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

(11) EP 3 018 243 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.05.2016 Bulletin 2016/19

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

(21) Application number: **15191798.6**

(22) Date of filing: **28.10.2015**

(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
Designated Validation States:
MA

(30) Priority: **07.11.2014 JP 2014226994**

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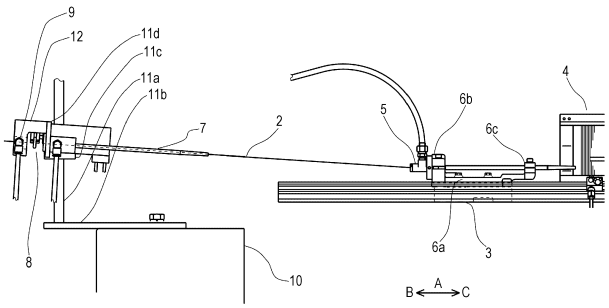
(54) THREADING DEVICE FOR AIR JET LOOM

(57) Provided is a threading device (20) for an air jet loom (1) including a plurality of weft insertion nozzles (5, 7) each including a nozzle body (14) in which an insertion hole (14a) is formed and a thread guide (15) that is disposed in the insertion hole (14a) of the nozzle body (14) and in which a thread guide hole (18) extending therethrough in an axial direction is formed, each weft insertion nozzle (5, 7) performing weft insertion of a weft yarn (2), which is inserted into the thread guide hole (18) of the thread guide (15), by using a jet of compressed air that is formed when the compressed air is supplied to the insertion hole (14a) and ejected from an ejection hole at an end of the weft insertion nozzle (5, 7) through a space around the thread guide (15) in the insertion hole (14a). The air jet loom (1) performs one weft insertion by cooperation of the plurality of weft insertion nozzles (5, 7). For at least one of the plurality of weft insertion nozzles (5, 7), the weft yarn (2) is threaded into the thread guide hole (18) by using compressed air ejected toward the thread guide hole (18) of the thread guide (15) from a nozzle (9) disposed behind the at least one of the weft insertion nozzles (5, 7). The threading device (20) includes a guide unit that has a through-hole (27) and that is provided so that a center of the through-hole (27) coincides with a center of the thread guide hole (18) when viewed in the axial direction of the thread guide (15) into which the weft yarn (2) is threaded by using the compressed air, and an air discharging unit that is provided so as to be continuous with the guide unit with respect to the axial direction and in which an inner space portion that is continuous with a space in the through-hole (27) of the guide unit is formed so as to be connected to the outside. The threading device (20) is disposed so as to be continuous with a back end of the thread guide (15) with respect to the axial direction. The threading device (20) includes the guide unit in at least an end portion thereof on an opposite side to the thread guide side in the axial direction.

FIG. 1



EP 3 018 243 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a threading device for an air jet loom including a plurality of weft insertion nozzles in each of which a thread guide, in which a thread guide hole extending therethrough in an axial direction is formed, is disposed in an insertion hole of a nozzle body. The air jet loom performs one weft insertion by cooperation of the plurality of weft insertion nozzles. For at least one of the plurality of weft insertion nozzles, the weft yarn is threaded into the thread guide hole by using compressed air ejected toward the thread guide hole of the thread guide from a nozzle disposed behind the at least one of the weft insertion nozzles.

2. Description of the Related Art

[0002] In an air jet loom, if, for example, yarn breakage occurs at a position on the upstream side of a weft insertion nozzle, a threading operation of rethreading a weft yarn into the weft insertion nozzle is performed in the repair operation or the like. A technology related to such a threading operation is disclosed in Japanese Unexamined Patent Application Publication No. 01-085348. To be specific, the technology disclosed in Japanese Unexamined Patent Application Publication No. 01-085348 is a threading method in which ejection of air from a nozzle that is disposed behind a weft insertion nozzle, into which a weft yarn is to be threaded, is used to thread a weft yarn into the weft insertion nozzle as described above.

[0003] The threading method disclosed in Japanese Unexamined Patent Application Publication No. 01-085348 is used for an air jet loom that performs one weft insertion by cooperation of a plurality of (in a specific example, two) weft insertion nozzles. To be more specific, the air jet loom disclosed in Japanese Unexamined Patent Application Publication No. 01-085348 includes a plurality of (two) weft insertion nozzles, which are a main nozzle and a so-called auxiliary main nozzle and which are disposed in series so that the axes thereof coincide. The main nozzle is a weft insertion nozzle that is disposed at the most downstream position (on the reed side) in the weft insertion direction and that mainly contributes to weft insertion. The auxiliary nozzle is a weft insertion nozzle that is disposed behind the main nozzle and that assists the main nozzle in performing weft insertion.

[0004] In the threading method described in Japanese Unexamined Patent Application Publication No. 01-085348, a weft yarn is threaded into the main nozzle, which is disposed in front of the auxiliary main nozzle, by using compressed air ejected from the auxiliary main nozzle.

[0005] Regarding threading of a weft yarn into the auxiliary main nozzle on the upstream side, Japanese Unexamined Patent Application Publication No. 01-085348 only describes that a suction effect is used. The suction effect occurs due to a negative pressure that is generated in a thread guide hole of a thread guide when compressed air is supplied to the auxiliary main nozzle and the auxiliary main nozzle ejects the compressed air. However, some existing air jet looms use a threading method similar to that of Japanese Unexamined Patent Application Publication No. 01-085348 also in order to thread a weft yarn into an auxiliary main nozzle on the upstream side. To be specific, a nozzle dedicated for threading (threading nozzle) is provided on the upstream side of the auxiliary main nozzle, and threading of a weft yarn into the auxiliary main nozzle is performed by using compressed air ejected from the threading nozzle.

[0006] However, the threading method disclosed in Japanese Unexamined Patent Application Publication No. 01-085348 has a problem in that, when threading a weft yarn into the weft insertion nozzle, the position of an end portion of the weft yarn becomes unstable behind the weft insertion nozzle and it becomes difficult to thread the weft yarn. The details are as follows.

[0007] When threading a weft yarn into the weft insertion nozzle by using ejection of air from the nozzle disposed behind the weft insertion nozzle as described above, threading of the weft yarn is performed in such a way that air ejected from the nozzle is introduced from the back end of the thread guide hole into the thread guide hole together with the weft yarn. As air is introduced from the back end of the thread guide hole, air in the thread guide hole is discharged from the front end of the thread guide hole.

[0008] In a thread guide of a general weft insertion nozzle, a thread guide hole has a back-end portion and a small-diameter portion. The back-end portion, which is a part between a position near the center and the back end of the thread guide hole, has a tapered shape whose diameter gradually decreases from the back end toward the front end. The small-diameter portion, which is a part on the front side of the back end portion, has a uniform diameter. Accordingly, in such a thread guide, the amount of air that can pass through the small-diameter portion of the thread guide hole per unit time is smaller than the amount of air that can pass through the back-end portion of the thread guide hole per unit time.

[0009] Moreover, when threading a weft yarn into the weft insertion nozzle as described above, the weft yarn is threaded into the weft insertion nozzle while being transported by ejection of air from the nozzle disposed behind the weft insertion nozzle to the weft insertion nozzle in front of the nozzle. Therefore, it is necessary that the amount of air ejected from the nozzle be sufficiently large so that the weft yarn can be transported in such a way. Accordingly, the amount of air is generally set to be larger than the amount of air that can pass through the small-diameter portion of the thread guide hole per unit time.

[0010] Therefore, in the case of threading a weft yarn into the weft insertion nozzle by using ejection of air from the nozzle provided behind the weft insertion nozzle, as air is ejected from the nozzle and introduced into a thread guide hole of a thread guide, the thread guide hole becomes saturated with air. In the state in which the thread guide hole is saturated with air, it is difficult to further introduce air into the thread guide hole, and air ejected from the nozzle is bounced back behind the thread guide. As a result, the airflow becomes turbulent behind the thread guide; the position of an end portion of the weft yarn, which is transported toward the weft insertion nozzle by using ejection of air from the nozzle, becomes unstable behind the weft insertion nozzle; and the weft yarn is not introduced into the thread guide hole of the thread guide.

SUMMARY OF THE INVENTION

[0011] An object of the present invention is to provide a threading device for an air jet loom in which compressed air is ejected toward a thread guide hole of a thread guide from a nozzle disposed behind a weft insertion nozzle when threading a weft yarn into the weft insertion nozzle. The threading device can prevent the airflow of compressed air ejected from the nozzle from becoming turbulent behind the thread guide and can stably introduce the weft yarn into the thread guide hole of the thread guide of the weft insertion nozzle.

[0012] A threading device according to the present invention is used for an air jet loom including a plurality of weft insertion nozzles each including a nozzle body in which an insertion hole is formed and a thread guide that is disposed in the insertion hole of the nozzle body and in which a thread guide hole extending therethrough in an axial direction is formed, each weft insertion nozzle performing weft insertion of a weft yarn, which is inserted into the thread guide hole of the thread guide, by using a jet of compressed air that is formed when the compressed air is supplied to the insertion hole and ejected from an ejection hole at an end of the weft insertion nozzle through a space around the thread guide in the insertion hole. The air jet loom performing one weft insertion by cooperation of the plurality of weft insertion nozzles. For at least one of the plurality of weft insertion nozzles, the weft yarn is threaded into the thread guide hole by using compressed air ejected toward the thread guide hole of the thread guide from a nozzle disposed behind the at least one of the weft insertion nozzles.

[0013] In order to achieve the object described above, the threading device according to the present invention includes a guide unit that has a through-hole and that is provided so that a center of the through-hole coincides with a center of the thread guide hole when viewed in the axial direction of the thread guide into which the weft yarn is threaded by using the compressed air, and an air discharging unit that is provided so as to be continuous with the guide unit with respect to the axial direction and in which an inner space portion that is continuous with a space in the through-hole of the guide unit is formed so as to be connected to the outside. The threading device is disposed so as to be continuous with a back end of the thread guide with respect to the axial direction. The threading device includes the guide unit in at least an end portion thereof on an opposite side to the thread guide side in the axial direction.

[0014] In the threading device for the air jet loom according to the present invention described above, the guide unit and the air discharging unit may be formed as an integrated member that is continuous in the axial direction; and the air discharging unit may have a through-hole and a vent hole, the through-hole being formed so as to be continuous with the through-hole of the guide unit in the axial direction and having an inner space that serves as the space portion, the vent hole being connected to the space portion and to the outside.

[0015] An end surface of a peripheral wall of the guide unit on a side in the axial direction from which the weft yarn is introduced, the peripheral wall surrounding the through-hole, may be arc-shaped.

