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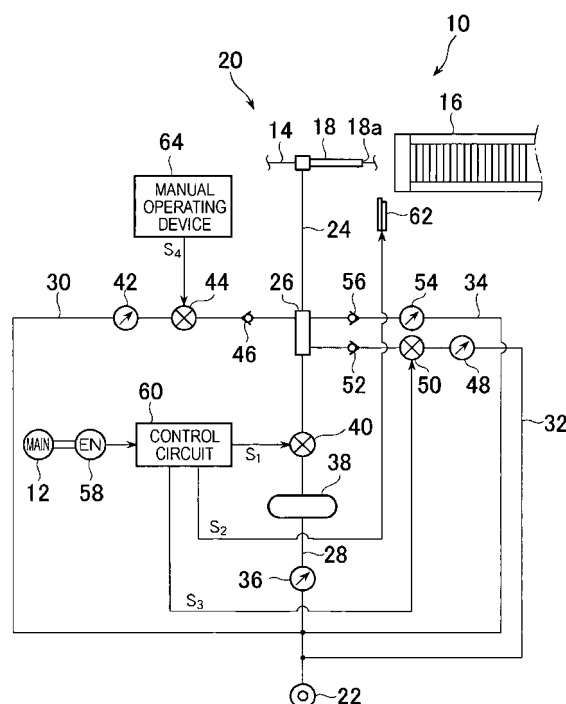
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(54) **Air jet loom**

(57) An air jet loom (10, 110) includes a weft insertion nozzle (18, 118) for inserting a weft thread (14, 114) through a shed by means of an airflow; a first supply channel (28, 128) for supplying the weft insertion nozzle with first compressed air for weft insertion; and a second supply channel (30, 130) for supplying the weft insertion nozzle with second compressed air used for threading the weft thread through the weft insertion nozzle and having a pressure different from that of the first compressed air. The second supply channel has an on-off valve (44, 144) for opening and closing the second supply channel. The on-off valve is opened in response to a control signal (S4) from a manual operating device (64). The manual operating device includes an operating switch (66) for outputting the control signal and a setting unit (70) for adjustably setting a time period in which the on-off valve is opened. When the operating switch is operated, the control signal is output to the on-off valve for the time period set by the setting unit.

FIG. 1



## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to an air jet loom that discharges compressed air from a weft insertion nozzle to insert a weft thread through a shed formed by warp threads.

#### 2. Description of the Related Art

**[0002]** In an air jet loom, as disclosed in, for example, Japanese Patent No. 2894465, a weft insertion nozzle is used for inserting a weft thread through a shed formed by warp threads. Specifically, the weft insertion nozzle discharges compressed air that carries the weft thread into the shed for weft insertion.

**[0003]** If the weft thread falls out of the weft insertion nozzle, the weft thread needs to be re-threaded through the weft insertion nozzle. In order to facilitate this threading process, compressed air with an air pressure suitable for threading is supplied to the weft insertion nozzle only at the time of the threading process.

**[0004]** Consequently, when the threading process is performed in a non-weaving state of the loom, this compressed air supplied to the weft insertion nozzle for the threading process can carry the weft thread relatively easily through the weft insertion nozzle.

**[0005]** However, in the air jet loom of this conventional example, there is no other way to adjust the pressure of the compressed air used for the threading process but to use a regulator disposed in a duct provided for transferring the compressed air used for the threading process. In addition, with the adjustment using this regulator, it is difficult to quickly and readily adjust the pressure of the compressed air used for the threading process, which is to be supplied to the weft insertion nozzle at the time of the threading process, to an appropriate pressure value that is suitable for the type of weft thread to be threaded through the weft insertion nozzle.

**[0006]** For these reasons, regardless of whichever type of weft thread is used in the air jet loom of this conventional example, the pressure of the compressed air used for the threading process is not adjusted to an appropriate pressure value that is suitable for each type of weft thread. If the air pressure for the threading process is too high, the weft thread may break while being threaded through the weft insertion nozzle. In contrast, if the air pressure for the threading process is too low, it may cause difficulties in threading the weft thread through the weft insertion nozzle, thus lowering the efficiency of the threading process. For these reasons, an air jet loom in which the jet force of the compressed air for the threading process to be discharged from the weft insertion nozzle can be readily and quickly adjusted to an appropriate value in accordance with the type of weft thread has been

in demand.

### SUMMARY OF THE INVENTION

**[0007]** Accordingly, it is an object of the present invention to provide an air jet loom in which a jet force of compressed air for the threading process to be discharged from a weft insertion nozzle can be readily and quickly adjusted to an appropriate jet force in accordance with the type of weft thread to be threaded through the weft insertion nozzle.

**[0008]** An air jet loom according to the present invention includes a weft insertion nozzle for inserting a weft thread through a shed by means of an airflow; a first supply channel for supplying the weft insertion nozzle with first compressed air for weft insertion; a second supply channel for supplying the weft insertion nozzle with second compressed air used for threading the weft thread through the weft insertion nozzle and having a pressure different from that of the first compressed air, the second supply channel having an on-off valve for opening and closing the second supply channel; and a manual operating device for outputting a control signal to the on-off valve such as to open the on-off valve to set the second supply channel in an opened state. The manual operating device includes an operating switch for outputting the control signal, and a setting unit for adjustably setting a time period in which the on-off valve is opened. When the operating switch is operated, the control signal is output to the on-off valve for the time period set by the setting unit.

