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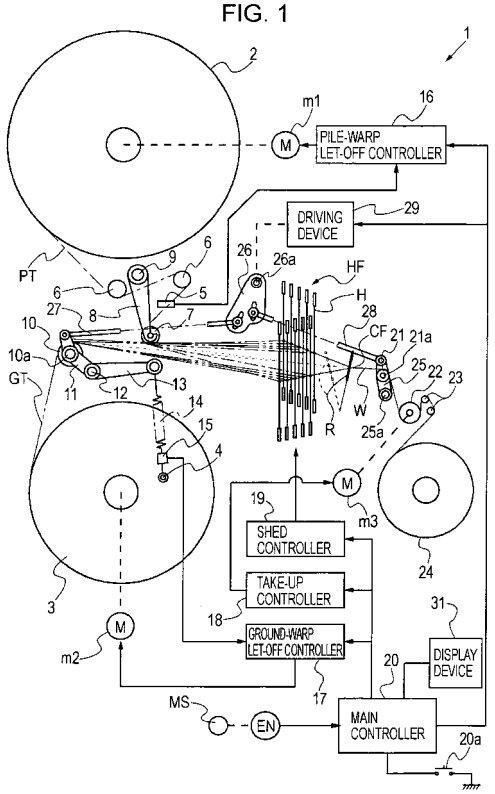
(54) **Shedding device in loom and gaiting method in loom equipped with the shedding device**

(57) In a shedding device (19) included in a loom (1) that performs a weaving operation using warp threads (PT, GT) let off from at least two warp beams (2, 3), controlling means (19a) is provided for electrically controlling individual movements of a plurality of heald frames (HF). The shedding device (19) is characterized by including a standby-frame setting unit (30) having set therein standby information on specific heald frames of the plurality of heald frames (HF), the specific heald frames including heald frames that correspond to the warp threads let off from one of the at least two warp beams (2, 3). The standby information is used for setting the specific heald frames in a standby state for a predetermined period. The standby-frame setting unit (30) is connected to the controlling means (19a).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a shedding device included in a loom that performs a weaving operation using warp threads let off from at least two warp beams, and to a gaiting process performed in such a loom after the warp threads on one of the warp beams become equal to or less than a predetermined amount and the warp beam has been replaced with a new one. The term "gaiting process" in the present invention refers to a series of steps that are performed between a point when a warp beam is replaced and a point when the loom is restarted for a continuous operation.

2. Description of the Related Art

[0002] Known examples of a loom that performs a weaving operation using warp threads let off from at least two warp beams are a pile loom and a sucker loom. For example, when a weaving operation is performed in a pile loom, the consumption of pile warp per unit time is greater than the consumption of ground warp per unit time. Therefore, there are often cases where the pile warp threads fall below a predetermined amount in the course of the weaving operation (namely, in a state where the ground warp threads are still remaining on the ground-warp beam). This implies that the warp beam for the pile-warp threads needs replacement quite frequently.

[0003] Generally, when a warp beam is replaced with a new one, a gaiting process is performed in which the warp threads already set in the loom (namely, the warp threads from the previous warp beam) are cut at a position behind the dropper (opposite side of the cloth fell) in order to keep the warp threads extended through the dropper, the healds, and the reed. Then, the cut ends of the warp threads and the warp threads let off from the new warp beam are connected to each other by tying them together. Subsequently, the warp threads are let off so as to move the tied knots of the warp threads to an area close to the cloth fell. Finally, after an adjusting operation, the loom is restarted for a continuous operation.

[0004] As described above, in the course of the gaiting process, the tied knots of the warp threads are shifted from the position behind the dropper to an area close to the cloth fell. In order to achieve this, a loom disclosed in Japanese Unexamined Patent Application Publication No. 8-284045 applies a technique in which a let-off device and a take-up device are driven while the loom is stopped so that the warp threads can be taken up while being let off from the warp beam.

[0005] With this technique, however, the warp threads are pulled by a take-up roller (surface roller) towards a take-up beam without having weft threads interwoven with the warp threads. In other words, only the warp threads are pulled towards the take-up side. For this reason, proper pulling by the take-up roller is difficult to achieve, thus leading to difficulties in achieving proper shifting of the warp threads including the knots. This is problematic in that the gaiting process cannot be performed smoothly. This problem is especially prominent with looms that are not equipped with a press roller for pressing a cloth (warp threads in the aforementioned case) against a take-up roller, such as a pile loom disclosed in Japanese Unexamined Patent Application Publication No. 10-317253 and a sucker loom disclosed in Japanese Unexamined Patent Application Publication No. 2-41439.

[0006] With pile looms, there are cases where an operator inserts a rod into a space between the ground warp and the pile warp near the cloth fell and then pulls the warp towards the take-up side by holding the rod against the cloth fell in order to assist with the take up of the warp. However, this work is burdensome for the operator and the content of the work is complicated, thus requiring too much time for the gaiting process.

SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the present invention to provide a shedding device that allows for a faster and smoother gaiting process after one of the warp beams provided in the above-described loom has been replaced, and to provide a gaiting method that employs such a shedding device.

[0008] The present invention provides a shedding device included in a loom that performs a weaving operation using warp threads let off from at least two warp beams, the shedding device including controlling means for electrically controlling individual movements of a plurality of heald frames. The shedding device is characterized by including a standby-frame setting unit having set therein standby information on specific heald frames of the plurality of heald frames, the specific heald frames including heald frames that correspond to the warp threads let off from one of the at least two warp beams. The standby information is used for setting the specific heald frames in a standby state for a predetermined period. The standby-frame setting unit is connected to the controlling means.

[0009] Furthermore, the standby information set in the standby-frame setting unit may include frame numbers designating the specific heald frames and a standby period of the specific heald frames.

[0010] The present invention also provides a gaiting method in a loom that performs a weaving operation using warp threads let off from at least two warp beams, the method being performed after one warp beam of the at least two warp beams has been replaced with a new one. The method is characterized by including the steps of connecting the warp threads already in the loom and formerly let off from the previous warp beam to warp

threads let off from the new warp beam; setting specific heald frames included in a plurality of heald frames in a standby state at a predetermined upper or lower position, the specific heald frames including heald frames that correspond to the warp threads let off from the new warp beam; and allowing the loom to perform a weaving operation by driving the remaining heald frames excluding the specific heald frames in a shedding motion for a predetermined standby period while maintaining the specific heald frames in the standby state.