[0016] The threading device according to the present invention is used for the air jet loom that performs one weft insertion by cooperation of the plurality of the weft insertion nozzles as described above. The threading device is disposed so as to be continuous with the back end of the thread guide of the weft insertion nozzle. The threading device includes the guide unit and the air discharging unit structured as described above. The threading device includes the guide unit in at least the end portion thereof on the opposite side to the thread guide side in the axial direction. Therefore, with the threading device, when threading a weft yarn into the weft insertion nozzle, the weft yarn is introduced into the thread guide hole of the thread guide of the weft insertion nozzle more stably than with existing threading devices.

[0017] To be more specific, with the threading device for the air jet loom according to the present invention, when threading a weft yarn into the weft insertion nozzle, compressed air ejected from the nozzle disposed behind the weft insertion nozzle is introduced into the threading device from the guide unit. Then, the compressed air is introduced into the thread guide hole of the thread guide through the through-hole of the guide unit and the space portion of the air discharging unit (the inner space portion that is continuous with the space in the through-hole of the guide unit). Because the space portion of the air discharging unit is connected to the outside, even in a state in which the inside of the thread guide hole has become saturated with air as the compressed air is introduced into the thread guide hole, compressed air that is subsequently ejected from the nozzle and introduced into the threading device is discharged through the air discharging unit to the outside. Thus, compressed air can be prevented from being bounced back behind the thread guide and the airflow can be prevented from becoming turbulent. As a result, with the threading device, the position

of the end portion of the weft yarn that is transported toward the weft insertion nozzle by using ejection of air from the nozzle is made more stable than with existing threading devices, and the weft yarn is introduced into the thread guide hole of the thread guide of the weft insertion nozzle more stably than with existing threading devices.

[0018] In the threading device for the air jet loom according to the present invention, the guide unit and the air discharging unit may be formed as an integrated member that is continuous in the axial direction, and the air discharging unit may have the through-hole and the vent hole. In this case, it is possible to dispose the threading device behind the weft insertion nozzle (thread guide) by using a simple structure, and it is possible to easily dispose the threading device so that the center of the through-hole of the guide unit coincides with the center of the thread guide hole of the thread guide as described above. The details are as follows.

[0019] In the threading device for the air jet loom according to the present invention described above, the guide unit and the air discharging unit are formed as an integrated member. In other words, a single member or an integrated member includes a part corresponding to the guide unit and a part corresponding to the air discharging unit having the vent hole, and the air discharging unit is formed as a member. However, this is not a limitation on the present invention, and the air discharging unit may be formed as a space. To be specific, a member corresponding to a guide unit having a through-hole may be disposed at a position that is separated from the back end of the thread guide in the axial direction, and a space between the member corresponding to the guide unit and the back end of the thread guide may be used as the air discharging unit. In this case, the member corresponding to the guide unit and the space constitute the threading device. Even with such a structure, the aforementioned effect of stabilizing introduction of a weft yarn can be obtained.

[0020] However, in this case, it is necessary to use a dedicated support member (bracket or the like) for disposing the guide unit at a position separated from the weft insertion nozzle as described above. Namely, it is necessary that the threading device include such a support member. Moreover, because the guide unit is to be disposed so that the center of the through-hole coincides with the center of the thread guide hole as described above, it is necessary to accurately position the member corresponding to the guide unit so that the member is disposed at a position separated from the weft insertion nozzle (thread guide) by using the support member. Therefore, the structure of the threading device becomes more complex, and it takes man-hours to attach the threading device so that the member can be disposed as described above.

[0021] In contrast, by configuring the threading device for an air jet loom so that the guide unit and the air discharging unit are formed as an integrated member as described above, that is, the integrated member itself includes the air discharging unit, it is not necessary to dispose the integrated member so as to be separated from the weft insertion nozzle (thread guide) in order to form the air discharging unit, and it is possible to directly attach the member (threading device) including the air discharging unit to the weft insertion nozzle. By using such a structure in which the threading device is directly attached to the weft insertion nozzle as described above, it is not necessary that the threading device include the support member as described above, and the structure of the threading device can be simplified. Moreover, in this case, it is possible to easily dispose the guide unit as described above, and it is possible to easily perform the operation of attaching the threading device.

[0022] In the threading device for the air jet loom according to the present invention, the end surface of the peripheral wall of the guide unit on the side in the axial direction from which a weft yarn is introduced, the peripheral wall surrounding the through-hole, may be arc-shaped. In this case, it is possible to more stably introduce a weft yarn into the threading device by using compressed air ejected from the nozzle, and it is possible to more stably introduce the weft yarn into the thread guide hole of the thread guide.

[0023] To be more specific, because an air jet generally has a property that the air jet is attracted to a nearby object and flows along the shape of the surface of the object (so-called Canada effect), by forming the end surface of the guide unit so as to be arc-shaped as described above, the compressed air ejected from the nozzle for threading easily flows along the arc shape of the end surface due to the Coanda effect, and the compressed air is introduced into to the through-hole in such a way that the compressed air converges. Thus, a weft yarn transported by using the compressed air toward the threading device is more stably introduced into the guide unit and the weft yarn is more stably introduced into the threading device. As a result, the weft yarn is more stably introduced into the thread guide hole of the thread guide.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 is a partial front view illustrating an example of an air jet loom for which a threading device according to the present invention is used;

Fig. 2 is a top view illustrating a threading device according to an embodiment of the present invention;

Fig. 3 is a sectional view illustrating the threading device according to the embodiment of the present invention; and

Fig. 4 is a partial enlarged sectional view illustrating a main part of Fig. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Hereinafter, an embodiment of the present invention will be described with reference to Figs. 1 to 3.

[0026] Fig. 1 illustrates an example of an air jet loom for which a threading device according to the present invention is used. In the present embodiment, it is assumed that the air jet loom includes a single-color weft insertion device including only one so-called main nozzle that mainly contributes to weft insertion. Moreover, it is assumed that the weft insertion device further includes one so-called auxiliary main nozzle, for assisting the main nozzle in performing weft insertion, at a position between the main nozzle and a measuring-and-storing device (not shown). Namely, in the air jet loom according to the present embodiment, the weft insertion device includes two weft insertion nozzles, which are the main nozzle and the auxiliary main nozzle, and performs one weft insertion by cooperation of the two weft insertion nozzles.

[0027] To be specific, as illustrated in Fig. 1, a main nozzle 5 is provided on a reed holder 3 for supporting a reed 4. To be more specific, a nozzle bracket 6a is disposed on the reed holder 3 at a position on the weft-supply side (upstream side) of the reed 4 in the weft insertion direction. The nozzle bracket 6a is provided in such a way that the nozzle bracket 6a is supported by the reed holder 3 in a similar way as the reed 4. A pipe holder 6c, which is located on the reed side, and a nozzle supporter 6b, which is located farther from the reed 4 than the pipe holder 6c, are attached to the nozzle bracket 6a. The main nozzle 5 is provided on the reed holder 3 in such a way that a pipe part thereof is supported by the pipe holder 6c and a body part thereof is supported by the nozzle supporter 6b.

[0028] An auxiliary main nozzle 7 is provided behind the main nozzle 5 in such a way that the auxiliary main nozzle 7 is supported by a support shaft and the like. To be more specific, a weft-supply-side loom frame 10 is disposed on the weft-supply side of the reed holder 3 with respect to the weft insertion direction. A nozzle base 11 b is attached to the loom frame 10 by using a screw member, such as a bolt or the like, and a support shaft 11 a is provided so as to stand on the nozzle base 11 b. An auxiliary main nozzle supporter 11 c is attached to the support shaft 11 a. A support bracket 11 d, which is a plate-shaped member for supporting the auxiliary main nozzle 7, is attached to the auxiliary main nozzle supporter 11c. A through-hole, for attaching the auxiliary main nozzle 7 to the support bracket 11 d, is formed in the support bracket 11 d. The auxiliary main nozzle 7 is attached to the support bracket 11 d in such a way that a body part thereof is fitted into the through-hole. Accordingly, the auxiliary main nozzle 7 is supported by the support shaft 11a via the support bracket 11 d and the auxiliary main nozzle supporter 11c.

[0029] The auxiliary main nozzle supporter 11c includes the through-hole, into which the support shaft 11a is fitted, and a split clamp mechanism including a slot that is connected to the through-hole. By using the split clamp mechanism, the auxiliary main nozzle supporter 11c is securely fixed to the support shaft 11a, which is inserted into the through-hole. Accordingly, the position (height position) at which the auxiliary main nozzle supporter 11c is attached to the support shaft 11a can be changed in the longitudinal direction of the support shaft 11a. A through-hole is formed in the auxiliary main nozzle supporter 11c so that the through-hole extends in a horizontal direction in a state in which the auxiliary main nozzle supporter 11c is attached to the support shaft 11a as described above.

[0030] As illustrated in Fig. 2, the support bracket 11 d is attached to the auxiliary main nozzle supporter 11c by screwing a fixing bolt, which is inserted into a through-hole in the auxiliary main nozzle supporter 11c. The support bracket 11 d is fixed to the auxiliary main nozzle supporter 11c in such a way that the auxiliary main nozzle supporter 11c is clamped between the head of the fixing bolt and the support bracket 11 d by tightening the fixing bolt. Accordingly, by loosening the fixing bolt, the support bracket 11 d can be rotated around the axis of the fixing bolt together with the fixing bolt, and the angle at which the support bracket 11 d is attached to the auxiliary main nozzle supporter 11c can be changed.

[0031] The height position of the auxiliary main nozzle 7 is set in accordance with the position of the auxiliary main nozzle supporter 11c relative to the support shaft 11a. Moreover, the auxiliary main nozzle 7 is provided so as to be directed toward the back end of the main nozzle 5 by adjusting the angle at which the support bracket 11 d is attached to the auxiliary main nozzle supporter 11c.

[0032] In a general air jet loom 1, the main nozzle 5 and the auxiliary main nozzle 7 have the same structure. Hereinafter, the structure of the auxiliary main nozzle 7 will be described below with reference to Figs. 3 and 4. It is assumed that the main nozzle 5 has basically the same structure as the auxiliary main nozzle 7.

