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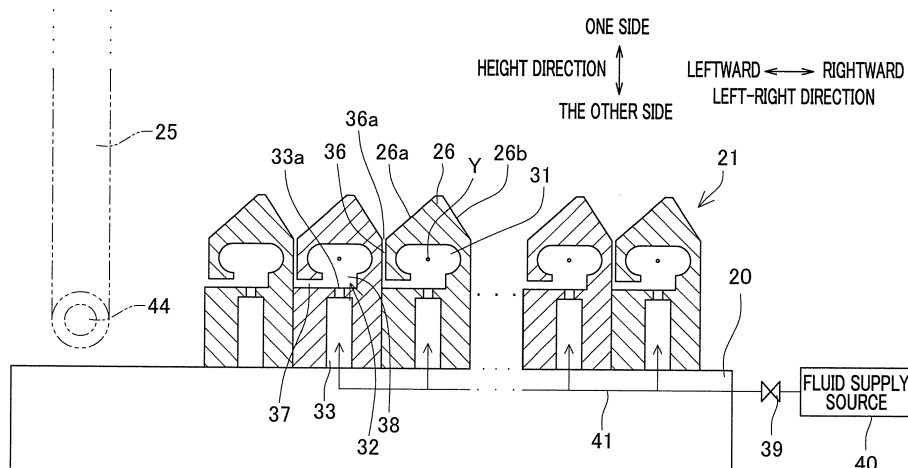
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(54) **INTERLACING DEVICE**

(57) A yarn is certainly inserted into a yarn introduction passage through which the yarns is introduced into a yarn running space. A yarn introduction passage 32 through which a yarn Y is introduced into a yarn running space 31 in which the yarn Y runs includes a first yarn passage 36 which extends in the height direction, a second yarn passage 37 which is connected to the first yarn passage 36 and extends in the left-right direction, and a third yarn passage 38 which extends in the height direction and connects the right end of the second yarn passage to the yarn running space 31. A swing member 25 is swung about a shaft 44 parallel to the yarn running

direction of the left side of the interlacing portion 21 so as to press the yarn Y. The yarn Y is pressed in the height direction by the swing member 25 so as to be inserted into the first yarn passage 36. The yarn Y then moves in the second yarn passage 37 on account of a component in the left-right direction of force exerted by the swing member 25 and the tension of the yarn Y itself. Thereafter, as the pressing of the yarn Y by the swing member 25 is canceled, the yarn Y moves in the third yarn passage 38 and reaches the yarn running space 31, on account of the tension of itself.

FIG.5



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an interlacing device configured to interlace yarns.

[0002] Patent Literature 1 (Japanese Unexamined Patent Publication No. 2016-160550) recites a spun yarn take-up apparatus including an interlacing device configured to interlace yarns. In this interlacing device, a plurality of yarn running spaces are lined up on a single line. In each yarn running space, yarns are interlaced by injecting fluid into the space while the yarns are running. Furthermore, in the interlacing device of Patent Literature 1, a yarn is introduced into each yarn running space through a slit (equivalent to a first yarn passage of the present invention) which extends in the up-down direction and a yarn insertion gap (equivalent to a second yarn passage of the present invention) which is connected to the lower end of the slit and extends horizontally.

SUMMARY OF THE INVENTION

[0003] In the spun yarn take-up apparatus including the interlacing device recited in Patent Literature 1, for example, insertion of a yarn into the slit of the interlacing device is prohibited, and after yarn threading to parts other than the interlacing device of the spun yarn take-up apparatus is completed, the prohibition is canceled, and the yarn is introduced into the yarn running space via the slit and the yarn insertion gap, by utilizing the tension of the yarn. However, in this case, at least some of the yarns may not be inserted into the slits even after the prohibition of insertion of yarns into the slit is canceled. The yarns not inserted into the slits are not introduced into the yarn running spaces. In such a case, the yarns must be manually introduced into the yarn running spaces by an operator.

[0004] An object of the present invention is to provide an interlacing device in which a yarn is certainly inserted into a yarn introduction passage through which the yarns is introduced into a yarn running space.

[0005] According to the first aspect of the invention, an interlacing device includes: an interlacing portion configured to interlace a yarn; and a yarn introduction device configured to introduce the yarn into the interlacing portion, the interlacing portion including: a yarn running space in which the yarn runs; an injection unit configured to inject air into the yarn running space; and a yarn introduction passage through which the yarn is introduced into the yarn running space, the yarn introduction passage including a first yarn passage which extends in a first direction orthogonal to a yarn running direction in the yarn running space and has a yarn insertion slot at an end on one side in the first direction, and the yarn introduction device including an insertion member which presses the yarn from the one side toward the other side in the first direction to insert the yarn into the first yarn

passage through the insertion slot.

[0006] According to this aspect, as the yarn is pressed from the one side toward the other side in the first direction by the insertion member, the yarn is certainly inserted into the first path extending in the first direction.

[0007] According to the second aspect of the invention, the interlacing device of the first aspect is arranged such that, the yarn introduction passage further includes a second yarn passage which is connected to an end of the first yarn passage on the other side in the first direction and extends along a second direction which is orthogonal to the yarn running direction and intersects with the first direction, and the yarn introduction device further includes a movement member which presses, in the second direction, the yarn inserted in the first yarn passage to move the yarn along the second yarn passage.

[0008] After the yarn is inserted into the first yarn passage by the insertion member, the yarn having been inserted into the first yarn passage may be caught in the second yarn passage. According to the aspect above, as the yarn inserted into the first yarn passage is pressed in the second direction by the movement member, the yarn moves along the second yarn passage extending in the second direction.

[0009] According to the third aspect of the invention, the interlacing device of the second aspect is arranged such that the yarn introduction device includes a common member which functions as both the insertion member and the movement member and is configured to press the yarn by exerting force including a component in the first direction and a component in the second direction to the yarn.

[0010] According to this aspect, because the common member functioning as both the insertion member and the movement member is provided, the structure of the interlacing device is simple as compared to cases where the insertion member and the movement member are independently provided.

[0011] According to the fourth aspect of the invention, the interlacing device of the third aspect is arranged such that the common member is a swing member which is swung to press the yarn.

[0012] According to this aspect, force having a component in the first direction and a component in the second direction can be applied to the yarn Y by the swing member which has a simple structure.

[0013] According to the fifth aspect of the invention, the interlacing device of the fourth aspect is arranged such that the swing member is swung about a shaft which is parallel to the yarn running direction.

[0014] According to this aspect, because the swing member is swung about the shaft parallel to the yarn running direction, the length of a space required to provide the swing member is short in the yarn running direction, and hence the interlacing device is downsized in the yarn running direction.

[0015] According to the sixth aspect of the invention, the interlacing device of any one of the second to fifth

aspects is arranged such that the yarn introduction passage further includes a third yarn passage which is connected to an end of the second yarn passage opposite to the first yarn passage, and extends toward the one side in the first direction from a junction with the second yarn passage.

[0016] According to this aspect, as the yarn is pressed by the insertion member and the movement member, the yarn is moved to the junction between the second yarn passage and the third yarn passage. Thereafter, as the pressing of the yarn by the insertion member and the movement member is canceled, the yarn moves in the third yarn passage and reaches the yarn running space, on account of the tension of itself.

[0017] According to the seventh aspect of the invention, the interlacing device of any one of the first to sixth aspects is arranged such that the yarn introduction device is provided upstream of at least the interlacing portion in the yarn running direction.

[0018] According to this aspect, as a yarn part upstream of the interlacing portion in the yarn running direction is pressed by the yarn introduction device, the yarn is inserted into the first yarn passage. When a running yarn is pressed by the yarn introduction device, a pressed part of the yarn is temporarily restricted. On this account, a part downstream of the pressed part of the yarn temporarily has increased tension, with the result that the yarn path becomes stable. Meanwhile, a part upstream of the pressed part of the yarn temporarily has decreased tension and is slackened, with the result that the yarn path becomes unstable. According to the aspect above, because the yarn introduction device is provided upstream of the interlacing portion in the yarn running direction, a yarn part with a stable yarn path, which is downstream of a part of the yarn pressed by the yarn introduction device, is introduced into the interlacing portion. On this account, according to the aspect above, the yarn is easily introduced to the interlacing portion as compared to cases where the yarn introduction device is provided downstream of the interlacing portion in the yarn running direction.

[0019] According to the eighth aspect of the invention, the interlacing device of the seventh aspect further includes a yarn guide which is provided upstream of the interlacing portion in the yarn running direction, the yarn introduction device being provided at least between the interlacing portion and the yarn guide in the yarn running direction.

[0020] When the yarn guide is provided upstream of the interlacing portion and the yarn introduction device is provided upstream of the yarn guide in the yarn running direction, the movement of the yarn in the interlacing portion when the yarn is pressed by the yarn introduction device may be obstructed by the yarn guide. According to the aspect above, the yarn introduction device is provided between the interlacing portion and the yarn guide in the yarn running direction. On this account, the movement of the yarn in the interlacing portion is not obstructed

by the yarn guide when the yarn is pressed by the yarn introduction device.

[0021] The present invention makes it possible to certainly introduce the yarn into the yarn introduction passage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a schematic diagram of a spun yarn take-up apparatus.

FIG. 2 is a perspective view showing the outline of an interlacing device.

FIG. 3 shows the interlacing device of FIG. 2 when viewed from one side in the height direction.

FIG. 4 shows the interlacing device of FIG. 2 when viewed from the right side.

FIG. 5 is a cross section of a part of an interlacing portion taken along a plane which is parallel to the left-right direction and the height direction.

FIG. 6 is a block diagram illustrating an electric structure of the interlacing device and a controller.

FIG. 7 corresponds to FIG. 3 and shows a state in yarn threading.

FIG. 8 corresponds to FIG. 4 and shows a state in yarn threading.

FIG. 9 corresponds to FIG. 3 and shows a state in which a yarn regulation bar is returned to a regulation cancellation position and a swing member is moved to a pressing completion position.

FIG. 10 corresponds to FIG. 4 and shows a state in which the yarn regulation bar is returned to the regulation cancellation position and the swing member is moved to the pressing completion position.

FIG. 11(a) shows a state in which a yarn outside a yarn introduction passage is pressed by a swing member. FIG. 11(b) shows a state in which a yarn in a first yarn passage is pressed by the swing member. FIG. 11(c) shows a state in which a yarn in a second yarn passage is pressed by the swing member. FIG. 11(d) shows a state in which a yarn in a third yarn passage and a yarn running space is pressed by the swing member.

