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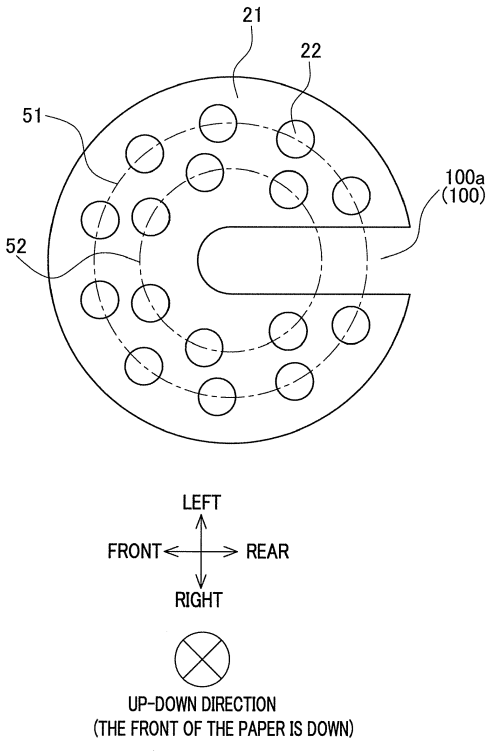
(54) YARN PRODUCTION SYSTEM

(57) An object of the present invention is to reduce height of a yarn production system including a spinning apparatus having spinning packs, even in a case in which the number of the spinning packs is increased.

A yarn production system 1 of the present invention includes spinning packs 22 in each of which molten polymer is stored and each of which spins out a yarn Y downward from a spinneret 24 provided at a lower end portion of each of the spinning packs 22, a spinning beam 21 in which the spinning packs 22 are inserted, first guides 6 which are provided immediately below the spinning packs 22 and which individually guide yarns Y, and a second guide 7 which is provided below the first guides 6 and which causes the yarns Y guided by the first guides 6 to be converged. The spinning packs 22 are arranged along a first arc 51 and a second arc 52 which is inside the first arc 51, in plan view.

FIG.4



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn production system which includes a spinning apparatus having spinning packs and which spins out yarns downward from a spinneret provided at a lower end portion of each spinning pack.

[0002] A spinning apparatus spinning out synthetic fiber yarns has been known. A typical spinning apparatus includes spinning packs each having a spinneret at a lower end portion. Molten polymer is supplied to the spinning packs, and this molten polymer is spun out downward form nozzles of the spinneret so that a yarn made of filaments is formed.

[0003] As shown in Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2015-140498), for example, a spinning apparatus in which the spinning packs are staggered to form two lines in plan view is developed. Below the spinning packs, cooling cylinders which cool spun-out yarns by means of cooling air are provided in a staggered manner. Below the cooling cylinders, oil supply guides which apply oil to the cooled yarns are provided in a staggered manner. In addition to that, the yarns to which the oil is applied are individually guided by first guides provided below the oil supply guides. Subsequently, the yarns converge in a second guide (comb guide) provided immediately below a substantial center of the first guides in a horizontal direction so as to be at regular intervals, and then run along the horizontal direction while being aligned at regular intervals.

SUMMARY OF THE INVENTION

[0004] When an angle (hereinafter, it is referred to as a yarn angle; as shown in FIG. 2) between a vertical direction and a yarn which runs between a second guide and one of first guides is large, friction between the yarn and the one of the first guides is also large so that quality of yarns may be deteriorated. Because of this, it is necessary to avoid the yarn angle from being large.

[0005] Recently, a spinning apparatus is required to increase the number of spinning packs included by the spinning apparatus, in order to simultaneously spin out yarns and to increase the number of the yarns. However, if the number of the spinning packs is increased in the spinning apparatus in which the spinning packs are staggered to form two lines as shown in Patent Literature 1, the spinning packs and the first guides provided below the spinning packs are arranged to extend along an arrangement direction. As a result, a distance between the first guides provided at both ends and the second guide is increased in a horizontal direction because the number of the first guides is increased in the arrangement direction, and therefore the yarn angle is also increased. The first guides provided at both ends cause the yarns to be converged at the second guide. In this case, the distance between the first guides and the second guide is required to be increased along the vertical direction in order to avoid increase in the yarn angle, which results in disadvantageously great height of the entire yarn production system including the spinning apparatus.

[0006] An object of the present invention is to reduce height of a yarn production system including a spinning apparatus having spinning packs, even in a case in which the number of the spinning packs is increased.

[0007] A first aspect of the present invention provides a yarn production system comprising: spinning packs in each of which molten polymer is stored and each of which spins out at least one yarn downward from a spinneret provided at a lower end portion of each of the spinning packs; a spinning beam in which the spinning packs are inserted; first guides which are provided below the spinning packs and which individually guide the yarns; and a second guide which is provided below the first guides and which causes the yarns guided by the first guides to be converged, and the spinning packs including a first line arranged along a curved line in plan view and a second line arranged along the first line.

[0008] A second aspect of the present invention provides a yarn production system comprising: spinning packs in each of which molten polymer is stored and each of which spins out at least one yarn downward from a spinneret provided at a lower end portion of each of the spinning packs; a spinning beam in which the spinning packs are inserted; first guides which are provided below the spinning packs and which individually guide the yarns; and a second guide which is provided below the first guides and which causes the yarns guided by the first guides to be converged, and the spinning packs including a first line arranged along straight lines intersecting one another in plan view and a second line arranged along the first line.

[0009] It is required to suppress the increase in each angle (yarn angle) between a vertical direction and each yarn running between each first guide and the second guide in order to ensure quality of yarns. Especially, a distance between each first guide provided at each end and the second guide in a horizontal direction is increased more than other distances between the first guides and the second guide in the horizontal direction. Because of this, distances between the first guides and the second guide in a vertical direction are required to be sufficiently increased so as to suppress the increase in yarn angles of yarns running between the first guides provided at both ends and the second guide. According to the first and second aspects of the present invention, the spinning packs are configured to include the first line arranged along the curved line or the straight lines intersecting one another in plan view and the second line arranged along the first line. Therefore, when the number of the spinning packs is increased, it is possible to suppress the increase in the distances between the first guides provided at both ends and the second guide in the horizontal direction, as compared to a case in which

the spinning packs are provided in a staggered manner so as to be aligned along one direction. Because of this, it is possible to decrease the distance between each first guide and the second guide in the vertical direction, and thus the height of the yarn production system can be suppressed even when the number of the spinning packs is increased. The decrease in the distance between each first guide and the second guide in the vertical direction is required for suppressing the increase in each yarn angle.

[0010] According to a third aspect of the present invention, the yarn production system of the first or second aspect is arranged such that an outer edge of the spinning beam is formed in accordance with an arrangement of the spinning packs.

[0011] In the present invention, the spinning beam can exclude a part in which the spinning packs are not provided, and space saving in the entire yarn production system can be achieved.

[0012] According to a fourth aspect of the present invention, the yarn production system of the first aspect is arranged such that all of the spinning packs are arranged along an arc in plan view.

