(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 476 788 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.07.2012 Bulletin 2012/29

(51) Int Cl.:
D03D 47/30 *(2006.01)*

(21) Application number: **12000009.6**

(22) Date of filing: **02.01.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **13.01.2011 JP 2011004549**

(71) Applicant: **TSUDAKOMA KOGYO KABUSHIKI KAISHA**
Kanazawa-shi,
Ishikawa-ken 921-8650 (JP)

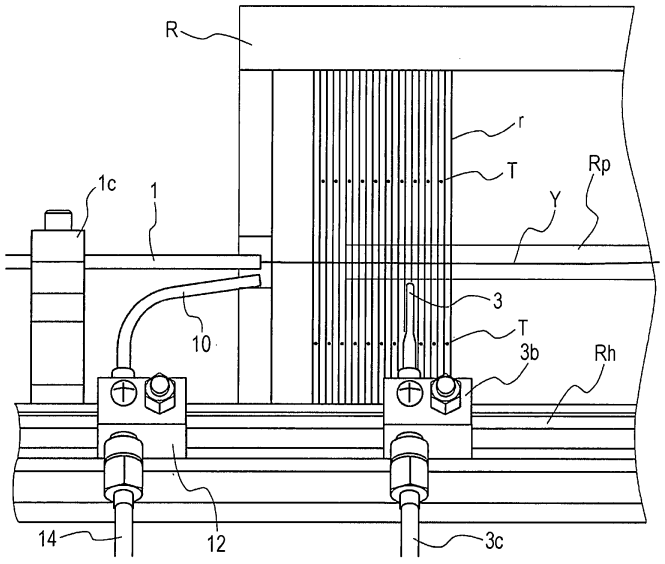
(72) Inventors:
- **Morimoto, Hitoshi**
  Kanazawa-shi
  Ishikawa-ken 921-8149 (JP)
- **Matsumoto, Masato**
  Kanazawa-shi
  Ishikawa-ken 921-8650 (JP)

(74) Representative: **Samson & Partner**
Widenmayerstrasse 5
80538 München (DE)

(54) Weaving method for air jet loom

(57) An air jet loom includes a main nozzle (1) for weft insertion and a plurality of sub-nozzles (3) arranged along a weft insertion path, the sub-nozzles (3) ejecting air at preset timings in a relay manner from the sub-nozzle (3) closest to a weft insertion side to assist a movement of a weft yarn (Y) ejected from the main nozzle (1). The air jet loom includes an auxiliary ejection nozzle (10, 20) provided such that an ejection hole thereof is positioned near a distal end portion of the main nozzle (1), the auxiliary ejection nozzle (10, 20) ejecting air such that the air acts on the weft yarn (Y) pulled out from the main nozzle (1). When the air jet loom uses a pre-dyed yarn as the weft yarn (Y), the auxiliary ejection nozzle (10, 20) is caused to eject the air in a predetermined period within a period from a time of completion of the weft insertion to a time at which the weft yarn (Y) is restrained by warp yarns (T).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to weaving methods for air jet looms, and more particularly, to a weaving method for when a pre-dyed yarn is used as a weft yarn in an air jet loom including a main nozzle for weft insertion and a plurality of groups of sub-nozzles arranged along a weft insertion path, the groups of sub-nozzles successively ejecting air at preset timings in a relay manner from the one closest to a weft insertion side to assist the movement of the weft yarn ejected from the main nozzle.

2. Description of the Related Art

[0002] As illustrated in Fig. 5, a general air jet loom includes a plurality of sub-nozzles 3 arranged along a weft insertion path in a weaving width area (area along a weaving width direction in which a line of warp yarns is present). The sub-nozzles 3 serve to assist the movement of a weft yarn Y that is ejected by a main nozzle 1.

[0003] In a known air jet loom, the sub-nozzles 3 are divided into groups in the order of arrangement from the weft insertion side, each group including several sub-nozzles 3. The sub-nozzles 3 that belong to the same group are connected to a common electromagnetic on-off valve 3a and are caused to eject air simultaneously. The groups of sub-nozzles 3 (sub-nozzle groups) are set so as to eject the air in preset periods illustrated in Fig. 6 in a relay manner from the one closest to the weft insertion side. In the graph illustrated in Fig. 6, the horizontal axis indicates a rotational angle (crank angle) of a main shaft of the loom and the vertical axis indicates the distance from a distal end of the main nozzle in the weaving width direction.

[0004] In the graph illustrated in Fig. 6, 1G, 2G, 3G, ... correspond to the sub-nozzle groups. The sub-nozzle group that is closest to the weft insertion side is denoted by 1G, and the following sub-nozzle groups are denoted by 2G, 3G, and so on in the order of arrangement. The sub-nozzles 3 are divided into eight sub-nozzle groups. The bar graph shows the ejection period of each sub-nozzle group in terms of the crank angle. The straight line that obliquely extends through the bar graph is a virtual line that shows the manner in which the weft yarn Y travels. In the illustrated example, the weft yarn Y starts to travel at 80° in terms of the crank angle, and the desired arrival time at which the weft yarn Y is to arrive at a predetermined position at a weft arrival side (side opposite to the weft insertion side) is 240° in terms of the crank angle. The bar drawn at the bottom of the graph shows the set ejection period of the main nozzle 1 (70° to 180° in terms of the crank angle).

[0005] The above-described ejection periods (ejection start times and ejection end times) of the main nozzle 1 and the sub-nozzles 3 are set by an input setting unit (not shown) and stored in a weft insertion controller 5 illustrated in Fig. 5. The weft insertion controller 5 receives a signal representing a rotational angle θ of a main shaft Ms of the loom in each revolution thereof from an encoder EN connected to the main shaft Ms.

[0006] The weft insertion controller 5 controls the operations of an electromagnetic on-off valve 1a connected to the main nozzle 1 and the electromagnetic on-off valves 3a connected to the respective sub-nozzle groups on the basis of the rotational angle θ of the main shaft Ms, which is based on the signal from the encoder EN, and the set ejection start and end times of the main nozzle 1 and the sub-nozzles 3. Thus, the main nozzle 1 and the sub-nozzles 3 are caused to eject the air over the set ejection periods. In Fig. 5, components denoted by reference numerals 1b and 3b are pressure regulators provided between a compressed air source As and the electromagnetic on-off valves 1a and 3a. The pressure regulator 1b regulates the pressure of the compressed air supplied to the main nozzle 1, and the pressure regulator 3b regulates the pressure of the compressed air supplied to the sub-nozzle groups.

[0007] The weft yarn Y is pulled out from a yarn supplier 7, and a certain length of weft yarn Y that corresponds to a single cycle of weft insertion (single pick) is temporarily stored by a measuring-and-storing device 9. The thus-stored weft yarn Y that corresponds to a single pick is pulled out from the measuring-and-storing device 9 by a pulling force generated by the compressed air (ejected air) ejected by the main nozzle 1. Thus, the weft insertion is started. During the weft insertion, the sub-nozzles 3 eject the compressed air toward the weft yarn Y that is ejected by the main nozzle 1. Thus, the movement of the weft yarn Y is assisted by the ejected air. After the weft insertion, the weft yarn Y is beaten up against a cloth fell of the woven cloth W by a reed R, and is then cut at a position between the woven cloth W and the main nozzle 1 by a yarn cutter 11 disposed at the weft insertion side. Thus, the weft yarn Y having the length corresponding to a single pick is woven into the woven cloth W.