[0011] Furthermore, the loom may be a pile loom, and the one warp beam of the at least two warp beams may be a pile warp beam. In this case, the specific heald frames correspond to pile warp threads let off from the pile warp beam and have the pile warp threads extending therethrough. The pile loom may perform the weaving operation over the predetermined standby period in the aforementioned allowing step by using only ground warp threads while maintaining the specific heald frames corresponding to the pile warp threads in the standby state.

[0012] Furthermore, the weaving operation performed over the predetermined standby period using the ground warp threads may be implemented by driving the heald frames that correspond to the ground warp threads on the basis of a shedding pattern for ground weaving.

[0013] According to the shedding device and the gaiting method that employs the shedding device of the present invention, after the warp beam has been replaced with a new one, the tied knots of the connected warp threads are automatically shifted towards the cloth fell. This process is performed within a short period of time and is not troublesome for the operator. In addition, when the knots are being shifted, at least some of the warp threads other than the connected warp threads are let off towards the take-up side while being interwoven with weft threads. Consequently, unlike the case where the pulling from the take-up side is implemented while merely letting off the warp threads, the pulling is implemented stably in a state similar to that at the time of continuous operation. Accordingly, this ensures proper shifting of the knots and achieves a smooth gaiting process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a block diagram illustrating a control system according to an embodiment of the present invention;

Fig. 2 is a block diagram illustrating a shedding device according to the embodiment of the present invention; and

Figs. 3A and 3B illustrate setting windows according to the embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] A preferred embodiment of the present invention will now be described with reference to the drawings.

[0016] Figs. 1 to 3 illustrate an exemplary embodiment of the present invention. The embodiment to be described below is directed to a pile loom equipped with two warp beams, which are a ground warp beam and a pile warp beam, and to a gaiting process to be performed when the pile warp beam has been replaced. The pile loom shown in the drawings is a cloth-shifting-type pile loom which form piles by periodically changing the position of the cloth fell using a terry motion mechanism.

[0017] Referring to Fig. 1, a pile loom 1 includes two warp beams, which are a pile-warp beam 2 around which a plurality of pile warp threads PT are wound in a sheet-like manner and a ground-warp beam 3 around which a plurality of ground warp threads GT are wound in a sheet-like manner.

[0018] When the pile-warp beam 2 is rotated by a let-off motor m1, the pile warp threads PT are let off from the pile-warp beam 2 and are wound around two guide rollers 6, 6 and a pile-warp tension roller 7 disposed downstream of the guide rollers 6, 6. The pile warp threads PT then pass through healds H of corresponding heald frames HF and through a reed R so as to be guided to a cloth fell CF of a woven cloth W. The pile loom 1 shown in Fig. 1 has ten heald frames HF, of which the first and second heald frames HF from the cloth fell CF and the ninth and tenth heald frames HF from the cloth fell CF correspond to the pile warp threads PT.

[0019] The pile-warp tension roller 7 is supported by a loom frame (not shown) by means of a tension lever 8 and a support shaft 9. The tension lever 8 is rotatably supported by the support shaft 9 at a specific position of the loom frame. Thus, the pile-warp tension roller 7 is supported in a revolvable fashion around the support shaft 9. Furthermore, the tension lever 8 is biased by means of biasing means (not shown), such as a spring and a driving motor, in a direction for applying tension to the pile warp threads PT. This biasing force acts on the pile warp threads PT via the pile-warp tension roller 7, whereby predetermined tension is applied to the pile warp threads PT.

[0020] On the other hand, when the ground-warp beam 3 is rotated by a let-off motor m2, the ground warp threads GT are let off from the ground-warp beam 3 and are wound around a ground-warp tension roller 10. Similar to the pile warp threads PT, the ground warp threads GT then pass through the corresponding healds H and through the reed R so as to be guided to the cloth fell CF.

[0021] The ground-warp tension roller 10 is supported by an intermediate portion of a support lever 11 by means of a shaft 10a. The support lever 11 is supported by the loom frame by means of a support shaft 12. The support shaft 12 is rotatably supported by the loom frame, and the support lever 11 is attached to the support shaft 12 in a relatively non-rotatable fashion. Consequently, with respect to the loom frame, the ground-warp tension roller 10 is supported in a revolvable fashion around the support shaft 12. Furthermore, the support shaft 12 has a

tension lever 13 attached thereto in a relatively non-rotatable fashion. The tension lever 13 has a first end that is secured to the support shaft 12 and a second end that is supported by the loom frame by means of a support shaft 4. The second end of the tension lever 13 and the support shaft 4 have a compression spring 14 and a tension detector 15, such as a load cell, disposed therebetween. Thus, the ground-warp tension roller 10 is biased by the compression spring 14 via the tension lever 13, the support shaft 12, and the support lever 11 in a direction for applying tension to the ground warp threads GT.

[0022] The driving of the let-off motor m1, which is provided for rotating the pile-warp beam 2, is controlled by a pile-warp let-off controller 16. Provided near the tension lever 8 that supports the pile-warp tension roller 7 is a displacement detector 5 for detecting positional displacement of the tension lever 8. The amount of pile warp threads PT let off per unit rotation angle of the pile-warp beam 2 changes proportionally to the amount of consumption of the pile warp threads PT (namely, the beam diameter of the pile-warp beam 2). As the let-off amount of pile warp threads PT per unit rotation angle changes, the tension of the pile warp threads PT changes, thus causing the tension lever 8 to become displaced. Accordingly, the displacement of the tension lever 8 is sampled periodically using the displacement detector 5 so that the amount of consumption of the pile warp threads PT can be indirectly determined. A detection signal of the displacement detector 5 is output to the pile-warp let-off controller 16. Based on the detection signal (i.e. the amount of consumption of the pile warp threads PT) from the displacement detector 5, the pile-warp let-off controller 16 controls the driving of the let-off motor m1 such that the let-off amount of pile warp threads PT per unit rotation angle is kept at a predetermined amount regardless of a change in the beam diameter of the pile-warp beam 2.

