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(54) SPUN YARN DRAWING APPARATUS

SPINNGARNEINZUGSVORRICHTUNG

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spun yarn drawing apparatus including rollers that takes up yarns spun out from a melt spinning apparatus and draw the yarns.

[0002] Spinning and take-up apparatuses each including a melt spinning apparatus, a spun yarn drawing apparatus and a take-up winder have been known. In such yarn drawing apparatuses, the spun yarn drawing apparatus includes rollers taking-up, drawing, and thermally setting yarns spun out from the melt spinning apparatus, and the take-up winder forms packages by winding yarns drawn by the spun yarn drawing apparatus.

[0003] A spun yarn drawing apparatus recited in Patent Literature 1 (International Publication No. 2011/009498 (Fig. 1)) is arranged such that, two preliminary heating rollers for conducting preliminary heating of yarns before drawn are lined up in a up-down direction, also two thermosetting rollers for conducting thermosetting of yarns after drawn are lined up in an up-down direction, and the two preliminary heating rollers and the two thermosetting rollers are disposed in a left-right direction. The two preliminary heating rollers are set to have the same temperature, the two thermosetting rollers are set to have the same temperature, and the temperature of the thermosetting rollers is set to be higher than the temperature of the preliminary heating rollers. Each of a plurality of yarns spun out from the melt spinning machine is wound onto two of the preliminary heating rollers from below upwards and is wound onto two of the thermosetting rollers from below upwards respectively at a winding angle of 360 degrees or lower. The two preliminary heating rollers on the upstream are rotated at substantially identical yarn feeding speeds, whereas the two thermosetting rollers on the downstream are rotated at substantially identical yarn feeding speeds that are higher than those of the two preliminary heating rollers on the upstream. The yarn running on these rollers is heated to a temperature not lower than a glass transition temperature by the preliminary heating rollers, is drawn between the preliminary heating rollers and the thermosetting rollers as the yarn feeding speed of the thermosetting roller is higher than that of the preliminary heating rollers, and is then thermally set by the thermosetting rollers.

SUMMARY OF THE INVENTION

[0004] In the structure recited in Patent Literature 1, heated air moves up, and the temperatures around the respective preliminary heating rollers lined up in the up-down direction are different on account of heat convection. It is therefore difficult to adjust the temperatures of the two preliminary heating rollers to be identical with each other. The same applies to the two thermosetting rollers. Furthermore, because the preliminary heating rollers and the thermosetting rollers, which are set at different temperatures, are densely provided in the left-right direction, the temperatures around the low-temperature preliminary heating rollers are increased by the heat from the high-temperature thermosetting rollers, and hence the temperature adjustment is difficult particularly in the preliminary heating rollers. This is particularly conspicuous in the structure recited in Patent Literature 1, in which the yarn is wound onto each roller at a winding angle of 360 degrees or lower and the rollers set at different temperatures are disposed to be close to one another in a single thermal insulation box.

[0005] An object of the present invention is to provide a spun yarn drawing apparatus, which is capable of performing stable temperature adjustment of rollers.

[0006] According to the first aspect of the invention, a spun yarn drawing apparatus includes rollers configured to take up a yarn spun out from a melt spinning apparatus and draw the yarn, the rollers including a first heating roller configured to thermally set the drawn yarn, and another roller where the yarn before drawn passes through, and wherein the first heating roller is provided above said another roller, the yarn is wound from the lowest roller to the highest roller in order, and wherein the yarn is wound onto each of the rollers from below upwards at a winding angle of 360° or lower.

[0007] According to the present invention, because the high-temperature first heating roller is provided above the other roller where the yarn before drawn passes through, the influence of heat convection is small and the temperature of the rollers is stably adjustable.

[0008] According to the second aspect of the invention, the spun yarn drawing apparatus of the first aspect further includes a thermal insulation box housing the rollers.

[0009] According to the present invention, because the rollers are housed in the thermal insulation box, the heat generated by the rollers does not escape to the outside. When, for example, another roller where the yarn before drawn passes through is heating roller, the heat from this roller is utilized for heating the first heating roller. As such, the heat generated by the rollers is effectively utilized.

[0010] According to the third aspect of the invention, the spun yarn drawing apparatus is arranged so that the thermal insulation box tilts with respect to a vertical plane.

[0011] Because in the present invention the thermal insulation box is arranged to tilt with respect to the vertical plane, the yarn entering the thermal insulation box does not contact the yarn leaving the thermal insulation box, when the yarn is supplied to the rollers in the thermal insulation box from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates and the yarn is forwarded from the rollers in the thermal insulation box to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates. This makes it possible to supply the yarn into the thermal insulation box and forward the yarn from the thermal insulation box without bending the yarn by a guide or the like.

[0012] According to the fourth aspect of the invention,

the spun yarn drawing apparatus is arranged so that rotation axes of the respective rollers in the thermal insulation box tilt with respect to a horizontal plane.

[0013] Because in the present invention the rotation axes of the rollers in the thermal insulation box are arranged to tilt with respect to the vertical plane, the yarn entering the thermal insulation box does not contact the yarn leaving the thermal insulation box, when the yarn is supplied to the rollers in the thermal insulation box from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates and the yarn is forwarded from the rollers in the thermal insulation box to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates. This makes it possible to supply the yarn into the thermal insulation box and forward the yarn from the thermal insulation box without bending the yarn by a guide or the like.

[0014] According to the fifth aspect of the invention, the spun yarn drawing apparatus of any one of first to fourth aspects is arranged so that, to the rollers, the yarn is supplied from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates, and from the rollers, the yarn is forwarded to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates.

[0015] According to the present invention, because the yarn is supplied to the rollers from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates and the yarn is forwarded from the rollers to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates, the space is efficiently used by providing the take-up winder winding the drawn yarn below the melt spinning apparatus.

[0016] According to the sixth aspect of the invention, the spun yarn drawing apparatus of any one of first to fifth aspects is arranged so that the another roller is a second heating roller that is set at a temperature lower than a temperature of the first heating roller.

[0017] According to the present invention, because the yarn before drawn is heated by the second heating roller, it is possible to stably produce drawn yarns made of resin having a high glass transition temperature such as polyester fibers.

[0018] According to the seventh aspect of the invention, the spun yarn drawing apparatus of the sixth aspect is arranged so that the number of the first heating roller and the number of the second heating roller are changeable.

[0019] According to the present invention, because the numbers of first and second heating rollers are changeable, it is possible to increase the number of types of yarns produced by the same type of apparatus, by changing the numbers of first and second heating rollers in accordance with the type of yarns such as thick yarns and low-elongation yarns to be produced.

[0020] According to the eighth aspect of the invention, the spun yarn drawing apparatus of the sixth aspect is arranged so that the number of the second heating roller is larger than the number of the first heating roller.

[0021] According to the present invention, because the number of the second heating roller is larger than the number of the first heating roller, the following problem is resolved: in the arrangement in which yarns are wound onto rollers at winding angles of 360 degrees or lower, the heating by the second heating roller is insufficient and yarns are not stably drawn when thick yarns are produced.

[0022] According to the ninth aspect of the invention, the spun yarn drawing apparatus of the sixth aspect is arranged so that the number of the first heating roller is larger than the number of the second heating roller.

[0023] According to the present invention, when yarns having extremely low elongation are produced by an arrangement in which yarns are wound onto rollers at winding angles of 360 degrees or lower, the thermosetting by the first heating roller is insufficient and yarns having sufficiently low elongation cannot be produced. This problem is resolved by setting the number of the high-temperature first heating roller to be larger than the number of the second heating roller.

