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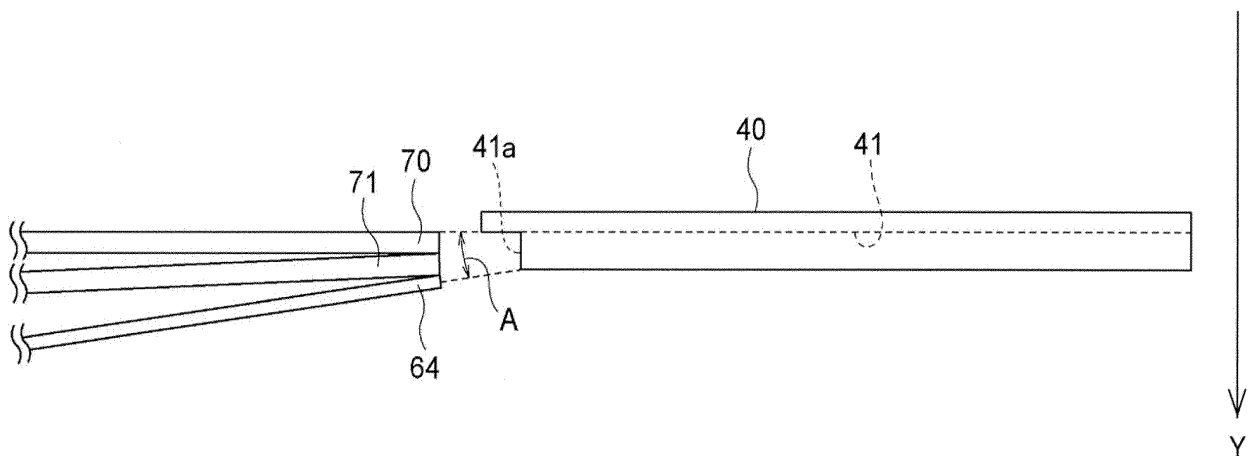
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(54) **WEFT INSERTION DEVICE OF AIR JET LOOM**

(57) A weft insertion device of an air jet loom (1) includes a modified reed (40) having a weft yarn travel passage (41), a main nozzle (22) from which air is discharged toward an inlet (41a) of the weft yarn travel passage (41) to inject a weft yarn (11) into the weft yarn travel passage (41), and an inducing nozzle (60, 60a, 66) dis-

posed in parallel with the main nozzle (22) and from which air is discharged to the inlet (41a) of the weft yarn travel passage (41). A timing at which air discharge from the inducing nozzle (60, 60a, 66) starts is prior to a timing at which air discharge from the main nozzle (22) starts.

FIG. 3



Description

BACKGROUND ART

[0001] The present invention relates to a weft insertion device of an air jet loom.

[0002] As a weft insertion device of an air jet loom which injects a weft yarn with compressed air (air) discharged from a weft insertion nozzle, for example, a device disclosed in Japanese Patent Application Publication No. H05-86544 has been known. The weft insertion device disclosed in the above Publication has a configuration to prevent a weft yarn from flying out from a weft yarn travel passage caused by air flowing out to an opening side of the weft yarn travel passage in a modified reed. In this configuration, a guide recess wall surface of a dent forming the weft yarn travel passage is formed so that an inclination angle of the guide recess wall surface in a portion of the weft yarn travel passage close to a main nozzle is smaller than that of the guide recess wall surface in a portion of the weft yarn travel passage opposite from the main nozzle.

[0003] However, even if forming the guide wall surface having the inclination angle, as disclosed in the weft insertion device of the air jet loom of the above-cited Publication, is formed in a dent, it is not possible to prevent air from flowing out toward the opening side of the weft yarn travel passage completely. It has been found out by experiments that flying out of weft yarn from the weft yarn travel passage may not be prevented, especially, when weft yarn having a great stiffness such as filament is used.

[0004] The present invention has been made to solve the above problem and is directed to providing a weft insertion device of an air jet loom that can execute weft insertion to a weft yarn travel passage stably by preventing air from flowing out toward an opening side of the weft yarn travel passage.

SUMMARY

[0005] In accordance with an aspect of the present disclosure, there is provided a weft insertion device of an air jet loom including a modified reed having a weft yarn travel passage, a main nozzle from which air is discharged toward an inlet of the weft yarn travel passage to inject a weft yarn into the weft yarn travel passage, and an inducing nozzle disposed in parallel with the main nozzle and from which air is discharged to the inlet of the weft yarn travel passage. A timing at which air discharge from the inducing nozzle starts is prior to a timing at which air discharge from the main nozzle starts.

[0006] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The disclosure, together with objects and advantages thereof, may best be understood by reference to the following description of the embodiments together with the accompanying drawings in which:

FIG. 1 is a schematic view of an air jet loom according to a first embodiment;

FIG. 2 is a schematic view of a main nozzle and an inducing nozzle illustrated in FIG. 1;

FIG. 3 is a plan view of a first main nozzle acceleration pipe, a second main nozzle acceleration pipe, and an inducing nozzle acceleration pipe illustrated in FIG. 2;

FIG. 4 is a schematic side view of the first main nozzle acceleration pipe, the second main nozzle acceleration pipe, and the inducing nozzle acceleration pipe illustrated in FIG. 3;

FIG. 5 is a timing chart showing timings of air discharge from the main nozzle and the inducing nozzle illustrated in FIG. 2;

FIG. 6 is a schematic view illustrating a distribution of flow rates of air in a weft yarn travel passage of a conventional air jet loom;

FIG. 7 is a schematic view illustrating a distribution of flow rates of air in a weft yarn travel passage of the air jet loom of the first embodiment;

FIG. 8 is a chart showing a relationship among an angle formed by a longitudinal direction of the weft yarn travel passage and an air discharge direction from the inducing nozzle, a weft yarn flying out frequency during weft insertion, and a variation in a weft yarn arrival time at an RH feeler;

FIG. 9 is a schematic side view, illustrating a first example of an arrangement of a first main nozzle acceleration pipe, a second main nozzle acceleration pipe, and an inducing nozzle acceleration pipe according to a second embodiment;

FIG. 10 is a schematic side view, illustrating a second example of an arrangement of the first main nozzle acceleration pipe, the second main nozzle acceleration pipe, and the inducing nozzle acceleration pipe according to the second embodiment;

FIG. 11 is a schematic side view, illustrating a third example of an arrangement of the first main nozzle acceleration pipe, the second main nozzle acceleration pipe, and the inducing nozzle acceleration pipe according to the second embodiment;

FIG. 12 is a schematic view of a main nozzle and an inducing nozzle according to a third embodiment.

FIG. 13 is a schematic side view of first to sixth main nozzle acceleration pipes and an inducing nozzle acceleration pipe illustrated in FIG. 12;

FIG. 14 is a schematic side view, illustrating a first example of an arrangement of first to sixth main nozzle acceleration pipe, a second main nozzle acceleration pipe, and an inducing nozzle acceleration

pipe according to a fourth embodiment;
 FIG. 15 is a schematic side view, illustrating a second example of an arrangement of the first to sixth main nozzle acceleration pipe, the second main nozzle acceleration pipe, and the inducing nozzle acceleration pipe according to the fourth embodiment;
 FIG. 16 is a schematic side view, illustrating a third example of an arrangement of the first to sixth main nozzle acceleration pipe, the second main nozzle acceleration pipe, and the inducing nozzle acceleration pipe according to the fourth embodiment;
 FIG. 17 is a plan view of a main nozzle and an inducing nozzle according to a fifth embodiment;
 FIG. 18 is a plan view of an inducing nozzle according to a sixth embodiment;
 FIG. 19 is a schematic side view of a first main nozzle acceleration pipe, a second main nozzle acceleration pipe, a first inducing nozzle outlet, and a second inducing nozzle outlet illustrated in FIG. 18; and
 FIG. 20 is a schematic view of an inducing nozzle of an air jet loom according to a seventh embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

First embodiment

[0008] The following will describe a first embodiment of the present invention in details with reference to the accompanying drawings.

[0009] FIG. 1 is a schematic view of an air jet loom according to the first embodiment. An air jet loom 1 includes a yarn supply device 10 configured to supply weft yarn 11. The weft yarn 11 is drawn out with rotation of a winding arm (not illustrated), and wound around a storage drum 12 to be stored. A weft yarn stop pin 13 configured to release the weft yarn 11 from the storage drum 12, or to stop the weft yarn 11, and a balloon sensor 14 configured to detect whether or not the weft yarn 11 has been released from the storage drum 12 are disposed near the storage drum 12. The yarn supply device 10, the storage drum 12, the weft yarn stop pin 13, and the balloon sensor 14 are fixed to a frame (not illustrated) of the air jet loom 1. The weft yarn stop pin 13 and the balloon sensor 14 are connected to a main control device 50 configured to control operations of the entire air jet loom 1. The main control device 50 controls the weft yarn stop pin 13 so that the weft yarn 11 is released or stopped. A result of detection by the balloon sensor 14 is inputted to the main control device 50.

[0010] The air jet loom 1 includes a weft insertion nozzle 20. The weft insertion nozzle 20 includes a tandem nozzle 21 from which compressed air (air) is discharged toward a weft insertion passage described below, specifically, an inlet 41a of a weft yarn travel passage 41 to draw the weft yarn 11 out from the storage drum 12, and a main nozzle 22 having an outlet from which air is discharged to send the weft yarn 11 toward the weft yarn travel passage 41. The weft insertion nozzle 20 further

includes an inducing nozzle 60 disposed in parallel with the main nozzle 22. The tandem nozzle 21 has a brake 23 for apply braking to the weft yarn 11 while travelling. The brake 23 is provided by a known brake device such as a mechanical brake or an air brake. The tandem nozzle 21 and the brake 23 are fixed to a frame (not illustrated) of the air jet loom 1. The brake 23 is connected to and controlled by the main control device 50. The weft insertion nozzle 20 forms a part of the weft insertion device.

[0011] The tandem nozzle 21 is connected to a tandem valve 26 through a hose 24. The main nozzle 22 is connected to a main valve 27 through a hose 25. The tandem valve 26 and the main valve 27 are connected to a main air tank 29 through a hose 28. The main air tank 29 stores air supplied from an air supply system (not illustrated) of a weaving factory where the air jet loom 1 is installed. Air stored in the main air tank 29 is discharged from the tandem nozzle 21 and the main nozzle 22. The tandem valve 26 and the main valve 27 are connected to and controlled by the main control device 50. The main air tank 29 forms a part of the weft insertion device.

[0012] The inducing nozzle 60 having an elongated shape is configured to lead the weft yarn 11 sent from the main nozzle 22 to the weft yarn travel passage 41 with air discharged from the inducing nozzle 60. Unlike the main nozzle 22 and the tandem nozzle 21, the weft yarn 11 does not pass through an inside of the inducing nozzle 60. The inducing nozzle 60 is connected to an inducing nozzle valve 62 through a hose 61. The inducing nozzle valve 62 is connected to an inducing nozzle air tank 63 through a hose 69. The inducing nozzle air tank 63 stores air supplied from the air supply system of the weaving factory where the air jet loom 1 is installed. Air stored in the inducing nozzle air tank 63 is discharged from the inducing nozzle 60. The inducing nozzle valve 62 is connected to and controlled by the main control device 50. The inducing nozzle air tank 63 forms a part of the weft insertion device.

[0013] The main nozzle 22, the inducing nozzle 60, a modified reed 40, and sub-nozzles 35 are mounted on a sley, which is not illustrated and described later, are reciprocally swung in a front-rear direction of the air jet loom 1. The modified reed 40 has the weft yarn travel passage 41 through which the weft yarn 11 travels. The weft yarn travel passage 41 extends through the entire modified reed 40 in the longitudinal direction thereof. That is, the weft yarn travel passage 41 extends from the upstream side toward the downstream side of the modified reed 40, which corresponds to the left end to the right end of the modified reed 40 in FIG. 1. A plurality of sub-nozzles 35 is disposed along the weft yarn travel passage 41, and air discharged from the sub-nozzles 35 transports the weft yarn 11 along the weft yarn travel passage 41 from the main nozzle 22 side, i.e., the upstream side of the weft yarn travel passage 41 on the left end of the modified reed in FIG. 1. That is, the weft yarn travel passage 41 is a transport passage for the weft yarn 11. The sub-nozzles 35 are connected to sub-valves 33 through

hoses 34. Each of the sub-valves 33 is connected to a sub-air tank 32. The sub-air tank 32 stores air supplied from the air supply system of the weaving factory where the air jet loom 1 is installed. Air stored in the sub-air tank 32 is discharged from the sub-nozzles 35. Each of the sub-valves 33 is connected to the main control device 50, and the main control device 50 executes an opening and closing control of the sub-valves 33.

