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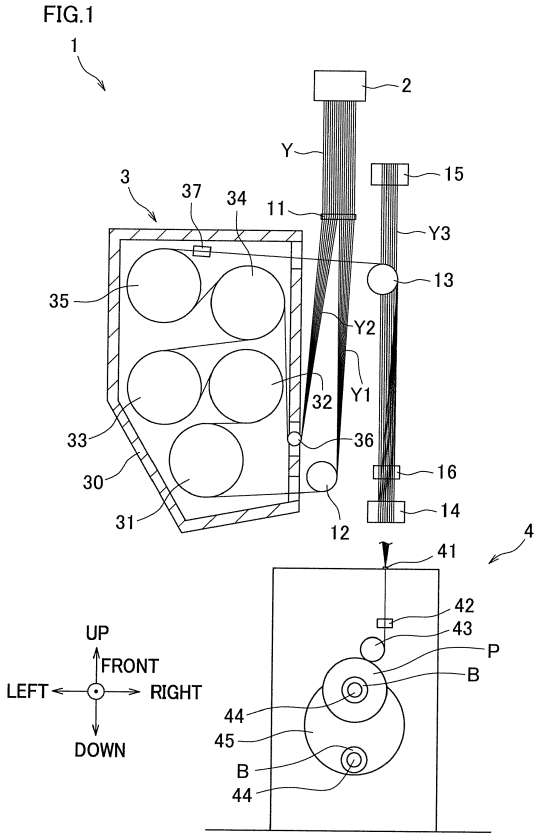
(54) COMBINED FILAMENT YARN PRODUCING DEVICE

(57) An object of the present invention is to decrease the power consumption of a combined filament yarn producing device.

A combined filament yarn producing device 1 includes: first heating rollers 31 to 33; second heating rollers 34 and 35 which are higher in yarn feeding speed and temperature than the first heating rollers 31 to 33; a thermal insulation box 30 in which the heating rollers 31 to 35 are provided; a guide roller 36 by which yarns Y are guided to the second heating roller 34 without passing the first heating rollers 31 to 33; and a yarn doubling unit 16 configured to perform yarn doubling for a first group of yarns Y1 and a second group of yarns Y2, the first group of yarns Y1 reach the second heating roller 34 via the first heating rollers 31 to 33 and are drawn between the first heating roller 33 and the second heating roller 34, the second group of yarns Y2 reach the second heating roller 34 via the guide roller 36, and the yarn doubling unit 16 performs the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2.

FIG.1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a combined filament yarn producing device which separates plural yarns spun out from a spinning apparatus into a first group of yarns and a second group of yarns, processes the first group of yarns and the second group of yarns differently from one another, and produces combined filament yarns by combining the first group of yarns with the second group of yarns.

[0002] A fully draw yarn (FDY) which has been drawn has a different shrinkage rate from a partially oriented yarn (POY) which is not drawn. A combined filament yarn (BSY) is produced by combining such two types of yarns which have different shrinkage rates from one another, and has good texture. A device configured to produce BSY has been proposed in the past.

[0003] In a device disclosed in Patent Literature 1 (Chinese Unexamined Patent Publication No. 101265627A), for example, some of yarns spun out from a spinning apparatus are heated by a heating roller 12, and then are drawn between the heating roller 12 and a roller 11 so as to be FDY. Meanwhile, the rest of the yarns spun out from the spinning apparatus do not pass the heating roller 12, but pass the roller 11, so as to be POY. Subsequently, after yarn doubling is peformed for FDY and POY, FDY and POY are thermally set by a heating roller 14 so as to produce BSY.

SUMMARY OF THE INVENTION

[0004] In a device disclosed in Patent Literature 1, before being thermally set by a heating roller 14, yarns heated by a heating roller 12 pass a roller 11 which is a non-heating roller. Therefore, the temperature of the yarns is likely to be decreased. In addition to that, because the heating roller 12 is housed in a thermal insulation box different from a thermal insulation box in which the heating roller 14 is housed, the yarns heated by the heating roller 12 run outside the insulation boxes before being heated by the heating roller 14. As a result, the temperature of the yarns is further decreased also at this stage. Therefore, the device disclosed in Patent Literature 1 requires a large amount of heat when yarns are heated by the heating roller 14, and power consumption is disadvantageously increased.

[0005] In consideration of the problem above, an object of a combined filament yarn producing device related to the present invention is to decrease power consumption.

[Solution to Problem]

[0006] The present invention relates to a combined filament yarn producing device which separates plural yarns spun out from a spinning apparatus into a first group of yarns and a second group of yarns, processes the first group of yarns and the second group of yarns differently from one another, and then produces combined filament yarns by combining the first group of yarns with the second group of yarns, the combined filament yarn producing device comprising: a first heating roller; a second heating roller which is provided downstream of the first heating roller in a yarn running direction and which is higher in yarn feeding speed and temperature than the first heating roller; a thermal insulation box in which the first heating roller and the second heating roller are provided; a guide roller by which the second group of yarns are guided to the second heating roller without passing the first heating roller; and a yarn doubling unit configured to perform yarn doubling for the first group of yarns and the second group of yarns, the first group of yarns reaching the second heating roller via the first heating roller and being drawn between the first heating roller and the second heating roller, the second group of yarns reaching the second heating roller via the guide roller, and the yarn doubling unit combining the first group of yarns with the second group of yarns.

[0007] In the present invention, because the first group of yarns are drawn between the first heating roller and the second heating roller, the first group of yarns having been heated by the first heating roller do not pass a non-heating roller before being thermally set by the second heating roller. In addition to that, because the first heating roller and the second heating roller are housed in the same thermal insulation box, the first group of yarns having been heated by the first heating roller do not run outside the thermal insulation box before being thermally set by the second heating roller. Therefore, decrease in temperature is suppressed in the first group of yarns heated by the first heating roller, and thus it is possible to reduce an amount of heat required for thermally setting the first group of yarns by the second heating roller. The second group of yarns are also able to be thermally set by the second heating roller provided in the thermal insulation box. The power consumption of the combined filament yarn producing device is therefore decreased.

[0008] In the present invention, preferably, the yarn doubling unit is an interlacing device configured to perform the yarn doubling for the first group of yarns and the second group of yarns by means of fluid.

[0009] Because the yarn doubling is performed for the first group of yarns and the second group of yarns by means of fluid, the yarn doubling is performed without causing damage to yarns.

[0010] In the present invention, preferably, a yarn doubling assisting unit configured to auxiliarly perform the yarn doubling the first group of yarns and the second group of yarns is provided between the first heating roller and the yarn doubling unit in a yarn running direction.

[0011] When the first group of yarns and the second group of yarns are heated by the second heating roller while the yarn doubling is not performed for the first group of yarns and the second group of yarns, tension is decreased in the second group of yarns which are not

drawn. As a result, yarn swing is likely to occur. By providing the above-described yarn doubling assisting unit so that the yarn doubling is performed in an early stage, the second group of yarns are able to be supported by the first group of yarns which have been drawn to be high in tension. Therefore, the occurrence of the yarn swing can be suppressed. In this regard, when plural first heating rollers are provided, the first heating roller of the present invention is the most downstream first heating roller in the yarn running direction.

[0012] In the present invention, preferably, the yarn doubling assisting unit is provided inside the thermal insulation box.

[0013] With this arrangement, because the yarn doubling assisting unit is able to be provided in the vicinity of the second heating roller, the effect to decrease the occurrence of the yarn swing is improved.

[0014] In the present invention, preferably, the yarn doubling assisting unit is provided downstream of the second heating roller in the yarn running direction.

[0015] When the yarn doubling assisting unit is provided upstream of the second heating roller in the yarn running direction, the yarn doubling is performed before or while the first group of yarns are drawn. As a result, the quality of combined filament yarns may be deteriorated. In connection with this, when the yarn doubling assisting unit is provided downstream of the second heating roller in the yarn running direction as described above, the decrease in the quality of combined filament yarns is further effectively suppressed. In this regard, when plural second heating rollers are provided, the second heating roller of the present invention is the most upstream second heating roller in the yarn running direction.

[0016] In the present invention, preferably, the yarn doubling assisting unit is provided closer to the second heating roller than to an intermediate position located between a position where the yarns leave the second heating roller and a position where the yarns go outside from the thermal insulation box.

[0017] With this arrangement, because the yarn doubling assisting unit is able to be provided to be further close to the second heating roller, the effect to decrease the occurrence of the yarn swing is further improved.

[0018] In the present invention, preferably, the yarn doubling assisting unit is provided between the first heating roller and the second heating roller in the yarn running direction.