[0008] In the above-described process of weft insertion, the ejected air (compressed air) that acts on the weft yarn Y does not act on the entire body of the weft yarn Y corresponding to a single pick. Instead, the air acts only on a portion of the entire weft yarn Y at the weft arrival side in the weft insertion direction. In other words, the weft yarn Y corresponding to a single pick does not receive the ejected air over the entire length thereof, and a portion of the weft yarn Y that is at the weft insertion side in the inserted state does not receive the ejected air at all during the weft insertion. As a result, in the case of weaving fabric, such as denim, using a pre-dyed yarn as the weft yarn Y, there is a possibility that a quality problem will occur in which the color of a weft-insertion-side portion of the woven cloth W differs from that of a weft-arrival-side portion of the woven cloth W. This will be described in more detail.

[0009] As described above, in a general air jet loom, the ejection periods of the sub-nozzle groups are set as follows. That is, the ejection start times are set such that the sub-nozzle groups successively eject the air in a relay manner from the one closest to the weft insertion side. Accordingly, the ejection end times are set such that the sub-nozzle groups successively stop ejecting the air from the one closest to the weft insertion side.

[0010] Fig. 7 is a diagram illustrating the relationship between the weft yarn Y and the ejection status of each sub-nozzle group in the weft insertion process. Fig. 7 illustrates the progress of weft insertion (weft insertion length) of the weft yarn Y and the ejection status of each sub-nozzle group (whether or not the air is being ejected) at each of the crank angles shown at the left side. Similar to the example of Fig. 6, it is assumed that the number of sub-nozzle groups is eight. The ellipses hatched with oblique lines show that the air is being ejected by the corresponding sub-nozzle groups. Here, crank angles with intervals of 20° within the weft insertion period (80° to 240° in terms of the crank angle) are shown. In Fig. 7, the state of weft insertion changes in order from top to bottom. In addition, the position in the horizontal direction corresponds to the position of each sub-nozzle group in the weaving width direction of the loom.

[0011] As is clear from Fig. 7, a second half portion a (portion closer to the weft arrival side than a central portion) of the weft yarn Y of the entire length that corresponds to a single pick receives the air ejected from the sub-nozzles 3 for at least a certain period in the weft insertion period. In particular, a leading end portion of the weft yarn receives the ejected air over the entire weft insertion period.

[0012] In contrast, a first half portion b (portion closer to the weft insertion side than the central portion) of the weft yarn Y of the entire length that corresponds to a single pick hardly receives the air ejected by the sub-nozzles 3 during the weft insertion period. In the illustrated example, the main nozzle 1 continuously ejects the air until 180° in terms of the crank angle. Therefore, a part of the first half portion b of the weft yarn Y that is near the central portion receives the air ejected by the main nozzle 1. However, the remaining part of the first half portion b of the weft yarn Y that is near the weft insertion side is woven into the woven cloth W without receiving the ejected air at all during the weft insertion period.

[0013] It is known that, in the case where a pre-dyed yarn is used as the weft yarn Y, fluff on the surface of the weft yarn Y is blown off when the weft yarn receives the ejected air during the weft insertion. However, as described above, the portion of the weft yarn Y corresponding to a single pick at the weft arrival side receives the ejected air, while the major part of the portion of the weft yarn Y at the weft insertion side does not receive the ejected air at all. Therefore, the weft yarn Y is woven into the woven cloth W while the manner in which fluff adheres to the surface of the weft yarn Y differs between the weft insertion side and the weft arrival side. As a result, the tone of the woven cloth W will differ between the weft insertion side and the weft arrival side.

[0014] Japanese Unexamined Patent Application Publication No. 11-229251 discloses a technique of causing sub-nozzle groups to eject air in a manner different from that in the example illustrated in Fig. 6. More specifically, after each sub-nozzle group finishes ejecting the air in the corresponding ejection period for weft insertion, each sub-nozzle group is caused to eject the air again in a predetermined period that is set within a period from before the sub-nozzle group closest to the weft arrival side finishes ejecting the air to when the beating-up motion is carried out.

[0015] The technique of Japanese Unexamined Patent Application Publication No. 11-229251 (related art) aims to increase the pulling force applied to the weft yarn by the air that is ejected from the sub-nozzles and acts on the weft yarn at the end of weft insertion, so that the tension applied to the weft yarn can be increased when the weft yarn is woven into the woven cloth. According to the technique of the related art, unlike the case in which the sub-nozzle groups eject the air only in a relay manner as illustrated in Fig. 6, a portion of the weft yarn corresponding to a single pick that is near the weft insertion side also receives the air ejected from the sub-nozzles. Therefore, the above-described difference in tone between the weft insertion side and the weft arrival side can be reduced.

[0016] However, even when the technique according to the related art is applied, there is still a problem that a part having a tone that largely differs from that of other parts remains in the woven cloth. This is because even when the air is ejected from all of the sub-nozzles, the ejected air does not act on the weft yarn over the entire length thereof. This will be described in more detail.

[0017] In the structure of a general air jet loom, the sub-nozzles are arranged in the weaving width area as described above, and even the sub-nozzle closest to the weft insertion side cannot eject the air such that the air acts on a portion of the weft yarn near a selvage at the weft insertion side. More specifically, even the sub-nozzle closest to the weft insertion side is disposed further toward the inside (closer to the center of the woven cloth) than the position of the selvage in the weaving width direction. In addition, the sub-nozzles are designed to eject the air toward the downstream side in the weft insertion direction to assist the movement of the weft yarn. Accordingly, the portion of the weft yarn that is near the selvage at the weft insertion side does not receive the air ejected by the sub-nozzles.

[0018] Therefore, although the object of increasing the pulling force applied to the weft yarn can be achieved by the ejection of the air from the sub-nozzles as in the related art, the ejected air cannot be caused to act on the weft yarn to be woven into the woven cloth over the entire length thereof according to the technique of the related art. As a result, the weft yarn will be woven into the woven

cloth while a large amount of fluff remains on the portion of the weft yarn near the selvage, and the tone of that part will differ from that of other parts.

[0019] To allow the portion of the weft yarn near the selvage to receive the air ejected from the sub-nozzles 3, the sub-nozzle 3 closest to the weft insertion side may be positioned such that the air ejected from the sub-nozzle 3 can act on the above-described portion of the weft yarn, that is, at a position closer to the main nozzle 1 than the selvage at the weft insertion side. However, such a structure requires a larger number of sub-nozzles 3, and the air is wastefully consumed. In addition, there is a possibility that the weft insertion will be adversely affected. This will be described in more detail.

