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(54) Spun yarn drawing apparatus

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Description

BACKGROUND OF THE INVENTION

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

[0002] Spinning and take-up apparatuses each including a spun yarn drawing apparatus and a take-up winder have been known. In such spinning and take-up apparatuses, the spun yarn drawing apparatus includes the plurality of heating rollers for 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 heating rollers for conducting preliminary heating of yarns before drawn are lined up in an up-down direction, and two heating rollers for conducting thermosetting of yarns after drawn are lined up in an up-down direction. The two preliminary heating rollers and the two thermosetting rollers are disposed in a left-right direction. The two preliminary heating rollers are heated to the same temperature, and the two thermosetting heating rollers are heated to the same temperature. The temperature of the thermosetting heating rollers is arranged to be higher than the temperature of the preliminary heating rollers. The yarns spun out from the melt spinning apparatus are wound onto two preliminary heating rollers from below upwards each at a winding angle of 360 degrees or lower, and are then wound onto the two thermosetting heating rollers from below upwards. The two preliminary heating rollers on the upstream are rotated at substantially identical rotation speeds, whereas the two thermosetting heating rollers on the downstream are rotated at substantially identical rotation speeds that are faster than those of the two preliminary heating rollers on the upstream. The yarns running on these heating rollers are heated to a temperature which is equal to or higher than a glass transition temperature by the preliminary heating rollers. The yarns are drawn between the preliminary heating rollers and the thermosetting rollers as the yarn feeding speed of the thermosetting heating roller is faster than that of the preliminary heating roller, and the yarns having been drawn are then thermally set by the thermosetting rollers.

SUMMARY OF THE INVENTION

[0004] In the spun yarn drawing apparatus recited in Patent Literature 1, it is necessary to keep the contacting length between each heating roller and the yarns to be sufficiently long to sufficiently heat the yarns to a predetermined temperature. This can be achieved by increasing the number of heating rollers onto which the yarns are wound or by increasing the diameter of each heating roller onto which the yarns are wound. This, however, is problematic in that high thermal energy is required to heat many heating rollers or large-diameter heating rollers. Furthermore, because the yarns are very thin, the contacting portion between the yarns and each heating roller is very small even if many yarns are wound onto the heating roller. The most part of the surface of each heating roller is therefore not covered with the yarns and exposed, and hence most of the heat of the heating roller intended to heat the yarns is wastefully released and not used for heating the yarns. As such, the use of the thermal energy is inefficient.

[0005] An object of the present invention is to provide a spun yarn drawing apparatus with improved heating efficiency, which requires less consumption of heat energy for heating yarns.

[0006] According to the first aspect of the invention, a spun yarn drawing apparatus includes at least one preliminary heating roller and at least one thermosetting roller configured to draw a yarn spun out from a melt spinning apparatus and a thermal insulation box that houses the at least one preliminary heating roller and the at least thermosetting roller therein, the at least one thermosetting roller having a higher heating temperature than the at least one preliminary heating roller, in the thermal insulation box being provided a contacting member that contacts the yarn before the yarn is wound onto the at least one preliminary heating roller and does not use a dedicated heat source for heating the contacting member during a stable operation, and wherein the contacting member is provided above the at least one thermosetting roller.

[0007] According to the present invention, because the thermal insulation box houses therein the contacting member that contacts the yarns before the yarns are wound onto the at least one preliminary heating roller and does not use a dedicated heat source for heating the contacting member during the stable operation, the air inside the thermal insulation box is heated by the heat radiated from the at least one thermosetting heating roller, and hence the contacting member is heated to a temperature substantially equal to the heated air. By the above-mentioned heated contacting members, the yarns are heated before being supplied to the at least one preliminary heating roller. This makes it possible to reduce the thermal energy which is required to heat the yarn by the at least one preliminary heating roller and the at least one thermosetting roller to the required temperature and shorten the contacting length between the yarn and the preliminary and the thermosetting heating rollers, with the result that the diameter of the preliminary heating and the thermosetting rollers is reduced and the number of the preliminary heating and the thermosetting rollers can be reduced as compared to the conventional spun yarn drawing apparatuses. Because the diameter and the number of the preliminary heating and the thermosetting rollers can be reduced, it is possible to reduce the thermal

energy required to heat the preliminary heating and the thermosetting rollers to their respective heating temperatures. Furthermore, because the yarn before drawn is heated by utilizing the heat radiated from the at least one thermosetting roller to the heating of the contacting members, the heat radiated from the at least one thermosetting roller can be effectively utilized and the heating efficiency is improved. It is noted that "stable operation" indicates that the at least one preliminary heating roller and the at least one thermosetting roller are at their predetermined temperatures and the spun yarn drawing apparatus is ready to draw the yarn.

[0008] According to the present invention, because the contacting member is provided above the at least one thermosetting roller, the air heated by the heat radiated from the at least one thermosetting roller moves up and hence the temperature in the thermal insulation box becomes high in the upper part thereof. Because the contacting member is heated by high-temperature air, the heat radiated from the at least one thermosetting roller can be further effectively utilized and hence the heating efficiency is improved.

[0009] According to the present invention, because the heating rollers having different heating temperatures are housed in the one thermal insulation box, the heat radiated from the thermosetting roller on the downstream having a high heating temperature can be utilized for heating the yarn at the preliminary heating roller on the upstream having a low heating temperature, with the result that the heat can be effectively utilized and the heating efficiency is improved.

[0010] According to the present invention, because the contacting member is provided above the thermosetting roller having a high heating temperature, the contacting member is heated by particularly high-temperature air in the space heated by the heat radiated from the thermosetting roller having the high heating temperature, with the result that the heat radiated from the high-heating-temperature thermosetting roller can be further effectively utilized and the heating efficiency is further improved.

[0011] According to the second aspect of the invention, the spun yarn drawing apparatus of the first aspect of the invention is arranged so that the contacting member is not provided with any heat source.

[0012] According to the present invention, the structure of the contacting member can be simplified as the contacting member is not provided with any heat source.

[0013] According to the third aspect of the invention, the spun yarn drawing apparatus of the first or second aspect is arranged so that the contacting member is made of a metal.

[0014] According to the present invention, because the contacting member is made of a metal having high thermal conductivity, the temperature of the surface contacting the yarn is further uniformized. Furthermore, as the thickness of the contacting member is arranged to be as thin as possible, the thermal capacity of the member is reduced and the time required to reach the predetermined temperature is shortened.

[0015] According to the fourth aspect of the invention, the spun yarn drawing apparatus of any one of first to third aspects is arranged so that the contacting member is a roller.

[0016] According to the present invention, the yarn contacting the contacting member is less damaged because the contacting member is a roller.