[0033] The auxiliary main nozzle 7 includes a nozzle body 14 as its main component, a thread guide 15 mounted in the nozzle body 14, and a pipe 17 attached to the nozzle body 14. The nozzle body 14 is a cylindrical member in which an insertion hole 14a is formed so as to extend therethrough in the axial direction. A through-hole, which extends from a peripheral surface of the nozzle body 14 to the insertion hole 14a, is formed in the nozzle body 14. This through-hole serves as an air supply hole 14b for supplying compressed air into the insertion hole 14a. The insertion hole 14a of the nozzle body 14 is formed so that the diameter of a part thereof at one end in the axial direction is slightly smaller. Therefore, a stepped portion 14c exists in the insertion hole. An airflow regulating member 16 is provided in the insertion hole in such a way that the airflow regulating member 16 is in contact with the stepped portion 14c. The pipe 17 is attached to the nozzle body 14 in such a way that the pipe 17 is press-fitted into the part of the insertion hole 14a

having a smaller diameter as described above.

[0034] The thread guide 15 is a pipe-shaped member in which a thread guide hole 18 is formed. The thread guide hole 18 has a center that coincides with the axis of the thread guide 15 and extends through the thread guide 15 in the axial direction. A back end portion 15e of the thread guide 15 has a flange-like shape having a diameter larger than the inside diameter of the insertion hole 14a of the nozzle body 14. The diameter of the thread guide 15 decreases stepwise toward the front end thereof. Namely, the thread guide 15 includes a fitting portion 15c, a middle portion 15b, and a needle portion 15a. The fitting portion 15c is a part of the thread guide 15 that is continuous with the back end portion 15e and that has a diameter such that the fitting portion 15c can be fitted into the insertion hole 14a of the nozzle body 14. The middle portion 15b is continuous with the fitting portion 15c via a tapered surface and has a smaller diameter than the fitting portion 15c. The needle portion 15a is continuous with the middle portion 15b via an arc-shaped tapered surface and has a diameter still smaller than the middle portion 15b. The thread guide hole 18 of the thread guide 15 is tapered so that the inside diameter thereof gradually decreases from the back end of the thread guide 15 to a position near a back end portion of the middle portion 15b.

[0035] The thread guide 15 has a male screw thread that is formed around an outer peripheral surface of a part of the fitting portion 15c on the back-end side of the center of the thread guide 15. Namely, the part of the fitting portion 15c on the back-end side is formed as a male screw-threaded portion 15d. An end portion of the insertion hole 14a of the nozzle body 14, opposite to the end portion to which the pipe 17 is attached, is a female screw-threaded portion 14d, in which a female screw thread is formed around an inner peripheral surface thereof. The thread guide 15 is mounted in the nozzle body 14 in the following way: the thread guide 15 is inserted from the end portion of the insertion hole 14a of the nozzle body 14 on the opposite side to the side to which the pipe 17 is attached; the male screw-threaded portion 15d is screwed into the female screw-threaded portion 14d of the insertion hole 14a; and a part of the fitting portion 15c on the front-end side of the male screw thread is fitted into the insertion hole 14a.

[0036] In the state in which the thread guide 15 is mounted in the nozzle body 14 as described above, the needle portion 15a extends in the insertion hole beyond the airflow regulating member 16 into the inside of the pipe 17 attached to the nozzle body 14.

[0037] In the thread guide 15, the middle portion 15b and the needle portion 15a each has a smaller diameter than of the fitting portion 15c as described above, that is, each has an outside diameter smaller than the inside diameter of the insertion hole 14a. Accordingly, when the thread guide 15 is mounted in the nozzle body 14 as described above, a flow path having an annular shape (an annular flow path 19) is formed in the insertion hole around the middle portion 15b and the needle portion 15a. The thread guide 15 has a plurality of airflow regulating fins at an end portion of the middle portion 15b on the needle-portion side. The airflow regulating fins extend radially from an outer peripheral surface of the end portion. Due to the airflow regulating fins, a regulation flow path is formed in the annular flow path near the middle portion.

[0038] The air supply hole 14b, which is formed in the nozzle body 14 as described above, is formed so as to be connected to a part of the annular flow path 19 in the insertion hole near the middle portion of the thread guide 15. A connector 13 is attached to the air supply hole 14b, and the auxiliary main nozzle 7 is connected to an air supply source through an air supply pipe connected to the connector 13.

[0039] In the present embodiment, the air jet loom 1 includes a weft braking device 8, which is provided behind the auxiliary main nozzle 7 in such a way that the weft braking device 8 is supported by the support bracket 11 d for supporting the auxiliary main nozzle 7. The weft braking device 8 is a device for braking a weft yarn 2 by giving a bending effect to the weft yarn 2, which is in the being inserted, in the final phase of weft insertion. The weft braking device 8 includes a push lever 8d that gives a bending effect to the weft yarn 2 by being rotated, an actuator 8a for rotating the push lever 8d, and a yarn guide 8e for increasing the bending effect given to the weft yarn 2.

[0040] The components of the weft braking device 8 will be described in detail. The actuator 8a is attached to a side surface of the support bracket 11 d on the reed side (downstream side) with respect to the weft insertion direction at a position on the support bracket 11 d between the auxiliary main nozzle 7 and the auxiliary main nozzle supporter 11 c in the longitudinal direction of the support bracket 11 d in such a way that an output shaft 8b is directed toward the upstream side. A through-hole is formed in the support bracket 11 d at a position corresponding to the output shaft 8b of the actuator 8a. The output shaft 8b is inserted into the through-hole so as to protrude from the support bracket 11 d toward the upstream side and so as to extend parallel to the weft insertion direction.

[0041] In the present embodiment, the push lever 8d includes a pair of rods. The push lever 8d is attached to the output shaft 8b via a holding member 8c, which is attached to the output shaft 8b of the actuator 8a, in such a way that the push lever 8d extends in a direction perpendicular to the direction in which the output shaft 8b extends (weft insertion direction). The push lever 8d is disposed at a position on the upstream side of the auxiliary main nozzle 7 with respect to the weft insertion direction. The actuator 8a reciprocatingly swings the push lever 8d between a stand-by position and an operation position. At the stand-by position, a part of the push lever 8d corresponding to a path

[0042] (weft path) of the weft yarn 2, which is guided

to the auxiliary main nozzle 7, is located above the weft path. At the operation position, the part of the push lever 8d is located below the weft path.

[0043] Next, the yarn guide 8e will be described. As illustrated in Figs. 2 and 3, a nozzle holder 12, which includes a support portion 12a and a holding portion 12b, is attached to the support bracket 11d. The support portion 12a is rectangular-parallelepiped-shaped and is attached to the support bracket 11 d. The holding portion 12b is rectangular-parallelepiped-shaped and is integrally formed with the support portion 12a so as to form an L-shape together with the support portion 12a in a side view. The nozzle holder 12 is located on the upstream side of the support bracket 11 d and is attached to the support bracket 11 d so that the nozzle holder 12 extends perpendicularly to the support bracket 11 d at a position above the weft path.

[0044] Moreover, the yarn guide 8e, which is an annular member in the present embodiment, is disposed between the pair of rods of the push lever 8d with respect to the weft insertion direction. The yarn guide 8e is supported by the support portion 12a of the nozzle holder 12 via a support member at a position such that the weft path extends through a hole in the yarn guide 8e when viewed from the upstream side in the weft insertion direction. Thus, the weft yarn 2 passes through the hole in the annular yarn guide 8e and is guided toward the auxiliary main nozzle 7.

[0045] With the weft braking device 8 having such a structure, when the push lever 8d is swung from the stand-by position toward the operation position, the push lever 8d and the yarn guide 8e give a bending effect to the weft yarn 2.

(Outline of Threading Nozzle)

[0046] The present embodiment further includes an air ejection nozzle for threading (a threading nozzle 9), which is provided at a position that is separated behind the auxiliary main nozzle 7 and that is on the upstream side of the weft braking device 8. The threading nozzle 9 is supported by the support bracket 11 d via the nozzle holder 12.

[0047] Namely, in the case where the air jet loom 1 includes the weft braking device 8 behind the auxiliary main nozzle 7 as described above, the space behind the auxiliary main nozzle 7 is small. Therefore, when performing a threading operation due to occurrence of yarn breakage as described above, it is difficult to move an end of the weft yarn 2 to a position near the back end of the auxiliary main nozzle 7 and to thread the weft yarn 2. Moreover, because the weft braking device 8 includes the yarn guide 8e as described above, when performing the threading operation, it is also necessary to thread the weft yarn 2 into the yarn guide 8e of the weft braking device 8. For this reason, in the present embodiment, the air jet loom 1 includes the threading nozzle 9 as described above. Accordingly, in the present embodiment, when threading a weft yarn into the weft insertion nozzles, the weft yarn 2 is threaded into the auxiliary main nozzle 7, which is one of the two weft insertion nozzles, by using compressed air ejected from the nozzle (threading nozzle 9) disposed behind the auxiliary main nozzle 7.

[0048] To be more specific, the threading nozzle 9 is provided as follows.

[0049] First, in the state in which the nozzle holder 12 is attached to the support bracket 11 d as described above, the nozzle holder 12 is provided so that the position of the holding portion 12b overlaps the position of the support bracket 11 d and so that the through-hole of the support bracket 11 d, to which the auxiliary main nozzle 7 is attached, is located in the range in which these positions overlap when viewed from the upstream side in the weft insertion direction. In the nozzle holder 12, a through-hole is formed so as to extend through the holding portion 12b in a direction parallel to the longitudinal direction of the support portion 12a. The center of the through-hole coincides with the center of the through-hole of the support bracket 11 d, to which the auxiliary main nozzle 7 is attached, when viewed from the upstream side. The through-hole of the nozzle holder 12 (holding portion 12b) serves as an attachment hole 12c for attaching the threading nozzle 9.

[0050] Moreover, the threading nozzle 9 is attached to the nozzle holder 12 in such a way that the ejection opening thereof is directed toward the support bracket (auxiliary main nozzle) and the outer peripheral surface thereof is fitted into the attachment hole 12c. Accordingly, the threading nozzle 9 is disposed at a position that is separated behind the auxiliary main nozzle 7 so that the axis of the threading nozzle 9 coincides with the axis of the auxiliary main nozzle 7.

[0051] In the present embodiment, as with the auxiliary main nozzle 7 (weft insertion nozzle) described above, the threading nozzle 9 includes a cylindrical nozzle body 9a as its main component and a thread guide 9b. The thread guide 9b is mounted in the nozzle body 9a in such a way that the thread guide 9b is inserted into an insertion hole formed in the nozzle body 9a. An air supply hole, for supplying compressed air into the insertion hole, is formed in the nozzle body 9a. As with the auxiliary main nozzle 7, compressed air is supplied from the air supply hole to an annular flow path around the thread guide 9b in the nozzle body 9a, passes through the annular flow path, and is ejected from an ejection opening at the front end of the threading nozzle 9. However, as illustrated in Fig. 3, in the present embodiment, the threading nozzle 9 does not include the pipe 17, which is included in the auxiliary main nozzle 7; and an airflow regulating member is not provided in the insertion hole of the nozzle body 9a. The air supply hole of the nozzle body 9a is formed so as to be connected to an air supply hole of the holding portion 12b, and the connector 13 is attached to the air supply hole of the holding portion 12b. Therefore, the threading nozzle 9 is connected to the air supply source through an air supply pipe connected by the connector

13.

