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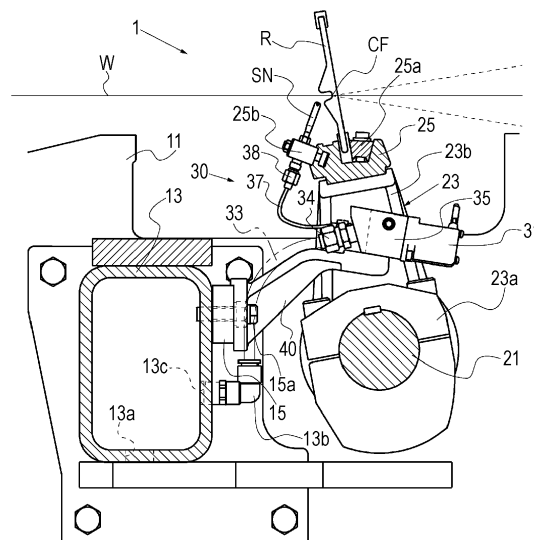
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(54) **AIR JET LOOM**

(57) An air jet loom (1) includes a support structure including a support stay (40) provided so as to extend in a front-rear direction of the loom (1), one end of the support stay (40) in the front-rear direction being attached to a beam member (13) fixed in the loom (1) and the other end of the support stay (40) in the front-rear direction supporting electromagnetic on-off valves (31). In the air jet loom (1), the electromagnetic on-off valves (31) are supported by the support structure so that, when viewed

in the width direction, connecting portions (36a) of supply-side tube joints (36) that are connected to the fluid supply tubes (37), the supply-side tube joints (36) being near the electromagnetic on-off valves (31), are at least partially located within a swing range (T) in which a line segment (Ta) swings, the line segment (Ta) connecting a center of a rocking shaft (21) to a center of an introduction end (38a) of each sub-nozzle (SN) when viewed in a width direction of the loom (1).

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air jet loom including a reed holder to which a reed is attached and which is supported by a rocking shaft with a plurality of sley swords provided between the reed holder and the rocking shaft; a plurality of sub-nozzles provided on the reed holder and arranged side by side along a weft traveling path; a compressed air tank that stores compressed air to be ejected from the sub-nozzles during weft insertion; a plurality of electromagnetic on-off valves, each of which is provided so as to correspond to one or more of the sub-nozzles and connected to the compressed air tank, the electromagnetic on-off valves controlling supply of the compressed air to the corresponding sub-nozzles; fluid supply tubes, each of which is provided so as to correspond to one of the sub-nozzles and supplies the compressed air to the corresponding sub-nozzle, the fluid supply tubes being flexible and connecting supply-side tube joints to introduction ends of air introduction portions of the sub-nozzles, the supply-side tube joints being attached to the electromagnetic on-off valves directly or indirectly with a channel-forming member provided between the supply-side tube joints and the electromagnetic on-off valves; and a beam member for supporting the electromagnetic on-off valves, the beam member being fixed so as to extend in a width direction of the loom.

2. Description of the Related Art

[0002] As illustrated in Fig. 5, in a typical air jet loom, a plurality of sub-nozzles SN, which are arranged side by side along a traveling path of a weft yarn Y ejected from a main nozzle MN, perform an ejection operation in relays, so that compressed air ejected from the sub-nozzles SN assist the movement of the weft yarn Y and weft insertion is achieved. The sub-nozzles SN, which are arranged with predetermined gaps therebetween, are attached to a reed holder (member to which a reed R is attached) that extends in a width direction of the loom (direction parallel to a weft insertion direction). The reed holder is non-rotatably supported by a rocking shaft with a plurality of sley swords provided therebetween. The reed holder swings in a reciprocating manner together with the reed R and the sub-nozzles SN as the rocking shaft rotates in a weaving operation of the air jet loom.

[0003] The air jet loom includes a compressed air tank ST that stores compressed air to be ejected from the sub-nozzles SN as described above. The sub-nozzles SN are connected to the compressed air tank ST by a fluid supply path for supplying the compressed air to the sub-nozzle SN. In recent years, many air jet looms have a structure in which a beam member (front top stay) that constitutes

a portion of a loom frame and that is fixed so as to extend between a pair of side frames (main portions of the loom frame located at both sides in the width direction) is formed as a hollow member, and the front top stay is used as a compressed air tank (compressed air is stored in the front top stay).

[0004] Electromagnetic on-off valves SV are disposed at fixed locations in the fluid supply path between the sub-nozzles SN and the compressed air tank ST. The electromagnetic on-off valves SV are turned on and off (opened and closed) at a preset timing to control the supply of the compressed air to the sub-nozzles SN (ejection of the compressed air from the sub-nozzles SN (hereinafter referred to also as "air ejection")). The electromagnetic on-off valves SV, which are fixed as described above, and the sub-nozzles SN, which swing in the weaving operation, are connected to each other by fluid supply tubes (flexible tubes) FT that are flexible and slightly elastic. Thus, the fluid supply path includes the electromagnetic on-off valves SV and the fluid supply tubes FT. The electromagnetic on-off valves SV and the fluid supply tubes FT are connected to each other with tube joints provided therebetween, and the tube joints are also included in the fluid supply path. The fluid supply tubes FT, which are connected to the electromagnetic on-off valves with the tube joints provided therebetween as described above, are connected to air introduction portions, which are end portions of the sub-nozzles SN to which the air is introduced.

[0005] In air jet looms according to the related art, generally, all of the sub-nozzles are divided into groups, each group including a plurality of sub-nozzles arranged next to each other in the weft insertion direction (the above-described width direction), and the sub-nozzles that belong to each group are connected to a common electromagnetic on-off valve. In such a structure, manifolds (dividers) are disposed between the electromagnetic on-off valves and the fluid supply tubes. The manifolds are integrally attached to the electromagnetic on-off valves, and the fluid supply tubes are connected to tube joints attached to the manifolds. Therefore, in this structure, the manifolds are also included in the fluid supply path as channel-forming members. However, air jet looms including a single electromagnetic on-off valve for each sub-nozzle, as illustrated in Fig. 5, also exist. In such a structure, the tube joints to which the fluid supply tubes are connected may be directly connected to the electromagnetic on-off valves.

[0006] In recent years, many air jet looms have a structure in which the above-described electromagnetic on-off valves are directly attached to the compressed air tank, as described in Japanese Unexamined Patent Application Publication No. 2003-239160 (hereinafter referred to as "structure of the related art"). However, this structure has a problem that a large amount of air is consumed for the following reason.

[0007] First, in the above-described structure of the related art, the electromagnetic on-off valves are at the

most upstream locations in the fluid supply path between the compressed air tank and the sub-nozzles. Accordingly, the lengths of the fluid supply tubes are increased. In particular, since the fluid supply tubes are connected to the sub-nozzles which swing in the weaving operation, the lengths of the fluid supply tubes need to be sufficiently longer than a distance from the air introduction portions of the sub-nozzles to the tube joints near the electromagnetic on-off valves (supply-side tube joints) at the time when the distance is at a maximum (maximum distance) during the swinging motion of the sub-nozzles.

[0008] More specifically, when the fluid supply tubes swing as the sub-nozzles swing, the fluid supply tubes receive a force that tries to stretch the fluid supply tubes due to, for example, the influence of inertia during the swinging motion. Therefore, when the lengths of the fluid supply tubes are not sufficiently longer than the above-described maximum distance, the fluid supply tubes may actually stretch due to the above-described force. More specifically, the fluid supply tubes stretch and contract each time the fluid supply tubes swing in a reciprocating manner. The stretching and contraction is repeated several hundred times per minute (number of times corresponding to the rotational speed of the loom) during the weaving operation, and therefore causes damage to the fluid supply tubes in an early stage. Accordingly, in the structure of the related art, the fluid supply tubes are required to be sufficiently long as described above.

