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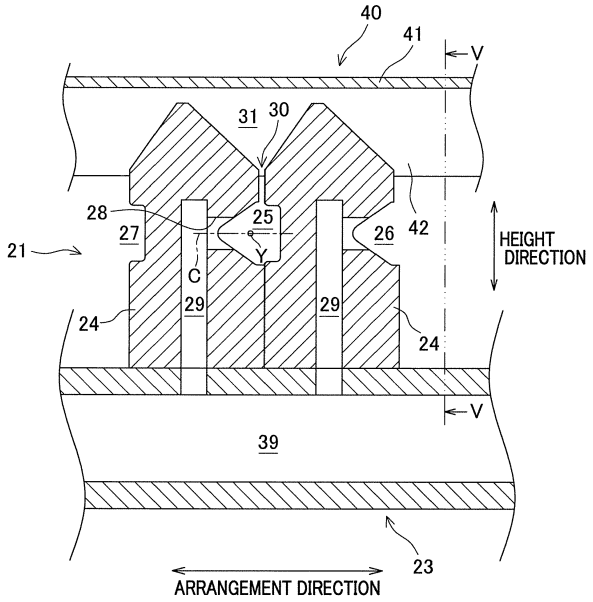
(54) INTERLACING DEVICE

(57) Interlacing capability is improved by a low-cost structure. An interlacing device includes an interlacing portion 21 including: a yarn running space 25 which is along a yarn running direction; and a fluid ejection orifice 28 from which fluid is ejected to the yarn running space 25. The interlacing device is configured to interlace a yarn Y running through the yarn running space 25 by fluid ejected from the fluid ejection orifice 28. The interlacing portion 21 includes a yarn insertion gap 30 through which the yarn Y is inserted into the yarn running space 25. A cover member 40 configured to cover the yarn insertion gap 30 is disposed at a position separated from the yarn running space 25.

FIG.3



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an interlacing device configured to interlace one or more yarns using fluid.

[0002] There have been known interlacing devices configured to interlace yarns using fluid. For example, Patent Literature 1 (Japanese Unexamined Patent Publication No. 2016-160550) discloses an interlacing device configured to interlace yarns by ejecting fluid from fluid ejection orifices to yarn running spaces provided in an interlacing portion. Fluid ejected from each fluid ejection orifice to the corresponding yarn running space branches into two fluid flows, which respectively head towards opposite sides in a yarn running direction, and then the two fluid flows are respectively discharged through both ends of the yarn running space. Because the flow of the fluid in the yarn running space has a large effect on the interlacing capability, it is preferable that the yarn running space is closed as tightly as possible except the both ends.

[0003] However, in Patent Literature 1, the interlacing portion has yarn insertion gaps through which yarns are inserted into the yarn running spaces. Air entering into the yarn running spaces through the yarn insertion gaps during an interlacing process may disturb the flow of the fluid in the yarn running spaces, leading to reduction in the interlacing capability. In this regard, an interlacing device described in Patent Literature 2 (Japanese Unexamined Patent Publication No. 2009-133018) includes: a first member in which yarn running spaces are disposed; and a second member configured to take a first position of being separated from the first member and a second position of being in contact with the first member. When the second member is in close contact with the first member, the yarn running spaces are tightly closed. Furthermore, an interlacing device described in Patent Literature 3 (German Unexamined Patent Publication No. DE 10038855 A1) is provided with a movable closure member configured to close a yarn insertion gap.

SUMMARY OF THE INVENTION

[0004] In practice, it is very difficult to bring the first and second members of Patent Literature 2 into close contact with each other completely. If even a small gap exists, yarns may be caught in the gap, disadvantageously. To eliminate such a gap, contact surfaces of the members have to be mirror surfaces. However, this also brings about disadvantages such as an increase in cost due to mirror polishing, and an increase in probability of occurrence of yarn breakage due to the friction between the mirror surfaces and yarns contacting the surfaces when the yarns are synthetic fiber yarns. Meanwhile, in Patent Literature 3, the closure member faces the yarn running space, and therefore a yarn moving around in the yarn running space during an interlacing process comes into contact with the closure member. Because of this, the closure member has to be made of ceramic, for example, which increases its cost.

[0005] In view of the above problems, an object of the present invention is to improve interlacing capability by a low-cost structure.

[0006] In an aspect of the present invention, an interlacing device includes an interlacing portion including: a yarn running space which is along a yarn running direction; and a fluid ejection orifice from which fluid is ejected to the yarn running space, the interlacing device being configured to interlace a yarn running through the yarn running space by fluid ejected from the fluid ejection orifice, wherein: the interlacing portion includes a yarn insertion gap through which the yarn is inserted into the yarn running space; and a cover member configured to cover the yarn insertion gap is disposed at a position separated from the yarn running space.

[0007] In the above aspect of the present invention, the cover member configured to cover the yarn insertion gap reduces or minimizes the entry of air into the yarn running space through the yarn insertion gap during an interlacing process, and this makes it possible to improve the interlacing capability. Moreover, the cover member is disposed at a position separated from the yarn running space, and therefore the yarn moving around in the yarn running space during the interlacing process never comes into contact with the cover member. Due to this, there is no particular limitation on the material of the cover member. Furthermore, the cover member does not have to undergo processing such as polishing in case of contact with the yarn. This leads to cost reduction of the cover member. Accordingly, in the above aspect of the present invention, it is possible to improve the interlacing capability by a low-cost structure.

[0008] In the above aspect of the present invention, it is preferable that the cover member includes a flat lid portion configured to cover the yarn insertion gap at a position separated from the interlacing portion.

[0009] Suppose that the yarn is wound around a bobbin downstream of the interlacing device, to form a package. When the yarn is cut at the time of replacing a full bobbin with an empty bobbin, the tension of the yarn temporarily becomes zero. The reduction of the tension to zero slackens the yarn, and the slack yarn may come out through the yarn insertion gap. If the lid portion is in contact with the interlacing portion in this situation, the coming-out yarn may be caught between the lid portion and the interlacing portion. However, the lid portion is separated from the interlacing portion, and this prevents the yarn from being caught.

[0010] In the above aspect of the present invention, it is preferable that the cover member further includes yarn restricting portions respectively disposed outward of both end faces of the interlacing portion in the yarn running direction, each yarn restricting portion being provided so as to partially overlap the interlacing portion when viewed

from the yarn running direction.

[0011] The above-described arrangement in which the lid portion is separated from the interlacing portion prevents the yarn from being caught. However, in this arrangement, the yarn may greatly come out through the gap between the lid portion and the interlacing portion. To deal with this, the above-mentioned yarn restricting portions are provided to the cover member. With this, the yarn trying to come out of the interlacing portion contacts one or each of the yarn restricting portions, and this reliably prevents the yarn from coming out.

[0012] In the above aspect of the present invention, it is preferable that in a cross section orthogonal to the yarn running direction, the yarn running space has a shape symmetrical with respect to a central axis of the fluid ejection orifice, and the yarn insertion gap is along a direction crossing the central axis of the fluid ejection orifice.

[0013] In the interlacing device structured as above, fluid flows symmetrically with respect to the central axis of the fluid ejection orifice in the yarn running space, and the flow of the fluid interlaces the yarn. In the arrangement where the yarn insertion gap is along a direction crossing the central axis of the fluid ejection orifice, however, air entering into the yarn running space through the yarn insertion gap may break the symmetry of the flow, and this tends to increase the degree of deterioration in the interlacing capability. In such a case, the configuration of the present invention, that is, to provide the cover member configured to cover the yarn insertion gap, is particularly effective.