[0017] According to the fifthaspect of the invention, the spun yarn drawing apparatus of the fourth aspect is arranged so that the contacting member is a hollow cylindrical roller.

[0018] According to the present invention, because the contacting member is a hollow cylindrical roller, the thermal capacity of the contacting member is small and hence the temperature of the contacting member can be easily increased.

[0019] According to the sixth aspect of the invention, the spun yarn drawing apparatus of the fourth or fifth aspect is arranged so that the yarn is wound onto the contacting member at a winding angle of 9 0 degrees or larger.

[0020] According to the present invention, because the yarn is wound onto the contacting member at the winding angle of 90 degrees or larger, the contacting length between the contacting member and the yarn becomes long and hence the yarn is heated with the long contacting length.

[0021] According to the present invention, because the thermal insulation box houses therein the contacting member that contacts the yarn before it is wound onto the at least one preliminary heating roller and does not use a dedicated heat source for heating the contacting member during the stable operation, the air inside the thermal insulation box is heated by the heat radiated from the at least one preliminary heating and the at least one thermosetting roller, and hence the contacting member is heated to a temperature substantially equal to the heated air. By this heated contacting member, the yarn is heated before being supplied to the at least one preliminary heating roller. Therefore, because the thermal energy for heating the yarn to the required temperature by the at least one preliminary heating and the at least one thermosetting roller is reduced and the contacting length between the yarn and the preliminary heating and thermosetting rollers is shortened, the diameter and the number of the preliminary heating and thermosetting rollers can be reduced as compared to the conventional spun yarn drawing apparatuses. Furthermore, because the diameter and the number of the preliminary heating and thermosetting rollers can be reduced, the thermal energy required to heat the at least one preliminary heating and thermosetting rollers to their respective heating temperatures can be reduced. Furthermore, because the heat radiated from the at least one thermosetting roller is utilized for heating the contacting member to heat the yarn before drawn, the heat radiated from the at least one thermosetting roller can be effectively utilized and

hence the heating efficiency is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

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 of a modification.

FIG. 4 is a front elevation of a spinning and take- up apparatus of another modification.

FIG. 5 shows another example of the contacting plate.

FIG. 6 shows an example of the contacting rollers in an arrangement in which yarns are wound onto the godet rollers more than once.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

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

[0024] 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 after being drawn by 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.

[0025] The spun yarn drawing apparatus 2 includes components such as godet rollers 18 to 21 to draw the yarns Y spun out from the melt spinning apparatus 4. Details will be given later.

[0026] The take-up winder 3 is provided below the melt spinning apparatus 4 and forms a plurality of packages P by winding, onto a plurality of bobbins B, a plurality of yarns Y drawn by the spun yarn drawing apparatus 2. The take-up winder 3 includes guide rollers 5 and 6, a plurality of fulcrum guides 7, and two winding units 8.

[0027] The guide rollers 5 and 6 are drive rollers driven by each of motors that are not shown in the figures, and the axial direction thereof is 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.

[0028] The plurality of fulcrum guides 7 are provided below the guide roller 6 and above a plurality of traverse guides 12, and are provided immediately above the plurality of traverse guides 12 and the bobbins B attached to a bobbin holder 11 along the axial direction of winding axis.

[0029] 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 that performs traversing of the yarns Y; 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.

[0030] 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.

[0031] 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.

[0032] Next, the spun yarn drawing apparatus 2 will be described. The spun yarn drawing apparatus 2 includes later-described contacting rollers 14 to 17 (contacting members), the godet rollers 18 to 21 (heating rollers) for drawing the yarns Y spun out from the melt spinning apparatus 4, a thermal insulation box 22 housing the contacting rollers 14 to 17 and the godet rollers 18 to 21 therein, and guide rollers 23 and 24 forwarding the yarns Y to a take-up winder 3. The spun yarn drawing apparatus 2 is provided below the melt spinning apparatus 4. FIG. 1 illustrates the thermal insulation box 22 in a see-through manner.

[0033] Each of the godet rollers 18 to 21 is a drive roller driven by an unillustrated motor and is cantilevered by an unillustrated frame. Each of the godet rollers 18 to 21 includes a heater therein. The godet rollers 18 to 21 are, for example, formed by chrome-plating the surface of the iron. The godet rollers 18 and 19 (heating rollers with low heating temperatures) are preliminary heating godet rollers for heating the yarns Y before drawn to at least the glass transition temperature. The godet rollers 18 and 19 are set at temperatures of 80 to 100°C because the yarns Y are made up of polyester fibers. The glass transition temperature varies in accordance with the type of the

polymer. The godet rollers 20 and 21 (heating rollers with high heating temperatures) are thermosetting godet rollers for thermally setting the drawn yarns Y. The godet rollers 20 and 21 are set at temperatures of 120 to 150°C when the yarns Y are made up of polyester fibers. As such, the heating temperatures of the godet rollers 20 and 21 are higher than the heating temperatures of the godet rollers 18 and 19.

[0034] The axes of the respective godet rollers 18 to 21 are in parallel to each other. For example, these rollers 18 to 21 are 220 to 300mm in diameter and are identical in diameter. The godet roller 18 is provided at the lower left part in the thermal insulation box 22, whereas the godet roller 19 is provided to be deviated downward and rightward from the godet roller 18. The godet roller 20 is provided to be deviated downward and rightward from the godet roller 19. The godet roller 21 is provided to be deviated upward and rightward from the godet roller 20. In other words, the godet rollers 18 to 21 are provided such that the godet rollers 18, 19, 20, and 21 are lined up in this order from left to right, and such that the godet rollers 18, 20, 19, and 21 are lined up in this order upward from below. The yarns Y are wound onto the godet rollers 18 to 21 each at a winding angle of 360 degrees or smaller. The yarns Y are wound onto the preliminary heating godet roller 18 and 19 and the thermosetting godet rollers 20 and 21 in this order, i.e., onto the godet rollers 18, 19, 20, and 21 in this order. The yarns Y coming out from the godet roller 21 are sent to the guide roller 23.

[0035] The thermal insulation box 22 is a substantially rectangular parallelepiped box made of a heat insulating material, which houses the contacting rollers 14 to 17 and the godet rollers 18 to 21 therein. The thermal insulation box 22 prevents the heat generated by the godet rollers 18 to 21 from escaping to the outside. Inside the thermal insulation box 22, the temperature in the upper part is higher than the temperature in the lower part on account of the convection of the heat radiated from the godet rollers 18 to 21. The temperature in the upper part is increased up to, for example, about 90°C. Furthermore, inside the thermal insulation box 22 walls 25 are provided to separate the preliminary heating godet rollers 18 and 19 from the thermosetting godet rollers 20 and 21 having heating temperatures different from those of the godet rollers 18 and 19, in order to prevent the preliminary heating godet rollers 18 and 19 and the thermosetting godet rollers 20 and 21, which have different heating temperatures, from influencing on the heating temperature of the other pair.