[0019] As such, because the yarn doubling assisting unit is provided between the first heating roller and the second heating roller, i.e., provided in an area in which the first group of yarns are drawn, the occurrence of the yarn swing is advantageously decreased in a further early stage.

[0020] In the present invention, preferably, the yarn doubling assisting unit is an interlacing device configured to perform the yarn doubling for the first group of yarns and the second group of yarns by means of fluid.

[0021] Because the yarn doubling is performed for the first group of yarns and the second group of yarns by means of fluid, the yarn doubling is performed without causing damage to yarns.

[0022] In the present invention, preferably, a first inlet for introducing the first group of yarns into the thermal insulation box and a second inlet for introducing the second group of yarns into the thermal insulation box are formed in the thermal insulation box.

[0023] With this arrangement, when yarns are introduced into the thermal insulation box, the yarn paths regarding the first group of yarns are able to be separated from the yarn paths regarding the second group of yarns. As a result, yarn threading is facilitated in the thermal insulation box.

[0024] In the present invention, preferably, the first inlet and the second inlet are formed in a same surface of the thermal insulation box.

[0025] With this arrangement, because yarns are able to be introduced into the thermal insulation box through the first inlet and the second inlet which are formed in the same surface of the thermal insulation box, the yarn threading is facilitated.

[0026] In the present invention, preferably, an outlet allowing the yarns to go outside from the thermal insulation box is formed in the surface of the thermal insulation box in which the first inlet and the second inlet are formed, and a distance between the second inlet and the first inlet is shorter than a distance between the second inlet and the outlet.

[0027] With this, because the first inlet is able to be provided in the vicinity of the second inlet, the yarn threading is further facilitated.

[0028] In the present invention, preferably, the second inlet is formed so as to face a space which is in the thermal insulation box, the first heating roller being provided in the space.

[0029] Because the second inlet is provided in addition to the first inlet, heat in the thermal insulation box tends to be easily escaped. As a result, a heat retaining property may be decreased. However, escape of heat due to the second inlet is suppressed in such a way that the second inlet is formed so as to face the space, as described above, provided with the first heating roller which is lower in temperature than the second heating roller. As a result, the decrease in the heat retaining property is suppressed.

[0030] In the present invention, preferably, the guide roller is provided in the second inlet.

[0031] This arrangement is preferable because it is not required to ensure a space for providing the guide roller.

[0032] In the present invention, preferably, when viewed in an axial direction of the guide roller, a part of the guide roller provided in the second inlet protrudes inside the thermal insulation box.

[0033] With this arrangement, even when the second group of yarns are significantly bent at a sharp angle at the guide roller, the second group of yarns are prevented from making contact with the peripheral edge portion of the second inlet.

[0034] In the present invention, preferably, when viewed from an axial direction of the guide roller, a part of the guide roller provided in the second inlet protrudes outside the thermal insulation box.

[0035] With this arrangement, even when the second group of yarns are significantly bent at a sharp angle at the guide roller, the second group of yarns are prevented from making contact with the peripheral edge portion of the second inlet.

[0036] In the present invention, preferably, a plurality of second heating rollers are provided, each second heating roller is equivalent to the second heating roller, and the second group of yarns reach the most upstream one of the plurality of the second heating rollers in the yarn running direction, via the guide roller.

[0037] Because of this, the second group of yarns are able to be heated by plural second heating rollers, and thus the second group of yarns are certainly and thermally set.

[0038] In the present invention, preferably, the guide roller is a drive roller.

[0039] When the guide roller is a drive roller, the tension in the second group of yarns can be adjusted by the rotational speed of the guide roller. As a result, the quality of the yarns is easily controlled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040]

FIG. 1 is a front view of a combined filament yarn producing device of an embodiment.

FIG. 2 is a side view of the combined filament yarn producing device of the embodiment.

FIG. 3 is a front view of a spun yarn drawing device.

FIG. 4 is a perspective view of the spun yarn drawing device.

FIG. 5 is a front view of a spun yarn drawing device of a modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Overall Structure of Combined Filament Yarn Producing Device)

[0041] The following will describe an embodiment of a combined filament yarn producing device related to the present invention. FIG. 1 is a front view of the combined filament yarn producing device of the present embodiment. FIG. 2 is a side view of the combined filament yarn producing device of the present embodiment. Hereinafter, a front-rear direction, a left-right direction, and an up-down direction in a combined filament yarn producing device 1 are defined as shown in FIG. 1 and FIG. 2.

[0042] In the combined filament yarn producing device 1 of the present embodiment, molten resin which is continuously spun out from a spinning apparatus 2 is solidified and formed as plural synthetic fiber yarns Y, the synthetic fiber yarns Y are separated into a first group of yarns Y1 and a second group of yarns Y2, and then the first group of yarns Y1 and the second group of yarns Y2 are processed differently from one another. To be more specific, the first group of yarns Y1 are drawn to be fully draw yarns (FDY), and the second group of yarns Y2 are not drawn and become partially oriented yarns (POY). After that, by combining the first group of yarns Y1 which are FDY with the second group of yarns Y2 which are POY, combined filament yarns Y3 (BSY) are produced. As such, the combined filament yarns Y3 are formed of two types of yarns Y1 and Y2 which have different shrinkage rates from one another, and have good texture. In this specification, when the type of yarns is not specified, the yarns are simply referred to as yarns Y.

[0043] The combined filament yarn producing device 1 includes a spun yarn drawing device 3, a winding device 4, a separation guide 11, godet rollers 12 to 15, and a yarn doubling unit 16. FIG. 2 does not show the godet rollers 12 and 13, and simply illustrates a yarn path at around the spun yarn drawing device 3.

[0044] The separation guide 11 is, e.g., a guide with a comb teeth shape, and provided below the spinning apparatus 2. All yarns Y spun out from the spinning apparatus 2 are separated in half in the separation guide 11, so as to be separated into the first group of yarns Y1 and the second group of yarns Y2. For example, when sixteen yarns Y are spun out from the spinning apparatus 2, the sixteen yarns Y are separated into the first group of eight yarns Y1 and the second group of eight yarns Y2, with the result that eight combined filament yarns Y3 are produced.

[0045] The godet rollers 12 to 15 are rotationally driven by unillustrated motors, respectively. Each of the godet rollers 12 and 13 includes a rotational shaft extending in the front-rear direction. Each of the godet rollers 14 and 15 includes a rotational shaft extending in the left-right direction. The godet roller 12 is provided between the separation guide 11 and the spun yarn drawing device 3 in a yarn running direction. The godet rollers 13 to 15 are provided between the spun yarn drawing device 3 and the winding device 4 in the yarn running direction.

[0046] The first group of yarns Y1 pass the separation guide 11 and the godet roller 12 in this order, and are introduced into the spun yarn drawing device 3. Meanwhile, the second group of yarns Y2 pass the separation guide 11 and a guide roller 36 provided at the spun yarn drawing device 3 in this order, and are introduced into the spun yarn drawing device 3. As described later, in the spun yarn drawing device 3, the first group of yarns Y1 which are FDY are auxiliarly combined with the second group of yarns Y2 which are POY by a yarn doubling assisting unit 37, with the result that combined filament yarns Y3 are produced.

[0047] The combined filament yarns Y3 go outside from the spun yarn drawing device 3, and then are sent to the winding device 4 via the godet rollers 13 to 15. The yarn doubling unit 16 is provided between the godet roll-

ers 14 and 15 in the yarn running direction. The yarn doubling unit 16 is an interlacing device configured to perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 by injecting compressed air (fluid). As described above, the combined filament yarns Y3 having been tentatively fixed in shape by the spun yarn drawing device 3 are firmly fixed in shape by the yarn doubling unit 16.

[0048] The winding device 4 includes fulcrum guides 41, traverse units 42, a contact roller 43, two bobbin holders 44, and a turret 45. The combined filament yarns Y3 having been sent to the winding device 4 are traversed in the front-rear direction by the traverse units 42 about the fulcrum guides 41, respectively. The contact roller 43 makes contact with the surfaces of packages P to adjust the shape of each package P by applying a predetermined contact pressure to each package P. To the bobbin holder 44 extending in the front-rear direction, bobbins B are attachable so as to be aligned in the front-rear direction. The bobbin holder 44 is rotationally driven by an unillustrated motor. The turret 45 cantilevers the two bobbin holders 44. As the turret 45 is rotationally driven by an unillustrated motor, the positions of the two bobbin holders 44 are changed upside down between a winding position on the upper side and a standby position on the lower side.

