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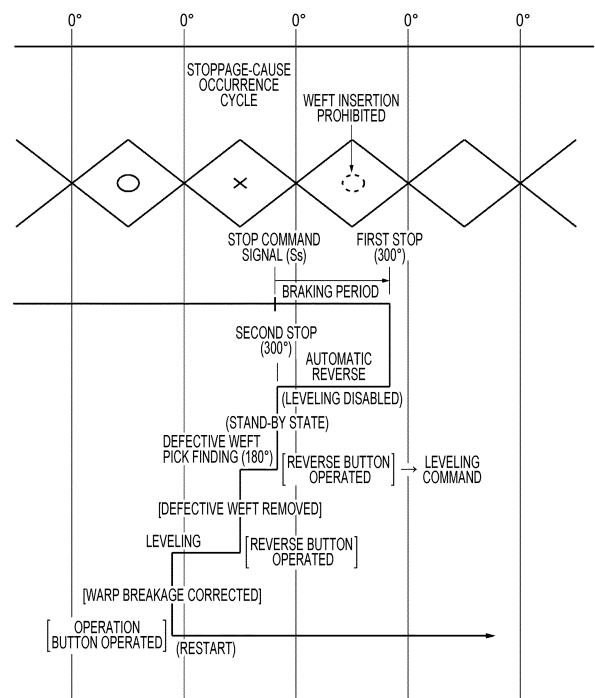
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(54) **METHOD FOR PREPARING RESTART OF LOOM**

(57) A main shaft is reversed from an initial stop time point, after a loom is stopped due to a cause of stoppage that is an occurrence of a weft insertion defect or due to causes of stoppage that are an occurrence of a warp breakage and an occurrence of a weft insertion defect accompanied with the warp breakage, while the leveling function of a warp shedding device is disabled to bring the loom into a stand-by state in a weaving cycle in which the cause or causes of stoppage have occurred. The main shaft is reversed in response to an operator operating a reverse button while the loom is in the stand-by state to bring the loom into a pick-found state, in which the defective weft pick is pickfound, and the operator is allowed to remove the defective weft pick in the pick-found state. The main shaft is reversed in response to the operator operating a button after a removal of the defective weft pick while the leveling function of the warp shedding device is enabled to bring the warps into a leveled state.

FIG. 4



## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to a method for preparing a restart of a loom including a main shaft and a warp shedding device, the warp shedding device being driven by the main shaft so as to move following a rotation of the main shaft, the warp shedding device having a leveling function with which it brings warps in a leveled state by reversing the main shaft, the loom allowing an operator to remove a defective weft pick at the occurrence of a weft insertion defect.

#### 2. Description of the Related Art

**[0002]** At the occurrence of a weft insertion defect, which is a cause of stoppage of a loom, the loom is stopped to perform a correcting operation, such as a removal of a defective weft pick causing the weft insertion defect. After the correcting operation is finished, the loom performs a predetermined operation for restart (start-up operation) and is then restarted. In some cases, a loom that does not include an (automatic) weft removal device, which automatically removes the defective weft pick, that is, a loom that requires an operator to remove a defective weft pick enters a stand-by state after bringing warps into a leveled state (state where all the warps are aligned at the same level) after the loom is stopped first due to the occurrence of the weft insertion defect. In that case, a warp shedding device of the loom that provides shedding motion to the warps has a leveling function with which it brings the warps into the leveled state. The warp shedding device of the loom is driven to bring the warps into the leveled state following a reverse operation after the first stop. When the warps are brought into the leveled state, the loom is stopped (second stop) again and enters the stand-by state.

**[0003]** When an operator is to perform a correcting operation, firstly, the operator releases the leveled warps. Then, the operator reverses the loom and performs an operation for a so-called pick finding, in which a defective weft pick is exposed through the cloth fell. The operator manually removes the defective weft pick in the state where the pick is found (or in the pick-found state). As needed in some cases, an operator similarly removes a weft pick inserted in front of the defective weft pick. After the operation of removing a defective weft pick and the like is finished, the loom is restarted following the above-described predetermined start-up operation.

**[0004]** Japanese Unexamined Patent Application Publication No. 06-116841 discloses an operation (method) for preparing a restart of such a loom from the first stop. Here, Japanese Unexamined Patent Application Publication No. 06-116841 discloses an operation for preparing a restart of the loom including an electronic dobby

shedding device as a warp shedding device. As disclosed in Japanese Unexamined Patent Application Publication No. 06-116841, when an operator performs the correcting operation of the loom including an electronic dobby shedding device while the loom is in the stand-by state, the operator firstly rotates the loom forward by one rotation of the main shaft. Then, the operator releases the leveled warps following the forward rotation of the loom. The operator then reverses the loom for the pick finding.

**[0005]** In some cases, the above-described weft insertion defect occurs in the loom concurrently with a warp breakage. Such a case is where, for example, a warp becomes slack as a result of an occurrence of a warp breakage and a weft pick inserted into the warp shed then comes into contact with the slack warp and causes a weft insertion defect. Specifically, in this case, a warp breakage and a weft insertion defect concurrently occur in the loom and the loom is stopped due to these two causes of stoppage. In such a case, a warp breakage is corrected while the loom in which the warps are leveled is in the stand-by state and then the correcting operation of the weft insertion defect involving the release of the leveled warps is performed, as disclosed in Japanese Unexamined Patent Application No. 06-116841.

**[0006]** In this case, however, by the time a defective weft pick is pickfound, a cloth fell of the woven cloth is beaten plural times by the loom in a non-weaving state as a result of reversing to bring the warps into the leveled state from the first stop, rotating forward to release the leveled warps, and reversing for the pick finding. Thus, a woven cloth that is being woven is more likely to have a weaving bar (stop bar). It is thus conceivable, as a measure to prevent an occurrence of such a stop bar, to set the loom so that the leveling function is disabled (turned off) while the loom is stopped due to a weft insertion defect.

**[0007]** Disabling the leveling function while the loom is stopped due to all of the cases where a weft insertion defect is included in plural causes of stoppage, however, renders correction of a warp breakage difficult since warps are not leveled in the above-described case where a warp breakage and a weft insertion defect occur concurrently. Specifically, correction of a warp breakage, involving finding of a broken warp or correction of the broken warp, is performed easily in the conditions where the warps are aligned on the same plane. When the warps are not aligned (in the shed state), finding of a broken warp is difficult and the broken warp is difficult to correct by being hindered by other warps.

**[0008]** While the loom is stopped due to a weft insertion defect, the loom may be required to be left in the stand-by state, for some reason, without being immediately restarted after a correcting operation for removing a defective weft pick is performed. While the loom is in the stand-by state, here, the warps are preferably in the leveled state. However, the warps are failed to be leveled in the case where the leveling function is disabled. To address this, the setting of the leveling function is conceivably

changed to bring the warps into the leveled state after the correcting operation for removing the defective weft pick is finished and the setting is changed (returned) again before the restart to disable the leveling function. Such operations are, however, troublesome. Besides, an operator may fail to return the setting and may restart the loom while the leveling function remains enabled.