[0014] In the above aspect of the present invention, it is preferable that the cover member is configured to be movable between: a first position at which the cover member covers the yarn insertion gap; and a second position at which an open space is created between the cover member and the interlacing portion and the yarn is insertable into the yarn insertion gap through the open space.

[0015] In the above arrangement, the yarn is easily insertable into the yarn insertion gap by moving the cover member from the first position to the second position. This enables rapid yarn threading to the interlacing device.

[0016] In the above aspect of the present invention, it is preferable that: the yarn running space includes a plurality of yarn running spaces and the fluid ejection orifice includes a plurality of fluid ejection orifices, and the interlacing portion is structured by a plurality of interlacing pieces lined up in an arrangement direction orthogonal to the yarn running direction, the interlacing pieces being shaped to provide the yarn running spaces and the fluid ejection orifices; and the interlacing device is configured to interlace a plurality of yarns running through the yarn running spaces.

[0017] With respect to such an interlacing device for multiple yarns, it is possible to improve the capability of interlacing multiple yarns by providing the cover member configured to cover the entire area of the interlacing portion. For example, reference is made to the above-mentioned Patent Literature 3, in which the yarn insertion gap is closed by the closure member. If this configuration is applied to the interlacing device for multiple yarns, a plurality of closure members have to be provided, which greatly increases the cost. In this regard, however, in the above aspect of the present invention, it is only required to provide the single cover member, and therefore the cost of the structure is effectively lowered.

[0018] In the above aspect of the present invention, it is preferable that the yarn insertion gap is formed between two adjacent interlacing pieces of the interlacing pieces, which are adjacent to each other in the arrangement direction.

[0019] This arrangement eliminates the necessity of conducting cutting processing or the like to form the yarn insertion gap inside the interlacing piece, and therefore the interlacing pieces can be easily produced.

[0020] In the above aspect of the present invention, it is preferable that each yarn running space is formed by combining a first space of one of the corresponding two interlacing pieces adjacent to each other in the arrangement direction with a second space of the other of the two interlacing pieces.

[0021] During the interlacing process, the yarns moving around in the yarn running spaces come into contact with inner circumferential surfaces of the yarn running spaces. Because of this, in some cases, the inner circumferential surfaces undergo processing such as polishing to make the surfaces resistant to the contact with the yarns. In such a case, the first space and the second space of the interlacing pieces of the above arrangement are exposed to the outside before the interlacing pieces are lined up so as to be adjacent to one another. This allows the inner circumferential surfaces of the first and second spaces to easily undergo processing such as polishing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a side view of an example of a spun yarn take-up apparatus including an interlacing device related to an embodiment of the present invention.

FIG. 2 is a perspective view of the interlacing device.

FIG. 3 is a cross section of an interlacing portion.

FIG. 4 is a perspective view of the interlacing device with a cover member.

FIG. 5 shows the interlacing portion viewed from a direction V of FIG. 3.

FIG. 6 is a side view illustrating how the cover member moves.

FIG. 7 is a cross section of an interlacing portion of a modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Spun yarn take-up apparatus)

[0023] The following will describe an embodiment of an interlacing device related to the present invention. As shown in FIG. 1, a spun yarn take-up apparatus 1 is configured to wind synthetic fiber yarns Y spun out from a spinning apparatus 2 onto bobbins B, respectively, to form packages P. In the present embodiment, upward, downward, forward, and rearward directions shown in FIG. 1 will be referred to as upward, downward, forward, and rearward directions of the spun yarn take-up apparatus 1.

[0024] The spun yarn take-up apparatus 1 includes godet rollers 3 and 4, an interlacing device 5, and a winding device 6. The spun yarn take-up apparatus 1 is provided below the spinning apparatus 2. The spinning apparatus 2 is configured to spin out synthetic fiber yarns Y downwardly through not-shown spinnerets. The synthetic fiber yarns Y are, for example, made of synthetic resin such as polyethylene terephthalate. The godet rollers 3 and 4 are rotationally driven by unillustrated motors, respectively. The yarns Y spun out from the spinning apparatus 2 are sent to the winding device 6 by the godet rollers 3 and 4. The interlacing device 5 is provided between the godet rollers 3 and 4. The interlacing device 5 is configured to interlace the yarns Y. The details of the interlacing device 5 will be given later.

[0025] The winding device 6 is configured to wind the yarns Y sent from the godet roller 4 onto the bobbins B, respectively, to form packages P. The winding device 6 includes members such as a mount 11, a turret 12, two bobbin holders 13, a supporting frame 14, a contact roller 15, and a traverse unit 16.

[0026] The turret 12 has a shape like a disc, and is attached to the mount 11. The turret 12 is rotationally driven by a motor which is not illustrated. The two long cylindrical bobbin holders 13 are cantilevered by the turret 12. The bobbin holders 13 extend in the front-rear direction. To each bobbin holder 13, the bobbins B are attached to be lined up along the axis of the bobbin holder 13. The two bobbin holders 13 at an upper winding position and a lower retracted position are replaceable by each other as the turret 12 rotates.

[0027] The supporting frame 14 is a frame-shaped member which is long in the front-rear direction. This supporting frame 14 is fixed to the mount 11. A roller supporting member 17 which is long in the front-rear direction is attached to a lower part of the supporting frame 14 so as to be vertically movable relative to the supporting frame 14. The roller supporting member 17 supports the contact roller 15 in a rotatable manner. The contact roller 15 extends in the axial direction of the bobbin holders 13. As this contact roller 15 comes into contact with packages P, a predetermined contact pressure is applied to the packages P, so that the shape of the packages P is adjusted.

[0028] The traverse unit 16 is provided immediately above the contact roller 15 of the roller supporting member 17. The traverse unit 16 includes traverse guides 16a lined up in the front-rear direction. The traverse guides 16a are driven by a motor (not illustrated) and are configured to reciprocate in the front-rear direction. As each traverse guide 16a holding the corresponding yarn Y reciprocates, the yarn Y is traversed in the front-rear direction about a corresponding fulcrum guide 18. The yarn Y is wound onto the corresponding bobbin B while being traversed, with the result that a package P is formed.

(Interlacing device)

[0029] Now, the interlacing device 5 will be detailed. The interlacing device 5 is configured to entangle a number of filaments constituting each yarn Y, to interlace the yarn Y. As shown in FIG. 2, the interlacing device 5 includes an interlacing portion 21, two guide members 22, and a base 23. The interlacing portion 21 is structured by interlacing pieces 24 lined up in a predetermined arrangement direction so as to be adjacent to one another. In the interlacing portion 21, a plurality of yarn running spaces 25 are disposed. Each yarn running space 25 is along a yarn running direction, which is orthogonal to the arrangement direction. In the present embodiment, a direction orthogonal to both the arrangement direction and the yarn running direction is defined as a height direction.

[0030] The guide members 22 are respectively provided on upstream and downstream sides of the interlacing portion 21 with respect to the yarn running direction. Each guide member 22 is a comb-shaped guide including guide portions 22a lined up in the arrangement direction. The yarns Y are regulated by the guide portions 22a of the two guide members 22 so that the yarns Y run inside the respective yarn running spaces 25. The base 23 supports the interlacing portion 21 and the guide members 22. The interlacing pieces 24 and the guide members 22, with which the yarns Y come into contact, are made of ceramic.

