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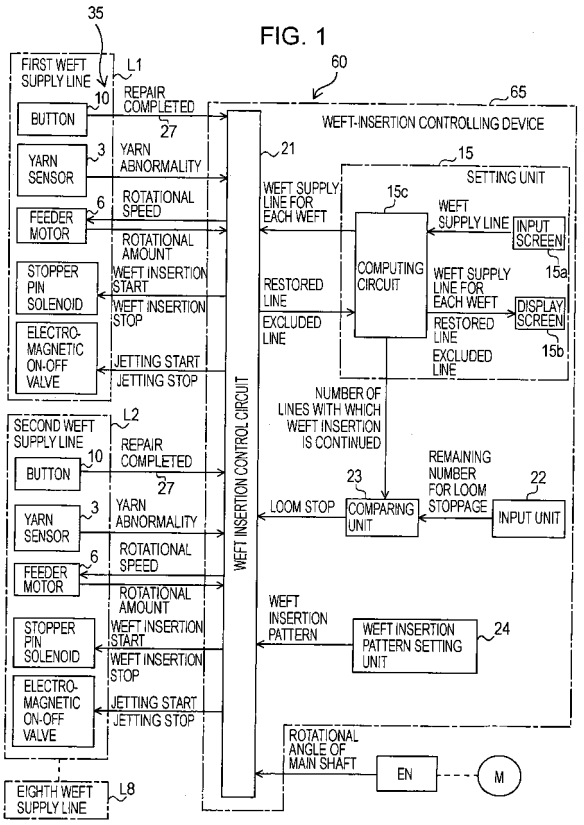
(54) Weft inserting apparatus in fluid jet loom

(57) A weft inserting apparatus (60, 70) for a fluid jet loom includes a plurality of weft supply lines (L), each having a yarn package (1), a weft measuring-and-retaining device (30), a weft-insertion nozzle (9), and a yarn sensor (3). The apparatus performs a weft insertion process by using the weft supply lines in a sequential alternating cycle. When a yarn abnormality is detected in a weft supply line, the apparatus excludes that weft supply line from the sequential alternating cycle and allows the weft insertion process to continue using only the remaining operable weft supply lines. Manually operated restoring means (35, 40) is connected to a weft-insertion controlling device (65, 75). The weft-insertion controlling device restores the excluded weft supply line on the basis of an output signal from the restoring means so that the excluded weft supply line is re-included in the sequential alternating cycle of the weft insertion process.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a weft inserting apparatus equipped with a plurality of weft supply lines in a fluid jet loom.

2. Description of the Related Art

[0002] A typical weft inserting apparatus in a fluid jet loom includes a plurality of weft supply lines, each having a yarn package, a weft measuring-and-retaining device, a weft-insertion nozzle, and a yarn sensor disposed upstream of the weft measuring-and-retaining device. A weft yarn in each weft supply line is carried and inserted into a warp shed by means of fluid discharged from the corresponding weft-insertion nozzle.

[0003] Each yarn sensor detects a yarn abnormality, such as when a yarn breaks in the yarn package or when the yarn is completely used up in the yarn package, and outputs a detection signal to a weft-insertion controlling device. Every time the weft-insertion controlling device receives such a detection signal, the loom is stopped. If the weft yarn in each yarn package is weak in strength, fuzzy, or short due to bulkiness, a yarn abnormality will often be detected, causing the loom to stop frequently. This lowers the operation rate of the loom as well as leading to a low quality of the woven cloth as a result of formation of weft bars.

[0004] Japanese Patent No. 2673447 discloses an apparatus for reducing frequent stopping of the loom to prevent the operation rate of the loom from lowering and to prevent weft bars from occurring. In this apparatus, a weft yarn of the same type is set on all of the weft supply lines, and the apparatus performs a weft insertion process by using the weft supply lines in a sequential alternating cycle. In addition, when a yarn abnormality, such as a yarn breakage, is detected in a weft supply line, that weft supply line is excluded from the sequential alternating cycle of the weft insertion process. The loom continues its operation without stopping until the yarn sensors of all the weft supply lines have detected yarn abnormalities.

[0005] Each weft measuring-and-retaining device includes a rotatable yarn guide and a motor that drives the rotatable yarn guide. A weft yarn from the corresponding yarn package extends through the rotatable yarn guide, and the motor rotates the rotatable yarn guide so as to wind the weft yarn around a retainer portion of the weft measuring-and-retaining device. In the apparatus discussed in Japanese Patent No. 2673447, when the number of weft supply lines excluded from the sequential alternating cycle of the weft insertion process increases, that is, when the number of operable weft supply lines used in the sequential alternating cycle for the weft insertion process decreases, the motor for the weft measuring-and-retaining device in each weft supply line involved in the weft insertion process needs to increase its rotational speed, or the stoppage time of the motor needs to be shortened if the motor is rotated intermittently. Thus, the motor will operate under a severe operating condition with a high heat value. If increasing the rotational speed will cause the motor to exceed its maximum rotational speed, the rotational speed cannot be increased any further. In that case, the operating speed of the loom must be reduced. Furthermore, the loom is not stopped until the yarn sensors in all the weft supply lines have detected yarn abnormalities. In other words, the loom will be stopped when the yarn sensors in all the weft supply lines have detected yarn abnormalities. For this reason, if the weft yarns in the yarn packages are weak in strength, fuzzy, or short due to bulkiness, all the yarn sensors will immediately detect yarn abnormalities, leading to a low operation rate of the loom and to a low quality of the woven cloth as a result of formation of weft bars.

SUMMARY OF THE INVENTION

[0006] Accordingly, it is an object of the present invention to provide a weft inserting apparatus in a fluid jet loom, which executes a weft insertion process by using a plurality of weft supply lines in a sequential alternating cycle, the weft inserting apparatus excluding a weft supply line detected as having a yarn abnormality from the sequential alternating cycle of the weft insertion process and allowing the weft insertion process to continue using only the remaining one or more weft supply lines, so as to prevent a motor for each weft measuring-and-retaining device from operating under a severe operating condition and to reduce the number of stoppages of the loom to enhance the operation rate of the loom and the quality of the woven cloth.

[0007] An aspect of the present invention provides a weft inserting apparatus for a fluid jet loom. The weft inserting apparatus includes a plurality of weft supply lines and a weft-insertion controlling device. Each weft supply line has a yarn package, a weft measuring-and-retaining device, a weft-insertion nozzle, and a yarn sensor disposed upstream of the weft measuring-and-retaining device. The weft-insertion controlling device performs a weft insertion process by using the weft supply lines in a sequential alternating cycle. When at least one of the yarn sensors detects a yarn abnormality in the corresponding weft supply line, the weft-insertion controlling device excludes the weft supply line from the sequential alternating cycle and allows the weft insertion process to continue using only the remaining one or more operable weft supply lines. The weft inserting apparatus is characterized in that manually operated restoring means is connected to the weft-insertion controlling device. While allowing the weft insertion process to continue without the excluded weft supply line using the remaining one or more operable weft supply lines; the weft-insertion con-

trolling device restores the excluded weft supply line on the basis of an output signal from the restoring means so that the excluded weft supply line is re-included in the sequential alternating cycle of the weft insertion process.

[0008] Accordingly, when the operator operates the restoring means, or more specifically, when the operator operates the restoring means after repairing the yarn, i.e. the weft yarn, in the excluded weft supply line or after replacing the yarn package with a new one, the restoring means outputs an output signal to the weft-insertion controlling device. Based on the output signal, the weft-insertion controlling device restores the excluded weft supply line so that it is re-included in the sequential alternating cycle of the weft insertion process. Accordingly, this increases the number of operable weft supply lines used in the sequential alternating cycle of the weft insertion process. For this reason, the motor for the weft measuring-and-retaining device in each weft supply line can reduce its rotational speed or the stoppage time of the motor can be extended if the motor is rotated intermittently. This alleviates the operating condition of the motor, whereby the motor can withstand a long period of use. On the other hand, if such restoring means is not provided, the number of operable weft supply lines used in the sequential alternating cycle of the weft insertion process will further decrease when the next yarn abnormality is detected. In that case, the motor will need to increase its rotational speed even further or the stoppage time thereof will need to be further shortened, leading to a more severe operating condition. There are also cases where the loom is stopped as a result of no operable weft supply lines being left for the weft insertion process. In contrast, according to the present invention, the excluded weft supply line is restored by manual operation so as to be re-included in the sequential alternating cycle of the weft insertion process. This not only alleviates the operating condition of the motor but also prevents the operating condition from becoming severe when the next weft abnormality is detected. Accordingly, this allows the motor to withstand a long period of use, and reduces stoppages of the loom.

[0009] Furthermore, the weft supply line excluded by the weft-insertion controlling device may include two or more weft supply lines, the weft-insertion controlling device allowing the weft insertion process to continue using the remaining one or more operable weft supply lines. The output signal output from the restoring means allows the weft-insertion controlling device to determine each of the two or more excluded weft supply lines.

[0010] Accordingly, the output signal output from the restoring means allows the weft-insertion controlling device to determine the corresponding one of the weft supply lines. Therefore, even when there are two or more excluded weft supply lines, the weft-insertion controlling device can determine each of the weft supply lines to be restored for re-inclusion into the sequential alternating cycle on the basis of the output signal from the restoring means.

[0011] Furthermore, the restoring means may include a plurality of restoring means provided in correspondence to the plurality of weft supply lines, the plurality of restoring means being connected to the weft-insertion controlling device via individual signal transmission paths.

[0012] Accordingly, the weft-insertion controlling device can determine which one of the weft supply lines is to be restored for re-inclusion into the sequential alternating cycle on the basis of the signal transmission path that has received the output signal.

[0013] Furthermore, the restoring means may include an output circuit that selectively outputs signals by which the weft supply lines are identifiable, the output circuit being connected to the weft-insertion controlling device via a common signal transmission path.

[0014] Accordingly, the output circuit of the restoring means outputs signals by which the weft supply lines are identifiable. Examples of the signals include pulse signals with different number of times of output in accordance with the respective weft supply lines, pulse signals with different voltage values in accordance with the respective weft supply lines, and pulse signals with different frequencies in accordance with the respective weft supply lines. Accordingly, the weft-insertion controlling device can determine the weft supply line to be restored for re-inclusion into the sequential alternating cycle on the basis of which one of the signals is output from the output circuit.