[0024] According to the tenth aspect of the invention, the spun yarn drawing apparatus of any one of first to ninth aspects is arranged so that the number of the rollers is an odd number.

[0025] According to the present invention, when the number of the rollers is an odd number, the yarn contacts the rollers at winding angles of not smaller than 180 degrees and not larger than 270 degrees yarn by, for example, arranging the rollers in zigzag, and the yarn is supplied to the rollers from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates and the yarn is forwarded from the rollers to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates.

[0026] The present invention realizes stable temperature adjustment of rollers because a high-temperature first heating roller is provided above the other roller where a yarn before drawn passes through and hence the influence of heat convection is small.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a front elevation of a spinning and take-up apparatus of an embodiment of the present invention.

FIG. 2 is a profile of the spinning and take-up apparatus of the embodiment of the present invention.

FIG. 3 is a front elevation of a spinning and take-up apparatus according to a modification.

FIG. 4 is a profile of the spinning and take-up apparatus of the modification.

FIG. 5 shows an example of the disposition of godet rollers.

FIG. 6 shows another example of the disposition of

godet rollers.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] The following will describe a preferred embodiment of the present invention.

[0029] FIG. 1 is a front elevation of a spinning and take-up apparatus including a spun yarn drawing apparatus of the embodiment of the present invention, whereas FIG. 2 is a profile of the spinning and take-up apparatus. As shown in FIG. 1 and FIG. 2, the spinning and take-up apparatus 1 includes a spun yarn drawing apparatus 2 and a take-up winder 3. Yarns Y serially spun out from a melt spinning apparatus 4 provided above the spinning and take-up apparatus 1 are supplied to the take-up winder 3 via the spun yarn drawing apparatus 2, and the yarns Y are wound by the take-up winder 3. The yarns Y are made of polyester fibers requiring preliminary heating before drawn.

[0030] The spun yarn drawing apparatus 2 includes components such as godet rollers 14 to 18 that take up the yarns Y spun out from the melt spinning apparatus 4 and draw the yarns Y. Details will be given later.

[0031] The take-up winder 3 is provided below the melt spinning apparatus 4 and forms a plurality of packages P by winding a plurality of yarns Y spun out from the melt spinning apparatus 4 onto a plurality of bobbins B through the spun yarn drawing apparatus 2 respectively. The take-up winder 3 includes guide rollers 5 and 6, a plurality of fulcrum guides 7, and two winding units 8.

[0032] The guide rollers 5 and 6 are drive rollers driven by each of motors that is not shown in the figure, and the axes thereof are in parallel to the left-right direction. The guide roller 6 is provided behind and above the guide roller 5. The yarns Y supplied from the spun yarn drawing apparatus 2 are forwarded to the fulcrum guides 7 below by the guide rollers 5 and 6.

[0033] The plurality of fulcrum guides 7 are provided below the guide roller 6 and above a plurality of traverse guides 12 and immediately above bobbins B attached to the plurality of traverse guides 12 and a bobbin holder 11 along the axial direction of winding axis at the same intervals as the bobbins B.

[0034] The winding unit 8 includes components such as: a main body frame 9; disc-shaped turrets 10 rotatably provided on the main body frame 9; two bobbin holders 11 which are cantilevered by the turrets 10, each of which has a horizontal winding axis, and to which a plurality of bobbins B are attached along the axial direction of the winding axis; traverse guides 12 configured to traverse the yarns; and contact rollers 13 which are movable in the up-down direction with respect to the main body frame 9 and movable with respect to the bobbins B attached to the bobbin holder 11.

[0035] The winding unit 8 winds the yarns Y onto the rotating bobbins B by rotating the bobbin holder 11 in such a way that the bobbin holder 11 is rotated by an unillustrated motor and hence the bobbins B attached to the bobbin holder 11 are rotated. At the same time, the yarns Y wound onto the bobbins B are traversed in the axial directions of the bobbins B about the fulcrum guides 7, by the traverse guides 12 provided above the respective bobbins B.

[0036] The yarns Y traversed about the fulcrum guides 7 by the traverse guides 12 are wound onto the bobbins B, with the result that packages P are formed. In so doing, the contact roller 13 contacts the outer circumferences of the packages P at the time of the winding of the yarns onto the bobbins B and rotates while applying a predetermined contact pressure to each package P. As such, the shape of each package P is adjusted. When becoming full, the packages P attached to the bobbin holder 11 are pushed forward by an unillustrated pusher and eventually removed from the bobbin holder 11.

[0037] Now, the spun yarn drawing apparatus 2 will be described. The spun yarn drawing apparatus 2 includes godet rollers 14 to 18 (rollers) taking-up yarns Y spun out from the melt spinning apparatus 4 and drawing them, a thermal insulation box 19 housing the godet rollers 14 to 18 therein, and guide rollers 20 and 21. The spun yarn drawing apparatus 2 is provided below the melt spinning apparatus 4. FIG. 1 illustrates the thermal insulation box 19 in a see-through manner.

[0038] The godet rollers 14 to 18 are drive rollers driven by an unillustrated motor and are cantilevered by an unillustrated frame. Each of the godet rollers 14 to 18 includes a heater therein. The godet rollers 14 to 16 (second heating rollers) are preliminary heating godet rollers for heating the yarns Y before drawn, as the yarns Y before drawn pass through the rollers. The godet rollers 14 to 16 are set at a temperature of 80 to 100 degrees Celsius in case of polyester fibers, when the yarns Y are heated to the glass transition temperature or higher. The glass transition temperature varies in accordance with the type of the polymer. The godet rollers 17 and 18 (first heating rollers) are thermosetting godet rollers for thermally setting the yarns Y having been drawn, and are set at a temperature of 120 to 150 degrees Celsius. As such, the temperature of the godet rollers 14 to 16 is lower than the temperature of the godet rollers 17 and 18.

[0039] The axes of the respective godet rollers 14 to 18 are in parallel to each other. For example, these rollers 14 to 18 are 220 to 300mm in diameter and are substantially identical in diameter. The godet rollers 14, 15, 16, 17, and 18 are provided in this order from below. The thermosetting godet rollers 17 and 18 are provided above the preliminary heating godet rollers 14 to 16. The godet rollers 14, 16, and 18 are arranged so that the axes thereof are provided substantially on the same line in the up-down direction. The godet rollers 15 and 17 are arranged to be deviated from the godet rollers 14, 16, and 18 in the left-right direction (i.e., arranged to the right of the godet rollers 14, 16, and 18) and the axes of the godet rollers 15 and 17 are provided substantially on the same line in the up-down direction. The godet rollers 14 to 18 are arranged in zigzags. The number of the preliminary

heating godet rollers 14 to 16 is larger than the number of the thermosetting godet rollers 17 and 18. In the spun yarn drawing apparatus 2, the motor for driving the preliminary heating godet rollers 14 to 16 and the motor for driving the thermosetting godet rollers 17 and 18 are of the same type, and the preliminary heating godet rollers 14 to 16 and the thermosetting godet rollers 17 and 18 are of the same type and substantially identical in diameter. For this reason, the numbers of the preliminary heating godet rollers and the thermosetting godet rollers to be provided are changeable in accordance with the type of the yarns to be produced, by changing the setting temperatures and simple rearrangement of the godet rollers.

[0040] Onto the godet rollers 14 to 18, the yarns Y are wound each at a winding angle of 360 degrees or lower. The yarn winding is performed from the lowest roller to the highest roller, i.e., from the godet roller 14 to the godet roller 18 in this order. The winding angles $\theta 1$ to $\theta 5$ of the yarn Y wound onto the godet rollers 14 to 18 are not smaller than 180 degrees and not larger than 360 degrees, preferably not smaller than 180 degrees and not larger than 270 degrees. In the present embodiment, the winding angles $\theta 1$ to $\theta 5$ are not smaller than 180 degrees and not larger than 270 degrees.

