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(54) **YARN JOINING DEVICE AND SPINNING MACHINE**

GARNVERBINDUNGSVORRICHTUNG UND SPINNMASCHINE

DISPOSITIF DE RATTACHEMENT DE FIL ET MACHINE À FILER

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a yarn joining device and a spinning machine.

BACKGROUND

[0002] For example, textile machinery such as a spinning machine and an automatic winder may be provided with a yarn joining device. The yarn joining device may include an untwisting pipe that has an inlet and an air injection hole, and in the untwisting pipe, a yarn end made in yarn by cutting of the yarn may be caught through the inlet by the action of air injected from the air injection hole and consequently be untwisted therein (see Japanese Unexamined Patent Publication No. 2014-234309, for example).

[0003] In such a yarn joining device, in order to easily catch a yarn end through an inlet, an air injection portion that can inject air from outside of an untwisting pipe toward the inlet of the untwisting pipe may be provided to the yarn joining device in a fixed manner (see Japanese Examined Patent Publication No. H3-47330).

SUMMARY

[0004] However, when the stiffness of yarn is high, it is difficult to catch the yarn end through the inlet only by the action of air injected from the air injection hole formed inside the untwisting pipe, and consequently variations may occur in the untwisted state of the yarn end. Even when an air injection portion that can inject air from outside of the untwisting pipe toward the inlet of the untwisting pipe is provided to the yarn joining device in a fixed manner, because the fixed position and the fixed angle, for example, of the air injection portion are limited such that drawing of yarn guided to the yarn joining device is not obstructed, high stiffness of the yarn makes it difficult for a yarn end to be caught through the inlet, and consequently variations may occur in the untwisted state of the yarn end. When variations occur in the untwisted state of the yarn end, holding force at a spliced point between yarn ends may decrease, or appearance of the spliced point between yarn ends may deteriorate.

[0005] In view of this, it is an object of the present disclosure to provide a yarn joining device and a spinning machine that can stably perform yarn joining even when the stiffness of yarn is high.

[0006] A yarn joining device according to the present disclosure includes: a holding portion that holds each of first yarn and second yarn; a cutting portion that cuts each of the first yarn and the second yarn held by the holding portion; a first untwisting pipe that has a first yarn-end inlet and a first air injection hole, and catches, through the first yarn-end inlet, a first yarn end made in the first yarn by cutting by the cutting portion and untwists the first yarn end in the first untwisting pipe by action of air injected from the first air injection hole; a second untwisting pipe that has a second yarn-end inlet and a second air injection hole, and catches, through the second yarn-end inlet, a second yarn end made in the second yarn by cutting by the cutting portion and untwists the second yarn end in the second untwisting pipe by action of air injected from the second air injection hole; an air injection portion that is capable of injecting air from outside of the first untwisting pipe and the second untwisting pipe toward the first yarn-end inlet and the second yarn-end inlet; a yarn joining portion that twists the first yarn end untwisted by the first untwisting pipe and the second yarn end untwisted by the second untwisting pipe; and a movable lever that is capable of advancing and retreating with respect to the first yarn-end inlet and the second yarn-end inlet. The air injection portion is provided to the movable lever.

[0007] In this yarn joining device, the air injection portion can inject air from outside of the first untwisting pipe and the second untwisting pipe toward the first yarn-end inlet and the second yarn-end inlet. In particular, because the air injection portion is provided to the movable lever, the air injection portion can be caused to inject air at a position and an angle that are appropriate for the first yarn-end inlet and the second yarn-end inlet. Thus, even when the stiffness of yarn is high, by causing the air injection portion to inject air, the first yarn end can be quickly brought into the first untwisting pipe through the first yarn-end inlet, and also the second yarn end can be quickly brought into the second untwisting pipe through the second yarn-end inlet. Consequently, variations can be prevented from occurring in the state of the first yarn end untwisted by the action of air injected from the first air injection hole and in the state of the second yarn end untwisted by the action of air injected from the second air injection hole. Thus, with this yarn joining device, even when the stiffness of yarn is high, yarn joining can be stably performed.

[0008] In the yarn joining device according to the present disclosure, the air injection portion may be positioned in front of the first yarn-end inlet and the second yarn-end inlet midway while the movable lever is advancing or retreating with respect to the first yarn-end inlet and the second yarn-end inlet. By this configuration, the air injection portion can be caused to inject air at a position and an angle that are more appropriate for the first yarn-end inlet and the second yarn-end inlet.

[0009] In the yarn joining device according to the present disclosure, the air injection portion may start injection of air before each of the first yarn and the second yarn is cut by the cutting portion, and may end the injection of air after each of the first yarn and the second yarn has been cut by the cutting portion. By this setting, the first yarn end can be reliably brought into the first untwisting pipe through the first yarn-end inlet, and also the second yarn end can be reliably brought into the second untwisting pipe through the second yarn-end inlet.

[0010] In the yarn joining device according to the present disclosure, the first air injection hole may start injection of air simultaneously when injection of air by the air injection portion ends or after the injection has ended, and the second air injection hole may start injection of air simultaneously when the injection of air by the air injection portion ends or after the injection has ended. By this setting, due to the effect of air injected from the air injection portion, variations in the untwisted state of the first yarn end and the untwisted state of the second yarn end can be prevented from occurring.

[0011] A spinning machine according to the present disclosure includes: the yarn joining device described above; a drafting device that drafts a fiber bundle; an air spinning device that twists the fiber bundle drafted by the drafting device to generate yarn; and a winding device that winds the yarn generated by the air spinning device to form a package.

[0012] With this spinning machine, because the yarn joining device described above is provided thereto, yarn joining can be stably performed even when the stiffness of yarn is high.

[0013] In the spinning machine according to the present disclosure, the air spinning device may include: a nozzle portion that generates swirling airflow in a spinning chamber; a guiding portion that guides the fiber bundle drafted by the drafting device into the spinning chamber; and a hollow guide shaft member that guides the yarn generated by twisting the fiber bundle by action of the swirling airflow in the spinning chamber to outside of the spinning chamber. Although yarn generated by this air spinning device tends to have a high stiffness, because the yarn joining device described above is provided, yarn joining can be stably performed.

[0014] According to the present disclosure, a yarn joining device and a spinning machine that can stably perform yarn joining even when the stiffness of yarn is high can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a front view of a spinning machine according to one embodiment;

FIG. 2 is a sectional view of an air spinning device in FIG. 1;

FIG. 3 is a perspective view of a yarn joining device in FIG. 1;

FIG. 4 is a sectional view of the yarn joining device in FIG. 3;

FIG. 5 is a sectional view of the yarn joining device in FIG. 3;

FIG. 6 is a sectional view of the yarn joining device in FIG. 3;

FIG. 7 is a sectional view of the yarn joining device in FIG. 3;

FIG. 8 is a timing chart for introduction assist air and untwisting air; and

FIG. 9 is a sectional view of a yarn joining device of a reference example.

DETAILED DESCRIPTION

[0016] An embodiment of the present disclosure will now be described in detail with reference to the drawings. In the drawings, like or equivalent elements are denoted by like numerals, and duplicate description is omitted.

[0017] As depicted in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining carrier 3, a doffing carrier (not depicted), a first end frame 4, and a second end frame 5. The spinning units 2 are aligned in a row. Each spinning unit 2 generates yarn Y to wind the yarn into a package P. When yarn Y has been cut or the yarn Y has broken for some reason in a certain spinning unit 2, the yarn joining carrier 3 performs yarn joining operation in the spinning unit 2. When a package P has been fully wound in a certain spinning unit 2, the doffing carrier doffs the package P, and supplies a new bobbin B to the spinning unit 2.

[0018] The first end frame 4 accommodates, for example, a collection device that collects fiber waste, yarn waste, and the like generated in the spinning units 2. The second end frame 5 accommodates, for example, an air supply unit that adjusts air pressure of compressed air (air) supplied to the spinning machine 1 and supply the air to the respective units in the spinning machine 1 and a driving motor that supplies power to the respective units in the spinning units 2. The second end frame 5 includes a machine control device 5a, a display screen 5b, and input keys 5c. The machine control device 5a intensively manages and controls the respective units of the spinning machine 1. The display screen 5b can display, for example, information on settings of the spinning units 2 and information on the states of the spinning units 2. An operator can make the settings of the spinning units 2 by performing appropriate operations with the input keys 5c.

[0019] Each spinning unit 2 includes, in the order from the upstream side in a direction in which yarn Y travels, a drafting device 6, an air spinning device 7, a yarn monitoring device 8, a tension sensor 9, a yarn pooling device 11, a waxing device 12, and a winding device 13. A unit controller 10 is provided for every predetermined number of spinning units 2, and controls operation of the spinning units 2.

[0020] The drafting device 6 drafts a sliver (fiber bundle) S. The air spinning device 7 generates yarn Y by twisting a fiber bundle F drafted by the drafting device 6 using swirling airflow. The yarn pooling device 11 eliminates slack in the yarn Y between the air spinning device 7 and the winding device 13. The waxing device 12 applies wax to the yarn Y between the yarn pooling device 11 and the winding device 13. The winding device 13 winds the yarn Y onto a bobbin B to form a package P.

[0021] The yarn monitoring device 8 monitors information on traveling yarn Y between the air spinning device

7 and the yarn pooling device 11 to detect the presence or absence of a yarn defect on the basis of the monitored information. When having detected a yarn defect, the yarn monitoring device 8 transmits a yarn defect detection signal to the unit controller 10. The tension sensor 9 measures the tension of travelling yarn Y between the air spinning device 7 and the yarn pooling device 11, and transmits a tension measurement signal to the unit controller 10. When the unit controller 10 determines that abnormality has occurred based on at least one of a result of detection by the yarn monitoring device 8 and a result of detection by the tension sensor 9, the yarn Y is cut in the spinning unit 2.