[0020] The original function of the sub-nozzles 3 is to eject the air in set periods in the weft insertion period so as to assist the movement of the weft yarn Y ejected from the main nozzle 1. In the area between an ejection hole in the main nozzle 1 and a region around the selvage, the air ejected from the main nozzle 1 sufficiently acts on the weft yarn Y at least in the period in which the sub-nozzle group closest to the weft insertion side ejects air. Therefore, when the object is simply to assist the movement of the weft yarn Y that travels, it is not necessary to cause the portion of the weft yarn Y around the selvage at the weft insertion side to receive the air ejected from the sub-nozzles 3. Accordingly, the air is wastefully consumed. On the contrary, in the above-described structure, the air ejected from the sub-nozzles 3 interferes with the air that has just been ejected from the main nozzle 1 immediately after the start of weft insertion. Therefore, there is a possibility that the flow of the air ejected from the main nozzle 1 will be disturbed and the weft insertion will be adversely affected.

SUMMARY OF THE INVENTION

[0021] In view of the related art having the above-described problem regarding the quality of the woven cloth, an object of the present invention is to improve the quality of the woven cloth produced by an air jet loom by using a pre-dyed yarn as a weft yarn.

[0022] The present invention is applied to an air jet loom including a main nozzle for weft insertion and a plurality of sub-nozzles arranged along a weft insertion path, the sub-nozzles ejecting air at preset timings in a relay manner from the sub-nozzle closest to a weft insertion side to assist the movement of a weft yarn ejected from the main nozzle.

[0023] According to a weaving method of the present invention, to achieve the above-described object, the air jet loom includes an auxiliary ejection nozzle having an ejection hole positioned near a distal end portion of the main nozzle, the auxiliary ejection nozzle ejecting air such that the air acts on the weft yarn pulled out from the main nozzle. The weaving method includes the step of causing, when the air jet loom uses a pre-dyed yarn as the weft yarn, the auxiliary ejection nozzle to eject the air in a predetermined period within a period from a time of completion of the weft insertion to a time at which the weft yarn is restrained by warp yarns.

[0024] According to the present invention, the area "near a distal end portion of the main nozzle" is an area including the distal end portion of the main nozzle (portion including the distal end (position of an ejection hole) of the main nozzle) and an area between the distal end of the main nozzle and the position of a selvage at the weft insertion side in a weft insertion direction. From the viewpoint of operation, when the ejection hole is positioned "near a distal end portion of the main nozzle", the ejected air can act on a portion of the weft yarn between the selvage at the weft insertion side and an area in which the air ejected from the sub-nozzle closest to the weft insertion side is effective.

[0025] In addition, the "time of completion of the weft insertion" is the time at which the weft yarn corresponding to a single pick is entirely pulled out from the main nozzle and the leading end of the weft yarn arrives at a predetermined position at the weft arrival side. In other words, the "time of completion of the weft insertion" is the time at which the movement of the weft yarn during the weft insertion is stopped. In addition, the "time at which the weft yarn is restrained by the warp yarns" is the time at which a shed formed by the warp yarns closes.

[0026] With regard to the "predetermined period within a period from the time of completion of the weft insertion to the time at which the weft yarn is restrained by the warp yarns", it does not mean that the air is ejected only in the "predetermined period" (the maximum of which is the period from the time of completion of the weft insertion to the time at which the weft yarn is restrained by the warp yarns). Instead, it means that the air is ejected at least in the above-described predetermined period. More specifically, the above-described predetermined period is set within the period from the time of completion of the weft insertion to the time at which the weft yarn is restrained by the warp yarns, and the auxiliary ejection nozzle is caused to eject the air at least in the set predetermined period. In other words, the auxiliary ejection nozzle may start ejecting the air before the completion of the weft insertion and continue to eject the air after the weft yarn is restrained by the warp yarns. The above-described predetermined period may be appropriately set in accordance with, for example, the condition of the weft yarn and the pressure of the compressed air to be ejected from the auxiliary ejection nozzle.

[0027] According to the weaving method for the air jet loom of the present invention, the auxiliary ejection nozzle is provided such that the ejection hole thereof is positioned near the distal end portion of the main nozzle. When the loom uses a pre-dyed yarn as the weft yarn Y, the auxiliary ejection nozzle ejects the air after the time of completion of the weft insertion, that is, the time at which the movement of the portion of the weft yarn at the weft insertion side is stopped. The thus-ejected air acts on a portion of the weft yarn to be woven into the woven

cloth, the portion being at the weft insertion side and positioned upstream of the area in which the air ejected by the sub-nozzle closest to the weft insertion side is effective. Accordingly, the manner in which fluff adheres to the above-described portion of the weft yarn can be made closer to that at other portions of the weft yarn, and the quality of the woven cloth can be improved.

[0028] The auxiliary ejection nozzle may be connected to a dedicated electromagnetic on-off valve that differs from the electromagnetic on-off valves to which the sub-nozzles are connected, so that the ejection period of the auxiliary ejection nozzle can be controlled and set irrespective of the weft insertion. In such a case, wasteful consumption of the air and the adverse effect on the weft insertion can be avoided.

[0029] The auxiliary ejection nozzle preferably stops ejecting the air at the time when the weft yarn is restrained by the warp yarns. This is because once the weft yarn is restrained by the warp yarns, the ejected air can hardly act on the weft yarn, and the effect of blowing off the fluff is reduced. Therefore, to reduce the consumption of the air, the air is preferably not ejected after the weft yarn is restrained by the warp yarns.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1 is a front view of an auxiliary ejection nozzle used in a weaving method according to an embodiment of the present invention;

Fig. 2 is a plan view of the auxiliary ejection nozzle used in the weaving method according to the embodiment of the present invention;

Fig. 3 is a time chart illustrating an example of an ejection period of the auxiliary ejection nozzle used in the weaving method according to the embodiment of the present invention;

Fig. 4 is a front view of an auxiliary ejection nozzle used in a weaving method according to another embodiment of the present invention;

Fig. 5 is a schematic diagram illustrating an air jet loom to which the present invention is applied;

Fig. 6 is a graph illustrating an example of ejection periods of sub-nozzle groups in a general air jet loom; and

Fig. 7 is a diagram illustrating the relationship between the manner in which a weft yarn travels and the ejection status of each sub-nozzle group in the general air jet loom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] Figs. 1 and 2 illustrate the main part of an example of a weft insertion device used to execute a weaving method for an air jet loom according to the present invention. In the present embodiment, the arrival time of the weft yarn in the example illustrated in the graph of Fig. 6 (240° in terms of the crank angle) is defined as the "time of completion of the weft insertion". In addition, the "time at which the weft yarn is restrained by the warp yarns" is 330° in terms of the crank angle, which is earlier than a beating-up time (0° in terms of the crank angle).

[0032] Figs. 1 and 2 illustrate an area around a distal end portion of the main nozzle 1. The main nozzle 1 is supported by a main nozzle bracket 1c at the distal end portion and a proximal end portion (not shown) thereof, and is provided on a reed holder Rh. The reed holder Rh supports a reed R, and is supported by a rocking shaft (not shown). The reed holder Rh rocks in response to rotation of the rocking shaft, thereby causing the reed R to perform a beating-up motion.

