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(54) **Start control apparatus and start control method for loom**

Startsteuervorrichtung und Startsteuerverfahren für eine Webmaschine

Dispositif et procédé de commande de démarrage pour métier à tisser

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a technique for preventing light filling bars caused by an insufficient beating force at the start of operation of a loom by executing a so-called blank beating start. In the blank beating start, a reverse rotation and operation without weft insertion are performed before starting weft insertion. More particularly, the present invention relates to a technique for preventing fabric defects caused when the blank beating start is executed irrespective of the characteristics of the weft.

2. Description of the Related Art

[0002] If a loom stops during a weaving operation, weft bars are easily generated when restarting the operation of the loom. In a normal start in which weft insertion is started after a drive operation signal is generated, the loom is activated, and beat-up motion is performed, weft bars are generated because the beating force immediately after the activation is weaker than that during steady operation. In comparison, a loom activation method called a blank beating start is disclosed in Japanese Unexamined Patent Application Publication No. 61-124651. In this method, when a loom is activated, a motor in the loom is rotated in the reverse direction by a predetermined amount, and then the main shaft of the loom is activated in the forward direction and is rotated in the forward direction by the same amount as the previous reverse rotation while performing blank beating, which is beat-up motion without weft insertion. Then, weft insertion is started. In looms, the above-mentioned starting methods are selectively used depending on the conditions of the weft bars.

[0003] When the reverse operation is performed upon reactivation of the loom as described above, a selvedge device which supplies selvedge yarns for restraining weft at the side edges of woven fabric to form selvedges also operates in the reverse direction. Therefore, a weft yarn positioned at a cloth fell upon reactivation receives no restraining force from the selvedge yarns or warp. Accordingly, in looms using the above-described activation method involving the blank beating start, if yarns like textured yarns and twisted yarns having contractile force (elasticity force) are used as the weft, the weft yarn positioned at the cloth fell will contract since it receives no restraining force from the selvedge yarns or the warp and accordingly fabric defects will occur.

[0004] To control the activation of a loom which selectively executes one of a plurality of starting methods at the start of the operation of the loom, the starting methods including a blank beating start involving a reverse operation and a normal start, is known from EP 1285984 A2.

SUMMARY OF THE INVENTION

[0005] Therefore, an object of the present invention is to control the activation of a loom depending on whether or not the weft yarn has elasticity . The loom is activated with a starting method which does not involve the reverse operation depending on the characteristics of the weft, more specifically, when the weft has elasticity.

[0006] According to a first aspect of the present invention, a start control apparatus of a loom includes a control unit which selects one of a plurality of starting methods and operates the loom in accordance with the selected starting method when a drive operation signal is input; and a weft-insertion control unit which selectively inserts one of a plurality of kinds of weft in accordance with information regarding weft selection while the loom is in operation. The starting methods include a normal start and a blank beating start in which a loom main shaft is rotated in a reverse direction by a predetermined amount, beat-up motion is performed without weft insertion while activating the loom, and then weft insertion is started, the amount of reverse rotation in the blank beating start being set such that a weft yarn positioned at a cloth fell is released from warp yarns. In addition, according to the present invention, when the drive operation signal is generated, whether or not the weft yarn positioned at the cloth fell has elasticity is determined on the basis of the information regarding weft selection, and the normal start is executed if it is determined that the weft yarn has elasticity. The information regarding weft selection includes not only weft selection information but also a weft-insertion pick number (count value) on the basis of which a weft selection signal is generated.

[0007] The information regarding the elasticity of the weft includes not only information which directly shows the elasticity, such as a twist direction, the number of twists per unit length, and whether or not an elasticizing process has been performed, but also information which indirectly reflects the above-mentioned information, such as a part number of a weft supplier. In addition, the information regarding the elasticity of the weft also includes information showing the degree of elasticity in addition to the presence/absence thereof. An evaluation criterion for the elasticity may be adequately set depending on the kind of the weft such that fabric defects can be prevented. In addition, the information regarding the elasticity may be manually input by the operator, read out from a memory medium such as a memory card, or automatically set via a loom management computer connected to the loom.

[0008] According to the first aspect, in looms of a multicolor weft insertion type in which multiple kinds of weft are selectively inserted in accordance with the weft selection information corresponding to the weft-insertion pick number, when a drive operation signal is generated, whether or not a weft yarn positioned at the cloth fell has elasticity can be determined on the basis of the information regarding weft selection such as the weft selection

signal and the weft-insertion pick number. Accordingly, when the drive operation signal of the loom is generated, if the weft yarn has elasticity according to the result of the above-described determination, the normal start which does not involve the reverse rotation is executed instead of the blank beating start which involves the reverse rotation. In reverse, if the weft yarn has no elasticity, either one of the blank beating start which involves the reverse rotation or the normal start may be executed. Accordingly, fabric defects caused when the blank beating start is executed and the loom main shaft is rotated in the reverse rotation at the start of operation since the weft yarn having elasticity contracts by being released from the warp are prevented.

[0009] In the first aspect, the normal start executed instead of the blank beating start may be performed manually. More specifically, the operator may visually check the result of determination and operate the loom by pressing an operation button selected from among a plurality of operation buttons provided in correspondence with the starting methods. Alternatively, it may also be automatically determined whether or not the blank beating start is adequate when the operator presses the operation button, and the loom may be operated with a starting method corresponding to the result of determination. As an example for realizing the latter system, when a drive operation signal is input, the control unit determines whether or not the weft yarn positioned at the cloth fell has elasticity on the basis of the information regarding weft selection, and executes the normal start when the weft yarn is determined to have elasticity. If the weft yarn is determined to have no elasticity, either one of the blank beating start or the normal start may be selected as the starting method, and the starting method is adequately set depending on the specifics of the fabric.

[0010] According to a second aspect of the present invention, a start control apparatus of a loom includes a setting unit to which selection information for selecting one of a plurality of starting methods and information regarding elasticity of weft are input; and a control unit which operates the loom in accordance with the selected starting method when a drive operation signal is input. The starting methods include a normal start and a blank beating start in which a loom main shaft is rotated in a reverse direction by a predetermined amount, beat-up motion is performed without weft insertion while activating the loom, and then weft insertion is started, the amount of reverse rotation in the blank beating start being set such that a weft yarn positioned at a cloth fell is released from warp yarns. In addition, according to the present invention, one of the setting unit and the control unit determines whether or not to restrict the selection of the blank beating start on the basis of the input information regarding the elasticity of the weft. According to the second aspect, whether or not the selection of the blank beating start is to be restricted is automatically determined on the basis of the information regarding the elasticity of the weft input to the setting unit. Therefore, when the weft having elasticity is used, the normal start, which is the substitute starting method for the blank beating start, may be executed in accordance with the result of determination. Accordingly, similar to the first aspect, unlike the known system, fabric defects caused by the contraction of the weft yarn when the blank beating start is performed (that is, when the reverse rotation of the loom main shaft is performed) are prevented.

[0011] The information regarding the result of determination obtained in the first and second aspects may be displayed in a visible manner via the setting unit. For example, with regard to the first aspect, the fact that the weft yarn positioned at the cloth fell has elasticity or the fact that the selection of the blank beating start is inadequate are displayed. Accordingly, the operator recognizes that the starting method is inadequate and corrects the setting of the starting method or manually operates the loom with the starting method other than the blank beating start. Thus, the fabric quality can be adequately controlled by checking the information showing the result of determination.

[0012] The normal starting method may include, for example, at least one of (1) a first start in which the loom is activated at a current drive operation position, beat-up motion is performed, and then weft insertion is started and (2) a second start in which the loom is activated at the current drive operation position, weft insertion is started, and then the beat-up motion is performed. More specifically, the normal starting method may include one or both of (1) and (2). When both of (1) and (2) are included, one of them may be set in advance or be selected in accordance with a predetermined algorithm on the basis of weaving conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a diagram showing the overall structure of an air jet loom to which the present invention is applied;

Fig. 2 is a block diagram showing the internal structure of a control apparatus included in the loom according to the present invention;

Fig. 3 is a diagram showing an operational flow performed between the period from the occurrence of a cause of stoppage to the start of the loom's operation in a case in which a 300° start is selected as a normal start in a start control of the loom according to the present invention in which whether or not to restrict the selection of a blank beating start is determined;

Fig. 4 is a diagram showing an example of setting of weft selection information on the basis of which it is determined whether or not the selection of the blank beating start is to be restricted in the present invention;

Fig. 5 is a flowchart showing a process in which a

control unit determines whether or not to restrict the selection of the blank beating start in the start control of the loom according to the present invention;

Fig. 6 is a flowchart showing a process in which a setting unit determines whether or not to restrict the selection of the blank beating start in a setting phase according to the present invention; and

Fig. 7 is a diagram showing an operational flow performed between the period from the occurrence of a cause of stoppage to the start of the loom's operation in a case in which a 60° start is selected as the normal start in the start control of the loom according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

[0014] Embodiments of the present invention will be described below with reference to the accompanying drawings. Fig. 1 shows an air jet loom 10 of a two-color weft insertion type which selectively inserts two kinds of weft depending on a weft-insertion pick number.

[0015] The loom 10 includes weft suppliers 12a and 12b for supplying weft yarns 11a and 11b, respectively, weft feeders 13a and 13b, stopper pins 14a and 14b installed adjacent to the weft feeders 13a and 13b, main nozzles 15a and 15b for inserting the weft yarns 11a and 11b by air jet, and a plurality of sub nozzles 16, 16... disposed in a warp shed 21 along a weft-insertion path for pushing the weft yarn 11a or 11b being inserted by the air jet. The main nozzles 15a and 15b are connected to their respective electromagnetic valves 17 and 17 and pressure adjusters 18 and 18 constituted of, for example, electro-pneumatic proportional valves or the like via air tanks (not shown). The sub nozzles 16, 16... disposed along the weft-insertion path are classified into a plurality of groups along the weft insertion direction, and each group is connected to an electromagnetic valve 17 and a pressure adjuster 18 via an air tank (not shown). The pressure adjusters 18, 18... are connected to a common fluid source 19 for supplying compressed air. Various devices of the loom 10 including a warp shedding device (not shown), a reed 22, a weft cutter 26, etc., are linked to a main shaft 20 of the loom 10 via motion conversion mechanisms (not shown), and a weft feeler 25 for detecting the weft yarn is disposed so as to face the weft-insertion path at a position near a fabric edge opposite from a weft-insertion position.

