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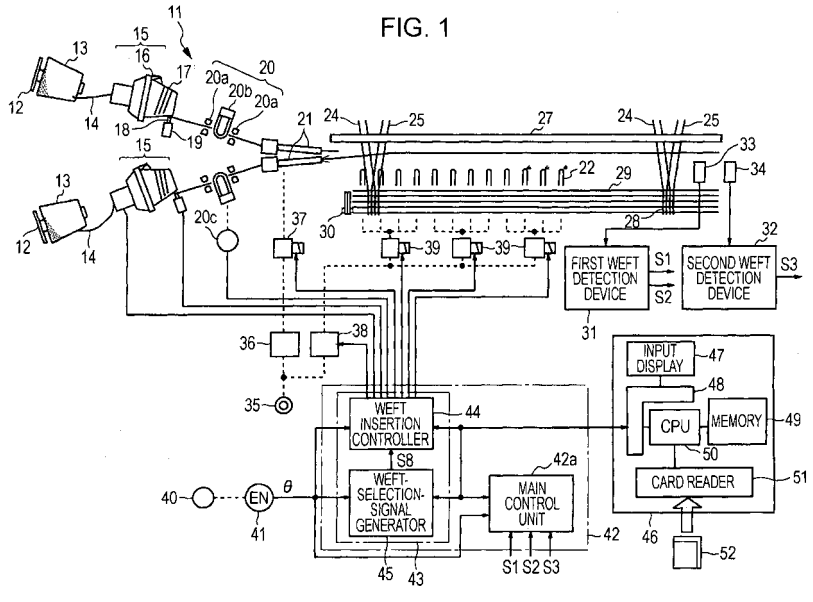
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(54) Method for setting weft-insertion conditions in multi-color weft insertion loom

(57) A setting method is used in a multi-color weft insertion loom including a weft insertion device (11) which includes two or more weft insertion systems that operate in a weft insertion operation, a setting device (46) which sets operation control values of weft-insertion-related devices belonging to the respective weft insertion systems, and a weft-insertion control unit (43) in which the control values are set in advance as weft insertion conditions in association with selection numbers assigned to the respective weft insertion systems. The setting device (46) performs the steps of reading control values for setting targets from control values included in weft insertion conditions stored in a storage device and corresponding to a selected selection number; and setting, in response to a generation of a setting command signal, the control values read in the reading step in the weft-insertion control unit (43) as control values for the setting targets in a weft insertion system corresponding to a designated selection number.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a method for setting control values of a weft insertion device provided with a plurality of weft insertion systems in a multi-color weft insertion loom including the weft insertion device.

2. Description of the Related Art

[0002] In general, looms perform a single cycle of weft insertion by activating a plurality of weft-insertion-related devices (a measuring-and-storing device, a main nozzle, sub-nozzles, etc.) in cooperation with each other. This set of weft-insertion-related devices is referred to herein as a "weft insertion system."

[0003] Multi-color weft insertion looms include a plurality of weft insertion systems, and a selection number is assigned to each of the weft insertion systems. For example, in a six-color weft insertion loom, one of selection numbers 1 to 6 is assigned to each of the weft insertion systems. A weft-insertion control device determines the weft insertion system to be activated on the basis of the selection number thereof.

[0004] In general, the relationship between the weft-insertion-related devices and the weft insertion systems to which the weft-insertion-related devices belong is fixed. More specifically, in, for example, a six-color weft insertion loom including six measuring-and-storing devices f1 to f6 and six main nozzles n1 to n6, the measuring-and-storing device f1 and the main nozzle n1 belong to a weft insertion system 1 (selection number 1) and the measuring-and-storing device f2 and the main nozzle n2 belong to a weft insertion system 2 (selection number 2). In this manner, the relationship between the weft-insertion-related devices and the weft insertion systems is fixed. In other words, the measuring-and-storing device and the main nozzle included in the weft insertion system 1 of selection number 1 are the measuring-and-storing device f1 and the main nozzle n1, respectively, and it is not common to change, for example, only the main nozzle to the main nozzle n2.

[0005] In such a multi-color weft insertion loom, control values are set in a weft-insertion control unit by a setting device as the weft insertion conditions in association with the selection numbers. The "control values" are values for controlling the weft-insertion-related devices which belong to the respective weft insertion systems, and are set in association with the selection numbers. The control values include, for example, an ejection pressure and an ejection time of each weft insertion nozzle; and an amount of operation and an operation time of a motor for driving a yarn winding arm of each measuring-and-storing device.

[0006] The control values are determined in accordance with the types or the like of the weft yarns to be subjected to weft insertion by the respective weft insertion systems, and are set in association with the selection numbers assigned to the respective weft insertion systems. The operations of the weft-insertion-related devices which belong to the respective weft insertion systems are controlled under the weft insertion conditions set in the weft-insertion control unit so that a weft insertion operation is performed by the weft-insertion-related devices activated in cooperation with each other.

[0007] According to the related art, in a process of setting the weft insertion conditions in the weft-insertion control unit or the like, the control values may be transmitted from an external recording medium, such as a memory card, in which the weft insertion conditions are stored or from a host computer connected to the loom. As an example of such a related art, Japanese Unexamined Patent Application Publication No. 2006-70410 discloses an invention titled "method for setting set values in loom" that can be applied to a multi-color weft insertion loom. According to this publication, first, an operator manually inputs the weft insertion conditions (control values) for a single weft insertion system (selection number). Then, the control values for another weft insertion system is set by using a copy function.

[0008] In addition, according to the related art, weaving conditions including the weft insertion conditions that have previously been set in an cloth weaving operation may be stored in a storage medium. Then, when the same type of cloth as the previously woven cloth is to be woven, all of the weaving conditions may be read from the storage medium and set in the weft-insertion control unit. In addition, there may also be a case in which cloth of a type different from that of the previously woven cloth is to be woven but some of the weft insertion conditions included in the previously set weaving conditions are to be set in the weft-insertion control unit. For example, there may be a case in which the conditions (control values) for one weft yarn (hereinafter called "weft yarn A") in weft yarns to be subjected to weft insertion are to be set to the same conditions (control values) as those set for the weft yarn A in a previously performed weaving operation. In such a case, it is desirable to read only the control values for weft insertion of the weft yarn A from the weft insertion conditions that are used in the previous weaving operation and stored in the storage medium. Then, the control values are set in the weft-insertion control unit.

