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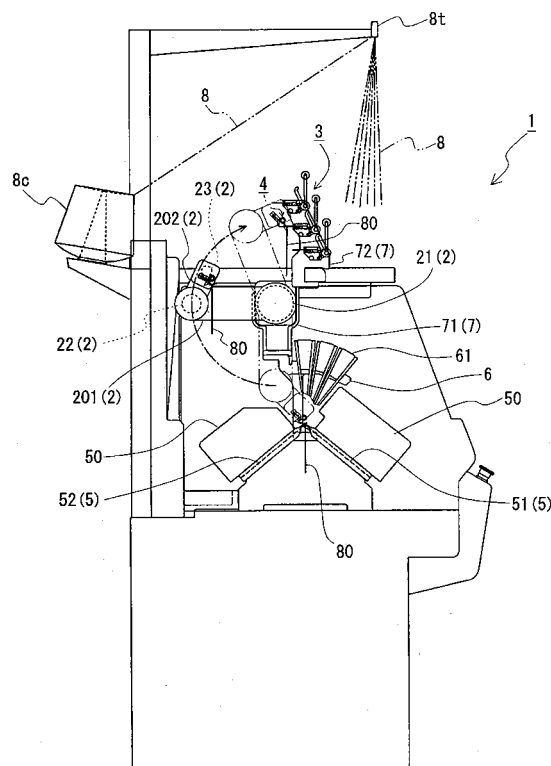
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(54) **TOPPING DEVICE**

(57) There is provided a topping device in which the track of each unit of the topping device falls within the installation space of the flat knitting machine main body, and in which the topping needles can draw a free track. A topping device 2 for removing a knitted fabric, which is knitted with a flat knitting machine 1 including a needle beds 5 in which a plurality of knitting needles are arranged in rows, from the knitting needles while maintaining an aligned state of stitches held at the knitting needles and transporting the knitted fabric is provided. The topping device 2 includes a first shaft 21 arranged in parallel to the needle beds 5 on the upper side of the needle beds 5 of the flat knitting machine 1; a first arm pair 201 extending from both ends of the first shaft 21; a second shaft 22 bridged in parallel to the first shaft 21 at distal ends of the first arm pair 201; a second arm pair 202 extending from both ends of the second shaft 22; a third shaft 23 bridged in parallel to the first shaft 21 at distal ends of the second arm pair 202; and a plurality of topping needle 25 arranged in rows at the third shaft 23.

Fig. 2



Description

TECHNICAL FIELD

[0001] The present invention relates to a topping device for removing a knitted fabric from the knitting needles of a needle bed and providing the same to a magazine in which magazine needles are arranged in rows.

BACKGROUND ART

[0002] In a flat knitting machine, a knitting fabric is knitted by moving the knitting needles into a needle bed gap from the needle beds opposing each other with a needle bed gap in between, and hooking a knitting yarn fed from the upper side of the needle bed gap to the hook of the knitting needle and drawing in the knitting yarn to the needle bed. The knitting yarn is fed to the needle bed gap from a yarn feeder of a yarn feeding member that reciprocates in a longitudinal direction of the needle bed at the upper side of the needle bed gap. Through the use of such flat knitting machine, sweaters, cardigans, and the like can be knitted without sewing.

[0003] There is a need to perform a linking process on a plurality of knitted fabrics to complete the clothing due to reasons in design. For instance, the body and the collar are separately knitted in the sweater, and the like, and the linking is performed in the post-step. In this case, a sweater with a beautiful finish and comfortable to wear is obtained by linking with the stitches at the joining position of the body and the collar corresponded to each other. However, the production efficiency is bad as it is troublesome and it takes time to match the stitches of the finished body and collar each time in time of linking.

[0004] In order to solve the above problem, each topping device described in Patent Documents 1 and 2 is proposed. The topping device is a device including a shaft in which the topping needles corresponded one to one with the knitting needles of the needle bed are arranged in rows, and an arm for supporting and moving the shaft, where the knitted fabric is automatically removed from the knitting needles of the needle bed and provided to the magazine in which the magazine needles corresponded one to one with the topping needles are arranged in rows.

[0005]

Patent Document 1: US Patent No. 3446042

Patent Document 2: German Patent No. 2005439

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] However, the flat knitting machine including the topping device of the above patent document has a configuration of approaching the topping needles to the knitted fabric with the arm extending towards the needle bed

from the outer side of the flat knitting machine main body, and has problems in that the installation area increases by the amount of the topping device. Since the track of the arm of the topping device greatly runs out from the outer side of the flat knitting machine main body, an installation space having room for the track of the arm is also required. Furthermore, in the devices of the documents, the track of the arm and the topping needle for transporting the knitted fabric can only draw one type of track due to the structure of the arm and the shaft supporting the arm, and thus the knitted fabric can only be detached from one of the front or back needle beds, and the position of the magazine to which the knitted fabric is provided is also limited.

[0007] It is an object of the present invention to provide a topping device in which the track of each unit of the topping device falls within the installation space of the flat knitting machine main body, and in which the topping needle can draw a free track.

MEANS FOR SOLVING THE PROBLEMS

[0008] The present invention relates to a topping device for removing a knitted fabric, which is knitted with a flat knitting machine including a needle bed in which a plurality of knitting needles are arranged in rows, from the knitting needles while maintaining an aligned state of stitches held at the knitting needles, and transporting the knitted fabric. The topping device of the present invention includes a first shaft arranged in parallel to the needle bed on an upper side of the needle bed of the flat knitting machine; a first arm pair extending in a direction orthogonal to a shaft direction of the first shaft from both ends of the first shaft, and rotating with a shaft center of the first shaft as a center; a second shaft bridged in parallel to the first shaft to connect distal ends of the first arm pair; a second arm pair extending in a direction orthogonal to a shaft direction of the second shaft from both ends of the second shaft, and rotating with a shaft center of the second shaft as a center; a third shaft bridged in parallel to the first shaft to connect distal ends of the second arm pair; and a topping needle arranged in rows in the third shaft.

[0009] A representative example of the configuration in which the arm pair rotates with respect to the shaft center includes a configuration of fixing the arm pair to the shaft and rotating the arm pair with respect to the shaft center by rotating the shaft, as described in the embodiment hereinafter. In addition, a configuration of fixing the shaft and having each arm pair to be rotatable with respect to the shaft may be adopted.

[0010] In one aspect of the present invention, the third shaft is preferably rotatably supported with respect to the second arm pair.

[0011] In one aspect of the present invention, if the flat knitting machine including the topping device is a flat knitting machine including a supporting member upright arranged at both ends of the flat knitting machine, and a

rail, bridged to connect the supporting members, for slidably supporting a yarn feeding member for feeding a knitting yarn to the knitting needle, the first shaft of the topping device is preferably bridged to connect the supporting members.

[0012] In one aspect of the present invention, the second arm pair is preferably arranged on an inner side than an area where the first arm pair is connected in the second shaft; and a length of the second arm pair is preferably formed shorter than a length of the first arm pair.

EFFECTS OF THE INVENTION

[0013] The topping device of the present invention has three shafts and two sets of arm pairs and this configuration of the device achieves setting of the movable range of each configuration with more flexibility. Furthermore, the track of each part of the device can be set so as to fall within the installation space of the flat knitting machine main body since the first shaft, which becomes the starting point of the device, is set on the upper side of the needle bed. Therefore, the topping device of the present invention has the following effects.