[0036] A slit 26 is provided at the upper surface of the thermal insulation box 22. Through this slit 26, the yarns Y spun out from the melt spinning apparatus 4 enter the thermal insulation box 22 from above. Furthermore, a slit 27 is provided at the right side of the thermal insulation box 22. Through this slit 27, the yarns Y come out from the thermal insulation box 22 to the outside.

[0037] The guide roller 23 is provided outside the thermal insulation box 22 to be deviated rightward from the lower part of the thermal insulation box 22. The guide roller 24 is provided outside the thermal insulation box 22 to be deviated rightward from the upper part of the thermal insulation box 22. The guide roller 24 is provided above and to the right of the guide roller 23. The yarns Y sent from the godet roller 21 are forwarded to the guide roller 24 by the guide roller 23 and are further forwarded to the guide roller 5 by the guide roller 24. The guide rollers 23 and 24 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 23 and 24 are drive rollers.

[0038] In the spun yarn drawing apparatus 2, the yarns Y are preliminarily heated to at least the glass transition temperature as the yarns Y contact the preliminary heating godet rollers 18 and 19, and the yarns Y are sent to the thermosetting godet rollers 20 and 21 on the downstream on account of the rotation of the preliminary heating godet rollers 18 and 19. In this regard, for example, the preliminary heating godet rollers 18 and 19 on the upstream rotate at substantially identical rotation speeds, and also the thermosetting godet rollers 20 and 21 on the downstream rotate at substantially identical rotation speeds. Furthermore, the thermosetting godet rollers 20 and 21 on the downstream rotate at higher rotation speeds than the preliminary heating godet rollers 18 and 19 on the upstream. Because the yarn feeding speeds of the godet rollers 20 and 21 on the downstream are higher than the speeds of the godet rollers 18 and 19 on the upstream, the yarns Y are drawn between the godet rollers 18 and 19 and the godet rollers 20 and 21. The yarns Y having been drawn are thermally set as the yarns Y contact the thermosetting godet rollers 20 and 21, and the yarns Y are sent to the guide rollers 23 and 24 by the rotation of the thermosetting godet rollers 20 and 21. Then the yarns Y are sent from the guide rollers 23 and 24 to the take-up winder 3.

[0039] As described above, preliminary heating to at least the glass transition temperature is required to draw the yarns Y. Because in the conventional spun yarn drawing apparatuses the yarns spun out from the melt spinning apparatus are not actively heated before they run on a preliminary heating godet roller, a large thermal energy is required to heat the yarns to at least the glass transition temperature by the preliminary heating godet roller. In this regard, the present invention is arranged so that, in the thermal insulation box 22, the contacting rollers 14 to 17 that do not use any heat source during the stable operation are provided to contact the yarns Y before they are wound onto the godet rollers 18 to 21, and the contacting rollers 14 to 17 heated by the air inside the thermal insulation box 22 heat the yarns Y before they run on the godet rollers 18 to 21. These contacting rollers 14 to 17 will be detailed herein.

[0040] The contacting rollers 14 to 17 are rollers made of a metal and cantilevered by an unillustrated frame, and are provided above the godet rollers 18 to 21 in the thermal insulation box 22. The axes of the contacting

rollers 14 to 17 are in parallel to each other, and the contact rollers 14 to 17 are disposed in a staggered manner in the up-down direction. In this connection, because the contacting rollers 14 to 17 are heated by the air in the thermal insulation box 22, the thermal conductivity is preferably high, the thermal capacity is preferably small, and the temperature is preferably increased evenly and easily, in consideration of the heating of the yarns Y. The thermal capacity is reduced by reducing the volume and the thermal capacity per unit volume of the contacting rollers 14 to 17. In the present embodiment, the contacting rollers 14 to 17 are made of aluminum which is a metal having high thermal conductivity and small thermal capacity per unit volume. Furthermore, in the present embodiment, each of the contacting rollers 14 to 17 is arranged to be a thin-walled hollow cylinder in order to reduce the volume of each of the contacting rollers 14 to 17. Each of the contacting rollers 14 to 17 is preferably as thin as possible at the cylindrical part, in consideration of the reduction of the volume. The diameters of the contacting rollers 14 to 17 are, for example, identical with each other and fall within the range of 70 to 150mm, and are shorter than the diameters of the godet rollers 18 to 21.

[0041] Furthermore, the contacting rollers 14 to 17 do not use any heat source for heating, during the stable operation. It is noted that, the phrase "do not use any heat source during the stable operation" indicates not only that the contacting rollers 14 to 17 are not provided with a heat source but also that, even if the contacting rollers 14 to 17 are provided with a heat source, the heat source dedicated to the heating of the contacting rollers 14 to 17 is not used during the stable operation. The phrase above further encompasses not only that a heat source such as an internal heater is not used but also that an outside heat source dedicated to heat the contacting rollers 14 to 17 is not used. It is noted that the contacting rollers 14 to 17 may be driven rollers or drive rollers. The term "stable operation" indicates that the godet rollers 18 to 21 are kept at predetermined temperatures and the spun yarn drawing apparatus 2 is able to draw the yarns Y, i.e., the spinning and take-up apparatus 1 is ready to produce the yarns Y.

[0042] In the present embodiment, the contacting rollers 14 to 17 are not provided with any heat source. For this reason, the contacting rollers 14 to 17 are not heated by a heat source during the stable operation. The phrase "not provided with any heat source" encompasses not only that a heat source such as an internal heater is not provided but also that an outside heat source dedicated to heat the contacting rollers 14 to 17 is not provided. For example, an external heat source for conducting induction heating of the contacting rollers 14 to 17 is not provided.

[0043] Onto the contacting rollers 14 to 17, the yarns Y are wound each at a winding angle of 90 degrees or larger (in the present embodiment, a winding angle of not smaller than 90 degrees and not larger than 180 degrees), such that, from right to left, the yarns Y are wound onto the contacting rollers 14, 15, 16, and 17 in this order. To the contacting roller 14, the yarns Y are supplied from above from the melt spinning apparatus 4, and the yarns Y come out downward from the contacting roller 17 and are forwarded to the godet rollers 18 to 21. In other words, the contacting rollers 14 to 17 contact the yarns Y before they are wound onto the godet rollers 18 to 21.

[0044] As described above, in the thermal insulation box 22, because the air heated by the heat radiated from the godet rollers 18 to 21 moves up, the temperature inside the thermal insulation box 22 is high in the upper part. By the high-temperature air, the contacting rollers 14 to 17 are heated to temperatures substantially equal to the high-temperature air. The yarns Y contacting these contacting rollers 14 to 17 are heated by the heated contacting rollers 14 to 17 and then sent to the godet rollers 18 to 21.

