapping operation in the longitudinal direction of the needle bed, and that can hook the warp on the protrusion to form a cut target portion;
holding means for hooking and holding the warp with which the cut target portion is formed by the warp insertion mechanism, on the knitting needle on the needle bed; and
cutting means for cutting the warp of the cut target portion.

Brief Description of Drawings

[0013] Other and further objects, features, and advantages of the invention will be more explicit from the following detailed description taken with reference to the drawings.

Fig. 1 is a side cross-sectional view of main portions of a weft knitting machine according to an embodiment of the invention.
Fig. 2 is a schematic front view of the weft knitting machine in Fig. 1.
Fig. 3 is a side cross-sectional view showing a state in which yarn feeding tubes in Fig. 1 are positioned at an intermediate position (0) on a back needle bed 6a.
Fig. 4 is a side cross-sectional view showing a state in which the yarn feeding tubes in Fig. 1 have been moved further away from a needle bed gap to a deep position (-) of the back needle bed 6a.
Fig. 5 is a side cross-sectional view showing a state in which a warp fed from the yarn feeding tube in Fig. 1 is positioned in front of the protrusion, a lace bar has been swung to the intermediate position (0).
Fig. 6 is a side cross-sectional view showing a state in which the yarn feeding tubes in Fig. 1 have been swung to a position (+) on a side of a front needle bed 6b, and the warp can be hooked on a needle body of a knitting needle 7b.
Fig. 7 is a side cross-sectional view showing a state in which the yarn feeding tubes in Fig. 1 have been swung to the intermediate position (0), and the knitting needle 7b has been retracted from the needle bed gap.
Fig. 8 is a front view showing a configuration as cutting means including the blade in Fig. 1.
Fig. 9 is a right side cross-sectional view of the cutting means in Fig. 8.
Fig. 10 is a front view showing shapes of a guide member and a spring.
Figs. 11A to 11C are diagrams showing an operation of forming a cut target portion in Figs. 3 to 7 and an operation of forming a holding portion by hooking the warp on the knitting needle 7b in Fig. 7 and thereafter.
Figs. 12A and 12B are diagrams showing an example in which the cut target portion that passes back and forth is formed using one protrusion.

Best Mode for Carrying out the Invention

[0014] Now referring to the drawings, preferred embodiments of the invention are described below.

[0015] Fig. 1 is a side cross-sectional view of the main portions in the schematic configuration of a weft knitting machine 1 according to an embodiment of the invention. The weft knitting machine 1 has a warp insertion mechanism 2 as disclosed in JP-B2 3452639, and a warp 4 can be fed to a needle bed gap 5 from yarn feeding tubes 3a, 3b, 3c, and 3d in the form of a plurality of rows attached to a lace bar (not shown). Herein, the yarn feeding tubes 3a, 3b, 3c, and 3d in the respective rows can perform a lapping operation in a direction perpendicular to the sheet of the drawing independently of each other, and perform a swing operation in a direction parallel to the sheet of the drawing in conjunction with each other.

[0016] In the weft knitting machine 1, needle beds 6a and 6b are opposed to each other with the needle bed gap 5 interposed therebetween. The needle beds 6a and 6b are arranged so as to have the longitudinal direction perpendicular to the sheet of the drawing, and to be plane-symmetric with respect to a vertical face 5a inside the needle bed gap 5. On each of the needle beds 6a and 6b, a plurality of needle plates 6c are arranged up-

right at constant intervals in the longitudinal direction. Knitting needles 7a and 7b are respectively accommodated in needle grooves formed between the needle plates 6c, and the tips of the knitting needles 7a and 7b can be slidingly displaced back and forth with respect to the needle bed gap 5. Sinkers 8a and 8b are also provided at a portion of the needle beds 6a and 6b facing the needle bed gap 5. A cam mechanism mounted on a carriage 9 that can travel back and forth in the longitudinal direction of the needle bed 6a drives the knitting needles 7a and 7b to be advanced to and retracted from the needle bed gap 5. The cam mechanism slidingly displaces the knitting needle 7a back and forth with respect to the needle bed gap 5, by guiding a butt 11 of a needle jack 10 linked to the base end of the knitting needle 7a. A yarn feeding member (not shown) such as a yarn feeder feeds a knitting yarn functioning as a weft from above the needle bed gap 5 to a hook at the tip of the knitting needle 7a. When the knitting needle 7a whose hook has received a fed knitting yarn is retracted from the needle bed gap 5 into the needle bed 6a, a needle loop of a stitch is formed at the hook portion, and a sinker loop is formed at the sinker 8a. Although not shown, a similar mechanism that drives the knitting needle 7b using a carriage is provided even on the side of the needle bed 6b, and can knit a knitted fabric with a weft fed in the needle bed gap 5.

[0017] Furthermore, a stitch can be transferred from the knitting needle 7a on the side of the needle bed 6a to the knitting needle 7b on the side of the needle bed 6b in the following manner. A stitch transfer piece 12 is provided on one knitting needle 7a. In a state where a stitch is held by the stitch transfer piece 12, the one knitting needle 7a is advanced to the needle bed gap 5, and thus the stitch transfer piece 12 is also advanced to the needle bed gap 5. The other knitting needle 7b is advanced to the needle bed gap 5, and the stitch held by the stitch transfer piece 12 is hooked on the hook of the knitting needle 7b. Although not shown, the stitch transfer piece 12 is also provided on the knitting needle 7b on the side of the needle bed 6b, and thus a stitch can be transferred from the knitting needle 7b to the knitting needle 7a. It should be noted that although latch needles are shown as the knitting needles 7a and 7b, compound needles can be used. In the case of a compound needle, a stitch can be transferred using a slider.

[0018] The above-described yarn feeding tubes 3a, 3b, 3c, and 3d in the respective rows, the needle beds 6a and 6b, the knitting needles 7a and 7b, and the sinkers 8a and 8b are collectively referred to as the yarn feeding tube 3, the needle bed 6, the knitting needle 7, and the sinker 8, without the letter a, b, c, or d.

[0019] For example, in a state where the knitting needle 7b on the side of the front needle bed 6b has advanced to the needle bed gap 5, the warp insertion mechanism 2 performs swing and lapping so as to hook the warp 4 on the hook at the tip of the knitting needle 7b. A conventional warp insertion mechanism 2 performs a swing operation between two positions, namely the position above the back needle bed 6a shown in Fig. 1 and the position above the front needle bed 6b shown in Fig. 6. According to the warp insertion mechanism 2 of this embodiment, a third position for the swing operation is provided on the side of the needle bed 6a at a deep position farther from the needle bed gap 5, as described later with reference to Fig. 4. A protrusion 13 is disposed upright on an iron belt 6d that presses the needle plate 6c on the needle bed 6a. The protrusion 13 is positioned away from the needle bed gap 5, and thus a warp cannot be hooked on the protrusion 13 with a conventional swing operation between two positions. According to the warp insertion mechanism 2, the yarn feeding tubes 3a, 3b, 3c, and 3d in the respective rows can perform a swing operation to the third position over the position of the protrusion 13. A plurality of protrusions 13 are arranged at intervals in the longitudinal direction of the needle bed 6a. With a swing operation of the yarn feeding tube 3 to the third position in combination with a lapping operation, the warp 4 can be hooked between the needle bed gap 5 and the protrusions 13 to form a cut target portion 14 that passes back and forth.

[0020] The cut target portion 14 of the warp 4 can be cut with a blade 15. For example, the blade 15 is situated on a holder 16, and the holder 16 can move on a track 17. The track 17 is in parallel to the longitudinal direction of the needle bed 6a. Rollers 18a and 18b situated on the holder 16 sandwich the track 17 to support the holder 16 in a movable manner. The track 17 is supported by a support post 20 that is situated at an end portion of a track 19 that guides travel of the carriage 9 on the needle bed 6a.

[0021] Herein, the protrusion 13 as a warp hook portion is a single component, and is caulked on the iron belt 6d with a piano wire inserted through the protrusion 13. The protrusion 13 may be integrally formed as an extended portion from the needle plate 6c instead of being a single component fixed onto the iron belt 6d. Also, the protrusion 13 may be formed as an extended portion from a plate member such as a spacer accommodated between the needle plates 6c. Instead of the protrusion 13, the warp hook portion may be a member that moves back and forth, a member that projects and withdraws, a member that holds a warp, or other various members.

[0022] Fig. 2 is a front view of the simplified overall configuration of the weft knitting machine 1. The needle bed 6b in Fig. 1 is on the front side, and the blade 15 as cutting means, the holder 16, and the track 17 are situated on the back needle bed 6a. A yarn guide rail 21 extends above the needle bed gap 5 between the needle beds 6a and 6b, and a knitting yarn functioning as a weft can be fed from a yarn feeder 22 that is brought by the carriage 9. In the warp insertion mechanism 2, the plurality of yarn feeding tubes 3 are attached to a lace bar 23, and a swing operation based on swinging displacement about a swing axis 24 and a lapping operation based on displacement in the axial direction of the swing

axis 24 can be performed. While a knitted fabric is being knitted with an operation of the carriage 9 and the warp insertion mechanism 2, the cutting means is put on standby at one end in the longitudinal direction of the needle bed 6. After knitting of the knitted fabric ends, formation of the cut target portion 14 in Fig. 1 and end yarn treatment as described later are performed, and the cutting means is moved to cut the cut target portion 14 with the blade 15. This sort of operation of treating the warp 4 is performed under control by a controller 25. Herein, a plurality of yarn guide rails 21 can be arranged, and a plurality of yarn feeders 22 can be arranged respectively on the yarn guide rails 21. Furthermore, a plurality of lace bars 23 may be arranged. However, for the sake of convenience of this description, only one of each is shown.

