



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.06.2012 Bulletin 2012/24

(51) Int Cl.:
D05B 35/06 (2006.01)

(21) Application number: **11192509.5**

(22) Date of filing: **08.12.2011**

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

(72) Inventors:
• **Nii, Tomio**
Tokyo 206-8551 (JP)
• **Yasuda, Shunsuke**
Tokyo 206-8551 (JP)

(30) Priority: **09.12.2010 JP 2010274353**

(74) Representative: **Hoeger, Stellrecht & Partner**
Patentanwälte
Uhlandstrasse 14c
70182 Stuttgart (DE)

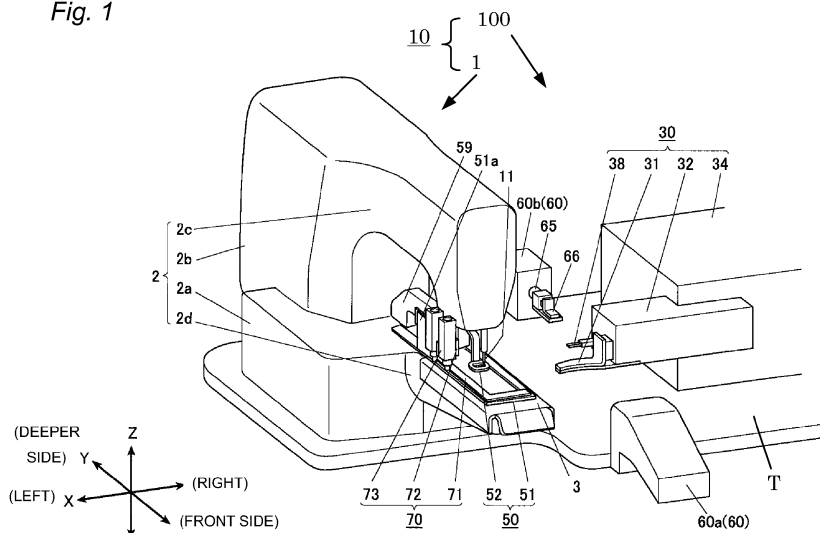
(71) Applicant: **JUKI Corporation**
Tama-shi
Tokyo
206-8551 (JP)

(54) **Belt loop sewing apparatus and method of controlling belt loop sewing apparatus**

(57) The invention relates to a belt loop sewing apparatus including: a holding unit which holds one of ends in a longitudinal direction of a belt loop disposed in the longitudinal direction; a clamp unit which includes a loop clamp capable of clamping or releasing the other end of the belt loop from a holding position set by the holding unit and which moves the loop clamp in a direction crossing the longitudinal direction; a fork unit which includes, on a tip, a fork formed into a forked shape and interposing the belt loop between the holding unit and the loop clamp, which is rotatable around an axis in the direction crossing the longitudinal direction and movable in the direction

crossing the longitudinal direction together with the loop clamp, and which folds one of the ends of the belt loop back toward a central side of the belt loop by a rotation of the fork unit; and a controller which controls the rotation of the fork unit in order to fold the one of the ends of the belt loop back toward the central side of the belt loop, wherein the held belt loop is moved in the direction crossing the longitudinal direction to place the belt loop in a sewing position of a sewing machine, and wherein the controller moves the loop clamp holding the belt loop by a predetermined amount in the direction crossing the longitudinal direction and then rotates the fork unit to fold the end of the belt loop.

Fig. 1



Description

[TECHNICAL FIELD]

[0001] The present invention relates to a belt loop sewing apparatus for feeding, to a sewing machine, a belt loop for inserting a belt therethrough which is to be sewn onto a waist part of pants or skirts, and a method of controlling the belt loop sewing apparatus.

[BACKGROUND ART]

[0002] When the belt loop is to be sewn, conventionally, an end of the belt loop is folded back toward a central side in a longitudinal direction of the belt loop and a seam is then formed on the end so that the belt loop is sewn onto a cloth. In some cases, however, there is caused a so-called dog ear in which the end is not folded back straight in the longitudinal direction but is sewn with a positional shift. In these cases, the end of the belt loop which is folded back is protruded from the central side in the longitudinal direction of the belt loop. For this reason, an appearance is poor and a commercial value of a sewn product is thus deteriorated.

[0003] For this reason, as disclosed in Japanese Patent Application Publication JP-A-2000-167282, there is conventionally known the technique in which a guide member is provided on both side ends of a belt loop and a portion to be folded back in the belt loop is regulated by means of the guide member and is thus folded back in a longitudinal direction when an end of the belt loop is to be folded back toward a central side in the longitudinal direction, for example.

[0004] In the technique of JP-A-2000-167282, however, in some cases in which a belt loop is formed by a raw material which is hard to fold back in a desirable direction, for example, a raw material having an oblique texture and such a characteristic as to be bent obliquely along the texture, an end of the belt loop is protruded beyond a guide member, resulting in an occurrence of a dog ear even if a portion to be folded back in the belt loop is regulated by the guide member.

[SUMMARY OF THE INVENTION]

[0005] It is an object of the invention to provide a belt loop sewing apparatus which can feed a belt loop to a sewing machine in a proper fold-back state so as not to cause a dog ear irrespective of a type of a raw material to be sewn, and a method of controlling the belt loop sewing apparatus.

[0006] A first aspect of the invention is directed to a belt loop sewing apparatus including: a holding unit configured to hold one of ends in a longitudinal direction of a belt loop disposed in the longitudinal direction; a clamp unit including a loop clamp capable of clamping or releasing the other end of the belt loop from a holding position set by the holding unit, the clamp unit configured

to move the loop clamp in a direction crossing the longitudinal direction; a fork unit including, on a tip thereof, a fork formed into a forked shape and interposing the belt loop provided between the holding unit and the loop clamp, the fork unit configured to be rotatable around an axis in the direction crossing the longitudinal direction and movable in the direction crossing the longitudinal direction together with the loop clamp to fold one of the ends of the belt loop back toward a central side of the belt loop by a rotation of the fork unit; and a controller configured to control the rotation of the fork unit to fold the one of the ends of the belt loop back toward the central side of the belt loop, wherein the held belt loop is moved in the direction crossing the longitudinal direction to place the belt loop in a sewing position of a sewing machine, and wherein the controller is configured to move the loop clamp holding the belt loop by a predetermined amount in the direction crossing the longitudinal direction and then to rotate the fork unit to fold the end of the belt loop.

[0007] The "predetermined amount" represents a value having a size and an orientation together and determines a moving amount for the movement of the loop clamp, and may include a moving direction thereof (a positive direction or a negative direction).

[0008] A second aspect of the invention has the same structure as the structure according to the first aspect, and the controller may be configured to move the loop clamp holding the belt loop by the predetermined amount in the direction crossing the longitudinal direction and then to rotate the fork unit to fold the other end of the belt loop back toward the central side of the belt loop in a state in which the one end side of the belt loop is sewn onto a cloth by the sewing machine and the other end side of the belt loop is clamped by the loop clamp.

[0009] A third aspect of the invention has the same structure as the structure according to the first or second aspect, and the sewing machine may further include: an operating unit configured to previously set and input a direction crossing the longitudinal direction and a moving amount in the direction.

[0010] A fourth aspect of the invention has the same structure as the structure according to the first aspect, and the controller may be configured to set a moving direction of the loop clamp to be the direction crossing the longitudinal direction and a direction in which one of the ends of the belt loop is protruded from the belt loop when the one of the ends is folded back.

[0011] A fifth aspect of the invention has the same structure as the structure according to the second aspect, and the controller may be configured to set a moving direction of the loop clamp to be the direction crossing the longitudinal direction and a reverse direction to a direction in which the other end of the belt loop is protruded from the belt loop when the other end is folded back.

[0012] According to the first aspect and the inventions described in dependent aspects, in the case in which it is assumed that the end to be folded back toward the central side of the belt loop is protruded from the central

side, it is possible to fold the end of the belt loop back toward the central side of the belt loop if the loop clamp interposing the belt loop having the one end side fixed thereto is moved by the predetermined amount in the direction crossing the longitudinal direction of the belt loop, that is, a direction cancelling the protrusion and the end of the belt loop is then folded back by the fork unit.

[0013] By sewing the portion in which the end of the belt loop is folded back toward the central side, it is possible to suppress an occurrence of a dog ear, thereby sewing the belt loop properly.

[0014] According to the second aspect and the inventions described in dependent aspects, in the case in which it is assumed that the other end is protruded from the central side of the belt loop when the end at the other end side of the belt loop interposed by the loop clamp is to be folded back toward the one end side of the belt loop sewn onto the cloth, the loop clamp interposing the belt loop is moved by the predetermined amount in a reverse direction to the direction in which the other end is protruded, thereby regulating the orientation of the belt loop and then folding back the other end of the belt loop by means of the fork unit. Thus, it is possible to fold back the other end of the belt loop without a protrusion from the central side of the belt loop.

[0015] According to the third aspect of the invention, the direction crossing the longitudinal direction and the moving amount in the direction can be previously set and input. Therefore, it is possible to continuously carry out an operation from a serial fold-back work to a work for sewing the belt loop.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0016] The following description of a preferred embodiment of the present invention serves to explain the invention in greater detail in conjoint with the drawings. These show:

Fig. 1 is a perspective view showing a whole belt loop sewing apparatus;

Fig. 2 is a perspective view showing a sewing machine body side of the belt loop sewing apparatus;

Fig. 3 is a block diagram showing a control system of the belt loop sewing apparatus;

Fig. 4 is a perspective view showing a periphery of a throat plate in the belt loop sewing apparatus;

Figs. 5A and 5B are explanatory views showing an example of a sewing shape of a belt loop, Fig. 5A shows a basic shape of the belt loop and Fig. 5B shows an applied shape of the belt loop;

Figs. 6A to 6C are views for explaining an operation of fold-back at one of end sides of the belt loop;

Figs. 7A to 7C are views for explaining an operation of fold-back at the other end side of the belt loop;

Fig. 8 is a general flow chart related to a control of the belt loop sewing apparatus; and

Fig. 9 is a flow chart for forming a belt loop.

[DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS]

[0017] A preferred embodiment for carrying out the invention will be described below with reference to the drawings. In the embodiment which will be described below, technically preferable various restrictions are imposed to carry out the invention. However, the scope of the invention is not restricted to the following embodiment and example shown in the drawings.

