(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 228 474 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.10.2014 Bulletin 2014/41

(21) Application number: **08866793.6**

(22) Date of filing: **09.12.2008**

(51) Int Cl.:
D04B 15/94 *(2006.01)* ***D04B 15/20*** *(2006.01)*
D04B 15/02 *(2006.01)*

(86) International application number:
PCT/JP2008/003673

(87) International publication number:
WO 2009/084158 (09.07.2009 Gazette 2009/28)

(54) **FABRIC TRANSFER DEVICE**

STOFFÜBERTRAGUNGSGERÄT

DISPOSITIF DE TRANSFERT DE TISSU

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR

(30) Priority: **28.12.2007 JP 2007340463**

(43) Date of publication of application:
15.09.2010 Bulletin 2010/37

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EP 2 228 474 B1

Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

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

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 low 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, the 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. When the knitted fabric is continuously transported to the magazine by the topping device, and a predetermined number of the knitted fabrics are provided to the magazine, the magazine itself is provided to the linking step as a whole to efficiently complete the clothing.

[0005] When transporting the knitted fabric to the magazine with such topping device, a configuration of smoothly transferring the knitted fabric from the topping needle to the magazine needle is required. For instance, in Fig. 1 of Patent Document 1, a transporting device (11) of the knitted fabric is arranged as a separate member from a magazine (10) on the magazine (10) side. In Fig. 5 of Patent Document 2, a device (49) is arranged near the magazine needle (5) to push the knitted fabric held at the relevant needle (.5) towards the back.

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, each transporting device of the knitted fabric described in the documents is arranged fixed in the vicinity of the magazine needle so as to be placed over the magazine needle, and thus the magazine with the knitted fabric becomes troublesome to handle. In particular, the magazine is hard to remove, as the transporting device becomes a hindrance when providing the knitted fabric provided to the magazine to the linking step.

[0007] It is an object of the present invention to provide a knitted fabric transporting device capable of moving the knitted fabric from the topping needles of the topping device to the magazine needles of the magazine, and facilitating the handling of the magazine.

MEANS FOR SOLVING THE PROBLEMS

[0008] The present invention relates to a flat knitting machine comprising a topping device, a magazine and a knitted fabric transporting device for moving stitches from topping needles to magazine needles when removing the stitches with the topping device including the topping needles for holding the stitches of a knitted fabric, which is knitted with a needle bed of the flat knitting machine, from the needle bed and transferring to the magazine needles. The knitted fabric transporting device of the present invention includes a rotation shaft rotatably supported by the topping device near the

topping needles; a plurality of knitted fabric transport plates arranged in a line in the rotation shaft; and a drive mechanism for rotating the rotation shaft. The plurality of knitted fabric transport plates are interposed between the adjacent topping needles by rotating the rotation shaft to send out the knitted fabric from the topping needles to the magazine needles with an edge of the knitted fabric transport plates.

[0009] In one aspect of the present invention, at least one of the plurality of knitted fabric transport plates is preferably arranged with the edges shifted with respect to the other knitted fabric transport plates to have a time difference in the movement of the knitted fabric from the topping needles to the magazine needles in a lateral direction of the stitches held at the topping needles. Representatively, such a configuration includes two configurations, a configuration of arranging the knitted fabric transport plates of the same shape such that the edges are shifted, and a configuration of using the knitted fabric transport plates of different shapes.

[0010] When forming at least one of the plurality of knitted fabric transport plates to have a different shape from the other knitted fabric transport plates to have a time difference in the movement of the knitted fabric by shifting the edges of the knitted fabric transport plates arranged in a line; a common edge having the same shape is preferably formed in each knitted fabric transport plate having different shapes so that the stitches of the knitted fabric moved to the magazine needle are finally aligned in the lateral direction of the stitches.

EFFECTS OF THE INVENTION

[0011] According to the knitted fabric transporting device of the present invention, the configuration near the magazine, which is the receiving side of the knitted fabric, can be simplified, and consequently, a free space forms near the magazine. Thus, attachment and detachment of the magazine to the flat knitting machine are facilitated, and the linking step of the knitted fabric in the post-step can be smoothly performed. Furthermore, a plurality of magazines can be provided to one flat knitting machine using the free space formed near the magazine. Moreover, it is economical even if a plurality of magazines are arranged with respect to one flat knitting machine, as only one knitted fabric transporting device is required.

[0012] Arranging at least one of the knitted fabric transport plates of the plurality of knitted fabric transport plates arranged in a line such that the edge is shifted from the other knitted fabric transport plates results in a time difference in the movement of the knitted fabric in the lateral direction of the stitches held at the topping needles by arranging. According to such a configuration, the load on the drive mechanism for rotating the rotation shaft can be alleviated since the stitches of knitted fabric held at the topping needles are transported to the magazine needles over plural times. A more compact drive mechanism thus can be adopted, and the load on the topping device, to which the knitted fabric transporting device of the present invention is attached, can be reduced. Furthermore, the topping device can be miniaturized by reducing the load on the topping device.

[0013] The stitches of the knitted fabric held at the magazine needles can be finally aligned in the lateral direction of the stitches when the knitted fabric is moved to the magazine by using the plates having different shapes and forming a common edge having the same shape in each knitted fabric transport plate having different shapes when shifting the edges of the knitted fabric transport plates arranged in a line. If the stitches of the knitted fabric provided to the magazine are aligned in the lateral direction of the stitches, the stitches of the knitted fabrics can be easily corresponded when linking the knitted fabric held at the magazine and the knitted fabric knitted separate from the relevant knitted fabric in the post-step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

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(a) is a front view of five knitted fabric transport plates having different shapes, and Fig. 3(b) to 3(f) are explanatory views showing a state of moving the knitted fabric with the knitted fabric transporting device including the plates shown in Fig. 3(a).

Fig. 4 is a first 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 S to B.

Fig. 5 is an enlarged view of the vicinity of the needle bed gap in Fig. 4.

Fig. 6 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. 7 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. 8 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. 9 is a fifth explanatory view showing the process of transporting the knitted fabric with the topping device shown in the embodiment, where Fig. 9(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. 8, Fig. 9(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 form the state of Fig. 9(a), and Fig. 9(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

[0015]

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, 41A, 41B, 41C, 41D, 41E	knitted fabric transport plate
410	base portion
411	fit-in portion
415	projecting portion
44	fourth shaft (rotation shaft)
42A, 42B, 42C, 42D, 42E	pushing edge
43	common edge
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

DETAIL DESPCRIPTION OF THE PREFERRED EMBODIMENT

[0016] Embodiments of the present invention will be described below with reference to the drawings.

[0017] Fig. 1 is a front view of a flat knitting machine attached with a topping device including a knitted fabric transporting device of the present invention, and Fig. 2 shows a left side view of the flat knitting machine.

[0018] 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.

[0019] 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.

[0020] 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 when 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, 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, and a knitted fabric transporting device 4 (omitted in Fig. 1) for moving a knitted fabric from a topping device 2 to a magazine 3.

[0021] 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>

[0022] 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.

[0023] 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 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.

[0024] 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.

[0025] 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. 5) 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.

[0026] 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.

[0027] 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.

[0028] 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 position shown with a chain double dashed line of Fig. 4.