[0041] To the godet rollers 14 to 18, the yarns Y are supplied from the side where the yarn path of the yarn Y spun out from the melt spinning apparatus 4 locates (i.e., from the right side of the godet rollers 14 to 18). From the godet rollers 14 to 18, the yarns Y are forwarded to the side where the yarn path of the yarn Y spun out from the melt spinning apparatus 4 locates (i.e., to the right side of the godet rollers 14 to 18). More specifically, the yarns Y are supplied to the godet roller 14 from the right side. Because the yarns Y are wound onto the roller at the winding angle of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are forwarded to the right side of the godet roller 14. To the godet roller 15 which is positioned to the upper right of the godet roller 14, the yarns Y are supplied from the left side. Because the yarns Y are wound onto the roller at the winding angle of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are forwarded to the left side of the godet roller 15. Furthermore, to the godet roller 16 which is positioned to the upper left of the godet roller 15, the yarns Y are supplied from the right side of the godet roller 16. Because the yarns Y are wound onto the roller at the winding angle of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are forwarded to the right side of the godet roller 16. To the godet roller 17 which is positioned to the upper right of the godet roller 16, the yarns Y are supplied from the left side. Because the yarns Y are wound onto the roller at the winding angle of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are forwarded to the left side of the godet roller 17. Lastly, to the godet roller 18 which is positioned to the upper left of the godet roller 17, the yarns Y are supplied from the right side of the godet roller 18. Because the yarns Y are wound onto the roller at the winding angle of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are forwarded to the right side of the godet roller 18. As such, as five (an odd number of) godet rollers 14 to 18 are arranged in zigzag, the yarns Y contact the godet rollers 14 to 18 at the winding angles of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are supplied to the godet rollers 14 to 18 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates, and the yarns Y are forwarded from the godet rollers 14 to 18 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates.

[0042] The thermal insulation box 19 is a substantially rectangular parallelepiped box that stores the godet rollers 14 to 18 and is made of a heat insulating material. The thermal insulation box 19 prevents the heat generated by the godet rollers 14 to 18 from escaping to the outside. Inside the thermal insulation box 19, the temperature of the upper part is higher than the temperature of the lower part because the thermosetting godet rollers 17 and 18 which are set at high temperatures are provided in the upper part and heat convection occurs.

[0043] The thermal insulation box 19 is arranged to tilt forward for about 10 degrees with respect to the vertical plane. The godet rollers 14 to 18 are arranged so that the axes thereof are in parallel to the thermal insulation box 19 and tilt with respect to the bobbin holder 11. This is to prevent yarns entering the thermal insulation box 19 from contacting yarns coming out from the thermal insulation box 19 by arranging the guide rollers 20 and 21 to be staggered back and forth (i.e., in the axial direction).

[0044] The thermal insulation box 19 has slits 22 and 23 at upper and lower parts of a single side wall. The yarns Y enter the thermal insulation box 19 through the lower slit 22, whereas the yarns Y come out from the thermal insulation box 19 through the upper slit 23. That is to say, into the thermal insulation box 19, the yarns Y enter from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., from the right side of the thermal insulation box 19), and from the thermal insulation box 19, the yarns Y come out to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., to the right side of the thermal insulation box 19).

[0045] The guide roller 20 is provided outside the thermal insulation box 19 to be deviated in the left-right direction from the slit 22 of the thermal insulation box 19 (i.e., deviated to the right side). This guide roller 20 changes the yarn path of the yarns Y spun out from the melt spinning apparatus 4 and guides the yarns Y to the thermal insulation box 19. The yarns Y are supplied to the guide roller 20 from above. The guide roller 21 is provided outside the thermal insulation box 19 to be deviated in the left-right direction from the slit 23 of the thermal insulation box 19 (i.e., deviated to the right side). This guide roller 21 changes the yarn path of the yarns Y coming out from the thermal insulation box 19, and

guides the yarns Y to the guide roller 5. The yarns Y are forwarded downward from the guide roller 21. The tilting angle θ6 of the yarns Y entering the thermal insulation box 19 with respect to the horizontal direction and the tilting angle θ7 of the yarns Y coming out from the thermal insulation box 19 with respect to the horizontal direction are 60 degrees or smaller, more preferably 30 degrees or smaller. Furthermore, the winding angles θ8 and θ9 of the yarns Y wound onto the guide rollers 20 and 21 are preferably 180 degrees or smaller, and the sum total of the winding angles θ8 and θ9 is preferably 240 degrees or smaller. The guide rollers 20 and 21 may be drive rollers or driven rollers. In this regard, the yarn path of the yarns Y can be easily changed when the guide rollers 20 and 21 are drive rollers.

[0046] The yarns Y spun out from the melt spinning apparatus 4 are preliminarily heated to a temperature not lower than the glass transition temperature by contacting the preliminary heating godet rollers 14 to 16. The yarns Y are sent to the thermosetting godet rollers 17 and 18 on the downstream, as the preliminary heating godet rollers 14 to 16 rotate. In this regard, for example, the preliminary heating godet rollers 14 to 16 on the upstream rotate at substantially identical peripheral velocities, whereas the thermosetting godet rollers 17 and 18 on the downstream rotate at substantially identical peripheral velocities that are higher than those of the preliminary heating godet rollers 14 to 16 on the upstream. Because the godet rollers 17 and 18 on the downstream have higher yarn feeding speeds than those of the godet rollers 14 to 16 on the upstream, the yarns Y are drawn between the godet rollers 14 to 16 and the godet rollers 17 and 18. The yarns Y having been drawn are thermally set on account of the contact with the thermosetting godet rollers 17 and 18, and are sent to the guide roller 20 by the rotation of the thermosetting godet rollers 17 and 18.

[0047] As described above, the spun yarn drawing apparatus 2 of the present embodiment includes godet rollers 14 to 18 that take up yarns Y spun out from the melt spinning apparatus 4 and draw these yarns Y. The godet rollers 14 to 18 include godet rollers 17 and 18 configured to thermally set the yarns Y having been drawn. Onto the godet rollers 14 to 18, the yarns Y are wound at winding angles of 360 degrees or smaller, serially from the lowest roller to the highest roller. The godet rollers 17 and 18 are provided above the godet rollers 14 to 16 where the yarns before drawn pass through.

[0048] In the spun yarn drawing apparatus 2 of the embodiment of the present invention arranged as above, because the high-temperature godet rollers 17 and 18 for thermally setting the drawn yarns are provided above the low-temperature godet rollers 14 to 16 where the yarns before drawn pass through, the influence of heat convection is small and hence the temperatures of the godet rollers 14 to 18 are stably adjusted. In particular, because the godet rollers 14 to 16 are preliminary heating godet rollers whereas the godet rollers 17 and 18 are thermosetting godet rollers, the temperatures of the godet rollers 14 to 16 are lower than the temperatures of the godet rollers 17 and 18. However, as the godet rollers 14 to 16 are provided below the godet rollers 17 and 18, the influence of heat convection is small and stable temperature adjustment is possible. Furthermore, on account of heat convection due to heat radiation from the godet rollers 14 to 16, the heat radiated from the godet rollers 14 to 16 is effectively used for heating the godet rollers 17 and 18 provided above.

[0049] Because the thermal insulation box 19 housing the godet rollers 14 to 18 is further provided, the heat generated from the godet rollers 14 to 18 does not escape to the outside, and hence the heat generated from the godet rollers 14 to 18 is effectively utilized.