**[0009]** In the air jet loom according to the present invention, the on-off valve in the second supply channel can be opened by operating the manual operating device. This opening operation of the on-off valve allows the compressed air used for the threading process to be supplied to the weft insertion nozzle. Moreover, the time period in which the on-off valve is opened in response to the operation of the manual operating device can be adjustably set by the setting unit provided in the manual operating device. By setting the open time period of the on-off valve to a longer time period, the jet force of the compressed air for the threading process to be discharged from the weft insertion nozzle can be increased. In contrast, by setting the open time period of the on-off valve to a shorter time period, the jet force of the compressed air for the threading process to be discharged from the weft insertion nozzle can be decreased.

**[0010]** Accordingly, by operating the setting unit, the open time period of the on-off valve can be preliminarily set to an appropriate value in accordance with the type of weft thread, whereby the jet force of the compressed air for the threading process to be discharged from the weft insertion nozzle can be adjusted to an optimal value. Thus, after the adjustment has been made by the setting unit, the jet force of the compressed air for the threading process to be discharged from the weft insertion nozzle can be adjusted to an appropriate value in accordance

with the type of weft thread to be threaded through the weft insertion nozzle by simply operating the operating switch in the manual operating device, regardless of how long the operating switch is operated.

**[0011]** According to the air jet loom of the present invention, compressed air with an appropriate jet force that is suitable for the type of weft thread to be threaded through the weft insertion nozzle can be discharged from the weft insertion nozzle without having to operate a regulator disposed in the supply channel intended for transferring the compressed air used for the threading process.

**[0012]** In addition to the aforementioned opening operation of the on-off valve, the on-off valve may be opened substantially when the weft thread passed through the weft insertion nozzle is cut by a thread cutter. By allowing the on-off valve to open substantially when the weft thread is cut by the thread cutter, a cutting blow similar to that in the conventional art can be supplied to the weft insertion nozzle through the second supply channel. Accordingly, the second supply channel can function both as a duct for the cutting blow and a duct for the threading process. This ensures that, without requiring a duct designated for the cutting blow, a kinked weft thread, which is caused by cutting of the weft thread by the thread cutter, is prevented from falling out of the weft insertion nozzle.

**[0013]** As described above, according to the present invention, by operating the setting unit, the jet force of the compressed air to be discharged from the weft insertion nozzle for the threading process can be adjusted to an appropriate value in accordance with the type of weft thread to be threaded through the weft insertion nozzle. Thus, the jet force at the time of the threading process can be quickly and readily adjusted in accordance with the type of weft thread, whereby the weft thread can be efficiently threaded through the weft insertion nozzle without being damaged, regardless of whichever type of weft thread is used.

## BRIEF DESCRIPTION OF THE DRAWINGS

### **[0014]**

Fig. 1 is a schematic diagram illustrating a weft insertion apparatus included in an air jet loom according to a first embodiment of the present invention; Fig. 2 is a block diagram of an illustrative example of a manual operating device according to the present invention shown in Fig. 1; and Fig. 3 is a schematic diagram similar to Fig. 1, which shows a weft insertion apparatus included in an air jet loom according to a second embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0015]** Preferred embodiments of the present inven-

tion will now be described with reference to the drawings.

### First Embodiment

**[0016]** Referring to Fig. 1, an air jet loom 10 according to the present invention includes a shedding apparatus (not shown) that is actuated synchronously with a rotation of a main shaft 12 of the air jet loom 10, a reed 16 that rocks in conjunction with the main shaft 12 to beat a weft thread 14 inserted in a shed formed by warp threads in response to the actuation of the shedding apparatus against a cloth fell, and a weft insertion apparatus 20 having a weft insertion nozzle 18 which is integrally supported by the reed 16. The reed 16 has a conventionally known air guide groove (not shown) that extends from one end of the reed 16 to the other end in the longitudinal direction thereof. The weft insertion nozzle 18 has an outlet 18a that is oriented towards the air guide groove.

**[0017]** The weft insertion apparatus 20 includes a pneumatic source 22 constituted by, for example, an air pump for generating compressed air, a first supply channel 28 for guiding the compressed air from the pneumatic source 22 to the weft insertion nozzle 18 by allowing the compressed air to travel through a connector 26 connected to the weft insertion nozzle 18 by means of a connecting tube 24, and second to fourth supply channels 30, 32, 34 that are arranged in parallel with the first supply channel 28.

**[0018]** The first supply channel 28 intended for weft insertion has a regulator 36 for setting the pressure of the compressed air from the pneumatic source 22 to an appropriate pressure for weft insertion, a tank 38 which withholds the compressed air, whose pressure has been adjusted by the regulator 36, so as to supply the compressed air stably to the weft insertion nozzle 18, and a first on-off valve 40 that blocks off the first supply channel 28 but opens the first supply channel 28 upon receiving a control signal. The regulator 36, the tank 38, and the first on-off valve 40 are arranged in that order from the pneumatic source 22 towards the connector 26.

**[0019]** The second to fourth supply channels 30, 32, 34 diverge from intermediate points of the first supply channel 28 extending from the pneumatic source 22, such as to bypass the regulator 36, the tank 38, and the first on-off valve 40 and then join the first supply channel 28 again to connect to the weft insertion nozzle 18. Thus, the second to fourth supply channels 30, 32, 34 each supply the weft insertion nozzle 18 with compressed air having a pressure different from that of the compressed air supplied by the first supply channel 28.