[0016] The weft feeders 13a and 13b retain the weft yarns 11a and 11b, respectively, by rotating yarn guides and winding the weft yarns 11a and 11b around drums, and the weft yarns 11a and 11b are restrained by the stopper pins 14a and 14b, respectively, which move toward and away from the circumferential surfaces of the drums. When the weft yarn 11a is selected, a weft-insertion control unit 28, which will be described below, operates such that the stopper pin 14a corresponding to the selected weft yarn 11a is retracted so as to release the weft yarn 11a wound around the drum in the open phase of the warp shed. At the same time, the electromagnetic valves 17, 17... are opened and closed such that the weft-insertion nozzles including the main nozzle 15a corresponding to the selected weft yarn 11a and the sub nozzles 16, 16... blow compressed air in relays. Accordingly, the selected weft yarn 11a is released from the weft feeder 13a and is inserted as shown in the figure. Then, when the weft yarn 11a is released from the weft feeder 13a by a predetermined number of windings, the weft-insertion control unit 28 causes the stopper pin 14a to extend and stop the weft yarn 11a. The inserted weft yarn 11a is beaten by the reed 22, cut by the weft cutter 26, and thereby becomes a part of a woven fabric 23. In this manner, the weft yarns 11a and 11b are selectively inserted and are woven into the fabric. The above-described air jet loom 10 is of the two-color weft insertion type in which the weft yarns 11a and 11b are selectively inserted in each rotation of the loom in accordance with a weft-insertion pattern. However, the loom may also be of a single-color weft insertion type, a three-color weft insertion type, or more.

[0017] The electromagnetic valves 17, 17... , the weft feeders 13a and 13b, and the stopper pins 14a and 14b are connected to output terminals of the weft-insertion control unit 28. An angle detector 27 constituted of, for example, a rotary encoder is connected to the loom main shaft 20, and an electric signal representing a crank angle of the main shaft 20 is output by the angle detector 27. An angle signal θ is input to an input terminal of the weft-insertion control unit 28, and a setting unit 50 for setting information such as conditions of weft insertion is connected to the weft-insertion control unit 28.

[0018] Fig. 2 is an internal block diagram of a control apparatus 30 of the loom which functions as a start control apparatus of the loom according to the present invention. The control apparatus 30 of the loom basically includes a control unit 32 to which the angle signal θ is input, the weft-insertion control unit 28 which controls actuators of the above-described weft-insertion devices, and the setting unit 50 for transmitting set values to the control units 32 and 28. The control unit 32 includes a main controller 34 which controls the overall operation of the loom and a determination unit 40 which outputs a weft selection signal S1 and determines whether or not to restrict the selection of the blank beating start.

[0019] The determination unit 40 basically includes a stepping-signal generator 41 which generates a forward-rotation stepping signal Sf or a reverse-rotation stepping signal Sr each time the loom main shaft angle θ reaches a predetermined angle depending on the rotational direction of the main shaft and a signal generator 42 which counts the stepping signals Sf and Sr input thereto and outputs a signal representing the count value as a weft pick number. The angle signal θ is input to the stepping-signal generator 41. Each time the loom operates by one turn and the input angle reaches the predetermined angle

(for example 0°), the stepping-signal generator 41 generates a single pulse of either the forward-rotation stepping signal Sf or the reverse-rotation stepping signal Sr depending on the rotational direction. The signal generator 42, which will be described in detail below, memorizes a weft selection pattern set via the setting unit 50, and is capable of counting the number of pulses of the two stepping signals Sf and Sr input to the signal generator 42. Accordingly, each time the input angle reaches the predetermined angle and the forward-rotation stepping signal Sf or the reverse-rotation stepping signal Sr is input, the signal generator 42 increments or decrements a weft-insertion pick count value by 1 and outputs the weft selection signal S1 corresponding to the pick count value on the basis of the memorized weft selection pattern. The determination unit 40 functions not only as a weft-selection-signal generator but also as a determination circuit which generates a blank-beating-start restriction signal S3. This will be described in more detail below. In the pick count performed by the signal generator 42, if the stepping signal Sf is input while the pick count value is at an upper limit "5", the signal generator 42 returns the pick count value to "1". In reverse, if the stepping signal Sr is input while the pick count value is at a lower limit "1", the signal generator 42 returns the pick count value to "5".

[0020] The main controller 34 includes, for example, a microprocessor unit (MPU), a memory which stores software, such as a control program of the loom, and a port for inputting/outputting signals to the MPU, none of which is shown in the figure. The main controller 34 receives signals from the loom's operation buttons including an drive button 35a, a reverse rotation button 35b, and a stop button (not shown); the main shaft angle signal θ from the angle detector 27; and abnormal signals from the weft feeler 25, a warp breakage sensor (not shown), etc. In addition, the main controller 34 outputs, for example, an activation signal S6, a reverse-rotation signal S7, and a brake command signal S8 to current generators 36 and 37 which supply current to a motor 38 and a loom brake 39, respectively, via ports (not shown), and also outputs an drive signal S4, a blank-weaving command signal S5, an activation preparation signal S9, etc., to the weft-insertion control unit 28, a warp control unit 44, which will be described below, and a weft detection unit 45 to which the weft feeler 25 is connected.

[0021] The setting unit 50 includes, for example, a touch-panel setting display 51 having a display function and is connected to the weft-insertion control unit 28, the main controller 34, and the determination unit 40 so that necessary information can be set and communicated between these units and the setting unit 50. More specifically, with regard to the determination unit 40, the setting unit 50 sets weft selection information for each weft-insertion pick number and information regarding elasticity of the weft. In addition, with regard to the weft-insertion control unit 28, the setting unit 50 sets data regarding weft insertion for each kind of selectable weft, the data including timing at which the compressed air is to be discharged from the main nozzle and sub nozzles, pressures of the compressed air supplied to the nozzles, the amount of rotation of a flyer of the weft feeder, that is, the number of windings of the weft yarn for each pick of weft insertion, and timing at which the weft yarn is to be released from the stopper pin. Further, the setting unit 50 sets data regarding the selectively set starting method and conditions for the set starting method in the main controller 34, and data regarding warp tension control and weft density control such as warp tension, a warp-beam diameter, and a weft density in the warp control unit 44. Such information may be input manually by the operator, read out from a memory medium such as a memory card, or automatically set via a loom management computer connected to the loom.

[0022] During steady operation, the activation signal S6 is output from the main controller 34, and accordingly the current generator 36 supplies current to the motor 38. The motor 38 rotates the main shaft 20 of the loom, and the angle signal θ corresponding to the rotation of the main shaft 20 is input to the stepping-signal generator 41, the weft-insertion control unit 28, and the main controller 34. Each time the main shaft 20 is rotated by one turn and the angle signal θ reaches 0°, the stepping-signal generator 41 outputs the stepping signal Sf and the signal generator 42 increments the count value of the weft-insertion pick number by 1. Then, on the basis of the memorized weft selection pattern and the incremented pick number, the signal generator 42 outputs one of selection signals CL1 and CL2 corresponding to the weft-insertion devices to the weft-insertion control unit 28 as the weft selection signal S1. Then, in order to insert the weft yarn corresponding to the weft selection signal S1, the weft-insertion control unit 28 outputs drive signals to the electromagnetic valves 17 and the pressure adjusters 18 under conditions set for each kind of weft (jet start angles, jet finish angles, and pressures), and drives the corresponding stopper pin 14 and the weft feeder 13 at the same time. The warp control unit 44 is a known device which detects a warp tension at a predetermined angle and rotates a warp beam (not shown) so as to maintain a desired warp tension during the operation of the loom. The warp control unit 44 also rotates a take-up roller (not shown) for winding the woven fabric such that the rotational speed of the loom and the weft density are maintained at predetermined values.

[0023] A process performed between the period from the occurrence of a cause of stoppage of the loom 10 during steady operation to the start of the loom's operation will be described in detail below with reference to Fig. 3.

[0024] In the loom 10, it is assumed that a total step number of the weft selection information is "5". More specifically, it is assumed that the weft selection pattern corresponding to the weft selection information is set such that a process of inserting a weft yarn "a" having no elasticity for four picks and a weft yarn "b" having elasticity

for one pick is repeated. The setting unit 50 sets, in the form of symbols, the selection information regarding the weft-insertion device (the main nozzle and the weft feeder) to which the weft is set for each weft-insertion pick number in the signal generator 42 included in the determination unit 40. The weft selection information (weft selection pattern) is transmitted to the signal generator 42 and is memorized in the form shown in, for example, Fig. 4. The loom 10 is operated under the above-described conditions.

[0025] During steady operation, if, for example, a weft-insertion error occurs as a cause of stoppage and a weft-insertion stop signal is generated when the weft-insertion pick number is "1", that is, when the weft yarn "a" is being inserted, the main controller 34 turns off the drive signal S4 and stops the motor 38 via the current generator 36. In addition, the main controller 34 outputs the brake command signal S8 and activates the brake 39 via the current generator 37 to immediately stop the rotation of the loom main shaft 20. Then, the main controller 34 rotates the main shaft 20 in the reverse direction until it reaches a predetermined angle (300°), so that the warp shed is closed in the standby state. When the operator arrives, he or she operates the reverse rotation button 35b to rotate the main shaft 20 in the reverse direction until it reaches 180°, and removes the defective weft yarn "a" appearing at the cloth fell 24. Then, the operator presses the reverse rotation button 35b again, and rotates the main shaft 20 in the reverse direction until it reaches a predetermined angle (300°), which is a drive operation position. Then, the operator presses the drive button 35a to restart the loom 10.

[0026] The setting unit 50 communicates with the operator through a display screen (not shown) on the setting display 51 so as to set weaving conditions of the loom, and a plurality of starting methods including the blank beating start and a normal start, which will be described below, are set such that they can be selected. In the setting unit 50, information showing that the blank beating start is to be selected as a preferred starting method and a 300° start is to be selected as a substitute starting method if the blank beating start is determined to be inadequate is set by the operator before starting the weaving operation.