[0033] When the air is ejected from the main nozzle 1, the weft yarn Y, which extends through the main nozzle 1, travels through a weft guide groove Rp formed in dents r of the reed R such that the weft yarn Y is inserted into a shed formed by warp yarns T. Thus, the weft guide groove Rp defines a weft insertion path.

[0034] The reed holder Rh is provided with a plurality of sub-nozzles 3 that are supported by nozzle supporters 3b and arranged along the weft insertion path (only the sub-nozzle 3 closest to the weft insertion side is illustrated in Figs. 1 and 2). These sub-nozzles 3 are connected to the above-described electromagnetic on-off valves 3a (see Fig. 5) by air supply tubes 3c. The weft insertion controller 5 controls the operations of the electromagnetic on-off valves 3a so as to cause the sub-nozzles 3 to eject the air in the preset ejection periods illustrated in Fig. 6.

[0035] The air jet loom having the above-described structure includes an auxiliary ejection nozzle 10 to perform the weaving method according to the present invention. The auxiliary ejection nozzle 10 has an ejection hole that is positioned near the distal end portion of the main nozzle 1.

[0036] In the example illustrated in Figs. 1 and 2, similar to the sub-nozzles 3, the auxiliary ejection nozzle 10 is supported by a nozzle supporter 12 and is provided on the reed holder Rh. In addition, the illustrated auxiliary ejection nozzle 10 is formed of a tubular member (for example, a copper pipe), and is curved to have an arc shape between a proximal end portion thereof that is supported by the nozzle supporter 12 and a distal end portion thereof.

[0037] More specifically, the proximal end portion of the auxiliary ejection nozzle 10 extends in substantially the same direction as the axial lines of the sub-nozzles 3, and an intermediate portion thereof is curved in an arc shape. The portion of the auxiliary ejection nozzle 10 between the arc-shaped curved portion and the ejection hole at the distal end is at an angle so as to approach the main nozzle 1 toward the distal end thereof in an area below the main nozzle 1 when the reed R is viewed from the front. Thus, the direction in which the air is ejected by the auxiliary ejection nozzle 10 is somewhat inclined with respect to the ejection direction of the main nozzle

1, that is, the weft insertion direction of the weft yarn Y. The auxiliary ejection nozzle 10 is capable of ejecting the air such that the air acts on an end portion of the weft yarn Y at the weft insertion side after the weft yarn Y is ejected from the main nozzle 1.

[0038] In the auxiliary ejection nozzle 10, the length of the proximal end portion, the curvature of the arc-shaped portion, and the inclination angle of the distal end portion with respect to the main nozzle 1 are appropriately set so that the ejection hole in the auxiliary ejection nozzle 10 is positioned near the main nozzle 1 in an area around the distal end portion of the main nozzle 1.

[0039] The position at which the nozzle supporter 12 is attached to the reed holder Rh is changeable in the direction in which the reed holder Rh extends. Therefore, the position of the auxiliary ejection nozzle 10 in the weaving width direction (direction in which the reed holder Rh extends) can be adjusted by changing the position at which the nozzle supporter 12 is attached. The auxiliary ejection nozzle 10 is arranged such that the position of the ejection hole thereof in the ejection direction is where the ejected air can effectively act on a portion of the weft yarn Y between the selvage at the weft insertion side in the weaving width direction and an area in which the air ejected by the sub-nozzle 3 closest to the weft insertion side is effective.

[0040] In the illustrated example, the auxiliary ejection nozzle 10 is disposed such that the ejection hole thereof is at substantially the same position as the position of the ejection hole in the main nozzle 1 in the weft insertion direction. The position of the auxiliary ejection nozzle 10 in the weft insertion direction may be appropriately set in accordance with the position of the ejection hole thereof around the main nozzle 1 (distance from the main nozzle 1) or the ejection direction (inclination angle of the distal end portion in the illustrated example). For example, the auxiliary ejection nozzle 10 may be positioned within the range of the distal end portion of the main nozzle 1 or between the distal end of the main nozzle 1 and the position of the selvage at the weft insertion side.

[0041] The auxiliary ejection nozzle 10 is connected, by an air supply tube 14, to a dedicated electromagnetic on-off valve (not shown) that differs from the electromagnetic on-off valves 3a to which the sub-nozzles 3 are connected. Similar to the electromagnetic on-off valves 3a to which the sub-nozzles 3 are connected, the operation of the dedicated electromagnetic on-off valve is controlled by the weft insertion controller 5 at a preset timing so that the air is ejected in a desired ejection period. In the present embodiment, as illustrated in Fig. 3, the ejection period of the auxiliary ejection nozzle 10 is set from 240° in terms of the crank angle, which is the desired arrival time of the weft yarn Y that is set as the time of completion of the weft insertion, to 330° in terms of the crank angle, which is the time at which the shed formed by the warp yarns T is closed and the weft yarn Y is restrained by the warp yarns T.

[0042] According to the above-described air jet loom, during the period from when the weft insertion is completed and the movement of the weft yarn Y is stopped (240° in terms of the crank angle) to when the weft yarn Y is restrained by the warp yarns T (330° in terms of the crank angle), the compressed air ejected from the auxiliary ejection nozzle 10 acts on the portion of the weft yarn Y between the selvage at the weft insertion side in the weaving width direction and the area in which the air ejected by the sub-nozzle 3 closest to the weft insertion side is effective. Accordingly, the portion of the weft yarn Y disposed in the area outside the area in which the air ejected from the sub-nozzles 3 is effective at the time of completion of the weft insertion can also receive the compressed air. Therefore, when a pre-dyed yarn is used as the weft yarn Y, the condition of the above-described portion of the weft yarn Y can be made closer to that of other portions before the weft yarn Y is woven into the woven cloth.

[0043] In the example illustrated in Figs. 1 and 2, the auxiliary ejection nozzle is formed of a curved tubular member, such as a copper pipe. However, the structure of the auxiliary ejection nozzle according to the present invention is not limited to this. For example, as illustrated in Fig. 4, a nozzle having the same structure as that of the sub-nozzles 3 may be used as an auxiliary ejection nozzle 20.

[0044] In addition, the ejection period of the auxiliary ejection nozzle is not limited to the entire period from the time of completion of the weft insertion to the time at which the weft yarn Y is restrained by the warp yarns T, and may instead be a part of that period. In other words, as described above, the ejection period of the auxiliary ejection nozzle may be appropriately set to a period within the period from the time of completion of the weft insertion to the time at which the weft yarn Y is restrained by the warp yarns T in accordance with, for example, the manner in which fluff adheres to the weft yarn Y and the pressure of the compressed air to be ejected.