[0022] The following describes the air spinning device 7 in more detail. As depicted in FIG. 2, the air spinning device 7 includes a nozzle portion 71, a guiding portion 72, and a hollow guide shaft member 73. In the nozzle portion 71, a plurality of air injection holes 71b are formed so as to be open to the inside of a spinning chamber 71a. The nozzle portion 71 injects air from the air injection holes 71b into the spinning chamber 71a, thereby generating swirling airflow in the spinning chamber 71a. The guiding portion 72 guides, through an insertion hole 72a, a fiber bundle F (fiber bundle F supplied from a roller pair 61 disposed most downstream among a plurality of roller pairs that the drafting device 6 has) drafted by the drafting device 6 into the spinning chamber 71a. The guiding portion 72 is provided with a needle 72b that prevents twisting of the fiber bundle F from being transmitted to the upstream side of the air spinning device 7. The hollow guide shaft member 73 guides the yarn Y generated by twisting the fiber bundle F by the action of the swirling airflow in the spinning chamber 71a to the outside of the spinning chamber 71a through the insertion hole 73a. Herein, the needle 72b may be omitted for configuration reasons.

[0023] The following describes the yarn joining carrier 3 in more detail. As depicted in FIG. 1, the yarn joining carrier 3 includes a yarn joining device 31, a suction pipe (first yarn catching portion) 32, and a suction mouth (second yarn catching portion) 33. The suction pipe 32 is rotatably supported, and guides yarn Y supplied from the air spinning device 7 to the yarn joining device 31. The suction mouth 33 is rotatably supported, and catches yarn Y wound around the package P to guide the yarn to the yarn joining device 31. The yarn joining device 31 performs yarn joining of joining a yarn end of the yarn Y guided by the suction pipe 32 and a yarn end of the yarn Y guided by the suction mouth 33.

[0024] The following describes the yarn joining device 31 in more detail. In the following description, for convenience, the air spinning device 7 side and the winding device 13 side are respectively called the upper side and the lower side. The side of a path of traveling yarn Y with respect to the yarn joining device 31 is called the front side, and the side opposite thereto is called the rear side.

[0025] As depicted in FIG. 3 and FIG. 4, the yarn joining device 31 includes: a first untwisting portion 40A and a second untwisting portion 40B; a yarn joining portion 50 disposed on the front side of the first untwisting portion 40A and the second untwisting portion 40B; a pair of yarn shifting levers 81 that can turn so as to sandwich the first untwisting portion 40A and the second untwisting portion 40B; a pair of twist stopping levers (movable levers) 82 that can turn so as to sandwich the yarn joining portion 50; and a pair of air injection portions 91 and 92 provided to the pair of twist stopping levers 82.

[0026] On the upper side and the lower side of the first untwisting portion 40A and the second untwisting portion 40B, a first guide plate 21 and a second guide plate 22 are respectively disposed so as to be opposed to each other with the yarn joining portion 50 interposed therebetween. On the first guide plate 21, a guide groove 21a and a guide groove 21b are formed, and on the second guide plate 22, a guide groove 22a and a guide groove 22b are formed. The guide groove 21a of the first guide plate 21 is vertically opposed to the guide groove 22a of the second guide plate 22, and the guide groove 21b of the first guide plate 21 is vertically opposed to the guide groove 22b of the second guide plate 22.

[0027] Into the guide groove 21a and the guide groove 22a that are vertically opposed to each other, upper yarn (first yarn) Y1 (i.e., yarn Y guided by the suction pipe 32) drawn by the yarn shifting levers 81 is introduced. Meanwhile, into the guide groove 21b and the guide groove 22b that are vertically opposed to each other, lower yarn (second yarn) Y2 (i.e., yarn Y guided by the suction mouth 33) drawn by the yarn shifting levers 81 is introduced.

[0028] On the upper side of the first guide plate 21, a first clamp (holding portion) 60A is provided, and on the upper side of the second guide plate 22, a first cutter (cutting portion) 70A is provided. The first clamp 60A holds the upper yarn Y1 introduced into the guide groove 21a. With the upper yarn Y1 being held by the first clamp 60A, the first cutter 70A cuts the upper yarn Y1 introduced into the guide groove 22a. In other words, the first cutter 70A cuts the upper yarn Y1 held by the first clamp 60A.

[0029] On the lower side of the second guide plate 22, a second clamp (holding portion) 60B is provided, and on the lower side of the first guide plate 21, a second cutter (cutting portion) 70B is provided. The second clamp 60B holds the lower yarn Y2 introduced into the guide groove 22b. With the lower yarn Y2 being held by the second clamp 60B, the second cutter 70B cuts the lower yarn Y2 introduced into the guide groove 21b. In other words, the second cutter 70B cuts the lower yarn Y2 held by the second clamp 60B.

[0030] With the upper yarn Y1 being held by the first clamp 60A, the first untwisting portion 40A catches and untwists a first yarn end Y1a that has been made in the upper yarn Y1 by cutting by the first cutter 70A. With the lower yarn Y2 being held by the second clamp 60B, the second untwisting portion 40B catches and untwists a second yarn end Y2a that has been made in the lower yarn Y2 by cutting by the second cutter 70B.

[0031] More specifically, the first untwisting portion

40A has a first untwisting pipe 41 that is open to the front side and the rear side. The opening of the first untwisting pipe 41 on the front side is a first yarn-end inlet 41a, and the opening of the first untwisting pipe 41 on the rear side is a first air outlet 41b. In the first untwisting pipe 41, a first air injection hole 42 is formed. The first untwisting pipe 41 catches the first yarn end Y1a through the first yarn-end inlet 41a, and untwists therein the first yarn end Y1a by the action of air injected from the first air injection hole 42.

[0032] The second untwisting portion 40B has a second untwisting pipe 43 that is open to the front side and the rear side. The opening of the second untwisting pipe 43 on the front side is a second yarn-end inlet 43a, and the opening of the second untwisting pipe 43 on the rear side is a second air outlet 43b. In the second untwisting pipe 43, a second air injection hole 44 is formed. The second untwisting pipe 43 catches the second yarn end Y2a through the second yarn-end inlet 43a, and untwists therein the second yarn end Y2a by the action of air injected from the second air injection hole 44.

[0033] The yarn joining portion 50 has a yarn joining nozzle 51. The yarn joining nozzle 51 includes an accommodating portion 52 and a guide inclined portion 53. The guide inclined portion 53 guides the upper yarn Y1 and the lower yarn Y2 drawn by the yarn shifting levers 81 to the accommodating portion 52. In the accommodating portion 52, an air injection hole 54 is formed. By the action of air injected from the air injection hole 54, the accommodating portion 52 twists the first yarn end Y1a untwisted by the first untwisting pipe 41 and the second yarn end Y2a untwisted by the second untwisting pipe 43. When the first yarn end Y1a and the second yarn end Y2a are twisted in the yarn joining portion 50, with the upper yarn Y1 being held by the first clamp 60A and with the lower yarn Y2 being held by the second clamp 60B, the first yarn end Y1a and the second yarn end Y2a are respectively drawn from the first untwisting pipe 41 and the second untwisting pipe 43 by the yarn shifting levers 81, and the first yarn end Y1a and the second yarn end Y2a are pressed near the yarn joining portion 50 by the twist stopping levers 82.

[0034] The air injection portion 91 is attached to the upper surface of the twist stopping lever 82 on the lower side, and the air injection portion 92 is attached to the lower surface of the twist stopping lever 82 on the upper side. In other words, the air injection portions 91 and 92 are provided to the pair of twist stopping levers 82 that can advance and retreat with respect to the first yarn-end inlet 41a of the first untwisting pipe 41 and the second yarn-end inlet 43a of the second untwisting pipe 43. In the air injection portion 91, an air injection hole 91a is formed. When the pair of twist stopping levers 82 have turned toward the first untwisting portion 40A and the second untwisting portion 40B, the air injection hole 91a faces the first yarn-end inlet 41a of the first untwisting pipe 41. In the air injection portion 92, an air injection hole 92a is formed. When the pair of twist stopping levers 82 have turned toward the first untwisting portion 40A and the second untwisting portion 40B, the air injection hole 92a faces the second yarn-end inlet 43a of the second untwisting pipe 43. In other words, the air injection portions 91 and 92 are respectively positioned in front of the first yarn-end inlet 41a and the second yarn-end inlet 43a (e.g., in positions where the air injection hole 91a is arranged on an extended line of the centerline of the first untwisting pipe 41 and the air injection hole 92a is arranged on an extended line of the centerline of the second untwisting pipe 43) midway while the twist stopping levers 82 are advancing or retreating with respect to the first yarn-end inlet 41a and the second yarn-end inlet 43a. The position indicated by the expression "midway while the twist stopping levers 82 are advancing or retreating with respect to the first yarn-end inlet 41a and the second yarn-end inlet 43a" includes a midway location while the twist stopping levers 82 are advancing, a midway location while the twist stopping levers 82 are retreating, and a location where movement of the twist stopping levers 82 changes from advancing to retreating. Thus, when the pair of twist stopping levers 82 have turned toward the first untwisting portion 40A and the second untwisting portion 40B, the air injection portion 91 can inject air from the outside of the first untwisting pipe 41 toward the first yarn-end inlet 41a, and the air injection portion 92 can inject air from the outside of the second untwisting pipe 43 toward the second yarn-end inlet 43a.

[0035] The following describes operation of the yarn joining device 31 configured as described above. As depicted in FIG. 5, the pair of yarn shifting levers 81 and the pair of twist stopping levers 82 turn toward the first untwisting portion 40A and the second untwisting portion 40B. By this turning, the upper yarn Y1 guided by the suction pipe 32 and the lower yarn Y2 guided by the suction mouth 33 are respectively drawn toward the first untwisting portion 40A and the second untwisting portion 40B. The upper yarn Y1 is introduced into the guide groove 21a of the first guide plate 21, the guide groove 22a of the second guide plate 22, and the accommodating portion 52 of the yarn joining portion 50. The lower yarn Y2 is introduced into the guide groove 21b of the first guide plate 21, the guide groove 22b of the second guide plate 22, and the accommodating portion 52 of the yarn joining portion 50. Subsequently, the upper yarn Y1 is held near the guide groove 21a by the first clamp 60A, and the lower yarn Y2 is held near the guide groove 22b by the second clamp 60B.