[0031] FIG. 3 is a cross section of the interlacing portion 21. Specifically, FIG. 3 shows the cross section cut orthogonally to the yarn running direction at a middle portion of the interlacing portion 21 in the yarn running direction. For the sake of convenience, FIG. 3 shows only two adjacent interlacing pieces 24. The same applies to FIG. 7. On a first-side surface (a right surface in FIG. 3) of each interlacing piece 24, which is on a first side relative to the arrangement direction, there is a first space 26 having a substantially triangular cross sectional shape. The first space 26 extends throughout the interlacing piece 24 in the yarn running direction. Meanwhile, on a second-side surface (a left surface in FIG. 3) of each interlacing piece 24, which is on a second side relative to the arrangement direction, there is a second space 27 having a substantially rectangular cross sectional shape. The second space 27 extends throughout the interlacing piece 24 in the yarn running direction. The first space 26

and the second space 27 are substantially leveled with each other with respect to the height direction. Because of this, bringing two interlacing pieces 24 into contact with each other so as to be adjacent to each other in the arrangement direction causes the first space 26 of one of the interlacing pieces 24 to be combined with the second space 27 of the other of the interlacing pieces 24, to form a yarn running space 25. It should be noted that the cross sectional shapes of the first space 26 and the second space 27, and by extension, the cross sectional shape of the yarn running space 25 are not limited to those illustrated in FIG. 3.

[0032] Each interlacing piece 24 has a fluid ejection orifice 28 from which fluid is ejected to the corresponding yarn running space 25. The fluid ejection orifice 28 is positioned at a middle portion of the interlacing piece 24 in the yarn running direction, and is along the arrangement direction. A right end portion of the fluid ejection orifice 28 communicates with the yarn running space 25, and a left end portion of the fluid ejection orifice 28 communicates with a fluid supply hole 29. The fluid supply hole 29 is disposed in the interlacing piece 24 and is along the height direction. The fluid supply hole 29 communicates with a fluid passage 39 disposed in the base 23. Fluid supplied from an unillustrated fluid supply source passes through the fluid passage 39 and each fluid supply hole 29, and then the fluid is ejected to the yarn running space 25 through the fluid ejection orifice 28.

[0033] A first-side surface (right surface in FIG. 3) of each interlacing piece 24 includes a leading-end-side portion (upper portion in FIG. 3), which is on a leading end side relative to the first space 26, and a base-end-side portion (lower portion in FIG. 3), which is on a base end side relative to the first space 26. The leading-end-side portion of the first-side surface is positioned slightly on the second side (to the left in FIG. 3) relative to the base-end-side portion of the first-side surface. Meanwhile, the second-side surface (left surface in FIG. 3) of each interlacing piece 24 includes a leading-end-side portion, which is on the leading end side relative to the second space 27, and a base-end-side portion, which is on the base end side relative to the second space 27. The leading-end-side portion of the second-side surface is flush with its base-end-side portion. Due to this structure, bringing two interlacing pieces 24 into contact with each other so as to be adjacent to each other in the arrangement direction forms a yarn insertion gap 30 between the two interlacing pieces 24. The yarn insertion gap 30 communicates with the yarn running space 25. This allows a yarn Y to be inserted into the yarn running space 25 through the yarn insertion gap 30. Furthermore, a leading end portion of each interlacing piece 24 has a chevron shape, i.e., becomes narrower toward its leading end. This creates a yarn introducing part 31 having a cross sectional shape of an inverted triangle between the leading end portions of the two interlacing pieces 24. Inclined surfaces defining the yarn introducing part 31 makes it possible to easily guide the corresponding yarn Y into the corresponding yarn insertion gap 30.

[0034] To interlace the yarns Y running through the respective yarn running spaces 25, fluid is supplied from the not-illustrated fluid supply source to the fluid passage 39. As such fluid, compressed air is used, for example. The fluid supplied to the fluid passage 39 is ejected to each yarn running space 25 from the corresponding fluid ejection orifice 28 through the corresponding fluid supply hole 29. The fluid ejected to the yarn running space 25 creates a swirling flow in the yarn running space 25, and interlaces the yarn Y running through the yarn running space 25. The flow of the fluid ejected to the yarn running space 25 branches toward upstream and downstream sides in the yarn running direction, and the branch flows are respectively discharged from both ends of the yarn running space 25.

[0035] As shown in FIG. 3, in the present embodiment, the cross section of each yarn running space 25 orthogonal to the yarn running direction is substantially symmetrical with respect to a central axis C of the corresponding fluid ejection orifice 28. Due to this, the fluid ejected from the fluid ejection orifice 28 creates, in the yarn running space 25, a swirling flow having symmetry with respect to the central axis C, and this preferably interlaces the yarn Y. Provided however, each yarn running space 25 does not have to be shaped so as to be substantially symmetrical with respect to the central axis C of the fluid ejection orifice 28.

[0036] Now, in the arrangement in which each yarn Y is interlaced by the above-mentioned swirling flow, it is preferable that each yarn running space 25 is sealed as tightly as possible except its openings at the both ends. However, in the present embodiment, there is the yarn insertion gap 30 through which the yarn Y is inserted into the yarn running space 25, and therefore air enters into the yarn running space 25 through the yarn insertion gap 30. Such entering air may disturb the flow of the fluid in the yarn running space 25, leading to reduction in the interlacing capability. Particularly, in the present embodiment, each yarn insertion gap 30 is along the height direction crossing (orthogonal to) the central axis C of the fluid ejection orifice 28. In this configuration, there would be a possibility that air entering into each yarn running space 25 thorough the corresponding yarn insertion gap 30 breaks the symmetry of the fluid flow with respect to the central axis C and significantly reduces the interlacing capability. In the present embodiment, to reduce the entry of air into the yarn running spaces 25 through the yarn insertion gaps 30, there is provided a cover member 40 configured to cover the yarn insertion gaps 30.

(Cover member)

[0037] As shown in FIG. 4, the cover member 40 is provided so as to cover the entire area of a leading-end-side portion of the interlacing portion 21. The cover member 40 includes a lid portion 41 and two yarn restricting portions 42, which are formed unitarily as one piece. The

lid portion 41 is a flat-plate portion sized to have an area to cover the entire area of the interlacing portion 21. The yarn restricting portions 42 are parts bent approximately 90 degrees toward the base end side of the interlacing portion 21 (downward in FIG. 4) at both end portions of the lid portion 41 in the yarn running direction, respectively.

[0038] As shown in FIG. 5, the cover member 40 is provided so that: the lid portion 41 is positioned on the leading end side relative to the interlacing portion 21 with a small gap between them; and the two yarn restricting portions 42 are respectively disposed outward of (on the outer side of) both end faces of the interlacing portion 21 in the yarn running direction with a small gap between each yarn restricting portion 42 and the corresponding end face. As such, the cover member 40 is provided so as not to be in contact with the interlacing portion 21, and this prevents damage to the interlacing portion 21. When cutting the yarns Y at the time of replacing the full bobbins B with empty bobbins B by rotating the turret 12 (see FIG. 1), the tension of the yarns Y temporarily becomes zero to slacken the yarns Y. The slack yarns Y may come out through the yarn insertion gaps 30. Such coming-out yarns Y may be caught between the lid portion 41 and the interlacing portion 21 if the lid portion 41 is in contact with the interlacing portion 21. However, because the lid portion 41 is separated from the interlacing portion 21, the yarns Y are not caught.