<Knitted fabric transporting device>

[0029] 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 Fig. 9, the knitted fabric transporting device 4 includes the fourth shaft (rotation 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 drive mechanism (motor m4 shown in Fig. 1) for rotating the fourth shaft 44. The motor m4 is incorporated in the second shaft 22 as described above, and rotates the fourth shaft 44 through the power transmission member c4.

[0030] The knitted fabric transport plate 41 is a plate-shaped piece including 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 (see also Fig. 3 and Fig. 9). Each knitted fabric transport plate 41 is arranged in a line in the fourth shaft 44 so as to be interposed between the adjacent topping needles 25 when the fourth shaft 44 is rotated, so that the knitted fabric 80 can be pushed out from the topping needle 25 with the edge of the projecting portion 415.

[0031] In the present embodiment, five knitted fabric transport plates 41A to 41E having different shapes shown in Fig. 3(a) are used. The base portion 410 of each knitted fabric transport plate 41A to 41E includes a fit-in portion 411 so that the projecting direction of the projecting portion 415 is regulated when the knitted fabric transport plate 41 is fitted to the fourth shaft 44. The projecting portion 415 includes pushing edges 42A to 42E for pushing the knitted fabric 80 held at the topping needles 25 and sending the knitted fabric 80 in the direction removing from the topping needles 25 when the knitted fabric transport plate 41 is rotated, and a common edge 43 for further pushing the sent knitted fabric 80 to perform the ultimate positioning of the knitted fabric 80 in the magazine needle 31. In the knitted fabric transport plate 41E, the same area of the projecting portion 415 serves as both the pushing edge 42E and the common edge 43.

[0032] In the present embodiment, twelve knitted fabric transport plates of the same shape are continuously lined to form one unit, where the unit in which twelve plates configure one unit is arranged to line in the order of unit of the knitted fabric transport plate 41A $\rightarrow$ 41B $\rightarrow$ 41C $\rightarrow$ 41D $\rightarrow$ 41E $\rightarrow$ 41D $\rightarrow$ 41C $\rightarrow$ 41B ... from the left side of Fig. 1. The arrangement order of the unit is not limited thereto, and the number of knitted fabric transport plates configuring the unit is also not particularly limited. The arrangement may be such that the adjacent knitted fabric transport plates are in different shapes. Furthermore, the number of knitted fabric transport plates of different shapes can be arbitrarily selected, or the shapes of all knitted fabric transport plates may be the same.

[0033] If five knitted fabric transport plates 41A to 41E of different shapes are arranged in the fourth shaft 44, the pushing edges 42A to 42E of each knitted fabric transport plate are shifted and the common edges 43 are aligned, as shown in Fig. 3(b). When the knitted fabric transport plates 41A to 41E are rotated in this state, the pushing edge 42A of the knitted fabric transport 41A first contacts the knitted fabric 80 and sends out the knitted fabric 80 (see Fig. 3(c)). When the knitted fabric transport plates 41A to 41E are further rotated, the portion on the nearside in the plane of drawing of the knitted fabric 80 is sent out by the pushing edges 42B, 42C of the knitted fabric transport plates 41B, 41C positioned on the nearside in the plane of drawing than the knitted fabric transport plate 41A, as shown in Figs. 3(d) and (e). Finally, a state in which the knitted fabric 80 is substantially contacts the common edge 43 of each plate 41A to 41E, that is, a state in which the stitches of the knitted fabric 80 are aligned in the vertical direction in the plane of drawing is obtained (see Fig. 3(f)).

[0034] As described above, shifting the pushing edges 42A to 42E of the lined knitted fabric transport plates 41A to 41E results in a time difference to the movement of the knitted fabric 80 in the direction the stitches of the knitted fabric 80 are lined. That is, with the above configuration, the stitches held at the topping needles 25 can be sequentially transferred rather than being transferred all at once to the magazine needle 31, and thus the load on the drive mechanism (motor m4 of Fig. 1) for rotating the knitted fabric transport plates 41A to 41E can be reduced. Therefore, a small motor can be used for the drive mechanism for rotating the knitted fabric transport plates 41A to 41E, and enlargement of the topping device 2 including the knitted fabric transporting device 4 can be avoided.

<Magazine>

[0035] 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. 7 to 9, 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 arranged 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>

[0036] The process of transporting the knitted fabric with the topping device having the above configuration will be hereinafter described with reference to Figs. 4 to 9. Figs. 4, and 6 to 9 are explanatory views describing the process of transporting the knitted fabric with the topping device with elapse of time, and Fig. 5 is an enlarged view of the vicinity of the needle bed gap in Fig. 4. In Figs. 4, and 6 to 9, 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. 4 to 9, 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. Only the knitted fabric transport plate 41A shown in Fig. 3 is representatively illustrated for the knitted fabric transport plate 41 in the figure.

[0037] As shown in Fig. 4, 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.

[0038] First, as shown in Fig. 5, 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 body 501 to be held at the slider 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 slider 502 are spread with the two sliders 502.

[0039] The topping device 2 at the standby position shown with a chain double-dashed line in Fig. 4 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. 5).

[0040] 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 kitting needles when transporting the knitted fabric 80 to the magazine, to be described later. Then, as shown in Fig. 6, 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 needles 25 is maintained and the knitted fabric 80 cannot be removed from the topping needles 25 so that the stitches of the knitted fabric 80 are always at the bent position of the topping needles 25 even during the transportation of the knitted fabric 80, to be described later.

[0041] Furthermore, as shown in Fig. 7, 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. 7 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.

[0042] Finally, as shown in Figs. 8 and 9, 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 needle 25 to the magazine needle 31 since the needles 25, 31 are coupled without substantially any step difference due to such fit-in.

[0043] As shown in Fig. 9(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 pushing edge 42 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. In this case, the common edge 43 substantially contacts the knitted fabric 80. Although not shown in Fig. 9, the common edges 43 of all knitted fabric transport plates 41A to 41E lined in the fourth shaft 44 are aligned, as described with reference to Fig. 3.

[0044] Furthermore, as shown in Figs. 9(b) and 9(c), the stitches of the knitted fabric 80 are further pushed towards the root side of the magazine needle 31 with the common edge 43 by moving the third shaft 23 in the order of H $\rightarrow$ G $\rightarrow$ F $\rightarrow$ I $\rightarrow$ J. In this case, all the stitches held at the magazine needles 31 can be pushed in a state aligned in the lateral direction of the stitches since the common edges 43 of the knitted fabric transport plate 41 arranged in a line are aligned. The additional pushing is carried out only by the drive of the arm of the topping device 2, and thus load does not apply to the drive mechanism of the knitted fabric transporting device 2. The pushing amount of the knitted fabric 80 can be controlled by adjusting the drive amount of each configuration of the topping device 2.

[0045] Each knitted fabric 80 can be held according to the transporting order while effectively utilizing the needle length of the magazine needle 31 from the far side (root side) to the near side (distal end side) of the magazine needle 31 when providing a plurality of knitted fabrics to one magazine 3 by changing the pushing amount of the knitted fabric 80 in further pushing the stitches of the knitted fabric 80 with the common edge 43. 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 I, J.

[0046] As shown in Fig. 9(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. 4), 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.