[0013] A spinning apparatus includes polymer pipes supplying the molten polymer to the spinning packs from a polymer tank. It is configured so that the polymer in the polymer pipes is heated. The polymer supplied to each spinning pack is required to be equally heated, in order to equalize a state of the molten polymer in each spinning pack so as to equalize the quality of the yarns spun out from the spinnerets. In the present invention, distances from an arc center to each line of the spinning packs arranged along the arc are equalized. Because of this, the lengths of the polymer pipes connected to the spinning packs arranged in each line are easily equalized, with the result that complicated passages are not required to equalize the lengths of the polymer pipes. Because of this, the structure in which the polymer passing through the polymer pipes is equally heated can be easily achieved.

[0014] The yarns spun out from the spinning packs are required to be threaded to the first guides, respectively. In the present invention, the first guides provided below the spinning packs are arranged to form plural lines along the arc in the same manner as the spinning packs. Therefore, an operator can move along the first guides arranged along the arc, and can perform yarn threading to the first guides arranged inside the arc from gaps between the first guides arranged outside the arc. Because of this, the yarn threading to the first guides can be easily performed without being interfered by the yarns being spun out downward, and controllability in operation is improved.

[0015] According to a fifth aspect of the invention, the yarn production system of the fourth aspect is arranged such that a not-arranged part is formed to extend in a circumferential direction in plan view, the spinning packs are not provided in the not-arranged part, and the not-arranged part extends toward a center from the outer edge of the spinning beam.

[0016] In the yarn production system, typically, cooling cylinders which cool the yarns by means of cooling air are provided below the spinning packs. In addition to that, oil supply guides which apply oil to the cooled yarns are provided below the cooling cylinders. Then, pipes supplying the cooling air are connected to a cooling apparatus in which the cooling cylinders are housed, and pipes supplying oil are connected to the oil supply guides. These pipes may be cut or clogged, and may be required to be replaced when the yarns are being spun out by the spinning packs. In the present invention, a space in which the yarns are not spun out is formed below the not-arranged part in which the spinning packs are not provided. Therefore, the pipes can be easily replaced even when the yarns are being spun out, in such a way that the operator reaches the cooling apparatus and the oil supply guides through the space which is below the not-arranged part of the spinning packs.

[0017] According to a sixth aspect of the present invention, the yarn production system of any one of the first to fifth aspects is arranged such that an angle between a vertical direction and each of the yarns running between the first guides and the second guide is nine degrees or less.

[0018] The quality of the yarns can be ensured further certainly, by providing the first guides and the second guide so that each yarn guide is nine degrees or less.

[0019] According to a seventh aspect of the present invention, the yarn production system of any one of the first to sixths aspect is arranged such that the spinning packs are formed of two lines which are the first line and the second line.

[0020] In the present invention, the yarns are threaded to the first guides more easily as compared to a case in which the spinning packs are arranged to form three lines or more.

[Advantageous Effects of Invention]

[0021] The present invention makes it possible to reduce height of the yarn production system including a spinning apparatus having spinning packs, even in a case in which the number of the spinning packs is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a side view of a yarn production system of an embodiment.

FIG. 2 is a partial cross section of a spinning apparatus and a cooling apparatus of the present embodiment.

FIG. 3 is a perspective view of a second guide of the present embodiment.

FIG. 4 is a cross section taken along a line IV-IV in FIG. 2.

FIG. 5 is a perspective view of the spinning apparatus, the cooling apparatus, and a housing space of the present embodiment.

FIGs. 6(a) to 6(c) show arrangements of spinning packs in modifications. FIG. 6(a) shows the spinning packs arranged to form a U-shape, FIG. 6(b) shows the spinning packs arranged to form a roughly U-shape, and FIG. 6(c) shows the spinning packs arranged to form a V-shape.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Overall Structure of Yarn Production System 1)

[0023] The following will describe a preferred embodiment of the present invention with reference to figures. FIG. 1 is a side view of a yarn production system 1 of the present embodiment. FIG. 2 is a partial cross section of a spinning apparatus 2 and a cooling apparatus 4. Hereinafter, front-rear, left-right, and up-down directions in FIG. 1 will be referred to as front-rear, left-right, and up-down directions of the yarn production system 1.

[0024] As shown in FIG. 1, the yarn production system 1 includes the spinning apparatus 2 and a spun yarn take-up apparatus 3. The spinning apparatus 2 is configured to spin out molten polymer downward as yarns Y, and includes a spinning beam 21 and spinning packs 22 attached to a housing formed at a lower portion of the spinning beam 21 as shown in FIG. 2. The spun yarn take-up apparatus 3 is configured to take up the yarns Y spun out from the spinning apparatus 2, and includes the cooling apparatus 4, an oil supply guide 5, a first guide 6, a second guide 7, godet rollers 8 and 9, and a spun yarn winding apparatus 10.

[0025] The cooling apparatus 4 is configured to cool the yarns Y which are spun out from the spinning packs 22 by means of cooling air. As shown in FIG. 2, the cooling apparatus 4 is provided below the spinning beam 21, and includes cooling cylinders 41 and a cooling air supply box 42 in which the cooling cylinders 41 are housed. The cooling cylinders 41 are provided immediately below the respective spinning packs 22. In each cooling cylinder 41 which is a substantially cylindrical member extending in the up-down direction, a yarn running space 43 which is open at both ends in the up-down direction is formed. A part forming a side wall of each yarn running space 43 of the cooling cylinder 41 adjusts the cooling air which flows into each yarn running space 43 from an internal space 44 of the cooling air supply box 42. The cooling air is sent to each internal space 44 of the cooling air supply box 42 through an unillustrated cooling air pipe from an unillustrated duct. In this regard, the cooling air pipe is provided behind the cooling apparatus 4 in the direction in which FIG. 2 is viewed.

[0026] The oil supply guide 5 applies oil to each of the yarns Y spun out downward from the spinning packs 22. The oil supply guide 5 is provided immediately below each cooling cylinder 41 as shown in FIG. 2. Each of the oil supply guides 5 is supplied with the oil through an oil pipe (unillustrated) . The oil supply guides 5 apply the oil to the yarns Y each of which is formed of formed of a plurality of filaments, and then the plurality of the filaments are, e.g., interlaced so as to be a yarn Y made of a single multifilament.

[0027] The first guide 6 regulates a yarn path so that each yarn Y is pressed on an oil supply face of each oil supply guide 5 in an appropriate manner. The first guide 6 is provided immediately below each oil supply guide 5 as shown in FIG. 2. The second guide 7 is a comb guide in which yarn running portions 71 for guiding yarns Y are provided at regular intervals along the left-right direction as shown in FIG. 3. Each yarn running portion 71 of the second guide 7 is open at the one of front and rear ends, and is open at both ends in the up-down direction. One second guide 7 is provided almost immediately below the center of the first guides 6 in the left-right and front-rear directions. The yarns Y guided in the first guides 6 are guided to the yarn running portions 71 in the second guide 7, and run downward while being aligned at regular intervals in the left-right direction.

[0028] In this regard, yarn threading to the oil supply guides 5, the first guides 6, and the second guide 7 may be performed by an operator, or may be performed automatically.