[0036] Subsequently, as depicted in FIG. 6, the air injection portion 91 starts injection of air toward the first yarn-end inlet 41a of the first untwisting pipe 41, and the air injection portion 92 starts injection of air toward the second yarn-end inlet 43a of the second untwisting pipe 43. Subsequently, while being held by the first clamp 60A, the upper yarn Y1 is cut near the guide groove 22a by the first cutter 70A. While being held by the second clamp 60B, the lower yarn Y2 is cut near the guide groove 21b by the second cutter 70B. At this time, because the in-

jections of air by the air injection portions 91 and 92 continue, the first yarn end Y1a is brought into the first untwisting pipe 41 through the first yarn-end inlet 41a, and the second yarn end Y2a is brought into the second untwisting pipe 43 through the second yarn-end inlet 43a.

[0037] Subsequently, the injections of air by the air injection portions 91 and 92 are ended, the first air injection hole 42 starts injection of air in the first untwisting portion 40A, and the second air injection hole 44 starts injection of air in the second untwisting portion 40B. By these injections, the first yarn end Y1a is untwisted in the first untwisting pipe 41 by the action of air injected from the first air injection hole 42, and the second yarn end Y2a is untwisted in the second untwisting pipe 43 by the action of air injected from the second air injection hole 44.

[0038] Subsequently, the injection of air by the first air injection hole 42 and the injection of air by the second air injection hole 44 are ended, and as depicted in FIG. 7, the pair of yarn shifting levers 81 further turn toward the first untwisting portion 40A and the second untwisting portion 40B. By this turning, the first yarn end Y1a is drawn out of the first untwisting pipe 41, and the second yarn end Y2a is drawn out of the second untwisting pipe 43. By the pair of twist stopping levers 82, the first yarn end Y1a and the second yarn end Y2a are pressed near the yarn joining portion 50. Subsequently, in the yarn joining portion 50, the air injection hole 54 starts injection of air. By this injection, in the accommodating portion 52, the first yarn end Y1a untwisted by the first untwisting pipe 41 and the second yarn end Y2a untwisted by the second untwisting pipe 43 are twisted by the action of air injected from the air injection hole 54.

[0039] Subsequently, the injection of air by the air injection hole 54 is ended, and the pair of yarn shifting levers 81 and the pair of twist stopping levers 82 turn in the reverse direction. The first clamp 60A releases holding of the upper yarn Y1, and the second clamp 60B releases holding of the lower yarn Y2. Consequently, yarn Y formed by connecting the upper yarn Y1 and the lower yarn Y2 returns to the traveling path on the front side of the yarn joining device 31.

[0040] FIG. 8 is a timing chart for introduction assist air and untwisting air. As depicted in FIG. 8, before the upper yarn Y1 and the lower yarn Y2 are respectively cut by the first cutter 70A and the second cutter 70B (time T2), the air injection portions 91 and 92 start injections of introduction assist air (air for bringing the first yarn end Y1a into the first untwisting pipe 41 through the first yarn-end inlet 41a and air for bringing the second yarn end Y2a into the second untwisting pipe 43 through the second yarn-end inlet 43a) (time T1). After the upper yarn Y1 and the lower yarn Y2 have been respectively cut by the first cutter 70A and the second cutter 70B (time T2), the air injection portions 91 and 92 end the injections of the introduction assist air (time T3). Simultaneously when the injections of the introduction assist air by the air injection portions 91 and 92 end, the first air injection hole 42 of the first untwisting pipe 41 and the second air injection hole 44 of the second untwisting pipe 43 start injections of untwisting air (air for untwisting the first yarn end Y1a in the first untwisting pipe 41 and air for untwisting the second yarn end Y2a in the second untwisting pipe 43) (time T3) and, after the elapse of a predetermined period of time, stop the injections of the untwisting air (time T4). The first air injection hole 42 of the first untwisting pipe 41 and the second air injection hole 44 of the second untwisting pipe 43 may start the injection of the untwisting air after the injections of the introduction assist air by the air injection portions 91 and 92 have ended (time T3).

[0041] Herein, the time T1 is time when a signal is switched from OFF to ON in a controller of the yarn joining carrier 3 in order to start the injections of the introduction assist air by the air injection portions 91 and 92. The time T3 is time when the signal is switched from ON to OFF in the controller of the yarn joining carrier 3 in order to end the injections of the introduction assist air by the air injection portions 91 and 92, and is also time when a signal is switched from OFF to ON in the controller of the yarn joining carrier 3 in order to start the injections of the untwisting air by the first air injection hole 42 and the second air injection hole 44. The time T4 is time when the signal is switched from ON to OFF in the controller of the yarn joining carrier 3 in order to end the injections of the untwisting air by the first air injection hole 42 and the second air injection hole 44.

[0042] As described in the foregoing, in the yarn joining device 31, the air injection portions 91 and 92 can inject air from the outside of the first untwisting pipe 41 and the second untwisting pipe 43 toward the first yarn-end inlet 41a and the second yarn-end inlet 43a. In particular, the air injection portions 91 and 92 are provided to the twist stopping levers 82 that can advance and retreat with respect to the first yarn-end inlet 41a and the second yarn-end inlet 43a. Thus, the air injection portions 91 and 92 can be caused to inject air at positions and angles that are appropriate for the first yarn-end inlet 41a and the second yarn-end inlet 43a. Thus, even when the stiffness of yarn is high, by causing the air injection portions 91 and 92 to inject air, the first yarn end Y1a can be quickly brought into the first untwisting pipe 41 through the first yarn-end inlet 41a, and also the second yarn end Y2a can be quickly brought into the second untwisting pipe 43 through the second yarn-end inlet 43a. Consequently, variations can be prevented from occurring in the state of the first yarn end Y1a untwisted by the action of air injected from the first air injection hole 42 and in the state of the second yarn end Y2a untwisted by the action of air injected from the second air injection hole 44. Thus, with the yarn joining device 31, for example, even when yarn Y is thick and the stiffness of the yarn Y is high, yarn joining can be stably performed.

[0043] In the yarn joining device 31, the twist stopping levers 82 that can advance and retreat with respect to the first yarn-end inlet 41a and the second yarn-end inlet 43a are provided with the air injection portions 91 and

92, respectively. Thus, when the upper yarn Y1 guided by the suction pipe 32 and the lower yarn Y2 guided by the suction mouth 33 are respectively drawn toward the first untwisting portion 40A and the second untwisting portion 40B, the air injection portions 91 and 92 do not obstruct the drawing of the upper yarn Y1 and the lower yarn Y2.

[0044] In the yarn joining device 31, midway while the twist stopping levers 82 are advancing or retreating with respect to the first yarn-end inlet 41a and the second yarn-end inlet 43a, the air injection portions 91 and 92 are positioned in front of the first yarn-end inlet 41a and the second yarn-end inlet 43a, respectively. By this configuration, the air injection portions 91 and 92 can be caused to inject air at positions and angles that are more appropriate for the first yarn-end inlet 41a and the second yarn-end inlet 43a.

[0045] In the yarn joining device 31, because the air injection portions 91 and 92 that inject introduction assist air are provided separately from the first air injection hole 42 and the second air injection hole 44 that inject untwisting air, the injected state of the introduction assist air and the injected state of the untwisting air can be optimized depending on the respective purposes.

[0046] In the yarn joining device 31, the air injection portions 91 and 92 start injections of air before the upper yarn Y1 and the lower yarn Y2 are respectively cut by the first cutter 70A and the second cutter 70B, and end the injections of air after the upper yarn Y1 and the lower yarn Y2 have been respectively cut by the first cutter 70A and the second cutter 70B. By this setting, the first yarn end Y1a can be reliably brought into the first untwisting pipe 41 through the first yarn-end inlet 41a, and also the second yarn end Y2a can be reliably brought into the second untwisting pipe 43 through the second yarn-end inlet 43a.

[0047] In the yarn joining device 31, the first air injection hole 42 starts injection of air simultaneously when injections of air by the air injection portions 91 and 92 end or after the injections have ended, and the second air injection hole 44 starts injection of air simultaneously when the injections of air by the air injection portions 91 and 92 end or after the injections have ended. By this setting, due to the effect of air injected from the air injection portions 91 and 92, variations in the untwisted state of the first yarn end Y1a and the untwisted state of the second yarn end Y2a can be prevented from occurring.

[0048] In the spinning machine 1, yarn Y is generated by the air spinning device 7, and thus the yarn Y tends to have a high stiffness. However, because the yarn joining device 31 described above is provided, yarn joining can be stably performed.

[0049] Although one embodiment of the present disclosure has been described in the foregoing, the present disclosure is not limited to the embodiment.

[0050] In the embodiment, the air injection portions 91 and 92 are provided to the twist stopping levers 82. However, the air injection portions 91 and 92 may be provided to movable levers other than the twist stopping levers 82 (which may be movable levers dedicated to the air injection portions 91 and 92, or may be movable levers that have another function).

[0051] In the embodiment, the yarn joining device 31, the suction pipe 32, and the suction mouth 33 are provided to the yarn joining carrier 3. However, the yarn joining device 31, the suction pipe 32, and the suction mouth 33 may be provided to each of the spinning units 2.

[0052] The yarn joining device of the present disclosure may be used for an automatic winder. In this case, the yarn joining device is provided to each of winding units constituting the automatic winder.