[0047] The knitted fabric transporting device 4 of the flat knitting machine 1 described above is arranged in the topping device 2, and thus is arranged at a position distant from the magazine 3 when the transportation of the knitted fabric 80 from the needle beds 5 of the flat knitting machine 1 to the magazine 3 is finished. Thus, the vicinity of the magazine 3 becomes a free space, whereby the magazine 3 can be easily detached from the flat knitting machine 1, and the magazine 3 can be easily attached. Furthermore, since the vicinity of the magazine 3 has a free space as in the present embodiment, a plurality of magazines 3 can be arranged and numerous knitted fabrics 80 can be provided to the plurality of magazines 3. Furthermore, since only one knitted fabric transporting device 4 is required even if a plurality of magazines 3 are arranged, the trouble, time, and cost of arranging a plurality of knitted fabric transporting devices 4 can be reduced.

INDUSTRIAL APPLICABILITY

[0048] The knitted fabric transporting device of the present invention is suitably used to move the knitted fabric from the topping device to the magazine.

Claims

1. A flat knitting machine (1) comprising a topping device (2), a magazine (3) and a knitted fabric transporting device (4) for moving stitches from topping needles (25) to magazine needles (31) when removing the stitches with the topping device (2), including the topping needles (25) for holding the stitches of a knitted fabric, which is knitted with a needle bed (5) of the flat knitting machine (1), from the needle bed (5) and transferring them to the magazine needles (31), **characterized in that** the knitted fabric transporting device (4) comprises:

a rotation shaft (44) rotatably supported by the topping device (2) near the topping needles (25);
a plurality of knitted fabric transport plates (41) arranged in a line on the rotation shaft (44); and
a drive mechanism for rotating the rotation shaft (44);

wherein

the plurality of knitted fabric transport plates (41) is interposed between the adjacent topping needles (25) by rotating the rotation shaft (44) to send out the knitted fabric from the topping needles (25) to the magazine needles (31) with the edges of the knitted fabric transport plates (4).

2. The flat knitting machine according to claim 1, wherein at least one of the plurality of knitted fabric transport plates (41) is arranged with the edge shifted with respect to the other knitted fabric transport plates (41) to have a time difference in the movement of the knitted fabric from the topping needles (25) to the magazine needles (31) in a lateral direction of the stitches held at the topping needles (25).

3. The flat knitting machine according to claim 1 or 2, wherein
at least one of the plurality of knitted fabric transport plates (41) has a different shape from the other knitted fabric transport plates (41); and
a common edge having the same shape is formed in each of the knitted fabric transport plates (41) having different shapes so that the stitches of the knitted fabric moved to the magazine needles (31) are finally aligned in the lateral direction of the stitches.

Patentansprüche

1. Flachstrickmaschine umfassend eine Übertragungs(Topping)-vorrichtung (2), ein Magazin (3) und eine Gestrickfördervorrichtung (4) zum Bewegen von Maschen von Übertragungsnadeln (25) zu Magazinnadeln (31), wenn die Maschen mit der Übertragungsvorrichtung (2) entfernt werden, beinhaltend die Übertragungsnadeln (25) zum Halten der Maschen eines Gestrickes, das mit einem Nadelbett (5) der Flachstrickmaschine (1) gestrickt ist, von dem Nadelbett (5) und zum Umhängen von ihnen auf die Magazinnadeln (31),
dadurch gekennzeichnet, dass die Gestrickfördervorrichtung (4) umfasst:

eine Drehwelle (44), drehbar gelagert durch die Übertragungsvorrichtung (2) in der Nähe der Übertragungsnadeln (25);
eine Vielzahl von Gestricktransportplatinen (41), angeordnet in einer Linie auf der Drehwelle (44); und
einen Antriebsmechanismus zum Drehen der Drehwelle (44);

wobei

die Vielzahl von Gestricktransportplatinen (41) zwischen die angrenzenden Übertragungsnadeln (25) durch Drehen der Drehwelle (44) eingeschoben werden, um das Gestrick von den Übertragungsnadeln zu den Magazinnadeln (31) mit den Kanten der Gestricktransportplatinen (4) zu bringen.

2. Flachstrickmaschine nach Patentanspruch 1, wobei zumindest eine der Vielzahl von Gestricktransportplatinen (41) so angeordnet ist, dass die Kante mit Bezug auf die anderen Gestricktransportplatinen (41) verschoben ist, um einen Zeitunterschied in der Bewegung des Gestrickes von den Übertragungsnadeln (25) zu den Magazinnadeln (31) in einer lateralen Richtung der von den Übertragungsnadeln (25) gehalten Maschen zu haben.

3. Flachstrickmaschine nach Patentanspruch 1 oder 2, wobei
zumindest eine der Vielzahl von Gestricktransportplatinen (41) eine von den anderen Gestricktransportplatinen (41) verschiedene Form aufweist; und
eine gemeinsame Kante mit der gleichen Form in jeder der Gestricktransportplatinen (41) mit verschiedenen Formen ausgebildet ist, so dass die Maschen des Gestrickes, die zu den Magazinnadeln (31) bewegt werden, letztendlich in der lateralen Richtung der Maschen ausgerichtet sind.

Revendications

1. Machine à tricoter à plat (1) comprenant un dispositif de remise (2), un magasin (3) et un dispositif de transport de tissu tricoté (4) pour déplacer des mailles à partir d'aiguilles de remise (25) vers des aiguilles de magasin (31) lors du retrait des mailles avec le dispositif de remise (2), comprenant les aiguilles de remise (25) pour maintenir les mailles d'un tissu tricoté, qui est tricoté avec une fonture (5) de la machine à tricoter à plat (1), à partir de la fonture (5) et les transférer vers les aiguilles de magasin (31), **caractérisé en ce que** le dispositif de transport de tissu tricoté (4) comprend :

   un arbre de rotation (44) supporté de façon rotative par le dispositif de remise (2) à proximité des aiguilles de remise (25) ;
   une pluralité de plaques de transport de tissu tricoté (41) agencées en ligne sur l'arbre de rotation (44) ; et
   un mécanisme d'entraînement pour faire tourner l'arbre de rotation (44) ;
   dans lequel
   la pluralité de plaques de transport de tissu tricoté (41) est intercalée entre les aiguilles de remise (25) adjacentes en faisant tourner l'arbre de rotation (44) pour envoyer le tissu tricoté des aiguilles de remise (25) vers les aiguilles de magasin (31) avec les bords des plaques de transport de tissu tricoté (4).

2. Machine à tricoter à plat selon la revendication 1, dans laquelle au moins l'une de la pluralité de plaques de transport de tissu tricoté (41) est agencée avec le bord décalé par rapport aux autres plaques de transport de tissu tricoté (41) pour avoir une différence de temps dans le mouvement du tissu tricoté à partir des aiguilles de remise (25) jusqu'aux aiguilles de magasin (31) dans une direction latérale des mailles maintenues au niveau des aiguilles de remise (25).

3. Machine à tricoter à plat selon la revendication 1 ou 2, dans laquelle
   au moins l'une de la pluralité de plaques de transport de tissu tricoté (41) a une forme différente des autres plaques de transport de tissu tricoté (41) ; et
   des bords communs ayant la même forme sont formés dans chacune des plaques de transport de tissu tricoté (41) avec des formes différentes afin que les mailles du tissu tricoté déplacées vers les aiguilles de magasin (31) soient finalement alignées dans la direction latérale des mailles.