<Summary of Sewing Machine>

<Summary of Belt Loop Sewing Apparatus>

[0018] In Figs. 1 to 4, a belt loop sewing apparatus 10 includes a belt loop sewing machine 1 having a sewing machine body 2 and a belt loop feeding apparatus 100.

[0019] The belt loop feeding apparatus 100 constituting a main part of the present invention includes holding unit (a loop holding pawl 66, a loop pull-in portion 60b) for holding one of ends in a longitudinal direction of a belt loop B disposed in the longitudinal direction, a clamp unit 30 which has a loop clamp 31 capable of interposing or releasing the other end side of the belt loop B from a holding position set by the holding unit and enables a movement of the loop clamp 31 in a direction crossing the longitudinal direction, a fork unit 38 which has, on a tip, a fork portion 38A forked to interpose the belt loop B between the holding unit and the loop clamp 31, is rotatable around an axis in the direction crossing the longitudinal direction and folds one of the ends of the belt loop B back toward a central side of the belt loop through a rotation and holds the end, and controller for controlling the rotation of the fork unit 38 in order to fold one of the ends of the belt loop B back toward the central side of the belt loop B, and feeds the belt loop held by the clamp unit 30 and the fork unit 38 to the belt loop sewing machine 1.

<Sewing Machine Body 2>

[0020] The sewing machine body 2 constituting the belt loop sewing machine has a frame structure including a bed portion 2a, a cylinder bed portion 2d extended horizontally from the bed portion 2a, a vertical drum portion 2b erected from the bed portion 2a, and an arm portion 2c extended from the vertical drum portion 2b along a part above the bed portion 2a and the cylinder bed portion 2d.

[0021] In the following description, it is assumed that a horizontal direction along a longitudinal direction of the cylinder bed portion 2d and the arm portion 2c is set to be a Y-axis direction, a horizontal direction which is orthogonal to the Y-axis direction is set to be an X-axis direction, and a vertical direction is set to be a Z-axis direction, and a surface portion side of the arm portion 2c to be one end side in the Y-axis direction is referred

to as a "front side" and the vertical drum portion 2b side to be the other end side in the Y-axis direction is referred to as a "deeper side" if necessary for explanation.

<Loop Feeding Mechanism 60>

[0022] A loop feeding mechanism 60 is positioned on a side of the belt loop sewing machine 1 and is disposed on a table T. The loop feeding mechanism 60 includes a loop send-out portion 60a fixed to a front side of the clamp unit 30 and a loop pull-in portion 60b fixed to a deeper side through the clamp unit 30.

[0023] The loop send-out portion 60a includes a delivering roller 61 (Fig. 3) for holding a long tape material wound around a reel and delivering the tape material to a send-out port provided on the deeper side, a send-out motor 62 (Fig. 3) for rotating and driving the delivering roller 61, a cutter 63 (Fig. 3) for cutting the tape material sent out in a predetermined length, and an air cylinder 64 for cutting (Fig. 3) which drives the cutter 63.

[0024] The loop pull-in portion 60b constitutes holding unit for holding one of the ends in the longitudinal direction of the belt loop.

[0025] The loop pull-in portion 60b includes a loop holding pawl 66 serving as a loop holding portion for interposing and holding a tip of the tape material sent out of the send-out port from upper and lower sides, a rod 65 having the loop holding pawl 66 on a tip, a Y-axis motor 68 (Fig. 3) for moving the rod 65 forward and backward in the Y-axis direction, and an air cylinder 67 (Fig. 3) for switching interposing and releasing states of the looping holding pawl 66.

[0026] The loop holding pawl 66 can be moved forward and backward between the send-out port of the loop send-out portion 60a and a standby position on the loop pull-in portion 60b side (the deeper side) beyond the clamp unit 30 with the forward and backward movements of the rod 65.

[0027] As will be described below, the tape material T is disposed to pass through the loop clamp 31 of the clamp unit 30 when the loop holding pawl 66 holding the tip of the tape material T is moved from the send-out port to the standby position.

[0028] The cutter 63 is disposed opposite to a tape material moving path between the reel portion and the send-out port and cuts the tape material in an operation of the air cylinder 64 for cutting.

[0029] A length of the tape material to be cut from the tip to the cutter 63, that is, a length of the belt loop B is determined by controlling a driving amount of the send-out motor 62 and a moving amount of the loop holding pawl 66 through controller 80.

<Clamp unit 30>

[0030] The clamp unit 30 has a loop clamp capable of interposing or releasing the other end of the belt loop in a state in which the longitudinal direction of the loop is

turned into a predetermined direction, and can move the loop clamp in the direction crossing the longitudinal direction.

[0031] The clamp unit 30 is disposed between the loop send-out portion 60a and the loop pull-in portion 60b in the loop feeding mechanism 60 in the Y-axis direction, and is positioned at an opposite side to the belt loop sewing machine 1 with an X-axis direction line passing through the loop send-out portion 60a and the loop pull-in portion 60b interposed therebetween in the X-axis direction.

[0032] The clamp unit 30 includes a hollow support member 34 fixed onto the table T, a holding block 32 supported on the support member 34 movably in the X-axis direction, the Y-axis direction and the Z-axis direction, and the loop clamp 31 supported on a tip of the holding block 32 (left in the X-axis direction in Fig. 1) and having an upper clamp 31a and a lower clamp 31b which interpose the belt loop B therebetween as shown in Fig. 4.

[0033] Furthermore, an air cylinder 33 for a clamp, an X-axis motor 35 for a clamp, a Y-axis motor 36 for a clamp, and a Z-axis air cylinder 37 for a clamp are fixedly disposed in the support member 34 of the clamp unit 30 as shown in Fig. 3. The air cylinder 33 for a clamp serves to move the upper clamp 31a of the loop clamp 31 upward and downward to switch the interposing and releasing states of the belt loop B. The X-axis motor 35 for a clamp serves to move the holding block 32 in the X-axis direction. The Y-axis motor 36 for the clamp serves to move the holding block 32 in the Y-axis direction. The Z-axis air cylinder 37 for a clamp serves to move the holding block 32 vertically in the Z-axis direction.

[0034] As shown in Fig. 4, the lower clamp 31b of the loop clamp 31 is fixed to the holding block 32 and the upper clamp 31a is supported to be vertically movable just above the lower clamp 31b. Moreover, a lower surface of a tip portion of the upper clamp 31a has a concave holding portion 31c formed thereon in a Y direction. The holding portion 31c has a slightly greater width than a width of the belt loop B. The belt loop B is held to be fitted in the holding portion 31c. The belt loop B is fitted and held in the holding portion 31c so that the hold is carried out with a longitudinal direction thereof set along the Y-axis direction.

[0035] A holding pressure of the belt loop B through the air cylinder 33 for a clamp is regulated in such a manner that the belt loop B can be pulled out upon receipt of a certain tension in the Y-axis direction.

[0036] The holding block 32 is supported on the support member 34 in a combination of a slide guide capable of carrying out a sliding motion in each of the X-, Y- and Z-axis directions, for example, and can perform a movement in each of the directions, which is not shown. The loop clamp 31 can be moved, together with the holding block 32, to an optional position and an optional height over an X - Y plane in cooperation with the X- and Y-axis motors 35 and 36 for a clamp and the Z-axis cylinder 37 for a clamp.

[0037] For example, by moving the loop clamp 31, it is possible to deliver the belt loop B from a feeding position through the loop feeding mechanism 60 to a sewing executing position in the vicinity of the tip of the cylinder bed portion 2d of the sewing machine shown in Fig. 4, to move the belt loop B depending on each of sewing places in the case in which a sewing operation is carried out over the places of the belt loop B in the sewing executing position, or to regulate an orientation or arrangement of the belt loop B in such a manner that the belt loop B takes a predetermined shape of the belt loop.

[0038] Moreover, the forked member 38 is provided adjacently to the loop clamp 31 at the loop pull-out portion 60b side (the deeper side) side by side with the holding block 32, and can be moved in the direction crossing the longitudinal direction together with the loop clamp 31.

[0039] In addition, the fork unit 38 is supported on the holding block 32 so as to be rotatable around an X axis and to be forward or backward movable in the X-axis direction with respect to the holding block 32.

[0040] A forward or backward moving operation in the X-axis direction is applied to the fork unit 38 by means of an air cylinder 40 for a fork which is provided on the holding block 32 so that the fork unit 38 is moved to a position placed side by side with the loop clamp 31 in the forward movement and is moved rightward from the loop clamp 31 in the backward movement.

[0041] Moreover, a rotating operation is applied to the fork unit 38 in a normal direction or a reverse direction around the X axis by means of a rotary actuator 41 provided on the holding block 32.

[0042] Furthermore, the fork unit 38 is provided with the fork portion 38A taking a forked shape in which two bar-shaped members are extended leftward in parallel from a tip portion (a left end in Fig. 1) in the X-axis direction, and is disposed in such a manner that the belt loop B is inserted into a part between the two bar-shaped members and is thus positioned when the fork unit 38 is moved forward. By rotating the fork unit 38 in the normal direction or the reverse direction around the X axis in a state in which the belt loop B is inserted into the part between the fork portions 38A, it is possible to wind the belt loop B by means of the fork portion 38A, thereby folding back the end of the belt loop B.

[0043] In other words, the fork unit 38 can be rotated around an axis in the direction crossing the longitudinal direction and can be moved in the direction crossing the longitudinal direction together with the loop clamp 31, and folds back one of the ends of the belt loop toward the central side of the belt loop through a rotation and holds the end in that state.

<Belt Loop Sewing Machine 1>

[0044] A structure of the belt loop sewing machine 1 will be briefly described.

[0045] The belt loop sewing machine 1 is fixedly disposed on the table T, and includes at least a sewing ma-

chine body 2, a needle 11 to which a vertical operation is to be applied by a well-known needle vertical moving mechanism (not shown), a throat plate 3 having a needle hole (not shown) for causing the needle 11 to penetrate formed thereon and fixed onto an upper surface of the cylinder bed 2d, a loop presser mechanism 50 having a bodice feeding lower plate 51 disposed on the throat plate 3 and serving to mount a cloth (a bodice) to which the belt loop B is to be sewn and a loop presser 52 for pressing the belt loop B by a downward moving operation onto the bodice feeding lower plate 51, a cloth presser mechanism 70 having a cloth presser 71 for holding the cloth, and a well-known shuttle mechanism (not shown) provided in the cylinder bed portion 2d.