[0023] Figs. 3 to 7 are side cross-sectional views of the main portions in an operation of cutting and holding the warp 4 in the weft knitting machine 1 in Fig. 1. Not all of the four yarn feeding tubes 3a, 3b, 3c, and 3d may be used, but all positions are shown for the sake of convenience of this description. In this state, knitting of a knitted fabric with the warp 4 fed from the warp insertion mechanism 2 has ended, and the knitted fabric has been released from the knitting needle 7b on the front needle bed 6b. It should be noted that the knitted fabric may be released any time. The knitted fabric may be released after the cut target portion 14 is formed, held, and then cut. After a stitch of the knitted fabric held by the knitting needle 7b on the front needle bed 6b is transferred to the knitting needle 7a on the back needle bed 6a, the cut target portion 14 may be formed and the end yarn may be held.

[0024] Fig. 3 shows a state in which the yarn feeding tubes 3 are positioned at an intermediate position (0) on the back needle bed 6a. The protrusion 13 is disposed upright at a position farther from the needle bed gap 5 than the intermediate position (0). For example, in a case where the warp 4 is fed from the yarn feeding tube 3a to a knitted fabric, the warp 4 from the knitted fabric drooping to the lower portion in the needle bed gap 5 is continued to the yarn feeding tube 3a. Fig. 4 shows a case in which the lace bar has been further swung with a swing operation, and thus the yarn feeding tubes 3 have been moved further away from the needle bed gap 5 to a deep position (-) above the back needle bed 6a. Since the yarn feeding tubes 3 are swung to a deeper position than the protrusion 13 on the needle bed 6a, the warp 4 can be hooked on the protrusion 13, by combining the swing operation with a lapping operation. Consequently, one side in the warp 4 in the cut target portion 14 in Fig. 1 can be stretched between the upper portion of the knitted fabric drooping to the lower portion in the needle bed gap 5 and the protrusion 13. Herein, when a stitch has not been released, one side in the warp 4 in the cut target portion 14 is stretched between the knitting needle 7b holding the stitch and the protrusion 13.

[0025] Fig. 5 shows a state in which after the lace bar has been moved frontward in Fig. 5 with lapping such that the warp 4 fed from the yarn feeding tube 3 is positioned in front of the protrusion 13, the lace bar has been swung to the intermediate position (0). The knitting needle 7b has been advanced to the needle bed gap 5 from the front needle bed 6b by travel of the carriage. Fig. 6 shows a state in which the yarn feeding tubes 3 have been swung to a position (+) above the front needle bed 6b, and the warp 4 can be hooked on the needle body of the knitting needle 7b. Fig. 7 shows a state in which the lace bar has been moved rearward in Fig. 7 with lapping, the yarn feeding tubes 3 have been swung to the intermediate position (0), and the knitting needle 7b has been retracted from the needle bed gap 5 by travel of the carriage. The cut target portion 14 in which the warp 4 passes back and forth is formed between the knitted fabric and the protrusion 13, and the tip of the knitting needle 7b and the protrusion 13. In the cut target portion 14, the warp 4 from the knitted fabric to the protrusion 13 formed in Fig. 4 and the warp 4 from the protrusion 13 to the tip of the knitting needle 7b formed in Fig. 7 are spaced away from each other, in a direction perpendicular to the sheet of the drawing, by the maximum gap between the protrusions 13 that are present within the distance by which the yarn feeding tubes 3 are displaced by the lapping operation between Figs. 4 and 5. Thus, when cutting the warp 4 with the blade 15 as in Fig. 1, it is possible to cut only the warp 4 in the cut target portion 14 closer to the blade 15 that has been put on standby at a position as shown in Fig. 2.

[0026] Hereinafter, swing to the position (+) above the front needle bed 6b is referred to as 'swing (+)'. Swing to the intermediate position (0) is referred to as 'swing (0)'. Swing to the deep position (-) above the back needle bed 6a is referred to as 'swing (-)'.

[0027] Figs. 8 and 9 show the configuration as the cutting means including the blade 15 in Fig. 1. Fig. 8 is a front view thereof. Fig. 9 is a side cross-sectional view thereof. Fig. 9 shows the simplified configuration of the holder 16. The holder 16 is supported by the rollers 18a and 18b sandwiching the track 17 from above and below, and can move on the track 17 by being pulled by a wire 26 that is situated on the side of the track 17. The wire 26 is driven at one end on the track 17. Relative movement of the wire 26 with respect to the track 17 rotates a pulley 27 on which the wire 26 is hooked. A gear 28 is coaxially disposed on the pulley 27, and rotates together with the pulley 27. The gear 28 is engaged with a gear 29 having a large diameter. The gear 29 is engaged with a gear 30 having a small diameter. The gears 28, 29, and 30 have the same module, and can be engaged with each other. Since the diameter of the gear 30 is smaller than that of the gear 28, the gear 30 rotates at higher speed than the gear 28. The round blade 15 is situated on the rotational shaft of the gear 30, and rotates together with the gear 30.

[0028] It should be noted that the blade 15 is not limited to a rotating round blade. It is also possible to use a stationary blade, a blade that moves back and forth, a blade

that ultrasonically oscillates, or the like. It is also possible to perform thermal cutting using heat rays, laser beams, or the like. It is also possible to cause the blade 15 to move by itself by mounting a drive source on the holder 16, instead of causing the blade 15 to be externally pulled by the wire 26 to move on the dedicated track 17. Further, it is also possible to use the yarn guide rail 21 or the like, instead of the track 17. Also, the blade may be mounted on the carriage 9 or selectively brought by the carriage 9, so as to act and cut the cut target portion 14 when necessary.

[0029] Fig. 10 shows the shape of a guide member 31 and a spring 32. When cutting the warp 4, the rotating blade 15 is moved to the cut target portion 14 as shown in Fig. 1, and is caused to cut the warp 4 on the side closer to the standby position. The cut target portion 14 also includes the warp 4 on the side farther from the standby position. The guide member 31 is provided for preventing the warp 4 on the side farther from the standby position from being hooked on the blade 15, after the warp 4 on the side closer to the standby position is cut and a tensile force of the warp 4 is reduced. The guide member 31 can be swingingly displaced relatively with respect to the holder 16, and is biased by the spring 32 away from the blade 15. The biasing force of the spring 32 is set to be smaller than the tensile force in a state where the warp 4 passes back and forth in the cut target portion 14. Accordingly, when the warp 4 in the cut target portion 14 is to be cut first, the tensile force of the warp 4 is larger than the biasing force of the spring 32, and thus the warp 4 pushes away the guide member 31 and is hooked on and cut by the blade 15. After the warp 4 on the side closer to the standby position, which is one side in the warp 4 that passes back and forth in the cut target portion 14, is cut, the tensile of the warp 4 is reduced to be substantially lost, and the guide member 31 returns to the original state due to the biasing force of the spring 32. Then, when the blade 15 reaches the warp 4 on the side farther from the standby position, which is the remaining portion of the warp 4 in the cut target portion 14, the tensile force of the warp 4 is small, and more specifically the biasing force of the spring 32 is larger than the tensile force, and thus the warp 4 cannot push away the guide member 31, and is not hooked on the blade 15 by being blocked by the guide member 31.

[0030] Herein, the guide member 31 that is biased by the spring 32 is not always necessary. However, the guide member 31 is effective, in a case where high-speed movement of driving the wire 26 at high speed is performed, or in a case where the warp 4 passes back and forth with a narrow gap therebetween in the cut target portion 14.

[0031] Figs. 11A to 11C show an operation of forming the cut target portion 14 in Figs. 3 to 7 and an operation of hooking the warp 4 on the knitting needle 7b in Fig. 7 and thereafter. As shown in Fig. 11A, the protrusions 13 are spaced away from each other, for example, at a rate of one in every four knitting needles 6a, at a position away from the needle bed gap 5 on the back needle bed 6a. After knitting of a knitted fabric ends, a warp functioning as a cut target portion 14a on the outward path is formed with the swing (-) of the yarn feeding tube 3 from the intermediate position (0) shown in Fig. 3 to the deep position (-) shown in Fig. 4. Next, a warp 4a that passes behind the protrusions 13 is fed with the lapping operation and the swing operation as shown in Fig. 5. Furthermore, a warp functioning as a cut target portion 14b on the return path is formed with the swing operation (0) from the deep position (-) to the intermediate position (0) as shown in Fig. 5. After the cut target portion 14b on the return path is formed, the yarn feeding tube 3 can hold the end of the end yarn even after the warp 4 in the cut target portion 14 is cut, with the swing operation between Figs. 6 and 7, the lapping operation to the knitting needle, and a knitting operation with the knitting needle.