[0045] In the above description, the preset desired arrival time of the weft yarn Y (set value) that is used, for example, to control the weft insertion in the loom is defined as the time of completion of the weft insertion. However, there is a possibility that the actual arrival time of the weft yarn Y in the weft insertion will be shifted from the set value. Accordingly, in the case where the auxiliary ejection nozzle is caused to eject the air over the entire period from the time of completion of the weft insertion that is assumed to be the above-described set value to the time at which the weft yarn Y is restrained by the warp yarns T, the auxiliary ejection nozzle may be caused to preliminarily start ejecting the air before the time of completion of the weft insertion. Instead of setting the ejection start time of the auxiliary ejection nozzle on the basis of the above-described set value, the arrival of the leading end of the weft yarn Y at a predetermined position at the weft arrival side may be detected, and the auxiliary ejection nozzle may be caused to start ejecting the air in response to the detection. In addition, the auxiliary ejection

nozzle may be caused to continue to eject the air for a while after the weft yarn Y is restrained by the warp yarns T.

[0046] According to the above description, in the air jet loom to which the present invention is applied, the sub-nozzles arranged along the weft insertion path are divided into plural groups, each of which includes several sub-nozzles, in the order of arrangement from the weft insertion side.

[0047] In addition, the sub-nozzles in each group are connected to a common electromagnetic on-off valve. However, the present invention is not limited to this, and the sub-nozzles may be connected to the electromagnetic on-off valves in a one-to-one correspondence, and the ejection period may be set for each of the sub-nozzles. Also in such a case, the sub-nozzles are arranged within the weaving width area (area along the weaving width direction in which the line of warp yarns is present), and the ejection periods are set so as to assist the movement of the weft yarn ejected from the main nozzle. A nozzle that is disposed closer to the main nozzle than the selvage at the weft insertion side and that performs the ejecting operation in the above-described predetermined period serves as an auxiliary ejection nozzle according to the present invention.

[0048] The present invention is not limited to any of the above-described embodiments, and various modifications are possible within the scope of the present invention.

Claims

1. A weaving method for an air jet loom including a main nozzle (1) for weft insertion and a plurality of sub-nozzles (3) arranged along a weft insertion path, the sub-nozzles (3) ejecting air at preset timings in a relay manner from the sub-nozzle (3) closest to a weft insertion side to assist a movement of a weft yarn (Y) ejected from the main nozzle (1),
   wherein the air jet loom includes an auxiliary ejection nozzle (10, 20) having an ejection hole positioned near a distal end portion of the main nozzle (1), the auxiliary ejection nozzle (10, 20) ejecting air such that the air acts on the weft yarn (Y) pulled out from the main nozzle (1), and
   wherein the weaving method comprises the step of causing, when the air jet loom uses a pre-dyed yarn as the weft yarn (Y), the auxiliary ejection nozzle (10, 20) to eject the air in a predetermined period within a period from a time of completion of the weft insertion to a time at which the weft yarn (Y) is restrained by warp yarns (T).

2. The weaving method according to Claim 1, wherein the sub-nozzles (3) included in the air jet loom are divided into groups, each of which includes several sub-nozzles (3), in the order of arrangement from the weft insertion side, the sub-nozzles (3) included in each group being connected to a common electromagnetic on-off valve (3a), and
   wherein the auxiliary ejection nozzle (10, 20) is connected to a dedicated electromagnetic on-off valve that differs from the electromagnetic on-off valves (3a) to which the groups of sub-nozzles (3) are connected.