[0046] The needle 11 and the shuttle mechanism are coupled to a sewing machine motor 13 (Fig. 3) such as a servo motor and are operated interlockingly with a driving source.

20 <Loop Presser Mechanism 50>

[0047] As shown in Figs. 2 and 4, the loop presser mechanism 50 includes a cloth feeding table 59 disposed movably in the X-axis direction and the Y-axis direction over the cylinder bed portion 2d, and the loop presser 52 supported on the tip attaching portion 58 of the cloth feeding table 59 so as to be vertically movable.

[0048] The cloth feeding table 59 is coupled to an X-axis motor 53 for a cloth (an X-axis motor) and a Y-axis motor 54 for a cloth (a Y-axis motor) which are disposed in the cylinder bed portion 2d. The X-axis motor 53 moves the cloth feeding table 59 in the X-axis direction and the Y-axis motor 54 moves the cloth feeding table 59 in the Y-axis direction.

[0049] Both the X-axis motor 53 and the Y-axis motor 54 are pulse motors, and a feedback control based on outputs of encoders 55 and 56 provided on respective output shafts is carried out in order to position the belt loop B and the cloth in such a manner that a needle location is carried out into a predetermined stitch point determined in a sewing pattern synchronously with a needle location for each needle.

[0050] The movement in the X direction of the cloth feeding table 59 may cause the loop presser 52 to be moved over an approximation straight line in the X direction by enabling the base portion of the cloth feeding table to be rotated around a vertical axis.

[0051] A vertical moving operation is applied to the loop presser 52 by means of a pulse motor 57 for a loop presser (Fig. 3) which is fixed to the cloth feeding table 59.

[0052] A lower end of the loop presser 52 is provided with an almost rectangular frame portion 52a having a slightly greater width than the width of the belt loop B.

55 <Cloth Presser Mechanism 70>

[0053] A support member 72 has a base portion supported on the cloth feeding table 59 movably in the Y

direction, and is extended in the Y-axis direction at the side of the cylinder bed portion 2d. The support member 72 fixedly supports, on a tip portion, a pair of cloth pressers 71 and 71 separated from each other in the Y-axis direction, and an air cylinder 73 for cloth pressing which moves the cloth pressers 71 and 71 upward and downward.

[0054] Both of the cloth pressers 71 and 71 are disposed to press the cloth (bodice) on both sides in the Y-axis direction of the frame portion 52a.

[0055] The support member 72 is moved integrally in the movement in the X-axis and Y-axis directions of the cloth feeding table 59, and furthermore, can be moved to enable a control of a moving amount separately from the cloth feeding table 59 with respect to the Y-axis direction by setting, as a driving source, the Y-axis motor 74 for a second cloth (a pulse motor) fixed to the cloth feeding table 59.

[0056] The support member 72 fixes the coupling plate 51a extended in the X-axis direction. The coupling plate 51a fixes the bodice feeding lower plate 51. Consequently, the bodice feeding lower plate 51 can be moved in the Y-axis direction integrally with the support member 72, that is, the cloth pressers 71 and 71.

[0057] The cloth presser mechanism 70 can move the cloth interposed between the bodice feeding lower plate 51 and the cloth presser 71 to an optional position in the Y-axis direction with respect to the frame portion 52a of the loop presser 52 and can position the cloth by the structure.

<Control System of Belt Loop Sewing Apparatus>

[0058] The controller 80 includes a CPU 81 for carrying out various processings and controls, an ROM 82 which writes an operation control program for executing an operation control of the belt loop sewing apparatus 10 and set information, an RAM 83 serving as a work area for storing various data in the processing of the CPU 81, and an EEPROM 84 for recording various set data.

[0059] Moreover, the controller 80 includes an I/O interface 85 for connecting various control targets and the encoders 55 and 56 to the CPU 81.

[0060] In other words, the sewing machine motor 13, the air cylinder 33 for a clamp, the X-axis motor 35 for a clamp, the Y-axis motor 36 for a clamp, the Z-axis air cylinder 37 for a clamp, the rotary actuator 41, the air cylinder 40 for a fork, the air cylinder 67 for a pawl, the Y-axis motor 68 for a pawl, the air cylinder 73 for a cloth presser, the Y-axis motor 74 for a second cloth, the air cylinder 64 for cutting, the send-out motor 62, the X-axis motor 53 for a cloth, the Y-axis motor 54 for a cloth, the pulse motor 57 for a loop presser, and the encoders 55 and 56 are connected to the CPU 81 through the I/O interface 85.

[0061] Moreover, operating unit 86 including a touch panel 87 for inputting various sets and a display panel 88 for displaying set information and a start switch 89 for

inputting a start of a sewing operation are connected to the controller 80 through the I/O interface 85.

[0062] Actuators of all the air cylinders 33, 37, 40, 64, 67 and 73 are controlled through an electromagnetic valve (not shown) for sucking/discharging air from/to the respective cylinders.

[0063] The CPU 81 executes a control described in a general flow shown in Fig. 8 in accordance with the operation control program stored in the ROM 82.

[0064] The controller 80 controls respective portions of the sewing machine, for example, a thread cutting device and a wiper device which are not shown, thereby executing various operations related to a sewing work.

[0065] At a various data setting step ST1, the following setting operation is carried out through the operation of the touch panel 87 of the operating unit 86, for example.

[0066] A sewing form of the belt loop B to be sewn by the belt loop sewing apparatus 10 has the most basic sewing form (see Fig. 5A) for folding back both ends inward each other and sewing the belt loop onto a bodice cloth or a sewing form (see Fig. 5B) for folding one of the ends of the belt loop B in an almost Z shape, folding back the other end inward and sewing the belt loop onto the bodice cloth, for example.

[0067] In the case in which the belt loops B in the sewing forms are to be sewn, it is necessary to set a plurality of parameters for the belt loops.

[0068] For example, in the case of the sewing form shown in Fig. 5A, seams L1 and L2 are sewn in order. As a parameter for the sewing operation, the operating unit 86 sets values, for example, a distance Ma from a seam L1 to an edge on one of ends of the belt loop B, a distance Mb from the seam L1 to a seam L2, a distance Md from the seam L1 to a fold-back part on one of the ends of the belt group B, a distance Me from the seam L2 to a fold-back part on the other end of the belt loop B, and a distance Mf from the seam L2 to an edge on the other end of the belt loop B.

[0069] In the case of the sewing form shown in Fig. 5B, moreover, the seams L1, L2 and L3 are sewn in order. As a parameter for the sewing operation, the operating unit 86 sets values, for example, a distance Ma from a seam L1 to an edge on one of the ends of the belt loop B, a distance Mb from a seam L2 to a seam L3, a distance Mc from the seam L1 to the seam L2, a distance Md from the seam L2 to a fold-back part of one of the ends of the belt loop B, a distance Me from a seam L3 to a fold-back part on the other end of the belt loop B, and a distance Mf from the seam L3 to an edge on the other end of the belt loop B.

[0070] A control program for controlling each portion of the sewing machine to form a sewing pattern of each seam which is selected or a control parameter for defining an operating amount or operating order for each stitch which is required for carrying out bar tack or basting is preset to the ROM 82 or the EEPROM 84.

[0071] When folding back the end of the belt loop B, moreover, a parameter for regulating the orientation or

arrangement of the belt loop B to fold the end of the belt loop B back toward the central side of the belt loop B is input through the touch panel 87 of the operating unit 86.

[0072] For example, there are set and input data on a moving amount and a moving direction for moving the loop clamp 31 interposing the belt loop B by a predetermined amount in the direction crossing the longitudinal direction of the belt loop B. The set data are recorded in the EEPROM 84 and are read and utilized in the control of the movement of the loop clamp.

[0073] When the various setting operations are ended, a belt loop forming step ST2 is executed through an operation of a completing switch (not shown) provided on the touch panel 87.

[0074] The belt loop forming step ST2 controls an operation for cutting the belt loop B having a predetermined length from the long tape material, holding one of the ends of the belt loop B through the loop clamp 31 and folding back the other end by means of the fork unit 38 in the belt loop feeding apparatus 100.

[0075] Description will be given to a moving control and a folding control of the loop clamp which are to be executed in the fold-back of the end of the belt loop B in relation to the invention.

<Fold-back of One End Side of Belt Loop>

[0076] Herein, the moving control and the folding control of the loop clamp in the fold-back of one end side of the belt loop B in the basic sewing form of the belt loop B shown in Fig. 5A will be described with reference to a view for explaining an operation in Fig. 6.

[0077] First of all, the loop holding pawl 66 of the loop pull-in portion 60b is caused to approach the vicinity of the send-out port of the loop send-out portion 60a through a driving operation of the pawl Y-axis motor 68, and furthermore, the loop holding pawl 66 of the loop pull-in portion 60b holds a tip b1 of the belt loop (tape material) B by the operation of the pawl air cylinder 67 (step S201).

[0078] Subsequently, the loop holding pawl 66 is returned and moved in a standby position direction by the pawl Y-axis motor 68 and the held belt loop (tape material) B is pulled in toward the clamp unit 30 side (step S202). When the belt loop (tape material) B is sent out by a predetermined length set in the various data setting step ST1 (Yes at step S203), the pawl Y-axis motor 68 is stopped (step S204). A pull-out amount of the belt loop (tape material) B is detected by an encoder 68A of the pawl Y-axis motor 68.

[0079] Subsequently, the clamp X-axis motor 35 moves the holding block 32 forward, and furthermore, the clamp air cylinder 33 is operated to interpose the belt loop (tape material) B pulled in by means of the loop clamp 31 of the clamp unit 30 (step S205).

[0080] Then, the cutting air cylinder 64 is operated so that the belt loop (tape material) B is cut to have a predetermined length by means of the cutter 63 and the belt loop B having the predetermined length is thus obtained

(step S206).

[0081] The belt loop B has one of the ends (a tip portion) b1 held by the loop holding pawl 66 and has an intermediate part interposed by the loop clamp 31.