**[0020]** The second supply channel 30 intended for threading the weft thread 14 through the weft insertion nozzle 18 has a regulator 42 for reducing the pressure of the compressed air from the pneumatic source 22 and a second on-off valve 44 that blocks off the second supply channel 30 but opens the second supply channel 30 upon receiving a control signal. The regulator 42 and the second on-off valve 44 are arranged in that order from the

upstream side of the second supply channel 30 towards the downstream side thereof that is connected to the connector 26. Moreover, the second on-off valve 44 and the connector 26 have a check valve 46 interposed therebetween for preventing a backflow of the compressed air.

**[0021]** The regulator 42 in the second supply channel 30 sets the pressure of the compressed air from the pneumatic source 22 to a value lower than that of the pressure set by the regulator 36 in the first supply channel 28 so that the pressure set by the regulator 42 is suitable for threading the weft thread 14 through the weft insertion nozzle 18. Consequently, setting the air pressure in the second supply channel 30 lower than the pressure of the compressed air supplied to the weft insertion nozzle 18 through the first supply channel 28 for weft insertion avoids an untwining effect on the weft thread 14 and thus prevents the weft thread 14 from untwining, whereby the threading process can be implemented readily.

**[0022]** The third supply channel 32 intended for a cutting blow has a regulator 48 for reducing the pressure of the compressed air from the pneumatic source 22 and a third on-off valve 50 that blocks off the third supply channel 32 but opens the third supply channel 32 upon receiving a control signal. The regulator 48 and the third on-off valve 50 are arranged in that order from the upstream side of the third supply channel 32 towards the downstream side thereof that is connected to the connector 26. Moreover, the third on-off valve 50 and the connector 26 have a check valve 52 interposed therebetween for preventing a backflow of the compressed air.

**[0023]** The regulator 48 in the third supply channel 32 sets the pressure of the compressed air from the pneumatic source 22 to a value lower than that of the pressure set by the regulator 36 in the first supply channel 28 so that the pressure set by the regulator 48 is suitable for the cutting blow.

**[0024]** For example, each of the on-off valves 40, 44, 50 may be a conventionally known solenoid valve which opens when a solenoid coil thereof is supplied with electricity upon receiving a control signal.

**[0025]** The fourth supply channel 34 intended for constant air supply has a regulator 54 for reducing the pressure of the compressed air from the pneumatic source 22 and a check valve 56 for preventing a backflow of the compressed air. The regulator 54 and the check valve 56 are arranged in that order from the upstream side of the fourth supply channel 34 towards the downstream side thereof that is connected to the connector 26. The regulator 54 sets the pressure of the compressed air from the pneumatic source 22 to a value even lower than the pressure values set by the regulators 42, 48 in the second and third supply channels 30, 32.

**[0026]** Unlike the first to third supply channels 28, 30, 32, the fourth supply channel 34 is not provided with an on-off valve. Accordingly, as long as the air jet loom 10 is turned on and the pneumatic source 22 is in operation, compressed air of a pressure lower than the pressures set by the regulators 42, 48 is constantly supplied to the

weft insertion nozzle 18 through the connecting tube 24, regardless of whether the air jet loom 10 is performing or not performing a weaving operation.

**[0027]** As is conventionally known, even while the air jet loom 10 is in a non-weaving state, this low-pressure compressed air constantly supplied to the weft insertion nozzle 18 avoids untwining of the weft thread 14 supplied to the weft insertion nozzle 18 from a weft measuring/retaining device (not shown) and threaded through the weft insertion nozzle 18. In addition, this low-pressure compressed air prevents deviation of the leading end of the weft thread 14, which extends through the weft insertion nozzle 18, from the traveling path of the weft thread 14 so as to ensure that the weft thread 14 is properly maintained within its traveling path.

**[0028]** The weft insertion apparatus 20 includes a controller 60 which opens the on-off valves 40, 50 on the basis of rotation-angle information of the main shaft 12 received from an encoder 58 provided for the main shaft 12. Based on the rotation-angle information of the main shaft 12 received from the encoder 58, the controller 60 outputs a control signal S1 to the on-off valve 40 for a predetermined time period so that the compressed air used for weft insertion is discharged from the weft insertion nozzle 18 at the time of insertion of the weft thread 14. While receiving the control signal S1, the on-off valve 40 opens for the weft insertion. The compressed air used for weft insertion will be referred to as "weft-insertion compressed air" hereinafter.

**[0029]** When the weft insertion nozzle 18 receives the weft-insertion compressed air in response to the opening of the on-off valve 40, the weft thread 14, which had been maintained in the proper orientation within the weft insertion nozzle 18 by the low-pressure compressed air constantly supplied to the weft insertion nozzle 18 through the third supply channel 32, is carried by the weft-insertion compressed air so as to be discharged outward from the outlet 18a of the weft insertion nozzle 18. In this case, the weft thread 14 is carried by the weft-insertion compressed air without losing its proper orientation. Accordingly, the weft thread 14 travels along the air guide groove of the reed 16 so as to be guided properly through the shed towards the side of the shed that is opposite to the thread-feeding side.