FIG. 1

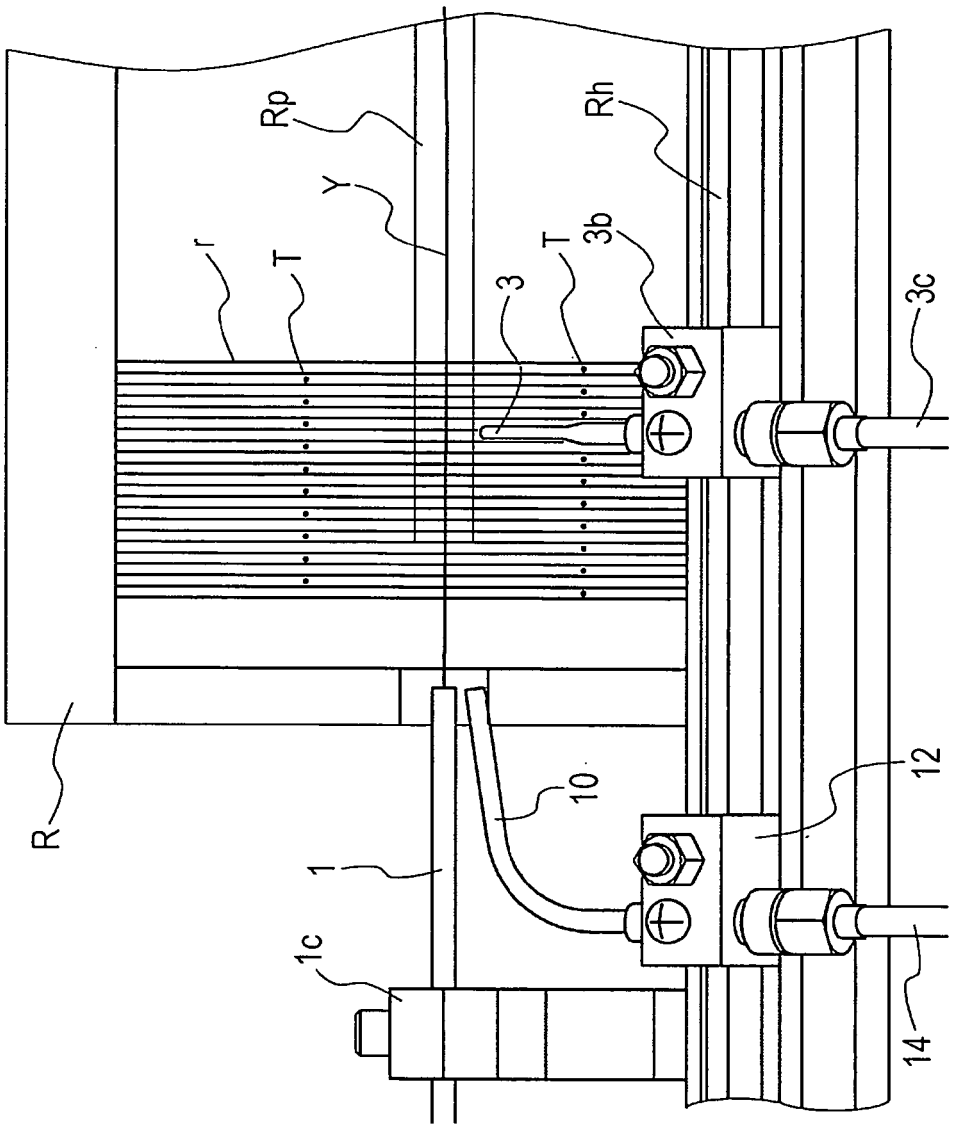


FIG. 2

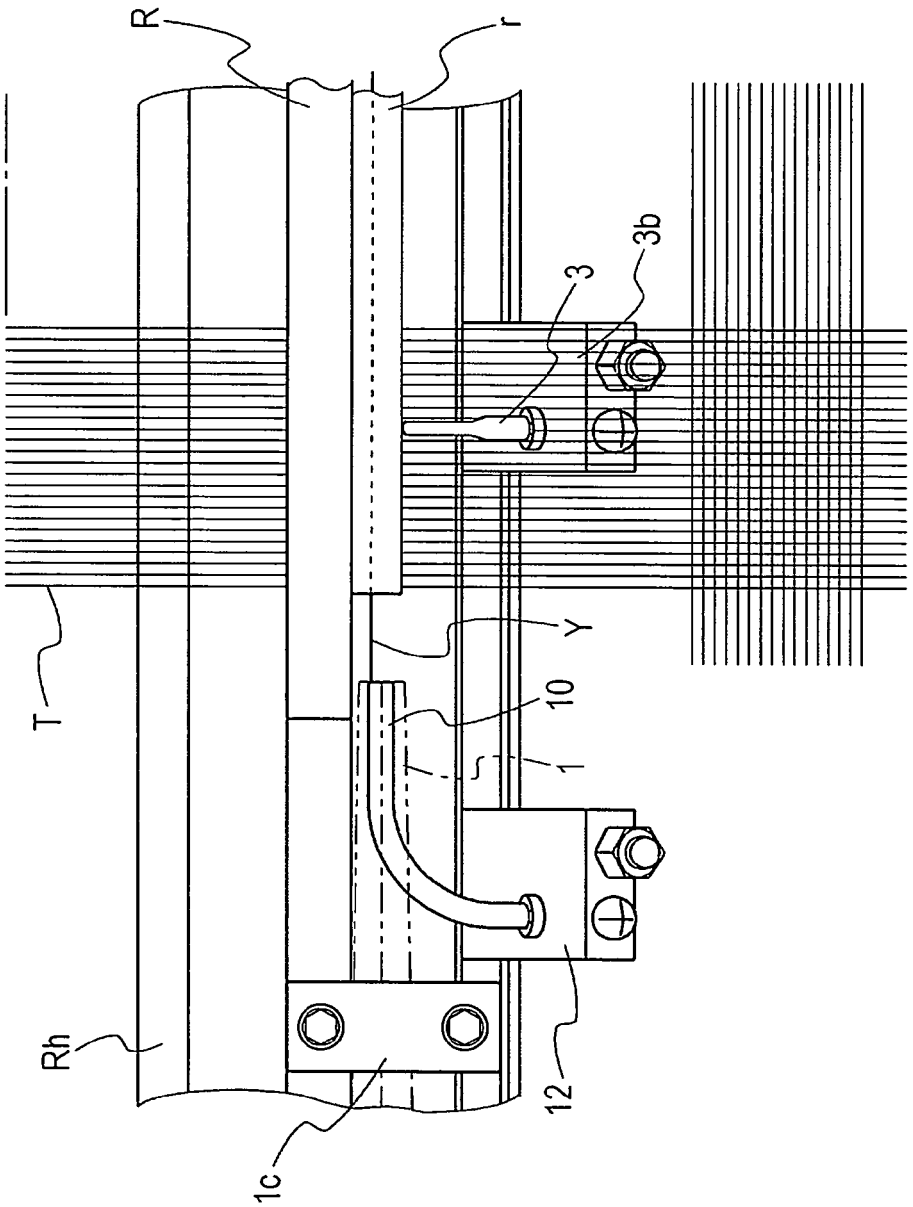


FIG. 3

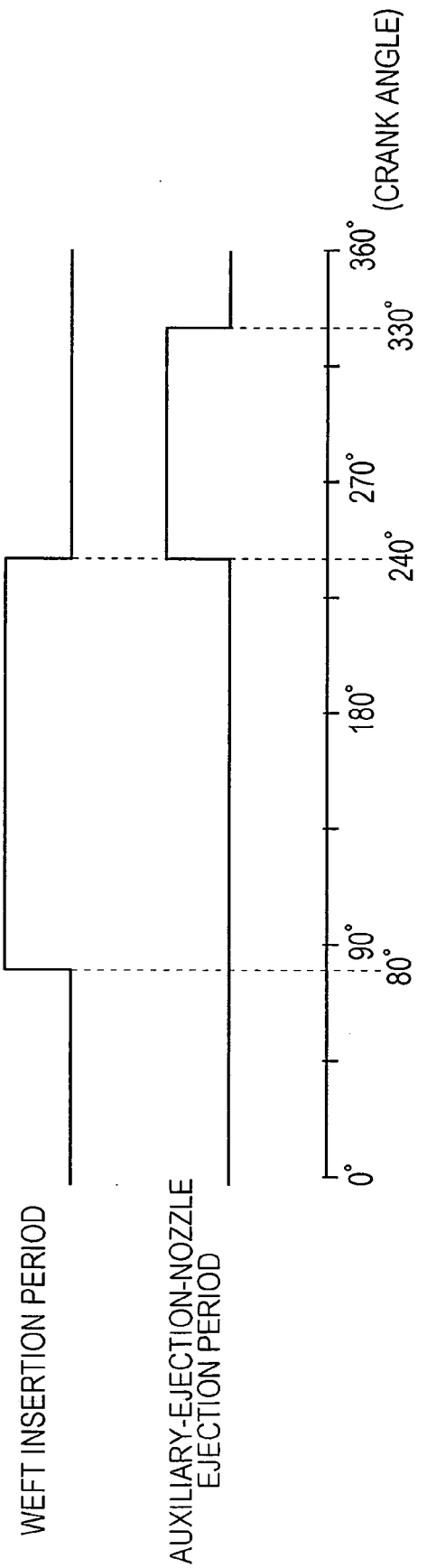

WEFT INSERTION PERIOD
AUXILIARY-EJECTION-NOZZLE EJECTION PERIOD
0°
80°
90°
180°
240°
270°
330°
360°
(CRANK ANGLE)

