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(71) Applicant: **TMT Machinery, Inc.**
Osaka-shi, Osaka 541-0041 (JP)

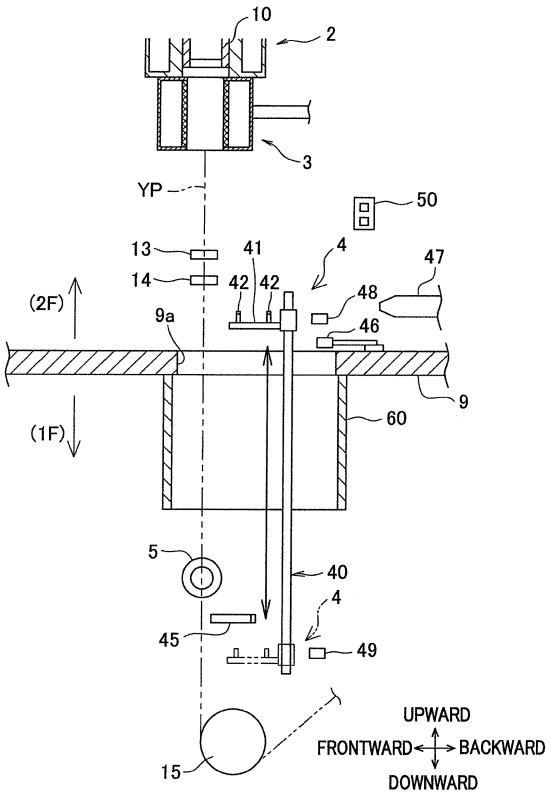
(72) Inventors:
- **Hioki, Masaaki**
  Kyoto 612-8686 (JP)
- **Shimoda, Fumiyuki**
  Kyoto 612-8686 (JP)
- **Hashimoto, Kinzo**
  Kyoto 612-8686 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) SPUN YARN TAKE-UP APPARATUS

(57) The success rate of handover of yarns which are taken down by a yarn take-down device is improved. A spun yarn take-up apparatus includes a take-up unit 6 provided on the first floor, a yarn sucking device 47 provided on the second floor to suck and retain yarns Y spun out from a spinning apparatus 2, and a yarn take-down device 4 configured to take the yarns retained by the yarn sucking device 47 down from the second floor to the first floor. The yarn take-down device 4 includes two yarn threading portions 42 which are separated from each other in a direction intersecting with an up-down direction, and each yarn Y is threaded onto these yarn threading portions in order.

FIG.4



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spun yarn take-up apparatus configured to take up yarns spun out from a spinning apparatus.

[0002] Patent Literature 1 (Japanese Unexamined Patent Publication No. 54-88315) recites an apparatus configured to take up yarns spun out from a spinning apparatus. This apparatus includes a supplying roller and a drawing roller provided below the spinning apparatus and a winding unit (spindle) provided below these rollers. The yarns spun out from the spinning apparatus are drawn between the supplying roller and the drawing roller and each of the yarns is wound by a winding unit.

[0003] At the time of yarn threading, after the yarns spun out from the spinning apparatus are wound onto the supplying roller and the drawing roller provided at a first processing area, the yarns are moved to a second processing area below and are wound onto the winding unit provided in the second processing area. To be more specific, to begin with, an operator places the yarns wound onto the drawing roller onto a guide roller which is movable between the first processing area and the second processing area, while retaining the yarns by using a suction gun. Thereafter, the operator moves the guide roller from the first processing area to the second processing area. After moving the guide roller to the second processing area, the operator operates a catching nozzle in the second processing area to catch the yarns wound onto the guide roller, and winds the yarns onto the winding unit.

SUMMARY OF THE INVENTION

[0004] In a typical spun yarn take-up apparatus, the distance between a spinning apparatus and winding equipment therebelow is considerably long (e.g., 3 to 6 meters). On this account, in the apparatus recited in Patent Literature 1, the bending angle of the yarn path bended to form a V-shape and having the guide roller as an apex is significantly small when the yarns are moved toward the winding unit below by the guide roller. For this reason, in the vicinity of the guide roller, a yarn part on the upstream of the guide roller and a yarn part on the downstream of the guide roller are close to each other.

[0005] According to Patent Literature 1, the operator catches the yarns by sucking, by using the catching nozzle, the yarn part on the upstream of the guide roller. In so doing, if the yarn part on the upstream of the guide roller and the yarn part on the downstream of the guide roller are close to each other, the yarn part on the downstream may be erroneously sucked together with the yarn part on the upstream, with the result that handover of the yarns to the catching nozzle may be failed.

[0006] In this regard, if the guide roller is considerably upsized, the distance between the yarn part on the upstream and the yarn part on the downstream is long, and hence the handover of the yarns is possible in the vicinity of the guide roller. However, when the guide roller is large, the entire apparatus for taking the yarns down is large, too. Furthermore, when the guide roller is a free rotary roller not having a driving power source, the contact resistance between the yarns and the roller is high when the roller is large, with the result that the success rate of the handover of the yarns is low due to yarn breakage.

[0007] In addition to the above, when yarns are placed on a single guide roller and the yarns are taken down, a position where the yarns are handed in a space to which the yarns are taken down is limited to the yarn part on the upstream of the guide roller. The design freedom of a tool for receiving the yarns is decreased, and the success rate of the handover of the yarns may be lowered.

[0008] An object of the present invention is to improve the success rate of handover of yarns which are taken down by a yarn take-down device.

[0009] According to the first aspect of the invention, a spun yarn take-up apparatus taking up yarns spun out from a spinning apparatus provided in a first yarn processing space includes:

> a take-up unit provided in a second yarn processing space below the first yarn processing space and configured to take up the yarns spun out from the spinning apparatus; a first yarn sucking unit provided in the first yarn processing space and configured to suck and retain the yarns spun out from the spinning apparatus; and a yarn take-down device configured to take the yarns retained by the first yarn sucking unit down from the first yarn processing space to the second yarn processing space, the yarn take-down device including yarn threading portions which are provided at intervals in a direction intersecting with an up-down direction, each of the yarns being threaded onto the yarn threading portions in order.

[0010] In the present invention, in the first yarn processing space, the yarns from the spinning apparatus are sucked by the first yarn sucking unit, and the sucked yarns are threaded onto the yarn threading portions of the yarn take-down device. Then the yarn take-down device moves down toward the yarn holding unit in the second yarn processing space. At this stage, each yarn forms a yarn path which extends from the first yarn processing space to the first yarn sucking unit in the first yarn processing space via the yarn take-down device in the second yarn processing space.

[0011] In the present invention, the yarn take-down device includes yarn threading portions which are provided at intervals in a direction intersecting with the up-down direction. As the yarn is threaded onto the yarn threading portions, the yarn part on the upstream of the yarn take-down device is distanced from the yarn part on the downstream of the yarn take-down device. This prevents a

yarn from being erroneously captured at two parts, with the result that the success rate of the handover of the yarn is improved. Furthermore, because each yarn is threaded onto the plural yarn threading portions, each yarn is captured at various positions. The design freedom of a tool for receiving the yarns used in the handover of the yarns is improved, and the success rate of the handover of the yarns is not deteriorated.

[0012] According to the second aspect of the invention, the spun yarn take-up apparatus of the first aspect is arranged such that the distance between two yarn threading portions which are outermost ones in the intersecting direction among the yarn threading portions is 30mm or longer. According to the third aspect of the invention, the spun yarn take-up apparatus of the second aspect is arranged such that the distance between two yarn threading portions which are outermost ones in the intersecting direction among the yarn threading portions is 120mm or longer.

[0013] The distance between the outermost ones of the yarn threading portions is 30mm or longer, and more preferably 120mm or longer. With this, the distance between the two yarns parts threaded onto the outermost yarn threading portions is long. This certainly prevents a single yarn from being erroneously captured at two parts. Furthermore, the yarn is easily captured between the two yarn threading portions.

[0014] According to the fourth aspect of the invention, the spun yarn take-up apparatus of any one of the first to third aspects is arranged such that, the yarn take-down device takes the yarns down to a position which is in the second yarn processing space and is deviated from a yarn path when the yarns are taken up by the take-up unit.

[0015] In the present invention, the yarn take-down device takes the yarns down to the position which is in the second yarn processing space and is deviated from the yarn path when the yarns are taken up by the take-up unit (i.e., the yarn path in yarn production). On this account, when the yarn take-down device is returned to the first yarn processing space after the handover of the yarns in the second yarn processing space, the yarn take-down device does not interfere with the yarns threaded onto the take-up unit.

[0016] According to the fifth aspect of the invention, the spun yarn take-up apparatus of the fourth aspect further includes a yarn convergence guide which is provided in the first yarn processing space and is configured to converge the yarns taken down by the yarn take-down device.

[0017] As the yarns sucked by the first yarn sucking unit are converged by the yarn convergence guide, the yarns are threaded in a converged manner onto the yarn threading portions of the yarn take-down device, with the result that yarn threading becomes easy. Furthermore, the yarns are less likely to be scattered when took down by the yarn take-down device.

[0018] According to the sixth aspect of the invention, the spun yarn take-up apparatus of the fourth or fifth aspect further includes a yarn holding unit which is provided in the second yarn processing space and sucks and retains the yarns supplied from the spinning apparatus, the yarn holding unit being capable of sucking the yarns taken down to the position deviated from the yarn path by the yarn take-down device.

[0019] The yarn holding unit in the second yarn processing space temporarily retains the yarns serially spun out from the spinning apparatus, when, for example, a malfunction occurs in the apparatus. The yarn holding unit is therefore provided in the vicinity of the yarn path in yarn production. In the meanwhile, in yarn threading onto the take-up unit, the yarns are taken down by the yarn take-down device to a position which is deviated from the yarn path in yarn production in the second yarn processing space.

[0020] In this regard, in the present invention, the yarn holding unit is arranged to be capable of sucking the yarns taken down to the position deviated from the yarn path. For this reason, the yarn threading unit receiving the yarns or the operator is not required to wait in the second yarn processing space in advance, when the yarns Y are taken down to the second yarn processing space. In other words, the operator working in the first yarn processing space is allowed to take yarns down at any timing, no matter whether the yarn threading unit or the operator is on standby in the second yarn processing space.

[0021] According to the seventh aspect of the invention, the spun yarn take-up apparatus of the sixth aspect is arranged such that the yarn holding unit includes a cutter by which the yarns are cut and a second yarn sucking unit configured to suck the yarns cut by the cutter, the cutter and the second yarn sucking unit being capable of moving close to and away from the yarns taken down by the yarn take-down device.

[0022] When the yarns are taken down to the second yarn processing space by the yarn take-down device, the cutter of the yarn holding unit moves toward the yarns and cuts the yarns. Furthermore, the yarns having been cut by the cutter are sucked by the second yarn sucking unit which moves together with the cutter. With this, even if the yarns are taken by the yarn take-down device down to a position deviated from the yarn path in yarn production, the yarn holding unit is able to suck the yarns.

[0023] According to the eighth aspect of the invention, the spun yarn take-up apparatus of the sixth aspect further includes a shifting unit configured to move, toward the yarn holding unit, the yarns taken down by the yarn take-down device.

[0024] When the yarns are taken down to the second yarn processing space by the yarn take-down device, the shifting unit moves the yarns toward the yarn holding unit. With this, even if the yarns are taken by the yarn take-down device down to a position deviated from the yarn path in yarn production, the yarn holding unit is able to suck the yarns.

[0025] According to the ninth aspect of the invention,

the spun yarn take-up apparatus of any one of the sixth to eighth aspects is arranged such that the yarn holding unit cuts the yarns between the spinning apparatus and the yarn take-down device and receives the yarns.

[0026] The yarn holding unit cuts the yarn part of each yarn between the spinning apparatus and the yarn take-down device, i.e., the yarn part on the upstream of the yarn take-down device. In this regard, in the present invention, the yarn take-down device includes plural yarn threading portions, and there is a distance in each yarn between the yarn part on the upstream of the yarn take-down device and the yarn part on the downstream of the yarn take-down device. On this account, when the yarn part on the upstream side is cut by the yarn holding unit, the yarn part on the downstream side is less likely to be cut together with the yarn part on the upstream side.

[0027] According to the tenth aspect of the invention, the spun yarn take-up apparatus of any one of the sixth to eighth aspects is arranged such that the yarn holding unit cuts the yarns between neighboring two of the yarn threading portions and receives the yarns.

[0028] According to this arrangement, because the yarns are cut between two yarn threading portions, a single yarn is less likely to be cut at two parts. Furthermore, because vibrations of the yarn is restrained at a part between the two yarn threading portions on account of the proximity to the yarn threading portions, the success rate of yarn cutting is high.

[0029] According to the eleventh aspect of the invention, the spun yarn take-up apparatus of any one of the first to tenth aspects is arranged such that the first yarn sucking unit is portable.

[0030] In the present invention, the term "portable" indicates that the operator is able to freely carry the first yarn sucking unit to various workplaces. When the yarns taken down to the second yarn processing space by the yarn take-down device are handed for the threading to the take-up unit in the second yarn processing space, the first yarn sucking unit finishes its role. On this account, after the completion of the handing of the yarns, the first yarn sucking unit may be moved to a suitable workplace and used for another operation.

[0031] According to the twentieth aspect of the invention, the spun yarn take-up apparatus of any one of the first to eleventh aspects further includes a yarn threading unit which is provided in the second yarn processing space and is configured to cut and receive the yarns taken down by the yarn take-down device and thread the received yarns onto the take-up unit.

[0032] In the present invention, the yarns taken down to the second yarn processing space by the yarn take-down device are handed to the yarn threading unit, and is threaded onto the take-up unit by the yarn threading unit.

[0033] According to the thirteenth aspect of the invention, the spun yarn take-up apparatus of the twentieth aspect is arranged such that the yarn threading unit cuts the yarns between the spinning apparatus and the yarn take-down device and receives the yarns.

[0034] The yarn threading unit cuts the yarn part of each yarn between the spinning apparatus and the yarn take-down device, i.e., the yarn part on the upstream of the yarn take-down device. In this regard, in the present invention, the yarn take-down device includes plural yarn threading portions, and there is a distance in each yarn between the yarn part on the upstream of the yarn take-down device and the yarn part on the downstream of the yarn take-down device. On this account, when the yarn part on the upstream side is cut by the yarn threading unit, the yarn part on the downstream side is less likely to be cut together with the yarn part on the upstream side.

[0035] According to the fourteenth aspect of the invention, the spun yarn take-up apparatus of the twentieth aspect is arranged such that the yarn threading unit cuts the yarns between neighboring two of the yarn threading portions and receives the yarns.

