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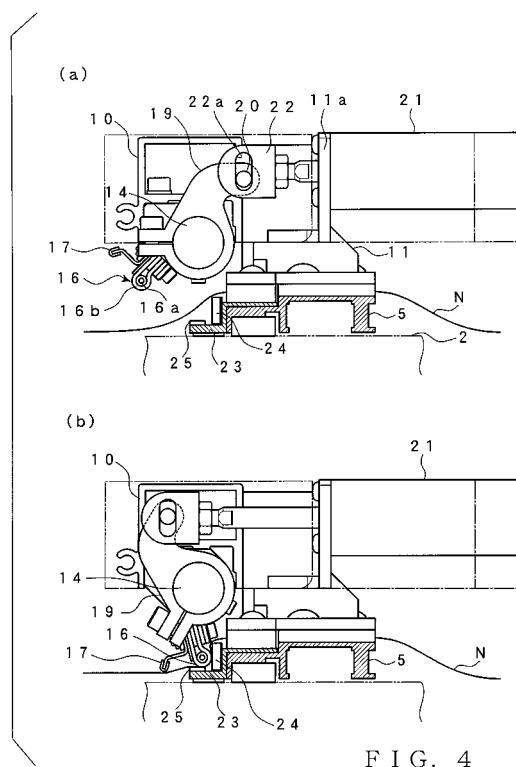
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(54) **SEWING MACHINE**

(57) Clamp members (8a, 8b), provided for supplying an elongated working fabric (N) from a fabric supply source to a controllably-driven fabric frame (5) and fixing the fabric to the frame, each include a retaining member (16) constructed to pivot about a pivot shaft (14) extending along a planar direction of the working fabric (N) positioned on the fabric frame (N), and an abutting engagement section (23) constructed to abuttingly engage the pivoted retaining member (16). The abutting engagement section (23) abuttingly engages the pivoted retaining member with the fabric (N) sandwiched between the retaining member (16) and the abutting engagement section (23), to thereby clamp the working fabric (N). Positioning mechanism (27) is provided at an intermediate position of a sash portion (10) suspending thereon the horizontal clamp members (8a, 8b). When the working fabric is to be fed, a vertically-movable member (31) of the positioning mechanism is caused ascend to permit feeding of the working fabric, while, when the working fabric is to be fixed, the vertically-movable member is caused to descend to support the intermediate position of the sash portion so as not to hang down or deform.



Description

Technical Field

[0001] The present invention relates generally to sewing machines for successively performing sewing on an elongated working fabric by repeating a sewing operation, such as an embroidery operation, while changing a to-be-fixed position of the working fabric relative to a fabric frame placed on a machine table. More particularly, the present invention relates to a sewing machine improved so as to reinforce fixation of a working fabric relative to a fabric frame.

Background Art

[0002] Heretofore, there have been known multi-head sewing machines in which an elongated working fabric is supplied from a fabric supply source to a fabric frame controllably driven in front-rear and left-right directions on a machine table, for fixation to the frame, and which is constructed to repeat sewing on the working fabric while changing a to-be-fixed position of the working fabric relative to the fabric frame by, upon completion of sewing on one portion of the working fabric fixed to the frame, canceling the fixation of the one portion and then fixes another portion of the fabric, to be sewn next, to the frame. Fig. 15 is a plan view of an example of such a type of sewing machine, where reference numeral 1 indicates a machine frame, 2 a machine table, 3 a plurality of machine heads, 5 a fabric frame. The fabric frame 5 is provided with horizontal clamp members 101a and 101b and vertical clamp members 102a and 102b for clamping a working fabric N.

[0003] The horizontal clamp members 101a and 101b are members of an identical construction merely positioned in opposed relation to each other, and thus, only one of the horizontal clamp members 101a will be representatively explained below. Fig. 16 is a sectional side view, taken along the III - III line in Fig. 15, of the front horizontal clamp member 101a. The horizontal clamp member 101a includes a fixing sash 104 having the same length as a horizontal side of the fabric frame 5, and the fixing sash 104 is fixed, at portions near its opposite ends, to the fabric frame 5 via brackets 103. A plurality of (six in the illustrated example) actuators 105 are provided on the fixing sash 104 at appropriate intervals, and a rod portion of each of the actuators 105 is fixed, at its distal end, to a respective predetermined portion of an elongated holding member 106 extending along the length of the horizontal clamp member 101a so that the rod portions of the actuators 105 cooperatively suspend thereon the holding member 106. Namely, the distal end of the rod portion of each of the actuators 105 is fixed to a predetermined portion of the single elongated holding member 106, and these (i.e., six) actuators 105 cooperate to cause the single holding member 106 to move in an up-down direction of the sewing machine. Abutting engage-

ment section 107 is formed on the horizontal side of the fabric frame 5 in a position corresponding to the holding member 106, so that the working fabric N can be held or sandwiched between the abutting engagement section 107 and the holding member 106 by the actuators 105 being activated simultaneously. Cushion members 108 are fixed to the holding member 106 and abutting engagement section 107 so as to reliably hold therebetween the working fabric N.

[0004] Next, the vertical clamp members 102a and 102b will be explained. The vertical clamp members 102a and 102b too are members of an identical construction merely positioned in opposed relation to each other, and thus, only one of the vertical clamp members 102a will be representatively explained below. Fig. 17 is a sectional side view, taken along the IV - IV line in Fig. 15, of the right vertical clamp member 102a. The vertical clamp member 102a includes a vertical sash 109, and the vertical sash 109 has a length slightly smaller than a distance between the horizontal clamp members 101a and 101b. First actuators 111 are fixed, via brackets 110, to opposite end portions of the vertical sash 109. Pivot levers 112 are pivotally supported on the brackets 110, and each of the pivot levers 112 is connected, via a pin 114, to a rod portion of the corresponding first actuator 111. Holding sash 113 having substantially the same length as the vertical sash 109 is disposed over the vertical sash 109, and the holding sash 113 is fixed, at its opposite end portions, to respective distal end portions of the two pivot levers 112. Cushion member 115 is fixed to the holding sash 113 along the entire length of the latter, and a felt piece 116 is attached to the holding sash 113 along the entire length of the latter. The working fabric N can be held between the cushion member 115 and the felt piece 116 by the holding sash 113 being caused to pivot downward through activation of the first actuator 111. Second actuators 117 are provided near the opposite ends of the vertical clamp member 102a, and the second actuators are mounted to the horizontal clamp members 101a and 101b, respectively. Rod portions of the two second actuators 117 are connected to the vertical sash 109 near the opposite ends of the sash 109, and the vertical sash 109 can be moved in the left-right direction through activation of the second actuators 117.

[0005] When the working fabric N is to be set on the sewing machine, the fabric N is paid out from a supply stand and passed over the fabric frame 5 in such a manner that it can be clamped by the individual clamp members, and then the fabric N is directed to a take-up stand. After that, the actuators of the horizontal clamp members 101a and 101b and vertical clamp members 102a and 102b are activated to fix the working fabric N to the fabric frame 5. Namely, first the actuators 105 of the horizontal clamp members 101a and 101b are activated to cause the working fabric N to be held between the holding members 106 and the abutting engagement sections 107, then the first actuators 111 of the vertical clamp members 102a and 102b are activated to cause the working fabric

N to be held between the cushion members 115 and felt pieces 116, and then the second actuators 117 are activated to increase an interval or distance between the vertical clamp members 102a and 102b so that the fabric N is stretched taut enough. In this way, the working fabric N can be appropriately fixed to the fabric frame 5.

[0006] Upon completion of sewing on one portion of the working fabric N fixed to the fabric frame 5, the actuators for the individual clamp members are activated to cancel the fixation of the fabric N, then another portion of the fabric N, to be sewn next, is positioned within an area surround by the fabric frame 5, and the other portion to be sewn next is fixed to the frame 5. The sewing machine repeats the aforementioned sewing operation while changing the to-be-fixed position of the working fabric N on the fabric 5.

[0007] According to the aforementioned conventional technique, the fixation of the working fabric N to the frame 5 is executed by the holding members 106 and holding sashes 113 being lowered to hold or sandwich the fabric N in conjunction with the abutting engagement section 107 and the vertical sash 109. Namely, the working fabric N is fixed by being pressed from above by the holding members 106 and holding sashes 113. However, a force pulling the working fabric N in a lateral (or planar) direction of the working fabric N would act on the fabric N due to, for example, contraction of the fabric N resulting from movement of the fabric frame 5 and progression of the sewing operation. Because the thus laterally-pulled fabric N is retained by being pressed from above, there would arise the inconvenience that the fabric N can not be fixed to the frame strongly or firmly enough. Particularly, where the working fabric N is a thin fabric, the inconvenience would become so serious that desired sewing can not be performed appropriately.

[0008] Further, the fixing sashes 104 of the horizontal clamp members 101a and 101b each have a relatively great length in correspondence with the width of the working fabric N. However, according to the conventional technique, the fixing sashes 104 are each merely fixed, at portions near its opposite ends, to the fabric frame 5, via the brackets 103, to extend along the fabric frame; this is for the purpose of passing the fabric N between the fixing sashes 104 and the fabric frame 5. Thus, the fixing sashes 104 can not be fixed at their intermediate portions. Consequently, when the holding members 106 have been lowered to sandwich the fabric N, intermediate portions of the fixing sashes 104 tend to deform (bend upwardly) so that the fabric N can not be reliably pressed by the fixing sashes 104. The deformation of the fixing sashes 104 too would become a negative factor preventing strong fixation of the working fabric N.

Disclosure of the Invention

[0009] In view of the foregoing, it is an object of the present invention to provide an improved fabric fixing mechanism which, in a sewing machine arranged to suc-

cessively perform sewing on an elongated working fabric by repeating a sewing operation, such as an embroidery operation, while changing a to-be-fixed position of the working fabric relative to a fabric frame on a machine table, can significantly reinforce the fixation of the working fabric relative to the fabric frame.

[0010] According to a first aspect of the present invention, there is provided a sewing machine of a type in which an elongated working fabric is supplied from a fabric supply source to a fabric frame, controllably driven on a machine table, to be fixed to the fabric frame via a clamp mechanism, and then, upon completion of sewing on a portion of the fabric fixed to the fabric frame, fixation, via the clamp mechanism, of the fabric is canceled to allow the fabric to move relative to the fabric frame so that another portion of the working fabric is fixed to the fabric frame for sewing on the other portion. In the sewing machine of the invention, the clamp mechanism for fixing the working fabric to the fabric frame includes a retaining member constructed to pivot about a pivot shaft extending along a planar direction of the working fabric positioned on the fabric frame, and an abutting engagement section constructed to abuttingly engage the retaining member having pivoted about the pivot shaft. The retaining member is caused to pivot about the pivot shaft with the working fabric positioned between the retaining member and the abutting engagement section, toward the abutting engagement section and abuttingly engaged by the abutting engagement section, to thereby clamp the working fabric to the fabric frame.

[0011] According to a second aspect of the present invention, there is provided a sewing machine of a type in which an elongated working fabric is supplied from a fabric supply source to a fabric frame, controllably driven on a machine table, to be fixed to the fabric frame via a clamp mechanism, and then, upon completion of sewing on a portion of the fabric fixed to the fabric frame, fixation, via the clamp mechanism, of the fabric is canceled to allow the fabric to move relative to the fabric frame so that another portion of the working fabric is fixed to the fabric frame for sewing on the other portion. wherein the clamp mechanism includes an elongated horizontal clamp member extending generally transverse to a feeding direction of the working fabric, and a sash portion connected and extending between opposite ends of the fabric frame and suspending thereon the horizontal clamp member, the clamp mechanism clamping the working fabric by moving the horizontal clamp member toward the fabric frame with the working fabric positioned between the horizontal clamp member and the fabric frame. The sewing machine of the present invention further comprises a positioning mechanism including a vertically-movable member suspended on an intermediate position of the sash portion, wherein, when the working fabric is to be fed, the positioning mechanism causes the vertically-movable member to ascend to permit feeding of the working fabric, while, when the working fabric is to be fixed, the positioning mechanism causes the vertical-

ly-movable member to descend to fix the working fabric between the vertically-movable member and the fabric frame and also support the intermediate position of the sash portion so as not to hang down or deform due to a reactive force from the fixed working fabric.