**[0030]** Subsequently, the weft thread 14 inserted through the shed is beaten against the cloth fell by the reed 16. Then, a thread cutter 62 which operates in response to a control signal S2 from the controller 60 cuts off the weft thread 14 from the weft insertion nozzle 18 at a section thereof that protrudes from the weft insertion nozzle 18 near the thread-feeding side. When the weft thread 14 is cut by the thread cutter 62, the controller 60 outputs a control signal S3 to the on-off valve 50.

**[0031]** While receiving the control signal S3, the on-off valve 50 opens the third supply channel 32. In response to this opening of the on-off valve 50, the compressed air used for a cutting blow is supplied to the weft insertion nozzle 18 through the third supply channel 32. This com-

pressed air used for a cutting blow will be referred to as "cutting-blow compressed air" hereinafter. As is conventionally known, the output timing and output time period of the control signal S3 are set such as to include the cutting timing of the weft thread 14 and a period immediately following the cutting timing. In other words, the output timing and output time period are set to an extent that the cut weft thread 14 does not fall out of the weft insertion nozzle 18 due to the kink in the weft thread 14 caused as a result of the cutting thereof. For example, this period is set such that the cutting-blow compressed air is supplied to the weft insertion nozzle 18 from a point just prior to the cutting timing of the weft thread 14 to a point immediately after the cutting timing. Supplying the cutting-blow compressed air to the weft insertion nozzle 18 ensures that the kinked weft thread 14 is prevented from falling out of the weft insertion nozzle 18 after the weft thread 14 has been cut by the thread cutter 62.

**[0032]** When the air jet loom 10 is in the course of a weaving operation, if the weft thread 14 from the measuring/retaining device is accidentally cut off and falls out of the weft insertion nozzle 18, the weaving operation of the air jet loom 10 needs to be stopped in order to rethread the weft thread 14 from the measuring/retaining device through the weft insertion nozzle 18. In order to facilitate this process for threading the weft thread 14 through the weft insertion nozzle 18, a manual operating device 64 is provided for opening the on-off valve 44 in the second supply channel 30.

**[0033]** When the manual operating device 64 is operated to implement the threading process on the weft insertion nozzle 18, a control signal S4 for opening the on-off valve 44 is output to the on-off valve 44. Upon receiving the control signal S4, the on-off valve 44 opens so as to set the second supply channel 30 in an opened state.

**[0034]** Referring to Fig. 2, the manual operating device 64 includes an operating switch 66, an output unit 68 which has an output cutoff circuit 68a and is capable of receiving an operation signal S5 from the operating switch 66, and a setting unit 70 for setting an output time period T for outputting the control signal S4 from the output unit 68, namely, an open time period of the on-off valve 44. The operating switch 66 may be, for example, an electric switch, such as a touch switch on an operation panel (not shown) included in the manual operating device 64, a push-button switch provided in a housing (not shown) of the manual operating device 64, a slide switch, or a rotary switch.

**[0035]** When the output cutoff circuit 68a in the output unit 68 is receiving a control signal S6 from the controller 60, which indicates that the air jet loom 10 is performing a weaving operation, the output cutoff circuit 68a cuts off the output of the output unit 68 for the control signal S4. In contrast, when the output cutoff circuit 68a is not receiving the control signal S6, the output cutoff circuit 68a permits the output unit 68 to output the control signal S4.

**[0036]** When the output unit 68 receives the operation

signal S5 from the operating switch 66, the setting unit 70 can digitally or analogically change the duration of the output of the control signal S4 from the output unit 68 to the on-off valve 50 in units of, for example, 0.1 seconds between one second to several seconds. By operating the setting unit 70, the output time period (i.e. the open time period) T can be set in the output unit 68 so that the output time period T can be preliminarily adjusted in accordance with the type of weft thread 14 to be threaded through the weft insertion nozzle 18, or more specifically, the strength of the weft thread 14. Furthermore, the output time period T may be set preliminarily for each type of weft thread 14 so that the output time period T can be determined simply by selecting the type of weft thread 14.

**[0037]** In a case where the strength and the rigidity of the weft thread 14 are relatively high, the output time period T may be set to a maximum value of, for example, two seconds in the setting unit 70. Thus, when the operating switch 66 is operated, the on-off valve 44 opens so that compressed air with a pressure slightly lower than that of the cutting-blow compressed air, for example, can be discharged from the weft insertion nozzle 18 as compressed air used for threading the weft thread 14 through the weft insertion nozzle 18. This compressed air used for threading will be referred to as "threading compressed air" hereinafter.

**[0038]** On the other hand, in a case where the strength of the weft thread 14 is relatively low, the output time period T may be set to a minimum value of, for example, one second in the setting unit 70. Thus, when the operating switch 66 is operated, the on-off valve 44 opens so that compressed air with a pressure slightly higher than that of the constantly-supplied compressed air, for example, can be discharged from the weft insertion nozzle 18 as the threading compressed air.

**[0039]** Accordingly, since the output time period T of the control signal S4 to be output to the on-off valve 44 can be set preliminarily in the setting unit 70, the pressure of the threading compressed air, which is to be discharged from the weft insertion nozzle 18, can be appropriately adjusted in accordance with the property of the weft thread 14 to be threaded through the weft insertion nozzle 18, or in other words, the type of weft thread 14.

**[0040]** Consequently, when the threading compressed air is supplied to the weft insertion nozzle 18 in a state where the leading end of the weft thread 14 is inserted in an insertion hole of the weft insertion nozzle 18, the airflow carries the weft thread 14 outward from the outlet 18a of the weft insertion nozzle 18 without causing the weft thread to untwine. Accordingly, the weft thread 14 can be threaded readily and quickly through the weft insertion nozzle 18.