[0009] However, in the structure of the related art in which the fluid supply tubes need to have long lengths as described above, the tube lines extending from the electromagnetic on-off valves to the ejection holes of the sub-nozzles have large capacities. Therefore, according to the structure of the related art, a pressure rise time from when the electromagnetic on-off valves are opened at a sub-nozzle ejection start timing, which is set as a weaving condition, to when the pressure of the compressed air ejected from the sub-nozzles reaches the desired pressure is long.

[0010] In addition, in the above-described structure of the related art, the time required for the residual pressure in the tube lines to be fully reduced after the electromagnetic on-off valves have been closed at a set sub-nozzle ejection end timing is also long. Therefore, in a high-speed loom, there is a possibility that the residual pressure in the tube lines cannot be fully reduced by the next sub-nozzle ejection start timing and the supply of compressed air to the sub-nozzles will be started (the electromagnetic on-off valves will be opened) while the residual pressure remains in the tube lines. The residual pressure in the tube lines is known to have an adverse effect on the above-described pressure rise, and the pressure rise time is increased due to the influence of the residual pressure.

[0011] In the case where the pressure rise time is long as described above, the ejection start timing needs to be advanced to eject the air at a pressure higher than or equal to a desired pressure for a desired period of time.

Therefore, in the above-described structure of the related art, the amount of air consumption is increased. In addition, because of the influence of the residual pressure, the structure of the related art cannot be applied to a high-speed loom (is not capable of ejecting the air at a pressure higher than or equal to a desired pressure over a desired period of time in a high-speed loom).

[0012] In addition, the sub-nozzles perform residual-pressure ejection after the set ejection end timing due to the residual pressure that remains in the tube lines at the time when the electromagnetic on-off valves are closed, as described above. When the capacities of the tube lines in which the residual pressure remains are large, the residual-pressure ejection is necessarily performed for a long time. Therefore, the same portion of the warp yarn receives the compressed air ejected from the sub-nozzles for a long time. As a result, the warp yarn may be damaged and the quality of the fabric may be degraded.

SUMMARY OF THE INVENTION

[0013] The present invention has been made in light of the above-described problems of the structure of the related art. An object of the present invention is to reduce the amount of air consumption in an air jet loom and to realize appropriate weft insertion in a high-speed loom.

[0014] To achieve the above-described object, according to the present invention, the above-described air jet loom includes a support structure including a support stay provided so as to extend in a front-rear direction of the loom, one end of the support stay in the front-rear direction being attached to the beam member and other end of the support stay in the front-rear direction supporting the electromagnetic on-off valves. The electromagnetic on-off valves are supported by the support structure so that, when viewed in the width direction, connecting portions of the supply-side tube joints that are connected to the fluid supply tubes, the supply-side tube joints being near the electromagnetic on-off valves, are at least partially located within a swing range in which a line segment swings as the reed holder swings, the line segment connecting a center of the rocking shaft to a center of the introduction end of each sub-nozzle when viewed in the width direction.

[0015] According to the present invention, the electromagnetic on-off valves for supplying the compressed air to the sub-nozzles are not directly attached to the compressed air tank, but are supported by the above-described support stay at locations other than (apart from) the compressed air tank. In addition, in the present invention, the electromagnetic on-off valves are arranged so that the connecting portions of the supply-side tube joints that are connected to the fluid supply tubes (flexible tubes), the supply-side tube joints being near the electromagnetic on-off valves, are located within the swing range in which the line segment (line segment connecting the center of the rocking shaft to the center of the introduction end of each sub-nozzle when viewed in the width

direction) swings as the reed holder swings. Therefore, according to the structure of the present invention, the lengths of the fluid supply tubes that connect the sub-nozzles to the tube joints near the electromagnetic on-off valves can be made as short as possible. Accordingly, the pressure rise time is shorter and the amount of air consumption is smaller than those in the structure according to the related art.

[0016] In addition, according to the present invention, the capacities of the tube lines that extend from the electromagnetic on-off valves to the ejection holes of the sub-nozzles are smaller than those in the structure of the related art. Therefore, the time required for the residual pressure that remains in the tube lines at the time when the electromagnetic on-off valves are closed to be fully reduced is reduced (the state in which the residual pressure remains in the tube lines is cancelled in a short time). Therefore, even in a high-speed loom, the influence of the residual pressure at the set sub-nozzle ejection start timing on the rise time is small, and appropriate weft insertion can be performed. In other words, according to the present invention, a high-speed loom capable of performing stable weaving operation based on appropriate weft insertion can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a partially sectioned side view of an air jet loom according to an embodiment of the present invention;

Figs. 2A, 2B, and 2C are a side view, a plan view, and a partially sectioned front view, respectively, of an example of electromagnetic on-off valves included in the air jet loom according to the embodiment of the present invention;

Fig. 3 is an explanatory side view illustrating the characteristics of the air jet loom according to the embodiment of the present invention;

Fig. 4 is a front view of the main portion of the air jet loom according to the embodiment of the present invention; and

Fig. 5 is a schematic explanatory view of an example of an air jet loom to which the present invention is applied.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] An embodiment of the present invention will be described with reference to Figs. 1 to 4.

[0019] Fig. 1 illustrates an area around a rocking shaft 21 of an air jet loom 1 to which the present invention is applied. The air jet loom 1 includes the rocking shaft 21, which is provided on a loom frame. The loom frame of the air jet loom 1 includes a pair of left and right side frames (only one of them is illustrated in Fig. 1) 11, which are apart from each other in a width direction of the loom

(direction parallel to a weft insertion direction), and a plurality of beams (typically four beams) that connect the side frames 11 to each other. Thus, the air jet loom 1 includes a plurality of beams that are fixed so as to extend in the width direction and that constitute portions of the loom frame. Among the beams, Fig. 1 shows only a front top stay 13, which is located further toward a take-up side of the woven fabric W than a cloth fell CF is in an upper section of the side frames 11.

[0020] The rocking shaft 21 is arranged so as to extend in the width direction, and is rotatably supported by the side frames 11 at both ends thereof. The rocking shaft 21 is provided so as to extend between the left and right side frames 11. A plurality of sley swords 23, which are arranged with gaps therebetween in an axial direction of the rocking shaft 21 (the above-described width direction), are non-rotatably attached to the rocking shaft 21. Each sley sword 23 includes an attachment portion 23a having a through hole that allows the rocking shaft 21 to be inserted therethrough and an arm portion 23b that extends in a radial direction of the through hole. The attachment portion 23a is attached to the above-described rocking shaft 21 so that the arm portion 23b extends upward.

[0021] The air jet loom 1 also includes a reed holder 25 that is supported by the arm portions 23b of the sley swords 23, which are attached to the rocking shaft 21 in the above-described manner, so as to extend between the left and right side frames 11 in the width direction. A reed R is attached to the reed holder 25 by a reed gripper 25a, and a plurality of sub-nozzles SN, which are arranged with predetermined gaps therebetween in the width direction, are attached to the reed holder 25. Thus, in the air jet loom 1, the sub-nozzles SN are arranged on the reed holder 25 along a weft traveling path at the time of weft insertion. The sub-nozzles SN are attached to the reed holder 25 by sub-nozzle holders 25b through which the sub-nozzles SN are inserted.

[0022] At the time of weft insertion during the weaving operation, compressed air is supplied to each sub-nozzle SN for a preset period within a weft insertion period, and the compressed air is ejected from each sub-nozzle SN. The compressed air to be supplied to the sub-nozzles SN is stored in a compressed air tank provided in the air jet loom 1. In the present embodiment, the front top stay 13 is used as the compressed air tank. More specifically, although the external shape of the front top stay 13 is substantially prismatic, the front top stay 13 has a hollow structure so that an inner space is provided therein. The front top stay 13 has a supply hole 13a through which the compressed air having a pressure adjusted by a regulator or the like (not shown) is supplied, and is configured to store the compressed air supplied through the supply hole 13a.