[0009] As described above, the control values included in the weft insertion conditions stored in the weft-insertion control unit of the loom are set in association with the selection numbers. Accordingly, the weft insertion conditions stored in the storage medium or the like are also set in association with the selection numbers. In the case where the weft insertion system (selection number) used to insert the weft yarn A in the current weaving operation is the same as that in the previous weaving operation, only the control values for the weft yarn A can be simply

read from the recording medium and set in the weft-insertion control unit. However, in the case where the weft insertion system (selection number) used to insert the weft yarn A in the current weaving operation is different from that in the previous weaving operation, the control values for the weft yarn A cannot be simply read and set in the weft-insertion control unit as in the case where the selection number does not change between the current and previous weaving operations, and a more complex setting process is necessary.

[0010] More specifically, in the case where weft insertion of the weft yarn A is performed by a weft insertion system corresponding to selection number 1 in the previous weaving operation, the control values for weft insertion of the weft yarn A are stored in association with selection number 1 in the storage device or the like. Therefore, if the control values are simply read and set in the weft-insertion control unit, the control values for weft insertion of the weft yarn A are set as control values for weft-insertion-related devices belonging to the weft insertion system corresponding to selection number 1. Therefore, in the case where, for example, weft insertion of the weft yarn A is performed by the weft insertion to be system corresponding to selection number 3 in the current weaving operation, the control values cannot be simply read from the storage medium or the like and set in the weft-insertion control unit. To set the control values for the weft yarn A, the control values read from the storage medium or the like must be provisionally set in the weft-insertion control unit, and then the thusset control values must be set as the control values for the weft insertion system corresponding to selection number 3 by using, for example, the copy function described in the above-described publication. Then, the control values for the weft insertion system corresponding to selection number 1 must be reset.

SUMMARY OF THE INVENTION

[0011] An object of the present invention is to provide a multi-color weft insertion loom which allows specific control values of weft insertion conditions stored in a storage medium, which stores control values as weft insertion conditions in association with selection numbers, to be readily set in the weft-insertion control unit as control values corresponding to an arbitrary selection number.

[0012] The present invention is applied to a method for setting weft insertion conditions in a multi-color weft insertion loom including a weft insertion device, a setting device, and a weft-insertion control unit. The weft insertion device includes two or more weft insertion systems which each include a plurality of weft-insertion-related devices that operate in a weft insertion operation. The setting device sets control values for controlling operations of the weft-insertion-related devices belonging to the respective weft insertion systems. The control values are set in advance in the weft-insertion control unit as the weft insertion conditions in association with selection numbers assigned to the respective weft insertion systems. The weft-insertion control unit controls, in accordance with the control values, the operations of the weft-insertion-related devices belonging to the respective weft insertion systems, thereby causing the weft-insertion-related devices to perform the weft insertion operation.

[0013] In the method for setting the weft insertion conditions in the multi-color weft insertion loom, the setting device performs the steps of reading control values for weft-insertion-related devices that are setting targets from control values included in weft insertion conditions stored in a storage device and corresponding to a selected selection number; and setting, in response to a generation of a setting command signal, the control values read in the reading step in the weft-insertion control unit as control values for the weft-insertion-related devices that are the setting targets in a weft insertion system corresponding to a designated selection number.

[0014] The control values of the weft-insertion-related devices that are the setting targets may either be set in advance or not. In order for the operator to easily recognize the weft-insertion-related devices which are set as the setting targets, the following features are preferably provided. That is, in the method for setting the weft insertion conditions, among the weft-insertion-related devices belonging to the respective weft insertion systems, the weft-insertion-related devices that are the setting targets for which the control values are to be set are individually or simultaneously selected by the operator before the step of reading the control values of the weft-insertion-related devices that are the setting targets.

[0015] According to the method for setting the weft insertion conditions of the present invention, control values for weft-insertion-related devices stored in the storage device in association with a certain selection number can be readily set as control values for weft-insertion-related devices belonging to a weft insertion system corresponding to another selection number. Therefore, time and labor for changing the settings of the weft insertion conditions can be saved.

[0016] In addition, in the method for setting the weft insertion conditions according to the present invention, among the weft-insertion-related devices belonging to the respective weft insertion systems, the weft-insertion-related devices that are the setting targets for which the control values are to be set may be set in advance, and one or more of the weft-insertion-related devices may be selected. In such a case, the setting process can be facilitated. In the selecting step, the weft-insertion-related devices to be set as the setting targets can be individually selected. In such a case, only the control values that are necessary to be set can be set. However, it is often necessary to set the control values of all of the weft-insertion-related devices. Therefore, in addition to the above-described selecting function, a function of simultaneously selecting all of the weft-insertion-related devices as the setting targets may also be provided. In such a case, the process can be further facilitated in many cases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a diagram illustrating the main section of a weft insertion device included in an air jet loom; and Fig. 2 is a diagram illustrating a display screen shown on a setting display device for setting weft insertion conditions in a weft-insertion controller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Fig. 1 illustrates the main section of a fluid jet (air jet) multi-color weft insertion loom as an example of a multi-color weft insertion loom to which the present invention is applied. Although only two weft insertion systems are shown in Fig. 1, it is assumed that a four-color weft insertion device 11 including four weft insertion systems is provided, and the following description is based on this assumption. In the weft insertion device 11 shown in Fig. 1, weft yarns 14 of colors C1, C2, ... are pulled out from respective yarn suppliers 13 supported by supplier stands 12, and are guided to the insides of, for example, yarn winding arms 16 included in drum-type measuring-and-storing devices 15. The yarn winding arms 16 rotate while the weft yarns 14 are retained by stopper pins 18 on outer peripheral surfaces of drums 17 in a stationary state, so that the weft yarns 14 are wound around the outer peripheral surfaces of the drums 17. Thus, a predetermined length of each weft yarn 14 necessary for a single cycle of weft insertion is wound around the corresponding drum 17 and is stored until weft insertion of the weft yarn 14 is executed.