[0029] The godet rollers 8 and 9 are provided on a downstream of the second guide 7 in a yarn running direction as shown in FIG. 1, and rotationally driven by unillustrated motors. The yarns Y spun out from the spinning apparatus 2 are wound onto the godet roller 8 and the godet roller 9 in this order through the yarn running spaces 43 of the cooling apparatus 4, the oil supply guides 5, the first guides 6, and the second guide 7. Subsequently, the yarns Y are sent to a spun yarn winding apparatus 10 by the godet rollers 8 and 9.

[0030] The spun yarn winding apparatus 10 is configured to wind the yarns Y onto bobbins B retained by a bobbin holder 11 so as to form packages P. The spun yarn winding apparatus 10 is provided with two bobbin holders 11. Each bobbin holder 11 is a shaft member extending in the front-rear direction, and is cantilevered at its rear end portion by a turret 13 provided on a frame 12. The bobbin holder 11 can hold the bobbins B which are aligned in an axial direction. For example, when eight yarns Y are sent from the spinning apparatus 2, the eight yarns Y are respectively wound onto eight bobbins B.

[0031] The spun yarn winding apparatus 10 includes a supporting frame 14 which extends in the front-rear direction to be substantially parallel to the bobbin holder 11. The supporting frame 14 is cantilevered at its rear end portion by the frame 12. Above the supporting frame 14, a guide supporter 15 is provided to extend in the front-rear direction. On the guide supporter 15, support guides 16 are provided to be lined up in the front-rear direction so as to correspond to the respective bobbins B attached

to the bobbin holder 11. On the supporting frame 14, traverse units 17 are provided to be lined up in the front-rear direction so as to correspond to the respective bobbins B attached to the bobbin holder 11. Each traverse unit 17 is configured to traverse each yarn Y in the front-rear direction about the corresponding support guide 16.

[0032] The spun yarn winding apparatus 10 includes a contact roller 18 which is supported by the supporting frame 14 to be rotatable. The contact roller 18 is provided below the supporting frame 14. Operations of parts of the spun yarn winding apparatus 10 are controlled by an unillustrated controller. The spun yarn winding apparatus 10 starts winding of the yarns Y traversed by the traverse units 17, on new bobbins B attached to the upper bobbin holder 11 among the two bobbin holders 11. The contact roller 18 is suitably moved up or down and/or the turret 13 is suitably rotationally driven while the yarns Y are wound. In this way, the packages P are formed in accordance with the increase in diameter of the packages P.

(Spinning Apparatus 2)

[0033] The spinning apparatus 2 includes the spinning beam 21 and the spinning packs 22 as described above, and further includes a polymer tank 23 in which polymer which is a material of the yarns Y is housed as shown in FIG. 2. The spinning beam 21 is able to heat the members provided therein, such as the spinning packs 22, the polymer tank 23, and a polymer pipe 25 connecting each spinning pack 22 with the polymer tank 23. The spinning pack 22 stores molten polymer therein, and has a spinneret 24 at a lower end portion. Molten polymer stored in the spinning pack 22 is spun out downward from through holes (not illustrated) formed in the spinneret 24, as a yarn Y which is formed of a plurality of filaments. The polymer tank 23 is configured to store polymer therein, and the polymer in the polymer tank 23 is sent to the spinning packs 22 through the polymer pipes 25. When the polymer is sent to the spinning pack 22 from the polymer tank 23, the polymer in the polymer tank 23 and the polymer pipes 25 is heated at a predetermined temperature by the spinning beam 21, with the result that molten polymer is made.

[0034] In a known spinning apparatus, for example, spinning packs are staggered to form two lines for a spinning beam which is rectangular in plan view, as shown in Patent Literature 1 described above. In such a spinning apparatus, when the number of the spinning packs 22 is increased, the spinning packs 22 are arranged to extend in an arrangement direction, i.e., the left-right direction in FIG. 2. In this case, the first guides 6 provided immediately below the spinning packs 22 are also arranged to extend in the left-right direction. As a result, the distance between each first guide 6 provided at each end and the second guide 7 is increased in a horizontal direction.

[0035] In the spun yarn take-up apparatus 3, each yarn angle θ is an angle between a vertical direction and each yarn Y running between each first guide 6 and each yarn running portion 71 of the second guide 7. The first guides 6 and the second guide 7 are provided so that each yarn angle θ is nine degrees or less. Each yarn angle θ is determined by distances in the vertical and horizontal directions between each first guide 6 and the second guide 7. By decreasing each yarn angle θ to nine degrees or less, it is possible to suppress the decrease in the quality of the yarns Y due to friction between the yarns Y and the first guides 6. When the distance between each first guide 6 and the second guide 7 in the horizontal direction is increased with the increase of the number of the spinning packs 22 as in a yarn production system including a traditional spinning apparatus, the distance between each first guide 6 and the second guide 7 in the vertical direction is required to be increased in order to decrease each yarn angle θ to nine degrees or less. In this case, the height of the entire yarn production system 1 is disadvantageously large in size.

[0036] In the spinning apparatus 2 of the present embodiment, as shown in FIG. 4, the spinning beam 21 is circular in plan view, and the spinning packs 22 are arranged to form two lines along a first arc 51 and a second arc 52 in plan view. In addition to that, the outer edge of the spinning beam 21 is formed along the spinning packs 22 arranged along the first arc 51. The circular spinning beam 21 has the same center as the first arc 51 and the second arc 52. Therefore, in the spinning apparatus 2 of the present embodiment, radii of the first arc 51 and the second arc 52 are also increased as the number of the spinning packs 22 is increased. In other words, because the spinning packs 22 are arranged to extend in both the front-rear and left-right directions, the spinning packs 22 less extend in one direction as compared to a case in which the spinning packs 22 are arranged to extend only in the left-right direction. Because of this, it is possible to suppress the increase in the distance between each first guide 6 provided at each end and the second guide 7 in the horizontal direction, and thus it is possible to suppress the increase in the distance between each first guide 6 and the second guide 7 in the vertical direction. The suppression of the distance between each first guide 6 and the second guide 7 in the vertical direction is required for decreasing each yarn angle θ to nine degrees or less. In this case, the height of the entire yarn production system 1 can be suppressed. "First line" recited in claims means the spinning packs 22 arranged along the first arc 51, and "second line" means the spinning packs 22 arranged along the second arc 52.

[0037] The cooling cylinders 41 provided immediately below the spinning packs 22, the oil supply guides 5, and the first guides 6 are also arranged to form two lines along the first arc 51 and the second arc 52 in plan view. In addition to that, the cooling apparatus 4 including the cooling cylinders 41 and the cooling air supply box 42 is also circular in plan view in the same manner as the spinning beam 21.