[0045] As described above, the spun yarn drawing apparatus 2 of the present embodiment includes the godet rollers 18 to 21 for drawing yarns Y spun out from the melt spinning apparatus 4 and the thermal insulation box 22 housing the godet rollers 18 to 21 therein. In the thermal insulation box 22, the contacting rollers 14 to 17 that contact the yarns Y before they are wound onto the godet rollers 18 to 21 and do not use any heat source in the stable operation are provided.

[0046] In the spun yarn drawing apparatus 2 of the present embodiment structured as above, because the contacting rollers 14 to 17 that contact the yarns Y before they are wound onto the godet rollers 18 to 21 and do not use any heat source in the stable operation are provided in the thermal insulation box 22, the air inside the thermal insulation box 22 is heated by the heat radiated from the godet rollers 18 to 21, and the contacting rollers 14 to 17 in the thermal insulation box 22 are heated to a temperature substantially equal to the heated air. By these heated contacting rollers 14 to 17, the yarns Y are heated before they are supplied to the godet rollers 18 to 21. This makes it possible to reduce the thermal energy which is required to heat the yarns Y by the godet rollers 18 to 21 to the required temperature and shorten the contacting length between the yarns Y and each of the godet rollers 18 to 21, with the result that the diameter of each of the godet rollers 18 to 21 can be reduced and the number of these rollers can be reduced as compared to the conventional spun yarn drawing apparatuses. Because the size and the number of the godet rollers 18 to 21 can be reduced, the thermal energy required to heat the godet rollers 18 to 21 to the heating temperature can be reduced. Furthermore, because the heat radiated from the godet rollers 18 to 21 is used for heating the contacting rollers 14 to 17 and heating the yarns Y before drawn, the heat radiated from the godet rollers 18 to 21 can be effectively utilized and hence the heating efficiency is improved.

[0047] Furthermore, the contacting rollers 14 to 17 are not provided with any heat source. This makes it possible

to simplify the structures of the contacting rollers 14 to 17.

[0048] Furthermore, because the contacting rollers 14 to 17 are provided above the godet rollers 18 to 21, the air heated by the heat radiated from the godet rollers 18 to 21 moves up and the temperature in the thermal insulation box 22 is high in the upper part, with the result that the contacting rollers 14 to 17 are heated by the high-temperature air. This makes it possible to effectively utilize the heat radiated from the godet rollers 18 to 21, so as to further improve the heating efficiency.

[0049] Furthermore, the godet rollers 18 to 21 having different heating temperatures are housed in the thermal insulation box 22, and the yarns Y are wound onto the godet rollers 18 and 19 having low heating temperatures and then wound onto the godet rollers 20 and 21 having high heating temperatures. Because the godet rollers 18 and 19 and the godet rollers 20 and 21 having different heating temperatures are housed in the one thermal insulation box 22, the heat radiated from the godet rollers 20 and 21 on the downstream having high heating temperatures can be utilized for heating the yarns Y at the godet rollers 18 and 19 on the upstream having low heating temperatures, with the result that the heat is effectively utilized and the heating efficiency is improved.

[0050] Furthermore, the contacting rollers 14 to 17 are made of a metal and therefore have high thermal conductivity. Furthermore, because in the present embodiment the contacting rollers 14 to 17 are arranged to be thin-walled hollow cylinders, the thermal capacity of the contacting rollers 14 to 17 is low. It is therefore possible to evenly and easily increase the temperatures of the contacting rollers 14 to 17 that have high thermal conductivity and low thermal capacity.

[0051] Furthermore, because the contacting rollers 14 to 17 are rollers, the yarns Y contacting the contacting rollers 14 to 17 are less damaged.

[0052] Furthermore, because the contacting rollers 14 to 17 are hollow cylindrical rollers, the contacting rollers 14 to 17 have low thermal capacity and hence the temperatures of the contacting rollers 14 to 17 can be easily increased.

[0053] Furthermore, because the yarns are wound onto the contacting rollers 14 to 17 each at a winding angle of 90 degrees or larger, the contacting length between the yarns Y and each of the contacting rollers 14 to 17 is long, and hence the yarns Y are heated with the long contacting lengths.

[0054] 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.

[0055] While in the embodiment above the heating temperatures of the preliminary heating godet rollers 18 and 19 are different from the heating temperatures of the thermosetting godet rollers 20 and 21 and the number of the preliminary heating godet rollers is identical with the number of the thermosetting godet rollers (both two), the number of the former rollers may be different from the number of the latter rollers. FIG. 3 is a front elevation of a spinning and take-up apparatus according to a modification. In this arrangement, a godet roller 28 is a preliminary heating godet roller (heating roller having a low heating temperature), whereas godet rollers 29 to 31 are thermosetting godet rollers (heating rollers having high heating temperatures). The godet roller 28 is separated from the godet rollers 29 to 31 by a wall 25. Furthermore, the contacting rollers 14 to 17 are provided above the godet rollers 29 to 31 having high heating temperatures. According to this arrangement, because the space above the godet rollers 29 to 31 having high heating temperatures has a particularly high temperature on account of the heat radiated from the high-heating-temperature godet rollers 29 to 31, the contacting rollers 14 to 17 are heated by the particularly high temperature. It is therefore possible to further effectively utilize the heat radiated from the high-heating-temperature godet rollers 29 to 31, and hence the heating efficiency is improved. 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.

[0056] Furthermore, while in the embodiment above the contacting rollers 14 to 17 that are contacting members are rollers, the contacting members may be flat plates. As shown in FIG. 4, a contacting plate 32 which is a flat plate may be provided above the godet rollers 18 to 21 in the thermal insulation box 22 to contact the yarns Y before they are wound onto the godet rollers 18 to 21. Alternatively, as shown in FIG. 5, contacting plates 33 to 36 that are flat plates may be provided to cause the guide rollers 37 to 39 to change the yarn path of the yarns Y near thermosetting godet rollers 40 and 41 having high heating temperatures. The contacting plates 33 to 36 contact the yarns Y before they are wound onto the godet rollers 40 and 41. That is to say, the contacting plates 33 to 36 are provided on the upstream of the yarn paths of the godet rollers 40 and 41. In this arrangement, because the contacting plates 33 to 36 are plural, the contacting lengths of the yarn Y on the contacting plates 33 to 36 is secured.