[0015] Furthermore, the plurality of weft supply lines may include three or more weft supply lines, and a plurality of weft supply lines included in the three or more weft supply lines may be set as a group, the group having a smaller number of weft supply lines than the total number of weft supply lines and having a weft of the same type set therein. A multicolor weft-insertion operation is performed using the plurality of weft supply lines in the group and a remaining one or more weft supply lines on the basis of a predetermined weft-insertion pattern. The weft insertion process for the weft of the type corresponding to the group is performed by sequentially alternating the weft supply lines in the group. The weft-insertion controlling device restores the excluded weft supply line in the group on the basis of the output signal from the restoring means so that the excluded weft supply line is re-included in the sequential alternating cycle of the weft insertion process.

[0016] Accordingly, a plurality of weft supply lines having a weft of the same type set therein is set as a group, and a multicolor weft-insertion operation is performed using the plurality of weft supply lines in the group and the remaining one or more weft supply lines on the basis of a predetermined weft-insertion pattern. Moreover, the weft insertion process for the weft of the type corresponding to the group can be performed by sequentially alternating the weft supply lines in the group. In that case, the weft-insertion controlling device restores the excluded weft supply line in the group on the basis of the output

signal from the restoring means so that the excluded weft supply line is re-included in the sequential alternating cycle of the weft insertion process. Accordingly, this prevents the operating condition of the motor for each weft measuring-and-retaining device from becoming severe when the next weft abnormality is detected in the weft supply lines within the group, thereby allowing the motor to withstand a long period of use and reducing stoppages of the loom.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a control block diagram of a weft inserting apparatus 60 according to a first embodiment of the present invention;

Fig. 2 illustrates an input screen 15a and a display screen 15b of a setting unit 15, and an input unit 22 according to the first embodiment;

Fig. 3 is a schematic view of the weft inserting apparatus 60;

Fig. 4 is a schematic view of the weft inserting apparatus 60 when a weft yarn C is broken;

Fig. 5 shows the display screen 15b when the weft yarn C is broken;

Fig. 6 shows numbers given to weft supply lines L with which weft insertions are performed;

Fig. 7 is a control block diagram of a weft inserting apparatus 70 according to a second embodiment of the present invention; and

Fig. 8 illustrates a selection screen 25 of restoring means 40 included in the weft inserting apparatus 70 according to the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Embodiments of the present invention will now be described with reference to the drawings. Figs. 1 to 5 illustrate a weft inserting apparatus 60 according to a first embodiment of the present invention, which is used in an air jet loom. The weft inserting apparatus 60 is of a multicolor type that performs weft insertion using a plurality of different types of weft yarns C based on a weft insertion pattern. The weft inserting apparatus 60 has a plurality of weft supply lines L that are divided into groups. Each group has the same type of weft C set therein. In each group, weft insertion is carried out by sequentially alternating the weft supply lines L. Fig. 1 is a control block diagram of the weft inserting apparatus 60. Fig. 2 illustrates an input screen 15a and a display screen 15b of a setting unit 15 used for dividing the weft supply lines L into groups. Fig. 3 is a schematic view of the weft inserting apparatus 60. Fig. 4 is a schematic view of the weft inserting apparatus 60 when a weft yarn C is broken. Fig. 5 shows the input screen 15a and the display screen 15b of the setting unit 15 when the weft yarn C is broken.

[0019] Referring to Fig. 3, the weft inserting apparatus 60 includes eight weft supply lines L, namely, a first weft supply line L1 to an eighth weft supply line L8. The first embodiment relates to an 8-color weft inserting apparatus 60 that can insert weft yarns C of up to eight different types.

[0020] Each weft supply line L includes a yarn package 1, yarn guides 11 and 12, a tensor 2, a weft measuring-and-retaining device 30, a yarn sensor 3, a yarn guide 13, and a weft-insertion nozzle 9. The yarn package 1 is mounted to a yarn peg (not shown). The yarn guides 11 and 12 guide a yarn (weft yarn C), released from the yarn package 1, downstream in a weft traveling direction. The tensor 2 is disposed between the yarn guides 11 and 12. The yarn sensor 3 is disposed between the yarn guide 12 and the weft measuring-and-retaining device 30. The yarn guide 13 is disposed downstream of the weft measuring-and-retaining device 30. The weft-insertion nozzle 9 is disposed downstream of the yarn guide 13, and an end of the weft-insertion nozzle 9 faces a warp shed S. The weft measuring-and-retaining device 30 includes a retainer drum 4, a rotatable yarn guide 5, a feeder motor 6, and a stopper pin 7 disposed downstream of the retainer drum 4. The rotatable yarn guide 5 receives the weft yarn C from the yarn package 1 having a pipe shape and is disposed upstream of the retainer drum 4 such that its downstream end faces the outer peripheral surface of the retainer drum 4. The feeder motor 6 drives the rotatable yarn guide 5. The stopper pin 7 disposed downstream of the retainer drum 4 advances towards or retreats from the retainer drum 4 as a result of being driven by a solenoid, so that the weft yarn C wound around the outer peripheral surface of the retainer drum 4 is non-releasable or releasable from the retainer drum 4. The length of the weft yarn C wound around the retainer drum 4 is equal to or greater than the length of weft yarn to be fed for one weft insertion. The weft measuring-and-retaining device 30 further includes a release sensor (not shown). The release sensor is disposed at the downstream end of the retainer drum 4 and detects the weft yarn C that is released from the retainer drum 4. In addition, each weft supply line L includes a button 10 serving as restoring means 35, which can be manually operated when the weft supply line L has been excluded from the other operable weft supply lines L being used in a sequential alternating cycle for the weft insertion process. In the first embodiment, the button 10 is mounted to an outer frame of the feeder motor 6. Furthermore, the yarn sensor 3 used in the first embodiment is a yarn breakage sensor that measures a contact pressure of the weft yarn C and outputs a yarn abnormality signal when the measured contact pressure falls below a predetermined threshold value. The breakage of weft yarn C detected by the yarn sensor 3 can occur upon releasing of the weft yarn C from the yarn package 1, that is, upon rotation of the rotatable yarn guide 5. A yarn breakage occurs between the yarn sensor 3 and the rotatable yarn guide 5, as shown in, for example, Fig. 4, at a location that is

upstream of the yarn wound around the outer peripheral surface of the retainer drum 4.

[0021] Referring to Fig. 1, a weft-insertion controlling device 65 included in the weft inserting apparatus 60 includes a weft-insertion controlling circuit 21, the setting unit 15, and a weft-insertion-pattern setting unit 24. The setting unit 15 includes an input screen 15a, a display screen 15b, and a computing circuit 15c, and is used for dividing the plurality of weft supply lines L into groups in accordance with the set wefts C, such that weft insertion is carried out in a sequential alternating cycle in each group. The weft-insertion controlling device 65 further includes an input unit 22 and a comparing unit 23. The weft-insertion controlling device 65 excludes a weft supply line L that has been detected as being abnormal from the sequential alternating cycle. Thus, when the number of weft supply lines in each group with which the weft insertion is continued reaches a predetermined remaining number, the operation of the loom is stopped.

[0022] Referring to Fig. 2, the input screen 15a and the display screen 15b of the setting unit 15 are provided within the same screen of an operation-condition input/display liquid crystal panel set in an operating panel. The input screen 15a is provided with a "weft supply line No." section 15ad serving as a selecting section for selecting each of the weft supply lines L. By touching a circular area given a certain number within the "weft supply line No." section 15ad, the weft supply line L that corresponds to that number can be selected. Circles displaying identifying colors of the respective wefts C are provided to the left of weft-C sections of the input screen 15a, namely, a "first weft C1" section, a "second weft C2" section, a "third weft C3" section, a "fourth weft C4" section, a "fifth weft C5" section, a "sixth weft C6" section, a "seventh weft C7" section, and an "eighth weft C8" section. The identifying colors of the circles for the respective wefts C are red, blue, yellow, brown, purple, green, pink, and orange. The colors are indicated by various patterns within the circles for convenience. The display screen 15b has eight circular areas that display numbers from 1 to 8. The numbers displayed in these circular areas correspond to the numbers given to the weft supply lines L. In other words, the No. 1 circular area corresponds to the first weft supply line L1, the No. 2 circular area corresponds to the second weft supply line L2, and so on. Each circular area is displayed in the same color as the identifying color for the corresponding weft C. Accordingly, the operator can determine by color which weft C is set in a weft supply line L of a certain number.

[0023] Based on a fabric specification and considering the frequency of weft insertion and the physical property of the wefts C, the number of weft supply lines L set in accordance with the wefts C is determined. The yarn packages 1 for the corresponding wefts C are set to the determined number of weft supply lines L. The fabric specification in the first embodiment relates to a four-color fabric including the first weft C1, the second weft C2, the third weft C3, and the fourth weft C4 as different types of wefts C, and has, for example, a weft-insertion pattern in which one weft insertion cycle is defined in the order: C1 → C2 → C3 → C4 → C1 → C2 → C1 → C3. In this weft-insertion pattern, the weft insertion of the first weft C1 is most frequently performed, and the weft insertion of the fourth weft C4 is least frequently performed. Thus, in the first embodiment, three weft supply lines L are set in correspondence to the first weft C1, two weft supply lines L are set in correspondence to the second weft C2, two weft supply lines L are set in correspondence to the third weft C3, and one weft supply line L is set in correspondence to the fourth weft C4. Consequently, the weft C that undergoes weft insertion with a higher frequency is set upon a larger number of weft supply lines L. In the first embodiment, based on an instruction that three weft supply lines L are to be set in correspondence to the first weft C1, two weft supply lines L are to be set in correspondence to the second weft C2, two weft supply lines L are to be set in correspondence to the third weft C3, and one weft supply line L is to be set in correspondence to the fourth weft C4; the operator sets the specified numbers of weft supply lines L in correspondence to the wefts C. As a result, the first weft C1 is set upon the first, second, and fifth weft supply lines L1, L2, L5, the second weft C2 is set upon the third and sixth weft supply lines L3, L6, the third weft C3 is set upon the fourth and seventh weft supply lines L4, L7, and the fourth weft C4 is set upon the eighth weft supply line L8.