[0039] However, in the arrangement in which the lid portion 41 is separated from the interlacing portion 21, there is a possibility that the yarns Y greatly come out through the gap between the lid portion 41 and the interlacing portion 21. To deal with this, in the present embodiment, as shown in FIG. 3, each yarn restricting portion 42 is arranged to partially overlap the interlacing portion 21 when viewed from the yarn running direction. In this arrangement, the yarns Y trying to come out of the interlacing portion 21 contact an end side of one or each of the yarn restricting portions 42. This reliably prevents the yarns Y from coming out of the interlacing portion 21. Furthermore, the thus provided yarn restricting portions 42 also reduce or minimize the entry of air from both end portions of each yarn introducing part 31 in the yarn running direction. It should be noted that during an interlacing process, tension is applied to the yarns Y, and therefore, basically, the yarns Y do not come out through the yarn insertion gaps 30.

[0040] As shown in FIG. 6, one end portion of the cover member 40 in the arrangement direction is supported by the base 23 so as to rotatable about a pivot axis 43. Due to this arrangement, the cover member 40 is movable between: a first position at which the cover member 40 covers the interlacing portion 21 as illustrated with solid lines in FIG. 6; and a second position at which the distance between the cover member 40 and the interlacing portion 21 is greater as illustrated with two-dot chain lines in FIG. 6. A handle 44 is attached to the other end portion of the cover member 40 in the arrangement direction. The cover member 40 is configured to be easily movable between the first position and the second position by an operator using the handle 44.

[0041] Furthermore, a sit portion 45 configured to be seated on a seat portion 23a provided on the base 23 is attached to the other end portion of the cover member 40 in the arrangement direction. When the cover member 40 is at the first position, the sit portion 45 is seated on the seat portion 23a, and the cover member 40 is supported by the seat portion 23a. In the present embodiment, a magnet is provided on either one of the sit portion 45 and the seat portion 23a, and the other is made of magnetic material. This structure ensures that the sit portion 45 is kept seated. However, the above structure is not essential.

[0042] When the yarns Y are interlaced by the interlacing device 5, the cover member 40 is positioned at the first position. With this, the yarn insertion gaps 30 of the interlacing portion 21 are covered with the cover member 40. As a result, air is less likely to enter into the yarn running spaces 25 through the yarn insertion gaps 30, and this improve the interlacing capability. In this regard, actual tests were conducted using 75 dtex/36 f yarns under the condition of the winding speed of 4900 mpm, to examine the difference in the number of knots per unit length between the situations in the presence and absence of the cover member 40. The results were as follows. The number of knots per unit length was 14.45 knots/m in the situation where the cover member 40 is not provided, while the number of knots increased to 16.58 knots/m in the situation where the cover member 40 is provided.

[0043] When the yarns Y are threaded onto the interlacing device 5, i.e., when the yarns Y are inserted into the yarn running spaces 25 through the yarn insertion gaps 30, the cover member 40 is moved to the second position. As a result, an open space S is created between the cover member 40 and the interlacing portion 21, and this allows the yarns Y to be inserted into the yarn insertion gaps 30 through the open space S. While in FIG. 6, the cover member 40 is moved from the first position to the second position by an angle less than 90 degrees, the cover member 40 may be configured to be movable from the first position to the second position by an angle equal to or more than 90 degrees.

(Advantageous Effects)

[0044] In the present embodiment, the cover member 40 configured to cover the yarn insertion gaps 30 reduces or minimizes the entry of air into the yarn running spaces 25 through the yarn insertion gaps 30 during the interlacing process, and this makes it possible to improve the capability of interlacing the yarns Y. Moreover, in the present embodiment, the cover member 40 is disposed at a position separated from the yarn running spaces 25, and therefore the yarns Y moving around in the yarn running spaces 25 during the interlacing process never

come into contact with the cover member 40. Because of this, there is less limitation on the cover member 40, for example, the cover member 40 does not have to be made of ceramic. Furthermore, the cover member 40 does not have to undergo processing such as polishing in case of contact with the yarns Y. This leads to cost reduction of the cover member 40. Accordingly, it is possible to improve the interlacing capability by a low-cost structure.

[0045] In the present embodiment, the cover member 40 includes the flat lid portion 41 configured to cover the yarn insertion gaps 30 at a position separated from the interlacing portion 21. Suppose that the yarns Y are wound around bobbins B downstream of the interlacing device 5, to form packages P. When the yarns Y are cut at the time of replacing full bobbins B with empty bobbins B, the tension of the yarns Y temporarily becomes zero. As a result, the slack yarns Y may come out through the yarn insertion gaps 30. If the lid portion 41 is in contact with the interlacing portion 21 in this situation, the coming-out yarns Y may be caught between the lid portion 41 and the interlacing portion 21. However, the lid portion 41 is separated from the interlacing portion 21, and this prevents the yarns Y from being caught.

[0046] In the present embodiment, the cover member 40 further includes the yarn restricting portions 42 respectively disposed outward of the both end faces of the interlacing portion 21 in the yarn running direction, each yarn restricting portion 42 being provided so as to partially overlap the interlacing portion 21 when viewed from the yarn running direction. The above-described arrangement in which the lid portion 41 is separated from the interlacing portion 21 prevents the yarns Y from being caught. However, in this arrangement, the yarns Y may greatly come out through the gap between the lid portion 41 and the interlacing portion 21. To deal with this, the above-mentioned yarn restricting portions 42 are provided to the cover member 40. With this, the yarns Y trying to come out of the interlacing portion 21 contact the yarn restricting portions 42, and this reliably prevents the yarns Y from coming out. Note that such an event can occur only at the time of replacing the bobbins B, and the yarns Y are not always in contact with the yarn restricting portions 42. Because of this, the yarn restricting portions 42 do not have to be made of ceramic.

[0047] In the present embodiment, in a cross section orthogonal to the yarn running direction, each yarn running space 25 has a shape symmetrical with respect to the central axis C of the corresponding fluid ejection orifice 28, and each yarn insertion gap 30 is along a direction crossing the central axis C of the fluid ejection orifice 28. In the interlacing device 5 structured as above, fluid flows symmetrically with respect to the central axis C of the fluid ejection orifice 28 in the yarn running space 25, and the flow of the fluid interlaces the yarn Y. In the arrangement where the yarn insertion gap 30 is along a direction crossing the central axis C, however, air entering into the yarn running space 25 through the yarn insertion gap 30 may break the symmetry of the flow, and this tends to increase the degree of deterioration in the interlacing capability. In such a case, the configuration of the present embodiment, that is, to provide the cover member 40 configured to cover the yarn insertion gaps 30, is particularly effective.

[0048] In the present embodiment, the cover member 40 is configured to be movable between: the first position at which the cover member 40 covers the yarn insertion gaps 30; and the second position at which the open space S is created between the cover member 40 and the interlacing portion 21 and the yarns Y are insertable into the yarn insertion gaps 30 through the open space S. In the above arrangement, the yarns Y are easily insertable into the yarn insertion gaps 30 by moving the cover member 40 from the first position to the second position. This enables rapid yarn threading to the interlacing device 5.

[0049] In the present embodiment, the interlacing portion 21 is structured by the plurality of interlacing pieces 24 lined up in the arrangement direction orthogonal to the yarn running direction, the interlacing pieces 24 being shaped to provide the yarn running spaces 25 and the fluid ejection orifices 28; and the device is configured to interlace the yarns Y running through the yarn running spaces 25. With respect to the interlacing device 5 for multiple yarns Y, it is possible to improve the capability of interlacing the multiple yarns Y by providing the cover member 40 configured to cover the entire area of the interlacing portion 21. For example, reference is made to the above-mentioned Patent Literature 3, in which the yarn insertion gap is closed by the closure member. If this configuration is applied to the interlacing device for multiple yarns, a plurality of closure members have to be provided, which greatly increases the cost. In this regard, however, in the present embodiment, it is only required to provide the single cover member 40, and therefore the cost of the structure is effectively lowered.