[0019] The operations of the measuring-and-storing devices 15 (rotating operations of the yarn winding arms 16 and the reciprocal operations of the stopper pins 18) and the operations of weft-insertion main nozzles 21, which will be described below, are performed by a weft insertion controller 44 in a weft-insertion control device 43 included in a loom control device 42. The operations are performed on the basis of the order of selection of the weft yarns 14 defined by a weft insertion pattern (also called a "weft selection pattern").

[0020] At a weft-insertion start time, the stopper pin 18 corresponding to the weft yarn 14 selected by the weft insertion controller 44 is removed from the outer peripheral surface of the corresponding drum 17 by an operating unit 19. Accordingly, the weft yarn 14 wound around the outer peripheral surface of the drum 17, that is, the predetermined length of weft yarn 14 which is necessary for a single cycle of weft insertion, is set to a releasable state on the drum 17. Then, the weft-insertion main nozzle 21 corresponding to the selected weft yarn 14 performs an air ejection operation so that the weft yarn 14, which extends from the drum 17 and is inserted through a weft yarn brake 20 and the main nozzle 21, is released from the drum 17 and is subjected to weft insertion.

[0021] The weft yarn brake 20, which is provided for each weft yarn 14, includes a pair of fixing guides 20a and 20a which guide the weft yarn 14 and which are spaced from each other and a movable guide 20b provided such that the movable guide 20b can reciprocate between the fixing guides 20a and 20a so as to bend the weft yarn 14. The movable guide 20b is reciprocated by an actuator 20c. In the last stage of weft insertion, the weft yarn brake 20 activates the actuator 20c so as to move the movable guide 20b into the space between the fixing guides 20a and 20a, so that the weft yarn 14 is bent and a braking force is applied to the weft yarn 14. Thus, breakage of the weft yarn 14 which occurs when the weft yarn 14 is restrained by the stopper pin 18 in the last stage of weft insertion can be prevented.

[0022] At the set weft-insertion start time, the main nozzle 21 corresponding to the selected weft yarn 14 starts to eject compressed air toward a shed 25 of warp yarns 24. The ejection of the compressed air is continued for a set ejection period, so that the predetermined length of weft yarn 14 is inserted into the shed 25. In this weft insertion operation, the weft yarn 14 travels along a weft traveling path in the shed 25. The compressed air is supplied from a compressed air source 35 to a pressure regulator 36, which adjusts the pressure of the compressed air to a pressure suitable for weft insertion. Then, the compressed air is supplied to the main nozzle 21 through an electromagnetic on-off valve 37. The electromagnetic on-off valve 37 is operated on the basis of the order of weft selection defined by the weft insertion pattern under the control of the weft insertion controller 44.

[0023] As described above, the weft insertion device 11 shown in Fig. 1 is a four-color weft insertion device. In the case where multi-color weft insertion for two or more colors, for example, is to be performed, the same number of yarn suppliers 13, measuring-and-storing devices 15, main nozzles 21, etc., as the number of colors (number of weft yarns) are provided and the weft yarns are subjected to weft insertion in the order of weft selection defined by the weft insertion pattern.

[0024] While the inserted weft yarn 14 travels along the weft traveling path in the shed 25, a plurality of groups of sub-nozzles 22 are caused to eject compressed air into the weft traveling path in the traveling direction of the weft yarn 14 by performing simultaneous ejection or relay ejection of the compressed air. Thus, the weft yarn 14 is accelerated in the weft insertion direction. The compressed air is supplied from the compressed air source 35 to a pressure regulator 38, which adjusts the pressure of the compressed air to a suitable air pressure. Then, the compressed air is supplied to the sub-nozzles 22 of each group through electromagnetic on-off valves 39 provided for respective groups. In the weft insertion operation, the electromagnetic on-off valves 39 supply the compressed air to the corresponding groups of sub-nozzles 22 at set times under the control of the weft insertion controller 44, and causes the sub-nozzles 22 to eject the compressed air to accelerate the weft yarn 14 in the weft insertion direction.

[0025] The above-described pressure regulator 38 for the sub-nozzles 22 may be a pressure regulating valve. However, in such a case, sufficient responsiveness cannot be obtained. Therefore, the pressure regulator 38 is preferably structured such that a selector valve can selectively switch between a plurality of flow passages which are provided with respective pressure regulating valves and the number of which corresponds to the number of weft insertion systems or the number of pressure values to be selected.

[0026] When the weft insertion of the weft yarn 14 is normally performed by the ejection operation performed by the main nozzle 21 and the groups of sub-nozzles 22, a beating up motion is performed in which the weft yarn 14 is beaten up against a cloth fell 29 of a woven cloth 28 by a reed 27. Thus, the weft yarn 14 is woven into the woven cloth 28. Then, the weft yarn 14 is cut by a yarn cutter 30 at a weft insertion side, and is separated from the weft yarn 14 in the main nozzle 21.

[0027] A first weft detection device (feeler) 31, a sensor (feeler head) 33 (hereinafter also referred to as a "first sensor") of the first weft detection device 31, a second weft detection device (feeler) 32, and a sensor (feeler head) 34 (hereinafter also referred to as a "second sensor") of the second weft detection device 32 are used for determining whether or not the weft insertion operation has been normally performed. The sensor 33 of the first weft detection device 31 is positioned such that the sensor 33 faces the weft traveling path in a region near the edge of the woven cloth 28 at a weft arrival side and such that the weft yarn 14 reaches the sensor 33 if the weft yarn 14 is normally inserted. Thus, the sensor 33 can detect the leading end of the weft yarn 14 if the weft yarn 14 is normally inserted. The detection is performed by comparing a level of a detection signal generated by the sensor 33 in a normal arrival time period (predetermined detection time period) of the weft yarn 14 with a reference signal level. Thus, the sensor 33 of the first weft detection device 31 can detect a weft insertion failure (short pick, bent pick, etc.) in which the leading end of the inserted weft yarn 14 does not reach the position of the first sensor 33. The detection period is generally set in terms of rotational angle of a main shaft 40.

[0028] When the first sensor 33 detects an arrival of the weft yarn 14 within the above-described detection period, the first sensor 33 generates a corresponding output signal. At this time, the first weft detection device 31 generates a yarn signal S1 indicating that a normal weft insertion has been performed on the basis of the output signal from the first sensor 33, and transmits the yarn signal S1 to a main control unit 42a in the loom control device 42. The main control unit 42a continues the operation of the loom (weaving operation) under the condition that the yarn signal S1, which indicates that a normal weft insertion has been performed, is being obtained.