[0024] Through the weft-insertion controlling device 65, the first, second, and fifth weft supply lines L1, L2, L5 corresponding to the first weft C1 are set as one group consisting of three weft supply lines L so that this group corresponds to the weft insertion of the first weft C1. Furthermore, the third and sixth weft supply lines L3, L6 corresponding to the second weft C2 are set as another group consisting of two weft supply lines L so that this group corresponds to the weft insertion of the second weft C2. Moreover, the fourth and seventh weft supply lines L4, L7 corresponding to the third weft C3 are set as another group consisting of two weft supply lines L so that this group corresponds to the weft insertion of the third weft C3. The eighth weft supply line L8 corresponding to the fourth weft C4 is set singularly as an independent weft supply line L that does not belong to a group so as to correspond to the weft insertion of the fourth weft C4.

[0025] This setting process in the weft-insertion controlling device 65 is carried out on the input screen 15a. The operator first touches a "setting start" section 15aa next to the "first weft (C1)" on the input screen 15a. This makes it possible to implement a setting process for the first weft C1, that is, to implement a setting process for the weft supply lines L with which weft insertion is to be performed when the first weft C1 is selected in accordance with the weft-insertion pattern. Subsequently, after making a selection by touching the circular area given the number 1 in the "weft supply line No." section 15ad, an "add" section 15ac is touched. This sets the first weft supply line L1 as a weft supply line L with which weft

insertion is to be performed when the first weft C1 is selected. At the same time, the first circular area in the display screen 15b turns red. Similarly, after touching the circular area given the number 2 in the "weft supply line No." section 15ad, the "add" section 15ac is touched. In addition, after touching the circular area given the number 5 in the "weft supply line No." section 15ad, the "add" section 15ac is touched. Then, a confirmation is made as to whether the circular areas given the numbers 1, 2, and 5 in the display screen 15b are all displayed in red, and the circular areas of the remaining numbers are not displayed in red. If any of the circular areas of the remaining numbers are displayed in red, the circular area corresponding to that number in the "weft supply line No." section 15ad is selected by touching, and a "delete" section 15ae is subsequently touched. This switches the red color of the circular area corresponding to that number in the display screen 15b to blue color, which is the identifying color for the subsequent second weft C2. Next, a "setting completed" section 15ab for the "first weft" is touched. Consequently, the first weft supply line L1, the second weft supply line L2, and the fifth weft supply line L5 are set as the weft supply lines L with which weft insertion is to be performed when the first weft C1 is selected. In other words, the first weft supply line L1, the second weft supply line L2, and the fifth weft supply line L5 are set as a weft supply line L group and are used in a sequential alternating cycle for performing weft insertion when the first weft C1 is selected in accordance with the weft-insertion pattern. With respect to the "second weft" on the input screen 15a, the same operation as that for the "first weft" is performed. When a confirmation is made as to whether the circular areas given the numbers 3 and 6 on the display screen 15b are displayed in blue, the "setting completed" section 15ab for the "second weft" is touched. Consequently, the third weft supply line L3 and the sixth weft supply line L6 are set as a weft supply line L group and are used in a sequential alternating cycle for performing weft insertion when the second weft C2 is selected in accordance with the weft-insertion pattern. The same operation is performed for the "third weft" on the input screen 15a. When a confirmation is made as to whether the circular areas given the numbers 4 and 7 on the display screen 15b are displayed in yellow, the "setting completed" section 15ab for the "third weft" is touched. Consequently, the fourth weft supply line L4 and the seventh weft supply line L7 are set as a weft supply line L group and are used in a sequential alternating cycle for performing weft insertion when the third weft C3 is selected in accordance with the weft-insertion pattern. Subsequently, after touching the "setting start" section 15aa for the "fourth weft" on the input screen 15a, the circular area given the number 8 in the "weft supply line No." section 15ad is touched. Then, the "add" section 15ac is touched. Consequently, the eighth weft supply line L8 is set as a weft supply line L with which weft insertion is to be performed when the fourth weft C4 is selected. At the same time, the circular area given the number 8 in the display screen 15b turns brown. When a confirmation is made as to whether the number 8 in the display screen 15b is displayed in brown, the "setting completed" section 15ab for the "fourth weft" is touched. Accordingly, this determines that only the eighth weft supply line L8 is set as a weft supply line L with which weft insertion is to be performed when the fourth weft C4 is selected. In other words, the eighth weft supply line L8 is set as an independent weft supply line L that does not belong to a group and is used for weft insertion every time the fourth weft C4 is selected in accordance with the weft-insertion pattern. Although selection is made for every weft supply line L to set each weft supply line L in accordance with its corresponding weft C, if a part of the previous weaving condition matches the current weaving condition and a weft supply line L is therefore already set to the corresponding weft C, the selecting and adding operations for that weft supply line L may be omitted.

[0026] Subsequently, using the input unit 22, the remaining number of weft supply lines L indicating when the operation will be stopped is set for each of the wefts C1, C2, C3, C4. The input unit 22 is provided on the same screen as the input screen 15a and the display screen 15b of the setting unit 15 and includes "remaining number for loom stoppage" sections 22a. Since the weft insertion of the first weft C1 is performed frequently, the number of weft supply lines L to become excluded due to detection of yarn abnormalities is large. When the number of normally operable weft supply lines with which weft insertion is continued is reduced to 1, that is, when the remaining number is 1 and the weft insertion of the first weft C1 is continued using only one weft supply line L, the operating condition of the feeder motor 6 for that weft supply line L becomes severe. For example, in a case where the weft insertion of the first weft C1 is carried out using three weft supply lines L in a sequential alternating cycle, assuming that each feeder motor 6 is operated at a rotational speed of 1000 rpm, if the weft insertion of the first weft C1 is continued using only one weft supply line L due to the remaining number being reduced to 1, it is necessary to drive the corresponding feeder motor 6 at a rotational speed of 3000 rpm, which is three times the rotational speed of 1000 rpm, if the stoppage time is not to be shortened. In some cases, even if the stoppage time is shortened, the rotational speed of the feeder motor 6 may exceed its maximum rotational speed. In that case, the operating speed of the loom must be reduced. In order to prevent the feeder motor 6 from operating under a severe operating condition in such a weft supply line L group where the weft insertion for the first weft C1 is carried out in a sequential alternating cycle, the operator sets the remaining number of weft supply lines L to indicate when the operation will be stopped.

[0027] The operator touches the "setting start" section 15aa for the "first weft" on the input screen 15a. This makes it possible to implement a setting process for the first weft C1. Next, the operator touches the corresponding "remaining number for loom stoppage" section 22a.

The number displayed changes every time the operator touches the section 22a, such that numbers 0 to 3 are displayed in the following order: 0 → 1 → 2 → 3 → 0 → 1 → 2 → 3. After changing the number to 1, the operator touches the corresponding "setting completed" section 15ab. Thus, for the first weft C1, a value "1" is set as the remaining number of operable weft supply lines L used in the sequential alternating cycle of the weft insertion process. Accordingly, the "setting start" sections 15aa and the "setting completed" sections 15ab are used both for the input unit 22 and the input screen 15a of the setting unit 15. Since the wefts other than the first weft C1 do not undergo weft insertion frequently, the remaining number is set to a value "0". This implies that until the weft supply lines L used for the weft insertion for those wefts C are completely used up, the loom is not stopped. As an alternative to setting a predetermined remaining number so that a loom stoppage signal is output when the number of weft supply lines with which weft insertion is continued reaches the set number, it is possible to set a number that is greater than the predetermined remaining number by one. In that case, the loom stoppage signal is output when the number of weft supply lines with which the weft insertion is continued falls below the set number by one. As a further alternative, the number of excluded weft supply lines may be set. In that case, the loom stoppage signal is output when the number of excluded weft supply lines becomes equal to the set value or greater than the set value by one, which is when the number of weft supply lines with which the weft insertion is continued reaches the predetermined remaining number.

[0028] The weft-insertion controlling device 65 will be described on the basis of the block diagram of Fig. 1 illustrating the multicolor weft inserting apparatus 60. In the setting unit 15, the weft supply lines L selected in accordance with the wefts C through the input screen 15a are set as groups of weft supply lines L and as an independent weft supply line L through the computing circuit 15c in accordance with the wefts C. In detail, the first weft supply line L1, the second weft supply line L2, and the fifth weft supply line L5 are set as one group consisting of three weft supply lines L. This group is made to correspond to the weft insertion of the first weft C1. The third weft supply line L3 and the sixth weft supply line L6 are set as another group consisting of two weft supply lines L. This group is made to correspond to the weft insertion of the second weft C2. The fourth weft supply line L4 and the seventh weft supply line L7 are set as another group consisting of two weft supply lines L. This group is made to correspond to the weft insertion of the third weft C3. The eighth weft supply line L8 is set as an independent weft supply line L that does not belong to a group and is made to correspond to the weft insertion of the fourth weft C4. The computing circuit 15c is configured to display the weft supply lines L in various colors on the display screen 15b, the various colors corresponding to the predetermined identifying colors for the wefts C. On the basis of information on these weft-insertion operation modes received from the computing circuit 15c, the weft-insertion controlling circuit 21 determines the order of weft supply lines L in each group to be used in a sequential alternating cycle for the weft insertion of the corresponding weft C. In the first embodiment, the weft-insertion controlling circuit 21 determines the order of weft supply lines L to be used in a sequential alternating cycle for the weft insertion of the first weft C1, the order being determined as follows: L1 → L2 → L5, that is, the first weft supply line L1 → the second weft supply line L2 → the fifth weft supply line L5 → the first weft supply line L1 → the second weft supply line L2 → the fifth weft supply line L5. Furthermore, the order of weft supply lines L to be used in a sequential alternating cycle for the weft insertion of the second weft C2 is determined as follows: L3 → L6, that is, the third weft supply line L3 → the sixth weft supply line L6 → the third weft supply line L3 → the sixth weft supply line L6. Furthermore, the order of weft supply lines L to be used in a sequential alternating cycle for the weft insertion of the third weft C3 is determined as follows: L4 → L7, that is, the fourth weft supply line L4 → the seventh weft supply line L7 → the fourth weft supply line L4 → the seventh weft supply line L7. The weft-insertion controlling circuit 21 includes a storage unit (not shown) that stores weft-insertion pattern information received from the weft-insertion-pattern setting unit 24. The weft-insertion controlling circuit 21 is connected to the buttons 10, the yarn sensors 3, the feeder motors 6, the solenoids of the stopper pins 7, and electromagnetic on-off valves included in the weft supply lines L. Each of the electromagnetic on-off valves intermittently supplies the corresponding weft-insertion nozzle 9 with air from a pneumatic source (not shown). The buttons 10 are provided as manually operable restoring means 35 and are connected to the weft-insertion controlling circuit 21 via individual signal lines, i.e. individual signal transmission paths 27.