[0057] Furthermore, while in the embodiment above the spun yarn drawing apparatus 2 is arranged so that the yarns Y are wound onto the godet rollers 18 to 21 each at a winding angle of 360 degrees or smaller, the spun yarn drawing apparatus may be arranged so that the yarns are wound onto each godet roller (heating roller) more than once. FIG. 6 shows an example in which contacting rollers are provided and yarns are wound onto a godet roller more than once. As shown in the figure, a godet roller 43 and a separate roller 44 are housed in a thermal insulation box 42. The godet roller 43 is a heating roller having a heater therein. The separate roller 44 is a drive roller. The yarns Y are wound onto the godet roller 43 and the separate roller 44 more than once such that the yarns Y are deviated from each other at predetermined intervals so as not to overlap each other. As the

yarns Y run on the godet roller 43 in accordance with the rotation of the godet roller 43 and the separate roller 44, the yarns Y are heated. The contacting rollers 45 to 48 are provided in an upper part in the thermal insulation box 42, and the yarns Y before wound onto the godet roller 43 are wound onto the contacting rollers 45 to 48. In other words, the contacting rollers 45 to 48 contact the yarns Y before they are wound onto the godet roller 43.

[0058] While in the embodiment above the contacting rollers 14 to 17 are made of a metal, the rollers may be made of a non-metal material such as ceramics. Alternatively, the rollers may be formed such that, for example, the surface of rigid plastic is metal-plated so that only the surface of the roller is made of a metal, in order to facilitate the temperature increase at the surface. Furthermore, while the contacting rollers 14 to 17 are hollow in the embodiment above, these rollers may not be hollow.

[0059] Furthermore, while in the embodiment above the contacting rollers 14 to 17 are provided above the godet rollers 18 to 21 (in the thermal insulation box 22), the contacting rollers 14 to 17 may not be provided above the godet rollers 18 to 21 (in the thermal insulation box 22) - this embodiment is however outside the scope of the appended claims. For example, when the temperature in the space below the godet rollers (in the thermal insulation box) is sufficiently high on account of the layout of the godet rollers which are heating rollers, the contacting rollers may be provided below the godet rollers (in the thermal insulation box). As such, the contacting rollers are preferably provided at a high-temperature part in the thermal insulation box.

[0060] Furthermore, while in the embodiment above the contacting rollers 14 to 17 are not provided with any heat source inside or outside thereof, an effect equal to the above is achieved when the contacting rollers 14 to 17 is provided with a heat source but the heat source is not in operation during the stable operation. Alternatively, for example, the contacting rollers 14 to 17 each having a heat source may be used as if rollers do not having a heat source, in such a way that the contacting rollers 14 to 17 are heated by the heat source only at the time of the cold start after the power down of the apparatus, and the power of the heat source of each of the contacting rollers 14 to 17 is shut off once the temperatures of the godet rollers 18 to 21 reach the stable state temperatures. It is noted that the time duration from the cold start after the power down to the time at which the temperatures of the godet rollers 18 to 21 reach the stable state temperatures (predetermined temperatures) is not regarded as the stable operation. In the stable operation, the temperatures of the godet rollers 18 to 21 have reached the stable state temperatures (predetermined temperatures) and the yarns Y can be drawn by the godet rollers 18 to 21. With the apparatus and the operation above, the stable state is quickly established after the apparatus having been powered down is started, and the production of the yarns can be quickly started and the time required to start the apparatus after it was powered down can be reduced. Furthermore, whether to use the heat source of each of the contacting rollers 14 to 17 may be selectable in accordance with, for example, the type of the yarns to be produced. That is to say, the heat source of each of the contacting rollers 14 to 17 is used when the yarns are thick, i.e., the contacting rollers 14 to 17 are used in a similar manner as the preliminary heating godet rollers 18 and 19 for preliminarily heating the yarns, however such use is outside the scope of the appended claims. On the other hand, the heat source of each of the contacting rollers 14 to 17 is not used when the yarns are relatively thin, such use being within the scope of the appended claims. This makes it possible to widen the range of the sizes of producible yarns and improve the thermal efficiency of the heating rollers, which is a characteristic of the present invention.

[0061] Furthermore, the diameter of each of the contacting rollers 14 to 17 and the number of these rollers are suitably changed in accordance with the required degree of heating of the yarns.

Claims

1. A spun yarn drawing apparatus comprising at least one preliminary heating roller and at least one thermosetting roller configured to draw a yarn spun out from a melt spinning apparatus and a thermal insulation box that houses the at least one preliminary heating roller and the at least one thermosetting roller therein, the at least one thermosetting roller having a higher heating temperature than the at least one preliminary heating roller,
in the thermal insulation box being provided a contacting member that contacts the yarn before the yarn is wound onto the at least one preliminary heating roller and does not use a dedicated heat source for heating the contacting member during a stable operation, and wherein the contacting member is provided above the at least one thermosetting roller.

2. The spun yarn drawing apparatus according to claim 1, wherein,
the contacting member is not provided with any heat source.

3. The spun yarn drawing apparatus according to claim 1 or claim 2, wherein,
the contacting member is made of a metal.

4. The spun yarn drawing apparatus according to any one of claims 1 to 3, wherein,
the contacting member is a roller.

5. The spun yarn drawing apparatus according to claim 4, wherein,
the contacting member is a hollow cylindrical roller.

6. The spun yarn drawing apparatus according to claim 4 or 5, wherein,
the yarn is wound onto the contacting member at a winding angle of 90 degrees or larger.

Patentansprüche

1. Spinngarneinzugsvorrichtung, umfassend mindestens eine vorausgehende Heizwalze und mindestens eine thermofixierende Walze, ausgelegt zum Ziehen eines Garns, das aus einer Schmelzspinnvorrichtung gesponnen wird, und eine Wärmeisolierungsbox, die die mindestens eine vorausgehende Vorheizwalze und die mindestens eine thermofixierende Walze darin beherbergt, wobei die mindestens eine thermofixierende Walze eine höhere Heiztemperatur als die mindestens eine vorausgehende Vorheizwalze aufweist,
wobei in der Wärmeisolierungsbox ein kontaktierendes Bauteil bereitgestellt ist, das das Garn kontaktiert, bevor das Garn auf die mindestens eine vorausgehende Vorheizwalze gewickelt ist und keine zweckbestimmte Wärmequelle zum Erhitzen des kontaktierenden Bauteils während eines stabilen Betriebs verwendet, und wobei das kontaktierende Bauteil über der mindestens einen thermofixierenden Walze bereitgestellt ist.

2. Spinngarneinzugsvorrichtung nach Anspruch 1, wobei
das kontaktierende Bauteil nicht ohne jegliche Wärmequelle versehen ist.

3. Spinngarneinzugsvorrichtung nach Anspruch 1 oder Anspruch 2, wobei
das kontaktierende Bauteil aus einem Metall hergestellt ist.