[0029] If the yarn signal S1 is not generated in the above-described detection period, that is, if a weft insertion failure occurs and the arrival of the weft yarn 14 is not detected by the first sensor 33, the first weft detection device 31 determines that an abnormality has occurred in the weft insertion operation and outputs a weft stop signal (hereinafter also referred to as a "first weft stop signal") S2. The weft stop signal S2 is transmitted to the main control unit 42a.

[0030] If the main control unit 42a receives the weft stop signal S2, the main control unit 42a immediately performs stop control and stops the loom at a predetermined angle.

[0031] The sensor 34 of the second weft detection device 32 faces the weft traveling path at a position farther from the edge of the woven cloth 28 at the weft arrival side than the first sensor 33 in the weft insertion direction. More specifically, the sensor 34 is positioned such that the weft yarn 14 does not reach the sensor 34 if the weft yarn 14 is normally inserted. The sensor 34 is provided to detect a weft insertion failure such as breakage of the weft yarn 14 and long pick. The detection is performed by comparing a level of a detection signal generated by the second sensor 34 at an abnormal arrival time (arrival angle) of the weft yarn 14 in a detection period with a reference signal level. The detection period is generally set in terms of rotational angle of the main shaft 40. If the second weft detection device 32 receives an output signal from the second sensor 34 within the above-described detection period, the second weft detection device 32 determines that an abnormality has occurred in the weft insertion operation and outputs a weft stop signal (hereinafter also referred to as a "second stop signal") S3. The weft stop signal S3 is transmitted to the main controller 42a.

[0032] If the main control unit 42a receives the weft stop signal S3, the main control unit 42a immediately stops the loom at a predetermined angle, similar to the case in which the first weft stop signal S2 is received.

[0033] The loom control device 42 controls the loom in synchronization with the rotation of the main shaft 40 of the loom and performs other necessary control operations. For this purpose, the loom control device 42 includes the main control unit 42a and the weft-insertion control unit 43 (which includes the weft insertion controller 44 and a weft-selection-signal generator 45). An encoder 41 is connected to the main shaft 40 to detect a rotational angle θ of the main shaft 40. In the weaving operation, the encoder 41 generates a signal representing the rotational angle θ of the main shaft 40, and outputs the signal to the main control unit 42a and to the weft insertion controller 44 and the weft-selection-signal generator 45 of the weft-insertion control unit 43.

[0034] The main control unit 42a controls the main operation of the loom or the operation of stopping the loom on the basis of the signal representing the rotational angle θ of the main shaft 40. The weft-selection-signal generator 45 in the weft-insertion control unit 43 determines the amount of rotation of the main shaft 40 from the rotational angle θ, and selects one of the weft yarns 14 on the basis of the order of weft selection set in the weft

insertion pattern. Then, the weft-selection-signal generator 45 generates a weft selection signal S8 corresponding to the selected weft yarn 14 and transmits the weft selection signal S8 to the weft insertion controller 44. The weft insertion controller 44 controls, in accordance with set control values, the operations of the measuring-and-storing device 15, the weft yarn brake 20, the main nozzle 21, and the sub-nozzles 22 which belong to the weft insertion system corresponding to the selected weft yarn 14 on the basis of the rotational angle θ. Thus, the weft insertion operation of the selected weft yarn 14 is performed by the corresponding weft insertion system.

[0035] Although it is explained above that the order of weft selection is set in the weft insertion pattern, to be accurate, the order of selection of the weft insertion systems (selection numbers assigned to the weft insertion systems) is set in the weft insertion pattern.

[0036] The "weft insertion system" is a group of weft-insertion-related devices that operate in cooperation with each other to perform a single cycle of weft insertion. In addition, the "weft-insertion-related devices" are devices which are used in the weft insertion operation for the weft yarns 14 pulled out from the yarn suppliers 13 and which are positioned downstream of the yarn suppliers 13. The weft-insertion-related devices include the measuring-and-storing devices 15, the weft yarn brakes 20, the main nozzles 21, the sub-nozzles 22, and the first and second weft detection devices 31 and 32. Among these components, the sub-nozzles 22 and the first and second weft detection devices 31 and 32 are used in common between the weft insertion systems.

[0037] The loom control device 42 described above may be structured as a combination of functional blocks. The loom control device 42 may be provided as a combination of devices provided as the blocks. Alternatively, predetermined software may be installed in a computer and be executed so that input/output means, storage means, and arithmetic/control means of the computer and the software cooperate with each other to provide the blocks, and the loom control device 42 may be provided as a combination of the thus-obtained blocks.

[0038] A setting display device 46, which functions as a setting device and which is capable of two-way communication, is provided to exchange data of weaving conditions with the main control unit 42a and the weft-insertion control unit 43.

[0039] The setting display device 46 includes an input display 47, a port 48, a memory 49 which functions as an internal storage unit, a central processing unit (CPU) 50 which functions as a processor, and a card reader 51 into which a memory card 52 that functions as a storage device (external storage unit) can be inserted. The port 48 receives data (including various signals) from the input display 47, the CPU 50, and the loom control device 42 and transmits data therebetween.

[0040] The memory 49 is rewritable. The memory 49 stores a program for controlling the input display 47, which is a touch-panel display, and other necessary software and data.

[0041] The CPU 50 is a so-called microprocessor and controls an input/output operation of the port 48 in accordance with predetermined software stored in the memory 49. The CPU 50 also controls the input display 47, reads predetermined data from the memory 49 or the memory card 52 in response to screen display requests from the input display 47, and causes the input display 47 to show the required display screen.

[0042] The memory card 52 stores some of weft insertion conditions used in previous weaving operations. More specifically, the memory card 52 stores control values for the weft-insertion-related devices belonging to the weft insertion systems used in the previous weaving operations. The control values are stored in correspondence (association) with the selection numbers assigned to the weft insertion systems. The weft insertion conditions stored in the memory card 52 are transmitted to the memory 49 and the weft insertion controller 44 through the CPU 50 in response to the operation of the setting display device 46, and are s stored (set) therein.