[0023] Each sub-nozzle SN is connected to the front top stay 13 that serves as a compressed air tank (hereinafter also referred to as "compressed air tank 13") by a fluid supply path 30. The fluid supply path 30 includes

electromagnetic on-off valves 31, which controls supply of the compressed air to the sub-nozzles SN. In the present embodiment, a single electromagnetic on-off valve 31 is provided for each sub-nozzle SN. In other words, the air jet loom 1 according to the present embodiment is structured so that the sub-nozzles SN and the electromagnetic on-off valves 31 are in one-to-one correspondence. The fluid supply path 30 will be described in more detail.

[0024] The fluid supply path 30 is connected to the compressed air tank 13 at the side near the compressed air tank 13 by tube joints 13b attached to the compressed air tank 13. The fluid supply path 30 includes tube bodies 33. One end of each tube body 33 is connected to the corresponding tube joint 13b. The other ends of the tube bodies 33 of the fluid supply path 30 are connected to the electromagnetic on-off valves 31. In the present embodiment, each tube body 33 is connected to two electromagnetic on-off valves 31 by a channel-forming member 35, which has a structure described below. More specifically, in the present embodiment, the electromagnetic on-off valves 31 provided for the respective sub-nozzles SN are arranged such that every two electromagnetic on-off valves 31 are connected to a single channel-forming member 35 (see Fig. 2), and each pair of electromagnetic on-off valves 31 are connected to the compressed air tank 13 by the corresponding channel-forming member 35, tube body 33, and tube joint 13b.

[0025] Therefore, the number of tube bodies 33 and the number of tube joints 13b to which the tube bodies 33 are connected are half the number of sub-nozzles SN included in the air jet loom 1. Each of the tube joints 13b is attached to the compressed air tank 13 at a location suitable for the corresponding two electromagnetic on-off valves 31. Accordingly, the compressed air tank 13 has a plurality of discharge openings 13c formed therein so that the discharge openings 13c are arranged with gaps therebetween in the width direction so as to correspond to the arrangement of the tube joints 13b. The tube joints 13b are attached to the discharge openings 13c of the compressed air tank 13.

[0026] As described above, the channel-forming members 35 are provided so that each channel-forming member 35 corresponds to two electromagnetic on-off valves 31. Each channel-forming member 35 is a block-shaped member having a rectangular shape as illustrated in Fig. 2C when viewed from the front (viewed in the direction of arrow A in Fig. 2B). Each channel-forming member 35 has a protruding portion on the front surface thereof, and is inverted L-shaped in the plan view illustrated in Fig. 2B. Thus, the front surface of each channel-forming member 35 includes a surface of the protruding portion (protruding surface 35c) and a surface of a portion excluding the protruding portion (main surface 35d).

[0027] Each channel-forming member 35 includes a single supply hole 35a to which the corresponding tube body 33 is connected and two discharge holes 35b for supplying the compressed air to the corresponding two

sub-nozzles SN. The supply hole 35a opens in the protruding surface 35c, and the two discharge holes 35b open in the main surface 35d so as to be arranged next to each other in the longitudinal direction of the channel-forming member 35 in front view. A tube joint 34 is attached to the supply hole 35a of each channel-forming member 35, so that each channel-forming member 35 is connected to the tube body 33 corresponding to the channel-forming member 35 by the tube joint 34.

[0028] The arrangement of each channel-forming member 35 in the width direction is set in accordance with the arrangement of the two sub-nozzles SN that correspond to the channel-forming member 35. Each channel-forming member 35 is connected to the corresponding tube joint 13b by the tube body 33 that is connected to the supply hole 35a of the channel-forming member 35 by the tube joint 34, as described above. Accordingly, the arrangement of each tube joint 13b in the width direction is set in accordance with the arrangement of the supply hole 35a of the corresponding channel-forming member 35 in the width direction.

[0029] Two electromagnetic on-off valves 31 are attached to a rear surface 35f of each channel-forming member 35 so as to be arranged next to each other in the longitudinal direction. Although not described in detail, each electromagnetic on-off valve 31 is configured such that an input port and an output port open in the same surface. Each electromagnetic on-off valve 31 is attached to the channel-forming member 35 so that the surface in which the input port and the output port open is in contact with the rear surface 35f of the channel-forming member 35.

[0030] The electromagnetic on-off valves 31 are attached to the channel-forming member 35 by screw members 31 b. More specifically, the electromagnetic on-off valves 31 include fixing portions 31 a on housings thereof, and through holes (not shown) are formed in the fixing portions 31 a. The screw members 31 b are inserted through the through holes in the fixing portions 31 a of the electromagnetic on-off valves 31, and are screwed into internally threaded holes (not shown) formed in the channel-forming member 35. Thus, the fixing portions 31 a of the electromagnetic on-off valves 31 are fastened by the screw members 31 b, and the electromagnetic on-off valves 31 are attached to the channel-forming member 35.

[0031] Each channel-forming member 35 has a plurality of channels formed therein. One of the channels is a supply channel 35e1 that extends in the longitudinal direction. The supply channel 35e1 is connected to the supply hole 35a by an inflow channel 35e2, and is connected to the input ports of the two electromagnetic on-off valves 31 attached to the channel-forming member 35 by two branching channels 35e3. Each channel-forming member 35 also has two outflow channels 35e4 that connect the output ports of the two electromagnetic on-off valves 31 to the two discharge holes 35b.

[0032] The inflow channel 35e2, the supply channel

35e1, and the branching channels 35e3 distribute the compressed air supplied from the corresponding tube body 33 through a single supply hole 35a between the two electromagnetic on-off valve 31. The portion of the channel-forming member 35 in which these channels are formed serves as a distributor (manifold). The outflow channels 35e4 connect the electromagnetic on-off valves 31 to a portion of the fluid supply path 30 that is located downstream of the channel-forming member 35. The portion of the channel-forming member 35 in which the outflow channels 35e4 are formed serves as a connector. The channel-forming member 35 according to the present embodiment has a structure in which the distributor and the connector are combined together.

[0033] A tube joint 36 is attached to each of the discharge holes 35b of each channel-forming member 35. In the present embodiment, the tube joints 36 attached to each channel-forming member 35 serve as supply-side tube joints, and the supply-side tube joints 36 are indirectly attached to the electromagnetic on-off valves 31 with the channel-forming member 35 (the above-described portion that serves as a connector) provided therebetween.

[0034] Each sub-nozzle SN has a tube joint 38 attached to an end portion opposite to an end portion having an ejection hole from which the compressed air is ejected. More specifically, each sub-nozzle SN includes an annular holder portion SNb that is fitted to the sub-nozzle holder 25b. A nozzle portion SNa in which the ejection hole is formed is attached to one end of the holder portion SNb, and the tube joint 38 is attached to the other end of the holder portion SNb (see Fig. 3). Thus, the tube joint 38 serves as a portion of the sub-nozzle SN through which the compressed air is introduced (air introduction portion), and an inlet 38a of the tube joint 38 serves as an introduction end of the sub-nozzle SN for the compressed air.

[0035] The supply-side tube joints 36 connected to the electromagnetic on-off valves 31 by the outflow channels 35e4 are connected to the tube joints 38 (introduction ends 38a) of the sub-nozzles SN corresponding to the electromagnetic on-off valves 31 by flexible tubes 37, which are flexible fluid supply tubes. The supply-side tube joints 36 include connecting portions 36a that are connected to the flexible tubes 37. Thus, the flexible tubes 37 extend from the ends of the connecting portions 36a of the supply-side tube joints 36 that are near the flexible tubes 37 (connecting ends 36b) to the introduction ends 38a of the sub-nozzles SN so as to connect the supply-side tube joints 36 to the sub-nozzles SN.