[0023] More specifically, the pile-warp let-off controller 16 calculates a correctional rotation speed value based on the detection signal from the displacement detector 5 and then adds or subtracts this calculated correctional rotation speed value to or from a basic rotation speed value of the let-off motor m1, which is received from a main controller 20 of the pile loom 1. Subsequently, based on the determined rotation speed value with the addition or subtraction of the correctional rotation speed value, the pile-warp let-off controller 16 controls the driving of the let-off motor m1 so that the pile warp threads PT are let off constantly from the pile-warp beam 2 during a weaving operation. The pile-warp let-off controller 16 is a feedback control system and normally responds to a large time constant. Therefore, the pile-warp let-off controller 16 does not control temporal forward/backward displacement of the pile-warp tension roller 7 in each cycle of the pile loom 1, which may occur in response to a shedding motion or pile forming process.

[0024] The driving of the let-off motor m2, which is provided for rotating the ground-warp beam 3, is controlled by a ground-warp let-off controller 17. As mentioned above, the ground-warp tension roller 10 is connected to the tension detector 15 with the support lever 11, the tension lever 13, and the compression spring 14 disposed therebetween. The tension detector 15 detects the load applied on the ground-warp tension roller 10 from the ground warp threads GT, or in other words, detects the tension of the ground warp threads GT. A detection signal of the tension detector 15 is output to the ground-warp let-off controller 17. Based on the detection signal from the tension detector 15, the ground-warp let-off controller 17 controls the driving of the let-off motor m2 such that the tension of the ground warp threads GT matches a preliminarily set target tension value.

[0025] More specifically, the ground-warp let-off controller 17 calculates a correctional rotation speed value based on a difference between the detection signal from the tension detector 15 and the preliminarily set target value. Moreover, the ground-warp let-off controller 17 calculates a basic speed value of the let-off motor m2 on the basis of, for example, a beam-diameter signal received from a beam-diameter detector (not shown), which is provided for detecting the beam diameter of the ground-warp beam 3, and the operating speed and the set density of the pile loom 1 received from the main controller 20 of the pile loom 1. The ground-warp let-off controller 17 then adds or subtracts the correctional rotation speed value to or from the calculated basic speed value so as to determine a rotation speed value for driving the let-off motor m2. The ground-warp let-off controller 17 controls the driving of the let-off motor m2 based on this determined rotation speed value, whereby the ground-warp beam 3 is driven such that the tension of the ground warp threads GT matches the target value. The ground-warp let-off controller 17 has an integrating circuit with a large time constant. By using the integrating function of the integrating circuit, the ground-warp let-off controller 17 compensates for a temporal tension fluctuation in the pile warp threads PT in each cycle of the pile loom 1, which may occur in response to a shedding motion or pile forming process.

[0026] The pile warp threads PT and the ground warp threads GT let off from the corresponding warp beams 2, 3 in the above-described manner form a shed in response to a vertical movement of the corresponding heald frames HF. A weft thread (not shown) is inserted through the shed formed by the pile warp threads PT and the ground warp threads GT and is then beaten against the cloth fell CF with the reed R, thereby forming the woven cloth W. The woven cloth W is wound around a cloth guide 21 and is pulled from the side of the cloth fell CF towards a take-up beam 24 by a take-up roller (surface roller) 22. The woven cloth W then passes through two guide rollers 23, 23 so as to be taken up by the take-up beam 24.

[0027] The cloth guide 21 is supported by an intermediate portion of a support lever 25 by means of a fulcrum shaft 21a. The support lever 25 is rotatably supported by the loom frame by means of a support shaft 25a. A take-

up motor m3 controlled by the take-up controller 18 rotates the take-up roller 22 in synchronization with a main shaft MS at a rotation speed that gives the woven cloth W a predetermined density set in the main controller 20. On the other hand, the take-up beam 24 is rotated by known driving means (not shown), such as a driving motor.

[0028] As mentioned above, the pile loom 1 is a cloth-shifting-type pile loom that forms piles by shifting the cloth fell CF with respect to the beating position of the reed R. The shifting of the cloth fell CF involves moving the ground-warp tension roller 10 and the cloth guide 21 constituting a terry motion mechanism in front-back directions.

[0029] An end of the support lever 11 supporting the ground-warp tension roller 10, which is opposite to the end with the support shaft 12, is linked to a rocking lever 26 by means of a linking rod 27. Likewise, an end of the support lever 25 supporting the cloth guide 21, which is opposite to the end with the support shaft 25a, is linked to the rocking lever 26 by means of a linking rod 28. The rocking lever 26 is attached in a relatively non-rotatable fashion to a rotary shaft 26a that is rotatably supported by the loom frame, such that the rocking lever 26 is rockable with respect to the loom frame. The rotary shaft 26a is connected to a driving device 29 and is driven by the driving device 29 in a reciprocable fashion. The driving device 29 may be defined by a designated driving motor, or by a cam or a crank mechanism having the main shaft MS of the pile loom 1 as a driving source.

[0030] When the rotary shaft 26a is driven in a reciprocating fashion by the driving device 29, the rocking lever 26 is rocked back and forth by an amount that corresponds to the rotation of the rotary shaft 26a. Then, the support levers 11, 25 linked to the rocking lever 26 by means of the respective linking rods 27, 28 rock around the corresponding support shafts, whereby the ground-warp tension roller 10 and the cloth guide 21 move synchronously in the front-back directions. Consequently, if one pile formation cycle in the pile loom 1 consists of three weaving cycles, the driving device 29 reciprocally rotates the rotary shaft 26a within a predetermined rotation angle range once in every three weaving cycles. This allows the cloth fell CF to move back and forth between the beating position of the reed R and a position distant therefrom towards the cloth guide 21, thereby forming piles on the woven cloth W.

[0031] An example of a shedding device according to the present invention will now be described. The shedding device according to the present invention can electrically control the driving of the heald frames HF. Examples of the shedding device are an electronic dobby shedding device and an electrically-operated shedding device (namely, a shedding device that drives heald frames with designated motors). The description below is directed to an example in which the shedding device is an electronic dobby shedding device.