[0050] In addition to the above, because the thermal insulation box 19 is arranged to tilt with respect to the vertical plane, the yarns Y entering the thermal insulation box 19 do not contact the yarns Y coming out from the thermal insulation box 19, when, as in the present embodiment, the yarns Y are supplied to the godet rollers 14 to 18 in the thermal insulation box 19 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates and the yarns Y are forwarded from the godet rollers 14 to 18 in the thermal insulation box 19 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates. With this, the yarns Y are supplied to the thermal insulation box 19 and come out from the thermal insulation box 19 without bending the yarns Y by a guide or the like.

[0051] Onto the godet rollers 14 to 18, the yarns Y are supplied from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates, and from the godet rollers 14 to 18, the yarns Y are forwarded to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates. This allows the take-up winder 3 to be provided below the melt spinning apparatus 4, and hence the space is efficiently used.

[0052] Also, because of the presence of the preliminary heating godet rollers 14 to 16 which are set at temperatures lower than those of the thermosetting godet rollers 17 and 18, the yarns Y before drawn are heated by the preliminary heating godet rollers 14 to 16. This makes it possible to stably produce the yarns Y made of polyester fibers having a high glass transition temperature.

[0053] Moreover, because the number of the preliminary heating godet rollers and the number of the thermosetting godet rollers to be provided are changeable, it is possible to increase the number of types of yarns produced by the same type of apparatus, by changing the number of preliminary heating godet rollers and the number of thermosetting godet rollers in accordance with the type of yarns to be produced such as thick yarns and low-elongation yarns.

[0054] Furthermore, because the number of the preliminary heating godet rollers 14 to 16 is larger than the number of the thermosetting godet rollers 17 and 18, the

following problem is resolved: in the arrangement in which yarns are wound onto godet rollers at winding angles of 360 degrees or lower as in the present embodiment, the heating by preliminary heating godet rollers is insufficient and yarns are not stably drawn when thick yarns are produced.

[0055] In addition to the above, because the number of the godet rollers 14 to 18 is an odd number (five), as in the present embodiment, the godet rollers 14 to 18 are arranged in zigzag, the yarns Y contact the godet rollers 14 to 18 at winding angles of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are supplied to the godet rollers 14 to 18 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates, and the yarns Y are forwarded from the godet rollers 14 to 18 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates.

[0056] Although the embodiment of the present invention has been described, the embodiment of the present invention is not limited to the above and can be suitably changed within the scope of the present invention as described in the examples below.

[0057] In the embodiment above, the guide rollers 20 and 21 are arranged to be staggered back and forth (in the axial direction), and in order to prevent the yarns entering the thermal insulation box 19 from contacting the yarns leaving the thermal insulation box 19, the thermal insulation box 19 tilts forward with respect to the vertical plane, and the godet rollers 14 to 18 are arranged so that the axes thereof are provided in parallel to the thermal insulation box 19 and tilt with respect to the bobbin holder 11. Alternatively, as shown in FIG. 3 and FIG. 4, guides 24 and 25 may be provided to bend the yarns Y in order to prevent the yarns entering the thermal insulation box 19 from contacting the yarns leaving the thermal insulation box 19 and to guide the yarns Y to the guide roller 20. The guide 24 bends the yarns Y toward the front, and the bended yarns Y are forwarded to the guide 25. The guide 25 bends the yarns Y toward the bottom, and the bended yarns Y are forwarded to the guide roller 20.

[0058] In the embodiment above, five (an odd number of) godet rollers 14 to 18 are arranged in zigzag, the yarns Y are wound onto the godet rollers 14 to 18 at winding angles of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are supplied to the godet rollers 14 to 18 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., from the right side of the godet rollers 14 to 18), and the yarns Y are forwarded from the godet rollers 14 to 18 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., to the right side of the godet rollers 14 to 18). Alternatively, as shown in FIG. 5, four (an even number of) godet rollers 26 to 29 are arranged in zigzag, the yarns Y are wound onto the lower godet roller 26 at a winding angle of 180 degrees or smaller and arranged to reach the roller from the right side and to be forwarded to the left side, the yarns Y are wound onto the other three godet rollers 27 to 29 at winding angles of not smaller than 180 degrees and not larger than 270 degrees and are arranged to be supplied to the godet rollers 26 to 29 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., from the right side of the godet rollers 26 to 29) and to be forwarded from the godet rollers 26 to 29 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., to the right side of the godet rollers 26 to 29). In this arrangement, the winding angle of the yarns Y at the godet roller 26 is small and hence the length of a part of each yarn Y which part contacts the godet roller 26 is short. In the example above only the winding angle of the yarns at the lower godet roller 26 is arranged to be smaller than the winding angles at the remaining godet rollers 27 to 29. Alternatively, only the winding angle of the yarns at the upper godet roller 29 is arranged to be smaller than the winding angles at the remaining godet rollers 26 to 28, or the winding angles of the yarns at more than one godet rollers are arranged to be smaller than the winding angles at the remaining godet rollers. In addition to the above, alternatively, as shown in FIG. 6, four (an even number of) godet rollers 30 to 33 are arranged in zigzag, the yarns Y are wound at winding angles of not smaller than 180 degrees and not larger than 270 degrees, the yarns Y are supplied to the godet rollers 30 to 33 from the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., from the right side of the godet rollers 30 to 33), and the yarns Y are forwarded from the godet roller 33 to the side where the yarn path of the yarns Y spun out from the melt spinning apparatus 4 locates (i.e., to the left side of the godet rollers 30 to 33). In this case, while the problem of the short contact length of each yarn on the godet rollers does not occur, the spinning and take-up apparatus must be wide in the left-right direction because the take-up winder 3 cannot be provided below the melt spinning apparatus 4.

[0059] The number and diameters of the godet rollers may be suitably changed in accordance with the heating temperatures of the yarns, the winding angles, or the like.

[0060] For example, while in the embodiment above the number of the preliminary heating godet rollers 14 to 16 is larger than the number of the thermosetting godet rollers 17 and 18, the number of the thermosetting godet rollers may be larger than the number of the preliminary heating godet rollers. In particular, when yarns having extremely low elongation are produced by an arrangement in which yarns are wound onto godet rollers at winding angles of 360 degrees or lower, the thermosetting by the thermosetting godet rollers is insufficient and yarns having sufficiently low extensibility cannot be produced. This problem is resolved by setting the number of the high-temperature thermosetting godet rollers to be larger than the number of the preliminary heating godet rollers. Alternatively, the number of the thermosetting godet rollers may be identical with the number of the preliminary

heating godet rollers (e.g., both numbers are identical and two or more).

[0061] In the embodiment above the number of godet rollers is five, the number of thermosetting godet rollers is two, the number of preliminary heating godet rollers is three and hence the number of the preliminary heating godet rollers is larger than the number of the thermosetting godet rollers. Alternatively, for example, the number of the preliminary heating godet rollers may be larger than the number of the thermosetting godet rollers such that the number of the thermosetting godet roller is one whereas the number of the preliminary heating godet rollers is two, or the number of the thermosetting godet rollers is three or more whereas the number of the preliminary heating godet rollers is four or more.

[0062] For example, while in the embodiment above the godet rollers 14 to 16 are godet rollers for heating, the godet rollers may be non-heating rollers each of which does not include a heater or may be used in a non-heating state as the heater therein is turned off, when the type of the yarns to be produced is, for example, nylon yarns that can be drawn at room temperatures. Furthermore, the most downstream godet roller 18 can also be used in the non-heating state as the heater therein is turned off.