**[0041]** The output cutoff circuit 68a in the output unit 68 cuts off the output of the control signal S4 from the output unit 68 when the air jet loom 10 is performing a weaving operation. Therefore, even if the operating switch 66 is accidentally operated in the course of weaving, the control signal S4 is prevented from being output

to the on-off valve 44. This ensures that undesired threading compressed air is prevented from being supplied to the weft insertion nozzle 18 when the air jet loom 10 is performing a weaving operation. Accordingly, this prevents the quality of the woven cloth from deteriorating due to damages in the weft thread 14 resulting from such undesired threading compressed air being supplied to the weft insertion nozzle 18.

**[0042]** Alternatively, the manual operating device 64 may be incorporated in the controller 60. In that case, the control signal S4 to be sent to the on-off valve 44 in response to the operation of the manual operating device 64 is output from the controller 60.

**[0043]** As described above, in the air jet loom 10 according to the present invention, the jet force of the threading compressed air to be discharged from the weft insertion nozzle 18 can be adjusted by operating the operating switch 66 of the manual operating device 64 without requiring an operation of the regulator 42.

**[0044]** Accordingly, by implementing the setting process using the setting unit 70 in the manual operating device 64, the threading compressed air having an appropriate pressure in accordance with the type of weft thread 14 can be discharged from the weft insertion nozzle 18, regardless of how long the operating switch 66 is operated. Thus, the weft thread 14 can be properly and readily threaded through the weft insertion nozzle 18 without being damaged or untwined.

**[0045]** In the first embodiment shown in Fig. 1, the second supply channel 30 intended for the threading process and the third supply channel 32 intended for the cutting blow are provided separately. Alternatively, one of the channels 30, 32 may serve both as the two supply channels. In that case, either the second supply channel 30 or the third supply channel 32 may be omitted.

**[0046]** In a case where the second supply channel 30 is omitted, the third on-off valve 50 in the third supply channel 32 intended for the cutting blow may be actuated in response to the control signal S3 as well as the control signal S4 from the manual operating device 64.

**[0047]** On the other hand, in a case where the third supply channel 32 is omitted, the second on-off valve 44 in the second supply channel 30 intended for the threading process may be actuated in response to the control signal S4 as well as the control signal S3 from the controller 60.

**[0048]** In either case, since one of the second supply channel 30 and the third supply channel 32 can have the functions of the two supply channels, a simplified duct arrangement can be achieved, which advantageously contributes to cost reduction. As a further alternative, for the remaining supply channels other than the supply channel intended for the cutting blow, one of or each of these supply channels may have dual functions, one function being its original function and the other being a function as a supply channel for the threading process. In that case, however, the operation time for performing the original function must not overlap the operation time

for the threading process.

## Second Embodiment

**[0049]** An air jet loom 110 shown in Fig. 3 includes a weft insertion apparatus 120 that can correspond to a plurality of weft threads of multiple colors, specifically, two weft threads 14, 114 of two colors in this embodiment. The weft insertion apparatus 120 shown in Fig. 3 includes a weft insertion nozzle 18 which is the same as that included in the weft insertion apparatus 20 in Fig. 1, and first, second, and fourth supply channels 28, 30, 34 in connection with the weft insertion nozzle 18. These components included in the weft insertion apparatus 120 are given the same reference numerals as those shown in Fig. 1. In Fig. 3 and the description below, a third supply channel (32) intended for the cutting blow provided for each weft insertion nozzle 18, 118 is neither shown nor described for the purpose of simplification.

**[0050]** The weft insertion apparatus 120 also includes a weft insertion nozzle 118 which guides a weft thread 114, which is different from the weft thread 14 threaded through the weft insertion nozzle 18, towards the air guide groove of the reed 16. In addition, the weft insertion apparatus 120 has first, second, and fourth supply channels 128, 130, 134 in connection with the weft insertion nozzle 118, which respectively diverge from the corresponding first, second, and fourth supply channels 28, 30, 34.

**[0051]** The first supply channel 128 has an on-off valve 140 and a connector 126 which respectively correspond to the on-off valve 40 and the connector 26 in the first supply channel 28. Furthermore, the second supply channel 130 has an on-off valve 144 and a check valve 146 which respectively correspond to the on-off valve 44 and the check valve 46 in the second supply channel 30. Moreover, the fourth supply channel 134 has a check valve 156 which corresponds to the check valve 56 in the fourth supply channel 34.

**[0052]** The controller 60 alternately outputs the control signal S1 to the on-off valves 40, 140 in the respective first supply channels 28, 128. Consequently, as is conventionally known, the weft threads 14 and 114 are alternately supplied from the respective weft insertion nozzles 18, 118 towards the shed in accordance with the rotation angle of the main shaft 12. The weft threads 14, 114 are then cut by the thread cutter 62 which operates in response to the control signal S2 from the controller 60.

**[0053]** In this case, when the thread cutter 62 cuts the weft threads 14, 114, appropriate cutting-blow compressed air is supplied to the corresponding weft insertion nozzles 18, 118 through the third supply channel (not shown) in the same manner as described in the first embodiment. Furthermore, due to the low-pressure compressed air constantly supplied to the weft insertion nozzles 18, 118 through the fourth supply channels 34, 134, the weft threads 14, 114 are properly maintained within the corresponding weft insertion nozzles 18, 118.