[0053] In each spinning unit 2, the respective devices are disposed such that yarn Y supplied from the upper side is wound in the lower side in the machine height direction. However, the respective devices may be disposed such that yarn Y supplied from the lower side is wound in the upper side. In FIG. 1, the spinning machine 1 is illustrated in which each package P is wound in a cheese shape. However, the package P may be wound in a cone shape.

[0054] In each spinning unit 2, the yarn pooling device 11 has a function of pulling out yarn Y from the air spinning device 7. However, the yarn Y may be pulled out from the air spinning device 7 by a delivery roller and a nip roller. When the yarn Y is pulled out from the air spinning device 7 by a delivery roller and a nip roller, instead of the yarn pooling device 11, a slack tube or a mechanical compensator, for example, that absorbs slack of the yarn Y using suction airflow may be provided.

[0055] In the traveling direction of the yarn Y, the tension sensor 9 may be provided on the upstream side of the yarn monitoring device 8. The unit controller 10 may be provided to each of the spinning units 2. In each spinning unit 2, the waxing device 12, the tension sensor 9, and the yarn monitoring device 8 may be omitted.

[0056] At least some configurations of the embodiment described above may be optionally used in combination with at least some other configurations of the embodiment.

Claims

1. A yarn joining device (31) comprising:

a holding portion (60A, 60B) that holds each of first yarn (Y1) and second yarn (Y2);
a cutting portion (70A, 70B) that cuts each of the first yarn (Y1) and the second yarn (Y2) held by the holding portion (60A, 60B);
a first untwisting pipe (41) that has a first yarn-end inlet (41a) and a first air injection hole (42), and catches, through the first yarn-end inlet (41a), a first yarn end (Y1a) made in the first yarn (Y1) by cutting by the cutting portion (70A, 70B) and untwists the first yarn end (Y1a) in the

first untwisting pipe (41) by action of air injected from the first air injection hole (42) ;
a second untwisting pipe (43) that has a second yarn-end inlet (43a) and a second air injection hole (44), and catches, through the second yarn-end inlet (43a), a second yarn end (Y2a) made in the second yarn (Y2) by cutting by the cutting portion (70A, 70B) and untwists the second yarn end (Y2a) in the second untwisting pipe (43) by action of air injected from the second air injection hole (44);
an air injection portion (91, 92) that is capable of injecting air from outside of the first untwisting pipe (41) and the second untwisting pipe (43) toward the first yarn-end inlet (41a) and the second yarn-end inlet (43a);
a yarn joining portion (50) that twists the first yarn end (Y1a) untwisted by the first untwisting pipe (41) and the second yarn end (Y2a) untwisted by the second untwisting pipe (43); and
a movable lever (82) that is capable of advancing and retreating with respect to the first yarn-end inlet (41a) and the second yarn-end inlet (43a), **characterized in that**
the air injection portion (91, 92) is provided to the movable lever (82).

2. The yarn joining device (31) according to claim 1, wherein the air injection portion (91, 92) is positioned in front of the first yarn-end inlet (41a) and the second yarn-end inlet (43a) midway while the movable lever (82) is advancing or retreating with respect to the first yarn-end inlet (41a) and the second yarn-end inlet (43a), which is in positions where the air injection hole (91a) is arranged on an extended line of the centerline of the first untwisting pipe (41) and the air injection hole (92a) is arranged on an extended line of the centerline of the second untwisting pipe (43).

3. The yarn joining device (31) according to claim 1 or 2, wherein the air injection portion (91, 92) is configured to start injection of air before each of the first yarn (Y1) and the second yarn (Y2) is cut by the cutting portion (70A, 70B), and is configured to end the injection of air after each of the first yarn (Y1) and the second yarn (Y2) has been cut by the cutting portion (70A, 70B).

4. The yarn joining device (31) according to any one of claims 1 to 3, wherein
the first air injection hole (42) is configured to start injection of air simultaneously when injection of air by the air injection portion (91, 92) ends or after the injection has ended, and
the second air injection hole (44) is configured to start injection of air simultaneously when injection of air by the air injection portion (91, 92) ends or after the injection has ended.

5. A spinning machine (1) comprising:

the yarn joining device (31) according to any one of claims 1 to 4;
a drafting device (6) that drafts a fiber bundle (S);
an air spinning device (7) that twists the fiber bundle (F) drafted by the drafting device (6) to generate yarn (Y); and
a winding device (13) that winds the yarn (Y) generated by the air spinning device (7) to form a package (P).

6. The spinning machine (1) according to claim 5, wherein
the air spinning device (7) comprising:

a nozzle portion (71) that generates swirling airflow in a spinning chamber (71a);
a guiding portion (72) that guides the fiber bundle (F) drafted by the drafting device (6) into the spinning chamber (71a); and
a hollow guide shaft member (73) that guides the yarn (Y) generated by twisting the fiber bundle (F) by action of the swirling airflow in the spinning chamber (71a) to outside of the spinning chamber (71a).

Patentansprüche

1. Garnverbindungsvorrichtung (31), umfassend:

einen Halteabschnitt (60A, 60B), der jeweils das erste Garn (Y1) und das zweite Garn (Y2) hält;
einen Schneidabschnitt (70A, 70B), der jeweils das erste Garn (Y1) und das zweite Garn (Y2) schneidet, das von dem Halteabschnitt (60A, 60B) gehalten wird;
ein erstes Aufdrehrohr (41), das einen ersten Garnende-Einlass (41a) und ein erstes Lufteinspritzloch (42) aufweist und durch den ersten Garnende-Einlass (41a) ein erstes Garnende (Y1a) aufnimmt, das in dem ersten Garn (Y1) durch Schneiden durch den Schneidabschnitt (70A, 70B) hergestellt wird, und das erste Garnende (Y1a) in dem ersten Aufdrehrohr (41) durch die Einwirkung von Luft, die aus dem ersten Lufteinspritzloch (42) eingespritzt wird, aufdreht;
ein zweites Aufdrehrohr (43), das einen zweiten Garnende-Einlass (43a) und ein zweites Lufteinspritzloch (44) aufweist und durch den zweiten Garnende-Einlass (43a) ein zweites Garnende (Y2a) aufnimmt, das in dem zweiten Garn (Y2) durch Schneiden durch den Schneidabschnitt (70A, 70B) hergestellt wird, und das

zweite Garnende (Y2a) in dem zweiten Aufdrehrohr (43) durch die Einwirkung von Luft, die aus dem zweiten Lufteinspritzloch (44) eingespritzt wird, aufdreht;
einen Lufteinspritzabschnitt (91, 92), der Luft von außerhalb des ersten Aufdrehrohrs (41) und des zweiten Aufdrehrohrs (43) in Richtung des ersten Garnende-Einlasses (41a) und des zweiten Garnende-Einlasses (43a) einspritzen kann;
einen Garnverbindungsabschnitt (50), der das erste Garnende (Y1a), das durch das erste Aufdrehrohr (41) aufgedreht ist, und das zweite Garnende (Y2a), das durch das zweite Aufdrehrohr (43) aufgedreht ist, verdreht; und
einen beweglichen Hebel (82), der in Bezug auf den ersten Garnende-Einlass (41a) und den zweiten Garnende-Einlass (43a) vorwärts und rückwärts bewegt werden kann, **dadurch gekennzeichnet, dass**
der Lufteinspritzabschnitt (91, 92) an dem beweglichen Hebel (82) bereitgestellt ist.

2. Garnverbindungsvorrichtung (31) nach Anspruch 1, wobei der Lufteinspritzabschnitt (91, 92) vor dem ersten Garnende-Einlass (41a) und dem zweiten Garnende-Einlass (43a) mittig positioniert ist, während sich der bewegliche Hebel (82) in Bezug auf den ersten Garnende-Einlass (41a) und den zweiten Garnende-Einlass (43a) vor- und zurückbewegt, der sich in Positionen befindet, in denen das Lufteinspritzloch (91a) auf einer verlängerten Linie der Mittenlinie des ersten Aufdrehrohrs (41) und des Lufteinspritzlochs (92a) auf einer verlängerten Linie der Mittenlinie des zweiten Aufdrehrohrs (43) angeordnet ist.

3. Garnverbindungsvorrichtung (31) nach Anspruch 1 oder 2, wobei der Lufteinspritzabschnitt (91, 92) zum Starten des Einspritzens von Luft konfiguriert ist, bevor jeweils das erste Garn (Y1) und das zweite Garn (Y2) durch den Schneidabschnitt (70A, 70B) geschnitten werden, und zum Beenden des Einspritzens von Luft konfiguriert ist, nachdem jeweils das erste Garn (Y1) und das zweite Garn (Y2) durch den Schneidabschnitt (70A, 70B) geschnitten wurden.

4. Garnverbindungsvorrichtung (31) nach einem der Ansprüche 1 bis 3, wobei
das erste Lufteinspritzloch (42) konfiguriert ist, um die Einspritzung von Luft gleichzeitig zu starten, wenn die Einspritzung von Luft durch den Lufteinspritzabschnitt (91, 92) endet oder nachdem die Einspritzung beendet ist, und
das zweite Lufteinspritzloch (44) konfiguriert ist, um die Einspritzung von Luft gleichzeitig zu starten, wenn die Einspritzung von Luft durch den Lufteinspritzabschnitt (91, 92) endet oder nachdem die Einspritzung beendet ist.

5. Spinnmaschine (1), umfassend:

die Garnverbindungsvorrichtung (31) nach einem der Ansprüche 1 bis 4;
eine Streckvorrichtung (6), die ein Faserbündel (S) streckt;
eine Luftspinnvorrichtung (7), die das von der Streckvorrichtung (6) gestreckte Faserbündel (F) verdreht, um ein Garn (Y) zu erzeugen; und
eine Wickelvorrichtung (13), die das von der Luftspinnvorrichtung (7) erzeugte Garn (Y) aufwickelt, um eine Verpackung (P) zu bilden.