[0027] In the present embodiment, detailed settings regarding the blank beating start set as the preferred starting method are determined as below as an example. First, the main shaft is rotated in the reverse direction from the main shaft angle 300°, which is the current drive operation position, by about one and a half turns and is stopped at 120°. Then, the loom is activated (forward direction) and blank weaving without weft insertion is performed for one and a half turns. Then, weft insertion is started. In the present embodiment, even though the blank beating start is set as the preferred starting method by the setting unit 50, if the weft yarn positioned at the cloth fell when the drive operation signal is input is determined to have elasticity, the operation of the loom is started by executing the 300° start, which is the normal start, as the substitute starting method for the blank beating start. If the weft yarn is determined to have no elasticity, the operation of the loom is started by executing the blank beating start, which is set as the preferred starting method.

[0028] When the operator presses the drive button 35a, the main controller 34 outputs a determination command signal S2 to the determination unit 40, and the determination unit 40 performs a predetermined determination in response to the input signal and outputs the blank-beating-start restriction signal S3 depending on the result of determination. After a predetermined time period from the output of the determination command signal S2, the main controller 34 selectively executes one of the starting methods depending on the blank-beating-start restriction signal S3 and starts the operation of the loom 10.

[0029] Fig. 5 shows the flow of a process performed by the main controller 34 in a period from the input of the drive operation signal S0 to the main controller 34 to the start of operation of the loom. First, when the drive button 35a is pressed and the drive operation signal S0 is input to the main controller 34, the main controller 34 outputs the determination command signal S2 to the determination unit 40 (Step 1) and reads out the starting method and detailed conditions regarding the starting method set in the setting unit 50 in advance (Step 2). The conditions include the amount of reverse rotation for the blank beating start (the number of picks of the reverse rotation and the main shaft crank angle at which the reverse rotation is to be stopped), and these conditions are set in the setting unit 50 in advance. Then, the main controller 34 checks whether or not the starting method set as the preferred starting method is the blank beating start (Step 3). If the blank beating start is set as the starting method (that is, if the result is 'yes'), the main controller 34 checks whether or not the blank-beating-start restriction signal S3 is output from the determination unit 40 (Step 4).

[0030] If the output of the blank-beating-start restriction signal S3 from the determination unit 40 is off in Step 4 (that is, if the result is 'no'), the process proceeds to the next step, i.e. Step 5 and the blank beating start set as the preferred starting method is executed. Then, the starting method-selecting process is finished. In addition, if it is determined that a starting method other than the blank beating start is set in Step 3 or if the output of the blank-beating-start restriction signal S3 from the determination unit 40 is on in Step 4 (that is, if the result is 'yes'), the process proceeds to Step 6 and the normal start (the 300° start described below), which is the starting method set as the substitute starting method for the blank beating start, is executed. Then, the starting method selecting process is finished.

[0031] In addition to the function of outputting the weft selection signal, the signal generator 42 shown in Fig. 2 also has a function of determining whether or not the weft yarn which is already woven in and positioned at the cloth

fell has elasticity, in other words, whether or not the weft yarn would contract in the reverse rotation of the blank beating start, and outputs the blank-beating-start restriction signal S3 depending on the result of determination. More specifically, the setting unit 50 transmits the information regarding whether or not the weft has elasticity, which is the information regarding the elasticity of the weft, to the signal generator 42 in correspondence with the symbols of the weft-insertion devices (the main nozzles and the weft feeders) to which the weft is set. Accordingly, the signal generator 42 is capable of recognizing that the weft yarn "a" having no elasticity is set in the main nozzle 15a and the weft feeder 13a included in the weft-insertion device corresponding to the symbol "a", and that the weft yarn "b" having elasticity is set in the main nozzle 15b and the weft feeder 13b included in the weft-insertion device corresponding to the symbol "b".

[0032] When the determination command signal S2 is input from the main controller 34 in Step 1 as described above, the signal generator 42 determines whether or not to restrict the selection of the blank beating start in accordance with, for example, a predetermined software algorithm, depending on the selected weft from the current weft pick number to that at the end of the reverse rotation in the blank beating start on the basis of the weft selection information and the amount of reverse rotation in the blank beating start. Then, the signal generator 42 outputs the blank-beating-start restriction signal S3 depending on the result of determination. As described above, the pick count value (weft pick number) of the signal generator 42 is synchronized with the rotation of the loom main shaft (the forward or reverse rotation of the loom main shaft) while the electric power to the control apparatus 30 is turned on. The loom 10 is stopped at the weft-insertion pick number "5" and the angle 300°. The weft selection signal in this state corresponds to the kind of the weft yarn which is already woven in and positioned at the cloth fell. Since the loom is stopped at the weft-insertion pick number "5" and the weft yarn "b" having elasticity is selected, the signal generator 42 determines that the weft yarn would contract if the reverse rotation is performed and turns on the output of the blank-beating-start restriction signal S3, as shown in Fig. 4.

[0033] In this case, only the weft yarn "b" of the two kinds of weft yarns "a" and "b" has elasticity. Since the output of the blank-beating-start restriction signal S3 is substantially the same as the weft selection signal CL2, as is clear from Fig. 4, the output of the selection signal CL2 may also be used in place of the output of the blank-beating-start restriction signal S3. However, since a fabric may be woven using three or more kinds of weft and there may be more than one kind of weft that has elasticity, it is not advisable to select a substitute signal for each case. In this view, the algorithm for determining whether or not to restrict the selection of the blank beating start is preferably capable of adequately providing an output irrespective of the combinations of the kinds of weft and the number of weft-insertion devices to which the weft is set.

[0034] Accordingly, in the above-described case, the main controller 34 reads out information indicating that the blank beating start is set as the preferred starting method in Step 2, determines that the output of the blank-beating-start restriction signal S3 is on in Step 4, and executes the 300° start, which is the normal starting method selected as the substitute starting method, in Step 6.

[0035] When the 300° start, which is the normal starting method, is selected, the loom is activated at 300°, which is the current drive operation position, as shown by the solid line in Fig. 3. More specifically, the beat-up motion is carried out once and the operation of the loom 10 is started by inserting the weft yarn "a" corresponding to the weft-insertion pick number "1".

[0036] For reference, the above-described blank beating start is shown by a dashed line in Fig. 3. In the blank beating start, first, the reverse rotation is performed from the current drive operation position 300° by about one and a half turns (to 120° where the weft-insertion pick number is "4", which corresponds to the previous pick). Then, the loom is activated in the forward direction while the output of the blank-weaving command signal S5 is turned on, so that blank weaving without weft insertion is performed for one and a half turns, in which the beat-up motion is carried out twice. Then, the output of the blank-weaving command signal S5 is turned off and the operation of the loom is started by restarting weft insertion with the weft yarn "a" corresponding to the weft-insertion pick number "1". In this case, when the main shaft 20 of the loom is rotated in the reverse direction from the current drive operation position 300° in the blank beating start and the warp shed is opened accordingly, the weft yarn "b" having elasticity is released from the warp and the selvedge yarns and contracts. Therefore, a fabric defect occurs. The main shaft angle at which the contraction of the weft yarn occurs varies depending on the shedding conditions in the warp shedding device such as dwell in the shedding curve, the area of the warp shed, and cross timing, the conditions of the selvedge device, the characteristics of the warp and weft, etc. As an example, in a certain loom, a main shaft angle around 260° is the limit when the cross timing of the warp shedding device is 300°.

[0037] According to the present invention, even when the operator selects the blank beating start as the preferred starting method through the setting unit 50 by mistake without taking the elasticity of the weft into account, if the input information regarding the elasticity of the weft indicates that the weft has elasticity, the normal start is automatically selected as the substitute starting method for the blank beating start which involves the reverse rotation when the loom is operated. Therefore, unlike the known system, fabric defects caused when the blank beating start involving the reverse rotation is executed irrespective of whether or not the weft has elasticity and the weft yarn "b" having elasticity which has already been

woven in contracts by being released at the cloth fell are prevented.

[0038] In the above-described embodiment, the weft selection pattern and the detailed settings for the selected start (settings regarding the start of the loom such as the amount of reverse rotation in the blank beating start) are not limited to the above-described example, and may be adequately set depending on the specifics of the fabric.

[0039] The above-described embodiment may also be modified as below. That is, the information for determining whether of not the weft at the drive operation has elasticity is not limited to the weft selection information (weft selection pattern). For example, weft having high elasticity somewhat contracts in a period from the end of discharge of the jet from the weft-insertion nozzles to the time at which the beat-up motion is carried out. Accordingly, the contraction of the weft yarn may be directly detected using the yarn signal from the weft feeler 25 and be memorized for each weft-insertion pick, and this information may be used instead of the weft selection information. The method for detecting the contraction of the weft yarn is not particularly limited.

[0040] The elasticity of the weft may also be evaluated on the basis of the degree of elasticity (the amount of contraction per unit length) in addition to the presence/absence thereof. When the degree of elasticity is used, the evaluation criterion may be adequately set depending on whether the fabric defects will occur due to the contraction of the weft yarn.

[0041] In the above-described embodiment, the blank-beating-start restriction signal is generated on the basis of the weft selection information and the information regarding whether or not the weft has elasticity. However, if, for example, the step number is relatively small as in the case where the loom is of the two-color weft insertion type and two kinds of weft are alternately inserted in, for example, two-color one-pick (1×1) or two-color two-pick (2x2) pattern, or if the weft having elasticity is always set in a predetermined one of the weft-insertion devices, the weft selection signal S1 corresponding to the weft-insertion device to which the weft having elasticity is set (one of CL1, CL2...) may also be used instead of the blank-beating-start restriction signal S3. In addition, instead of using the weft selection signal S1, the information which the weft selection signal is based on, for example, the ordinality of whether the weft-insertion pick number is even number or odd number may also be used for outputting the blank-beating-start restriction signal S3. In other words, the selection of the blank beating start may also be restricted depending only on the weft selection information without using the information regarding whether or not the weft has elasticity.

