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(54) **MULTI-HEAD SEWING MACHINE**

(57) A plurality of groups of fixation members (10a, 10b, 11a - 11d) are provided for releasably fixing a working fabric (N) to a fabric frame, and fixation and release of the working fabric relative to the fabric frame is locally executable separately for each of the groups. Thus, fixation of the working fabric can be released only at an inappropriately-stretched region of the fabric with the re-

maintaining regions kept fixed. Therefore, a human operator can pull the thus-released region into an appropriately-stretched condition relative to the fabric frame and then fix the released region by means of the corresponding fixation member. In this way, the human operator can fix the working fabric in an appropriate stretched-taut condition by just pulling the fabric only at the released region.

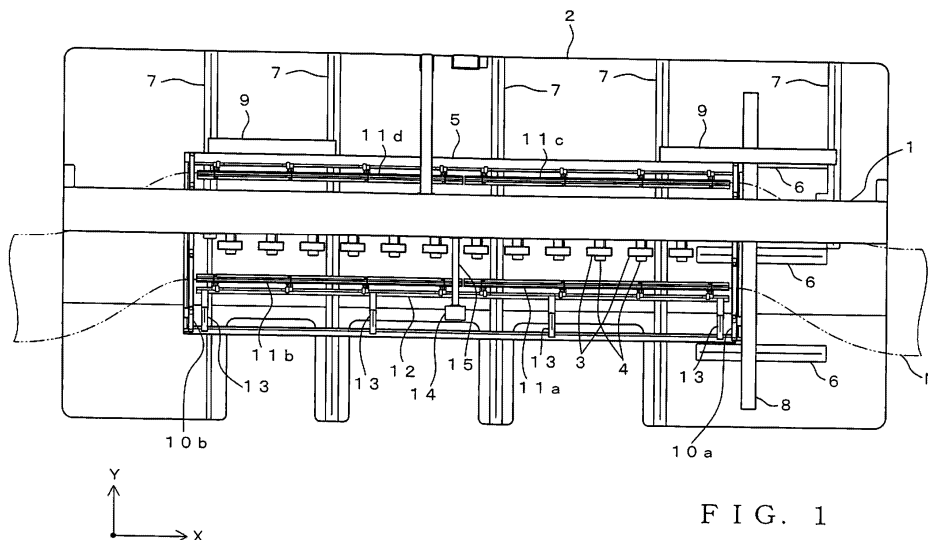


FIG. 1

Description

Technical Field

[0001] The present invention relates to multi-head sewing machines provided with a plurality of machine heads and capable of simultaneously and successively sewing many embroidery patterns and/or the like onto an elongated working fabric. More particularly, the present invention relates to a multi-head sewing machine which can readily sew embroidery patterns and/or the like onto a working fabric with the working fabric fixed in an appropriate stretched-taut condition.

Background Art

[0002] Heretofore, there have been known multi-head sewing machines capable of simultaneously and successively sewing many embroidery patterns and/or the like onto an elongated working fabric. Example of such conventionally-known multi-head sewing machines is briefed hereinbelow. First, a portion of an elongated working fabric supplied from a predetermined supply source is fixed to a working fabric frame that is controllably driven in front-rear and left-right directions on a table of the sewing machine provided with a plurality of machine heads. Then, the working fabric frame is driven so as to perform sewing onto the fixed portion of the fabric. Upon completion of the sewing, the fixation, by the working fabric frame, of the working fabric is released, and the portion of the working fabric on which desired sewing has been completed (sewn portion) is taken out to a take-up side while a new portion of the working fabric is supplied to the working fabric frame. Namely, the conventionally-known sewing machines are arranged to simultaneously and successively sew many embroidery patterns and/or the like onto an elongated working fabric by repeating sewing by the plurality of machine heads while sequentially changing the portion of the working fabric to be fixed to the working fabric frame.

[0003] In the most popularly-known type of such multi-head sewing machines, the plurality of machine heads are arranged in an X direction (i.e., in a direction perpendicular to a longitudinal direction of an elongated working fabric, namely, in a left-right direction as viewed from the front of the sewing machine), and a supply stand for supplying the working fabric wound in a rolled configuration and a take-up stand for taking up each sewn portion of the fabric are disposed in front of and at the back of the sewing machine, respectively. Therefore, a direction in which the working fabric is fed to the working fabric frame is perpendicular to the direction in which the plurality of machine heads are arranged. Another type of the multi-head sewing machines is disclosed in Japanese Patent No. 3368481 (hereinafter Patent Literature 1). In this disclosed sewing machine, the plurality of machine heads are arranged in the X direction, the fabric supply stand and take-up stand are disposed to the right and left of

the sewing machine spaced from each other in the X direction, and the direction in which the working fabric is fed to the working fabric frame agrees with the direction in which the plurality of machine heads are arranged.

5 With the fabric feeding direction agreeing with the machine-head-arranged direction as noted above, it is possible to simultaneously perform many sewing.

[0004] In the aforementioned conventional techniques, the working fabric is fixed to the working fabric frame of a rectangular shape by the fabric being gripped by section of clamp members that are provided on four sides of the working fabric frame and drivable via actuators to fix and release the fabric to and from the frame.