[0052] In the threading nozzle 9 having such a structure, the weft yarn 2, which has been supplied from a weft supply package (not shown) and passed through a measuring-and-storing device (not shown), is threaded into a thread guide hole 9c formed in the thread guide 9b. The weft yarn 2 is inserted into the threading nozzle 9 (thread guide 9b) as described above, passes through the threading nozzle 9, passes through the inside of the yarn guide 8e of the weft braking device 8, is inserted into the thread guide 15 of the auxiliary main nozzle 7 (thread guide hole 18), passes through the auxiliary main nozzle 7, and is guided toward the main nozzle 5.

[0053] The air jet loom 1, which has the structure described above, performs one weft insertion by cooperation of the two weft insertion nozzles, which are the main nozzle 5 and the auxiliary main nozzle 7. Namely, as described above, the weft yarn 2, which has been guided toward the auxiliary main nozzle through the threading nozzle 9, is first inserted into the thread guide of the auxiliary main nozzle 7 and then inserted into the thread guide of the main nozzle 5. During weaving, as compressed air is started to be supplied from an air supply source to the main nozzle 5 at a predetermined weft insertion start timing, the compressed air is ejected from the main nozzle 5. Accordingly, the weft yarn 2 is ejected from the main nozzle 5 by using a jet of compressed air, and thereby weft insertion is performed. Moreover, at the same time as compressed air is supplied to the main nozzle 5, compressed air is supplied also to the auxiliary main nozzle 7. As the compressed air is ejected from the auxiliary main nozzle 7, the weft yarn 2 is pulled from the weft-supply side and is fed toward the main nozzle 5 by using a jet of compressed air, and thereby the auxiliary main nozzle 7 assists the main nozzle 5 in performing the weft insertion. Thus, the weft insertion device including the two weft insertion nozzles, which are the main nozzle 5 and the auxiliary main nozzle 7, performs weft insertion by cooperation of the two weft insertion nozzles.

[0054] In the weft braking device 8, when starting weft insertion, the push lever 8d is disposed at the stand-by position. At a predetermined timing in the final phase of the weft insertion, the actuator 8a swings the push lever 8d so that the push lever 8d becomes displaced from the stand-by position to the operation position. Thus, the weft yarn 2, which is being inserted, becomes bent by receiving a bending effect as described above, and thereby the weft yarn 2 is braked in the final phase of the weft insertion.

[0055] According to the present invention, the air jet loom 1 described above includes a threading device including a guide unit that has a through-hole and that is provided so that the center the through-hole coincides with the center of the thread guide hole of the thread guide of the weft insertion nozzle, and an air discharging unit in which an inner space portion that is continuous with the through-hole of the guide unit is formed so as to be connected to the outside. The threading device is disposed so as to be continuous with the back end of the thread guide of the weft insertion nozzle. In the present embodiment, the threading device is provided for the auxiliary main nozzle 7, which is one of the two weft insertion nozzles; and the guide unit and the air discharging unit are formed as an integrated member that is continuous in the axial direction. Namely, in a member having a through-hole, a vent hole that connects the through-hole to the outside is formed; a part of the member having the vent hole functions as the air discharging unit; and a part of the member that is farther from the thread guide than the air discharging unit functions as a guide unit. Hereinafter, the threading device according to the present embodiment will be described in detail with reference to the drawings.

[0056] As illustrated in Fig. 4, a threading device 20 according to the present embodiment includes a body member 21, which includes a cylindrical portion 23 having a cylindrical shape, and a guide member 22, which is attached to the cylindrical portion 23 of the body member 21.

[0057] The body member 21 includes the cylindrical portion 23, which has a cylindrical shape having substantially the same diameter as the back end portion 15e of the auxiliary main nozzle 7, as its main component. A fitting insertion hole 25, which extends through the body member 21 in the axial direction, is formed in the body member 21. The fitting insertion hole 25 is formed so that the center thereof coincides with the axis of the cylindrical portion 23 and has a diameter that is slightly larger than the diameter of the back end portion of the thread guide hole 18 of the thread guide 15 of the auxiliary main nozzle 7.

[0058] The body member 21 includes an annular flange portion 24 that is formed at one end of the cylindrical portion 23 in the axial direction in such a way that a part of the flange portion 24 overlaps the cylindrical portion 23 in the axial direction. The flange portion 24 is integrally formed with the cylindrical portion 23 so as to expand radially from an outer peripheral edge of the cylindrical portion 23 when viewed in the axial direction.

[0059] The flange portion 24 is used to attach the threading device 20 (body member 21) to the auxiliary main nozzle 7. In the present embodiment, the body member 21 is attached to the auxiliary main nozzle 7 by bringing an end surface of the flange portion 24 on the opposite side to the cylindrical portion side into contact with the back end surface of the nozzle body 14 of the auxiliary main nozzle 7 and by screwing screw members 28, such as bolts or the like inserted into the flange portion 24, into the nozzle body 14 of the auxiliary main nozzle 7.

[0060] Therefore, in the present embodiment, the flange portion 24 has such an outside diameter that holes (attachment holes), into which the screw members 28 are inserted, can be formed in the flange portion 24. To be specific, the outside diameter of the flange portion 24 is substantially the same as the outside diameter of the nozzle body 14 of the auxiliary main nozzle 7. In the flange

portion 24, a plurality of (for example, two) attachment holes, into which the screw members 28 are inserted, are formed in such a way that the centers thereof are located on a circle centered at the center of the flange portion 24 (the axis of the cylindrical portion 23) so as to be arranged in the circumferential direction at an equal distance. In the nozzle body 14, female screw-threaded holes corresponding to the attachment holes are formed on a circle that is centered at the axis of the nozzle body 14. This circle has the same diameter as the circle on which the centers of the attachment holes are located. The centers of the female screw-threaded holes coincide with the centers of corresponding attachment holes. Accordingly, in the state in which the body member 21 (threading device 20) is attached to the nozzle body 14 as described above, the position of the axis of the cylindrical portion 23 of the body member 21 coincides with the axis of the nozzle body 14 of the auxiliary main nozzle 7 when viewed in the axial direction. As a result, the position of the axis of the cylindrical portion 23 coincides with the position of the axis of the thread guide 15 when viewed in the axial direction.

[0061] As described above, the flange portion 24 has an annular shape and has a hole extending therethrough in the thickness direction at the center thereof. The flange portion 24 and the cylindrical portion 23 partially overlap in the axial direction as described above in such a way that a part of the cylindrical portion 23 at one end in the axial direction is located in the hole. Accordingly, the inside diameter of the hole in the flange portion 24 is substantially the same as the outside diameter of the cylindrical portion 23. As described above, the cylindrical portion 23 has substantially the same outside diameter as the back end portion of the auxiliary main nozzle 7. Accordingly, the inside diameter of the hole in the flange portion 24 is substantially the same as the outside diameter of the back end portion of the auxiliary main nozzle 7.

[0062] In the case where the threading device 20 (body member 21) is attached to the body portion of the auxiliary main nozzle 7 by attaching the flange portion 24 to the body portion as described above, the back end portion 15e of the thread guide 15 of the auxiliary main nozzle 7 is located in the body member. In the present embodiment, in the state in which the threading device 20 is attached to the auxiliary main nozzle 7 in this way, the back end portion 15e of the thread guide 15 is disposed in the body member in such a way that the back end portion 15e is accommodated in the hole of the flange portion 24 within the range of the flange portion 24 in the axial direction. Therefore, the dimension (thickness) of the flange portion 24 in the axial direction is larger than the length of the back end portion 15e of the thread guide 15 in the axial direction.

[0063] In the present embodiment, in the state in which the threading device 20 is attached to the auxiliary main nozzle 7 as described above, that is, in the state in which the back end portion 15e of the thread guide 15 is accommodated in the hole in the flange portion 24 (hereinafter, referred to as the "accommodation hole"), the back end surface of the thread guide 15 is in contact with the end surface of the cylindrical portion 23 on the flange portion side in the axial direction. Accordingly, the thickness of a part of the flange portion 24, excluding the range in which the flange portion 24 overlaps the cylindrical portion 23 in the axial direction, is the same as the length of the back end portion 15e of the thread guide 15 in the axial direction.

[0064] The cylindrical portion 23 has through-holes 26 near a part thereof that overlaps the flange portion 24 in the axial direction as described above. The through-holes 26 extend from the outer peripheral surface of the cylindrical portion 23 toward the fitting insertion hole 25. In the present embodiment, the number of the through-holes 26 is plural (in the example shown in the figures, four), and the through-holes 26 are arranged in the circumferential direction of the cylindrical portion 23 at an equal distance.

[0065] The guide member 22 is a cylindrical member having a through-hole 27. The guide member 22 includes a part (a small-diameter portion 22a) whose outside diameter is substantially the same as the inside diameter of the fitting insertion hole 25 formed in the cylindrical portion 23 of the body member 21, and a part (a large-diameter portion 22b) whose outside diameter is substantially the same as the outside diameter of the cylindrical portion 23 of the body member 21. The guide member 22 is attached to the body member 21 in such a way that the small-diameter portion 22a is fitted into the fitting insertion hole 25 of the body member 21 and the end surface of the large-diameter portion 22b on the small diameter portion side is in contact with the end surface of the cylindrical portion 23 on the opposite side to the flange portion side.

[0066] In the guide member 22, the length of the small-diameter portion 22a in the axial direction is smaller than the length of the cylindrical portion 23 from the end surface on the opposite side to the flange portion side to the through-holes 26 of the cylindrical portion 23. Accordingly, in the state in which the guide member 22 is attached to the body member 21 as described above, that is, in the state in which the small-diameter portion 22a of the guide member 22 is fitted into the fitting insertion hole 25 of the body member 21, an end edge of the small-diameter portion 22a of the guide member 22 on the opposite side to the large diameter portion side is located farther from the flange portion than the through-holes 26 of the cylindrical portion 23. Therefore, the through-holes 26 of the cylindrical portion 23 are not closed by the small-diameter portion 22a of the guide member 22, and the inner space portion in the cylindrical portion 23 is connected to the outside of the cylindrical portion 23 through the through-holes 26.