## SUMMARY OF THE INVENTION

**[0009]** Accordingly, it is an object of the present invention to provide a loom including a warp shedding device having the above-described leveling function and not including the above-described weft removal device, the loom minimizing an occurrence of the above-described stop bar while the loom is stopped due to causes of stoppage including the weft insertion defect, the loom facilitating operations other than removal of a defective weft pick at the stoppage.

**[0010]** In order to achieve the above-described object, a method for preparing a restart of a loom according to the present invention includes reversing the main shaft from an initial stop time point, after the loom is stopped due to a cause of stoppage that is an occurrence of a weft insertion defect or due to causes of stoppage that are an occurrence of a warp breakage and an occurrence of a weft insertion defect accompanied with the warp breakage, while the leveling function of the warp shedding device is disabled to bring the loom into a stand-by state in a weaving cycle in which the cause or causes of stoppage have occurred, reversing the main shaft in response to an operator operating a reverse button while the loom is in the stand-by state to bring the loom into a pick-found state, in which the defective weft pick is pick-found, and allowing the operator to remove the defective weft pick in the pick-found state, and reversing the main shaft in response to the operator operating a button after a removal of the defective weft pick while the leveling function of the warp shedding device is enabled to bring the warps into the leveled state.

**[0011]** The method for preparing a restart of a loom according to the present invention may include outputting a leveling command in response to the operator operating the reverse button while the loom is in the stand-by state.

**[0012]** According to the present invention, while the loom is stopped due to a cause of stoppage that is an occurrence of a weft insertion defect or due to causes of stoppage that are an occurrence of a warp breakage and an occurrence of a weft insertion defect accompanied with the warp breakage, the loom is reversed to an angle at which the loom is in a stand-by state from an initial stop time point, that is, a first stop time point after an idling rotation of the loom subsequent to the generation of a stop command signal (so-called a first stop time point), after the leveling function of the warp shedding device is disabled. Thus, the operation of the loom for pick finding of a defective weft pick from the stand-by

state only requires a reverse rotation without the need of releasing the leveled warps. The omission of the releasing operation of the leveled warps in the loom accordingly reduces the likelihood of the occurrence of a stop bar.

5 According to the present invention, the warps are brought into the leveled state after the correcting operation of the weft insertion defect (operation of removing a defective weft pick) is performed. Thus, the loom can be easily left in the stand-by state as it is or, at the occurrence of a warp breakage, a correcting operation of the broken warp can be easily performed.

## BRIEF DESCRIPTION OF THE DRAWINGS

15 **[0013]**

Fig. 1 is a schematic side view of a loom to which the present invention is applied;

Fig. 2 is a block diagram of part of the loom and a control device;

Fig. 3 illustrates a selection pattern in an electronic dobby shedding device;

Fig. 4 illustrates an example of a method for preparing a restart according to the invention; and

Fig. 5 illustrates another example of a method for preparing a restart according to the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 **[0014]** Fig. 1 schematically illustrates the entire configuration of a loom 1 to which the invention is applied. In the loom 1, a large number of warps T are fed, while being in a sheet form, from a warp beam 3 to a cloth fell CF of a fabric W via a back roller 4 and then passing multiple healds 5 and a reed 6. The warp beam 3 that feeds the warps T is driven by a let-off motor M2. The let-off motor M2 is driven while being controlled so that the warps T are fed from the warp beam 3 at a predetermined tension, determined on the basis of parameters such as the rotation speed of a main shaft 2, a predetermined weft density of the woven cloth W, and the detected tension of the warps T. The main shaft 2 is driven by a main motor MM to rotate at a predetermined rotation speed.

45 **[0015]** Each heald 5 through which a warp T is inserted is supported by a corresponding one of heald frames 7. Each heald frame 7 is driven to reciprocate vertically by a warp shedding device. Into a shed of warps T formed as a result of the heald frames 7 (healds 5) being vertically driven, a weft pick Y is inserted by a weft insertion mechanism (not illustrated). Concurrently, the weft pick Y is beaten by the reed 6 up to the cloth fell CF, so that a woven cloth W is formed.

50 **[0016]** Then, the woven cloth W is guided to a cloth roller 13 via a guide roller 9, a take-up roller 11, and press rollers 12 and wound around the cloth roller 13. At this time, the woven cloth W is pulled as a result of the take-up roller 11 being driven to rotate and woven at a weft

density corresponding to the speed of let-off in response to the pulling. The take-up roller 11 is driven by a take-up motor M1. The take-up motor M1 is controlled so as to drive the take-up roller 11 so that the weft density of the woven cloth W, which is being woven, coincides with the predetermined weft density on the basis of the rotation speed of the main shaft 2 and the predetermined weft density of the woven cloth W.

**[0017]** Fig. 2 is a block diagram of a control structure of the loom 1. The loom 1 includes a main control device 21. The main control device 21 includes a storage unit 21 a. The storage unit 21 a stores various weaving conditions including a predetermined rotation speed of the main shaft 2, a predetermined weft density of the woven cloth W, and a predetermined tension of the warps T. The main control device 21 is connected to a main shaft controlling unit 25, which controls driving of the main motor MM, a let-off control device 27, which controls driving of a let-off motor M2, and a take-up control device 29, which controls driving of the take-up motor M1.

**[0018]** In this embodiment, a warp shedding device that provides shedding motion to each heald frame 7 (heald 5) is an electronic dobby shedding device (herein after also simply referred to as "a dobby shedding device") 23. The dobby shedding device is a shedding device that drives the heald frames so that the vertical position of each heald frame (vertical position at the maximum shedding of the warps T) in each loom weaving cycle is positioned at the position determined in the shedding pattern by switching the driving state of the driving mechanism, provided for each heald frame, in accordance with a predetermined shedding pattern. Here, the weaving cycle is a unit of a weaving motion repeated for each rotation of the main shaft 2. One weaving cycle corresponds to a rotation angle of the main shaft 2 (hereinafter also referred to as "a crank angle") from 0° to 360° (to the next crank angle 0°). The shedding pattern is determined as one repetition of a weave structure on the basis of the vertical position of the heald frames for each weaving cycle. A selection pattern, described below, is the state of the vertical position of each heald frame determined for each weaving cycle.

**[0019]** Thus, the dobby shedding device 23 includes a dobby controlling device 23a, in which a shedding pattern for forming an intended weave structure of the woven cloth W is set, and a shedding driving unit 23b, which includes multiple driving mechanisms (not illustrated) each including components such as a solenoid, a swing lever, and a selection lever, the driving mechanisms being disposed so as to correspond to the heald frames 7. The dobby shedding device 23 is connected to the main control device 21 at the dobby controlling device 23a.

**[0020]** Since the configuration of the dobby shedding device 23 is publicly known, the details of the configuration are neither illustrated nor described. In the dobby shedding device 23, each driving mechanism included in the shedding driving unit 23b includes a swing lever, connected to the main shaft 2 and driven to swing by a

rotation of the main shaft 2. The swing of the swing lever changes the vertical position of the corresponding heald frame 7. Specifically, the dobby shedding device 23 is driven by the main shaft 2 to drive the heald frames 7 and driven so as to move following a rotation of the main shaft 2. In the dobby shedding device 23, each of the driving mechanism of the shedding driving unit 23b is connected to the corresponding heald frame 7 with a publicly known driving transfer mechanism (not illustrated) interposed therebetween.