[0050] In the present embodiment, each yarn insertion gap 30 is formed between the corresponding two interlacing pieces 24 adjacent to each other in the arrangement direction. This arrangement eliminates the necessity of conducting cutting processing or the like to form the yarn insertion gaps 30 inside the interlacing pieces 24, and therefore the interlacing pieces 24 can be easily produced.

[0051] In the present embodiment, each yarn running space 25 is formed by combining the first space 26 of one of the corresponding two interlacing pieces 24 adjacent to each other in the arrangement direction with the second space 27 of the other of the two interlacing pieces 24. During the interlacing process, the yarns Y moving around in the yarn running spaces 25 come into contact with the inner circumferential surfaces of the yarn running spaces 25. Because of this, in some cases, the inner circumferential surfaces undergo processing such as polishing to make the surfaces resistant to the contact with the yarns Y. In such a case, the first space 26 and the second space 27 of the two interlacing pieces 24 of

the above arrangement are exposed to the outside before the interlacing pieces 24 are lined up so as to be adjacent to one another. This allows the inner circumferential surfaces of the first space 26 and second space 27 to easily undergo processing such as polishing.

(Other Embodiments)

[0052] The following will describe modifications of the above-described embodiment.

[0053] In the above-described embodiment, the interlacing device 5 is for multiple yarns Y and is configured to interlace multiple yarns Y. However, the interlacing device 5 may be a device for a single yarn, which is configured to interlace a single yarn Y.

[0054] In the above-described embodiment, the cover member 40 includes the lid portion 41 and the yarn restricting portions 42. However, the yarn restricting portions 42 do not have to be provided, as long as the cover member 40 is configured so that one or more slack yarns Y do not come out through the yarn insertion gaps 30. Furthermore, the cover member 40 does not have to be separated from the interlacing portion 21. A part of the cover member 40 may be in contact with the interlacing portion 21 as long as an arrangement is made to prevent one or more yarns Y from being caught between the cover member 40 and the interlacing portion 21. Furthermore, the lid portion 41 may be shaped so as to match with the chevron shape of the leading end portions of the interlacing pieces 24. Still further, the lid portion 41 and the yarn restricting portions 42 may be individual members, instead of formed unitarily as one piece.

[0055] In the above-described embodiment, each yarn running space 25 has a shape symmetrical with respect to the central axis C of the corresponding fluid ejection orifice 28, and each yarn insertion gap 30 is along a direction crossing the central axis C of the corresponding fluid ejection orifice 28. However, the shapes of the yarn running spaces 25, fluid ejection orifices 28, and yarn insertion gaps 30, and their relative positional relationship are not limited to those described in the embodiment.

[0056] In the above-described embodiment, the cover member 40 is configured to be movable between the first position and the second position. However, the cover member 40 does not have to be configured to be movable. The cover member 40 may be detachably attached at least to the interlacing portion 21. For example, the cover member 40 may be detachably bolted to the interlacing portion 21, or may be detachably fitted to the interlacing portion 21 with the use of the elasticity of the material of the cover member 40.

[0057] In the above-described embodiment, each yarn insertion gap 30 is formed between the corresponding two interlacing pieces 24 adjacent to each other in the arrangement direction. However, each yarn insertion gap 30 may be disposed in corresponding one of the interlacing pieces 24.

[0058] In the above-described embodiment, each yarn running space 25 is formed by combining the first space 26 of one of the corresponding two interlacing pieces 24 adjacent to each other in the arrangement direction with the second space 27 of the other of the two interlacing pieces 24. In this regard, however, the configuration of an interlacing portion 51 shown in FIG. 7 is also possible. In the interlacing portion 51, each yarn running space 55 is disposed in corresponding one of interlacing pieces 54. The following will describe the structure of the interlacing portion 51.

[0059] The interlacing portion 51 is structured by interlacing pieces 54 lined up in the arrangement direction so as to be adjacent to one another. In each interlacing piece 54, there is a yarn running space 55 passing through the interlacing piece 54 in the yarn running direction. The cross sectional shape of the yarn running space 55 is elliptical with its longer axis extending in the height direction. In this regard, however, each yarn running space 55 may have another cross sectional shape. To the left of each yarn running space 55, there is a yarn insertion space 56 extending throughout the interlacing piece 54 in the yarn running direction. The yarn insertion space 56 is positioned at a level of a middle portion of the yarn running space 55 in the height direction. A right end portion of the yarn insertion space 56 communicates with the yarn running space 55.

[0060] At a right end portion of each interlacing piece 54, there is a fluid ejection orifice 58 from which fluid is ejected to the yarn running space 55 of its adjacent interlacing piece 54 on the right. The fluid ejection orifice 58 is positioned at a middle portion of the interlacing piece 54 in the yarn running direction, and is substantially level with the yarn insertion space 56 in the height direction. A right end portion of each fluid ejection orifice 58 communicates with the corresponding yarn insertion space 56, and a left end portion of each fluid ejection orifice 58 communicates with a fluid supply hole 59. The fluid supply hole 59 is disposed in the interlacing piece 54 and is along the height direction. The fluid supply hole 59 communicates with a fluid passage 39 provided in the base 23. Fluid supplied from an unillustrated fluid supply source passes through the fluid passage 39 and each fluid supply hole 59, and then the fluid is ejected to each yarn running space 55 through the corresponding fluid ejection orifice 58 and through the corresponding yarn insertion space 56.

[0061] A left surface of each interlacing piece 54 includes a leading-end-side portion (upper portion in FIG. 7), which is on the leading end side relative to its yarn insertion space 56, and a base-end-side portion (lower portion in FIG. 7), which is on the base end side relative to the yarn insertion space 56. The leading-end-side portion of the left surface is positioned slightly to the right relative to the base-end-side portion of the left surface. Meanwhile, the right surface of the interlacing piece 24 is a flat surface. Due to this structure, bringing two interlacing pieces 54 into contact with each other so as to be adjacent to each other in the arrangement direction forms

a yarn insertion gap 60 between the two interlacing pieces 54. Because the yarn insertion gap 60 communicates with the corresponding yarn running space 55 through the corresponding yarn insertion space 56, the yarn Y is insertable into the yarn running space 55 through the yarn insertion gap 60. With respect to the interlacing portion 51 structured as above, the cover member 40 configured to cover the yarn insertion gaps 60 may be provided similarly to the above-described embodiment, and this makes it possible to improve the interlacing capability.

Claims

1. An interlacing device comprising
an interlacing portion including: a yarn running space which is along a yarn running direction; and a fluid ejection orifice from which fluid is ejected to the yarn running space, the interlacing device being configured to interlace a yarn running through the yarn running space by fluid ejected from the fluid ejection orifice, wherein:

   the interlacing portion includes a yarn insertion gap through which the yarn is inserted into the yarn running space; and
   a cover member configured to cover the yarn insertion gap is disposed at a position separated from the yarn running space.

2. The interlacing device according to claim 1, wherein the cover member includes a flat lid portion configured to cover the yarn insertion gap at a position separated from the interlacing portion.

3. The interlacing device according to claim 2, wherein the cover member further includes yarn restricting portions respectively disposed outward of both end faces of the interlacing portion in the yarn running direction, each yarn restricting portion being provided so as to partially overlap the interlacing portion when viewed from the yarn running direction.

