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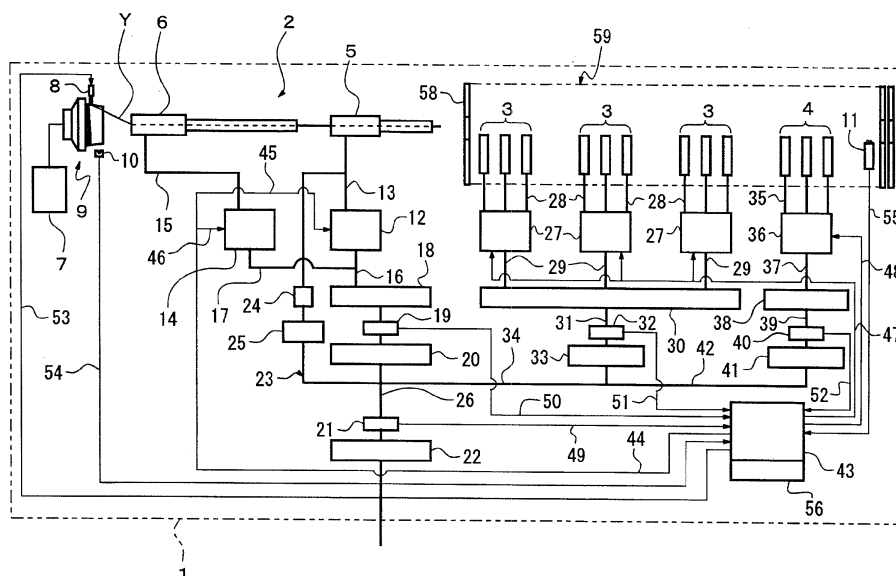
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(54) **Apparatus for setting weft insertion condition in an air jet loom**

(57) An apparatus for setting weft insertion condition in an air jet loom includes a weft insertion device causing a weft yarn to move by compressed air injected from a main nozzle and plural sub-nozzles arranged in the direction of weft insertion, and a controller storing fabric conditions and weaving conditions. The controller stores a database in which data of optimum sub-nozzle pressure is linked to data of loom speed for different types of

reed dent. The data of optimum sub-nozzle pressure is obtained based on the variation of angular difference between the time of weft insertion completion and the time of weft release completion in the fabric conditions and the weaving conditions. The controller selects the optimum sub-nozzle pressure from the database based on the fabric conditions, the type of reed dent and the loom speed.

FIG. 1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an apparatus for setting weft insertion condition in an air jet loom.

[0002] For weaving a fabric in an air jet loom, data of weaving conditions (compressed air pressures at a main nozzle, a tandem nozzle and sub-nozzles, and loom speeds, and so on) based on fabric conditions (the kind of weft yarn and warp yarn and weaving width, and so on) is input previously to a controller as initial setting of weaving conditions. Generally, the initial weaving conditions are so set as to maintain the time of weft yarn arrival at the side of the reed opposite from the main nozzle and also to provide stable flight of weft yarn. There has been recently proposed weft insertion at a lowered pressure of compressed air at sub-nozzles in order to provide energy saving in an air jet loom.

[0003] Japanese Unexamined Patent Application Publication No. 4-241135 discloses a pressure control device in an air jet loom which allows less consumption of compressed air for weft insertion while preventing weft yarn shrinkage and weft insertion failure. The device has a detector that detects the time of weft yarn arrival and a pressure control valve that is automatically controlled during weaving operation in response to a detection signal from the detector thereby to control the injection pressure at the main nozzle. The device further has another detector that detects the time of weft release completion. The device further has another pressure control valve that is automatically controlled based on the difference between the time of weft release completion and the time of weft yarn arrival detected by the respective detectors thereby to control the injection pressure at the sub-nozzles. Data of the difference between the time of weft release completion and the time of weft yarn arrival that is suitable for weft insertion under given conditions such as weaving width, loom speed and weft yarn type is previously input to a control computer as a target value. When the difference detected during the weaving operation of the loom fails to fall within a given range of the target value, the air injection pressure at the sub-nozzles is automatically adjusted.

[0004] The publication No. 4-241135 discloses the control of air injection pressure at the sub-nozzles during the weaving operation, but fails to disclose initial setting of injection pressure at the sub-nozzles prior to the start of the weaving operation. Generally, the air injection pressures at the main nozzle and sub-nozzle are empirically set based on the past data of conditions under which stable weft insertion has been accomplished during weaving operation.

[0005] However, such past data does not cover all fabric and weaving conditions and does not necessarily result in optimum weft insertion and energy saving either. The above-described injection pressure control at the sub-nozzle based on the difference between the time of

weft release completion and the time of weft yarn arrival offers significant advantages, but the application of such injection pressure control to the initial setting of weaving condition does not necessarily provide a method that offers optimum energy saving while maintaining stable weft insertion for all fabric and weaving conditions.