[0014] An RH feeler 36 that detects a travelling condition of a weft yarn is disposed on the right end side of the modified reed 40. The RH feeler 36 is connected to the main control device 50. The main control device 50 is connected to a function panel 51. The function panel 51 is a touch panel that displays a state of the air jet loom 1 and is for a user to operate the air jet loom 1.

[0015] FIG. 2 is a schematic view of the main nozzle 22 and the inducing nozzle 60. The main nozzle 22 is a two colors weft yarn sending main nozzle to send weft yarn of two colors, and includes a main nozzle base portion 22a, and a first main nozzle acceleration pipe 70 and a second main nozzle acceleration pipe 71 corresponding to respective colors of weft yarn. The first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71 are disposed in the main nozzle base portion 22a. The inducing nozzle 60 is disposed in the main nozzle base portion 22a, and has an inducing nozzle acceleration pipe 64 having an elongated shape and extending in parallel with the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71. A main nozzle supply port 80 formed on the side surface of the main nozzle base portion 22a is connected to the main valve 27 through the hose 25 (see FIG. 1), and an inducing nozzle supply port 65 formed on the side surface of the main nozzle base portion 22a is connected to the inducing nozzle valve 62 through the hose 61 (see FIG. 1). For the sake of description, the hose 25 and the hose 61 are not illustrated in FIG. 2.

[0016] Air is supplied to the main nozzle 22 from the main nozzle supply port 80, and air is supplied to the inducing nozzle 60 from the inducing nozzle supply port 65. The main nozzle base portion 22a is mounted on a sley 42 with a main nozzle support member 82 interposed therebetween. The first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 are supported by an acceleration pipe support member 81. The acceleration pipe support member 81 is mounted to the main nozzle support member 82.

[0017] FIG. 3 is a plan view illustrating outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64. The first main nozzle acceleration pipe 70 is disposed generally in the same direction as the longitudinal direction of the weft yarn travel passage 41 of the modified reed 40. The second main nozzle acceleration pipe 71 is disposed on a front side of the modified reed 40 (a Y-direction) with respect to the first main nozzle acceleration pipe 70, and is in contact with the first

main nozzle acceleration pipe 70 on a side close to the weft yarn travel passage 41 to form an acute angle with the first main nozzle acceleration pipe 70. The inducing nozzle acceleration pipe 64 (the inducing nozzle 60) is disposed on the front side of the modified reed 40 (a Y-direction) with respect to the second main nozzle acceleration pipe 71, and is in contact with the second main nozzle acceleration pipe 71 on the side close to the weft yarn travel passage 41. It is noted that the front side of the modified reed 40 is a front side of the weft yarn travel passage 41 in the horizontal direction in the air jet loom 1 (see FIG. 1), and corresponds to an opening side (opened side) of the weft yarn travel passage 41. The first main nozzle acceleration pipe 70 (the main nozzle 22) and the inducing nozzle acceleration pipe 64 (the inducing nozzle 60) are disposed so that an extending direction of the first main nozzle acceleration pipe 70, i.e., the longitudinal direction of the weft yarn travel passage 41, and the inducing nozzle acceleration pipe 64 form an acute angle A. The angle A is preferably within a range from 5 degrees to 25 degrees. The angle A may be an obtuse angle, but the effect of the inducing nozzle 60 may be reduced because a point where air from the acceleration pipes meets is positioned too close to the main nozzle 22. Therefore, the angle A is preferably an acute angle. Although the angle A may be out of the range from 5 degrees to 25 degrees when the angle A is an acute angle, the angle A is more preferably within the range from 5 degrees to 25 degrees in order to suppress the frequency of weft flying out and variation in the weft yarn arrival time, as illustrated in FIG. 8.

[0018] FIG. 4 is a schematic side view illustrating the outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64, as viewed from the modified reed 40 side. The second main nozzle acceleration pipe 71 is disposed on the front side (in the Y-direction) of the weft yarn travel passage 41 with respect to the first main nozzle acceleration pipe 70, that is, the outer side far from the rear wall side of the weft yarn travel passage 41. The inducing nozzle acceleration pipe 64 is disposed on the front side of the second main nozzle acceleration pipe 71. That is, the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 are disposed linearly in this order from the rear wall side, i.e., inner side, of the weft yarn travel passage 41.

[0019] Referring to FIG. 3 again, the longitudinal direction of the weft yarn travel passage 41 and the inducing nozzle acceleration pipe 64 form the angle A, which is an acute angle. Thus, air discharged from the inducing nozzle acceleration pipe 64 illustrated in FIG. 4 blows to an inlet 41a of the weft yarn travel passage 41 while blowing in a B direction, i.e., a direction toward the rear wall side (the inner side) of the weft yarn travel passage 41.

[0020] A diameter ϕU of the outlet of the inducing nozzle acceleration pipe 64 (the outlet of the inducing nozzle 60) is smaller than a diameter $\phi 1$ of the outlet of the first

main nozzle acceleration pipe 70 (the outlet of the main nozzle 22) and a diameter $\phi 2$ of the outlet of the second main nozzle acceleration pipe 71 (the outlet of the main nozzle 22). The diameter ϕU of the outlet of the inducing nozzle acceleration pipe 64 is preferably from 14 percent to 50 percent of the diameter $\phi 1$ of the outlet of the first main nozzle acceleration pipe 70 and the diameter $\phi 2$ of the outlet of the second main nozzle acceleration pipe 71. The cross-sectional area of the outlet of the inducing nozzle acceleration pipe 64 is preferably equal to or less than 25 percent of a total of the cross sectional area of the outlet of the first main nozzle acceleration pipe 70 and the cross sectional area of the outlet of the second main nozzle acceleration pipe 71. It is noted that the diameter ϕU of the outlet of the inducing nozzle acceleration pipe 64 (the outlet of the inducing nozzle 60) may be equal to or greater than the diameter $\phi 1$ of the outlet of the first main nozzle acceleration pipe 70 (the outlet of the main nozzle 22) and the diameter $\phi 2$ of the outlet of the second main nozzle acceleration pipe 71 (the outlet of the main nozzle 22), but is more preferably smaller than those.

[0021] The following will describe an operation of the air jet loom 1 according to the first embodiment.

[0022] When weft insertion is executed in the air jet loom 1 illustrated in FIG. 1, a weft yarn 11 is drawn out from the storage drum 12 and injected toward the main nozzle 22 with air discharged from the tandem nozzle 21. The injected weft yarn 11 is inserted into the weft yarn travel passage 41 of the modified reed 40 with air discharged from the main nozzle 22 and the inducing nozzle 60 toward the inlet 41a of the weft yarn travel passage 41. The main control device 50 controls opening and closing of the tandem valve 26, thereby discharging air from the tandem nozzle 21. The main control device 50 controls opening and closing of the main valve 27, thereby discharging air from the main nozzle 22. The main control device 50 controls opening and closing of the inducing nozzle valve 62, thereby discharging air from the inducing nozzle 60.

[0023] The weft yarn 11 inserted into the weft yarn travel passage 41 of the modified reed 40 is transported with air discharged from the main nozzle 22 and the inducing nozzle 60 to the weft yarn travel passage 41 and air discharge from the sub-nozzles 35 to travel toward the downstream of the weft yarn travel passage 41. The main control device 50 controls opening and closing of the sub-valves 33, thereby discharging air from the sub-nozzles 35.

[0024] FIG. 5 is a timing chart showing air discharge from the main nozzle 22 (see FIG. 2) and the inducing nozzle 60. In an interval between a time when the crank angle of the loom, i.e., the rotation angle of the loom main shaft (not illustrated) is 0 degrees to a time when the crank angle becomes 0 degrees next during the operation of the air jet loom 1 (see FIG. 1), air is discharged from the main nozzle 22 from a main nozzle air discharge start timing M1 to a main nozzle air discharge stop timing

M2, and air is discharged from the inducing nozzle 60 from an inducing nozzle air discharge start timing N1 to an inducing nozzle air discharge stop timing N2. The inducing nozzle air discharge start timing N1 of the inducing nozzle 60 is prior to the main nozzle air discharge start timing M1. That is, air discharge from the main nozzle 22 starts at the main nozzle air discharge start timing M1 after a predetermined delay time T1 elapses from the inducing nozzle air discharge start timing N1. The inducing nozzle air discharge stop timing N2 is at a timing after a predetermined discharge time T2 elapses from the inducing nozzle air discharge start timing N1, and is prior to the main nozzle air discharge stop timing M2.

[0025] The air discharge time T2 for the inducing nozzle 60 in the first embodiment is set in advance depending on a type of the weft yarn 11 to be used. Depending on the type of the weft yarn 11, the air discharge time may be optionally set to an air discharge time T3 longer than the air discharge time T2 by changing the inducing nozzle air discharge stop timing N2 for the inducing nozzle 60 to the inducing nozzle air discharge stop timing N3. The inducing nozzle air discharge stop timing N3 is prior to the main nozzle air discharge stop timing M2. The pressure of the air discharged from the inducing nozzle 60 is set equal to or higher than the pressure of the air discharged from the main nozzle 22.

[0026] FIG. 6 is a schematic view of a conventional air jet loom that does not have the inducing nozzle 60 (see FIG. 1) of the first embodiment, illustrating a distribution of the flow rate of air in the weft yarn travel passage 41 as viewed from the inlet 41a of the weft yarn travel passage 41. The distribution of the flow rate of air is measured at a position between a first sub-nozzle 35a disposed closest to the main nozzle 22 and a second sub-nozzle 35b disposed side by side with the first sub-nozzle 35a. Reference characters V1, V2, V3 represent flow rates of air, which are lines drawn by connecting positions where the flow rates of air are equal, and the flow rate V1 is the highest among V1, V2, V3, the flow rate V2 is the second highest after V1, and V3 is the lowest. In this modified reed 40 of the conventional air jet loom, air discharged from the main nozzle 22 spreads and expands from an early stage of air discharge after its start. Then, the spread and expanded air outflows toward the front side (the outer side) of the weft yarn travel passage 41, so that areas surrounded by the flow rate V2 and the flow rate V3 of air are positioned on the front side of the weft yarn travel passage 41. That is, air spreads and expands to the outside of the weft yarn travel passage 41.

[0027] Therefore, in the conventional modified reed 40, particularly when yarn having a relatively greater stiffness such as spun yarn and filament yarn is used for the weft yarn 11 (see FIG. 1), there is a case where such weft yarn 11 is carried by air flowing out to the front side of the weft yarn travel passage 41 and a leading end of the weft yarn 11 flies out to the front side (the outer side) of the weft travel passage 41 at the time of weft insertion. Further, in the conventional modified reed 40, since the

leading end of the weft yarn 11 returns to the rear wall side (the inner side) of the weft yarn travel passage 41 with a trailing part of the weft yarn 11 traveling from the upstream, it may take a longer time for the weft yarn 11 to travel a predetermined distance. Accordingly, depending on a condition of the leading end of the weft yarn 11 that flies out of the weft yarn travel passage 41, the weft yarn 11 fails to travel to the outlet of the weft yarn travel passage 41 within a predetermined time, and is not detected by the RH feeler 36, which may be determined as a failure of weft insertion of the weft yarn 11.

[0028] FIG. 7 is a schematic view, illustrating a distribution of the flow rates of air in the weft yarn travel passage 41 as viewed from the inlet 41a of the weft yarn travel passage 41, of the air jet loom 1 having the inducing nozzle 60 (see FIG. 1) and the main nozzle 22 of the first embodiment. The distribution of the flow rate is measured at the same position as in FIG. 6. In this case, firstly, air is discharged from the inducing nozzle 60 at a pressure higher than a pressure of air discharged from the main nozzle 22 at the inducing nozzle air discharge start timing N1 prior to the main nozzle air discharge start timing M1 (see FIG. 5) of the main nozzle 22. Thus, a relatively high-speed flow of air which tends to spread less is generated at the inlet 41a of the weft yarn travel passage 41. This relatively high-speed flow of air, which is generated firstly, leads a flow of air subsequently discharged from the main nozzle 22 at an initial stage of air discharge after its start to the inside of the weft yarn travel passage 41.

[0029] Air discharge from the inducing nozzle 60 leads air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41, which suppresses spreading and expanding of air discharged from the main nozzle 22. This suppresses air flowing out to the front side (the outside) of the weft yarn travel passage 41, so that the areas defined by the flow rate V2 and the flow rate V3 of air are positioned inside the weft yarn travel passage 41. Further, there is a flow rate V0 higher than the V1 in FIG. 6 due to the high-speed air discharged from the inducing nozzle 60 prior to air discharge from the main nozzle 22. As a result, weft insertion may take place stably even when yarn having a great stiffness such as filament yarn or spun yarn is used for the weft yarn 11. Accordingly, the operation rate of the air jet loom 1 may be improved by reducing the frequency of the operation stop of the air jet loom 1 due to the weft insertion failure.