**[0021]** In the dobby shedding device 23 (as in the case of a dobby shedding device publicly known), each heald frame 7 is positioned at a shedding position (the vertical position) determined in the shedding pattern in each weaving cycle as a result of a solenoid select command being given per weaving cycle in accordance with the selection pattern for the weaving cycle in a shedding pattern determined in the dobby controlling device 23a on the basis of the shedding pattern and then bringing the solenoid of each driving mechanism in the shedding driving unit 23b into an excited state in response to the given select command. Here, in the dobby shedding device 23, the select command is given approximately one cycle prior to the weaving cycle determined in the shedding pattern in relation to the driving mechanism (Fig. 3).

**[0022]** The loom 1 also includes, as typical loom components, a weft detection feeler 8, which detects a weft pick Y inserted in the manner described above, and a warp breakage sensor 10, which detects a breakage of warps T (warp breakage). The weft detection feeler 8 and the warp breakage sensor 10 are connected to the main control device 21. The main control device 21 determines whether a weft insertion has succeeded or failed on the basis of a weft detection signal Sy input from the weft detection feeler 8 per weft insertion in each weaving cycle. When the main control device 21 detects a weft insertion defect, in which a weft insertion is failed, the main control device 21 outputs a stop command signal Ss to the main shaft controlling unit 25. Similarly, when the main control device 21 detects a warp breakage, the main control device 21 outputs a stop command signal Ss to the main shaft controlling unit 25 in response to an input of a warp breakage detection signal St generated by the warp breakage sensor 10 at a detecting of a warp breakage.

**[0023]** The main shaft controlling unit 25 operates a braking device (not illustrated), which damps the main shaft 2, to stop the rotation of the main shaft 2 in response to the input of the stop command signal Ss and implements a stop control to stop the main motor MM. Thus, after the main shaft controlling unit 25 starts an operation of stopping the loom 1 in response to the generation of the stop command signal Ss, the loom 1 is left in the stationary state after passing a braking period, in which the main shaft 2 idly rotates approximately one rotation. During the braking period, the loom 1 is in a weft insertion prohibited state, in which a weft insertion is not performed even when the crank angle arrives at a weft insertion

start angle.

**[0024]** The loom 1 also includes an operation button, operated to activate the loom 1 in the stationary state, a stop button operated to stop the loom 1 in a continuous operation, a jogging button 15a, operated to slightly rotate forward the main shaft 2 of the loom 1 in the stationary state, and a reverse button 15b, operated to reverse the main shaft 2 of the loom 1 in the stationary state at low speed. The loom 1 includes an input setting device 17 including a display screen (such as a touch display screen). The operation button, the stop button, the jogging button 15a, and the reverse button 15b are disposed on the input setting device 17 in the form of, for example, being displayed on the display screen. The input setting device 17 here is used to set the above-described weaving conditions and capable of displaying information of the loom 1 such as operation information or stoppage information.

**[0025]** When the loom 1 is stopped due to an occurrence of a cause of stoppage such as the above-described weft insertion defect or a warp breakage, the cause of stoppage is displayed on the display screen of the input setting device 17 to notify the operator of the cause of stoppage. When the loom 1 is stopped due to the concurrent occurrences of a warp breakage and a weft insertion defect, the warp breakage sensor 10 outputs a warp breakage detection signal St to the main control device 21 and the main control device 21 detects the occurrence of a warp breakage. Concurrently, the main control device 21 detects the occurrence of the weft insertion defect on the basis of a weft detection signal Sy from the weft detection feeler 8. In response, the main control device 21 causes the input setting device 17 to display these causes of stoppage. Thus, the operator can be notified of the causes of stoppage.

**[0026]** When a weft insertion defect occurs during weaving in the above-described loom 1, the main control device 21 outputs the above-described stop command signal Ss at a predetermined time point (for example, at the crank angle of 290°) after the completion of the weft insertion period determined in the weaving cycle in which the weft insertion defect has occurred, as illustrated in Fig. 3. In response to the output, the main shaft controlling unit 25 performs the stop control, so that the loom 1 is brought into a temporary initial stop (first stop) state at the crank angle (for example at 300°) passing the braking period of approximately one rotation of the main shaft 2 from the time point at which the stop command signal Ss is generated.

**[0027]** The loom 1, in the first stop state, is then subjected to operations such as a reverse operation for removal of a defective weft pick causing the weft insertion defect. The present invention is designed for a loom that does not include a weft removal device, which automatically removes (pulls out) a defective weft pick, that is, designed for a loom that requires an operator to remove a defective weft pick when a weft insertion defect occurs. The loom 1 according to the embodiment does not in-

clude such a weft removal device, either. The loom 1 is thus left in the stand-by state by the time when an operator arrives to remove a defective weft pick.

**[0028]** The loom 1 in the first stop state thus automatically performs a reverse operation, in which the loom 1 reverses by approximately one rotation of the main shaft 2. The loom 1 then stops (second stop) at, for example, the crank angle of approximately 300° in the previous weaving cycle (weaving cycle in which the weft insertion defect (cause of stoppage) occurs), which precedes the weaving cycle in which the loom has the first stop, and the loom 1 is left in the stand-by state, in which the loom 1 is left waiting for the arrival of the operator. The warp beam 3 (let-off motor M2) and the take-up roller 11 (take-up motor M1) are driven in synchronization with the main shaft 2 (main motor MM) during weaving. Also during the reverse operation (or the forward rotation operation) of the loom 1 in the stationary state, the warp beam 3 (let-off motor M2) and the take-up roller 11 (take-up motor M1) are driven to reverse (or rotate forward) by the amount corresponding to the reverse amount (or forward rotation amount) of the main shaft 2 (main motor MM) in synchronization with the main shaft 2 (main motor MM).

**[0029]** Also in the case where a warp breakage occurs during weaving in the loom 1, the warp breakage is usually corrected by an operator. Thus, the loom 1 in the first stop state automatically performs a reverse operation and enters the stand-by state at the crank angle for the second stop.

**[0030]** When the dobby shedding device 23 drives the heald frames 7 in accordance with the selection pattern for weaving during the reverse operation (hereinafter also referred to as "a first reverse") in which the loom 1 reverses from the crank angle for the first stop to the crank angle for the second stop, the dobby controlling device 23a of the dobby shedding device 23 generates a select command of the form illustrated in the middle one of the layers in Fig. 3.