FIG. 12 relates to an interlacing portion of a modification and corresponds to FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] The following will describe a preferred embodiment of the present invention.

(Spun Yarn Take-Up Apparatus)

[0024] As shown in FIG. 1, a spun yarn take-up apparatus 1 takes up synthetic fiber yarns Y spun out from a spinning apparatus 2 and formed of filaments f, and forms packages P by winding the yarns Y onto bobbins B, re-

spectively. The description below is given on the premise that the up-down direction, front-back direction, and left-right direction in FIG. 1 are respectively the up-down direction relative to the spun yarn take-up apparatus 1, the front-back direction relative to the spun yarn take-up apparatus 1, and the left-right direction relative to the spun yarn take-up apparatus 1.

[0025] The spun yarn take-up apparatus 1 includes members such as a cooling unit 3, an oil supply unit 4, a drawing unit 5, take-up rollers 6 and 7, an interlacing device 8 (an interlacing device of the present invention), and a winding device 9. In the spinning apparatus 2, polymer supplied from a polymer supplier (not illustrated), which is a gear pump, for example, is extruded downward through spinnerets 2a which are lined up in the left-right direction (the direction away from the viewer of FIG. 1). As a consequence, yarns Y formed of filaments F are spun out while being lined up in the left-right direction.

[0026] The yarns Y spun out from the spinnerets 2a of the spinning apparatus 2 travel along a yarn path through the cooling unit 3, the oil supply unit 4, the drawing unit 5, the take-up roller 6, the interlacing device 8, and the take-up roller 7, while being lined up in the left-right direction. The yarns Y are distributed in the front-back direction from the take-up roller 7, and are then wound onto the bobbins B at the winding device 9.

[0027] The cooling unit 3 includes a plurality of cylindrical cooling cylinders 10. Each cooling cylinder 10 is provided below the corresponding spinneret 2a of the spinning apparatus 2. The yarns Y spun out from the spinnerets 2a of the spinning apparatus 2 run downward in internal spaces 10a of the cooling cylinders 10, along the axial direction of the cooling cylinder 10. A flow adjustment section 10b is provided around the internal space 10a. Cooling wind supplied from an unillustrated pressurized air supplier flows into the internal space 10a while being adjusted by the flow adjustment section 10b. The flow adjustment section 10b mainly performs the adjustment in such a way that the flow rate of the cooling wind flowing into the internal space 10a is more or less even in the circumferential direction of the cooling cylinder 10.

[0028] The oil supply unit 4 includes oil supply guides 11 which are provided below the respective cooling cylinders 10. The oil supply guide 11 gathers filaments F spun out from the spinneret 2a into a single yarn Y, and applies oil to the yarn Y (filaments F).

[0029] The drawing unit 5 is provided below the oil supply unit 4. The drawing unit 5 includes: a heat retaining box 12; and heating rollers (not illustrated) accommodated in the heat retaining box 12. By the heating rollers, the drawing unit 5 draws the yarns Y while heating them.

[0030] The yarns Y drawn by the drawing unit 5 are sent to the winding device 9 by the take-up rollers 6 and 7. The interlacing device 8 is provided between the take-up roller 6 and the take-up roller 7 to interlace filaments F constituting each yarn Y. The details of the interlacing device 8 will be given later.

[0031] The winding device 9 includes members such as a frame 13, a turret 14, two bobbin holders 15, a supporting frame 16, a contact roller 17, and a traverse unit 18. The winding device 9 simultaneously winds the yarns Y sent from the take-up roller 7 onto the bobbins B by rotating the bobbin holder 15, so as to form packages P.

[0032] The turret 14 is a disc-shaped member and is attached to the frame 13. The turret 14 is rotationally driven by a motor which is not illustrated. The two bobbin holders 15 are cantilevered by the turret 14 to extend in the front-back direction. To each bobbin holder 15, cylindrical bobbins B are attached to be lined up along the axial direction of the bobbin holder 15. As the turret 14 rotates, the positions of the two bobbin holders 15 are switched between an upper winding position and a lower retracted position.

[0033] The supporting frame 16 is a frame-shaped member which is long in the front-back direction. This supporting frame 16 is fixed to the frame 13. A roller supporting member 19 which is long in the front-back direction is attached to a lower part of the supporting frame 16 so as to be vertically movable relative to the supporting frame 16. The roller supporting member 19 supports the contact roller 17 in a rotatable manner. The contact roller 17 extends in the axial direction of the bobbin holders 15. As this contact roller 17 makes contact with a package P under the formation and the contact roller 17 applies a predetermined contact pressure to the package P, the shape of the package P is adjusted.

[0034] The traverse unit 18 includes traverse guides 18a lined up in the front-back direction. The traverse guides 18a are driven by a motor (not illustrated) and are configured to reciprocate in the front-back direction. As each traverse guide 18a to which the yarn Y is threaded reciprocates, the yarn Y is wound onto the corresponding bobbin B while being traversed about a fulcrum guide 18b.

(Interlacing Device)

[0035] Now, the interlacing device 8 will be detailed. As shown in FIG. 2 to FIG. 5, the interlacing device 8 includes a base 20, an interlacing portion 21, upstream yarn guides 22, downstream yarn guides 23, a yarn regulation bar 24, and a swing member 25 (a common member of the present invention). In the interlacing device 8, yarns Y run in a yarn running direction which is inclined relative to the front-back direction so as to be a positive slope in the rearward direction. Furthermore, hereinafter, a direction orthogonal to both the yarn running direction and the left-right direction (a second direction in the present invention) is defined as a height direction of the interlacing device 8 (a first direction in the present invention), and one side and the other side in the height direction are defined as shown in FIG. 2.

[0036] The base 20 is substantially rectangular parallelepiped in shape. An interlacing portion 21 is constructed such that interlacing pieces 26 are lined up in the left-

right direction on a surface of the base 20 on one side in the height direction. The interlacing portion 21 includes yarn running spaces 31, yarn introduction passages 32, and injection passages 33. The yarn running spaces 31 are formed in the respective interlacing pieces 26. The yarn running space 31 is substantially elliptical in shape and is long in the left-right direction when viewed in the yarn running direction. In the yarn running direction, the yarn running space 31 extends over the entire length of the interlacing piece 26 and is open at the both ends.

[0037] The yarn introduction passages 32 are passages provided for the respective yarn running spaces 31 to introduce the yarns Y to the yarn running spaces 31. In the yarn running direction, the yarn introduction passage 32 extends over the entire length of the interlacing piece 26 and is open at the both ends. The yarn introduction passage 32 includes a first yarn passage 36, a second yarn passage 37, and a third yarn passage 38.

[0038] The first yarn passage 36 is a gap formed between two neighboring interlacing pieces 26, and extends in the height direction at a substantially upper half of the interlacing piece 26. One end in the height direction of the first yarn passage 36 is an insertion slot 36a from which the yarn Y is inserted.

[0039] The second yarn passage 37 is connected to the other end of the first yarn passage 36 in the height direction, and extends rightward from the junction with the first yarn passage 36. The third yarn passage 38 is connected to the right end of the second yarn passage 37, and extends toward the one side in the height direction from the junction with the second yarn passage 37. An end on the one side in the height direction of the third yarn passage 38 is connected to the yarn running space 31.

[0040] A substantial left half of the surface on the one side in the height direction of the interlacing piece 26 is an inclined surface 26a which is inclined relative to the left-right direction so as to be a negative slope in the leftward direction if it is assumed that the height direction is the vertical direction. A substantial right half of the surface on the one side in the height direction of the interlacing piece 26 is an inclined surface 26b which is inclined relative to the left-right direction so as to be a negative slope in the rightward direction if it is assumed that the height direction is the vertical direction. As such, the inclined surfaces 26a and 26b are positioned on the respective sides of the first yarn passage 36 in the left-right direction, and the yarn Y is guided by the inclined surfaces 26a and 26b and inserted into the first yarn passage 36.

[0041] The injection passages 33 are provided for the respective yarn running spaces 31. One injection passage 33 is formed for each interlacing piece 26 and extends in the height direction. A leading end (end on the one side) of the injection passage 33 is an injection port 33a which is open to a wall surface of the junction between the second yarn passage 37 and the third yarn passage 38, on the other side in the height direction. The

injection port 33a therefore opposes the yarn running space 31 across the third yarn passage 38 in the height direction. A lower end portion of the injection passage 33 is connected to a fluid supply source 40 via a fluid supply path 41. A valve 39 is provided on the fluid supply path 41. When the valve 39 is opened, fluid such as air supplied from the fluid supply source 40 is supplied to the injection passage 33 via the fluid supply path 41, and is injected into the yarn running space 31 from the injection port 33a of the injection passage 33. As a result, a swirling flow is generated in the yarn running space 31, and the filaments F forming the yarn Y running in the yarn running space 31 are interlaced.

[0042] In the present embodiment, a combination of the injection passage 33, the fluid supply source 40, the fluid supply path 41, and the valve 39 is equivalent to an injection unit of the present invention.

[0043] The upstream yarn guides 22 are provided upstream of the interlacing portion 21 in the yarn running direction and on the surface of the base 20 on the one side in the height direction, and are lined up in the left-right direction. Each upstream yarn guide 22 is a column extending in the height direction. The downstream yarn guides 23 are provided downstream of the interlacing portion 21 in the yarn running direction and on the surface of the base 20 on the one side in the height direction, and are lined up in the left-right direction. Each downstream yarn guide 23 is a column similar to the upstream yarn guide 22. The upstream yarn guides 22 and the downstream yarn guides 23 are substantially symmetrical in position in the left-right direction. Because the yarn Y running in the yarn running direction passes between the neighboring upstream yarn guides 22 and between the neighboring downstream yarn guides 23, the movement of the yarn Y in the left-right direction is regulated, and the yarn path is defined. The yarn guides 22 and 23 have a function of supporting the yarn Y when the yarn Y is interlaced at the interlacing portion 21.