[0036] As described above, the fluid supply path 30, which connects the tube joints 13b attached to the compressed air tank 13 to the tube joints 38 on the sub-nozzles SN, includes the tube bodies 33, the tube joints 34, the channel-forming members 35 (channels formed therein), the electromagnetic on-off valves 31 (channels formed therein), the tube joints (supply-side tube joints) 36, and the flexible tubes 37. In the air jet loom 1, the

supply of the compressed air to the sub-nozzles SN (ejection of the compressed air from the sub-nozzles SN) is controlled by performing on-off control of the electromagnetic on-off valves 31, which are connected to the compressed air tank 13 by the tube bodies 33, the channel-forming members 35, and other components.

[0037] According to the present invention, the air jet loom 1 that is structured as described above includes a support structure in which a support stay is attached to a beam member that is fixed to the loom so as to extend in the width direction, and in which the electromagnetic on-off valves 31 are supported by the support stay. In the present embodiment, the front top stay 13, which is a beam that constitutes a portion of the loom frame and which is used as a compressed air tank as described above, serves as the beam member to which the support stay is attached. The structure of the present embodiment will be described in detail.

[0038] A base plate 15 is attached to an outer surface of the front top stay 13 that faces the rocking shaft 21. The base plate 15 has an oblong rectangular shape when viewed in the thickness direction thereof, and the dimension thereof in the longitudinal direction is greater than that of the area in which the sub-nozzles SN are provided on the reed holder 25. The base plate 15 is attached to the outer surface of the front top stay 13 by a plurality of screw members (not shown) so as to cover the area in which the sub-nozzles SN are provided on the reed holder 25 in the width direction.

[0039] A plurality of support stays 40, which are arranged with gaps therebetween in the width direction, are attached to the base plate 15 so as to correspond to the electromagnetic on-off valves 31, which are arranged as described above in the air jet loom 1. Thus, each support stay 40 is supported by (attached to) the front top stay 13, which is a beam member, with the base plate 15 provided therebetween. The structure of each support stay 40 will be described in detail. In the following description, the structure of each support stay 40 in the state in which the support stay 40 is attached to the base plate 15 will be described.

[0040] Each support stay 40 includes a plate-shaped base portion 40a, and the base portion 40a is attached to the base plate 15 by screw members 15a. The base portion 40a of each support stay 40 has a substantially rectangular shape when viewed in the thickness direction thereof, and two through holes (not shown) are formed so as to extend through the base portion 40a in the thickness direction at locations on both sides of the center of the base portion 40a in the longitudinal direction. The two through holes are large enough to allow the shaft portions of the screw members 15a to be inserted therethrough. In each support stay 40, one of the two surfaces of the base portion 40a in which the above-described through holes open serves as an attachment surface 40a1. Each support stay 40 is fixed to the base plate 15 by the screw members 15a in such a state that the attachment surface 40a1 is in contact with the base plate 15. Each support

stay 40 is fixed to the base plate 15 by inserting the screw members 15a through the through holes in the base portion 40a and screwing the screw members 15a into internally threaded holes 15b formed in the base plate 15.

[0041] Each support stay 40 also includes an extending portion 40b that extends toward the rocking shaft 21 in a front-rear direction of the loom (direction parallel to the direction in which the woven fabric W is fed from the cloth fell CF). More specifically, each support stay 40 includes the extending portion 40b, which is formed integrally with the base portion 40a and extends at least in the thickness direction of the base portion 40a from a surface of the base portion 40a at a side opposite to the side of the attachment surface 40a1 in the thickness direction. Accordingly, in the state in which the base portion 40a is attached to the base plate 15 as described above, the extending portion 40b extends from the base portion 40a toward the rocking shaft 21. In the present embodiment, the extending portion 40b includes a plate-shaped support portion 40b1, which is formed such that the thickness direction thereof coincides with the short-side direction of the attachment surface 40a1 of the base portion 40a, and a reinforcing rib 40b2.

[0042] As illustrated in Fig. 3, the extending portion 40b extends obliquely upward from the base portion 40a when viewed in the width direction (direction perpendicular to the plane of Fig. 3). More specifically, the extending portion 40b extends not only in the thickness direction, as described above, but also in the upward direction. A distal portion of the extending portion 40b (portion at an end opposite to the end adjacent to the base portion 40a) is bent so that the end thereof (distal end portion) slightly faces downward. The extending portion 40b is formed in this shape to bring the supply-side tube joints 36 closer to the introduction ends 38a of the sub-nozzles SN in the vertical direction when the electromagnetic on-off valves 31 (channel-forming member 35) are supported on the support stay 40 as described below.

[0043] The extending portion 40b is formed so that the distal edge thereof is within an area in which the rocking shaft 21 is provided in the front-rear direction (in the illustrated example, the distal edge substantially coincides with an end of the area in which the rocking shaft 21 is provided, the end being adjacent to the front top stay 13).

[0044] Each support stay 40 also includes a plate-shaped attachment portion 40c that is formed integrally with the extending portion 40b so as to extend continuously from the distal end portion of the extending portion 40b and to which the electromagnetic on-off valves 31 are attached. The attachment portion 40c extends from the distal edge of the extending portion 40b in a direction away from the base portion 40a in such a manner that the thickness direction thereof coincides with that of the distal end portion of the plate-shaped support portion 40b1 of the extending portion 40b. In the present embodiment, the dimension of the attachment portion 40c in the direction in which the attachment portion 40c extends

from the extending portion 40b is such that the edge of the attachment portion 40c at an end opposite to the end adjacent to the extending portion 40b slightly protrudes from the center of the area in which the rocking shaft 21 is provided in the front-rear direction.

[0045] The dimension in the width direction (width) of the attachment portion 40c of each of the support stays 40 according to the present embodiment is slightly greater than the dimension of the channel-forming members 35 in the longitudinal direction. The width of the support portion 40b1 of the extending portion 40b is smaller than the width of the attachment portion 40c. The attachment portion 40c is formed so that one side edge thereof in the width direction coincides with the side edge of the support portion 40b1 at the same side. Thus, each support stay 40 is configured so that the other side edge of the attachment portion 40c is located outside the support portion 40b1 (see Fig. 4) in the width direction.

[0046] In the air jet loom 1, each support stay 40 having the above-described structure supports the electromagnetic on-off valves 31 corresponding to the support stay 40. As described above, in the present embodiment, the electromagnetic on-off valves 31 are attached to and integrated with the corresponding channel-forming member 35. Accordingly, in the air jet loom 1, the channel-forming member 35 is attached to the support stay 40 in such a state that the channel-forming member 35 is placed on the attachment portion 40c of the support stay 40. More specifically, the air jet loom 1 according to the present embodiment includes, as a structure for supporting the electromagnetic on-off valves 31, a support structure in which the electromagnetic on-off valves 31 are supported by the support stay 40 with the channel-forming member 35 provided therebetween.

[0047] The channel-forming member 35 is attached to the support stay 40 by screw members 40d inserted through the attachment portion 40c of the support stay 40. More specifically, a plurality of through holes (for example, two through holes) are formed in the attachment portion 40c of the support stay 40 so as to be arranged next to each other in the width direction. The screw members 40d are inserted through the through holes, and are screwed into internally threaded holes 35h formed in the channel-forming member 35. Thus, the channel-forming member 35 is fixed (attached) to the support stay 40 (attachment portion 40c) by the screw members 40d.

[0048] Each channel-forming member 35 supported by the corresponding support stay 40 in the above-described manner is arranged such that the two discharge holes 35b thereof (two tube joints 36 attached to the two discharge holes 35b) are disposed between the two sub-nozzles SN corresponding to the channel-forming member 35 in the width direction. In other words, each support stay 40 provided to support the corresponding channel-forming member 35 (electromagnetic on-off valves 31) is attached to the base plate 15 at a location where the channel-forming member 35 is arranged as described above in the width direction.