[0012] In the sewing machine constructed according to the first aspect of the present invention, the retaining member of the clamp mechanism is set in the clamping position by pivoting about the pivot shaft extending along the planar direction of the working fabric positioned on the fabric frame, and thus, moment of the retaining member acts substantially laterally (in the planar direction of the working fabric) at the time of working fabric clamping. Thus, as compared to the conventional counterpart which merely presses or holds down the working fabric from above, the clamp mechanism in the present invention can fix the working fabric more firmly with respect to the lateral direction (planar direction) in which the working fabric is pulled. Namely, when the working fabric is pulled in the lateral direction (planar direction), the retaining member operates to fix the working fabric even more firmly without moving with the pulled fabric, so that the working fabric can be fixed with an increased reliability. As a result, even where the working fabric is a thin fabric, it can be fixed reliably to the fabric frame.

[0013] In the sewing machine constructed according to the second aspect of the present invention, the positioning mechanism is provided at an intermediate position of the sash portion suspending thereon the horizontal clamp member. When the working fabric is to be fed, the vertically-movable member of the positioning mechanism is caused ascend to permit feeding of the working fabric, while, when the working fabric is to be fixed, the vertically-movable member is caused to descend to fix the working fabric between the vertically-movable member and the fabric frame and also support the intermediate position of the sash portion so as not to hang down or deform due to a reactive force from the fixed working fabric. Thus, the sash portion can be constantly positioned at an appropriate height, so that the working fabric can be fixed reliably over an almost entire length of the elongated sash portion. Further, it is possible to prevent vibration of the sash portion during movement of the fabric frame, which allows the fabric to be fixed with an even further increased reliability.

Brief Description of Drawings

[0014]

Fig. 1 is a plan view of a multi-head embroidery sewing machine in accordance with an embodiment of the present invention;

Fig. 2 is a schematic side view of the multi-head embroidery sewing machine in accordance with the embodiment of the present invention;

Fig. 3 is a plan view showing in enlarged scale a left end portion of a front horizontal clamp member em-

ployed in the embodiment;

Fig. 4 is a left side view of the horizontal clamp member, where (a) shows an unclamped state while (b) shows a clamped state;

Fig. 5 is a sectional view taken along the I - I line of Fig. 3;

Fig. 6 is a sectional view taken along the II - II of Fig. 3;

Fig. 7 is a side view showing, in further enlarged scale, clamping operation by the horizontal clamp member;

Fig. 8 is a perspective view showing an example of a positioning mechanism additionally provided on an intermediate portion of the horizontal clamp member;

Fig. 9 is a partly sectional side view explanatory of behavior of the positioning mechanism;

Fig. 10 is a sectional side view of a vertical clamp member;

Fig. 11 is a side view showing an example of a fabric supply stand;

Fig. 12 is a perspective view showing in enlarged scale a partial construction of a pay-out member of the fabric supply stand;

Fig. 13 is a perspective view showing an example construction of a positional adjustment member provided on a rear end portion of a machine table;

Fig. 14 is a side view showing a modified embodiment of the horizontal clamp member in the present invention;

Fig. 15 is a plan view of an example of a conventional sewing machine;

Fig. 16 is a sectional side view, taken along the III - III line in Fig. 15, of a horizontal clamp member in the conventional sewing machine; and

Fig. 17 is a sectional side view, taken along the IV - IV line in Fig. 15, of a vertical clamp member in the conventional sewing machine.

Best Mode for Carrying Out the Invention

[0015] Fig. 1 is a plan view of a multi-head embroidery sewing machine in accordance with an embodiment of the present invention, in which reference numeral 1 indicates a machine frame and 2 a machine table. A plurality of (twelve in the illustrated example) machine heads 3 are arranged on the machine frame 1 at equal intervals in a left-right (horizontal) direction as viewed from the front of the machine. Needle plates 4 are provided on the table 2 in positional corresponding relation to the machine heads 3. Fabric frame 5 is placed on the table 2 and drivable two-dimensionally, i.e. in front-rear and left-right directions, by means of an X drive mechanism and Y drive mechanism 7 disposed under the table 2. Horizontal clamp members 8a and 8b are provided along opposite horizontal sides of the fabric frame 5, and vertical clamp members 9a and 9b are provided along opposite vertical sides of the fabric frame 5. Working fabric N can be fixed to the fabric frame 5 by means of these

horizontal and vertical clamp members 8a, 8b and 9a, 9b. As illustratively shown in Fig. 2, the working fabric N is paid out from a fabric supply stand S1 disposed behind the embroidery sewing machine, and then fixed to the fabric frame 5 via the clamp members 8a, 8b, 9a and 9b. Once sewing on a portion of the working fabric N, fixed to the fabric frame 5, is completed, the fixation, by the fabric frame 5, of the portion of the fabric N is temporarily canceled, and the thus-released fabric portion is taken up by a take-up stand S2 disposed in front of the machine. Fig. 2 is a schematic side view of the embroidery sewing machine according to the embodiment, which particularly shows a case where a quilting operation is to be performed by the sewing machine. In this case, a working fabric N, comprising cotton (N3) sandwiched between two fabrics (N1 and N2), is supplied from the supply stand S1 to the fabric frame 5.

[0016] The horizontal clamp members 8a and 8b are members of an identical construction merely positioned in opposed relation to each other, and thus, only one of the horizontal clamp members (i.e., front horizontal clamp member) 8a will be representatively explained below.

Fig. 3 is a plan view showing in enlarged scale a left end portion of the front horizontal clamp member 8a, Fig. 4 is a left side view of the horizontal clamp member 8a, Fig. 5 is a sectional view taken along the I - I line of Fig. 3, and Fig. 6 is a sectional view taken along the II - II of Fig. 3. As clearly seen from these figures, the horizontal clamp member 8a includes a fixing sash 10 fixed to the fabric frame 5 via a bracket 11. To the fixing sash 10 are fixed a plurality of bearings 12 at appropriate intervals in such a manner that positions, in the front-rear direction (left-right direction in Figs. 5 and 6), of the bearings are adjustable. Pipe members 13 are disposed between the bearings 12, and the pipe members 13 are interconnected via pivot shafts 14 pivotably supported by the respective bearings 12. Retaining member 16 and holding member 17 are provided on each of the pipe members 13 via mounting members 15 mounted on the outer peripheries of opposite end portions and middle portion of the pipe member 13. As illustrated in Fig. 5, the mounting members 15 provided on the opposite end portions of each of the pipe members 13 are fixed to the corresponding pivot shaft 14 by means of a screw 18, and each of the mounting members 15 has an elongated mounting hole. Thus, if the screw 18 fixing the opposite-end mounting members 15 is loosened, the position of each of the mounting members 15 relative to the pipe member 13 can be adjusted in a direction about the axis of the pipe member 13. Each of the retaining members 16 comprises a core portion 16a having suitable hardness extending in the horizontal direction and a contact portion 16b covering the outside of the core portion 16a, and the contact portion 16b is formed of, for example, resilient rubber that is deformable and hardly slippable relative to the working fabric N when contacting the fabric N.

[0017] In Fig. 3, the leftmost pivot shaft 14 has a left

end portion projecting beyond the fixing sash 10, and an actuating member 19 is fixed to the projecting left end portion of the pivot shaft 14. Connecting pin 20 is fixed to the distal end of the actuating member 19, and the connecting pin 20 is fitted in a connecting hole 22a of a connecting member 22 that is fixed to a rod of an air cylinder 21. The air cylinder 21 is fixed to a mounting portion 11a formed on the bracket 11. Thus, by activation of the air cylinder 21, each of the pivot shafts 14 and pipe members 13 is caused to pivot, so that the retaining member 16 and holding member 17 provided on each of the pipe members 13 pivot. Right end portion of the horizontal clamp member 8a is constructed similarly to the above-described left end portion, so that the horizontally-elongated retaining member 16 and holding member 17 are caused to pivot together by activation of the two, left and right, air cylinders 21. The working fabric N is fixed (clamped) and released (unclamped) to and from the fabric frame 5 by the pivoting movement of the retaining and holding members 16 and 17. The fabric frame 5 has abutting engagement sections 23 for holding or sandwiching and fixing the working fabric N in conjunction with the retaining members 16, and rubber members 24 and 25 are provided on each of the abutting engagement sections 23 to form a substantial right-angled corner portion.

[0018] (a) of Fig. 4 shows the working fabric N in a released (or unclamped) position or state, and (b) of Fig. 4 shows the working fabric N in a fixed (or clamped) position or state. In the unclamped state as shown in (a) of Fig. 4, the working fabric N is passed between the fabric frame 5 and each of the fixing sashes 10 and positioned on the fabric frame 5. Then, each of the air cylinders 21 is activated, so that the corresponding retaining member 16 and holding member 17 are caused to pivot to positions shown in (b) of Fig. 4 through the pivoting movement of the pivot shafts 14 and pipe members 13. In this way, the working fabric N can be held between the retaining members 16 and the abutting engagement sections 23 (rubber members 24 and 25) and thereby fixed relative to the fabric frame 5.

[0019] Fig. 7 shows, in further enlarged scale, how the working fabric N is held between the retaining members 16 and the abutting engagement sections 23 and fixed relative to the fabric frame 5. (a) of Fig. 7 shows the contact portion 16b of the retaining member 16 having contacted a distal end portion of the abutting engagement section 23 (i.e., distal end portion of the rubber member 25) as the retaining member 16 is caused to pivot in a counterclockwise direction of Fig. 7. During that time, the working fabric N is held or sandwiched between the retaining member 16 and the distal end portion of the abutting engagement section 23 (i.e., distal end portion of the rubber member 25). "Teflon" (trademark) tape 26 is attached to the upper surface of the distal end portion of the abutting engagement section 23 (rubber member 25) so that the fabric N can be easily tensioned by the pivoting movement of the retaining member 16. Namely, because the upper surface of the working fabric N held between

the retaining member 16 and the abutting engagement section 23 contacts the hardly-slippable retaining member 16 while the lower surface of the working fabric N contacts the easily-slippable Teflon (trademark) tape 26, the fabric N is pulled by the retaining member 16 in the pivoting direction (rightward in Fig. 7 or toward the front of the sewing machine) of the retaining member 16 as the retaining member 16 further continues to pivot in the counterclockwise direction to a fixing position (clamping position) shown in (c) of Fig. 7, until it is fixed to the fabric frame 5. For the rear horizontal clamp member 8b, there are provided retaining member 16 etc. that are similar in construction to the aforementioned retaining member 16 etc. Because the retaining member 16 etc. for the rear horizontal clamp member 8b are provided in opposed relation to the retaining member 16 etc. for the front horizontal clamp member 8a, the working fabric N is pulled in a direction opposite the forward direction (i.e., rearward direction); thus, the working fabric N is pulled in the forward and rearward directions on the fabric frame 5 to be fixed to the frame 5 in a forward-and-rearward stretched-taut condition. (b) of Fig. 7 shows the retaining member 16 at a time point when the lower end of the retaining member 16 has reached immediately beneath the shaft center of the pivot shafts 14 during the pivoting movement of the retaining member 16 from the position indicated in (a) of Fig. 7 to (c) of Fig. 7. At that time, the lower end of the retaining member 16 is located at a lowermost position pressing and distorting the rubber member 25. Once the retaining member 16 moves further rightward to the fixing (i.e., clamping) position shown in (c) of Fig. 7, the rubber member 25 is partly recovered from the distorted condition while the other rubber member 24 is pressed and distorted by the retaining member 16. In this way, the retaining member 16 can be retained firmly between the rubber member 25 and rubber member 24 of the abutting engagement section 23 forming the right-angled corner portion. Consequently, the tension of the working fabric N increases as the embroidery operation progresses; when a force pulling the working fabric N leftward in Fig. 7, the retaining member 16 too is subjected to a force causing the member 16 to pivot leftward, but the retaining member 16 can be prevented from pivoting leftward because such leftward pivoting movement presses and distorts (again) the rubber member 25. Also, in this retaining position (clamping position), the retaining member 16 will not pivot leftward together with the fabric N even when the working fabric N is subjected to a force pulling the clamped working fabric N leftward in Fig. 7; instead, such a pulling force acts to even more firmly fix the fabric N relative to the fabric frame. Namely, the working fabric N can be fixed to the fabric frame 5 even more firmly by being pulled in the aforementioned manner. Note that the holding member 17 provided in relation to the retaining member 16 functions to depress the working fabric N to reduce a distance between the fabric N and the table 2 as it is caused to pivot to the fixing position (clamping position); in this way, it is possible to minimize fluttering

of the fabric N caused by the sewing and thereby prevent a thread breakage etc.