**[0031]** A typical dobby shedding device has a leveling function with which it brings warps into the leveled state in accordance with reverse of the main shaft, which drives the loom, after the loom is changed from the stationary state. Specifically, a typical dobby shedding device has a function of causing a dobby control device to generate a so-called reverse-pattern-based select command, obtained by reversing the selection pattern corresponding to the weaving cycle in which the loom is stopped, when the dobby shedding device is changed from the stationary state to the state where the main shaft, driving the dobby shedding device, is reversed, as illustrated in the bottom layer in Fig. 3. When the main shaft is reversed in response to the reverse-pattern-based select command described above, the warps are leveled. Thus, the function of the dobby shedding device with which it causes generation of the reverse-pattern-based select command is a leveling function of the dobby shedding device. The leveling function is enabled as a result of a leveling command being output to the dobby controlling device

(in the state where the reverse-pattern-based select command is generated).

**[0032]** In the loom 1, whether the leveling function of the dobby shedding device 23 is to be enabled or disabled during the first reverse can be differently set depending on each cause of stoppage (weft insertion defect, a warp breakage, and others) by the input setting device 17. The main control device 21 outputs a leveling command Lc at the time of the first stop in accordance with the different setting.

**[0033]** At the occurrence of a warp breakage, a correcting operation of the warp breakage is usually performed by an operator. Thus, the warps are brought into the leveled state while the loom is in the stand-by state at the crank angle for the second stop. Here, the setting in the input setting device 17 indicates that the leveling function is enabled for the case where the cause of stoppage is a warp breakage. Thus, in the case where a warp breakage occurs during weaving in the loom, the main control device 21 outputs a leveling command Lc to the dobby controlling device 23a at the first stop in response to an input of the warp breakage detection signal St from the warp breakage sensor 10. In response to the output, the reverse-pattern-based select command is generated by the dobby controlling device 23a at the first reverse, so that the warps T are brought into the leveled state while the loom 1 is in the stand-by state at the crank angle for the second stop.

**[0034]** In an existing loom that does not include a weft removal device, as described above, at the occurrence of a weft insertion defect, the dobby shedding device is controlled at the first reverse in the same manner as in the case of the occurrence of a warp breakage, such that the warps are brought into the leveled state while the loom is in the stand-by state. Specifically, during the first reverse at the occurrence of a weft insertion defect, an existing loom is subjected to a reverse operation by reversing the main shaft while the leveling function of the dobby shedding device is enabled.

**[0035]** In the invention, on the other hand, when causes of stoppage include a weft insertion defect, the reverse operation (the first reverse) of the loom 1 from the crank angle for the first stop to the crank angle (the stand-by state) for the second stop is performed while the leveling function of the dobby shedding device is disabled. The warps are brought into the leveled state after a correcting operation (a defective-weft-pick removal operation) involving a removal of a defective weft pick is performed. Hereinbelow, the present invention is described using a case where a warp breakage and a weft insertion defect concurrently occur in the loom 1 as an example of the case where causes of stoppage include a weft insertion defect (see Fig. 4).

**[0036]** When a warp breakage occurs in the loom 1 during weaving (while the loom 1 is in operation), a warp breakage is detected by the warp breakage sensor 10 and the warp breakage sensor 10 outputs a warp breakage detection signal St to the main control device 21.

Thus, the main control device 21 detects the occurrence of a warp breakage. When a weft insertion defect occurs following the warp breakage, the main control device 21 detects the occurrence of the weft insertion defect on the basis of a weft detection signal Sy output from the weft detection feeler 8 to the main control device 21 for each weft insertion. On the basis of the detection of the occurrences of the warp breakage and the weft insertion defect, the main control device 21 outputs a stop command signal Ss to the main shaft controlling unit 25 at a predetermined time point (for example, at the crank angle of 290°) in the weaving cycle in which the warp breakage and the weft insertion defect have occurred. In response to the detection of the occurrences of the warp breakage and the weft insertion defect, the main control device 21 outputs a display command for displaying the causes of stoppage to the input setting device 17. Thus, the causes of stoppage are displayed on the display screen of the input setting device 17.

**[0037]** In response to the input of the stop command signal Ss from the main control device 21, the main shaft controlling unit 25 performs a stop operation of the loom 1 (main shaft 2), described above. Thus, after passing a braking period, the loom 1 is brought into the first stop state at an intended stop angle (for example, at the crank angle of 300°) in the subsequent weaving cycle following the weaving cycle in which the causes of stoppage occur (hereinafter this weaving cycle is also referred to as "an event cycle").

**[0038]** At the time point when the main shaft 2 is completely stopped and in the first stop state, the main control device 21 outputs a reverse command to the main shaft controlling unit 25 to reverse the main shaft 2 to the crank angle for the second stop (for example, at the crank angle of 300° in the event cycle) at which the loom is in the stand-by state. Thus, the reverse operation of the loom 1 is performed by reversing the main shaft 2 and the loom 1 enters the stand-by state in which it is left waiting for arrival of an operator.

**[0039]** As described above, the first reverse to the crank angle for the second stop is performed in the state where the leveling function of the dobby shedding device 23 is disabled. Specifically, in this embodiment, as to whether the leveling function at the first reverse is enabled or disabled for each of the causes of stoppage, the leveling function is disabled when a warp breakage and a weft insertion defect concurrently occur. Thus, the reverse operation of the loom 1 back to the event cycle is performed so that the vertical position of each heald frame 7 in the event cycle is positioned in accordance with the selection pattern for weaving.

**[0040]** Thereafter, when an operator arrives at the loom 1, the operator performs a defective-weft-pick removal operation, in which he/she removes a defective weft pick from the woven cloth W. Thus, the operator operates the reverse button 15b to cause the loom 1 to perform the reverse operation so that a defective weft pick is exposed from the cloth fell CF (the pick is found).

Thus, the loom 1 performs the reverse operation (second reverse) in which the main shaft 2 is reversed.

**[0041]** In response to the operation on the reverse button 15b while the loom 1 according to the embodiment is in the stand-by state, the main control device 21 outputs a leveling command Lc to the dobby controlling device 23a of the dobby shedding device 23. In other words, when a warp breakage and a weft insertion defect are concurrently detected, the main control device 21 outputs a leveling command to the dobby controlling device 23a in response to the operation on the reverse button 15b firstly performed after the second stop. Thus, when the reverse button 15b is operated in the loom 1 that is in the stand-by state, as described above, a leveling command Lc is output from the main control device 21 to the dobby controlling device 23a. In response to the output, the leveling function of the dobby controlling device 23a is enabled and a reverse-pattern-based select command is generated at this time. Thus, the second reverse is performed in the state where the leveling function of the dobby shedding device 23 is enabled.

**[0042]** As described above, the state (driving state) of the dobby shedding device 23 for driving the heald frames 7 in the shedding driving unit 23b is changed for each weaving cycle so that each heald frame 7 is moved to the vertical position corresponding to the selection pattern. The control performed to change the driving state of the shedding driving unit 23b is based on the select command generated by the dobby controlling device 23a at the time point approximately one cycle prior to the weaving cycle set in the shedding pattern. The control in the reverse operation (reversing the main shaft 2) of the loom 1 is performed similarly.