[0042] In addition, the blank-beating-start restriction signal S3 may also be generated depending only on the information regarding the elasticity of the weft. More specifically, the signal generator 42 in the determination unit 40 receives the information regarding the elasticity of the weft from the setting unit 50, and outputs the blank-beating-start restriction signal S3 if it determines that at least one of a plurality of kinds of weft has elasticity. In such a case, the loom is operated by executing the normal start, which is set as the substitute starting method, irrespective of the preferred starting method set by the setting unit 50.

[0043] In the above-described first embodiment, the following modifications are possible. First, although the blank beating start is set as the preferred starting method for the case in which the weft yarn positioned at the cloth fell when the drive operation signal is generated has no elasticity in the above-described embodiment, the setting may also be such that the normal start is executed. The starting method for the case in which the weft yarn has no elasticity may be selected from the blank beating start and the normal start, which is the substitute starting method for the blank beating start, by taking the actual states of weft bars and other conditions into account.

[0044] In the first embodiment, a single preferred starting method is set in the setting unit 50 in advance, and the substitute starting method, which is also set in advance, is executed instead of the preferred starting method depending on the result of determination regarding the elasticity of the weft yarn positioned at the cloth fell. However, various other methods are possible with regard to the selective execution of the starting methods. For example, the starting method to be executed when the drive operation signal is generated may also be set for each of the weft-insertion pick numbers in advance by the setting unit 50 in accordance with the elasticity of the weft yarn positioned at the cloth fell. When the drive operation signal is generated, the control unit 32 checks the weft-insertion pick number, and the operation of the loom is started using the starting method corresponding to the determined pick number. As described above, the weft-insertion pick number is updated in synchronization with the rotation of the main shaft in the operation of the loom and the reverse rotation. Therefore, the use of the weft pick number when the drive operation signal is generated is included within the scope of the first aspect of the present invention in which whether or not the weft yarn positioned at the cloth fell when the drive operation signal is generated has elasticity is determined on the basis of the information regarding the weft selection.

[0045] In addition, in the above-described embodiment, determination of whether or not the weft yarn positioned at the cloth fell has elasticity is performed when the drive operation signal S0 is generated. However, the drive operation position of the loom (for example, the operation corresponding to the amount of reverse rotation of the loom main shaft in the recovery operation for the weft insertion error) is sometimes uniquely determined depending on the cause of stoppage. Accordingly, the position (main shaft angle) at which the drive operation is performed may be estimated from the kind of a signal representing the cause of stoppage before the generation of the drive operation signal (more specifical-

ly, in a period from the generation of the signal representing the cause of stoppage to the generation of the drive operation signal). Then, similar to the above-described embodiment, the determination is performed based on the weft selection information. Thus, the time at which whether or not the weft yarn has elasticity is determined is not limited. The causes of stoppage are classified into a weft trouble, such as the weft insertion error, and other troubles, such as the warp breakage and the operation of a stop button. This is because the amount of rotation (amount of reverse rotation) of the loom main shaft performed for the recovery operation differs depending on whether or not the cause of stoppage is related to the weft trouble. More specifically, when the weft trouble occurs, reverse rotation of more than one turn from the standby angle at the time of stoppage (300°) is manually performed for removing the defective weft yarn, and then the loom is operated. In comparison, when the cause of stoppage is not related to the weft trouble, the loom is directly operated from the standby angle at the time of stoppage of the loom (300°).

[0046] In the above-described embodiment, the normal start is automatically selected instead of the blank beating start depending on the result of determination based on the weft selection information or the kind of weft yarn. However, instead of the automatic process, a warning about the risk of fabric defects due to the contraction of the weft may also be issued. For example, a dedicated warning lamp may be turned on or a warning message like "risk of fabric defects due to reverse rotation in blank beating start" may be shown on the setting display 51 of the setting unit 50 to attract the operator's attention. When the operator notices the warning, he or she operates the drive operation button corresponding to the normal start to start the operation with the normal start instead of the blank beating start which involves the reverse rotation, or resets the selected starting method to the normal start.

Second Embodiment

[0047] A second embodiment of the present invention will be described below. In the first embodiment, the normal start, which is the substitute starting method for the preferred starting method, is executed by the control unit 32 which controls the loom. In comparison, in the second embodiment, this is performed by the setting unit 50. More specifically, when the operator sets weaving conditions of the loom, the information regarding the elasticity of the weft is input first and the setting unit 50 determines whether or not the weft has elasticity. If it is determined that the weft has elasticity, the blank beating start which involves the reverse rotation is eliminated from the list of settable starting methods so that only the normal start can be set. The circuit structure corresponding to this embodiment is obtained simply by removing the blank-beating-start restriction signal S3 from the structure shown in Fig. 2, and therefore explanations regarding the circuit are omitted.

[0048] Fig. 6 shows the flow of a process performed by the setting unit 50 when the operator sets the weaving conditions. First, the operator inputs weft-kind information by operating the setting unit 50 (Step 1). The weft-kind information input in this step includes, for example, information regarding whether or not the weft has elasticity such as the kind of weft, whether or not an elasticizing process has been performed, the twist number, etc. After the weft-kind information for a plurality of kinds of weft to be set is input, the setting unit 50 proceeds to the next step (Step 2). In this step, in accordance with a predetermined algorithm, the setting unit 50 determines whether or not the weft has elasticity and sets an elasticity flag if the weft has elasticity. If the weft has no elasticity, the setting unit 50 clears the elasticity flag. Then, the setting unit 50 determines whether the elasticity flag is set or cleared (Step 3). If the elasticity flag is cleared (that is, if the result is 'no'), the process proceeds to the display of a starting method selection screen and shows both the blank beating start and the normal start in a menu of selectable starting methods (Step 4). The operator inputs one of the two starting methods being displayed (Step 5), and the setting unit 50 displays an input screen for inputting detailed conditions corresponding to the set starting method. Then, the operator inputs required information (Step 6), and when the input is finished, the process proceeds to the step for inputting weaving conditions such as weft-insertion conditions (Step 7). Then, the starting method selecting process is finished.

[0049] If the elasticity flag is set in Step 3 (that is, if the result is 'yes'), it is determined that the blank beating start cannot be selected and the 300° start, which is the normal start, is set as the selected starting method (Step 8). Then, the setting unit 50 displays an input screen for inputting detailed conditions corresponding to the normal start, and the operator inputs required information (Step 6). Then, when the input is finished, the process proceeds to the step for inputting weaving conditions such as weft-insertion conditions (Step 7) and the starting method selecting process is finished.

[0050] Thus, the information regarding the elasticity of the weft is input in advance, and if the information input to the setting unit 50 indicates that the weft has elasticity, the blank beating start which involves the reverse rotation is eliminated from the list of selectable starting methods. Accordingly, the normal starting method is selected and set as the starting method of the loom. Therefore, the operator is prevented from selecting the blank beating start without taking the elasticity of the weft into account by mistake. As a result, similar to the first embodiment, unlike the known system, fabric defects caused when the blank beating start involving the reverse rotation is executed and the weft yarn "b" having elasticity which has already been woven in contracts by being released at the cloth fell are prevented. Therefore, a problem in that the quality of the woven fabric is degraded for a long time until the operator or a fabric inspector notices the incor-

rect setting of the starting method is prevented.

[0051] The above-described first and second embodiments may also be modified as below.

[0052] In the above-described embodiments, the 300° start is used as the normal start which functions as the substitute starting method. In this starting method, the loom is activated at the current drive operation position (angle 300°) and weft insertion is started after the timing of the beat-up motion (angle 0°) is reached. However, the drive operation position (standby angle) is not limited to 300°. For example, it is not necessary that the drive operation position be in front of the position corresponding to the timing of the beat-up motion, and the drive operation position may also be set behind the position corresponding to the timing of the beat-up motion. For example, as shown in Fig. 7, the starting method may also be such that the standby angle at the stoppage of the loom is set to 60° and the drive operation position is set to 60°. Then, the loom is activated from the current drive operation position, and the beat-up motion is performed after starting the weft insertion. The reason why this starting method may be used will be described below. When the weave pattern is a twill weave of 2/1, 3/1, etc., the opening of the shed is at a maximum at one of the heald frames when the angle is 300°, and therefore weft bars (wavy set marks) due to the vertical displacement of the cloth fell are generated. In order to eliminate these weft bars, the loom is preferably started at a main shaft angle at which the warp shed is somewhat opened in the direction of the shedding motion so that the cloth fell is prevented from being displaced in the vertical direction, and such a state of the warp shed is obtained when the main shaft angle is around 60°. In this detailed explanation, the 300° start is an example of a first start, and the 60° start is an example of a second start. The drive operation positions (angles) of the former and latter starts are not limited to 300° and 60°, respectively, and may be set arbitrarily as long as the intended effects can be obtained.

[0053] In addition, in the above-described first and second embodiments, only the 300° start is set as the normal start which is used as the substitute starting method for the blank beating start. However, the 60° start may also be set instead of the 300° start. Alternatively, the substitute starting method may also be selected from among a plurality of starting methods including the 300° start and the 60° start. With respect to a method for selecting the substitute starting method, the operator may set the starting method to be selected in advance from experience. Alternatively, an adequate substitute starting method may be selected automatically by analyzing data set in the setting unit 50 such as the information regarding the kind of weft and warp, the weft density, the weaving pattern, etc., in accordance with a predetermined algorithm, and be transmitted to the control unit as starting method selection information.

[0054] In the above-described embodiments, preferably, other weft-bar prevention techniques are used in combination. The other weft-bar prevention techniques may include, for example, a technique of generating the activation preparation signal S9 when the loom is operated and rotating the take-up roller and the warp beam by predetermined amounts to correct the position of the cloth fell. These techniques are additionally used when, for example, the normal start is selected instead of the blank beating start as described above. Alternatively, these techniques may also be used irrespective of the starting method. More preferably, the amounts of rotation for correcting the position of the cloth fell are set to different values depending on whether the blank beating start is set or the normal start is set.

[0055] In the circuit structure of the control unit 32 shown in Fig. 2, the main controller 34 for controlling the start of the loom and the determination unit 40 for determining whether or not to restrict the blank beating start on the basis of the weft selection information and the information regarding the elasticity of the weft are provided independently of each other. However, they may also be provided as a single circuit. In addition, the main controller 34 included in the control unit 32 may also be structured as a circuit having additional functions of various processes of the loom regarding the warp control unit, the feeler, etc., and all of these processes may be performed by the microprocessor unit and a software installed in advance.

