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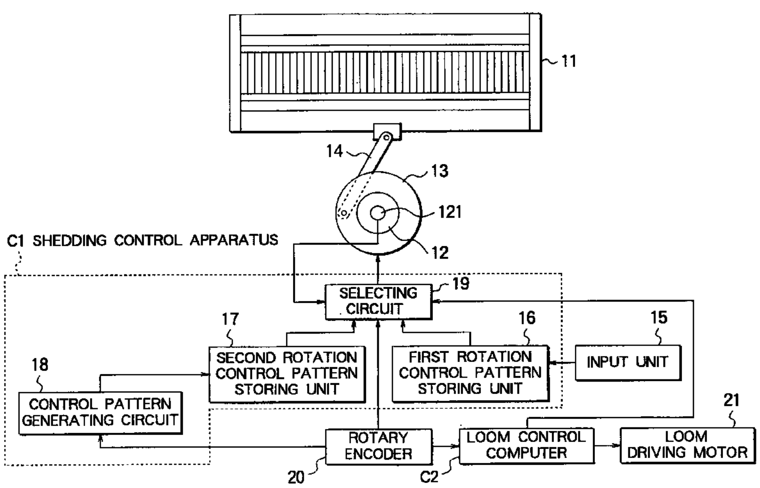
(54) Shedding control method and apparatus for a loom

(57) In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control apparatus which can ensure enhanced stability of motion of the heald frame while suppressing the power consumption to a minimum. The shedding control apparatus for controlling the shedding drive motor through a feedback loop includes a first rotation control pattern storing unit for storing a first rotation control pattern, a second rotation control pattern storing unit for storing a second one, a control pattern generating circuit for generating the second rotation control pattern and a selecting circuit. The control pattern generating circuit generates the second rotation control pattern on the basis of the rotation speed information obtained from a rotary encoder. The selecting circuit is so designed as to select the first or second rotation control patterns on the basis of the rotation speed changing information obtained from the rotary encoder.

FIG. 1



EP 0 761 856 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a shedding control method and a shedding control apparatus for a weaving machine or loom. More specifically, the invention is concerned with a shedding control for allowing shedding operation to follow rotation of a loom with enhanced accuracy.

2. Description of Related Art

For having better understanding of the invention, the technical background thereof will first be described in some detail. There are disclosed in Japanese Unexamined Patent Application Publications Nos. 25751/1993 (JP-A-5-25751) and 322644/1994 (JP-A-6-322644) such shedding control apparatuses in which a plurality of heald frames are driven separately from one another by means of electric motors which are dedicated to the heald frames, respectively, wherein each of the heald frames is operatively connected to the dedicated motor in one-to-one correspondence relation.

In either one of the shedding control apparatuses disclosed in JP-A-5-25751 and JP-A-6-322644, difference or deviation between a target or desired rotation of the drive motor given in terms of a rotation angle of a main shaft of the loom and an actual rotation thereof is detected for controlling the rotation of the drive motor so that the difference as detected makes disappearance. In this conjunction, it is however noted that in the case of the shedding control apparatus disclosed in JP-A-5-25751, a control loop gain is regulated in dependence on the deviation, whereas in the case of the shedding control apparatus disclosed in JP-A-6-322644, the control loop gain is regulated on the basis of the information concerning the operating position of the heald frame.

More specifically, in the case of the shedding control apparatus disclosed in JP-A-5-25751, the control loop gain is adjusted in dependence on magnitude of the deviation so that the drive motor can follow the rotation of the main shaft of the loom with high accuracy. However, rotation of the main shaft of the loom is susceptible to fluctuations due to the beating, change in the tension of warps or for the like cause. Consequently, when rotation speed of the main shaft of the loom changes or varies, rotation of the drive motor is so controlled as to follow such variations. However, such control will necessarily be accompanied with repetition of acceleration and deceleration, which is of source undesirable. Needless to say, such operation of the electric motor will incur increasing of the power consumption.

On the other hand, in the case of the shedding control apparatus disclosed in JP-A-6-322644, the control loop gain is increased upon closing of the shed defined by the warps which requires a high-accuracy control, while in the shed Opening operation (i.e., shedding) in which requirement imposed on the control is not so severe, the loop gain is deceased. However, changing-over of the control accuracy in the steady operation state of the loom will lead to poor stability of the control system, giving rise to a problem in respect to the smoothness of motion of the heald frame assembly.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide for a shedding apparatus of a loom in which a heald frame assembly is driven by a shedding drive motor provided independent of a loom drive motor a shedding control method which can ensure enhanced stability of motion of the heald frame assembly while suppressing the electric power consumption to a possible minimum.

Another object of the present invention is to provide a shedding control apparatus for carrying out the control method mentioned above.

In view of the above and other objects which will become apparent as the description proceeds, there is provided according to one aspect of the present invention a shedding control method according to which a rotation control pattern for controlling the shedding drive motor as a function of a time as a variable, is generated on the basis of rotation speed of a loom as detected, wherein operation of the shedding drive motor is controlled in accordance with the rotation control pattern.

With the shedding control method mentioned above, the shedding drive motor is operated in accordance with the rotation control pattern as a function of the time lapse given as a variable during the operation phase of the loom in which synchronism of high accuracy is not required between the rotation angle of the loom and the operating position of the heald frame assembly. Thus, smooth motion of the heald frame assembly can be realized. The rotation control pattern based on the time as the variable is generated on the actual rotation speed of the loom. Thus, with the method of controlling the shedding drive motor by using the rotation control pattern generated on the basis of the rotation speed of the loom as detected, there can be realized a stabilized motion of the heald frame assembly while suppressing the electric power consumption to a possible minimum.

According to another aspect of the present invention, there is provided a shedding control method according to which a first rotation control pattern for controlling a shedding drive motor as a function of rotation angle of the loom as a variable and a second rotation control pattern for controlling the shedding drive motor as a function of time as a variable are generated or prepared, wherein operation of the shedding drive motor is controlled in accordance with the first rotation control pattern during a speed-variable operation phase of the loom, while controlling the shedding drive motor in accordance with the second rotation control pattern during a constant-speed operation phase of the loom.