[0036] According to this arrangement, because the yarns are cut between two yarn threading portions, a single yarn is less likely to be cut at two parts. Furthermore, because vibrations of the yarn is restrained at a part between the two yarn threading portions on account of the proximity to the yarn threading portions, the success rate of yarn cutting is high.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037]

FIG. 1 is a profile of a spun yarn take-up apparatus of an embodiment.

FIG. 2 is a block diagram which schematically shows a control system of the spun yarn take-up apparatus.

FIG. 3 is a front view of the yarn holding unit shown in FIG. 1.

FIG. 4 shows an upper structure of the spun yarn take-up apparatus including a yarn take-down device.

FIG. 5 is a perspective view of the yarn take-down device.

FIG. 6 shows the spun yarn take-up apparatus immediately after the start of spinning.

FIG. 7 shows the spun yarn take-up apparatus when the yarns are retained by a sucking unit.

FIG. 8 shows the spun yarn take-up apparatus when the yarns are threaded to an oil guide and a yarn regulating guide.

FIG. 9 shows the spun yarn take-up apparatus when the yarns are threaded onto a yarn convergence guide.

FIG. 10 shows the spun yarn take-up apparatus immediately before taking the yarns down.

FIG. 11 shows the spun yarn take-up apparatus immediately after moving down the yarn take-down device.

FIG. 12 shows the spun yarn take-up apparatus when the yarns are handed to a yarn threading unit.

FIG. 13 shows the spun yarn take-up apparatus when the yarns are threaded by the yarn threading unit.

FIG. 14 shows the spun yarn take-up apparatus when the yarns are handed to a yarn holding unit by a yarn shifting member.

FIG. 15 shows the spun yarn take-up apparatus after the handover of the yarns to the yarn holding unit is completed.

FIG. 16 relates to a modification and shows a spun yarn take-up apparatus when yarns are handed to a yarn threading unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] The following will describe an embodiment of the present invention. FIG. 1 is a profile of a spun yarn take-up apparatus 1 of the present embodiment. FIG. 2 is a block diagram which schematically shows a control system of the spun yarn take-up apparatus 1. The spun yarn take-up apparatus 1 takes up synthetic fiber yarns Y spun out from a spinning apparatus 2 and forms packages P by winding the yarns Y onto bobbins B, respectively. Though illustration is omitted, plural spun yarn take-up apparatuses 1 are lined up in the direction orthogonal to the plane of FIG. 1.

[0039] For convenience, the up-down direction in FIG. 1 will be referred to as an up-down direction of the spun yarn take-up apparatus 1, the direction which is orthogonal to the plane of FIG. 1 and in which the spun yarn take-up apparatuses 1 are lined up will be referred to as a left-right direction of the spun yarn take-up apparatus, and the left-right direction in FIG. 1 will be referred to as a front-back direction of the spun yarn take-up apparatus 1.

(Outline of Spun Yarn Take-Up Apparatus)

[0040] As shown in FIG. 1, the spun yarn take-up apparatus 1 of the present embodiment includes members such as a yarn take-down device 4, a yarn holding unit 5, a take-up unit 6, a winding device 7, and a controller 8. In the present embodiment, the internal space of the building in which the spinning apparatus 2 and the spun yarn take-up apparatus 1 are provided is partitioned into an upper floor and a lower floor (second floor and first floor) by a partition wall 9. On the second floor of the building (i.e., a first yarn processing space in the present invention), the spinning apparatus 2 and a part (e.g., the yarn take-down device 4) of the spun yarn take-up apparatus 1 are provided. In the meanwhile, on the first floor of the building (i.e., a second yarn processing space of the present invention), the remaining part (e.g., the yarn holding unit 5, the take-up unit 6, and the winding device 7) of the spun yarn take-up apparatus 1 are provided. On the first floor of the building, furthermore, a yarn threading unit 23 shared between the spun yarn take-up apparatuses 1 is provided to be movable in the left-right direction (i.e., the direction orthogonal to the plane of FIG. 1).

<Arrangement on Second Floor of Building>

[0041] To begin with, to the spinning apparatus 2 on the second floor, a spinning pack 10 having a spinneret 10a is attached. As molten polymer which is supplied from a polymer supplier (not illustrated) formed of a gear pump or the like and is hot is pushed out from the spinneret 10a, yarns Y are spun out from the spinneret 10a. Immediately below the spinning apparatus 2, a cooling unit 3 is provided. The yarns Y spun out from the spinneret 10a are solidified as they are cooled by gas supplied from a duct 12 while passing through a spun yarn tube 11 of the cooling unit 3.

[0042] On the second floor of the building, an oil guide 13 and a yarn regulating guide 14 are provided below the spinning apparatus 2. To the yarns Y spun out from the spinning apparatus 2, oil is applied at the oil guide 13. The yarn regulating guide 14 below the oil guide 13 is provided for regulating the yarn path of the yarns Y to which oil is applied at the oil guide 13.

[0043] On the second floor of the building, the yarn take-down device 4 is further provided. This yarn take-down device 4 is provided for taking the yarns Y spun out from the spinning apparatus 2 down to the first floor on which the take-up unit 6 and the winding device 7 are provided, at the time of preparation operations (e.g., yarn threading) before the start of the production of packages P. The details of the yarn take-down device 4 will be given later.

<Arrangement on First Floor of Building>

[0044] On the first floor of the building, members such as the yarn holding unit 5, the take-up unit 6, and the winding device 7 are provided. Through the partition wall 9 separating the first floor from the second floor of the building, a yarn passing hole 9a is formed to allow the yarns Y spun out from the spinning apparatus 2 to pass therethrough. Below the yarn passing hole 9a, a cover 60 is provided to prevent the occurrence of yarn swing or the like.

[0045] The yarn holding unit 5 is fixedly provided at a position immediately below the yarn passing hole 9a of the partition wall 9. When a trouble or the like occurs at a device (e.g., the take-up unit 6 and the winding device 7) on the downstream, this yarn holding unit 5 cuts the yarns Y spun out from the spinning apparatus 2 and temporarily retains them until the trouble or the like is resolved. For this purpose, the yarn holding unit 5 is provided in the vicinity of a yarn path YP in yarn production when the yarns Y from the spinning apparatus 2 are taken up by the take-up unit 6, and is provided to overlap with the yarn path YP in the left-right direction.

[0046] FIG. 3 is a front view (left side view in FIG. 1) of the yarn holding unit 5 shown in FIG. 1. As shown in

FIG. 3, the yarn holding unit 5 includes a holder 20, a sucking pipe 21, and a cutter 22. The sucking pipe 21 is provided in the holder 20. This sucking pipe 21 is connected with a fluid cylinder 27 (see FIG. 2). The fluid cylinder 27 is driven by pressure fluid supplied from a fluid supplying unit 28. By the fluid cylinder 27, the sucking pipe 21 is driven to advance and retract in the left-right direction and move in and out of the holder 20. The cutter 22 is provided at a leading end portion of the sucking pipe 21.

[0047] The yarn holding unit 5 is driven as follows. To begin with, when the fluid cylinder 27 is driven in a waiting state shown in FIG. 3(a) and the sucking pipe 21 advances rightward in which direction the yarns Y run as shown in FIG. 3(b), the yarns Y are serially cut by the cutter 22 at the leading end portion of the sucking pipe 21. The yarns Y having been cut are sucked into the sucking pipe 21 through an opening at the leading end and are retained. After the sucking pipe 21 sucks the yarns Y, as shown in FIG. 3(c), the sucking pipe 21 is driven to retract leftward by the fluid cylinder 27.

[0048] As the yarns Y spun out from the spinning apparatus 2 are retained by the yarn holding unit 5, the yarns Y are not sent to the take-up unit 6 and the winding device 7 which are on the downstream side. This allows the operator to perform operations such as trouble shooting of the take-up unit 6 or the winding device 7. When it becomes possible to start the production of the yarns Y, the yarns Y retained by the yarn holding unit 5 are handed to the yarn threading unit 23, and yarn threading onto the take-up unit 6 and the winding device 7 is carried out by the yarn threading unit 23. Alternatively, the operator may receive the yarns Y from the yarn holding unit 5 by using the suction gun and perform the yarn threading.

[0049] As shown in FIG. 1, the take-up unit 6 takes up the yarns Y coming down from the second floor through the yarn passing hole 9a which is formed through the partition wall 9. The take-up unit 6 includes two godet rollers 15 and 16. The two godet rollers 15 and 16 are rotationally driven by motors 17 and 18 (see FIG. 2), respectively. By the two godet rollers 15 and 16, the take-up unit 6 sends the yarns Y from the spinning apparatus 2 to the winding device 7.

[0050] Among the two godet rollers 15 and 16, the godet roller 15 on the upstream in the yarn running direction is provided at a position substantially immediately below the yarn holding unit 5. In the meanwhile, the godet roller 16 on the downstream in the yarn running direction is arranged to be movable between a position for yarn placement close to the godet roller 15 (i.e., a position indicated by two-dot chain lines in FIG. 1) and a position for yarn production immediately above the winding device 7 (i.e., a position indicated by full lines in FIG. 1). The positional switching of the godet roller 16 is carried out by a positional switching mechanism which has an appropriate arrangement including a positional switching motor 19 (see FIG. 2). When yarn placement onto the two godet rollers 15 and 16 is performed, the positional switching mechanism moves the godet roller 16 to the lower yarn placement position to facilitate the yarn placement. When the yarn placement finishes, the positional switching mechanism moves the godet roller 16 up from the yarn placement position to the yarn production position.

[0051] The winding device 7 includes members such as a turret 30, two bobbin holders 31, a traverse unit 32, and a contact roller 33. By the turret 30, the two bobbin holders 31 are rotatably supported. As the turret 30 rotates, the positions of the two bobbin holders 31 are changed upside down. To each bobbin holder 31, bobbins B are attached. The traverse unit 32 includes traverse guides 32a which correspond to the respective bobbins B attached to the bobbin holder 31. As each traverse guide 32a reciprocates, the yarn Y is wound onto the bobbin B while being traversed about a fulcrum guide 34, with the result that a package P is formed. The contact roller 33 makes contact with the packages P formed on the upper bobbin holder 31 to apply contact pressure to each package P.

[0052] The yarn threading unit 23 is a yarn threading robot controlled by a program. The yarn threading unit 23 includes a main body 24 which is movable in the left-right direction (i.e., the direction orthogonal to the plane of FIG. 1) and a yarn threading arm 25 which is provided on the main body and has a multi-joint section to be freely movable in a three-dimensional manner. At the leading end portion of the yarn placement arm 25, a cutter 54 for cutting the yarns Y and a yarn sucking section 55 for sucking the yarns Y cut by the cutter 54 are provided (see FIG. 12 and FIG. 13). when a yarn threading requirement signal is received from a spun yarn take-up apparatus 1 among the spun yarn take-up apparatuses 1 lined up in the left-right direction, the yarn threading unit 23 moves to a position forward of that spun yarn take-up apparatus 1 and performs yarn placement onto the two godet rollers 15 and 16 of the take-up unit 6 and onto the winding device 7.

[0053] The controller 8 controls the overall operation of the spun yarn take-up apparatus 1. As shown in FIG. 2, the controller 8 receives signals from a winding controller 35 controlling the winding device 7, sensors, and switches. Furthermore, the controller 8 controls the rotation of the godet rollers 15 and 16 driven by the motors 17 and 18. Furthermore, the controller 8 controls the positional switching motor 19 to perform positional switching of the godet roller 16. Furthermore, the controller 8 controls the driving of the yarn holding unit 5 by the fluid cylinder 27, the later-described moving up and moving down of the yarn take-down device 4 by an elevation cylinder 40, the yarn threading by the yarn threading unit 23 (see FIG. 12), and so on.

(Yarn Take-Down Device)

[0054] Now, the details of the yarn take-down device

4 and its surroundings will be given. FIG. 4 shows an upper structure of the spun yarn take-up apparatus 1 including the yarn take-down device 4. FIG. 5 is a perspective view of the yarn take-down device 4. As shown in FIG. 4 and FIG. 5, an elevation cylinder 40 is provided to extend from the second floor of the building to a position in the vicinity of the yarn holding unit 5 on the first floor, through the yarn passing hole 9a of the partition wall 9. The yarn take-down device 4 is attached to the elevation cylinder 40 and is movable between an upper limit position (indicated by full lines in FIG. 4) on the second floor and a lower limit position (indicated by two-dot chain lines in FIG. 4) in the vicinity of the yarn holding unit 5 on the first floor.

[0055] As shown in FIG. 4 and FIG. 5, the yarn take-down device 4 includes a pipe member 41 and two yarn threading portions 42. The pipe member 41 extends substantially horizontally (front-back direction) and is attached, at its back end portion, to the elevation cylinder 40 via a connection member 43. Each yarn threading portion 42 is a yarn guide fixedly provided on the pipe member 41. The two yarn threading portions 42 are attached to the pipe member 41 with an interval in the front-back direction. The distance L in the front-back direction between the two yarn threading portions 42 is, for example, preferably 30mm or longer, and more preferably 120mm or longer.

[0056] As pressure fluid is supplied from the fluid supplying unit 44 (see FIG. 2) to the elevation cylinder 40, the connection member 43 is moved up and down by the pressure of the pressure fluid, with the result that the yarn take-down device 4 moves up and down. Furthermore, as shown in FIG. 4, an operation switch 50 for operating the elevation cylinder 40 is provided on the second floor of the building.

[0057] In the yarn production in which the yarns Y from the spinning apparatus 2 are taken up by the take-up unit 6 and are then wound by the winding device 7, each yarn Y from the spinning apparatus 2 runs on a yarn path YP (hereinafter, the yarn path in yarn production) extending straight down toward the godet roller 15 via the guides 13 and 14 and the yarn holding unit 5. In the meanwhile, as shown in FIG. 4, the position of the yarn take-down device 4 is deviated backward as compared to the position directly below the spinneret 10a of the spinning apparatus 2. With this arrangement, the yarn take-down device 4 moves up and down along a passage which is deviated backward from the yarn path YP in yarn production, and takes the yarns Y down to a position deviated from the yarn path YP when the yarn take-down device 4 reaches the first floor.

[0058] At a position which is around the yarn passing hole 9a of the partition wall 9 and is backward of the yarn take-down device 4, a yarn sucking device 47 (first yarn sucking unit of the present invention) is provided. This yarn sucking device 47 sucks the yarns Y spun out from the spinning apparatus 2 in order to temporarily retain the yarns Y when the yarn take-down device 4 takes the yarns Y down to the first floor.