[0032] As shown in Fig. 11B, a holding portion 40 for holding an end yarn is knitted, for example, by hooking the warp 4 in the shape of an 8 for a plurality of times, using the knitting needles 7b on the front needle bed 6b, in the vicinity of the position where the cut target portion 14b on the return path is formed. For example, in a case where three knitting needles A, B, and C exist, the holding portion 40 is formed between the knitting needles A and C skipping the knitting needle B.

[0033] For example, in a case where three cam systems that drive the knitting needles 7b are mounted on the carriage 9 on the front needle bed 6b, the middle cam is used as a cam for ordinary knitting or stitch transfer, and both side cams are used as cams for a warp. In the first operation of knitting the holding portion 40, no stitch is hooked on the knitting needles A, B, and C, the carriage 9 travels to the right, and the third cam system S3 advances the knitting needle A to the needle bed gap. Next, in the second operation, the yarn feeding tube 3 is moved from the left side of the knitting needle A to the right side of the knitting needle C with the lapping after the swing (+) of the lace bar, and the warp 4 is hooked on the needle body of the knitting needle A with the swing (0). In the third operation, the carriage travels from the right to left, the first cam system S1 retracts the knitting needle A, and the third cam system S3 advances the knitting needle C to the needle bed gap. In the fourth operation, the yarn feeding tube 3 is moved from the right side of the knitting needle C to the left side of the knitting needle A with the lapping after the swing (+) of the lace bar, and the warp 4 is hooked on the needle body of the knitting needle C with the swing (0).

[0034] In the fifth operation, the carriage travels from the left to right, the first cam system S1 retracts the knitting needle C, and the third cam system S3 advances the knitting needle A to the needle bed gap. A stitch of the warp 4 formed on the hook of the knitting needle A by retracting the knitting needle A in the third operation moves backward from the hook according to the advancing movement of the knitting needle A, and remains on the side of the needle body. In the sixth operation, the

yarn feeding tube 3 is moved from the left side of the knitting needle A to the right side of the knitting needle C with the lapping after the swing (+) of the lace bar, and the warp 4 is hooked on the needle body of the knitting needle A with the swing (0). In the seventh operation, the carriage travels from the right to left, the first cam system S1 retracts the knitting needle A, and the third cam system S3 advances the knitting needle C to the needle bed gap. A stitch of the warp 4 formed on the hook of the knitting needle C by retracting the knitting needle C in the fifth operation moves backward from the hook according to the advancing movement of the knitting needle C, and remains on the side of the needle body. The knitting needle A pulls the warp 4 hooked on the needle body in the sixth operation to form a stitch. The stitch remaining on the side of the needle body in the fifth operation is knocked over and removed from the knitting needle A.

[0035] In the eighth operation, the yarn feeding tube 3 is moved from the right side of the knitting needle C to the left side of the knitting needle A with the lapping after the swing (+) of the lace bar, and the warp 4 is hooked on the needle body of the knitting needle C with the swing (0). In the ninth operation, the carriage travels from the left to right, the first cam system S1 retracts the knitting needle C, and the third cam system S3 advances the knitting needle A to the needle bed gap. A stitch of the warp 4 formed on the hook of the knitting needle A by retracting the knitting needle A in the seventh operation moves backward from the hook according to the advancing movement of the knitting needle A, and remains on the side of the needle body. The knitting needle C pulls the warp 4 hooked on the needle body in the eighth operation to form a stitch. The stitch remaining on the side of the needle body in the seventh operation is knocked over and removed from the knitting needle C.

[0036] Next, in the tenth operation, the yarn feeding tube 3 is moved from the left side of the knitting needle A to the right side of the knitting needle A with the lapping after the swing (+) of the lace bar, and the warp 4 is hooked on the needle body of the knitting needle A with the swing (0). Next, in the eleventh operation, the carriage travels from the right to left, the first cam system S1 retracts the knitting needle A, and the stitch remaining on the side of the needle body in the ninth operation is knocked over.

[0037] Fig. 11C shows a state in which the warp 4 has been hooked on the knitting needles A and C in the order of A, C, A, C, and then A, the knitting needles A and C being arranged skipping one knitting needle on the front needle bed 6b, and thus the holding portion 40 knitted by hooking the warp 4 on the knitting needles A and C in the shape of an 8 has been formed. It should be noted that a function similar to that of the holding portion 40 can be realized not only by hooking the warp in the shape of an 8, but also by simply winding the warp. Furthermore, the number of the needles or the gap between the needles are not limited to this. It is also possible to hold the warp by winding the warp around one knitting needle for a plurality of times.

[0038] In Fig. 11C, after the cut target portion 14 is formed, the holding portion 40 shown in Fig. 11B is formed, and a warp in the cut target portion 14b on the return path on the side closer to the standby position of the blade 15 shown in Fig. 2 is cut. For example, in a case where knitting of a knitted fabric 41 continued to the cut target portion 14a on the outward path ends in the unit of a garment, and the knitted fabric 41 is released from a knitting needle, when the cut target portion 14b on the return path is cut, the remaining portion of the cut target portion 14 constituted by the warp 4a that passes behind the protrusions 13 and the cut target portion 14a on the outward path is pulled by the knitted fabric 41 and drops to the lower portion in the needle bed gap 5. The warp 4 on the side of the yarn feeding tube 3 is moved cut in the cut target portion 14b on the return path is held by the knitting needles A and C at the holding portion 40.

[0039] Herein, it is also possible to leave the cut target portion 14b on the return path, by cutting the cut target portion 14a on the outward path closer to the knitted fabric 41. However, in this case, the warp 4a that passes behind the protrusions 13 and the cut target portion 14b on the return path remain in front of the holding portion 40. In a case where the cut target portion 14b on the return path is cut, when the knitted fabric 41 drops, a long end yarn after the cutting also drops together with the knitted fabric 41. Accordingly, only a short end yarn remains on the side of the holding portion 40, which does not obstruct.

[0040] Figs. 12A and 12B show an example in which the cut target portion 14 that passes back and forth is formed using one protrusion 13. Fig. 12A shows a case in which the gap between the cut target portion 14a on the outward path and the cut target portion 14b on the return path is narrow. Fig. 12B shows a state in which the cut target portion 14b on the return path is formed such that the distance between the protrusion 13 and the knitting needles 7b is long, and thus the gap between the cut target portion 14a on the outward path and the cut target portion 14b on the return path is large. Even when the gap is narrow as in Fig. 12A, it is possible to cut only one cut target portion 14 by moving the blade 15 at lower speed or more precisely.

[0041] In a case where a knitted fabric for the next garment is continuously knitted after the warp 4 is cut, set up knitting is performed continuously after knitting of the holding portion 40. The holding portion 40 is knitted into waste courses at the time of set up. Then, a portion that becomes the knitted fabric for the next garment is actually knitted.

[0042] As described above, in the weft knitting machine 1 in which the warp 4 can be inserted, the cut target portion 14 intersecting while passing back and forth with a gap interposed in the longitudinal direction of the needle bed 6 is formed in the warp 4, with a swing operation in a direction perpendicular to the longitudinal direction of the needle bed 6 and a lapping operation in a direction parallel to the longitudinal direction by the warp insertion

mechanism 2. The warp 4 in which the cut target portion 14 has been formed is hooked and held on the plurality of knitting needles 7. The warp 4 is cut by causing the blade 15 that moves back and forth in the longitudinal direction of the needle bed 6 to act on the held cut target portion 14. The warp 4 between the cut position of the cut target portion 14 and the warp insertion mechanism 2 is hooked and held on one or a plurality of knitting needles 7. The next knitting with the warp 4 can be started in a state where the end of the warp 4 is held.

[0043] The cut target portion 14 and the holding portion 40 can be formed as described above in a case where cutting and holding is performed for each garment. When knitting of a desired knitted fabric in the unit of a garment ends, after knitting of one or more waste courses with wefts and fraying prevention treatment are performed, a stitch of the knitted fabric is released from a knitting needle holding the stitch by causing the knitting needle to perform a knit operation without feeding a yarn thereto. Herein, the knitted fabric is continuously pulled down in the needle bed gap by causing a knitted fabric pulling-down apparatus such as lowering rollers to continuously sandwich the knitted fabric as in the knitting process. After the stitch is released from the knitting needle, the warp 4 from the yarn feeding tube 3 droops in a state where the warp is continued to the knitted fabric positioned below the needle bed gap 5 and above the lowering rollers. The cut target portion 14 is formed by winding the warp 4 around the protrusions 13 with the swing (-), the lapping (racking), and then the swing (0) of the lace bar as shown in Fig. 11A. The cut target portion 14a on the outward path extending from the knitted fabric to the protrusions 13 and the cut target portion 14b on the return path extending from the protrusions 13 to the yarn feeding tube 3 are formed in the warp 4. Subsequently, the holding portion 40 is formed, and the cut target portion 14b on the return path is cut with the blade 15. The knitted fabric continued to the cut target portion 14a on the outward path is discharged by the lowering rollers. The cut target portion 14a on the outward path from the knitted fabric, the warp 4a that passes behind the protrusions 13, and the remaining portion of the warp 4 after cutting in the cut target portion 14b on the return path drops through the needle bed gap 5. The warp 4 on the side closer to the holding portion 40 than the cut position in the cut target portion 14b on the return path and the warp 4 from the holding portion 40 to the yarn feeding tube 3 remain. It is possible to knit a knitted fabric for the next garment by performing set up in this state.