[0030] Additionally, using pipes each having a large outlet diameter, that is, $\phi 1$ and $\phi 2$, as the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71 illustrated in FIG. 4 increases a propulsive force for weft yarn to travel, but increases the degree of spreading of air discharged from the main nozzle 22 increases. Therefore, it has been difficult to use such acceleration pipes each having a large diameter. On the other hand, in a case where the inducing nozzle 60 is provided as described in the first embodiment, air discharged from the main nozzle 22 is led to the inside of

the weft yarn travel passage 41 by the flow of air discharged from the inducing nozzle 60 to suppress air flowing out to the front side (the outer side) of the weft yarn travel passage 41. Therefore, weft insertion can be performed stably even when an acceleration pipe having a large diameter is used. In this way, an acceleration pipe having a large diameter can be used, which increases a propulsive force for the weft yarn 11 (see FIG. 1) to travel. As a result, the pressure of air discharged from the sub-nozzles 35 and the consumption of air can be reduced. Thus, the operation cost of the air jet loom 1 may be reduced.

[0031] FIG. 8 is a chart showing a relationship among the angle A formed by the longitudinal direction of the weft yarn travel passage 41 and the inducing nozzle acceleration pipe 64 (see FIG. 3), a weft yarn flying out frequency F corresponding to the frequency of the occurrence of flying out of the weft yarn 11 from the weft yarn travel passage 41, and a variation G in the weft yarn arrival time to the RH feeler 36 resulting from flying out of the weft yarn 11. The horizontal axis of the chart represents the angle A of air discharged from the inducing nozzle 61 to the weft yarn travel passage 41, the vertical axis on the left of the chart represents the weft yarn flying out frequency F, and the vertical axis on the right of the chart represents the variation G in the weft yarn arrival time. It has been found out by the experiments that the weft yarn flying out frequency F and the variation G in the weft yarn arrival time can be kept in a low range when the angle A is within the range from 5 to 25 degrees shown as a range E in the chart.

[0032] The weft insertion nozzle 20 of the air jet loom 1 according to the first embodiment includes the modified reed 40 having the weft yarn travel passage 41, the main nozzle 22 from which air is discharged toward the inlet 41a of the weft yarn travel passage 41 to inject the weft yarn 11 into the weft yarn travel passage 41, and the inducing nozzle 60 disposed in parallel with the main nozzle 22 and from which air is discharged toward the inlet 41a of the weft yarn travel passage 41. Since the inducing nozzle air discharge start timing N1 at which air discharge from the inducing nozzle 60 starts is prior to the main nozzle air discharge start timing M1 at which air discharge from the main nozzle 22 starts, air flowing out to the opening side of the weft yarn travel passage 41 is suppressed, which allows the weft yarn 11 to be inserted into the weft yarn travel passage 41 stably.

[0033] Since the diameter ϕU of the outlet of the inducing nozzle 60 is 14 to 50 percent of the diameter $\phi 1$ of the outlet of the first main nozzle acceleration pipe 70 and the diameter $\phi 2$ of the outlet of the second main nozzle acceleration pipe 71 of the main nozzle 22, air discharged from the inducing nozzle 60 leads air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41 more effectively.

[0034] The inducing nozzle 60 is disposed on the front side of the air jet loom 1 with respect to the main nozzle 22 and air discharge direction from the inducing nozzle

60 has the angle A of 5 degrees to 25 degrees relative to the longitudinal direction of the weft yarn travel passage 41, so that air discharged from the inducing nozzle 60 can lead air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41 more effectively.

[0035] The pressure of air discharged from the inducing nozzle 60 is higher than that from the main nozzle 22, which allows air discharged from the inducing nozzle 60 to lead air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41 more effectively.

[0036] The weft insertion device includes the main air tank 29 storing air to be discharged from the main nozzle 22, and the inducing nozzle air tank 63 provided separately from the main air tank 29 and storing air to be discharged from the inducing nozzle 60, which stabilize the pressure of air discharged from the inducing nozzle 60 through the inducing nozzle air tank 63 provided separately from the main air tank 29 without an influence of the main air tank 29, so that air discharged from the main nozzle 22 is led to the inside of the weft yarn travel passage 41 stably.

[0037] The inducing nozzle air discharge stop timing N2 at which air discharge from the inducing nozzle 60 stops is prior to the main nozzle air discharge stop timing M2 at which air discharge from the main nozzle 22 stops, which permits reducing the operation cost of the air jet loom 1 by reducing the consumption of air.

[0038] Although the pressure of air discharged from the inducing nozzle 60 is equal to or higher than that from the main nozzle 22 in the first embodiment, the pressure of air discharged from the inducing nozzle 60 may be less than that from the main nozzle 22. Although the main air tank 29 and the inducing nozzle air tank 63 are provided separately in the present embodiment, the main air tank 29 may also serve as the inducing nozzle air tank 63. However, in order to stabilize the pressure of air discharged from the inducing nozzle 60, the inducing nozzle air tank is preferably provided separately.

[0039] Although the inducing nozzle air discharge stop timing N2 at which air discharge from the inducing nozzle 60 stops is prior to the main nozzle air discharge stop timing M2 at which air discharge from the main nozzle 22 stops in the first embodiment, the inducing nozzle air discharge stop timing N2 and the main nozzle air discharge stop timing M2 may be at the same time in order to simplify a control.

Second embodiment

[0040] The following will describe a weft insertion device of an air jet loom according to a second embodiment of the present invention.

[0041] In the following description, reference numerals the same as those of the first embodiment in FIGS. 1 through 8 represent the same or similar parts, and the detailed descriptions thereof will be omitted. The weft insertion device of the air jet loom of the second embod-

iment differs from that of the first embodiment in that positions of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 are changed.

[0042] FIGS. 9 through 11 are schematic side views each illustrating the outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 disposed at different positions from those in the first embodiment, as viewed from the modified reed 40 side. In an example illustrated in FIG. 9, the inducing nozzle acceleration pipe 64 is disposed on the front side (the outer side) of the weft yarn travel passage 41 with respect to the first main nozzle acceleration pipe 70. The second main nozzle acceleration pipe 71 is disposed on the front side of the weft yarn travel passage 41 with respect to the inducing nozzle acceleration pipe 64. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward the inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction, i.e., a direction toward the rear wall side (the inner side) of the weft yarn travel passage 41. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0043] In another example of the second embodiment illustrated in FIG. 10, the radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed upward with respect to the radial centers of the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71 in the vertical direction. In addition, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the inducing nozzle acceleration pipe 64 is positioned on the front side of the weft yarn travel passage 41 with respect to the radial center of the outlet of the first main nozzle acceleration pipe 70, and on the rear wall side of the weft yarn travel passage 41 with respect to the radial center of the outlet of the second main nozzle acceleration pipe 71. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward an inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction which is diagonally downwardly inward direction, i.e., a direction toward the rear wall side of the weft yarn travel passage 41 and downward in the vertical direction. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0044] In an example illustrated in FIG. 11, the radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed vertically downward with respect to the radial centers of the outlets of the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71. In addition, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the inducing nozzle acceleration pipe 64 is positioned on the front side of the weft yarn travel passage 41 with respect to the radial center of the outlet of the first main nozzle acceleration pipe 70, and on the rear wall side of the weft yarn travel passage 41 with respect

to the radial center of the outlet of the second main nozzle acceleration pipe 71. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward the inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction which is diagonally upwardly inward direction, i.e., a direction toward the rear wall side of the weft yarn travel passage 41 and upward in the vertical direction. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0045] In this way, even with the arrangements of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 according to the second embodiment, similarly to the first embodiment, air discharged from the inducing nozzle 60 leads air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41, which allows the weft yarn 11 to be inserted into the weft yarn travel passage 41 stably.

[0046] It is noted that the arrangements of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 described in the second embodiment are examples and the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, and the inducing nozzle acceleration pipe 64 may be arranged in a manner other than the above-described examples.

Third embodiment

[0047] The following will describe a weft insertion device of an air jet loom according to a third embodiment of the present invention.

[0048] The weft insertion device of the air jet loom of the third embodiment differs from that of the first embodiment in that the main nozzle is changed to a main nozzle having main nozzle acceleration pipes corresponding to weft yarn of six colors.

[0049] FIG. 12 is a schematic view of a main nozzle 22 and an inducing nozzle 60. The main nozzle 22 is a six colors weft yarn sending main nozzle configured to send weft yarn of six colors, and includes a main nozzle base portion 22a, and six main nozzle acceleration pipes provided in the main nozzle base portion 22a and corresponding to the colors of weft yarn. The six main nozzle acceleration pipes includes a first main nozzle acceleration pipe 70, a second main nozzle acceleration pipe 71, a third main nozzle acceleration pipe 72, a fourth main nozzle acceleration pipe 73, a fifth main nozzle acceleration pipe 74, and a sixth main nozzle acceleration pipe 75. The first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle acceleration pipe 64 are supported by an acceleration pipe support member 81. The inducing nozzle acceleration pipe 64 is formed so that the diameter

of an inducing nozzle acceleration pipe inlet 64b is greater than that of an inducing nozzle acceleration pipe outlet 64a.

[0050] FIG. 13 is a schematic side view illustrating outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle acceleration pipe 64, as viewed from the modified reed 40 side. The first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75 are arranged in two rows, i.e., the upper row and lower row. In the upper row, the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72 are disposed in this order from the rear wall side (inner side) of the weft yarn travel passage 41. In the lower row, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, and the sixth main nozzle acceleration pipe 75 are disposed in this order from the rear wall side of the weft yarn travel passage 41.

[0051] The inducing nozzle acceleration pipe 64 is disposed on the front side of the weft yarn travel passage 41 with respect to the third main nozzle acceleration pipe 72 and the sixth main nozzle acceleration pipe 75. In addition, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the drawing nozzle acceleration pipe 64 is positioned vertically downward of the radial center of the outlet of the third main nozzle acceleration pipe 72, and vertically upward of the radial center of the outlet of the sixth main nozzle acceleration pipe 75. Air from the inducing nozzle acceleration pipe 64 is discharged toward the inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction, i.e., a direction toward the rear wall side of the weft yarn travel passage 41. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0052] In this way, even in a case where six main nozzle acceleration pipes are provided so as to correspond to the number of weft yarn to be used, air discharged from the inducing nozzle 60 leads air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41, which allows the weft yarn 11 to be inserted into the weft yarn travel passage 41 stably, similarly to the first embodiment. Further, since the inducing nozzle acceleration pipe 64 of the inducing nozzle 60 is formed so that the diameter of the inlet is greater than that of the outlet, the pressure loss of air in the inducing nozzle acceleration pipe 64 is reduced and the flow rate of air discharged from the inducing nozzle acceleration pipe 64 may be increased.

[0053] The number of main nozzle acceleration pipes are six in the third embodiment, but is not limited thereto, and any number of main nozzle acceleration pipes cor-

responding to the number of colors of weft yarn to be used may be provided.

Fourth embodiment

[0054] The following will describe a weft insertion device of an air jet loom according to a fourth embodiment of the present invention.

[0055] The weft insertion device of the air jet loom of the fourth embodiment differs from that of the third embodiment in that positions of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle acceleration pipe 64 are changed. In the following description, reference numerals the same as those of the third embodiment in FIGS. 12 and 13 represent the same or similar parts, and the detailed descriptions thereof will be omitted.

[0056] FIGS. 14 through 16 are schematic side view each illustrating the outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle acceleration pipe 64 disposed at different positions from those in the third embodiment, as viewed from the modified reed 40 side. In an example illustrated in FIG. 14, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the inducing nozzle acceleration pipe 64 is positioned on the front side of the weft yarn travel passage 41 with respect to the radial centers of the outlets of the second main nozzle acceleration pipe 71 and the fifth main nozzle acceleration pipe 74, and on the rear wall side of the weft yarn travel passage 41 with respect to the radial centers of the outlets of the third main nozzle acceleration pipe 72 and the sixth main nozzle acceleration pipe 75. The radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed vertically downward with respect to the radial centers of the outlets of the second main nozzle acceleration pipe 71 and the third main nozzle acceleration pipe 72 and is disposed vertically upward with respect to the radial centers of the outlets of the fifth main nozzle acceleration pipe 74 and the sixth main nozzle acceleration pipe 75. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward an inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction, i.e., a direction toward the rear wall side of the weft yarn travel passage 41. The rest of the configuration of the weft insertion device is the same as that of the third embodiment.

[0057] In an example illustrated in FIG. 15, the radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed vertically upward with respect to the radial centers of the outlets of the second main nozzle

acceleration pipe 71 and the third main nozzle acceleration pipe 72. In addition, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the inducing nozzle acceleration pipe 64 is positioned on the front side (the outer side) of the weft yarn travel passage 41 with respect to the radial center of the outlet of the second main nozzle acceleration pipe 71, and on the rear wall side (the inner side) of the weft yarn travel passage 41 with respect to the radial center of the outlet of the third main nozzle acceleration pipe 72. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward an inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction which is diagonally downwardly inward direction, i.e., a direction toward the rear wall side and the vertically downward direction of the weft yarn travel passage 41. The rest of the configuration of the weft insertion device is the same as that of the third embodiment.