[0044] As described below, the yarn regulation bar 24 prevents the yarn Y from being introduced into the yarn running space 31 at the time of yarn threading to the spun yarn take-up apparatus 1. The yarn regulation bar 24 is a substantially columnar member which extends in the left-right direction over the interlacing pieces 26 (the upstream yarn guides 22 and the downstream yarn guides 23) and has an axis extending in the left-right direction. The yarn regulation bar 24 is cantilevered at a leading end portion of a lever 42. The lever 42 is swingable about a shaft 43 extending in the left-right direction, and is swung about the shaft 43 by a lever driver 51 (see FIG. 6). When the yarns Y having been spun out are taken up in the spun yarn take-up apparatus 1, as shown in FIG. 2 to FIG. 4, the yarn regulation bar 24 is positioned downstream in the yarn running direction of the downstream yarn guides 23 and is on the other side in the height direction of the yarn paths in the interlacing device 8. (Hereinafter, this position may be referred to as a regulation cancellation position.) When the yarn regulation

bar 24 is at the regulation cancellation position, the yarn regulation bar 24 does not interfere with the yarns Y and does not prevent the yarns Y from entering the yarn running spaces 31.

[0045] As described below, the swing member 25 is provided to introduce the yarns Y into the yarn running spaces 31. The swing member 25 is a long plate-shaped member. The length of the swing member 25 is longer than the interlacing portion 21 in the left-right direction. The swing member 25 is positioned between the interlacing portion 21 and the upstream yarn guides 22 in the yarn running direction. The swing member 25 is swingable about a shaft 44 which is to the left of the interlacing pieces 26 (the upstream yarn guides 22 and the downstream yarn guides 23) and is parallel to the yarn running direction. The swing member 25 is swung about the shaft 44 by a swing member driver 52 (see FIG. 6). When the yarns Y having been spun out are taken up in the spun yarn take-up apparatus 1, as shown in FIG. 2 to FIG. 5, the swing member 25 is postured so that the length thereof is substantially parallel to the height direction, and is at a position out of the yarn paths of the interlacing device 8 (hereinafter, this position may be referred to as a pressing cancellation position). The swing member 25 at the pressing cancellation position does not interfere with the yarns Y running in the interlacing device 8.

[0046] In the present embodiment, as shown in FIG. 6, the controller 50 controls operations of the lever driver 51, the swing member driver 52, and the valve 39 of the interlacing device 8.

(Introduction of Yarns into Interlacing Device)

[0047] Now, a method of performing yarn threading to the spun yarn take-up apparatus 1 will be described. In the spun yarn take-up apparatus 1, after yarn threading to the oil supply guide 11, the heating roller of the drawing unit 5, and the take-up rollers 6 and 7 is performed, yarn threading to the interlacing device 8 (i.e., introduction of the yarn into the yarn running space 31 and yarn threading to the yarn guides 22 and 23) is performed. Subsequently, yarn threading to the fulcrum guides 18b and the bobbins B is performed.

[0048] Before the yarn threading to parts other than the interlacing device 8 in the spun yarn take-up apparatus 1, the controller 50 controls the lever driver 51 to swing the lever 42, with the result that the yarn regulation bar 24 is at a position (hereinafter, this position may be referred to as a regulation position) which is on one side in the height direction of the interlacing portion 21, as shown in FIG. 7 and FIG. 8. Thereafter, the operator performs yarn threading to the parts other than the interlacing device 8 in the spun yarn take-up apparatus 1. In so doing, the operator places the yarns onto the yarn regulation bar 24. On this account, at the time of the yarn threading to the parts other than the interlacing device 8 in the spun yarn take-up apparatus 1, yarn threading of the yarns Y to the interlacing device 8 (i.e., introduction

of the yarn into the yarn running space 31 and yarn threading to the yarn guides 22 and 23) is prohibited by the yarn regulation bar 24.

[0049] After the yarn threading to the parts other than the interlacing device 8 in the spun yarn take-up apparatus 1 is completed, the controller 50 controls the lever driver 51 to swing the lever 42, with the result that the yarn regulation bar 24 returns from the regulation position to the regulation cancellation position, as shown in FIG. 9 and FIG. 10. Thereafter, the controller 50 controls the swing member driver 52 to swing the swing member 25 from the pressing cancellation position to a position (hereinafter, this position may be referred to as a pressing completion position) where the length of the swing member 25 is substantially parallel to the left-right direction. Subsequently, the controller 50 controls the swing member driver 52 to return the swing member 25 from the pressing completion position to the pressing cancellation position.

[0050] When the yarn regulation bar 24 is returned to the regulation cancellation position, the regulation of the yarns Y by the yarn regulation bar 24 is canceled, and the yarns Y are threaded to the upstream yarn guides 22 and the downstream yarn guides 23 on account of the tensions of the yarns Y. At this stage, a part of each yarn Y, which is above the interlacing portion 21, moves on account of the tension T of itself. The tension T is force exerted toward the yarn running space 31. As a result of this movement of the yarns Y, all yarns Y may be introduced into the yarn running spaces 31. However, at least some of the yarns Y may be outside the yarn introduction passages 32 as they are caught on one of the inclined surfaces 26a and 26b, or may be caught in the yarn introduction passages 32.

[0051] Thereafter, when the swing member 25 is moved from the pressing cancellation position to the pressing completion position, the yarns Y are pressed by the swing member 25. In this connection, before reaching the pressing completion position, the swing member 25 makes contact with and presses the yarns Y, while the length of the swing member 25 is inclined relative to the left-right direction. On this account, as shown in FIG. 11(a) to FIG. 11(d), the pressing force E with which the swing member 25 presses the yarn Y includes a component E1 (hereinafter, a component E1 in the height direction) exerted from the one side to the other side in the height direction and a component E2 (hereinafter, a component E2 in the left-right direction) exerted from the left side to the right side.

[0052] Therefore, as shown in FIG. 11(a), when pressed by the swing member 25, the yarn Y outside the yarn introduction passage 32 is inserted into the first yarn passage 36 through the insertion slot 36a, mainly on account of the component E1 in the height direction of the pressing force E. Furthermore, as shown in FIG. 11(b), when pressed by the swing member 25, the yarn Y inside the first yarn passage 36 is moved to the junction between the first yarn passage 36 and the second yarn passage

37, mainly on account of the component E1 in the height direction of the pressing force E.

[0053] Furthermore, as shown in FIG. 11(c), when pressed by the swing member 25, the yarn Y either at the junction between the first yarn passage 36 and the second yarn passage 37 or in the second yarn passage 37 is moved to the junction between the second yarn passage 37 and the third yarn passage 38, on account of the component E2 in the left-right direction of the pressing force E and the tension T.

[0054] Furthermore, as shown in FIG. 11(d), when pressed by the swing member 25, the yarn Y in the third yarn passage 38 and the yarn running space 31 is moved to the junction between the second yarn passage 37 and the third yarn passage 38, mainly on account of the component E1 in the height direction of the pressing force E.

[0055] In this way, when the swing member 25 reaches the pressing completion position, all yarns Y have been moved to the junction between the second yarn passage 37 and the third yarn passage 38 as shown in FIG. 11(d).

[0056] Thereafter, the pressing of the yarns Y by the swing member 25 is canceled as the swing member 25 is returned from the pressing completion position to the pressing cancellation position. As a result, the yarn Y having been moved to the junction between the second yarn passage 37 and the third yarn passage 38 is moved to the one side in the height direction in the third yarn passage 38 on account of the tension T of itself, and is introduced into the yarn running space 31.

(Advantageous Effects)

[0057] As described above, when the regulation by the yarn regulation bar 24 is canceled after yarn threading to parts other than the interlacing device 8 of the spun yarn take-up apparatus 1 is performed, the yarns Y may be introduced into the yarn running spaces 31 on account of their tensions, but some of the yarn Y may not be introduced into the yarn running spaces 31 because, for example, they are not inserted into the yarn introduction passages 32 or caught in the yarn introduction passages 32. For this reason, in the present embodiment, the yarns Y are pressed by the swing member 25 after the cancellation of the regulation by the yarn regulation bar 24, and then the pressing of the yarns Y by the swing member 25 is canceled. This causes all yarns Y to be introduced into the yarn running spaces 31.

[0058] In the present embodiment, the yarn introduction passage 32 includes the first yarn passage 36 extending in the height direction, the second yarn passage 37 connected to the first yarn passage 36 and extending in the left-right direction, and the third yarn passage 38 connected to the second yarn passage 37 and extending in the height direction. On this account, to reach the yarn running space 31, the yarn Y is required to move in the first yarn passage 36 in the height direction and then change the moving direction and move in the second yarn passage 37 in the left-right direction, and further

change the moving direction and move in the third yarn passage 38 in the height direction. The yarn Y is therefore likely to be caught before reaching the yarn running space 31 if the yarn Y is moved solely by the tension of itself.

[0059] In this regard, in the present embodiment, as the yarn Y is pressed by the swing member 25, pressing force E having the component E1 in the height direction and the component E2 in the left-right direction is applied to the yarn Y. With this arrangement, as described above, the yarn Y pressed by the swing member 25 moves in the first yarn passage 36 and in the second yarn passage 37 in order, and reaches the junction between the second yarn passage 37 and the third yarn passage 38. Thereafter, as the pressing of the yarn Y by the swing member 25 is canceled, the yarn Y moves in the third yarn passage 38 and reaches the yarn running space 31, on account of the tension of itself.

[0060] In regard to the above, in the present embodiment, because one swing member 25 exerts the pressing force E having the component E1 in the height direction and the component E2 in the left-right direction to the yarn Y, the structure of the interlacing device 8 is simple as compared to cases where a member which presses the yarn Y in the height direction to insert the yarn Y into the first yarn passage 36 and a moving member which presses the yarn Y in the left-right direction to move the yarn Y in the left-right direction are independently provided.

[0061] In the present embodiment, as the yarn Y is pressed by the swing member 25 which is swung about the shaft 44, the pressing force E having a component E1 in the height direction and a component E2 in the left-right direction can be applied to the yarn Y by a simple structure. In this connection, because the shaft 44 is parallel to the yarn running direction, the length of a space required to swing the swing member 25 is short in the yarn running direction, and hence the interlacing device 8 is downsized in the yarn running direction.