5 **[0082]** Subsequently, the fork air cylinder 40 is operated to move the fork unit 38 forward (step S207) to bring a state in which a tip side of the belt loop B is inserted into the fork portion of the fork unit 38 (See Fig. 6A).

10 **[0083]** In this state, for example, in the case in which it is predicted that a so-called dog ear is generated on the end b1 at one end side or the case in which generation is confirmed in a previous trial work as shown in a two-dotted chain line of Fig. 6A, an operator of a sewing machine presets a regulating operation for eliminating the dog ear (a loop clamp moving control) to be valid or invalid, and furthermore, inputs and sets data on a parameter (a numeric value or a mark) related to a direction and a moving amount in order to move the loop clamp 31 interposing the belt loop B in such a direction that the end b1 of the belt loop B is assumed to be protruded in the X direction at the various data setting step (step ST1).

15 **[0084]** In the case of Fig. 6A, in the case in which the end b1 of the belt loop B is protruded toward a right side in the drawing, the loop clamp 31 is set to be moved by a predetermined length rightward in the drawing.

20 **[0085]** For example, in the case in which the loop clamp 31 is moved by "2 mm" rightward in the drawing along the X-axis direction, "-2 (a moving amount of 2 mm and a negative side in a moving direction) is input as a parameter. The parameter represents a value decided to be valid for folding the end of the belt loop B by the operator depending on the orientation of the belt loop B recognized visually by the operator or the raw material of the belt loop B and may be an optional value.

25 **[0086]** In the setting, if the regulating operation is valid (Yes at step S208), the loop clamp 31 interposing the belt loop B is moved by 2 mm in a rightward direction to regulate the orientation of the belt loop B in a state in which the loop holding pawl 66 holds the end b1 of the belt loop B (step S209).

30 **[0087]** Consequently, the other end is shifted and bent corresponding to an assumed protrusion of the end b1 in an assumed bending direction of the end b1 around the end b1 interposed by the loop holding pawl 66 as in a belt loop B' shown in a two-dotted chain line of Fig. 6B.

35 **[0088]** After the loop clamp moving control is executed to regulate the orientation of the belt loop B or the fork unit 38 is moved forward when the regulating operation is invalid, subsequently, a fold-back operation is carried out (step S210). In the fold-back operation, the rotary actuator 41 is operated to execute a folding control for rotating the fork unit 38 around the X axis, for example, in a normal direction.

40 **[0089]** In other words, when the fork unit 38 is rotated in the normal direction at a predetermined angle of 180 degrees or more, that is, an angle at which the belt loop B can be wound and held, and furthermore, is rotated in the normal direction at a predetermined rotating angle in

the middle, the air cylinder 67 for a pawl is operated to release the loop holding pawl 66. Consequently, the tip fork portion 38A pulls the end b1 of the belt loop B out of the loop holding pawl 66, and furthermore, the end b 1 of the belt loop B is folded back inward (downward in Fig. 6C). Thus, it is possible to fold the end b1 of the belt loop B toward the central side of the belt loop B and to thus hold the end b1.

[0090] Accordingly, the controller 80 constitutes controller for controlling the rotation of the fork unit in order to fold one of the ends of the belt loop toward the central side of the belt loop.

[0091] It is also possible to pull the belt loop tip out of the loop holding pawl 66 by only a rotating force of the fork unit 38 without releasing the loop holding pawl 66.

[0092] When the folding control is ended, the belt loop B held by the loop clamp 31 and the fork unit 38 is moved in the direction crossing the longitudinal direction and is placed in a sewing position of the belt loop sewing machine 1 (step ST3).

[0093] More specifically, the X-axis motor 35 and the Y-axis motor 36 for a clamp move the holding block 32 to deliver the belt loop B to a sewing execution position of the cloth put on the throat plate 3 in a state in which the belt loop B having the end b 1 folded back is held by the loop clamp 31 and the fork unit 38 in the clamp unit 30. At this time, the belt loop B is disposed in such a manner that the vicinity of the end b1 is opposed to a vertical moving position of the needle 11.

[0094] Then, a sewing operation is started by a starting switching manipulation for the sewing operation through the operator so that a belt loop sewing step is executed (step ST4).

[0095] In other words, the pulse motor 57 is operated so that the loop presser 52 is moved downward to press and hold the end b 1 of the belt loop B which is folded back and the cloth. Moreover, the air cylinder 40 does not act so that the fork unit 38 is returned and moved backward to an initial position. After the fork portion is pulled out of the belt loop B, the cloth feeding table 59 is moved by means of the X-axis motor 53 and the Y-axis motor 54 for the cloth, and furthermore, the driving source of the sewing machine body is subjected to an operation control so that the seam L1 having a predetermined number of stitches is formed and the end b1 of the belt loop B is thus sewn onto the cloth.

[0096] In the case in which it is assumed that the end b 1 is protruded from the central side of the belt loop B when the end b1 of the belt loop B is folded back, thus, the loop clamp 31 interposing the belt loop B is moved by a predetermined amount in such a direction that the end b1 is protruded and the direction of the belt loop B is regulated, and the end b1 of the belt loop B is folded back by the fork unit 38. Consequently, it is possible to fold the end b 1 of the belt loop B without the protrusion from the central side of the belt loop B.

[0097] It is possible to hold the belt loop B by the fork unit 38 and the loop clamp 31 and to deliver and place

the belt loop B in the sewing position of the sewing machine in that state. Therefore, a portion in which the end b 1 of the belt loop B is accurately folded back toward a central side thereof is sewn. Accordingly, it is possible to suppress the occurrence of the dog ear, thereby sewing the belt loop B properly.

[0098] Although the description has been given by taking, as an example, the control for moving the loop clamp 31 rightward against the protrusion of the end b1 of the belt loop B which is folded back from the central side toward the right side in the embodiment, it is sufficient to execute a control for moving the loop clamp 31 leftward in the case in which the end b 1 of the belt loop B which is folded back is protruded from the central side toward the left side.

[0099] Moreover, it is also possible to advance the step through the switch manipulation by the operator without automatically executing the operation steps (step S201 to step S210).

<Fold-back of Other End Side of Belt Loop>

[0100] At the belt loop sewing step ST4, a control to be carried out when folding the other end back in order to form the seam L1 and to then form the seam L2 on the other end of the belt loop B will be described with reference to the view for explaining an operation in Fig. 7.

[0101] There is brought a state in which the seam L1 on the end side is formed and the end b1 is sewn onto the bodice cloth, and then, the loop clamp 31 once releases the belt loop B and is moved in the Y direction, and the other end of the belt loop B is interposed. Accordingly, the seam L1 serves as the loop holding pawl 66 in the fold-back of the one end side.

[0102] Thereafter, the fork unit 38 is moved forward and stands by between the loop clamp 31 and the seam L1 in a state in which the belt loop B is inserted into the fork portion on the tip (see Fig. 7A).

[0103] In the case in which it is assumed that the other end b2 is protruded from the belt loop B so that the dog ear (a two-dotted chain line) is formed when the other end b2 of the belt loop B is folded back toward the one end side of the belt loop B in this state, the operator of the sewing machine previously selects a validity or an invalidity of the operation for regulating the other end or inputs and sets various parameters (data) for regulating the orientation and arrangement of the belt loop B in various data setting steps in the same manner as in the operation for regulating the end b1.

[0104] In this case, it is necessary to move the loop clamp 31 toward a left side of Figs. 7A to 7C which is reverse to the protruding direction, thereby cancelling the protrusion against the protrusion of the other end b2 of the belt loop B rightward in Figs. 7A to 7C, for example. Accordingly, "+2 (a moving amount of 2 mm and a positive side in a moving direction)" is input and set as a parameter for moving the loop clamp 31 by a predetermined amount leftward in Figs. 7A to 7C in the X-axis

direction, for example.

[0105] When the loop clamp moving control is executed so that the regulating operation is carried out, the loop clamp 31 interposing the belt loop B is moved leftward by 2 mm to regulate the orientation of the belt loop B in a state in which the end side of the belt loop B is fixedly sewn onto the cloth (Fig. 7B).

[0106] There is made a difference in that the loop clamp 31 is set to be moved in the same direction as the shift assuming direction of the end in the case of the end b1, while the loop clamp 31 is moved in a reverse direction to the shift assuming direction of the end in the case of the other end b2.

[0107] After the loop clamp moving control is executed to regulate the orientation of the belt loop B, the rotary actuator 41 is then rotated in a reverse direction to reversely rotate the fork unit 38. Consequently, the other end b2 of the belt loop B is pulled out of the loop clamp 31 and the end b2 on the other end side of the belt loop B is folded back toward the end side of the belt loop B, and the other end b2 of the belt loop B is folded downward from the central side of the belt loop B as shown in Fig. 7C.

[0108] The loop presser 52 is moved downward onto the portion thus obtained by folding the other end b2 back so that the other end b2 of the belt loop B which is folded back and the cloth are pressed and held. Moreover, the fork unit 38 is moved backward and the other end b2 is then pulled out of the belt loop B, and thereafter, each portion of the sewing machine is subjected to an operation control so that the seam L2 is sewn and the other end b2 of the belt loop B is sewn onto the cloth.

[0109] In the case in which it is assumed that the other end b2 is protruded from the belt loop B when the other end b2 is to be folded back, thus, the loop clamp 31 interposing the belt loop B is moved by a predetermined amount in a reverse direction to the protrusion assuming direction of the other end b1 to regulate the orientation of the belt loop B, and the other end b2 of the belt loop B is then folded back by the fork unit 38. Consequently, the other end b2 of the belt loop B can be folded back without the protrusion from the central side of the belt loop B.

[0110] By sewing a portion in which the other end b2 of the belt loop B is folded back toward the central side, it is possible to suppress the occurrence of the dog ear, thereby sewing the belt loop B properly.

[0111] In the case in which it is assumed that the other end b2 of the belt loop B which is folded back is not protruded from the central side, moreover, the fork unit 38 is rotated to fold the other end b2 of the belt loop B back toward the central side of the belt loop B without the execution of the loop clamp moving control.

[0112] In the embodiment, the description has been given by taking, as an example, the control for moving the loop clamp 31 leftward against the protrusion of the other end b2 of the belt loop B which is folded back from the central side toward the right side. In the case in which the other end b2 of the belt loop B which is folded back

is protruded from the central side toward the left side, however, it is sufficient to execute the control for moving the loop clamp 31 rightward.