[0063] For example, while in the embodiment above the godet rollers 14 to 18 have the same diameter, the diameters of the preliminary heating godet rollers 14 to 16 may be different from the diameters of the thermosetting godet rollers 17 and 18. For example, the preliminary heating godet rollers 14 to 16 are larger in diameter than the thermosetting godet rollers 17 and 18. In this regard, because the peripheral velocities of the preliminary heating godet rollers 14 to 16 are low, the heat loss does not significantly vary even if the diameters are increased. It is therefore possible to restrain the thermal energy consumption by increasing the diameters of the preliminary heating godet rollers 14 to 16 and decreasing the number of these rollers.

Claims

1. A spun yarn drawing apparatus comprising rollers configured to take up a yarn spun out from a melt spinning apparatus and draw the yarn,

   the rollers including a first heating roller configured to thermally set the drawn yarn, and another roller where the yarn before drawn passes through, and **characterised in that**
   the first heating roller is provided above said another roller,
   the yarn is wound from the lowest roller to the highest roller in order, and
   wherein the yarn is wound onto each of the rollers from below upwards at a winding angle of 360° or lower.

2. The spun yarn drawing apparatus according to claim 1, further comprising:

   a thermal insulation box housing the rollers.

3. The spun yarn drawing apparatus according to claim 2, wherein,

   the thermal insulation box tilts with respect to a vertical plane.

4. The spun yarn drawing apparatus according to claim 3, wherein,

   rotation axes of the respective rollers in the thermal insulation box tilt with respect to a horizontal plane.

5. The spun yarn drawing apparatus according to any one of claims 1 to 4, wherein,

   to the rollers, the yarn is supplied from the side where the yarn path of the yarn spun out from the melt spinning apparatus locates, and
   from the rollers, the yarn is forwarded to the side where the yarn path of the yarn spun out from the melt spinning apparatus locates.

6. The spun yarn drawing apparatus according to any one of claims 1 to 5, wherein,

   the another roller is a second heating roller that is set at a temperature lower than a temperature of the first heating roller.

7. The spun yarn drawing apparatus according to claim 6, wherein,

   the number of the first heating roller and the number of the second heating roller are changeable.

8. The spun yarn drawing apparatus according to claim 6, wherein,

   the number of the second heating roller is larger than the number of the first heating roller.

9. The spun yarn drawing apparatus according to claim 6, wherein,

   the number of the first heating roller is larger than the number of the second heating roller.

10. The spun yarn drawing apparatus according to any one of claims 1 to 9, wherein,

    the number of the rollers is an odd number.

Patentansprüche

1. Spinngarnziehvorrichtung, umfassend Rollen, die konfiguriert sind, um Garn, das von einer Schmelzspinnvorrichtung ausgesponnen wird, aufzunehmen und das Garn zu ziehen,
wobei die Rollen eine erste Heizrolle, die konfiguriert ist, um das gezogene Garn thermisch zu fixieren, und eine andere Rolle, durch die das Garn vor dem Ziehen hindurch läuft, aufweisen, und **dadurch gekennzeichnet, dass**
die erste Heizrolle über der anderen Rolle vorgesehen ist,
das Garn der Reihe nach von der niedrigsten Rolle zu der höchsten Rolle gewickelt wird, und
wobei das Garn auf jede der Rollen von unten nach oben, bei einem Wicklungswinkel von 360° oder weniger, gewickelt wird.

2. Spinngarnziehvorrichtung nach Anspruch 1, weiter umfassend:

   eine Wärmedämmungsbox, die die Rollen aufnimmt.

3. Spinngarnziehvorrichtung nach Anspruch 2, wobei sich die Wärmedämmungsbox in Bezug auf eine vertikale Ebene neigt.

4. Spinngarnziehvorrichtung nach Anspruch 3, wobei sich Drehachsen der jeweiligen Rollen in der Wärmedämmungsbox in Bezug auf eine horizontale Ebene neigen.

5. Spinngarnziehvorrichtung nach einem der Ansprüche 1 bis 4, wobei
das Garn von der Seite, wo der Fadenlauf des Garns, das von der Schmelzspinnvorrichtung ausgesponnen wird, angeordnet ist, den Rollen zugeführt wird, und
das Garn von den Rollen zu der Seite weitergeleitet wird, wo der Fadenlauf des Garns, das von der Schmelzspinnvorrichtung ausgesponnen wird, angeordnet ist.

6. Spinngarnziehvorrichtung nach einem der Ansprüche 1 bis 5, wobei
die andere Rolle eine zweite Heizrolle ist, die auf eine Temperastur gesetzt ist, die niedriger als eine Temperatur der ersten Heizrolle ist.

7. Spinngarnziehvorrichtung nach Anspruch 6, wobei die Anzahl der ersten Heizrolle und die Anzahl der zweiten Heizrolle veränderbar sind.

8. Spinngarnziehvorrichtung nach Anspruch 6, wobei die Anzahl der zweiten Heizrolle größer ist, als die Anzahl der ersten Heizrolle.

9. Spinngarnziehvorrichtung nach Anspruch 6, wobei die Anzahl der ersten Heizrolle größer ist, als die Anzahl der zweiten Heizrolle.

10. Spinngarnziehvorrichtung nach einem der Ansprüche 1 bis 9, wobei
die Anzahl der Rollen eine ungerade Zahl ist.

Revendications

1. Appareil d'étirage de fil filé comprenant des rouleaux configurés pour prendre un fil filé hors d'un appareil de filage par fusion et pour étirer le fil,
les rouleaux incluant un premier rouleau chauffant configuré pour durcir thermiquement le fil étiré, et un autre rouleau, le fil passant à travers avant d'être étiré, et **caractérisé en ce que**
le premier rouleau chauffant est disposé au-dessus dudit autre rouleau,
le fil est enroulé du rouleau le plus bas au rouleau le plus haut dans l'ordre, et dans lequel le fil est enroulé sur chacun des rouleaux à partir du dessous vers le haut à un angle d'enroulement de 360° ou moins.

2. Appareil d'étirage de fil filé selon la revendication 1, comprenant en outre :

   une boîte d'isolation thermique logeant les rouleaux.

3. Appareil d'étirage de fil filé selon la revendication 2, dans lequel,
la boîte d'isolation thermique s'incline par rapport à un plan vertical.

4. Appareil d'étirage de fil filé selon la revendication 3, dans lequel,
les axes de rotation des rouleaux respectifs dans la boîte d'isolation thermique s'inclinent par rapport à un plan horizontal.

5. Appareil d'étirage de fil filé selon l'une quelconque des revendications 1 à 4, dans lequel,
vers les rouleaux, le fil est amené à partir du côté où le chemin de fil du fil filé hors de l'appareil de filage par fusion se situe, et
en provenance des rouleaux, le fil est acheminé jusqu'au côté où le chemin de fil du fil filé hors de l'appareil de filage par fusion se situe.

6. Appareil d'étirage de fil filé selon l'une quelconque des revendications 1 à 5, dans lequel,
l'autre rouleau est un second rouleau chauffant qui est réglé à une température plus basse qu'une température du premier rouleau chauffant.

7. Appareil d'étirage de fil filé selon la revendication 6, dans lequel,
le nombre de premiers rouleaux chauffants et le nombre de seconds rouleaux chauffants sont variables.

8. Appareil d'étirage de fil filé selon la revendication 6, dans lequel,
le nombre de seconds rouleaux chauffants est plus grand que le nombre de premiers rouleaux chauffants.

9. Appareil d'étirage de fil filé selon la revendication 6, dans lequel,
le nombre de premiers rouleaux chauffants est plus grand que le nombre de seconds rouleaux chauffants.

10. Appareil d'étirage de fil filé selon l'une quelconque des revendications 1 à 9, dans lequel,
le nombre des rouleaux est un nombre impair.