[0038] As shown in FIG. 5, a not-arranged space (not-arranged part) 100a in which the spinning packs 22 are

not provided is formed at a part of the spinning beam 21 in the circumferential direction in plan view. The not-arranged space 100a extends in the front-rear direction toward the center from the outer edge of the spinning beam 21, and penetrates the spinning beam 21 to the lower end from the upper end. In other words, the spinning beam 21 is partially cut out from the part of the circular outer edge to the center in plan view as shown in FIG. 4. A lower space 100b in which the cooling cylinders 41, the oil supply guides 5, and the first guides 6 are not provided is formed immediately below the not-arranged space 100a. Because the spinning packs 22 are not provided in the not-arranged space 100a, the yarns Y are not spun out to the lower space 100b from the spinning packs 22. The not-arranged space 100a and the lower space 100b are collectively referred to as a housing space 100. A wall 101 is formed in front of, to the left of, and to the right of the housing space 100 so as to surround the housing space 100, and the housing space 100 is open to the rear. In addition to that, an opening 102 is provided on the front side of the wall 101 at the lower space 100b. In this regard, the polymer tank 23, the polymer pipes 25, and the cooling cylinders 41 are not illustrated in FIG. 5. In addition to that, only one spinning pack 22 is illustrated, and other spinning packs 22 are not illustrated.

[0039] In the housing space 100, the above-described cooling air pipes and oil pipes (both of which are not illustrated) are housed. The cooling air pipes are connected to the cooling air supply box 42 of the cooling apparatus 4 through the opening 102. In addition to that, the oil pipes are connected to the respective oil supply guides 5 through the opening 102. The cooling air supply box 42 of the cooling apparatus 4 and the oil supply guides 5 are outside the housing space 100. Although not illustrated, the oil supply guides 5 and the first guides 6 are attached on the wall 101 so as to be provided immediately below the respective spinning packs 22 from the wall 101 of the housing space 100, via unillustrated supporting members.

(Effects)

[0040] A yarn production system 1 of the present embodiment includes spinning packs 22, a spinning beam 21 in which the spinning packs 22 are inserted, first guides 6 provided immediately below the spinning packs 22, and a second guide 7 provided below the first guides 6. The spinning packs 22 are arranged along a first arc 51 which is circular-arc-shaped and a second arc 52 which is inside the first arc 51. It is required to suppress the increase in each yarn angle θ of each yarn Y running between each first guide 6 and the second guide 7 in order to ensure the quality of yarns Y. For example, methods of suppressing the increase in each yarn angle θ include the elongation of the distance between each first guide 6 and the second guide 7 in a vertical direction. However, the height of the yarn production system 1 is disadvantageously increased in this case. In the present embodiment, the spinning packs 22 are arranged along the first arc 51 and the second arc 52. Therefore, when the number of the spinning packs 22 is increased, it is possible to suppress the increase in the distance in the horizontal direction between the first guides 6 provided immediately below the spinning packs 22 and the second guide 7 provided below the first guides 6, as compared to a case in which the spinning packs 22 are arranged along one direction. Because of this, it is possible to decrease the distance between each first guide 6 and the second guide 7 in the vertical direction, and thus the height of the yarn production system 1 can be suppressed even when the number of the spinning packs 22 is increased. The decrease in the distance between each first guide 6 and the second guide 7 in the vertical direction is required for suppressing the increase in each yarn angle θ.

[0041] In the yarn production system 1 of the present embodiment, the spinning beam 21 is circular, and the outer edge of the spinning beam 21 is formed along the spinning packs 22 arranged along the first arc 51. Because of this, the spinning beam 21 can exclude a part in which the spinning packs 22 are not provided, and space saving in a spinning apparatus 2 can be achieved, with the result that the space saving in the entire yarn production system 1 can be achieved.

[0042] In the present embodiment, the distance from the center of the first arc 51 to the spinning packs 22 arranged along the first arc 51 is equal to the distance from the center of the second arc 52 to the spinning packs 22 arranged along the second arc 52. Therefore, the lengths of polymer pipes 25 connected to the spinning packs 22 arranged along the first arc 51 are easily equalized to the lengths of the polymer pipes 25 connected to the spinning packs 22 arranged along the second arc 52, with the result that complicated passages are not required to equalize the lengths of the polymer pipes 25. Because of this, the structure in which polymer passing through the polymer pipes 25 is equally heated is easily achieved.

[0043] The yarns Y spun out from the spinning packs 22 are required to be threaded to the first guides 6, respectively. In the present embodiment, the first guides 6 provided below the spinning packs 22 are arranged to form two lines along the first arc 51 and the second arc 52 in the same manner as the spinning packs 22. Therefore, an operator can move along the arc, and can perform yarn threading to the first guides 6 arranged along the second arc 52 from gaps between the first guides 6 arranged along the first arc 51. Because of this, the yarn threading to the first guides 6 can be easily performed without being interfered by the yarns Y being spun out downward, and controllability in operation is improved. The same holds for the yarn threading to oil supply guides 5.

[0044] In the yarn production system 1 of the present embodiment, a not-arranged space 100a which is not

provided at a part of a circumferential direction in plan view is formed in the spinning packs 22. The not-arranged space 100a extends toward the center from the outer edge in a front-rear direction of the spinning beam 21. Cooling air pipes (not illustrated) supplying cooling air to a cooling apparatus 4 and oil pipes (not illustrated) supplying oil to the oil supply guides 5 may be cut or clogged, and the cooling air pipes or the oil pipes may be required to be replaced when the yarns Y are being spun out by the spinning packs 22. In the present embodiment, a lower space 100b in which the yarns Y are not spun out is formed below the not-arranged space 100a in which the spinning packs 22 are not provided. Therefore, the pipes can be easily replaced even when the yarns Y are being spun out, in such a way that the operator reaches the cooling apparatus 4 and the oil supply guides 5 through the lower space 100b.

[0045] In the present embodiment, the first guides 6 and the second guide 7 are provided so that each yarn angle θ is nine degrees or less. Each yarn angle θ is the angle between the vertical direction and each yarn Y running between each first guide 6 and each yarn running portion 71 of the second guide 7. Because of this, the quality of the yarns Y can be ensured further certainly. In the present embodiment, the spinning packs 22 are arranged to form two lines arranged along the first arc 51 and the second arc 52. Because of this, the yarns Y are threaded to the first guides 6 more easily as compared to a case in which the spinning packs 22 are arranged to form three lines or more.

[0046] A preferred embodiment of the present invention has been described. It should be noted that the present invention is not limited to the above-described embodiment, and various changes, substitutions, and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

[0047] In the embodiment above, the spinning packs 22 are arranged along the first arc 51 which is arc-shaped and the second arc 52 which is inside the first arc 51. Alternatively, spinning packs 122 may be arranged to form two lines along a U-shape as shown in FIG. 6(a). In this case, a spinning beam 121 has the U-shape formed so that the outer edge of the spinning beam 121 fits the row of the spinning packs 122. Alternatively, the spinning packs 22 may be arranged to form two lines along straight lines intersecting with one another. For example, as shown in FIG. 6(b), spinning packs 222 may be arranged to form two lines along a square U-shape and a spinning beam 221 may have a square U-shape. For another example, as shown in FIG. 6(c), spinning packs 322 may be arranged to form two lines along a V-shape and a spinning beam 321 may have a V-shape. Central spaces of the U-shape of the spinning packs 122, the square U-shape of the spinning packs 222, and the V-shape of the spinning packs 322 are respectively available as "not-arranged parts". The spinning packs 22 may be arranged in such a way that some of the spinning packs 22 are arranged to form two lines along the curved line or the intersecting straight lines while the remaining spinning packs 22 are arranged to form two lines along the straight line.