**[0043]** Since the reverse-pattern-based select command is generated at the time when the reverse button 15b is operated (at the crank angle for the second stop in the event cycle), as described above, the dobby shedding device 23 is driven to reverse following the reverse of the main shaft 2 in such a manner that the vertical position of each heald frame 7 in the previous weaving cycle preceding the event cycle is positioned in accordance with the reverse-pattern-based select command. Specifically, when, for example, the main shaft 2 is continuously reversed from the stand-by state up to the crank angle (180°) at which the warps T form the maximum shed in the previous weaving cycle preceding the event cycle, each heald frame 7 at the crank angle 180° in the event cycle is positioned at the vertical position corresponding to the selection pattern of the weaving cycle during weaving. In addition, the dobby shedding device 23 is driven while the each heald frame 7 is positioned at the vertical position corresponding to the selection pattern at the crank angle 180° in the previous weaving cycle preceding the event cycle.

**[0044]** Firstly, the defective-weft-pick removal operation is performed, as described above. Thus, the second reverse is stopped once at the time point when a defective weft pick is pickfound, that is, when the crank angle ar-

rives at 180° in the event cycle and the loom 1 is stopped (third stop) at the crank angle. Then, in the state of the third stop (in the pick-found state in which a defective weft pick is pickfound), the loom 1 is subjected to the above-described defective-weft-pick removal operation by an operator.

**[0045]** After finishing the operation, the operator operates the reverse button 15b again. Thus, the second reverse is restarted in the state where the leveling function of the dobby shedding device 23 is enabled. Thereafter, the second reverse is continued by the time when the crank angle arrives at the crank angle (for example, at the crank angle of 300°) set as the end of the previous weaving cycle preceding the event cycle and the second reverse is stopped at the crank angle. Thus, the warps T are brought into the leveled state while the loom 1 is stopped (fourth stop).

**[0046]** In the state where the loom 1 is in the fourth stop while the warps T are in the leveled state, the operator performs a correcting operation of the warp breakage. After the operator finishes the correcting operation of the warp breakage, the operator operates the operation button. Thus, the loom 1 performs a predetermined start-up operation (not described in detail) for restart and resumes a weaving operation.

**[0047]** According to the above-described method for preparing a restart, the loom 1 is reversed up to the crank angle for the second stop, at which the loom 1 is in the stand-by state, while the leveling function of the dobby shedding device 23 is disabled. Thus, the subsequent reverse operation of the loom 1 performed for pick finding of a defective weft pick is performed without releasing the leveled warps T. This configuration thus minimizes the occurrence of a stop bar. In the case where a warp breakage occurs besides a weft insertion defect as in the above-described case, a correcting operation of the warp breakage also needs to be performed. When the loom 1 is in the fourth stop state after the defective-weft-pick removal operation (the third stop), the warps T are in the leveled state, in which the correcting operation is facilitated, since the second reverse after the second stop is performed while the leveling function of the dobby shedding device 23 is enabled. Thus, the correcting operation of the warp breakage is easily performed.

**[0048]** Thus far, an embodiment (example) of the present invention is described. The present invention, however, is not limited to the above-described embodiment and may be embodied in the following embodiments (modification examples).

(1) In the above-described embodiment, the loom 1 is reversed from the second stop, at which the loom 1 is in the stand-by state, to the third stop, at which a defective weft pick is pickfound, while the leveling function of the dobby shedding device 23 is enabled. Specifically, the main control device 21 is configured so as to output a leveling command Lc for enabling the leveling function of the dobby shedding device

23 to the dobby shedding device 23 (dobby controlling device 23a) in response to an operation on the reverse button 15b for the reverse. In the invention, instead of performing the reverse operation of the loom 1 from the stand-by state up to pick finding of a defective weft pick while the leveling function of the dobby shedding device 23 is enabled, the reverse operation may be performed while the leveling function of the dobby shedding device 23 is disabled, as illustrated in Fig. 5.

Specifically, in the example illustrated in Fig. 5, the main control device 21 does not output a leveling command Lc even after an operator operates the reverse button 15b in the stand-by state. Thus, the reverse operation of the loom 1 toward the crank angle for the third stop is performed while the leveling function of the dobby shedding device 23 is disabled. Thus, in the reverse operation of the loom 1, the dobby shedding device 23 is driven to reverse so as to move the heald frames 7 to the vertical position corresponding to the selection pattern for weaving.

After the defective-weft-pick removal operation is performed in the above-described third stop state, an operation for bringing the warps T into the leveled state is performed in this invention. To perform this operation, first, the loom 1 is driven to rotate forward up to a crank angle at which the leveling function of the dobby shedding device 23 is enabled and that is smaller than the crank angle of 360° in the weaving cycle (the above-described event cycle) for the third stop. Here, the loom 1 is driven to rotate forward by, for example, operating the jogging button 15a.

After the completion of the forward rotation driving, the operator operates the reverse button 15b to cause the loom 1 to perform the reverse operation up to a crank angle corresponding to the crank angle for the fourth stop in the embodiment. In this example, the main control device 21 is configured so as to output a leveling command Lc to the dobby shedding device 23 in response to the operation of the reverse button 15b at this time. Thus, the reverse operation of the loom 1 up to the crank angle for the fourth stop is performed while the leveling function of the dobby shedding device 23 is enabled. After the loom 1 performs the reverse operation up to the crank angle for the fourth stop, the warps T are brought into the leveled state at the crank angle, as in the case of the embodiment.

In this example, in the forward rotation driving after the third stop, the loom 1 may be automatically driven to rotate forward to the above-described crank angle in response to the operation on the reverse button 15b in the third stop state. In this case, the main control device 21 may be configured so as to output a forward rotation command to the main shaft controlling unit 25 in response to the operation on the reverse button 15b at this time. In this case, the loom 1 is driven to reverse continuously with the forward

rotation and, concurrently, the main control device 21 outputs the leveling command Lc to the dobby shedding device 23 in response to the operation on the reverse button 15b.

(2) The above-described embodiment describes, as an example, the case where the loom 1 is stopped at the concurrent occurrences of a warp breakage and a weft insertion defect. The case to which the present invention is applicable, however, is not limited to the case where a warp breakage and a weft insertion defect concurrently occur. For example, even when only a weft insertion defect occurs as a cause of stoppage, the loom may be required, after the defective-weft-pick removal operation, to be brought into the stand-by state while the warps T are in the leveled state. The present invention is applicable to the case where such a case is conceivable. In such a case, the loom 1 itself fails to be notified of such a request for the stand-by state after the defective-weft-pick removal operation. Thus, as to whether the leveling function at the first reverse is enabled or disabled depending on each cause of stoppage, the leveling function is disabled for the case where a weft insertion defect is included in the cause of stoppage. In this case, the operation may be performed, for example, in the following manner. The main control device 21 does not output the leveling command Lc even when the reverse button 15b is operated in the state where the loom 1 is in the second stop, as illustrated in the example of Fig. 5. When the operation button is operated after the defective-weft-pick removal operation in the state where the loom 1 is in the third stop, the loom 1 is restarted after a predetermined start-up operation is performed. When the reverse button 15b is operated, the subsequent reverse operation of the loom 1 may be performed while the leveling function of the dobby shedding device 23 is enabled.