[0062] In addition to the above, when the swing member 25 presses a running yarn Y, a pressed part of the yarn Y is temporarily restricted. On this account, a part downstream of the pressed part of the yarn Y temporarily has increased tension, with the result that the yarn path becomes stable. Meanwhile, a part upstream of the pressed part of the yarn Y temporarily has decreased tension and is slackened, with the result that the yarn path becomes unstable. For this reason, in the present embodiment, the swing member 25 is provided upstream of the interlacing portion 21 in the yarn running direction. With this arrangement, a yarn part with a stable yarn path, which is downstream of a part of the yarn pressed by the swing member 25 in the yarn running direction, is introduced into the interlacing portion 21. The yarn Y is therefore easily introduced into the interlacing portion 21, as compared to cases where the swing member 25 is provided downstream of the interlacing portion 21.

[0063] Being different from the present embodiment, assume that the swing member 25 is provided upstream

of the upstream yarn guides 22 in the yarn running direction. In such a case, because the upstream yarn guides 22 are provided between the swing member 25 and the interlacing portion 21, the movement of a part of the yarn Y running at the interlacing portion 21 may be obstructed by the upstream yarn guide 22 when the yarn Y is pressed by the swing member 25.

[0064] In this regard, in the present embodiment, the swing member 25 is provided between the interlacing portion 21 and the upstream yarn guides 22 in the yarn running direction. On this account, the movement of the yarn Y in the interlacing portion 21 is not obstructed by the upstream yarn guide 22 when the yarn Y is pressed by the swing member 25.

[0065] A preferred embodiment of the present invention has been described. It should be noted that the present invention is not limited to the above-described embodiment, and various changes, substitutions, and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

[0066] While in the embodiment above the upstream yarn guides 22 are provided upstream of the interlacing portion 21 in the yarn running direction and the swing member 25 is provided between the upstream yarn guides 22 and the interlacing portion 21, the disclosure is not limited to this arrangement. For example, when the interlacing device 8 includes only the downstream yarn guides 23 among the upstream yarn guides 22 and the downstream yarn guides 23, the swing member 25 may be provided upstream of the interlacing portion 21 in the yarn running direction.

[0067] While in the embodiment above the swing member 25 is provided upstream of the interlacing portion 21 in the yarn running direction, the disclosure is not limited to this arrangement. For example, the swing member 25 may be provided downstream of the interlacing portion 21 in the yarn running direction. Alternatively, swing members 25 are provided both upstream and downstream of the interlacing portion 21 in the yarn running direction.

[0068] When the swing member 25 is provided downstream of the interlacing portion 21 in the yarn running direction, if the interlacing device 8 includes a plurality of downstream yarn guides 23 as in the embodiment above, the swing member 25 may be provided between the interlacing portion 21 and the downstream yarn guides 23 in the yarn running direction. With this arrangement, the movement of the yarn Y in the interlacing portion 21 is not obstructed by the downstream yarn guide 23 when the yarn Y is pressed by the swing member 25.

[0069] While in the embodiment above the swing member 25 is swingable about the shaft 44 which is parallel to the yarn running direction, the disclosure is not limited to this arrangement. The swing member 25 may be swingable about a shaft which is slightly inclined relative to the yarn running direction.

[0070] While in the embodiment above the yarn Y is

pressed by the swingable swing member 25, the disclosure is not limited to this arrangement. For example, the yarn Y may be pressed by a member (the common member of the present invention) which moves in a parallel manner in a direction orthogonal to the yarn running direction and intersecting with the height direction and the left-right direction. Also in this case, pressing force having a component in the height direction and a component in the left-right direction can be applied to the yarn Y.

[0071] While, in the embodiment above, force having a component in the height direction and a component in the left-right direction is applied to the yarn Y by one swing member 25, the disclosure is not limited to this arrangement. For example, in the embodiment above, an insertion member which presses the yarn Y in the height direction to insert the yarn Y into the first yarn passage 36 through the insertion slot 36a and a movement member which presses, in the left-right direction, the yarn Y inserted into the first yarn passage 36 to move the yarn Y in the left-right direction along the second yarn passage 37 may be independently provided instead of the swing member. The insertion member is, for example, a long member which extends parallel to the left-right direction and over the interlacing pieces 26, and moves in a parallel manner in the height direction. The movement member may be a comb-teeth member, for example. Alternatively, at least one set of the yarn guides 22 and 23 may be arranged to be movable in the left-right direction as a movement member.

[0072] In addition to the above, the yarn Y may not be pressed by force having a component in the height direction and a component in the left-right direction. For example, a movement member for moving the yarn Y in the left-right direction may not be provided when an insertion member pressing the yarn Y in the height direction to insert the same into the first yarn passage is provided. In this case, a yarn Y which is not inserted into the first yarn passage and a yarn Y caught in the first yarn passage are pressed by the insertion member and moved to the junction between the first yarn passage and the second yarn passage. With this arrangement, thereafter, movement of the yarn Y along the second yarn passage on account of its tension is facilitated. The yarn Y is therefore likely to be introduced into the yarn running space 31 as compared to cases where no insertion member is provided.

[0073] While in the embodiment above the second yarn passage 37 extends to be parallel to the left-right direction orthogonal to the height direction in which the first yarn passage 36 extends, the disclosure is not limited to this arrangement. The second yarn passage 37 may extend in a direction which is orthogonal to the running direction in the interlacing device 8 and is inclined relative to the left-right direction.

[0074] While in the embodiment above the yarn introduction passage 32 through which the yarn is introduced into the yarn running space 31 includes the first yarn passage 36, the second yarn passage 37, and the third yarn

passage 38, the disclosure is not limited to this arrangement.

[0075] For example, according to a modification, an interlacing device 101 is formed of interlacing pieces 102 lined up in the left-right direction, as shown in FIG. 12. The interlacing device 101 includes yarn running spaces 103, yarn introduction passages 104, and injection passages 105.

[0076] The yarn running space 103 is substantially elliptical in shape and is long in the height direction when viewed in the yarn running direction. The yarn introduction passage 104 includes a first yarn passage 106 and a second yarn passage 107. The first yarn passage 106 is a gap between two neighboring interlacing pieces 102. The first yarn passage 106 extends in the height direction, and one end in the height direction of the first yarn passage 106 is an insertion slot 106a from which the yarn Y is inserted. The second yarn passage 107 is connected to the other end of the first yarn passage 106 in the height direction, extends rightward from the junction with the first yarn passage 106, and is connected to the yarn running space 103 at the right end.

[0077] The injection passage 105 is formed in each interlacing piece 102 and extends in the height direction. At an upper end portion of the injection passage 105, an injection port 105a is formed to open in the left inner wall surface of the first yarn passage 106. With this arrangement, the injection port 105a of each interlacing piece 102 opposes, in the left-right direction, the yarn running space 103 of the interlacing piece 102 which is directly to the right of the each interlacing piece 102. The injection passage 105 is connected to a fluid supply source 109 via a fluid supply path 108. A valve 110 is provided on the fluid supply path 108. When the valve 110 is opened, fluid such as air supplied from the fluid supply source 109 is injected into the yarn running space 103 from the injection port 105a. As a result, a swirling flow is generated in the yarn running space 103, and the yarn Y is interlaced.

[0078] In this interlacing device 101, as the controller 50 controls the swing member driver 52 to swing the swing member 25 from the pressing cancellation position to the pressing completion position, pressing force including a component in the height direction and a component in the left-right direction is exerted to the yarn Y. Therefore, when pressed by the swing member 25, the yarn Y outside the yarn introduction passage 104 is inserted into the first yarn passage 106 through the insertion slot 106a, mainly on account of the component in the height direction of the pressing force. Furthermore, when pressed by the swing member 25, the yarn Y inside the first yarn passage 106 is moved in the first yarn passage 106 and reaches the junction with the second yarn passage 107, mainly on account of the component in the height direction of the pressing force. Furthermore, when pressed by the swing member 25, the yarn Y inside the second yarn passage 107 is moved in the second yarn passage 107 and reaches the yarn running space 103,

mainly on account of the component in the left-right direction of the pressing force.

[0079] Alternatively, the yarn introduction passage may include only the first yarn passage, and the first yarn passage may be directly connected to the yarn running space. In this case, as the yarn Y is pressed in the height direction, the yarn Y is introduced into the yarn running space via the first yarn passage. In this case, a movement member for moving the yarn Y in the left-right direction is unnecessary, when an insertion member pressing the yarn Y in the height direction to insert the same into the first yarn passage is provided.

Claims

1. An interlacing device comprising:

an interlacing portion configured to interlace a yarn; and
a yarn introduction device configured to introduce the yarn into the interlacing portion, the interlacing portion including:

a yarn running space in which the yarn runs;
an injection unit configured to inject air into the yarn running space; and
a yarn introduction passage through which the yarn is introduced into the yarn running space,
the yarn introduction passage including
a first yarn passage which extends in a first direction orthogonal to a yarn running direction in the yarn running space and has a yarn insertion slot at an end on one side in the first direction, and
the yarn introduction device including

an insertion member which presses the yarn from the one side toward the other side in the first direction to insert the yarn into the first yarn passage through the insertion slot.

2. The interlacing device according to claim 1, wherein, the yarn introduction passage further includes a second yarn passage which is connected to an end of the first yarn passage on the other side in the first direction and extends along a second direction which is orthogonal to the yarn running direction and intersects with the first direction, and
the yarn introduction device further includes a movement member which presses, in the second direction, the yarn inserted in the first yarn passage to move the yarn along the second yarn passage.

3. The interlacing device according to claim 2, wherein, the yarn introduction device includes a common member which functions as both the in-

sertion member and the movement member and is configured to press the yarn by exerting force including a component in the first direction and a component in the second direction to the yarn.