[0113] Moreover, it is also possible to advance the respective operation steps through a switch manipulation by the operator without automatically executing them.

[0114] Although the description has been given to the example of the belt loop B taking the basic sewing shape shown in Fig. 5A in the embodiment, moreover, it is possible to fold back the other end of the belt loop B toward the central side of the belt loop B by executing the same loop clamp moving control and folding control also in the case in which the seam L3 is formed on one of the end sides of the belt loop B in a sewing form taking an almost Z shape at the other end side shown in Fig. 5B.

[0115] The invention is not restricted to the embodiment.

[0116] For example, in some cases in which the end (the end b1, the other end b2) of the belt loop B is folded back toward the central side of the belt loop B to prevent the end from being protruded from the belt loop B and the fork unit 38 is then moved backward and is thus pulled out of the belt loop B, the arrangement of the end of the belt loop B dragged to follow the movement of the fork unit 38 is shifted so that the end is protruded from the central side of the belt loop B.

[0117] In the case in which it is assumed that the fork unit 38 is moved backward and the arrangement of the end of the belt loop B is thus shifted so that the end of the belt loop B is protruded from the central side of the belt loop B, thus, it is sufficient to execute the loop clamp moving control in order to obtain an arrangement in which the end is previously inclined in a reverse direction to the direction in which the fork unit 38 is moved backward.

[0118] If the end of the belt loop B is previously inclined in the reverse direction to the direction in which the fork unit 38 is moved backward, the end of the belt loop B dragged by the fork unit 38 in the backward movement of the fork unit 38 is folded back onto the belt loop B.

[0119] For example, in the case of the loop clamp moving control in the fold-back of the belt loop B at one of the end sides shown in Figs. 6A to 6C, a control for previously moving the loop clamp 31 rightward in the drawing is executed corresponding to the protrusion of the end b1 of the belt loop B due to the dragging against the assumption that the end b1 is dragged by the fork unit 38 moved backward in the X-axis direction, that is, toward the right side in the drawing and is thus protruded from the belt loop B rightward in the drawing.

[0120] For example, there is executed a loop clamp moving control based on a parameter of "-3" obtained in a combination of a parameter of "-1" for correcting the protrusion of the end which is caused by the backward movement of the fork unit 38 with a parameter of "-2" for folding back the end b1 of the belt loop B. Consequently, there is brought a state in which the end b1 of the belt loop B subjected to the fold-back control is previously protruded slightly from the left side of the belt loop B.

When the fork unit 38 is moved backward, thus, the end b1 of the belt loop B is hidden under the belt loop B and is thus folded back.

[0121] For example, moreover, in the case of the loop clamp moving control in the fold-back of the belt loop B at the other end side shown in Figs. 7A to 7C, a control for previously moving the loop clamp 31 leftward in the drawing is executed corresponding to the protrusion of the other end b2 of the belt loop B due to the dragging against the assumption that the other end b2 is dragged by the fork unit 38 moved backward in the X-axis direction, that is, toward the right side in the drawing and is thus protruded from the belt loop B rightward in the drawing.

[0122] For example, there is executed a loop clamp moving control based on a parameter of "+3" obtained in a combination of a parameter of "+1" for correcting the protrusion of the end which is caused by the backward movement of the fork unit 38 with a parameter of "+2" for folding back the other end b2 of the belt loop B. Consequently, there is brought a state in which the other end b2 of the belt loop B subjected to the fold-back control is previously protruded from the left side of the belt loop B. When the fork unit 38 is moved backward, thus, the other end b2 of the belt loop B is hidden under the belt loop B and is thus folded back.

[0123] Although the case in which the parameters for correcting the protrusion of the end with the backward movement of the fork unit 38 are set to be "-1" and "+1" respectively is taken as an example in the embodiment, the corrected parameter may be an optional value depending on a shift amount of the end dragged by the movement of the fork unit 38, for example, represents a value decided by the operator as to whether the raw material of the belt loop B easily follows the movement of the fork unit 38 or a value for correcting the shift after actual dragging.

[0124] It is a matter of course that a corrected parameter is "zero" when the end of the belt loop B follows the movement of the fork unit 38 with difficulty and is not dragged.

[0125] The application of the invention is not restricted to the embodiment but changes can be properly made without departing from the gist of the invention.

[0126] In the above-described embodiment, the belt loop feeding apparatus 100 includes the loop holding pawl 66 and a loop pull-in portion 60b as the holding unit. However, according to the invention, an embodiment may be employed in which any holding unit (the loop holding pawl 66, the loop pull-in portion 60b) is not provided on the belt loop feeding apparatus 100. For example, in a case that the one end b1 of the belt loop B has been already sewn onto a bodice cloth and only the other end b2 of the belt loop B is needed to be folded back toward the one end side of the belt loop B, it is not necessary to provide the holding unit (the loop holding pawl 66, the loop pull-in portion 60b) on the belt loop feeding apparatus 100 of the present invention.

Claims

1. A belt loop sewing apparatus comprising:

a holding unit configured to hold one of ends in a longitudinal direction of a belt loop disposed in the longitudinal direction;
a clamp unit including a loop clamp capable of clamping or releasing the other end of the belt loop from a holding position set by the holding unit, the clamp unit configured to move the loop clamp in a direction crossing the longitudinal direction;
a fork unit including, on a tip, a fork formed into a forked shape and interposing the belt loop provided between the holding unit and the loop clamp, the fork unit configured to be rotatable around an axis in the direction crossing the longitudinal direction and movable in the direction crossing the longitudinal direction together with the loop clamp to fold one of the ends of the belt loop back toward a central side of the belt loop by a rotation of the fork unit; and
a controller configured to control the rotation of the fork unit to fold the one of the ends of the belt loop back toward the central side of the belt loop, wherein the held belt loop is moved in the direction crossing the longitudinal direction to place the belt loop in a sewing position of a sewing machine, and wherein the controller is configured to move the loop clamp holding the belt loop by a predetermined amount in the direction crossing the longitudinal direction and then to rotate the fork unit to fold the end of the belt loop.

2. The belt loop sewing apparatus according to claim 1, wherein the controller is configured to move the loop clamp holding the belt loop by the predetermined amount in the direction crossing the longitudinal direction and then to rotate the fork unit to fold the other end of the belt loop back toward the central side of the belt loop in a state in which the one end side of the belt loop is sewn onto a cloth by the sewing machine and the other end side of the belt loop is clamped by the loop clamp.

3. The belt loop sewing apparatus according to claim 1 or 2, further comprising:

an operating unit configured to previously set and input a direction crossing the longitudinal direction and a moving amount in the direction.

4. The belt loop sewing apparatus according to claim 1, wherein the controller is configured to set a moving direction of the loop clamp to be the direction cross-

ing the longitudinal direction and a direction in which one of the ends of the belt loop is protruded from the belt loop when the one of the ends is folded back.

5. The belt loop sewing apparatus according to claim 2, wherein the controller is configured to set a moving direction of the loop clamp to be the direction crossing the longitudinal direction and a reverse direction to a direction in which the other end of the belt loop is protruded from the belt loop when the other end is folded back. 5 10

6. A method of controlling a belt loop sewing apparatus, comprising: 15

holding one of ends in a longitudinal direction of a belt loop disposed in the longitudinal direction by a holding unit;
clamping or releasing, by a loop clamp, the other end of the belt loop from a holding position of the holding unit; 20
interposing the belt loop provided between the holding unit and the loop clamp by a fork unit;
rotating the fork unit around an axis in the direction crossing the longitudinal direction and moving the fork unit in the direction crossing the longitudinal direction together with the loop clamp; 25
folding back the one end of the belt loop back toward a central side of the belt loop by rotating the fork unit; and 30
moving the belt loop held by the loop clamp and the fork unit in the direction crossing the longitudinal direction to place the belt loop in a sewing position of a sewing machine, 35
wherein the loop clamp which holds the belt loop is moved by a predetermined amount in the direction crossing the longitudinal direction, and then the fork unit is rotated to fold the one end of the belt loop back toward the central side of the belt loop. 40

7. The controlling method according to claim 6, wherein the loop clamp which holds the belt loop is moved by a predetermined amount in the direction crossing the longitudinal direction, and then the fork unit is rotated to fold the other end of the belt loop back toward the central side of the belt loop in a state in which the one end side of the belt loop is sewn onto a cloth by the sewing machine and the other end side of the belt loop is then interposed by the loop clamp. 45 50

8. The controlling method according to claim 6, wherein a moving direction of the loop clamp is the direction crossing the longitudinal direction and a direction in which the one end of the belt loop is protruded from the belt loop when the one end is folded back. 55

9. The controlling method according to claim 7, wherein a moving direction of the loop clamp is the direction crossing the longitudinal direction and a reverse direction to a direction in which the other end of the belt loop is protruded from the belt loop when the other end is folded back.