6. Spinnmaschine (1) nach Anspruch 5, wobei die Luftspinnvorrichtung (7) umfasst:

einen Düsenabschnitt (71), der einen wirbelnden Luftstrom in einer Spinnkammer (71a) erzeugt;
einen Führungsabschnitt (72), der das von der Streckvorrichtung (6) gestreckte Faserbündel (F) in die Spinnkammer (71a) führt; und
ein hohles Führungswellenelement (73), welches das Garn (Y), das durch Verdrehen des Faserbündels (F) durch Einwirkung des Wirbelluftstroms in der Spinnkammer (71a) erzeugt wurde, außerhalb der Spinnkammer (71a) führt.

Revendications

1. Dispositif de rattachement de fil (31) comprenant :

une partie de maintien (60A, 60B) qui maintient chacun d'un premier fil (Y1) et d'un second fil (Y2) ;
une partie de coupe (70A, 70B) qui coupe chacun du premier fil (Y1) et du second fil (Y2) maintenus par la partie de maintien (60A, 60B) ;
un premier tuyau de détorsion (41) qui comporte une entrée de première extrémité de fil (41a) et un premier trou d'injection d'air (42), et saisit, à travers l'entrée de première extrémité de fil (41a), une première extrémité de fil (Y1a) réalisée dans le premier fil (Y1) par coupe par la partie de coupe (70A, 70B) et détord la première extrémité de fil (Y1a) dans le premier tuyau de détorsion (41) par action d'air injecté à partir du premier trou d'injection d'air (42) ;
un second tuyau de détorsion (43) qui comporte une entrée de seconde extrémité de fil (43a) et un second trou d'injection d'air (44), et saisit, à travers l'entrée de seconde extrémité de fil (43a), une seconde extrémité de fil (Y2a) réalisée dans le second fil (Y2) par coupe par la partie de coupe (70A, 70B) et détord la seconde extrémité de fil (Y2a) dans le second tuyau de détorsion (43) par action d'air injecté à partir du

second trou d'injection d'air (44) ;
une partie d'injection d'air (91, 92) qui est capable d'injecter de l'air à partir de l'extérieur du premier tuyau de détorsion (41) et du second tuyau de détorsion (43) vers l'entrée de première extrémité de fil (41a) et l'entrée de seconde extrémité de fil (43a) ;
une partie de rattachement de fil (50) qui tord la première extrémité de fil (Y1a) détordue par le premier tuyau de détorsion (41) et la seconde extrémité de fil (Y2a) détordue par le second tuyau de détorsion (43) ; et
un levier mobile (82) qui est capable d'avancer et de reculer par rapport à l'entrée de première extrémité de fil (41a) et l'entrée de seconde extrémité de fil (43a), **caractérisé en ce que**
la partie d'injection d'air (91, 92) est fournie sur le levier mobile (82).

2. Dispositif de rattachement de fil (31) selon la revendication 1, dans lequel la partie d'injection d'air (91, 92) est positionnée devant l'entrée de première extrémité de fil (41a) et l'entrée de seconde extrémité de fil (43a) à mi-distance tandis que le levier mobile (82) avance ou recule par rapport à l'entrée de première extrémité de fil (41a) et à l'entrée de seconde extrémité de fil (43a), qui est dans des positions où le trou d'injection d'air (91a) est agencé sur un prolongement de l'axe longitudinal du premier tuyau de détorsion (41) et le trou d'injection d'air (92a) est agencé sur un prolongement de l'axe longitudinal du second tuyau de détorsion (43).

3. Dispositif de rattachement de fil (31) selon la revendication 1 ou 2, dans lequel la partie d'injection d'air (91, 92) est configurée pour démarrer une injection d'air avant que chacun du premier fil (Y1) et du second fil (Y2) ne soit coupé par la partie de coupe (70A, 70B), et est configurée pour terminer l'injection d'air après que chacun du premier fil (Y1) et du second fil (Y2) a été coupé par la partie de coupe (70A, 70B).

4. Dispositif de rattachement de fil (31) selon l'une quelconque des revendications 1 à 3, dans lequel
le premier trou d'injection d'air (42) est configuré pour démarrer une injection d'air simultanément lorsqu'une injection d'air par la partie d'injection d'air (91, 92) se termine ou après que l'injection est terminée, et
le second trou d'injection d'air (44) est configuré pour démarrer une injection d'air simultanément lorsqu'une injection d'air par la partie d'injection d'air (91, 92) se termine ou après que l'injection est terminée.

5. Machine à filer (1) comprenant :

le dispositif de rattachement de fil (31) selon l'une quelconque des revendications 1 à 4 ;
un dispositif d'étirage (6) qui étire un faisceau de fibres (S) ;
un dispositif de filature pneumatique (7) qui tord le faisceau de fibres (F) étiré par le dispositif d'étirage (6) pour générer un fil (Y) ; et
un dispositif d'enroulement (13) qui enroule le fil (Y) généré par le dispositif de filature pneumatique (7) pour former un rouleau (P).

6. Machine à filer (1) selon la revendication 5, dans lequel le dispositif de filature pneumatique (7) comprend :

une partie buse (71) qui génère un écoulement d'air tourbillonnant dans une chambre de filature (71a) ;
une partie de guidage (72) qui guide le faisceau de fibres (F) étiré par le dispositif d'étirage (6) dans la chambre de filature (71a) ; et
un élément d'arbre de guidage creux (73) qui guide le fil (Y) généré par torsion du faisceau de fibres (F) par action de l'écoulement d'air tourbillonnant dans la chambre de filature (71a) vers l'extérieur de la chambre de filature (71a).