[1] When the topping device is applied to the flat knitting machine, the installation space for the topping device greater than the installation space of the flat knitting machine main body is not required.

[2] When applied to the flat knitting machine including a plurality of needle beds, the knitted fabric can be removed from any needle bed.

[3] There is much wider option of setting the arrangement position of the magazine, which is the receiving side of the transporting knitted fabric. Furthermore, a plurality of magazines can be arranged.

[0014] If the third shaft in the topping device of the present invention is configured to be rotatable with respect to the second arm pair, the angle of the topping needles arranged in rows in the third shaft can be freely set, and hence the knitted fabric can be easily removed from the needle bed. The removed knitted fabric may be made difficult to be removed from the topping needles or the knitted fabric may be easily transferred from the topping needles to the magazine needles of the magazine by changing the angle of the topping needle.

[0015] The track of each configuration of the device becomes small since the first shaft is arranged at substantially the upper side of the needle bed gap according to the configuration in which the first shaft in the topping device of the present invention is bridged to the supporting members, where the rail of the flat knitting machine is supported.

[0016] The distal end of the second arm pair can be avoided from contacting the first shaft even if the second arm pair is rotated 360° with respect to the second shaft by forming the length of the second arm pair in the topping device of the present invention shorter than the length of

the first arm pair and arranging the second arm pair on the inner side than the first arm pair. Thus, the track of each configuration of the device can be made small.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a schematic front view of a flat knitting machine shown in an embodiment.

Fig. 2 is a schematic side view of the flat knitting machine shown in the embodiment.

Fig. 3 is a first explanatory view showing the process of transporting the knitted fabric with a topping device shown in the embodiment, and shows a state in which a third shaft is moved from S to B.

Fig. 4 is an enlarged view of the vicinity of the needle bed gap in Fig. 3.

Fig. 5 is a second explanatory view showing the process of transporting the knitted fabric with the topping device shown in the embodiment, and shows a state in which the third shaft is moved from B to D.

Fig. 6 is a third explanatory view showing the process of transporting the knitted fabric with the topping device shown in the embodiment, and shows a state in which the third shaft is moved from D to E.

Fig. 7 is a fourth explanatory view showing the process of transporting the knitted fabric with the topping device shown in the embodiment, and shows a state in which the third shaft is moved from E to H.

Fig. 8 is a fifth explanatory view showing the process of transporting the knitted fabric with the topping device shown in the embodiment, where Fig. 8(a) shows the positional relationship of the topping needle, the magazine needle, and the knitted fabric transporting device in the case where the knitted fabric transporting device is operated from the state of Fig. 7, Fig. 8(b) shows the track in the case where the third shaft is moved from H to J when pushing the knitted fabric to the root side of the magazine needle from the state of Fig. 8(a), and Fig. 8(c) shows the positional relationship of the topping needle, the magazine needle, and the knitted fabric transporting device in the case where the third shaft is at J.

DESCRIPTION OF SYMBOLS

[0018]

1	flat knitting machine
2	topping device
21	first shaft
22	second shaft
23	third shaft
201	first arm pair
202	second arm pair
m1 to m4	motor
C2 to c4	power transmission member

25	topping needle
3	magazine
31	magazine needle
32	magazine bar
4	knitted fabric transporting device
41	knitted fabric transport plate
410	base portion
415	projecting portion
44	fourth shaft
5	needle bed
51	front needle bed
52	back needle bed
50	carriage
501	needle main body
502	slider
6	yarn feeding member
61	rail
7	supporting member
71	supporting arm
72	supporting columnar part
8	knitting yarn
80	knitted fabric
8c	cone
8t	tension equipment

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] Embodiments of the present invention will be hereinafter described with reference to the drawings.

[0020] Fig. 1 shows a front view of a flat knitting machine including a topping device of the present invention. Fig. 2 shows a left side view of the flat knitting machine including the topping device of the present invention.

[0021] A flat knitting machine 1 is a machine for knitting a knitted fabric by feeding a knitting yarn 8 from a yarn feeding member 6 to a needle bed gap between a pair of front and back needle beds 5 (front needle bed 51, back needle bed 52) arranged opposite to each other, and knitting a knitted fabric with the knitting needles arranged in rows in the needle beds 5. The knitting needle moves forward and backward with respect to the needle gap bed through the action of a cam system (not shown) mounted on a carriage 50 that reciprocates on the needle beds 5 to perform three knitting operations of knit, tuck, and miss, and to transfer the stitches between the front and back needle beds.

[0022] The yarn feeding member 6 receives the supply of the knitting yarn 8 fed through a tension equipment 8t and a side tension device (not shown) at the side of the flat knitting machine from a cone 8c installed at the cone stand. The yarn feeding member 6 is bridged between supporting members 7 upright arranged at both ends of the flat knitting machine 1, and is slidably attached to a plurality of rails 61 extending along the longitudinal direction of the needle beds 5 at the upper side of the front needle bed 51.

[0023] If the knitted fabric 80 is knitted using such flat

knitting machine 1, the finished knitted fabric 80 is normally sent to the lower side of the needle bed gap, and collected from the take-out port at the lower side of the flat knitting machine 1. However, when continuously knitting only the collar with the flat knitting machine 1, and linking the knitted collar to the body knitted separate from the collar in the post-step, it is convenient in linking to leave the stitches at the final course of the collar while maintaining the aligned state held at the knitting needles. The flat knitting machine 1 shown in Figs. 1 and 2 includes a topping device 2 for removing the knitted fabric 80 held at the knitting needles of the needle beds 5 from the knitting needles while maintaining the aligned state of the stitches of the final course, and a magazine 3 (omitted in Fig. 1) for receiving the knitted fabric 80 from the topping device 2 and temporarily placing the knitted fabric 80.

[0024] As shown in Fig. 2, the topping device 2 is a device that moves to remove the knitted fabric 80 held at the knitting needles of the needle beds 5, takes out the knitted fabric 80 to the upper side of the needle beds 5, and transports to the magazine 3 installed on the upper side of the yarn feeding member 6. The transfer of the knitted fabric 80 from the topping device 2 to the magazine 3 is carried out by a knitted fabric transporting device 4 arranged at the distal end of the topping device 2 (third shaft 23, to be described later). Hereinafter, the topping device 2, the magazine 3, and the knitted fabric transporting device 4 will be hereinafter described in detail, and the state of movement of the knitted fabric will also be described.

<Topping device>

[0025] The topping device 2 includes a first shaft 21, a second shaft 22, a third shaft 23, which are parallel to each other, a first arm pair 201 for connecting the first shaft 21 and the second shaft 22, a second arm pair 202 for connecting the second shaft 22 and the third shaft 23, and a plurality of topping needles 25 arranged in rows at the third shaft 23.