[0006] The present invention is directed to providing an apparatus for setting weft insertion condition in an air jet loom which provides good energy saving while maintaining stability in weft insertion.

SUMMARY OF THE INVENTION

[0007] In accordance with an aspect of the present invention, an apparatus for setting weft insertion condition in an air jet loom includes a weft insertion device causing a weft yarn to move by compressed air injected from a main nozzle and plural sub-nozzles arranged in the direction of weft insertion, and a controller storing fabric conditions and weaving conditions. The controller stores a database in which data of optimum sub-nozzle pressure is linked to data of loom speed for different types of reed dent. The data of optimum sub-nozzle pressure is obtained based on the variation of angular difference between the time of weft insertion completion and the time of weft release completion in the fabric conditions and the weaving conditions. The controller selects the optimum sub-nozzle pressure from the database based on the fabric conditions, the type of reed dent and the loom speed.

[0008] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a configuration block diagram of a weft insertion device and an apparatus for setting weft insertion conditions of an air jet loom according to an embodiment of the present invention;

Fig. 2 is a diagram of a database showing a relation between the optimum sub-nozzle pressures and their corresponding loom speeds for three different types of reed dents;

Fig. 3 is a diagram showing a relation of the time of weft insertion completion, angular difference, and sub-nozzle pressure;

Fig. 4 shows a screen of a display of the air jet loom, indicating fabric conditions and weaving conditions for weft yarn;

Fig. 5 is similar to Fig. 4, but indicating fabric condi-

tions and weaving conditions for warp yarn; and

Fig. 6 is similar to Figs. 4 and 5, but indicating that optimum sub-nozzle pressures have been set.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] The following will describe one embodiment of an apparatus for setting weft insertion conditions in an air jet loom according to the present invention with reference to Figs. 1 to 6. It is noted that the terms "upstream" and "downstream" appearing in the following description are used to denote directions or relative positions with respect to the direction in which a weft yarn is inserted into a warp shed and also in which compressed air supplied from an external source flows.

[0011] Referring to Fig. 1, the air jet loom designated by 1 includes a weft insertion device 2, plural sub-nozzles 3 and end nozzles 4 disposed downstream of the weft insertion device 2 along a reed 59 having a number of reed dents 58. In the drawing, compressed air supply line to the weft insertion device 2, the sub-nozzles 3 and the end nozzles 4 is also shown in the form of a block diagram. The weft insertion device 2 has a main nozzle 5 and a tandem nozzle 6 disposed upstream of the main nozzle 5. The main nozzle 5, the sub-nozzles 3, the end nozzles 4 and the reed 59 are disposed on a slay (not shown) and swing back and forth with the slay.

[0012] The tandem nozzle 6 is fixedly mounted to a frame (not shown) of the air jet loom 1 or to a bracket (not shown either) mounted on the floor. There is provided upstream of the tandem nozzle 6 a weft measuring and storing device 9 equipped with a movable pin 8 that is operable to engage with or disengage from a weft yarn Y. The weft measuring and storing device 9 serves to measure a predetermined length of weft yarn Y, i.e. a length that corresponds to the weaving width of the loom, drawn from a yarn supply package 7 and also to store temporarily the weft yarn Y. The weft measuring and storing device 9 is equipped with a detector 10 that detects a balloon formed by the weft yarn Y being released from the weft measuring and storing device 9, for the purpose of detecting the number of releases of weft yarn Y and the time of weft release completion, that is the time when release of weft yarn Y from the weft measuring and storing device 9 is completed.

[0013] There is also provided downstream of the end nozzles 4 another detector 11 that detects the arrival of weft yarn Y at the side of the reed 59 opposite from the main nozzle 5, thereby detecting the time of weft insertion completion, that is the time when insertion of weft yarn Y is completed, or any failure in weft insertion. The time of weft release completion and the time of weft insertion completion detected by the respective detectors 10, 11 are both recognized as an angular position of the air jet loom 1.

[0014] Although only one set of the weft insertion device 2 and its associated yarn supply package 7 and weft

measuring and storing device 9 is shown in Fig. 1, the air jet loom 1 in the present embodiment is intended to include two sets of the weft insertion devices 2 and their associated yarn supply packages 7 and weft measuring and storing devices 9, serving as a multicolor weft insertion device. It is noted that the multicolor weft insertion device may use not only weft yarns of different colors, but also weft yarns of the same color. The sub-nozzles 3 and the end nozzles 4 are used commonly for such two sets of the weft insertion devices 2.

[0015] The main nozzle 5 is connected through a pipe 13 to a main valve 12 that allows or stops the supply of compressed air to the main nozzle 5. The tandem nozzle 6 is connected through a pipe 15 to a tandem valve 14 that allows or stops the supply of compressed air to the tandem nozzle 6. The main and tandem valves 12, 14 are both connected to a common main air tank 18 through pipes 16, 17, respectively. The main air tank 18 is connected through a main pressure gauge 19, a main regulator 20, an initial pressure gauge 21 and a filter 22 to a common air compressor (not shown) installed in a weaving factory.