[0059] In the horizontal direction which is in parallel to the partition wall 9, the yarn sucking device 47 may be able to come close to and move away from the yarn passing hole 9a. With this arrangement, the yarn sucking device 47 is provided around the yarn passing hole 9a only when the yarns are taken down, and the yarn sucking device 47 is moved away from the yarn passing hole 9a in other cases to avoid interference.

[0060] As shown in FIG. 4 and FIG. 5, between the yarn take-down device 4 and the yarn sucking device 47, a yarn convergence guide 46 is provided to protrude to a position above the yarn passing hole 9a of the partition wall 9. This yarn convergence guide 46 is configured to converge the yarns Y sucked by the yarn sucking device 47.

[0061] On the second floor, at a position above the yarn passing hole 9a formed through the partition wall 9, an elevation detection sensor 48 is provided to detect that the yarn take-down device 4 is at the upper limit position. In the meanwhile, on the first floor, at a position below the yarn holding unit 5, a depression detection sensor 49 is provided to detect that the yarn take-down device 4 reaches the lower limit position. The elevation detection sensor 48 and the depression detection sensor 49 are not limited to any particular sensors. For example, a contact sensor or a non-contact sensor can be employed as each of these sensors.

[0062] Immediately below the yarn holding unit 5 on the first floor, a yarn shifting member 45 (shifting unit of the present invention) is provided. This yarn shifting member 45 shifts the yarns Y taken down to a position deviated from the yarn path YP in yarn production, toward the yarn holding unit 5 which is in the vicinity of the yarn path YP. The yarn shifting member 45 is driven by a yarn shifting driver 53 (see FIG. 2) formed of a cylinder, a motor, or the like and is swingable within the horizontal plane between a retracted position where no interference with the yarns Y occurs (FIG. 4) and a yarn shifting position where the yarns Y are shifted toward the yarn holding unit 5 (FIG. 14).

(Yarn Threading)

[0063] Now, preparations such as yarn threading by an operator at the start of the production of the yarns Y by the spun yarn take-up apparatus 1 and operations of the spun yarn take-up apparatus 1 at this stage will be described with reference to FIG. 6 to FIG. 11. Before the start of the yarn production, the operator stands at a position backward of the yarn passing hole 9a of the partition wall 9 on the second floor, and the operator performs operations such as cleaning of the spinning apparatus 2 and those related to the yarn take-down device 4. As shown in FIG. 1, on the first floor, the yarn threading unit 23 is provided to be movable in the left-right direction (the direction orthogonal to the plane of FIG. 1). When receiving a yarn threading requirement signal from a

spun yarn take-up apparatus 1, the yarn threading unit 23 moves to that apparatus. The yarn threading unit 23 then receives the yarns Y taken down by the yarn take-down device 4 and places the yarns Y onto the two godet rollers 15 and 16 of the take-up unit 6.

[0064] FIG. 6 shows the spun yarn take-up apparatus 1 immediately after the start of spinning. Operations regularly performed by the operator on the second floor, after the yarns spun out from the spinneret 10a are cut and the spinning and the yarn production are temporarily stopped, are as below. The first one of these operations is cleaning of the spinneret 10a of the spinning pack 10. This is an operation to remove deposits on the spinneret 10a and spray silicone onto the spinneret 10a. This operation is performed almost everyday, for example. Another operation is replacement of the spinning pack 10. In an apparatus producing yarns for cloths, this operation is performed about once in a week, for example. After these operations, to start the production again, it is necessary to thread the yarns Y spun out from the spinneret 10a, from the guides 13 and 14 to the take-up unit 6 and the winding device 7 in order.

[0065] To carry out the yarn placement above, to begin with, the operator on the second floor places an inclined plate 51 at a position below the cooling unit 3. This inclined plate 51 is provided to receive polymer 52 in order to prevent the polymer 52 flowing out from the spinneret 10a from dropping to the first floor during the preparations. When, for example, the inclined plate 51 is placed, the yarn sucking device 47 provided around the yarn passing hole 9a of the partition wall 9 may obstruct the placement of the inclined plate 51. In this connection, the yarn sucking device 47 is preferably moved from around the yarn passing hole 9a to a remote position in advance.

[0066] FIG. 7 shows the spun yarn take-up apparatus 1 when the yarns are retained by the yarn sucking device. FIG. 8 shows the spun yarn take-up apparatus 1 when the yarns are threaded onto the oil guide 13 and the yarn regulating guide 14. FIG. 9 shows the spun yarn take-up apparatus 1 when the yarns are threaded onto the yarn convergence guide 46. FIG. 10 shows the spun yarn take-up apparatus 1 immediately before the take down of the yarns.

[0067] When it becomes possible to spin out yarns Y from the spinning apparatus 2, the operator on the second floor guides the yarns Y spun out from the spinneret 10a to the yarn sucking device 47 backward of the yarn passing hole 9a, and causes the yarn sucking device 47 to suck and retain the yarns Y, as shown in FIG. 7. When the yarns Y are retained by the yarn sucking device 47, the inclined plate 51 is detached. Furthermore, as shown in FIG. 8, the operator threads the yarns Y spun out from the spinneret 10a onto the oil guide 13 and the yarn regulating guide 14.

[0068] Thereafter, as shown in FIG. 5 and FIG. 9, the yarns Y being sucked by the yarn sucking device 47 are threaded onto the yarn convergence guide 46 protruding to the yarn passing hole 9a, at a position slightly forward of the yarn sucking device 47. With this, the yarns Y being sucked by the yarn sucking device 47 are converged. Furthermore, as shown in FIG. 10, the converged yarns Y are serially threaded onto the two yarn threading portions 42 of the yarn take-down device 4. As such, as the yarns Y sucked by the yarn sucking device 47 are threaded onto the yarn convergence guide 46 and converted, the yarns Y are threaded onto the two yarn threading portions 42 in the converged state, with the result that yarn threading becomes easy. Furthermore, the yarns Y are less likely to be scattered when took down by the yarn take-down device 4.

[0069] When the yarns Y are retained by the yarn take-down device 4, the operator on the second floor operates the operation switch 50 for yarn take down. When a yarn take-down signal is supplied to the controller 8 from the operation switch 50, the controller 8 controls the fluid supplying unit 44 (see FIG. 2) and drives the elevation cylinder 40, with the result that the yarn take-down device 4 moves down.

[0070] FIG. 11 shows the spun yarn take-up apparatus 1 immediately after the depression of the yarn take-down device 4. As shown in FIG. 11, the yarn take-down device 4 moves down from the second floor through the yarn passing hole 9a of the partition wall 9, so that the yarns Y retained by the yarn take-down device 4 are taken down to the first floor. In so doing, the yarns Y form a substantially V-shaped yarn path which extends from the spinning apparatus 2 on the second floor to the yarn sucking device 47 on the second floor via the yarn take-down device 4 on the first floor. Furthermore, because the yarn take-down device 4 moves down along the passage backward of the yarn path YP in yarn production, the yarns Y retained by the yarn take-down device 4 are taken down to a position backward of the yarn path YP.

[0071] When the yarn take-down device 4 reaches the lower limit position which is in the vicinity of the yarn holding unit 5 on the first floor, this state is detected by the depression detection sensor 49. Upon receiving this detection signal, the controller 8 stops the move down of the yarn take-down device 4 by the elevation cylinder 40, and causes the yarn take-down device 4 to wait at the lower limit position for a predetermined waiting time. The waiting time is suitably set in accordance with a later-described time which is required for handing the yarns Y to the yarn threading unit 23 or the yarn holding unit 5.

[0072] The yarns Y taken down to the first floor by the yarn take-down device 4 are handed to the yarn threading unit 23 to be threaded onto the take-up unit 6. At this stage, when the yarn threading unit 23 has already reached a position forward of the spun yarn take-up apparatus 1 and has been on standby, the yarns Y are directly handed from the yarn take-down device 4 to the yarn threading unit 23. In the meanwhile, when the yarns Y are taken down but the yarn threading unit 23 is not on standby, the yarns Y are passed to the yarn holding unit 5 and then handed from the yarn holding unit 5 to the yarn threading unit 23 after the yarn threading unit 23

moves to the position. Whether the yarns Y taken down by the yarn take-down device 4 are handed to the yarn threading unit 23 or to the yarn holding unit 5 is determined by the controller 8 based on the positional information of the yarn threading unit 23.

(1) Handover of Yarns to Yarn Threading Unit 23

[0073] Now, handover of the yarns Y from the yarn take-down device 4 to the yarn threading unit 23 will be described. FIG. 12 shows the spun yarn take-up apparatus 1 when the yarns are handed to the yarn threading unit 23. FIG. 13 shows the spun yarn take-up apparatus 1 when the yarns are threaded by the yarn threading unit 23. Upon receiving the detection signal from the depression detection sensor 49, the controller 8 causes the yarn threading unit 23 to receive the yarns Y from the yarn take-down device 4.

[0074] As shown in FIG. 12, at the leading end portion of the yarn threading arm 25 of the yarn threading unit 23, the cutter 54 and the yarn sucking unit 55 are provided. To begin with, the yarn threading unit 23 moves the leading end portion of the yarn threading arm 25 to a position between the spinning apparatus 2 and the yarn take-down device 4, i.e., a position on the upstream of the yarn threading portion 42 on the front side (on the upstream in the yarn running direction). The cutter 54 is driven at this position, with the result that each of the yarns Y is cut at a yarn part Ya which is on the upstream of the yarn take-down device 4. The yarns Y having been cut are sucked into the yarn sucking unit 55 in the vicinity of the cutter 54 and are retained.

[0075] In regard to the above, because the yarn take-down device 4 is provided with two yarn threading portions 42, as shown in FIG. 12, the distance between the yarn part Ya on the upstream of the yarn take-down device 4 and the yarn part Yb on the downstream of the yarn take-down device 4 is long in each yarn Y. On this account, when the yarn part Ya on the upstream side is cut by the yarn threading unit 23, the yarn part Yb on the downstream side is less likely to be cut together with the yarn part Ya.

[0076] When the yarns Y are retained by the yarn threading arm 25, as shown in FIG. 13, the yarn threading unit 23 operates the yarn threading arm 25 to place the yarns Y onto the godet rollers 15 and 16 of the take-up unit 6 in order. After the handover of the yarns Y to the yarn threading unit 23 is finished, the yarn take-down device 4 is no longer required to be on the first floor. On this account, after the above-described waiting time elapses, the controller 8 moves up the yarn take-down device 4 back to the second floor by the elevation cylinder 40. Alternatively, after the handover of the yarns Y, the yarn take-down device 4 may not automatically return to the second floor but manually return to the second floor as the operator operates the operation switch 50.

[0077] The yarn take-down device 4 moves up and down along the passage backward of the yarn path YP in yarn production on the first floor, and takes the yarns Y down to a position deviated from the yarn path YP. For this reason, even if the yarns Y are handed to the yarn threading unit 23 on the first floor and the yarn take-down device 4 is moved back to the second floor while the yarns Y are threaded onto the take-up unit 6, the yarn take-down device 4 does not interfere with the yarns Y threaded onto the take-up unit 6.

(2) Handover of Yarns to Yarn Holding Member 5

[0078] Now, handover of the yarns Y from the yarn take-down device 4 to the yarn holding unit 5 will be described. FIG. 14 shows the spun yarn take-up apparatus 1 when the yarns are handed to the yarn holding unit 5. FIG. 15 shows the spun yarn take-up apparatus 1 after the completion of the handover of the yarns to the yarn holding unit 5. Upon receiving the detection signal from the depression detection sensor 49, the controller 8 sends a control signal to the yarn shifting driver 53 (see FIG. 2) which swings the yarn shifting member 45 and to the yarn holding unit 5, so as to cause them to perform the handover of the yarns Y to the yarn holding unit 5.

[0079] To begin with, the yarn shifting driver 53 swings the yarn shifting member 45 from the retracted position shown in FIG. 11 to the yarn shifting position shown in FIG. 14. With this, as shown in FIG. 14, the yarns Y taken down by the yarn take-down device 4 are moved to be close to the yarn path YP in yarn production.

[0080] Subsequently, the yarn holding unit 5 sucks and retains the yarns Y shifted by the yarn shifting member 45. To be more specific, as shown in FIG. 3(b), the sucking pipe 21 advances by means of the fluid cylinder 27. As a result, the yarns Y taken down by the yarn take-down device 4 are cut by the cutter 22 provided at the leading end portion of the sucking pipe 21. The yarns Y having been cut are sucked and retained by the sucking pipe 21. With this, as shown in FIG. 15, the yarns Y taken down by the yarn take-down device 4 are handed to the yarn holding unit 5. Thereafter, in a manner similar to the handover of the yarns Y to the yarn threading unit 23, the controller 8 moves up the yarn take-down device 4 back to the second floor by the elevation cylinder 40, after a predetermined waiting time elapses.

[0081] As such, the yarn holding unit 5 of the present embodiment is able to suck the yarns Y which are taken down by the yarn take-down device 4 at a position deviated from the yarn path YP in yarn production. For this reason, it is unnecessary to arrange the yarn threading unit 23 to wait for the yarns Y in advance, when the yarns Y are taken down from the second floor. In other words, the operator working on the second floor is allowed to take yarns down at any timing, no matter whether the yarn threading unit 23 on the first floor waits for the yarns Y.

[0082] After the yarns Y are handed to the yarn holding unit 5 shown in FIG. 15, the yarn threading unit 23 (see FIG. 1) moves to a position forward of the spun yarn take-

up apparatus 1. The yarn threading unit 23 cuts the yarns Y retained by the yarn holding unit 5 by the cutter 54 and receives the yarns Y by sucking them by the yarn sucking unit 55. The yarn threading unit 23 then places the yarns Y onto the godet rollers 15 and 16 of the take-up unit 6 by moving the yarn threading arm 25.

[0083] In the spun yarn take-up apparatus 1 of the present embodiment described above, the yarn take-down device 4 includes two yarn threading portions 42 which are distanced from each other in the front-back direction, and each of the yarns Y is threaded onto the two yarn threading portions 42 in order. As each of the yarns Y is threaded onto the two yarn threading portions 42, the yarn part Ya on the upstream of the yarn take-down device 4 is distanced from the yarn part Yb on the downstream of the yarn take-down device 4. This prevents a yarn Y from being erroneously cut at two parts by the cutter 54 of the yarn threading unit 23 or the cutter 22 of the yarn holding unit 5, with the result that the success rate of the handover of the yarns Y is improved.