[0067] In the threading device 20 having such a structure, as described above, the body member 21 is attached to the auxiliary main nozzle 7 by using the screw members 28 in such a way that the end surface of the

flange portion 24 on the opposite side to the cylindrical portion side is in contact with the nozzle body 14 of the auxiliary main nozzle 7 and the back end portion 15e of the thread guide 15 is accommodated in the accommodation hole. Moreover, in the threading device 20, as described above, the guide member 22 is attached to the body member 21 in such a way that the small-diameter portion 22a of the guide member 22 is inserted into the fitting insertion hole 25 of the cylindrical portion 23 of the body member 21 from an opposite side to the flange portion side and the end surface of the large-diameter portion 22b on the small diameter portion side is in contact with the end surface of the cylindrical portion 23 on the opposite side to the flange portion side. The body member 21, which is attached to the auxiliary main nozzle 7 in this way, and the guide member 22, which is attached to the body member 21, constitute the threading device 20.

[0068] In the state in which the threading device 20 is attached to the auxiliary main nozzle 7 as described above, the end surface of the cylindrical portion 23 of the body member 21 of the threading device 20 on the flange portion side is in contact with the back end surface of the thread guide 15. Namely, in the threading device 20 according to the present embodiment, the cylindrical portion 23 is disposed so as to be continuous with the back end of the thread guide 15 with respect to the axial direction.

[0069] Moreover, as described above, the through-holes 26, which connect the inner space (fitting insertion hole 25) in the cylindrical portion 23 to the outside, are formed in a part of the cylindrical portion 23 near a part of the cylindrical portion 23 that overlaps the flange portion 24. Accordingly, this part of the cylindrical portion 23 in which the through-holes 26 are formed corresponds to the air discharging unit in the present embodiment and the through-holes 26 correspond to the vent hole formed in the air discharging unit. In the present embodiment, the air discharging unit is in the range from the end surface of the cylindrical portion 23 that is in contact with the back end surface of the thread guide 15 as described above to the end edge of the guide member 22 in the axial direction.

[0070] In the present invention, as described above, the threading device 20 includes the guide unit and the air discharging unit, and the guide unit is located in at least the end portion of the threading device 20 on the opposite side to the thread guide side in the axial direction. Accordingly, because the air discharging unit is defined as described above, in the threading device 20 according to the present embodiment, a part of the cylindrical portion 23 farther from the thread guide than the air discharging unit corresponds to the guide unit. However, in the present embodiment, the guide member 22 is attached to the part of the cylindrical portion 23 corresponding to the guide unit, and the guide member 22 is also a part of the guide unit. In other words, in the threading device 20 according to the present embodiment, a part of the cylindrical portion 23 excluding the air discharging unit and the guide member 22 constitute the guide unit.

[0071] As described above, the fitting insertion hole 25, which extends in the axial direction, is formed in the cylindrical portion 23 of the body member 21 of the threading device 20. A part of the fitting insertion hole 25 in the range of the air discharging unit in the axial direction corresponds to a through-hole formed in the air discharging unit, and the space in the through-hole corresponds to a space portion in an air discharging unit according to the present invention. As described above, because the small-diameter portion 22a of the guide member 22 is fitted into the part of the cylindrical portion 23 excluding the air discharging unit, the through-hole 27 of the guide member 22 corresponds to a through-hole in a guide unit according to the present invention. Needless to say, the through-hole (space portion) of the air discharging unit and the through-hole of the guide unit (the through-hole 27 of the guide member 22) are continuous in the axial direction.

[0072] In the present embodiment, the end surface of the large-diameter portion 22b of the guide member 22 on the opposite side to the small diameter portion side, that is, the end surface of the peripheral wall of an end portion the guide unit on a side from which the weft yarn 2 is introduced, the peripheral wall surrounding the through-hole 27, is arc-shaped.

[0073] To be more specific, in the present embodiment, the guide member 22 is attached to the cylindrical portion 23 (body member 21) in such a way that the small-diameter portion 22a is fitted into the fitting insertion hole 25 of the cylindrical portion 23 (body member 21) and the end surface of the large-diameter portion 22b on the small diameter portion side is in contact with the cylindrical portion 23. Accordingly, the large-diameter portion 22b of the guide member 22 is located farther from the thread guide than the cylindrical portion 23 of the body member 21 in the axial direction, that is, closer to the side from which the weft yarn 2 is introduced; and the end surface of the large-diameter portion 22b on the opposite side to the small diameter portion side is the end surface of the guide unit on the side from which the weft yarn 2 is introduced. The guide member 22 is a member having the through-hole 27 as described above, and, in a sectional view taken in a direction perpendicular to the axial direction, the guide member 22 surrounds the through-hole 27 with the wall (peripheral wall) thereof around the through-hole 27. In other words, the guide member 22 includes the peripheral wall around the through-hole, which is continuous in the axial direction.

[0074] Moreover, as shown in the figures, in the guide member 22 according to the present embodiment, in any sectional surface extending in the axial direction, the shape of the peripheral wall of the large-diameter portion 22b around the through-hole is such that the end edge on the opposite side to the small diameter portion side is arc-shaped. Namely, the end surface of the guide member 22 on the opposite side to the small diameter portion side is arc-shaped.

[0075] To be specific, in the present embodiment, this arc shape is substantially semicircular arc shape in the sectional view, and the vertex of the arc shape is located at substantially the center of the aforementioned peripheral wall of the large-diameter portion 22b in the thickness direction. Thus, in the present embodiment, the end surface of the guide member 22 on the opposite side to the small diameter portion side, that is, the end surface of the peripheral wall of the guide unit around the through-hole on the side from which the weft yarn 2 is introduced has an arc shape including a part that is formed so as to gradually expand outward in the thickness direction toward an opposite side to the thread guide side (from which the weft yarn 2 is introduced) in the axial direction in the sectional view and that is a part of the inner peripheral surface of the through-hole. In other words, this is a structure such that the through-hole of the guide unit includes, at the end portion in the axial direction on the side from which the weft yarn 2 is introduced, a part that is formed so that the inside diameter thereof gradually increases toward the opposite side to the thread guide side.

[0076] In the air jet loom 1 including the threading device 20 according to the present embodiment, for example, if yarn breakage of the weft yarn 2 occurs at a position on the upstream side of the auxiliary main nozzle 7 (threading nozzle 9) during weaving, the loom is stopped. While the loom is being stopped, the weft yarn 2, which has been inserted into the main nozzle 5, the auxiliary main nozzle 7, and the threading nozzle 9, is removed. Then, a threading operation of rethreading the weft yarn 2 into these nozzles is performed. When performing the threading operation, first, the weft yarn is threaded into the auxiliary main nozzle 7 by using the threading nozzle 9 as described above; and after this has been finished, the weft yarn is threaded into the main nozzle 5.

[0077] When threading the weft yarn into the auxiliary main nozzle 7, first, compressed air is supplied from the air supply source to the auxiliary main nozzle 7, so that a suction effect is generated in a weft inlet of the thread guide hole 18 of the thread guide 15. At the same time, compressed air is supplied also to the threading nozzle 9 from the air supply source. Thus, in the threading nozzle 9, compressed air passes through the annular flow path around the thread guide and is ejected from the ejection hole. Due to ejection of the compressed air, the pressure of the inside of the thread guide hole of the thread guide 9b becomes a negative pressure, and a suction effect is generated in the weft inlet of the thread guide hole 9c.

[0078] When an operator moves an end portion of the weft yarn 2 to be threaded to a position near the back end portion of the threading nozzle 9 (the weft inlet of the thread guide hole), the end portion of the weft yarn 2 is introduced into the thread guide hole of the thread guide 9b of the threading nozzle 9 due to the aforementioned suction effect. Moreover, the end portion of the weft yarn 2 is transported toward the auxiliary main nozzle by using compressed air ejected from the threading nozzle 9. The end portion of the weft yarn 2, which is transported by using compressed air ejected from the threading nozzle 9 toward the thread guide hole 18 of the thread guide 15 of the auxiliary main nozzle 7, receives the suction effect in the auxiliary main nozzle 7 and is introduced into the thread guide hole of the thread guide 15 of the auxiliary main nozzle 7. During this process, the end portion of the weft yarn 2 passes through the inside of the yarn guide of the weft braking device 8. Thus, threading of the weft yarn into the auxiliary main nozzle 7 and the yarn guide 8e of the weft braking device 8, which is provided between the auxiliary main nozzle 7 and the threading nozzle 9, is performed by using compressed air ejected from the threading nozzle 9.

[0079] In the air jet loom 1 according to the present embodiment, as described above, the threading device 20 is provided in such a way that the cylindrical portion 23 thereof is continuous with the back end portion 15e of the thread guide 15 of the auxiliary main nozzle 7. Therefore, compressed air ejected from the threading nozzle 9 is first introduced into the through-hole of the threading device 20, passes through the through-hole, and is introduced into the thread guide hole of the thread guide 15 of the auxiliary main nozzle 7. Because the threading device 20 (cylindrical portion 23) includes the air discharging unit (vent hole) as described above, even if it becomes difficult to introduce air into the thread guide hole of the thread guide 15 of the auxiliary main nozzle 7, compressed air ejected from the threading nozzle 9 is not bounced back toward the threading nozzle, and the compressed air is discharged from the vent hole of the air discharging unit in the radial direction of the cylindrical portion 23 toward the outside.

[0080] As compressed air is started to be ejected from the threading nozzle 9 and the compressed air is introduced into the thread guide hole of the thread guide 15 of the auxiliary main nozzle 7 as described above, the inside of the thread guide hole becomes saturated with air and it becomes difficult for the compressed air to be introduced into the thread guide hole. However, with the structure described above, compressed air ejected from the threading nozzle 9 can be prevented from bounced back toward the threading nozzle and the airflow can be prevented from becoming turbulent. Therefore, when threading is subsequently performed as described above, the position of the end portion of the weft yarn 2 transported by using compressed air ejected from the threading nozzle 9 does not become unstable due to turbulence in airflow. Accordingly, the end portion is stably introduced into the through-hole of the threading device 20 (the thread guide hole 18 of the thread guide 15 of the auxiliary main nozzle 7).