[0058] In an example illustrated in FIG. 16, the radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed vertically downward with respect to the radial centers of the outlets of the fifth main nozzle acceleration pipe 74 and the sixth main nozzle acceleration pipe 75. In addition, the inducing nozzle acceleration pipe 64 is disposed so that the radial center of the outlet of the inducing nozzle acceleration pipe 64 is disposed on the front side of the weft yarn travel passage 41 with respect to the radial center of the outlet of the fifth main nozzle acceleration pipe 74, and on the rear wall side of the weft yarn travel passage 41 with respect to the radial center of the outlet of the sixth main nozzle acceleration pipe 75. In this example, air from the inducing nozzle acceleration pipe 64 is discharged toward an inlet 41a (see FIG. 1) of the weft yarn travel passage 41 while blowing in the B direction which is diagonally upwardly inward direction, i.e., a direction toward the rear wall side of the weft yarn travel passage 41 and the vertically upward direction. The rest of the configuration of the weft insertion device is the same as that of the third embodiment.

[0059] In this way, even with the arrangements of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle acceleration pipe 64 according to the fourth embodiment, similarly to the third embodiment, air discharged from the inducing nozzle 60 leads air discharged from the main nozzle 22 to the inside of the weft yarn travel passage 41, which allows the weft yarn 11 to be inserted into the weft yarn travel passage 41 stably.

[0060] It is noted that the arrangements of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the third main nozzle acceleration pipe 72, the fourth main nozzle acceleration pipe 73, the fifth main nozzle acceleration pipe 74, the sixth main nozzle acceleration pipe 75, and the inducing nozzle accelera-

tion pipe 64 described in the fourth embodiment are examples, these pipes may be arranged in a manner other than the above-described examples.

Fifth embodiment

[0061] The following will describe a weft insertion device of an air jet loom according to a fifth embodiment of the present invention.

[0062] The weft insertion device of the air jet loom of the fifth embodiment differs from that of the first embodiment in that the shape of the outlet of the inducing nozzle acceleration pipe is changed.

[0063] FIG. 17 is a plan view illustrating a main nozzle 22 and an inducing nozzle 60 according to the fifth embodiment. The inducing nozzle acceleration pipe 64 of the inducing nozzle 60 has in the outlet thereof a bent portion 64c bent toward the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71 of the main nozzle 22.

[0064] An extending direction of the first main nozzle acceleration pipe 70, i.e., the longitudinal direction of the weft yarn travel passage 41 and the bent port 64c of the inducing nozzle acceleration pipe 64 form an angle C which is an acute angle. The bent portion 64c is formed so that the angle C is larger than the angle formed by the longitudinal direction of the weft yarn travel passage 41 and the inducing nozzle acceleration pipe 64. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0065] In this way, the formation of the bent portion 64c of the inducing nozzle acceleration pipe 64 secures a large angle for air discharged from the inducing nozzle acceleration pipe 64 relative to the longitudinal direction of the weft yarn travel passage 41 even in a case where an angle of the inducing nozzle acceleration pipe 64 relative to the longitudinal direction of the weft yarn travel passage 41 cannot be made so large due to the restriction for a space for disposing the inducing nozzle 60.

Sixth embodiment

[0066] The following will describe a weft insertion device of an air jet loom according to a sixth embodiment of the present invention.

[0067] The weft insertion device of the air jet loom of the sixth embodiment has two outlets in the inducing nozzle acceleration pipe as compared with the first embodiment. FIG. 18 is a plan view of an inducing nozzle according to the sixth embodiment. An inducing nozzle 66 has an inducing nozzle acceleration pipe 64. The inducing nozzle acceleration pipe 64 has two outlets in total, namely, a first inducing nozzle outlet 64d and a second inducing nozzle outlet 64e.

[0068] The first inducing nozzle outlet 64d has a bent portion 64c. An angle C is formed between the bent portion 64c and a direction in which the first main nozzle acceleration pipe 70 extends, i.e., the longitudinal direc-

tion of the weft yarn travel passage 41. The second inducing nozzle outlet 64e is formed straight and does not have a bent portion. The second inducing nozzle outlet 64e is disposed so that an angle A is formed by the second inducing nozzle outlet portion 64e and the direction in which the first main nozzle acceleration pipe 70 extends, i.e., the longitudinal direction of the weft yarn travel passage 41.

[0069] FIG. 19 is a schematic side view illustrating the outlets of the first main nozzle acceleration pipe 70, the second main nozzle acceleration pipe 71, the first inducing nozzle outlet 64d, and the second inducing nozzle outlet 64e, as viewed from the modified reed 40 side. The first inducing nozzle outlet 64d is disposed on the front side of the weft yarn travel passage 41 with respect to the second main nozzle acceleration pipe 71. The second inducing nozzle outlet 64e is disposed on the front side of the weft yarn travel passage 41 with respect to the first inducing nozzle outlet 64d. Air discharged from the first inducing nozzle outlet 64d and the second inducing nozzle outlet 64e is discharged toward the inlet 41 a of the (see FIG. 1) weft yarn travel passage 41 while blowing in the B direction, i.e., a direction toward the rear wall side (the inner side) of the weft yarn travel passage 41. The rest of the configuration of the weft insertion device is the same as that of the first embodiment.

[0070] As described above, the inducing nozzle 66 has the first inducing nozzle outlet 64d having the bent portion 64c, and the second inducing nozzle outlet 64e that is straight, which can offer the same effects as those of the first embodiment and the fifth embodiment.

[0071] Although two outlets, namely, the first inducing nozzle outlet 64d and the second inducing nozzle outlet 64e are formed in the inducing nozzle acceleration pipe 64 of the sixth embodiment, three or more outlets may be formed.

Seventh embodiment

[0072] The following will describe a weft insertion device of an air jet loom according to a seventh embodiment of the present invention.

[0073] The weft insertion device of the air jet loom of the seventh embodiment differs from that of the first embodiment in that the shape of the inducing nozzle is changed. FIG. 20 is a schematic view of the inducing nozzle of the air jet loom according to the seventh embodiment. An inducing nozzle 60a is provided near the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71 of the main nozzle 22. The inducing nozzle 60a has a body portion 68 having a rectangular parallelepiped shape, a joint member 67 extending diagonally downwardly from the body portion 68, an inducing nozzle tip portion 64h extending upwardly from the body portion 68. The joint member 67 is fitted to a T-groove 43 of the sley 42 of the air jet loom 1 (see FIG. 1), thereby connecting the sley 42 with the inducing nozzle 60a.

[0074] The inducing nozzle tip portion 64h is disposed near the outlets of the first main nozzle acceleration pipe 70 and the second main nozzle acceleration pipe 71. An inducing nozzle outlet hole 64f is formed in the inducing nozzle tip portion 64h. The inducing nozzle outlet hole 64f is formed so that a direction in which the inducing nozzle outlet hole 64f is opened forms a predetermined acute angle with respect to the extending direction of the first main nozzle acceleration pipe 70. An inducing nozzle supply port 65 is formed near the main nozzle base portion 22a of the body portion 68. The inducing nozzle 60a has therein an air passage 64g that provides communication between the inducing nozzle supply port 65 and the inducing nozzle tip portion 64h. The rest of the configuration of the weft insertion device is the same as that of the first embodiment. It is noted that the inducing nozzle 60a may be formed by the same nozzle as the sub-nozzle 35.

[0075] The following will describe an operation of the air jet loom 1 according to the seventh embodiment. In discharging air from the inducing nozzle 60a, air D supplied to the inducing nozzle supply port 65 flows through the air passage 64g and is discharged from the inducing nozzle outlet hole 64f.

[0076] According to the seventh embodiment, the inducing nozzle 60a having a different shape from the inducing nozzle 60 of the first embodiment having an elongated shape is used (see FIG. 2). Since the inducing nozzle 60a has a relatively shorter air passage such as 64g than the inducing nozzle 60 has, it is advantageous in reducing the pressure loss of air discharged from the inducing nozzle. Further, since the inducing nozzle 60a of the seventh embodiment is mounted to the air jet loom 1 with the joint member 67 fitted to the T-groove 43 of the sley 42, the position of the inducing nozzle outlet hole 64f can be changed easily by taking a measure such as providing a spacer between the T-groove 43 and the joint member 67, in a case where the number of main nozzle acceleration pipes or positions thereof is changed due to a change in the number of colors of weft yarn to be used and the like, so that the initial cost before the operation of the air jet loom 1 may be reduced.

[0077] A weft insertion device of an air jet loom (1) includes a modified reed (40) having a weft yarn travel passage (41), a main nozzle (22) from which air is discharged toward an inlet (41a) of the weft yarn travel passage (41) to inject a weft yarn (11) into the weft yarn travel passage (41), and an inducing nozzle (60, 60a, 66) disposed in parallel with the main nozzle (22) and from which air is discharged to the inlet (41a) of the weft yarn travel passage (41). A timing at which air discharge from the inducing nozzle (60, 60a, 66) starts is prior to a timing at which air discharge from the main nozzle (22) starts.

Claims

1. A weft insertion device of an air jet loom (1), the weft

insertion device comprising:

a modified reed (40) having a weft yarn travel passage (41); and
a main nozzle (22) from which air is discharged toward an inlet (41a) of the weft yarn travel passage (41) to inject a weft yarn (11) into the weft yarn travel passage (41), **characterized in that** an inducing nozzle (60, 60a, 66) disposed in parallel with the main nozzle (22) and from which air is discharged to the inlet (41a) of the weft yarn travel passage (41),
a timing at which air discharge from the inducing nozzle (60, 60a, 66) starts is prior to a timing at which air discharge from the main nozzle (22) starts.

2. The weft insertion device of the air jet loom (1) according to claim 1, **characterized in that**, a diameter of an outlet of the inducing nozzle (60, 60a, 66) is smaller than a diameter of an outlet of the main nozzle (22).
3. The weft insertion device of the air jet loom (1) according to claim 1 or 2, **characterized in that** the inducing nozzle (60, 60a, 66) is disposed on the front side of the modified reed (40) with respect to the main nozzle (22), and a direction of the air discharge from the inducing nozzle (60, 60a, 66) forms an acute angle (A) with a longitudinal direction of the weft yarn travel passage (41).
4. The weft insertion device of the air jet loom (1) according to any one of claims 1 through 3, **characterized in that** a pressure of the air discharged from the inducing nozzle (60, 60a, 66) is equal to or higher than a pressure of the air discharged from the main nozzle (22).
5. The weft insertion device of the air jet loom (1) according to any one of claims 1 through 4, further comprising, a main air tank (29) storing air to be discharged from the main nozzle (22), and an inducing nozzle air tank (63) provided separately from the main air tank (29) and storing air to be discharged from the inducing nozzle (60, 60a, 66).
6. The weft insertion device of the air jet loom (1) according to any one of claims 1 through 5, **characterized in that** a timing at which the air discharge from the inducing nozzle (60, 60a, 66) stops is prior to a timing at which the air discharge from the main nozzle (22) stops.