Fig. 1

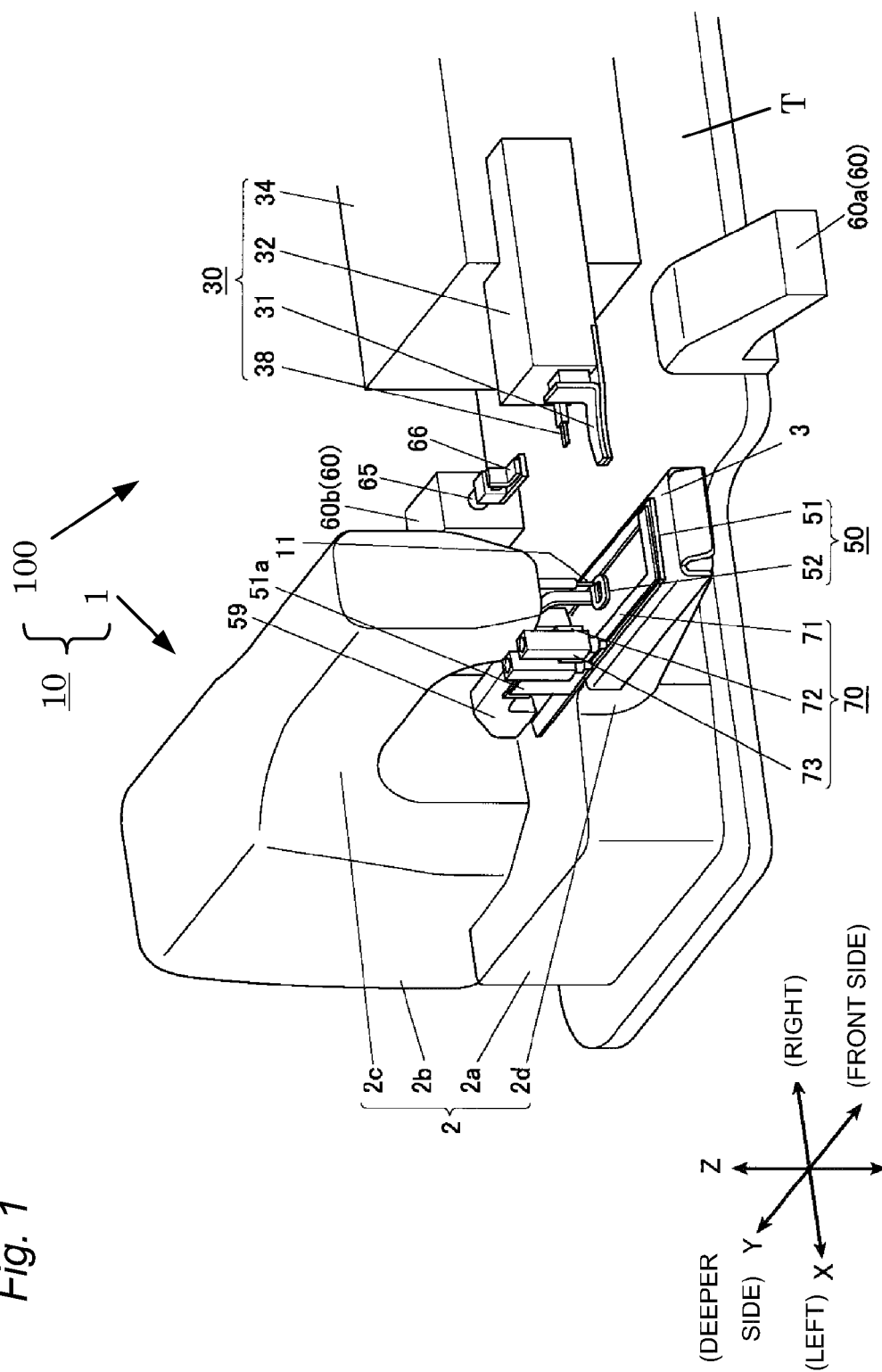


Fig. 2

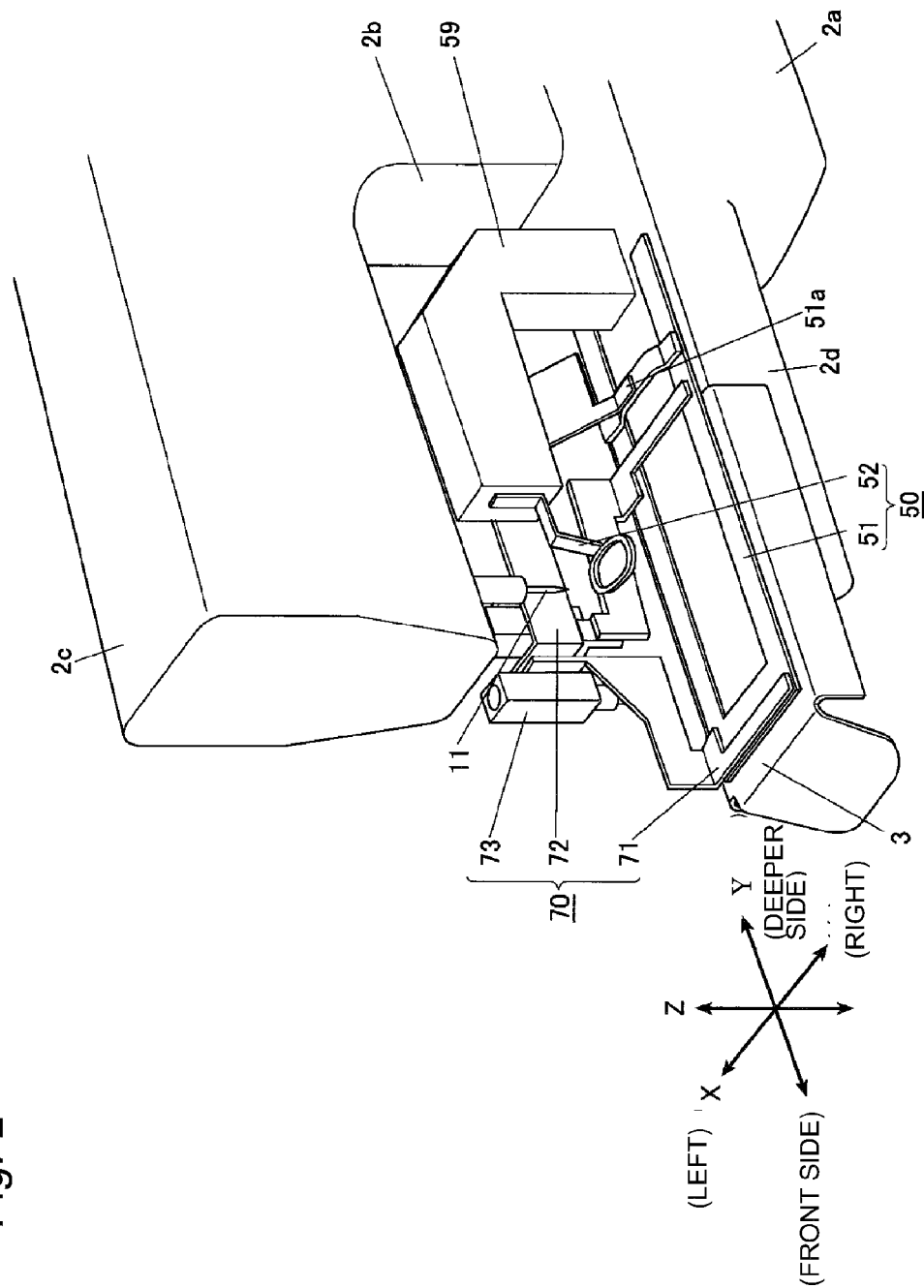


Fig. 3

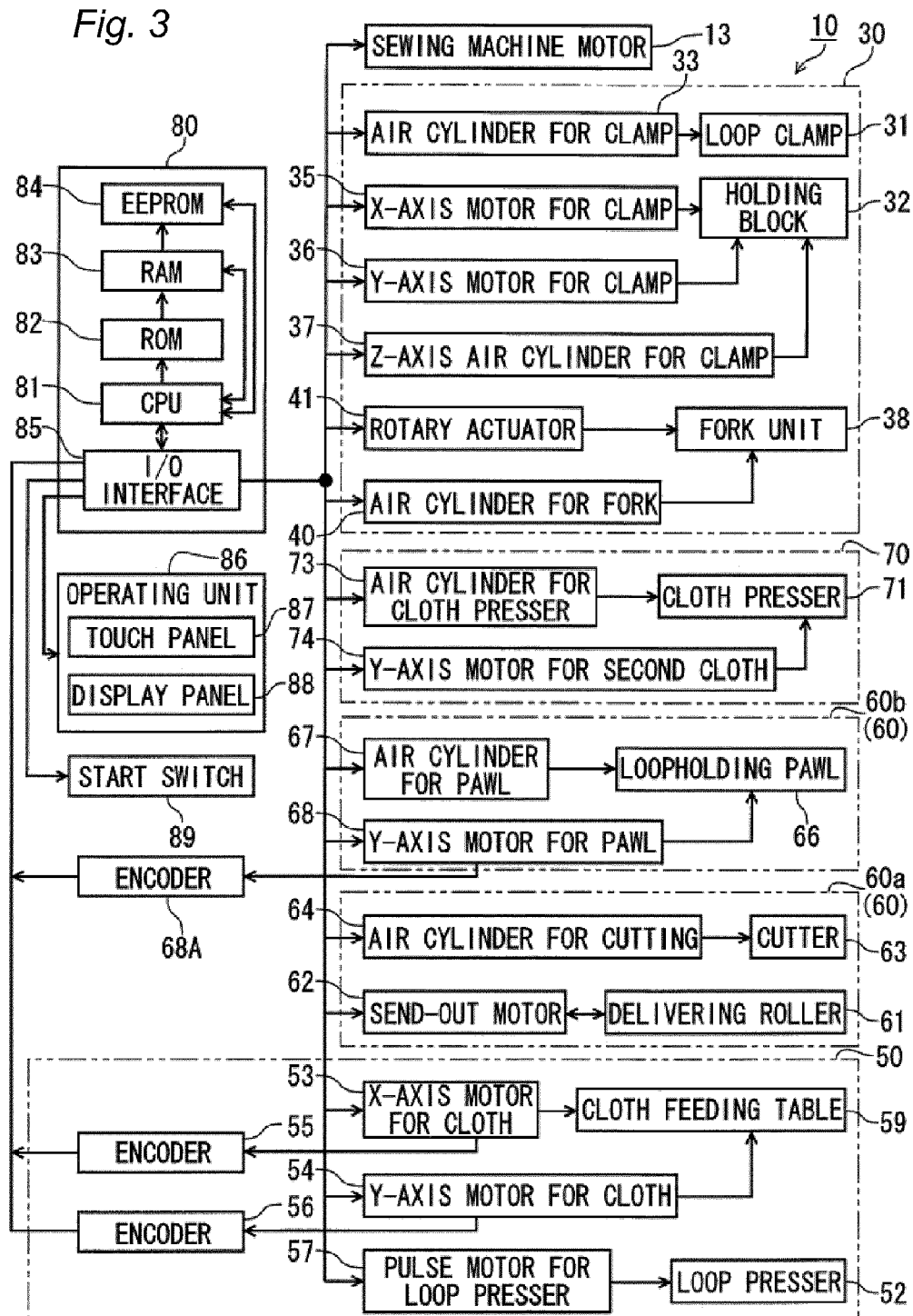