[0016] The initial pressure gauge 21 measures initial pressure of compressed air to be supplied from the factory air compressor to the air jet loom 1. The compressed air supplied from the air compressor is regulated to a predetermined pressure by the main regulator 20 and stored in the main air tank 18. The main pressure gauge 19 measures the pressure of compressed air to be supplied to the main air tank 18.

[0017] The main nozzle 5 is also connected to a breeze circuit 23 that is connected to the pipe 13 at a position downstream of the main valve 12 and bypasses the main valve 12. The breeze circuit 23 has a throttle valve 24 and a breeze regulator 25 and is connected directly to a pipe 26 that connects between the main regulator 20 and the initial pressure gauge 21 both provided upstream of the main air tank 18. The compressed air of initial pressure supplied from the air compressor is regulated by the breeze regulator 25 and the throttle valve 24 of the breeze circuit 23 so that a slight amount of low pressure compressed air is supplied constantly from the breeze circuit 23 through the pipe 13 to the main nozzle 5 and injected from the main nozzle 5. The compressed air thus injected from the main nozzle 5 serves to hold the weft yarn Y remaining in the main nozzle 5 after the completion of weft insertion in an appropriate position.

[0018] The sub-nozzles 3 are divided into three separate groups. The three groups of sub-nozzles 3 are connected through pipes 28 to respective sub-valves 27 which are fixedly mounted to a frame (not shown) of the air jet loom 1. The sub-nozzles 3 need not necessarily be separated into three groups. For example, four or more groups of sub-nozzles 3 and their associated sub-valves 27 may be provided depending on the weaving width of the loom. The sub-valves 27 are connected through pipes 29 to a common sub-air tank 30.

[0019] The sub-air tank 30 is connected to a sub-reg-

ulator 33 through a pipe 31 that is equipped with a sub-pressure gauge 32. The sub-regulator 33 is connected through a pipe 34 to the pipe 26 that connects between the main regulator 20 and the initial pressure gauge 21. The pressure of the compressed air supplied from the air compressor is adjusted to a predetermined pressure by the sub-regulator 33 and stored in the sub-air tank 30. The pressure of the compressed air supplied to the sub-air tank 30 is always measured by the sub-pressure gauge 32.

[0020] The end nozzles 4 are provided by plural sub-nozzles disposed adjacent to the selvage of woven fabric on the side of the reed 59 opposite from the main nozzle 5. The end nozzles 4 are connected through pipes 35 to a sub-valve 36 that is in turn connected through a pipe 37 to a sub-air tank 38. The sub-air tank 38 is connected to a sub-regulator 41 through a pipe 39 that is equipped with a sub-pressure gauge 40. The sub-regulator 41 is connected through a pipe 42 to the pipe 34 that is connected to the pipe 26.

[0021] The pressure of the compressed air supplied from the air compressor is regulated to a predetermined pressure by the sub-regulator 41 and stored in the sub-air tank 38. The sub-regulator 41 regulates the pressure of the compressed air to be supplied to the sub-air tank 38 to a pressure that is below the pressure of compressed air regulated by the sub-regulator 33. The sub-pressure gauge 40 measures the pressure of compressed air to be supplied to the sub-air tank 38. The end nozzles 4 inject air whose pressure has been regulated below the injection pressure at the sub-nozzles 3, thereby controlling the flight speed of the weft yarn Y just before the completion of weft insertion and also reducing the consumption of compressed air.

[0022] The main valve 12, the tandem valve 14, the sub-valves 27, the sub-valve 36, the initial pressure gauge 21, the main pressure gauge 19, the sub-pressure gauge 32 and the sub-pressure gauge 40 are electrically connected to a controller 43 of the air jet loom 1 through electric wires 44, 45, 46, 47, 48, 49, 50, 51 and 52. The pin 8 of the weft measuring and storing device 9 and the detectors 10, 11 are also electrically connected to the controller 43 through electric wires 53, 54 and 55. The controller 43 is equipped with a display 56 for indication and input of information and data. The display 56 has a screen 57 (see Figs. 4 to 6) where data and information of various items are indicated. Data for respective items may be newly input and rewritten directly on the screen 57.

[0023] The initial pressure gauge 21 measures the initial pressure of compressed air supplied from the air compressor and transmits its data to the controller 43. The main pressure gauge 19 measures the pressure of compressed air regulated by the main regulator 20, the sub-pressure gauge 32 measures the pressure of compressed air regulated by the sub-regulator 33, and the sub-pressure gauge 40 measures the pressure of compressed air regulated by the sub-regulator 41. Such pres-

sure data is respectively transmitted to the controller 43.