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4. The interlacing device according to claim 3, wherein, the common member is a swing member which is swung to press the yarn.
5. The interlacing device according to claim 4, wherein, the swing member is swung about a shaft which is parallel to the yarn running direction. 10
6. The interlacing device according to any one of claims 2 to 5, wherein, the yarn introduction passage further includes a third yarn passage which is connected to an end of the second yarn passage opposite to the first yarn passage, and extends toward the one side in the first direction from a junction with the second yarn passage. 15 20
7. The interlacing device according to any one of claims 1 to 6, wherein, the yarn introduction device is provided upstream of at least the interlacing portion in the yarn running direction. 25
8. The interlacing device according to claim 7, further comprising a yarn guide which is provided upstream of the interlacing portion in the yarn running direction, the yarn introduction device being provided at least between the interlacing portion and the yarn guide in the yarn running direction. 30 35

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FIG.1

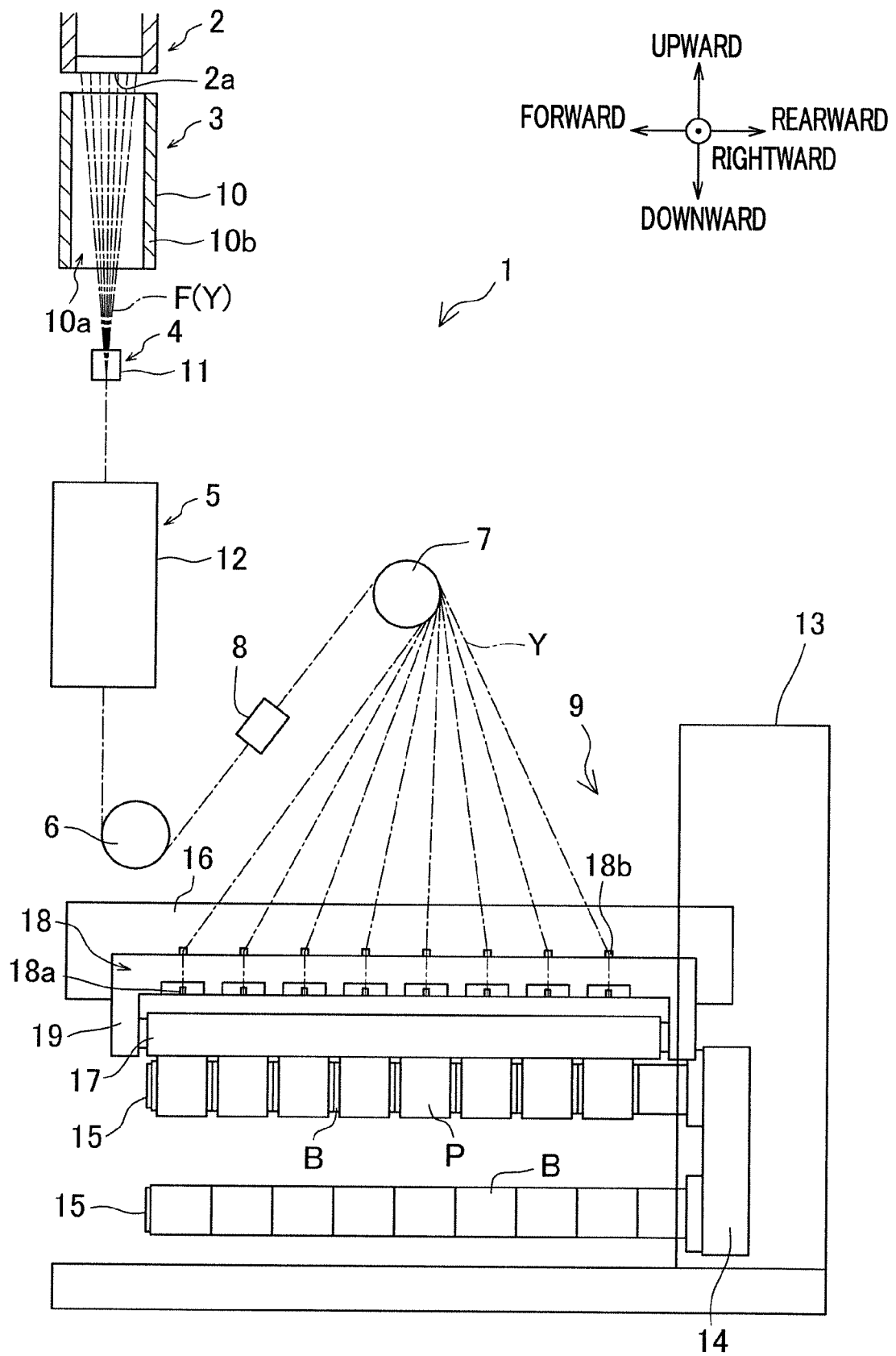


FIG.2

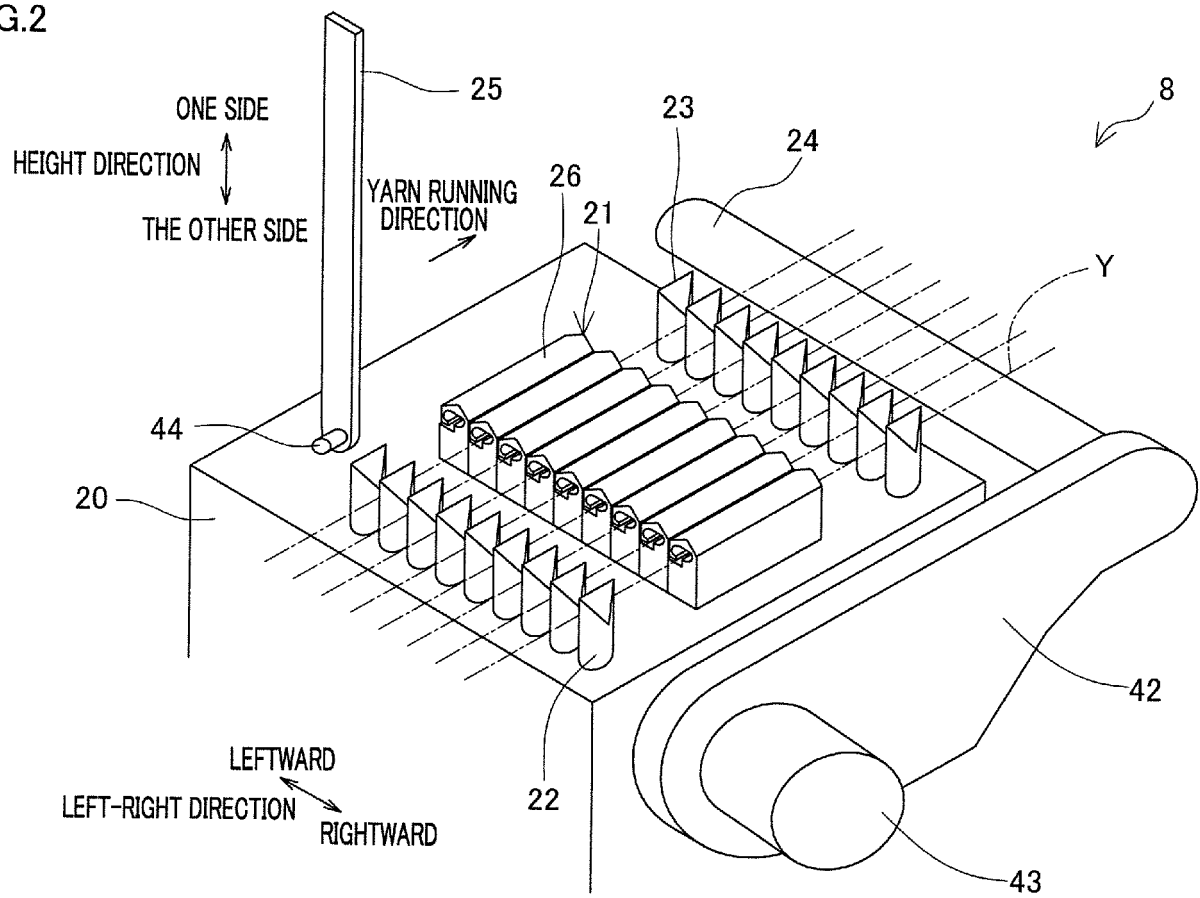


FIG.3

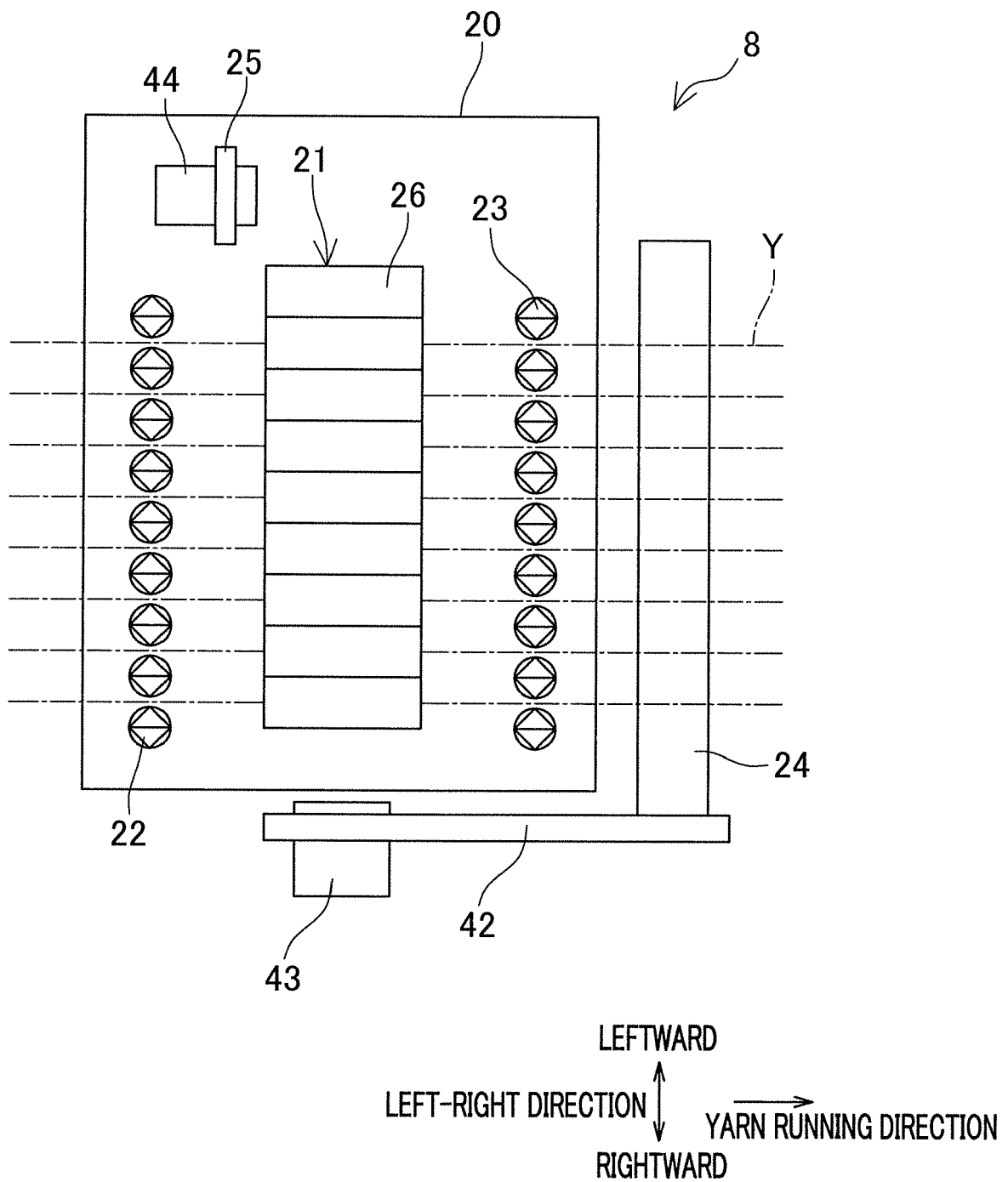


FIG.4

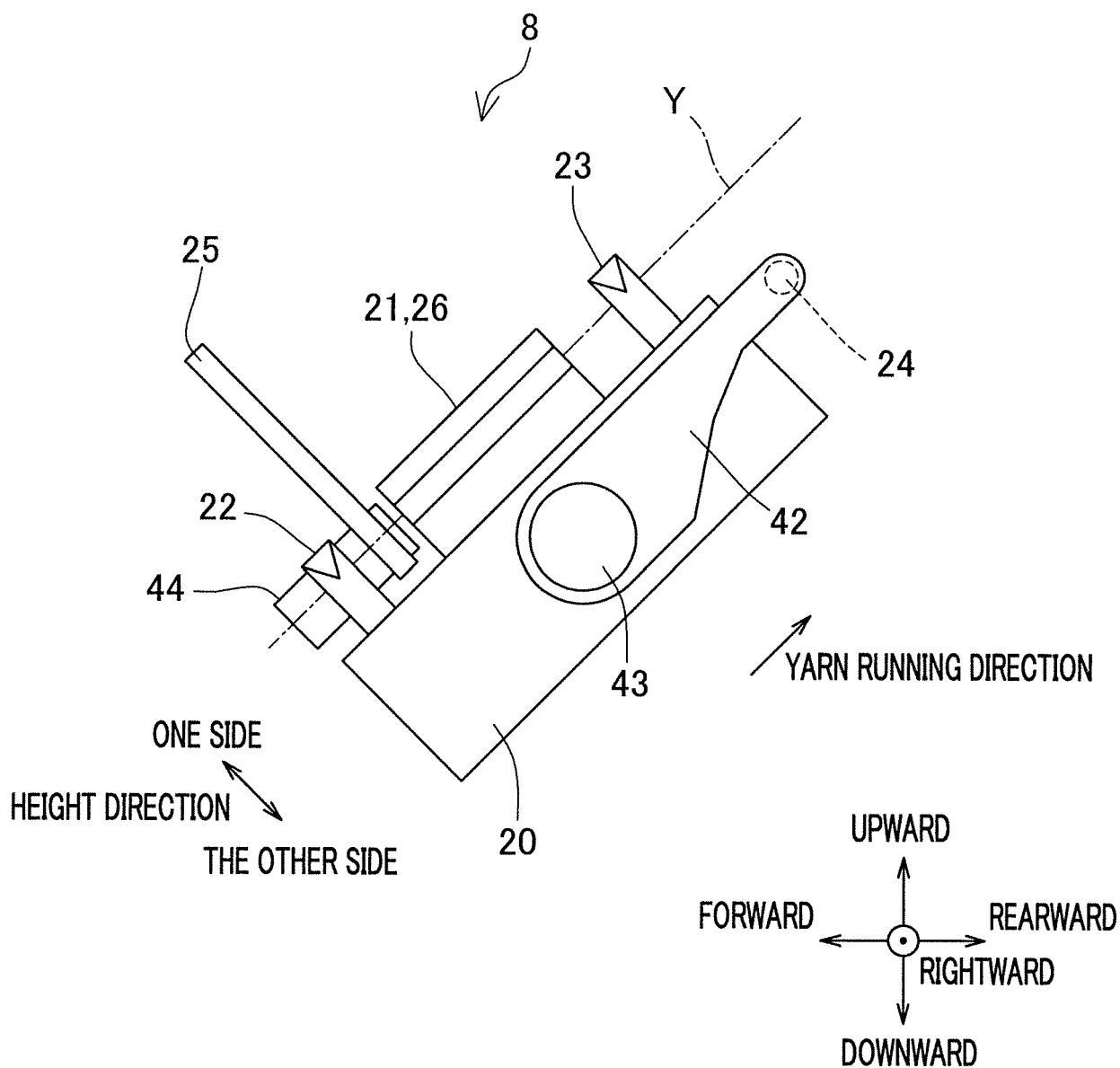


FIG.5

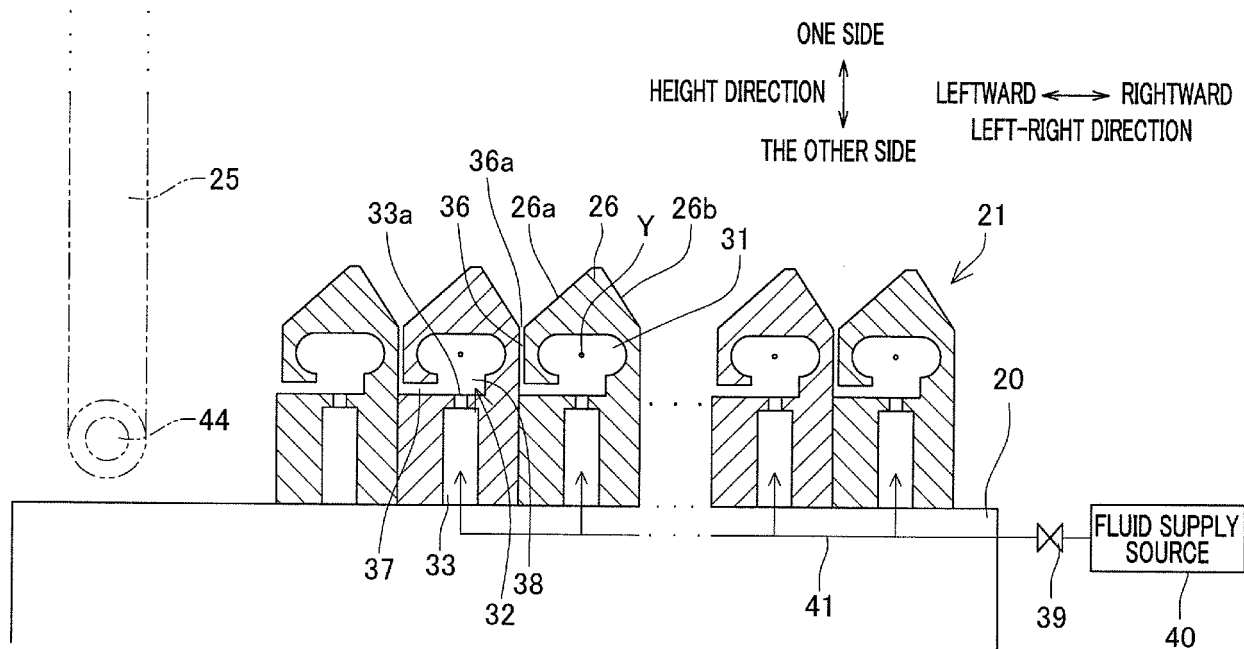


FIG.6

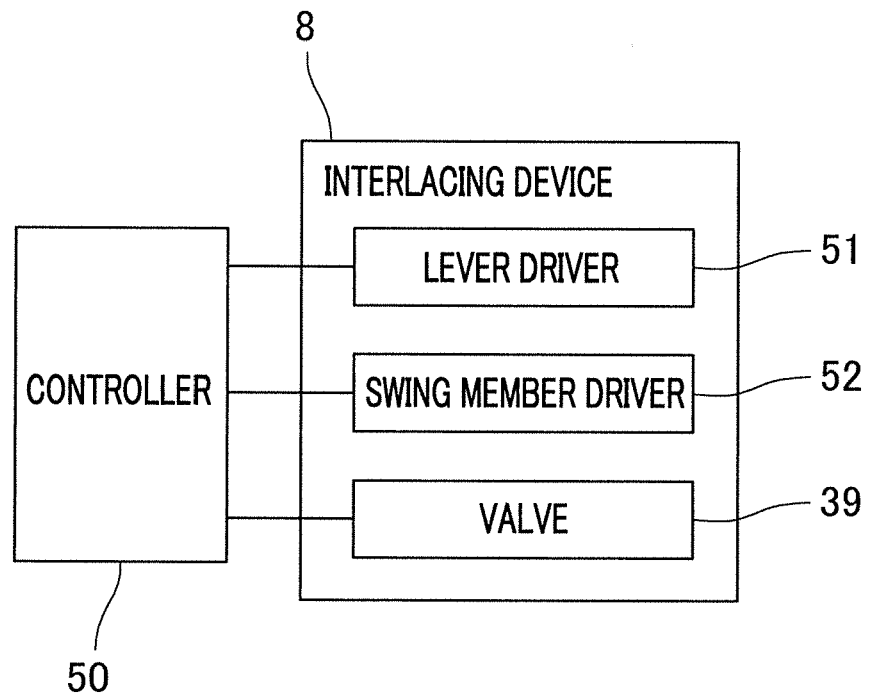


FIG.7

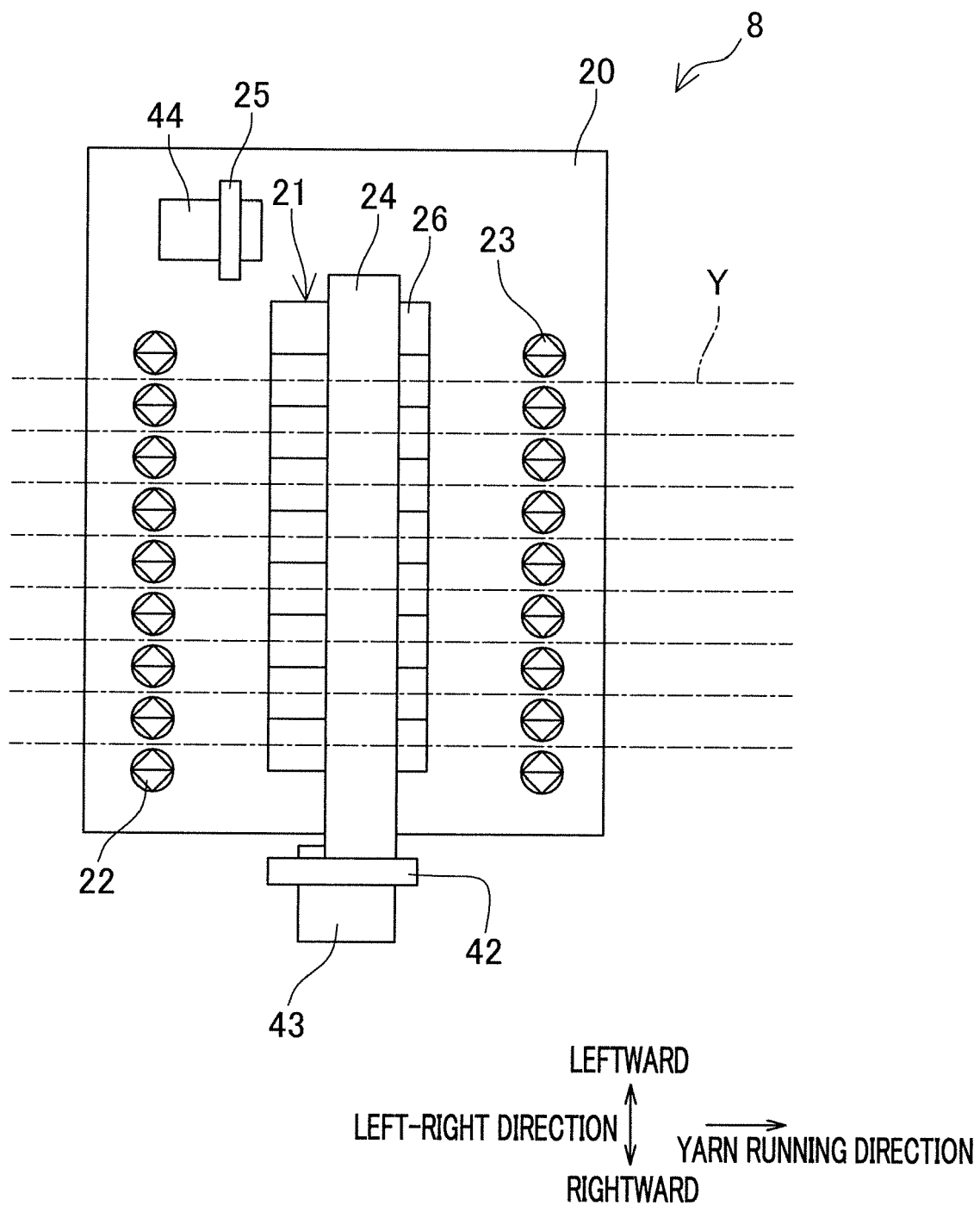