[0029] When the loom starts its operation, the weft-insertion controlling circuit 21 reads out the weft C to be inserted from the stored weft-insertion pattern information. Based on the order of weft supply lines L to be used in a sequential alternating cycle for the weft insertion of that weft C, the weft-insertion controlling circuit 21 determines which one of the weft supply lines L is to be used for weft insertion every time a main shaft of the loom makes one rotation (i.e. one weft-insertion cycle). Based on information on the rotational angle of the loom main shaft (not shown) received from an encoder EN connected to a main motor M that drives the loom main shaft, the weft-insertion controlling circuit 21 drives, for a predetermined time, the electromagnetic on-off valve of the predetermined weft supply line L being used for the weft insertion, thereby starting and ending an air jetting process from the weft-insertion nozzle 9. In the first embodiment, a four-color fabric is to be formed using four types of wefts C, which are the first weft C1, the second weft C2, the third weft C3, and the fourth weft C4, and is formed based on a weft-insertion pattern which indicates

that one cycle consists of weft insertion processes performed in the order of C1 → C2 → C3 → C4 → C1 → C2 → C1 → C3. Thus, referring to Fig. 6, for each weft insertion process, the weft-insertion controlling circuit 21 executes weft insertion using a weft supply line L that corresponds to an indicated number.

[0030] When a yarn abnormality, such as a yarn breakage, is detected in a weft supply line L by the yarn sensor 3, the weft-insertion controlling circuit 21 receives a yarn abnormality signal. The weft-insertion controlling circuit 21 then excludes that weft supply line L from the sequential alternating cycle of the weft insertion process, so that the weft insertion process is continued using the remaining normally operable weft supply lines L. In the example shown in Fig. 6, a yarn abnormality is detected in the second weft supply line L2 after the 13th weft insertion. Therefore, the second weft supply line L2 is subject to exclusion. Accordingly, the 21st weft insertion is carried out using the fifth weft supply line L5 instead of the second weft supply line L2. Subsequently, the first weft supply line L1 and the fifth weft supply line L5 are used in a sequentially alternating cycle for weft insertion so that the weft insertion of the first weft C1 based on the weft-insertion pattern is continued.

[0031] Information on the excluded weft supply line L is input to the display screen 15b from the weft-insertion controlling circuit 21 via the computing circuit 15c. The excluded weft supply line L is then displayed on the display screen 15b. In the first embodiment, a lighting mode for the identifying color of the circular area corresponding to the excluded weft supply line L displayed on the display screen 15b is switched from a continuous lighting mode to a blinking lighting mode. Thus, referring to Fig. 5, the circular area given the number 2 and corresponding to the second weft supply line L2 is displayed blinkingly in red. Based on the continuous lighting mode of the two remaining red circular areas and the set value of 1 in the "remaining number for loom stoppage" section 22a for the "first weft" corresponding to the same red color, the operator is able to know that the loom will be stopped if a yarn abnormality is detected next in either one of the two weft supply lines L with which the weft insertion of the first weft C1 is being continued. Accordingly, the operator is able to know by color that the yarn package 1 of the second weft supply line L2 needs immediate repairing or replacement.

[0032] While the loom is in operation, the operator replaces the yarn package 1 or repairs the weft C of the excluded weft supply line L without stopping the loom. Subsequently, in order to re-include the repaired weft supply line L into the sequential alternating cycle of the weft insertion process, the operator operates the corresponding button 10 mounted to an external frame of the feeder motor 6. The weft-insertion controlling circuit 21 has a plurality of connections with respect to the signal transmission paths 27 of the buttons 10, and these connections are provided in correspondence to the weft supply lines L. By identifying which one of the connections has received an output signal, the weft-insertion controlling circuit 21 can determine the corresponding weft supply line L. The weft-insertion controlling circuit 21 identifies which one of the buttons 10 has sent an output signal, or in other words, identifies which one of the connections has received a repair completion signal so as to determine the corresponding weft supply line L. The weft-insertion controlling circuit 21 restores the determined weft supply line L so that the weft supply line L is re-included in the sequential alternating cycle of the weft insertion process. In the example shown in Fig. 6, the button 10 is operated after the 85th weft insertion. From the 89th weft insertion onward, the second weft supply line L2 is re-included in the sequential alternating cycle of the weft insertion process for the first weft C1. Furthermore, based on information received from the weft-insertion controlling circuit 21, which indicates the re-inclusion of the repaired weft supply line L into the sequential alternating cycle, the computing circuit 15c allows the lighting mode for the identifying color of the circular area corresponding to the re-included weft supply line L to return to continuous lighting on the display screen 15b.

[0033] Unless the repairing or replacement of the yarn package 1 in the excluded weft supply line L is carried out before the number of normally operable weft supply lines L with which the weft insertion is being continued reaches the set remaining number, the loom will be stopped when a next yarn abnormality occurs. In other words, based on information on the excluded-but-reincluded weft supply line L received from the weft-insertion controlling circuit 21 and information on the weft supply lines L in each group for the corresponding weft C, the computing circuit 15c calculates the number of operable weft supply lines with which the weft insertion of the corresponding weft C is being continued. The number of operable weft supply lines is calculated by the computing circuit 15c for each group, and is output to the comparing unit 23. The comparing unit 23 compares the remaining number set by the input unit 22 with the number of operable weft supply lines, received from the computing circuit 15c, for each of the groups set in correspondence to the wefts C. When the number of operable weft supply lines for any one of the groups reaches a predetermined remaining number, that is, the remaining number set in the corresponding "remaining number for loom stoppage" section 22a in the first embodiment, a loom stoppage signal is output to the weft-insertion controlling circuit 21 to stop the loom.

[0034] In the first embodiment, the weft-insertion controlling circuit 21 reads out the weft C to be inserted from the stored weft-insertion pattern information. Based on the determined order of weft supply lines L to be used in a sequential alternating cycle for the weft insertion of that weft C, the weft-insertion controlling circuit 21 determines which one of the weft supply lines L is to be used for performing the weft insertion every time a main shaft of the loom makes one rotation (i.e. one weft-insertion cycle). Every time a weft supply line L is excluded due to

detection of a yarn abnormality, or every time an excluded weft supply line L is repaired and restored for re-inclusion, the order of operable weft supply lines L used in a sequential alternating cycle for the weft insertion process is changed. Alternatively, on the basis of the weft-insertion pattern information and the order of the weft supply lines L for each weft C, the weft-insertion controlling circuit 21 may program and preliminarily determine over a plurality of weft-insertion cycles which of the weft supply lines L are to be used for performing the respective weft insertions. In that case, every time a weft supply line L is excluded due to detection of a yarn abnormality, or every time an excluded weft supply line L is repaired and restored for re-inclusion, the programming is changed.

[0035] In the first embodiment, the restoring means 35 that can be manually operated is defined by the buttons 10 that are provided in correspondence to the respective weft supply lines L. Each button 10 is connected to the weft-insertion controlling circuit 21 via the designated signal transmission path 27. Alternatively, the restoring means may have an output circuit that can selectively output signals by which the weft supply lines L are identifiable. In that case, the output circuit may be connected to the weft-insertion controlling circuit 21 via a common signal transmission path.

[0036] A multicolor weft inserting apparatus 70 according to a second embodiment of the present invention will now be described with reference to Figs. 7 and 8. The weft inserting apparatus 70 is equipped with restoring means 40 that includes an output circuit 26 and a common signal transmission path 28, which are similar to those mentioned above. Similar to the multicolor weft inserting apparatus 60 according to the first embodiment, the multicolor weft inserting apparatus 70 is of an 8-color type that includes eight weft supply lines L.

[0037] Referring to a control block diagram of Fig. 7, the weft inserting apparatus 70 has a weft-insertion controlling device 75 which includes the weft-insertion controlling circuit 21, the setting unit 15 for dividing the plurality of weft supply lines L into groups, the input unit 22, the comparing unit 23, and the weft-insertion-pattern setting unit 24. In addition, the weft-insertion controlling device 75 includes a selection screen 25 and the output circuit 26, which constitute the restoring means 40 for restoring a repaired weft supply line L so as to re-include the repaired weft supply line L into the sequential alternating cycle of the weft insertion process.

[0038] Referring to Fig. 8, the selection screen 25 of the restoring means 40 is provided within the same screen as the input screen 15a and the display screen 15b of the setting unit 15 in an operation-condition input/display liquid crystal panel set in an operating panel. While the loom is in operation, the operator repairs a weft C set on a weft supply line L excluded from the sequential alternating cycle of the weft insertion process or performs replacement of the yarn package 1 in the excluded weft supply line L. Subsequently, in order to re-include the repaired weft supply line L into the sequential alternating cycle, the operator touches a "restore select" section 25a on the selection screen 25. This makes it possible to select the weft supply line L. The selection screen 25 has a selecting section, that is, the "weft supply line No." section 15ad, which is mutually used for the input screen 15a of the setting unit 15. While referring to a circular area displayed in a blinking lighting mode on the display screen 15b of the setting unit 15, the operator touches the corresponding circular area in the "weft supply line No." section 15ad, thereby selecting the weft supply line L to be re-included into the sequential alternating cycle of the weft insertion process. In a case where there are two or more circular areas displayed in a blinking lighting mode on the display screen 15b, the operator must be careful not to select weft supply lines L other than the currently repaired weft supply line L. Subsequently, the operator touches a "restore enter" section 25b. Consequently, based on the selected weft supply line L, the output circuit 26 outputs different output signals in accordance with the respective weft supply lines L to the weft-insertion controlling circuit 21 via the common signal transmission path 28. Examples of the different output signals include pulse signals with different number of times of output in accordance with the respective weft supply lines L, pulse signals with different voltage values in accordance with the respective weft supply lines L, and pulse signals with different frequencies in accordance with the respective weft supply lines L. The weft-insertion controlling circuit 21 identifies the signals received from the output circuit 26 and determines which one of the weft supply lines L is to be re-included into the sequential alternating cycle. Similar to the first embodiment, the weft-insertion controlling circuit 21 restores this determined weft supply line L so as to re-include the weft supply line L into the sequential alternating cycle of the weft insertion process.