In an operation phase in which the motion speed of the loom rises up to a steady operation speed or during a period in which the loom is decelerated from the steady operation state to the stationary state, it is required to establish synchronism with high accuracy between the rotation angle of the loom and the operating position of the heald frame assembly. In this conjunction, it should be noted that according to the shedding control method mentioned above, the shedding drive motor is operated in accordance with the first rotation control pattern during the speed-changing operation phase of the loom such as a period during which the loom speed is increased up to a steady operation speed or a period in which the loom is decelerated to the stationary state, in order to establish synchronism between the rotation angle of the loom and the operating position of the heald frame assembly. On the other hand, in the steady operation state of the loom in which high-accuracy synchronism is not required to be established between the rotation angle of the loom and the operating position of the heald frame assembly, the shedding drive motor is operated in accordance with the second rotation control pattern in order to ensure smooth motion of the heald frame assembly. Thus, with the method mentioned just above, the stability of operation or motion of the heald frame assembly can be enhanced while suppressing the power consumption to a minimum.

According to yet another aspect of the present invention, there is provided a shedding control method according to which a first rotation control pattern for controlling the shedding drive motor as a function of rotation angle of the loom as a variable and a second rotation control pattern for controlling the shedding drive motor as a function of time as a variable are generated or prepared, wherein the first rotation control pattern and the second rotation control pattern may concurrently be employed in combination for controlling the shedding drive motor.

More specifically, according to the shedding control method described just above, X % of the first rotation control pattern and (100 - X) % of the second rotation control pattern are employed in combination for controlling the shedding drive motor. Thus, when the rotation speed according to the first rotation control pattern is represented by V1 with the rotation speed according to the second rotation control pattern being represented by V2, then the shedding drive motor is driven at a combined or synthesized speed given by

$$V1 \cdot X + V2\,(100 - X).$$

By virtue of such combined control as mentioned above, there can be realized the shedding control which satisfies both requirements imposed on the follow-up motion of the heald frame assembly and the stability of motion of the heald frame assembly.

In a preferred mode for carrying out the method mentioned just above, the second rotation control pattern may preferably be generated on the basis of an actual rotation speed of the loom as detected.

According to a further aspect of the present invention, there is provided a shedding control apparatus which includes a first rotation control pattern setting means for setting a first rotation control pattern for controlling a shedding drive motor as a function of rotation angle of the loom as a variable, a second rotation control pattern setting means for setting a second rotation control pattern for controlling the shedding drive motor as a function of time lapse as a variable, an operation speed detecting means for detecting an operation speed of the loom, and a selecting means for selecting at least one of the first rotation control pattern and the second rotation control pattern on the basis of operation speed state detected by the operation speed detecting means.

According to the shedding control apparatus mentioned above, the shedding drive motor is operated in accordance with the first rotation control pattern during the speed-changing operation phase of the loom such as a period during which the loom speed is increased up to a steady operation speed or a period in which the loom is decelerated to the stationary state, in order to establish synchronism or matching between the rotation angle of the loom and the operating position of the heald frame assembly. On the other hand, in the steady operation state of the loom in which high-accuracy synchronism is not required to be established between the rotation angle of the loom and the operating position of the heald frame assembly, the shedding drive motor is operated in accordance with the second rotation control pattern in order to ensure smooth motion of the heald frame assembly.

The above and other objects, features and attendant advantages of the present invention will more easily be understood by reading the following description of the preferred embodiments thereof taken, only by way of example, in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the course of the description which follows, reference is made to the drawings, in which:

Fig. 1 is a view showing schematically a shedding mechanism together with a shedding control apparatus according to an embodiment of the present invention;

Fig. 2 is a view for graphically illustrating a first rotation control pattern employed in the control performed by the shedding control apparatus;

Fig. 3 is a view for graphically illustrating a second rotation control pattern employed in the control performed by the shedding control apparatus;

Fig. 4 is a flow chart for illustrating a shedding control method according to a first embodiment of the invention;

Fig. 5 is a flow chart for illustrating a shedding control method according to the first embodiment of the invention;

Fig. 6 is a flow chart for illustrating a shedding control method according to a second embodiment of the invention; and

Fig. 7 is a flow chart for illustrating a shedding control method according to a third embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the present invention will be described in detail in conjunction with what is presently considered as preferred or typical embodiments thereof by reference to the drawings. In the following description, like reference characters designate like or corresponding parts throughout the several views.

Embodiment 1

A first embodiment of the present invention will be described by reference to Figs. 1 to 5.

Referring to Fig. 1, a shedding drive motor 12 is disposed underneath a heald frame assembly 11. The shedding drive motor 12 may be constituted by a variable-speed electric motor of a servo-motor type. A crank disk 13 is fixedly mounted on an output shaft of the shedding drive motor 12, wherein the crank disk 13 is operatively coupled to a lower heald frame of the heald frame assembly 11 by means of a connecting rod 14. The crank disk 13 constitutes a crank mechanism in cooperation with the connecting rod 14, wherein the rotation of the shedding drive motor 12 in one direction is translated to upward/downward motions of the heald frame assembly 11 by means of the crank mechanism. The shedding drive motor 12 is controlled under the command of a shedding control apparatus generally designated by reference character C1. The shedding control apparatus C1 is so designed as to control the shedding drive motor 12 through a feedback loop on the basis of the rotation angle information which can be obtained from a rotary encoder 121 incorporated in or provided in association with the shedding drive motor 12.

The shedding control apparatus C1 is comprised of a first rotation control pattern storing unit 16 for storing a first rotation control pattern which is inputted through an input unit 15, a second rotation control pattern storing unit 17 for storing a second rotation control pattern, a control pattern generating circuit 18 for generating the second rotation control pattern, and a selecting circuit 19 for selecting either the first rotation control pattern or the second rotation control pattern. In this conjunction, it should be mentioned that the input unit 15 and the first rotation control pattern storing unit 16 cooperate to constitute a first rotation control pattern setting means, while the second rotation control pattern storing unit 17 and the control pattern generating circuit 18 constitute a second rotation control pattern setting means. The control pattern generating circuit 18 generates the second rotation control pattern on the basis of the rotation speed information obtained from the rotary encoder 20 which serves as a means for detecting a rotation angle of the loom. The selecting circuit 19 constituting the selecting means is so designed as to select either one of the first and second rotation control patterns on the basis of the rotation speed information obtained from the rotary encoder 20 which constitutes an operation speed detecting means.

The selecting circuit 19 controls the operation of the shedding drive motor 12 through a feedback loop on the basis of the rotation control pattern as selected and rotation angle information obtained from the rotary encoder 121 provided in association with the shedding drive motor 12. In other words, the selecting circuit 19 issues a speed command signal in accordance with a difference between the rotation angle obtained from the rotary encoder 121 and the rotation angle determined by the rotation control pattern.