FIG. 1

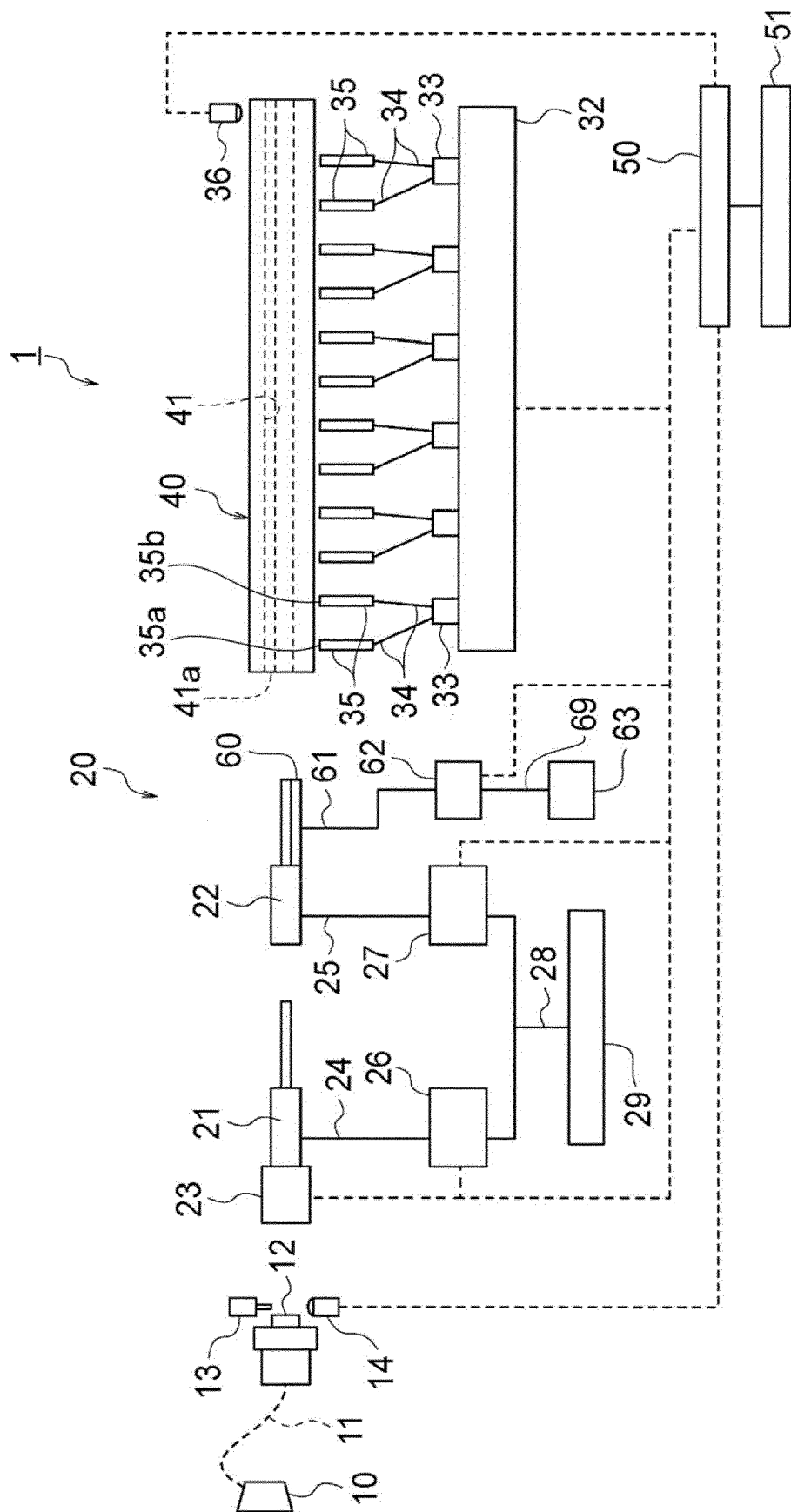


FIG. 2

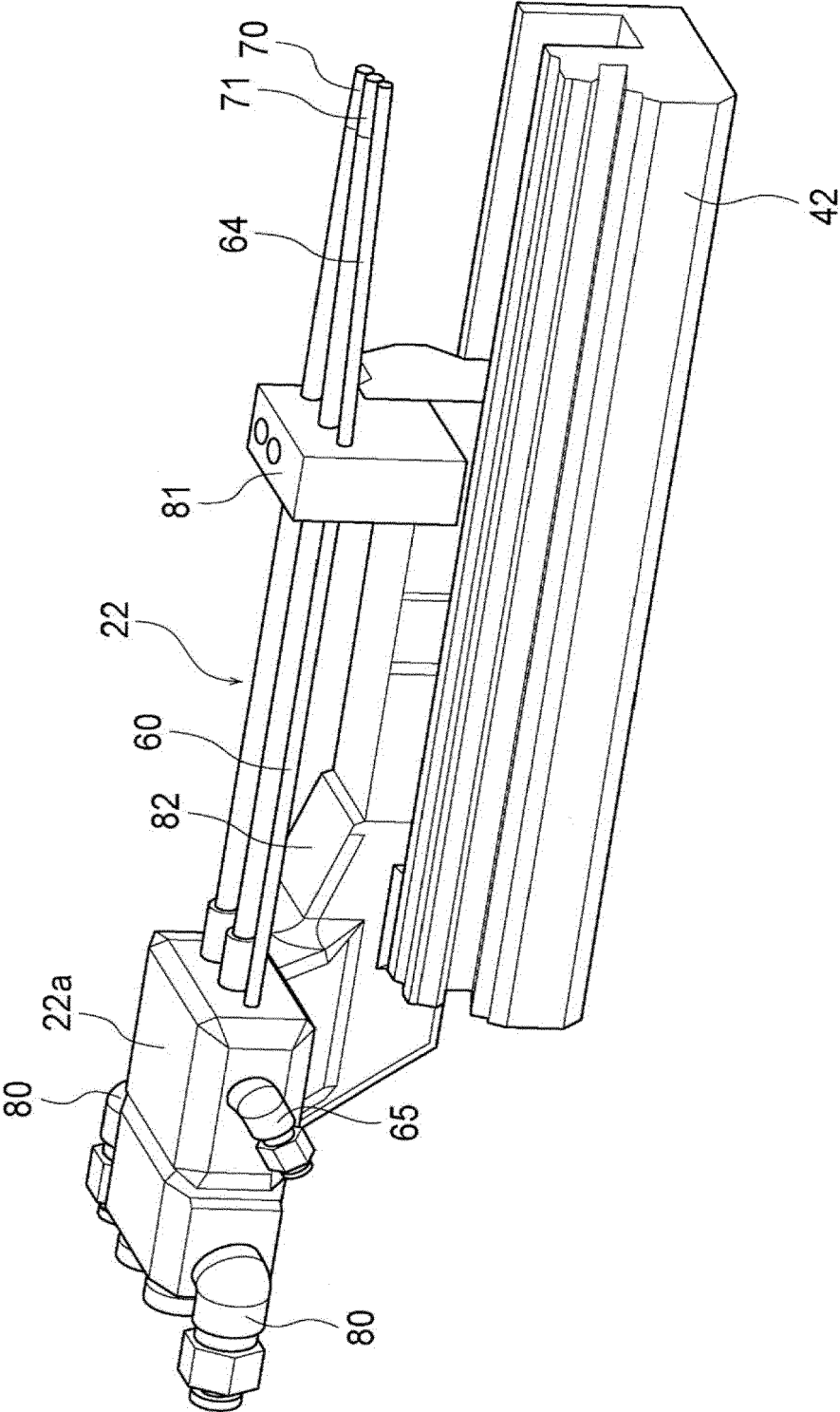


FIG. 3

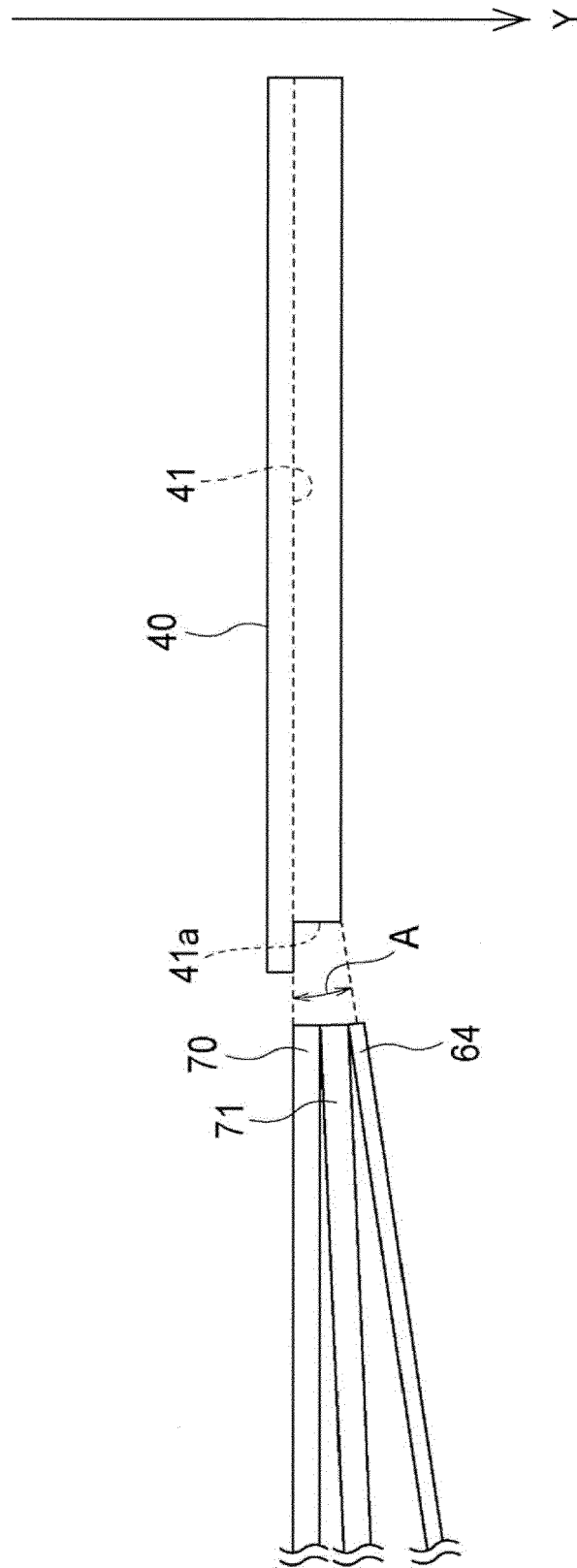


FIG. 4

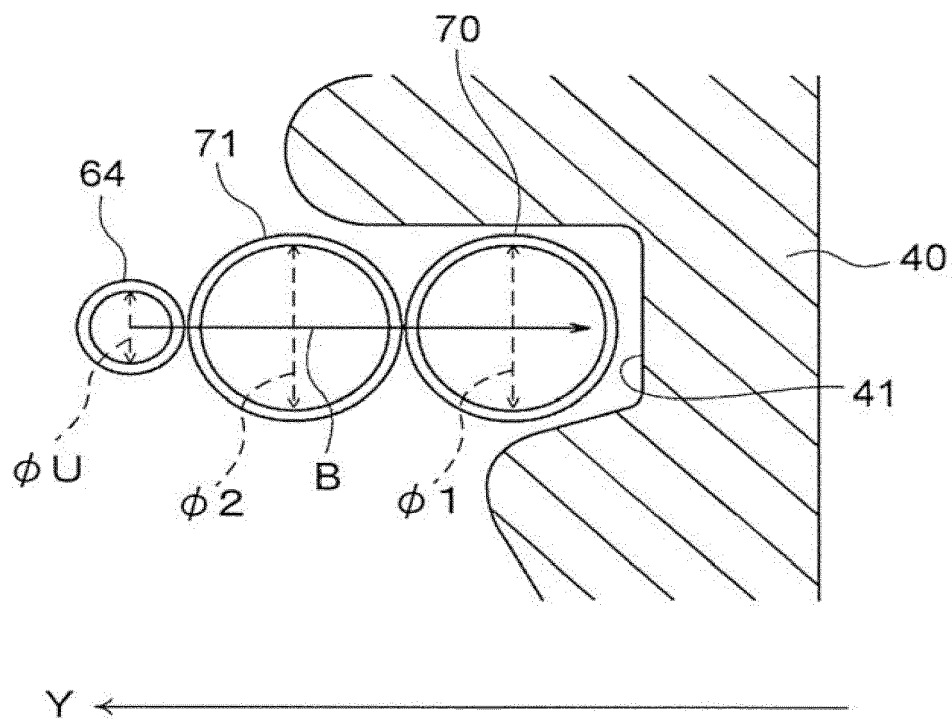


FIG. 5

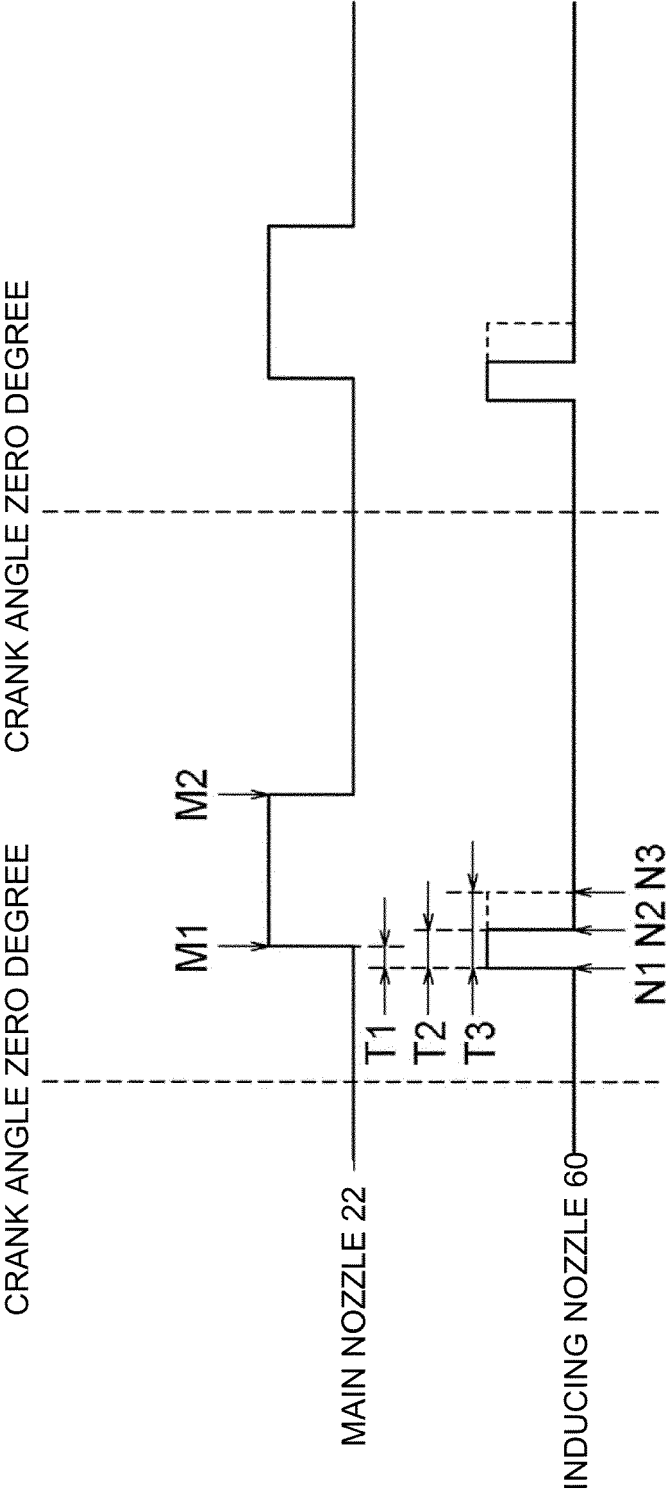


FIG. 6

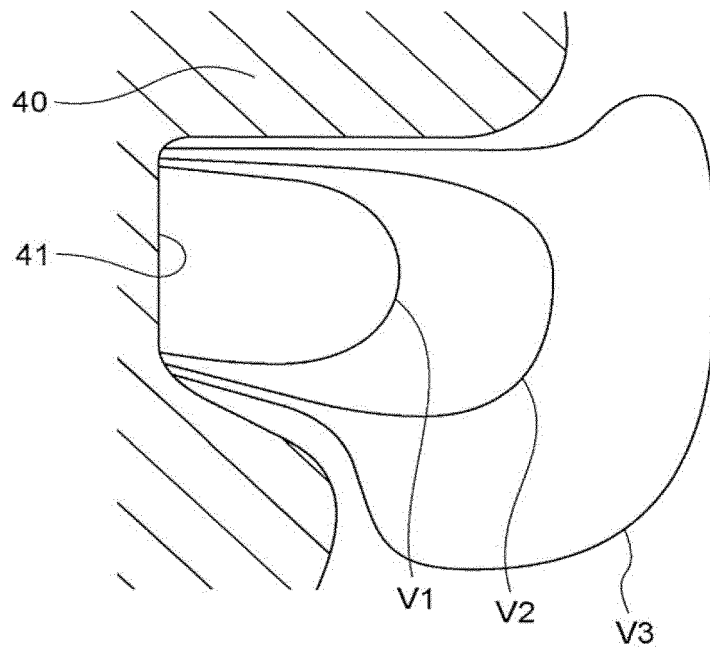


FIG. 7

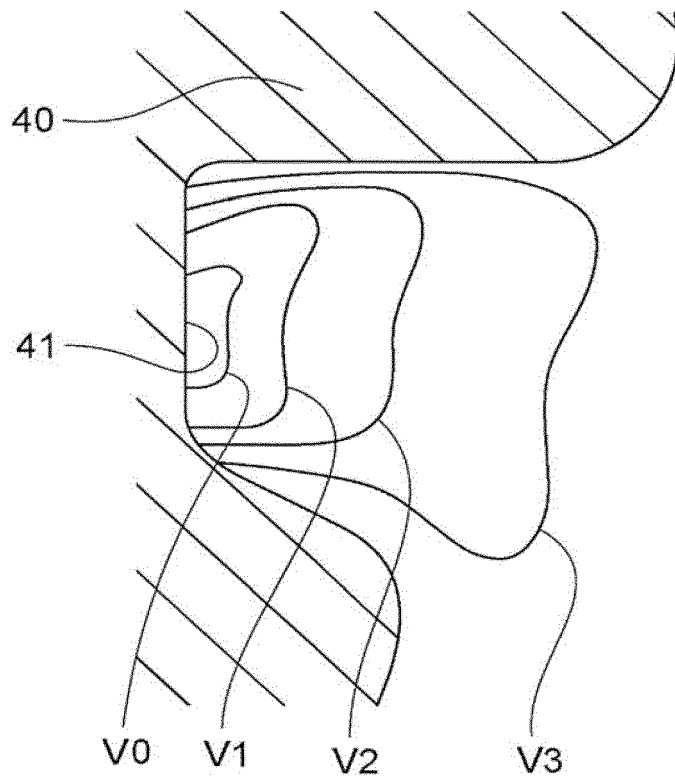


FIG. 8

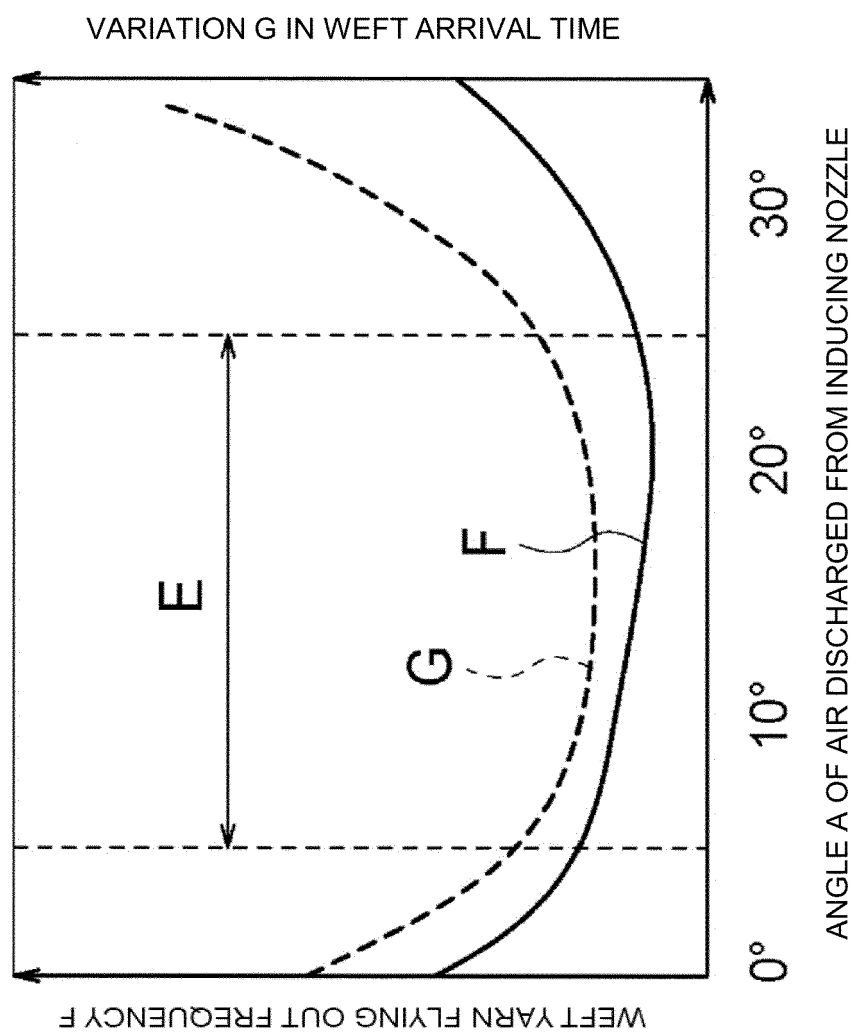


FIG. 9

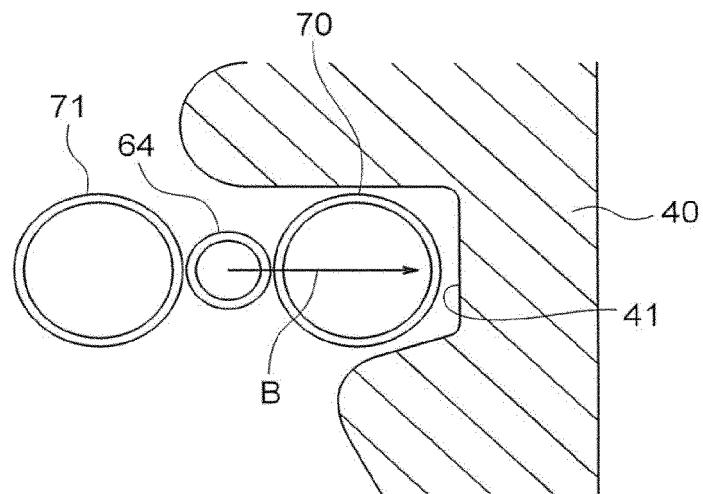


FIG. 10

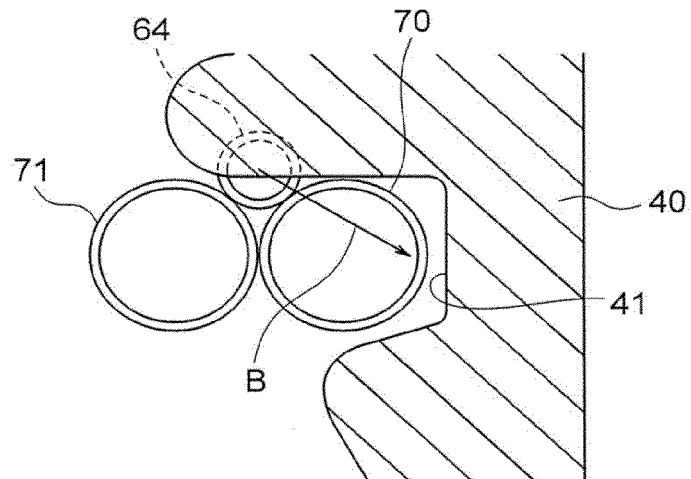


FIG. 11