10 The fixation and release by such clamp members is automatically performed during the feeding of the working fabric or by operation of an operator section provided on an operation panel. But, if the working fabric is fixed to the working fabric frame in an insufficiently-stretched condition, the working fabric tends to be fixed improperly

15 so that intended sewing may not be performed appropriately; in such a case, there is a need to re-fix the working fabric through operation of the operator section. In the conventional techniques, arranged in such a manner that the fixation and release of the working fabric to and from

20 the working fabric frame is performed by activation of the actuators of all of the clamp members provided on all of the four sides of the working fabric frame, the re-fixation of the working fabric too has to be effected by first releasing the fixation on all of the four sides of the working fabric frame. However, if the fixation of the working fabric

25 is released on all of the four sides in a case where, for example, the working fabric fixed to the working fabric frame has a loosely-stretched part or region of the fixed working fabric has wrinkles, another region of the fabric may become loosely stretched or have wrinkles due to the re-fixing. Thus, careful operation is required to fix the working fabric to the working fabric frame with the entire surface of the fabric stretched appropriately, which tends to be very time-consuming. For sewing onto the fabric in

30 an appropriately-stretched state, the fabric only has to be fixed to the fabric frame in a stretched-taut condition. However, in the conventional techniques, the fixation of the working fabric is simultaneously released on all of the four sides of the working fabric frame and thus the working fabric tends to be undesirably paid out from the supply or take-up stand if the fabric is pulled strongly, and thus, there is no choice but to have the working fabric stretched rather insufficiently, in order to avoid the inconvenience. Particularly, in the multi-head sewing machine disclosed in Patent Literature 1, where the fabric-feeding direction agrees with the machine-head-arranged direction, the working fabric is fixed to the left and right ends of the working fabric frame and thus the portion of the working fabric fixed to the working fabric frame has a relatively great length, which would make it extremely difficult to have the working fabric appropriately stretched without being pulled too strongly.

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Disclosure of the Invention

[0005] In view of the foregoing, it is an object of the present invention to provide a multi-thread sewing machine which can readily perform satisfactory sewing with a working fabric fixed in an appropriate stretched-taut condition, by causing only a selected group of fixation member(s) to release fixation of an inappropriately-fixed portion of the fabric and then allowing only the thus-released portion of the fabric to be strongly pulled so that the released portion can be re-fixed in an appropriately-stretched condition.

[0006] In order to accomplish the above-mentioned object, the present invention provides a multi-head sewing machine with a plurality of machine heads in which an elongated working fabric is supplied from a supply source to a fabric frame that is controllably driven on a machine table to fix the working fabric thereto and in which, upon completion of sewing on a portion of the working fabric fixed to the fabric frame, the portion of the working fabric fixed to the fabric frame is changed and sewing is repeated on a newly fixed portion of the working fabric, the multi-head sewing machine being characterized by comprising a plurality of groups of fixation members for releasably fixing the working fabric to the fabric frame, fixation and release of the working fabric relative to the fabric frame being locally executable separately for each of the clamp groups.

[0007] By the provision of plurality of groups of fixation members for releasably fixing the working fabric to the fabric frame and with the arrangement that fixation and release of the working fabric relative to the fabric frame is locally executable separately for each of the clamp groups, the present invention allows the fixation of the working fabric to be released only at an inappropriately-stretched region of the fabric with the remaining regions kept fixed. Therefore a human operator can pull the thus-released region into an appropriately-stretched condition relative to the fabric frame and then re-fix the released region by means of the corresponding fixation member. In this way, the human operator can fix the working fabric in an appropriate stretched-taut condition by just pulling the fabric only at the released region, so that desired sewing can be performed on the fabric fixed in an appropriately-stretched condition.

[0008] According to another aspect of the present invention, there is provided a multi-head sewing machine with a plurality of machine heads in which an elongated working fabric is supplied from a supply source to a rectangular fabric frame that is controllably driven on a machine table to fix the working fabric thereto and in which, upon completion of sewing on a portion of the working fabric fixed to the fabric frame, the fabric is fed in an arranged direction of the machine heads to change the portion of the working fabric to fixed to the fabric frame so that sewing is repeated on a newly fixed portion of the working fabric, the multi-head sewing machine being characterized by comprising a plurality of fixation mem-

bers, provided on individual sides of the rectangular fabric frame, for fixing the working fabric to the fabric frame, at least the fixation members provided on horizontal sides of the fabric frame. The fixation member provided on a right vertical side of the fabric frame and the fixation member provided on a left vertical side of the fabric frame are capable of fixing and releasing the working fabric separately from one another. With such arrangements, the human operator can release only a particular region of the fabric with another region kept fixed on a given side of the fabric frame and re-fix the released region to a predetermined side of the fabric frame while pulling the released region. Thus, desired sewing can be readily performed on the working fabric fixed to the fabric frame in an appropriate stretched-taut condition.

[0009] By the provision of plurality of groups of fixation members for releasably fixing the working fabric to the fabric frame and with the arrangement that fixation and release of the working fabric relative to the fabric frame is locally executable separately for each of the clamp groups, the present invention permits local releasing and fixing operation of any desired one of the fixation members when the working fabric is to be re-fixed to the fabric frame. For example, in a case where a region of the working fabric is in a loosely-stretched condition or has wrinkles produced thereon, the fixation by the fixation member(s) of the clamp group corresponding to that inappropriately-fixed region can be released to allow only that region to be re-fixed. Because the working fabric remains fixed by the fixation members of the other clamp groups, the released region of the fabric can be pulled strongly so that the fabric can be readily fixed appropriately. Further, in a case where the working fabric fixed to the working fabric frame is loosely stretched overall, the fixation member provided on one of vertical sides of the fabric frame is placed in a fabric-releasing position with the fixation member provided on the other vertical side kept in a fabric-fixing position. Then, the working fabric may be pulled strongly from, for example, an opposite side to the other vertical side, so that the fabric can be readily re-fixed in an appropriate stretched-taut condition.