[0049] The winding device 4 forms packages P, by rotating the bobbin holder 44 which is at the winding position located above so as to wind the combined filament yarns Y3 onto the respective bobbins B. When the formation of the packages P is completed, the turret 45 is rotated to switch the positions of the two bobbin holders 44. Then, combined filament yarns Y3 are wound onto bobbins B attached to the bobbin holder 44 having been moved to the winding position.

(Spun Yarn Drawing Device)

[0050] The spun yarn drawing device 3 will be detailed. FIG. 3 is a front view of the spun yarn drawing device 3. FIG. 4 is a perspective view of the spun yarn drawing device 3. FIG. 3 shows the first group of yarns Y1 by an one-dot chain line, the second group of yarns Y2 by a two-dot chain line, and combined filament yarns Y3 by a solid line. The spun yarn drawing device 3 includes a thermal insulation box 30 and plural (five in the present embodiment) heating rollers 31 to 35 which are housed in the thermal insulation box 30.

[0051] Each of the heating rollers 31 to 35 includes a rotational shaft extending in the front-rear direction, and is rotationally driven in the direction indicated by an arrow shown in FIG. 3 by an unillustrated motor. The heating rollers 31 to 35 each including an unillustrated heater are configured to heat yarns Y wound onto the circumferential surfaces of the heating rollers 31 to 35. The outer diameters of the heating rollers 31 to 35 are substantially same as one another. Among the five heating rollers 31 to 35, the three heating rollers 31 to 33 which are first heating rollers provided upstream of the heating rollers 34 and 35 in the yarn running direction are preheating rollers provided for preheating yarns Y before yarns Y are drawn. The surface temperatures of the first heating rollers 31 to 33 are arranged to be equal to or higher than the glass transition temperature (e.g., set at about 80 degrees centigrade) of yarns Y. Meanwhile, among the five heating rollers 31 to 35, the two heating rollers 34 and 35 which are second heating rollers provided downstream of the first heating rollers 31 to 33 in the yarn running direction are thermal setting rollers provided for thermally setting yarns Y. The surface temperatures of the second heating rollers 34 and 35 are arranged to be higher than the surface temperatures (e.g., set at about 130 to 140 degrees centigrade) of the first heating rollers 31 to 33. The rotational speeds, i.e., yarn feeding speeds of the second heating rollers 34 and 35 are higher than those of the first heating rollers 31 to 33.

[0052] Among the three first heating rollers 31 to 33, the first heating roller 31 is the most upstream first heating roller in the yarn running direction, and provided below the first heating rollers 32 and 33. In connection above, the first heating roller 32 is the second most upstream first heating roller in the yarn running direction, and the first heating roller 33 is the third most upstream first heating roller in the yarn running direction. The second most upstream first heating roller 32 and the third most upstream first heating roller 33 are provided to be adjacent to one another in the left-right direction. The shaft center of the second most upstream first heating roller 32 is positioned to the right of the shaft center of the most upstream first heating roller 31. The shaft center of the third most upstream first heating roller 33 is positioned to the left of the shaft center of the most upstream first heating roller 31.

[0053] Above the first heating rollers 31 to 33, the two second heating rollers 34 and 35 are provided to be adjacent to one another in the left-right direction. The second heating roller 34 is the most upstream second heating roller among the two second heating rollers 34 and 35 in the yarn running direction, and provided adjacent to and above the second most upstream first heating roller 32. The second heating roller 35 is the most downstream second heating roller among the two second heating rollers 34 and 35 in the yarn running direction, and provided above the third most upstream first heating roller 33. In this regard, the second heating roller 35 provided downstream of the second heating roller 34 in the yarn running direction is deviated upward from the second heating roller 34 provided upstream of the second heating roller 35 in the yarn running direction. To be more specific, the shaft center of the second heating roller 35 provided downstream of the second heating roller 34 in the yarn running direction is located above the shaft center of the second heating roller 34 provided upstream of the second heating roller 35 in the yarn running direction.

[0054] As such, the five heating rollers 31 to 35 are provided to be gathered in the left-right direction and the

up-down direction.

[0055] As shown in FIG. 4, the thermal insulation box 30 includes a main body portion 38 the front part of which is open and a door member 39 which is able to close the opening of the main body portion 38. When the spun yarn drawing device 3 is activated, the door member 39 is closed. A first inlet 30a, a second inlet 30b, and an outlet 30c are formed in the right side face of the main body portion 38. The first inlet 30a is formed at the lower end portion of the right side face of the main body portion 38, and open for allowing the first group of yarns Y1 to be introduced into the thermal insulation box 30. The outlet 30c is formed at the upper end portion of the right side face of the main body portion 38, and open for allowing combined filament yarns Y3 to go outside from the thermal insulation box 30. The second inlet 30b is formed between the first inlet 30a and the outlet 30c, and open for allowing the second group of yarns Y2 to be introduced into the thermal insulation box 30. The second inlet 30b is formed at a lower part of the thermal insulation box 30 so as to be lower than the center of the right side face of the thermal insulation box 30 in the up-down direction, and provided adjacent to and above the first inlet 30a. In other words, the second inlet 30b is formed so that the distance between the second inlet 30b and the first inlet 30a is shorter than the distance between the second inlet 30b and the outlet 30c. In addition to that, the second inlet 30b faces a space provided with the first heating rollers 31 to 33 which are lower in temperature than the second heating rollers 34 and 35.

[0056] At the second inlet 30b, the guide roller 36 is provided. The guide roller 36 is a rotatable roller including a rotational shaft extending in the front-rear direction. The outer diameter of the guide roller 36 is larger than the thickness of the wall of the right side face of the thermal insulation box 30. The guide roller 36 is provided so as to protrude outside and inside the thermal insulation box 30 from the right side face of the thermal insulation box 30 when viewed from the axial direction of the guide roller 36. The guide roller 36 is preferably a drive roller configured to be rotationally driven by an unillustrated motor while the guide roller 36 may be a driven roller configured to be rotated by the friction with yarns Y. When the guide roller 36 is a drive roller, the tension of yarns Y can be adjusted by the rotational speed of the guide roller 36. As a result, the quality of the yarns Y is easily controlled.

[0057] In the spun yarn drawing device 3, the yarn doubling assisting unit 37 is provided. As shown in FIG. 3, the yarn doubling assisting unit 37 is provided closer to the second heating roller 35 than to a middle position A3 located between a position A1 where yarns Y leave the most downstream second heating roller 35 and a position A2 where yarns Y go outside from the thermal insulation box 30. In other words, the yarn doubling assisting unit 37 is provided downstream of the second heating roller 35 in the yarn running direction and in the vicinity of the second heating roller 35. The yarn doubling assisting unit 37 is an interlacing device configured to perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 by injecting the compressed air in the same manner as the yarn doubling unit 16. However, the yarn doubling assisting unit 37 is arranged to inject the compressed air with a lower pressure than the yarn doubling unit 16. Therefore, the yarn doubling assisting unit 37 does not firmly perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 as compared to the yarn doubling unit 16, and plays a role of auxiliarly combining the first group of yarns Y1 with the second group of yarns Y2.

[0058] In the spun yarn drawing device 3 structured as described above, the first group of yarns Y1 are introduced into the thermal insulation box 30 through the first inlet 30a via the godet roller 12, and threaded to the first heating rollers 31 to 33, the second heating rollers 34 and 35, and the yarn doubling assisting unit 37. In the thermal insulation box 30, the first group of the yarns Y1 are wound onto all of the heating rollers 31 to 35. To be more specific, the first group of the yarns Y1 are wound onto, in a zigzag pattern, the first heating roller 31, the first heating roller 32 provided to the right of and above the first heating roller 31, the first heating roller 33 provided to the left of the first heating roller 32, the second heating roller 34 provided to the right of and above the first heating roller 33, and the second heating roller 35 provided to the left of the second heating roller 34 in this order from an upstream side in the yarn running direction. The first group of the yarns Y1 are preheated to a temperature (not lower than the glass transition temperature) at which the yarns Y can be drawn, by the first heating rollers 31 to 33. The first group of the preheated yarns Y1 are drawn by the difference between the yarn feeding speeds of the first heating roller 33 and the second heating roller 34 so as to be FDY. The first group of the yarns Y1 are thermally set in the drawn state by the second heating rollers 34 and 35.