[0048] The embodiment above describes the spinning packs 22 each of which spins out the yarn Y made of filaments. However, the present invention is applicable to the spinning packs 22 each of which spins out two or more yarns Y. The spinning packs 22 may be arranged to form three or more lines along the arc. However, it is preferable to arrange the spinning packs 22 so as to form two lines because the yarn threading to the oil supply guides 5 and the first guides 6 is easy.

[0049] In the embodiment above, the not-arranged space 100a penetrates the spinning beam 21 to a lower end from an upper end, and has the shape in which the spinning beam 21 is partially cut out from the part of the circular outer edge to the center in plan view. Alternatively, the spinning beam 21 may be completely circular in plan view, and may include the not-arranged part in which the spinning packs 22 are simply not arranged at the part of the circumferential direction in plan view. In this case, the not-arranged space 100a is not formed, and the housing space 100 is formed only of the lower space 100b.

[0050] The not-arranged part in which the spinning packs 22 are not provided may not be formed. In this case, the spinning packs 22 are arranged along the entire circumference of a circle. In this regard, in a case in which the spinning packs 22 do not include the not-arranged part, when the cooling air pipes and the oil pipes are replaced when the yarns Y are being spun out, the cooling air pipes and the oil pipes are required to be replaced through, e.g., gaps between the yarns Y being spun out. Alternatively, the spinning beam 21 requires a through hole penetrating a central part of the spinning beam 21 in the up-down direction, in order to replace the cooling air pipes and oil pipes which extend downward from above the through hole. Therefore, the spinning packs 22 preferably include the not-arranged part because of difficulty in operation in these cases.

[0051] In the embodiment above, the comb guide is used as the second guide 7. Alternatively, a guide such as a U-shaped guide may be adopted. In this guide, one yarn running portion which guides the yarns Y is provided at one guide member.

[0052] In the embodiment above, the wall 101 is formed in front of, to the left of, and to the right of the housing space 100 so as to surround the housing space 100. Alternatively, the wall 101 may not be formed. In this case, the pipes are housed in the housing space 100 which is not surrounded by the wall 101. In this regard, it is preferable to provide the wall 101 because the yarns Y spun out from the spinning apparatus 2 easily make contact with the pipes so that the replacement of the pipes is difficult. Alternatively, the wall 101 may be formed in front of, to the left of, to the right of, above, and below the housing space 100 so as to surround the housing

space 100. Alternatively, two plates may be provided on both one side and the other side in the left-right direction of the housing space 100, instead of the wall 101.

[0053] In the embodiment above, one opening 102 is provided in the wall 101 surrounding the housing space 100. Alternatively, plural openings 102 may be provided. In this case, the cooling air pipes and the oil pipes are connected to the internal spaces 44 and the oil supply guides 5 through the predetermined openings 102, respectively.

[0054] In the embodiment above, the first guides 6 and the second guide 7 are provided so that each yarn angle θ is nine degrees or less. Alternatively, each yarn angle θ may not be nine degrees or less. For example, each yarn angle θ is set to be less than a predetermined value in accordance with the required quality of the yarns Y.

Claims

1. A yarn production system (1) comprising:

spinning packs (22, 122) in each of which molten polymer is stored and each of which spins out at least one yarn (Y) downward from a spinneret (24) provided at a lower end portion of each of the spinning packs (22, 122);
a spinning beam (21, 121) in which the spinning packs (22, 122) are inserted;
first guides (6) which are provided below the spinning packs (22, 122) and which individually guide the yarns (Y); and
a second guide (7) which is provided below the first guides (6) and which causes the yarns (Y) guided by the first guides (6) to be converged, and
the spinning packs (22, 122) including a first line arranged along a curved line in plan view and a second line arranged along the first line.

2. A yarn production system (1) comprising:

spinning packs (222, 322) in each of which molten polymer is stored and each of which spins out at least one yarn (Y) downward from a spinneret (24) provided at a lower end portion of each of the spinning packs (222, 322);
a spinning beam (221, 321) in which the spinning packs (222, 322) are inserted;
first guides (6) which are provided below the spinning packs (222, 322) and which individually guide the yarns (Y); and
a second guide (7) which is provided below the first guides (6) and which causes the yarns (Y) guided by the first guides (6) to be converged, and
the spinning packs (222, 322) including a first line arranged along straight lines intersecting one another in plan view and a second line arranged along the first line.

3. The yarn production system (1) according to claim 1 or 2, wherein, an outer edge of the spinning beam (21, 121, 221, 321) is formed in accordance with an arrangement of the spinning packs (22, 122, 222, 322).

4. The yarn production system (1) according to claim 1, wherein, all of the spinning packs (22) are arranged along an arc (51, 52) in plan view.

5. The yarn production system (1) according to claim 4, wherein, a not-arranged part (100a) is formed to extend in a circumferential direction in plan view, the spinning packs (22) are not provided in the not-arranged part (100a), and
the not-arranged part (100a) extends toward a center from the outer edge of the spinning beam (21).

6. The yarn production system (1) according to any one of claims 1 to 5, wherein, an angle between a vertical direction and each of the yarns (Y) running between the first guides (6) and the second guide (7) is nine degrees or less.

7. The yarn production system (1) according to any one of claims 1 to 6, wherein, the spinning packs (22, 122, 222, 322) are formed of two lines which are the first line and the second line.