[0026] The first shaft 21 is bridged to extend parallel to the needle beds 5 at the upper side of the rail 61. More specifically, the first shaft 21 is one part of the supporting member 7, and extends further to the upper side than the rail 61 and is rotatably supported by a supporting arm part 71 curved to a far side of the knitting machine, which is opposite to the near side of the knitting machine where the yarn feeding members 6 are lined. That is, the first shaft 21 is arranged at the upper side of the needle bed gap side of the back needle bed 52 so as not to come in the way of the sliding of the yarn feeding member 6 and the carriage 50. The first shaft 21 rotates with respect to the supporting arm 71 by a motor m1. A motor m2 for rotating the second shaft 22, to be described later, is also arranged inside the first shaft 21.

[0027] The first arm pair 201 connecting the first shaft 21 and the second shaft 22 is a pair of I-shaped pieces

extending in a direction orthogonal to the shaft direction of the first shaft 21 from both ends of the first shaft 21. One end of each I-shaped piece is fixed to the first shaft 21, and rotates with the shaft center of the first shaft 21 as the center by rotating the first shaft 21. The length of the I-shaped piece is a length that does not run out from the flat knitting machine main body when the I-shaped piece (first arm pair 201) is rotated. A power transmission member (e.g., chain, timing belt, etc.) c2 for transmitting power of the motor m2, arranged inside the first shaft 21, is arranged inside one of the I-shaped pieces.

[0028] The second shaft 22 is rotatably supported so as to connect the end of each arm of the first arm pair 201 on the side opposite to the first shaft 21, and rotates by the driving force of the motor m2 transmitted through the power transmission member c2. A motor m3 for rotating the third shaft 23, to be described later, is incorporated at one end (right side in the plane of drawing of Fig. 1) of the second shaft 22. A motor m4 for rotating the fourth shaft 44 (see Fig. 4) of the knitted fabric transporting device 4 (see Fig. 2) is incorporated at the other end (left side in the plane of drawing of Fig. 1) of the second shaft 22.

[0029] The second arm pair 202 connecting the second shaft 22 and the third shaft 23 is a pair of L-shaped pieces extending in a direction orthogonal to the shaft direction of the second shaft 22 from the position on the inner side than the first arm pair 201 at both ends of the second shaft 22. One side of each L-shaped piece is fixed to the second shaft 22, and the other side of the L-shaped piece extends in a direction orthogonal to the shaft direction of the second shaft 22. The length of the other side of the L-shaped piece is formed shorter than the length of the first arm pair 201, so that the distal end of the second arm pair 202 and the third shaft 23 and the knitted fabric transporting device 4 attached to the second arm pair 202 do not contact the first shaft 21 supporting the first arm pair 201 when the second arm pair 202 is rotated.

[0030] The third shaft 23 is bridged parallel to the second shaft 22 so as to connect the second arm pair 202 at the end of the second arm pair 202 (other end of the L-shaped piece) on the side opposite to the second shaft 22. The third shaft 23 is rotatably supported with the shaft center of the third shaft 23 as the center, and is configured to rotate by the driving force of the motor m3 transmitted through the power transmission member c3. The topping needle 25 for picking up the knitted fabric 80 held at the needle beds 5 is fixed to the third shaft 23. The topping needle 25 is an L-shaped needle, and is arranged in rows in the shaft direction of the third shaft 23 by the number same as the knitting needles arranged in rows in the needle beds 5. The topping needle 25 has a predetermined region at the distal end side formed to a V-shaped cross-section.

[0031] Each part of the topping device is controlled by a computer so as to operate at the rotation angle and the rotation speed defined in advance from the standby po-

sition shown with a chain double dashed line of Fig. 3.

<Knitted fabric transporting device>

[0032] Furthermore, the third shaft 23 includes the knitted fabric transporting device 4 for sending the stitches of the knitted fabric 80 held at the topping needles 25 in the direction of removing from the topping needles 25. As shown in Figs. 4 and 8, the knitted fabric transporting device 4 includes the fourth shaft 44 rotatably supported by the second arm pair 202 so as to lie along the third shaft 23, a plurality of knitted fabric transport plates 41 arranged in a line in the shaft direction of the fourth shaft 44, and a motor m4 for rotating the fourth shaft 44. The knitted fabric transport plate 41 includes an annular base portion 410 with a through-hole for passing the fourth shaft 44, and a projecting portion 415 projecting radially outward from the base portion 410. Each knitted fabric transport plate 41 is arranged in a line in the fourth shaft 44 so as to be arranged between the adjacent topping needles 25, so that the knitted fabric 80 can be pushed out from the topping needles 25 with the edge of the projecting portion 415 when the fourth shaft 44 is rotated. The motor m4 is incorporated in the second shaft 22, as previously described, and rotates the fourth shaft 44 through a power transmission member c4.

<Magazine>

[0033] The knitted fabric 80 removed from the needle beds 5 with the topping device 2 is held by the magazine 3. In the present embodiment, three magazines 3 are removably attached to the supporting columnar part 72 configuring a part of the supporting member 7 and extending further to the upper side from the supporting arm 71. As shown in Figs. 6 to 8, each magazine 3 includes a magazine bar 32 extending parallel to each shaft 21 to 23, and magazine needles 31 arranged in rows in the magazine bar 32. The magazine needle 31 is arranged by the same number as the topping needle 25, and the arrangement position in the longitudinal direction of the magazine bar 32 corresponds on one to one to the arrangement position of the topping needle 25 in the shaft direction of the fourth shaft 44. In other words, the arrangement position of the magazine needles 31 in the longitudinal direction of the magazine bar 32 also corresponds with the arrangement position of the knitting needles in the longitudinal direction of the needle bed. The magazine needle 31 has a predetermined region at the distal end side formed to a reverse V-shaped cross-section, so that the V-shaped distal end of the topping needle 25 can be accommodated in the reverse V-shaped groove. The topping device 2 of the present embodiment has a configuration including three shafts 21, 22, 23 and two sets of arm pairs 201, 202, and thus the transporting range of the knitted fabric is wide, and the arrangement position of the magazine 3 can be arbitrarily selected in the range the topping needle 25 can be reached.

<Transport process of knitted fabric using topping device>

[0034] The process of transporting the knitted fabric with the topping device having the above configuration will be hereinafter described with reference to Figs. 3 to 8. Figs. 3, and 5 to 8 are explanatory views describing the process of transporting the knitted fabric with the topping device with elapse of time, and Fig. 4 is an enlarged view of the vicinity of the needle bed gap in Fig. 3. In Figs. 3, and 5 to 8, the track of the center axis of the second shaft 22 and the track of the center axis of the third shaft 23 are shown with a chain dashed line in the figure, and an alphabet is denoted to the position important in the track of the third shaft 23. Furthermore, in Figs. 3 to 8, the illustration of the configuration of the flat knitting machine not relevant to the transportation of the knitted fabric 80 such as the yarn feeding member is omitted.

[0035] As shown in Fig. 3, in the present embodiment, an example of moving to get the knitted fabric 80 (e.g., collar etc.) held at the back needle bed 52 with the topping device 2 at the standby position (shown with chain double-dashed line in the figure) will be described.

[0036] First, as shown in Fig. 4, after the knitting of the knitted fabric 80 is finished, the slider 502 of the knitting needle is moved to the needle bed gap, and the stitches of the knitted fabric 80 are removed from the hook of the needle main bodies 501 to be held at the sliders 502. The knitting needle in the present embodiment uses a compound needle (see e.g., Japanese Patent No. 2917146) configured by the slider 502 including two blades having a tongue at the distal end and the needle main body 501 having a hook at the distal end, so that the stitches held at the sliders 502 are spread with the two sliders 502.