[0032] Referring to Fig. 2, an electronic dobby shedding device 19 for driving a set of heald frames HF corresponding to the pile warp threads PT and a set of heald frames HF corresponding to the ground warp threads GT includes a shed controller 19a serving as controlling means and a frame driver 19b. This electronic dobby shedding device 19 is basically similar to, for example, the one disclosed in Japanese Unexamined Patent Application Publication No. 4-91257. Specifically, the frame driver 19b is equipped with a plurality of solenoids in correspondence to the plurality of heald frames HF. The solenoids are controlled by the shed controller 19a. The shed controller 19a selectively magnetizes and demagnetizes the solenoids so as to move the heald frames HF vertically in accordance with a predetermined shedding pattern.

[0033] The shed controller 19a is additionally provided with a shedding-pattern setting unit 19c. The shedding-pattern setting unit 19c has a shedding pattern set therein. The shedding pattern indicates upper and lower positions for all the heald frames HF for every repeat process consisting of a plurality of weaving cycles. Based on a timing signal Ts output from the main controller 20 at a predetermined timing with respect to every rotation (i.e. one weaving cycle) of the main shaft MS, the shed controller 19a determines a cycle number in each repeat process of the shedding pattern. The shed controller 19a then controls the magnetization and demagnetization of the solenoids in correspondence to the heald frames HF on the basis of the determined cycle number and the shedding pattern set in the shedding-pattern setting unit 19c. Accordingly, each of the heald frames HF is driven under a mode that is based on the shedding pattern.

[0034] Furthermore, in addition to the shedding-pattern setting unit 19c, the shed controller 19a is also provided with a standby-frame setting unit 30. The standby-frame setting unit 30 has standby information on designated specific heald frames HF set therein, the standby information being used for setting the specific heald frames HF in a standby state at a set position. In this embodiment, the standby information set in the standby-frame setting unit 30 includes information on heald frames HF that are to be set in the standby state, information on a standby position, and information on a standby period. The standby information can be set by means of a touch-panel display screen of a display device 31 additionally provided in the main controller 20.

[0035] Figs. 3A and 3B illustrate an example of such a display screen of the display device 31 used for the setting process. When a "maintenance" window related to cloth cutting and warp consumption information is selected, the display window shown in Fig. 3A is displayed. By touching a key 31a provided at the lower right corner of the window, the screen switches to a setting window related to frame standby information, as shown in Fig. 3B. On this setting window, a frame number input section 31b is provided for designating which of the heald frames HF are to be set in a standby state. Desired frame numbers can be arbitrarily input to this input section 31b. In

this case, the term "frame number" refers to a number that is given to each of the heald frames HF based on the position thereof. In Fig. 3B, for example, the numbers "1", "2", "9", and "10" represent the first, second, ninth, and tenth heald frames HF from the cloth fell CF.

[0036] Furthermore, another input section 31c is provided for setting a period (i.e. frame standby period) in which the designated heald frames HF are to be kept in the standby state. A desired numerical value can be input arbitrarily to the input section 31c. In the example shown in Fig. 3B, the frame standby period is set based on the number of picks (i.e. number of weft insertions).

[0037] Moreover, a pull-down menu 31d is also provided for selecting a position at which the designated heald frames HF are to be set in the standby state. In the example shown in Fig. 3B, the standby position can be selected from an upper position (i.e. an uppermost position for the heald frames HF) and a lower position (i.e. a lowermost position for the heald frames HF) which is not shown.

[0038] When the setting process of the abovementioned setting parameters is completed, the setting window in Fig. 3B may be closed by touching a "close" key 31e. At the same time, the set contents are sent to the standby-frame setting unit 30 as standby information via the main controller 20. The frame standby period described above is also set in the main controller 20.

[0039] The following description will be directed to a gaiting process to be performed using the shedding device according to the present invention when the pile-warp beam 2 has been replaced in the above-described pile loom 1.

[0040] First, when the pile warp threads PT on the pile-warp beam 2 become equal to or less than a predetermined amount, the pile loom 1 is stopped manually or automatically so that the pile-warp beam 2 can be replaced with a new one. During the replacement process, the previously set pile warp threads PT are cut at a position behind the heald frames HF (further behind that position if the loom is equipped with a warp-cut detector) so as to skip the process of putting the pile warp threads PT through the reed R and the healds H again. Subsequently, the pile-warp beam 2 is replaced with a new one, and the cut ends of the previous pile warp threads PT on the pile loom 1 are tied onto the pile warp threads PT from the newly set pile-warp beam 2. In this case, a predetermined region of the pile warp threads PT between the cloth fell CF and the tied area will not be used for weaving since the knots formed in the tied area may appear on the pile fabric or the knots may interfere with the weft insertion process. Generally, after tying the previous pile warp threads PT to the new pile warp threads PT, the pile warp threads PT are let off without being subject to weaving so that the knots can be shifted to an area close to the cloth fell CF.

[0041] According to this embodiment, in order to move the knots formed in the pile warp threads PT to an area near the cloth fell CF, the heald frames HF for the pile warp threads PT are kept in a standby state at the uppermost position. While maintaining the standby state, the heald frames HF for the ground warp threads GT undergo a shedding motion so that a weaving operation using only the ground warp threads GT is implemented. This kind of weaving operation will be referred to as a gaiting-weaving operation hereinafter.

[0042] As described above, the driving of the heald frames HF is controlled by the shed controller 19a in the shedding device 19. In the above case, the driving of the heald frames HF for the pile warp threads PT is controlled based on the standby information set in the standby-frame setting unit 30 and is thus different from that for continuous operation.

[0043] In detail, after or before tying the previous pile warp threads PT to the new pile warp threads PT, an operator may set the standby information in the frame standby setting window shown in Fig. 3B to designate which of the heald frames HF are to be set in a standby state. In this embodiment, the first, second, ninth, and tenth heald frames HF for the pile warp threads PT correspond to the specific heald frames HF that are to be set in the standby state. Therefore, the frame numbers to be input to the input section 31b of the setting window are "1" - "2" and "9" - "10". Furthermore, the operator may input a numerical value for the frame standby period to the input section 31c and select a standby position from the pull-down menu 31d (i.e. "upper" position in Fig. 3B). A frame standby period (i.e. the number of picks in Fig. 3B) is a time period required for shifting the knots of the pile warp threads PT to a desired position close to the cloth fell CF and is set in view of, for example, the density of a ground weaving portion and the length of the pile warp threads PT between the cloth fell CF and the knots at the time of the thread tying process. The numerical values of the frame numbers and the frame standby period are input using a numeric keypad (not shown).