[0044] More specifically, a tensile force is applied to the warp 4 forming the cut target portion 14 that passes back and forth. When one side in the warp 4 that passes back and forth in the cut target portion 14 is cut, the tensile force of the other side in the warp 4 is reduced. The other side in the warp 4 whose tensile force has been reduced after the cutting of the one side in the warp 4 is prevented from being cut with the blade 15. Thus, it is possible to cut only one side in the warp 4 that is formed so as to pass back and forth in the cut target portion 14, and to not cut the other side. In a case where both sides in the cut target portion 14 that pass back and forth are cut, a short end yarn may be separated and attached to a knitted fabric as lint. However, according to this embodiment, the remaining portion of the cut target portion 14 is not cut, and thus lint can be prevented from being generated.

[0045] Furthermore, even in knitting of a knitted fabric in the unit of a garment, in a case where regions that are to be knitted with the warp 4 are spaced away from each other in the course direction, a cross yarn is formed between the regions. When knitting of one region with the warp 4 ends, it is possible to cut the cross yarn, by performing the end yarn treatment as performed between garments, except for release of a stitch. In a case where the cross yarn remains, the cross yarn has to be eliminated in post-treatment after knitting of the knitted fabric. Thus, it is possible to save steps necessary in the post-treatment.

[0046] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and the range of equivalency of the claims are therefore intended to be embraced therein.

Industrial Applicability

[0047] According to the invention, a cut target portion, which is different from a knitted fabric, can be formed in a warp, and the warp forming the cut target portion can be hooked and held on a knitting needle, with a swing operation in a direction perpendicular to a longitudinal direction of a needle bed and a lapping operation in a direction parallel to the longitudinal direction by a warp insertion mechanism. In a case where a blade is caused to act on the cut target portion to cut the warp after the warp is held, the warp from the cut position to the warp insertion mechanism is hooked and held on a knitting needle. Thus, the end yarn after the cutting can be held as appropriate. The next knitting with the warp can be started in a state where the end of the warp is held.

[0048] Furthermore, according to the invention, a swing operation of the warp insertion mechanism can be performed over a warp hook portion that is disposed upright at a position away from a needle bed gap. Accordingly, the cut target portion can be formed by hooking the warp on the warp hook portion, and the warp can be cut and held.

[0049] Furthermore, according to the invention, when knitted fabrics for a plurality of garments are continuously knitted, the cut target portion is formed between the garments, and thus the knitted fabrics can be separated by cutting and the yarn end can be held.

[0050] Furthermore, according to the invention, in a

case where knitting of a knitted fabric and cutting of a weft end before a cut target portion is formed, a tensile force to drop the knitted fabric is applied to a warp of the cut target portion by shaking off a stitch. Even after the warp of the cut target portion is cut, a warp on the side of the warp insertion mechanism is held by a knitting needle, and the tensile force of the remaining portion in the cut warp of the cut target portion is reduced. Thus, the remaining portion is pulled by the knitted fabric, and drops together with the knitted fabric.

[0051] Furthermore, according to the invention, a tensile force is applied to the warp of the cut target portion that is formed so as to pass back and forth. When one side in the cut target portion is cut, the tensile force of the other side in the warp is reduced. The other side in the warp whose tensile force has been reduced is prevented from being cut with the blade. Thus, it is possible to cut only one side in the warp that is formed so as to pass back and forth in the cut target portion, and to not cut the other side. In a case where both sides in the cut target portion that pass back and forth are cut, a short end yarn is separated to be lint. It is possible to prevent generation of lint by cutting one side and not cutting the other side.

[0052] Furthermore, according to the invention, after knitting of a knitted fabric, a cut target portion can be formed by hooking a warp on a protrusion that is disposed upright at a position away from a needle bed gap, and the warp forming the cut target portion can be hooked and held on a knitting needle, with a swing operation among three positions in a direction perpendicular to the longitudinal direction of the needle bed and a lapping operation in a direction parallel to the longitudinal direction of the needle bed by a warp insertion mechanism. After the warp is hooked and held on the knitting needle, the warp of the cut target position can be cut with cutting means. The warp from the cut position to the warp insertion mechanism is hooked and held on a knitting needle. Thus, the end yarn after the cutting can be held as appropriate. The next knitting with the warp can be started in a state where the end of the warp is held.

Claims

1. A method for cutting and holding a warp in a weft knitting machine in which a warp can be inserted, comprising:

   forming a cut target portion, which is different from a knitted fabric, with a warp, in a swing operation of a warp insertion mechanism in a direction perpendicular to a longitudinal direction of a needle bed and a lapping operation thereof in a direction parallel to the longitudinal direction;
   hooking and holding the warp forming the cut target portion, on a knitting needle; and
   thereafter, causing a blade to act to cut the cut target portion.

2. The method of claim 1, wherein, at least one warp hook portion is disposed at a position away from a needle bed gap in the longitudinal direction of the needle bed,
   the swing operation of the warp insertion mechanism can be performed beyond the warp hook portion, and the cut target portion is formed by hooking the warp on the warp hook portion.

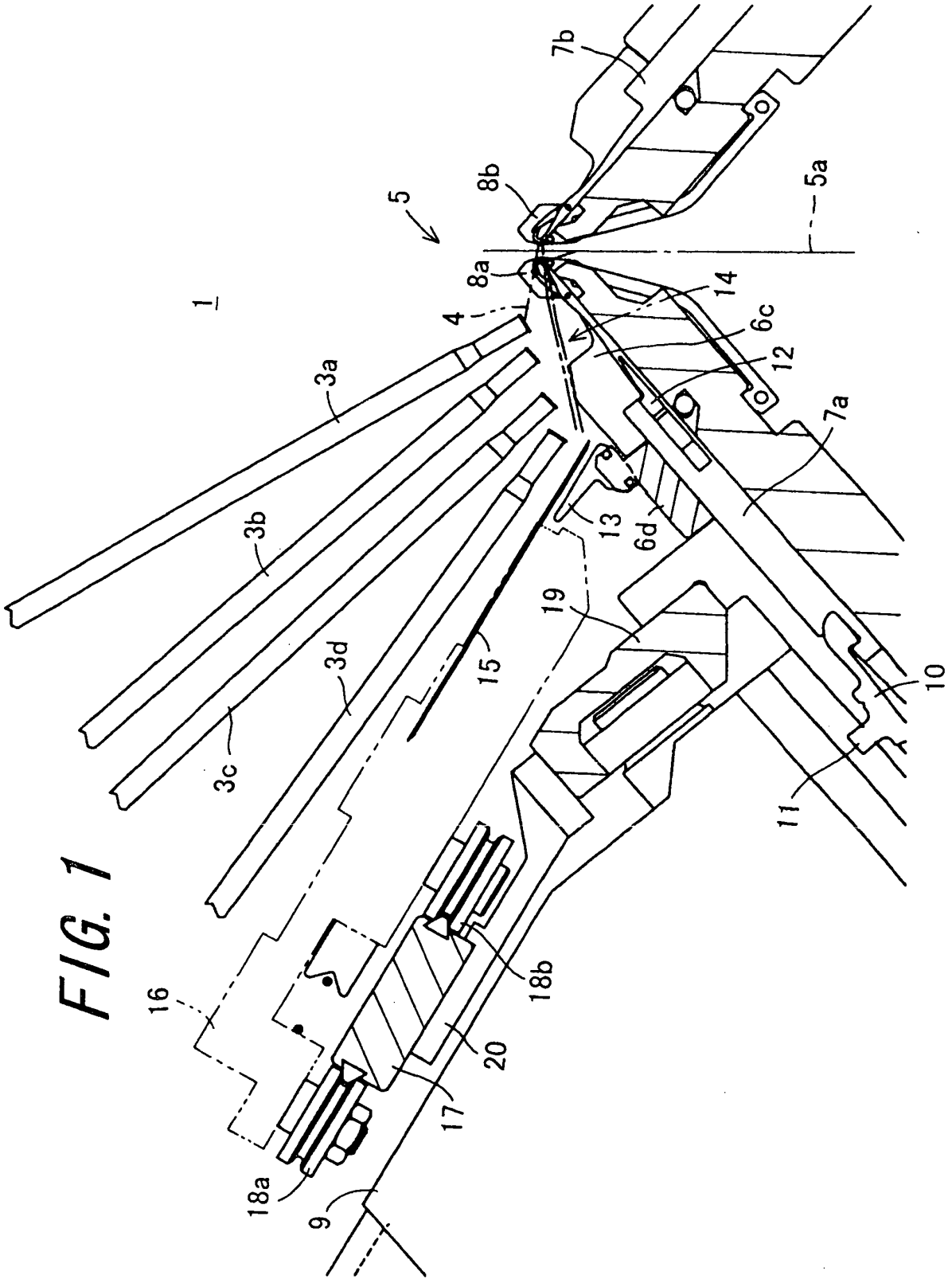
3. The method of claim 1 or 2, wherein when knitted fabrics for a plurality of garments are continuously knitted, the cut target portion is formed between the garments.