Fig. 1

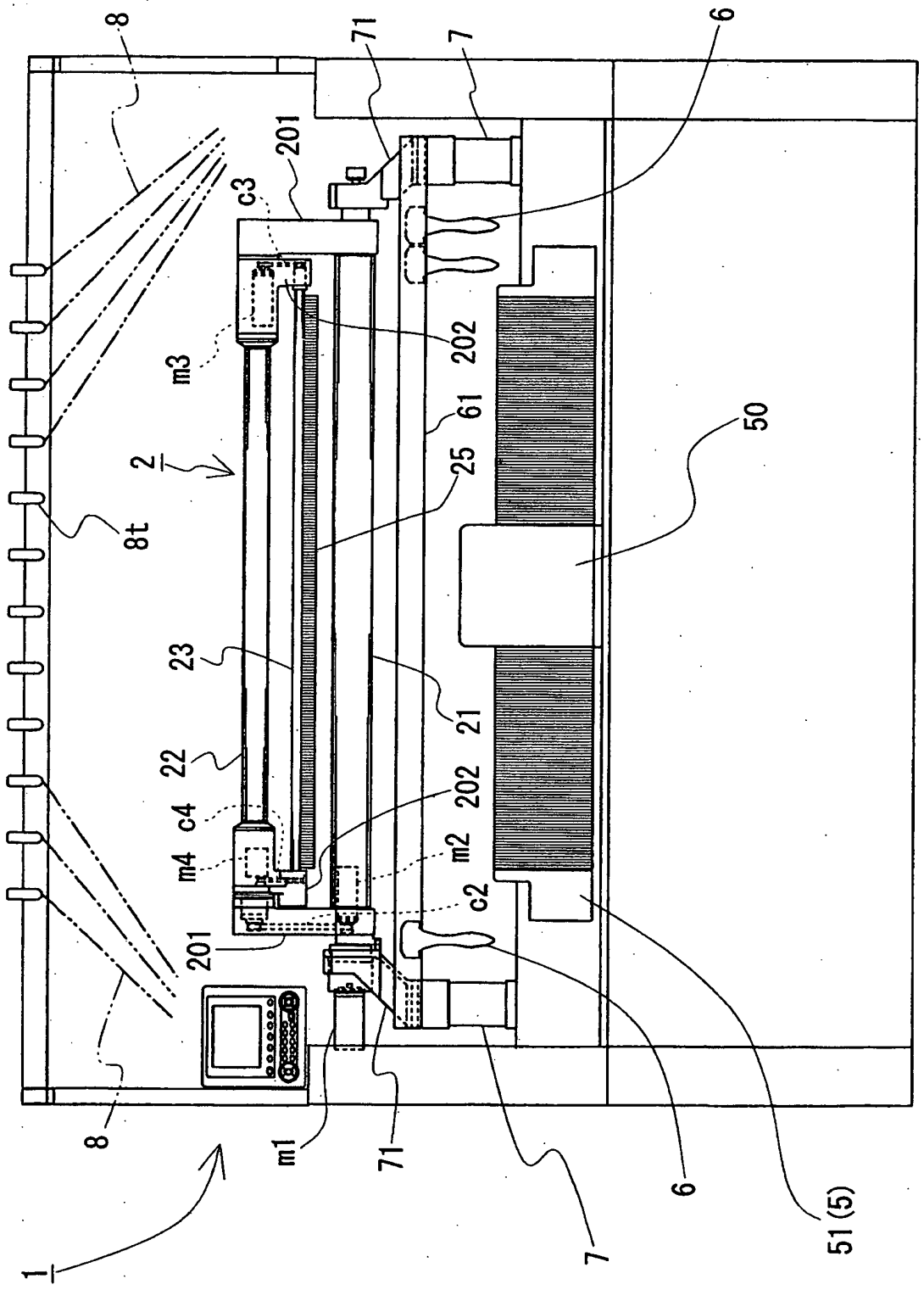

8
71
7
6
201
c3
202
m3
61
50
2
25
8t
23
21
22
202
c4
m4
m2
c2
201
8
m1
71
6
7
51 (5)
1

Fig. 2

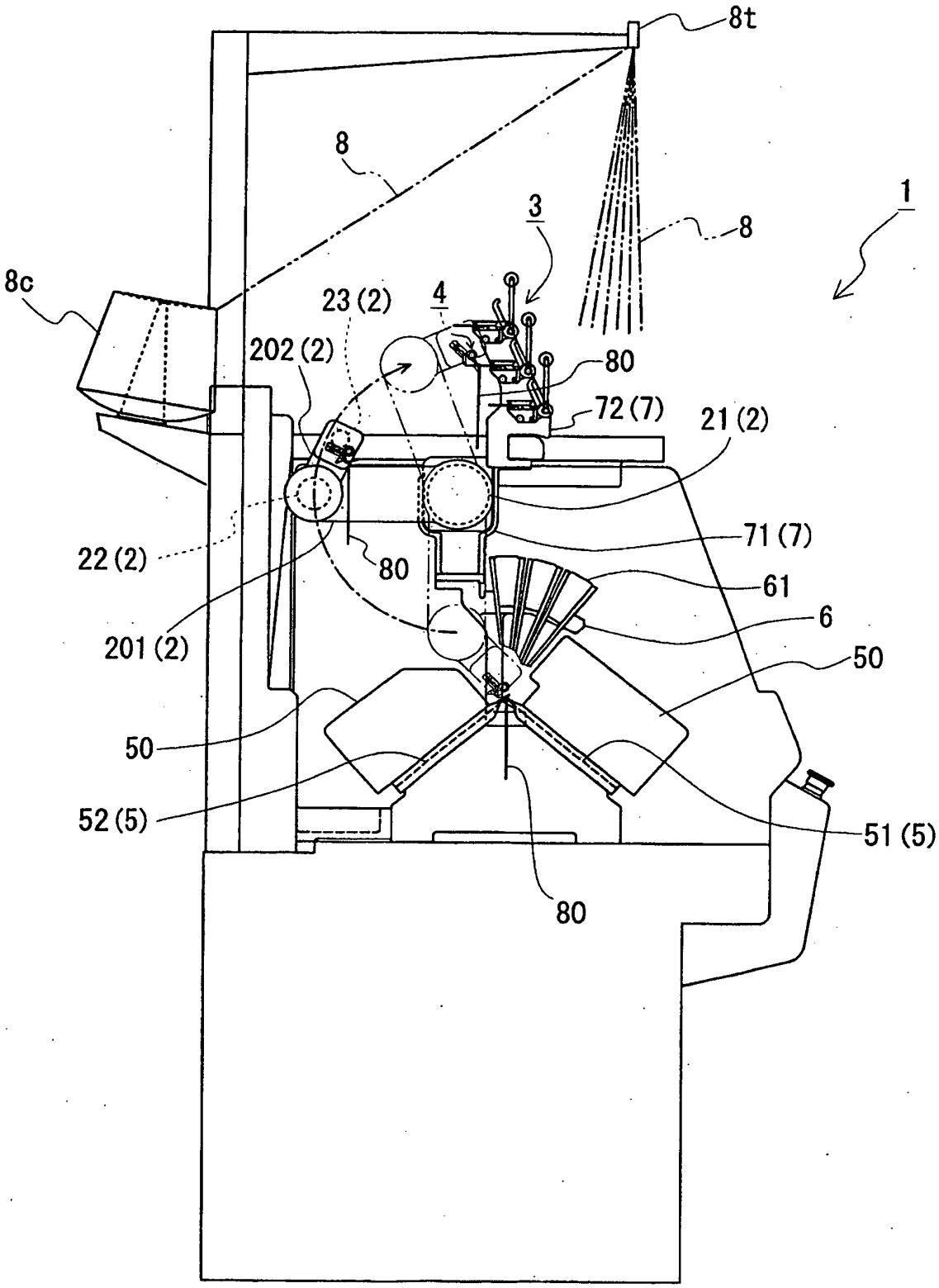

8t
8
1
3
8
8c
23 (2)
4
202 (2)
80
72 (7)
21 (2)
22 (2)
71 (7)
80
61
6
201 (2)
50
50
52 (5)
51 (5)
80