[0043] The input display 47 is a display device, and a portion of the display screen of the input display 47 functions as a touch-panel input device. The operator can input display requests, various commands, a command for setting the weft insertion conditions, etc., by touching display keys (display buttons) shown on the display screen.

[0044] Fig. 2 illustrates an example of a display screen 53 displayed on the input display 47. The display screen 53 shown in Fig. 2 is a so-called touch-panel display, and shows display contents for setting the weft insertion conditions in the weft insertion controller 44 on a single screen. The display contents include display keys 54 to 62 which can be selected or designated (touched) by the operator. The display keys (display buttons) include display keys showing selection numbers for a transmission source, selection numbers for a transmission destination, and items (hereinafter referred to as "items of control values") that can be set as setting targets for which the control values are to be set in the weft insertion system corresponding to the selection number designated as the transmission destination. In addition, an execution key and a close key are also provided. Each of the display keys will be described in detail. In the following description, the transmission source means the memory card 52 in the illustrated example, and the selection numbers of the transmission source are the selection numbers stored in the memory card 52 in association with the control values and assigned to the weft insertion systems for which the control values were used in previous weaving operations. In addition, the transmission destination means the weft insertion controller 44 of the loom in which the control values are to be set, and the selection numbers of the transmission destination are the selection numbers assigned to the respective weft insertion systems in the loom and set in the weft insertion controller 44.

[0045] A plurality of display keys 54 showing the se-

lection numbers of the transmission source and a plurality of display keys 63 showing the selection numbers of the transmission destination are collectively displayed to form display key groups 54a and 63a showing the selection numbers of the transmission source and the transmission destination, respectively. The display key group 54a showing the selection numbers of the transmission source and the display key group 63a showing the selection numbers of the transmission destination are separately disposed in the upper section of the display screen 53. In Fig. 2, the display key group 54a showing the selection numbers of the transmission source is shown in the upper right section of the display screen 53, and is labeled "CARD" at a position near the display key group 54a. Similarly, the display key group 63a showing the selection numbers of the transmission destination is shown in the upper left section of the display screen 53, and is labeled "SETTING" at a position near the display key group 63a. One of the display keys 54 can be selected (provisionally selected) from the display key group 54a showing the selection numbers of the transmission source, and one of the display keys 63 can be selected (provisionally selected) from the display key group 63a showing the selection numbers of the transmission destination.

[0046] The display keys 54 showing the selection numbers of the transmission source include yarn supplier marks 54b and selection numbers 54c which are different from each other and displayed in association with the yarn supplier marks 54b. The selection numbers 54c are assigned to (correspond to) the control values included in the weft insertion conditions stored in the memory card 52.

[0047] The display keys 63 showing the selection numbers of the transmission destination also include yarn supplier marks 63b and selection numbers 63c which are different from each other and displayed in association with the yarn supplier marks 63b. The selection numbers 63c are assigned to the weft insertion systems controlled by the weft insertion controller 44 in the multi-color weft insertion loom, and are associated with the control values included in the weft insertion conditions to be set.

[0048] Referring to Fig. 2, in the display key groups 54a and 63a showing the selection numbers of the transmission source and the transmission destination, respectively, eight display keys 54 and eight display keys 63 are arranged in two rows and four columns. Therefore, the display in the illustrated example can be used for a weft insertion device 11 capable of performing weft insertion of eight colors of weft yarns 14 (eight weft yarns 14) at a maximum, which differs from the number of weft insertion systems actually included in the loom. Therefore, the display can be used in common between multiple kinds of looms.

[0049] In the display screen, among the display keys 54 showing the selection numbers of the transmission source, the display keys 54 corresponding to selection numbers 1 to 6 are shown clearly to show that they are selectable. This shows that the weft insertion conditions stored in the memory card 52 have been used in a six-color weft insertion device 11. In addition, among the display keys 63 showing the selection numbers of the transmission destination, the display keys 63 corresponding to selection numbers 1 to 4 are shown clearly to show that they are selectable. This shows that the loom including the weft insertion controller 44, which is the transmission destination, includes a four-color weft insertion device 11 including four weft insertion systems. In addition, the display keys 54 corresponding to selection numbers 7 and 8 in the display keys 54 showing the selection numbers of the transmission source and the display keys 63 corresponding to selection numbers 5 to 8 in the display keys 63 showing the selection numbers of the transmission destination are displayed with a low brightness to show that they cannot be selected or designated. In addition, among the display keys 54 and 63 showing the selection numbers of the transmission source and the transmission destination, respectively, the display keys 54 and 63 selected or designated by the operator are displayed in a certain manner (smudged or shaded) on the display screen to distinguish them from display keys that are not selected or designated.

[0050] The display keys 55 to 60 showing the items of control values are displayed in a middle section of the display screen 53. The display keys 55 to 60 show the weft-insertion-related devices that can be selected as setting targets for which the control values (control values for controlling the weft-insertion-related devices that belong to the weft insertion systems) are set. In the illustrated example, the weft-insertion-related devices that can be selected as setting targets for which the control values are set include the main nozzles 21, the sub-nozzles 22, the weft yarn brakes 20 (display key: WBS key 57), the measuring-and-storing devices 15 (display key: feeder key 58), and the first and second weft feelers 31 and 32 (display key: feeler key 59). With regard to the main nozzles 21 and the sub-nozzles 22, the control values of the electromagnetic on-off valves 37 and 39 (display key: main/sub key 55) that control the ejection times and the pressure regulators 36 and 38 (display key: pressure key 56) that adjust the pressures are set.

[0051] The control values of the weft-insertion-related devices displayed by the display keys will now be described. The control values of the main/sub key 55 are the ejection times (that is, on/off times of the electromagnetic on-off valves 37 and 39). The control values of the pressure key 56 are the ejection pressures (adjustment values of the pressure regulators 36 and 38) of the main and sub nozzles 21 and 22. The control values of the WBS key 57 define the operation mode of the actuator 20c for reciprocating the movable guides 20b. The control values of the feeder key 58 define the control mode (the amount of operation (the winding amount), the rotational speed, the acceleration and deceleration, etc.) of the drive motor for driving the yarn winding arms 16 in the measuring-and-storing devices 15. The control values of

the feeler key 59 include control gains for processing the yarn signals from the first and second weft detection devices 31 and 32 and thresholds (reference signal levels) for determining whether or not weft insertion has been normally performed. The control values are set in the weft insertion controller 44.