[0056] Although the embodiment of Fig. 1 shows a loom of the two-color weft insertion type, the present invention may also be applied to looms of a single-color weft insertion type, a three-color weft insertion type, or more. In addition, although an air jet loom is explained in the above-described embodiments, the present invention may also be applied to other shuttleless looms such as water jet looms and rapier looms. In addition, the present invention may also be applied to looms having automatic repair devices which automatically solve the cause of stoppage, such as weft insertion error and yarn breakage of weft or warp, and restart the operation.

Claims

1. A start control method for a start control apparatus (30) of a loom (10), the start control apparatus (30) including:

a control unit (32) which selects one of a plurality of starting methods and operates the loom (10) in accordance with the selected starting method when a drive operation signal is input; and
a weft-insertion control unit (28) which selectively inserts one of a plurality of kinds of weft in accordance with information regarding weft selection while the loom (10) is in operation,
wherein the starting methods include a normal start and a blank beating start in which a loom main shaft (20) is rotated in a reverse direction

by a predetermined amount, beat-up motion is performed without weft insertion while activating the loom (10), and then weft insertion is started, the amount of reverse rotation in the blank beating start being set such that a weft yarn positioned at a cloth fell (24) is released from warp yarns, **characterised in that**
the start control method comprises a step of determining whether or not the weft yarn positioned at the cloth fell (24) has elasticity on the basis of the information regarding weft selection when the drive operation signal is generated and a step of executing the normal start if it is determined that the weft yarn has elasticity.

2. A start control apparatus (30) of a loom (10), comprising:

a setting unit (50) to which selection information for selecting one of a plurality of starting methods and information regarding elasticity of weft are input;
a control unit (32) which operates the loom (10) in accordance with the selected starting method when a drive operation signal is input; and
a weft-insertion control unit (28) which selectively inserts one of a plurality of kinds of weft in accordance with information regarding weft selection while the loom (10) is in operation,
wherein the starting methods include a normal start and a blank beating start in which a loom main shaft (20) is rotated in a reverse direction by a predetermined amount, beat-up motion is performed without weft insertion while activating the loom (10), and then weft insertion is started, the amount of reverse rotation in the blank beating start being set such that a weft yarn positioned at a cloth fell (24) is released from warp yarns, and
wherein the control unit (32) determines whether or not the weft yarn positioned at the cloth fell (24) has elasticity on the basis of the information regarding weft selection when the drive operation signal is generated and executes the normal start if it is determined that the weft yarn has elasticity.

3. A start control apparatus (30) of a loom (10), comprising:

a setting unit (50) to which selection information for selecting one of a plurality of starting methods and information regarding elasticity of weft are input; and
a control unit (32) which operates the loom (10) in accordance with the selected starting method when a drive operation signal is input,
wherein the starting methods include a normal start and a blank beating start in which a loom main shaft (20) is rotated in a reverse direction by a predetermined amount, beat-up motion is performed without weft insertion while activating the loom (10), and then weft insertion is started, the amount of reverse rotation in the blank beating start being set such that a weft yarn positioned at a cloth fell (24) is released from warp yarns, and
wherein one of the setting unit (50) and the control unit (32) determines whether or not to restrict the selection of the blank beating start on the basis of the input information regarding the elasticity of the weft.

4. The start control method according to Claim 1, wherein the result of determination is displayed in a visible manner.

5. The start control method according to Claim 1, wherein the normal start includes at least one of:

(1) a first start in which the loom (10) is activated at a current drive operation position, beat-up motion is performed, and then weft insertion is started; and
(2) a second start in which the loom (10) is activated at the current drive operation position, weft insertion is started, and then the beat-up motion is performed.

Patentansprüche

1. Startsteuerverfahren für eine Startsteuervorrichtung (30) einer Webmaschine (10), wobei die Startsteuervorrichtung (30) folgendes umfaßt:

eine Steuereinheit (32), die eines von mehreren Startverfahren auswählt, und die Webmaschine (10) entsprechend dem ausgewählten Startverfahren betreibt, wenn ein Antriebsbetriebssignal eingegeben wird; und
eine Schußfadensteuereinheit (28), die wahlweise einen von mehreren Schußfadensorten entsprechend die Schußfadenauswahl betreffender Informationen einträgt, während die Webmaschine (10) in Betrieb ist,
wobei die Startverfahren einen Normalstart und einen Leeranschlagstart umfassen, bei dem die Hauptantriebswelle (20) des Webstuhls um einen bestimmten Betrag in entgegengesetzter Richtung rotiert wird, die Anschlagbewegung ohne Schußfadeneintrag während der Aktivierung der Webmaschine (10) stattfindet, und dann der Schußfadeneintrag gestartet wird, der Betrag der Rückwärtsrotation beim Leeranschlagstart so eingestellt ist, daß ein Schußfa-

den an der Fachspitze (24) von den Kettfäden gelöst wird, **dadurch gekennzeichnet, daß** das Startsteuerverfahren den Schritt aufweist:

Feststellen, ob der Schußfaden an der Fachspitze (24) Elastizität aufweist, auf der Grundlage der die Schußfadenauswahl betreffenden Information, wenn das Antriebsbetriebssignal erzeugt wird, und den Schritt:

Ausführen des normalen Starts, wenn festgestellt wird, daß der Schußfaden eine Elastizität aufweist.

2. Startsteuervorrichtung (30) einer Webmaschine (10), aufweisend:

eine Einstelleinheit (50), in die Auswahlinformationen zur Auswahl eines von mehreren Startverfahren und Informationen zur Elastizität des Schußfadens eingegeben werden;
eine Steuereinheit (32), die den Webstuhl gemäß einem ausgewählten Startverfahren in Betrieb setzt, wenn ein Antriebsbetriebssignal eingegeben wird; und
eine Schußfadensteuereinheit (28), die wahlweise einen von mehreren Schußfadensorten entsprechend die Schußfadenauswahl betreffender Informationen einträgt, während die Webmaschine (10) in Betrieb ist,
wobei die Startverfahren einen Normalstart und einen Leeranschlagstart umfassen, bei dem die Hauptantriebswelle (20) des Webstuhls um einen bestimmten Betrag in entgegengesetzter Richtung rotiert wird, die Anschlagbewegung ohne Schußfadeneintrag während der Aktivierung der Webmaschine (10) stattfindet, und dann der Schußfadeneintrag gestartet wird, der Betrag der Rückwärtsrotation beim Leeranschlagstart so eingestellt ist, daß ein Schußfaden an der Fachspitze (24) von den Kettfäden gelöst wird,
wobei die Steuereinheit bestimmt, ob der Schußfaden an der Fachspitze (24) Elastizität aufweist, auf der Grundlage der die Schußfadenauswahl betreffenden Information, wenn das Antriebsbetriebssignal erzeugt wird und den normalen Start ausführt, wenn festgestellt wird, daß der Schußfaden Elastizität aufweist.

3. Startsteuereinrichtung (30) einer Webmaschine (10), aufweisend:

eine Einstelleinheit (50), in die Auswahlinformationen zur Auswahl eines von mehreren Startverfahren und Informationen zur Elastizität des Schußfadens eingegeben werden; und
eine Steuereinheit (32), die den Webstuhl gemäß einem ausgewählten Startverfahren in Betrieb setzt, wenn ein Antriebsbetriebssignal eingegeben wird,
wobei die Startverfahren einen Normalstart und einen Leeranschlagstart umfaßt, bei dem die Hauptantriebswelle (20) des Webstuhls um einen bestimmten Betrag in entgegengesetzter Richtung rotiert wird, die Anschlagbewegung ohne Schußfadeneintrag während der Aktivierung der Webmaschine (10) stattfindet, und dann der Schußfadeneintrag gestartet wird, der Betrag der Rückwärtsrotation beim Leeranschlagstart so eingestellt ist, daß ein Schußfaden an der Fachspitze (24) von den Kettfäden gelöst wird, und
wobei entweder die Einstelleinheit (50) oder die Steuereinheit (32) festlegt, ob die Auswahl des Leeranschlagstarts auf der Grundlage der die Elastizität des Schußfadens betreffenden Information verhindert wird oder nicht.

4. Startsteuerverfahren nach Anspruch 1, bei welchem das Ergebnis der Festlegung sichtbar dargestellt wird.

5. Startkontrollverfahren nach Anspruch 1, bei welchem der Normalstart wenigstens folgendes aufweist:

(1) einen ersten Start, bei dem die Webmaschine in einer laufenden Antriebsbetriebsstellung aktiviert wird, die Anschlagbewegung durchgeführt wird und dann der Schußfadeneintrag gestartet wird; und
(2) einen zweiten Start, bei dem die Webmaschine in der laufenden Antriebsbetriebsstellung aktiviert wird, der Schußfadeneintrag gestartet wird und dann die Anschlagbewegung durchgeführt wird.

Revendications

1. Procédé de commande de démarrage pour un appareil de commande de démarrage (30) d'un métier à tisser (10), l'appareil de commande de démarrage (30) comprenant :

une unité de commande (32) qui choisit l'un d'une pluralité de procédés de démarrage et fait fonctionner le métier à tisser (10) selon le procédé de démarrage choisi lorsqu'un signal d'opération d'entraînement est entré ; et
une unité de commande d'insertion de trame (28) qui insère sélectivement l'un d'une pluralité de types de trame selon des informations concernant la sélection de trame tandis que le métier à tisser (10) est en fonctionnement,

dans lequel les procédés de démarrage comprennent un démarrage normal et un démarrage de tassage d'ébauche dans lequel un arbre principal du métier à tisser (20) est mis en rotation dans un sens inverse d'une quantité prédéterminée, un mouvement de frappe est effectué sans insertion de trame tout en activant le métier à tisser (10), puis l'insertion de trame est démarrée, la quantité de rotation inverse dans le démarrage de tassage d'ébauche étant fixée de telle sorte qu'un fil de trame positionné au niveau d'une ligne de serrage de duite (24) est libéré des fils de chaîne, **caractérisé en ce que**
le procédé de commande de démarrage comprend une étape consistant à déterminer si oui ou non le fil de trame positionné au niveau de la ligne de serrage de duite (24) présente une élasticité sur la base des informations concernant la sélection de trame lorsque le signal d'opération d'entraînement est généré et une étape consistant à exécuter le démarrage normal s'il est déterminé que le fil de trame présente une élasticité.