Further provided is a loom control computer C2 which is in charge of controlling the operation of a loom driving motor 21. The loom control computer C2 is so implemented as to start operation of the loom driving motor 21 in response to a closing operation of a starting switch (not shown) to thereby output a loom operation start signal to both the control pattern generating circuit 18 and the selecting circuit 19. Furthermore, in case abnormality such as weft insertion failure or error, warp breakage or the like takes place, the loom control computer C2 stops operation of the loom driving motor 21 and at the same time outputs a weaving operation stop signal to both the control pattern generating circuit 18 and the selecting circuit 19.

Now, referring to Fig. 2, a curve D shown therein represents a shedding motion pattern of the heald frame assembly 11, while a curve E1 represent a first rotation control pattern corresponding to the shedding motion pattern of the heald frame assembly 11. In this conjunction, it is to be noted that in the coordinate system for the curve D, the rotation angle of the loom is taken along the abscissa, while the height of the heald frame assembly 11 is taken along the ordinate. Similarly, as for the curve E1, the rotation angle of the loom is taken along the abscissa, while that of the shedding drive motor 12 is taken along the ordinate. Further referring to Fig. 3, each of pulse-like waveforms F1, F2, F3 and F4 represents an origin signal outputted from the rotary encoder 20 upon every complete rotation of the loom. Additionally, a curve E2 represents the second rotation control pattern is generated by the control pattern generating circuit 18 on the basis of rotation speeds of the loom determined on the basis of the time lapses intervening between the origin signals F1, • • •, F4. In the coordinate system for the curve E2, time is taken along the abscissa with the rotation angle of the shedding drive motor 12 being taken along the ordinate. For generating the second rotation control pattern between the origin signals F4 and F3, the rotation speed between the origin signals F3 and F2 is utilized, while for generation of the rotation control pattern section between the origin signals F3 and F2, the rotation speed between the origin signals F2 and F1 is employed. To say in another way, for generation of the rotation control pattern between given origin signals, the rotation speed during a period defined by an immediately preceding origin signals is utilized. In this conjunction, it should be noted that the rotation speed in the second rotation control pattern between the origin signals F1 and F3 is constant, while during the period between the origin signals F3 and F4, the rotation speed remains equal to zero.

Figures 4 and 5 are flow charts for illustrating shedding control operation carried out by the shedding control apparatus C1. Referring tho the figures, the selecting circuit 19 arithmetically determines change of the rotation speed (i.e., acceleration or deceleration) of the loom on the basis of the rotation angle detection information derived from the output of the rotary encoder 20. When the change of the rotation speed is equal to or greater than a predetermined value, the selecting circuit 19 decides that the rotation speed of the loom is changing (Fig. 4, step S1, "YES"), to read out the first rotation control pattern from the first rotation control pattern storing unit 16 (step S2). Thus, operation of the shedding drive motor 12 is controlled through the feedback loop in accordance with the first rotation control pattern selected by the selecting circuit 19 and on the basis of the rotation angle information derived from the output of the rotary encoder 121 provided in association with the shedding drive motor 12. By virtue of this feedback control, it is possible to allow the shedding drive motor 12 to follow the change of the rotation speed of the loom.

Concurrently, the control pattern generating circuit 18 starts generation of the second rotation control pattern in response to the input of a weaving operation start signal (Fig. 5, step S7, "YES"). More specifically, the control pattern generating circuit 18 arithmetically determines the rotation speed of the loom on the basis of the origin signals as inputted from the rotary encoder 20 (Fig. 5, steps S8 and S9), and then generates the second rotation control pattern on the basis of the rotation speed as determined arithmetically (Fig. 5, step S10).

On the other hand, when the decision step S2 shown in Fig. 4 results in negation "NO", the selecting circuit 19 decides that the loom is operating in a steady operation mode, to thereby select the second rotation control pattern read out from the second rotation control pattern storing unit 17 (Fig. 4, step S3). Thus, the shedding drive motor 12 is controlled through a feedback loop in accordance with the second rotation control pattern as selected and on the basis of the rotation angle information derived from the rotary encoder 121 provided in association with the shedding drive motor 12. Furthermore, when the weaving operation stop signal is inputted (Fig. 4, step S4, "YES"), the selecting circuit 19 controls operation of the shedding drive motor 12 through the feedback loop in accordance with the second rotation control pattern and on the basis of the rotation angle information derived from the output of the rotary encoder 121 incorporated in the shedding drive motor 12 (Fig. 4, steps S4, S1, S2). Parenthetically, in the case of the feedback control in accordance with the second rotation control pattern, the shedding drive motor 12 can rotate smoothly without being affected by change in the rotation speed of the loom during one complete rotation.

As will now be appreciated from the above description, upon acceleration or deceleration of the rotation speed of the loom which requires that the shedding drive motor 12 be controlled in following the rotation speed of the loom with high accuracy, the first rotation control pattern is selected so that the shedding operation of the heald frame assembly 11 can follow the acceleration or deceleration of the loom. By contrast, in the steady operation of the loom in which the rotation speed of the loom need not be followed up with high accuracy, the second rotation control pattern is selected. Thus, the shedding motion or operation of the heald frame assembly 11 can be carried out smoothly nevertheless of occurrence of change in the speed of the loom during every complete rotation of the loom. Such smooth operation or motion of the heald frame assembly 11 contributes significantly to lowering or reduction of the electric power consumption. Additionally, the control system for the loom is stabilized, whereby the shedding motion performed by the heald frame assembly 11 can be effected in a stable state.

At this juncture, it should be mentioned that even when a change in the rotation speed of the loom occurs, the rotational position in the first rotation control pattern will necessarily intersect the rotational position in the second rotation control pattern. The position of such intersect can be arithmetically determined on the basis of the first rotation control pattern and the second rotation control pattern which is generated during every complete rotation of the loom. In this conjunction, it should be noted that change-over between the first rotation control pattern and the second rotation control pattern is performed at a time point at which the above-mentioned rotational positions in both the rotation control patterns intersect each other. By setting the timing for changing over the first and second rotation control patterns in this manner, shock which may occur upon changing-over of the rotation control patterns can be suppressed to a possible minimum, which is very advantageous for stable operation of the control system.