[0052] Selection of the weft-insertion-related devices as the setting targets is performed by touching the corresponding display keys. However, at this time, the selection is provisional.

[0053] In the illustrated example, a display key (all key 60) for selecting all of the above-described display keys showing the weft-insertion-related devices is shown therebelow as one of the display keys of the items of control values. When the operator touches this display key 60, all of the five items (five weft-insertion-related devices) shown above the display key 59 are set to the selected state.

[0054] A display key (execution key 61) is displayed in a lower section of the display screen 53. When this display key 61 is selected, selection and designation (provisional selection and provisional designation) of the display keys 54 and 63 showing the selection numbers of the transmission source and the transmission destination and the selection (provisional selection) of the display keys 55 to 60 showing the items of control values are made effective (confirmed). Then, the control values corresponding to the selected selection number of the transmission source are read into the setting display device 46 from the memory card 52 as the control values for the selected weft-insertion-related devices, and are set in the weft insertion controller 44 in association with the designated selection number of the transmission destination.

[0055] Another display key (close key 62) is displayed in the lower section of the display screen 53. When this display key 62 is selected, the display screen 53 for setting the weft insertion conditions (control values) in the weft insertion controller 44 by using the memory card 52 is closed and another display screen is presented. For example, a display screen for inputting numerical values of the items of control values is presented, and the numerical values of the items of control values can be input in association with the selection numbers on this screen.

[0056] A method for setting the weft insertion conditions in the multi-color weft insertion loom will now be described on the basis of the following assumption. That is, the multi-color weft insertion loom is a four-color air jet loom in which four weft yarns 14 pulled out from respective yarn suppliers 13 are subjected to weft insertion by four weft insertion systems corresponding to the respective yarn supplies 13. Weft yarns C1, C2, C3, and C4 are used, and selection numbers 1, 2, 3, and 4 are assigned to the weft insertion systems corresponding to the weft yarns C1, C2, C3, and C4, respectively. In the following description, the weft insertion systems corresponding to the selection numbers 1, 2, 3, and 4 are called the weft insertion systems 1, 2, 3, and 4, respectively. The control values of the weft-insertion-related devices used in weft insertion of the weft yarns C1 to C4 are set in the weft insertion controller 44 in association with the selection numbers 1, 2, 3, and 4 assigned to the weft insertion systems to which the weft-insertion-related devices belong. In addition, as described above, the control values included in the weft insertion conditions used in previous weaving operations are stored in the memory card 52 in association with the selection numbers (1 to 6).

[0057] In this example, it is assumed that the control values for the weft-insertion-related devices included in one of the four weft insertion systems used in the current weaving operation are read from the memory card 52 by the setting display device 46 and are set in the weft insertion controller 44. It is also assumed that the selection number of the transmission destination corresponding to the control values to be set in the weft insertion controller 44 differs from the selection number of the transmission source corresponding to the control values to be read from the memory card 52.

[0058] On the basis of the above-described assumption, an operation of reading the control values stored in association with selection number 3 from the weft insertion conditions stored in the memory card 52 and setting the thus-obtained control values in the weft insertion controller 44 as the control values for the weft-insertion-related devices included in the weft insertion system 2 will be described with reference to steps (1) to (6). Control values for the weft-insertion-related devices belonging to weft insertion systems other than the weft insertion system 2 (selection number 2) may be set in the weft insertion controller 44 by reading weft insertion conditions stored in another memory card or allowing the operator to input numerical control values. In the case where the weft insertion conditions are read from a memory card, the control values stored in that card in association with selection number 2 are also set as the control values for the weft insertion system 2 in the weft insertion controller 44.

(1) The memory card 52, in which the weft insertion conditions are stored, is inserted into the card reader 51 in the setting display device 46.

(2) The input display 47 included in the setting display device 46 is operated such that the display screen 53 shown in Fig. 2 is displayed on the input display 47. The display screen 53 is used to set the weft insertion conditions (control values) in the weft insertion controller 44 by using the memory card 52.

(3) Selection number 2 is designated as the selection number corresponding to the weft insertion system for which the control values are to be set in the weft insertion controller 44. More specifically, in the display key group 63a that is displayed in the upper left section of the display screen 53 and that shows the selection numbers of the transmission destination, the operator touches the selection number (display key labeled "2" in the illustrated example) corre-

sponding to the weft insertion system for which the control values are to be set. As a result, the selection number is set in a designated (provisionally designated) state. At this time, a provisional destination signal is output from the input display 47 to the CPU 50 through the port 48.

(4) Selection number 3 is selected as the selection number corresponding to the control values that are to be read from the memory card 52. More specifically, in the display key group 54a that is displayed in the upper right section of the display screen 53 and that shows the selection numbers of the transmission source, the operator touches the selection number (display key labeled "3" in the illustrated example) corresponding to the control values to be read. As a result, the selection number is set in a selected (provisionally selected) state. At this time, a provisional selection signal is output from the input display 47 to the CPU 50 through the port 48.

(5) The weft-insertion-related devices for which the control values are to be set are selected. More specifically, the operator touches the display keys 55 to 60 that are displayed in the middle section of the display screen 53 and that show the items of control values corresponding to the respective weft-insertion-related devices, so that the corresponding weft-insertion-related devices are set to the selected state. In the display screen 53, the operator may touch the "all" key 60. In such a case, all of the weft-insertion-related devices belonging to the selected weft insertion system (selection number) are simultaneously set to the selected state. In the following description, it is assumed that the "all" key has been touched. Accordingly, a provisional selection signal is output from the input display 47 to the CPU 50 through the port 48.

(6) Then, an execution operation is performed to make the provisional selection and provisional designation effective, and a setting command signal is generated in response to the execution operation. Accordingly, the control values of the setting targets corresponding to selection number 3 are read from the memory card 52 and are set in the weft insertion controller 44 as the control values for selection number 2. More specifically, when the operator touches the "execution" key 61 shown in the lower section of the display screen 53, the setting command signal is output from the input display 47 to the CPU 50 through the port 48. When the CPU 50 receives the setting command signal, the CPU 50 determines that the provisional selection and provisional designation are effective. The setting command signal also functions as a reading command signal, so that the control values are read out to the CPU 50 from the memory card 52 and are set in the weft insertion controller 44.