[0037] The topping device 2 at the standby position shown with a chain double-dashed line in Fig. 3 is driven to get the knitted fabric 80. Specifically, the L-shaped distal end of the topping needle 25 is arranged in a horizontal state at substantially right beside the stitches by rotating each arm pair 201, 202 and moving the third shaft 23 from S to A. The distal end of the topping needle 25 is then horizontally moved and inserted between the two sliders 502 by moving the third shaft 23 from A to B (see also Fig. 4).

[0038] The slider 502 is then pulled into the back needle bed 52 to completely remove the knitted fabric 80 from the knitting needles so that the stitches of the knitted fabric 80 are held at the topping needles 25, and furthermore, the knitted fabric 80 transferred to the topping needles 25 is prevented from being caught at the knitting needles when transporting the knitted fabric 80 to the magazine, to be described later. Then, as shown in Fig. 5, the third shaft 23 is rotated in the counterclockwise direction so that the stitches of the knitted fabric 80 are at the bent position of the topping needles 25, whereby the knitted fabric 80 cannot be removed from the topping needles 25 when transporting the knitted fabric 80. After

the third shaft 23 is pulled up substantially perpendicularly (moved from B to C) and then moved to D, the topping device 2 is returned to a state of substantially standby position. The knitted fabric 80 is less likely to be caught at the knitting needle in the process of moving the third shaft 23 to D by once pulling up the third shaft 23 perpendicularly. Each configuration of the topping device 2 is controlled so that the orientation of the topping needle 25 is maintained and the knitted fabric 80 cannot be removed from the topping needle 25 so that the stitches of the knitted fabric 80 are always at the bent position of the topping needle 25 even during the transportation of the knitted fabric 80, to be described later.

[0039] Furthermore, as shown in Fig. 6, the arm pairs 201, 202 are rotated to move the third shaft 23 from D to E so that the knitted fabric 80 is at the vicinity of the magazine 3 of three stages. In the present embodiment, the operation of providing the knitted fabric 80 to the magazine 3 positioned at the middle stage will be described as below, but the topping device 2 once takes the arrangement, shown with a solid line, of Fig. 6 where the third shaft 23 is at the position of E even when providing the knitted fabric 80 to the upper stage and the lower stage.

[0040] Finally, as shown in Figs. 7 and 8, the knitted fabric 80 is transferred from the topping needles 25 to the magazine needles 31 of the magazine 3. More specifically, the third shaft 23 is moved from E to F and the third shaft 23 is rotated, and the distal end portion of the topping needle 25 is arranged at a position parallel to the magazine needle 31 and lower than the magazine needle 31. The third shaft 23 is then moved from F to G so that the topping needle 25 and the magazine needle 31 overlap when seen in top view. In this case, the topping needle 25 is at a position lower than the magazine needle 31, and thus the needles do not contact and have no damage. The third shaft 23 is thereafter moved from G to H so that the V-shaped distal end of the topping needle 25 is fitted to the reverse V-shaped groove of the magazine needle 31. The stitches can be smoothly guided from the topping needles 25 to the magazine needles 31 since the needles 25, 31 are coupled without substantially any step difference due to such fit-in.

[0041] As shown in Fig. 8(a), the knitted fabric transport plate 41 of the knitted fabric transporting device 4 is rotated in the counterclockwise direction to push the knitted fabric 80 towards the magazine needle 31 side with the side edge of the projecting portion 415 and transfer the stitches of the knitted fabric 80 held at the topping needles 25 to the magazine needles 31.

[0042] As shown in Figs. 8(b), 8(c), the third shaft 23 is moved in the order of H → G → F → I → J to further push the stitches of the knitted fabric 80 towards the root side of the magazine needle 31 with the side edge of the projecting portion 415. The pushing amount of the knitted fabric 80 can be controlled by adjusting the drive amount of each configuration of the topping device 2. With the configuration of changing the pushing amount of the knit-

ted fabric 80, the knitted fabric 80 can be held according to the transporting order while effectively using the needle length of the magazine needle 31 from the far side (root side) towards the near side (distal end side) of the magazine needle 31 when providing a plurality of knitted fabrics 80 to one magazine 3. The topping needle 25 is at above the magazine needle 31 and thus the needles 25, 31 do not contact and are not damaged when the third shaft 23 is at the positions of I, J.

[0043] As shown in Fig. 8(b), after the pushing of the knitted fabric 80 is finished, the position of the third shaft 23 is returned to E, the entire topping device is returned to the standby position (arrangement shown with a chain double-dashed line of Fig. 3), and the transportation of the knitted fabric 80 is completed. The knitting of the knitted fabric 80 with the needle beds 5 and the transportation of the knitted fabric 80 to the magazine 3 are repeated, where the magazine 3 is detached from the flat knitting machine 1 and supplied to the linking step when a predetermined number of knitted fabrics 80 are held at the magazine 3.

[0044] The topping device arranged in the flat knitting machine described above does not require an installation space greater than the installation space of the flat knitting machine without the topping device since the track of each part does not run out from the outline of the main body of the flat knitting machine. Furthermore, in the present embodiment, an example of removing the knitted fabric from the back needle bed has been described, but the topping device of the present invention can also remove the knitted fabric held at the front needle bed since the track of each part of the device can be freely changed.

[0045] The embodiment of the present invention is not limited to the embodiment described above, and may be appropriately changed within a scope not deviating from the gist of the present invention. For instance, describing with reference to Fig. 2, the position of the magazine 3 may be arranged on the cone 8c side or the first shaft 21 may be arranged at the position of the second shaft 22 in the figure. Regardless of which arrangement is selected, the topping device of the present invention is configured from three shafts and two sets of arm pairs, and hence the movement region of the topping needle for holding the knitted fabric is very wide and the knitted fabric can be transported to the magazine.

INDUSTRIAL APPLICABILITY

[0046] When continuously knitting a plurality of knitted fabrics to be performed with linking in the post-step with the flat knitting machine, the topping device of the present invention is suitably used to hold the knitted fabric at the magazine while maintaining the aligned state of stitches in the final course of the knitted fabric.

Claims

1. A topping device for removing a knitted fabric, which is knitted with a flat knitting machine including a needle bed in which a plurality of knitting needles are arranged in rows, from the knitting needles while maintaining an aligned state of stitches held at the knitting needles, and transporting the knitted fabric, the topping device comprising:

a first shaft arranged in parallel to the needle bed on the upper side of the needle bed of the flat knitting machine;

a first arm pair extending in a direction orthogonal to a shaft direction of the first shaft from both ends of the first shaft, and rotating with a shaft center of the first shaft as a center;

a second shaft bridged in parallel to the first shaft to connect distal ends of the first arm pair;

a second arm pair extending in a direction orthogonal to a shaft direction of the second shaft from both ends of the second shaft, and rotating with a shaft center of the second shaft as a center;

a third shaft bridged in parallel to the first shaft to connect distal ends of the second arm pair; and

a topping needle arranged in rows at the third shaft.