[0049] The arrangement of each channel-forming member 35 (electromagnetic on-off valves 31) in the front-rear direction is such that, when viewed in the width direction, the supply-side tube joints 36 connected to the output ports of the electromagnetic on-off valves 31 by the channel-forming member 35 (in particular, the connecting portions 36a of the supply-side tube joints 36 that are connected to the flexible tubes 37 (connecting ends 36b)) are located within the region T illustrated in Fig. 3 (hatched region). The region T is a swing range in which a line segment Ta swings, the line segment Ta connecting the center 21 a of the rocking shaft 21 to the center of the introduction end 38a of each sub-nozzle SN when viewed in the width direction.

[0050] More specifically, during the weaving operation, the reed R swings between the foremost position (position at the beating time, which is shown by the solid lines in Fig. 3) and the rearmost position (position shown by the two-dot chain lines in Fig. 3), and the swinging movement of the reed R is realized by the swinging movement of the reed holder 25. As the reed holder 25 swings, the sub-nozzles SN, which are supported by the reed holder 25, also swing. As the sub-nozzles SN swing, the line segment Ta also swings around the center 21 a of the rocking shaft 21. The swing range of the swinging movement of the line segment Ta corresponds to the above-described region T. Owing to the arrangement of the channel-forming member 35 in the front-rear direction, the supply-side tube joints 36 are arranged so as to be disposed in the region T when viewed in the width direction. In other words, the arrangement of the supply-side tube joints 36 in the front-rear direction is such that the supply-side tube joints 36 are disposed in the region T when viewed in the width direction, and such an arrangement is achieved by the arrangement of the channel-forming member 35 (electromagnetic on-off valves 31) in the front-rear direction.

[0051] In the present embodiment, the arrangement of the supply-side tube joints 36 is such that, when viewed in the width direction, the connecting portions 36a of the supply-side tube joints 36 partially overlap the middle position of the swing range of the line segment Ta in the region T (position shown by the one-dot chain line Tb in Fig. 3, which is the position of the line segment Ta at the time when the reed R is at the middle position between the foremost position and the rearmost position). In other words, the location of the supply-side tube joints 36 (channel-forming member 35) in the front-rear direction is set so that, when viewed in the width direction, the line segment Ta passes through the connecting portions 36a of the supply-side tube joints 36 in the state in which the line segment Ta is at the middle position of the swing range.

[0052] With the above-described structure of the present embodiment, the supply-side tube joints 36, which are the tube joints near the electromagnetic on-off valves 31, are disposed near the sub-nozzles SN, which are apart from the compressed air tank 13, in the front-

rear direction. In addition, when viewed in the width direction, the difference between the distance from the connecting portions 36a of the supply-side tube joints 36 to the introduction ends 38a of the sub-nozzles SN at the time when the reed R is at the foremost position and that at the time when the reed R is at the rearmost position is small. Accordingly, the length of the flexible tubes 37, which serve as the fluid supply tubes that connect the supply-side tube joints 36 to the sub-nozzles SN, can be made as short as possible. Therefore, the amount of air consumption can be reduced, and stable weaving operation can be performed in a high-speed loom.

[0053] Although an embodiment of the present invention is described above, the air jet loom according to the present invention is not limited to the structure of the above-described embodiment, and the following embodiments (modifications) are also possible.

[0054] (1) With regard to the air jet loom to which the present embodiment is applied, in the above-described embodiment, the air jet loom 1 is structured so that the sub-nozzles SN and the electromagnetic on-off valves 31 are in one-to-one correspondence and every two electromagnetic on-off valves 31 are connected to the compressed air tank 13 by a common channel-forming member 35 (portion of the channel-forming member 35 that serves as a distributor). However, the structure of the air jet loom to which the present invention is applied is not limited to this, and may instead be such that sub-nozzles and electromagnetic on-off valves are in one-to-one correspondence and each electromagnetic on-off valve is independently connected to a compressed air tank with no channel-forming member provided therebetween. In such a case, a tube joint (which corresponds to the tube joint 34 in the above-described embodiment) is directly attached to the input port of each electromagnetic on-off valve, and the tube body 33 according to the above-described embodiment is connected to the tube joint.

[0055] Similarly, the connection between the electromagnetic on-off valves and the sub-nozzles corresponding to the electromagnetic on-off valves may be different from the structure in which the electromagnetic on-off valves are connected to the sub-nozzles by the channel-forming member 35 (portion of the channel-forming member 35 corresponding to a connector) as in the above-described embodiment. Instead, each electromagnetic on-off valve may be independently connected to the corresponding sub-nozzle with no channel-forming member provided therebetween. In such a case, a tube joint (which corresponds to the supply-side tube joint 36 according to the above-described embodiment) is directly connected to the output port of each electromagnetic on-off valve, and the flexible tube 37 according to the above-described embodiment (fluid supply tube according to the present invention) is connected to the tube joint. In this case, the connection between each electromagnetic on-off valve and the compressed air tank may be such that each electromagnetic on-off valve is connected to the compressed air tank by a channel-forming member

(distributor). In other words, for example, every two electromagnetic on-off valves may be connected to a common tube body, which is connected to the compressed air tank, by a channel-forming member (distributor) as in the above-described embodiment, and the output port of each electromagnetic on-off valve may be directly attached to the supply-side tube joint.

[0056] In addition, the air jet loom to which the present invention is applied is not limited to those in which the sub-nozzles SN and the electromagnetic on-off valves 31 are in one-to-one correspondence as in the air jet loom 1 according to the above-described embodiment, and may be structured so that two or more sub-nozzles are connected to each electromagnetic on-off valve. In such a case, a distributor (manifold) having a plurality of discharge holes and configured to distribute the compressed air supplied from a single supply hole between the discharge holes is attached to the output port of each electromagnetic on-off valve. The air jet loom is structured so that a tube joint is attached to each of the discharge holes and is connected to the corresponding sub-nozzle by a fluid supply tube (flexible tube). In such a case, each of the tube joints connected to the distributor corresponds to a supply-side tube joint according to the present invention.

[0057] (2) In the air jet loom 1 according to the above-described embodiment, the front top stay 13, which constitutes a portion of the loom frame, is used also as a compressed air tank. The structure of the air jet loom to which the present invention is applied is not limited to this, and may instead be such that a compressed air tank is provided separately from (independently of) beams (for example, the front top stay) that constitute a portion of the loom frame.

[0058] In the above-described embodiment, the front top stay 13 is used as the beam member according to the present invention to which the support stay that supports the electromagnetic on-off valves are attached. However, the beam member is not limited to a beam that constitutes a portion of the loom frame, such as the front top stay, and may be any member that is included in the air jet loom for another purpose as long as the member is fixed so as to extend over the area in which the sub-nozzles are provided in the width direction. For example, in an air jet loom in which the compressed air tank is provided independently of the front top stay as described above, the compressed air tank may be used as the beam member according to the present invention.

[0059] Furthermore, the beam member is not limited to a member that is originally provided in the air jet loom for another purpose as described above, and may instead be a dedicated member of a support structure that supports the electromagnetic on-off valves according to the present invention. In other words, the beam member may be a member provided in the air jet loom only for the purpose of holding the support stay. The beam member is not limited to a single member, and may instead be formed of a plurality of members. More specifically,

when a plurality of members are arranged in the air jet loom in the width direction so as to cover the area in which the sub-nozzles are provided in the width direction (or when a plurality of members are provided in such a manner), and when the support stay is attached to each of the members, the combination of the members corresponds to the beam member according to the present invention.

[0060] The location at which the beam member is disposed in the front-rear direction is not limited to the location further toward the take-up side of the woven fabric W (front side) than the rocking shaft 21 is as with the front top stay 13 according to the above-described embodiment, and may instead be a location further toward the side opposite to the take-up side in the front-rear direction (rear side or let-off side of the warp yarns) than the rocking shaft is. In such a case, the support stay is arranged so as to extend toward the front side from a location on the rear side of the rocking shaft in the front-rear direction.