Brief Description of Drawings

[0010]

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

Fig. 2 is a perspective view showing a construction of a switch box provided in the multi-head sewing machine of Fig. 1; and

Fig. 3 is a schematic top plan view explanatory of how a working fabric is fixed in the multi-head sewing machine of Fig. 1.

Best Mode for Carrying Out the Invention

[0011] Embodiments of the present invention will hereinafter be described in detail with reference to the accompanying drawings.

Fig. 1 is a schematic top plan view of a multi-head sewing machine in accordance with an embodiment of the present invention. Fig. 2 is a perspective view showing a construction of a switch box provided in the multi-head sewing machine shown in Fig. 1. Fig. 3 is a schematic top plan view of the multi-head sewing machine, which is explanatory of how a working fabric is fixed in the sewing machine. In the embodiment of the multi-head sewing machine, an elongated working fabric N is sequentially let out or paid out, a predetermined amount at a time, in a left-right direction of the figure (i.e., horizontal left-right direction as viewed from the front of the sewing machine) so as to be set in a predetermined fixation position, and then sewing is performed on a portion of the elongated working fabric N having been set in the predetermined fixation position. Fig. 1 shows a state of the multi-head sewing machine while performing a sewing process on the working fabric N, and Fig. 3 shows a state of the multi-head sewing machine prior to a sewing process on the working fabric N. The following paragraphs describe behavior of the multi-head sewing machine of the present invention with reference to Figs. 1-3. In each of Figs. 1 and 3, the bottom side of the figure corresponds to the front side of the multi-head sewing machine where the human operator is situated in sewing operation.

[0012] In Fig. 1, reference numeral 1 indicates a machine frame, and 2 the above-mentioned table. On the machine frame 1, there are provided a plurality of (twelve in the illustrated example) machine heads 3 at predetermined intervals along the left-right (horizontal or longitudinal) direction of the multi-head sewing machine. The table 2 is elongated in the left-right direction of the figure along which the working fabric N passes as it is paid out, and needle plates 4 are disposed on the table 2 in opposed relation to the respective machine heads 3 provided on the machine frame 1. Further, a rectangular working fabric frame 5 is placed on the table 2, and this working fabric frame 5 is driveable in the front-rear and left-right directions along X-axis and Y-axis drive members 8 and 9 by X-axis and Y-axis drive mechanisms 6 and 7 provided on a right underside region of the table 2. The working fabric frame 5 has a size sufficient for surrounding a predetermined area such that the plurality of machine heads 3 can simultaneously perform sewing, such as embroidery pattern sewing, on the elongated working fabric N; the working fabric frame 5 is elongated in the direction the machine heads 3 are arranged.

[0013] Left and right vertical clamp members 10a and 10b are provided on the inner surfaces of left and right sides, respectively, of the working fabric frame 5. Although not specifically shown, each of the vertical clamp members 10a and 10b has provided therein an actuator (clamping actuator), such as an air cylinder, and holding

frame member that is driven by the actuator to reciprocally move in the up-down direction (i.e., perpendicularly to the sheet of the figure). By appropriate movement of the holding frame member in the up-down direction, a portion of the working fabric N, positioned in correspondence with the working fabric frame 5, can be fixed and released relative to the working fabric frame 5. Further, two pairs of clamp members 11a, 11b and 11c, 11d are provided on front and rear sides, respectively, of the working fabric frame 5 in parallel relation to the front and rear sides. The front or rear horizontal clamp members have respective holding frame members (not shown) provided on their inner surfaces opposed to those of the rear or front horizontal clamp members, and each of the holding frame members is driven by a first actuator (clamping actuator), provided on the corresponding horizontal clamp member 11a - 11d, to reciprocally move in the up-down direction (i.e., perpendicularly to the sheet of the figure). By appropriate movement of the holding frame members in the up-down direction, a portion of the working fabric N, positioned in correspondence with the working fabric frame 5, can be fixed and released relative to the working fabric frame 5 by the horizontal clamp member 11a - 11d in generally the same manner as by the vertical clamp member 10a, 10b. Further, each of the horizontal clamp members 11a - 11d is provided with a second actuator (tensioning actuator) for adjusting a distance of that horizontal clamp member from the horizontal clamp member opposed thereto. Namely, the horizontal clamp members 11a - 11d can hold the working fabric N in a stretched-taut condition by first activating the first actuators to fix the working fabric N to the working fabric frame 5 and then activating the second actuators to increase the distances between the mutually-opposed horizontal clamp members 11a and 11c, and 11b and 11d.