[0059] Meanwhile, the second group of yarns Y2 are introduced into the thermal insulation box 30 through the second inlet 30b via the guide roller 36, and threaded to the second heating rollers 34 and 35 and the yarn doubling assisting unit 37. In the thermal insulation box 30, the second group of the yarns Y2 are guided from the guide roller 36 to the second heating roller 34 provided adjacent to the right side face of the thermal insulation box 30. In other words, without passing the first heating rollers 31 to 33, the second group of the yarns Y2 reach the most upstream second heating roller 34. Because the second group of the yarns Y2 are not drawn between the first heating roller 33 and the second heating roller 34, the second group of the yarns Y2 are thermally set as POY by the second heating rollers 34 and 35.

[0060] The first group of the yarns Y1 are merged with the second group of the yarns Y2 at the most upstream second heating roller 34, and the yarn doubling is performed for the first group of the yarn Y1 and the second group of the yarns Y2 by the yarn doubling assisting unit 37 so as to be combined filament yarns Y3. The combined

filament yarns Y3 go outside from the thermal insulation box 30 through the outlet 30c, and are wound by the yarn winding device 4 via the godet rollers 13 to 15. Between the godet rollers 13 and 14, the combined filament yarns Y3 are fixed again in shape by the yarn doubling unit 16.

[0061] At this stage, the first group of the yarns Y1 are merged with the second group of the yarns Y2 on the circumferential surface of the second heating roller 34, and run while overlapping with the corresponding yarns Y2. When the first group of the yarns Y1 and the second group of the yarns Y2 are thermally set by the second heating rollers 34 and 35, the second group of the yarns Y2 which are POY are loosened due to the decrease in tension while tension is not changed in the first group of the yarns Y1, which are FDY, having been already drawn. Therefore, as the second group of the yarns Y2 are loosened while the yarn doubling is not performed for the first group of the yarns Y1 and the second group of the yarns Y2, yarn swing is likely to disadvantageously occur. In order to solve problems such as yarn swing, in the present embodiment, the yarn doubling assisting unit 37 is provided immediately after the most downstream second heating roller 35 so as to perform the yarn doubling in an early stage. With this arrangement, because the second group of the yarns Y2 are able to be supported by the first group of the yarns Y1 in which tension is high, the occurrence of the yarn swing is suppressed.

[0062] In the present embodiment, the first heating roller 32 is provided adjacent to and above the guide roller 36. In other words, the second most upstream first heating roller 32 exists between the guide roller 36 and the most upstream second heating roller 34. In this structure, the second group of yarns Y2 pass through the narrow gap between the first heating roller 32 and the right side face of the thermal insulation box 30 from the guide roller 36, and then are guided to the second heating roller 34 provided above the first heating roller 32. Because of this, regarding the second group of yarns Y2, yarn paths extending to the second heating roller 34 from the guide roller 36 provided in the second inlet 30b are formed to extend in the up-down direction along the right side face of the thermal insulation box 30. Therefore, the second group of yarns Y2 may interfere with the peripheral edge portion of the second inlet 30b. In the present embodiment, as described above, because the guide roller 36 is provided to protrude inside the thermal insulation box 30 from the right side face of the thermal insulation box 30, the second group of yarns Y2 easily avoid the interference with the peripheral edge portion of the second inlet 30b without providing another guide roller inside the thermal insulation box 30.

[0063] Meanwhile, regarding the second group of yarns Y2, yarn paths extending to the guide roller 36 from the separation guide 11 are also formed to extend in the up-down direction along the right side face of the thermal insulation box 30, outside the thermal insulation box 30. Therefore, outside the thermal insulation box 30, the second group of yarns Y2 may interfere with the peripheral edge portion of the second inlet 30b. In the present embodiment, because the guide roller 36 is provided to protrude also outside the thermal insulation box 30 from the right side face of the thermal insulation box 30, the second group of yarns Y2 guided to the guide roller 36 from the separation guide 11 easily avoid the interference with the peripheral edge portion of the second inlet 30b without providing another guide roller outside the thermal insulation box 30.

[0064] Therefore, the structure in which the second group of yarns Y2 are spun out downward toward the second inlet 30b on the outside of the thermal insulation box 30, pass through the second inlet 30b, and then are guided upward toward the second heating roller 34 at a sharp angle is achieved with only one guide roller 36.

[0065] In the combined filament yarn producing device 1, when all yarns Y spun out from the spinning apparatus 2 are arranged to be wound onto the heating rollers 31 to 35, all yarns Y are able to be FDY. In other words, the combined filament yarn producing device 1 is also available as a fully drawn yarn producing device.

(Advantageous Effects)

[0066] As described above, the first heating rollers 31 to 33 and the second heating rollers 34 and 35 are housed in the thermal insulation box 30, in the combined filament yarn producing device 1 of the present embodiment. The first group of yarns Y1 reach the second heating roller 34 via the first heating rollers 31 to 33, and are drawn between the first heating roller 33 and the second heating roller 34. The second group of yarns Y2 reach the second heating roller 34 via the guide roller 36. The yarn doubling unit 16 is configured to perform the yarn doubling for the first group of the yarns Y1 and the second group of the yarns Y2 which are merged at the second heating roller 34.

[0067] With this arrangement, because the first group of yarns Y1 are drawn between the first heating roller 33 and the second heating roller 34, the first group of yarns Y1 having been heated by the first heating rollers 31 to 33 do not pass a non-heating roller before being thermally set by the second heating rollers 34 and 35. In addition to that, because the first heating rollers 31 to 33 and the second heating rollers 34 and 35 are housed in the same thermal insulation box 30, the first group of yarns Y1 having been heated by the first heating rollers 31 to 33 do not run outside the thermal insulation box 30 before being thermally set by the second heating rollers 34 and 35. Because of this, decrease in temperature is suppressed in the first group of yarns Y1 having been heated by the first heating rollers 31 to 33, with the result that it is possible to reduce an amount of heat required for thermally setting the first group of yarns Y1 by the second heating rollers 34 and 35. The second group of yarns Y2 are also able to be thermally set by the second heating rollers 34 and 35 provided in the thermal insulation box 30. The power consumption of the combined filament yarn pro-

ducing device 1 is therefore decreased.

[0068] In the present embodiment, the yarn doubling unit 16 is configured to perform the yarn doubling for the first group of yarns Y1 and the second group of the yarns Y2 by means of fluid. Because the yarn doubling is performed for the first group of yarns Y1 and the second group of yarns Y2 by means of fluid, the yarn doubling is performed without causing damage to yarns Y.

[0069] In the present embodiment, the yarn doubling assisting unit 37 configured to auxiliarly perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 is provided between the yarn doubling unit 16 and the first heating roller 33 which is the most downstream first heating roller among the first heating rollers 31 to 33 in the yarn running direction. When the first group of yarns Y1 and the second group of yarns Y2 merged at the second heating roller 34 are heated by the second heating rollers 34 and 35 while the yarn doubling is not performed for the first group of yarns Y1 and the second group of yarns Y2, tension is decreased in the second group of yarns Y2 which are not drawn. As a result, yarn swing is likely to occur. By providing the yarn doubling assisting unit 37 so that the yarn doubling is performed in an early stage, the second group of yarns Y2 are able to be supported by the first group of yarns Y1 which are drawn to be high in tension. As a result, the occurrence of the yarn swing is suppressed.

[0070] In the present embodiment, the yarn doubling assisting unit 37 is provided inside the thermal insulation box 30. With this arrangement, because the yarn doubling assisting unit 37 is able to be provided in the vicinity of the second heating roller 35, the effect to decrease the occurrence of the yarn swing is improved.

[0071] In the present embodiment, the yarn doubling assisting unit 37 is provided downstream of the most upstream second heating roller 34. When the yarn doubling assisting unit 37 is provided upstream of the second heating roller 34 in the yarn running direction, the yarn doubling is performed before or while the first group of yarns Y1 are drawn. As a result, the quality of combined filament yarns Y3 may be deteriorated. In connection with this, when the yarn doubling assisting unit 37 is provided downstream of the second heating roller 34 in the yarn running direction as described above, the decrease in the quality of combined filament yarns Y3 is further effectively suppressed.

[0072] In the present embodiment, the yarn doubling assisting unit 37 is provided closer to the second heating roller 35 than to the middle position A3 located between the position A1 where yarns Y leave the second heating roller 35 and the position A2 where yarns Y go outside from the thermal insulation box 30. With this arrangement, because the yarn doubling assisting unit 37 is able to be provided to be further close to the second heating roller 35, the effect to decrease the occurrence of the yarn swing is further improved.

[0073] In the present embodiment, the yarn doubling assisting unit 37 performs the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 by means of fluid. Because the yarn doubling is performed for the first group of yarns Y1 and the second group of yarns Y2 by means of fluid, the yarn doubling is performed without causing damage to yarns.