4. Spinngarneinzugsvorrichtung nach einem der Ansprüche 1 bis 3, wobei
das kontaktierende Bauteil eine Walze ist.

5. Spinngarneinzugsvorrichtung nach Anspruch 4, wobei
das kontaktierende Bauteil eine hohlzylindrische Walze ist.

6. Spinngarneinzugsvorrichtung nach Anspruch 4 oder 5, wobei
das Garn auf das kontaktierende Bauteil bei einem Aufwickelwinkel von 90 Grad oder größer gewickelt ist.

Revendications

1. Appareil d'étirage de fil filé comprenant au moins un rouleau de chauffage préliminaire et au moins un rouleau de thermo-durcissement configurés pour étirer un fil filé hors d'un appareil de filage à l'état fondu, et un boîtier d'isolation thermique dans lequel est logé l'au moins un rouleau de chauffage préliminaire et l'au moins un rouleau de thermo-durcissement, l'au moins un rouleau de thermo-durcissement ayant une température de chauffage plus élevée que l'au moins un rouleau de chauffage préliminaire,
dans le boîtier d'isolation thermique étant prévu un élément de contact qui entre en contact avec le fil avant que le fil ne soit enroulé sur l'au moins un rouleau de chauffage préliminaire et qui n'utilise pas une source de chaleur dédiée pour chauffer l'élément de contact durant un fonctionnement stable, et dans lequel l'élément de contact est prévu au-dessus de l'au moins un rouleau de thermo-durcissement.

2. Appareil d'étirage de fil filé selon la revendication 1, dans lequel
l'élément de contact est dépourvu de toute source de chaleur.

3. Appareil d'étirage de fil filé selon la revendication 1 ou la revendication 2, dans lequel
l'élément de contact est constitué d'un métal.

4. Appareil d'étirage de fil filé selon l'une quelconque des revendications 1 à 3, dans lequel
l'élément de contact est un rouleau.

5. Appareil d'étirage de fil filé selon la revendication 4, dans lequel
l'élément de contact est un rouleau cylindrique creux.

6. Appareil d'étirage de fil filé selon la revendication 4 ou 5, dans lequel,
Le fil est enroulé sur l'élément de contact avec un angle d'enroulement égal ou supérieur à 90 degrés.

FIG.1

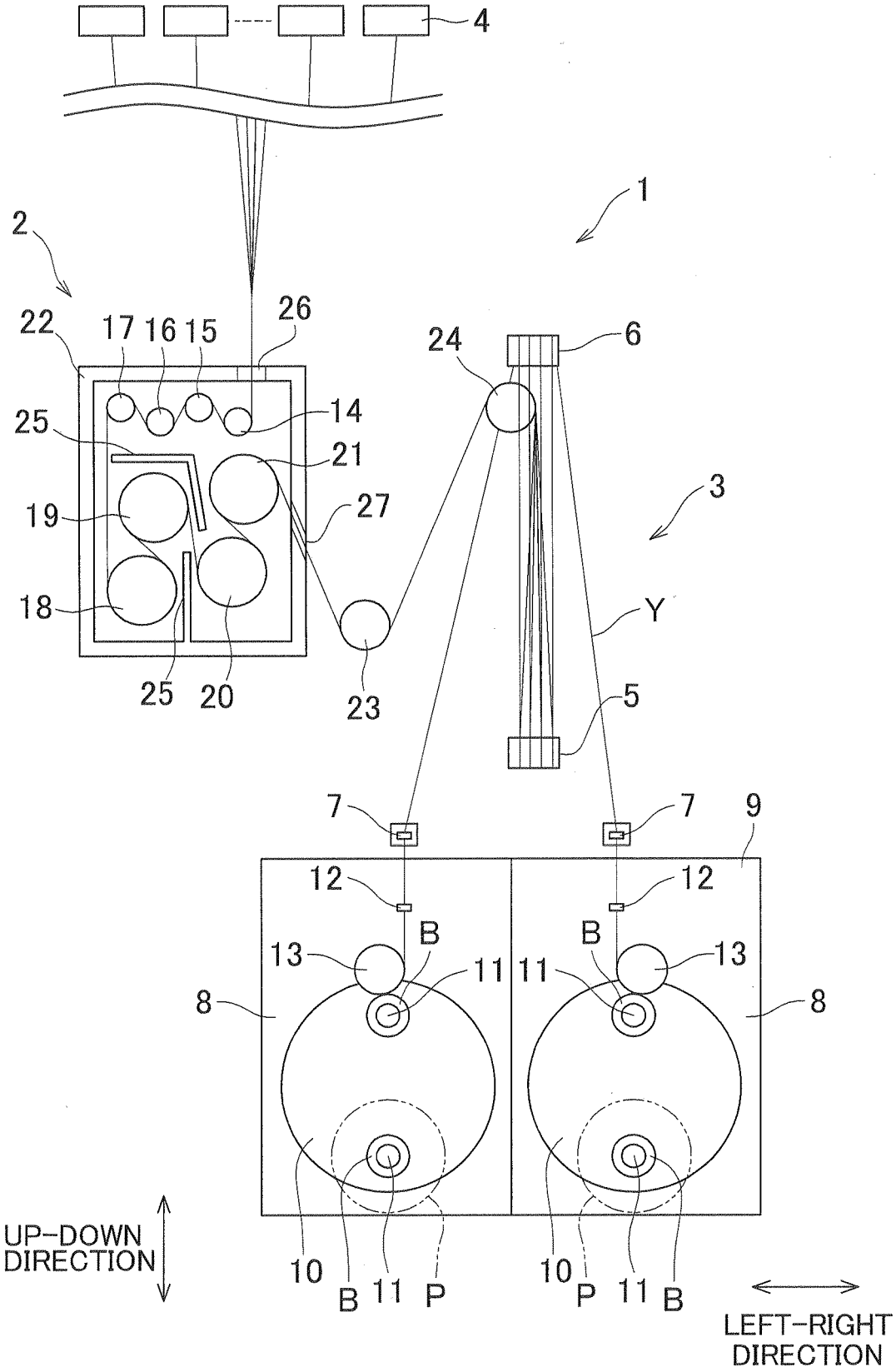

4
1
2
22
17
16
15
26
24
6
25
14
21
3
19
27
18
Y
25
20
23
5
7
7
9
12
12
B
B
13
11
11
13
8
8
10
B
11
P
10
P
11
B
UP-DOWN DIRECTION
LEFT-RIGHT DIRECTION