[0014] The front horizontal clamp members 11a and 11b of the multi-head sewing machine are provided on a support member 12, and the support member 12 is fixed, via a connection member 13, to the front horizontal side section of the working fabric frame 5. The connection member 13 is adjustable into a suitable length, so that the front horizontal clamp members 11a and 11b (support member 12) are adjustable in position in accordance with the width of the working fabric N. Fixation and release, by the left and right vertical clamp members 10a and 10b and front and rear horizontal clamp members 11a - 11d, of the working fabric N relative to the working fabric frame 5 is performed, at the time of feeding of the working fabric N, automatically, in response to user's instruction given via a not-shown operation panel, or in any other suitable manner. At that time, all of the actuators for driving the left and right vertical clamp members 10a and 10b and front and rear horizontal clamp members 11a - 11d are activated, so that the fixation and release of the working fabric N is performed simultaneously by all of the clamp members 10a and 10b and 11a - 11d.

[0015] In the multi-head sewing machine of the present invention, the fixation and release of the working fabric

N can be performed selectively at individual positions of the fabric N, separately from the aforementioned operations, by activating predetermined one or more clamp members of a selected one of a plurality of clamp groups as indicated below.

(1) Fixation and release only at a right side region of the working fabric N by means of the right vertical clamp member 10a.

(2) Fixation and release only at a left side region of the working fabric N by means of the left vertical clamp member 10a.

(3) Fixation and release at the right front and right rear side regions of the working fabric N by means of the right horizontal clamp members 11a and 11c, and adjustment in distance between the mutually-opposed horizontal clamp members 11a and 11c.

(4) Fixation and release at the left front and rear side positions of the working fabric N by means of the left horizontal clamp members 11b and 11d, and adjustment in distance between the mutually-opposed horizontal clamp members 11b and 11d.

The following paragraphs describe such selective fixation and release of the fabric.

[0016] On the machine frame 1, there is provided a switch box 14 provided with a plurality of switches for instructing fixation and release of the working fabric N separately (or independently) for each of the clamp groups as indicated above. The switch box 14 is fixed to the machine frame 1 via a pipe member 15 in such a manner that a hand or hands of the human operator can readily reach the switch box 14. Detailed construction of the switch box 14 will be described below with reference to Fig. 2. As described below in relation to Fig. 2, four toggle switches are provided on the switch box 14. Left/right selection switch 16a provided on an upper area of the switch box 14 is operable to switch between the left and right clamp groups. The right clamp group can be selected by the left/right selection switch 16a being pivoted to the right, while the left clamp group can be selected by the left/right selection switch 16a being toggled to the left. Three switches 16b, 16c and 16d toggled below the left/right selection switch 16a are ON/OFF switches operable to drive the actuators of the clamp members allocated thereto. Namely, the right actuator drive switch 16b, middle actuator drive switch 16c and left actuator drive switch 16d are ON/OFF switches for driving the actuators (clamping actuators) of the vertical clamp members 10a and 10b, second actuators (tensioning actuators) of the horizontal clamp members 11a - 11d and first actuators (clamping actuators) of the horizontal clamp members 11a - 11d, respectively. As explained below, selecting the operational position or state of the left/right selection switch 16a can select the actuators to be turned on/off.

[0017] While the right clamp group is selected by the left/right selection switch 16a, the actuator (clamping ac-

tuator) of the right vertical clamp member 10a can be driven by operation of the actuator drive switch 16b, the second actuators (tensioning actuators) of the right horizontal clamp members 11a and 11c can be driven by operation of the middle actuator drive switch 16c, and the first actuators (clamping actuators) of the right horizontal clamp members 11a and 11c can be driven by operation of the actuator drive switch 16d. On the other hand, while the left clamp group is selected by the left/right selection switch 16a, the actuator (clamping actuator) of the left vertical clamp member 10b can be driven by operation of the right actuator drive switch 16b, the second actuators (tensioning actuators) of the left horizontal clamp members 11b and 11d can be driven by operation of the middle actuator drive switch 16c, and the first actuators (clamping actuators) of the left vertical clamp members 11b and 11d can be driven by operation of the left actuator drive switch 16d. Namely, once the actuator drive switch 16b or 16d is turned off by being toggled to the right, the actuator of each of the corresponding clamp members is driven to release the fixation of the working fabric N, while, once the actuator drive switch 16b or 16d is turned on being toggled to the left, each of the corresponding clamp members operates to fix the working fabric N. Further, once the middle actuator drive switch 16c is toggled to the right, each of the corresponding horizontal clamp members is moved to reduce the distance from the opposing horizontal clamp member, but, once the middle actuator drive switch 16c is pivoted to the left, each of the corresponding horizontal clamp members is moved to increase the distance from the opposing horizontal clamp member.

[0018] Next, an example manner in which the working fabric N is fixed to the working fabric frame 5 in the multi-head sewing machine arranged as described above will be described briefly in accordance with a sequence of sewing operations performed on the working fabric N. The working fabric N is paid out from a working fabric roll on a not-shown supply stand disposed to the right of the multi-head sewing machine, then passed over the table 2 and thence led to a not-shown take-up stand disposed to the left of the multi-head sewing machine. When setting the working fabric N, the working fabric frame 5 is moved toward the front surface of the sewing machine (toward the lower end in the figure) so as to positionally correspond to the working fabric N fed straight from the supply stand to the take-up stand as illustrated in Fig. 3. Then, a desired portion of the working fabric N is passed onto the working fabric frame 5 so that the fabric portion paid out from the supply stand to the fabric frame 5 can be fixed via the individual clamp members, and it is thence led to the take-up stand. Once the human operator operates a predetermined operation panel (not shown) in this state, the actuators of the vertical clamp members 10a and 10b and horizontal clamp members 11a - 11d are each activated or driven to fix the working fabric N to the working fabric frame 5. Specifically, to fix the working fabric N to the working fabric frame 5, first the actuators

(clamping actuators) of the vertical clamp members 10a and 10b are driven, and then the first actuators (clamping actuators) of the horizontal clamp members 11a - 11d are driven to grasp left and right sides of the working fabric N. After that, the second actuators (tensioning actuators) of the horizontal clamp members 11a - 11d are driven to move the horizontal clamp members 11a - 11d. In this way, the working fabric N can be fixed to the working fabric frame 5 in a taut condition.