[0044] After the thread tying process, the operator may turn on a gaiting-weaving switch 20a provided in the main controller 20. The main controller 20 then outputs a command signal Cs for executing the gaiting-weaving operation to the shed controller 19a in the shedding device 19. In response to this command signal Cs, the shed controller 19a is set to a gaiting-weaving mode.

[0045] When set under a gaiting-weaving mode, the shed controller 19a controls the magnetization and demagnetization of the solenoids provided for driving the heald frames HF corresponding to the ground warp threads GT on the basis of a shedding pattern set in the shedding-pattern setting unit 19c. In this case, the shedding pattern used is the same pattern as the shedding pattern used for ground weaving during continuous operation, regardless of the weaving mode at the time of stopping of the pile loom 1. More specifically, in a typical pile loom, for the cutting of the woven cloth, the same pattern is used as the shedding pattern for each ground weaving process performed between pile weaving processes, and an additional shedding pattern (which will be

referred to as a second shedding pattern hereinafter) is set, which indicates a longer cycle than that for weaving a ground weaving portion. Without referring to the shedding pattern for continuous operation, the shed controller 19a, when set in the gaiting-weaving mode, reads out the second shedding pattern from the shedding-pattern setting unit 19c and controls the driving of the heald frames HF for the ground warp threads GT based on that pattern.

[0046] On the other hand, regarding a control operation for driving the heald frames HF corresponding to the pile warp threads PT, the shed controller 19a performs the control operation in accordance with the contents set in the standby-frame setting unit 30 instead of referring to the shedding patterns set in the shedding-pattern setting unit 19c. More specifically, the second shedding pattern also includes information on shedding motion for the heald frames HF corresponding to the pile warp threads PT. However, for the first, second, ninth, and tenth heald frames HF set in the standby-frame setting unit 30, that is, the heald frames HF for the pile warp threads PT, the shedding-pattern setting unit 19c under a gaiting-weaving mode does not follow the second shedding pattern read out for driving the heald frames HF for the ground warp threads GT. Instead, the shedding-pattern setting unit 19c controls the magnetization and demagnetization of the solenoids corresponding to the first, second, ninth, and tenth heald frames HF such as to set these heald frames HF in a standby state at the uppermost position set in the standby-frame setting unit 30. Here, the term "standby state" refers to a state where these heald frames HF are maintained at a set position. In the above case, the heald frames HF for the pile warp threads PT are maintained at the uppermost position for a predetermined frame standby period. The heald frames HF in such a standby state are not involved in the weaving operation.

[0047] When the gaiting-weaving switch 20a is turned on, each of the heald frames HF is driven in the above-described manner while the main controller 20 commands the ground-warp let-off controller 17 and the take-up controller 18 to execute the same control as that at the time of continuous operation. Thus, the rotation of the ground-warp beam 3 is controlled based on the controlling of the tension of the ground warp threads GT, whereby the ground warp threads GT are let off. The take-up roller 22 is rotated in synchronization with the main shaft MS so that the woven cloth W is given a predetermined density. Then, a weaving operation is performed in which a weft insertion device (not shown) inserts a weft thread into a shed formed by the ground warp threads GT for every weaving cycle, and the weft thread is beaten against the cloth fell CF by the reed R. In this case, the driving device 29 for driving the terry motion mechanism is in a non-operative state, which is the same state as that at the time of ground weaving, and the rocking lever 26 is maintained at a predetermined position.

[0048] On the other hand, since the pile warp threads PT just after the thread tying process are loose and the tension lever 8 is thus displaced by a great degree, the driving of the pile-warp beam 2 is not restarted immediately after the thread tying process. As the above-described weaving operation using the ground warp threads GT proceeds and the joint section between the pile warp threads PT and the woven cloth W moves toward the take-up side, the tension of the pile warp threads PT gradually increases. In response to this increase in the tension of the pile warp threads PT, the let-off motor m1 restarts the driving of the pile-warp beam 2 to rotate the pile-warp beam 2.

[0049] As described above, a weaving operation using the ground warp threads GT is performed while the heald frames HF for the pile warp threads PT are maintained in a standby state. Consequently, as the weaving operation proceeds, a section of the woven cloth W positioned at the cloth fell CF at the time of the replacement process of the pile-warp beam 2 is shifted towards the take-up side. As this section of the woven cloth W moves towards the take-up side, the pile warp threads PT including the knots connected to this section of the woven cloth W are pulled towards the take-up side. Accordingly, the knots of the pile warp threads PT are gradually shifted from the position thereof at the time of the thread tying process towards the cloth fell CF until finally reaching an area close to the cloth fell CF. Furthermore, since the weft threads are interwoven with the ground warp threads GT, the pulling of the woven cloth W by the take-up roller 22 is more reliable in comparison to a case where the pulling towards the take-up side is implemented while merely letting off the warp threads. Accordingly, this ensures smooth and proper shifting of the knots.

[0050] The gaiting-weaving operation using only the ground warp threads GT continues throughout the frame standby period set in the standby-frame setting unit 30. When the weaving for the number of picks set as the frame standby period is completed, a command signal indicating that the gaiting-weaving operation has been completed is sent from the main controller 20 to the shed controller 19a in the shedding device 19, the ground-warp let-off controller 17, and the take-up controller 18. In response to this command signal, the gaiting-weaving mode of the shed controller 19a in the shedding device 19 becomes cancelled, and the pile loom 1 is stopped.

[0051] After the gaiting-weaving operation is completed and the pile loom 1 has stopped, an inching weft insertion process as discussed in, for example, Japanese Unexamined Patent Application Publication No. 2-169750 is performed several times, and the warp tension and the position of the cloth fell CF are appropriately adjusted. After repeating these steps several times, the overall gaiting process is completed. Subsequently, the pile loom 1 is restarted for a continuous operation.