FIG.2

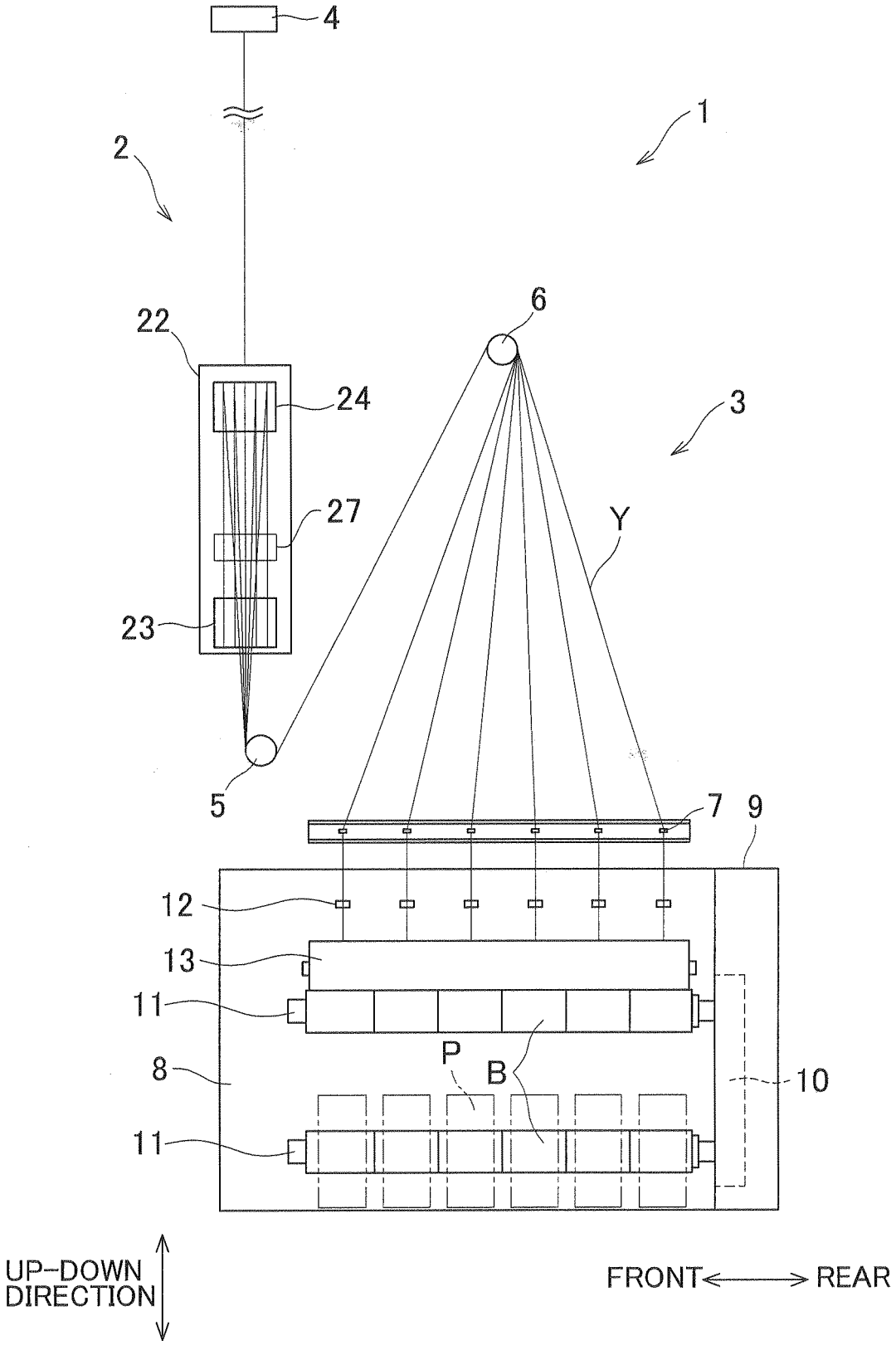

4
1
2
6
22
24
3
27
Y
23
5
7
9
12
13
11
P
B
8
10
11
UP-DOWN DIRECTION
FRONT
REAR

FIG.3

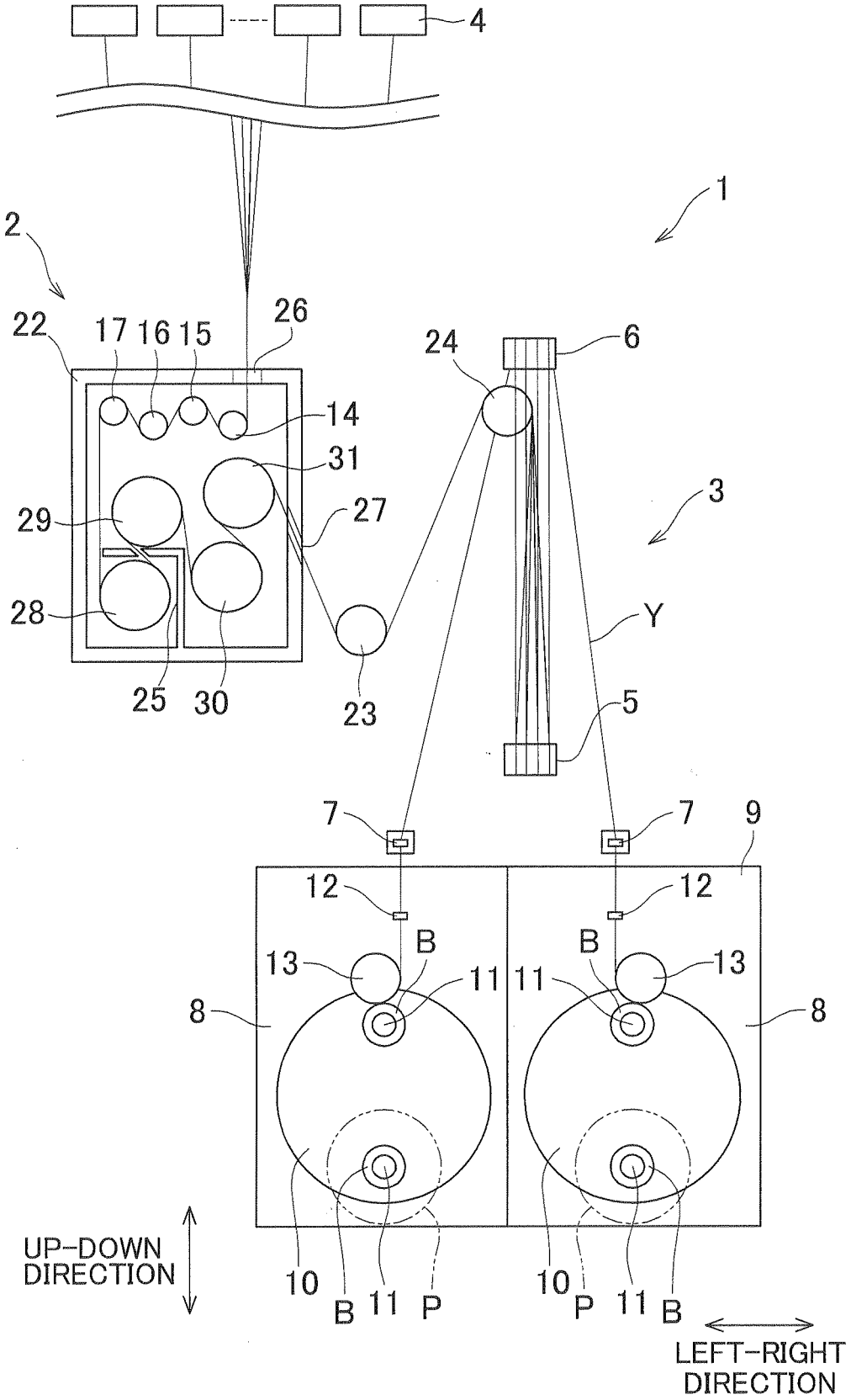

4
1
2
22
17
16
15
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24
6
14
31
3
29
27
28
Y
25
30
23
5
7
7
9
12
12
B
B
13
11
11
13
8
8
10
B
11
P
10
P
11
B
UP-DOWN DIRECTION
LEFT-RIGHT DIRECTION