[0074] In the present embodiment, the first inlet 30a for introducing the first group of yarns Y1 into the thermal insulation box 30 and the second inlet 30b for introducing the second group of yarns Y2 into the thermal insulation box 30 are formed in the thermal insulation box 30. With this arrangement, when yarns Y are introduced into the thermal insulation box 30, the yarn paths regarding the first group of yarns Y1 are able to be separated from the yarn paths regarding the second group of yarns Y2. As a result, yarn threading is easily performed in the thermal insulation box 30.

[0075] In the present embodiment, the first inlet 30a and the second inlet 30b are formed in the same surface of the thermal insulation box 30. With this arrangement, because yarns Y are able to be introduced into the thermal insulation box 30 through the first inlet 30a and the second inlet 30b which are formed in the same surface of the thermal insulation box 30, the yarn threading is facilitated.

[0076] In the present embodiment, in the surface in which the first inlet 30a and the second inlet 30b of the thermal insulation box 30 are formed, the outlet 30c is formed for allowing yarns Y to go outside from the thermal insulation box 30. The distance between the second inlet 30b and the first inlet 30a is shorter than the distance between the second inlet 30b and the outlet 30c. With this, because the first inlet 30a is able to be provided in the vicinity of the second inlet 30b, the yarn threading is further facilitated.

[0077] In the present embodiment, the second inlet 30b is formed to face the space which is in the thermal insulation box 30 and in which the first heating rollers 31 to 33 are provided. Because the second inlet 30b is provided in addition to the first inlet 30a, heat in the thermal insulation box 30 is likely to be escaped. As a result, a heat retaining property may be decreased. However, escape of heat due to the second inlet 30b is suppressed in such a way that the second inlet 30b is provided so as to face the space provided with the first heating rollers 31 to 33 which are lower in temperature than the second heating rollers 34 and 35. As a result, the decrease in the heat retaining property is suppressed.

[0078] In the present embodiment, the guide roller 36 is provided in the second inlet 30b. This arrangement is preferable because it is not required to ensure a space for providing the guide roller 36.

[0079] In the present embodiment, when viewed in the axial direction of the guide roller 36, a part of the guide roller 36 provided in the second inlet 30b protrudes inside the thermal insulation box 30. With this arrangement, even when the second group of yarns Y2 are sent upward at a sharp angle at the guide roller 36, the peripheral edge portion of the second inlet 30b is preventable from

interfering with the second group of yarns Y2.

[0080] In the present embodiment, when viewed in the axial direction of the guide roller 36, a part of the guide roller 36 provided in the second inlet 30b protrudes outside the thermal insulation box 30. With this arrangement, even when the second group of yarns Y2 are sent upward at a sharp angle at the guide roller 36, the peripheral edge portion of the second inlet 30b is preventable from interfering with the second group of yarns Y2.

[0081] In the present embodiment, via the guide roller 36, the second group of yarns Y2 reach the most upstream second heating roller 34. The second group of yarns Y2 are therefore able to be heated by the second heating rollers 34 and 35, and thus the second group of yarns Y2 are certainly and thermally set.

(Other embodiments)

[0082] The following will describe modifications of the above-described embodiment.

[0083] In the embodiment above, the yarn doubling unit 16 and the yarn doubling assisting unit 37 are provided as units which perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2. When the yarn swing described above does not cause a problem or when the yarn swing is solved by another method, the yarn doubling assisting unit 37 may be omitted. Alternatively, the yarn doubling unit 16 may be omitted and only the yarn doubling assisting unit 37 may be provided. In this case, the yarn doubling assisting unit 37 is equivalent to the yarn doubling unit of the present invention.

[0084] While in the embodiment above the yarn doubling assisting unit 37 is an interlacing device, a device different from an interlacing device may be used as the yarn doubling assisting unit 37 as long as the device is able to perform the yarn doubling for the first group of yarns Y1 and the second group of yarns Y2 so as to decrease the occurrence of the yarn swing.

[0085] In the embodiment above, the yarn doubling assisting unit 37 is provided downstream of and in the vicinity of the most downstream second heating roller 35. However, the position of the yarn doubling assisting unit 37 is not limited to this. The position of the yarn doubling assisting unit 37 may be arranged as long as the yarn doubling assisting unit 37 is provided at a merging point where the first group of yarns Y1 are merged with the second group of yarns Y2 or provided downstream of the merging point in the yarn running direction. The yarn doubling assisting unit 37 may be provided between the second heating rollers 34 and 35 or provided outside the thermal insulation box 30. When the first group of yarns Y1 are merged with the second group of yarns Y2 on the upstream of the most upstream second heating roller 34, the yarn doubling assisting unit 37 may be provided at the merging point or provided between the merging point and the second heating roller 34. In other words, in the yarn running direction, the yarn doubling assisting unit 37 may be provided at a desired position located between (the merging point is also included) the yarn doubling unit 16 and the merging point where the first group of yarns Y1 are merged with the second group of yarns Y2.

[0086] FIG. 5 is a front view of a spun yarn drawing device 3 of a modification. The components having the same structures as those in the above-described embodiment are given the same reference numerals, and the description thereof will be omitted. In the present modification, in a yarn running direction, a yarn doubling assisting unit 37 is provided between a first heating roller 32 provided downstream of first heating rollers 31 and 33 and the second heating roller 34 provided upstream of the second heating roller 35. In other words, the yarn doubling assisting unit 37 is provided in an area in which a first group of yarns Y1 are drawn. In this case, the first group of yarns Y1 are merged with the second group of yarns Y2 at a yarn doubling assisting unit 37. In other words, because the yarn doubling assisting unit 37 is provided at a merging position where the first group of yarns Y1 are merged with the second group of yarns Y2, the yarn swing is advantageously suppressed in a further early stage. Also in this modification, when the yarn swing described above does not cause a problem or when the yarn swing is solved by another method, the yarn doubling assisting unit 37 may be omitted. Alternatively, the yarn doubling unit 16 may be omitted and only the yarn doubling assisting unit 37 may be provided. In this case, the yarn doubling assisting unit 37 is equivalent to the yarn doubling unit of the present invention.

[0087] In the modification shown in FIG. 5, the first group of yarns Y1 are wound onto, in a zigzag pattern, the first heating roller 31, a first heating roller 33 provided to the left of and above the first heating roller 31, the first heating roller 32 provided to the right of the first heating roller 33, the second heating roller 34 provided above the first heating roller 32, and a second heating roller 35 provided to the left of the second heating roller 34 in this order from an upstream side in the yarn running direction, in a different manner from the embodiment above. Because of this, the first group of yarns Y1 are able to run in the vicinity of the second group of yarns Y2 between the first heating roller 32 and the second heating roller 34. It is therefore possible to decrease the occurrence of damage due to significant bending of the first group of yarns Y1 or the second group of yarns Y2 in the yarn doubling assisting unit 37.

[0088] In the embodiment above, the following inlets are provided: the first inlet 30a for allowing the first group of yarns Y1 to be introduced into the thermal insulation box 30; and the second inlet 30b for allowing the second group of yarns Y2 to be introduced into the thermal insulation box 30. The first group of yarns Y1 and the second group of yarns Y2 may be introduced into the thermal insulation box 30 through one inlet. In this case, because a large inlet is easily formed as compared to cases where two inlets are provided to be separated from one another, the first group of yarns Y1 and the second group of yarns Y2 are easily introduced into the thermal insulation box

30 in the yarn threading. The specific positional relationship between the first inlet 30a, the second inlet 30b, and the outlet 30c may be different from those in the embodiment above.

[0089] While in the embodiment above the guide roller 36 is provided in the second inlet 30b, the position of the guide roller 36 is not limited to this. The guide roller 36 may be provided outside or inside the thermal insulation box 30. Alternatively, plural guide rollers 36 may be provided.

[0090] In the embodiment above, the three first heating rollers 31 to 33 and the two second heating rollers 34 and 35 are provided. The number of the first heating rollers and the number of the second heating rollers may be suitably changed as long as at least one first heating roller and at least one second heating roller are provided.

[0091] While in the embodiment above the second group of yarns Y2 are wound onto all of the second heating rollers 34 and 35, it is not necessary to wind the second group of yarns Y2 onto all of the second heating rollers. The second group of yarns Y2 may be wound onto some of the second heating rollers, which include the most downstream second heating roller in the yarn running direction.