<u>Embodiment 2</u>

A second embodiment of the present invention will be described by reference to Fig. 6. Although the general configuration of the loom control system is same as the first embodiment described above, the function of the selecting circuit 19 differs from that of the first embodiment. Parenthetically, generation of the second rotation control pattern is same as in the case of the first embodiment. According to the teaching of the invention incarnated in the instant embodiment, the selecting circuit 19 is so implemented as to select a combination of X % of the first rotation control pattern and (100 - X) % of the second rotation control pattern, wherein X represents a weighting factor for the first rotation control pattern and (100 - X) represents a weighting factor for the second rotation control pattern. When the rotation speed in the operation effected in accordance with the first rotation control pattern is represented by V1, while representing the rotation speed in the second rotation control pattern mode by V2, the selecting circuit 19 is so implemented as to select a combined or synthesized speed given by the following expression (1) (see Fig. 6, S13) when the operation speed of the loom is changing (Fig. 6, S12, "YES"):

$$V1 \cdot \alpha 1 + V2 \cdot \alpha 2 \qquad (1)$$

where coefficients $\alpha 1$ and $\alpha 2$ represent, respectively, the weighting factors which are so determined as to satisfy the conditions that $\alpha 1 + \alpha 2 = 1$ and that $\alpha 1 \geqq \alpha 2$.

On the other hand, when the loom is operated in a steady mode (Fig. 6, S12, "NO"), the selecting circuit 19 selects a combined or synthesized speed given by the following expression (2) (Fig. 6, S14):

$$V1 \cdot \beta 1 + V2 \cdot \beta 2 \qquad (2)$$

where coefficients $\alpha 1$ and $\alpha 2$ represent, respectively, the weighting factors which meet the conditions that $\beta 1 < \beta 2$. Thus, the motion stability of the heald frame assembly is enhanced as the weighting factor 2 is selected greater. As will be appreciated from the above description, owing to the combined control using the weighting factors as described above, not only the capability of the heald frame assembly 11 to follow the rotational positions of the loom with accuracy as well as the stability of operation of the heald frame assembly 11 can be realized satisfactorily.

Embodiment 3

A third embodiment of the present invention will be described by reference to a flow chart shown in Fig. 7. Although the general configuration of the loom control system is same as the first embodiment described above, the function of the selecting circuit differs from that of the selecting circuit 19 of the first embodiment. Generation of the second rotation control pattern is same as in the case of the first embodiment. When the loom control computer C2 outputs the weaving operation start signal to the selecting circuit 19 (Fig. 7, S22), the first rotation control pattern is selected by the selecting circuit 19 (Fig. 7, S23). Upon lapse of a predetermined time t from the outputting of the weaving operation start signal (Fig. 7, decision step S24), the selecting circuit 19 selects the second rotation control pattern (Fig. 7, S25). At this juncture, the predetermined time or period t is so set as to correspond substantially to a rise-up time taken for the loom to attain the steady operation state. When the loom control computer C2 outputs the weaving operation stop signal to the selecting circuit 19 (Fig. 7, S26), the first rotation control pattern is selected by the selecting circuit 19 (Fig. 7, step S27).

In the case of the third embodiment of the invention, the first rotation control pattern is selected only during a period intervening between the start of the loom operation and the steady operation state thereof and a period intervening between the steady operation state and stoppage of the loom operation. However, in the instant embodiment, substantially same advantageous effects as those described hereinbefore in conjunction with the first embodiment can be obtained. In addition, because the arithmetic processing for determining change in the rotation speed is rendered unnecessary according to the instant embodiment of the invention, the control or procedure for detecting change in the rotation speed of the loom can be much simplified, to a further advantage.

Many features and advantages of the present invention are apparent from the detailed description and thus it is intended by the appended claims to cover all such features and advantages of the system which fall within the true spirit and scope of the invention. Further, since numerous modifications and combinations will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation illustrated and described.

By way of example, in the case of the loom in which the operation speed thereof changes only during the weaving operation, the first rotation control pattern may be selected only during the weaving operation. Further, the second rotation control pattern may be prepared on the basis of the rotation speed of the loom set previously for the steady operation.

Further, the first embodiment may be so modified that the first rotation control pattern is selected during a predetermined period starting from the time point at which the loom start signal is inputted. With such modification, detection of the rotation speed change of the loom can be spared, whereby the control system can correspondingly be simplified. To this end, the first rotation control pattern may be selected in response to the input of the loom operation stop signal.

Besides, change-over between the first rotation control pattern and the second rotation control pattern may be performed at a time point at which the rotational positions of the shedding drive motor in both patterns intersect with each other. In that case, the shock which may occur upon changing-over of the first and second rotation control patterns can be mitigated, which in turn means that stability of the control system can be enhanced.

Accordingly, all suitable modifications and equivalents may be resorted to, falling within the spirit and scope of the invention.

In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control apparatus which can ensure enhanced stability of motion of the heald frame while suppressing the power consumption to a minimum. The shedding control apparatus for controlling the shedding drive motor through a feedback loop includes a first rotation control pattern storing unit for storing a first rotation control pattern, a second rotation control pattern storing unit for storing a second one, a control pattern generating circuit for generating the second rotation control pattern and a selecting circuit. The control pattern generating circuit generates the second rotation control pattern on the basis of the rotation speed information obtained from a rotary encoder. The selecting circuit is so designed as to select the first or second rotation control patterns on the basis of the rotation speed changing information obtained from the rotary encoder.

Claims

1. In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control method comprising the steps of:

   preparing a rotation control pattern for controlling said shedding drive motor as a function of a time as a variable, said rotation control pattern being generated on the basis of rotation speed of a loom as detected; and
   controlling operation of said shedding drive motor in accordance with said rotation control pattern.

2. In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control method comprising the steps of:

   preparing a first rotation control pattern for controlling said shedding drive motor as a function of rotation angle of said loom as a variable;
   preparing a second rotation control pattern for controlling said shedding drive motor as a function of time as a variable; and
   controlling operation of said shedding drive motor in accordance with said first rotation control pattern in a speed-variable operation phase of said loom, while controlling said shedding drive motor in accordance with said second rotation control pattern in a constant-speed operation phase of said loom.

3. In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control method comprising the steps of:

   preparing a first rotation control pattern for controlling said shedding drive motor as a function of rotation angle of said loom as a variable; and
   preparing a second rotation control pattern for controlling said shedding drive motor as a function of time as a variable;

   wherein said first rotation control pattern and said second rotation control pattern are concurrently used in combination for controlling said shedding drive motor.

4. A shedding control method in a loom according to any one of claims 2 and 3, wherein said second rotation control pattern is generated on the basis of a rotation speed of said loom as detected.