Fig. 4

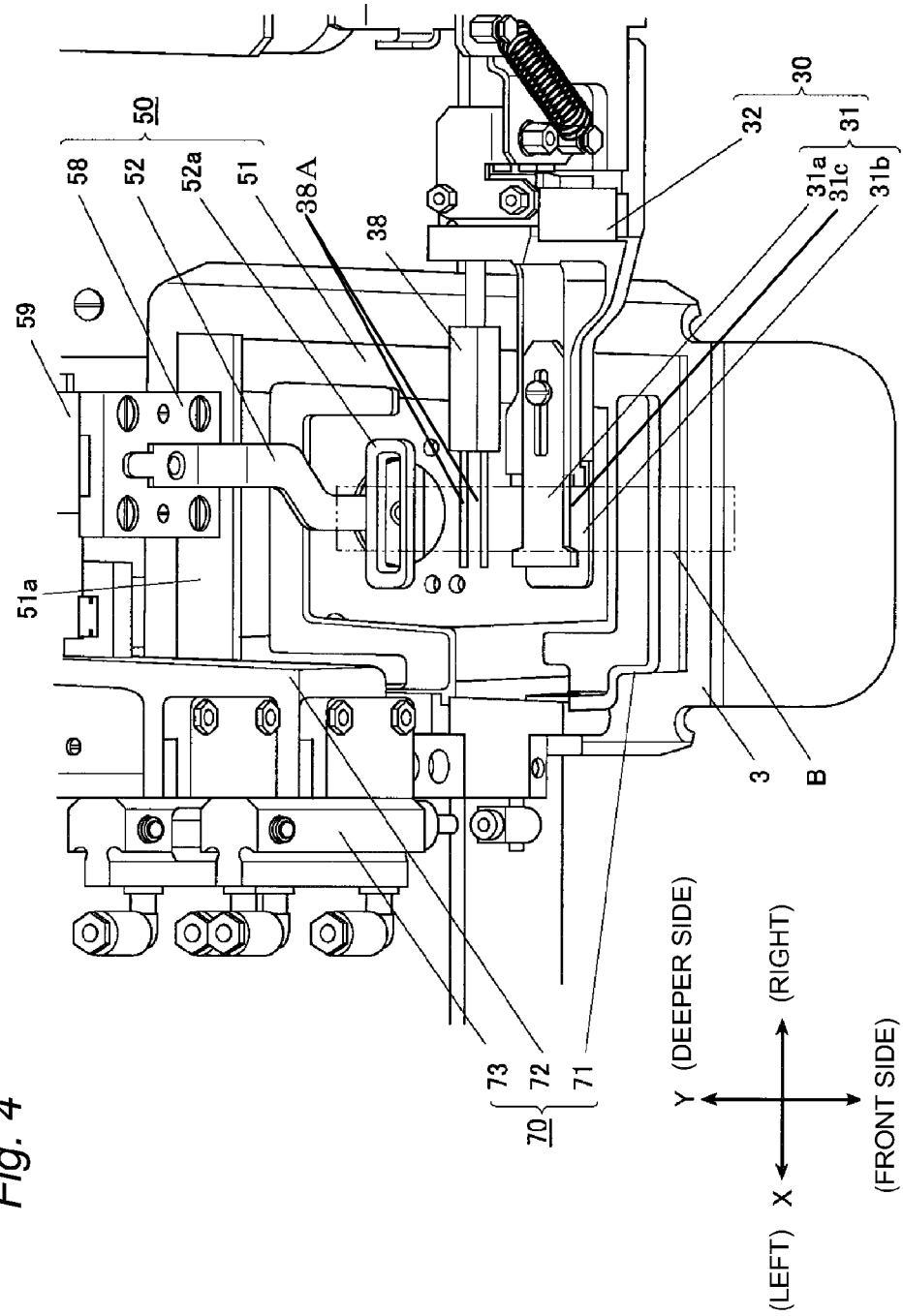


Fig. 5A

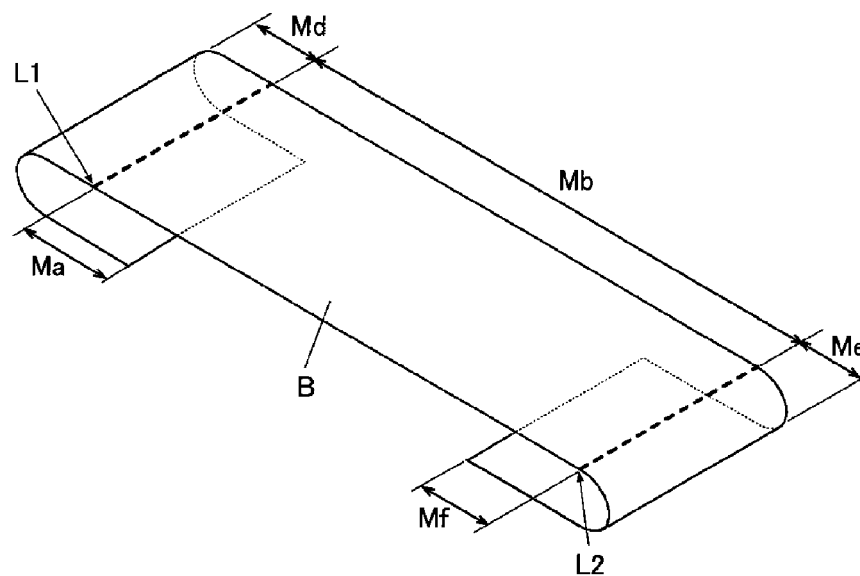
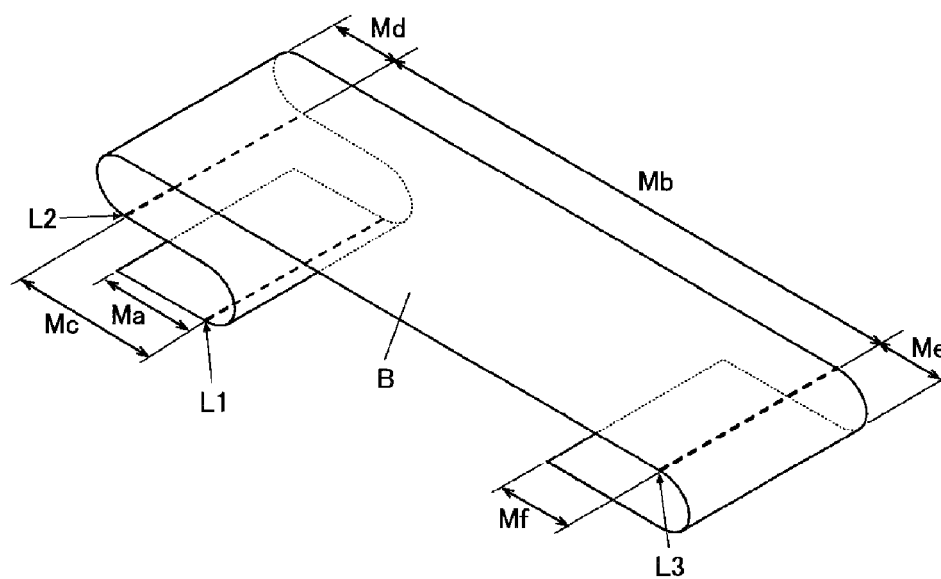