[0081] In the present embodiment, the end surface of the guide member 22 on the opposite side to the small diameter portion side, that is, the end surface of the peripheral wall around the through-hole of the guide unit is arc-shaped. Moreover, the through-hole of the guide unit includes a part whose inside diameter gradually increas-

es toward the end portion on the side from which the weft yarn 2 is introduced. Therefore, compressed air ejected from the threading nozzle 9 can easily flow along the aforementioned part into the through-hole due to the Coanda effect, and the end portion of the weft yarn 2 transported by using compressed air can be more easily introduced into the through-hole of the threading device 20 and the thread guide hole 18 of the thread guide 15 of the auxiliary main nozzle 7.

[0082] Moreover, in the present embodiment, as described above, a part of the cylindrical portion 23 functions as the air discharging unit, that is, the guide unit and the air discharging unit are included in the body member 21, which is a single (integrated) member, and the threading device 20 is directly attached to the auxiliary main nozzle 7 by attaching the flange portion 24 of the body member 21, which is the main component of the threading device 20, to the auxiliary main nozzle 7. Therefore, by using a simple structure, it is possible to dispose the threading device 20 behind the thread guide 15 in a state in which the position of the center of the through-hole of the guide unit (cylindrical portion 23) coincides with the position of the center of the thread guide hole 18 of the thread guide 15 of the auxiliary main nozzle 7 when viewed in the axial direction.

[0083] Heretofore, a threading device according to an embodiment of the present invention has been described. However, a threading device according to the present invention is not limited to the embodiment described above, and can be modified in various ways within the technical scope of the present invention. Hereinafter, other embodiments will be described.

[0084] (1) In the embodiment described above, the threading device includes the body member and the guide member attached to the body member. However, in the structure of the embodiment, the guide member is not particularly necessary and may be omitted. In this case, an end surface of a peripheral wall of an end portion of the body member on the side from which a weft yarn is introduced, the end portion corresponding to the guide unit and the peripheral wall surrounding the through-hole, that is, an end surface of the body member on the opposite side to the thread guide side (on the opposite side to the air discharging unit side) may be arc-shaped.

[0085] A threading device according to the present invention is not limited to such a device in which the end surface of the peripheral wall of the through-hole of the guide unit on the side from which a weft yarn is introduced is arc-shaped. Alternatively, the end surface (end surface of the guide member or the cylindrical portion on the opposite side to the thread guide side) may have a shape other than an arc shape (for example, a planar shape).

[0086] (2) In the embodiment described above, a part of the cylindrical portion of the body member functions as a guide unit according to the present invention, and the outer shape of the guide unit is circular when viewed in the axial direction. However, regarding the guide unit, it is only necessary that the guide unit have a through-hole that extends therethrough in the axial direction and into which a weft yarn is introduced. Therefore, the outer shape of the guide unit is not limited to a circular shape as in the embodiment, and may be a polygonal shape. In the embodiment described above, the body member, which is the main component of the threading device, is attached to the nozzle body of the weft insertion nozzle (auxiliary main nozzle) and is supported by the nozzle body (weft insertion nozzle). Instead, the body member may be supported, via a support member such as a bracket or the like, by a member other than the weft insertion nozzle (nozzle body) (such as a support bracket for supporting the threading device and the like, or a support column or the like for supporting the auxiliary main nozzle).

[0087] (3) In the embodiment described above, a part of the cylindrical portion of the body member farther from the thread guide than the middle part of the cylindrical portion in the axial direction functions as the air discharging unit, a part of the cylindrical portion farther from the thread guide than the air discharging unit functions as the guide unit, the air discharging unit is continuous with the back end of the thread guide in the axial direction, and the guide unit is located only at a position farther from the thread guide than the air discharging unit. However, in a threading device according to the present invention, it is only necessary that, in a state in which the threading device is disposed so as to be continuous with the back end of the thread guide with respect to the axial direction, the guide unit be located in at least an end portion of the threading device on the opposite side to the thread guide side in the axial direction. The position of the air discharging unit in the axial direction is not limited to such a position that the air discharging unit is continuous with the back end of the thread guide as in the embodiment described above. Accordingly, in the threading device according to the present invention, which includes the guide unit and the air discharging unit, a guide unit may be disposed also at a position closer to the thread guide than the air discharging unit.

[0088] To be specific, for example, the embodiment described above has a structure in which, the air discharging unit is integrally formed with a part that functions as the guide unit in the cylindrical portion of the body member, and a part in which the vent hole is formed functions as the air discharging unit. In this structure, the position of the vent hole in the axial direction may be farther from the thread guide than that in the embodiment, and a part closer to the thread guide than the part in which the vent hole is formed in the axial direction may be larger than that in the embodiment. In this case, the part closer to the thread guide than the part in which the vent hole is formed also functions as the guide unit. Accordingly, in the state in which the threading device is disposed so as to be continuous with the back end of the thread guide, the threading device is provided with a guide unit at a position continuous with the back end portion of the thread guide in addition to the guide unit located in the

end portion on the opposite side to the thread guide side, and the air discharging unit is disposed between the two guide units.

[0089] In the embodiment described above, the threading device includes the guide member, and the guide member functions only as a part of the guide unit. For this reason, in the state in which the guide member is attached to the body member, the end edge of the guide member on the thread guide side is located farther from the thread guide than the vent hole so that the guide member would not close the vent hole. However, in the present invention, in the case where the threading device includes the guide member, it is not necessary that the entirety of the guide member functions as a part of the guide unit. A part of the guide member may have a structure similar to that of the air discharging unit of the body member (cylindrical portion) and may function as the air discharging unit. To be specific, in the structure according to the embodiment, the end edge may be located closer to the thread guide than the vent hole formed in the cylindrical portion and the vent hole may be formed so as to extend also through the guide member.

[0090] (4) In the embodiment described above, the vent hole is formed in the cylindrical portion of the body member, and a part of the cylindrical portion in which the vent hole is formed functions as the air discharging unit, and therefore the guide unit and the air discharging unit are included in the single body member, that is, the guide unit and the air discharging unit are formed as an integrated member. However, it is not necessary that a threading device according to the present invention has such a structure in which the guide unit and the air discharging unit are included in a single member. Alternatively, the guide unit the air discharging unit may be formed as different members and these members may be integrated with each other.

[0091] In this case, the air discharging unit may have a shape different from that of the guide unit. For example, the air discharging unit may be a mesh (porous) member having a cylindrical shape; and the air discharging unit, which is the cylindrical mesh member, may be attached to a guide unit, which is made from a cylindrical member, in such a way that the air discharging unit is continuous with the guide unit in the axial direction. In this case, each mesh of the mesh member of the air discharging unit serves as a vent hole that connects an inner space portion of the air discharging unit to the outside.

[0092] It is not necessary that the air discharging unit be a cylindrical member in which a through-hole is formed so as to connect an inner space portion of the cylindrical member (space portion that is continuous with a space in the through-hole of the guide unit) to the outside. Alternatively, a space portion that is continuous with the space in the through-hole of the guide unit with respect to the axial direction may be formed so as to be open to the outside, and thereby the space portion may connect the space in the through-hole to the outside and function as the air discharging unit. Namely, a space may be formed between the guide unit and the thread guide in the axial direction, and the space may function as the air discharging unit.

[0093] To be specific, a guide unit on the side from which a weft yarn is introduced (inlet-end-side guide unit) is formed as a member including a cylindrical portion and an annular flange portion that is integrally formed at one end of the cylindrical portion. The inlet-end-side guide unit is attached to the nozzle body or a cylindrical member (thread-guide-side guide unit) attached to the nozzle body, which functions as a guide unit, by using a screw member inserted into flange portion. The inlet-end-side guide unit is disposed so as to be separated from the nozzle body (thread guide) or the thread-guide-side guide unit. The inlet-end-side guide unit may be provided so as to be separated as described above by using, for example, the following structure: a cylindrical bush having a length corresponding to the distance between the inlet-end-side guide unit and the thread guide or the thread-guide-side guide unit is used; the cylindrical bush is fitted onto the screw member and the screw member, which has such a length that the screw member protrudes from the cylindrical bush; and the inlet-end-side guide unit is attached by screwing a part of the screw member protruding from the cylindrical bush into the nozzle body or the thread-guide-side guide unit.

[0094] With this structure, a space is formed between the inlet-end-side guide unit and the thread guide or the thread-guide-side guide unit in the axial direction. In this structure, a part of the space that is located in the range of the through-hole of the inlet-end-side guide unit when viewed in the axial direction serves as a space portion continuous with the through-hole of the guide unit, and the space portion is open to a surrounding space, that is, connected to the outside. Accordingly, the space between the inlet-end-side guide unit and the thread guide or the thread-guide-side guide unit functions as the air discharging unit.

[0095] In the example described above, the inlet-end-side guide unit is provided so as to be separated from the nozzle body (thread guide) or the thread-guide-side guide unit, that is, a space is formed between the guide unit and the thread guide or the thread-guide-side guide unit in the axial direction; the inlet-end-side guide unit is attached to the nozzle body or the thread-guide-side guide unit by using a screw member; and the cylindrical bush fitted onto the screw member is used. Instead, the inlet-end-side guide unit may be supported by a part other than the nozzle body via a support member (bracket) or the like so as to be disposed at a position separated from the nozzle body (thread guide) or the thread-guide-side guide unit.

[0096] (5) In the embodiment described above, it is assumed that the air jet loom includes only one auxiliary main nozzle that performs one weft insertion in cooperation with the main nozzle, that is, the air jet loom includes two weft insertion nozzles that perform one weft insertion in cooperation. It is also assumed that the threading de-

vice according to the present invention is applied to a weft insertion nozzle (auxiliary main nozzle) that is at the most upstream position. However, an air jet loom to which the present invention is applied may include three weft insertion nozzles (that is, one main nozzle and two auxiliary main nozzles). In this case, the threading device according to the present invention may be applied to a weft insertion nozzle different from the auxiliary main nozzle disposed at the most upstream position as in the embodiment described above. The details are as follows.

[0097] Some air jet looms including the two auxiliary main nozzles as described above may further include a second auxiliary main nozzle in addition to the auxiliary main nozzle (first auxiliary main nozzle) in the embodiment described above. The second auxiliary main nozzle is supported on the weft-supply-side loom frame as with the first auxiliary main nozzle at a position between the main nozzle and the first auxiliary main nozzle and is disposed so that the axis thereof coincides with the axis of the first auxiliary main nozzle when viewed in the axial direction of the first auxiliary main nozzle. Some of such air jet looms perform threading of a weft yarn into the second auxiliary main nozzle (introduction of the weft yarn into the thread guide hole of the thread guide) by using compressed air ejected from the first auxiliary main nozzle. Namely, threading of a weft yarn into the second auxiliary main nozzle is performed by using compressed air ejected from the first auxiliary main nozzle, which is a nozzle disposed behind the second auxiliary main nozzle and which ejects compressed air when threading a weft yarn into the second auxiliary main nozzle. In such an air jet loom, a threading device according to the present invention may be applied to the second auxiliary main nozzle, into which a weft yarn is threaded as described above.