[0052] In the embodiment described above, the standby-frame setting unit 30 eliminates the need for preparing a designated shedding pattern for the gaiting-weaving operation. In other words, in the above embodiment, the heald frames HF for the ground warp threads GT are

operated based on the same shedding pattern used for ground weaving while maintaining the heald frames HF for the pile warp threads PT in a standby state at the uppermost position. As an alternative to the above embodiment, a designated shedding pattern for the gaiting-weaving operation may be prepared and set in the shedding-pattern setting unit 19c in the shedding device 19 so that, when performing the gaiting-weaving operation, the shed controller 19a may control the driving of the heald frames HF on the basis of this designated shedding pattern for the gaiting-weaving operation. In that case, the shedding-pattern setting unit 19c also functions as a standby-frame setting unit. Moreover, this designated shedding pattern indicating that the heald frames HF for the pile warp threads PT are to be set in the standby state at the uppermost position corresponds to the standby information for the specific heald frames HF.

[0053] Furthermore, in the above embodiment, the gaiting-weaving operation for the shifting of the knots is performed using all of the heald frames HF that correspond to the ground-warp beam 3. However, the present invention is not limited to this technique. With respect to at least two warp beams provided in the present invention, it is essential that the heald frames corresponding to the replaced warp beam be set in the standby state. However, of the remaining heald frames corresponding to the other warp beam, not all of the heald frames need to undergo a shedding motion for weaving. Instead, at least some (at least two) of the heald frames may be subject to a shedding motion while the remaining heald frames may be set in a standby state like the heald frames corresponding to the replaced warp beam. For example, in the case of the above embodiment, of the third to eighth heald frames HF that correspond to the ground warp threads GT, the fourth to seventh heald frames HF may be used for the gaiting-weaving operation while the third and eighth heald frames HF may be set in the standby state together with the heald frames HF for the pile warp threads PT. In other words, in the present invention, the number of heald frames to be used for the gaiting-weaving operation is not limited as long as at least some of the heald frames are used for the operation.

[0054] Furthermore, in the above embodiment, the heald frames to be driven for performing the gaiting-weaving operation are driven based on the same shedding pattern used for continuous operation. Alternatively, the gaiting-weaving operation may be performed by driving the heald frames on the basis of a designated shedding pattern that is different from the shedding pattern used for the continuous operation.

[0055] Furthermore, in the above embodiment, the driving of the ground-warp beam 3, the take-up roller 22, and the like for the gaiting-weaving operation is performed under the same mode as that for continuous operation. In other words, the ground-warp beam 3, the take-up roller 22, and the like are driven based on the same weaving condition as that at the time of continuous operation. Alternatively, the weaving condition for the gaiting-weaving operation may be different from that for the continuous operation. For example, the tension of the ground warp threads GT at the time of the gaiting-weaving operation may be set lower than that for the continuous operation, or the weft density at the time of the gaiting-weaving operation may be set rougher than for the continuous operation.

[0056] Furthermore, although the standby position for the heald frames in the standby state is set at the uppermost position of the heald frames when driven based on a shedding pattern in the above embodiment, the standby position may alternatively be set at the lowermost position. Moreover, if it is possible in view of the mechanism of the shedding device, the standby position may be set to a position that is different from the uppermost position and the lowermost position as long as the position does not interfere with the weaving operation. Furthermore, not all of the heald frames to be set in the standby state have to be maintained at the same position for the standby state. For example, half of the heald frames to be set in the standby state may be set at the uppermost position for the standby state while the other half may be set at the lowermost position for the standby state. In other words, the standby position for the heald frames in the present invention may be set in an arbitrary manner as long as they do not interfere with the weaving operation.

[0057] The shedding device according to the present invention is not limited to an electronic dobby shedding device as in the above embodiment. For example, the shedding device may alternatively be an electrically-operated shedding device having designated electrically-operated actuators such as driving motors that individually drive the corresponding heald frames. Moreover, the present invention is not limited to a pile loom as in the above embodiment and may be applicable to other types of looms that use two or more warp beams for performing a weaving operation, such as a sucker loom.

[0058] The technical scope of the present invention is not limited to the above embodiment, and modifications are permissible within the scope and spirit of the present invention.

Claims

1. A shedding device (19) included in a loom (1) that performs a weaving operation using warp threads (PT, GT) let off from at least two warp beams (2, 3), the shedding device (19) including controlling means (19a) for electrically controlling individual movements of a plurality of heald frames (HF), the shedding device (19) comprising:

   a standby-frame setting unit (30) having set therein standby information on specific heald frames of the plurality of heald frames (HF), the specific heald frames including heald frames that correspond to the warp threads let off from

one of said at least two warp beams (2, 3), the standby information being used for setting the specific heald frames in a standby state for a predetermined period,
wherein the standby-frame setting unit (30) is connected to the controlling means (19a).

2. The shedding device (19) according to Claim 1, wherein the standby information set in the standby-frame setting unit (30) includes frame numbers designating the specific heald frames and a standby period of the specific heald frames.