[0061] (3) In the air jet loom 1 according to the above-described embodiment, each support stay 40 supports two electromagnetic on-off valves 31. However, in the case where each electromagnetic on-off valve is independently connected to the compressed air tank and the corresponding sub-nozzle as described above, the air jet loom may include a support stay for each electromagnetic on-off valve (the electromagnetic on-off valves and the support stays may be in one-to-one correspondence).

[0062] With regard to the structure (shape) of the support stay, the support stays 40 according to the above-described embodiment are merely an example, and the support stay according to the present invention may have any appropriate structure (shape) in accordance with, for example, the position of the beam member to which the support stay is attached and the number of electromagnetic on-off valves to be supported. In addition, in the above-described embodiment, every two electromagnetic on-off valves 31 are combined by the corresponding channel-forming member 35 as a pair, and each pair of electromagnetic on-off valves 31 are supported by a single support stay 40. However, in the present invention, in the case where a plurality of electromagnetic on-off valves form a group, the number of groups of electromagnetic on-off valves supported by a single support stay is not limited to one as in the above-described embodiment, and may instead be two or more. In such a case, each support stay is structured so as to be capable of supporting the corresponding groups of electromagnetic on-off valves. For example, each support stay may be structured so that the attachment portion thereof is long in the width direction within a range in which the attachment portion does not interfere with the arm portions of the sley swords, and is supported relative to the base portion by two or more extending portions. Thus, a plurality of groups of electromagnetic on-off valves can be supported. Also when each electromagnetic on-off valve is independently connected to the compressed air tank and the corresponding sub-nozzle, the number of elec-

tromagnetic on-off valves supported by each support stay is not limited to one as described above, and may instead be two or more.

[0063] (4) With regard to the arrangement of the supply-side tube joints, in the above-described embodiment, the supply-side tube joints 36 according to the above-described embodiment are arranged such that the entireties thereof are within the above-described region T when viewed in the width direction, and such that the connecting portions 36a partially overlap the middle position of the swing range of the line segment Ta (line segment connecting the center 21a of the rocking shaft 21 to the center of the air introduction end 38a of each sub-nozzle SN when viewed in the width direction).

[0064] However, in the present invention, the arrangement of the supply-side tube joints is not limited as long as the connecting portions of the supply-side tube joints are located within the region T when viewed in the width direction. Therefore, in the air jet loom according to the present invention, the arrangement of the supply-side tube joints in the front-rear direction may be different from that in the above-described embodiment as long as the connecting portions of the supply-side tube joints are located within the region T when viewed in the width direction. For example, the air jet loom may have a structure in which the supply-side tube joints are arranged such that the connecting portions thereof are located within the region T so as not to overlap the middle position of the swing range of the line segment Ta when viewed in the width direction. Alternatively, the air jet loom may have a structure in which the supply-side tube joints are arranged such that the connecting portions thereof are located within the region T and portions of the supply-side tube joints excluding the connecting portions are partially or entirely located outside the region T.

[0065] Furthermore, the structure of the air jet loom is not limited to those in which the connecting portions of the supply-side tube joints are entirely located within the region T when viewed in the width direction, and may instead be such that at least portions of the connecting portions (in particular, the connecting ends that are connected to the fluid supply tubes) are located within the region T. However, to reduce the length of the fluid supply tubes (flexible tubes), it is most preferable to arrange the supply-side tube joints such that the centers of the connecting ends of the connecting portions are located on the middle position of the swing range of the line segment Ta when viewed in the width direction. With such an arrangement, when viewed in the width direction, the difference between the distance from the connecting portions of the supply-side tube joints to the introduction ends of the sub-nozzles at the time when the reed R is at the foremost position and that at the time when the reed R is at the rearmost position is minimized (substantially eliminated). Therefore, the length of the fluid supply tubes can be minimized.

[0066] The positional relationship between the region T and the supply-side tube joints (connecting portions)

when viewed in the width direction is determined by the arrangement of the supply-side tube joints in the front-rear direction. The arrangement of the supply-side tube joints in the front-rear direction is realized by the arrangement of the support structure for the electromagnetic on-off valves including the support stay and the arrangement of the electromagnetic on-off valves supported by the support structure in the front-rear direction. In the case where the support structure includes no channel-forming member as described above, the electromagnetic on-off valves are directly supported by the support stay. The support structure may either be such that a member integrated with the electromagnetic on-off valves, such as the channel-forming member according to the above-described embodiment, are provided, or such that the electromagnetic on-off valves are directly supported by the support stay. The support stay of the support structure is not limited to a single member as in the above-described embodiment, and may instead be formed by combining a plurality of members.

[0067] The present invention is not limited to any of the above-described embodiments, and various modifications are possible within the gist of the present invention.

Claims

1. An air jet loom (1) comprising:

a reed holder (25) to which a reed (R) is attached and which is supported by a rocking shaft (21) with a plurality of sley swords (23) provided between the reed holder (25) and the rocking shaft (21);

a plurality of sub-nozzles (SN) provided on the reed holder (25) and arranged side by side along a weft traveling path;

a compressed air tank (13) that stores compressed air to be ejected from the sub-nozzles (SN) during weft insertion;

a plurality of electromagnetic on-off valves (31), each of which is provided so as to correspond to one or more of the sub-nozzles (SN) and connected to the compressed air tank (13), the electromagnetic on-off valves (31) controlling supply of the compressed air to the corresponding sub-nozzles (SN);

a plurality of fluid supply tubes (37), each of which is provided so as to correspond to one of the sub-nozzles (SN) and supplies the compressed air to the corresponding sub-nozzle (SN), the fluid supply tubes (37) being flexible and connecting supply-side tube joints (36) to introduction ends (38a) of air introduction portions (38) of the sub-nozzles (SN), the supply-side tube joints (36) being attached to the electromagnetic on-off valves (31) directly or indirectly with a channel-forming member (35) pro-

vided between the supply-side tube joints (36) and the electromagnetic on-off valves (31); and a beam member (13) for supporting the electromagnetic on-off valves (31), the beam member (13) being fixed so as to extend in a width direction of the loom (1), 5

wherein the loom (1) further comprises a support structure including a support stay (40) provided so as to extend in a front-rear direction of the loom (1), 10 one end of the support stay (40) in the front-rear direction being attached to the beam member (13) and other end of the support stay (40) in the front-rear direction supporting the electromagnetic on-off valves (31), and 15 wherein the electromagnetic on-off valves (31) are supported by the support structure so that, when viewed in the width direction, connecting portions (36a) of the supply-side tube joints (36) that are connected to the fluid supply tubes (37) are at least partially located within a swing range (T) in which a line segment (Ta) swings as the reed holder (25) swings, the line segment (Ta) connecting a center of the rocking shaft (21) to a center of the introduction end (38a) of each sub-nozzle (SN) when viewed in the width 25 direction. 20