[0020] Degree of the fixation, by the retaining members 16, of the working fabric N decreases in a direction toward the middle of the fixing sash 10. This is because the pivoting of the retaining members 16 is effected by means of the air cylinders 21 provided on the opposite end portions of the fixing sash 10. The degree of the fixation, by the retaining member 16, of the working fabric N may also vary due to dimensional errors of the individual component parts. In such a case, the degree of the fixation, by the retaining members 16, of the working fabric N can be made uniform by the positional adjustment of the bearings 12 and positional adjustment of the mounting members 15 relative to the pipe members 13.

[0021] As seen in Fig. 1, a positioning mechanism 27 is provided on a substantial middle portion of each of the horizontal clamp members 8a and 8b. Fig. 8 is a perspective view of the positioning mechanism 27, and Fig. 9 is a partly sectional side view of the positioning mechanism 27. As clearly seen from Figs. 8 and 9, the positioning mechanism 27 has a base member 28 fixed to the fixing sash 10. Air cylinder 30 is fixed to the base member 28 via a bracket 29, and an elevator member 31 is connected to the distal end of the air cylinder 30. Two guide shafts 32 are provided on and extend vertically upward from the elevator member 31 and have lower portions inserted through guide holes formed in the base member 28. Thus, through activation of the air cylinder 30, the elevator member 31 is caused to ascend and descend while being guided by the guide shafts 32. Guide plate 33 is fixed to the upper surface of the fabric frame 5 corresponding to the elevator member 31, and a guide groove 31a engaging with the guide plate 33 is formed in the lower surface of the elevator member 31. The fixing sash 10 for each of the horizontal clamp members 8a and 8b is fixed, only at its opposite end portions, to the fabric frame 5 via the bracket 11 (Fig. 3) and spanning the fabric frame 5. Although the fixing sash 10 has an elongated shape and it is desirable that its intermediate portion too be fixed to the fabric frame 5, no fixing/supporting means, such as the bracket 11, can be provided on the intermediate portion because the working fabric N has to be passed between the fixing sash 10 and the fabric frame 5. Therefore, the intermediate portion of the fixing sash 10 will hang down under its own weight. When the retaining member 16 is caused to pivot in this condition, the pivoting movement of the retaining member 16 may undesirably stop by being interfered with by the front surface of the abutting engagement section 23 of the fabric frame 5. The positioning mechanism 27 is therefore provided to avoid this inconvenience; that is, when the working fabric N is to be fed, the positioning mechanism 27 activates the air cylinder 30 to cause the elevator 31 to ascend to a position indicated by a solid line in Fig. 9 so that the elevator 31 does not interfere with the feeding of the fabric N. When the working fabric N is to be fixed (clamped), the air cylinder 30 is activated, prior to the

start of the pivoting movement of the retaining member 16, to cause the elevator 31 to descend to a position indicated by an imaginary line in Fig. 9 and thereby raise the hanging-down middle portion of the fixing sash 10 so that the hanging-down middle portion can be positioned at generally the same height as the opposite end portions of the fixing sash 10. In this way, the retaining member 16 can be caused to pivot reliably. Further, because the guide groove 31a of the elevator member 31 engages the guide plate 33, a position, in the front-rear direction (left-right direction in Fig. 9), of the fixing sash 10 can be appropriately restricted, the fixation, by the retaining member 16, of the fabric N can be effected reliably. With such arrangements, it is also possible to prevent vibration of the fixing sash 10 during the movement of the fabric frame 5. The elevator member 31 in the lowered position allows the working fabric N to be sandwiched between the guide groove 31a and the guide plate 33. Cushioning material, such as felt, may be attached to the guide groove 31a and guide plate 33 to prevent the working fabric N from getting scratched by the sandwiching between guide groove 31a and the guide plate 33. The aforementioned position restricting structure may be constructed in any desired manner, without being limited to the combination of the guide groove 31a (recessed portion) and guide plate 33 (projecting portion), as long as it can appropriately restrict the position of the fixing sash by a combination of recessed and projecting portions.

[0022] The following paragraphs describe the vertical clamp members 9a and 9b. The vertical clamp members 9a and 9b too are members of an identical construction merely positioned in opposed relation to each other, and thus, only the right vertical clamp member 9a will be representatively explained below.

Fig. 10 is a sectional side view of the vertical clamp member 9a. The vertical clamp member 9a includes a vertical sash 34, and the vertical sash 34 has a length slightly smaller than a distance between the horizontal clamp members 8a and 8b. First air cylinders 36 are fixed, via brackets 35, to opposite end portions of the vertical sash 34. Pivot levers 37 are pivotally supported on the brackets 35, and each of the pivot levers 37 is connected, via a pin 37a, to a rod portion of the corresponding first actuator 36. Holding sash 38 has a retaining member 39 provided thereon, and the retaining member 39 has substantially the same length as the holding sash 38. The retaining member 39 is formed of, for example, resilient rubber that is deformable and hardly slippable relative to the working fabric N when contacting the fabric N. Holding member 40 is provided on a distal end portion of the holding sash 38. Rubber member 41 is attached to the upper surface of the vertical sash 37 in a position corresponding to the retaining member 39. Support member 42 is fixed at its opposite ends to the vertical sash 37, and an auxiliary member 43 for preventing lift-up of a middle portion of the holding sash 38 is fixed to the support member 42. Thus, the working fabric N is sandwiched and fixed between the retaining member 39 and

the rubber member 41 of the vertical sash 34 by the first air cylinder 36 being activated to cause the pivot lever 37 to pivot downward so that the holding sash 38 is brought to a position shown in Fig. 10. At that time, the working fabric can be fixed more reliably with the auxiliary member 43 holding the middle portion of the holding sash 38 against unwanted lift-up. If, on the other hand, the first air cylinder 36 is activated to cause the pivot lever 37 to pivot upward, the holding sash 38 is moved upward so that the fixation of the working fabric N is canceled.

[0023] Second air cylinders 44 are provided near the opposite ends of the vertical clamp member 9a, and the second air cylinders 44 are mounted to the horizontal clamp members 8a and 8b, respectively. Rod portions of the two second air cylinders 44 are connected to the vertical sash 34 near the opposite ends of the sash 34, and the vertical sash 34 can be moved in the left-right direction through activation of the second air cylinders 44. After the working fabric N is fixed in place through activation of the first air cylinders 36, the second air cylinders 44 are activated so that the vertical sash 34 is moved in such a direction as to increase the distance between the opposed vertical clamp members 9a and 9b.

[0024] Fig. 11 is a side view showing an example of the supply stand S1. The supply stand S1 includes a pair of stand frames 45 spaced apart from each other in a width direction of the sewing machine. Two abutting engagement sections 46a and 46b and one abutting engagement section 46c for supporting a roll of the working fabric N are provided on a front (left in Fig. 11) portion and rear (right in Fig. 11) portion, respectively. Where quilting is to be performed, rolls of fabric (N1 and N2) are set on the two front abutting engagement sections 46a and 46b while a roll of cotton (N3) is set on the rear abutting engagement section 46c, as seen in Fig. 2. Where embroidery or the like is to be performed on a single fabric, only a roll of fabric N is set on the front upper abutting engagement section 46a, as illustrated in Fig. 11. The supply stand S1 also includes a pay-out mechanism for paying out a fabric in a case where embroidery is to be performed on the fabric and the fabric is a thin fabric. The pay-out mechanism includes a pivot 47 pivotally mounted on the stand frame 45. Rod portion of an air cylinder 48 is connected, at its distal end, to the pivot lever 47 via a pin, and the air cylinder 48 is pivotally fixed to the stand frame 45. Engaging portion 47a in the form of an elongated hole is formed in a distal end portion of the pivot lever 47, and a shaft portion 49a of a vertically-movable pay-out member 49 is engaged in the engaging portion 47a. The shaft portion 49a of the pay-out member 49 is also engaged in a guide hole 50a of a plate 50 that is in turn fixed to the stand frame 45. As clearly seen from Fig. 12, a rack gear 51 is fixed to the plate 50 along the guide hole 50a, and a pinion gear 52 meshing with the rack gear 51 is fixedly mounted on the shaft portion 49a of the pay-out member 49. Thus, as the pivot lever 47 is caused to pivot through activation of the air cylinder 48, the pay-out member 49 is vertically moved along the

guide hole 50a of the plate 50. Namely, the pay-out member 49 is vertically moved while being rotated via the rack gear 51 and pinion gear 52.

[0025] In the case where the working fabric N is a single thin fabric, a roll of the fabric N is set on the front upper abutting engagement section 46a, and a portion of the fabric N paid out from the roll is fed, by way of a guide shaft 53, to the pay-out member 49, passed around the pay-out member 49 and then directed to the fabric frame 5 via a later-described position adjustment member 54 provided on a rear end portion of the machine table 2. The pay-out member 49 is vertically movable between a lower-end pivot position indicated by a solid line in Fig. 11 and an upper-end pivot position indicated by an imaginary line in Fig. 11. When the working fabric N is fixed to the fabric frame 5, the air cylinder 48 is activated to cause the pivot lever 47 from a pivot position indicated by an imaginary line in Fig. 11 to a pivot position indicated by a solid line in Fig. 11. Thus, the pay-out member 49 is moved from the upper-end pivot position to the lower-end pivot position, so that another portion of the working fabric N, corresponding to an amount to be fed to the fabric frame 5, is paid out from the roll, during which time the pay-out member 49 is lowered while being rotated, in a direction opposite the fed direction of the working fabric N, via the rack gear 51 and pinion gear 52. This is for the purpose of preventing the working fabric N from being paid out more than necessary. When embroidery on the portion of the working fabric N fixed to the frame 5 has been completed and another to-be-embroidered portion of the fabric N is to be positioned within the area surrounded by the frame 5, the pivot lever 47 is caused to pivot, through activation of the air cylinder 48, from the solid-line position of Fig. 11 to the imaginary-line position of Fig. 11, so as to move the pay-out member 49 upward to the upper-end pivot position. After that, the working fabric N is fed out. In this way, the feeding-out of the working fabric N can be carried out smoothly.