FIG. 4

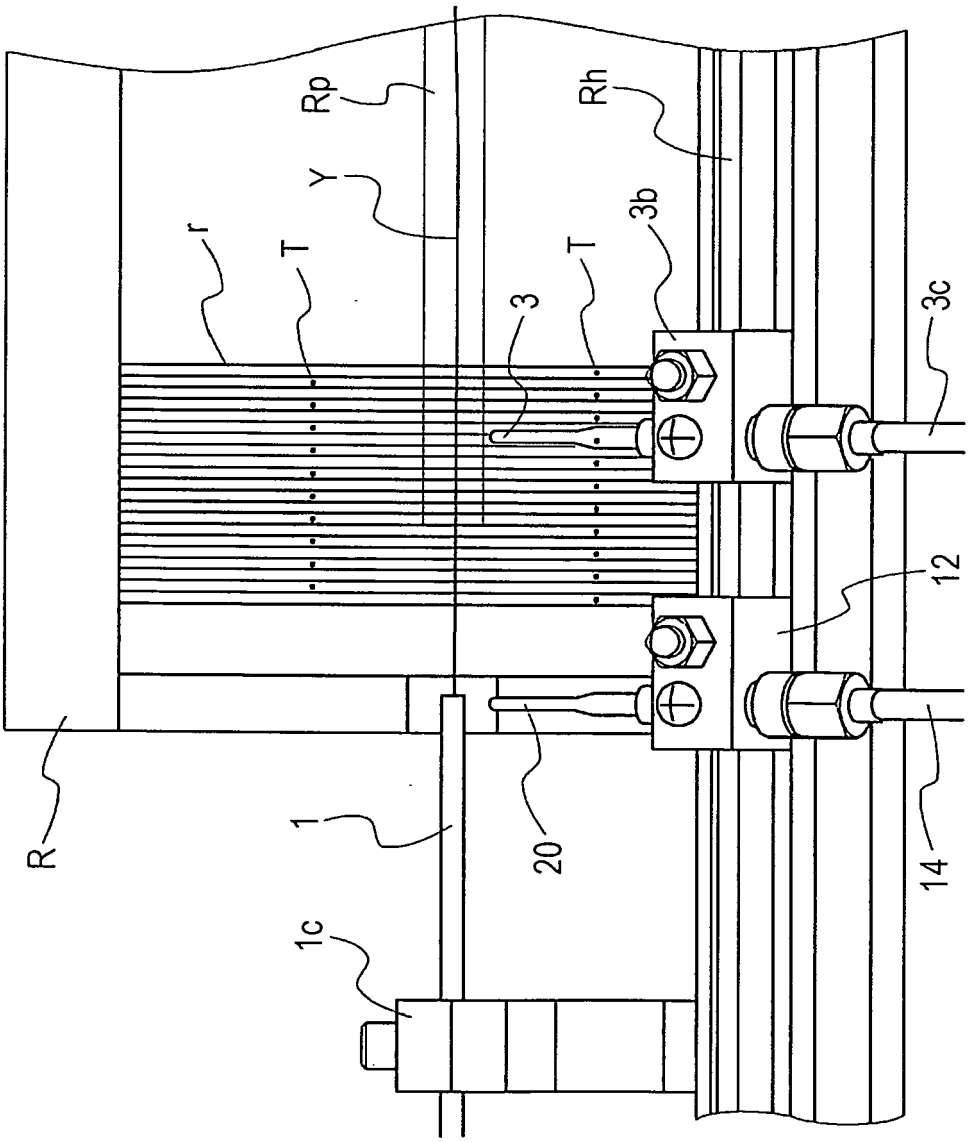


FIG. 5

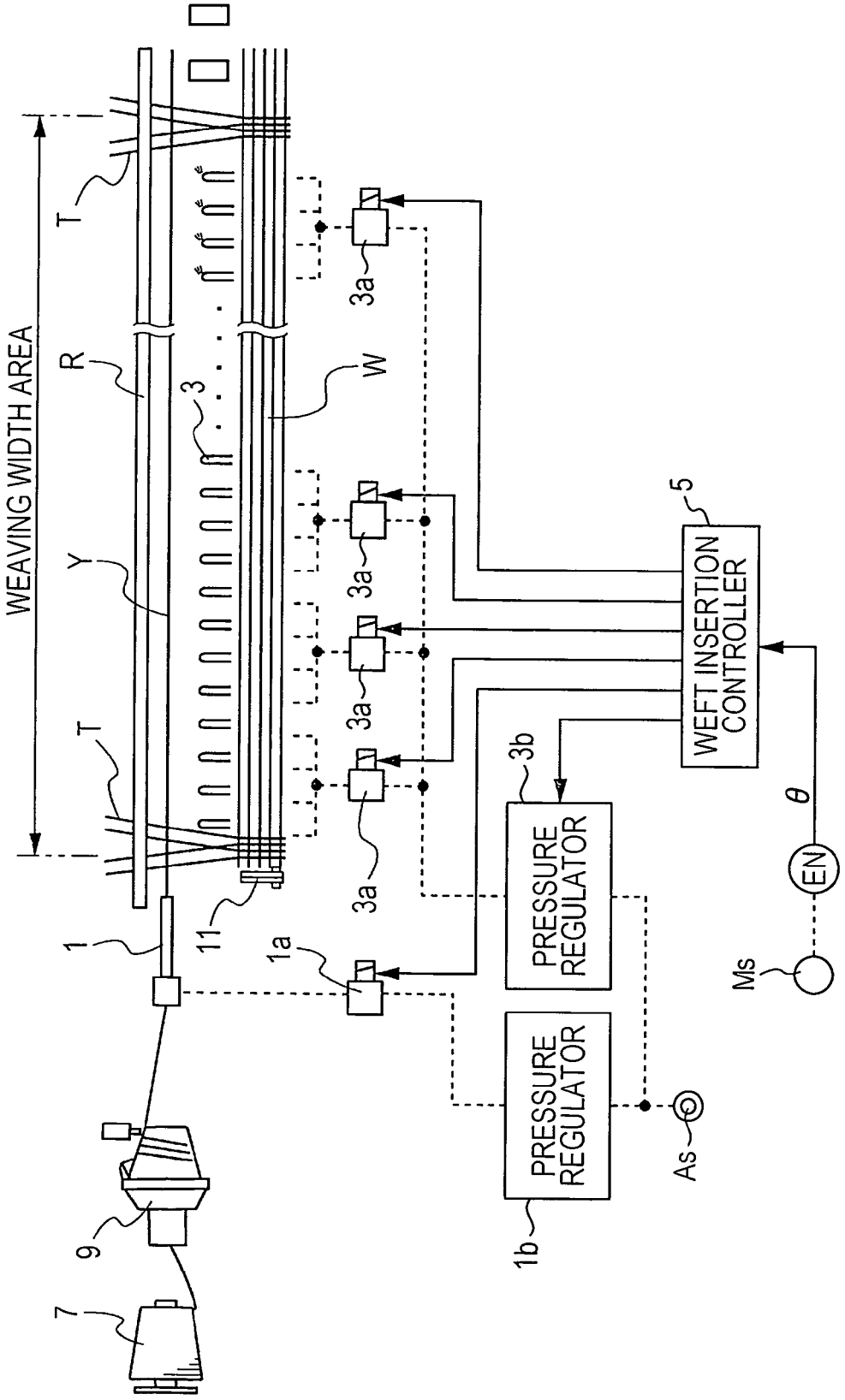

WEAVING WIDTH AREA
T
R
Y
T
W
3
3a
3a
3a
3a
11
1
1a
5
WEFT INSERTION CONTROLLER
3b
PRESSURE REGULATOR
PRESSURE REGULATOR
1b
θ
EN
Ms
As
9
7