FIG.1

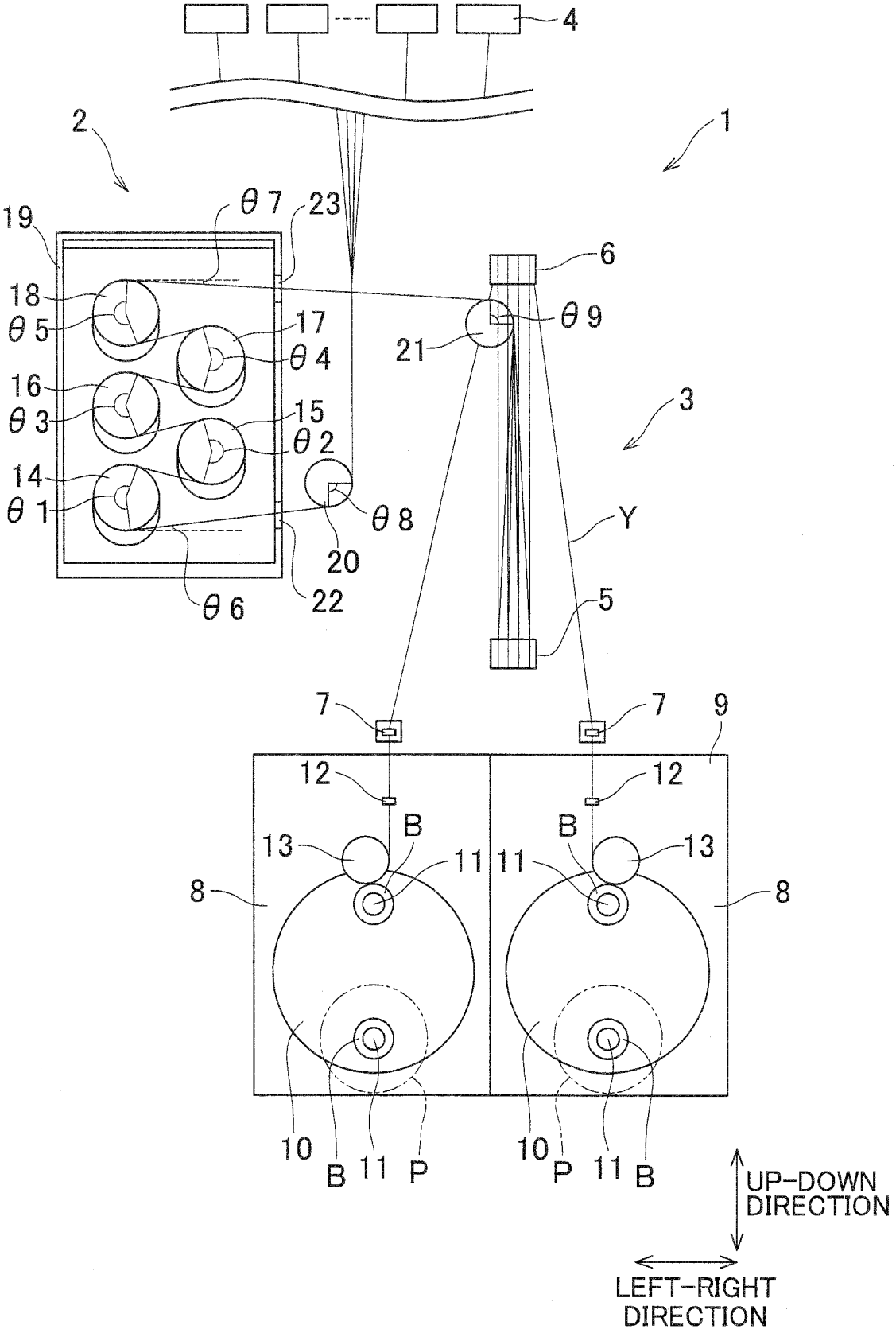

4
2
1
19
θ 7
23
6
18
θ 5
17
θ 4
θ 9
21
16
θ 3
15
θ 2
3
14
θ 1
θ 8
Y
20
22
θ 6
5
7
7
9
12
12
B
B
13
11
11
13
8
8
10
B
11
P
10
P
11
B
UP-DOWN DIRECTION
LEFT-RIGHT DIRECTION

FIG.2

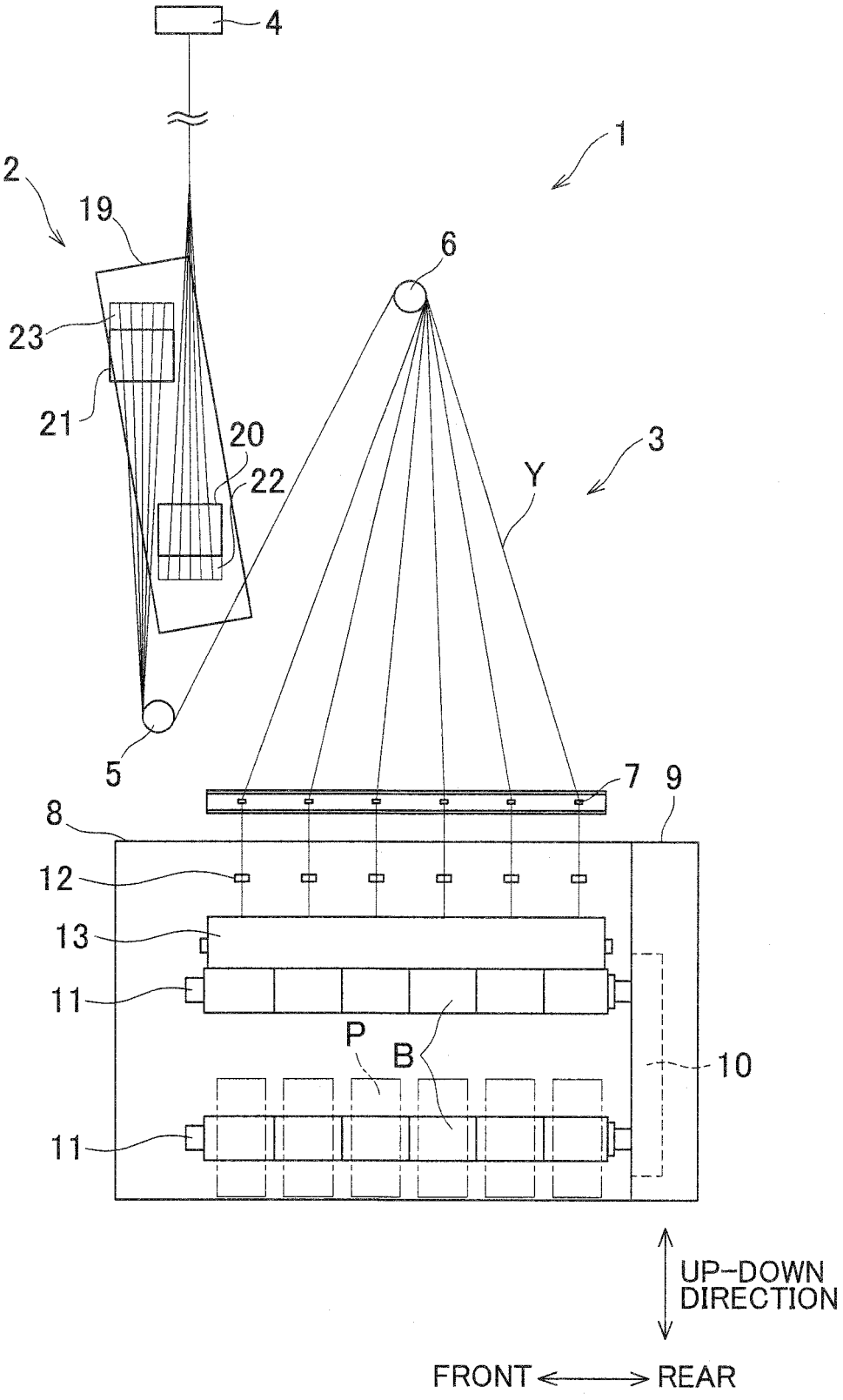

4
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2
19
6
23
21
20
22
Y
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9
8
12
13
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P
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11
UP-DOWN DIRECTION
FRONT
REAR