[0019] After the working fabric N is fixed to the working fabric frame 5, the human operator depresses a "sewing start switch" provided, for example, on the operation panel, to thereby activate the multi-head sewing machine. Once the sewing machine is activated, sewing is performed on the working fabric N fixed to the working fabric frame 5 while the working fabric frame 5 is moved in the front-rear and left-right directions as necessary. Upon completion of the sewing operation on the working fabric N, the working fabric frame 5 is returned to the position shown in Fig. 3, and the actuators of the vertical clamp members 10a and 10b and horizontal clamp members 11a - 11d are driven to release the fixation of the working fabric N to the working fabric frame 5. When releasing the fixation of the working fabric N to the working fabric frame 5, the actuators of the individual clamp members are driven in sequence opposite to the aforementioned sequence employed when fixing the working fabric N to the working fabric frame 5. After the fixation of the working fabric N to the working fabric frame 5 is released, the portion of the working fabric N where the sewing has been performed (i.e., area of the fabric N on which the machine heads 3 can simultaneously perform sewing, such as embroidery pattern sewing, on the elongated working fabric N) is taken up by the take-up stand. Then, another portion of the working fabric N on which sewing is to be performed next (i.e., to-be-next-sewn portion) is fed from the working fabric roll onto the fabric frame 5. The take-up stand has a drive source for taking up the sewn portion of the working fabric N; the sewn portion of the working fabric N can be taken up by the drive source being activated in interlocked relation to feeding of the working fabric N. Then, once the next portion of the working fabric N where sewing is to be performed next (i.e., to-be-next-sewn portion) is delivered onto the fabric frame 5 as the sewn portion of the working fabric N is taken up by the take-up stand, the take-up by the take-up stand is terminated, then the next portion of the working fabric N is fixed to the fabric frame 5 by means of the vertical clamp members 10a and 10b and horizontal clamp members 11a - 11d, and thence the sewing machine is activated again to perform the sewing. By thus sequentially repeating sewing while changing the portion of the working fabric N to be fixed to the working fabric frame 5, the multi-head sewing machine performs sewing, such as embroidery pattern sewing, on the elongated working fabric simultaneously and successively.

[0020] The aforementioned operations following the depression of the "sewing start switch" are carried out

automatically. Namely, of the fixation and release of the working fabric N relative to the fabric frame 5, only the initial fixation is executed in response to operation, by the human operator, on the operation panel, and the subsequent fixation and release is automatically executed in response to the feeding of the working fabric N. When the fixation and release is automatically executed in response to the feeding of the working fabric N, there may occur, for some reason, a condition where the working fabric N is not fixed to the working fabric frame 5 in an appropriate stretched-taut condition. In such a case, the sewing can not be performed neatly or beautifully, which would result in some inconveniences. Thus, when the working fabric N is not fixed to the working fabric frame 5 in an appropriate stretched-taut condition, it is necessary for the human operator to redo the fixation of (i.e., re-fix) the working fabric N in view of the current fixed state of the fabric N, by depressing a "stop switch" provided, for example, on the operation panel, to thereby deactivate the multi-head sewing machine. The following paragraphs describe operation to be performed by the human operator when it has been found that the working fabric N is not currently fixed to the working fabric frame 5 in an appropriate stretched-taut condition, in relation to two specific examples.

[0021] First, the operation to be performed by the human operator when the working fabric N is not fixed to the working fabric frame 5 in an appropriately-stretched condition is explained in relation to the first example where wrinkles have been produced in a left side region of the working fabric N fixed to the working fabric frame 5. In this case, the human operator operates the switches 16a - 16d of the switch box 14 to release the fixation of the working fabric N by the left vertical clamp member 10b and horizontal clamp members 11b and 11d, and then re-fix the working fabric N only at the released positions. Namely, the human operator first toggles the left/right selection switch 16a to the left to select the left clamp group and then toggles the actuator drive switches 16b, 16c and 16d to the right to release the fixation of the working fabric N. In this way, the left side region can be easily pulled by the human operator with the right side region of the fabric N kept fixed; thus, the human operator can readily re-fix the left side region of the working fabric N by toggling to the left the actuator drive switches 16b - 16d of the switch box 14 while pulling the fabric N. As a consequence, the working fabric N can be fixed in an appropriate stretched-taut condition with the wrinkles removed from the left side region. Namely, by releasing the fixation of only the inappropriately-stretched fabric region with the remaining fabric regions kept fixed as noted above, only the released fabric region can be pulled into an appropriate stretched-taut condition; thus, the human operator is allowed to readily re-fix the working fabric N by only pulling the released fabric region. In this case, the actuator drive switch 16c need not be operated; namely, it is not necessary to perform operation for increasing the distance in the left-right direction between

the clamp members.