5. In a shedding apparatus for driving a heald frame assembly of a loom by a shedding drive motor installed independent of a loom driving motor, a shedding control apparatus comprising:

   first rotation control pattern setting means for setting a first rotation control pattern for controlling said shedding drive motor as a function of rotation angle of said loom as a variable;
   second rotation control pattern setting means for setting a second rotation control pattern for controlling said shedding drive motor as a function of time as a variable;
   operation speed detecting means for detecting an operation speed of said loom; and
   selecting means for selecting at least one of said first rotation control pattern and said second rotation control pattern on the basis of the operation speed state detected by said operation speed detecting means.

FIG. 1

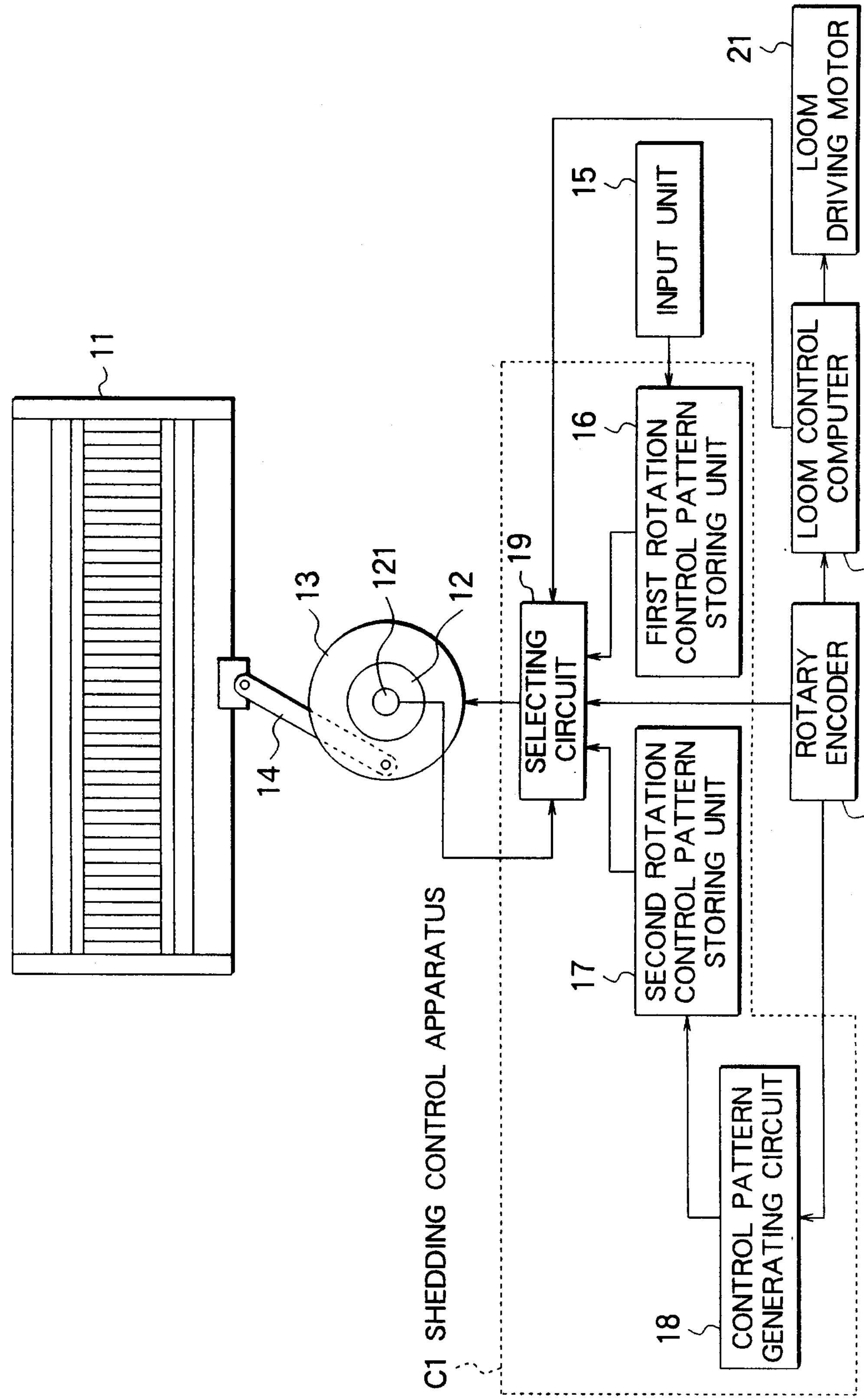

11
13
121
12
14
19
SELECTING CIRCUIT
FIRST ROTATION CONTROL PATTERN STORING UNIT
16
INPUT UNIT
15
SECOND ROTATION CONTROL PATTERN STORING UNIT
17
CONTROL PATTERN GENERATING CIRCUIT
18
C1 SHEDDING CONTROL APPARATUS
ROTARY ENCODER
20
LOOM CONTROL COMPUTER
C2
LOOM DRIVING MOTOR
21