Fig. 3

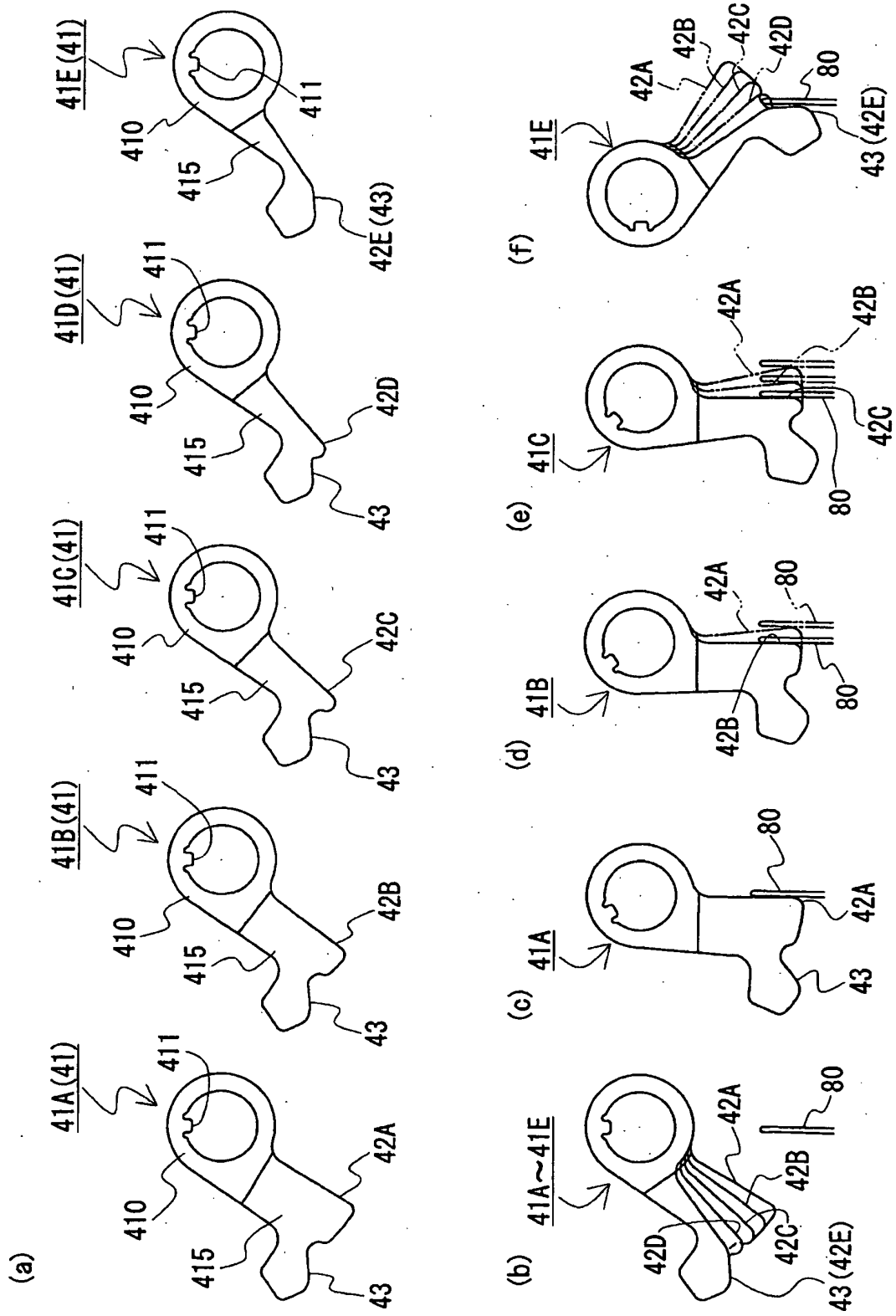

(a)
41A(41)
410
411
415
42A
43
41B(41)
42B
41C(41)
42C
41D(41)
42D
41E(41)
42E(43)
(b)
41A~41E
42A
42B
42C
42D
80
43(42E)
(c)
41A
(d)
41B
(e)
41C
(f)
41E