[0039] In the second embodiment, the restoring means 40 that can be manually operated is constituted by the selection screen 25, the output circuit 26, and the common signal transmission path 28. Unlike the first embodiment where the buttons 10 are provided as the restoring means 35, the second embodiment is not provided with manually operated switches in the respective weft supply lines L. Alternatively, in addition to the selection screen 25, the output circuit 26, and the common signal transmission path 28, the restoring means 40 may be provided with such manually operated switches in the respective weft supply lines L. In that case, the selection screen 25 or one of the switches that corresponds to a repaired weft supply line L is manually operated to re-include the weft supply line L into the sequential alternating cycle of the weft insertion process.

[0040] In the second embodiment, even when a weft abnormality is detected in one weft supply line L in each of the group for the first weft C1, the group for the second weft C2, and the group for the third weft C3 such that two or more weft supply lines L or a maximum of three weft supply lines L are excluded, the loom will still continue

its operation. However, in a weft inserting apparatus with a small number of weft supply lines L where the operation of the loom is stopped when weft abnormalities are detected in two of the weft supply lines L, it is not necessary to determine which of the weft supply lines L have been repaired. In that case, the restoring means may be constituted by the common signal transmission path 28 and manually operated switches or a screen.

[0041] Although the weft inserting apparatuses 60, 70 according to the first and second embodiments are of a multicolor type that performs weft insertion using a plurality of different types of weft yarns C based on a weft insertion pattern, the weft inserting apparatus according to the present invention may be of a single-color type in which weft yarns C of the same type are all set on a plurality of weft supply lines L. In that case, a weft supply line L with an abnormality in the weft C detected by the yarn sensor 3 is excluded and the weft insertion process is continued using only the remaining weft supply lines L. At the same time, the restoring means 35 or 40 is manually operated so that the weft supply line L with the weft C repaired is re-included into the sequential alternating cycle of the weft insertion process.

[0042] The technical scope of the present invention is not limited to the above embodiments, and modifications are permissible to an extent that they do not depart from the scope of the claimed invention.

Claims

1. A weft inserting apparatus (60, 70) for a fluid jet loom, the apparatus (60, 70) including a plurality of weft supply lines (L) and a weft-insertion controlling device (65, 75), each weft supply line (L) having a yarn package (1), a weft measuring-and-retaining device (30), a weft-insertion nozzle (9), and a yarn sensor (3) disposed upstream of the weft measuring-and-retaining device (30), wherein the weft-insertion controlling device (65, 75) performs a weft insertion process by using the weft supply lines (L) in a sequential alternating cycle, and wherein when at least one of the yarn sensors (3) detects a yarn abnormality in the corresponding weft supply line (L), the weft-insertion controlling device (65, 75) excludes the weft supply line (L) from the sequential alternating cycle and allows the weft insertion process to continue using only the remaining one or more operable weft supply lines (L),
wherein the weft inserting apparatus (60, 70) is **characterized in that** manually operated restoring means (35, 40) is connected to the weft-insertion controlling device (65, 75), and wherein while allowing the weft insertion process to continue without the excluded weft supply line (L) using the remaining one or more operable weft supply lines (L), the weft-insertion controlling device (65, 75) restores the excluded weft supply line (L) on the basis of an output signal from the restoring means (35, 40) so that the excluded weft supply line (L) is re-included in the sequential alternating cycle of the weft insertion process.

2. The weft inserting apparatus (60, 70) according to Claim 1, wherein the weft supply line (L) excluded by the weft-insertion controlling device (65, 75) comprises two or more weft supply lines (L), the weft-insertion controlling device (65, 75) allowing the weft insertion process to continue using the remaining one or more operable weft supply lines (L), and wherein the output signal output from the restoring means (35, 40) allows the weft-insertion controlling device (65, 75) to determine each of said two or more weft supply lines (L).

3. The weft inserting apparatus (60, 70) according to Claim 2, wherein the restoring means (35, 40) comprises a plurality of restoring means (35) provided in correspondence to the plurality of weft supply lines (L), the plurality of restoring means (35) being connected to the weft-insertion controlling device (65) via individual signal transmission paths (27).

4. The weft inserting apparatus (60, 70) according to Claim 2, wherein the restoring means (40) includes an output circuit (26) that selectively outputs signals by which the weft supply lines (L) are identifiable, the output circuit (26) being connected to the weft-insertion controlling device (75) via a common signal transmission path (28).

5. The weft inserting apparatus (60, 70) according to any one of Claims 1 to 4, wherein the plurality of weft supply lines (L) comprises three or more weft supply lines, wherein a plurality of weft supply lines included in said three or more weft supply lines is set as a group, the group having a smaller number of weft supply lines than the total number of weft supply lines and having a weft of the same type set therein, wherein a multicolor weft-insertion operation is performed using the plurality of weft supply lines in the group and a remaining one or more weft supply lines on the basis of a predetermined weft-insertion pattern, wherein the weft insertion process for the weft of the type corresponding to the group is performed by sequentially alternating the weft supply lines in the group, and wherein the weft-insertion controlling device (65, 75) restores said excluded weft supply line (L) in the group on the basis of the output signal from the restoring means (35, 40) so that said excluded weft supply line is re-included in the sequential alternating cycle of the weft insertion process.

FIG. 1

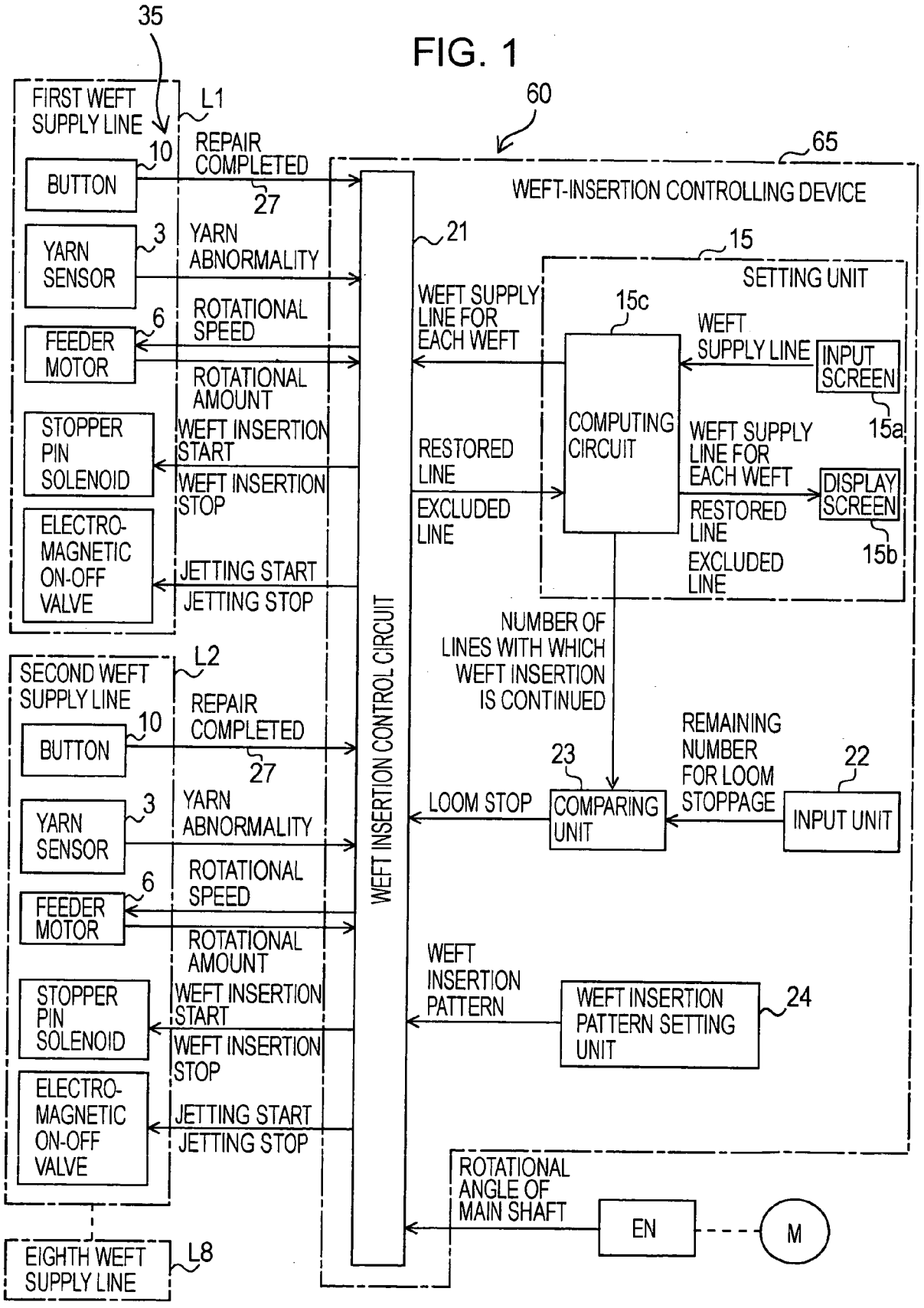

35
60
65
FIRST WEFT SUPPLY LINE
L1
10
BUTTON
REPAIR COMPLETED
27
3
YARN SENSOR
YARN ABNORMALITY
6
FEEDER MOTOR
ROTATIONAL SPEED
ROTATIONAL AMOUNT
STOPPER PIN SOLENOID
WEFT INSERTION START
WEFT INSERTION STOP
ELECTRO-MAGNETIC ON-OFF VALVE
JETTING START
JETTING STOP
SECOND WEFT SUPPLY LINE
L2
EIGHTH WEFT SUPPLY LINE
L8
WEFT INSERTION CONTROL CIRCUIT
21
WEFT-INSERTION CONTROLLING DEVICE
15
SETTING UNIT
15c
WEFT SUPPLY LINE FOR EACH WEFT
COMPUTING CIRCUIT
WEFT SUPPLY LINE
INPUT SCREEN
15a
RESTORED LINE
EXCLUDED LINE
DISPLAY SCREEN
15b
NUMBER OF LINES WITH WHICH WEFT INSERTION IS CONTINUED
REMAINING NUMBER FOR LOOM STOPPAGE
22
23
LOOM STOP
COMPARING UNIT
INPUT UNIT
WEFT INSERTION PATTERN
WEFT INSERTION PATTERN SETTING UNIT
24
ROTATIONAL ANGLE OF MAIN SHAFT
EN
M