FIG. 2

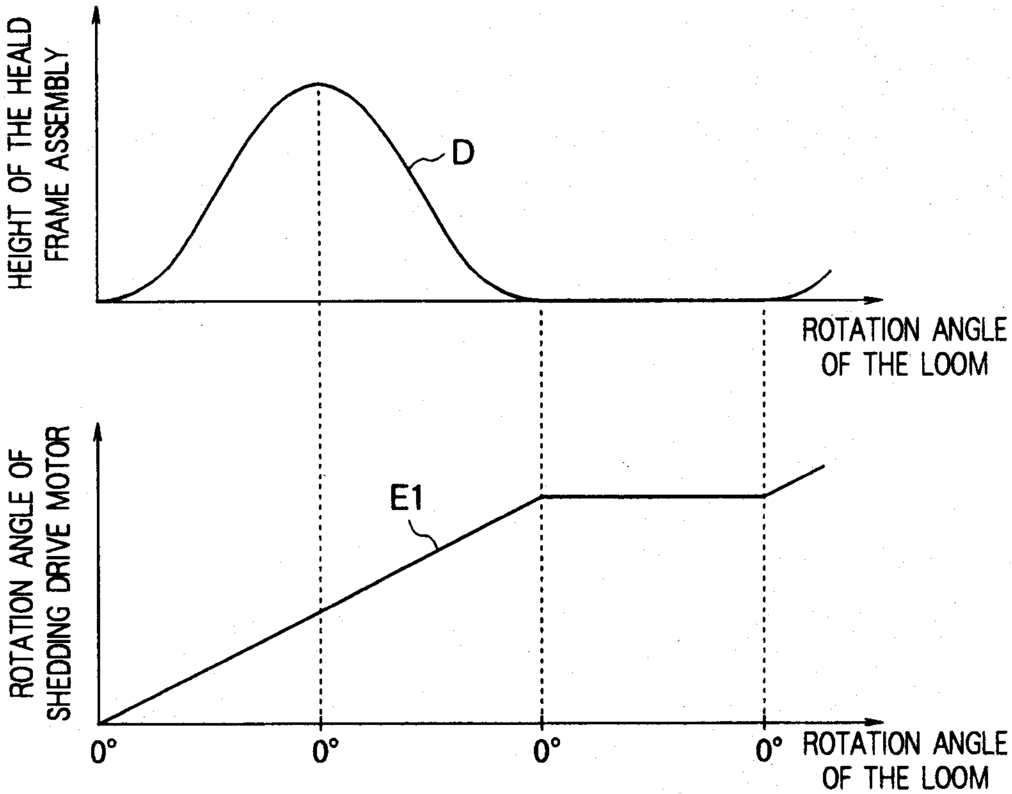

HEIGHT OF THE HEALD
FRAME ASSEMBLY
D
ROTATION ANGLE
OF THE LOOM
ROTATION ANGLE OF
SHEDDING DRIVE MOTOR
E1
0°
0°
0°
0°
ROTATION ANGLE
OF THE LOOM

FIG. 3

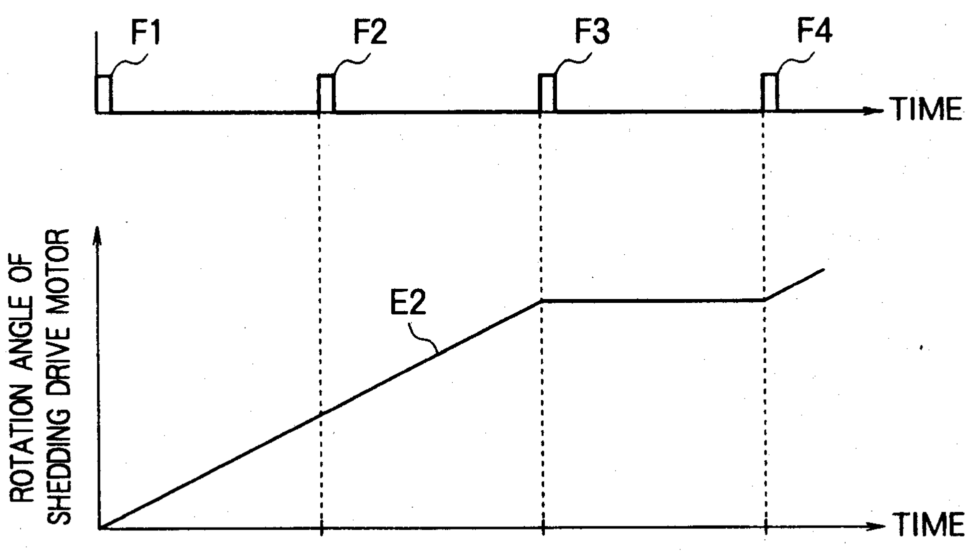
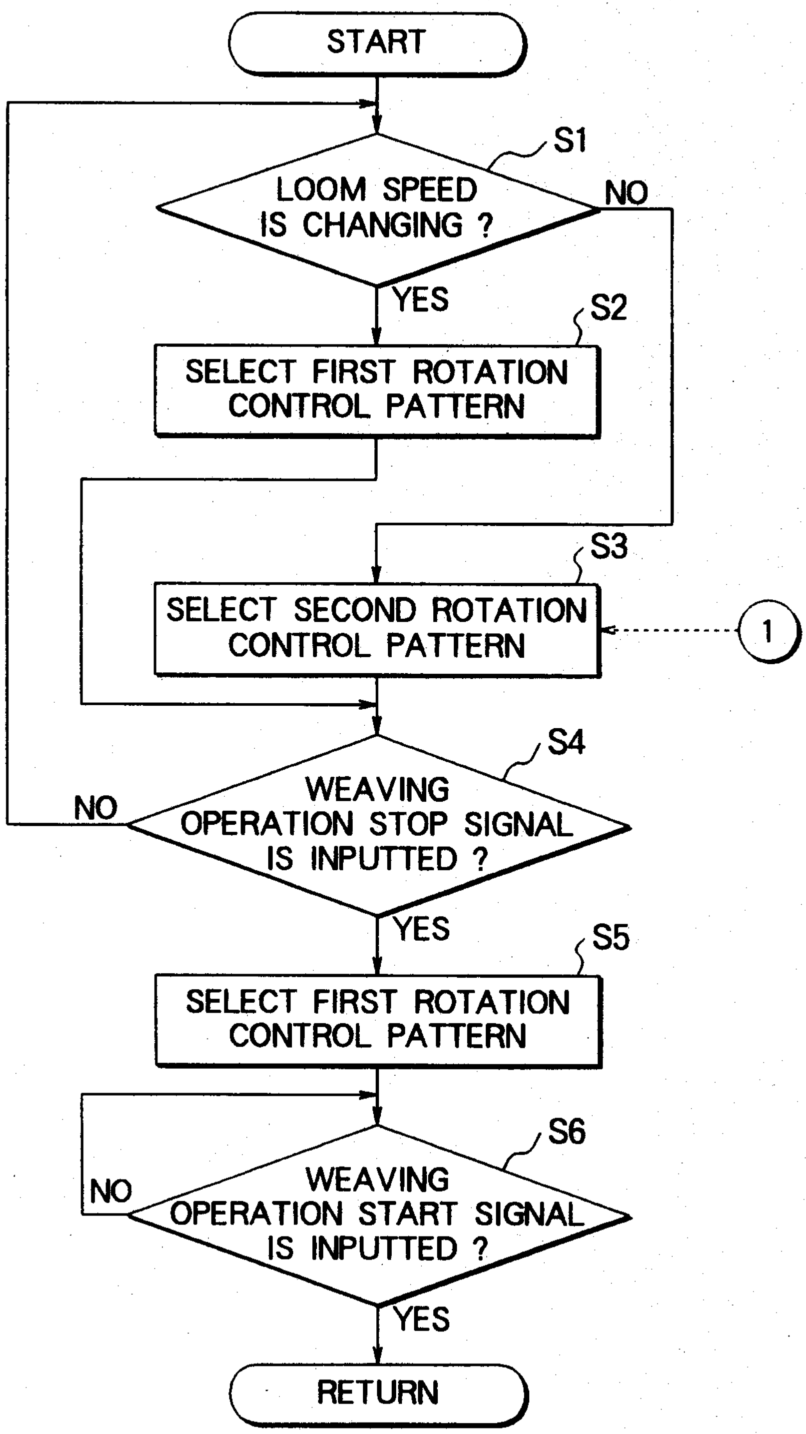