Fig. 4

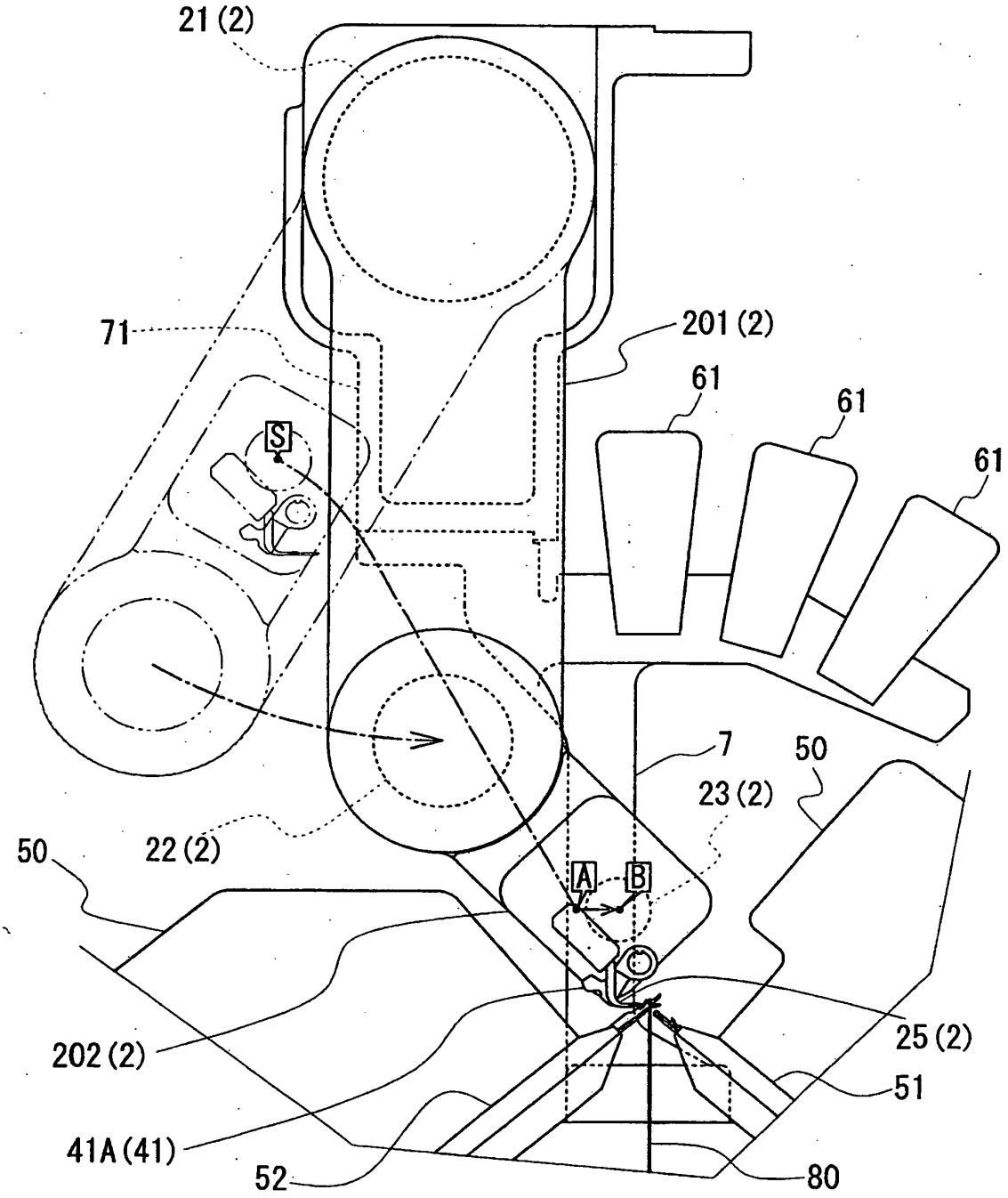


Fig. 5

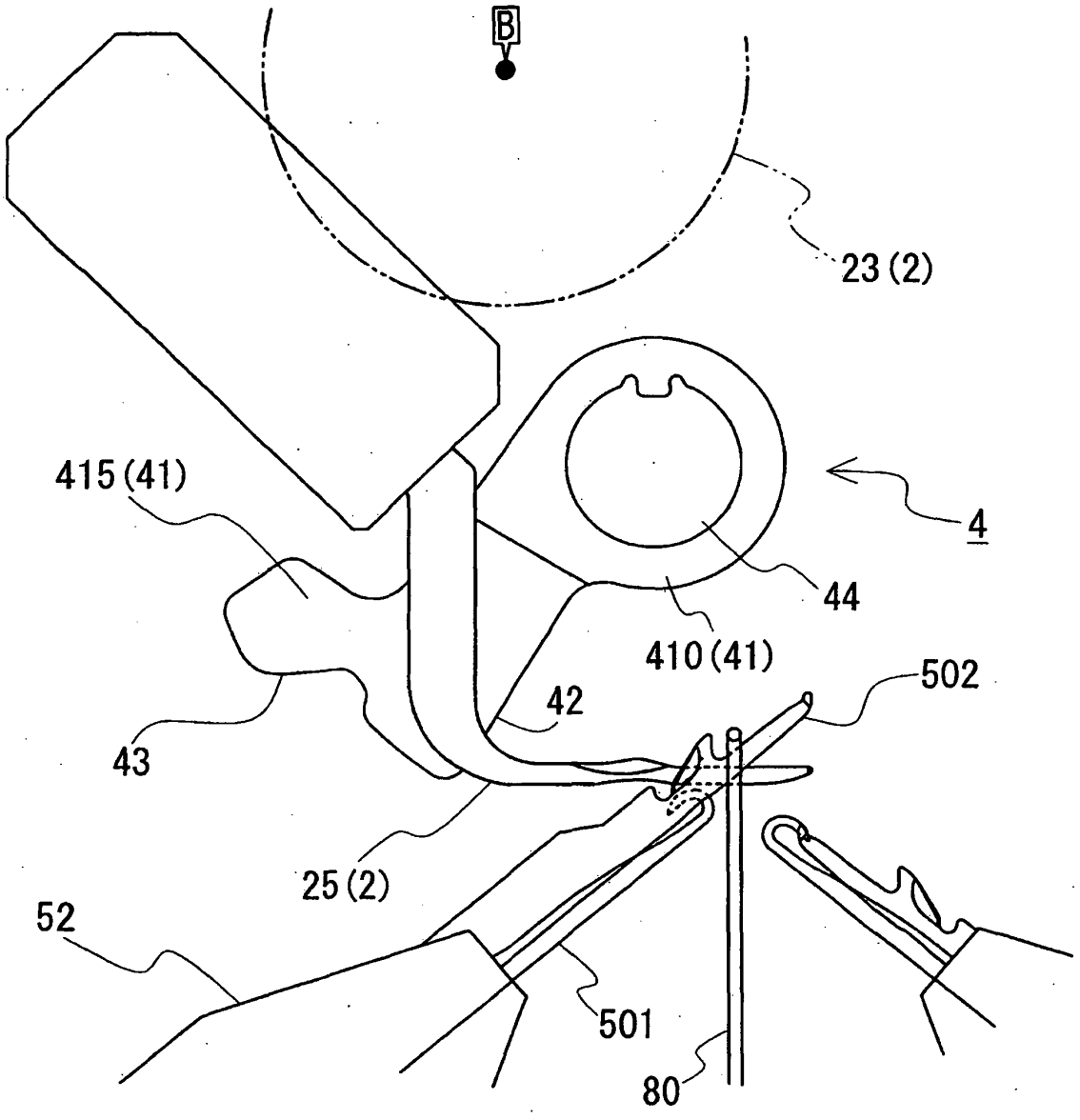


Fig. 6

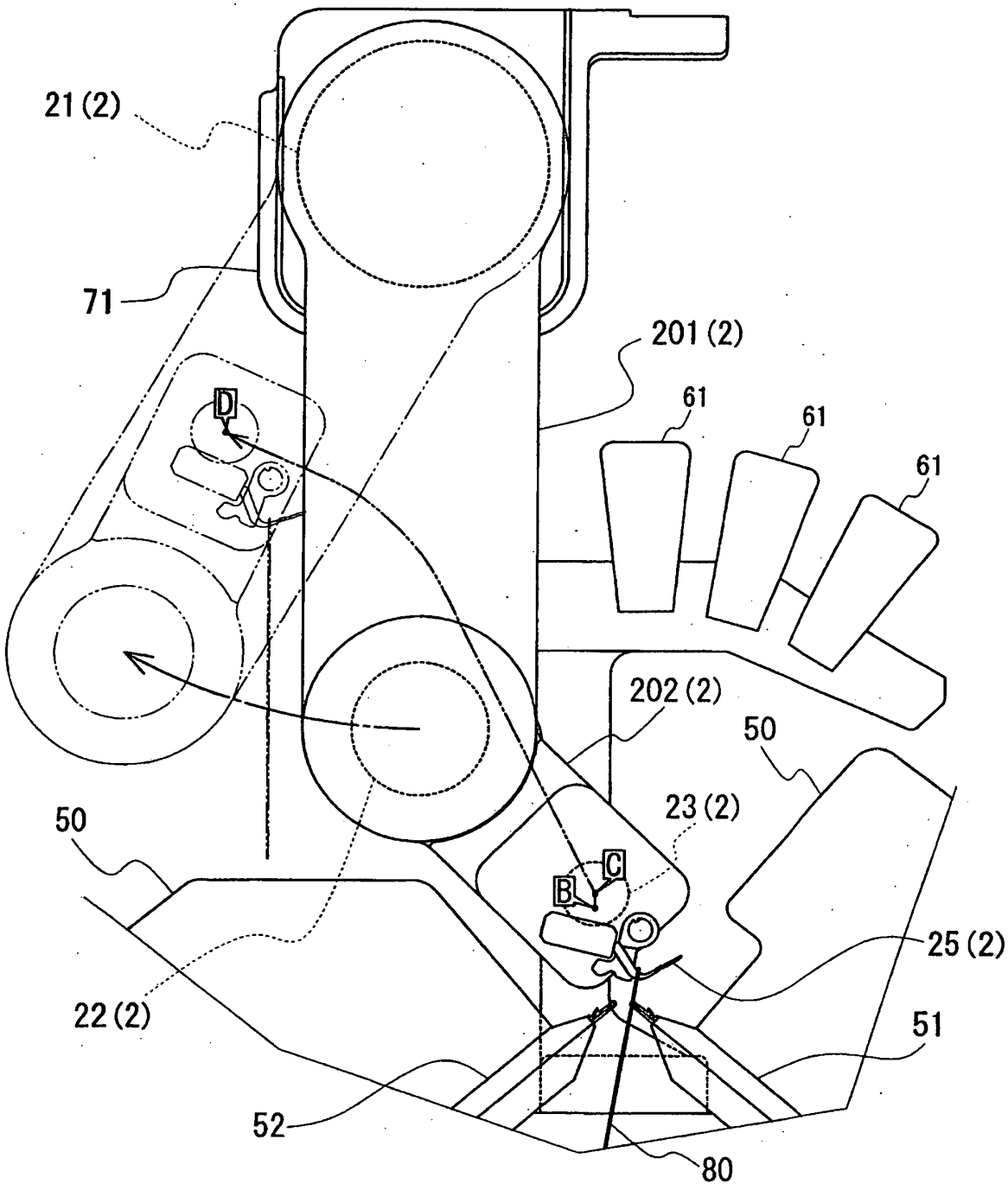


Fig. 7

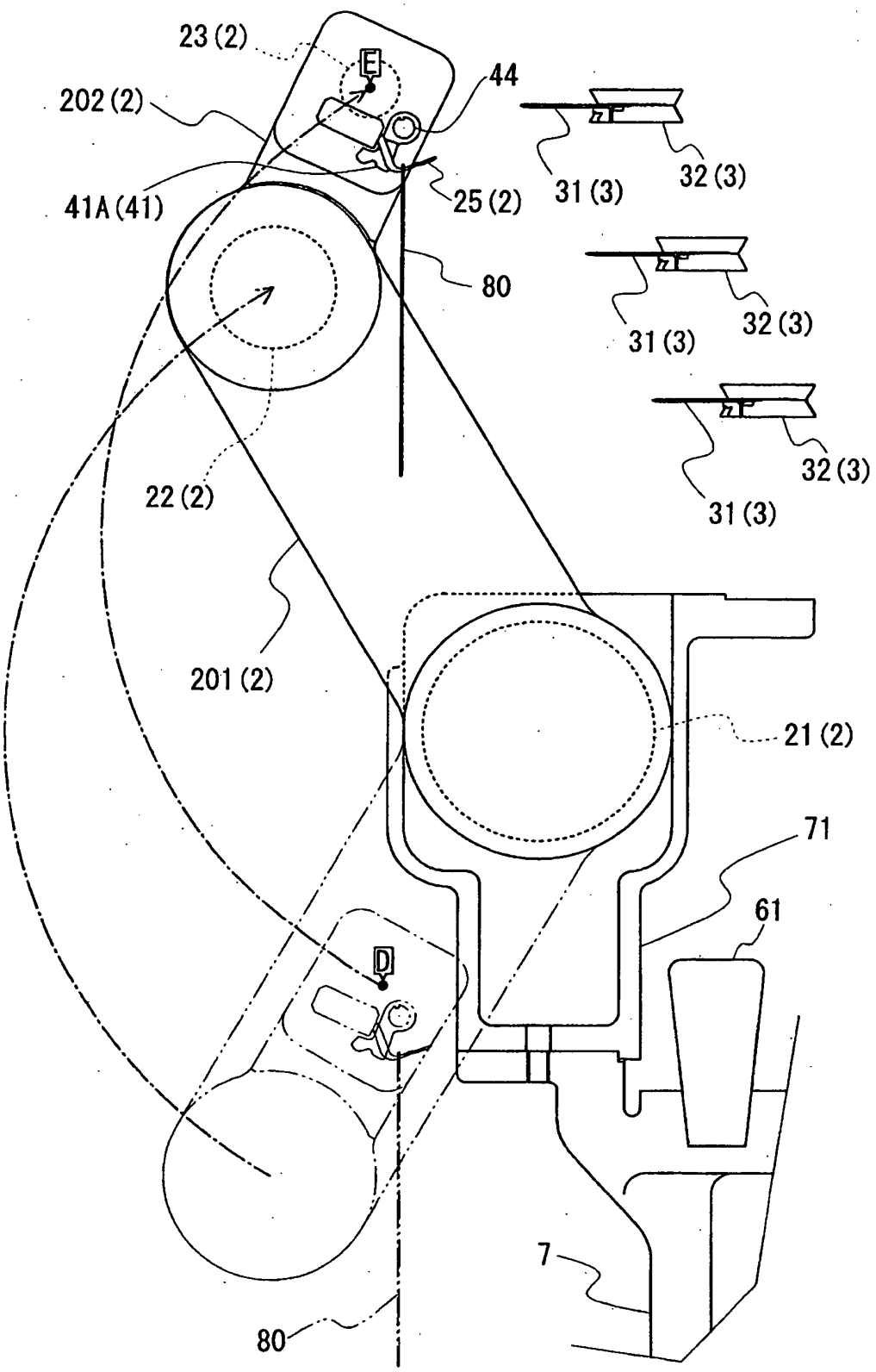

23 (2)
E
44
202 (2)
41A (41)
25 (2)
31 (3)
32 (3)
80