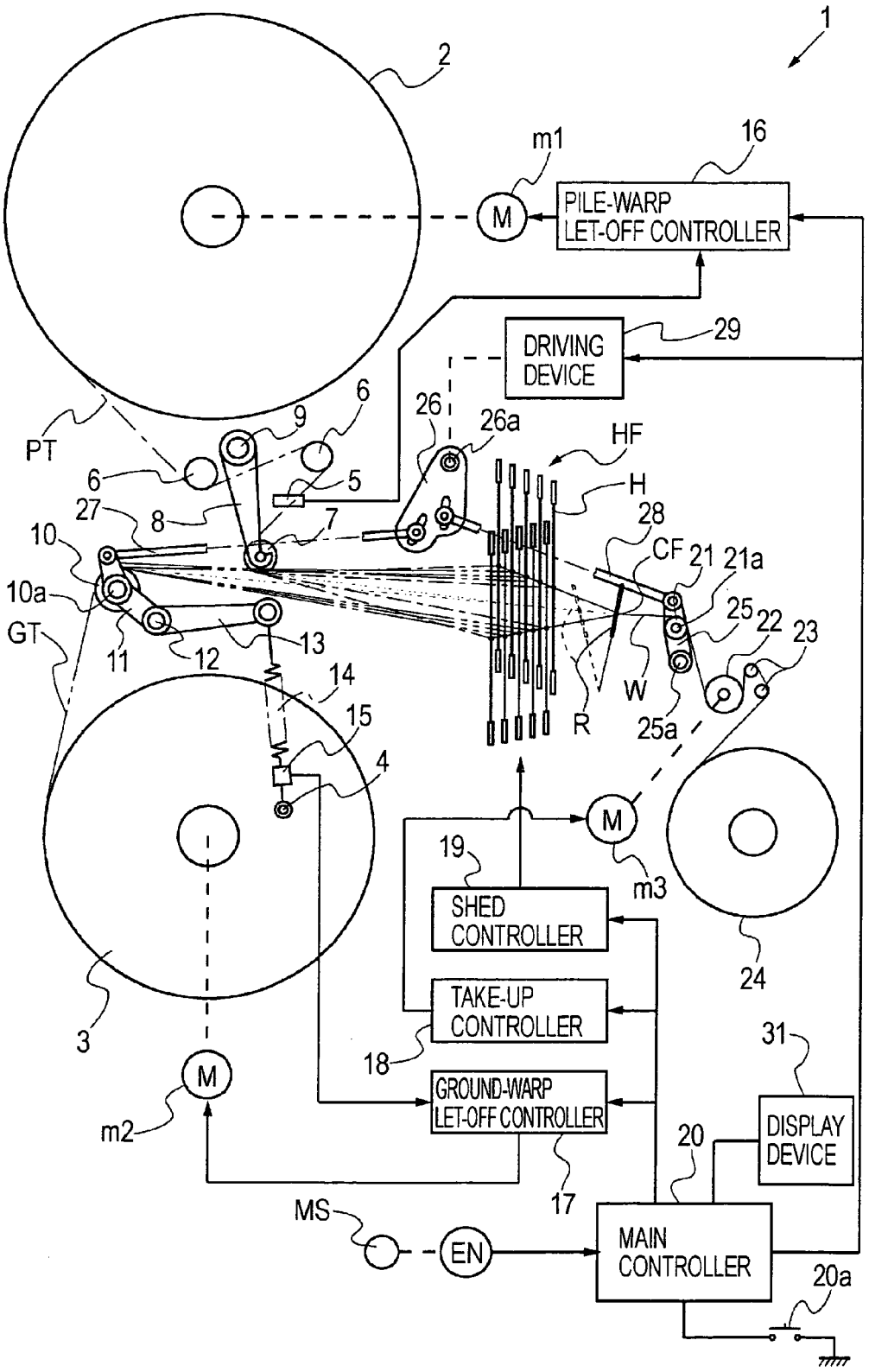
3. A gaiting method in a loom (1) that performs a weaving operation using warp threads (PT, GT) let off from at least two warp beams (2, 3), the method being performed after one warp beam of said at least two warp beams (2, 3) has been replaced with a new one, the method comprising the steps of:

connecting the warp threads already in the loom (1) and formerly let off from the previous warp beam to warp threads let off from the new warp beam;
setting specific heald frames included in a plurality of heald frames (HF) in a standby state at a predetermined upper or lower position, the specific heald frames including heald frames that correspond to the warp threads let off from the new warp beam; and
allowing the loom (1) to perform a weaving operation by driving the remaining heald frames excluding the specific heald frames in a shedding motion for a predetermined standby period while maintaining the specific heald frames in the standby state.

4. The gaiting method according to Claim 3, wherein the loom (1) comprises a pile loom, wherein said one warp beam of said at least two warp beams (2, 3) comprises a pile warp beam (2), and wherein the specific heald frames correspond to pile warp threads (PT) let off from the pile warp beam (2) and have the pile warp threads (PT) extending therethrough, and
wherein the pile loom (1) performs the weaving operation over the predetermined standby period in said allowing step by using only ground warp threads (GT) while maintaining the specific heald frames corresponding to the pile warp threads (PT) in the standby state.

5. The gaiting method according to Claim 4, wherein the weaving operation performed over the predetermined standby period using the ground warp threads (GT) is implemented by driving the heald frames that correspond to the ground warp threads (GT) on the basis of a shedding pattern for ground weaving.

FIG. 1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6
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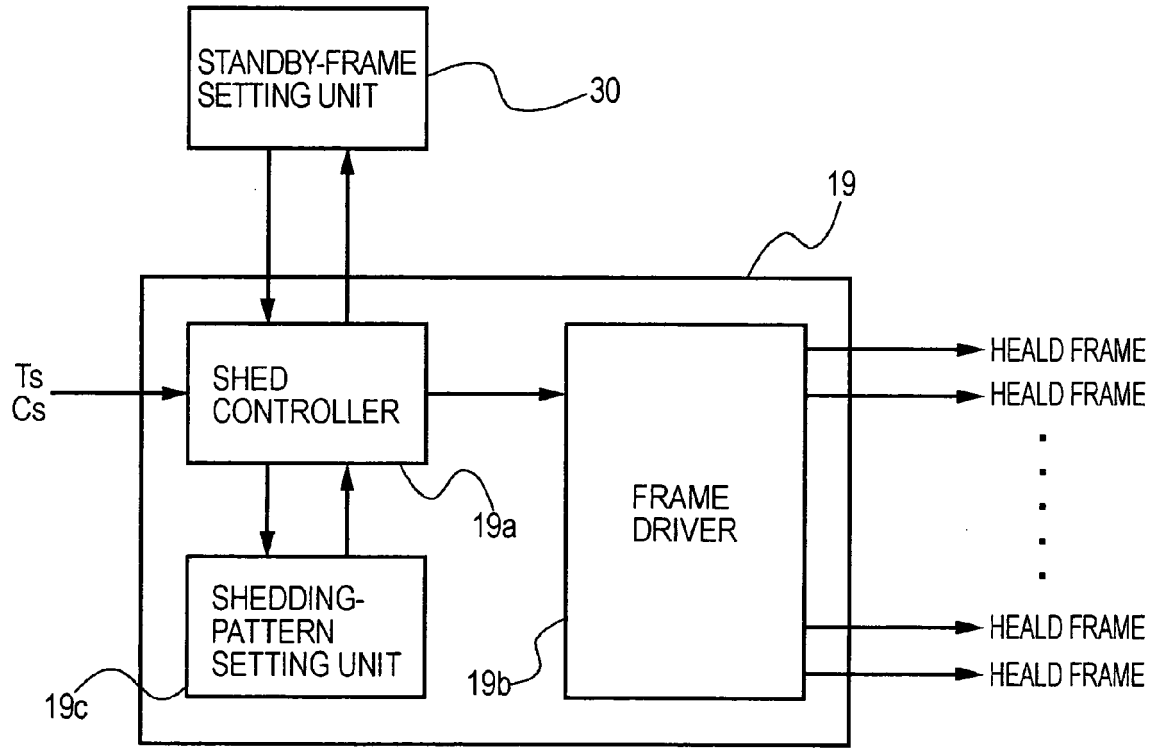
26a
HF
H
6
5
27
8
7
28
10
CF
21
21a
10a
25
22
23
GT
11
12
13
14
15
4
R
W
25a
M
m3
19
SHED CONTROLLER
TAKE-UP CONTROLLER
24
3
18
31
M
m2
GROUND-WARP LET-OFF CONTROLLER
DISPLAY DEVICE
20
17
MS
EN
MAIN CONTROLLER
20a