F1
F2
F3
F4
TIME
ROTATION ANGLE OF
SHEDDING DRIVE MOTOR
E2
TIME

FIG. 4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LOOM SPEED
IS CHANGING ?
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YES
S2
SELECT FIRST ROTATION
CONTROL PATTERN
S3
SELECT SECOND ROTATION
CONTROL PATTERN
1
S4
NO
WEAVING
OPERATION STOP SIGNAL
IS INPUTTED ?
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S5
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CONTROL PATTERN
S6
NO
WEAVING
OPERATION START SIGNAL
IS INPUTTED ?
YES
RETURN

FIG. 5

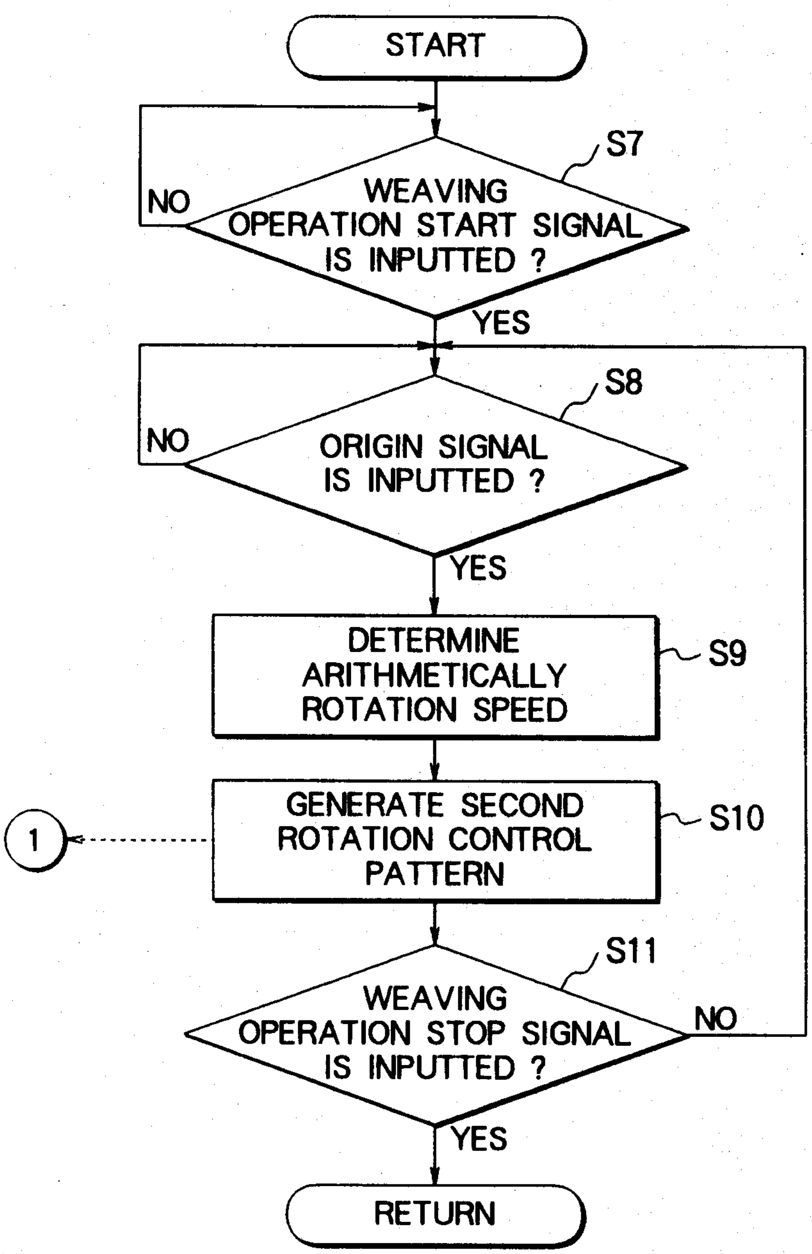

START
S7
WEAVING OPERATION START SIGNAL IS INPUTTED ?
NO
YES
S8
ORIGIN SIGNAL IS INPUTTED ?
NO
YES
DETERMINE ARITHMETICALLY ROTATION SPEED
S9
GENERATE SECOND ROTATION CONTROL PATTERN
S10
1
S11
WEAVING OPERATION STOP SIGNAL IS INPUTTED ?
NO
YES
RETURN