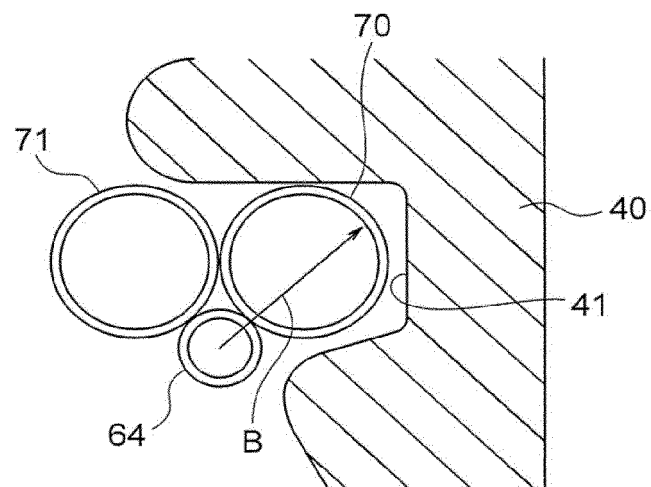


FIG. 12

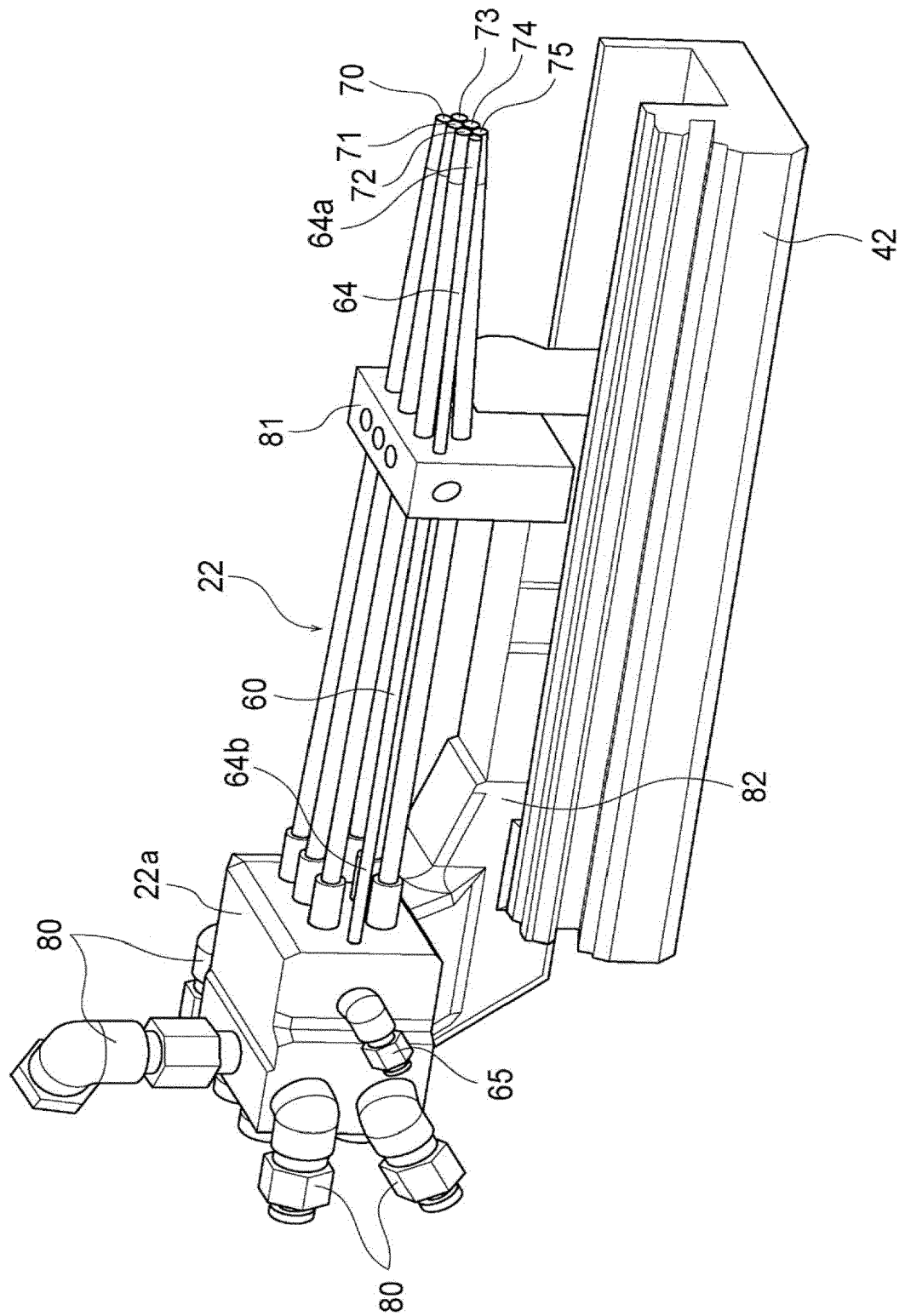


FIG. 13

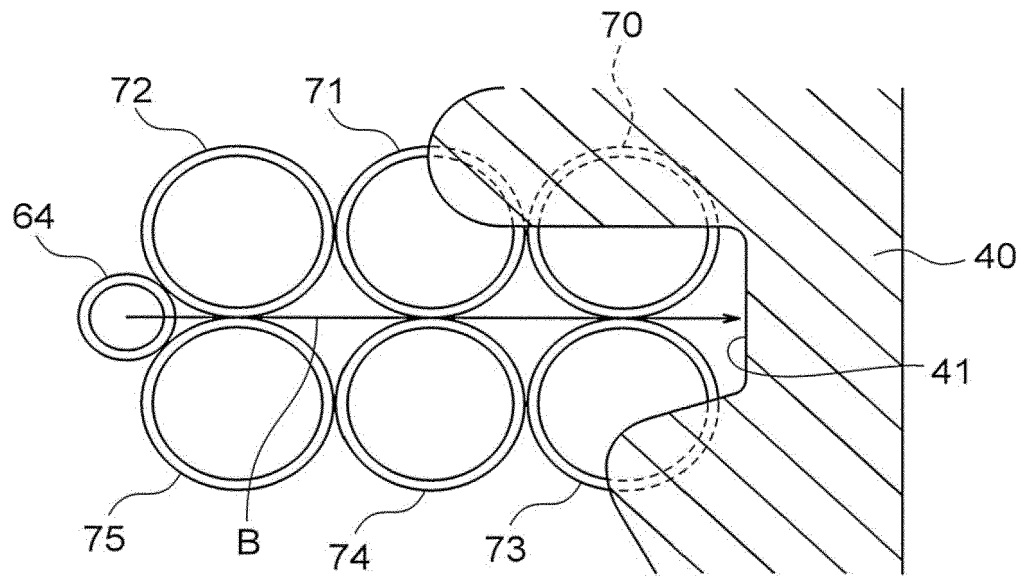


FIG. 14

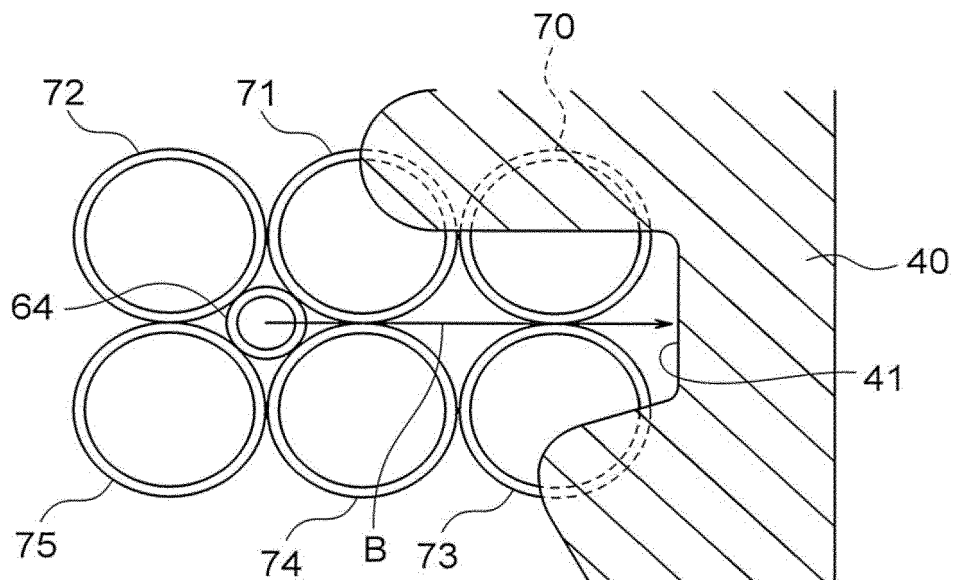


FIG. 15

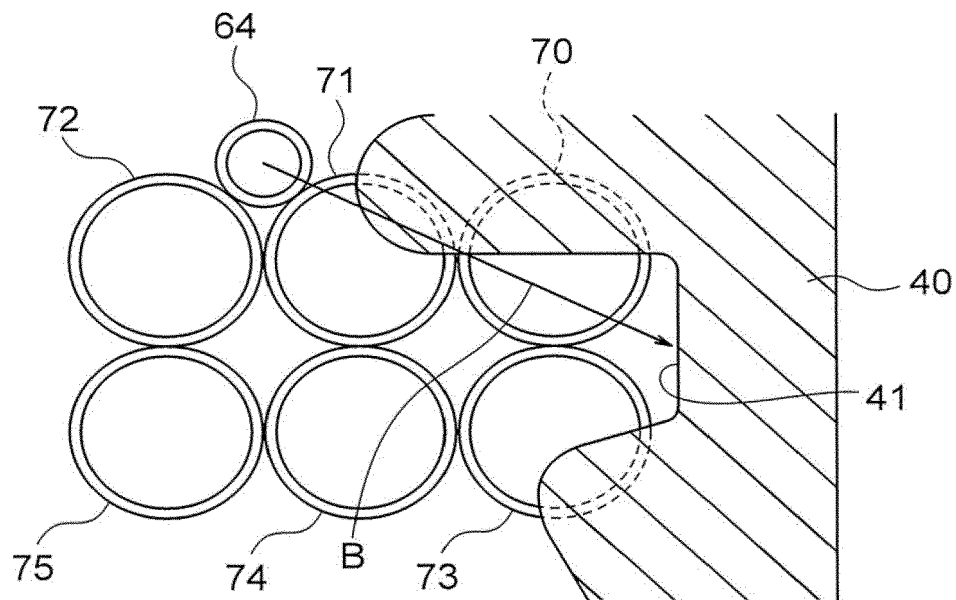


FIG. 16

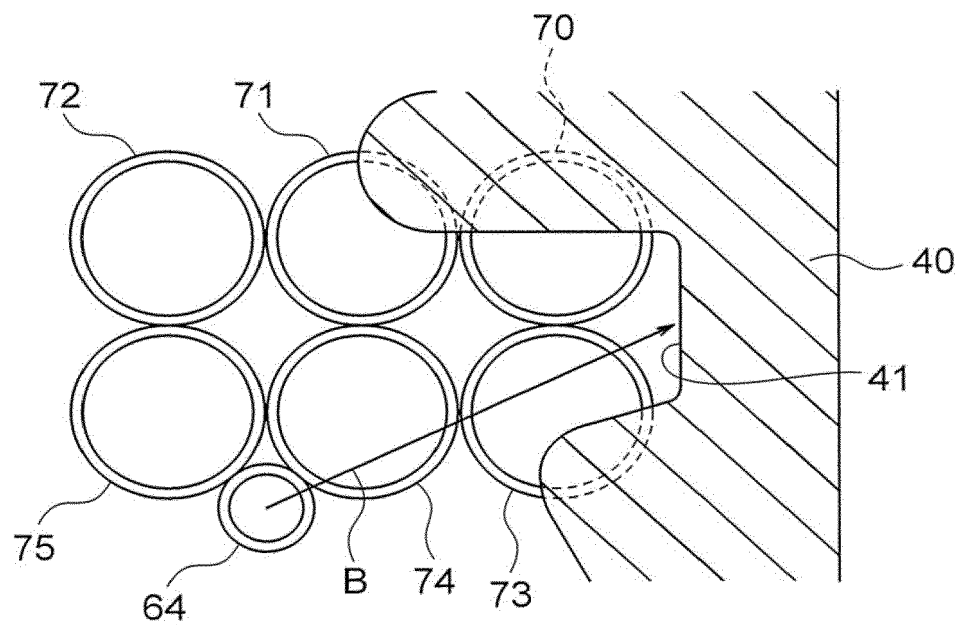


FIG. 17

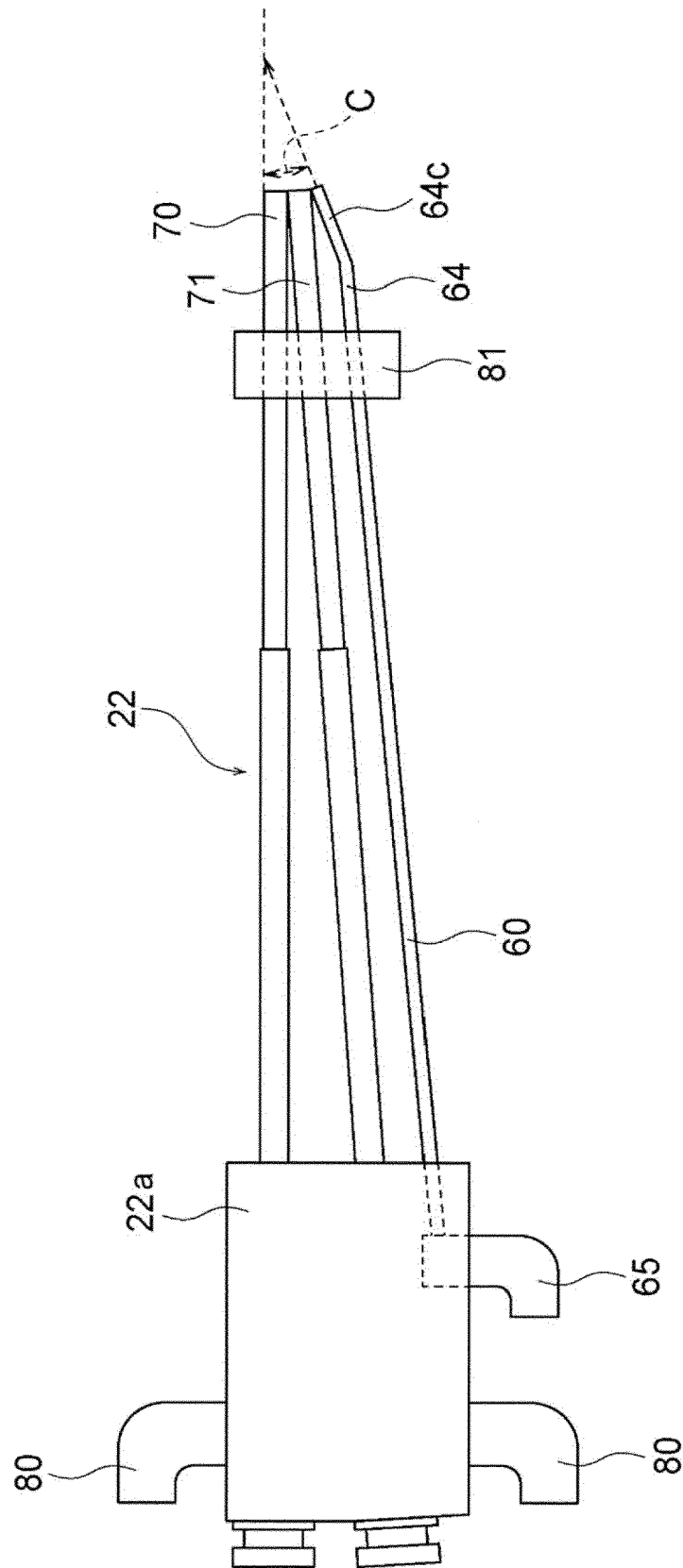


FIG. 18

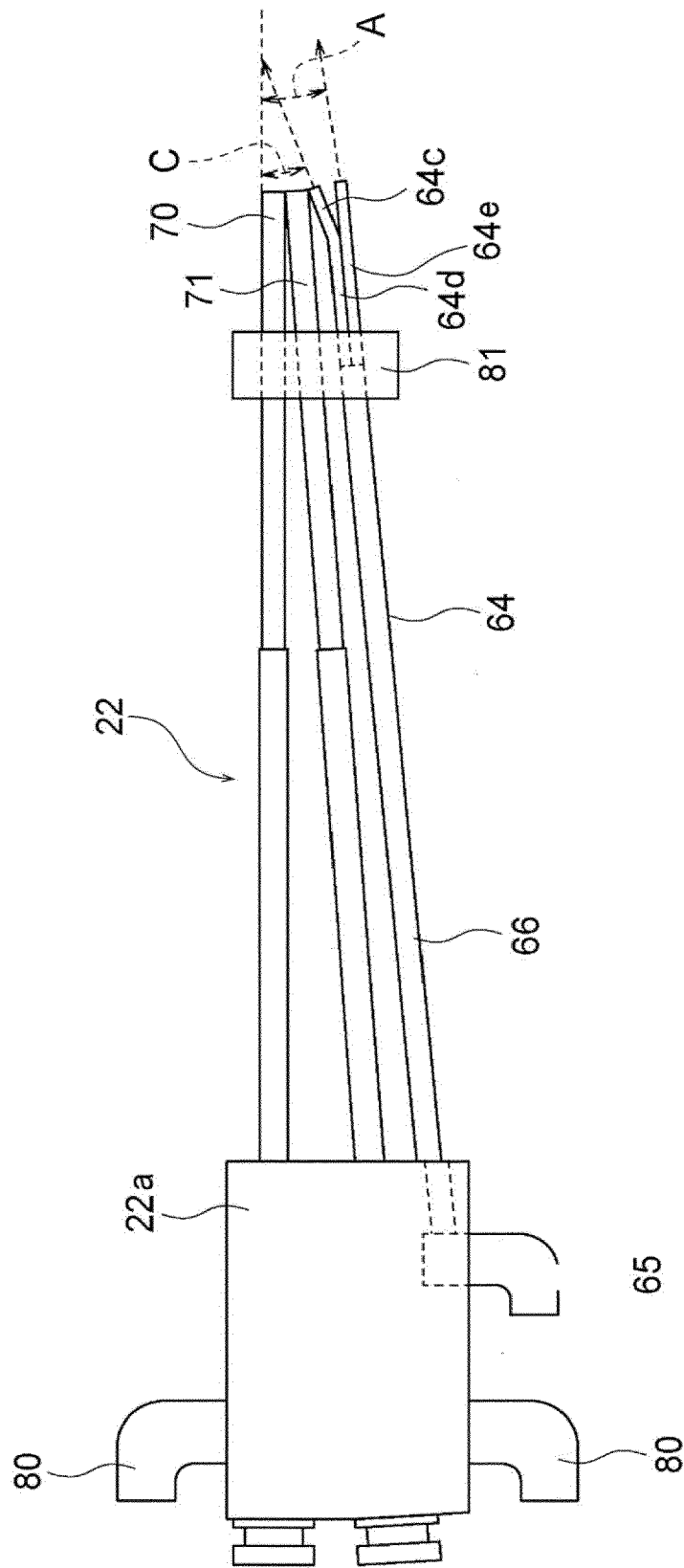


FIG. 19

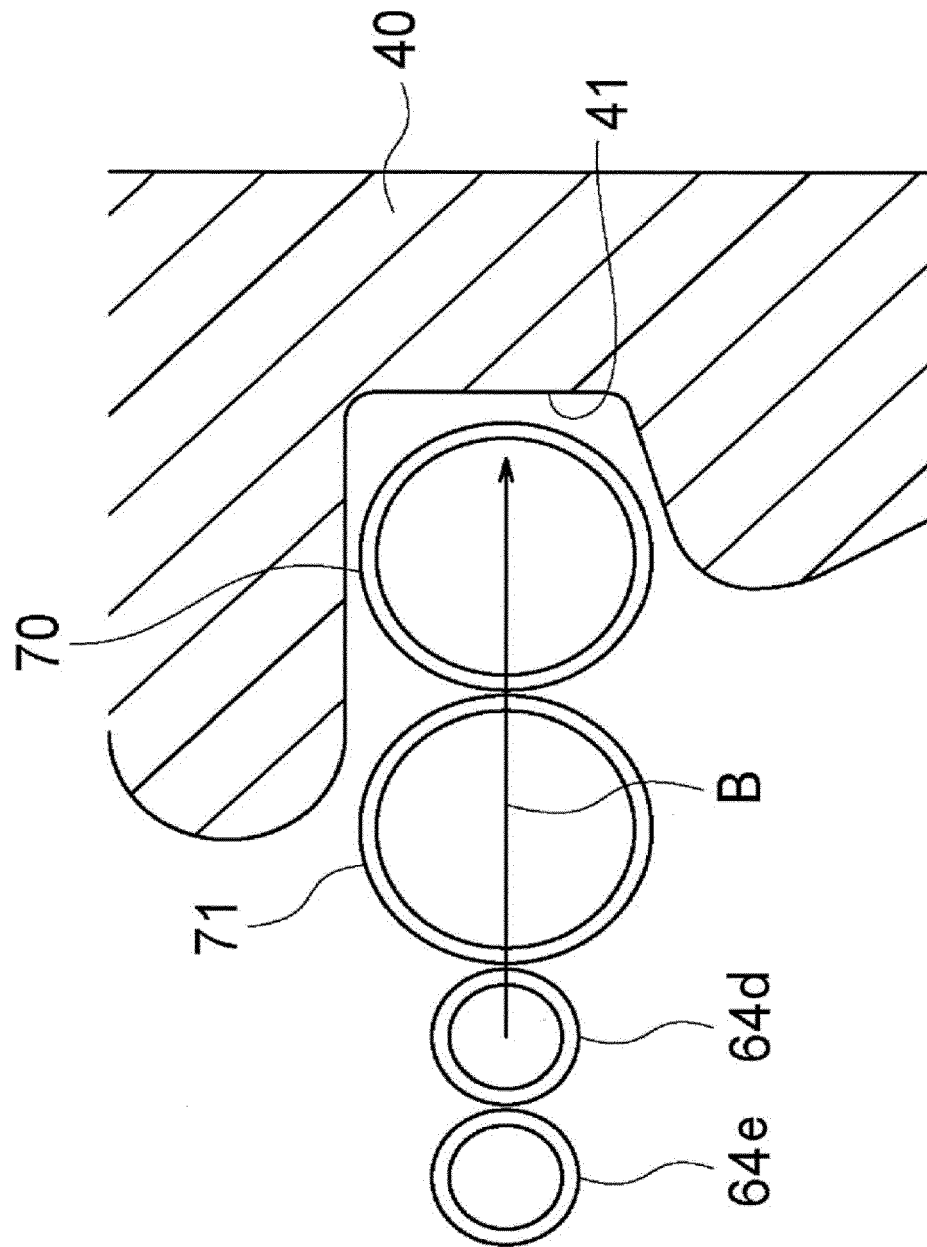
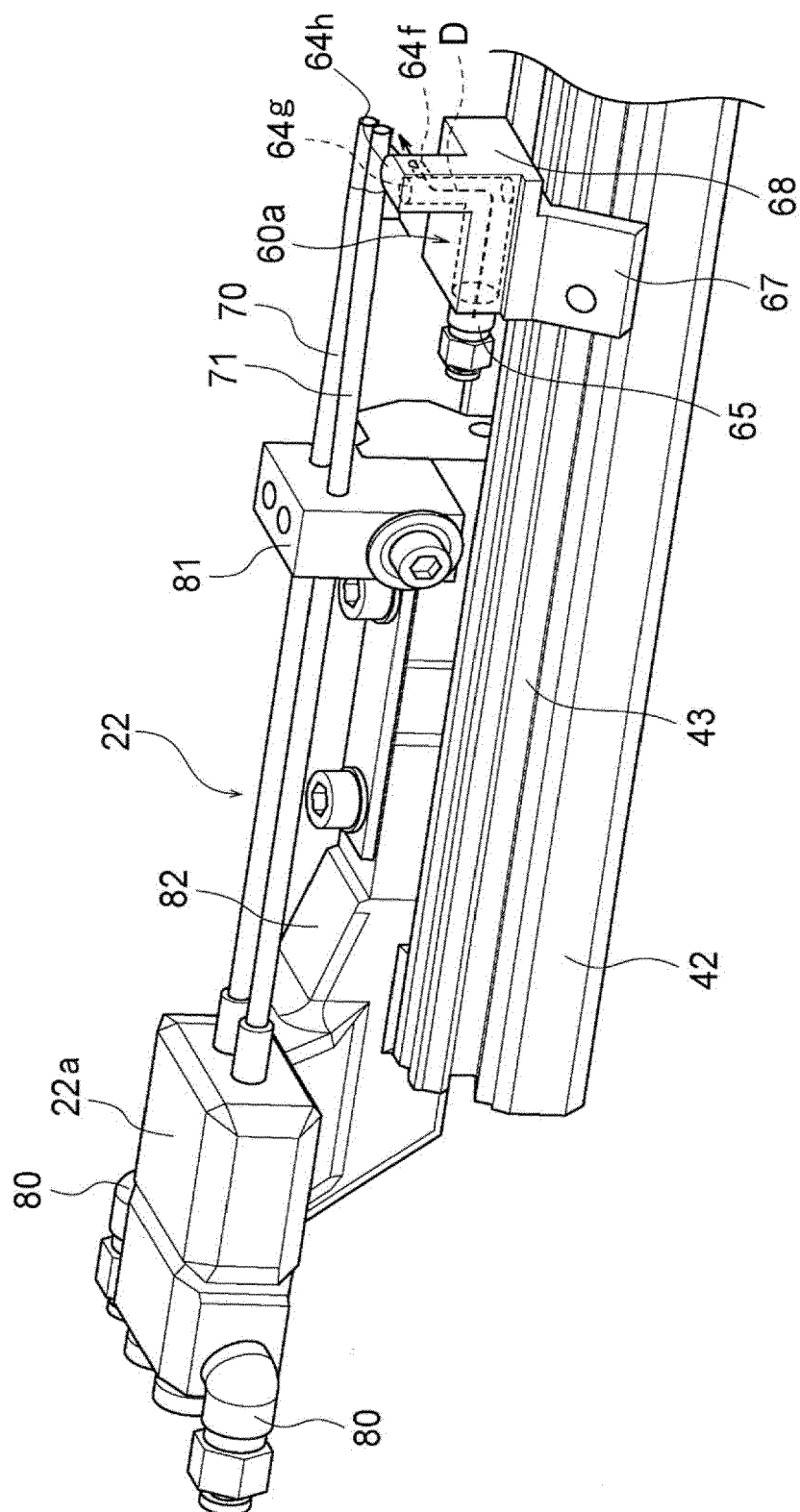


FIG. 20





EUROPEAN SEARCH REPORT

Application Number

EP 21 19 6482

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	BE 1 024 804 A1 (PICANOL NV [BE]) 3 July 2018 (2018-07-03) * paragraph [0041]; claim 12; figure 9 *	1-6	INV. D03D47/30
A	US 4 735 237 A (TAKEGAWA YUJIRO [JP] ET AL) 5 April 1988 (1988-04-05) * column 2, lines 28-55 * * column 3, lines 32-40; figures 1-8 *	1-6	
			TECHNICAL FIELDS SEARCHED (IPC)
			D03D
1	The present search report has been drawn up for all claims		
Place of search Munich		Date of completion of the search 4 February 2022	Examiner Louter, Petrus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 21 19 6482

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04-02-2022

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
BE 1024804	A1	03-07-2018	NONE
US 4735237	A	05-04-1988	EP 0239232 A1
			30-09-1987
		JP H0665775 B2	24-08-1994
		JP S62215046 A	21-09-1987
		KR 870009062 A	23-10-1987
		US 4735237 A	05-04-1988

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Patent documents cited in the description

- JP H0586544 B [0002]