FIG.1

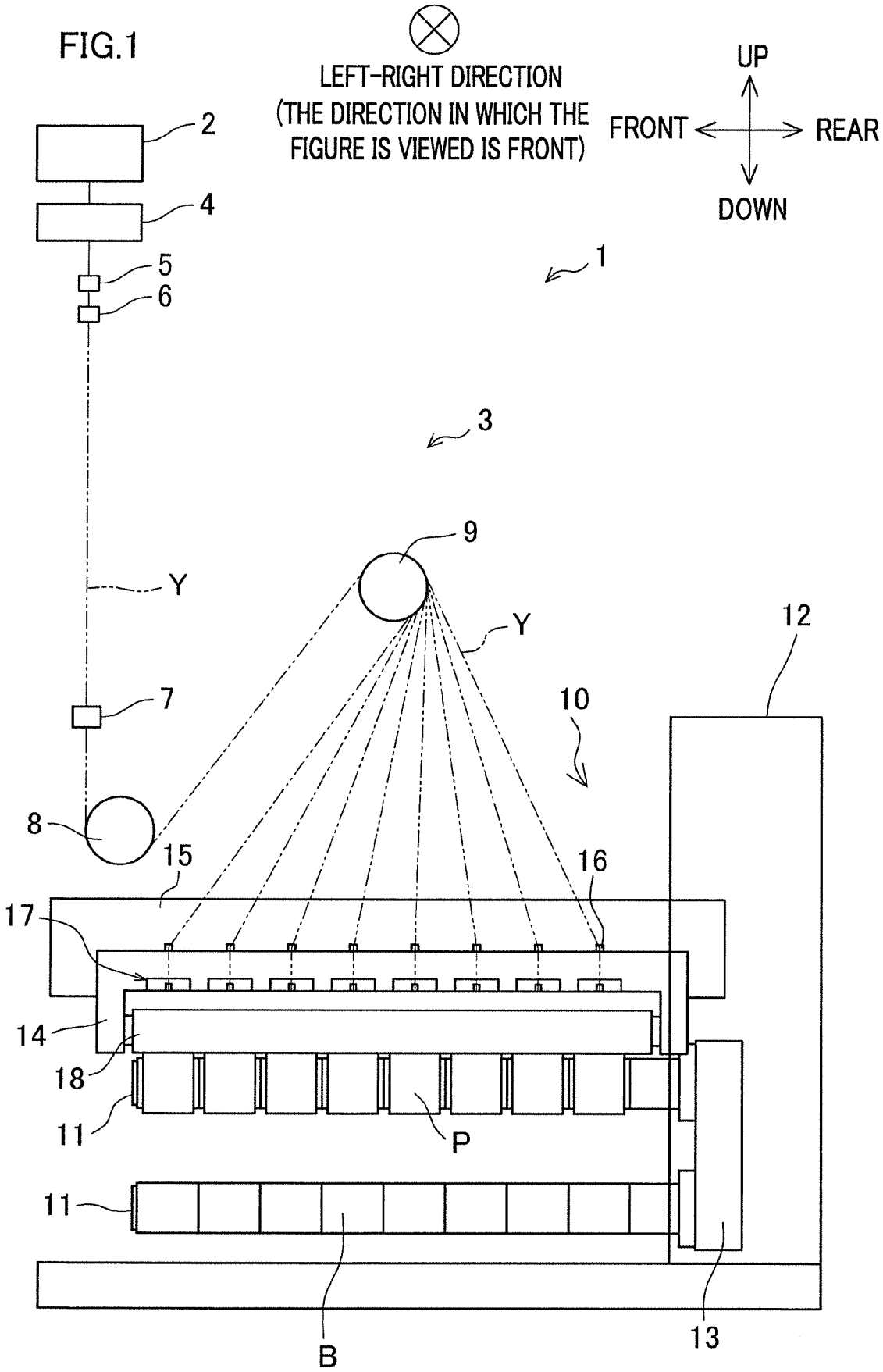

LEFT-RIGHT DIRECTION
(THE DIRECTION IN WHICH THE FIGURE IS VIEWED IS FRONT)
UP
FRONT
REAR
DOWN
1
2
3
4
5
6
7
8
9
10
11
11
12
13
14
15
16
17
18
B
P
Y
Y

FIG.2

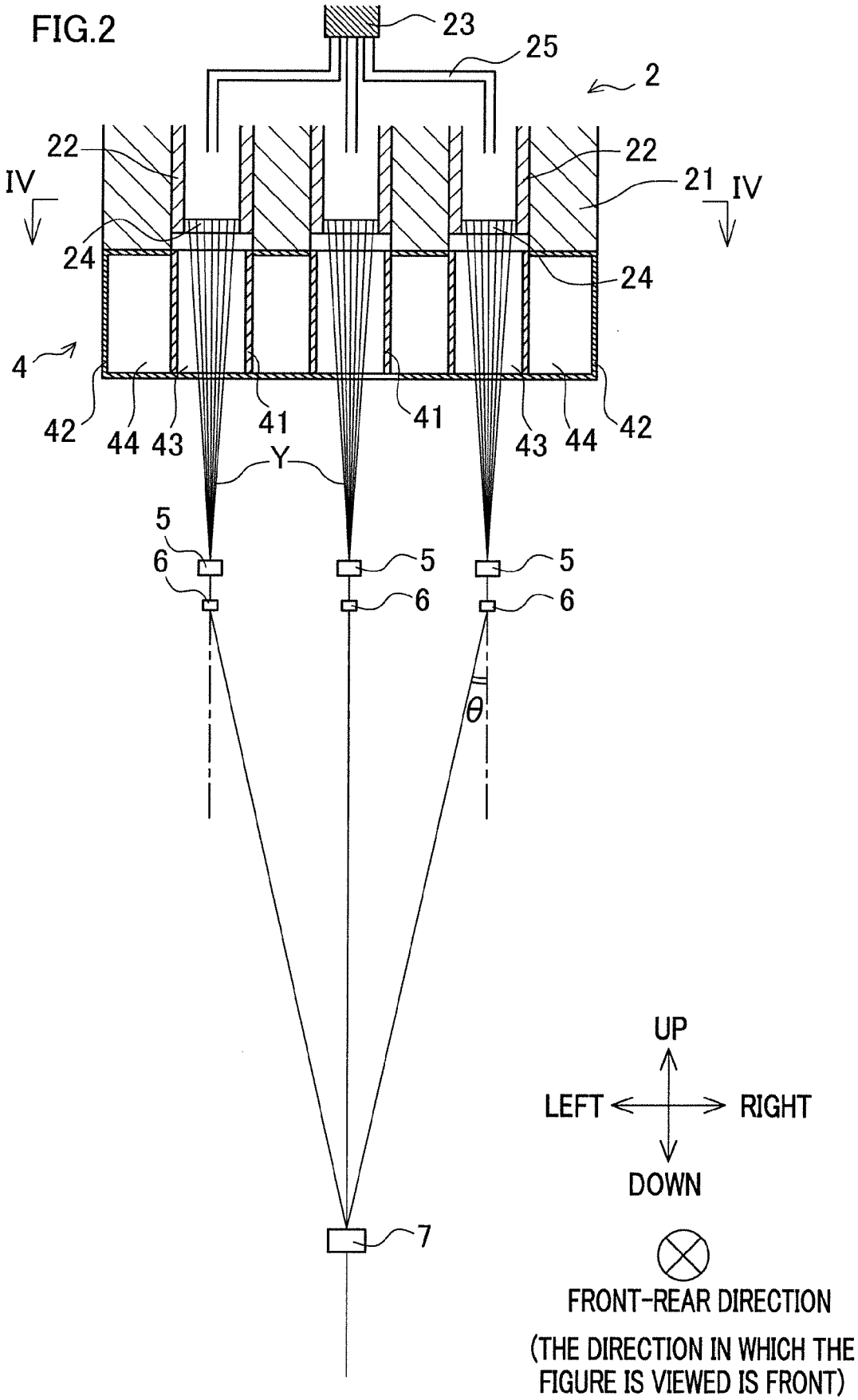

23
25
2
22
22
IV
21
IV
24
24
4
42
44
43
41
41
43
44
42
Y
5
6
5
5
6
6
θ
7
UP
LEFT
RIGHT
DOWN
FRONT-REAR DIRECTION
(THE DIRECTION IN WHICH THE FIGURE IS VIEWED IS FRONT)