FIG. 6

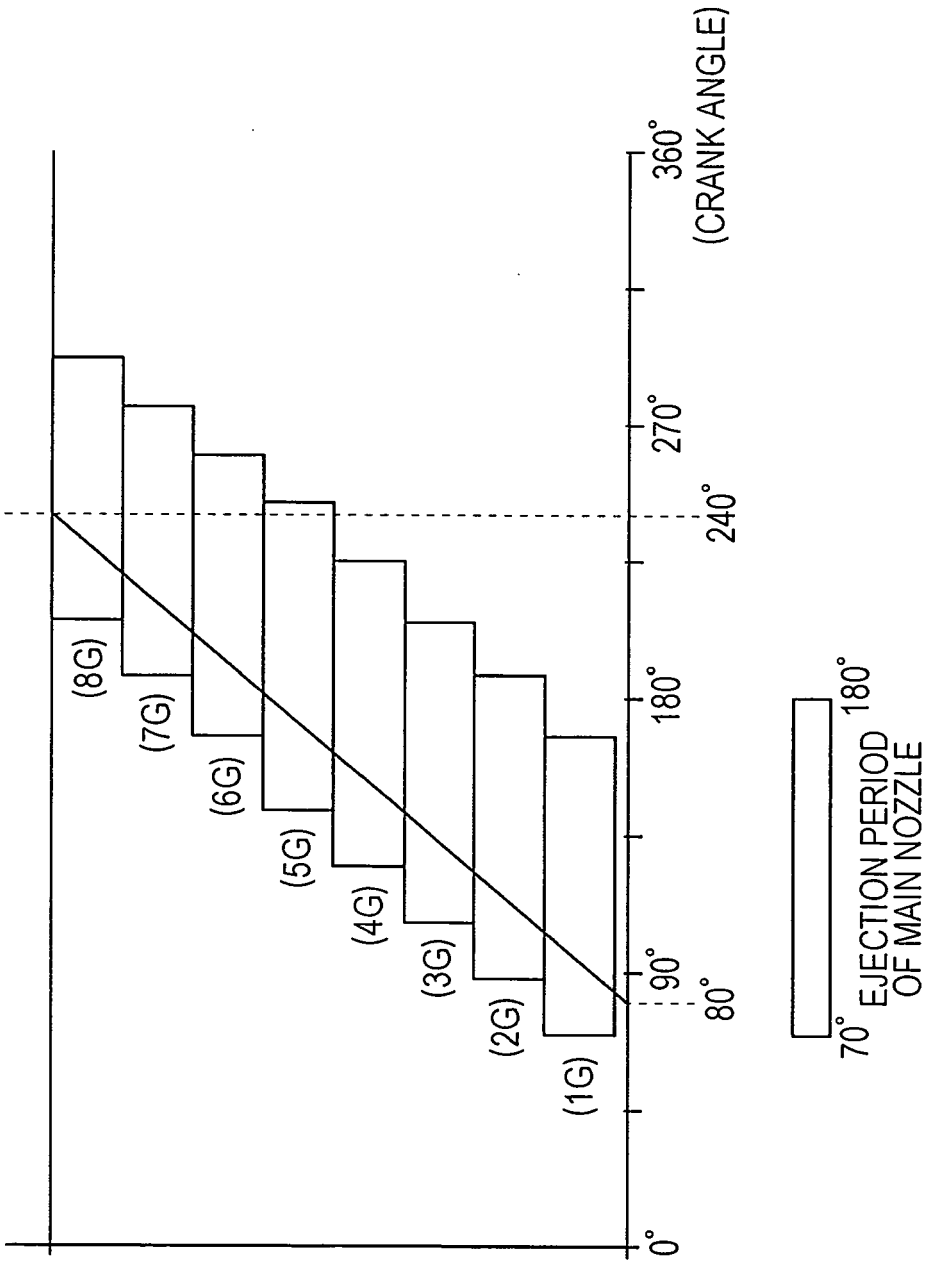
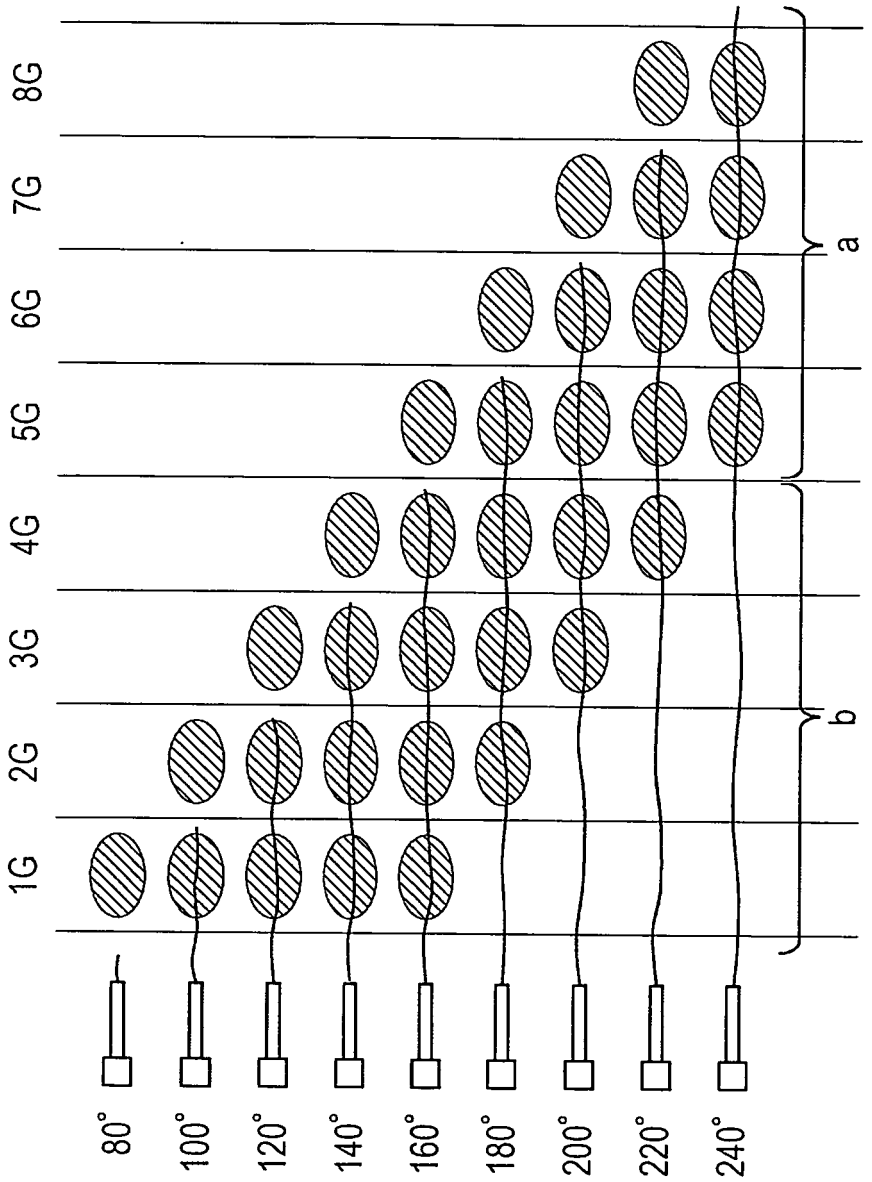

360°
(CRANK ANGLE)
270°
240°
180°
90°
80°
0°
(8G)
(7G)
(6G)
(5G)
(4G)
(3G)
(2G)
(1G)
70°
180°
EJECTION PERIOD
OF MAIN NOZZLE

FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 11229251 A **[0014] [0015]**