4. The interlacing device according to any one of claims 1 to 3, wherein in a cross section orthogonal to the yarn running direction, the yarn running space has a shape symmetrical with respect to a central axis of the fluid ejection orifice, and the yarn insertion gap is along a direction crossing the central axis of the fluid ejection orifice.

5. The interlacing device according to any one of claims 1 to 4, wherein the cover member is configured to be movable between: a first position at which the cover member covers the yarn insertion gap; and a second position at which an open space is created between the cover member and the interlacing portion and the yarn is insertable into the yarn insertion gap through the open space.

6. The interlacing device according to any one of claims 1 to 5, wherein:
the yarn running space includes a plurality of yarn running spaces and the fluid ejection orifice includes a plurality of fluid ejection orifices, and the interlacing portion is structured by a plurality of interlacing pieces lined up in an arrangement direction orthogonal to the yarn running direction, the interlacing pieces being shaped to provide the yarn running spaces and the fluid ejection orifices; and the interlacing device is configured to interlace a plurality of yarns running through the yarn running spaces.

7. The interlacing device according to claim 6, wherein the yarn insertion gap is formed between two adjacent interlacing pieces of the interlacing pieces, which are adjacent to each other in the arrangement direction.

8. The interlacing device according to claim 6 or 7, wherein each yarn running space is formed by combining a first space of one of the corresponding two interlacing pieces adjacent to each other in the arrangement direction with a second space of the other of the two interlacing pieces.

FIG.1

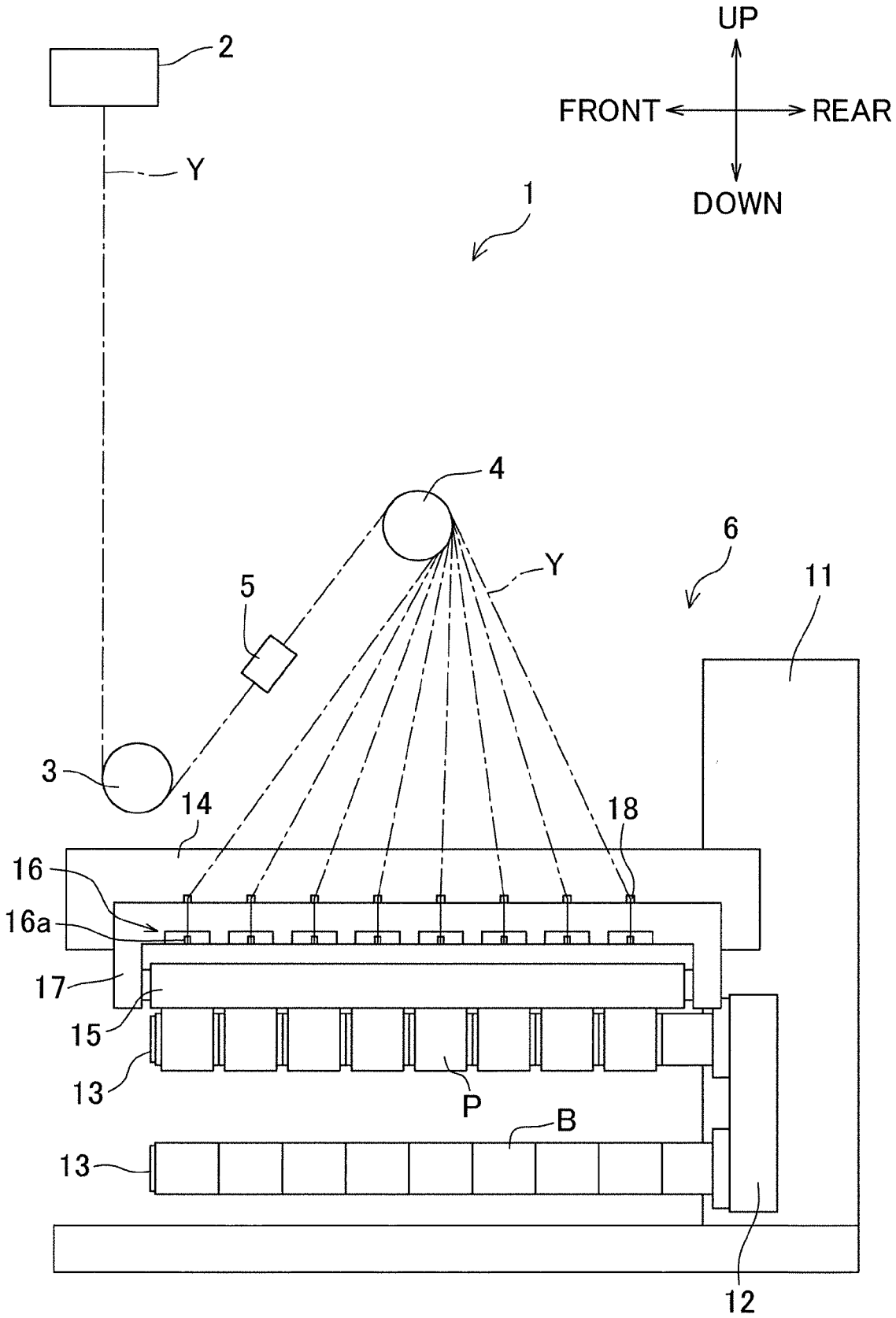
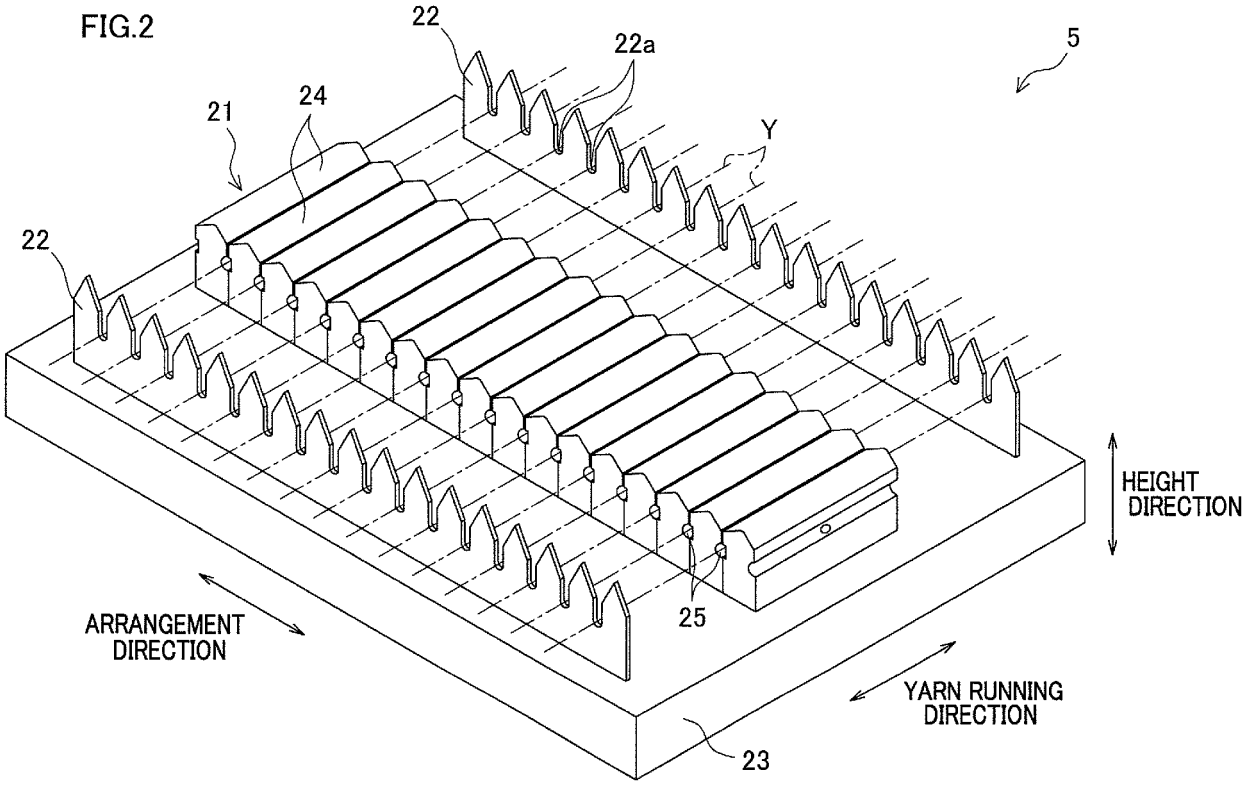