FIG. 6

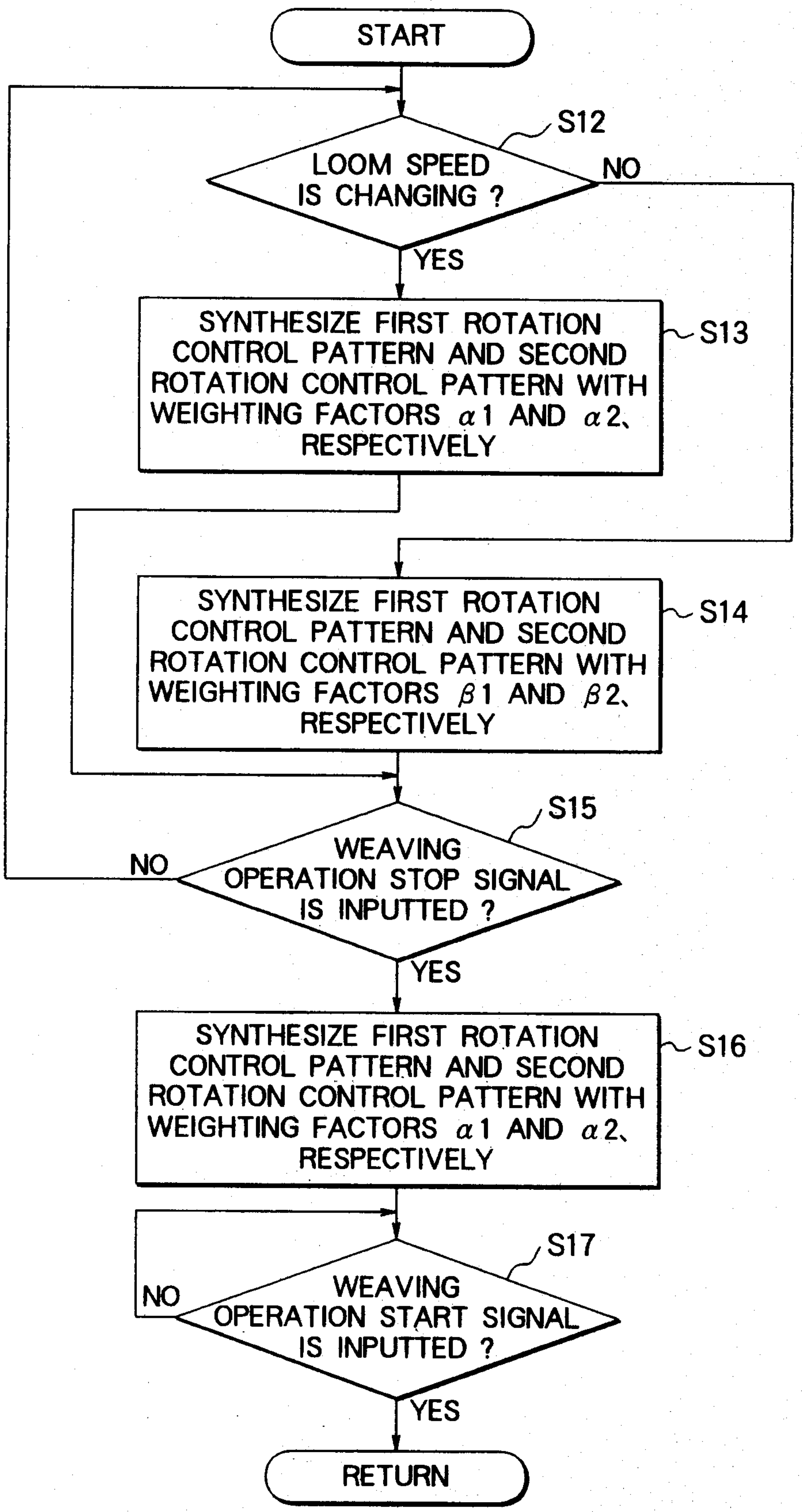
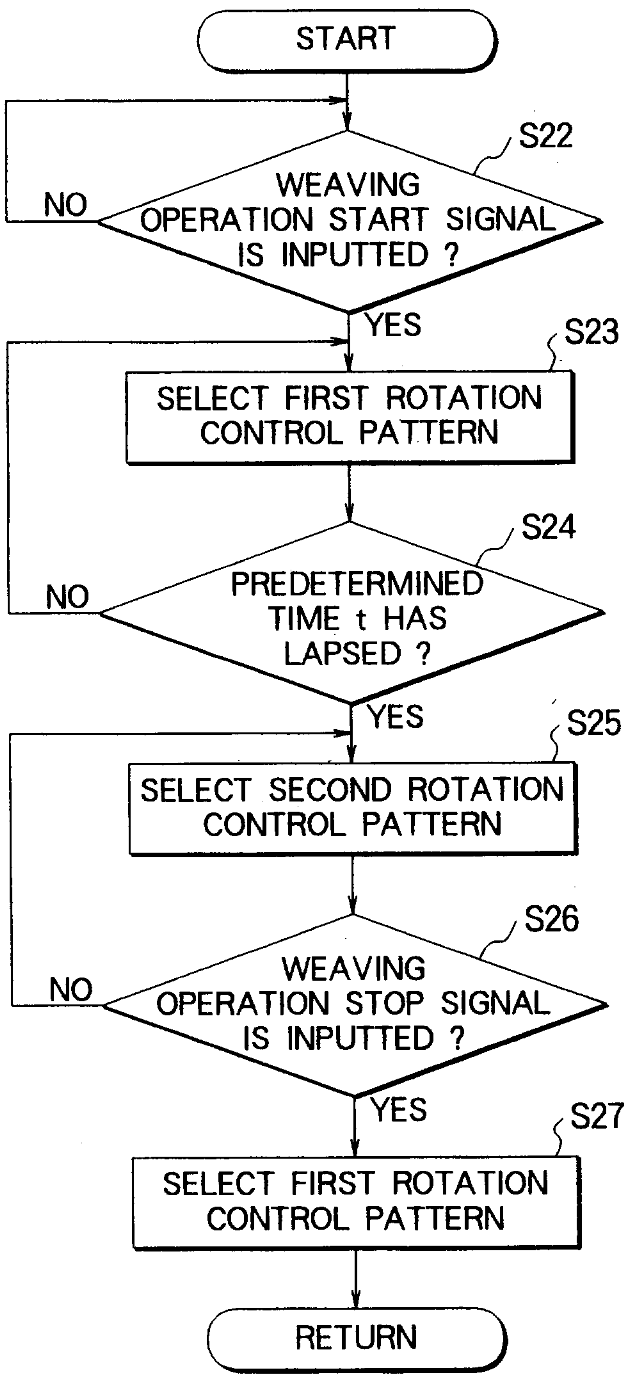

START
S12
LOOM SPEED IS CHANGING ?
NO
YES
SYNTHESIZE FIRST ROTATION CONTROL PATTERN AND SECOND ROTATION CONTROL PATTERN WITH WEIGHTING FACTORS α1 AND α2、RESPECTIVELY
S13
SYNTHESIZE FIRST ROTATION CONTROL PATTERN AND SECOND ROTATION CONTROL PATTERN WITH WEIGHTING FACTORS β1 AND β2、RESPECTIVELY
S14
S15
WEAVING OPERATION STOP SIGNAL IS INPUTTED ?
NO
YES
SYNTHESIZE FIRST ROTATION CONTROL PATTERN AND SECOND ROTATION CONTROL PATTERN WITH WEIGHTING FACTORS α1 AND α2、RESPECTIVELY
S16
S17
WEAVING OPERATION START SIGNAL IS INPUTTED ?
NO
YES
RETURN

FIG. 7


START
S22
WEAVING
OPERATION START SIGNAL
IS INPUTTED ?
NO
YES
S23
SELECT FIRST ROTATION
CONTROL PATTERN
S24
PREDETERMINED
TIME t HAS
LAPSED ?
NO
YES
S25
SELECT SECOND ROTATION
CONTROL PATTERN
S26
WEAVING
OPERATION STOP SIGNAL
IS INPUTTED ?
NO
YES
S27
SELECT FIRST ROTATION
CONTROL PATTERN
RETURN