FIG.3

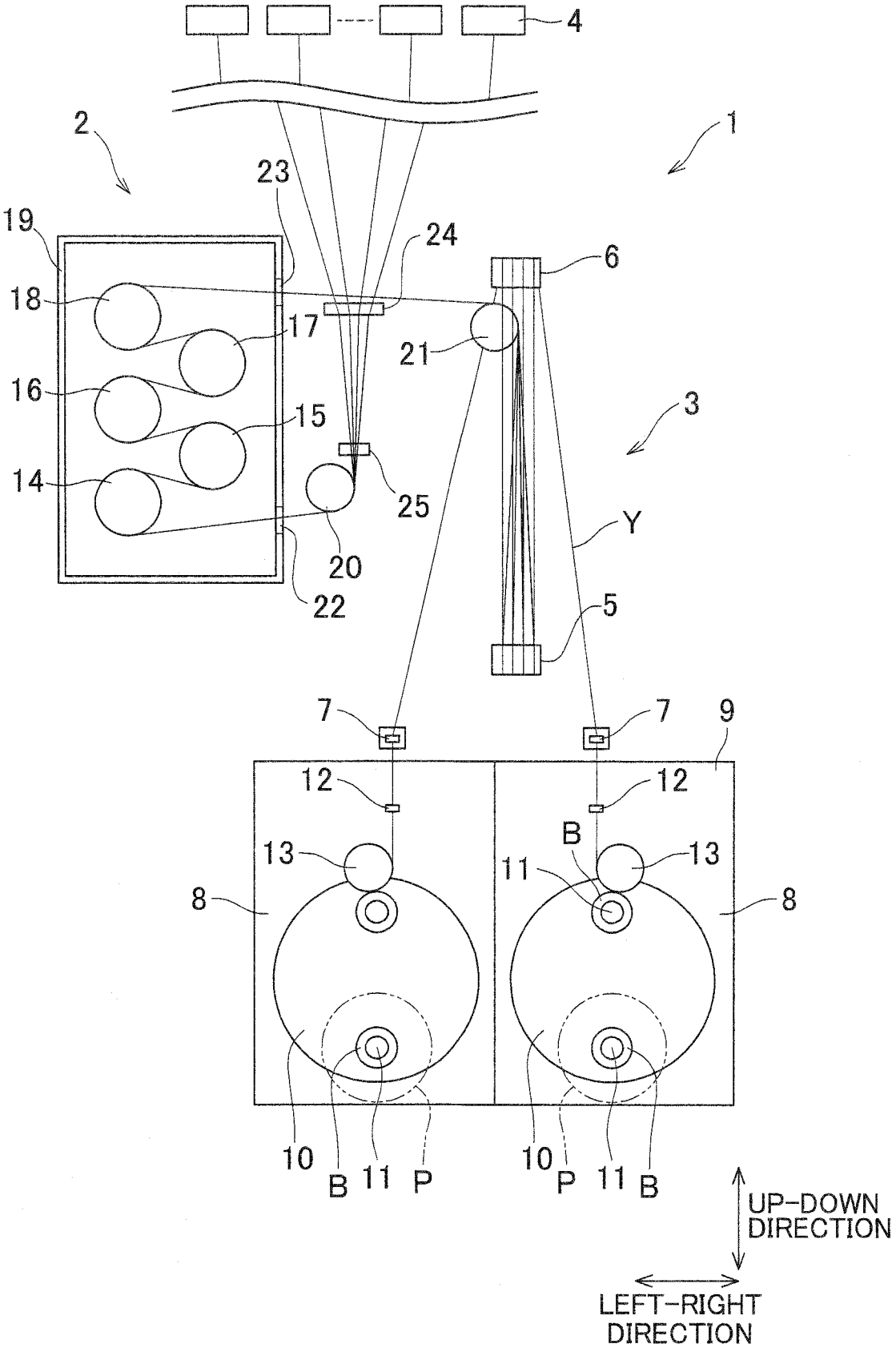

4
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1
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19
24
6
18
17
21
16
15
3
14
25
Y
20
22
5
7
7
9
12
12
B
13
13
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8
10
B
11
P
10
P
11
B
UP-DOWN DIRECTION
LEFT-RIGHT DIRECTION