[0059] The present invention is not limited to the above-described example. For example, in the above-described example, the weft-insertion-related devices set as the setting targets for which the control values are to be set are selected in step (5). However, this step may also be omitted, and a similar setting operation may be performed by steps (1), (2), (3), (4), and (6). In this case, it is assumed that the weft-insertion-related devices for which the control values are to be set are set in advance in the program as setting targets.

[0060] In addition, in the above-described example, steps (1) to (6) are performed in that order. However, the steps may also be performed in the order of (1), (2), (4), (5), (3), and (6).

[0061] In addition, in the above-described example, first, the weft insertion system for which the control values read from the storage device are to be set is designated and the selection number corresponding to the control values to be read from the storage device is selected. Then, the setting command signal is generated so that the control values are read from the storage device and are set in the weft insertion controller 44. However, instead of performing the above-described operation, the process of reading the control values from the storage device and the process of setting the control values in the weft insertion controller 44 may be separately performed as in the following steps (01) to (05).

(01) The selection number corresponding to the control values to be read from the storage device is selected by the operator.

(02) In response to a generation of a reading command signal based on the selection, the setting display device 46 reads control values corresponding to the selected selection number from the storage device. In this case, a display key (button) dedicated to the reading command is provided.

(03) The control values read in step (02) are stored in the memory 49 included in the setting display device 46 or the like.

(04) The weft insertion system (selection number) for which the control values read from the storage device are to be set is designated by the operator.

(05) In response to a generation of a setting command signal based on the designation, the control values stored in the memory in step (03) are set in the weft insertion controller 44 by the setting display device 46 as the control values for the selection number designated in step (04).

[0062] In the present embodiment, the memory card 52 is used as the storage device. However, the present invention is not limited to this. For example, the multicolor weft insertion loom may be connected to a host computer such that two-way communication can be performed therebetween, and a memory included in the host computer may be used as the storage device according to the present invention. In this case, desired control values may be read from the weft insertion conditions stored

in this memory. Alternatively, the memory included in the loom control device 42 of the multi-color weft insertion loom may be structured such that the weft insertion conditions can be stored in and read out from the memory. In such a case, the desired control values may be selected and read from the weft insertion conditions stored in the memory.

[0063] The input device of the input display 47 is not limited to the touch-panel input device, and may also be another kind of input device, such as a keyboard.

Claims

1. A method for setting weft insertion conditions in a multi-color weft insertion loom including a weft insertion device (11), a setting device (46), and a weft-insertion control unit (43), the weft insertion device (11) including two or more weft insertion systems which each include a plurality of weft-insertion-related devices that operate in a weft insertion operation, the setting device (46) setting control values for controlling operations of the weft-insertion-related devices belonging to the respective weft insertion systems, the control values being set in advance in the weft-insertion control unit (43) as the weft insertion conditions in association with selection numbers assigned to the respective weft insertion systems, the weft-insertion control unit (43) controlling, in accordance with the control values, the operations of the weft-insertion-related devices belonging to the respective weft insertion systems, thereby causing the weft-insertion-related devices to perform the weft insertion operation,
wherein the setting device (46) performs the steps of:

   reading control values for weft-insertion-related devices that are setting targets from control values included in weft insertion conditions stored in a storage device and corresponding to a selected selection number; and
   setting, in response to a generation of a setting command signal, the control values read in the reading step in the weft-insertion control unit (43) as control values for the weft-insertion-related devices that are the setting targets in a weft insertion system corresponding to a designated selection number.

2. The method according to claim 1, wherein, among the weft-insertion-related devices belonging to the respective weft insertion systems, the weft-insertion-related devices that are the setting targets for which the control values are to be set are individually or simultaneously selected by the operator before the step of reading the control values of the weft-insertion-related devices that are the setting targets.