[0026] Next, a description will be given about the position adjustment member 54 provided on a rear end portion of the table 2. As shown in Fig. 13, the position adjustment member 54 includes two supporting rods 55. Each of the supporting rods 55 is fixed at its opposite ends to brackets 56 that are in turn fixed to the rear end portion of the table 2. Air cylinder 57 is disposed beneath substantial middle portions of the two supporting rods 55, and it is fixed to a bracket 58 that is in turn fixed to the rear end portion of the table 2. Supporting member 59 for supporting the two supporting rods 55 is fixed to the air cylinder 57, so that the supporting member 59 is vertically movable through activation of the air cylinder 57. As shown in Fig. 11, the working fabric N paid out from the supply stand S1 to the fabric frame 5 is placed on the two supporting rods 55 of the position adjustment member 54. The supporting member 59 is normally in a lowered position as shown in Fig. 13, during which time an intermediate portion of each of the supporting members 59 is located at the same height as opposite end

portions of the supporting member 59. When the working fabric N is to be fed, the air cylinder 57 is activated to move upward the supporting member 59, so that the intermediate portion of the supporting member 59 is raised to be bent higher than the opposite end portions. Thus, the working fabric N passing over the two supporting rods 55 is pulled toward the opposite end portions of the supporting member 59 lower in height than the intermediate portion. The position adjustment member 54 and pay-out mechanism of the supply stand S1 constructed in the aforementioned manner can prevent the working fabric N from meandering during feeding of the fabric N.

[0027] Next, a description will be given about how sewing is performed on the working fabric N in the instant embodiment.

First, to set the working fabric N, the working fabric N is paid out from the supply stand S1 and passed over the fabric frame 5 in such a manner that it can be clamped by the individual clamp members 8a, 8b, 9a and 9b, and then the fabric N is directed to the take-up stand S2. In this state, the working fabric N is fixed to the fabric frame 5 by means of the clamp members 8a, 8b, 9a and 9b. For the fixation of the working fabric N, the first air cylinders 36 for the clamp members 9a and 9b are activated so that the widthwise end portions of the working fabric N are sandwiched and fixed between the retaining members 39 and the rubber members 41 of the vertical sashes 34. At the same time, the air cylinder 30 of each of the positioning mechanisms 27 is activated so that the hanging-down middle portion of the fixing sash 10 is raised. Then, the air cylinders 21 for the horizontal clamp members 8a and 8b are activated, so that the working fabric N is sandwiched between the retaining members 16 and the rubber members 24 and 25. Last, the second air cylinders 44 for the vertical clamp members 9a and 9b are activated to move the vertical sashes 34, so that the working fabric N is stretched taut. Once the sewing machine is activated by the human operator depressing a start switch of the sewing machine after the fabric N has been fixed in the aforementioned manner, the fabric frame 5 starts to be driven in the front-rear and left-right directions in accordance with sewing data, such as embroidery pattern data, but also a sewing operation by the machine heads 3 is initiated. In this way, desired sewing is performed on the working fabric N fixed to the fabric frame 5.

[0028] Upon completion of the sewing, the sewing machine is deactivated, and the individual air cylinders are activated to cancel the fixation, to the frame 5, of the working fabric N (i.e., unclamp the fabric N). Once the fixation of the working fabric N is canceled, the working fabric N is fed so that another to-be-embroidered portion of the fabric N is positioned within the area surrounded by the frame 5, the individual air cylinders are activated to cause the other to-be-embroidered portion of the fabric N to be fixed to the fabric frame 5 in the same manner as set forth above, and then the sewing machine is again activated to perform sewing on the fixed to-be-embroidered portion. Namely, the sewing machine repeats the

sewing operation while changing the to-be-fixed position of the working fabric N relative to the fabric frame 5.

[0029] As set forth above, the fixation, by the horizontal clamp members 8a and 8b, of the working fabric N can be reinforced by the pivoting movement of the retaining members 16. Further, because the retaining members 16 serve to even more firmly fix the working fabric N by pulling the fabric N, the fabric N can be fixed firmly with increased reliability even when the fabric N is a thin fabric. Further, with the positioning mechanisms 27 positioned on intermediate portions of the horizontal clamp members 8a and 8b, not only the working fabric N can be fixed firmly at any positions (particularly, intermediate portion) of the horizontal clamp members 8a and 8b, but also vibration of the fixing sashes 10 during the movement of the fabric frame 5 can be prevented so that the fixation of the working fabric N can be even further reinforced.

[0030] Now, a modified embodiment of the horizontal clamp members 8a and 8b will be described with reference to Fig. 14. In the modification of Fig. 14, the horizontal clamp member 8a or 8b is provided with a further retaining member 60 in addition to the retaining member 16 and holding member 17 pivotable as in the above-described embodiment. As the retaining member 16 pivots in the aforementioned manner, the further retaining member 60 is caused to pivot in a direction opposite the pivoting direction of the retaining member 16. The abutting engagement section 23 of the fabric frame 5 has a retaining wall 62. Not only the abutting engagement section 23 includes the rubber members 24 and 25 as in the above-described first embodiment, but also a rubber member 63 corresponding to the retaining member 60 is provided on the right side surface of the retaining wall 62. When the working fabric N is to be fixed to the fabric frame 5, the retaining member 16 is caused to pivot to a position as indicated by an imaginary line in Fig. 14, so as to sandwich the fabric N between the retaining member 16 and the rubber members 24 and 25. In this second embodiment, the working fabric N can be even more firmly because the fabric N is sandwiched by the retaining members 16 and 60 at left and right sides of the retaining wall 62.

[0031] Whereas the embodiments of the present invention have been described above in relation to the case where the individual members are driven by the air cylinders, the individual members may be driven by electric actuators or other suitable actuators. Whereas the clamping by the horizontal clamp members 8a and 8b has been described as effected on the basis of the pivoting movement of the retaining members 16, the present invention is not so limited. For example, the vertical clamp members 9a and 9b too may function to fix (clamp) the working fabric N on the basis of pivoting movement of similar retaining members.

Further, whereas, in the above-described embodiments, one positioning mechanism 27 is provided at a single position of the substantial middle portion of the corresponding horizontal clamp member 8a or 8b, any other

suitable number, rather than one, of the positioning mechanisms 27 may be provided distributively at suitable intermediate positions of the corresponding horizontal clamp member 8a or 8b.

- 5 Note that positioning of a to-be-next-sewn portion of the working fabric N within the area surrounded by the fabric frame 5 may be effected either by movement of the fabric frame 5 or by the sewing-completed portion of the fabric N being taken up by the take-up stand S2. In the case
10 where the to-be-next-sewn portion of the working fabric N is positioned within the area surrounded by the fabric frame 5 by the movement of the fabric frame 5, there may be provided a holding-down member for holding down the working fabric N near the sewing position of the machine head. Such a holding-down member may be vertical moved by an actuator provided on the machine head
15 3. Thus, when the to-be-next-sewn portion of the working fabric N is to be positioned within the area surrounded by the fabric frame 5, the holding-down member is lowered by the actuator to hold down the working fabric N to prevent the fabric N from being undesirably moved by the movement of the fabric frame 5.

25 Claims

1. A sewing machine in which an elongated working fabric is supplied from a fabric supply source to a fabric frame, controllably driven on a machine table, to be fixed to the fabric frame via a clamp mechanism, and then, upon completion of sewing on a portion of the fabric fixed to the fabric frame, fixation, via the clamp mechanism, of the fabric is canceled to allow the fabric to move relative to the fabric frame so that another portion of the working fabric is fixed to the fabric frame for sewing on the other portion, wherein said clamp mechanism for fixing the working fabric to the fabric frame includes a retaining member constructed to pivot about a pivot shaft extending along a planar direction of the working fabric positioned on the fabric frame, and an abutting engagement section constructed to abuttingly engage said retaining member having pivoted about the pivot shaft, and
30 wherein said retaining member is caused to pivot about the pivot shaft with the working fabric positioned between said retaining member and said abutting engagement section, toward said abutting engagement section and abuttingly engaged by said abutting engagement section, to thereby clamp the working fabric to the fabric frame.
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2. A sewing machine as claimed in claim 1 wherein said clamp mechanism, including a combination of said retaining member and said abutting engagement section, is provided at least on each of two opposed sides of the fabric frame.
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3. A sewing machine as claimed in claim 2 wherein the retaining members of the clamp mechanisms provided on the opposed sides of the fabric frame are arranged to pivot outwardly from the fabric frame so that a portion of the working fabric, positioned within an area surrounded by the fabric frame, is fixed to the fabric in a stretched-taut condition. 5
4. A sewing machine as claimed in claim 2 wherein the two opposed sides of the fabric frame, having at least said clamp mechanisms provided thereon, are sides extending in a direction transverse to a longitudinal direction of the working fabric. 10
5. A sewing machine as claimed in claim 2 wherein the two opposed sides of the fabric frame, having at least said clamp mechanisms provided thereon, are sides extending along a longitudinal direction of the working fabric. 15
6. A sewing machine as claimed in claim 1 wherein said abutting engagement section has a corner portion for abuttingly engaging said retaining member having pivoted about the pivot shaft and a resilient member provided on the corner portion, and said abutting engagement section engages said retaining member resiliently via the resilient member. 20
7. A sewing machine as claimed in claim 1 which further includes a holding member provided, in association with said retaining member, for pivoting movement together with said retaining member, and wherein, when the working fabric is in a clamped position between said retaining member and said abutting engagement section, a distal end of said holding member is located lower than another portion of said holding member having clamped the working fabric so that the working fabric fixed to the fabric frame is depressed further downward by the distal end of said holding member and thereby fixed with an increased stability during sewing. 25 30 35 40
8. A sewing machine in which an elongated working fabric is supplied from a fabric supply source to a fabric frame, controllably driven on a machine table, to be fixed to the fabric frame via a clamp mechanism, and then, upon completion of sewing on a portion of the fabric fixed to the fabric frame, fixation, via the clamp mechanism, of the fabric is canceled to allow the fabric to move relative to the fabric frame so that another portion of the working fabric is fixed to the fabric frame for sewing on the other portion, wherein said clamp mechanism includes an elongated horizontal clamp member extending generally transverse to a feeding direction of the working fabric, and a sash portion connected and extending between opposite ends of the fabric frame and suspending thereon said horizontal clamp member, said clamp mechanism clamping the working fabric by moving said horizontal clamp member toward the fabric frame with the working fabric positioned between said horizontal clamp member and the fabric frame, and which further comprises a positioning mechanism including a vertically-movable member suspended on an intermediate position of said sash portion, wherein, when the working fabric is to be fed, said positioning mechanism causes said vertically-movable member to ascend to permit feeding of the working fabric, while, when the working fabric is to be fixed, said positioning mechanism causes said vertically-movable member to descend to fix the working fabric between said vertically-movable member and the fabric frame and also support the intermediate position of said sash portion so as not to hang down or deform due to a reactive force from the fixed working fabric. 45 50 55
9. A sewing machine as claimed in claim 8 wherein said positioning mechanism includes said vertically-movable member and a power source for vertically driving said vertically-movable member, said vertically-movable member has, at a lower end thereof, an abutting portion corresponding to the fabric frame, the abutting portion of said vertically-movable member functioning as one of cooperating recessed and projecting portions of a positional restricting structure, and the fabric holder has an abutting portion corresponding to the lower end of said vertically-movable member, the abutting portion of the fabric holder functioning as other of the cooperating recessed and projecting portions of the positional restricting structure.