FIG.8

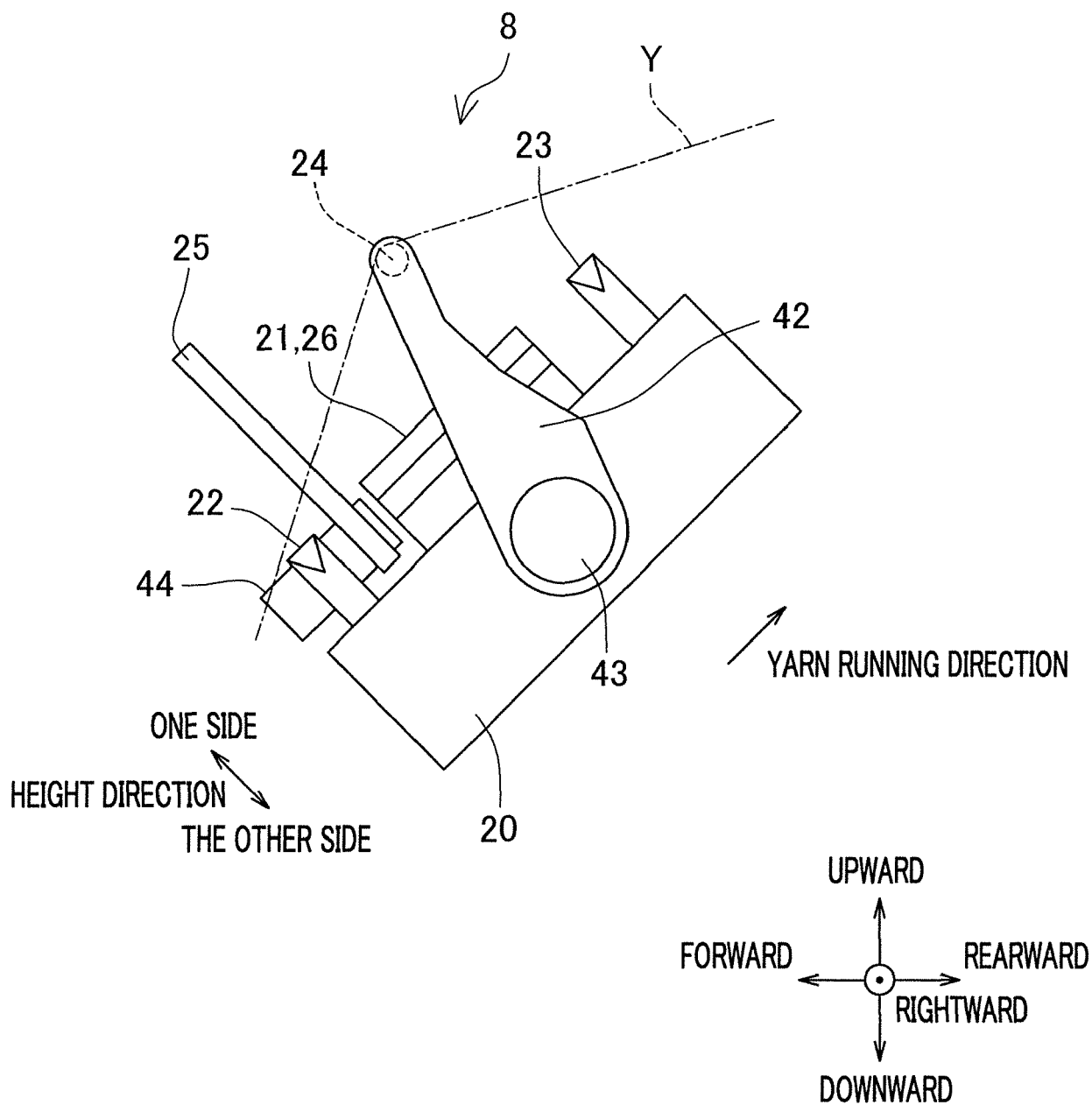


FIG.9

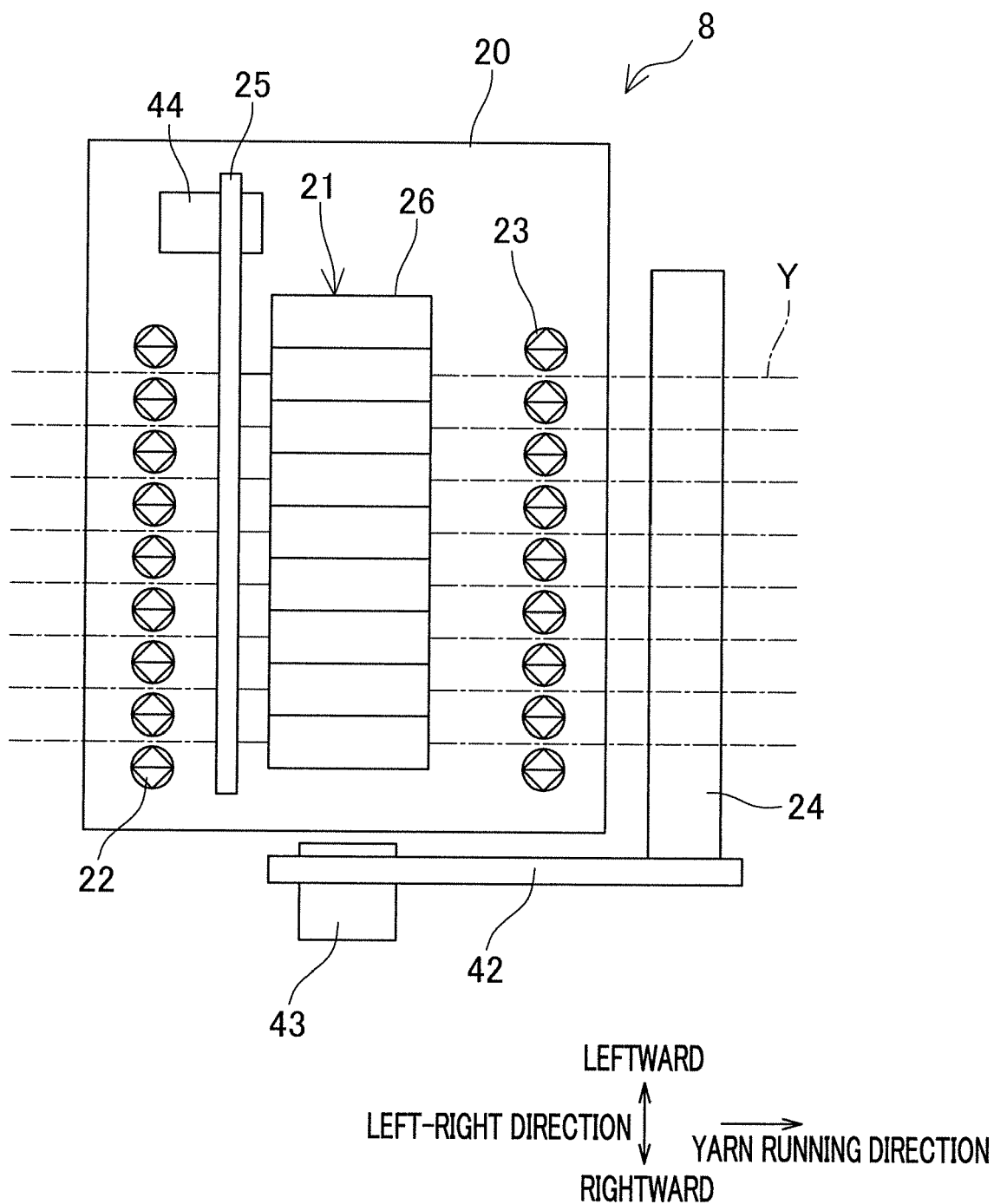


FIG.10

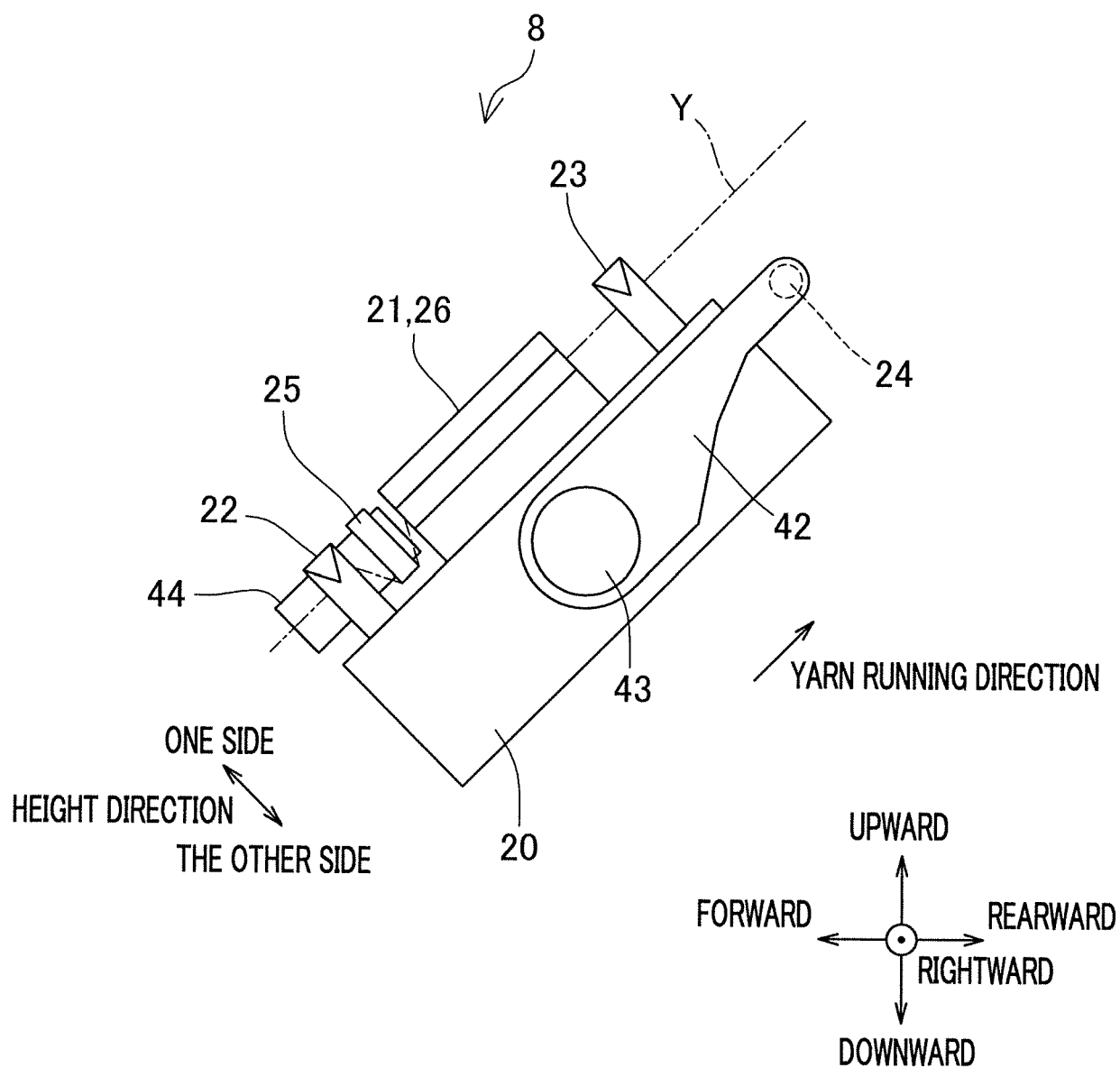


FIG.11

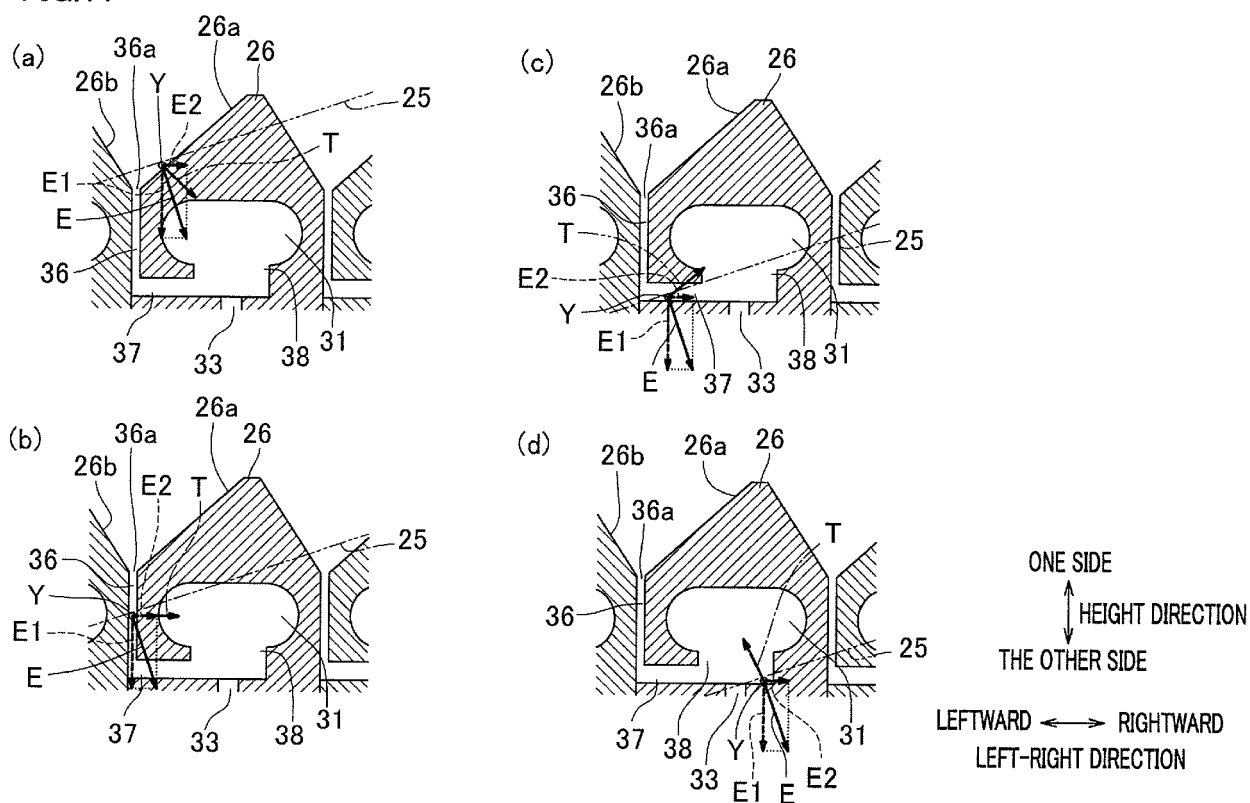
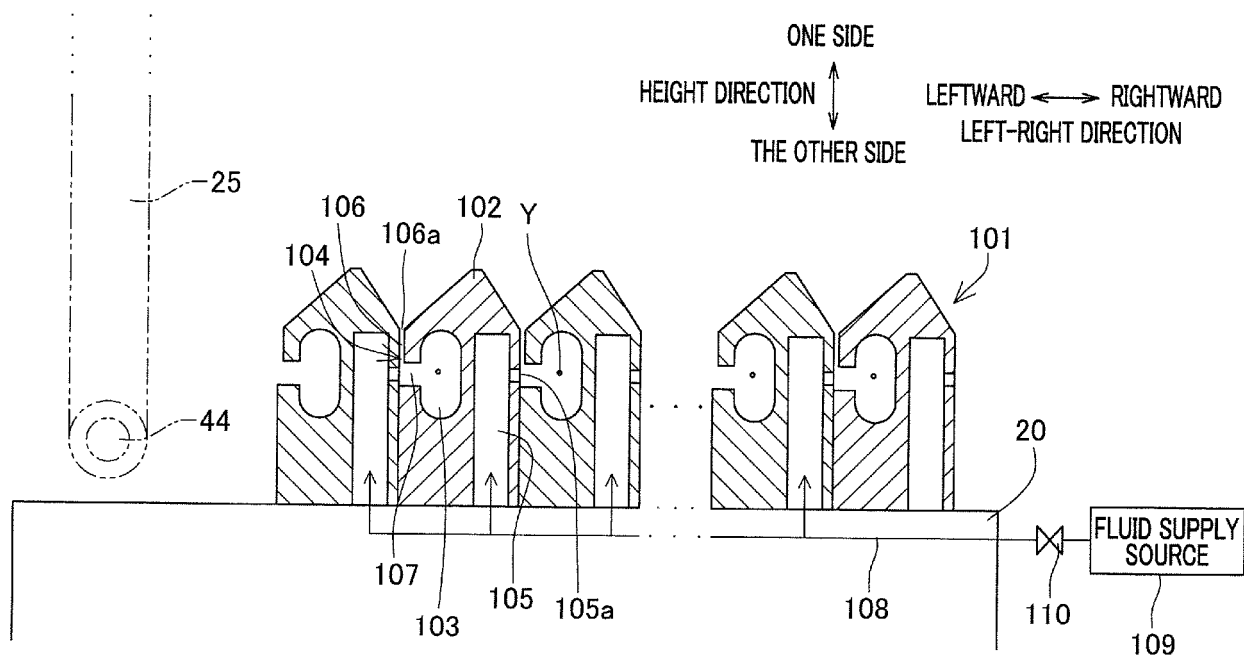


FIG.12





EUROPEAN SEARCH REPORT

Application Number
EP 18 20 3674

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Place of search The Hague		Date of completion of the search 1 April 2019	Examiner Van Beurden-Hopkins
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