[0024] The controller 43 previously stores data regarding the time when the pin 8 of the weft measuring and storing device 9, the main valve 12, the tandem valve 14 and the sub-valves 27, 36 should start to operate and also data of the duration of such operation. The controller 43 transmits signals to the pin 8, the main valve 12 and the tandem valve 14 to start insertion of weft yarn Y, and subsequently transmits signals to the sub-valves 27, 36 during the insertion of weft yarn Y, so that insertion of weft yarn Y is completed.

[0025] The controller 43 counts the number of detection signals transmitted from the detector 10 each indicative of a balloon formed by the weft yarn Y, and transmits a signal to the pin 8 to engage with the weft yarn Y when the counted number of balloons reaches a predetermined value. The time when the number of balloons reaches the predetermined value is detected by an encoder (not shown) in terms of the angular position of the air jet loom 1, and the angular position then detected is stored in the controller 43 as the time of weft release completion. In response to a detection signal from the detector 11 that is indicative of the arrival of the leading end of the weft yarn Y, the controller 43 determines whether or not any failure of weft insertion has occurred and stores the angular position of the air jet loom 1 then detected by the encoder as the time of weft insertion completion.

[0026] The controller 43 registers and stores therein plural databases 65, 66, 67 as shown in Fig. 2, in which data of optimum sub-nozzle pressure is linked to data of loom speed for different types of reed dent. The databases 65, 66, 67 are made for three different sets of fabric and weaving conditions. As shown in Fig. 2 wherein the database 65 is shown in the form of a diagram, the horizontal axis represents the loom speed and the vertical axis represents the optimum sub-nozzle pressure. In the diagram, lines 60, 61, 62 show the relation between the optimum sub-nozzle pressure and the loom speed for three different types T1, T2, T3 of the reed dent 58. Although the diagram of Fig. 2 shows only three different types of the reed dent 58 for simplicity, there may be four or more types of the reed dent 58 in an actual diagram. The following will describe how to prepare the databases shown in Fig. 2.

[0027] In the present embodiment, weaving operation is performed previously under specific fabric and weaving conditions, and a diagram of the relation of the time of weft insertion completion, angular difference and sub-nozzle pressure as shown in Fig. 3 is prepared based on the data obtained from the detectors 10, 11, the main pressure gauge 19 and the sub-pressure gauge 32 during the above weaving operation. In the diagram of Fig. 3, the horizontal axis represents the sub-nozzle pressure or the air injection pressure of the sub-nozzles 3, the left-hand side vertical axis represents the time of weft insertion completion, and the right-hand side vertical axis represents the angular difference that is indicative of the difference between the time of weft insertion completion

and the time of weft release completion. In the diagram of Fig. 3, line 63 that is indicative of the variation of the time of weft insertion completion with a change of the sub-nozzle pressure and line 64 that is indicative of the variation of the angular difference with a change of the sub-nozzle pressure are drawn based on the data that is obtained during the weaving operation in which the sub-nozzle pressure is varied so that the time of weft insertion completion is stabilized.

[0028] As is clear from the lines 63, 64 in Fig. 3, the time of weft insertion completion is constant regardless of the sub-nozzle pressure. This is because the time of weft insertion completion needs to be maintained within a given range for stable weft insertion. On the other hand, the angular difference is approximately constant when the sub-nozzle pressure is higher than the pressure P at the point X, but gradually increased as the sub-nozzle pressure is decreased from the pressure P at the point X.

[0029] A factor of such an increase of the angular difference is as follows. When the sub-nozzle pressure is low, the flight of weft yarn Y is less assisted, which leads to a variation, such as delay, in the time of weft insertion completion. To prevent such variation in the time of weft insertion completion which causes unstable weft insertion, the pressure of air injected from the main nozzle 5 or the tandem nozzle 6 is increased so as to increase weft insertion speed and hence to keep the time of weft insertion completion constant. Increasing the air injection pressure of the main nozzle 5 or the tandem nozzle 6 accelerates the time of weft release completion, thereby increasing the angular difference, that is the difference between the constant time of weft insertion completion and the time of weft release completion. Excessive increase of the speed of weft insertion by the main nozzle 5 or the tandem nozzle 6 may result in unstable flight of the weft yarn Y.

[0030] Thus, as the sub-nozzle pressure suitable for any given fabric conditions and weaving conditions under which the diagram of Fig. 3 may be obtained in weaving operation, the pressure P at the point X or higher should preferably be selected based on the line 64 of Fig. 3 that is indicative of the change of angular difference. In view of energy saving, however, excessive sub-nozzle pressure is disadvantageous because the line 64 indicative of the change of angular difference is approximately constant when the sub-nozzle pressure is higher than the pressure P at the point X. In the present embodiment, the pressure P at the point X is selected as the optimum sub-nozzle pressure that results in constant time of weft insertion completion and stable flight of the weft yarn Y and also allows less consumption of air by the sub-nozzles which contributes to an energy saving.