FIG.4

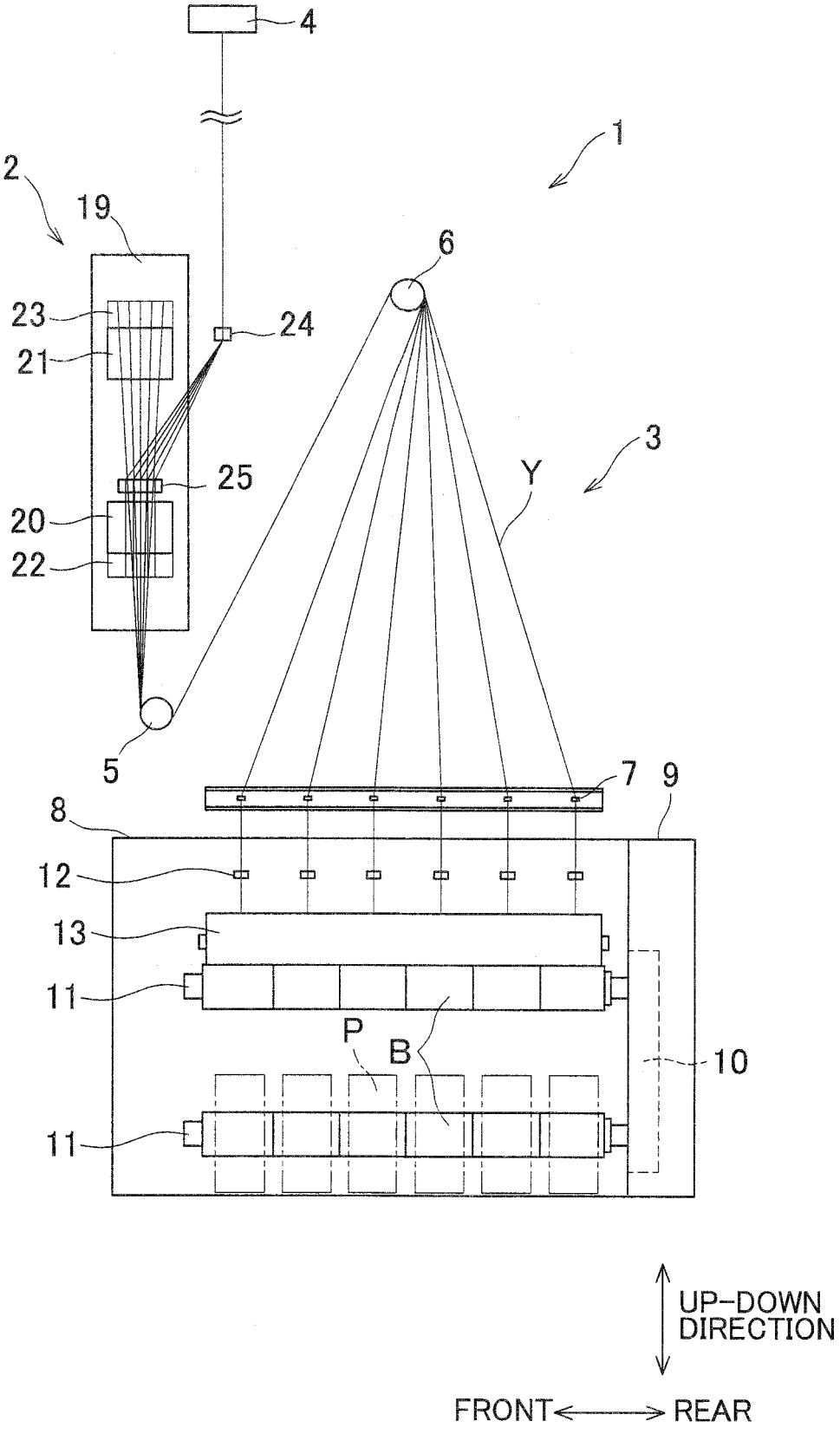

4
1
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19
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24
21
3
25
Y
20
22
5
7
9
8
12
13
11
P
B
10
11
UP-DOWN DIRECTION
FRONT
REAR

FIG.5

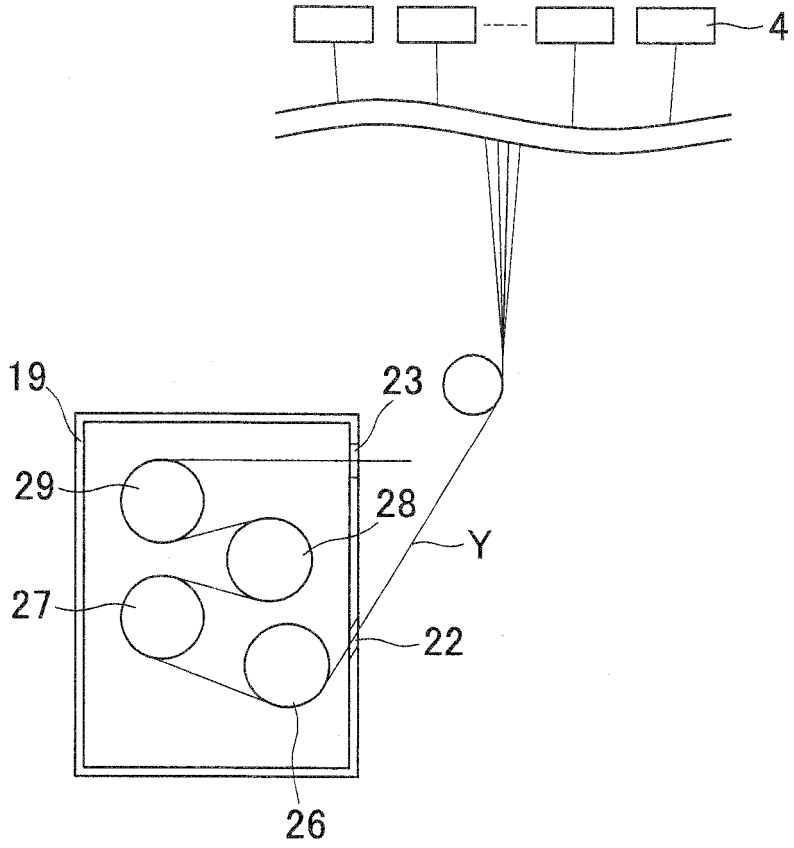
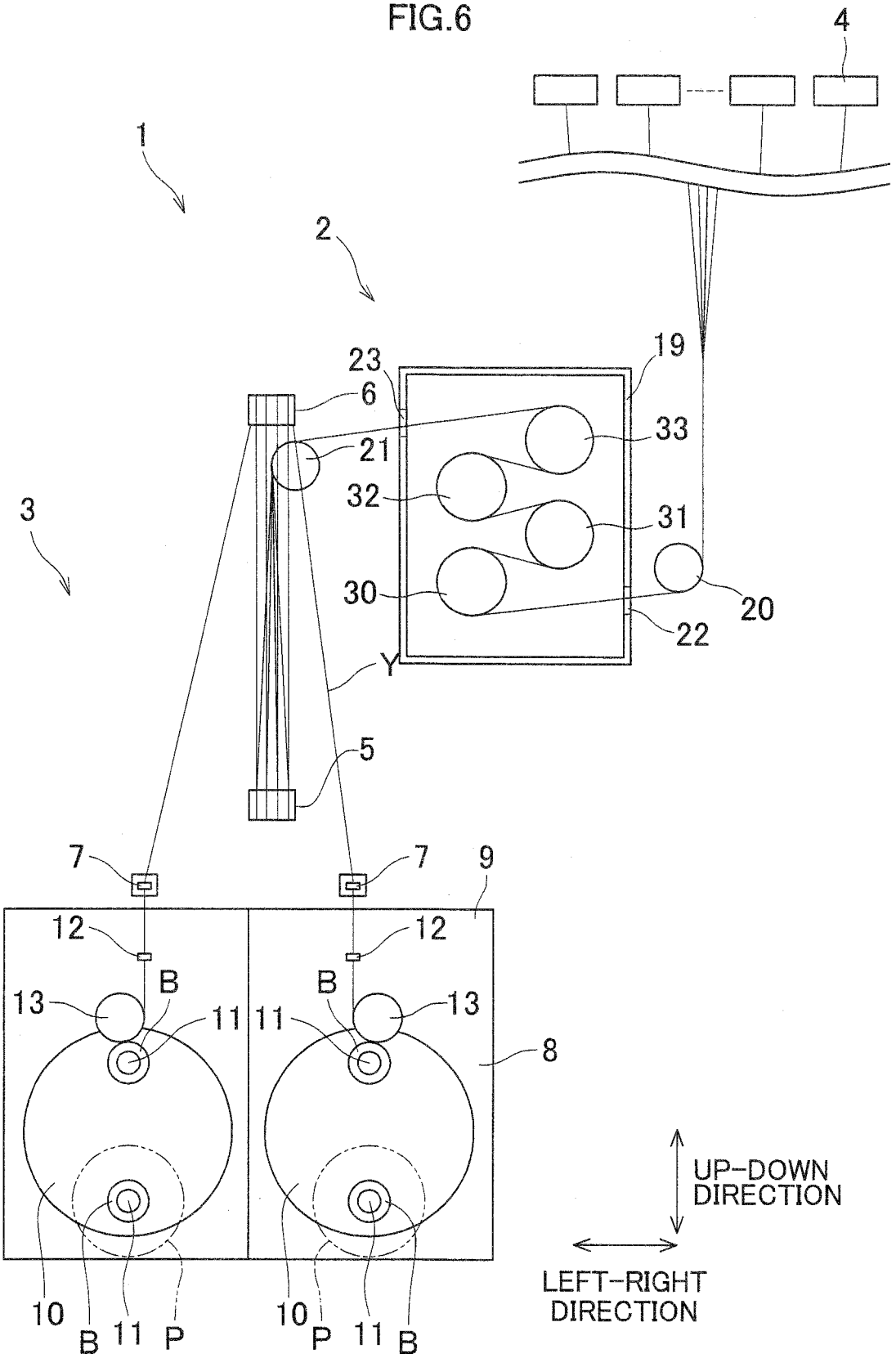


FIG.6


4
1
2
3
23
19
6
33
21
32
31
30
20
22
Y
5
7
7
9
12
12
B
B
13
11
11
13
8
10
B
11
P
10
P
11
B
UP-DOWN DIRECTION
LEFT-RIGHT DIRECTION