[0084] The distance L in the front-back direction between the two yarn threading portions 42 is preferably 30mm or longer, and more preferably 120mm or longer. With this, the distance between the two yarn parts Ya and Yb threaded onto the two yarn threading portions 42, respectively, is long. This certainly prevents a single yarn Y from being erroneously captured at two parts. Furthermore, when the distance L is 120mm or longer, the yarn threading arm 25 is able to pass the gap between the two yarn threading portions 42. This facilitates the handover of the yarns Y to the yarn threading arm 25. Even is the distance L is much shorter than this, the handover of the yarns Y is successfully done when the distance L is at least about 30mm, by advancing only a part of the yarn threading arm 25 (e.g., the cutter 54 or the yarn sucking unit 55).

[0085] The following will describe modifications of the above-described embodiment of the present invention. The members identical with those in the embodiment above will be denoted by the same reference numerals and the explanations thereof are not repeated.

1] While in the embodiment above the yarns Y taken down to the first floor by the yarn take-down device 4 are handed to the yarn threading unit 23 and are threaded onto the take-up unit 6 by the yarn threading unit 23, the yarn threading unit 23 is not prerequisite. The yarns Y taken down to the first floor by the yarn take-down device 4 may be received by the operator on the first floor by means of the suction gun, and the yarn threading may be manually done. Also in this case, it is possible to prevent a yarn Y from being erroneously caught at two parts, because the yarn part Ya on the upstream side is distanced from the yarn part Yb on the downstream side by the two yarn threading portions 42 of the yarn take-down device 4.

2] In the embodiment above, the yarn take-down device 4 moves up and down along a passage backward of the yarn path YP in yarn production, and takes the yarns Y down to a position deviated rearward from the yarn path YP on the first floor. In this regard, the position where the yarns Y are taken down may be deviated frontward, leftward, or rightward from the yarn path YP.

In the embodiment above, the yarn threading unit 23 moves to the front side of the spun yarn take-up apparatus 1 and the yarn threading unit 23 performs the yarn threading from the front side. In connection with this, when the yarn take-down device 4 is arranged to take the yarns Y down to a position deviated frontward from the yarn path YP, the yarn threading unit 23 is able to easily receive the yarns Y from the yarn take-down device 4. This is true for a case where the operator receives the yarns Y from the front side by means of the suction gun, too,

3] While in the embodiment above the yarn shifting member 45 shifts the yarns Y to the yarn holding unit 5 by swinging, the disclosure is not limited to this arrangement. For example, as described in Japanese Unexamined Patent Publication No. 2013-57148 (FIG. 10), the yarns may be shifted by linear motion.

In addition to the above, the yarn shifting member is not prerequisite. For example, when the yarns Y are taken down by the yarn take-down device 4 to a position deviated rightward (the side close to the viewer of FIG. 1) from the yarn path YP in yarn production, the yarn holding unit 5 is able to suck the yarns Y without the help of the yarn shifting member 45. That is to say, as shown in FIG. 3, the yarn holding unit 5 is provided with the sucking pipe 21 which advances and retracts in the left-right directions (i.e., the directions of moving close to and away from the yarns Y) and the cutter 22 provided at the leading end portion of the sucking pipe 21. Even if the position where the yarns Y are taken down is deviated rightward from the yarn path YP, the yarns Y are cut as the sucking pipe 21 advances and the cutter 22 moves rightward. The yarns Y having been cut by the cutter 22 are sucked by the sucking pipe 21. In this case, the leading end portion of the sucking pipe 21 of the yarn holding unit 5 is equivalent to a second yarn sucking unit of the present invention.

4] On the second floor of the building, the yarn sucking device 47 which sucks and retains the yarns Y spun out from the spinning apparatus 2 may be a portable device such as a suction gun. In a single spun yarn take-up apparatus 1, when the operator finishes the operations on the second floor and moves the yarn take-down device 4 down to the first floor, and the handover of the yarns Y to the yarn threading unit 23 or the yarn holding unit 5 is completed, the yarns Y leave the yarn sucking device 47 on the second floor (see FIG. 13 and FIG. 15). In other words, the yarn sucking device 47 becomes

no longer required. On this account, when the take down of the yarns is finished in one spun yarn take-up apparatus 1, the yarn sucking device 47 may be carried to another place to perform other operations (e.g., preparations for another spun yarn take-up apparatus 1).

5] In the embodiment above, for each of the yarns Y, the yarn threading unit 23 cuts the yarn part Ya on the upstream of the yarn take-down device 4 and receives the yarn Y. Alternatively, as shown in FIG. 16, the yarn threading unit 23 may cut the yarn Y between the two yarn threading portions 42 and receive the yarn Y. Also in this case, erroneous cutting of one yarn at two parts is less likely to occur. Furthermore, because vibrations of the yarn Y is restrained at a part between the two yarn threading portions 42 on account of the proximity to the yarn threading portions, the success rate of yarn cutting is high. Similarly, when the yarns Y are received by the yarn holding unit 5 or when the yarn threading is performed by the operator by using the suction gun, a yarn may be cut at a position between the two yarn threading portions 42 and received.

In addition to the above, because each yarn is threaded onto the two yarn threading portions, cutting and handover of the yarns Y can be done at three positions, namely a position upstream of the yarn take-down device 4, a position between the two yarn threading portions 42, and a position on the downstream of the yarn take-down device 4. It is therefore possible to differentiate a captured part in accordance with the size of a tool used for handing the yarns Y. For example, assume that the yarn holding unit 5 is larger in size than the leading end portion of the yarn threading arm 25 of the yarn threading unit 23. In this case, when the yarn Y is received by the large yarn holding unit 5, the yarn Y is received after the yarn part Ya on the upstream of the yarn take-down device 4 is cut as shown in FIG. 14. In the meanwhile, when the yarn Y is received by the small yarn threading unit 23, the yarn Y is received after the yarn Y is cut between the two yarn threading portions 42 as shown in FIG. 16.

6] While in the embodiment above the two yarn threading portions 42 of the yarn take-down device 4 are distanced from each other in the front-back direction, the direction in which the two yarn threading portions 42 are lined up (i.e., the direction in which the yarn part on the upstream of the yarn take-down device 4 is distanced from the yarn part on the downstream) may be any directions on condition that the direction intersects with the up-down direction. For example, the two yarn threading portions 42 may be lined up at an interval in the left-right direction.

7] The number of the yarn threading portions 42 of the yarn take-down device 4 is not limited to 2 and may be 3 or more. When the number of the yarn threading portions 42 is three or more, the distance between the two yarn threading portions 42 which are the outermost ones in a direction intersecting with the up-down direction is preferably a predetermined distance (e.g., 30mm) or longer.

8] Each yarn threading portion of the yarn take-down device 4 may be a roller which is freely rotatable. This arrangement restrains damage of the yarn Y at the yarn threading portion, with the result that yarn breakage at the time of yarn threading is restrained.

9] The elevation detection sensor 48 and the depression detection sensor 49 which detect that the yarn take-down device 4 reaches the upper limit position and the lower limit position are not prerequisite. For example, as a driving unit for moving the yarn take-down device 4 up and down, a motor which is positionally controllable such as a servo motor may be employed. In such a case, the sensors 48 and 49 above are unnecessary. In the meanwhile, the operator may manually stop the yarn take-down device 4 by visually checking the position of the yarn take-down device 4. The sensors 48 and 49 are unnecessary also in this case.

10] While the spun yarn take-up apparatus of the embodiment above is an apparatus for producing POY, which winds yarns Y spun out from the spinning apparatus 2 directly onto packages P without drawing them, the spun yarn take-up apparatus may be an apparatus for producing FDY, which winds spun yarns Y onto packages P after drawing them. In the apparatus for producing FDY, the take-up unit 6 includes, in addition to the two godet rollers 15 and 16, drawing rollers which are provided on the upstream in the yarn running direction of the rollers 15 and 16 to draw the yarns Y.

Claims

1. A spun yarn take-up apparatus taking up yarns spun out from a spinning apparatus provided in a first yarn processing space, comprising:

a take-up unit provided in a second yarn processing space below the first yarn processing space and configured to take up the yarns spun out from the spinning apparatus;
a first yarn sucking unit provided in the first yarn processing space and configured to suck and retain the yarns spun out from the spinning apparatus; and
a yarn take-down device configured to take the yarns retained by the first yarn sucking unit down from the first yarn processing space to the second yarn processing space,

the yarn take-down device including yarn threading portions which are provided at intervals in a direction intersecting with an up-down direction, each of the

yarns being threaded onto the yarn threading portions in order.

2. The spun yarn take-up apparatus according to claim 1, wherein, the distance between two yarn threading portions which are outermost ones in the intersecting direction among the yarn threading portions is 30mm or longer.

3. The spun yarn take-up apparatus according to claim 2, wherein, the distance between two yarn threading portions which are outermost ones in the intersecting direction among the yarn threading portions is 120mm or longer.

4. The spun yarn take-up apparatus according to any one of claims 1 to 3, wherein, the yarn take-down device takes the yarns down to a position which is in the second yarn processing space and is deviated from a yarn path when the yarns are taken up by the take-up unit.

5. The spun yarn take-up apparatus according to claim 4, further comprising a yarn convergence guide which is provided in the first yarn processing space and is configured to converge the yarns taken down by the yarn take-down device.

6. The spun yarn take-up apparatus according to claim 4 or 5, further comprising
a yarn holding unit which is provided in the second yarn processing space and sucks and retains the yarns supplied from the spinning apparatus,
the yarn holding unit being capable of sucking the yarns taken down to the position deviated from the yarn path by the yarn take-down device.

7. The spun yarn take-up apparatus according to claim 6, wherein,
the yarn holding unit includes a cutter by which the yarns are cut and a second yarn sucking unit configured to suck the yarns cut by the cutter,
the cutter and the second yarn sucking unit being capable of moving close to and away from the yarns taken down by the yarn take-down device.

8. The spun yarn take-up apparatus according to claim 6, further comprising
a shifting unit configured to move, toward the yarn holding unit, the yarns taken down by the yarn take-down device.

9. The spun yarn take-up apparatus according to any one of claims 6 to 8, wherein,
the yarn holding unit cuts the yarns between the spinning apparatus and the yarn take-down device and receives the yarns.

10. The spun yarn take-up apparatus according to any one of claims 6 to 8, wherein,
the yarn holding unit cuts the yarns between neighboring two of the yarn threading portions and receives the yarns.

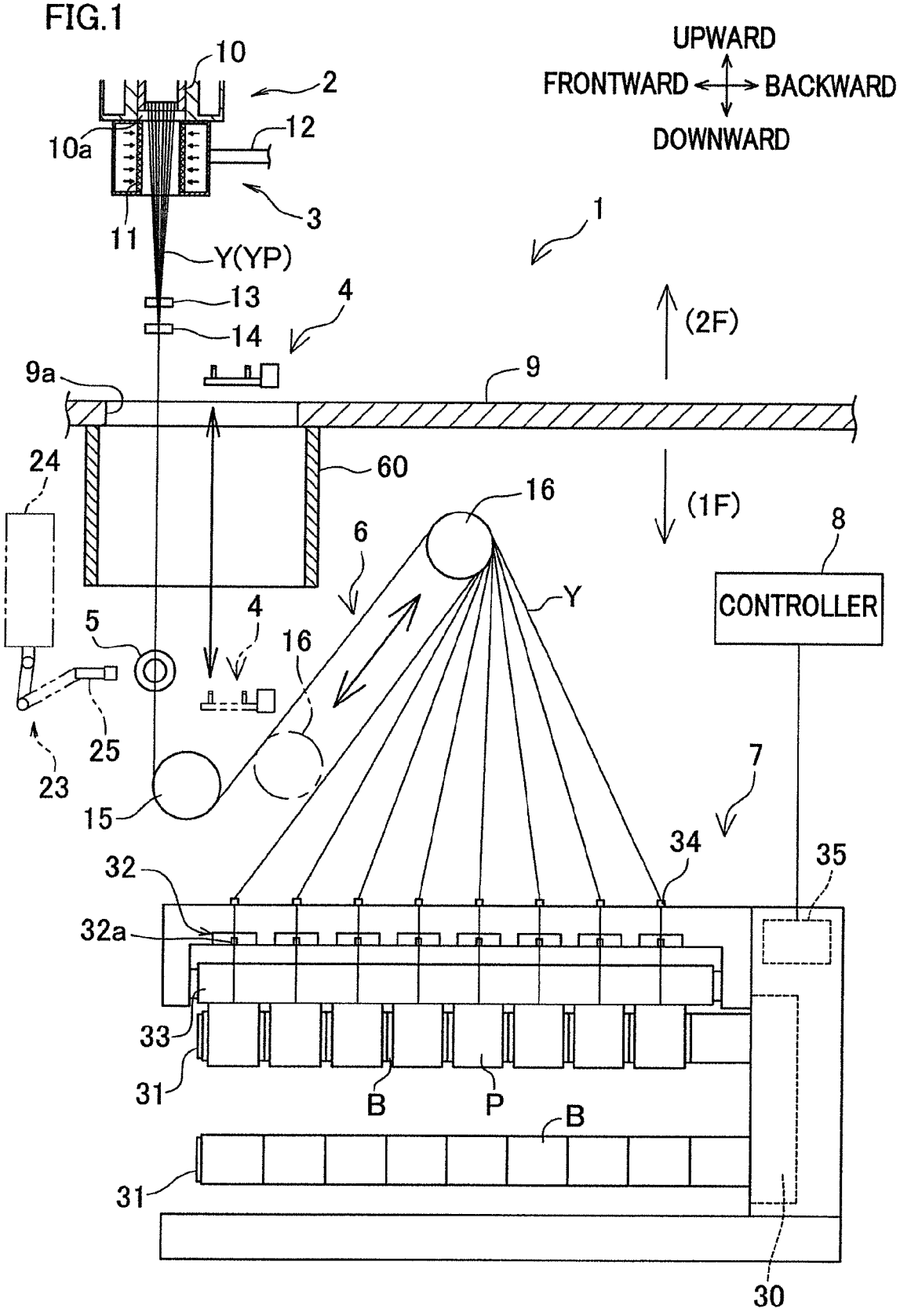
11. The spun yarn take-up apparatus according to any one of claims 1 to 10, wherein,
the first yarn sucking unit is portable.

12. The spun yarn take-up apparatus according to any one of claims 1 to 11, further comprising
a yarn threading unit which is provided in the second yarn processing space and is configured to cut and receive the yarns taken down by the yarn take-down device and thread the received yarns onto the take-up unit.

13. The spun yarn take-up apparatus according to claim 12, wherein,
the yarn threading unit cuts the yarns between the spinning apparatus and the yarn take-down device and receives the yarns.

14. The spun yarn take-up apparatus according to claim 12, wherein,
the yarn threading unit cuts the yarns between neighboring two of the yarn threading portions and receives the yarns.