4. The method of claim 3, wherein before the cut target portion is formed between the garments, the knitted fabric is released from the knitting needle.

5. The method of any one of claims 1 to 4, wherein the cut target portion is formed so as to pass back and forth, the blade is used for cutting one side in the cut target portion that passes back and forth, and the other side in the cut target portion whose tensile force has been reduced after cutting the one side is prevented from being cut with the blade.

6. An apparatus for cutting and holding a warp in a weft knitting machine in which a warp can be inserted, comprising:

   a plurality of protrusions that are arranged upright at a position away from a needle bed gap in a longitudinal direction of a needle bed;
   a warp insertion mechanism that can perform a swing operation among at least three positions including two positions for hooking a warp on a knitting needle in a vicinity of the needle bed gap and a position for hooking the warp on the protrusion, and a lapping operation in the longitudinal direction of the needle bed, and that can hook the warp on the protrusion to form a cut target portion;
   holding means for hooking and holding the warp with which the cut target portion is formed by the warp insertion mechanism, on the knitting needle on the needle bed; and
   cutting means for cutting the warp of the cut target portion.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3b
3c
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6d
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FIG. 1

FIG. 2

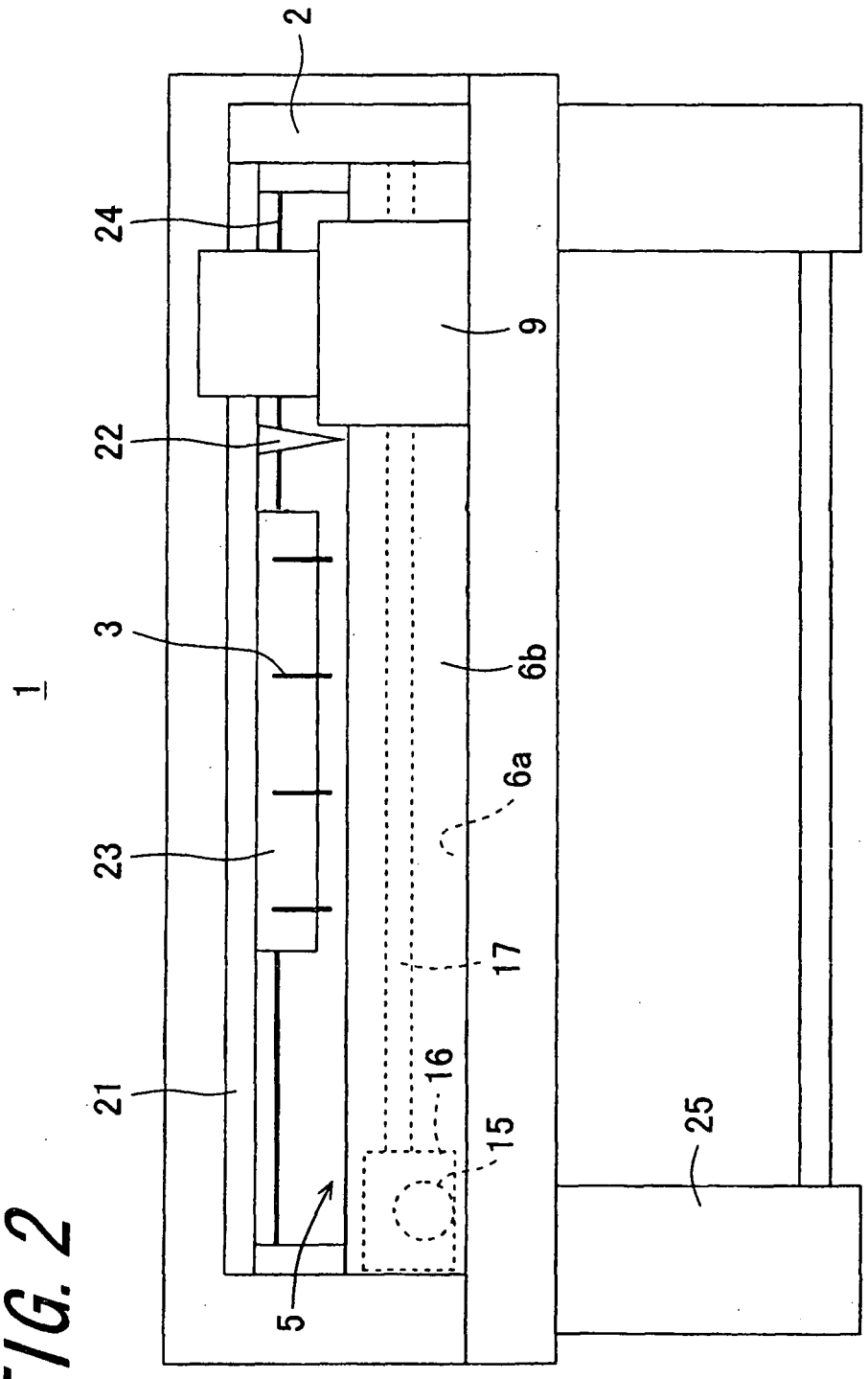


FIG. 3

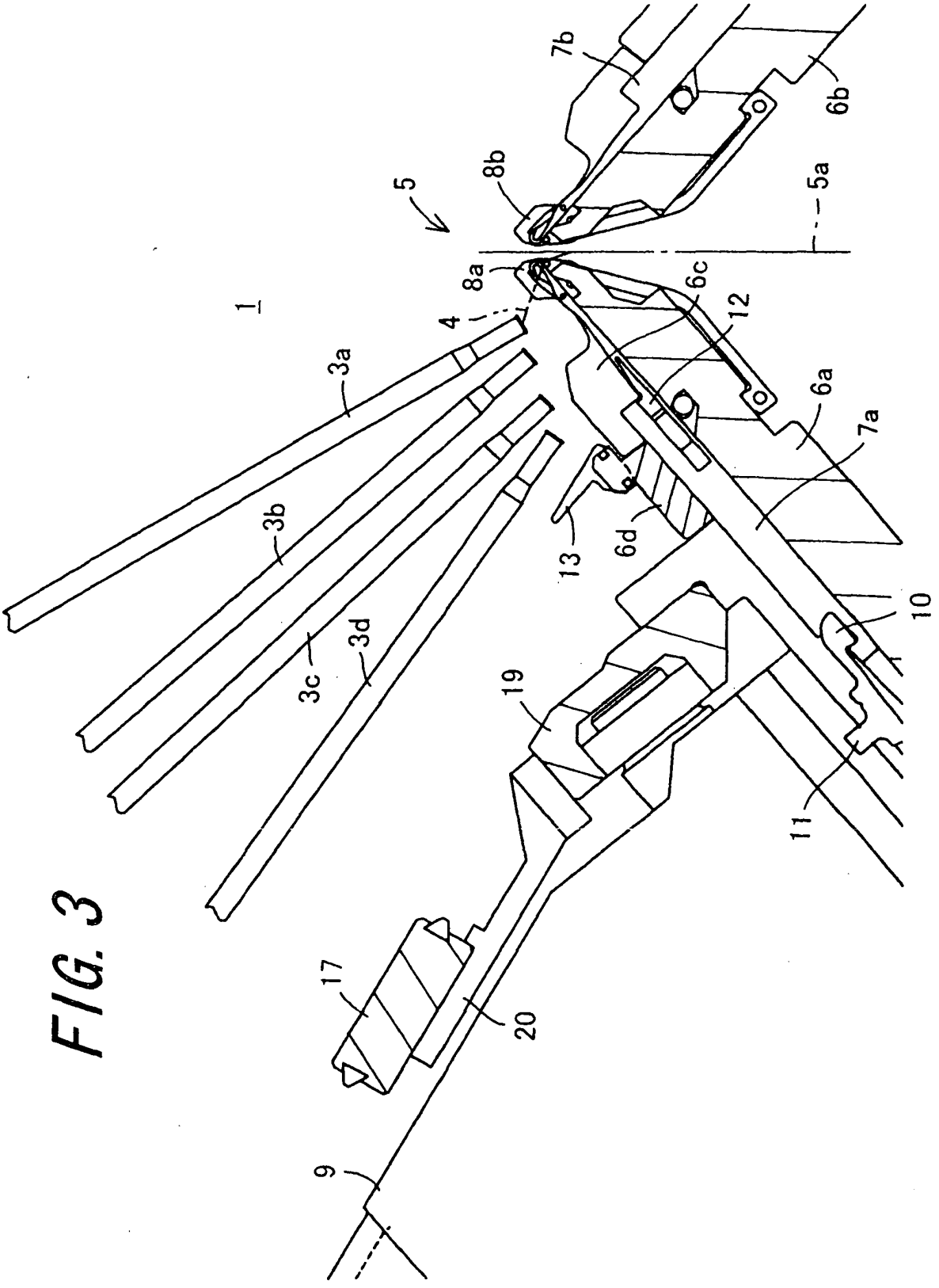


FIG. 4

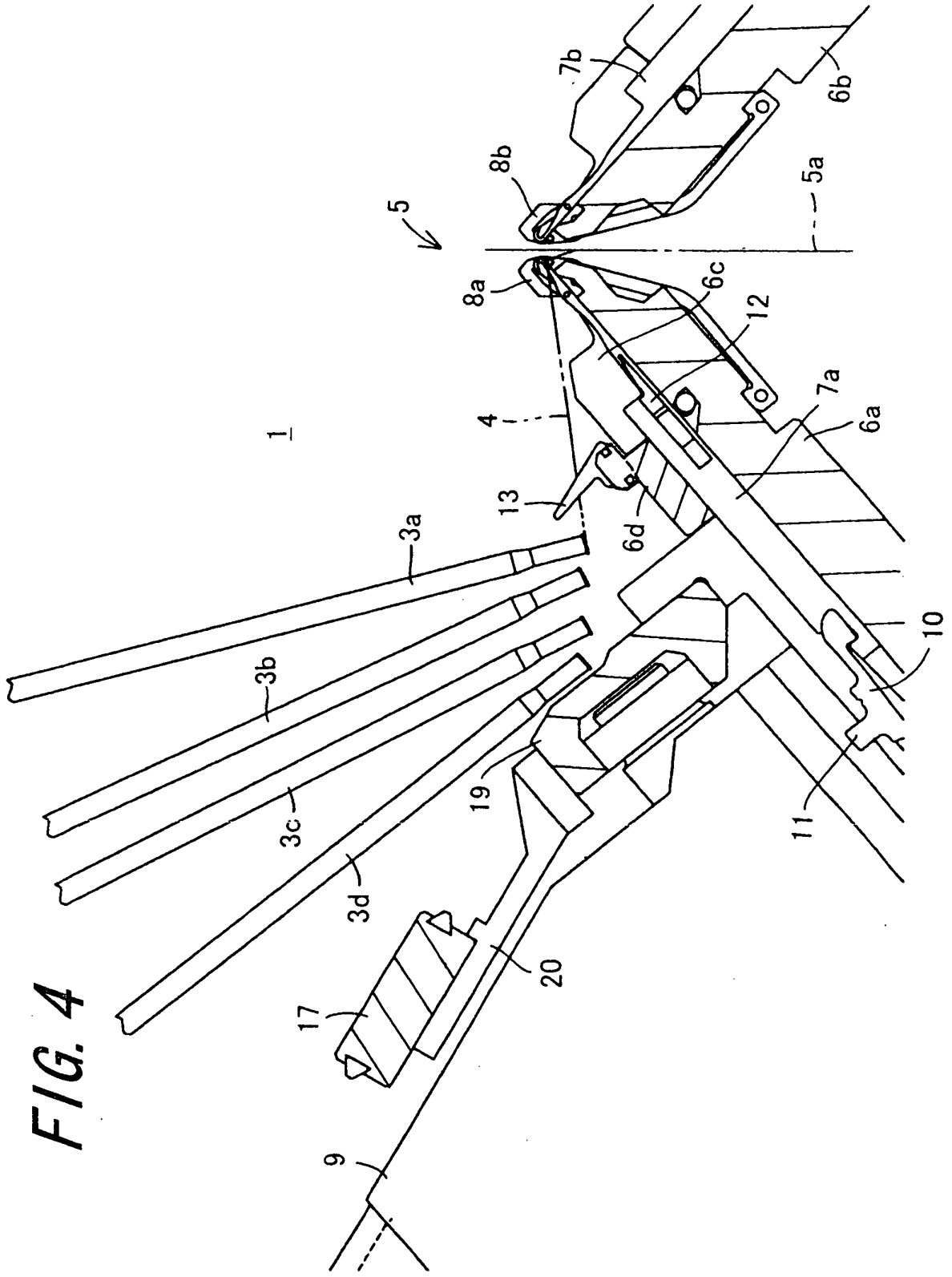


FIG. 5

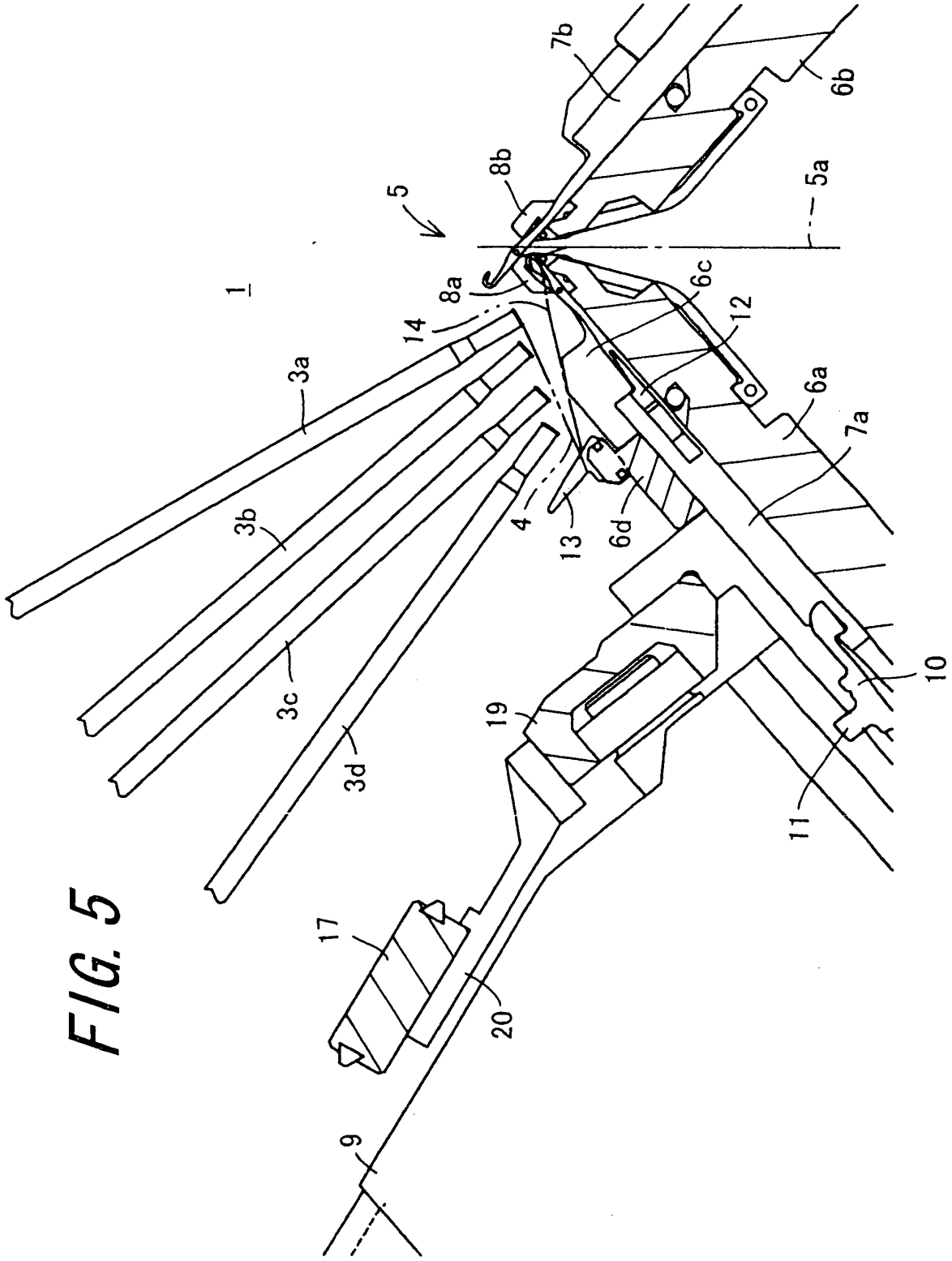


FIG. 6

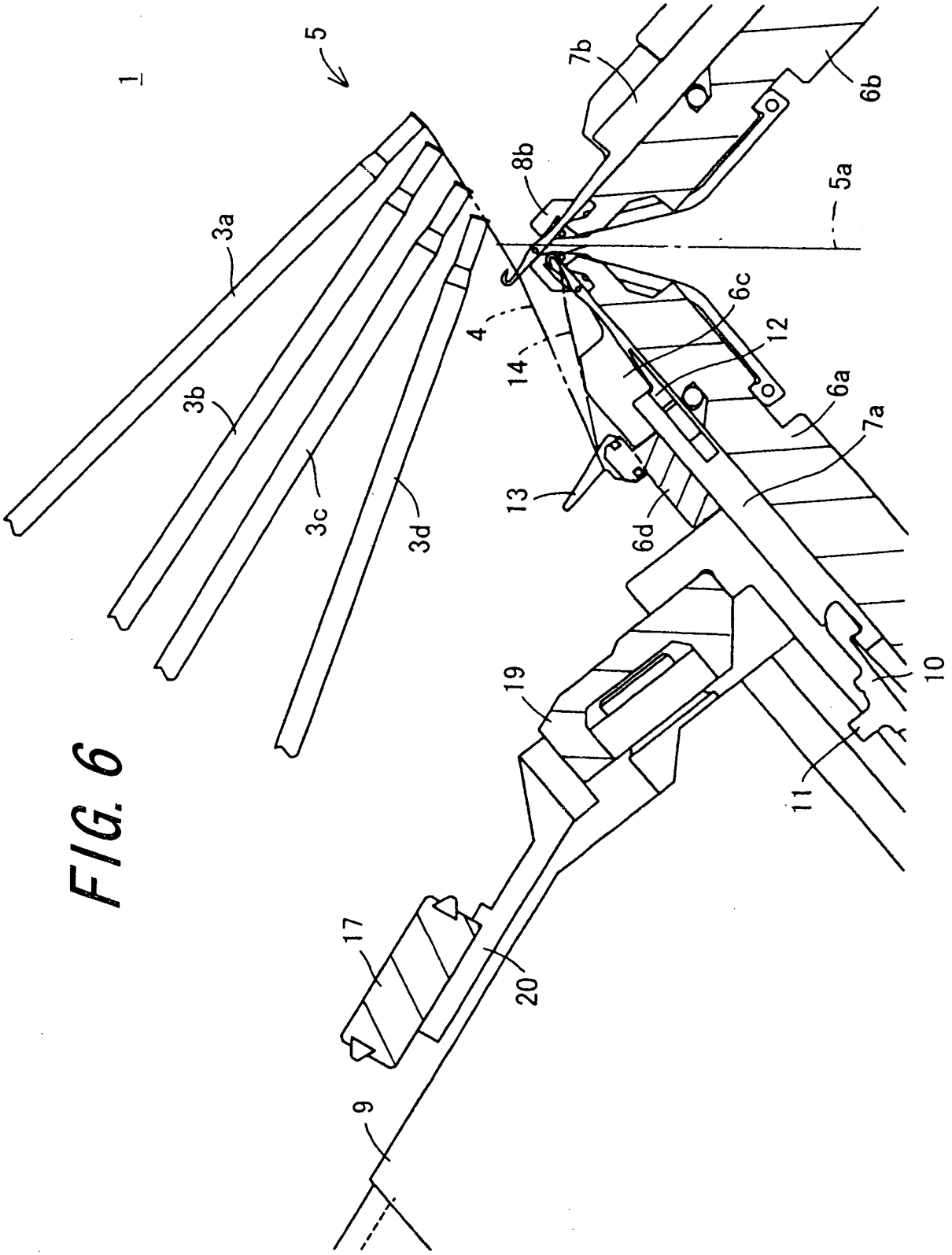


FIG. 7

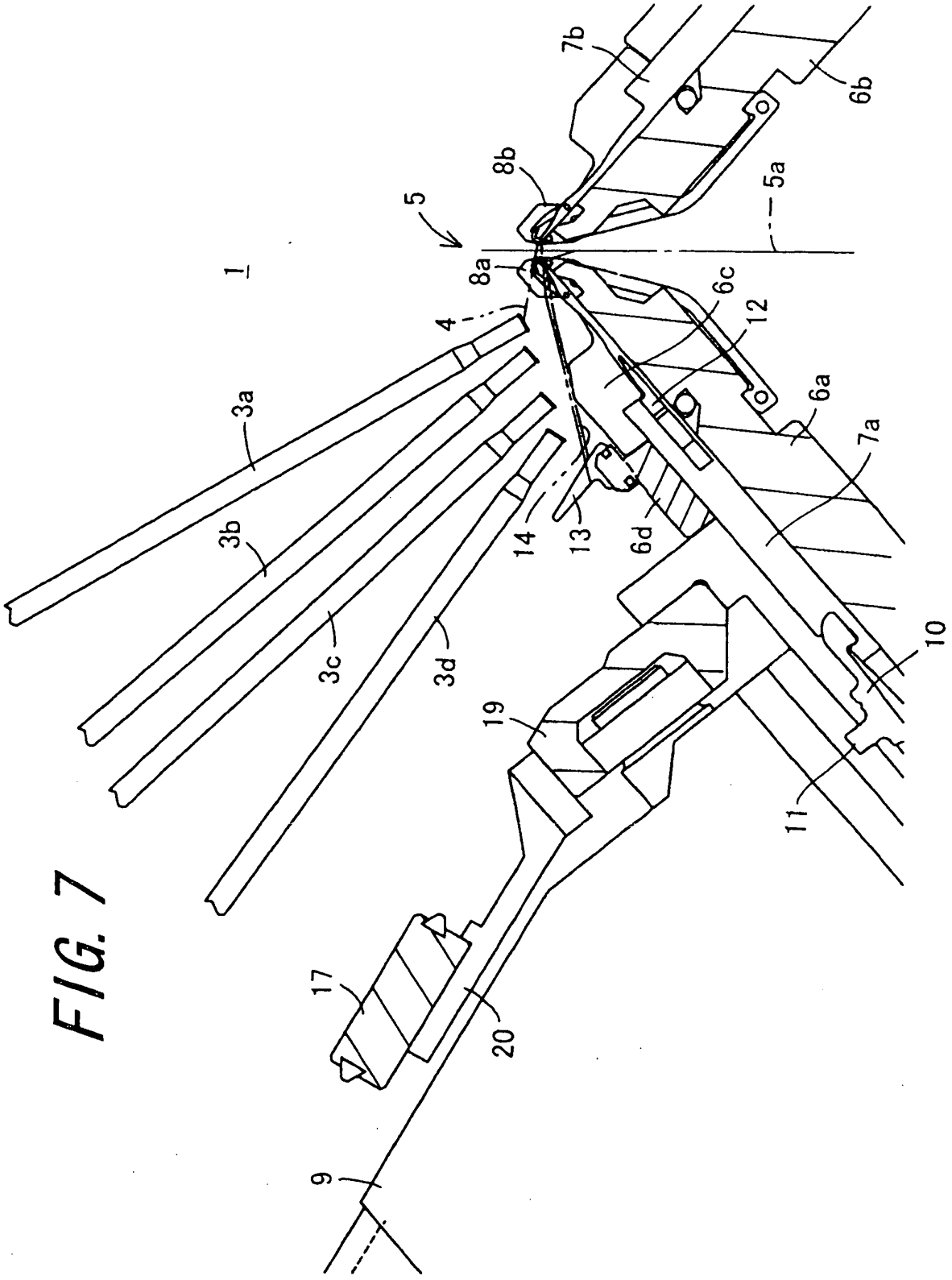


FIG. 8

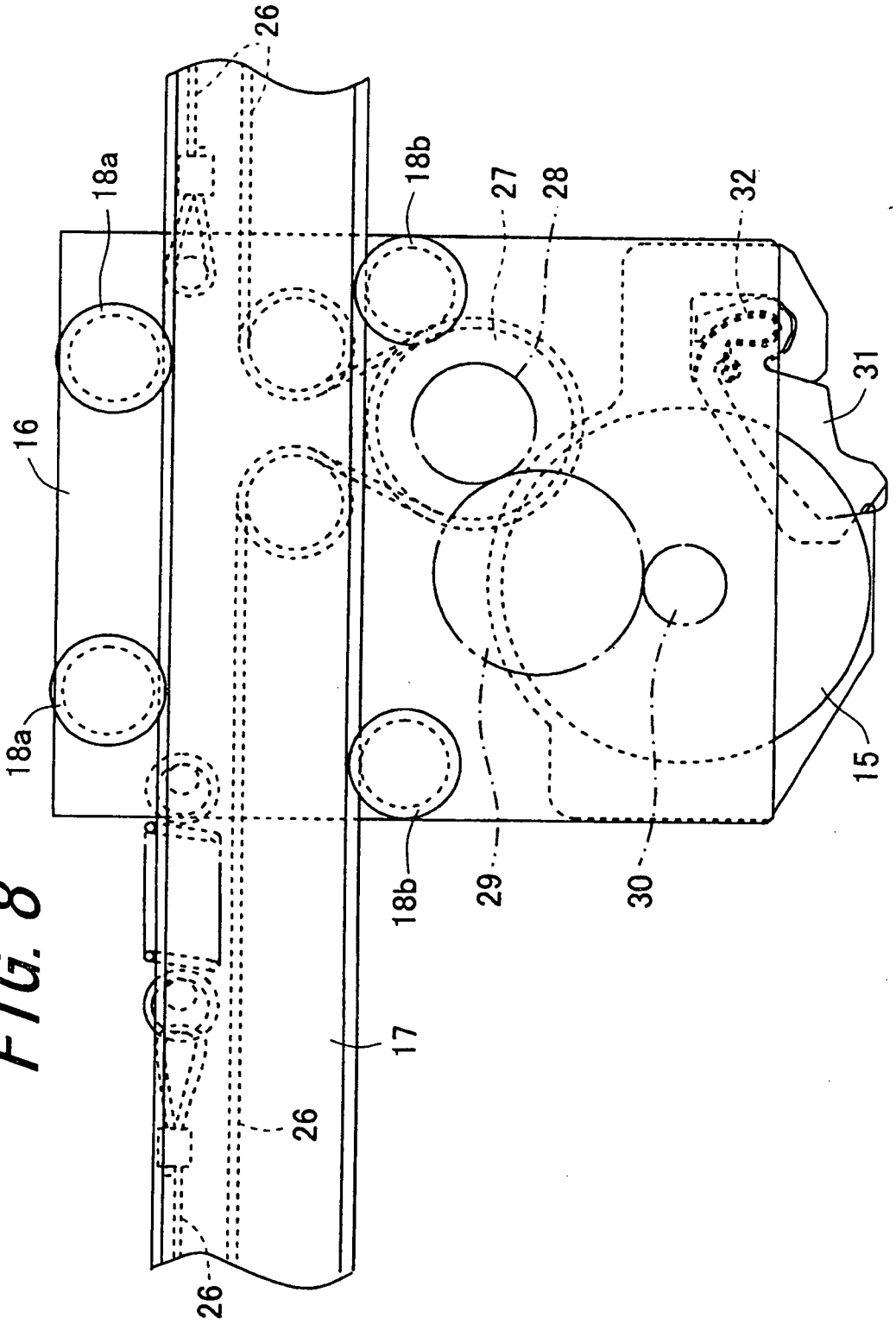


FIG. 9

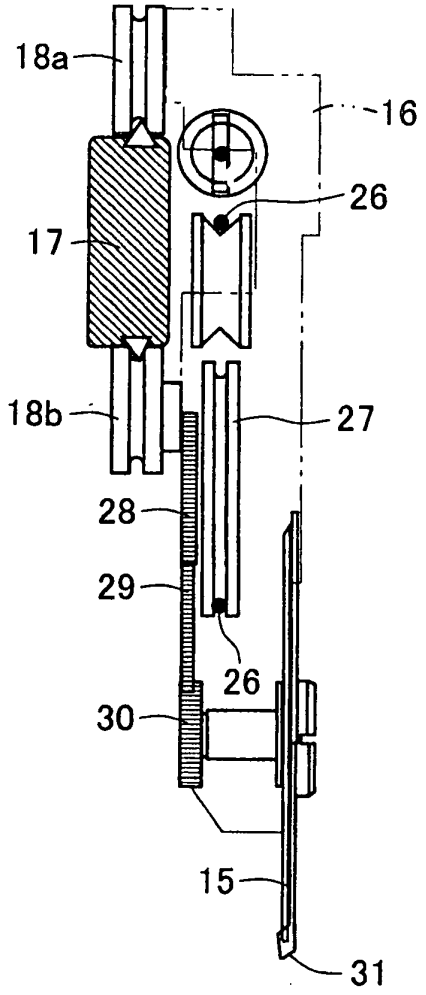