FIG.2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Y
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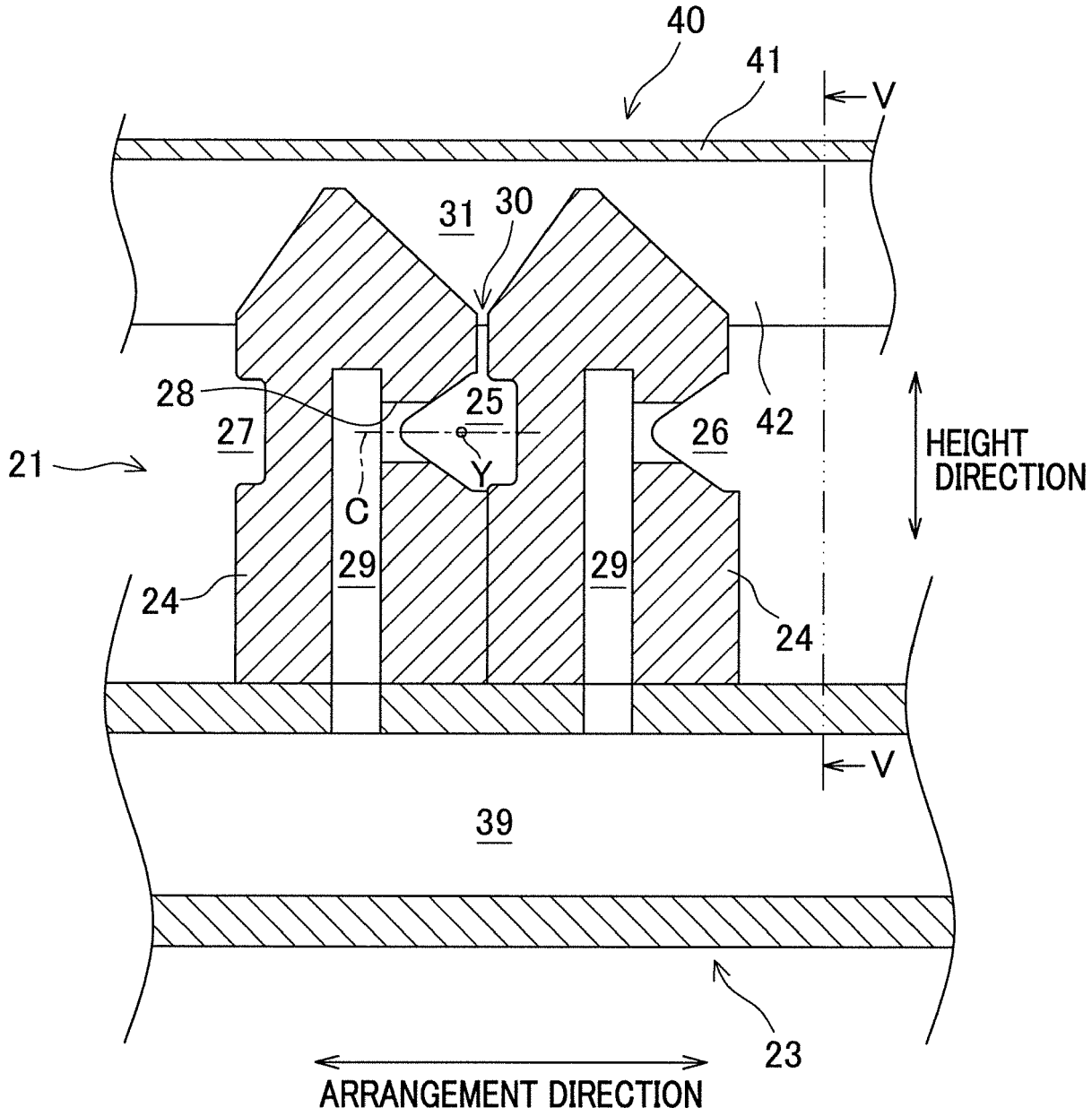
HEIGHT
DIRECTION
ARRANGEMENT
DIRECTION
25
YARN RUNNING
DIRECTION
23

FIG.3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V
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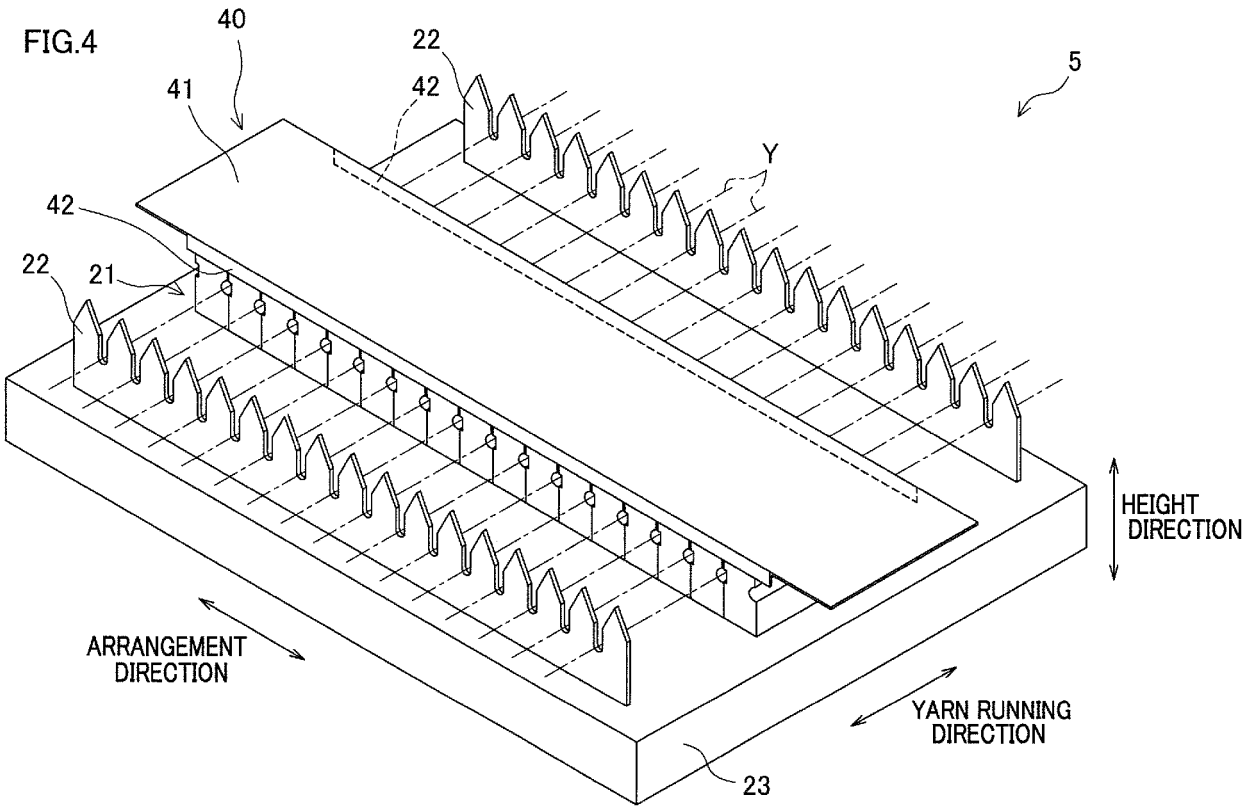
ARRANGEMENT DIRECTION