FIG.1


UPWARD
FRONTWARD
BACKWARD
DOWNWARD
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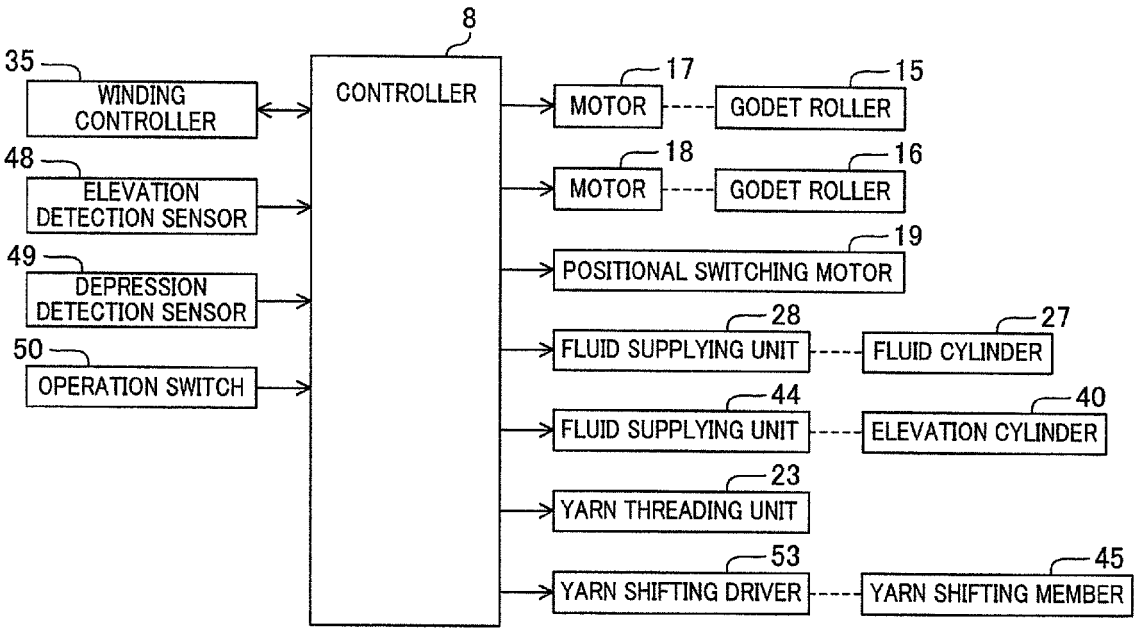
2
10a
12
3
11
Y(YP)
1
13
4
14
(2F)
9a
9
24
60
16
(1F)
8
6
Y
CONTROLLER
5
4
16
25
23
15
7
34
35
32
32a
33
31
B
P
B
31
30

FIG.2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35
WINDING CONTROLLER
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ELEVATION DETECTION SENSOR
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DEPRESSION DETECTION SENSOR
50
OPERATION SWITCH
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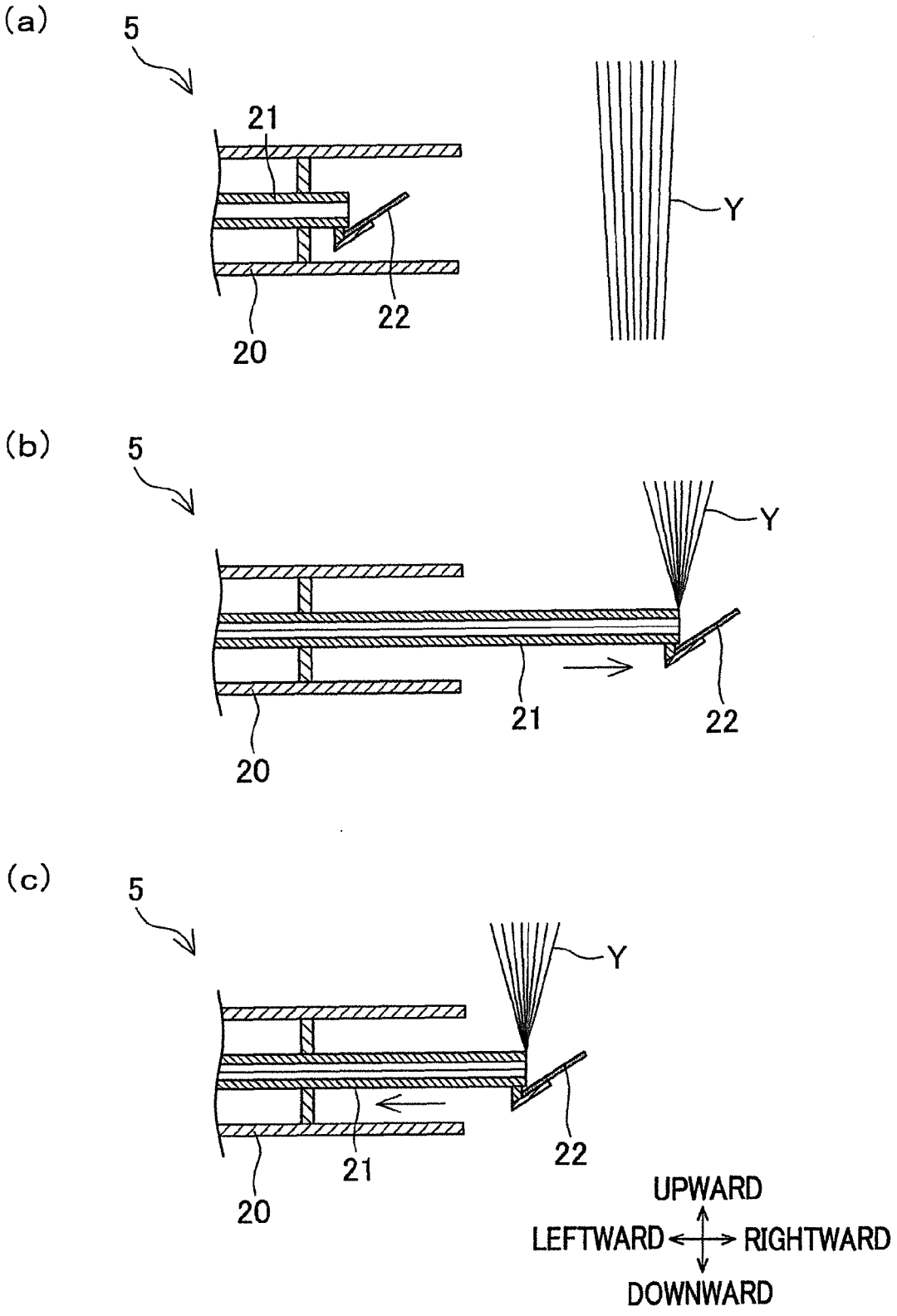
MOTOR
15
GODET ROLLER
18
MOTOR
16
GODET ROLLER
19
POSITIONAL SWITCHING MOTOR
28
FLUID SUPPLYING UNIT
27
FLUID CYLINDER
44
FLUID SUPPLYING UNIT
40
ELEVATION CYLINDER
23
YARN THREADING UNIT
53
YARN SHIFTING DRIVER
45
YARN SHIFTING MEMBER

FIG.3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5
21
22
20
Y
(b)
5
Y
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22
20
(c)
5
Y
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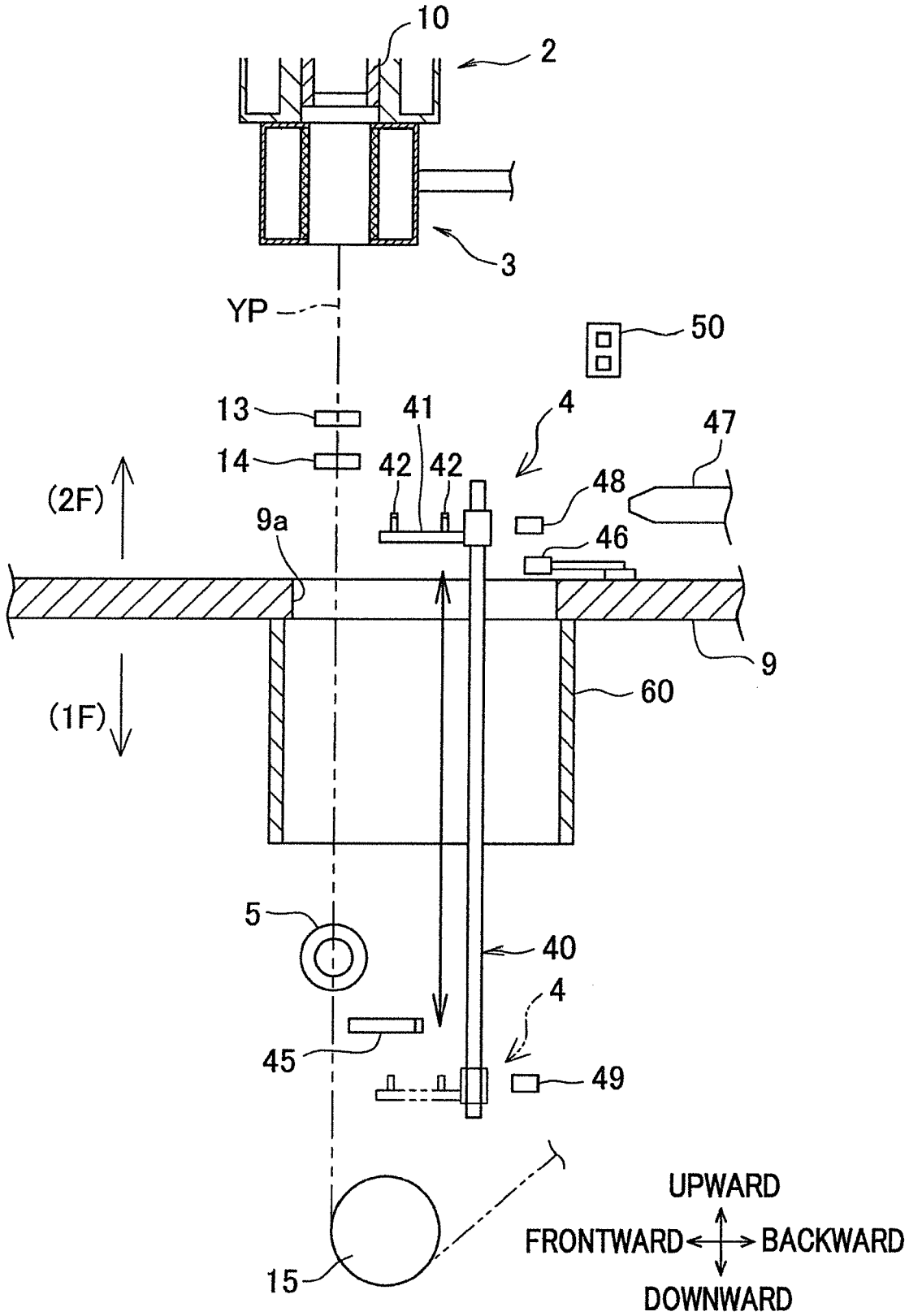
22
20
UPWARD
LEFTWARD
RIGHTWARD
DOWNWARD

FIG.4


10
2
3
YP
50
13
41
4
47
14
42
42
48
(2F)
9a
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9
(1F)
60
5
40
4
45
49
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.5