31 (3)
32 (3)
31 (3)
32 (3)
22 (2)
201 (2)
21 (2)
71
61
D
7
80

Fig. 8

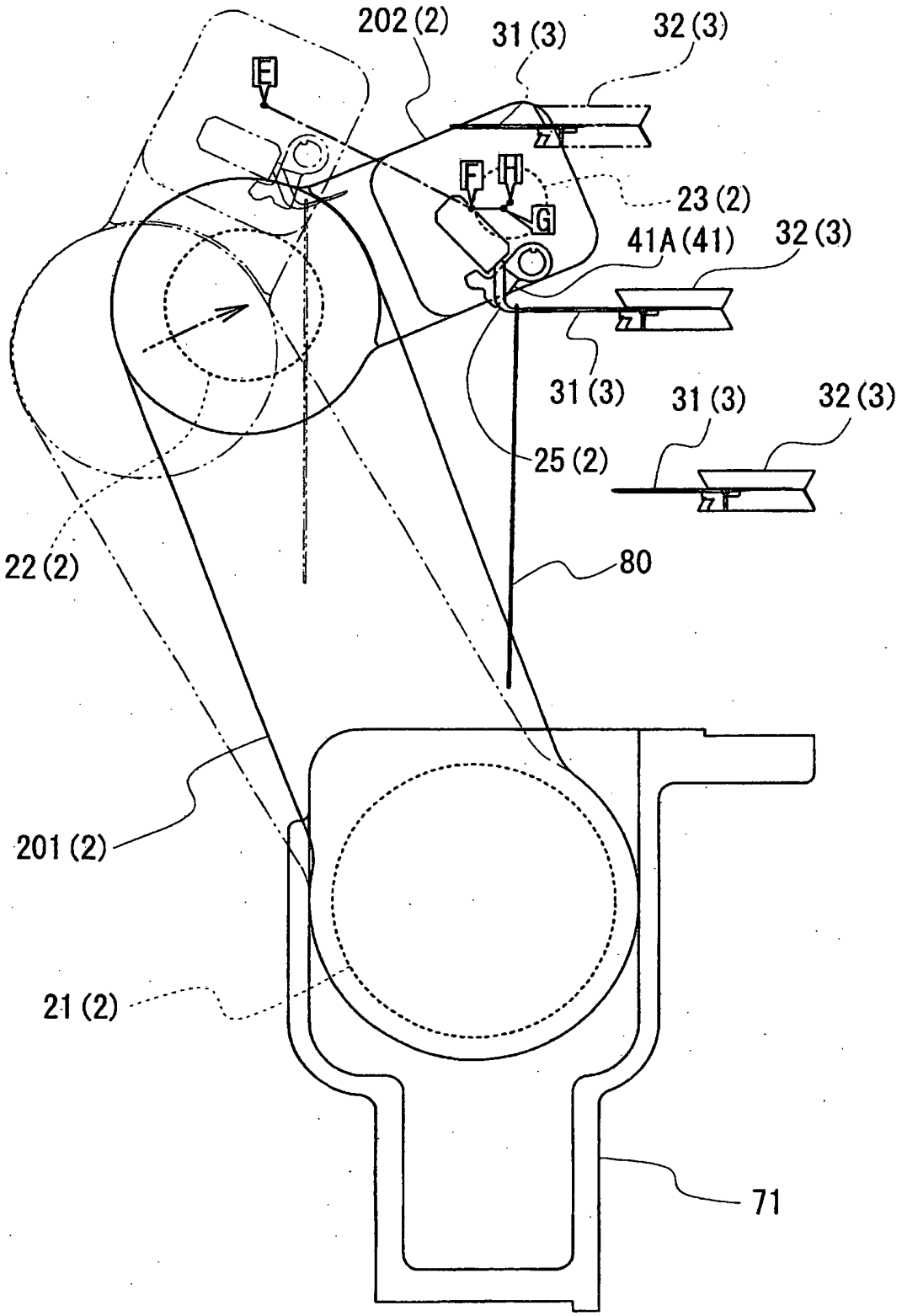
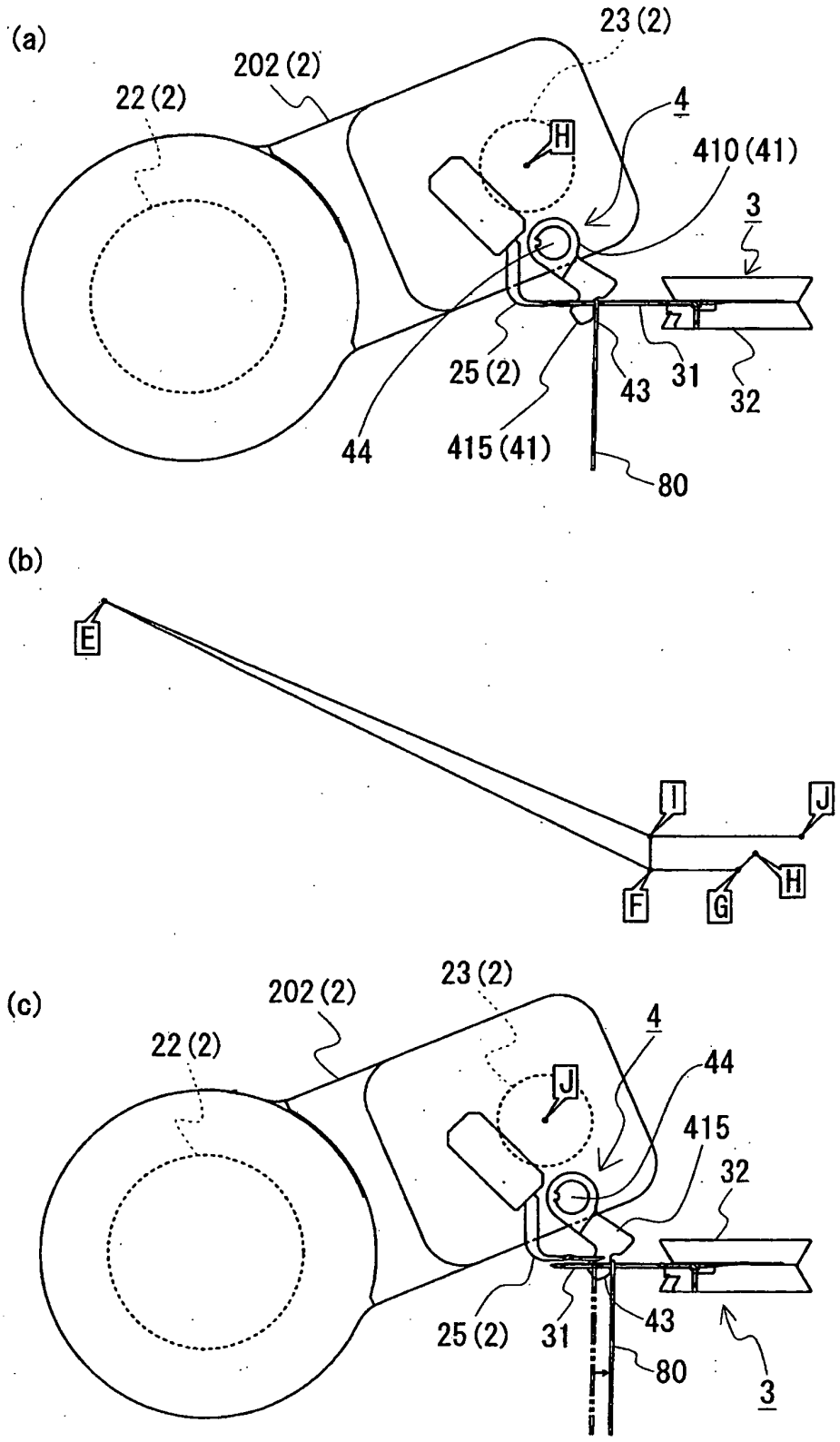

202 (2)
31 (3)
32 (3)
E
F
H
G
23 (2)
41A (41)
32 (3)
31 (3)
31 (3)
32 (3)
25 (2)
22 (2)
80
201 (2)
21 (2)
71

Fig. 9


(a)
23 (2)
202 (2)
22 (2)
4
H
410 (41)
3
25 (2)
43
31
32
44
415 (41)
80
(b)
E
I
J
F
G
H
(c)
202 (2)
23 (2)
22 (2)
4
J
44
415
32
25 (2)
31
43
80
3

REFERENCES CITED IN THE DESCRIPTION

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