(3) In the above-described embodiment, the present invention has been described using the case where the loom 1 includes the electronic dobby shedding device 23 as a warp shedding device that provides shedding motion to the heald frames (healds). The loom to which the present invention is applicable, however, is not limited to the loom including such an electronic dobby shedding device as a warp shedding device. The loom may include an electronic jacquard shedding device as a warp shedding device for driving, using a main shaft, each heald in accordance with a predetermined woven design pattern (selection pattern).

**[0049]** The present invention is not limited to any of the above-described embodiments and can be changed in various difference manners within the scope not departing from the gist of the invention.



## Claims

1. A method for preparing a restart of a loom including a main shaft and a warp shedding device, the warp shedding device being driven by the main shaft so as to move following a rotation of the main shaft, the warp shedding device having a leveling function with which the warp shedding device brings warps into a leveled state concurrently with a reverse rotation of the main shaft, the loom allowing an operator to remove a defective weft pick at an occurrence of a weft insertion defect in the loom, the method comprising:

reversing the main shaft from an initial stop time point, after the loom is stopped due to a cause of stoppage that is an occurrence of a weft insertion defect or due to causes of stoppage that are an occurrence of a warp breakage and an occurrence of a weft insertion defect accompanied with the warp breakage, while the leveling function of the warp shedding device is disabled to bring the loom into a stand-by state in a weaving cycle in which the cause or causes of stoppage have occurred;

reversing the main shaft in response to an operator operating a reverse button while the loom is in the stand-by state to bring the loom into a pick-found state, in which the defective weft pick is pickfound; and

reversing the main shaft in response to the operator operating a button after the loom has been brought into the pick-found state and the defective weft pick has been removed by the operator while the leveling function of the warp shedding device is enabled to bring the warps into the leveled state.

2. The method according to Claim 1, further comprising:

outputting a leveling command in response to the operator operating the reverse button while the loom is in the stand-by state.