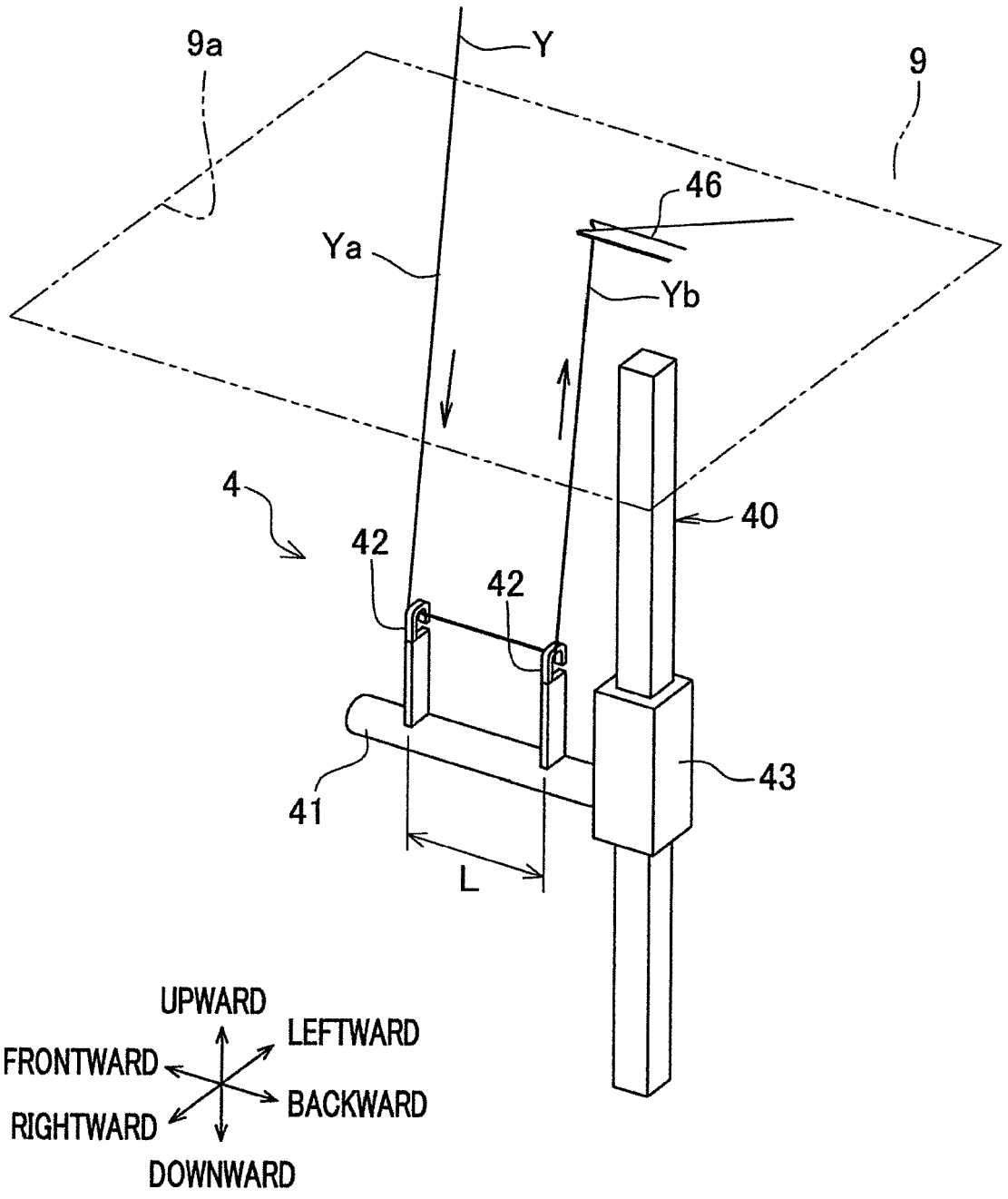
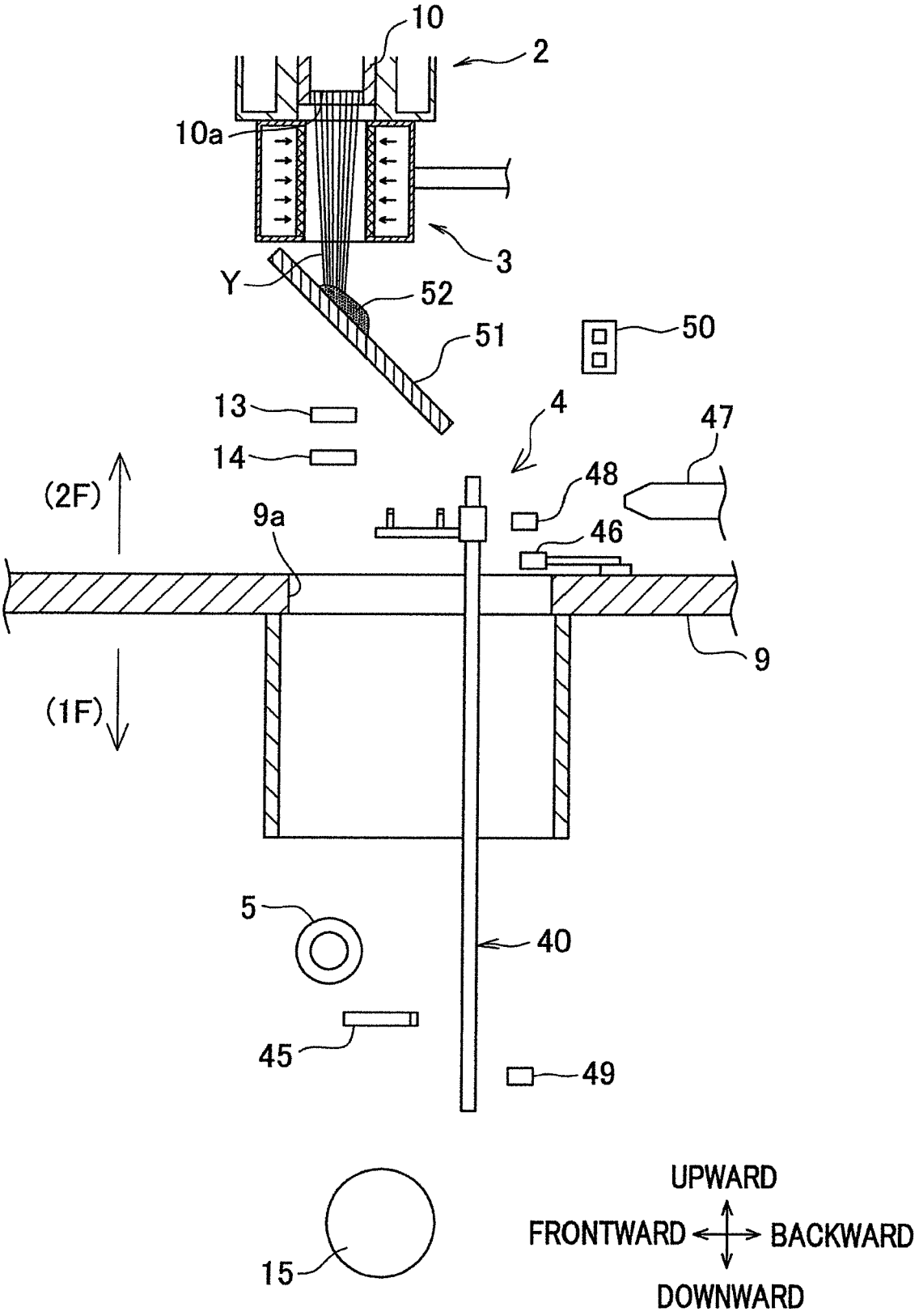