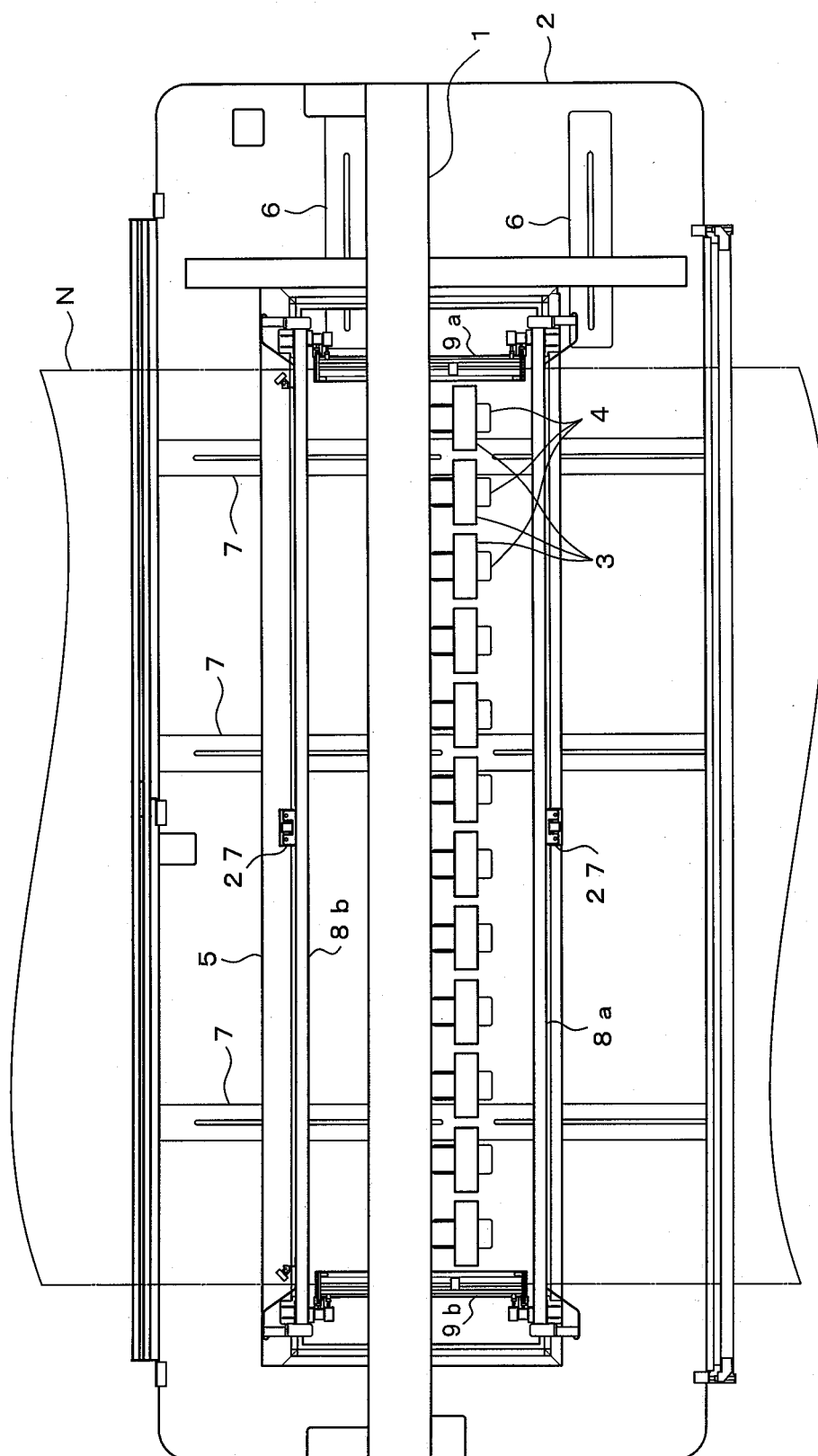


FIG. 1

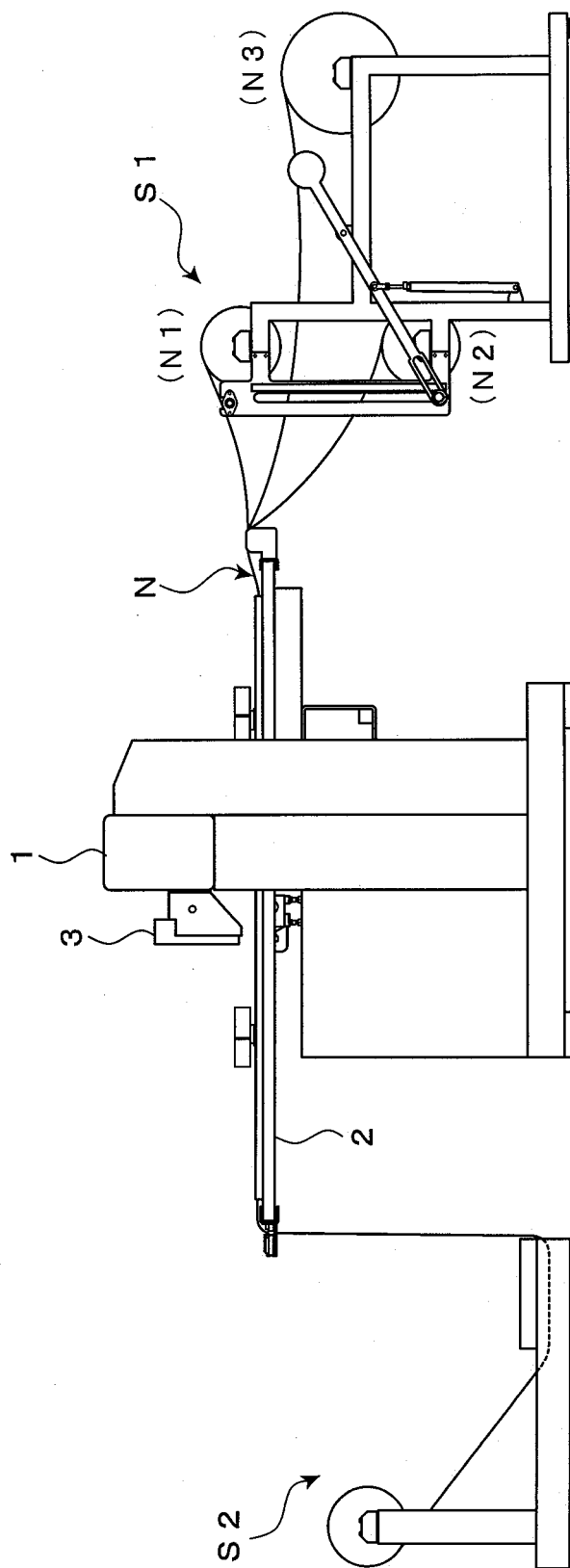


FIG. 2

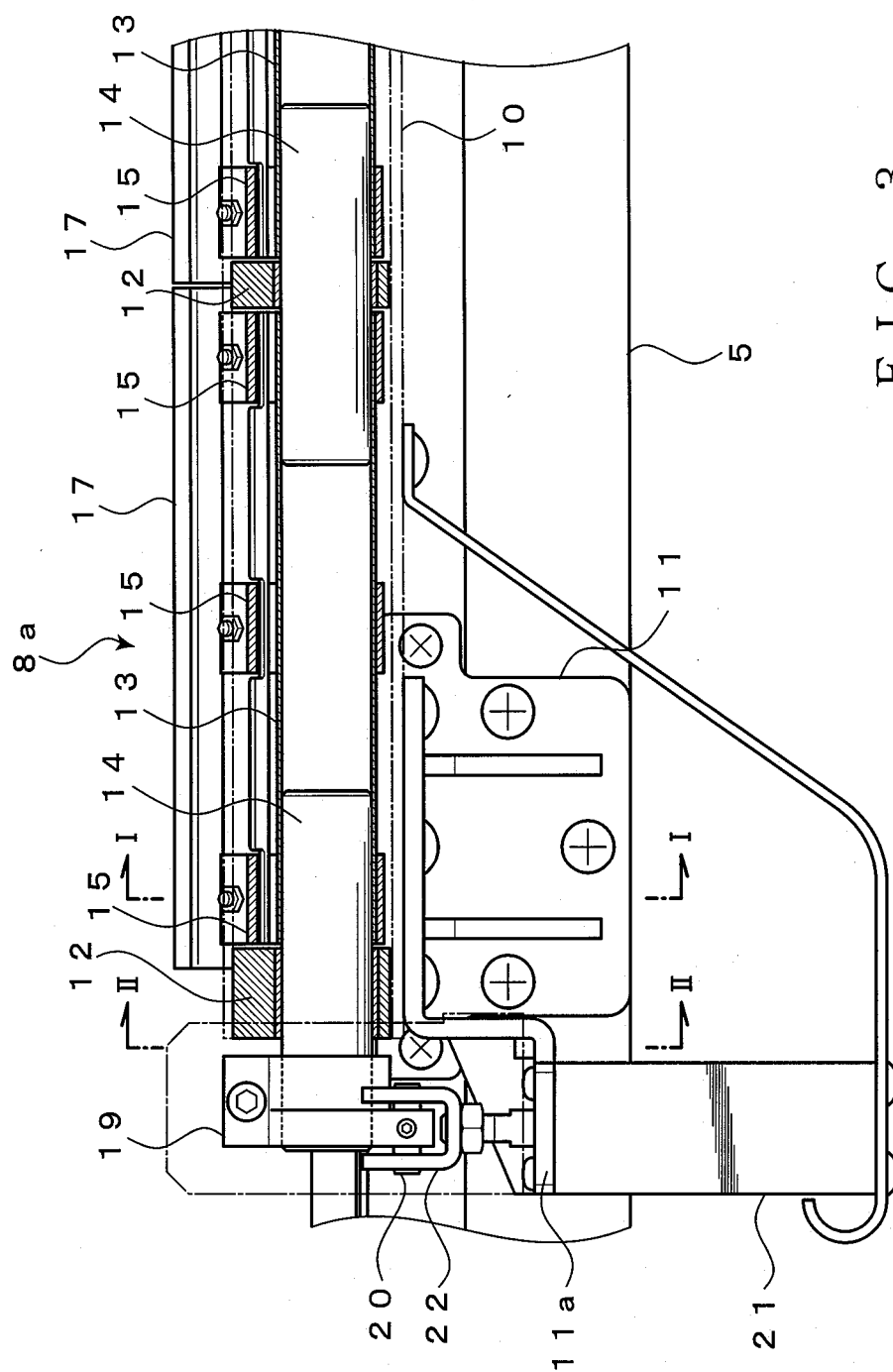
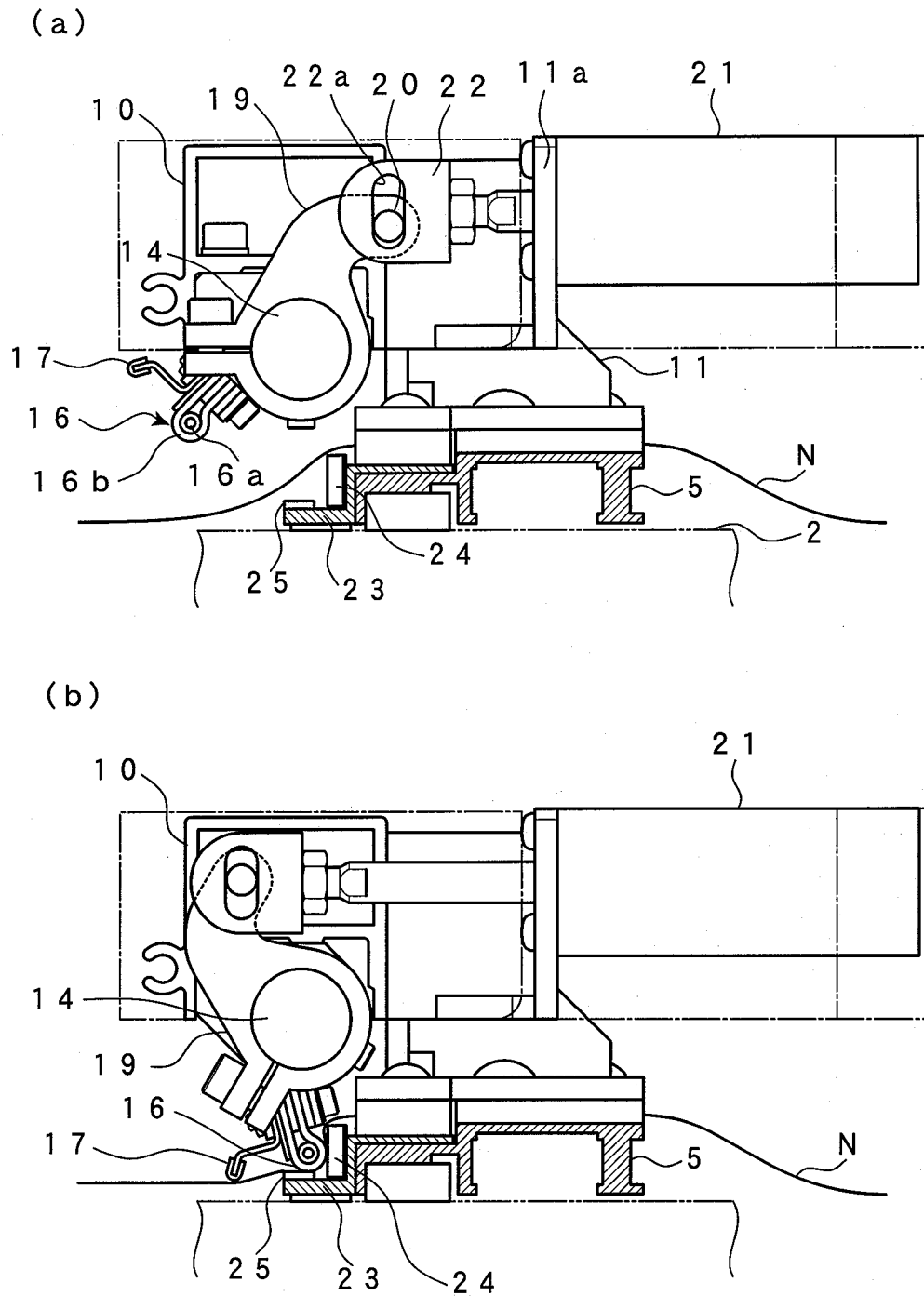