[0022] Next, the operation to be performed by the human operator when the working fabric N is not fixed to the working fabric frame 5 in an appropriately-stretched condition is explained in relation to the second example where the working fabric N fixed to the working fabric frame 5 is loosely stretched overall. In this case, the human operator operates the switches 16a - 16d of the switch box 14 to release the fixation of the working fabric N by the left vertical clamp member 10b and all of the horizontal clamp members 11a - 11d, so that the working fabric N remains fixed only by the right vertical clamp member 10a. Then, the human operator operates the individual switches 16a - 16d of the switch box 14 while keeping the working fabric N pulled from the side of the take-up stand, to thereby re-fix the working fabric N. In this way, the working fabric N can be fixed with its entirety appropriately stretched taut. Namely, when the working fabric N is not fixed to the working fabric frame 5 with its entirety appropriately stretched taut, the working fabric N is kept fixed by the clamp member on one side of the working fabric frame 5, so that the fabric N can be appropriately stretched by being pulled from the opposite side to the fixed side.

[0023] As having been described above, the multi-head sewing machine of the present invention allows the human operator to re-fix the working fabric N. by permitting fixation and release by the clamp member(s) separately for each of the clamp groups.

In the case where the sewing on the working fabric N is automatically repeated as noted above, it tends to be difficult to check whether or not the working fabric N is currently in an appropriately-stretched condition, and/or deactivation of the sewing machine tends to get delayed. To avoid such inconveniences, the multi-head sewing machine may be temporarily deactivated when a to-be-next-sewn portion of the working fabric N has been fixed as the fabric N is fed and then activated again by the human operator depressing the start switch. In this way, the human operator is allowed to check, with a sufficient time leeway, whether or not the working fabric N is currently in an appropriately-stretched condition.

[0024] Note that the above-described group-specific fixation and release by the clamp members may also be executed by operation of switches, operators or the like provided on the operation panel, in which case the switch box 14 may of course be dispensed with.

The present invention may also be applied to cases where the feeding of the working fabric N to the fabric frame 5 is carried out in a direction perpendicular to the direction along which the plurality of machine heads 3 are arranged (i.e., in the front-to-rear direction of the sewing machine).

Whereas the embodiment of the present invention has been described above in relation to the case where the take-up stand includes a drive source for taking up the working fabric N and the fabric N is taken up in interlocked relation to the feeding of the fabric N, the present inven-

tion is not so limited; for example, the taking-up and feeding of the working fabric N may be executed via manual operation of the human operator. In such a case, the fabric frame 5 may be returned to the position shown in Fig. 3 upon completion of desired sewing on the fabric N fixed to the fabric frame 5, and the multi-head sewing machine may be deactivated once the fixation of the fabric N is released.

Claims

1. A multi-head sewing machine with a plurality of machine heads in which an elongated working fabric is supplied from a supply source to a fabric frame that is controllably driven on a machine table to fix the working fabric thereto and in which, upon completion of sewing on a portion of the working fabric fixed to the fabric frame, the portion of the working fabric fixed to the fabric frame is changed so that sewing is repeated on a newly fixed portion of the working fabric, said multi-head sewing machine comprising a plurality of groups of fixation members for releasably fixing the working fabric to said fabric frame, fixation and release of the working fabric relative to said fabric frame being locally executable separately for each of the groups.
2. A multi-head sewing machine with a plurality of machine heads in which an elongated working fabric is supplied from a supply source to a rectangular fabric frame that is controllably driven on a machine table to fix the working fabric thereto and in which, upon completion of sewing on a portion of the working fabric fixed to the fabric frame, the working fabric is fed in an arranged direction of the machine heads to change the portion of the working fabric fixed to the fabric frame so that sewing is repeated on a newly fixed portion of the working fabric, said multi-head sewing machine comprising:

a plurality of fixation members, provided on individual sides of said rectangular fabric frame, for fixing the working fabric to said fabric frame at least the fixation members provided on horizontal sides of said fabric frame, the fixation member provided on a right vertical side of said fabric frame and the fixation member provided on a left vertical side of said fabric frame are capable of fixing and releasing the working fabric separately from one another.
3. A multi-head sewing machine as claimed in claim 1 or 2 which further comprises drive means for driving each of said fixation members to a fixing or releasing position relative to said fabric frame, and control means for controlling said drive means to drive said fixation members separately from one another, and

wherein fixation and release of the working fabric relative to said fabric frame is locally executable in accordance with separate drive control performed on each of said fixation members by said drive means and said control means.