9a
Y
9
46
Ya
Yb
4
40
42
42
43
41
L
UPWARD
LEFTWARD
FRONTWARD
BACKWARD
RIGHTWARD
DOWNWARD

FIG.6


10
2
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3
Y
52
51
50
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4
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14
48
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9a
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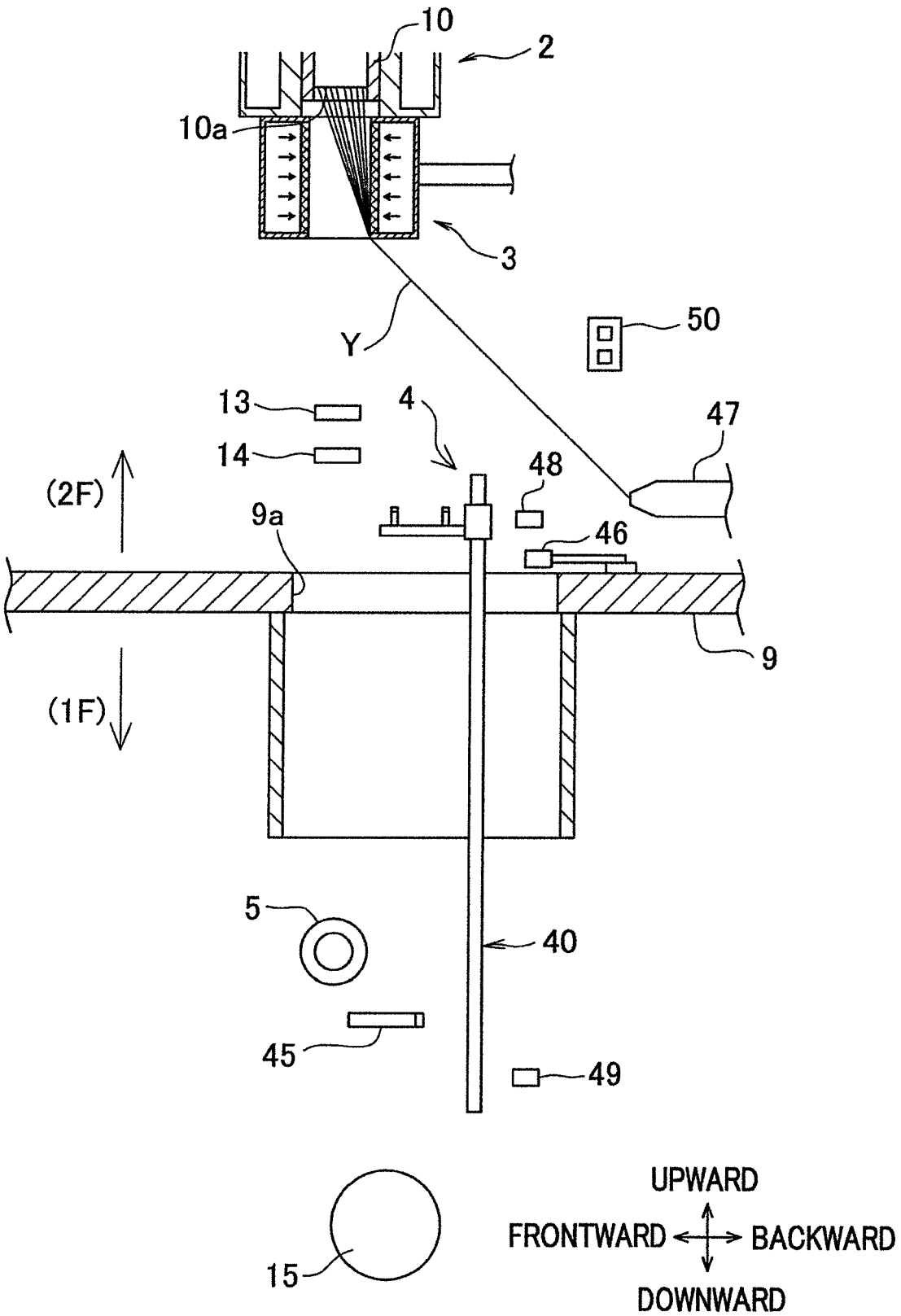
9
(1F)
5
40
45
49
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.7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14
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9a
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(1F)
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45
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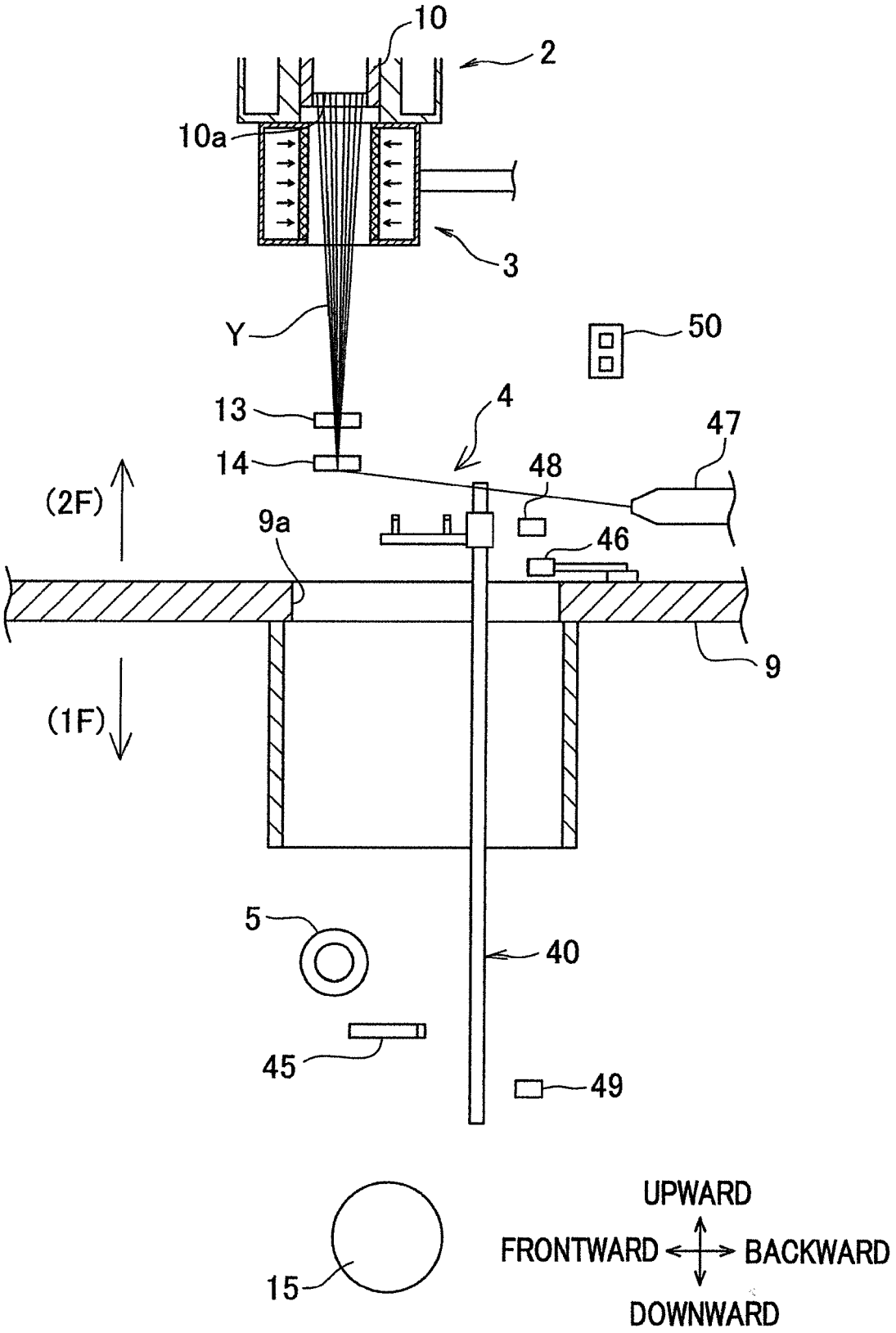
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.8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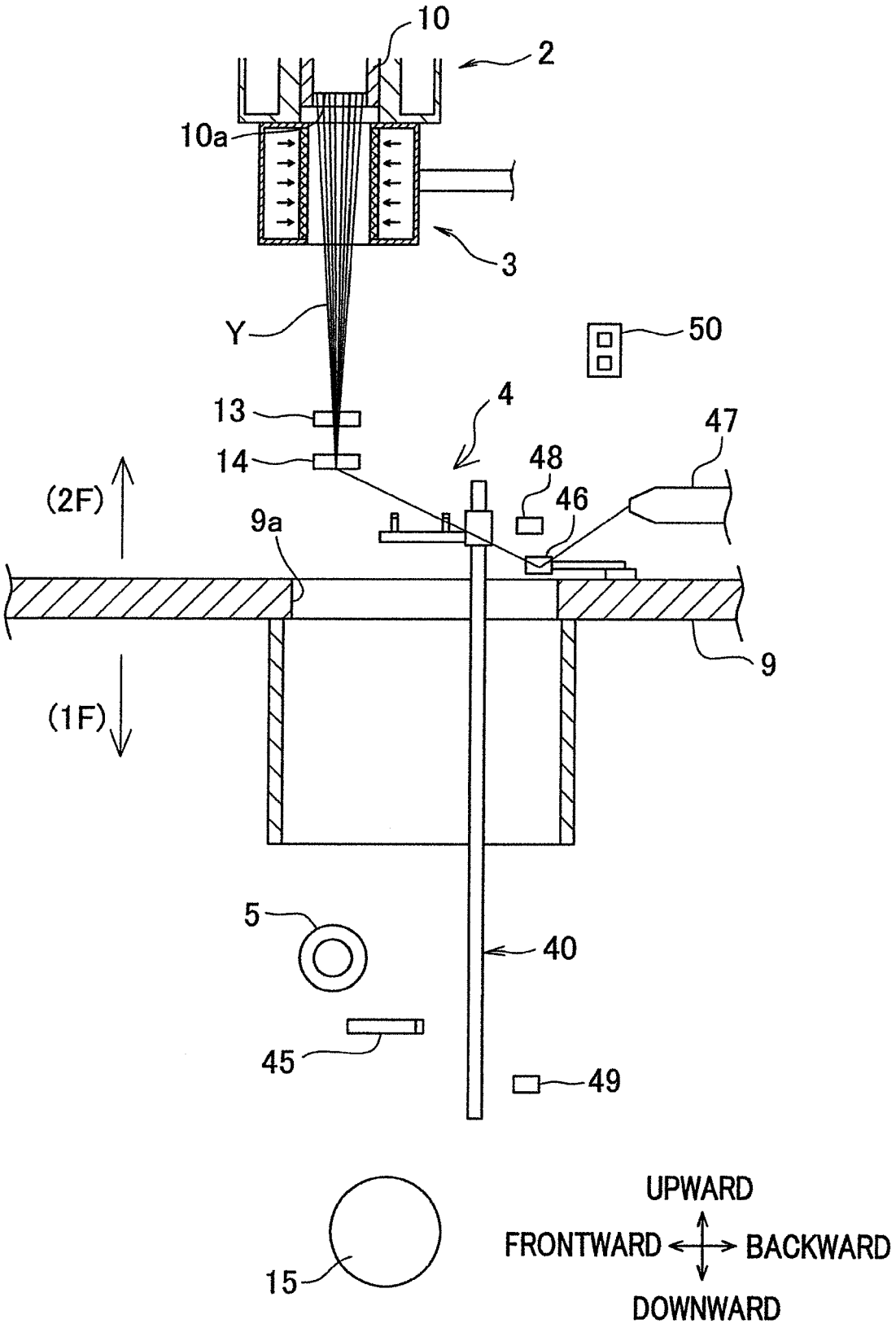
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.9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(2F)
9a
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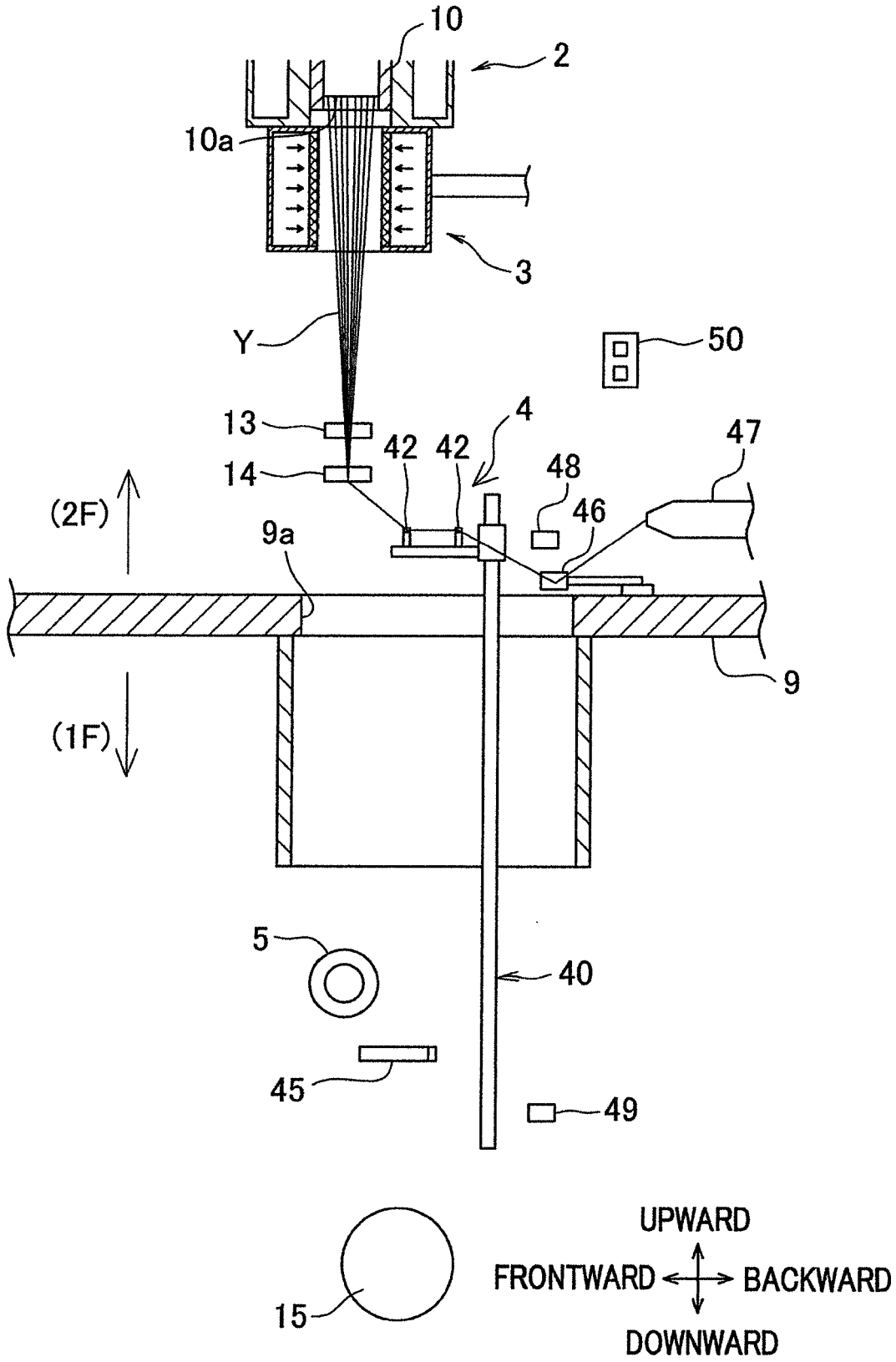
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.10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9a
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(1F)
5
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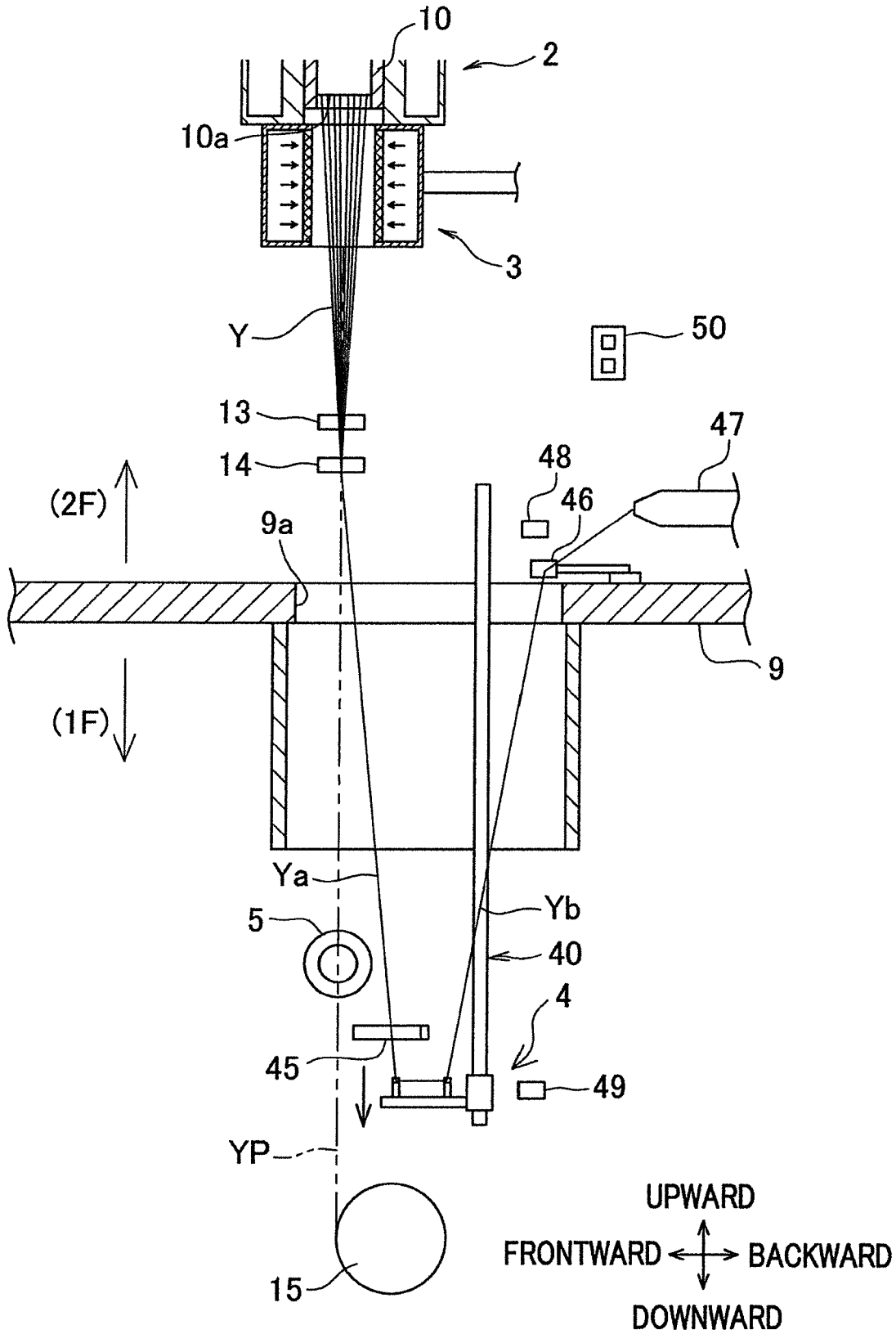
45
49
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.11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Ya
Yb
5
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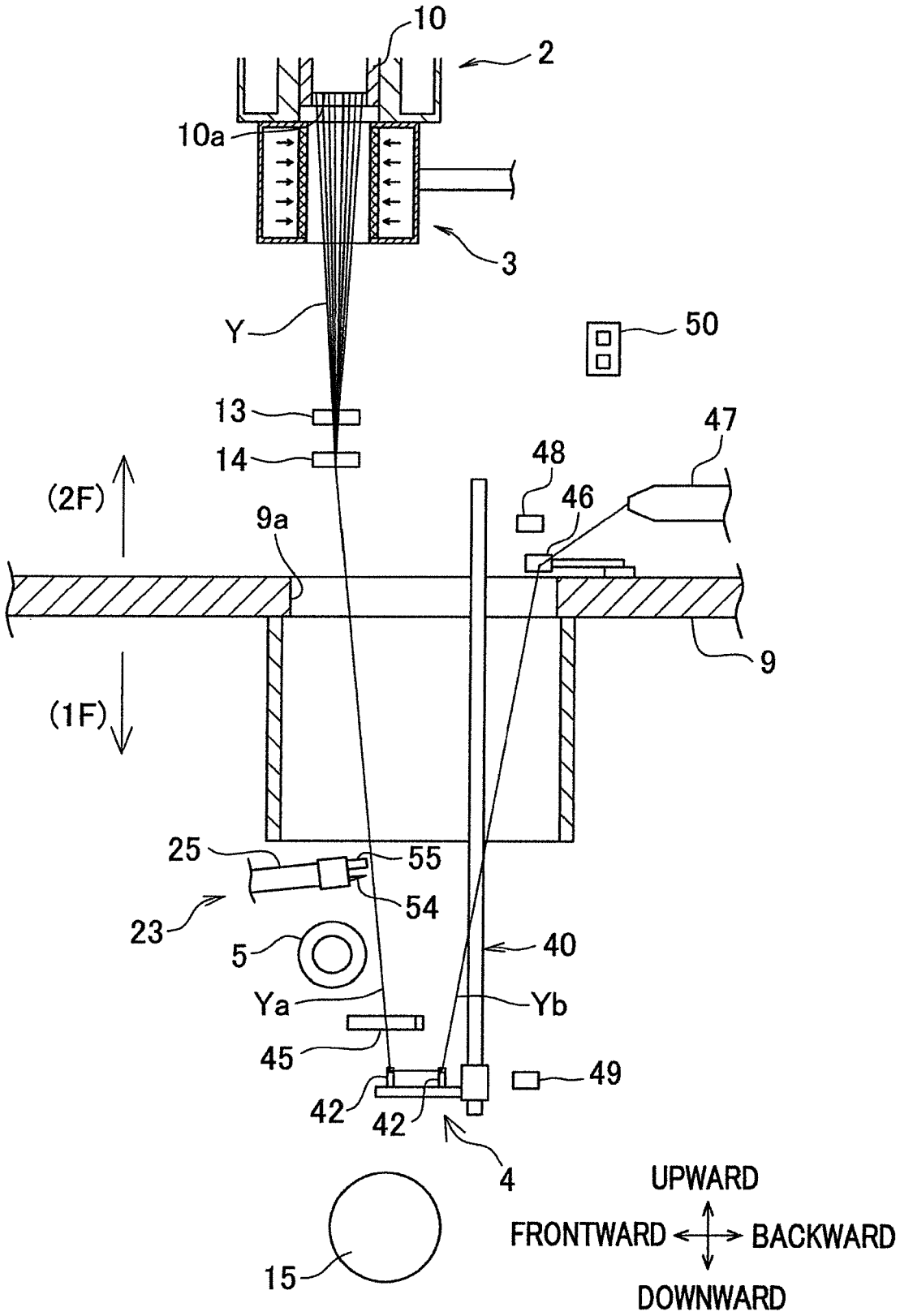
49
YP
15
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.12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(1F)
25
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40
Ya
Yb
45
49
42
42
4
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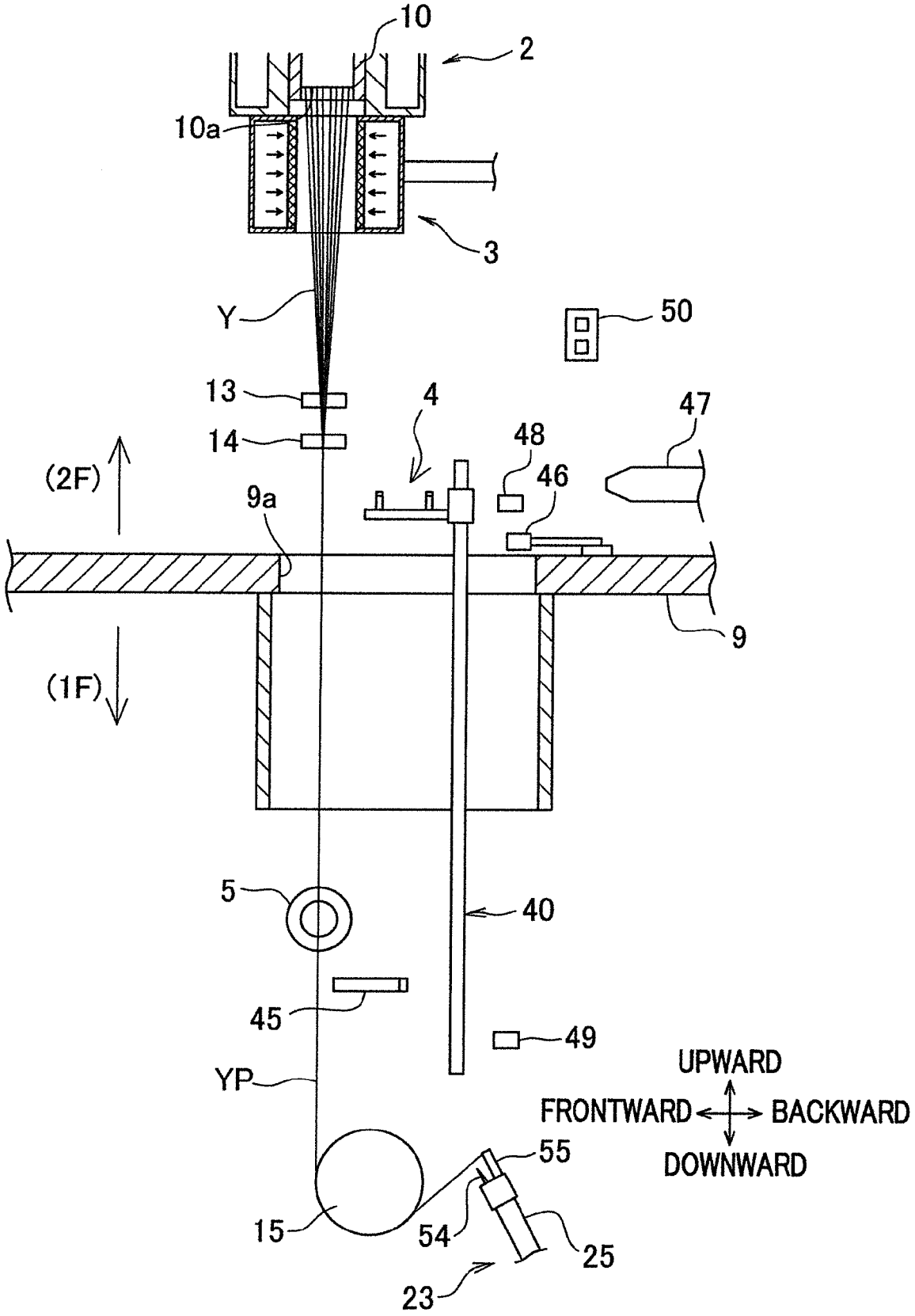
UPWARD
FRONTWARD
BACKWARD
DOWNWARD