2. Appareil de commande de démarrage (30) d'un métier à tisser (10) comprenant :

une unité de réglage (50) dans laquelle des informations de sélection destinées à choisir l'un d'une pluralité de procédés de démarrage et des informations concernant l'élasticité de trame sont entrées ;
une unité de commande (32) qui fait fonctionner le métier à tisser (10) selon le procédé de démarrage choisi lorsqu'un signal d'opération d'entraînement est entré ; et
une unité de commande d'insertion de trame (28) qui insère sélectivement l'un d'une pluralité de types de trame selon les informations concernant la sélection de trame tandis que le métier à tisser (10) est en fonctionnement ;
dans lequel les procédés de démarrage comprennent un démarrage normal et un démarrage de tassage d'ébauche dans lequel un arbre principal de métier à tisser (20) est mis en rotation dans un sens inverse d'une quantité prédéterminée, un mouvement de frappe est effectué sans insertion de trame tout en activant le métier à tisser (10), puis l'insertion de trame est démarrée, la quantité de rotation inverse dans le démarrage de tassage d'ébauche étant fixée de telle sorte qu'un fil de trame positionné au niveau d'une ligne de serrage de duite (24) est libéré des fils de chaîne, et
dans lequel l'unité de commande (32) détermine si oui ou non le fil de trame positionné au niveau de la ligne de serrage de duite (24) présente une élasticité sur la base des informations concernant la sélection de trame lorsque le signal d'opération d'entraînement est généré et exécute le démarrage normal s'il est déterminé que le fil de trame présente une élasticité.

3. Appareil de commande de démarrage (30) d'un métier à tisser (10) comprenant :

une unité de réglage (50) dans laquelle des informations de sélection destinées à choisir l'un d'une pluralité de procédés de démarrage et des informations concernant l'élasticité de trame sont entrées ; et
une unité de commande (32) qui fait fonctionner le métier à tisser (10) selon le procédé de démarrage choisi lorsqu'un signal d'opération d'entraînement est entré,
dans lequel les procédés de démarrage comprennent un démarrage normal et un démarrage de tassage d'ébauche dans lequel un arbre principal de métier à tisser (20) est mis en rotation dans un sens inverse d'une quantité prédéterminée, un mouvement de frappe est effectué sans insertion de trame tout en activant le métier à tisser (10), puis l'insertion de trame est démarrée, la quantité de rotation inverse dans le démarrage de tassage d'ébauche étant fixée de telle sorte qu'un fil de trame positionné au niveau d'une ligne de serrage de duite (24) est libéré des fils de chaîne et,
dans lequel l'une de l'unité de réglage (50) et de l'unité de commande (32) détermine si oui ou non restreindre la sélection du démarrage de tassage d'ébauche sur la base des informations entrées concernant l'élasticité de la trame.

4. Procédé de commande de démarrage selon la revendication 1, dans lequel le résultat de la détermination est affiché de manière visible.

5. Procédé de commande de démarrage selon la revendication 1, dans lequel le démarrage normal comprend au moins l'un parmi :

(1) un premier démarrage dans lequel le métier à tisser (10) est activé à une position d'opération d'entraînement actuelle, un mouvement de frappe est effectué, puis l'insertion de trame est démarrée ; et
(2) un second démarrage dans lequel le métier à tisser (10) est activé à la position d'opération d'entraînement actuelle, l'insertion de trame est démarrée, puis le mouvement de frappe est effectué.

FIG. 1

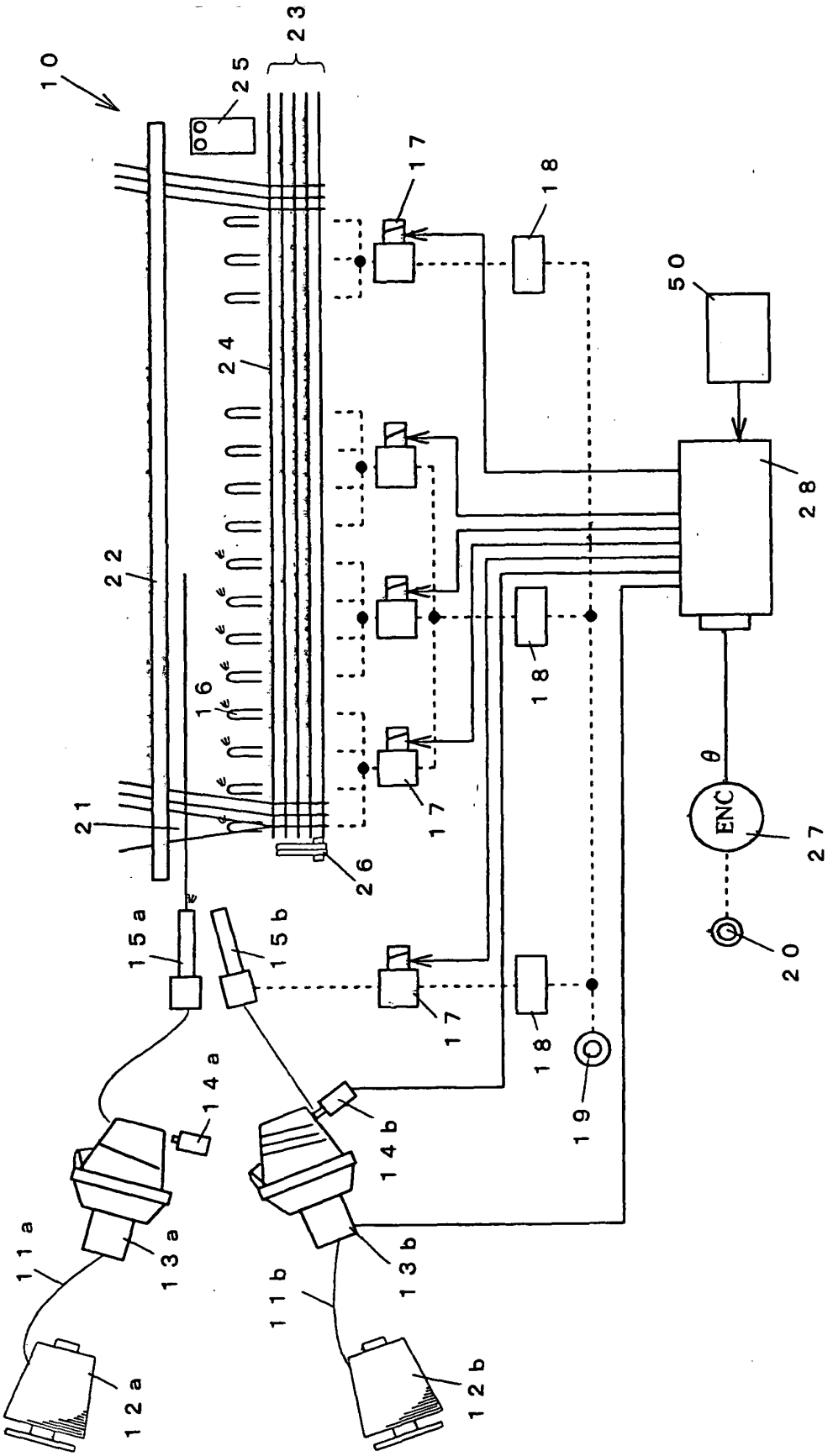

10
23
25
17
18
50
24
28
22
16
18
θ
ENC
27
21
17
26
20
15a
15b
17
18
14a
14b
19
11a
13a
13b
11b
12a
12b