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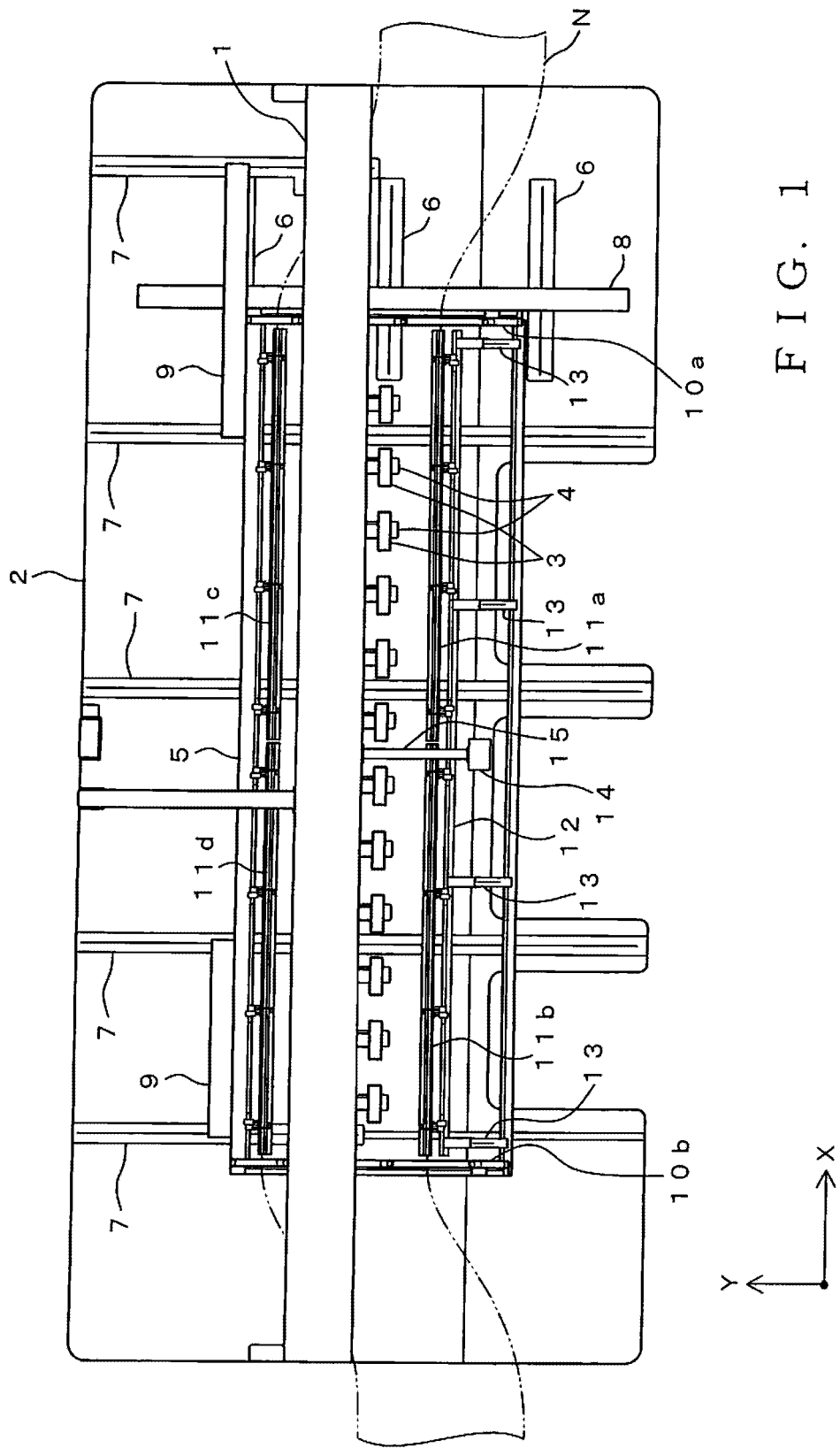