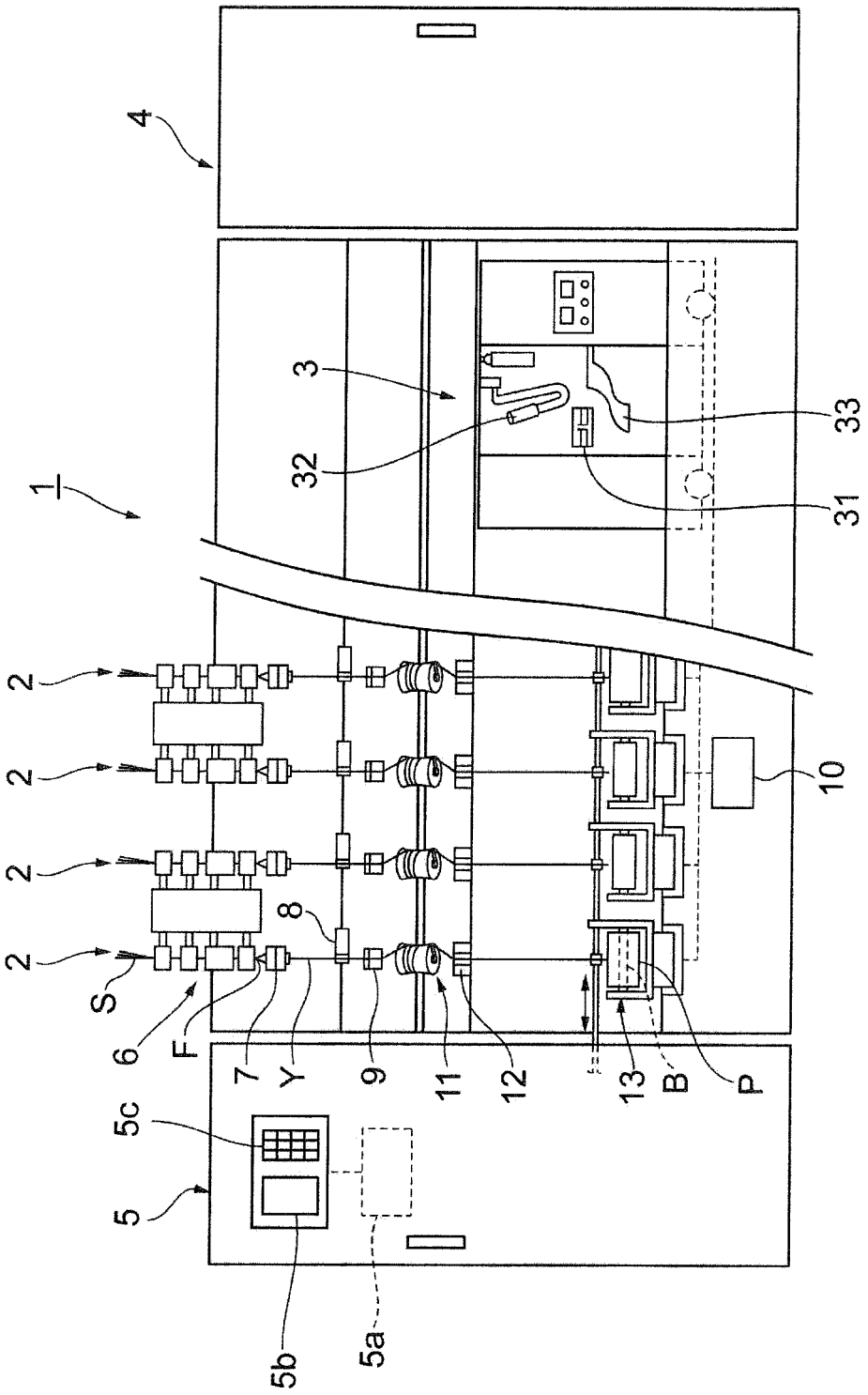


Fig.1

Fig.2

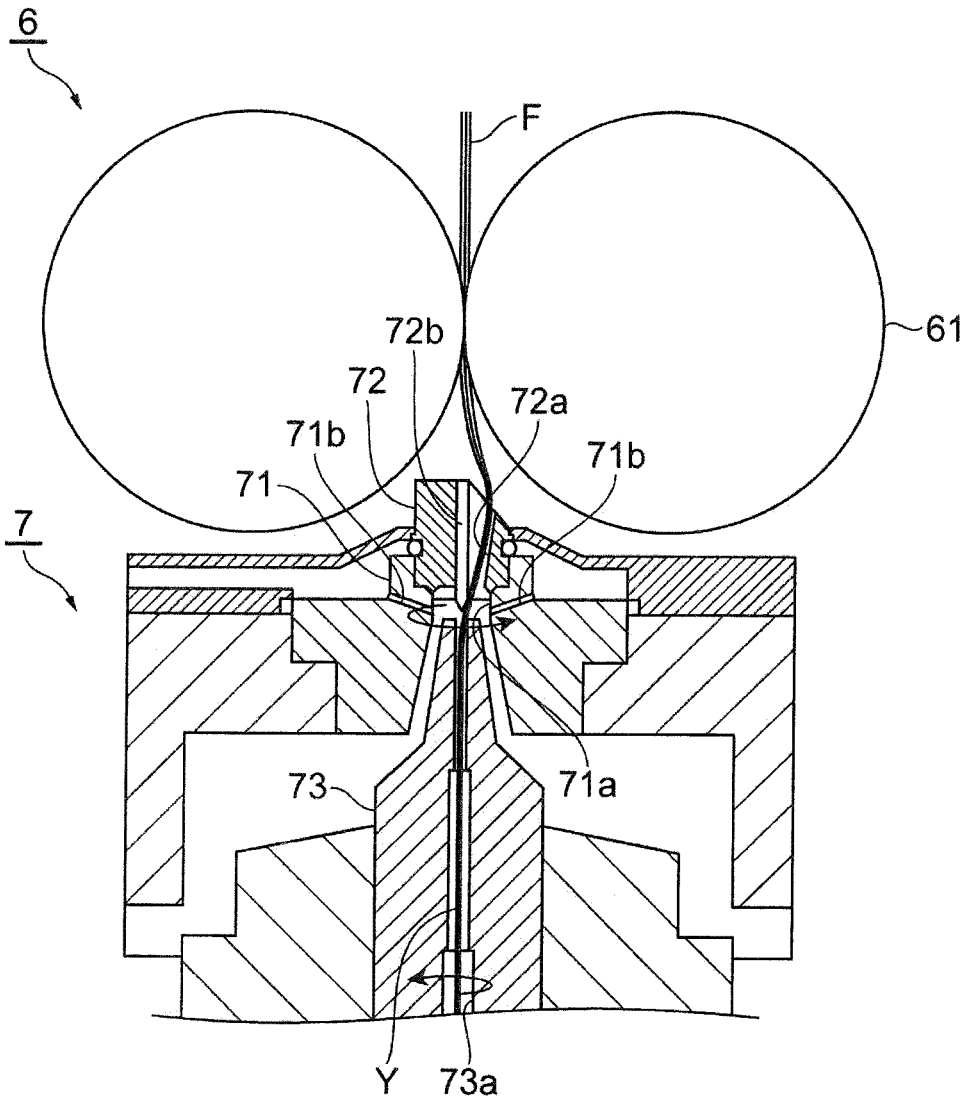
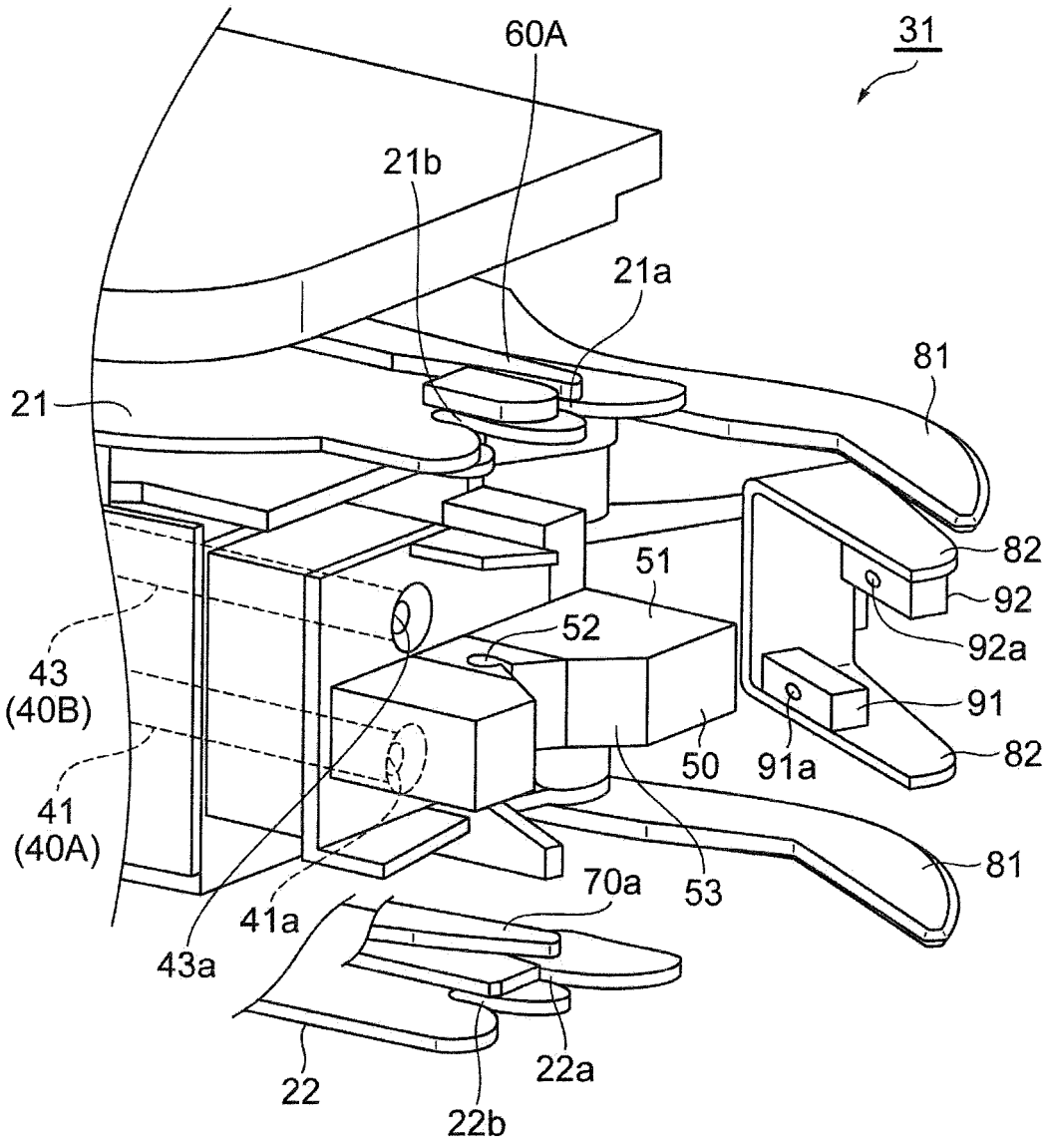


Fig.3


60A
31
21b
21a
81
21
82
51
92
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92a
43
(40B)
91
91a
82
50
41
(40A)
81
70a
53
41a
43a
22a
22
22b