FIG. 2

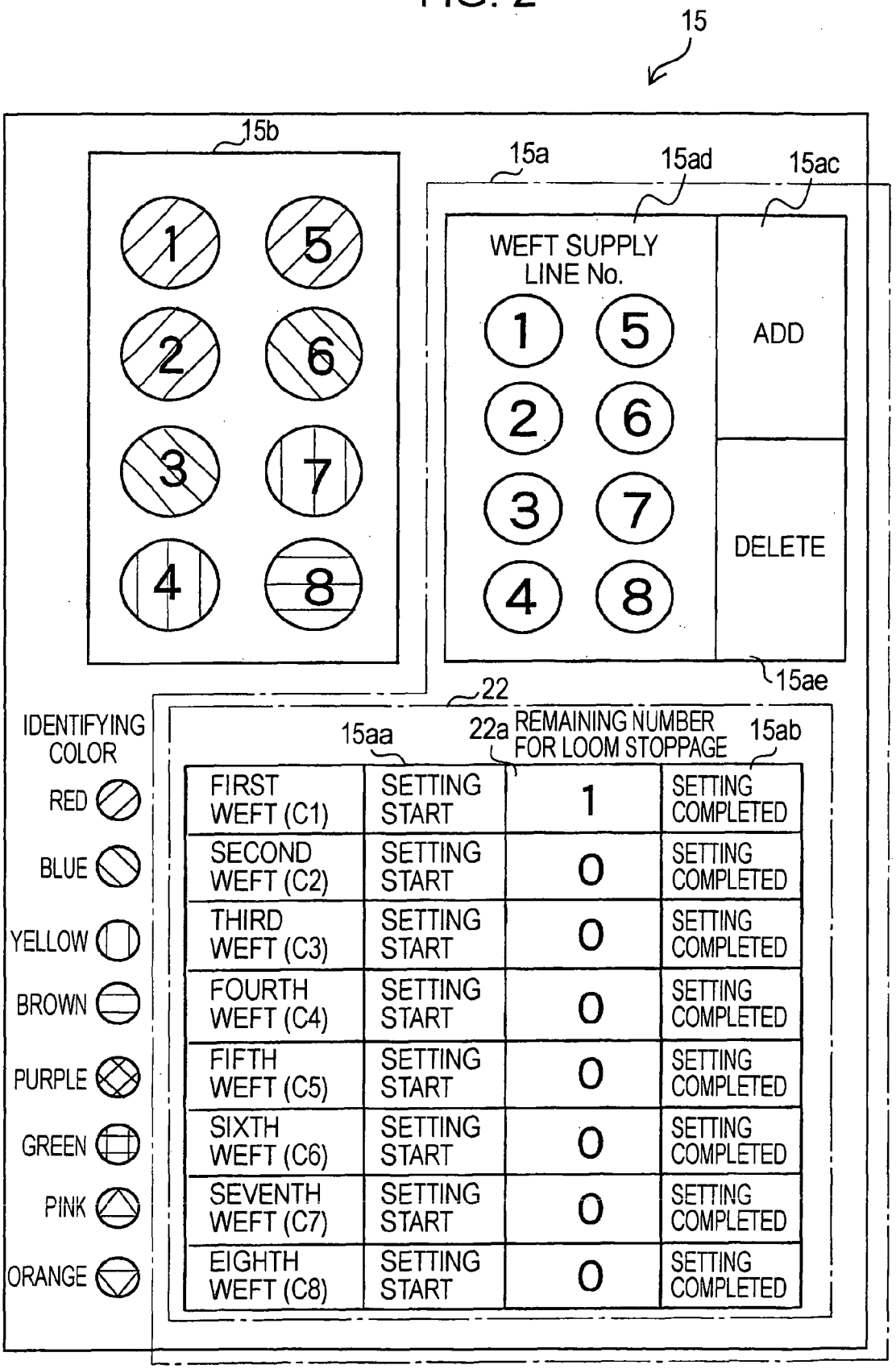

15
15b
15a
15ad
15ac
1
5
2
6
3
7
4
8
WEFT SUPPLY LINE No.
ADD
DELETE
15ae
22
IDENTIFYING COLOR
RED
BLUE
YELLOW
BROWN
PURPLE
GREEN
PINK
ORANGE
15aa
22a
REMAINING NUMBER FOR LOOM STOPPAGE
15ab
FIRST WEFT (C1) SETTING START 1 SETTING COMPLETED
SECOND WEFT (C2) SETTING START 0 SETTING COMPLETED
THIRD WEFT (C3) SETTING START 0 SETTING COMPLETED
FOURTH WEFT (C4) SETTING START 0 SETTING COMPLETED
FIFTH WEFT (C5) SETTING START 0 SETTING COMPLETED
SIXTH WEFT (C6) SETTING START 0 SETTING COMPLETED
SEVENTH WEFT (C7) SETTING START 0 SETTING COMPLETED
EIGHTH WEFT (C8) SETTING START 0 SETTING COMPLETED