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FIG. 1

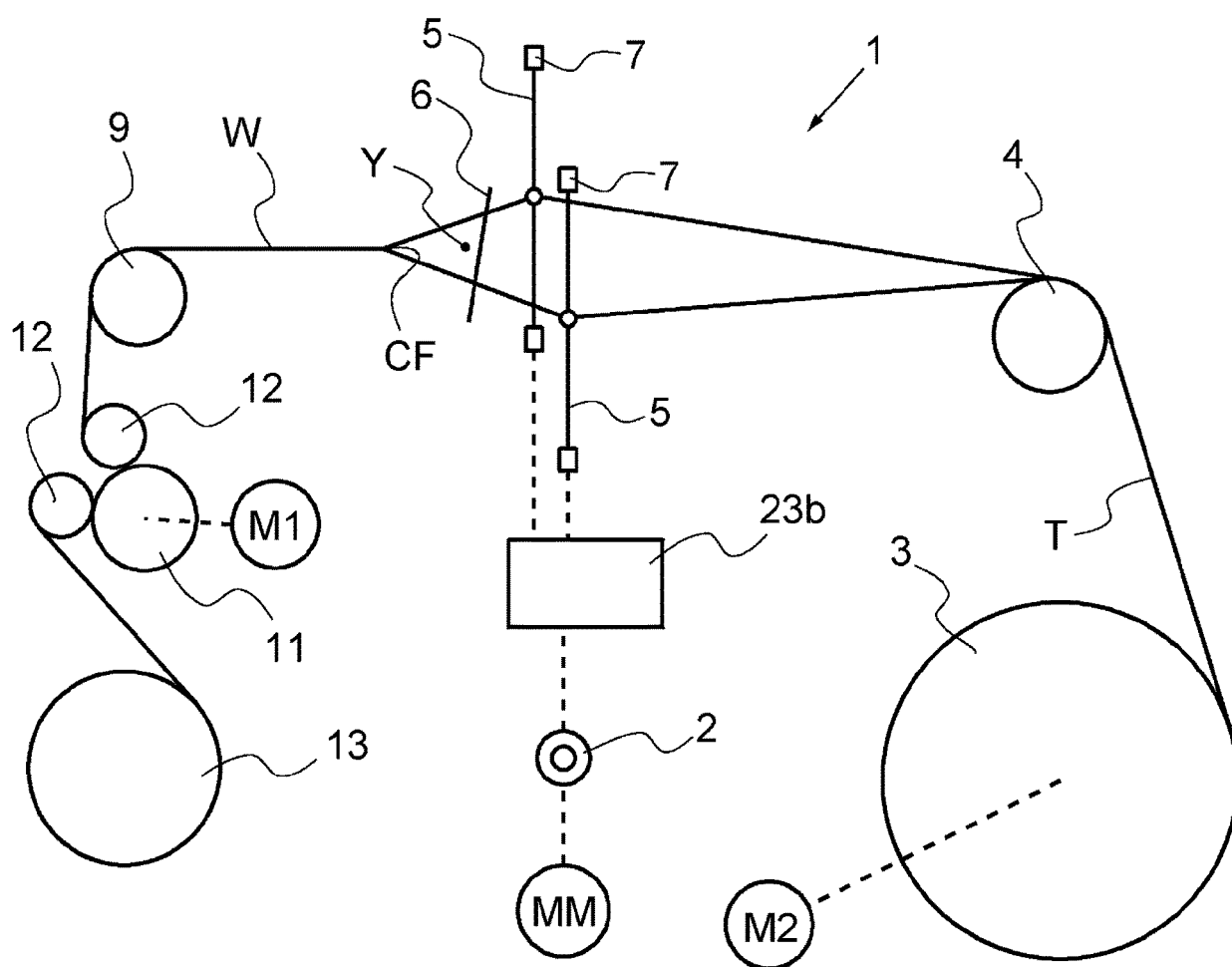


FIG. 2

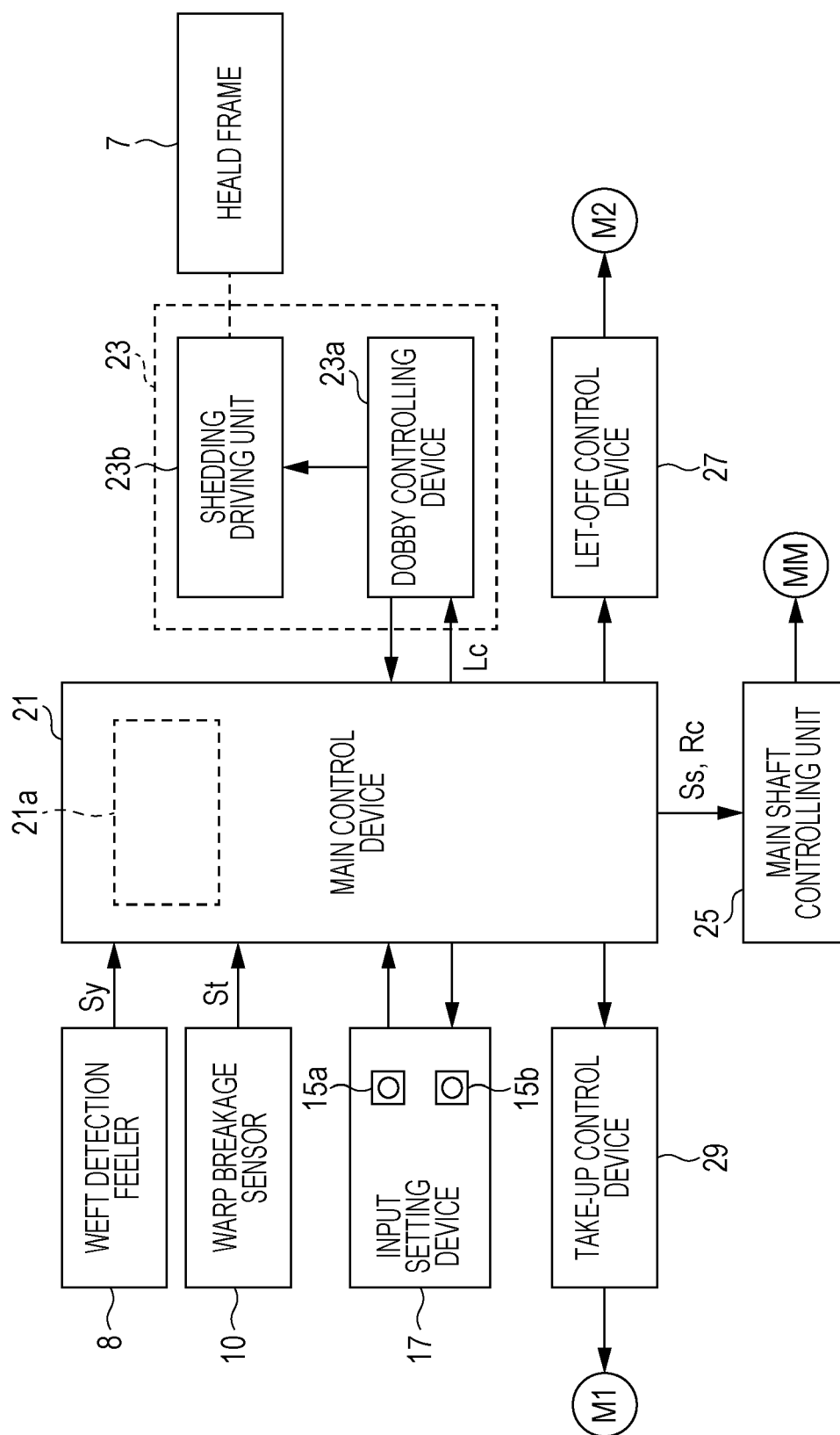


FIG. 3

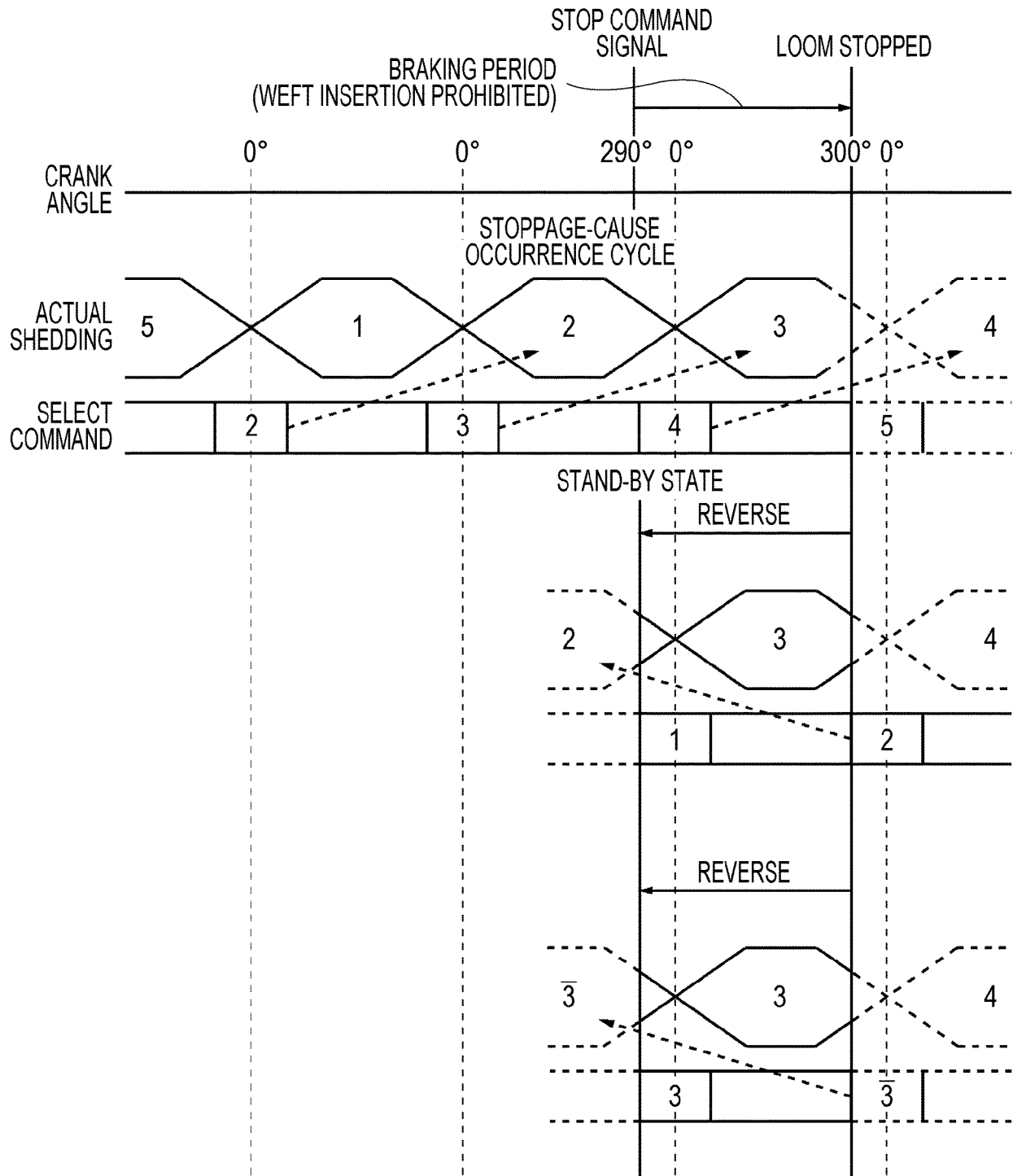