FIG. 10

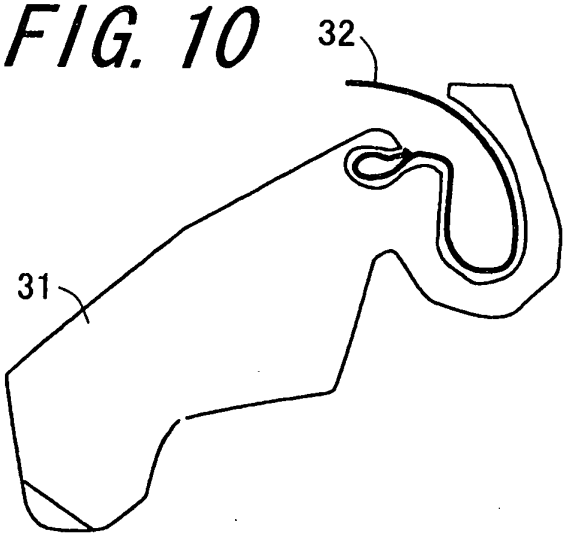


FIG. 11A

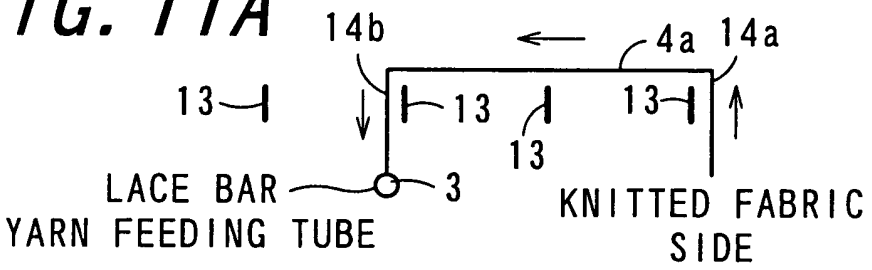


FIG. 11B

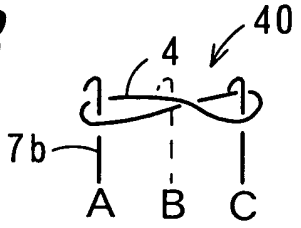


FIG. 11C

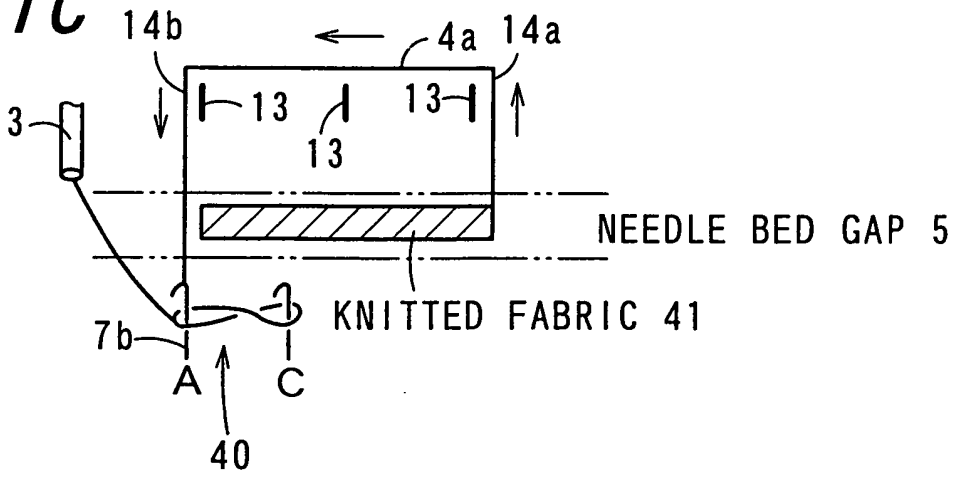


FIG. 12A

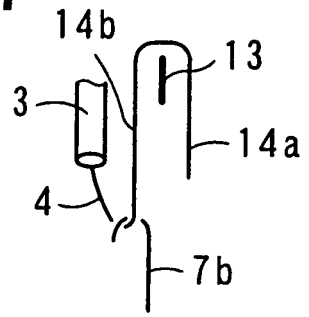
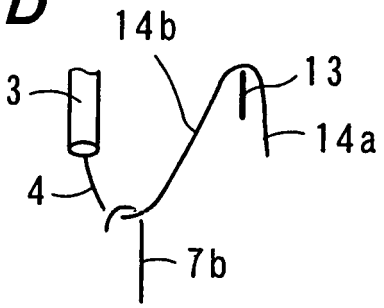


FIG. 12B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/322887

A. CLASSIFICATION OF SUBJECT MATTER
D04B7/14(2006.01)i, *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)
D04B7/12-7/18, D04B15/56

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 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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.
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Y	JP 2529640 B2 (Shima Seiki Mfg., Ltd.), 28 August, 1996 (28.08.96), & US 5452592 A & EP 632153 A1 & DE 69413139 C & KR 9615659 B	3,4
Y	JP 3541134 B2 (Shima Seiki Mfg., Ltd.), 07 July, 2004 (07.07.04), (Family: none)	3,4

☒ 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	Date of mailing of the international search report
30 November, 2006 (30.11.06)	12 December, 2006 (12.12.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/322887

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 34-4254 Y1 (Toshiro SUMIDA), 27 March, 1959 (27.03.59), (Family: none)	1-6
A	JP 2005-290572 A (Shima Seiki Mfg., Ltd.), 20 October, 2005 (20.10.05), & WO 2005/95697 A1	1-6
A	JP 2547683 B2 (Shima Seiki Mfg., Ltd.), 23 October, 1996 (23.10.96), (Family: none)	1-6
A	JP 3099304 B2 (Shima Seiki Mfg., Ltd.), 16 October, 2000 (16.10.00), & US 5628209 A1 & EP 699791 A1 & DE 69502557 C	1-6
A	JP 3-77298 B2 (Shima Seiki Mfg., Ltd.), 10 December, 1991 (10.12.91), & GB 2228017 A	1-6

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REFERENCES CITED IN THE DESCRIPTION

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- JP 3452639 B **[0002] [0015]**
- JP 2547683 B **[0003] [0004]**
- JP 3099304 B **[0003] [0004]**
- JP 3077298 B **[0003] [0004]**