FIG.4

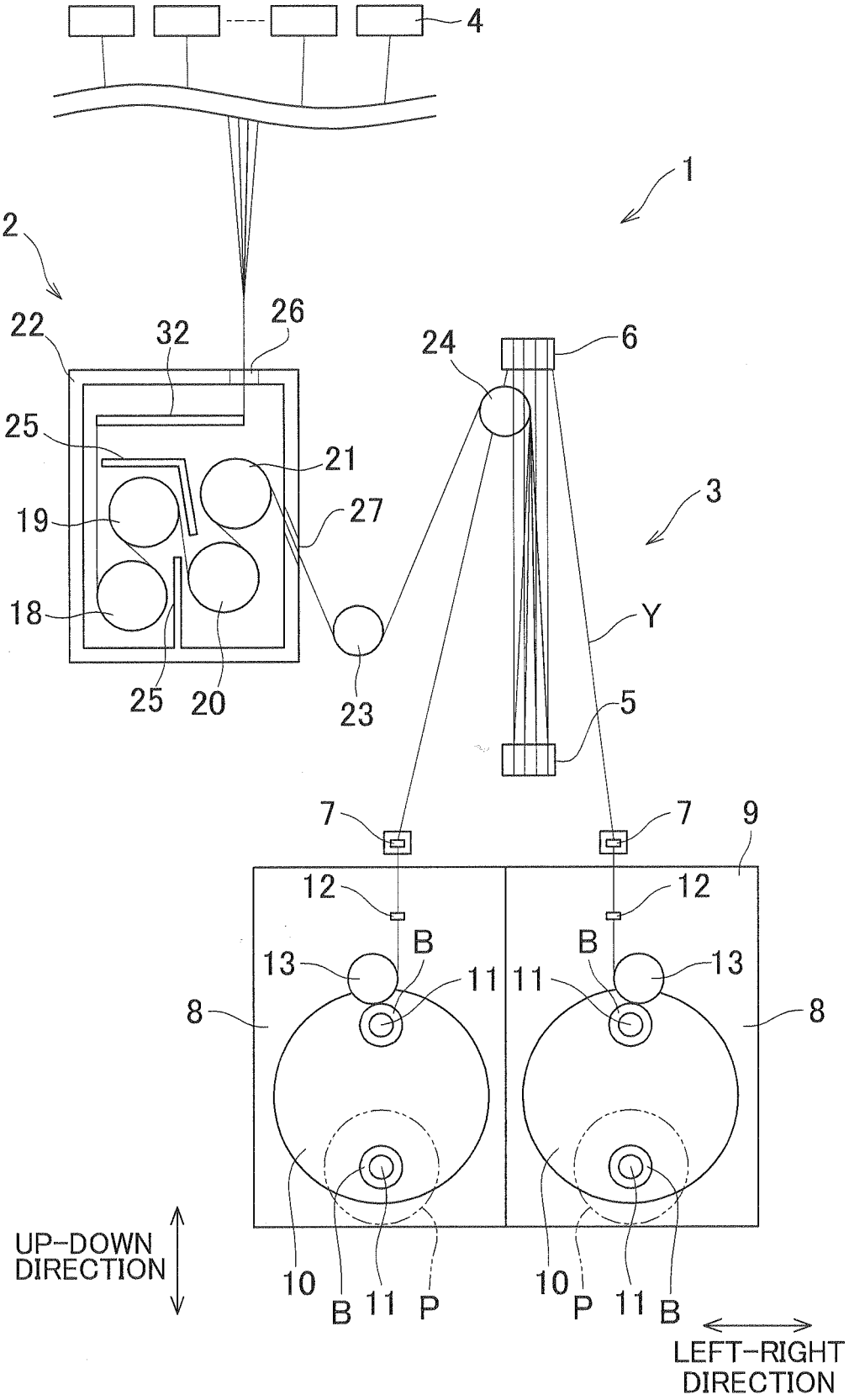

4
1
2
22
32
26
24
6
25
21
3
19
27
18
Y
25
20
23
5
7
7
9
12
12
B
B
13
11
11
13
8
8
UP-DOWN DIRECTION
10
B
11
P
10
P
11
B
LEFT-RIGHT DIRECTION

FIG.5

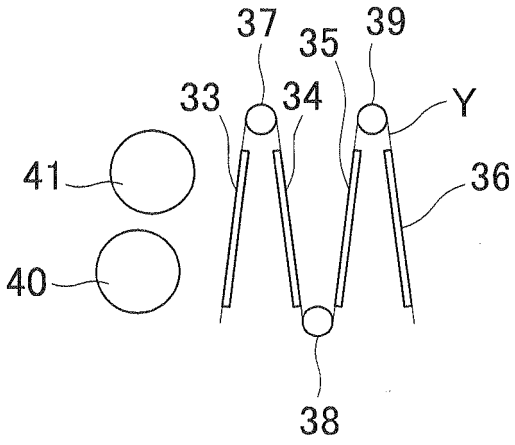
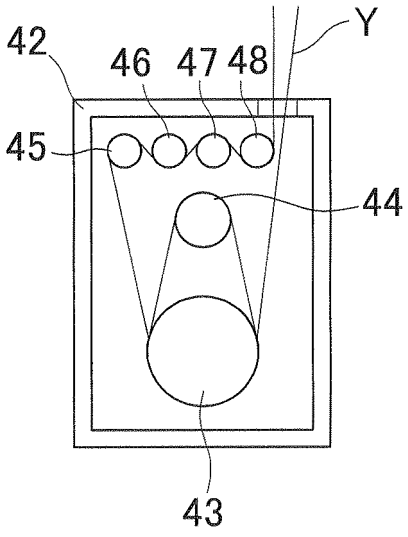


FIG.6

Not according to present invention



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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