[0031] In the diagram of Fig. 3, the line 64 indicative of the change of angular difference is obtained through the weaving operation under given fabric conditions and weaving conditions. The inventors of the present invention have found through various experiments that the optimum sub-nozzle pressure P significantly changes de-

pending on the loom speed of the air jet loom 1 and the type of the reed dent 58 which are part of the weaving conditions. The type of the reed dent 58 can be specified by the dent thickness, the dent count, the space ratio. In the present embodiment, the dent thickness is used to specify the type of the reed dent 58, and indicated as an item of the weaving condition on the screen 57 of the display 56 (see Fig. 5).

[0032] Weaving operation is performed at various loom speeds and using various types of the reed dent 58 under the same fabric and weaving conditions other than the loom speed and the type of the reed dent 58, and plural diagrams similar to the diagram of Fig. 3 are prepared by the different loom speeds for each type of the reed dent 58. Then, data of the optimum sub-nozzle pressure P at the point X on the lines 64 in the respective diagrams is extracted by different types of the reed dent 58 and different loom speeds. Such data of optimum sub-nozzle pressure P obtained from the lines 64 is linked to the data of loom speed by types of the reed dent 58 such as T1, T2, T3 so that the database 65 as shown in Fig. 2 and the similar databases 66, 67 indicated by two-dot chain lines are prepared. The databases 65, 66, 67 are registered and stored in the controller 43. The databases 65, 66, 67 may be stored not only in the form of a diagram, but also in the form of a mathematical formula made based on such diagram.

[0033] In the description of the present embodiment, only three kinds of the databases 65, 66, 67 prepared for three different fabric and weaving conditions are shown in Fig. 2 for simplicity. Actually, four or more different databases are prepared and stored in the controller 43. Preparing plural databases such as 65, 66, 67 allows easy selection of optimum sub-nozzle pressure for any kind of fabric.

[0034] The controller 43 stores therein a program that allows optimum sub-nozzle pressure to be selected from the database 65, 66 or 67 based on the fabric conditions and the weaving conditions including the type of reed dent and the loom speed, and also allows the selected optimum sub-nozzle pressure to be indicated on the display 56. The following will describe an example of setting condition for weft insertion by the program stored in the controller 43 with reference to Figs. 4 to 6.

[0035] As shown in Fig. 4, part of the fabric conditions and weaving conditions for weft yarn Y is indicated on the screen 57 of the display 56. Specifically, weft yarn type, weft yarn count, weft yarn density are indicated as the items of the fabric condition, while the time of weft insertion start and the time of weft insertion completion are indicated as the items of the weaving condition, for each of the colors 1, 2 that corresponds to the two sets of weft insertion devices 2 for multicolor weft insertion. Data for the respective items that is previously stored in the controller 43 or input on the screen 57 is also indicated.

[0036] As shown in Fig. 5, part of the fabric conditions and weaving conditions for warp yarns and other condi-

tion is also indicated on the same screen 57 of the display 56. Specifically, warp yarn type, warp yarn count, warp yarn density are indicated as the items of the fabric condition, while reed dent thickness indicative of the type of the reed dent 58, reed width, loom speed are indicated as the items of the weaving condition. Data for the respective items that is previously stored in the controller 43 or input on the screen 57 is also indicated.

[0037] The controller 43 reads out the database 65 of Fig. 2 whose fabric and weaving conditions correspond to the conditions shown in Figs. 4, 5. Then, based on the reed dent thickness T1 and the loom speed R1 indicated on the screen 57 (see Fig. 5), the sub-nozzle pressure linked to such T1, R1 is searched in the database 65. The pressure P1 linked to the loom speed R1 on the line 60 indicative of optimum sub-nozzle pressure for the type of reed dent or reed dent thickness T1 is selected from the database 65 by the controller 43 as the optimum sub-nozzle pressure, and the selected sub-nozzle pressure is indicated on the screen 57 (see Fig. 6).

[0038] As shown in Fig. 6, the main nozzle pressure, the tandem nozzle pressure, the sub-nozzle pressure and the end nozzle pressure as the items of weaving conditions are indicated for each of the respective colors 1, 2 on the screen 57. The optimum sub-nozzle pressure of P1 selected from the database 65 of Fig. 2 by the controller 43 is indicated in the field of the sub-nozzle pressure. The end nozzle pressure of P1- α , or the pressure that is lower than the optimum sub-nozzle pressure P1 by α , is indicated in the field of the end nozzle pressure. The indication of such pressures on the screen 57 as shown in Fig. 6 may be used as reference by an operator of the loom in adjusting the corresponding conditions. It may be so arranged that such adjustment is done automatically. In this case, indication of the pressure as in Fig. 6 may be dispensed with.