**[0054]** In the weft insertion apparatus 120 having the

plurality of weft insertion nozzles 18, 118 as described above, by operating the setting unit 70 in the manual operating device 64 in the same manner as in the first embodiment, the output time periods T for outputting the control signal S4 to the second on-off valves 44, 144 can be set individually through the manual operating device 64. Thus, appropriate threading compressed air can be supplied to the weft insertion nozzles 18, 118 in accordance with the types of weft threads 14, 114.

**[0055]** Accordingly, the open time periods of the on-off valves 44, 144 change in accordance with the control signal S4 output to the on-off valves 44, 144 from the manual operating device 64. Therefore, depending on the type or property of the weft threads 14, 114 to be threaded through the respective weft insertion nozzles 18, 118, the threading compressed air can be discharged with an optimal jet force from the weft insertion nozzles 18, 118.

**[0056]** If the weft threads 14, 114 used have the same strength, the single control signal S4 from the setting unit 70 of the manual operating device 64 may be output dividedly to the on-off valves 44, 144. In that case, it is not necessary to provide an operating switch 66 for each of the nozzles. Instead, only a single operating switch 66 is required, and by operating that operating switch 66, the threading compressed air can be discharged from both weft insertion nozzles 18, 118 with the same jet force.

**[0057]** In the weft insertion apparatus 120 that can correspond to multiple colors as shown in Fig. 3, the first supply channels 28, 128 intended for weft insertion and connected to the weft insertion nozzles 18, 118 share a common regulator 36. Alternatively, in a case where the weft insertion apparatus 120 corresponds to four colors, a common regulator may be used for each pair of weft insertion nozzles 18, 118.

**[0058]** As an alternative to providing the regulators 42, 142 in the respective second supply channels 30, 130 intended for the threading process, a common regulator may be provided. This can simplify the configuration of the supply channels 30, 130.

**[0059]** In that case, although different from the technical concept of the present invention, the pressure of the threading compressed air to be discharged from the weft insertion nozzles 18, 118 can be adjusted by operating the common regulator based on the control signal S4 from the manual operating device 64. Furthermore, throttle valves (flow controlling units) may alternatively be provided on the downstream side of the regulators 42, 142 in the second supply channels 30, 130. In that case, the throttle valves are operated based on the control signal S4 from the manual operating device 64 so that the flow rate of the threading compressed air to be discharged from the weft insertion nozzles 18, 118 can be adjusted.

**[0060]** The on-off valves 44, 144 in the respective second supply channels 30, 130 may be opened for the threading process in conjunction with the pressing of a weaving stop button of the loom 110 or the pressing of a release button for a stopper pin of the weft measuring/

retaining device. In that case, the on-off valves 44, 144 open with a predetermined time lag after the weaving stop button or the release button has been operated. Furthermore, the operating switch 66 may operate in conjunction with the release button or may serve also as the release button. In that case, the stopper pin can be released by operating the operating switch 66.

**[0061]** It is not specifically described in the above embodiment how the loom operates in response to the pressing of the operating switch 66 when the on-off valves 44, 144 are in the process of being opened for the threading process of the weft thread 14, 114. When the operating switch 66 is operated, the control signal S4 is output to the on-off valves 44, 144, and if the threading process is completed while the on-off valves 44, 144 are in the process of being opened, the operating switch 66 may be operated again to stop the output of the control signal S4. Thus, the on-off valves 44, 144 close, thereby stopping the discharge from the weft insertion nozzles 18, 118.

**[0062]** In the above embodiment, the second to fourth supply channels 30, 32, 34 bypass the regulator 36, the tank 38, and the first on-off valve 40 included in the first supply channel 28 extending from the pneumatic source 22 so as to connect to the weft insertion nozzle 18. Alternatively, for example, by providing each of the weft insertion nozzles 18, 118 with two or more air inlets, the second to fourth supply channels 30, 32, 34 may be made independent of the first supply channel 28.

**[0063]** Although the first supply channel 28, the regulator 36, and the tank 38, which are intended for weft insertion, in the configuration shown in Fig. 3 are mutually shared by the plurality of weft insertion nozzles 18, 118, these components are generally provided for each of the weft insertion nozzles.

**[0064]** The technical scope of the present invention is not limited to the above embodiments, and modifications are permissible without departing from the scope of the claimed invention.

## Claims

1. An air jet loom (10, 110) that discharges compressed air from a weft insertion nozzle (18, 118) to insert a weft thread (14, 114) through a shed formed by warp threads, the air jet loom (10, 110) comprising:

the weft insertion nozzle (18, 118) for inserting the weft thread (14, 114) through the shed by means of an airflow;

a first supply channel (28, 128) for supplying the weft insertion nozzle (18, 118) with first compressed air for weft insertion;

a second supply channel (30, 130) for supplying the weft insertion nozzle (18, 118) with second compressed air used for threading the weft thread (14, 114) through the weft insertion nozzle (18, 118).

zle (18, 118) and having a pressure different from that of the first compressed air, the second supply channel (30, 130) having an on-off valve (44, 144) for opening and closing the second supply channel (30, 130); and  
a manual operating device (64) for outputting a control signal (S4) to the on-off valve (44, 144) such as to open the on-off valve (44, 144) to set the second supply channel (30, 130) in an opened state,

wherein the manual operating device (64) includes an operating switch (66) for outputting the control signal (S4), and  
a setting unit (70) for adjustably setting a time period in which the on-off valve (44, 144) is opened, wherein when the operating switch (66) is operated, the control signal (S4) is output to the on-off valve (44, 144) for the time period set by the setting unit (70).