[0098] Some air jet looms including the two auxiliary main nozzles (first and second auxiliary main nozzles) have the following structure, which is different from the aforementioned structure in which the two auxiliary main nozzles are disposed on the loom frame. Namely, the first auxiliary main nozzle is disposed on the loom frame as in the embodiment described above, and the second auxiliary main nozzle is disposed on the reed holder as with the main nozzle. In this case, the second auxiliary main nozzle is disposed behind the main nozzle so that the axis thereof coincides with the axis of the main nozzle when viewed in the axial direction of the main nozzle. In some of such air jet looms, as disclosed in Japanese Unexamined Patent Application Publication No. 01-085348, threading of a weft yarn into the main nozzle is performed by using compressed air ejected from the second auxiliary main nozzle, which is a nozzle that is disposed behind the main nozzle and that ejects compressed air when threading the weft yarn into the main nozzle. In such an air jet loom, a threading device according to the present invention may be applied to the main nozzle, into which a weft yarn in inserted as described above.

[0099] Thus, in the present invention, a nozzle that is disposed behind the weft insertion nozzle into which a weft yarn is to be threaded and that ejects compressed air when threading the weft yarn into the weft insertion nozzle is not limited to a dedicated threading nozzle as in the embodiment described above, and may be an auxiliary main nozzle that is disposed behind the weft insertion nozzle into which the weft yarn is to be threaded.

[0100] (6) In the embodiment described above, the weft braking device and the threading nozzle, which are provided behind the auxiliary main nozzle disposed at the most upstream position, is supported via the nozzle holder by the support shaft (support bracket) for supporting the auxiliary main nozzle. However, in the case where the weft braking device and the threading nozzle are disposed behind the auxiliary main nozzle at the most upstream position, a structure for supporting the weft braking device and the threading nozzle is not limited to that of the embodiment. Alternatively, the weft braking device and the threading nozzle may be supported by a support mechanism that is independent from the support shaft or the like for supporting the auxiliary main nozzle. It is not necessary that the weft braking device and the threading nozzle be supported by the same bracket or the like, and each of these may be supported independently.

[0101] In the embodiment described above, a structure in which a threading device according to the present invention is applied to an air jet loom including a single-color weft insertion device including only one main nozzle is described as an example. However, an air jet loom to which the present invention is applied is not limited to such an air jet loom including a single-color weft insertion device, and may be an air jet loom including a multiple-color weft insertion device including a plurality of main nozzles. A threading device according to the present invention can be used to thread a weft yarn into a weft insertion nozzle of such a multiple-color weft insertion device.

[0102] The present invention is not limited to any of the embodiments described above and can be appropriately modified within the spirit and scope of the present invention.

Claims

1. A threading device (20) for an air jet loom (1) including a plurality of weft insertion nozzles (5, 7) each including a nozzle body (14) in which an insertion hole (14a) is formed and a thread guide (15) that is disposed in the insertion hole (14a) of the nozzle body (14) and in which a thread guide hole (18) extending therethrough in an axial direction is formed, each weft insertion nozzle (5, 7) performing weft insertion of a weft yarn (2), which is inserted into the thread guide hole (18) of the thread guide (15), by using a jet of compressed air that is formed when the compressed air is supplied to the insertion hole

(14a) and ejected from an ejection hole at an end of the weft insertion nozzle (5, 7) through a space around the thread guide (15) in the insertion hole (14a), the air jet loom (1) performing one weft insertion by cooperation of the plurality of weft insertion nozzles (5, 7), wherein, for at least one of the plurality of weft insertion nozzles (5, 7), the weft yarn (2) is threaded into the thread guide hole (18) by using compressed air ejected toward the thread guide hole (18) of the thread guide (15) from a nozzle (9) disposed behind the at least one of the weft insertion nozzles (5, 7),
the threading device (20) comprising:

a guide unit that has a through-hole (27) and that is provided so that a center of the through-hole (27) coincides with a center of the thread guide hole (18) when viewed in the axial direction of the thread guide (15) into which the weft yarn (2) is threaded by using the compressed air; and
an air discharging unit that is provided so as to be continuous with the guide unit with respect to the axial direction and in which an inner space portion that is continuous with a space in the through-hole (27) of the guide unit is formed so as to be connected to the outside,
wherein the threading device (20) is disposed so as to be continuous with a back end of the thread guide (15) with respect to the axial direction, and
wherein the threading device (20) includes the guide unit in at least an end portion thereof on an opposite side to the thread guide side in the axial direction.

2. The threading device (20) for the air jet loom (1) according to Claim 1,
wherein the guide unit and the air discharging unit are formed as an integrated member that is continuous in the axial direction, and
wherein the air discharging unit has a through-hole and a vent hole (26), the through-hole being formed so as to be continuous with the through-hole (27) of the guide unit in the axial direction and having an inner space that serves as the space portion, the vent hole (26) being connected to the space portion and to the outside.

3. The threading device (20) for the air jet loom (1) according to Claim 1 or 2,
wherein an end surface of a peripheral wall of the guide unit on a side in the axial direction from which the weft yarn (2) is introduced, the peripheral wall surrounding the through-hole (27), is arc-shaped.