FIG.13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YP
UPWARD
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BACKWARD
DOWNWARD
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FIG.14

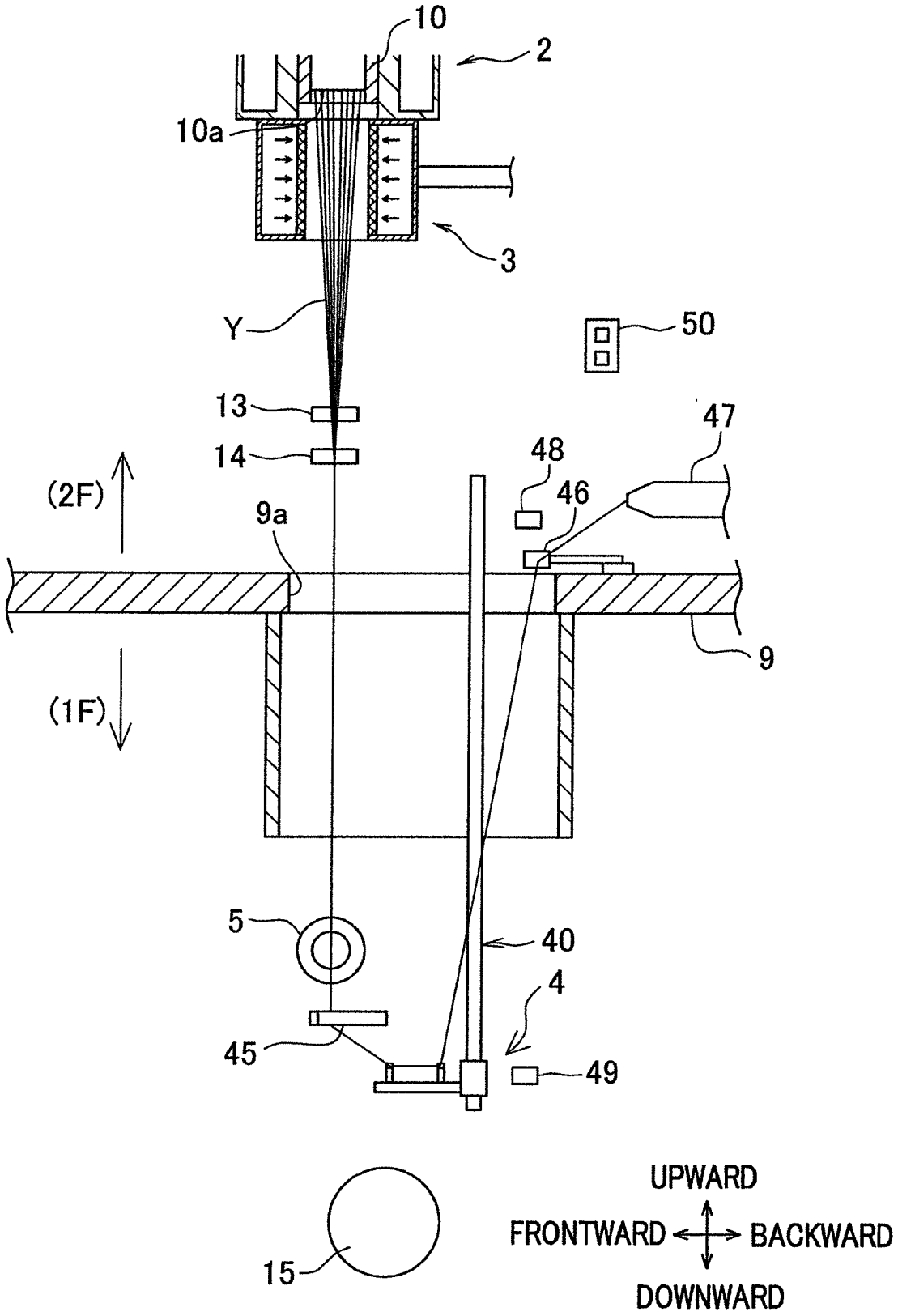
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FIG.15

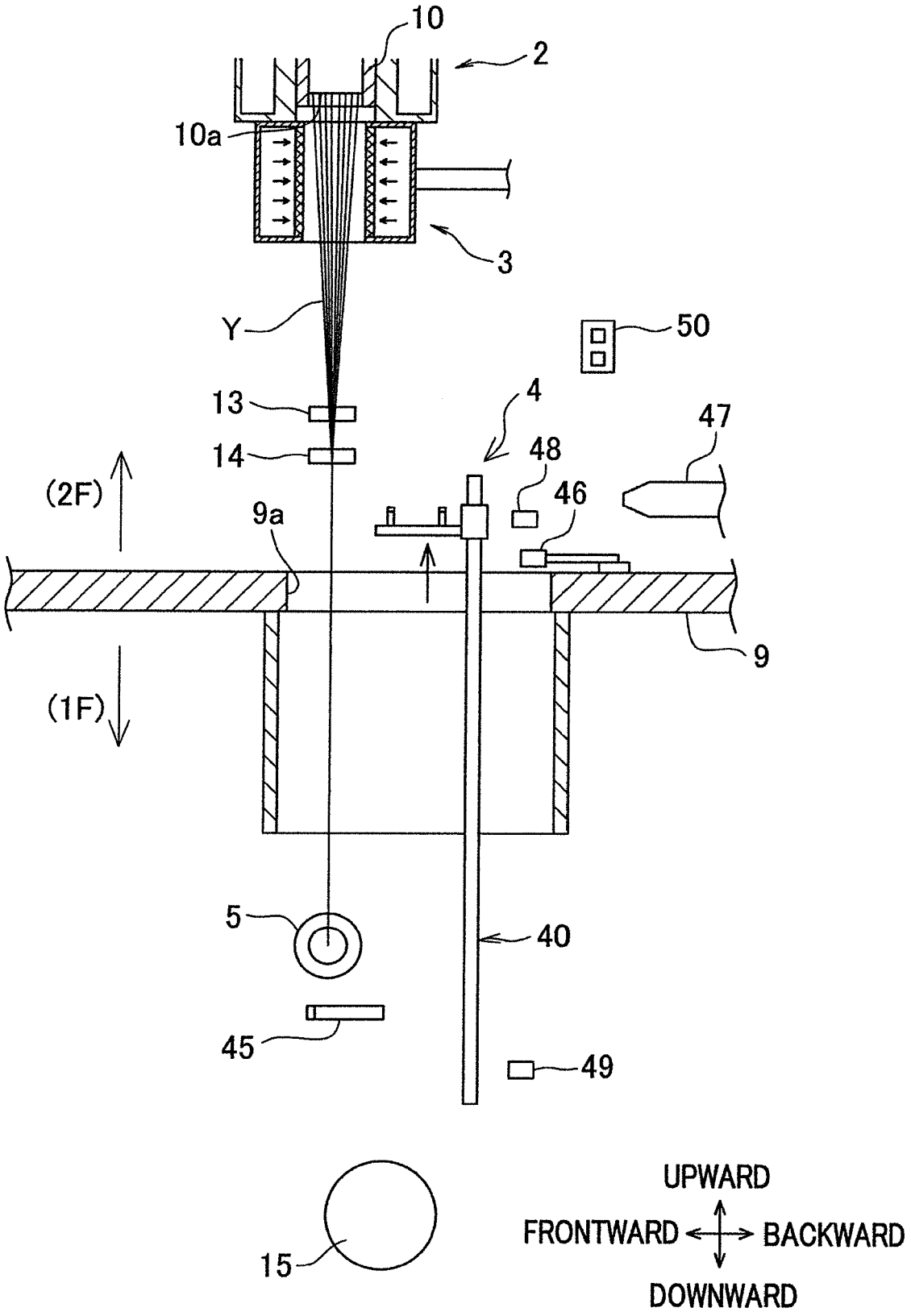
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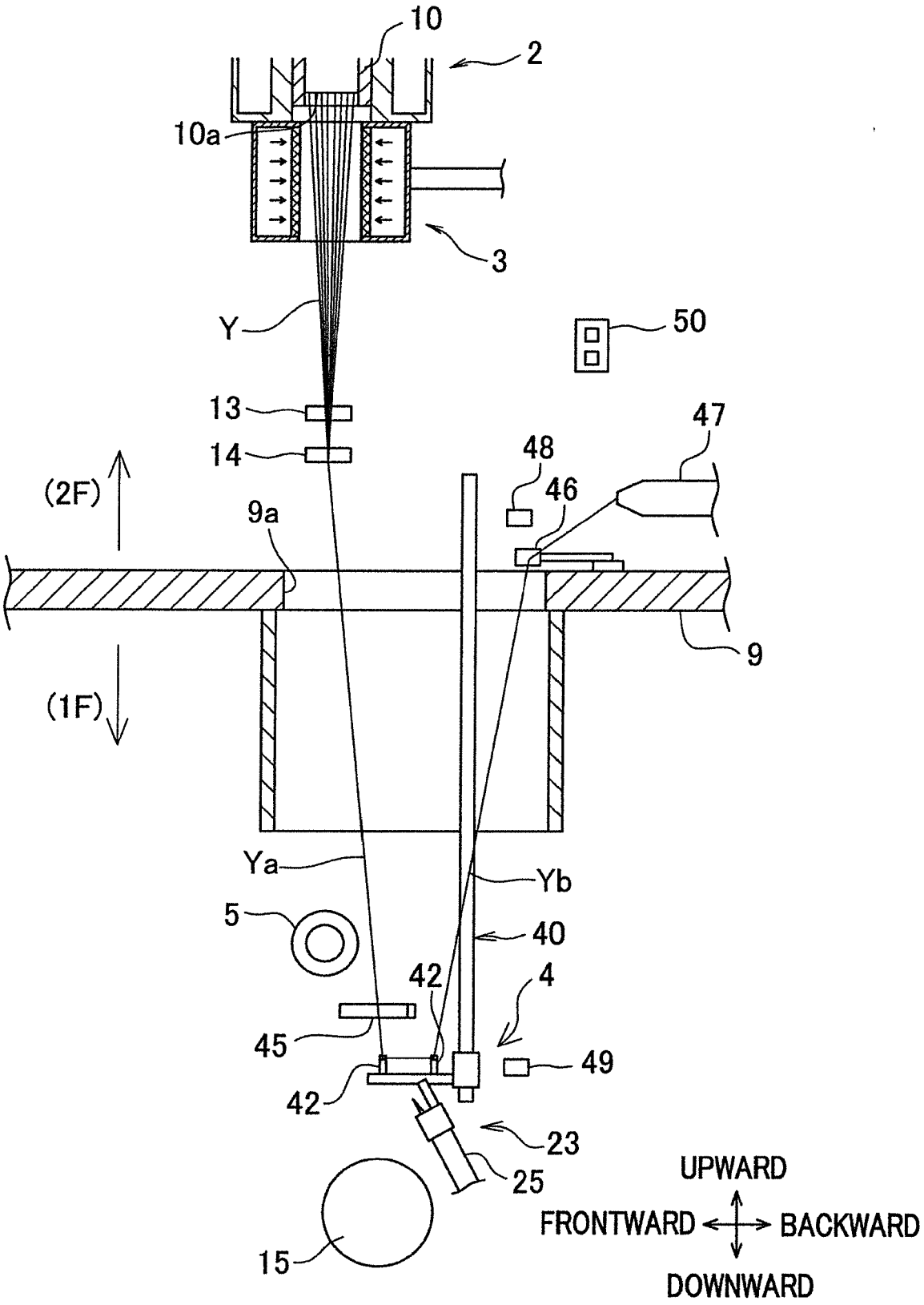
FIG.16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UPWARD
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BACKWARD
DOWNWARD

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 4793

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 101 17 087 A1 (BARMAG BARMER MASCHF [DE]) 11 October 2001 (2001-10-11) * abstract; claims 1-6; figures 1,3,4 * * paragraphs [0021] - [0025], [0027] - [0034] *	1-5,11	INV. D01D13/00 B65H51/28 B65H54/86
A	EP 2 407 408 A2 (TMT MACHINERY INC [JP]) 18 January 2012 (2012-01-18) * paragraphs [0026] - [0029]; claims 1,2; figures 1,3-6 *	1-14	
A	US 3 807 270 A (WIRZ A) 30 April 1974 (1974-04-30) * abstract; claims 1-8; figures 1,6,9,10 *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

D01D
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 March 2017	Malik, Jan

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21-03-2017

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- JP 2013057148 A **[0085]**