Fig. 5B



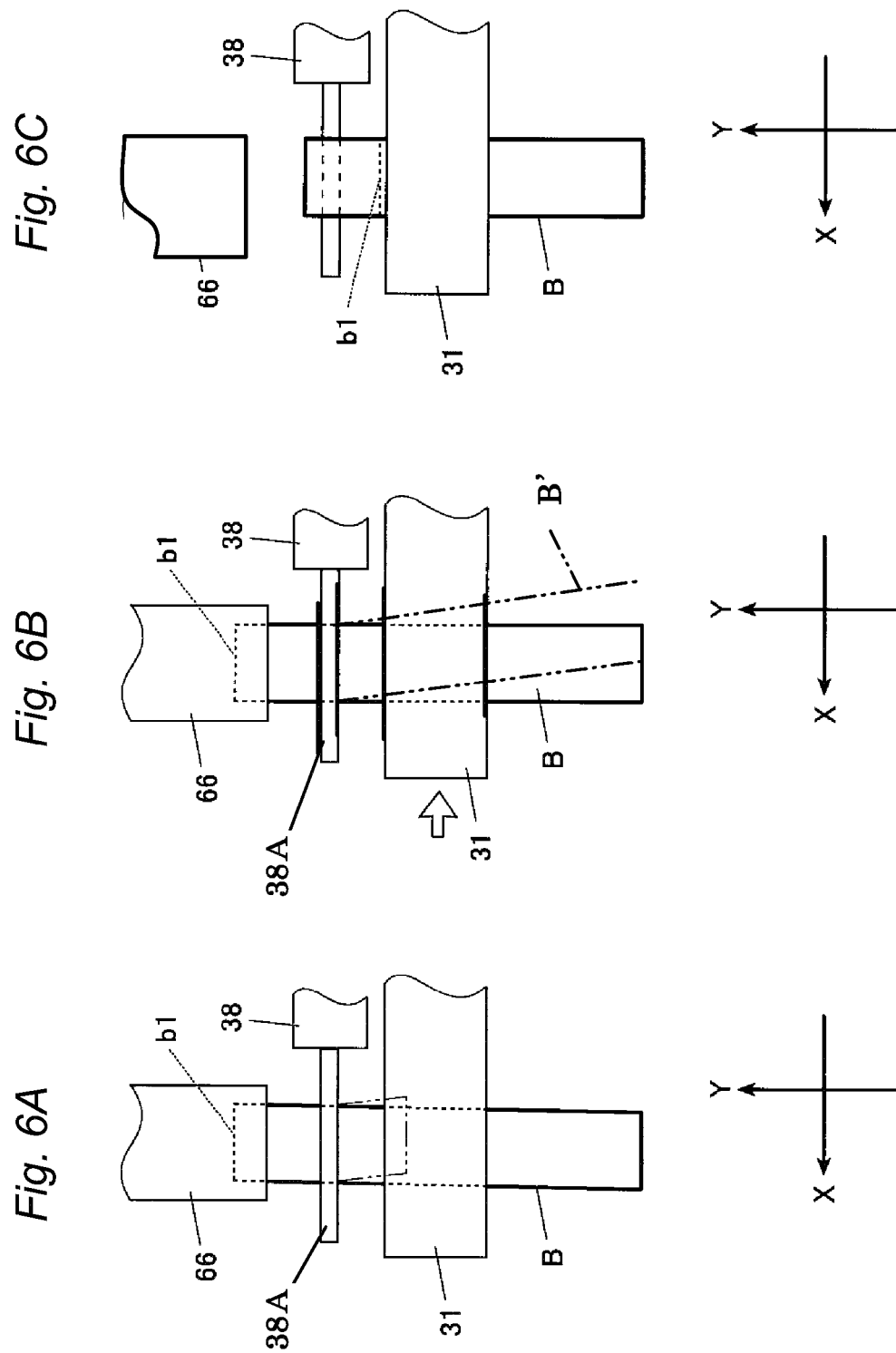


Fig. 7C

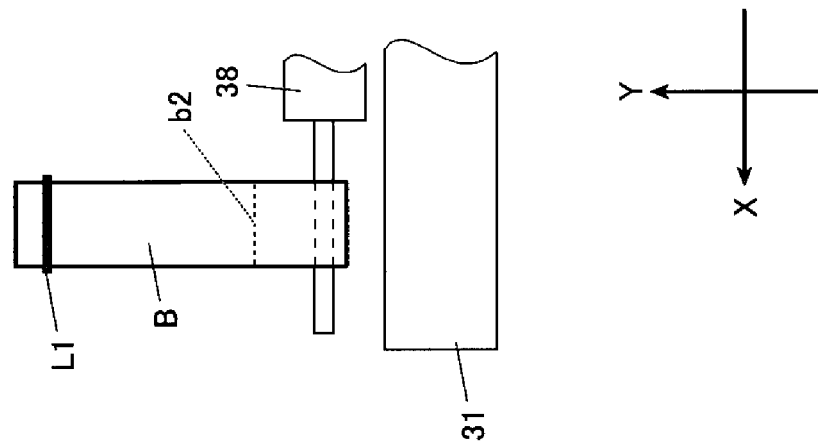


Fig. 7B

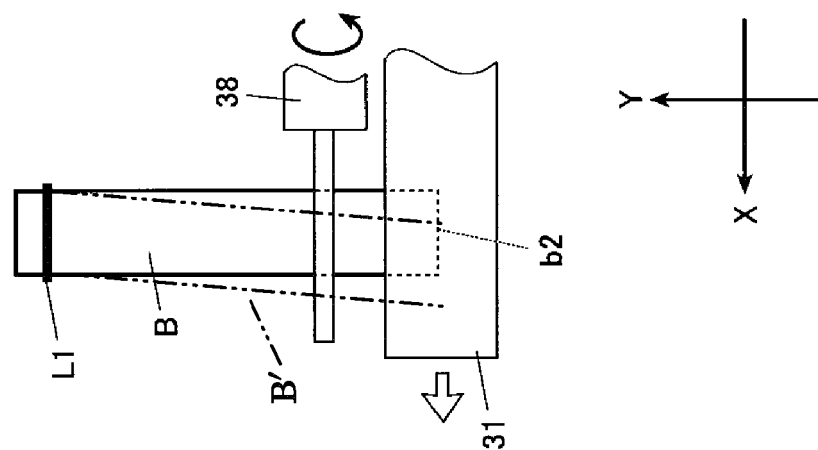


Fig. 7A

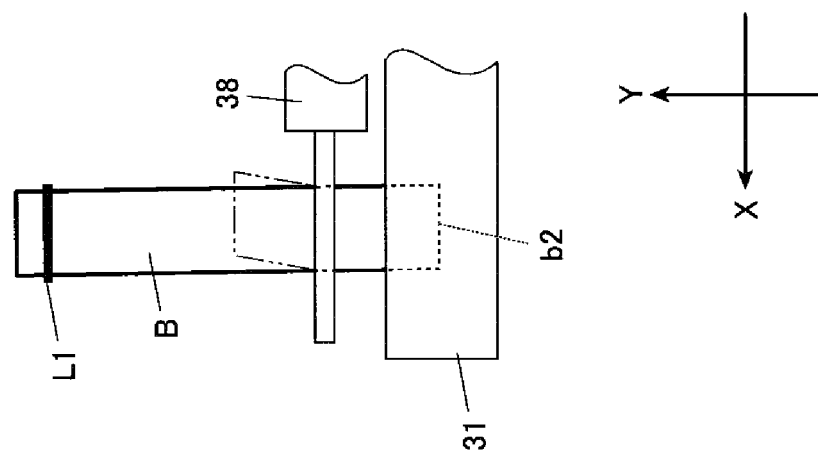


Fig. 8

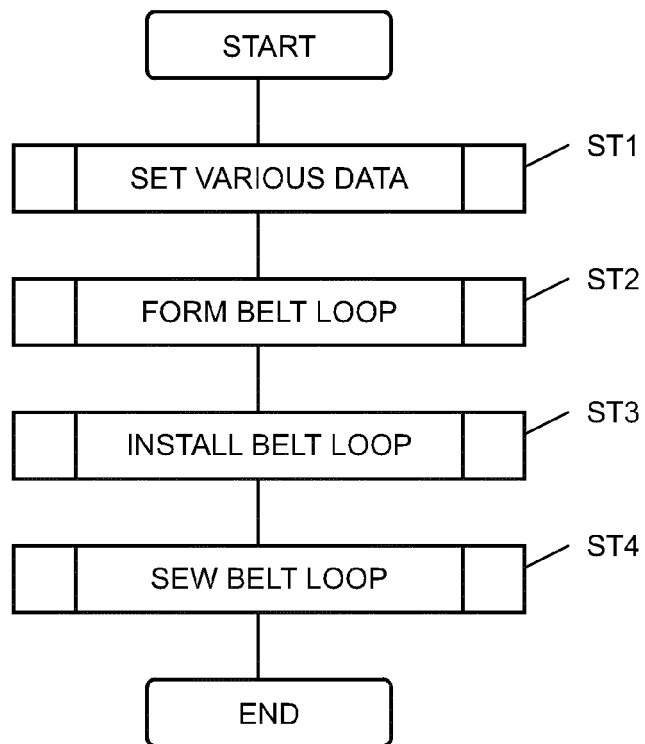
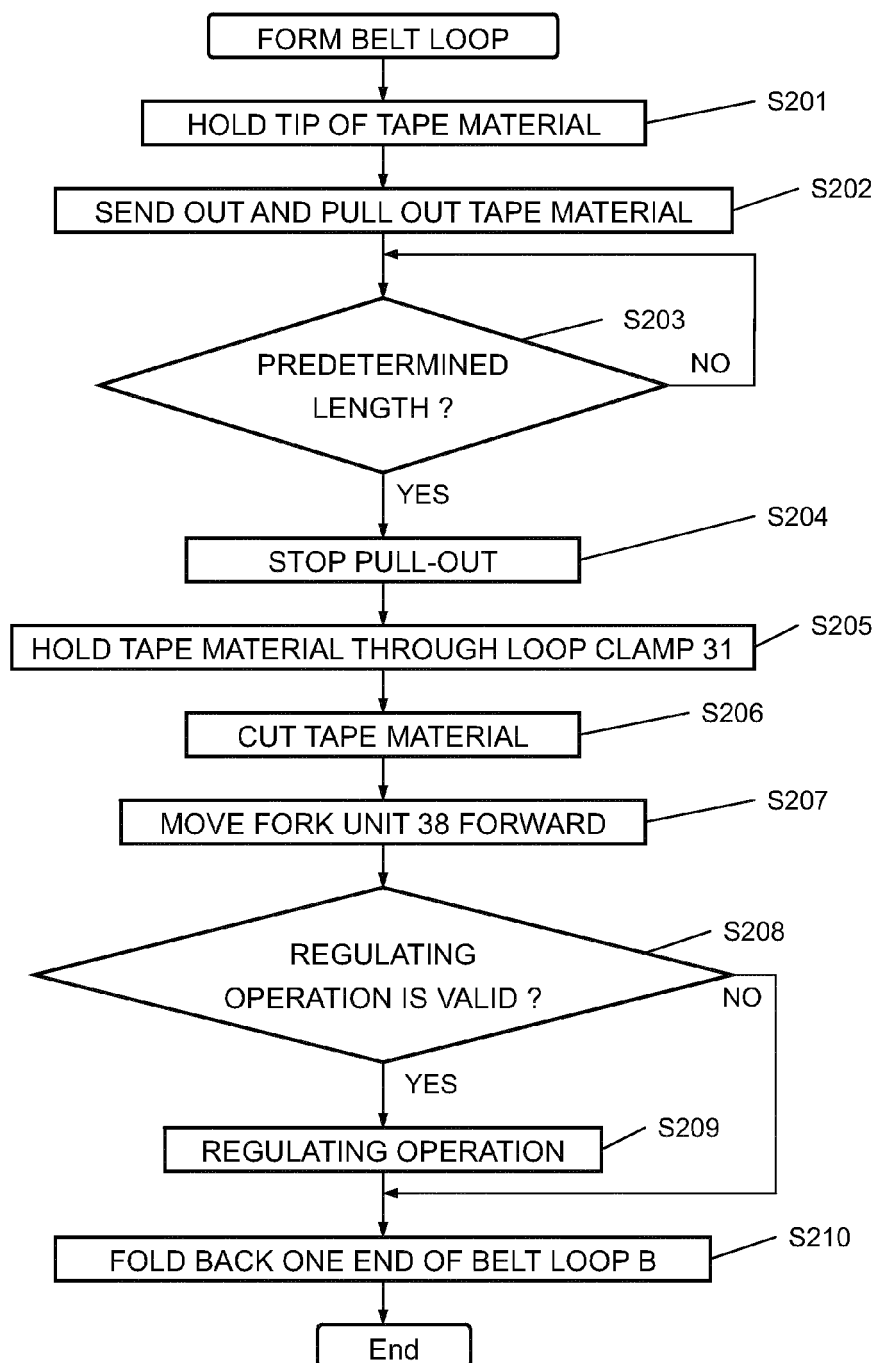


Fig. 9



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2000167282 A [0003] [0004]