Claims

1. A combined filament yarn producing device (1) which separates plural yarns (Y) spun out from a spinning apparatus (2) into a first group of yarns (Y1) and a second group of yarns (Y2), processes the first group of yarns (Y1) and the second group of yarns (Y2) differently from one another, and then produces combined filament yarns (Y3) by combining the first group of yarns (Y1) with the second group of yarns (Y2), the combined filament yarn producing device (1) comprising:

a first heating roller (31 to 33);
a second heating roller (34, 35) which is provided downstream of the first heating roller (31 to 33) in a yarn running direction and which is higher in yarn feeding speed and temperature than the first heating roller (31 to 33) ;
a thermal insulation box (30) in which the first heating roller (31 to 33) and the second heating roller (34, 35) are provided;
a guide roller (36) by which the second group of yarns (Y2) are guided to the second heating roller (34, 35) without passing the first heating roller (31 to 33); and
a yarn doubling unit (16) configured to perform yarn doubling for the first group of yarns (Y1) and the second group of yarns (Y2), the first group of yarns (Y1) reaching the second heating roller (34, 35) via the first heating roller (31 to 33) and being drawn between the first heating roller (31 to 33) and the second heating roller (34, 35), the second group of yarns (Y2) reaching the second heating roller (34, 35) via the guide roller (36), and the yarn doubling unit (16) combining the first group of yarns (Y1) with the second group of yarns (Y2).

2. The combined filament yarn producing device (1) according to claim 1, wherein, the yarn doubling unit (16) is an interlacing device configured to perform the yarn doubling for the first group of yarns (Y1) and the second group of yarns (Y2) by means of fluid.

3. The combined filament yarn producing device (1) according to claim 1 or 2, wherein, a yarn doubling assisting unit (37) configured to auxiliarly perform the yarn doubling for the first group of yarns (Y1) and the second group of yarns (Y2) is provided between the first heating roller (31 to 33) and the yarn doubling unit (16) in a yarn running direction.

4. The combined filament yarn producing device (1) according to claim 3, wherein, the yarn doubling assisting unit (37) is provided inside the thermal insulation box (30) .

5. The combined filament yarn producing device (1) according to claim 4, wherein, the yarn doubling assisting unit (37) is provided downstream of the second heating roller (34, 35) in the yarn running direction.

6. The combined filament yarn producing device (1) according to claim 5, wherein, the yarn doubling assisting unit (37) is provided closer to the second heating roller (35) than to a middle position (A3) located between a position (A1) where the yarns (Y) leave the second heating roller (35) and a position (A2) where the yarns (Y) go outside from the thermal insulation box (30).

7. The combined filament yarn producing device (1) according to claim 4, wherein, the yarn doubling assisting unit (37) is provided between the first heating roller (31 to 33) and the second heating roller (34, 35) in the yarn running direction.

8. The combined filament yarn producing device (1) according to any one of claims 3 to 7, wherein, the yarn doubling assisting unit (37) is an interlacing device configured to perform the yarn doubling for the first group of yarns (Y1) and the second group of yarns (Y2) by means of fluid.

9. The combined filament yarn producing device (1) according to any one of claims 1 to 8, wherein, a first inlet (30a) for introducing the first group of yarns (Y1) into the thermal insulation box (30) and a second inlet (30b) for introducing the second group of yarns

(Y2) into the thermal insulation box (30) are formed in the thermal insulation box (30).

10. The combined filament yarn producing device (1) according to claim 9, wherein, the first inlet (30a) and the second inlet (30b) are formed in a same surface of the thermal insulation box (30).

11. The combined filament yarn producing device (1) according to claim 10, wherein, an outlet (30c) allowing the yarns (Y) to go outside from the thermal insulation box (30) is formed in the surface of the thermal insulation box (30) in which the first inlet (30a) and the second inlet (30b) are formed, and
a distance between the second inlet (30b) and the first inlet (30a) is shorter than a distance between the second inlet (30b) and the outlet (30c).

12. The combined filament yarn producing device (1) according to any one of claims 9 to 11, wherein, the second inlet (30b) is formed so as to face a space which is in the thermal insulation box (30), the first heating roller (31 to 33) being provided in the space.

13. The combined filament yarn producing device (1) according to any one of claims 9 to 12, wherein, the guide roller (36) is provided in the second inlet (30b).

14. The combined filament yarn producing device (1) according to claim 13, wherein, when viewed in an axial direction of the guide roller (36), a part of the guide roller (36) provided in the second inlet (30b) protrudes inside the thermal insulation box (30).

15. The combined filament yarn producing device (1) according to claim 13 or 14, wherein, when viewed from an axial direction of the guide roller (36), a part of the guide roller (36) provided in the second inlet (30b) protrudes outside the thermal insulation box (30).

16. The combined filament yarn producing device (1) according to any one of claims 1 to 15, further comprising a plurality of second heating rollers (34, 35) each of which is the second heating roller (34, 35), and
the second group of yarns (Y2) reach the most upstream one (34) of the plurality of the second heating rollers (34, 35) in the yarn running direction, via the guide roller (36).

17. The combined filament yarn producing device (1) according to any one of claims 1 to 16, wherein, the guide roller (36) is a drive roller.