FIG. 2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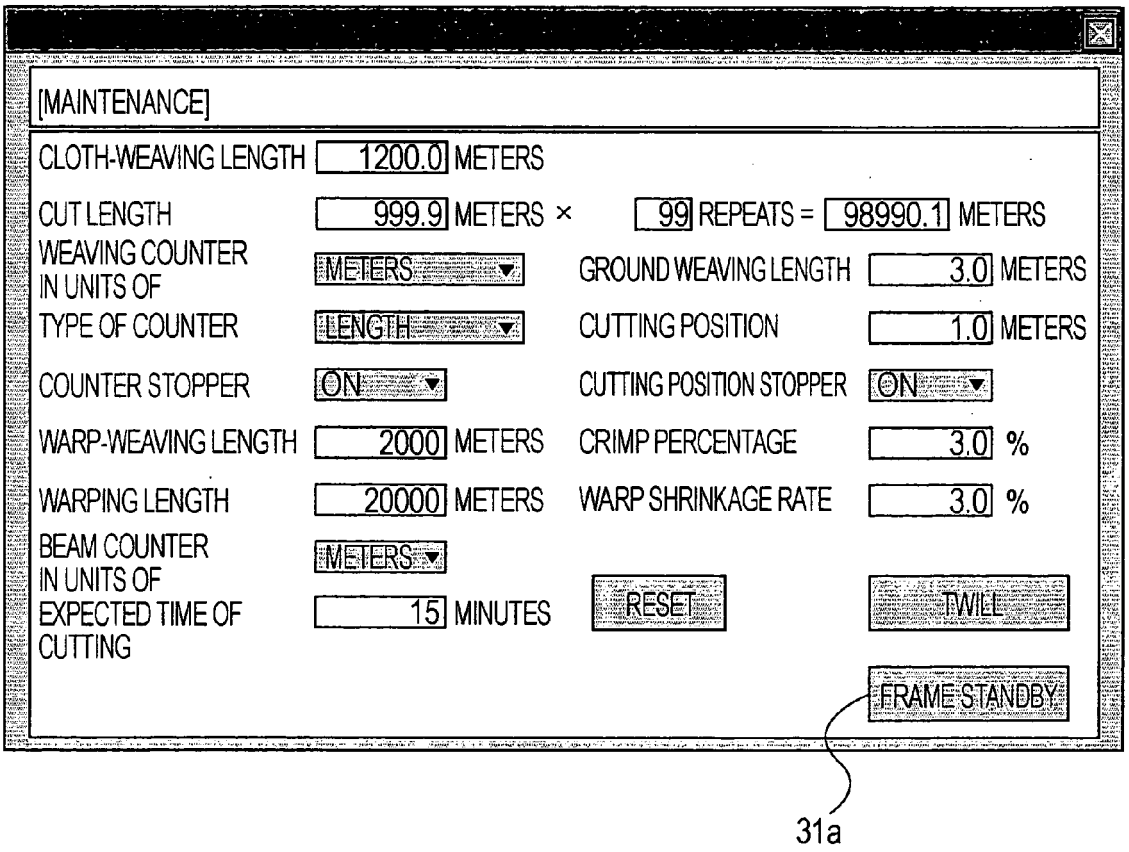
19
Ts
Cs
SHED CONTROLLER
19a
SHEDDING-PATTERN SETTING UNIT
19c
FRAME DRIVER
19b
HEALD FRAME
HEALD FRAME
HEALD FRAME
HEALD FRAME

FIG. 3A


[MAINTENANCE]
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CUT LENGTH
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METERS ×
99
REPEATS =
98990.1
METERS
WEAVING COUNTER IN UNITS OF
METERS
GROUND WEAVING LENGTH
3.0
METERS
TYPE OF COUNTER
LENGTH
CUTTING POSITION
1.0
METERS
COUNTER STOPPER
ON
CUTTING POSITION STOPPER
ON
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METERS
CRIMP PERCENTAGE
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%
WARPING LENGTH
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METERS
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%
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METERS
EXPECTED TIME OF CUTTING
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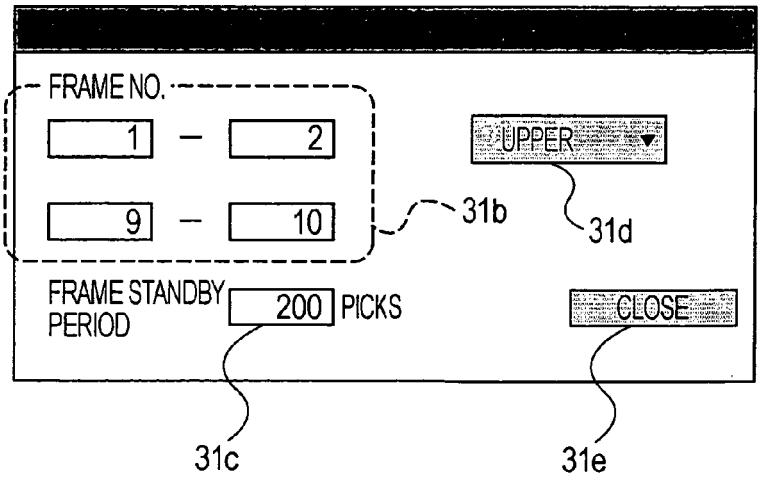
MINUTES
RESET
TWILL
FRAME STANDBY
31a

FIG. 3B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9
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UPPER
31d
FRAME STANDBY PERIOD
200
PICKS
CLOSE
31c
31e

REFERENCES CITED IN THE DESCRIPTION

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