2. The topping device according to claim 1, wherein the third shaft is further rotatably supported with respect to the second arm pair.

3. The topping device according to claim 1 or 2, wherein the flat knitting machine includes a supporting member upright arranged at both ends of the flat knitting machine, and a rail, bridged to connect the supporting members, for slidably supporting a yarn feeding member for feeding a knitting yarn to the knitting needle; and the first shaft is bridged to connect the supporting members.

4. The topping device according to any one of claims 1 to 3, wherein the second arm pair is arranged on an inner side than an area where the first arm pair is connected in the second shaft; and a length of the second arm pair is formed shorter than a length of the first arm pair.

Fig. 1

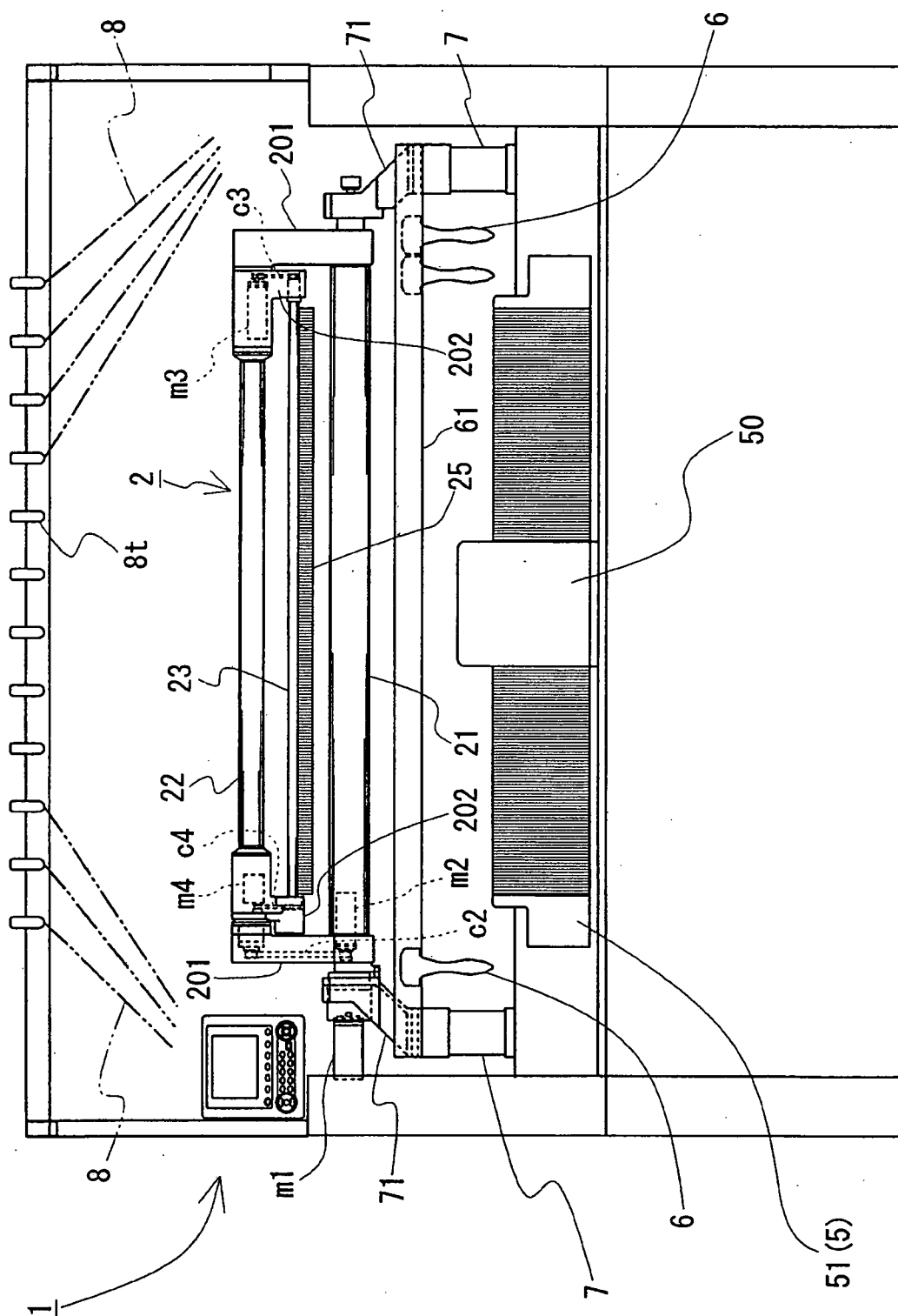


Fig. 2

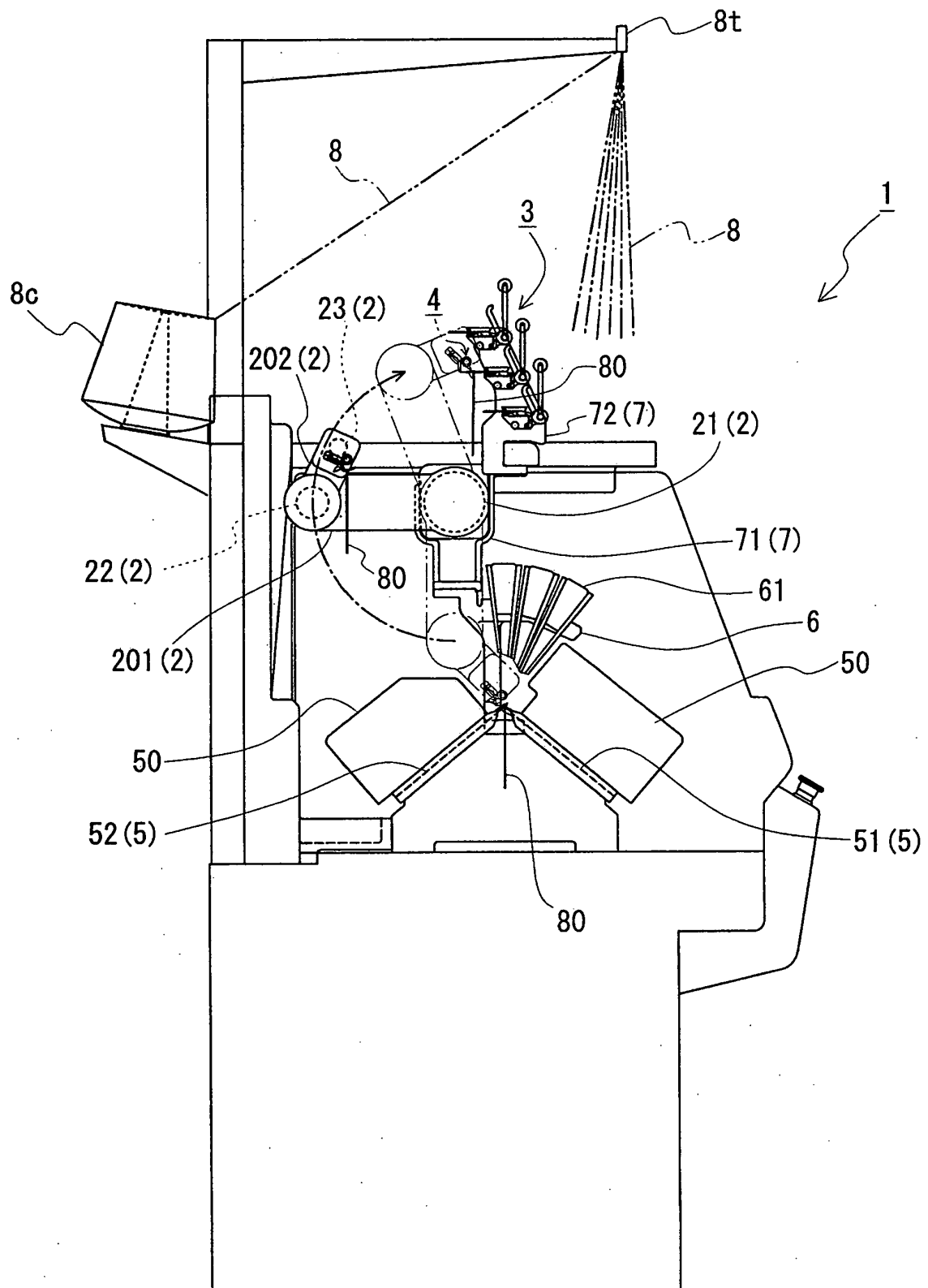


Fig. 3

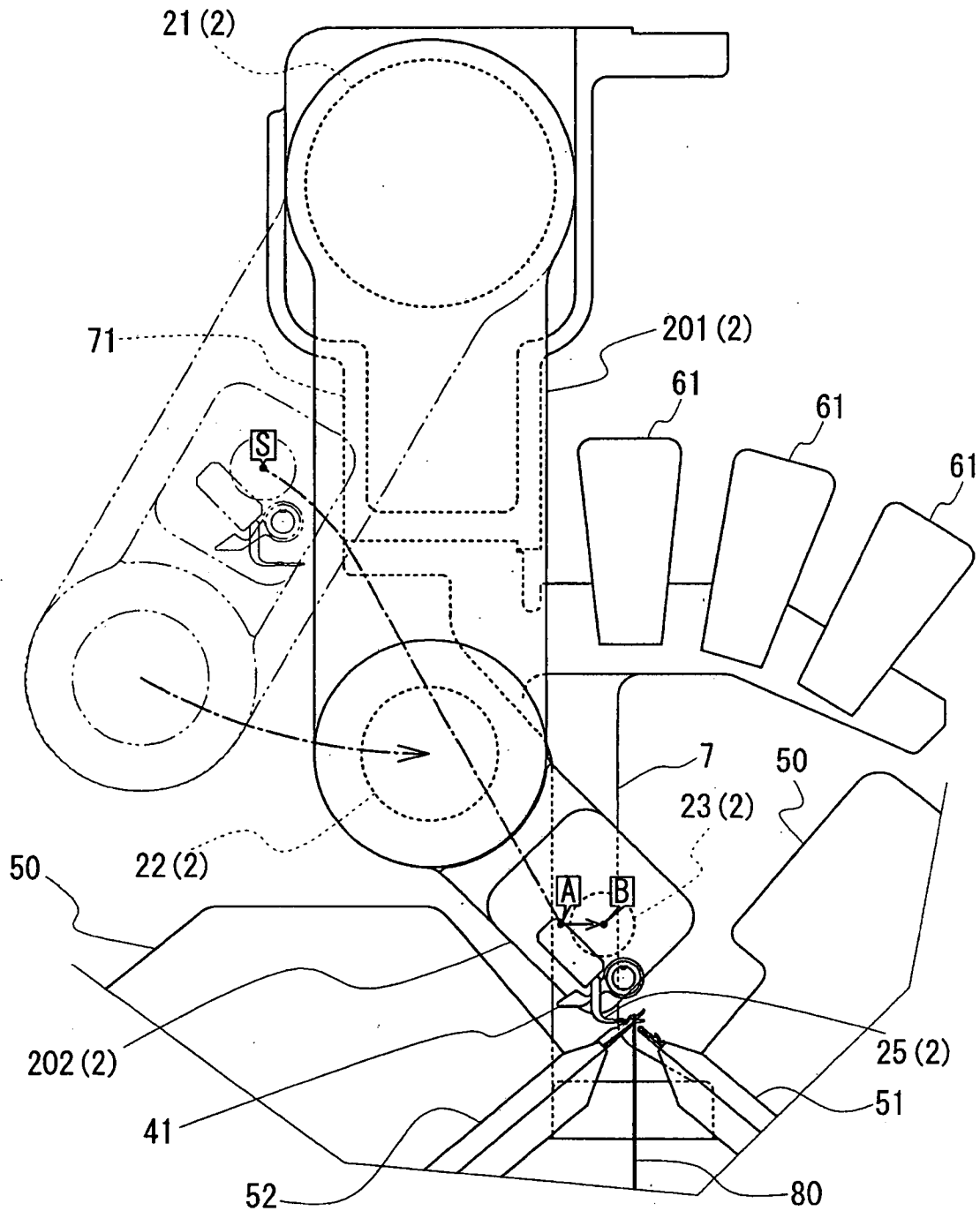


Fig. 4

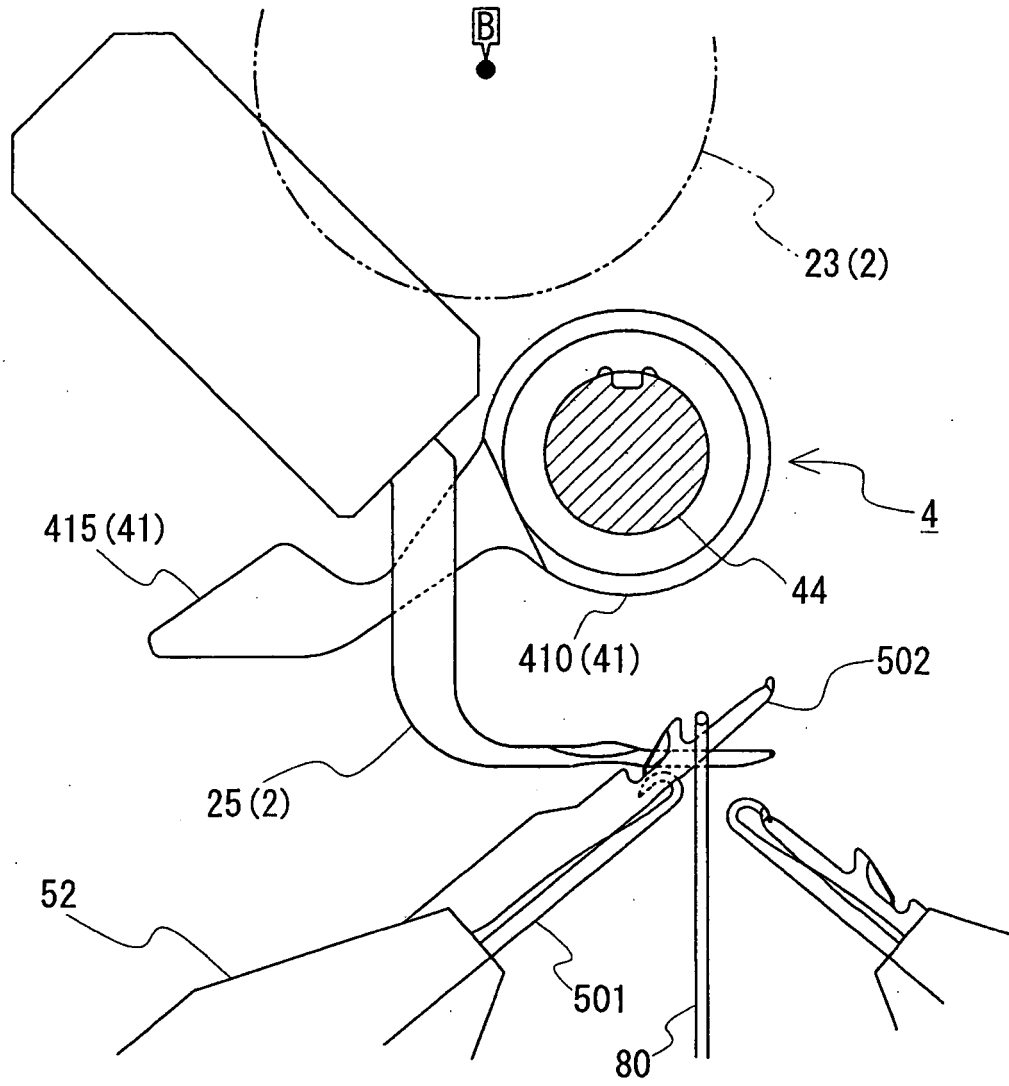


Fig. 5

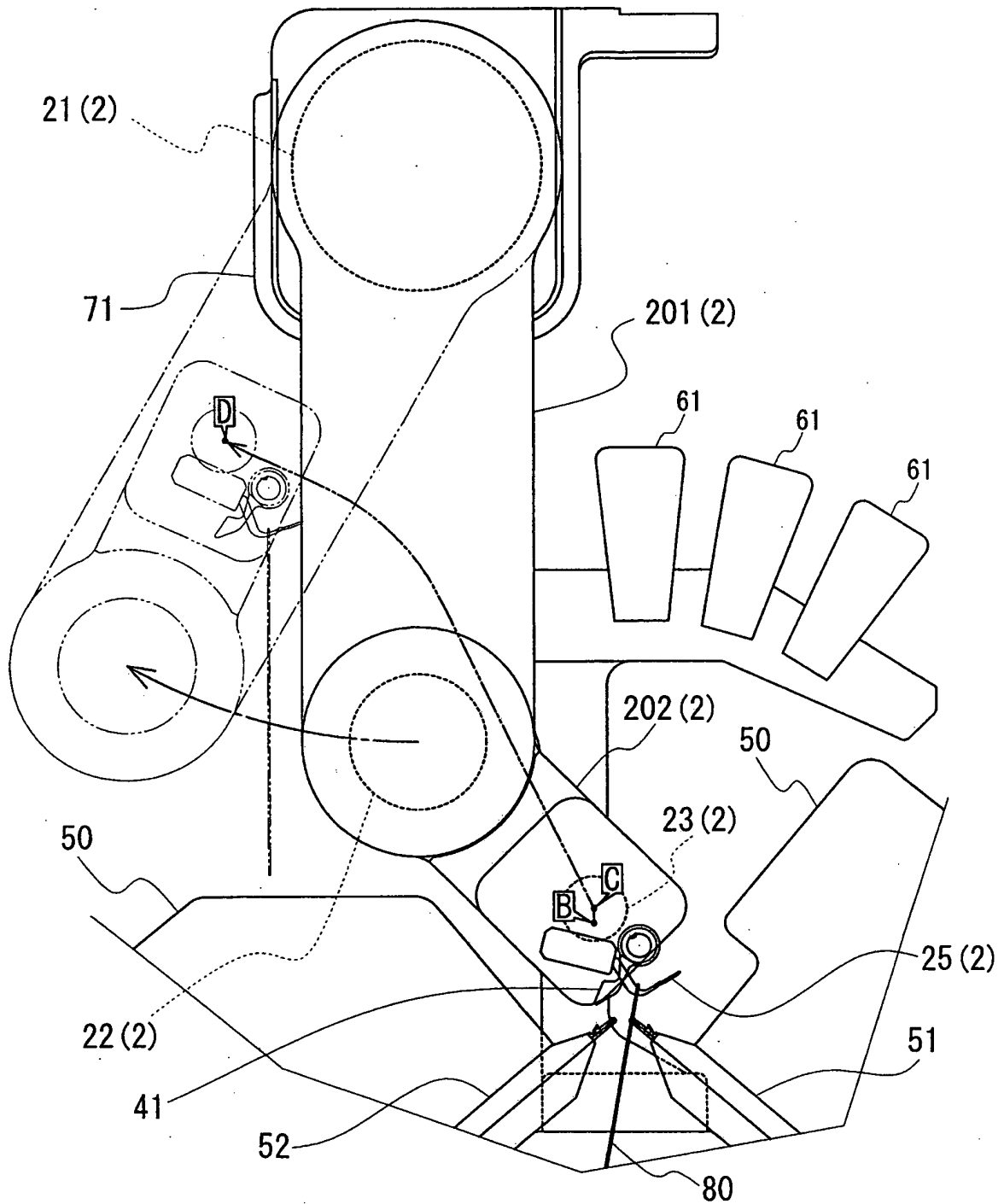


Fig. 6

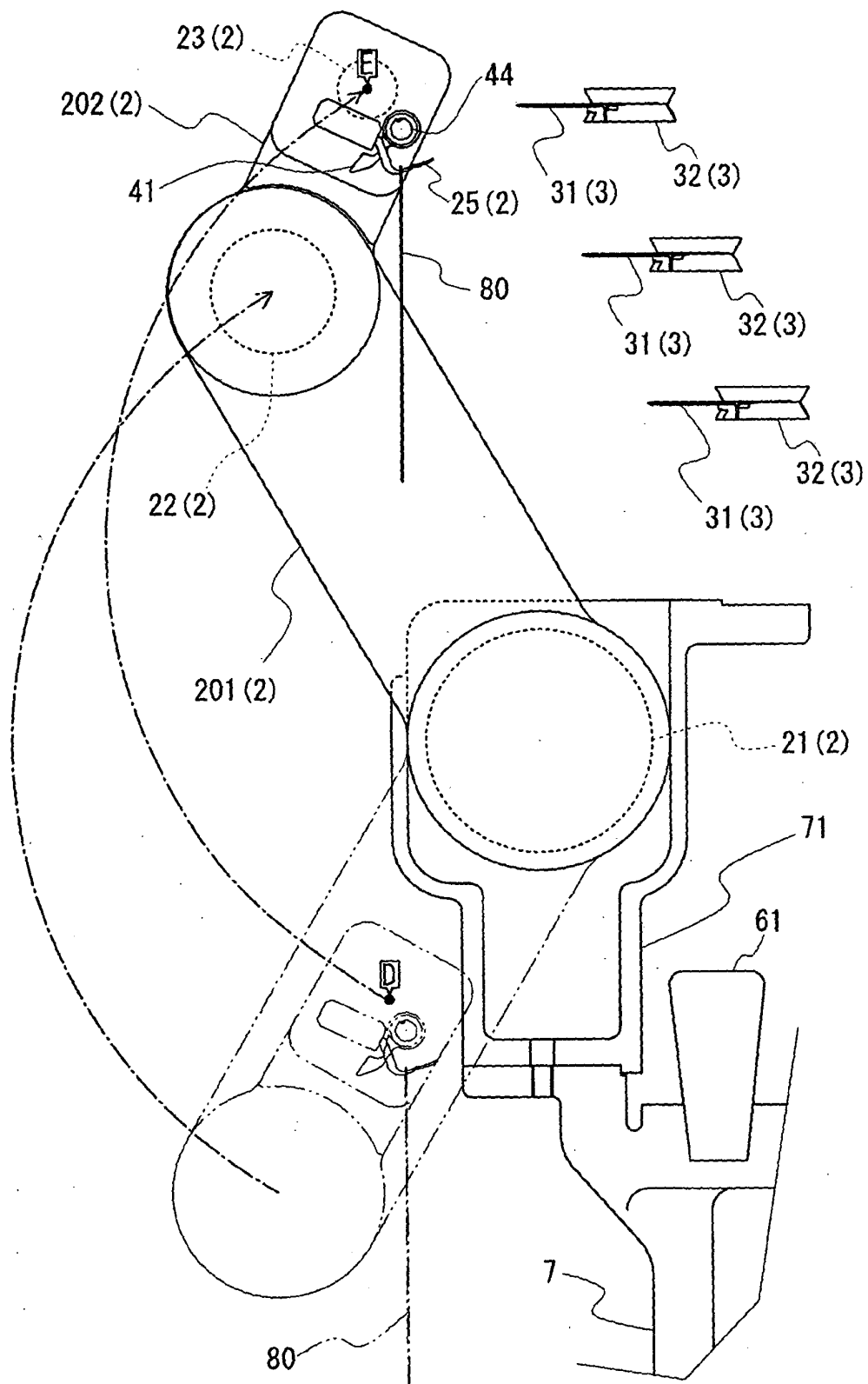
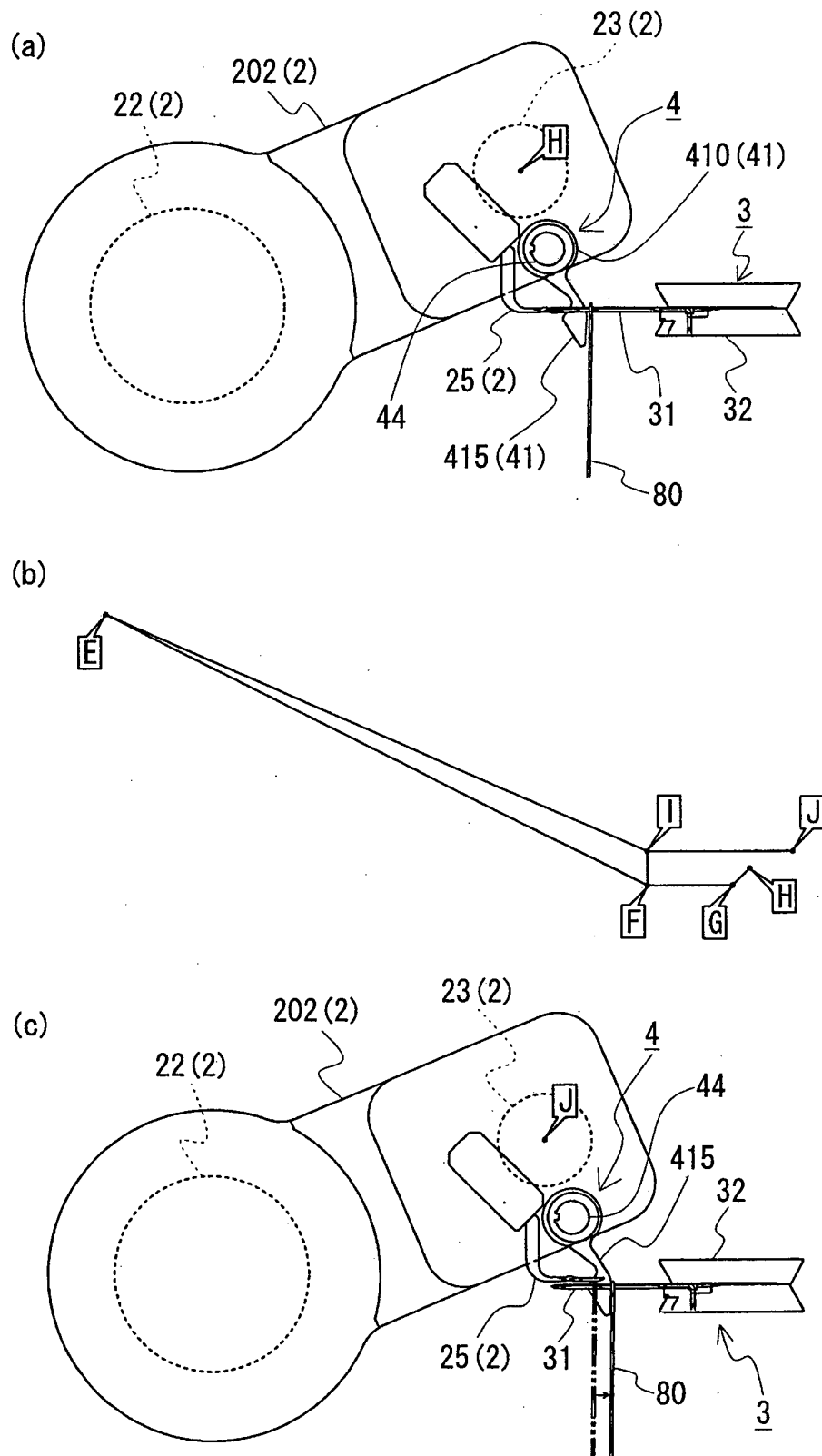


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/003672

A. CLASSIFICATION OF SUBJECT MATTER

D04B15/02 (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)

D04B11/24, 15/02-15/04, 15/90

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	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3446042 A (ARMES DE GUERRE FAB NAT), 27 May, 1969 (27.05.69), & GB 1165781 A & DE 1635790 A & CH 462366 A & NL 6701148 A	1-4
A	US 2186023 A (WILDMAN MFG CO.), 09 January, 1940 (09.01.40), (Family: none)	1-4
A	US 3563063 A (COTTON LTD. W), 16 February, 1971 (16.02.71), & GB 1229788 A & FR 1601753 A & CH 499651 A	1-4
A	US 3633385 A (ARMES DE GUERRE FAB NAT), 11 January, 1972 (11.01.72), & GB 1299221 A & BE 728048 A	1-4

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

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
09 January, 2009 (09.01.09)Date of mailing of the international search report
20 January, 2009 (20.01.09)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/003672

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 62-54900 B2 (Corah Ltd.), 17 November, 1987 (17.11.87), & US 4336697 A & EP 10982 A1	1-4
A	DE 2005439 A (Fabrique Nationale d'Armes de Guerre S.A., Herstal), 19 November, 1970 (19.11.70), & CH 507399 A	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3446042 A [0005]
- DE 2005439 [0005]
- JP 2917146 B [0036]