FIG.3

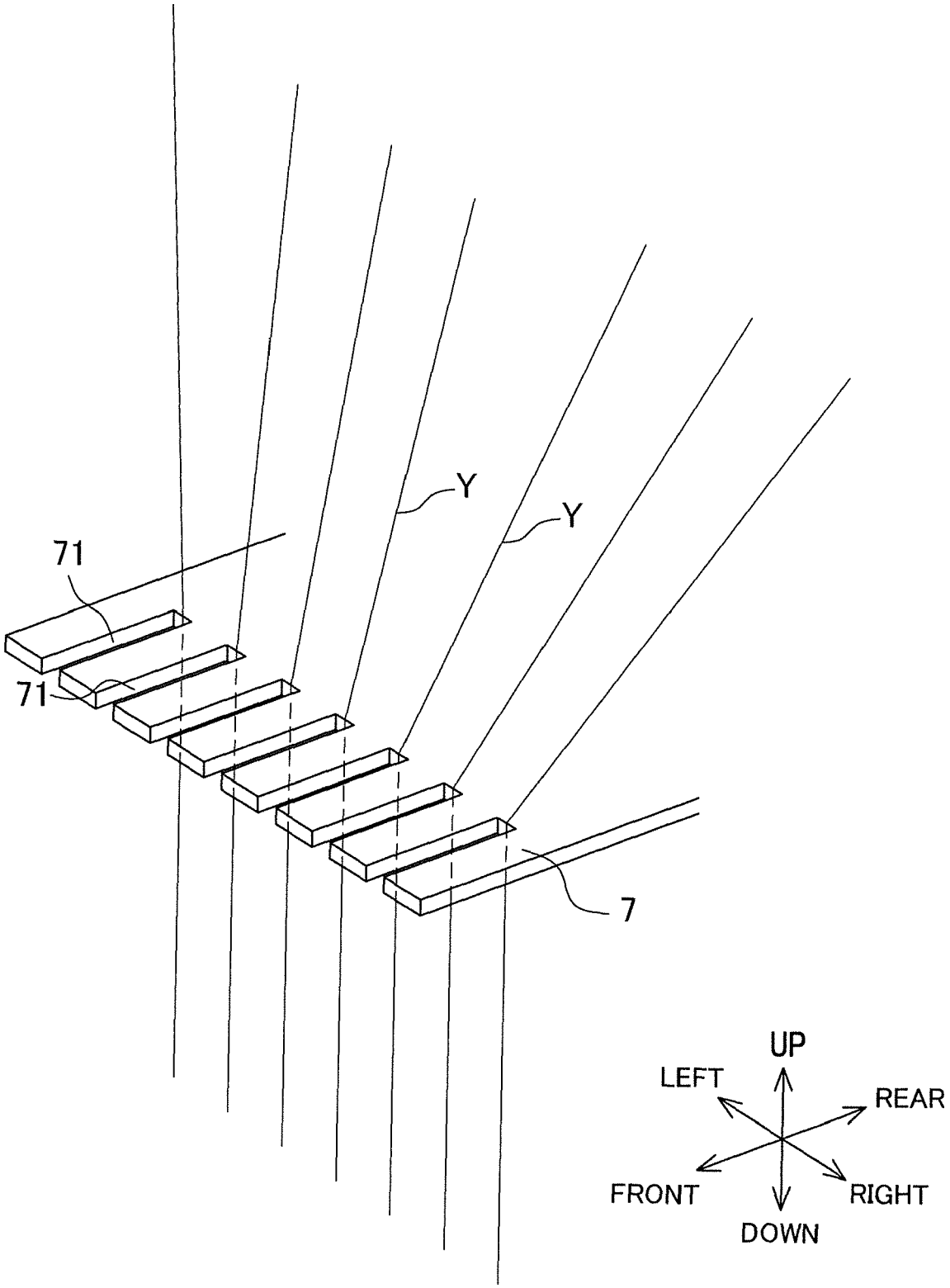


FIG.4

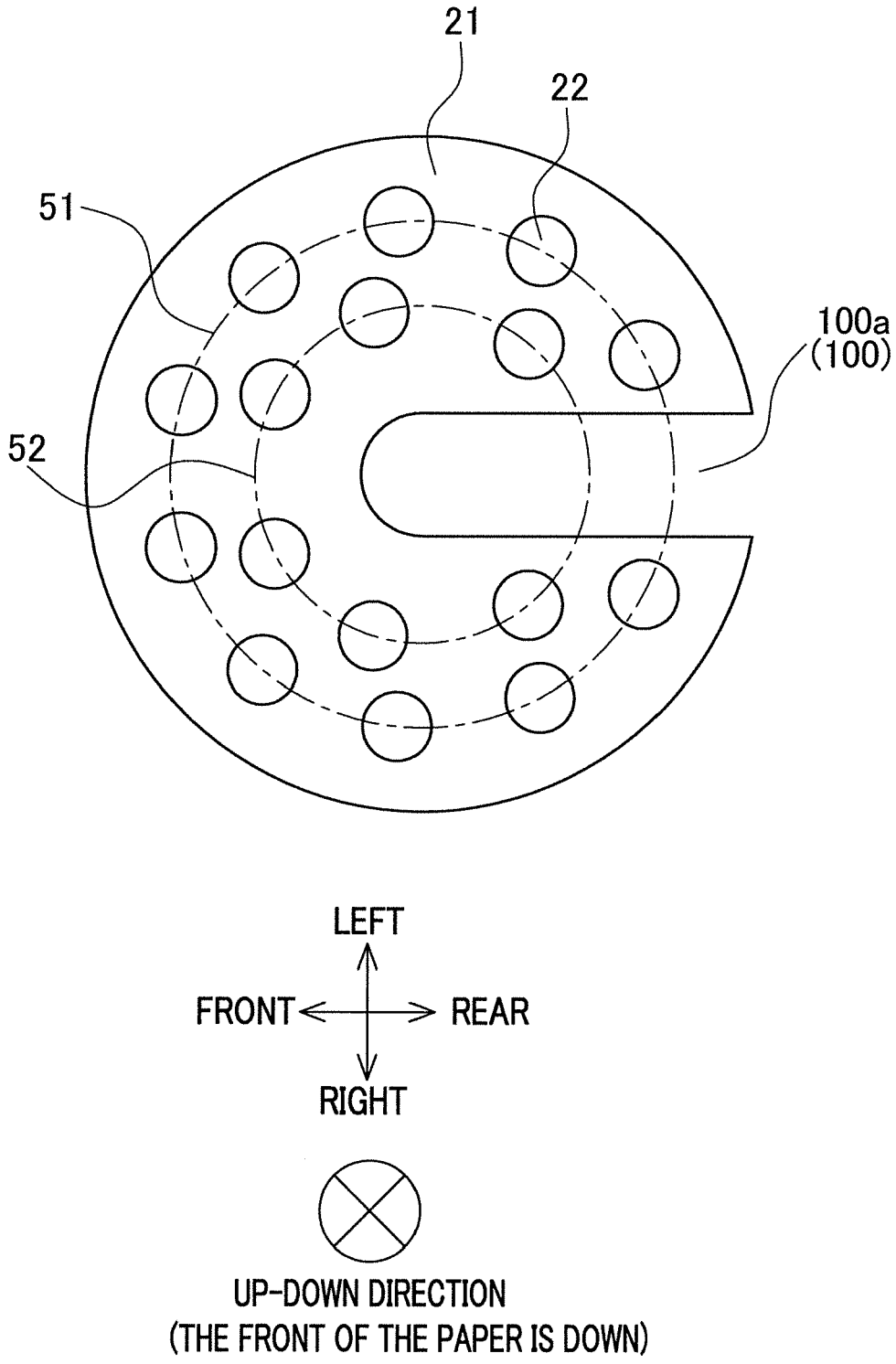

21
22
51
100a
(100)
52
LEFT
FRONT
REAR
RIGHT
UP-DOWN DIRECTION
(THE FRONT OF THE PAPER IS DOWN)