FIG. 3



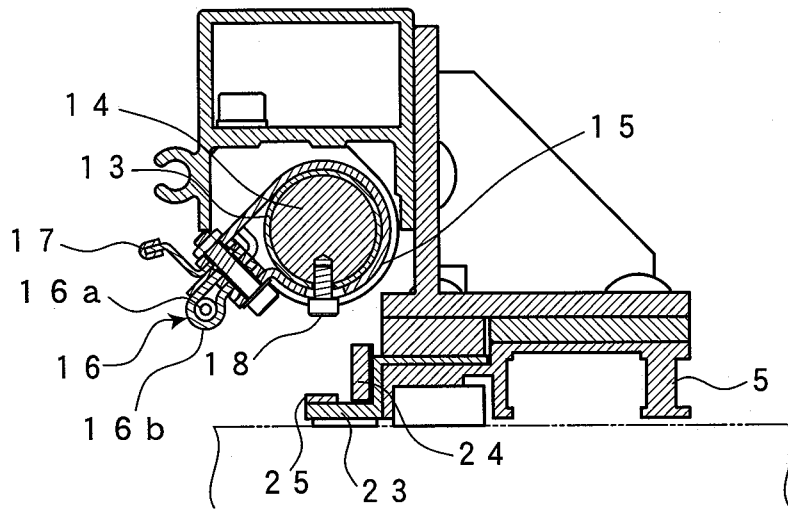


FIG. 5

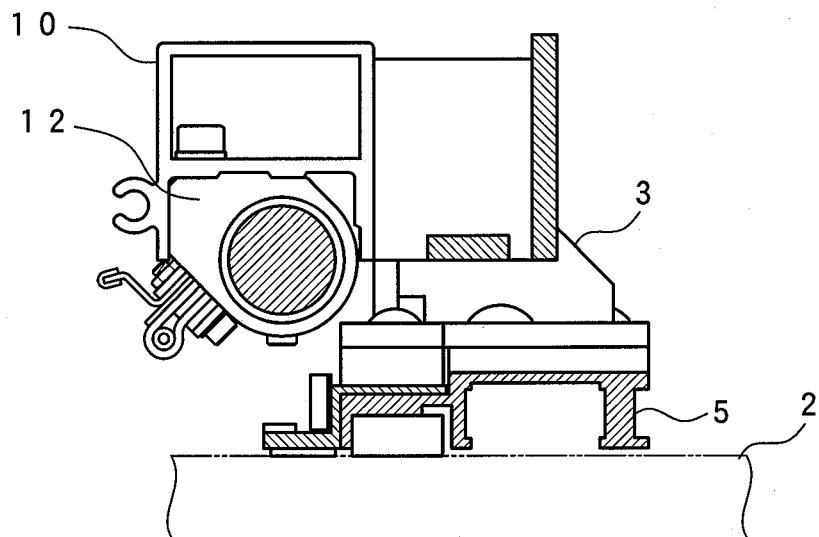


FIG. 6

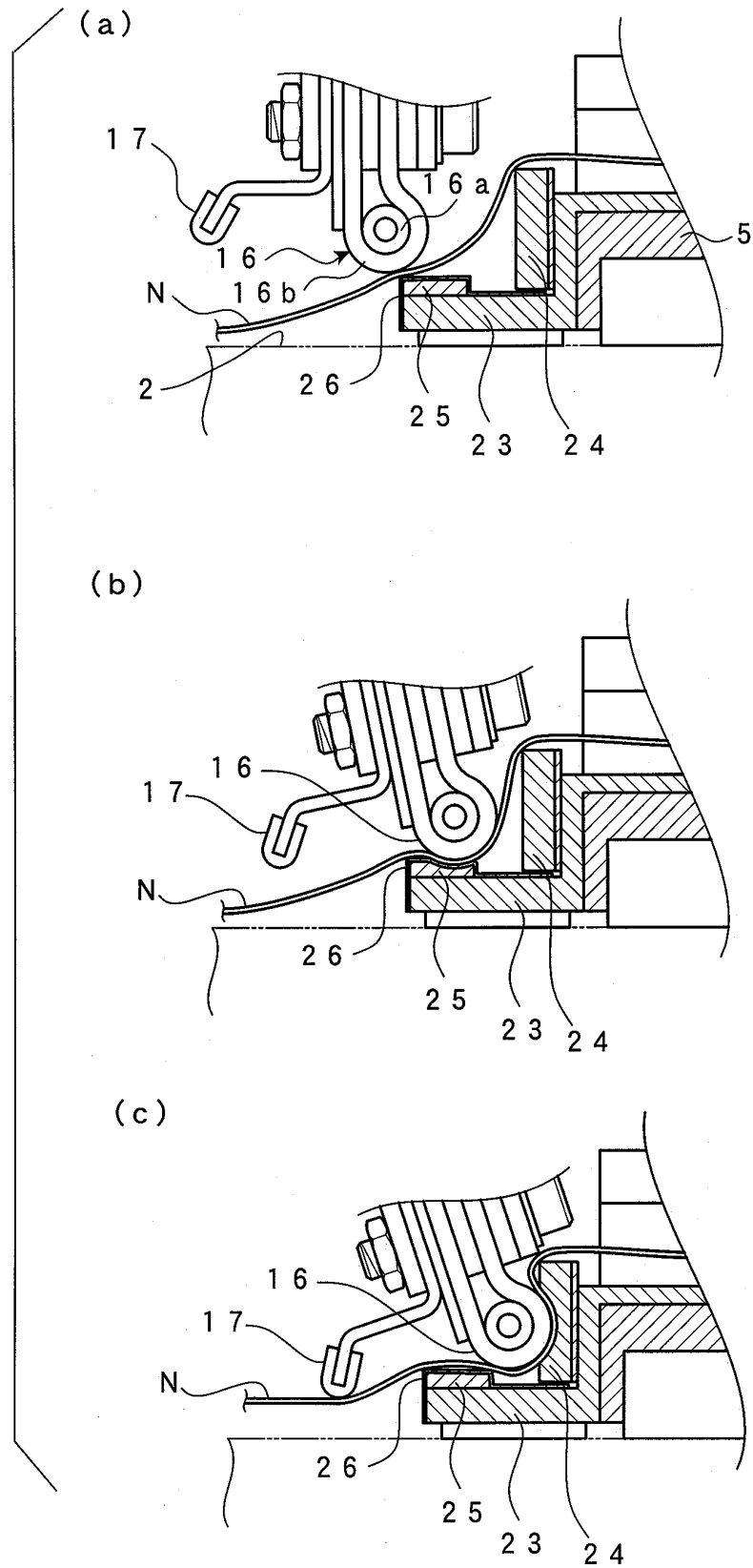


FIG. 7

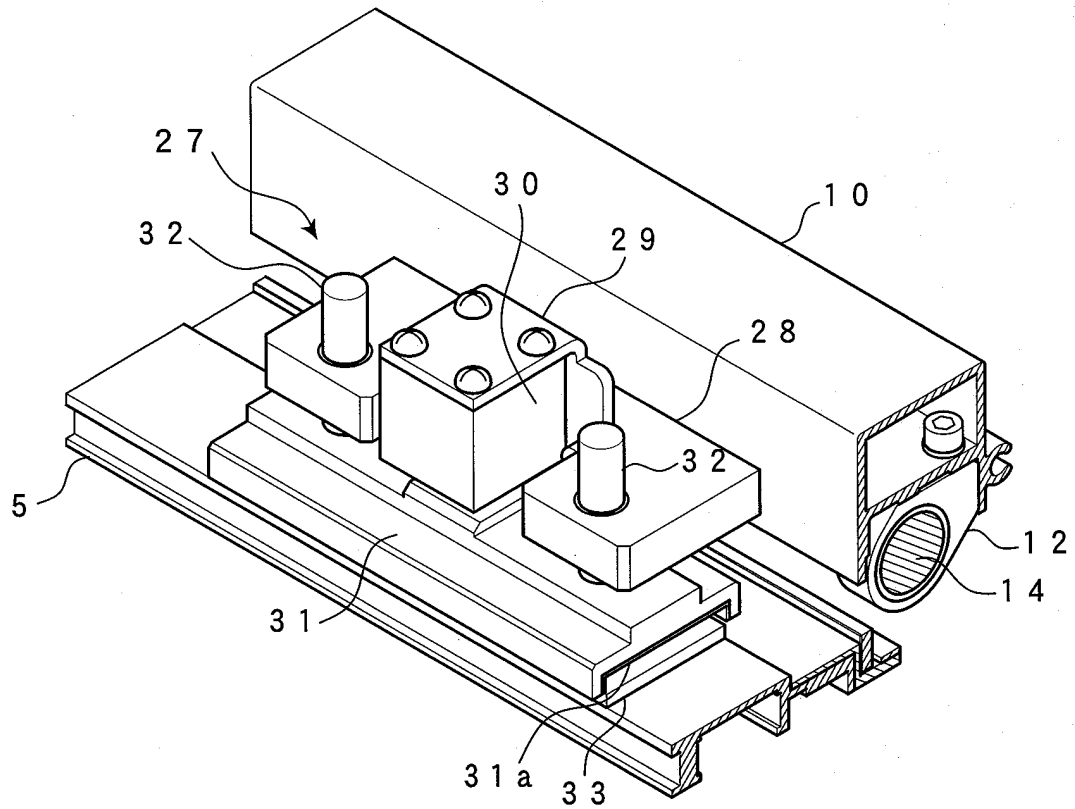


FIG. 8

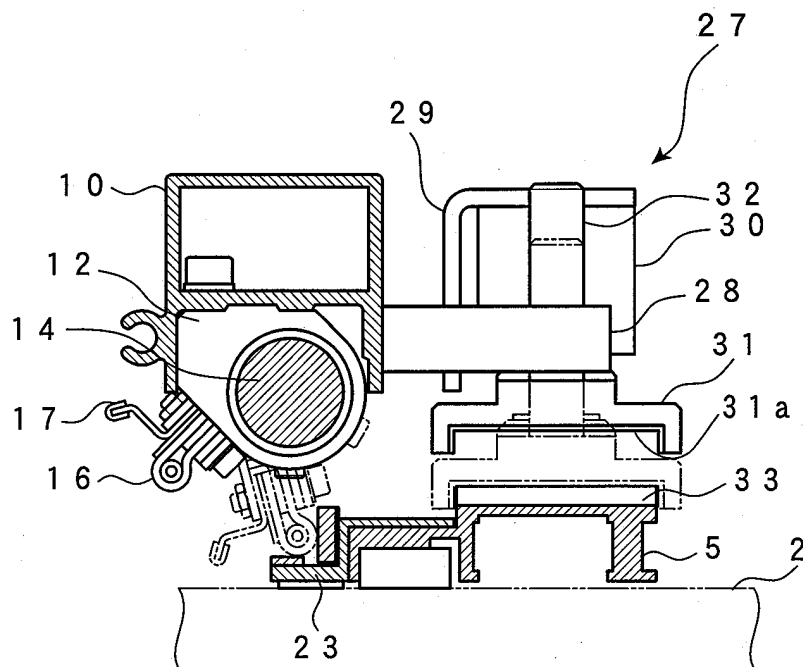


FIG. 9

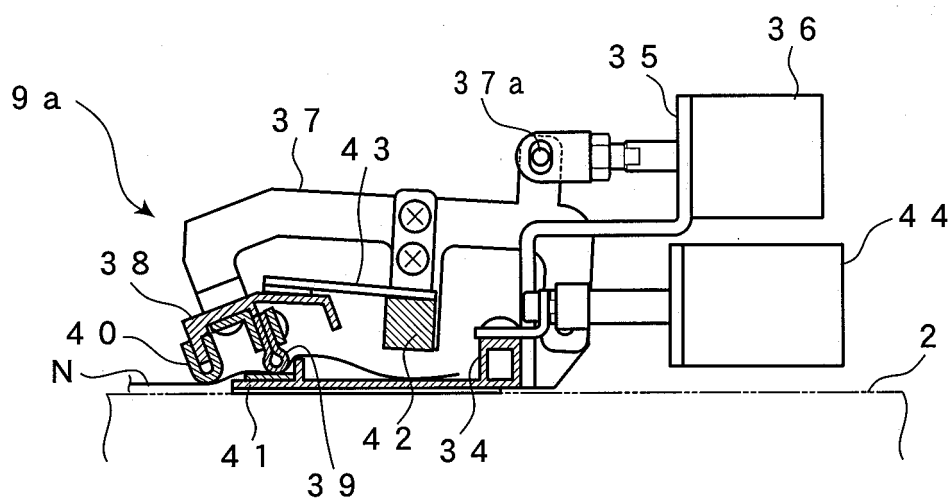


FIG. 10

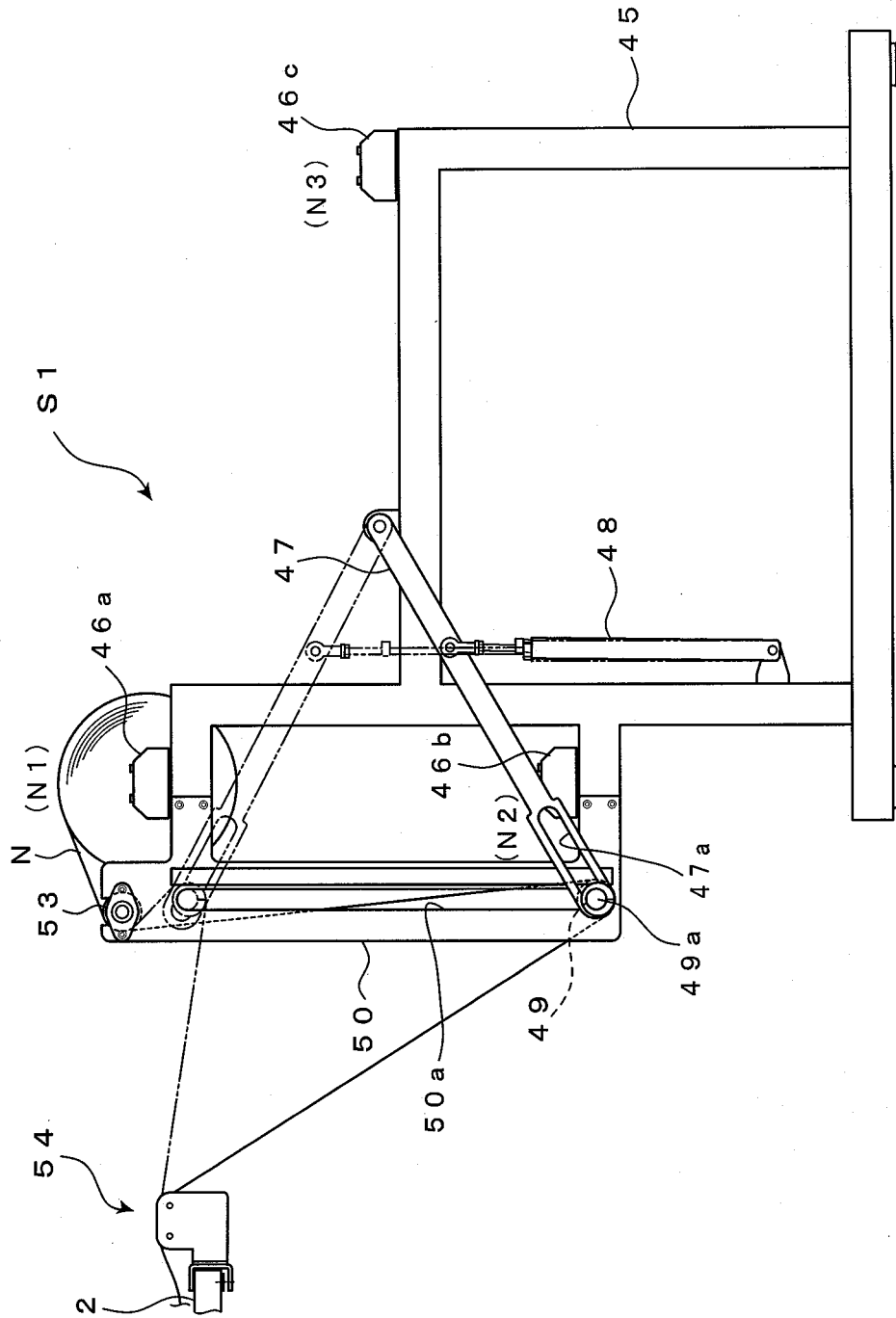


FIG. 11

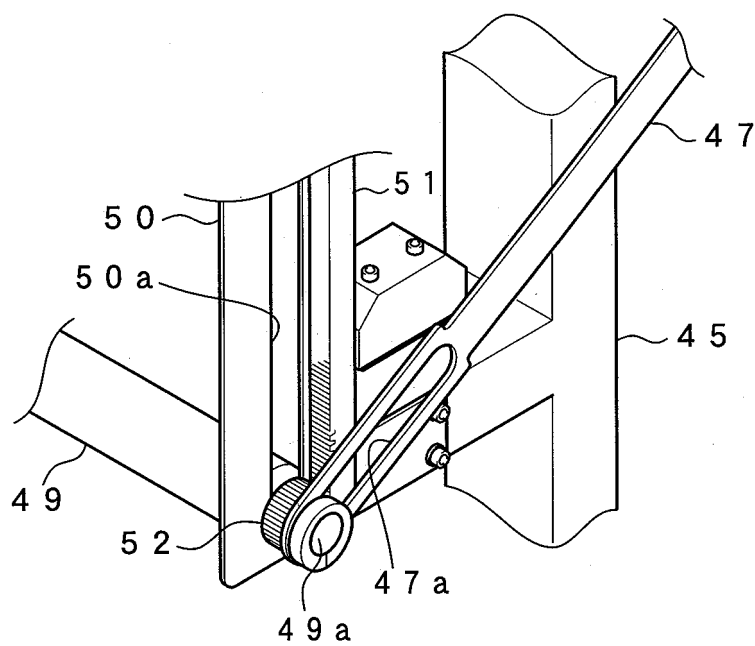


FIG. 12

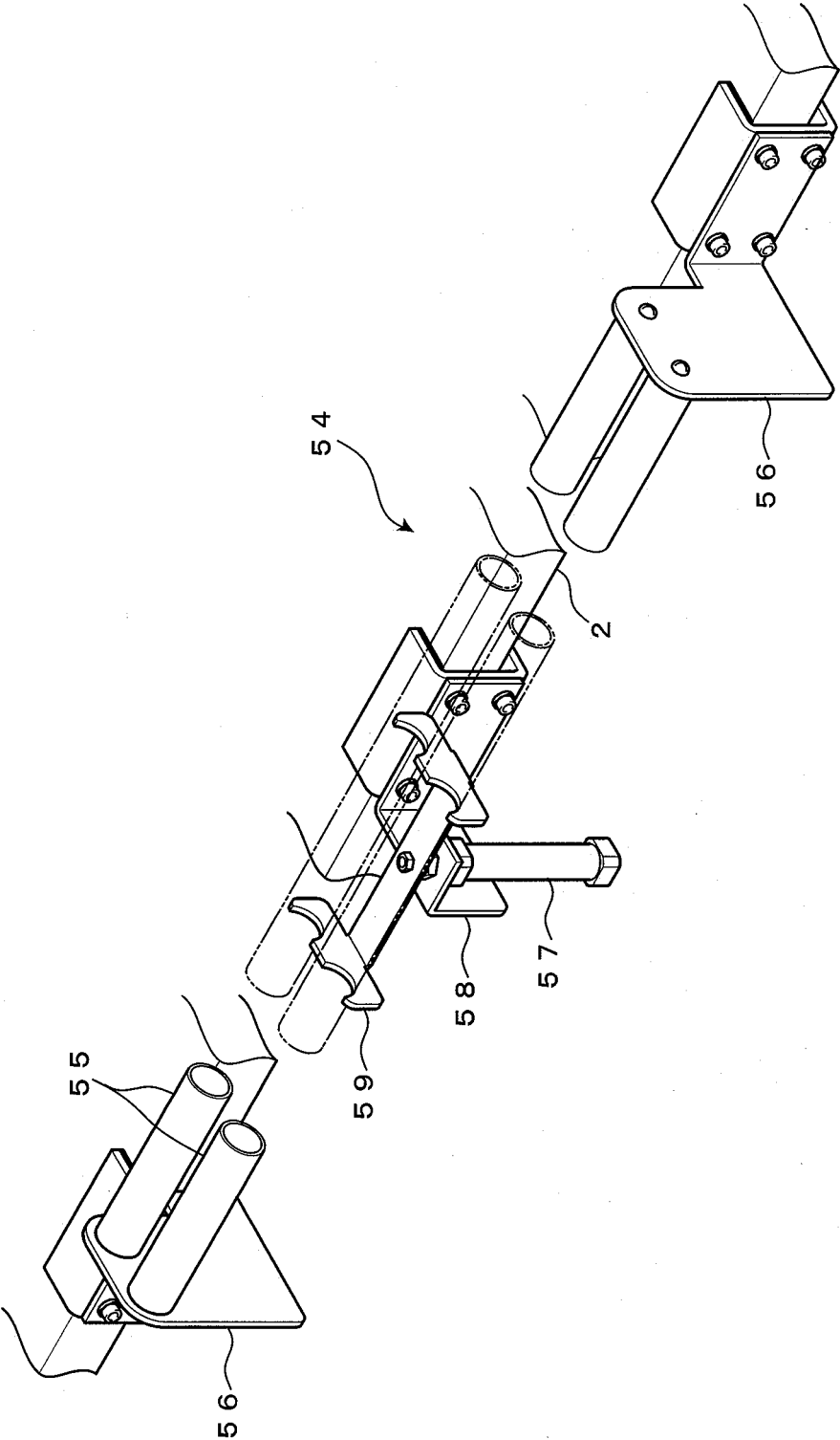


FIG. 13

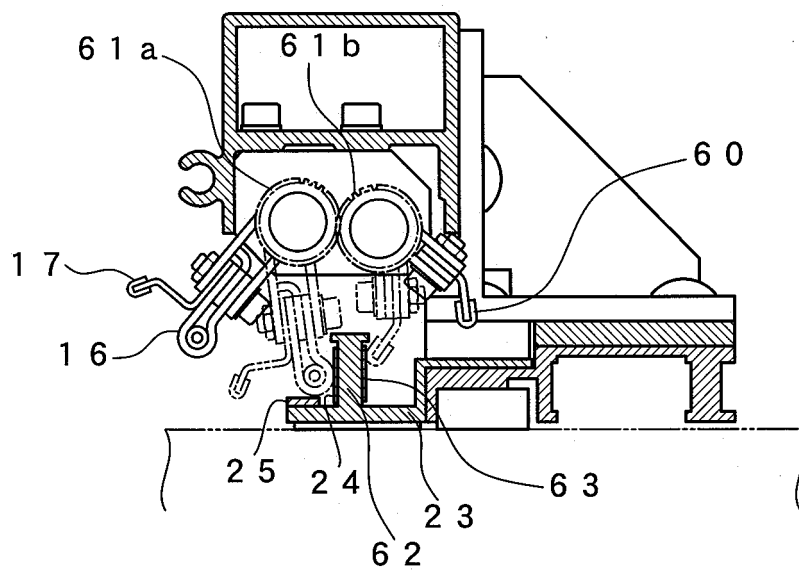


FIG. 14

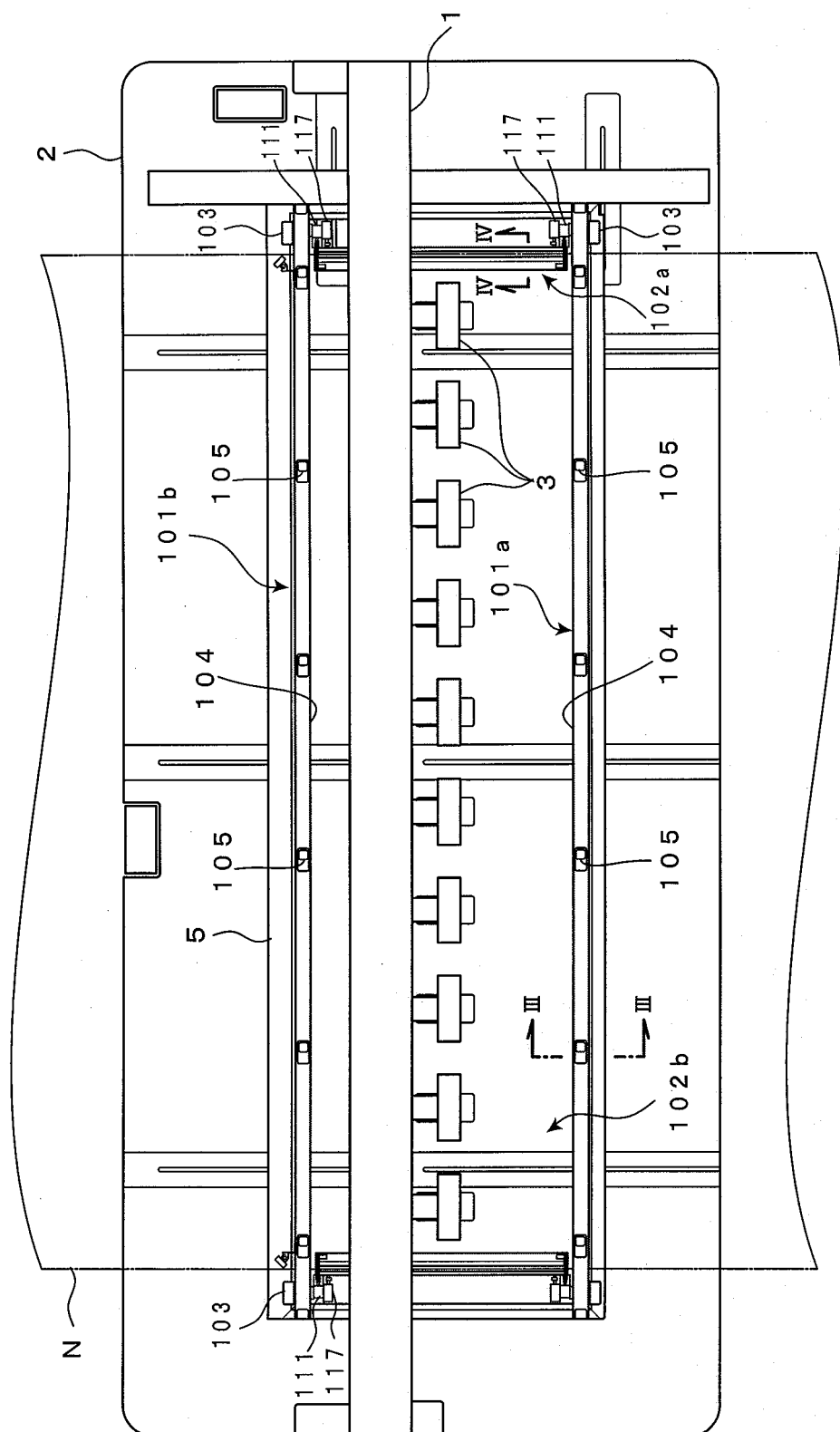


FIG. 15

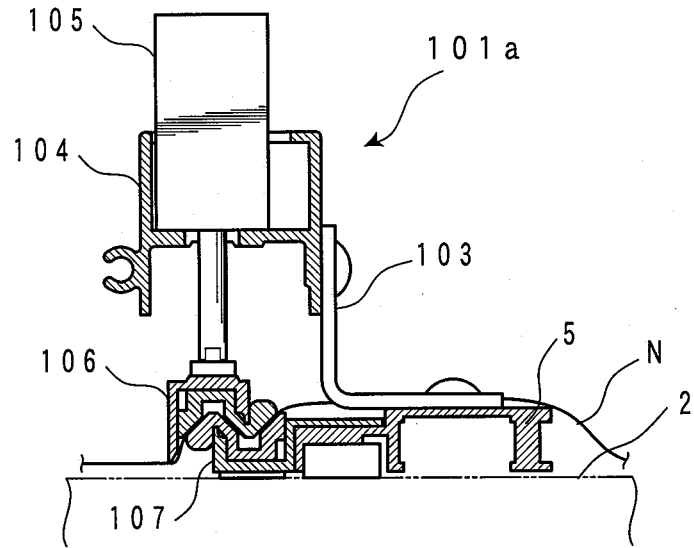


FIG. 16

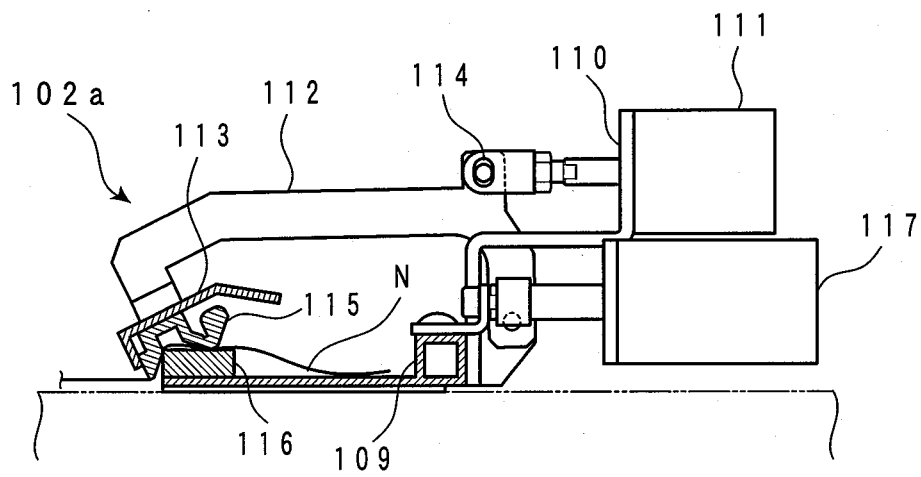


FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/010616

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ D05C9/04, D05B39/00														
According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED														
Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ D05C9/04, D05B39/00														