FIG. 3

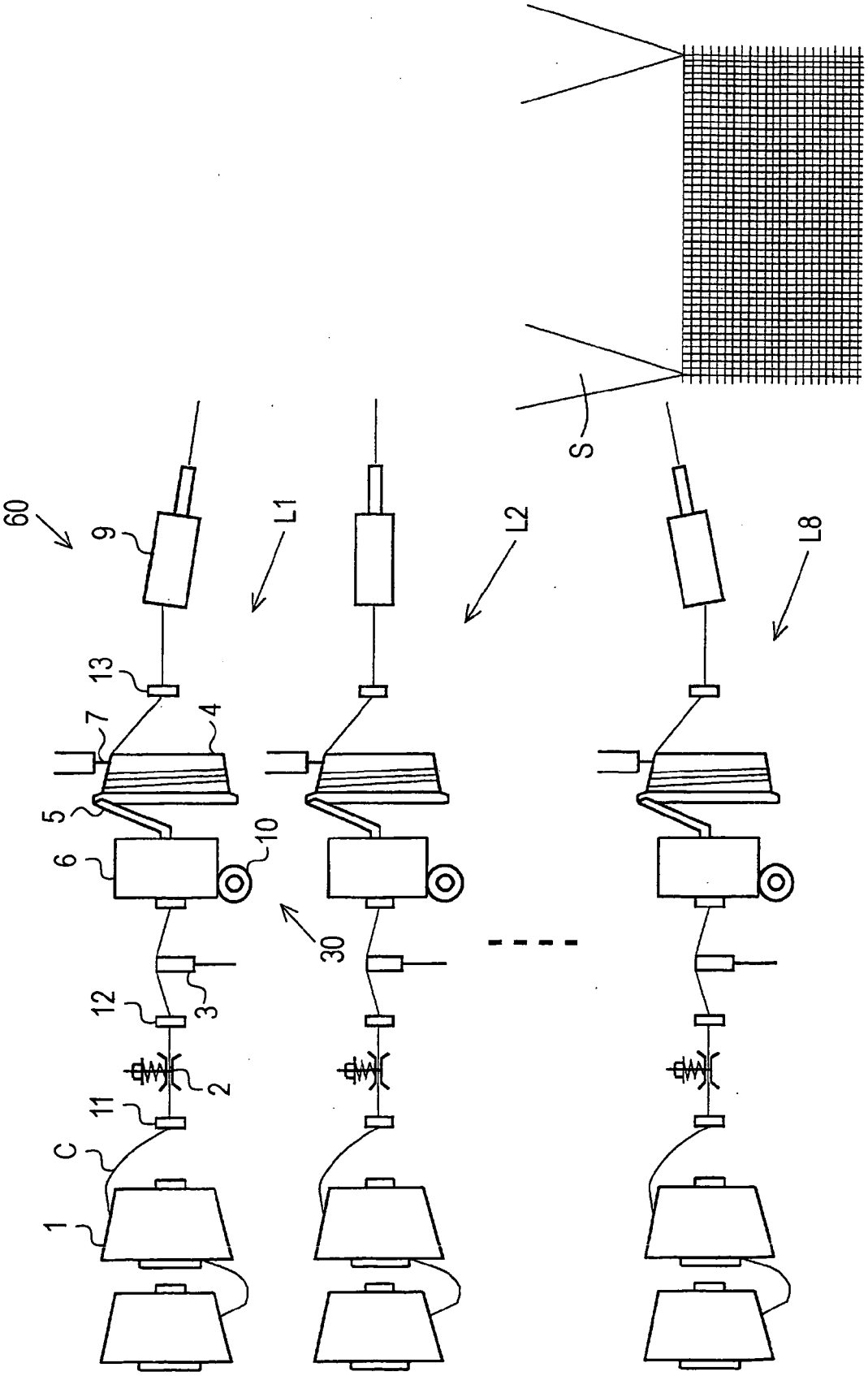


FIG. 4

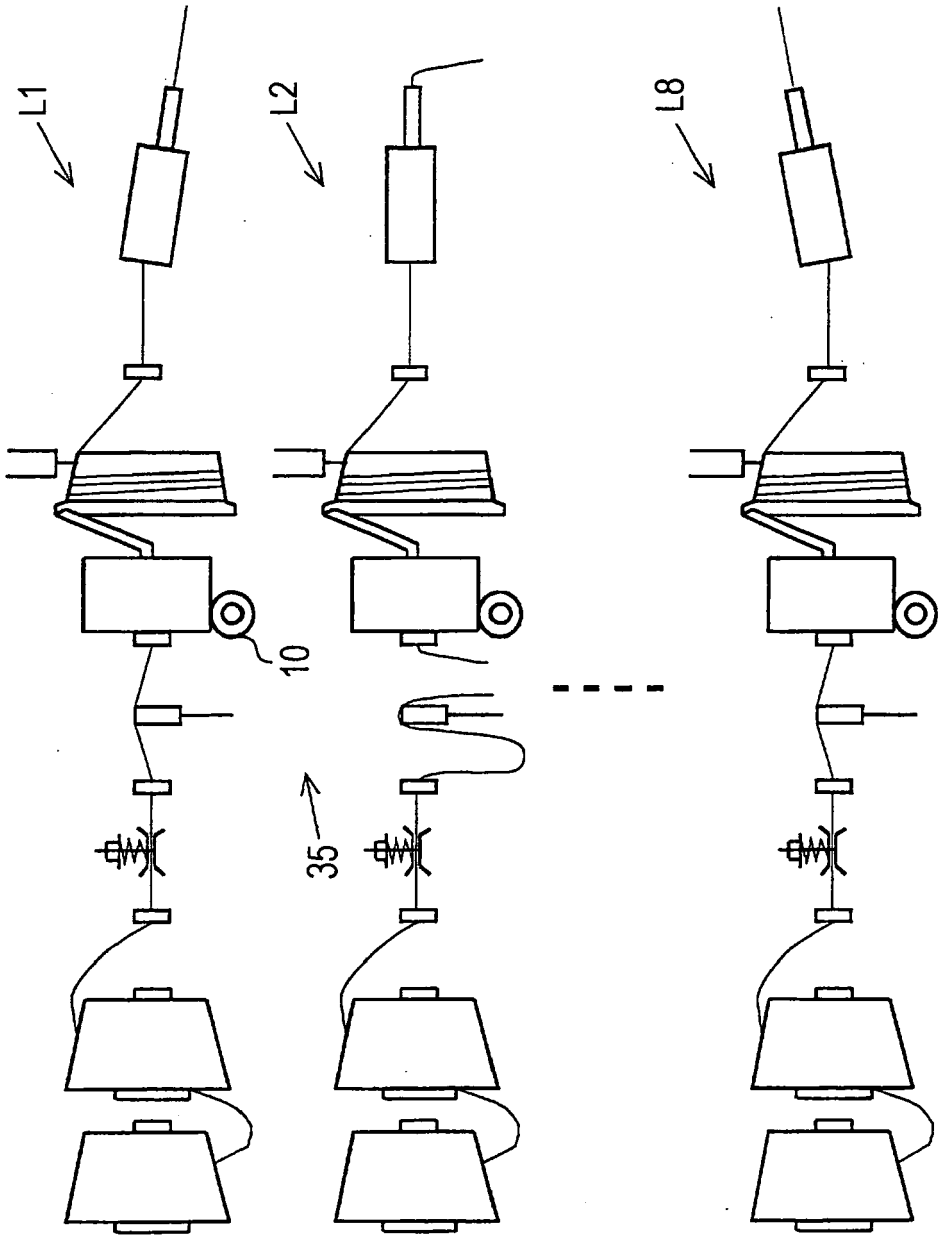
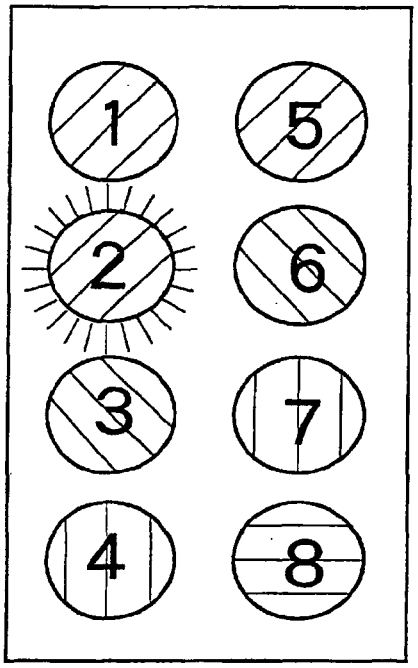
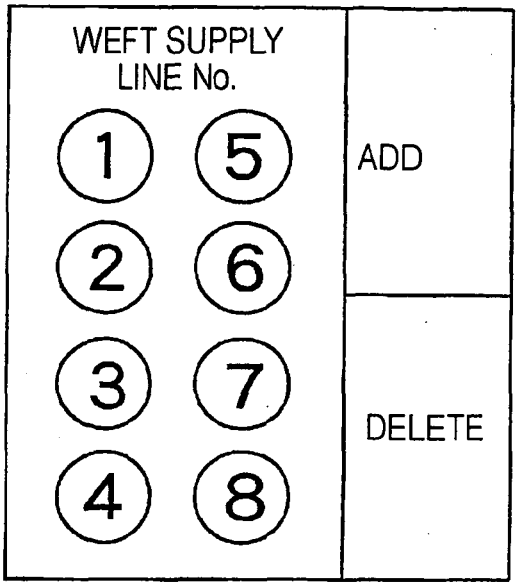


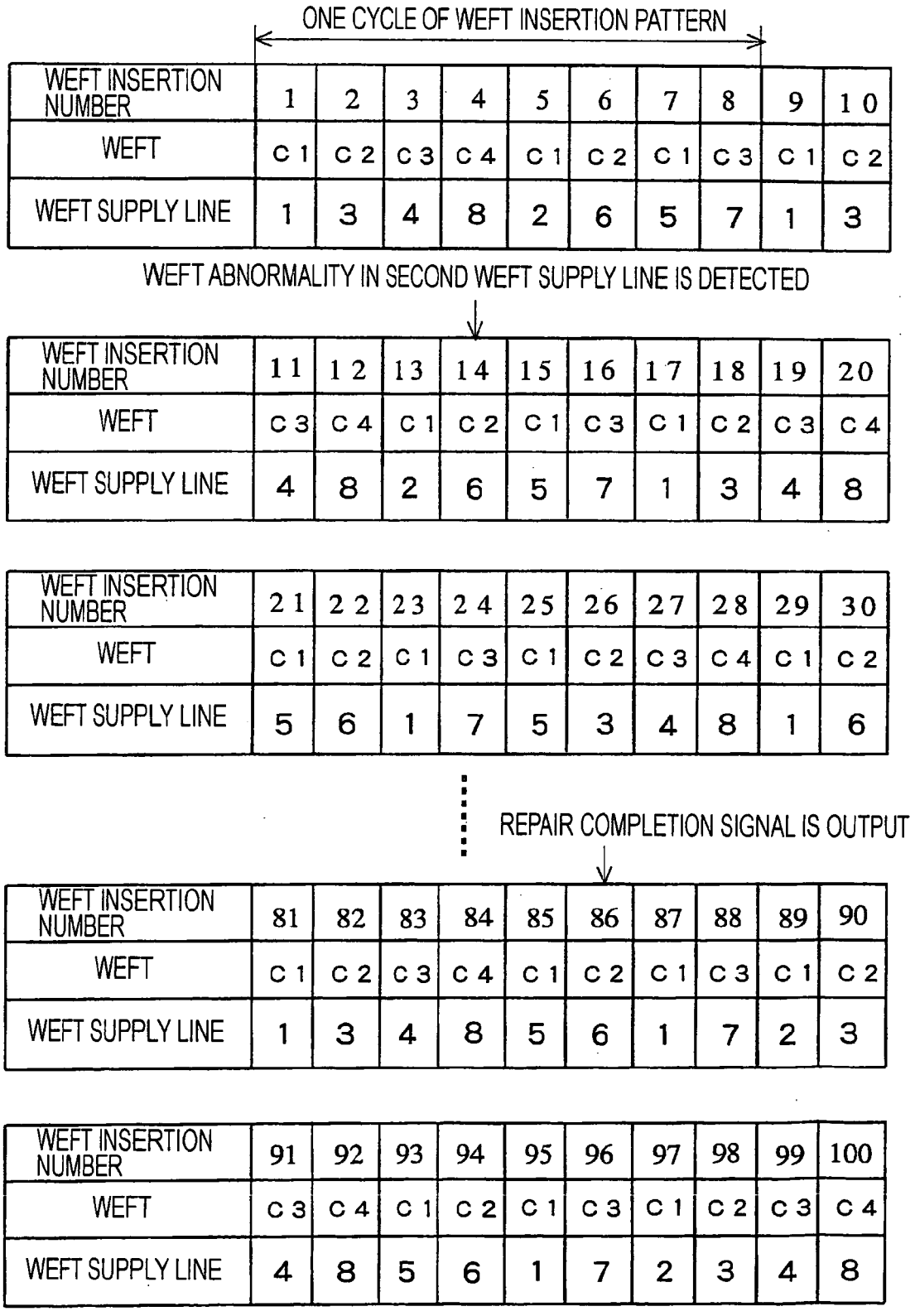
FIG. 5





		REMAINING NUMBER FOR LOOM STOPPAGE	
FIRST WEFT (C1)	SETTING START	1	SETTING COMPLETED
SECOND WEFT (C2)	SETTING START	0	SETTING COMPLETED
THIRD WEFT (C3)	SETTING START	0	SETTING COMPLETED
FOURTH WEFT (C4)	SETTING START	0	SETTING COMPLETED
FIFTH WEFT (C5)	SETTING START	0	SETTING COMPLETED
SIXTH WEFT (C6)	SETTING START	0	SETTING COMPLETED
SEVENTH WEFT (C7)	SETTING START	0	SETTING COMPLETED
EIGHTH WEFT (C8)	SETTING START	0	SETTING COMPLETED

FIG. 6



WEFT INSERTION NUMBER	1	2	3	4	5	6	7	8	9	10
WEFT	C1	C2	C3	C4	C1	C2	C1	C3	C1	C2
WEFT SUPPLY LINE	1	3	4	8	2	6	5	7	1	3

WEFT INSERTION NUMBER	11	12	13	14	15	16	17	18	19	20
WEFT	C3	C4	C1	C2	C1	C3	C1	C2	C3	C4
WEFT SUPPLY LINE	4	8	2	6	5	7	1	3	4	8

WEFT INSERTION NUMBER	21	22	23	24	25	26	27	28	29	30
WEFT	C1	C2	C1	C3	C1	C2	C3	C4	C1	C2
WEFT SUPPLY LINE	5	6	1	7	5	3	4	8	1	6

WEFT INSERTION NUMBER	81	82	83	84	85	86	87	88	89	90
WEFT	C1	C2	C3	C4	C1	C2	C1	C3	C1	C2
WEFT SUPPLY LINE	1	3	4	8	5	6	1	7	2	3

WEFT INSERTION NUMBER	91	92	93	94	95	96	97	98	99	100
WEFT	C3	C4	C1	C2	C1	C3	C1	C2	C3	C4
WEFT SUPPLY LINE	4	8	5	6	1	7	2	3	4	8