[0039] In the present embodiment, the controller 43, the plural databases 65, 66, 67 and the program for selecting optimum sub-nozzle pressure cooperate to constitute the apparatus for setting the weft insertion condition. The use of the database 65, 66, 67 shown in Fig. 2 results in constant time of weft insertion completion and stable flight of weft yarn Y during the weft insertion, and also allows possible reduction of the pressure of compressed air for injection from the sub-nozzles 3 and the end nozzles 4, which leads to a significant energy saving in the air jet loom 1. Preparing plural databases such as 65, 66, 67 allows easy selection of optimum sub-nozzle pressure for any kind of fabric.

[0040] It is to be understood that the present invention is not limited to the above-described embodiment, but it may be modified in various ways as exemplified below without departing from the scope of the invention.

(1) Although in the illustrated embodiment plural databases such as 65, 66, 67 shown in Fig. 2 are prepared to be stored in the controller 43, only a single database such as 65 may be prepared for storage

in the controller 43. Even the use of the single database 65 allows easy selection of optimum sub-nozzle pressure P in weaving a fabric under common fabric and weaving conditions other than the type of the reed dent 58 and the loom speed, thereby providing significant advantages.

(2) In the illustrated embodiment, the reed dent thickness as the type of the reed dent 58 and the loom speed are indicated as the items of weaving condition on the screen 57 as shown in Fig. 5, and the controller 43 selects the optimum sub-nozzle pressure P1 based on the data T1, R1 indicated corresponding to the respective items of condition. Such indication of the reed dent thickness and the loom speed is intended to allow their data to be rewritten and input on the screen 57. Therefore, the reed dent thickness and the loom speed need not necessarily be indicated on the screen 57 if data of reed dent thickness and loom speed is previously stored in the controller 43 as a part of weaving condition.

(3) Although in the illustrated embodiment the sub-nozzles 3 connected to the sub-air tank 30 are provided separately from the end nozzles 4 connected to the another sub-air tank 38, only the sub-nozzles 3 and their associated sub-air tank 30 may be provided.

[0041] An apparatus for setting weft insertion condition in an air jet loom includes a weft insertion device causing a weft yarn to move by compressed air injected from a main nozzle and plural sub-nozzles arranged in the direction of weft insertion, and a controller storing fabric conditions and weaving conditions. The controller stores a database in which data of optimum sub-nozzle pressure is linked to data of loom speed for different types of reed dent. The data of optimum sub-nozzle pressure is obtained based on the variation of angular difference between the time of weft insertion completion and the time of weft release completion in the fabric conditions and the weaving conditions. The controller selects the optimum sub-nozzle pressure from the database based on the fabric conditions, the type of reed dent and the loom speed.

Claims

1. An apparatus for setting weft insertion condition in an air jet loom, comprising:

a weft insertion device (2) causing a weft yarn (Y) to move by compressed air injected from a main nozzle (5) and plural sub-nozzles (3) arranged in the direction of weft insertion; and a controller (43) storing fabric conditions and weaving conditions,

characterized in that the controller (43) stores a database (65, 66, 67) in which data of optimum sub-nozzle pressure is linked to data of loom speed for different types of reed dent (T1, T2, T3), the data of optimum sub-nozzle pressure is obtained based on the variation of angular difference between the time of weft insertion completion and the time of weft release completion in the fabric conditions and the weaving conditions, the controller (43) selects the optimum sub-nozzle pressure (P1) from the database (65, 66, 67) based on the fabric conditions, the type of reed dent (T1) and the loom speed (R1).

2. The apparatus of claim 1, wherein plural databases (65, 66, 67) are made for different fabric conditions and weaving conditions, one database (65) is selected from the plural databases (65, 66, 67) based on the fabric conditions and the weaving conditions, and the optimum sub-nozzle pressure (P1) is selected from the selected database (65) based on the type of reed dent (T1) and the loom speed (R1).
3. The apparatus of claim 1 or 2, wherein the controller (43) is equipped with a display (56) having a screen (57) on which the optimum sub-nozzle pressure (P1), the type of reed dent (T1) and the loom speed (R1) are indicated.
4. The apparatus of claim 3, wherein dent thickness, dent count or space ratio is indicated on the screen (57) of the display (56) as the type of reed dent (T1).