FIG.5

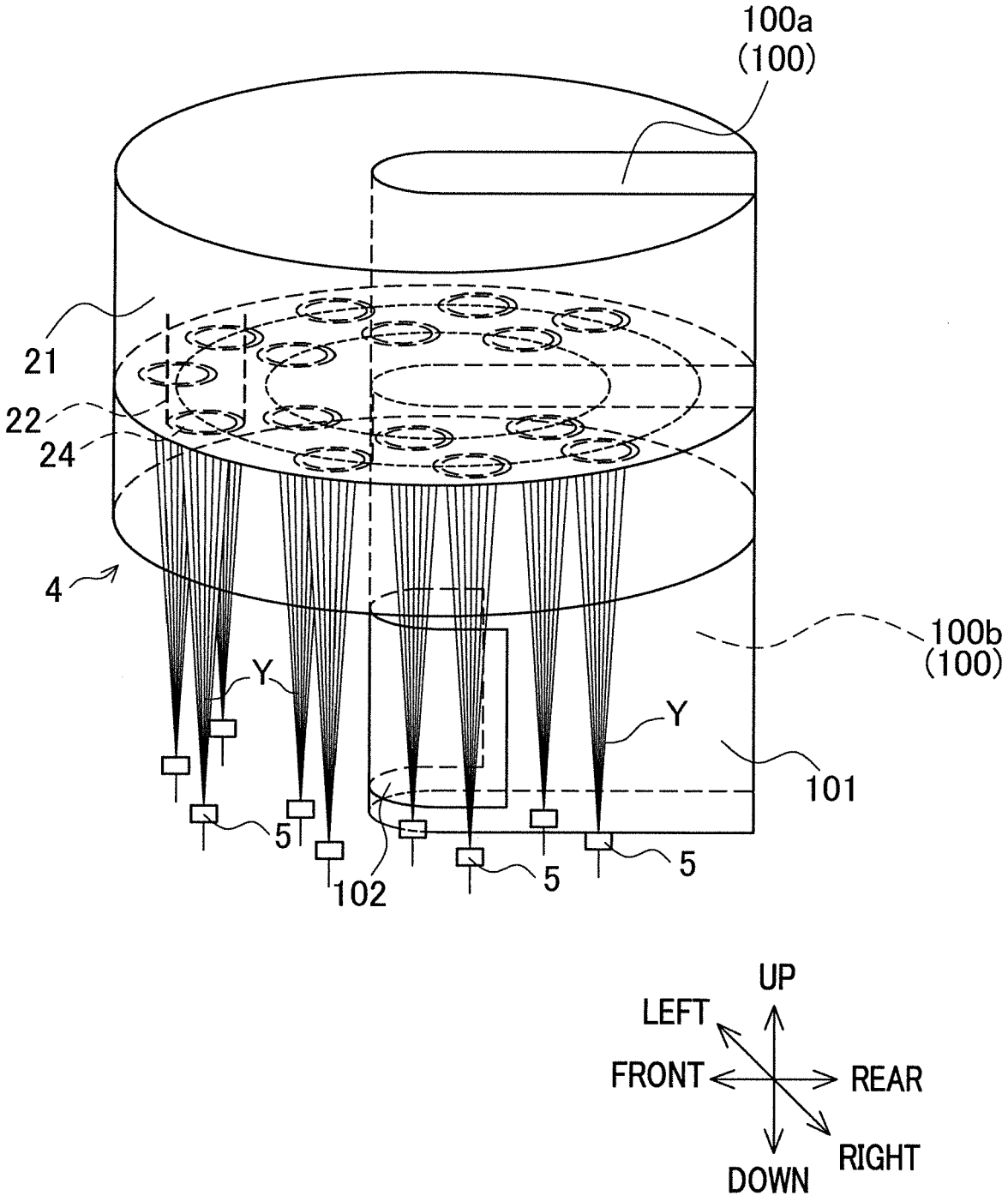
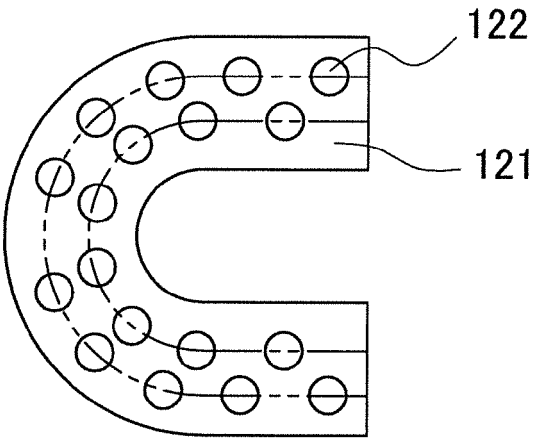
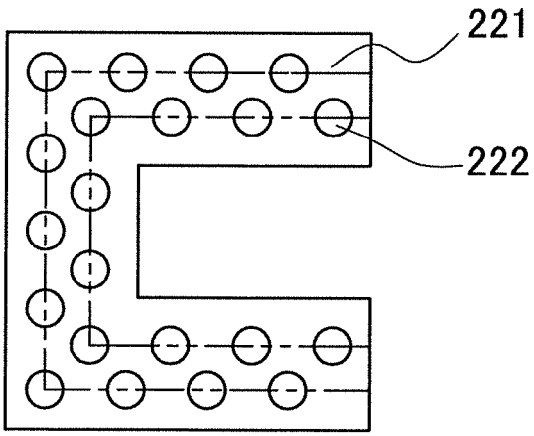

100a
(100)
21
22
24
4
100b
(100)
Y
Y
101
5
5
5
102
UP
LEFT
FRONT
REAR
RIGHT
DOWN

FIG.6

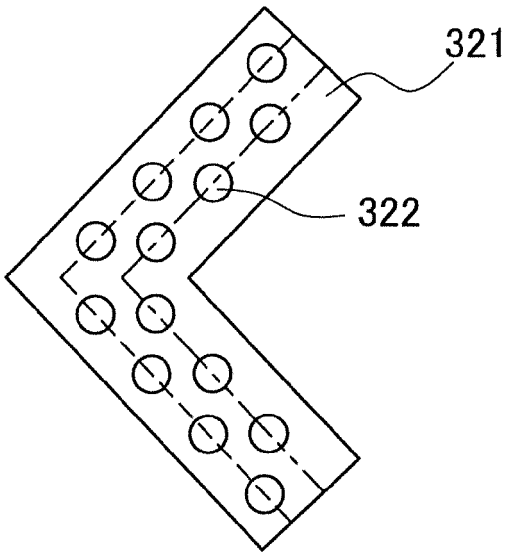
(a)



(b)



(c)



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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