FIG. 7

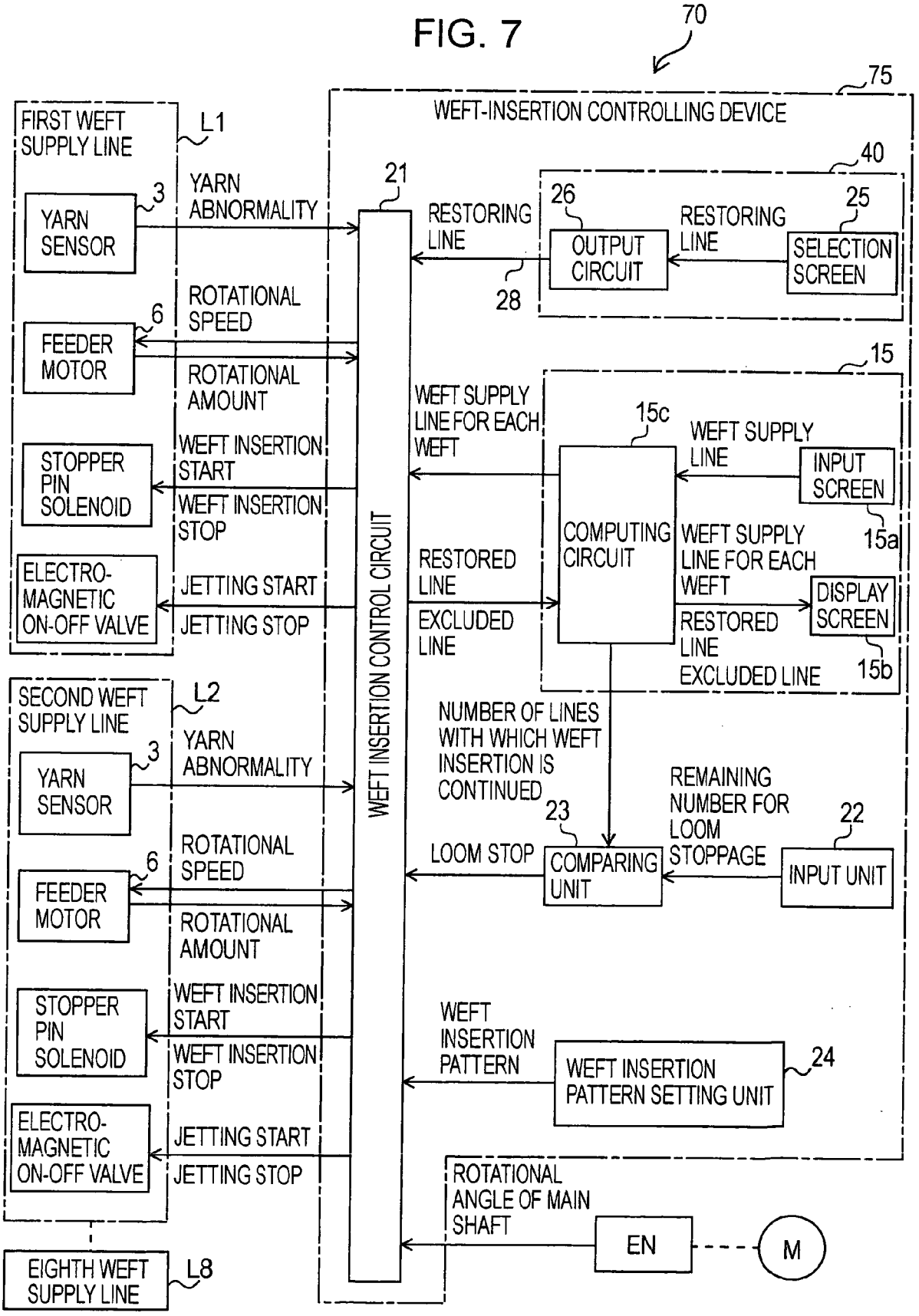
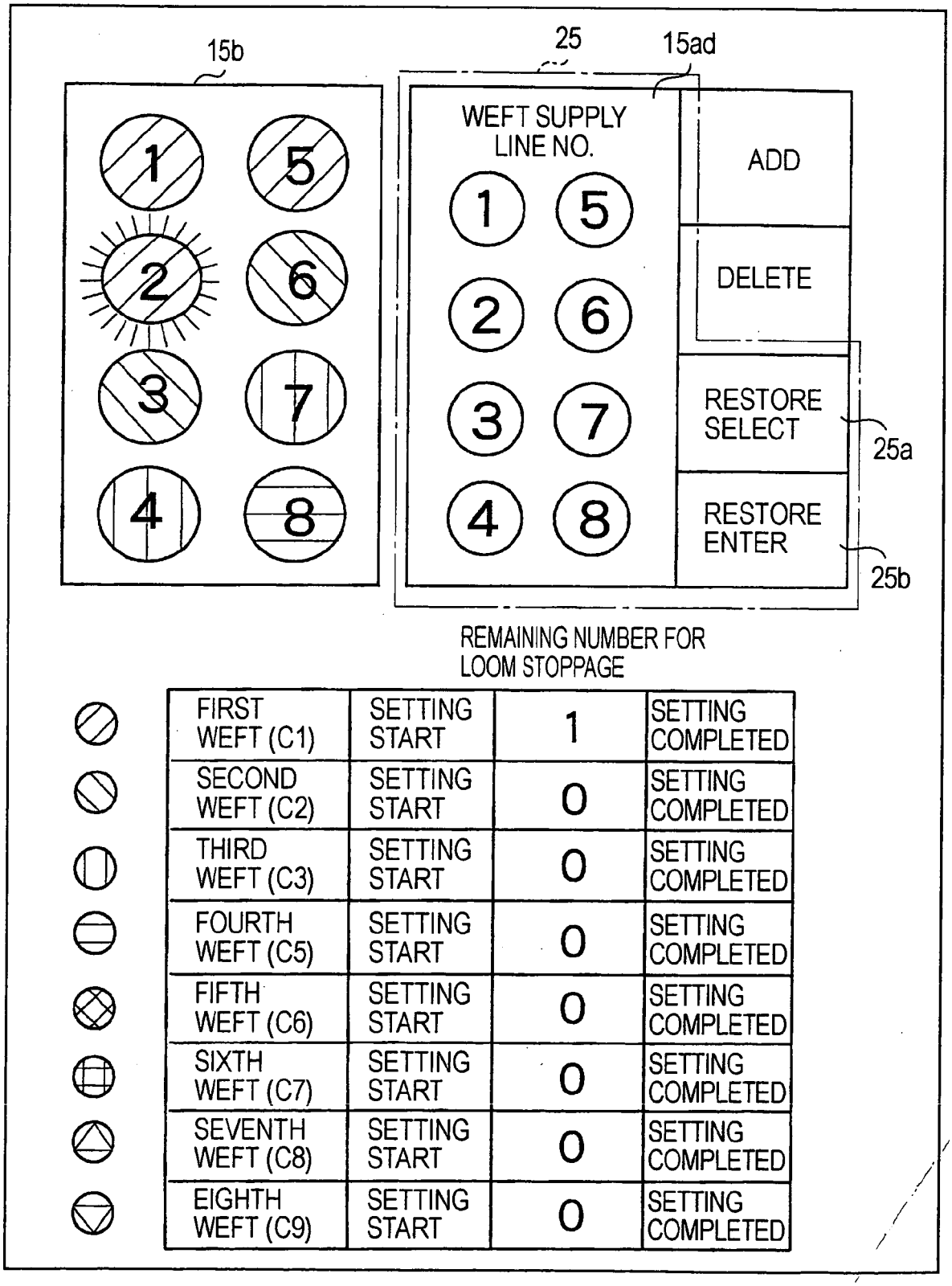

70
75
WEFT-INSERTION CONTROLLING DEVICE
FIRST WEFT SUPPLY LINE
L1
YARN SENSOR
3
YARN ABNORMALITY
FEEDER MOTOR
6
ROTATIONAL SPEED
ROTATIONAL AMOUNT
STOPPER PIN SOLENOID
WEFT INSERTION START
WEFT INSERTION STOP
ELECTRO-MAGNETIC ON-OFF VALVE
JETTING START
JETTING STOP
SECOND WEFT SUPPLY LINE
L2
YARN SENSOR
3
YARN ABNORMALITY
FEEDER MOTOR
6
ROTATIONAL SPEED
ROTATIONAL AMOUNT
STOPPER PIN SOLENOID
WEFT INSERTION START
WEFT INSERTION STOP
ELECTRO-MAGNETIC ON-OFF VALVE
JETTING START
JETTING STOP
EIGHTH WEFT SUPPLY LINE
L8
21
WEFT INSERTION CONTROL CIRCUIT
40
26
OUTPUT CIRCUIT
RESTORING LINE
28
RESTORING LINE
25
SELECTION SCREEN
15
WEFT SUPPLY LINE FOR EACH WEFT
15c
COMPUTING CIRCUIT
WEFT SUPPLY LINE
INPUT SCREEN
15a
RESTORED LINE
EXCLUDED LINE
WEFT SUPPLY LINE FOR EACH WEFT
DISPLAY SCREEN
RESTORED LINE
EXCLUDED LINE
15b
NUMBER OF LINES WITH WHICH WEFT INSERTION IS CONTINUED
23
COMPARING UNIT
LOOM STOP
REMAINING NUMBER FOR LOOM STOPPAGE
22
INPUT UNIT
WEFT INSERTION PATTERN
WEFT INSERTION PATTERN SETTING UNIT
24
ROTATIONAL ANGLE OF MAIN SHAFT
EN
M

FIG. 8



FIRST WEFT (C1)	SETTING START	1	SETTING COMPLETED
SECOND WEFT (C2)	SETTING START	0	SETTING COMPLETED
THIRD WEFT (C3)	SETTING START	0	SETTING COMPLETED
FOURTH WEFT (C5)	SETTING START	0	SETTING COMPLETED
FIFTH WEFT (C6)	SETTING START	0	SETTING COMPLETED
SIXTH WEFT (C7)	SETTING START	0	SETTING COMPLETED
SEVENTH WEFT (C8)	SETTING START	0	SETTING COMPLETED
EIGHTH WEFT (C9)	SETTING START	0	SETTING COMPLETED

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2673447 B **[0004] [0005]**