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FIG. 1

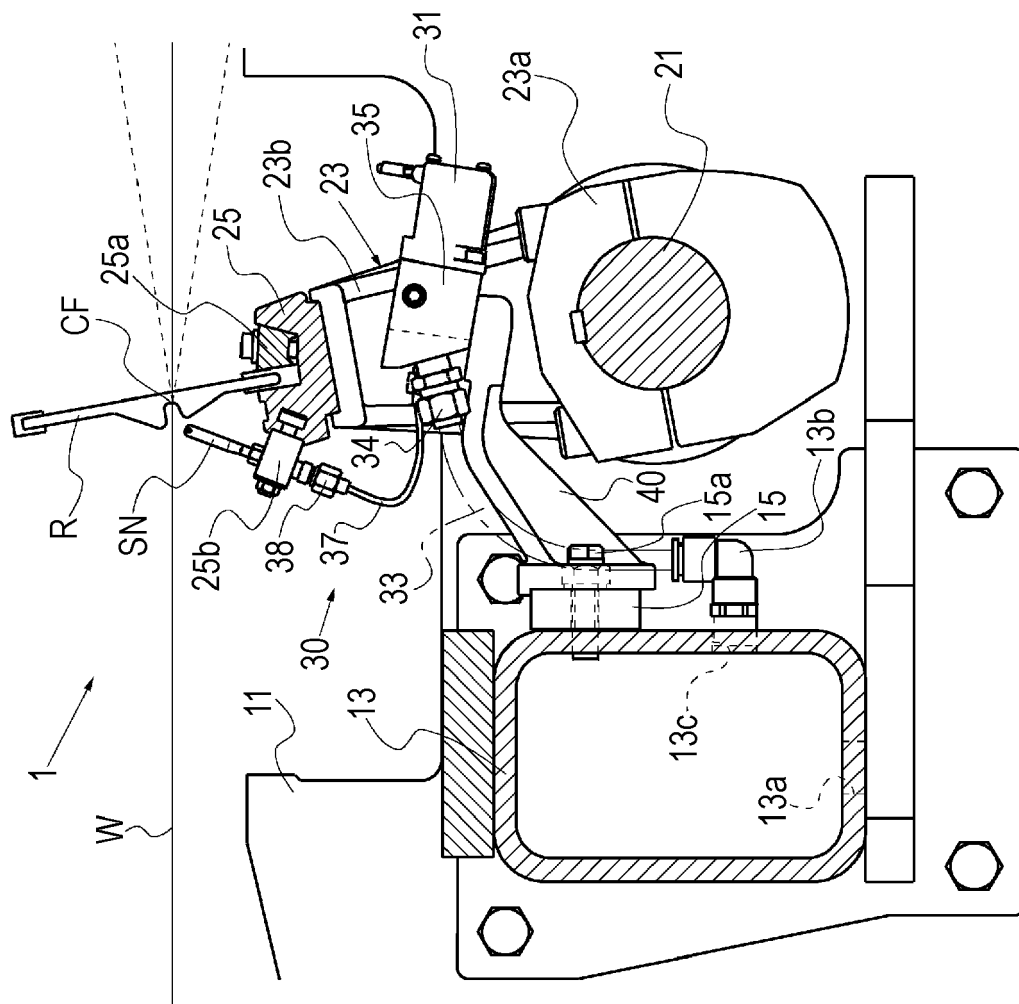


FIG. 2A

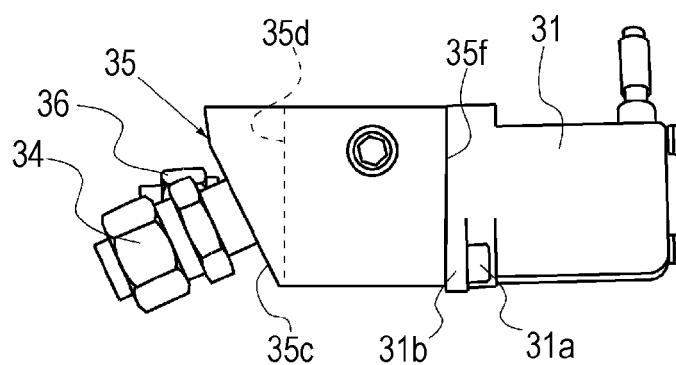


FIG. 2B

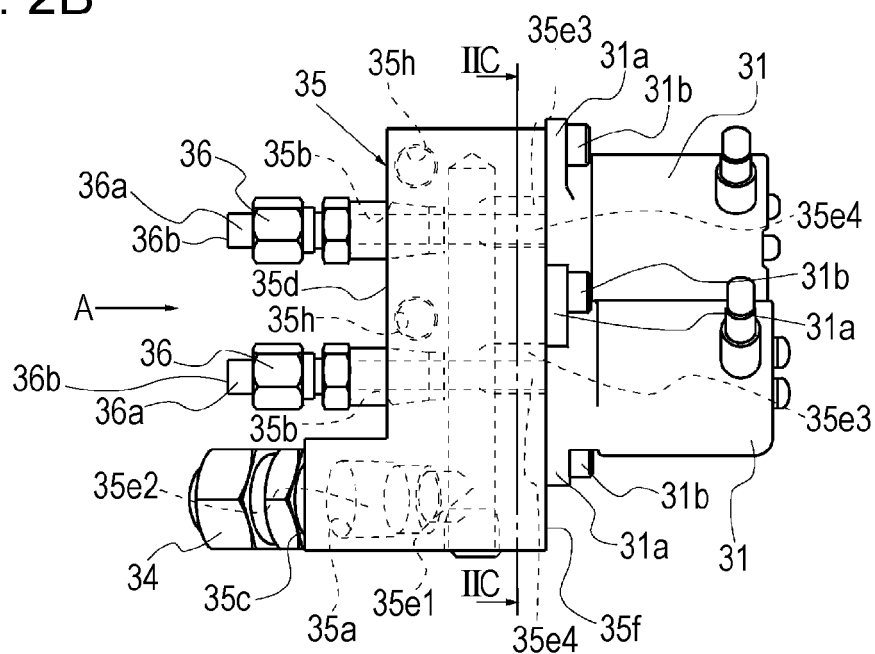


FIG. 2C

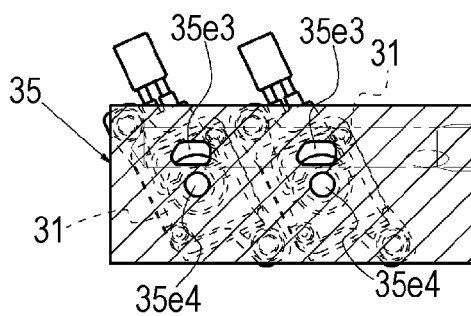