FIG. 1

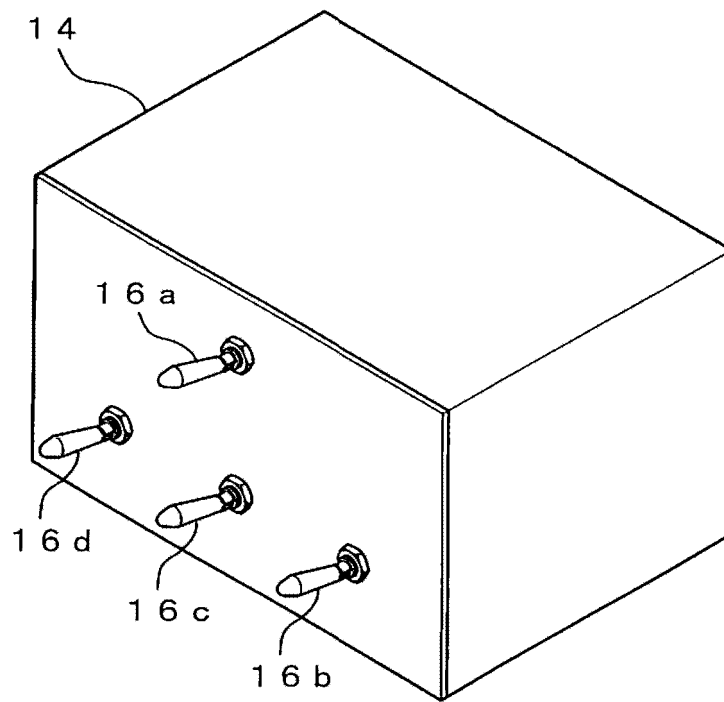


FIG. 2

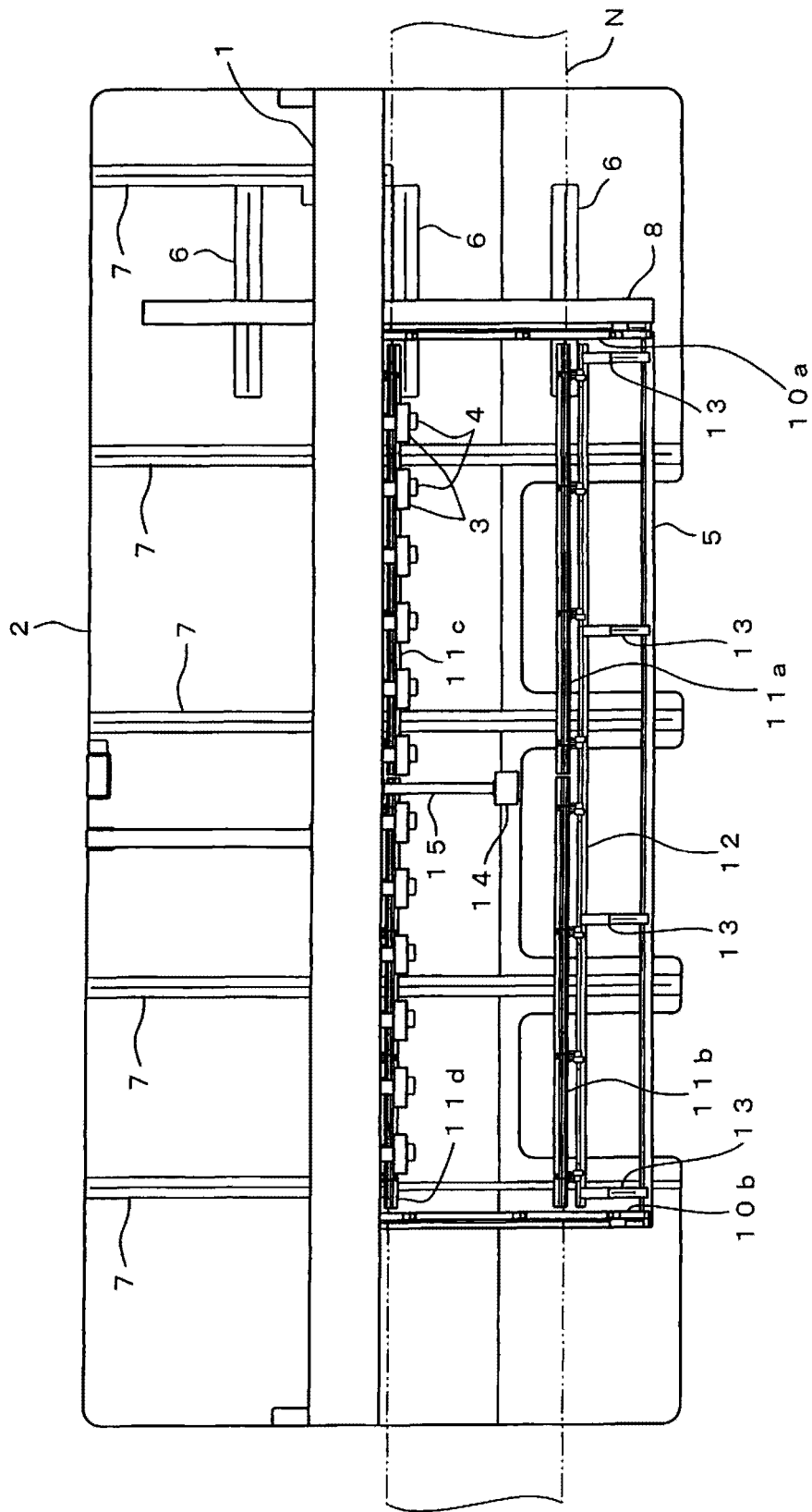


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/019392

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ D05C9/06, 9/22; 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 D05C9/00-9/22; 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 Toroku Jitsuyo Shinan Koho 1994-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Jitsuyo Shinan Toroku Koho 1996-2005		
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	JP 3368481 B2 (Kabushiki Kaisha Barudan), 20 January, 2003 (20.01.03), (Family: none)	1-3
Y	JP 2-38711 B2 (Pafu Industriemaschinen GmbH), 31 August, 1990 (31.08.90), Column 7, line 34 to column 8, line 28 & DE 3733886 A & IT 1224470 A	1-3
A	JP 61-5744 B2 (Happi Kogyo Mishin Kabushiki Kaisha), 20 February, 1986 (20.02.86), (Family: none)	1-3
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"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	
"E" earlier application or patent but published on or after the international filing date	"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	
"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)	"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 21 January, 2005 (21.01.05)	Date of mailing of the international search report 08 February, 2005 (08.02.05)	
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	
Facsimile No.	Telephone No.	

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/019392

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 63-9476 B2 (Tokai Kogyo Mishin Kabushiki Kaisha), 29 February, 1988 (29.02.88), (Family: none)	1-3
A	JP 3054168 B2 (Aisin Seiki Co., Ltd., Maruhiro Mishin Shokai), 19 June, 2000 (19.06.00), (Family: none)	1-3
A	JP 7-54258 A (Kabushiki Kaisha Barudan), 28 February, 1995 (28.02.95), (Family: none)	1-3
A	JP 10-53951 A (Kabushiki Kaisha Barudan), 24 February, 1998 (24.02.98), (Family: none)	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3368481 B [0003]