FIG. 1

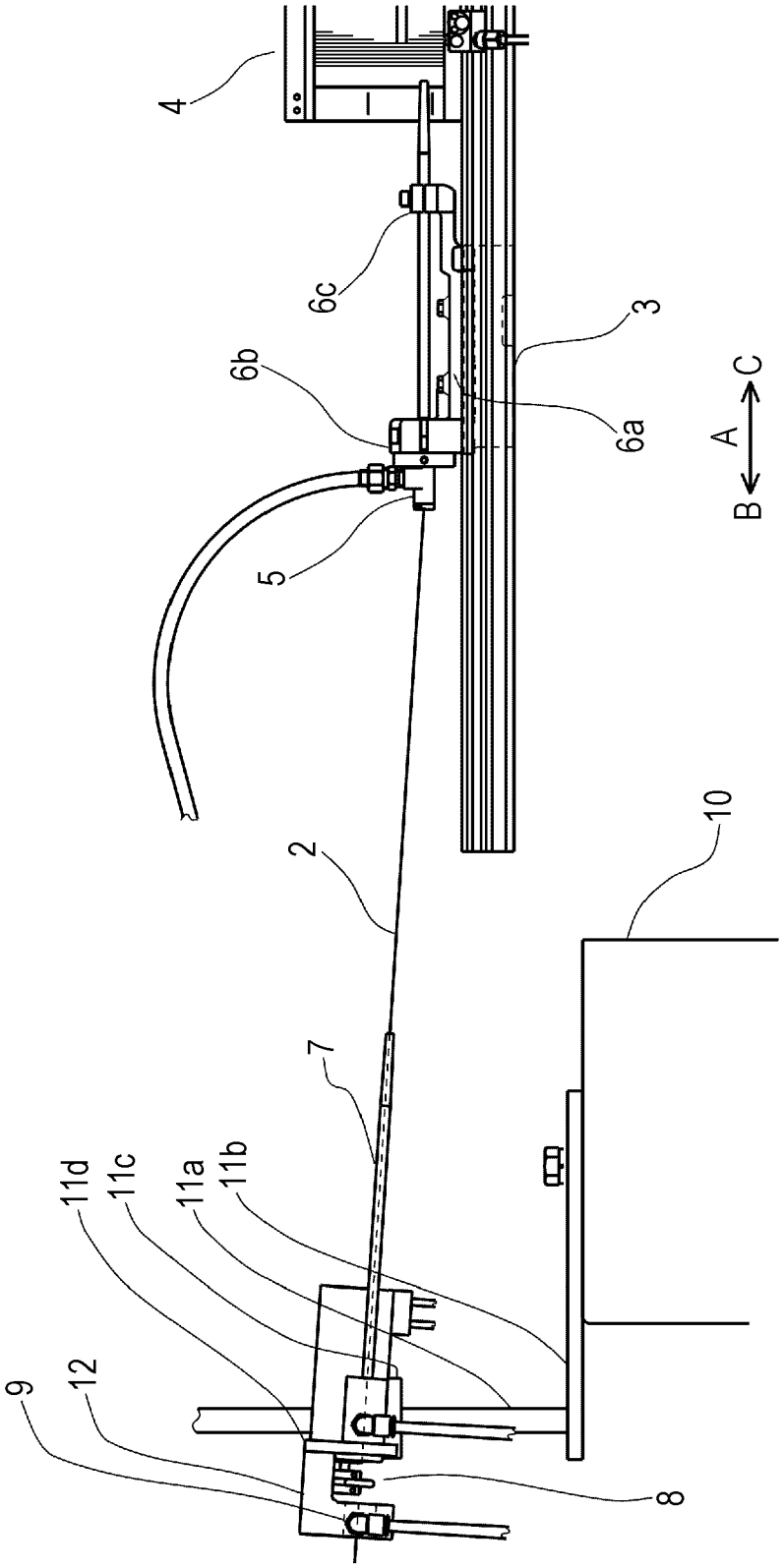


FIG. 2

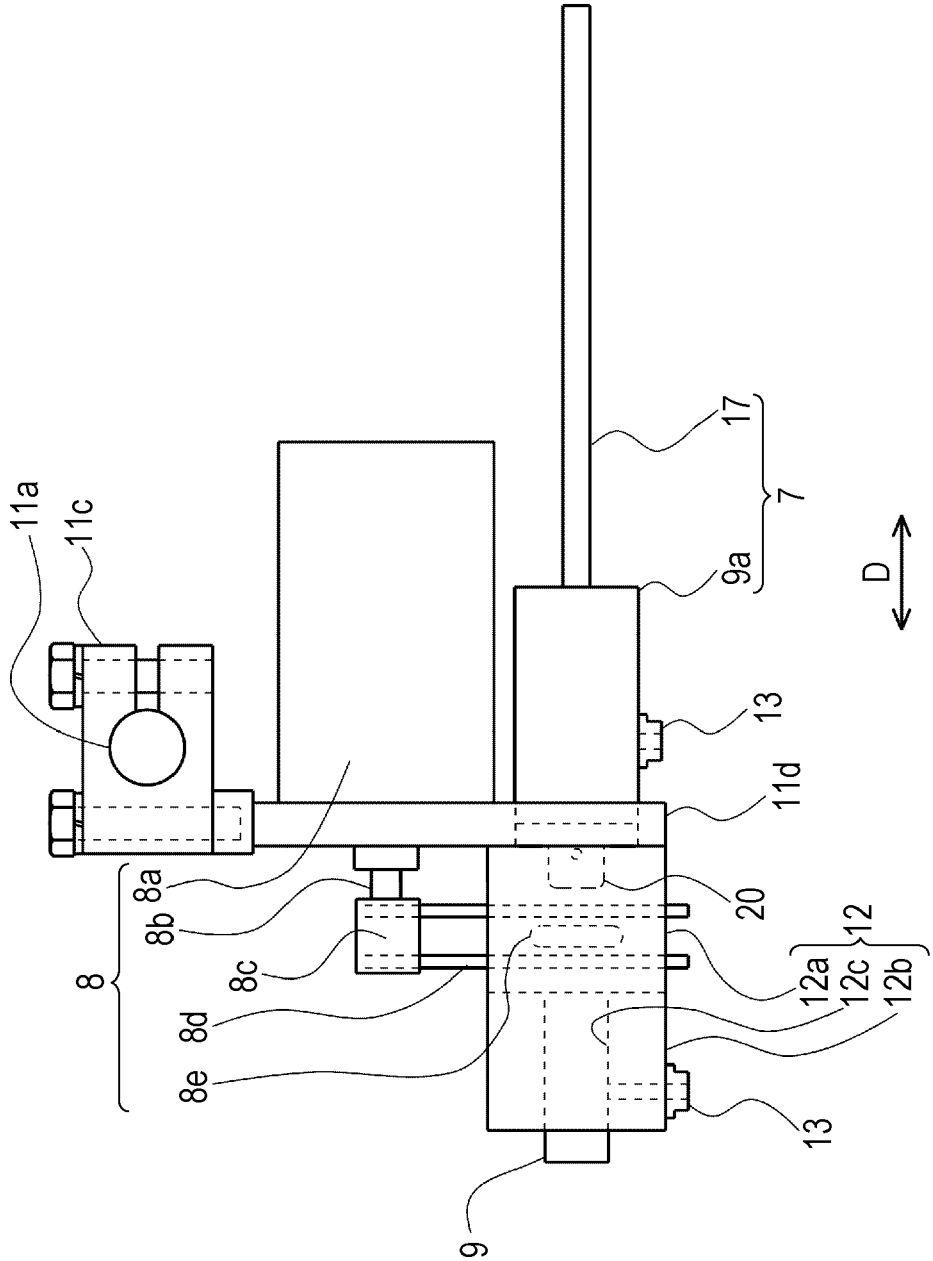


FIG. 3

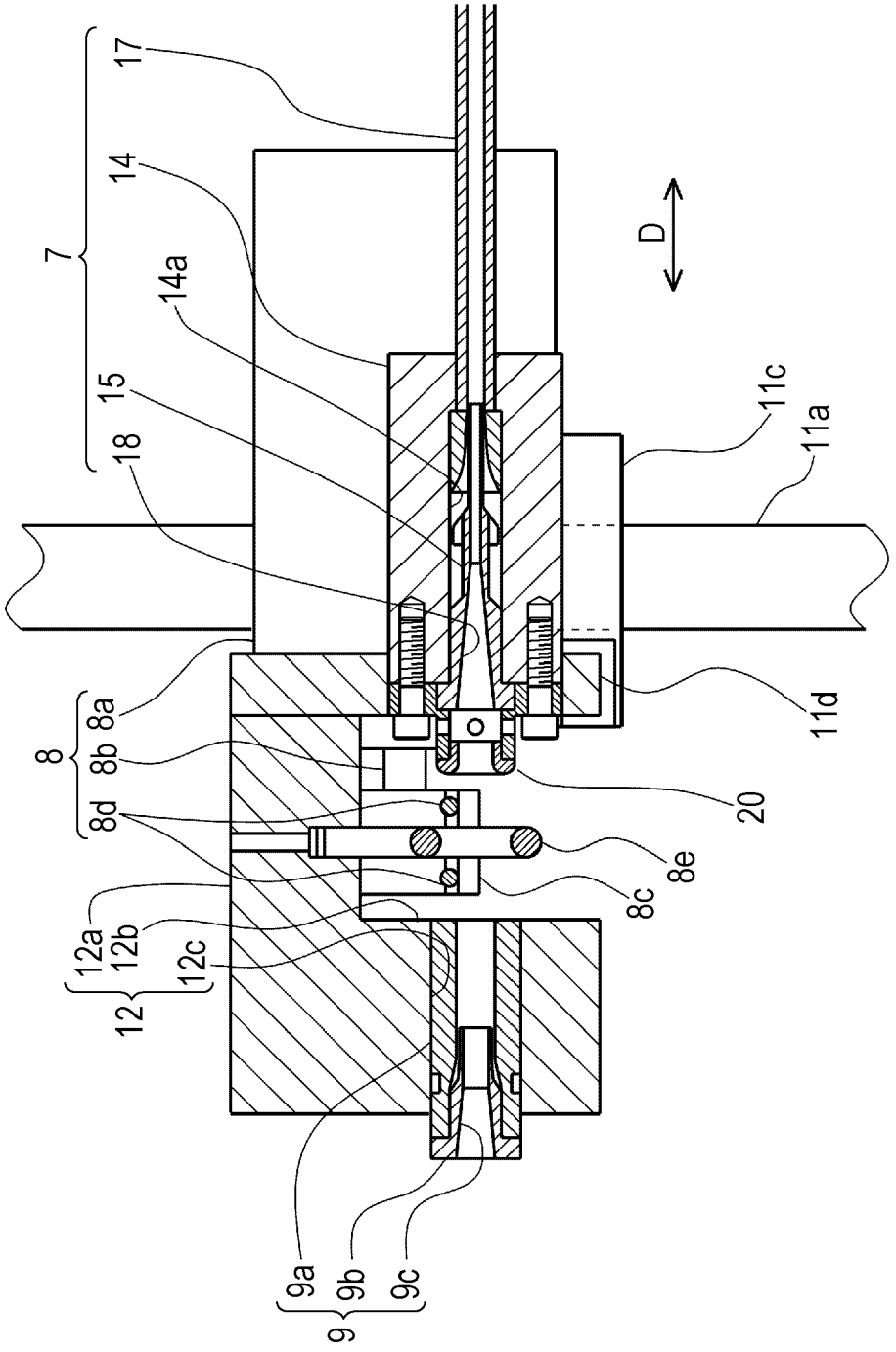

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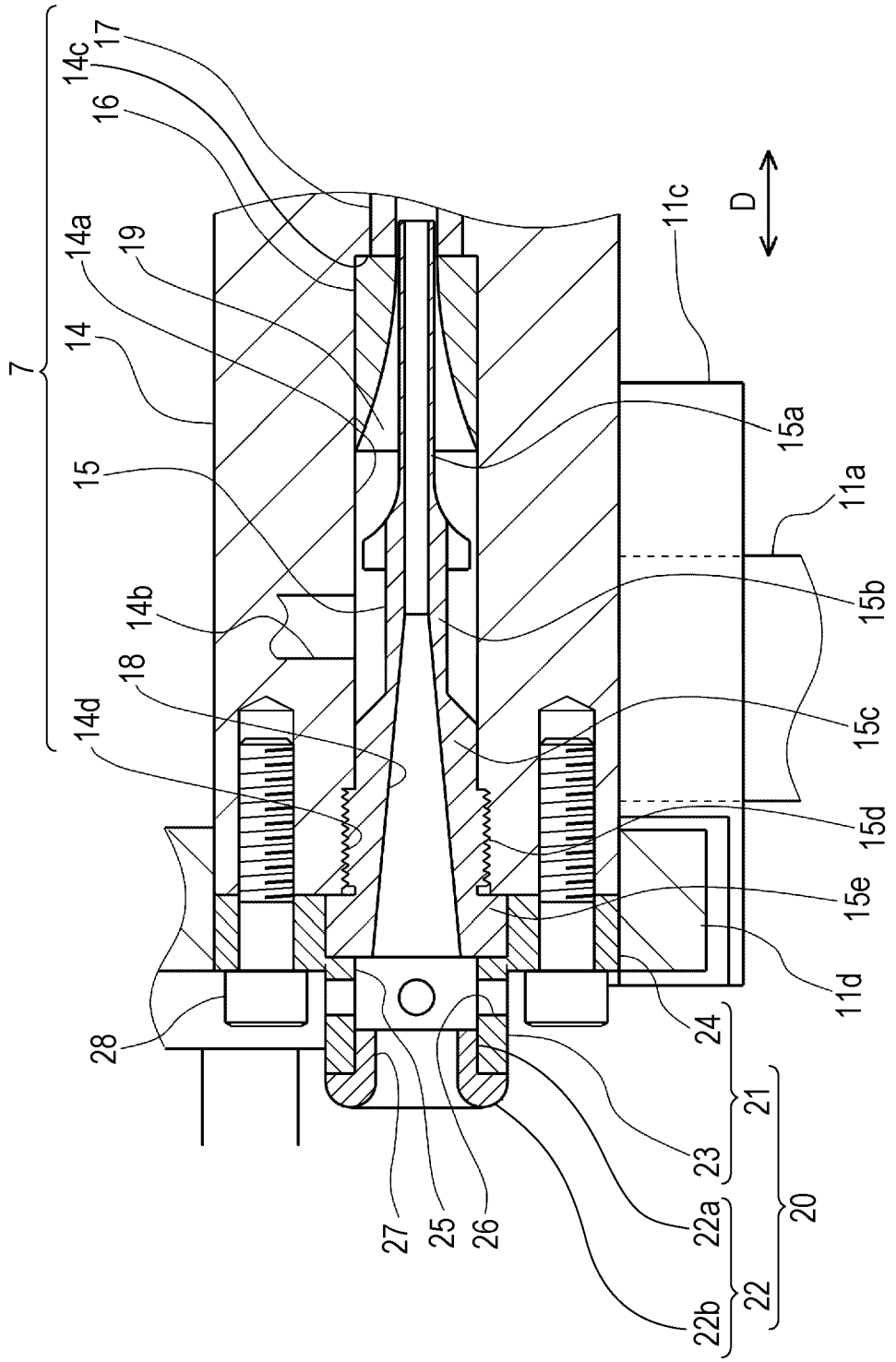
FIG. 4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REFERENCES CITED IN THE DESCRIPTION

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- JP 1085348 A **[0002] [0003] [0004] [0005] [0006] [0098]**