FIG. 2

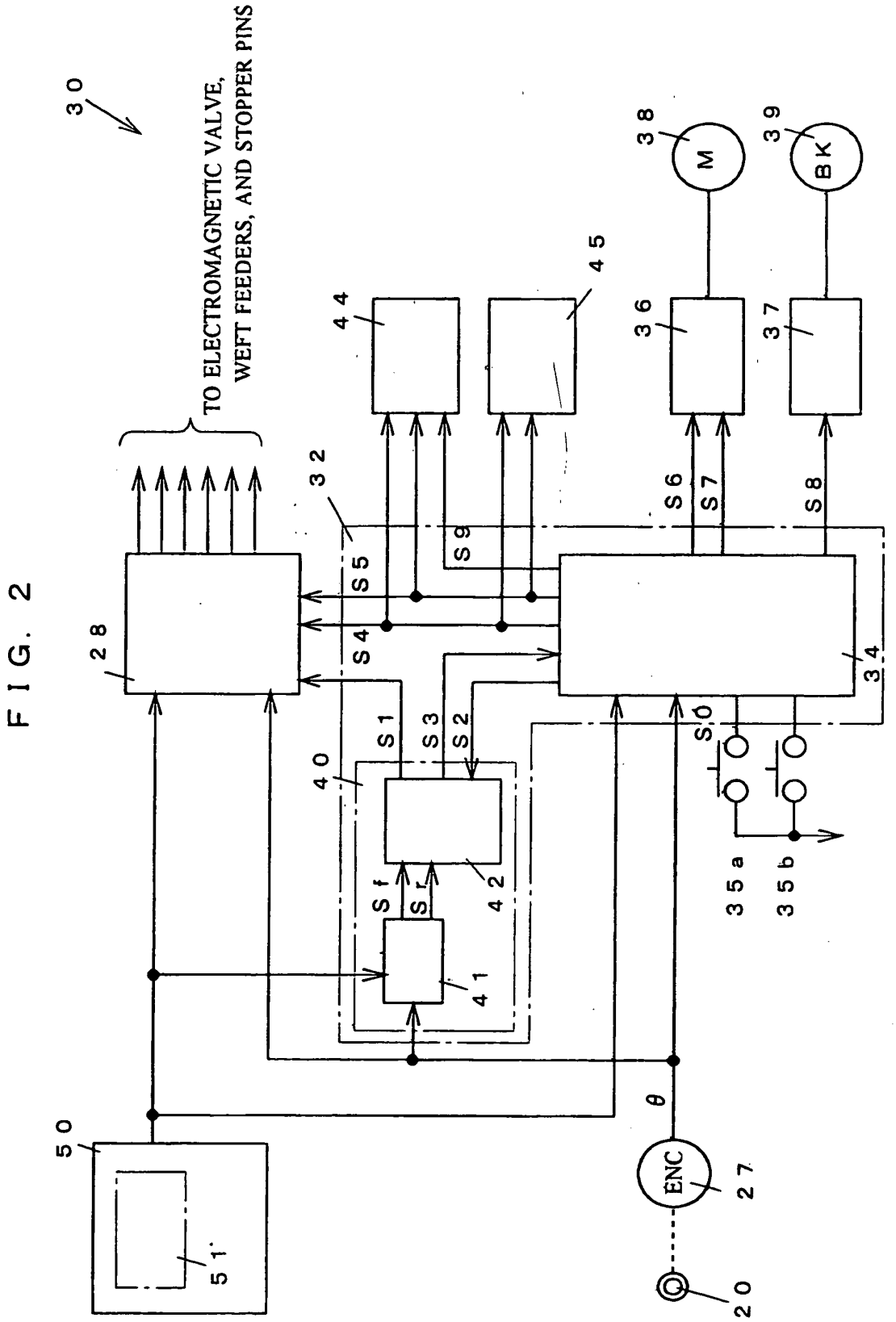

30
TO ELECTROMAGNETIC VALVE, WEFT FEEDERS, AND STOPPER PINS
38
M
39
BK
45
44
36
37
32
S6
S7
S8
S9
S5
S4
28
34
S1
S3
S2
S0
40
Sf
Sr
42
41
35a
35b
50
51
θ
ENC
27
20

FIG. 3

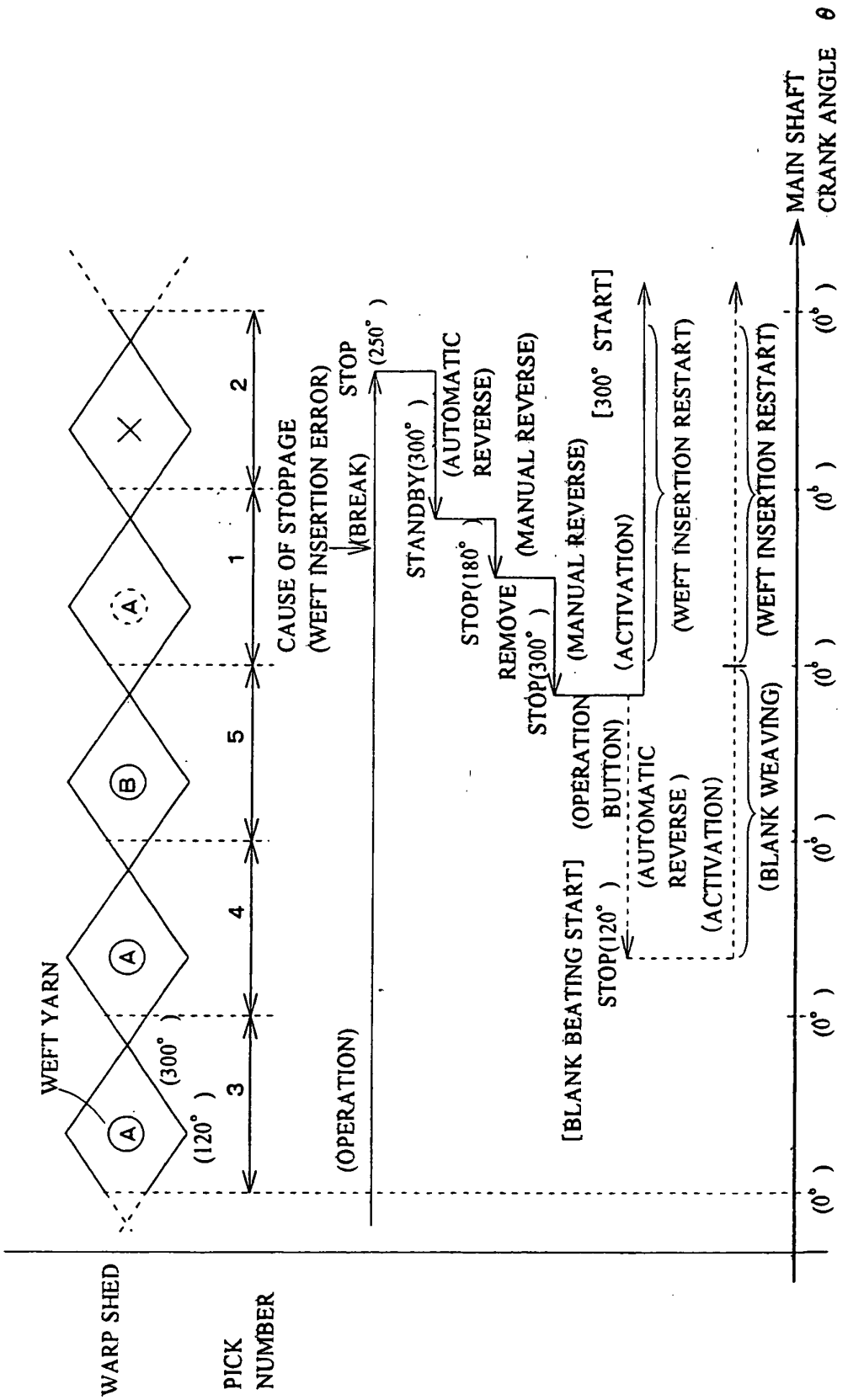

WARP SHED
PICK NUMBER
WEFT YARN
(300°)
(120°)
A
B
1
2
3
4
5
CAUSE OF STOPPAGE
(WEFT INSERTION ERROR)
STOP
(250°)
(BREAK)
(OPERATION)
STANDBY(300°)
(AUTOMATIC REVERSE)
STOP(180°)
REMOVE
STOP(300°)
(MANUAL REVERSE)
[BLANK BEATING START]
STOP(120°)
(OPERATION BUTTON)
(MANUAL REVERSE)
(ACTIVATION)
[300° START]
(AUTOMATIC REVERSE)
(ACTIVATION)
(WEFT INSERTION RESTART)
(BLANK WEAVING)
(WEFT INSERTION RESTART)
MAIN SHAFT CRANK ANGLE θ
(0°)
(0°)
(0°)
(0°)
(0°)
(0°)

FIG. 4

WEFT PICK NUMBER	KIND OF WEFT	WEFT SELECTION SIGNAL S1 OUTPUT	BLANK-BEATING-START RESTRICTION SIGNAL S3 OUTPUT
1	a	CL1	OFF
2	a	CL1	OFF
3	a	CL1	OFF
4	a	CL1	OFF
5	b	CL2	ON

FIG. 5

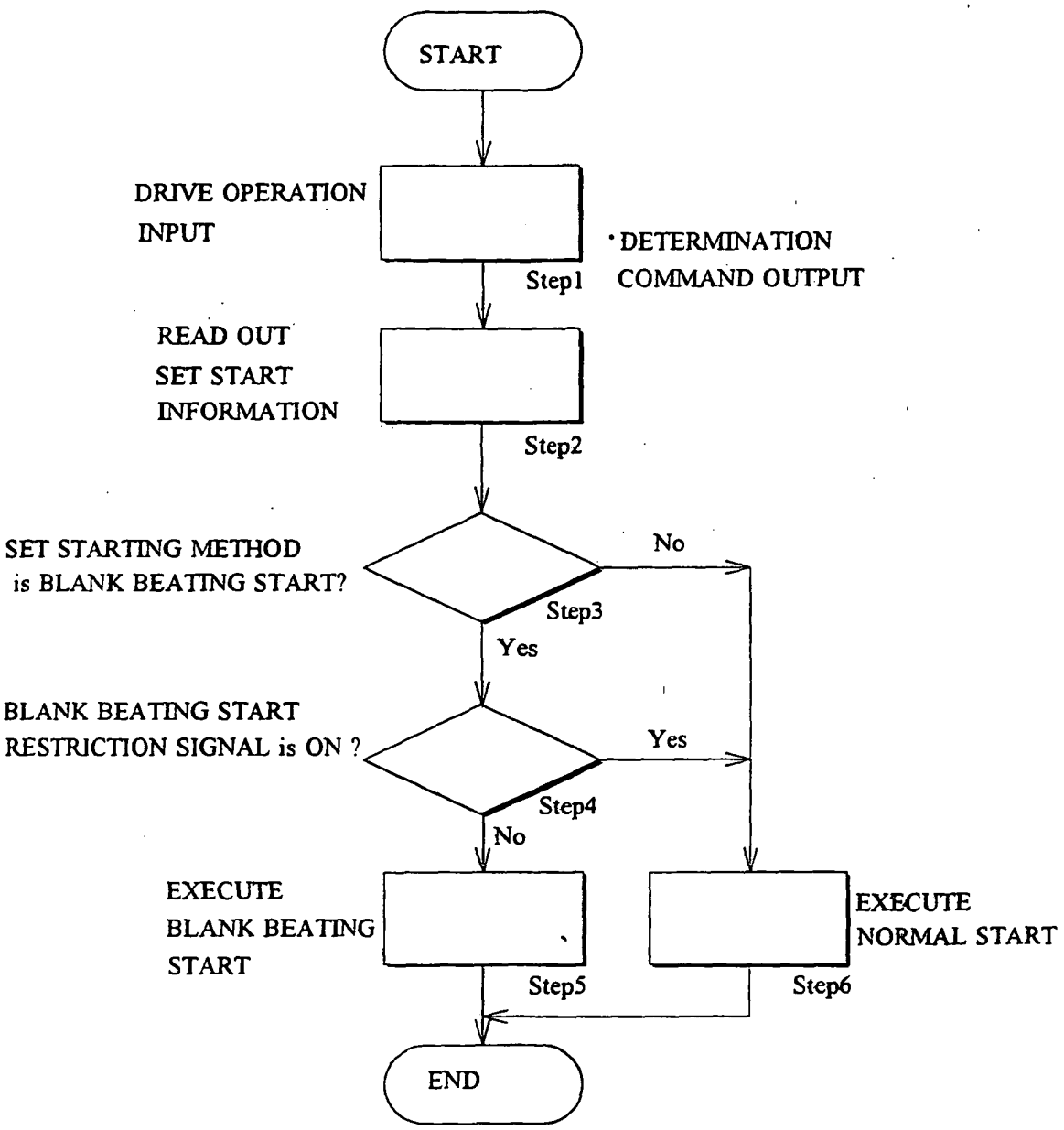

START
DRIVE OPERATION INPUT
Step1
・DETERMINATION COMMAND OUTPUT
READ OUT SET START INFORMATION
Step2
SET STARTING METHOD is BLANK BEATING START?
Step3
No
Yes
BLANK BEATING START RESTRICTION SIGNAL is ON ?
Step4
Yes
No
EXECUTE BLANK BEATING START
Step5
EXECUTE NORMAL START
Step6
END