FIG. 1

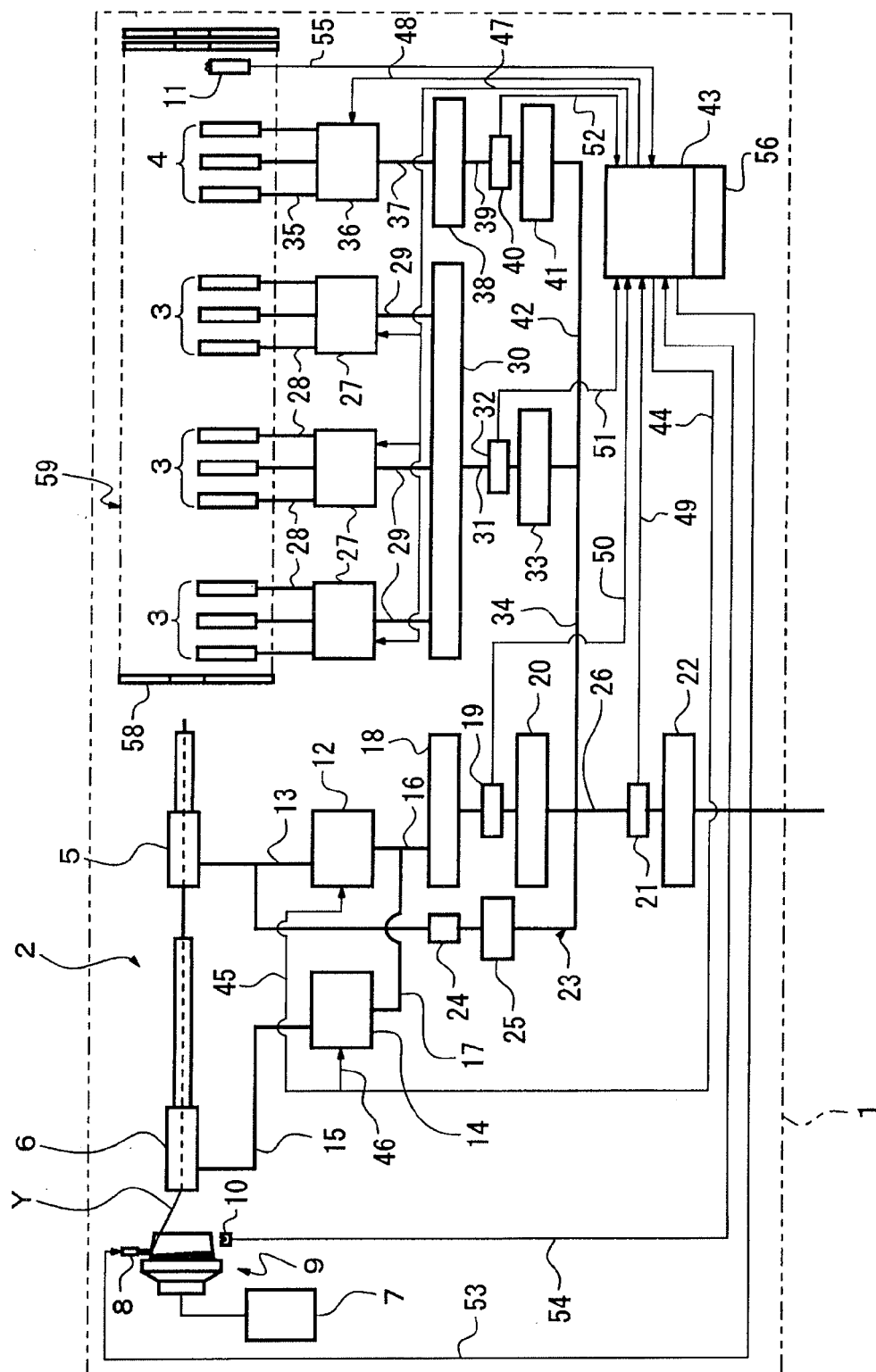


FIG. 2

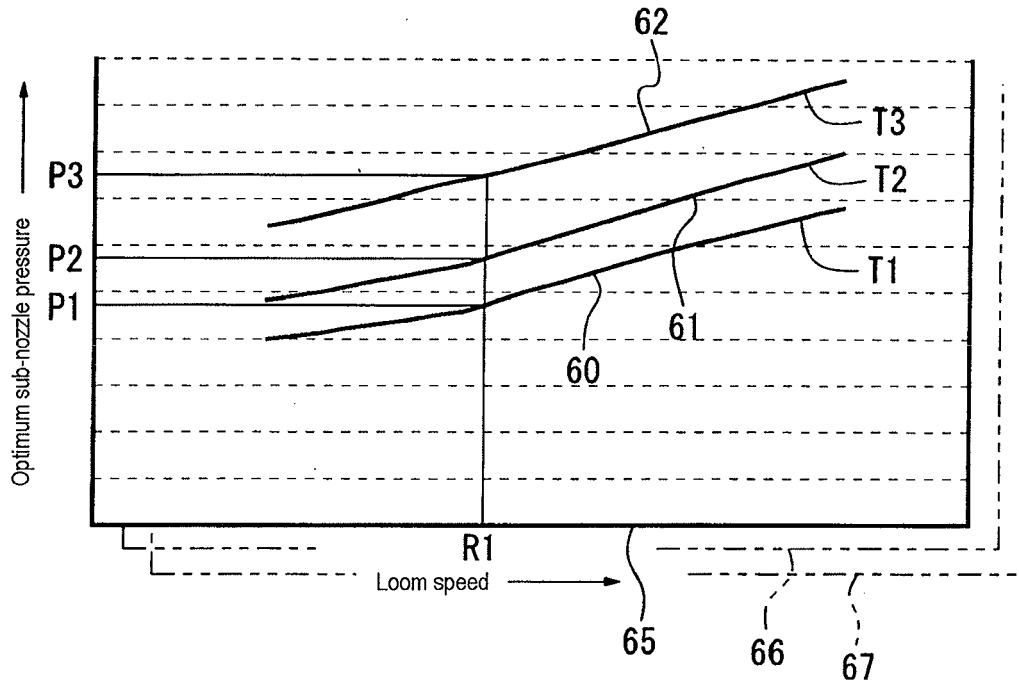


FIG. 3

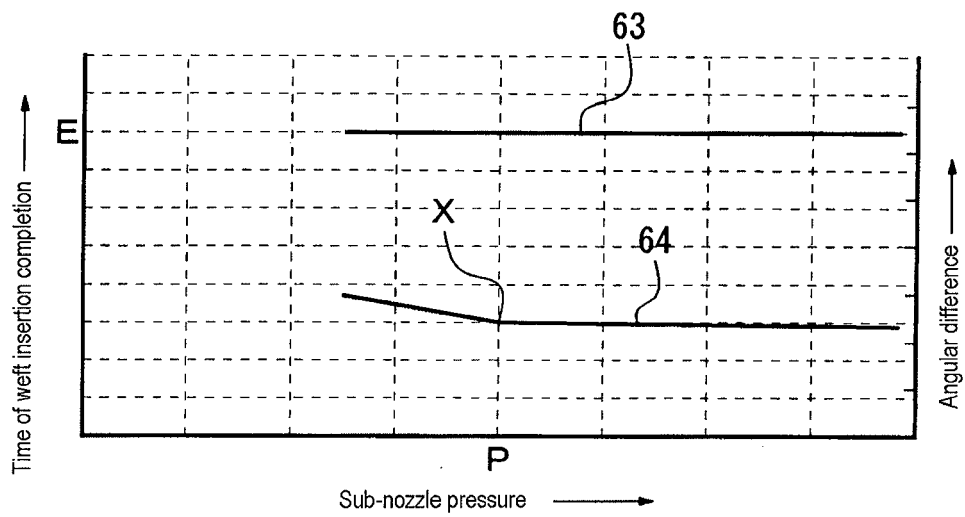


FIG. 4

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	Color 1	Color 2
Weft yarn type	A1	A2
Weft yarn count	B1	B2
Weft yarn density	C/inch	C/inch
Weft insertion start	D degrees	D degrees