FIG.1

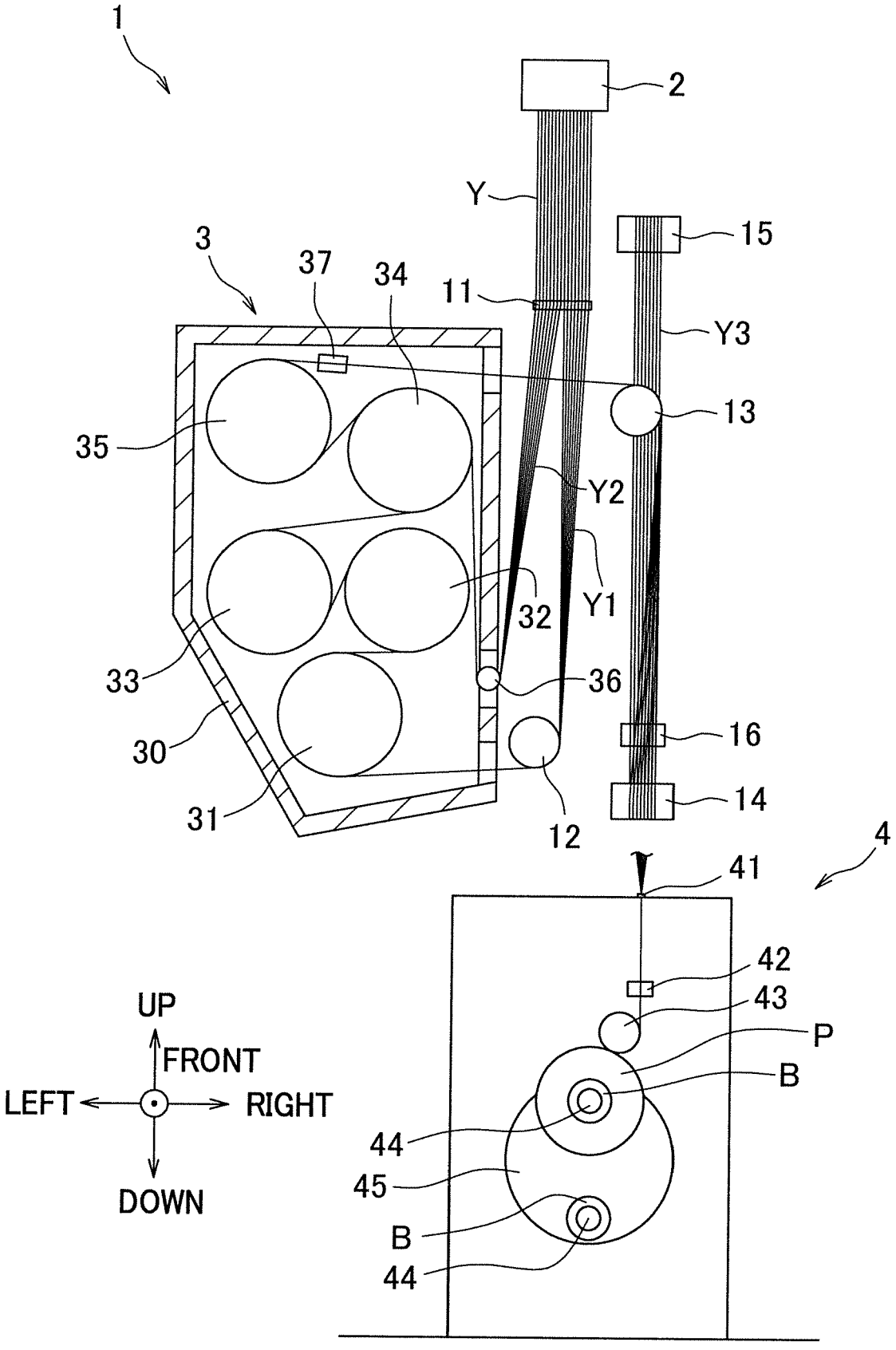

1
2
Y
15
3
37
34
11
Y3
13
35
Y2
32
Y1
33
36
30
16
31
14
12
4
41
42
43
P
B
44
45
B
44
UP
FRONT
LEFT
RIGHT
DOWN

FIG.2

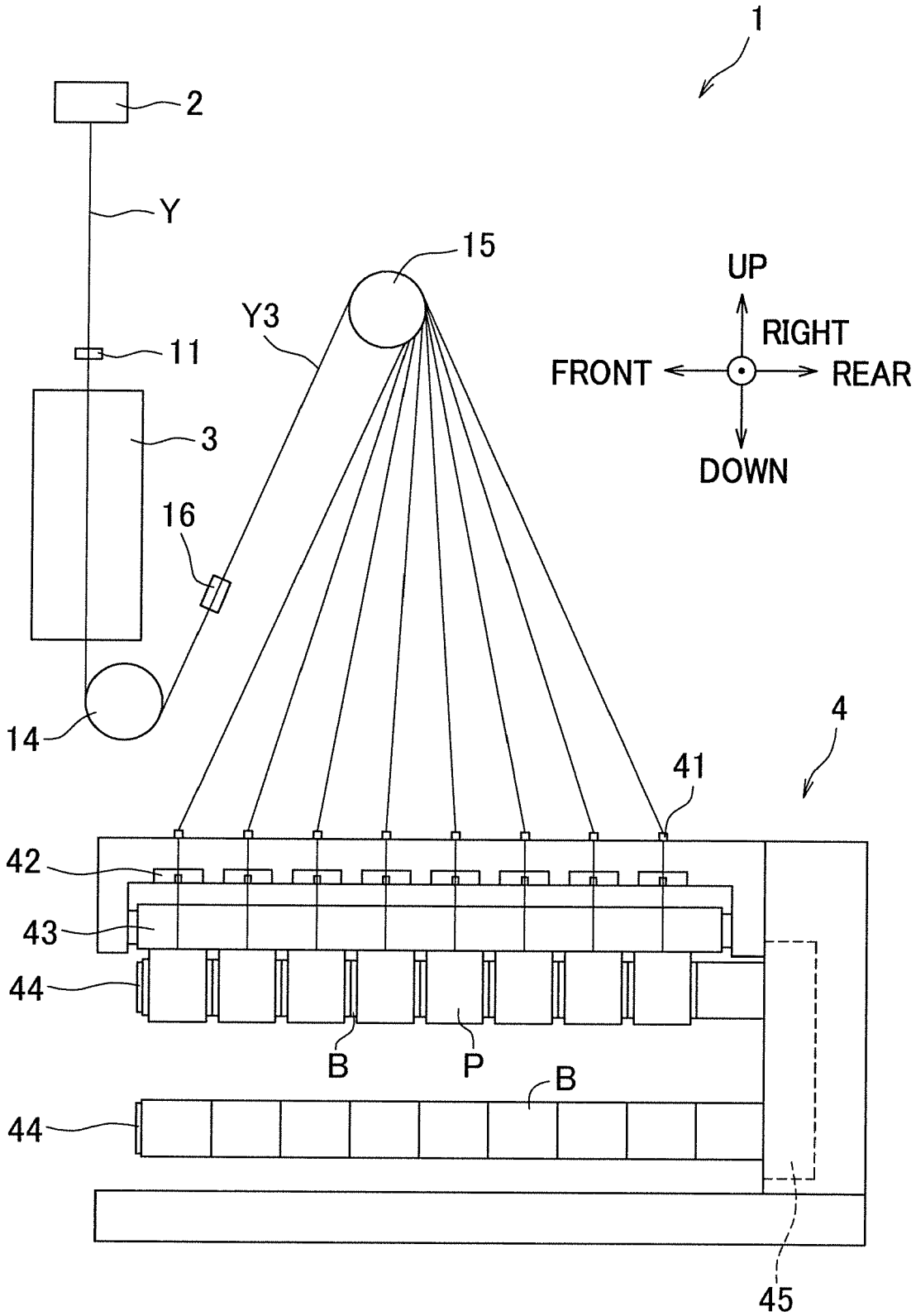

1
2
Y
15
Y3
11
3
16
14
UP
RIGHT
FRONT
REAR
DOWN
4
41
42
43
44
B
P
B
44
45

FIG.3

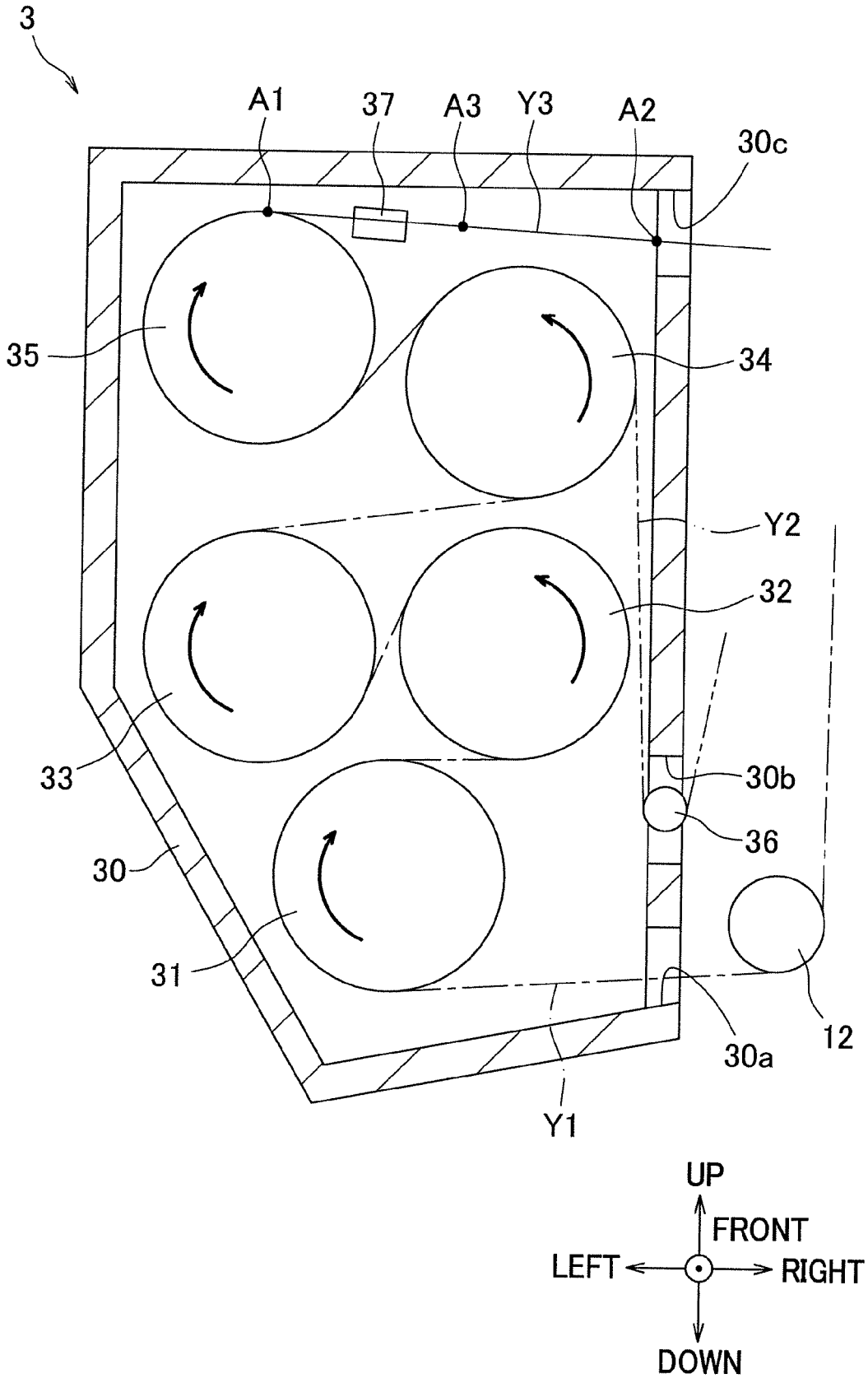

3
A1
37
A3
Y3
A2
30c
35
34
Y2
32
33
30b
36
30
31
12
30a
Y1
UP
FRONT
LEFT
RIGHT
DOWN

FIG.4

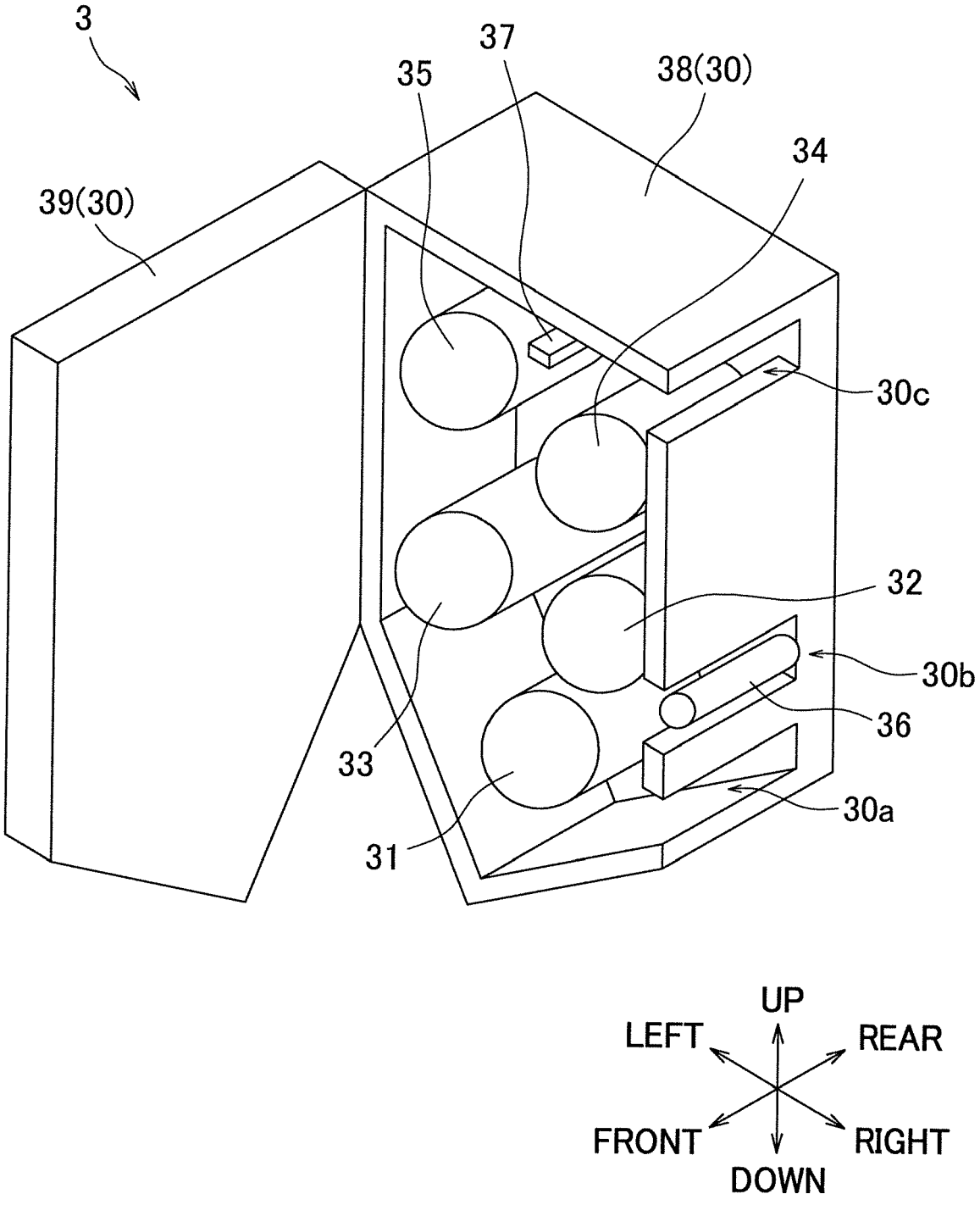
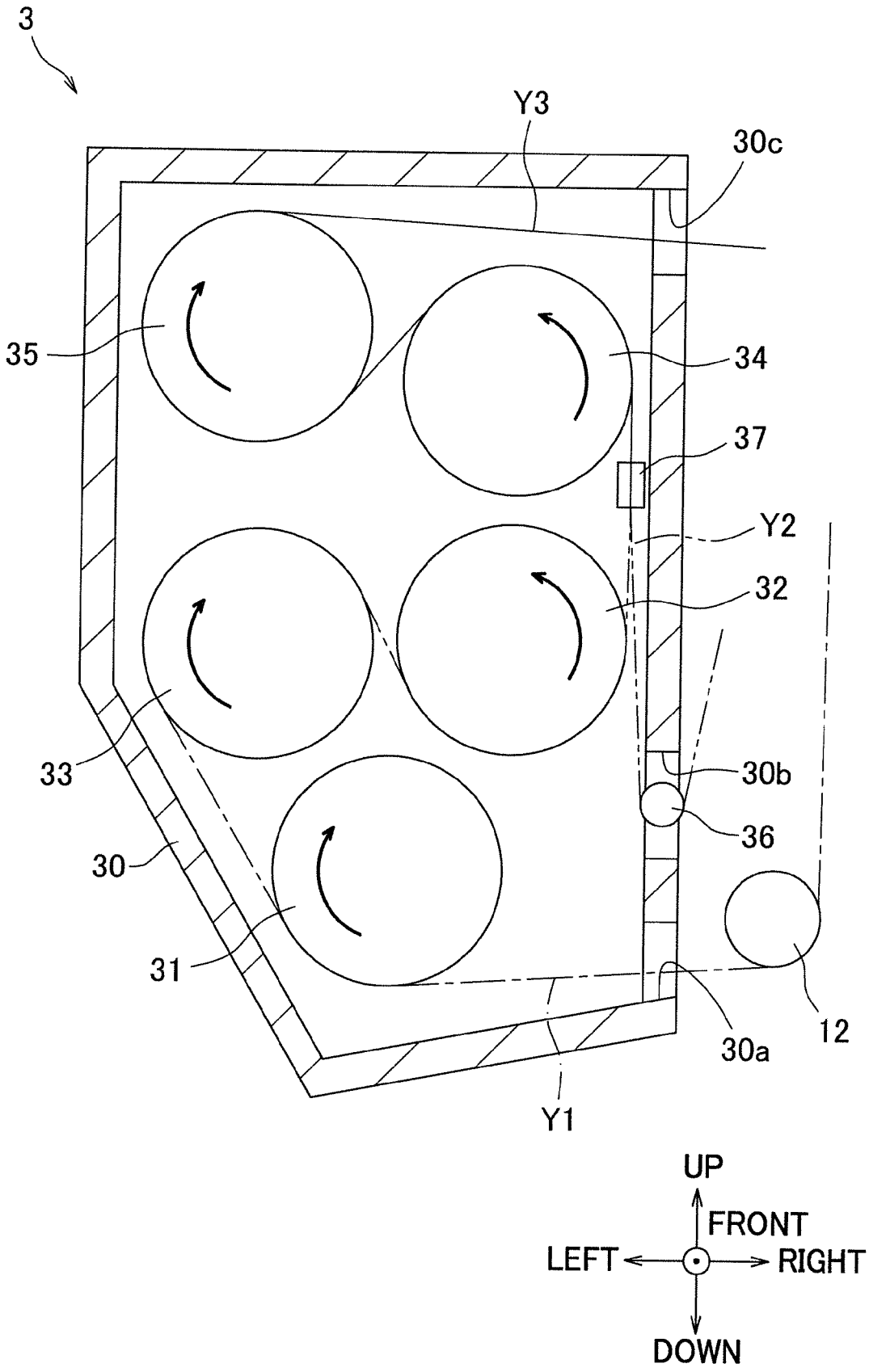

3
37
35
38(30)
34
39(30)
30c
32
30b
36
33
30a
31
UP
LEFT
REAR
FRONT
RIGHT
DOWN

FIG.5


3
Y3
30c
35
34
37
Y2
32
33
30b
36
30
31
12
30a
Y1
UP
FRONT
LEFT
RIGHT
DOWN

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EUROPEAN SEARCH REPORT

Application Number
EP 20 20 9492

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 095 900 A1 (TMT MACHINERY INC [JP]) 23 November 2016 (2016-11-23) * paragraphs [0023], [0027] - [0030]; figures 1,2,3 * -----	1-17	INV. D01D5/16 D01D10/02 D01D10/04 D01D13/00
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TECHNICAL FIELDS SEARCHED (IPC)

D01D
D02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 May 2021	Van Beurden-Hopkins

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11-05-2021

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