Fig.4

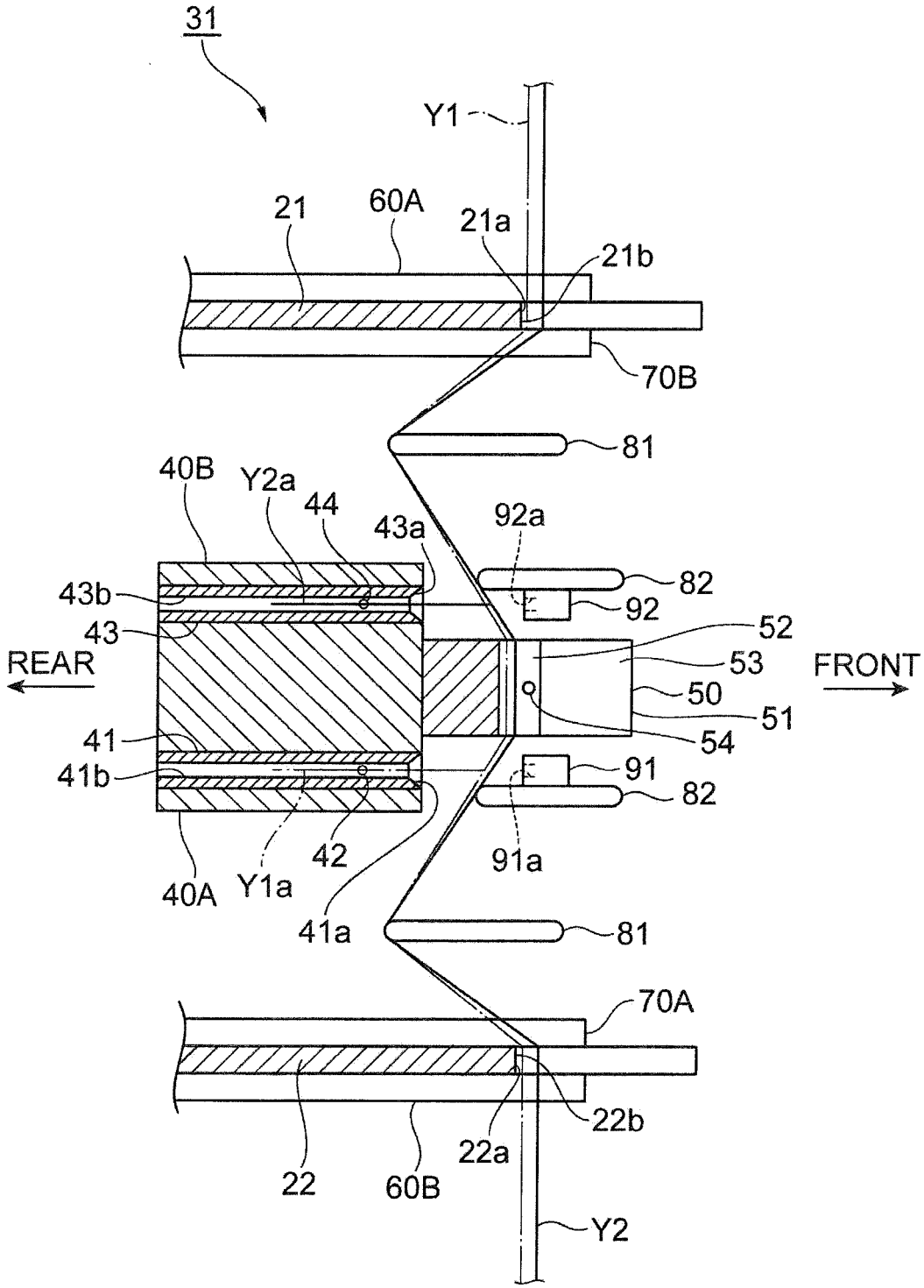
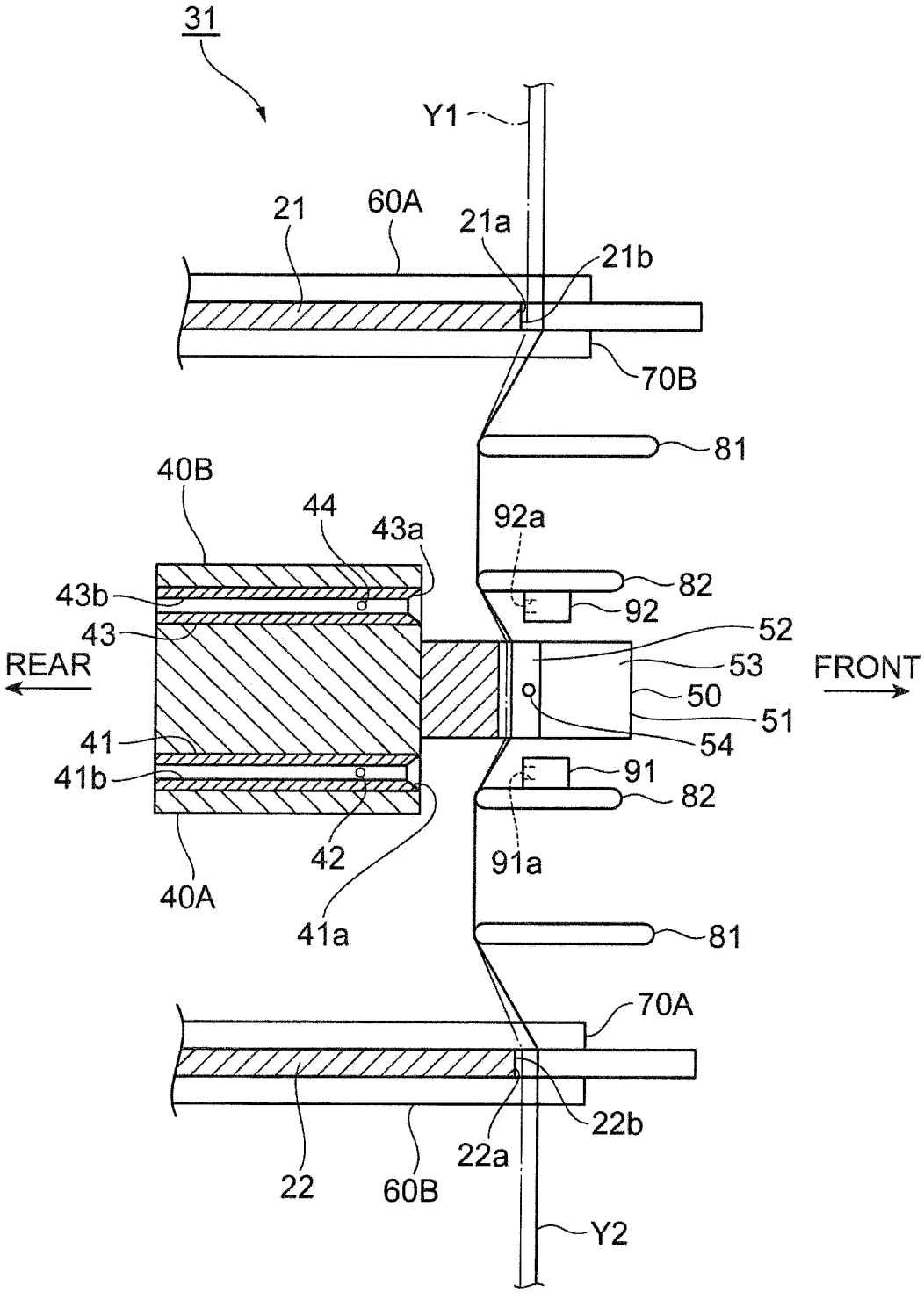

31
Y1
21
60A
21a
21b
70B
81
40B
Y2a
44
43a
92a
82
92
43b
43
52
REAR
53
FRONT
50
51
54
41
41b
91
82
42
91a
40A
Y1a
41a
81
70A
22b
22a
22
60B
Y2

Fig.5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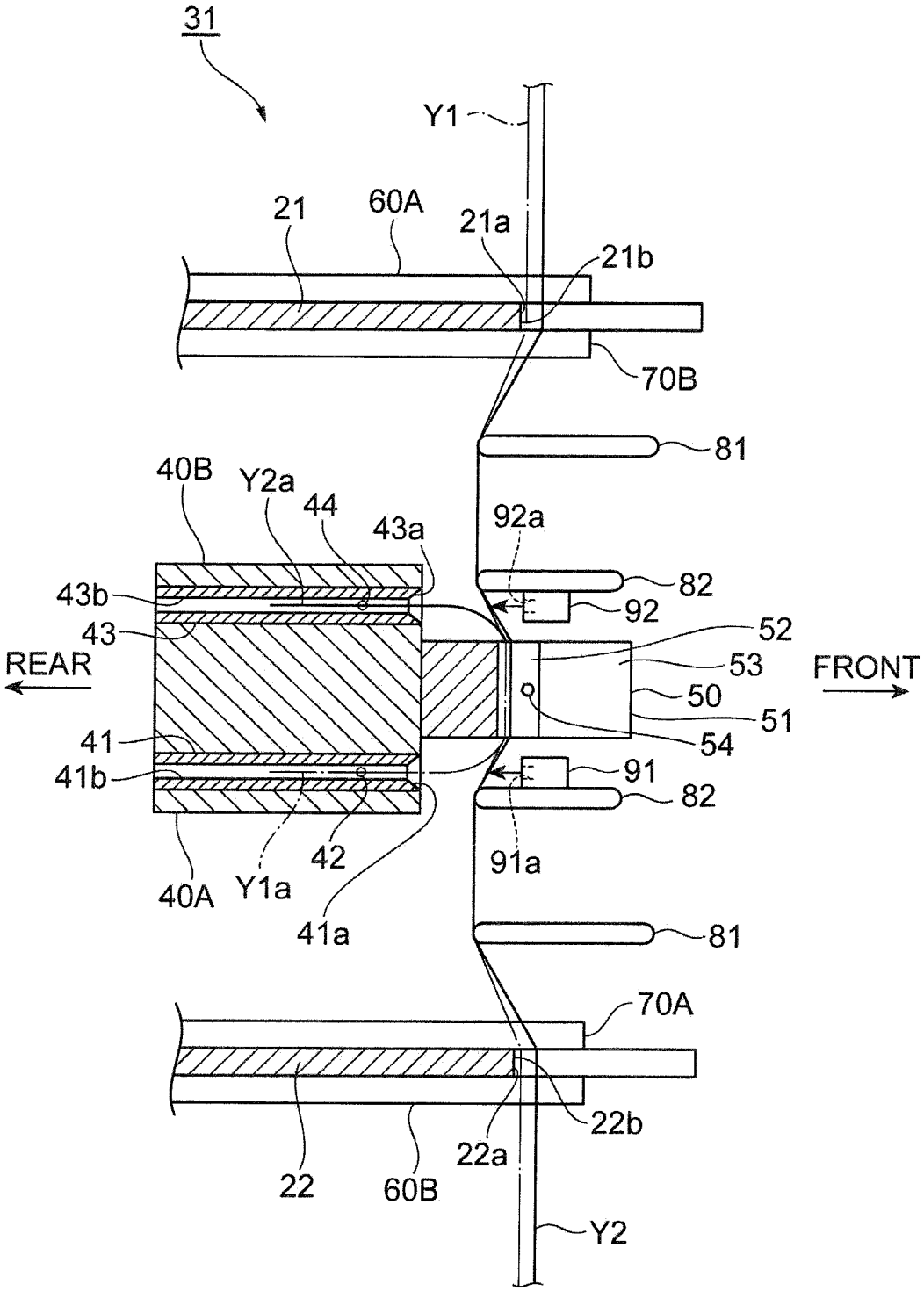
70A
22b
22a
22
60B
Y2