FIG. 1

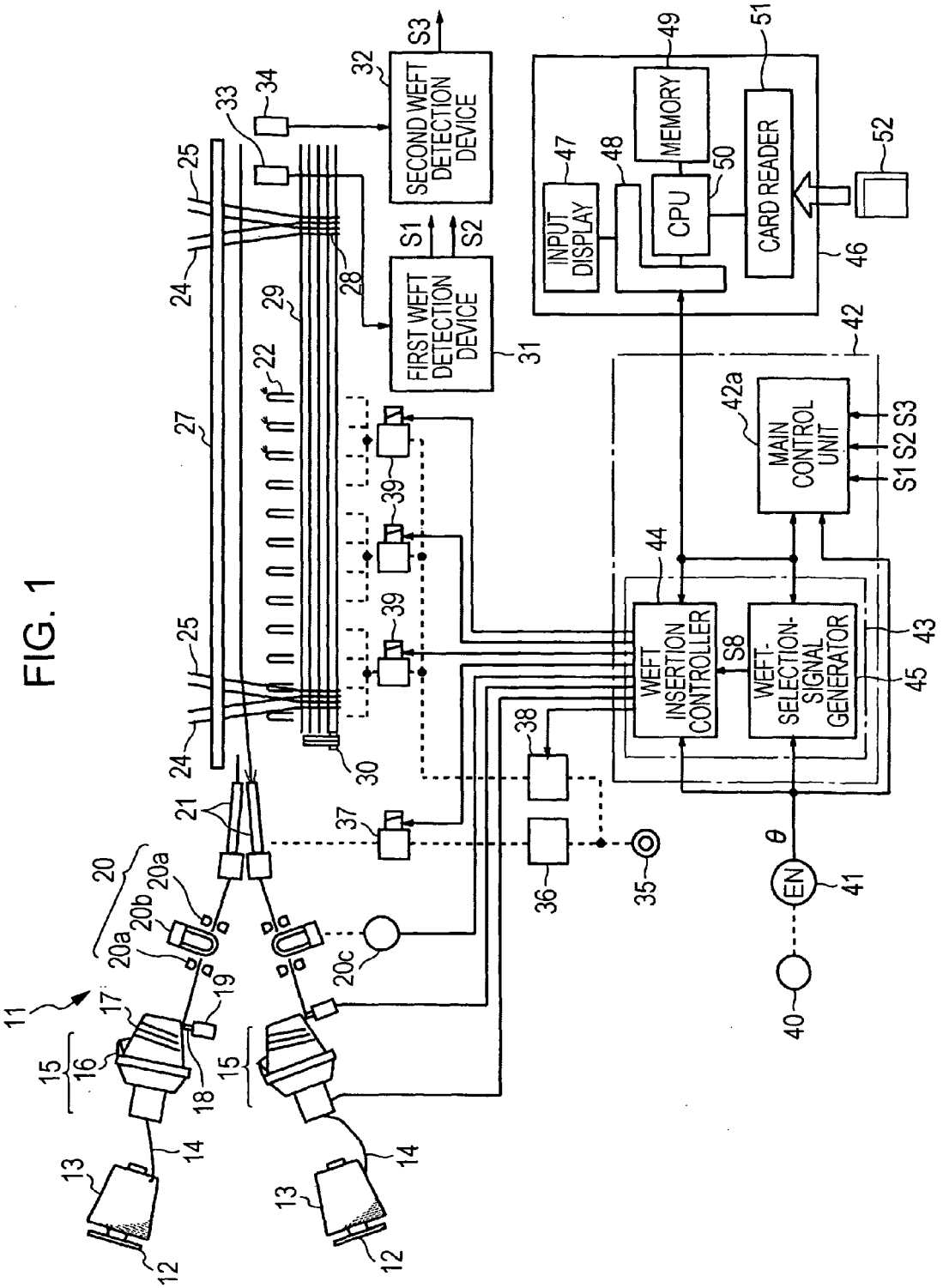
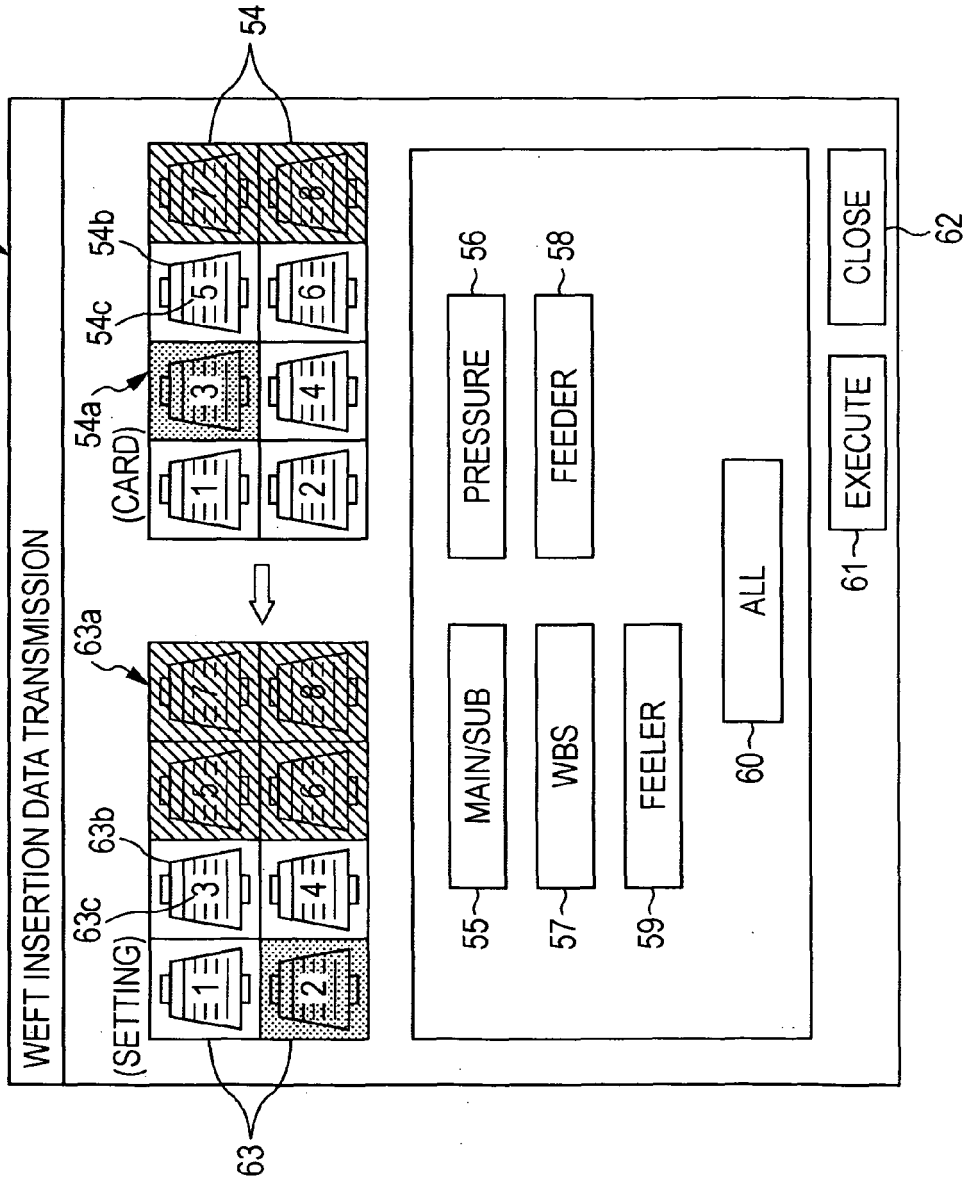

SECOND WEFT DETECTION DEVICE
FIRST WEFT DETECTION DEVICE
INPUT DISPLAY
MEMORY
CPU
CARD READER
MAIN CONTROL UNIT
WEFT INSERTION CONTROLLER
WEFT-SELECTION-SIGNAL GENERATOR
S1
S2
S3
S8
EN
θ

FIG. 2


53
54
WEFT INSERTION DATA TRANSMISSION
54a
(CARD)
54b
54c
63a
63b
63c
(SETTING)
63
PRESSURE
56
FEEDER
58
MAIN/SUB
55
WBS
57
FEELER
59
ALL
60
EXECUTE
61
CLOSE
62

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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