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005														
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)														
C. DOCUMENTS CONSIDERED TO BE RELEVANT														
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
Y A	JP 2581912 B2 (Kabushiki Kaisha Barudan), 21 November, 1996 (21.11.96), (Family: none)	1-2, 4-6 3, 7-9												
Y A	JP 2-38711 B2 (Pafu Industriemaschinen GmbH), 31 August, 1990 (31.08.90), & IT 1224470 B & DE 3733886 C	1-2, 4-6 3, 7-9												
Y A	JP 2001-207370 A (Kabushiki Kaisha Barudan), 03 August, 2001 (03.08.01), (Family: none)	1-2, 4-6 3, 7-9												
A	JP 2570675 Y2 (Brother Industries, Ltd.), 06 May, 1998 (06.05.98), (Family: none)	1-7												
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.														
<table border="0"> <tr> <td>* Special categories of cited documents:</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed	
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"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art													
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Date of the actual completion of the international search 19 August, 2005 (19.08.05)		Date of mailing of the international search report 06 September, 2005 (06.09.05)												
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer												
Facsimile No.		Telephone No.												

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/010616

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2770550 B2 (Brother Industries, Ltd.), 17 April, 1998 (17.04.98), (Family: none)	1-7
A	JP 3054168 B2 (Aisin Seiki Co., Ltd.), 19 June, 2000 (19.06.00), (Family: none)	1-7
A	JP 4-505036 A (GM PFAFF AG.), 03 September, 1992 (03.09.92), & WO 89/10443 A1 & EP 481973 A & US 5129171 A & DE 3843000 A	1-7
A	JP 9-119059 A (Tokai Kogyo Mishin Kabushiki Kaisha), 06 May, 1997 (06.05.97), (Family: none)	8-9

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