Fig.6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43b
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FRONT
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41
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41b
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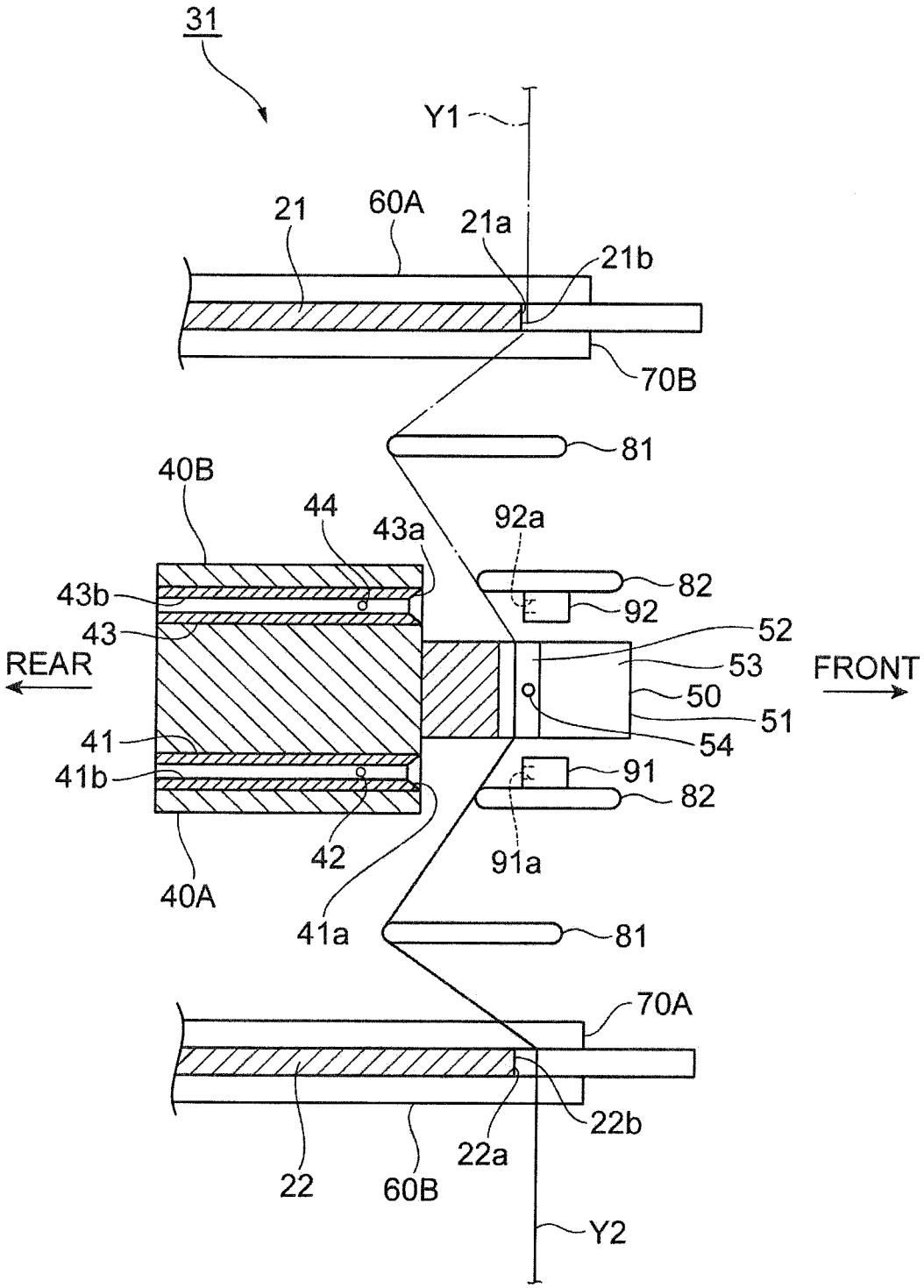
Y1a
41a
81
70A
22b
22
60B
22a
Y2

Fig.7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60A
21a
21b
70B
81
40B
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43a
92a
82
43b
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43
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REAR
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FRONT
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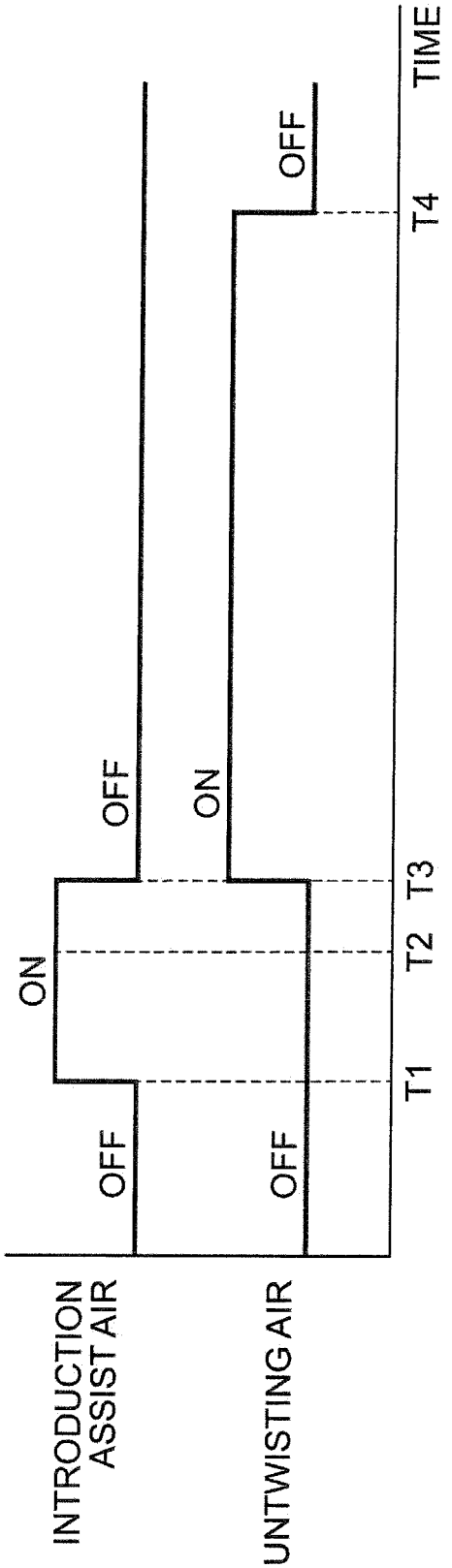
41b
91
82
42
91a
40A
41a
81
70A
22b
22a
22
60B
Y2

Fig.8


INTRODUCTION ASSIST AIR
UNTWISTING AIR
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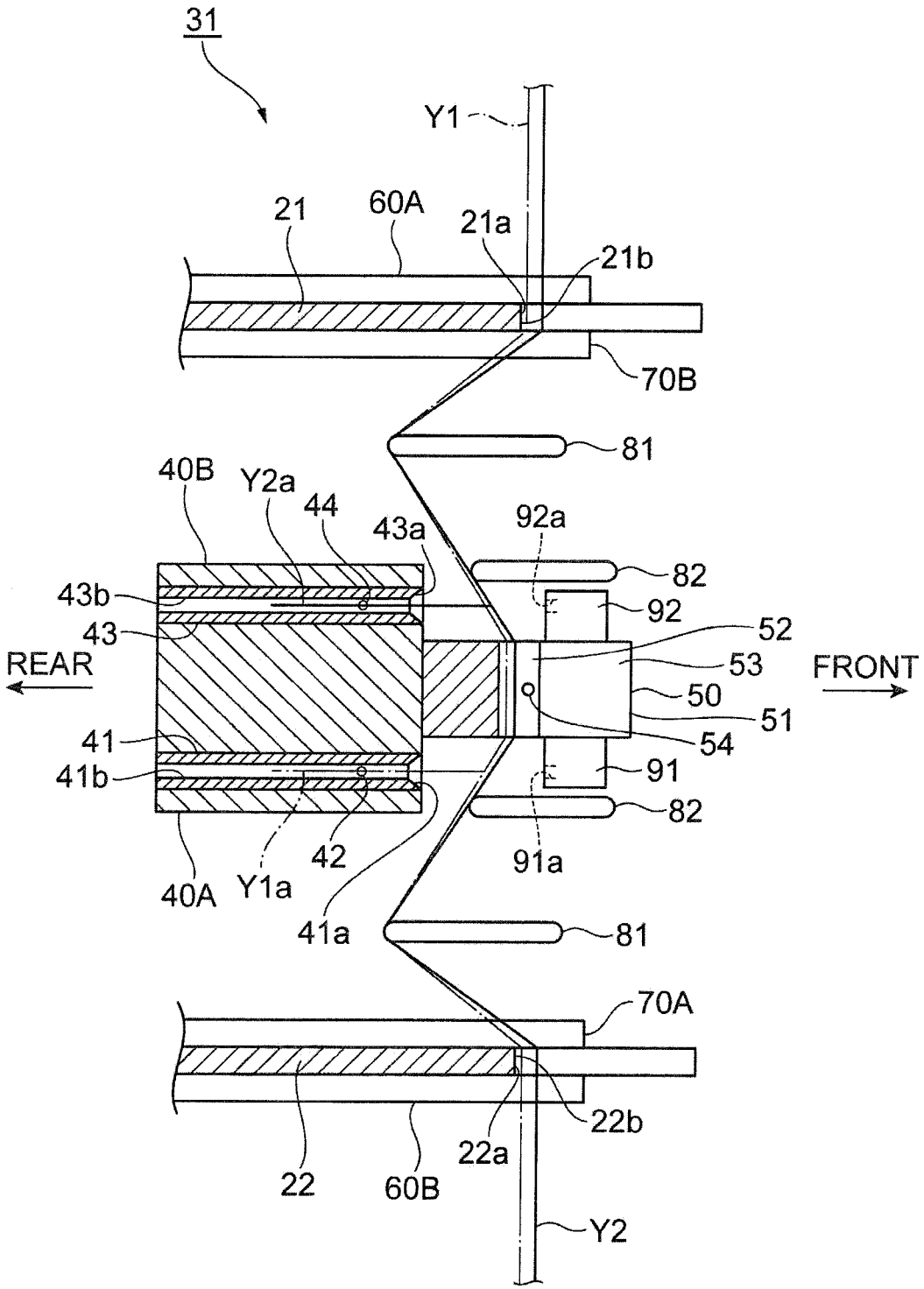
T1
T2
T3
T4
TIME

Fig.9


31
Y1
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92a
82
43b
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REAR
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FRONT
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41
54
41b
91
82
42
91a
40A
Y1a
41a
81
70A
22b
22a
22
60B
Y2

REFERENCES CITED IN THE DESCRIPTION

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- JP H347330 B **[0003]**