FIG. 4

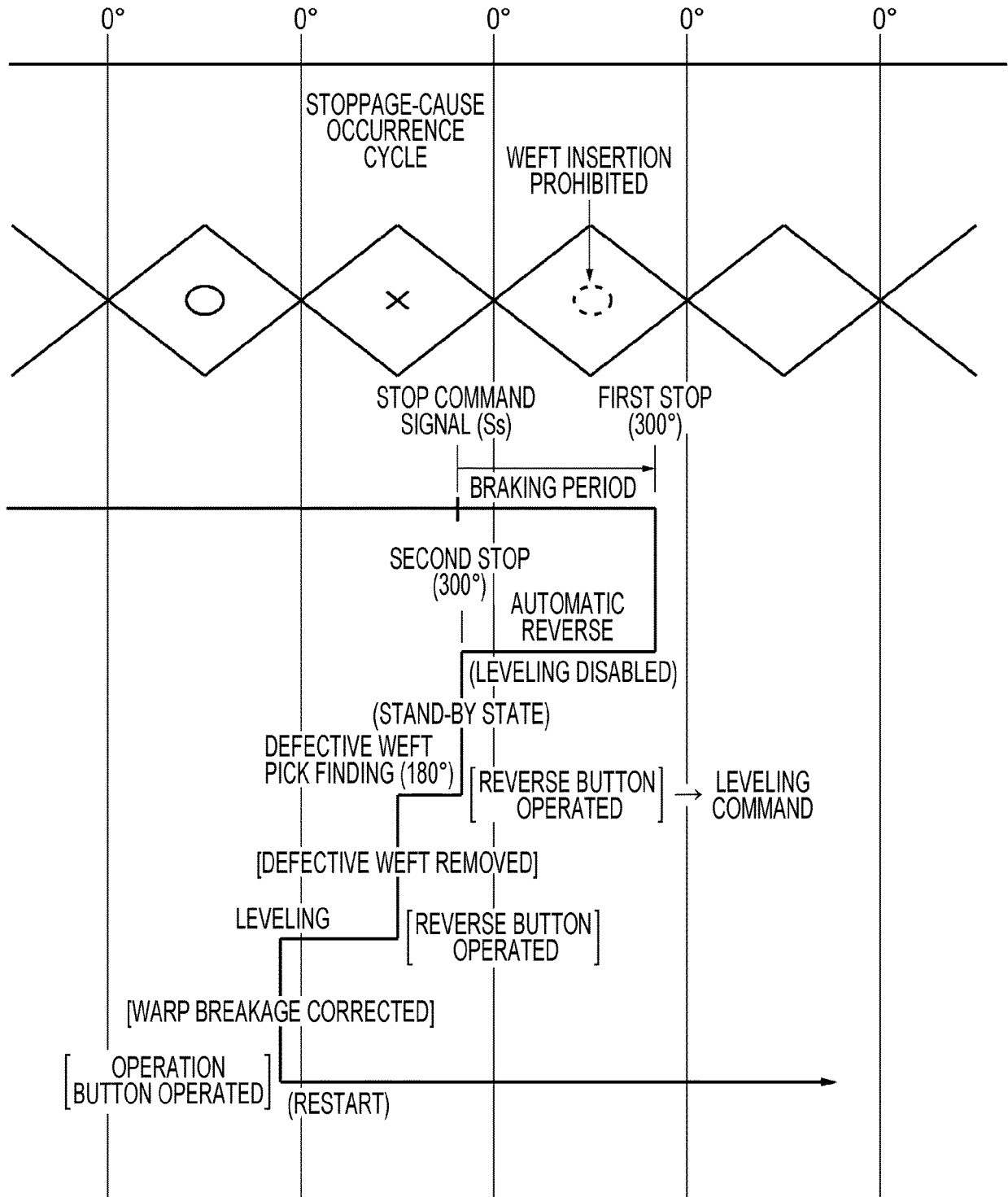
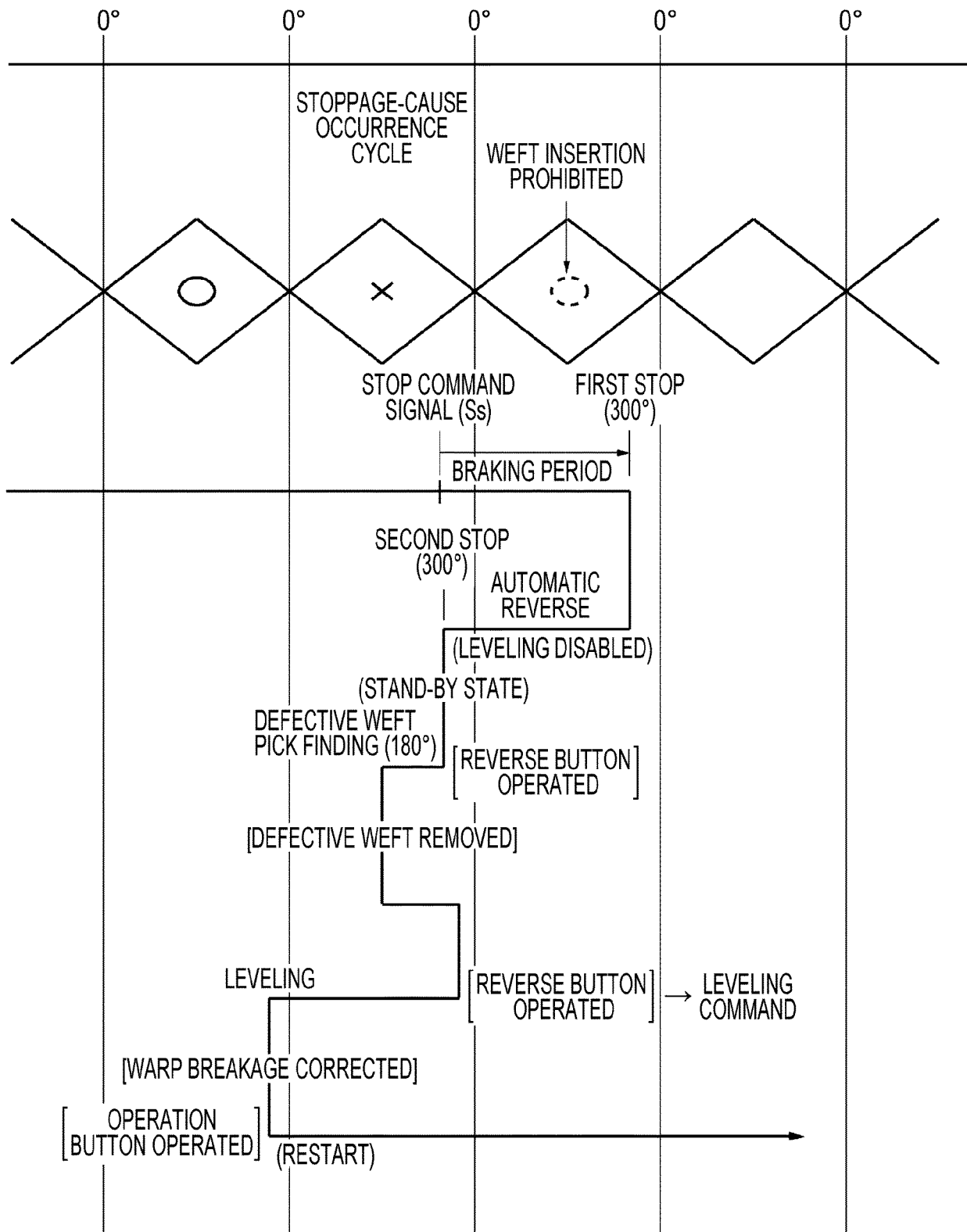


FIG. 5



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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