Weft insertion completion	E degrees	E degrees

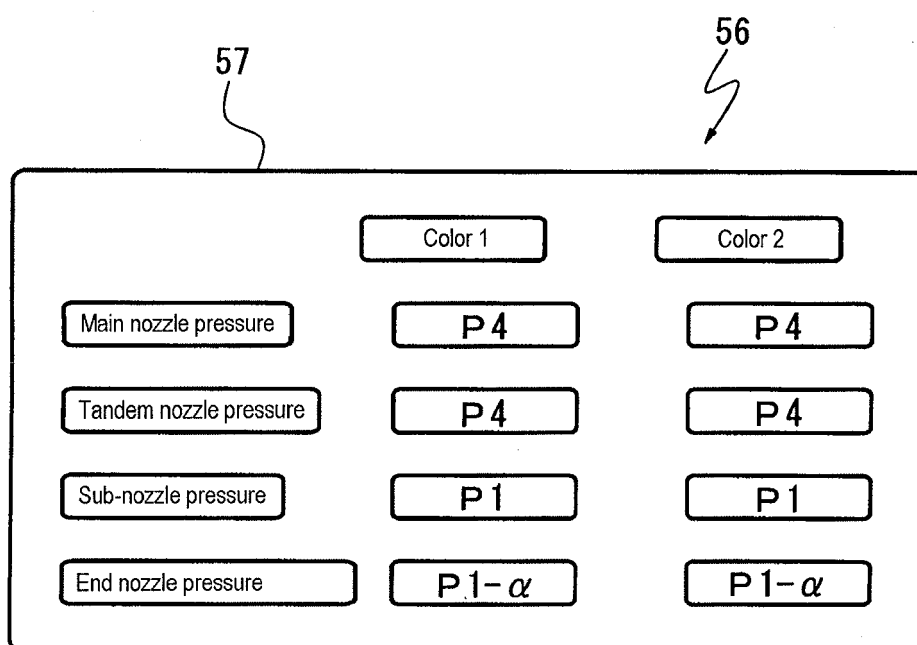
FIG. 5

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Warp yarn type	F
Warp yarn count	G
Warp yarn density	H/inch
Reed dent thickness	T1 mm
Reed width	L mm
Loom speed	R1 rpm

FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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