FIG. 6

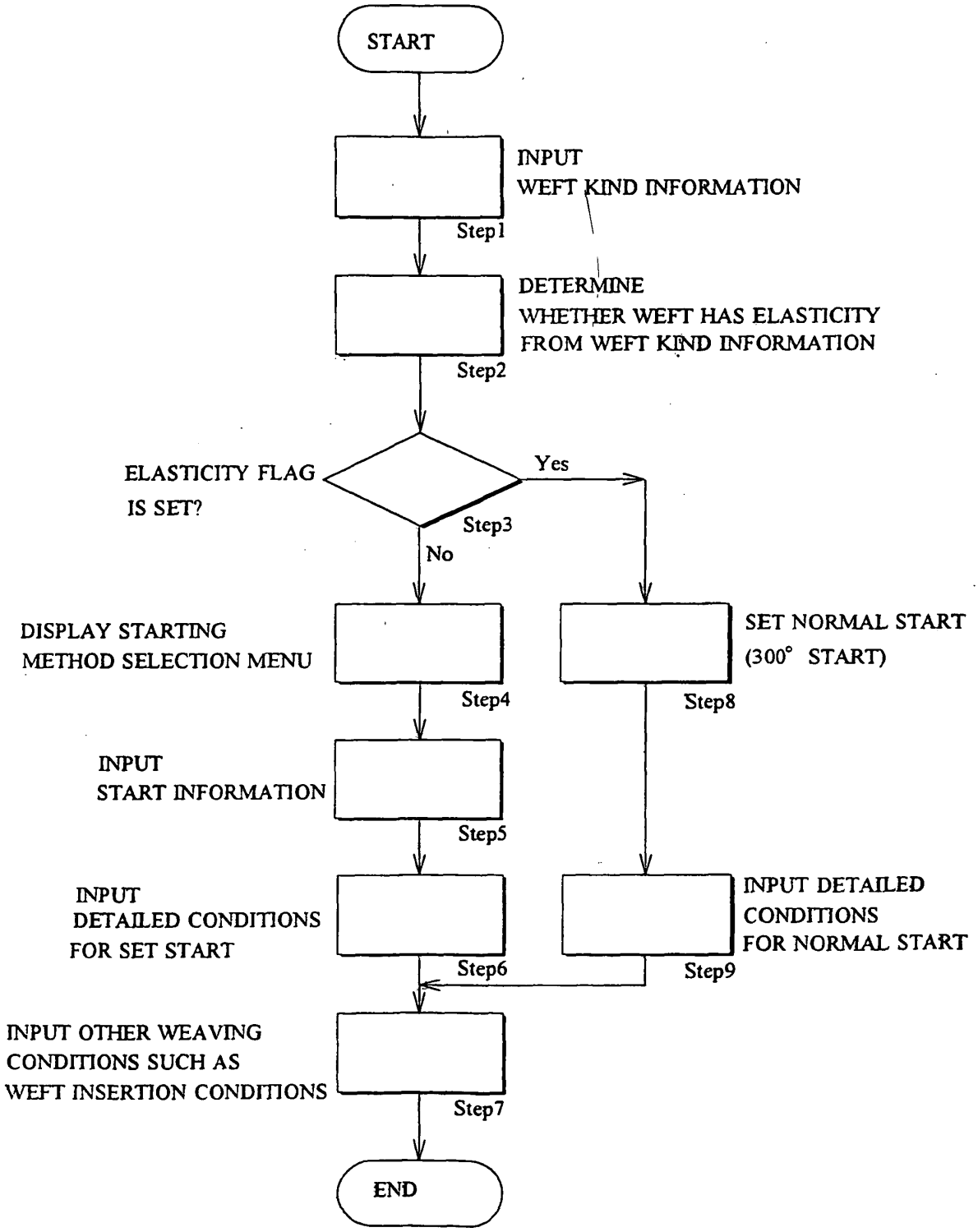
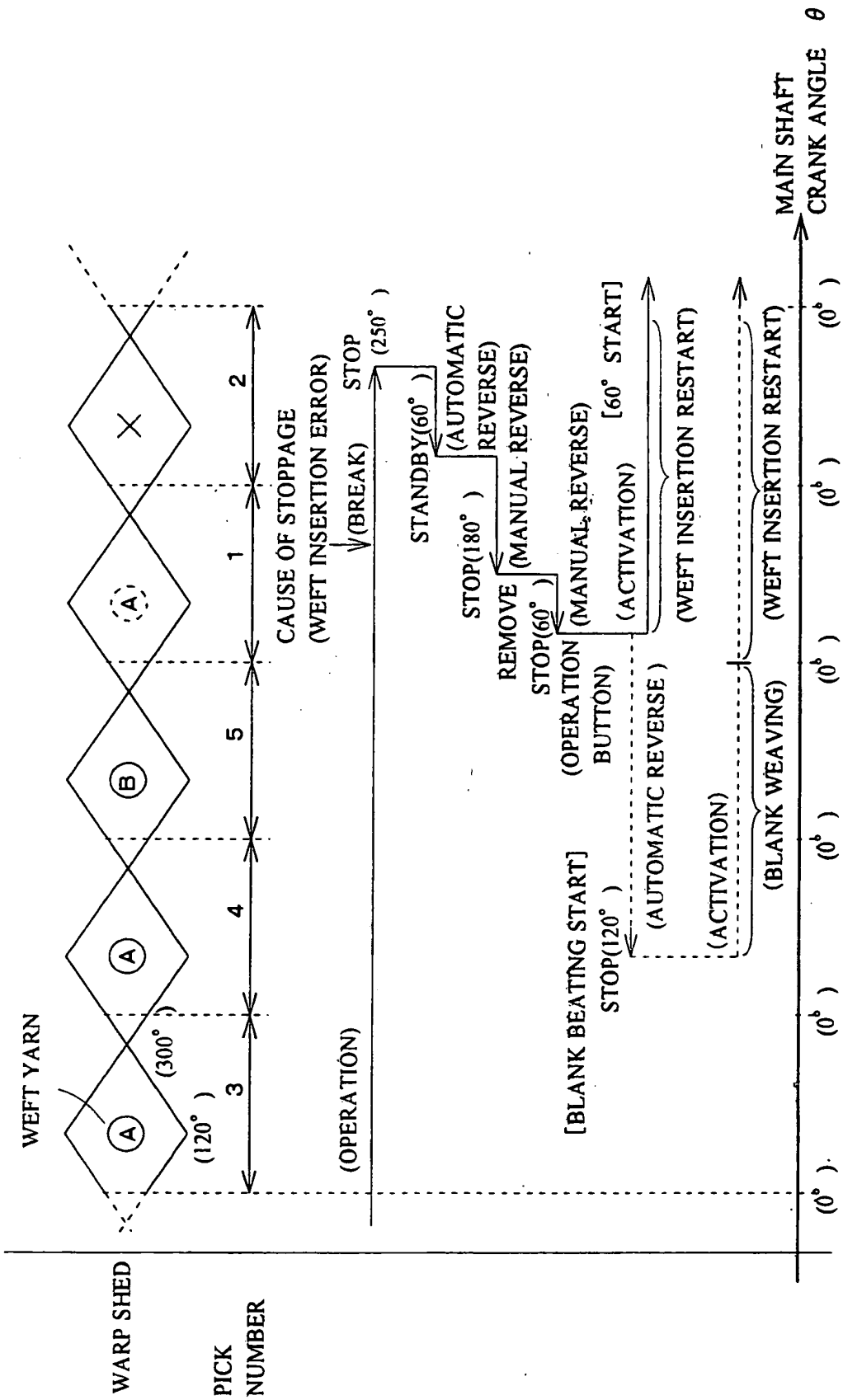

START
INPUT
WEFT KIND INFORMATION
Step1
DETERMINE
WHETHER WEFT HAS ELASTICITY
FROM WEFT KIND INFORMATION
Step2
ELASTICITY FLAG
IS SET?
Yes
Step3
No
DISPLAY STARTING
METHOD SELECTION MENU
Step4
SET NORMAL START
(300° START)
Step8
INPUT
START INFORMATION
Step5
INPUT
DETAILED CONDITIONS
FOR SET START
Step6
INPUT DETAILED
CONDITIONS
FOR NORMAL START
Step9
INPUT OTHER WEAVING
CONDITIONS SUCH AS
WEFT INSERTION CONDITIONS
Step7
END

FIG. 7


WARP SHED
PICK NUMBER
WEFT YARN
(120°)
(300°)
A
B
A
X
1
2
3
4
5
(OPERATION)
CAUSE OF STOPPAGE
(WEFT INSERTION ERROR)
(BREAK)
STOP (250°)
STANDBY(60°)
(AUTOMATIC REVERSE)
STOP(180°)
(MANUAL REVERSE)
REMOVE
STOP(60°)
(MANUAL REVERSE)
(OPERATION BUTTON)
[BLANK BEATING START]
STOP(120°)
(ACTIVATION)
[60° START]
(AUTOMATIC REVERSE)
(WEFT INSERTION RESTART)
(ACTIVATION)
(BLANK WEAVING)
(WEFT INSERTION RESTART)
(0°)
MAIN SHAFT CRANK ANGLE θ

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 61124651 A **[0002]**
- EP 1285984 A2 **[0004]**