2. The air jet loom (10, 110) according to Claim 1, wherein the on-off valve (44, 144) is opened substantially when the weft thread (14, 114) passed through the weft insertion nozzle (18, 118) is cut by a thread cutter (62).

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FIG. 1

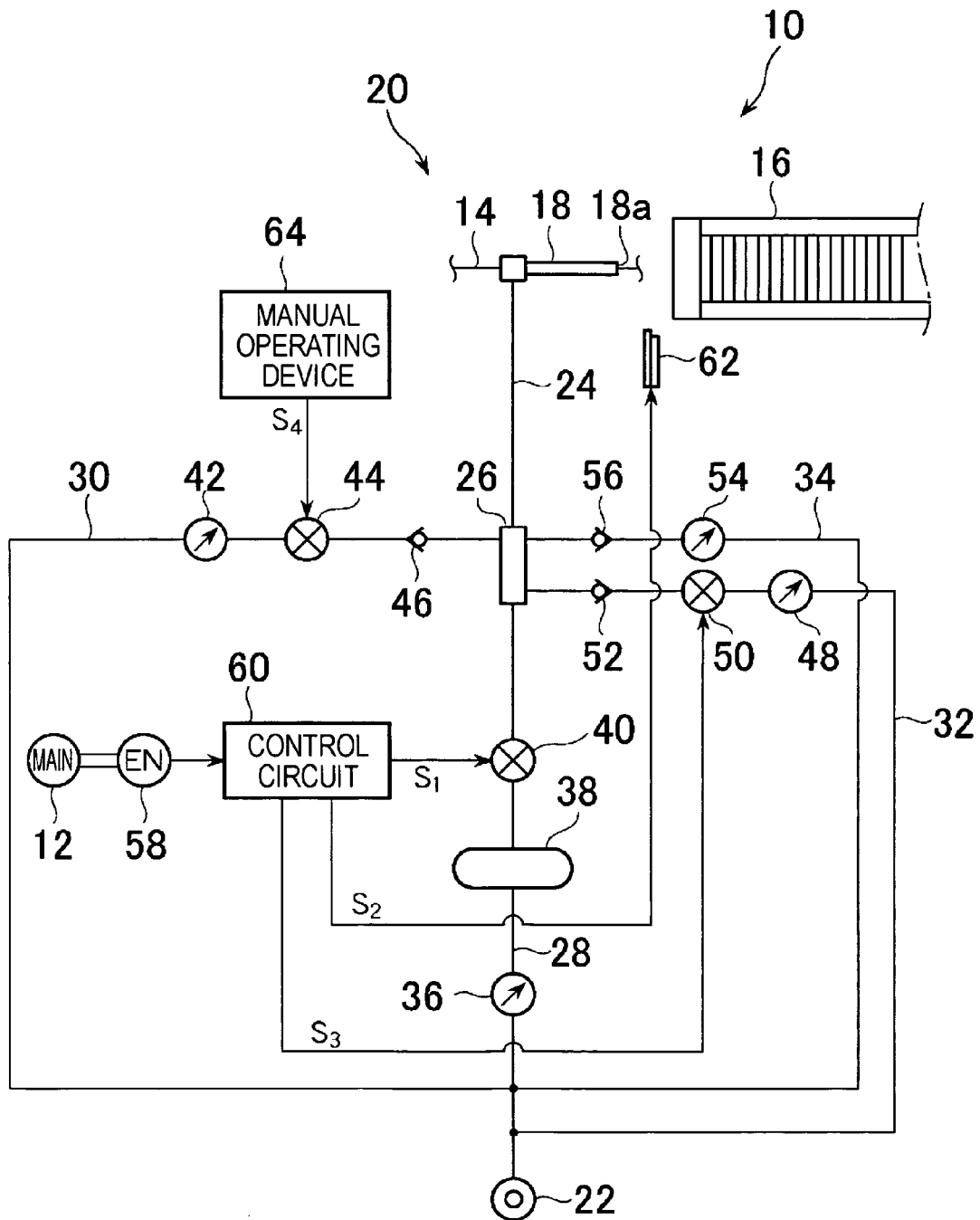


FIG. 2

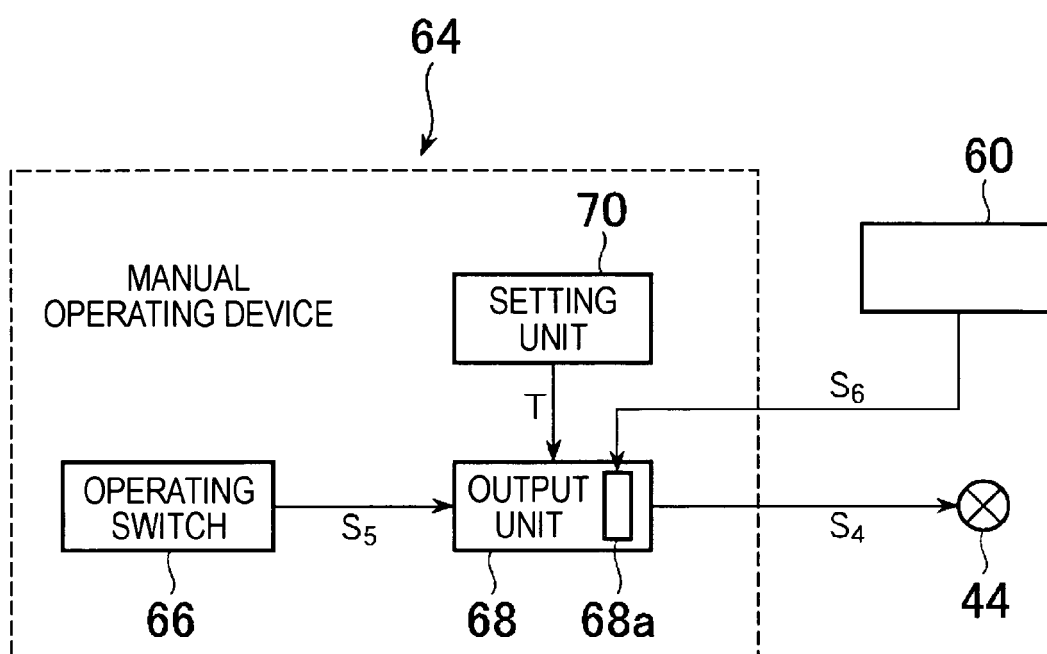
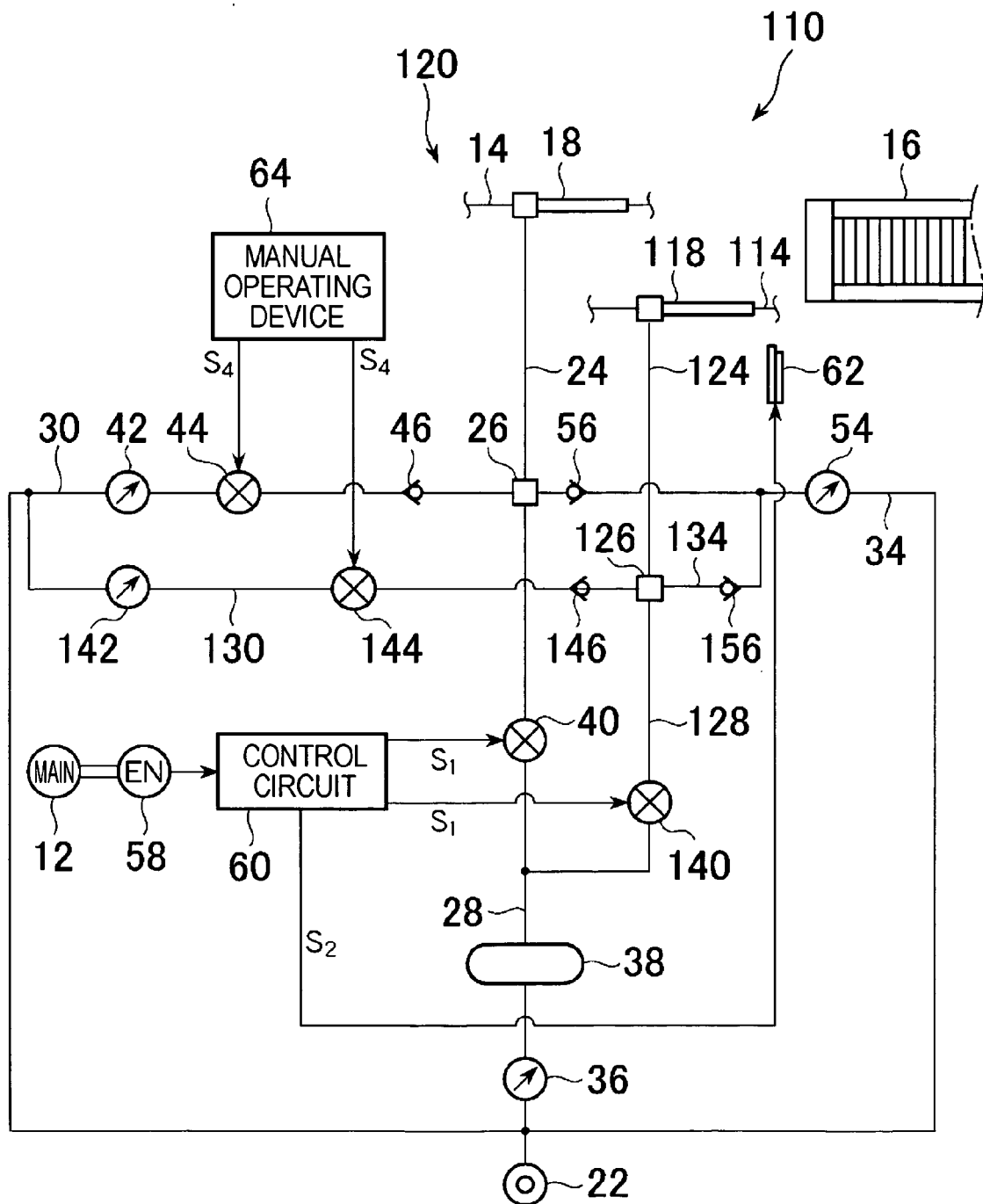


FIG. 3



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2894465 B [0002]