FIG. 3

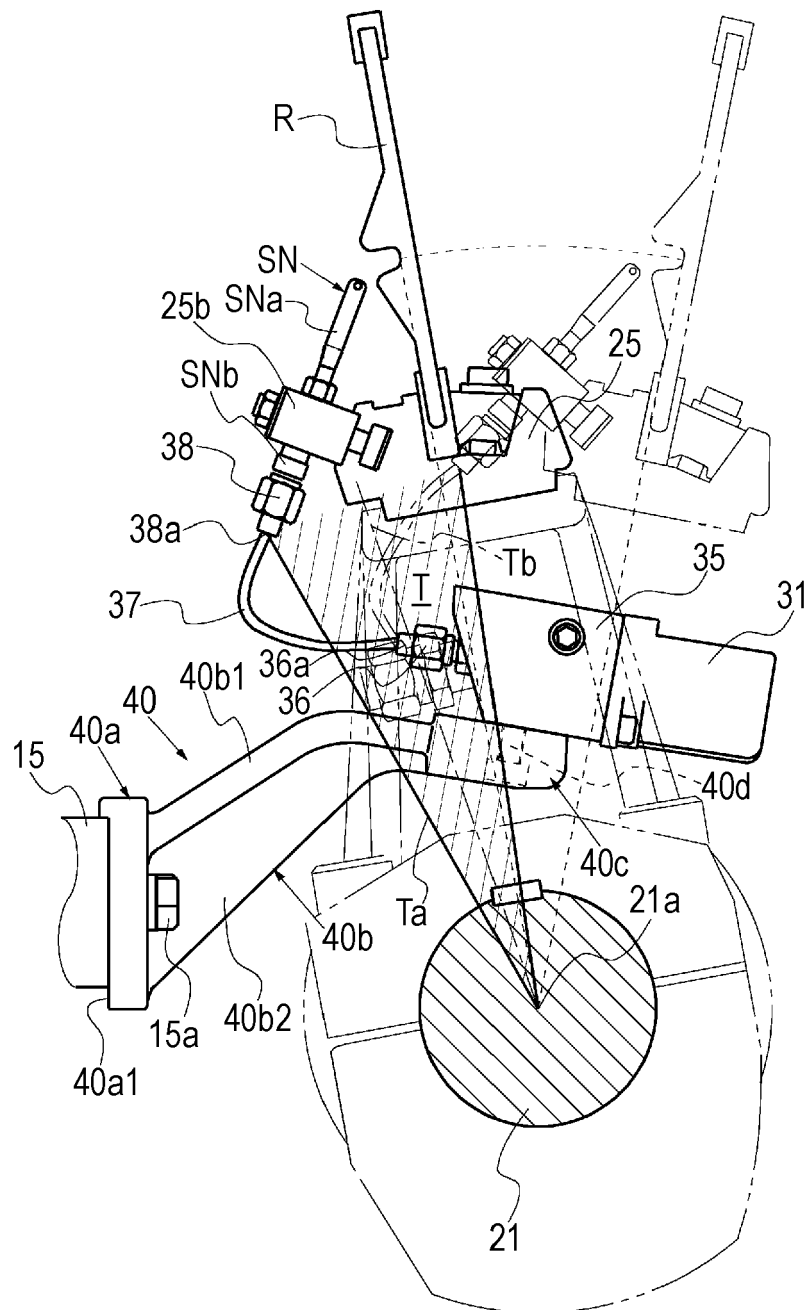


FIG. 4

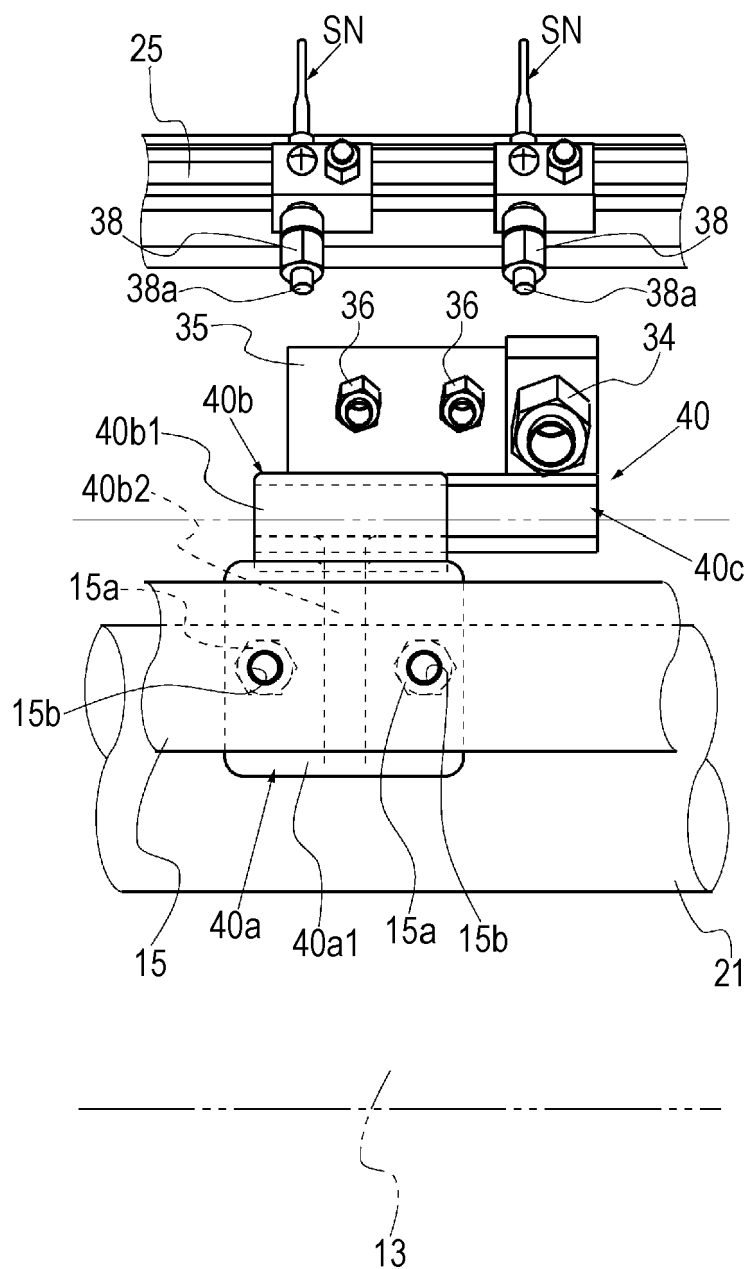
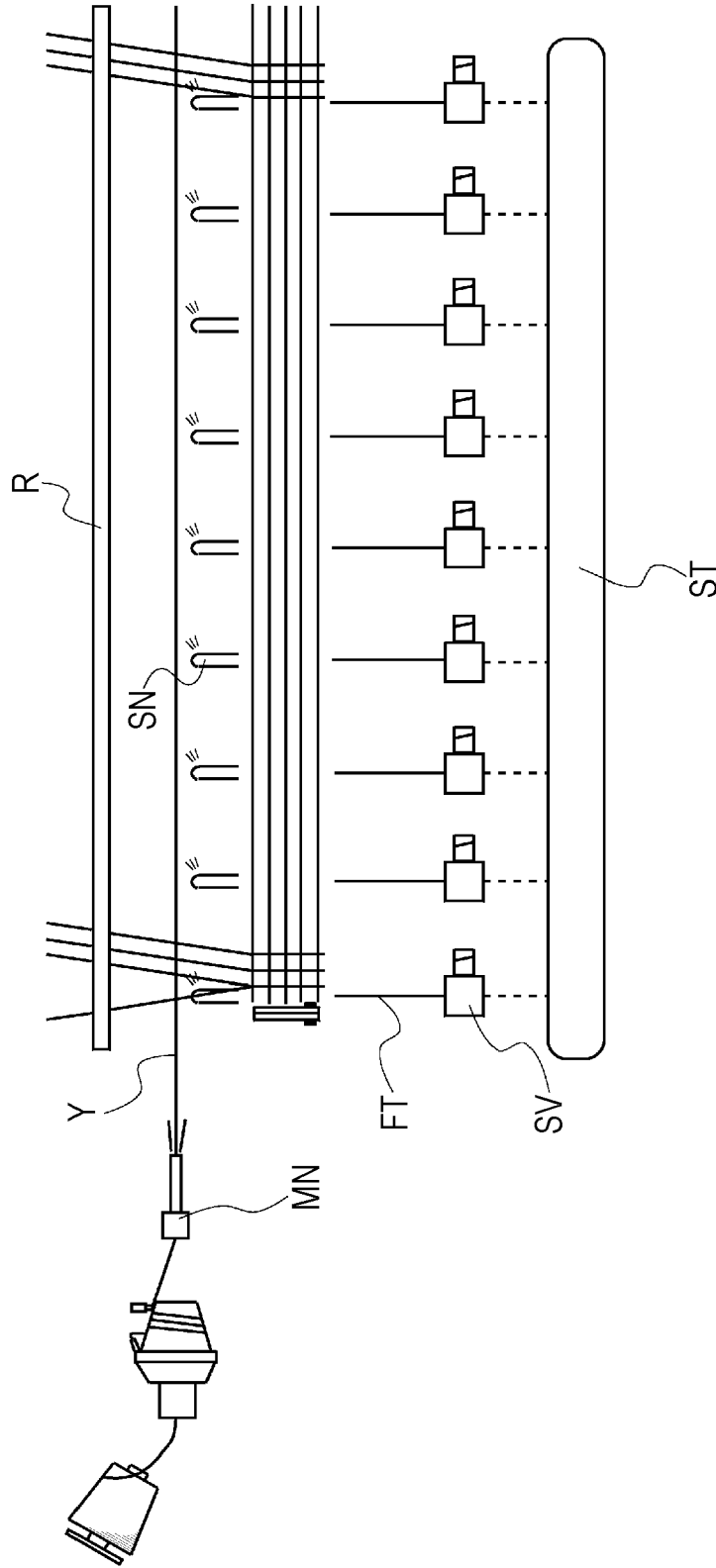


FIG. 5





EUROPEAN SEARCH REPORT

 Application Number
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