FIG.4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HEIGHT DIRECTION
ARRANGEMENT DIRECTION
YARN RUNNING DIRECTION
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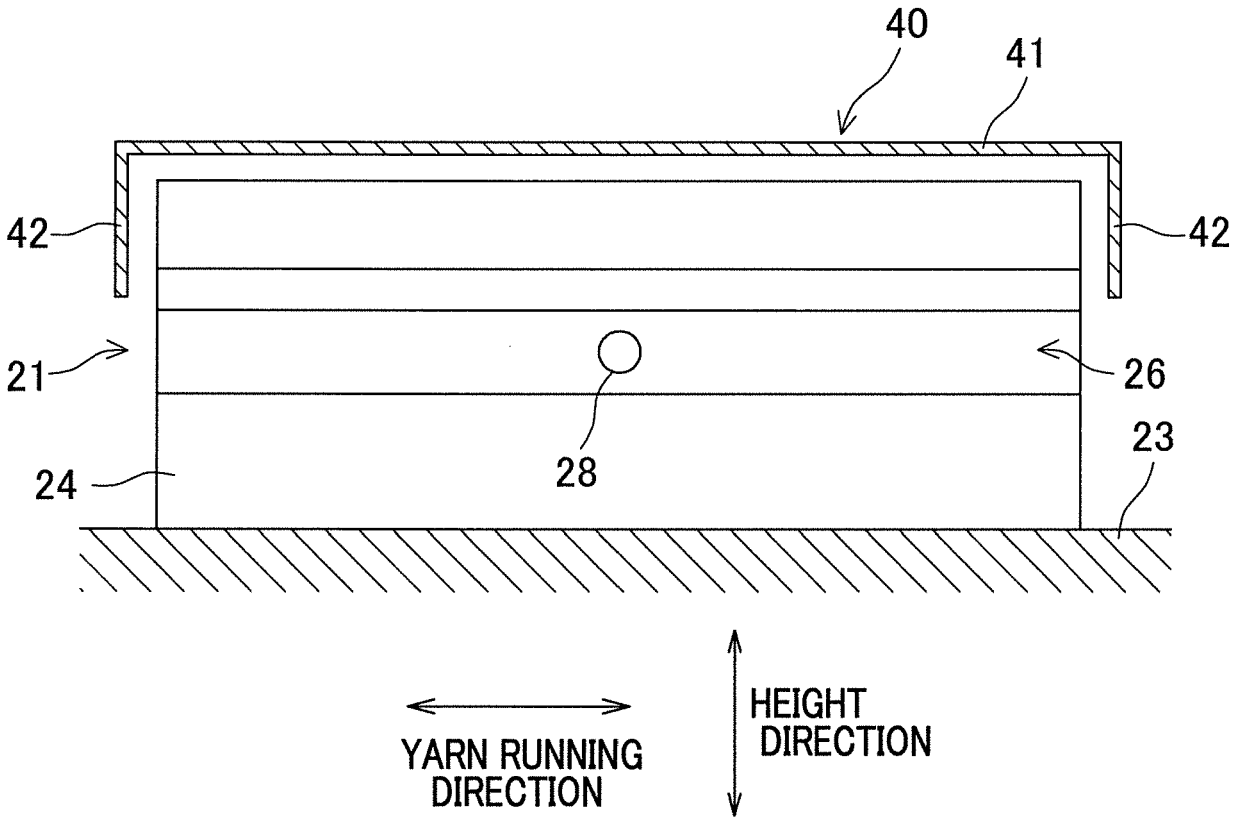
FIG.5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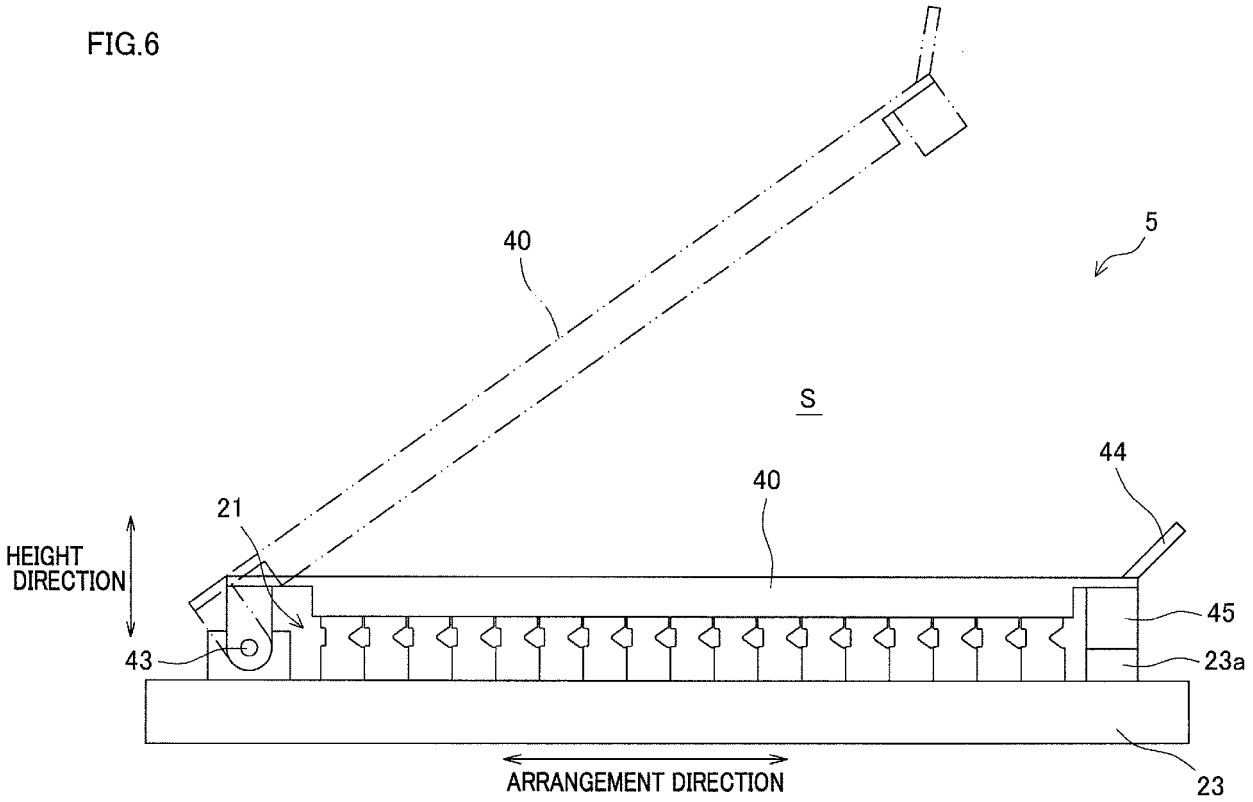
YARN RUNNING DIRECTION
HEIGHT DIRECTION

FIG.6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ARRANGEMENT DIRECTION
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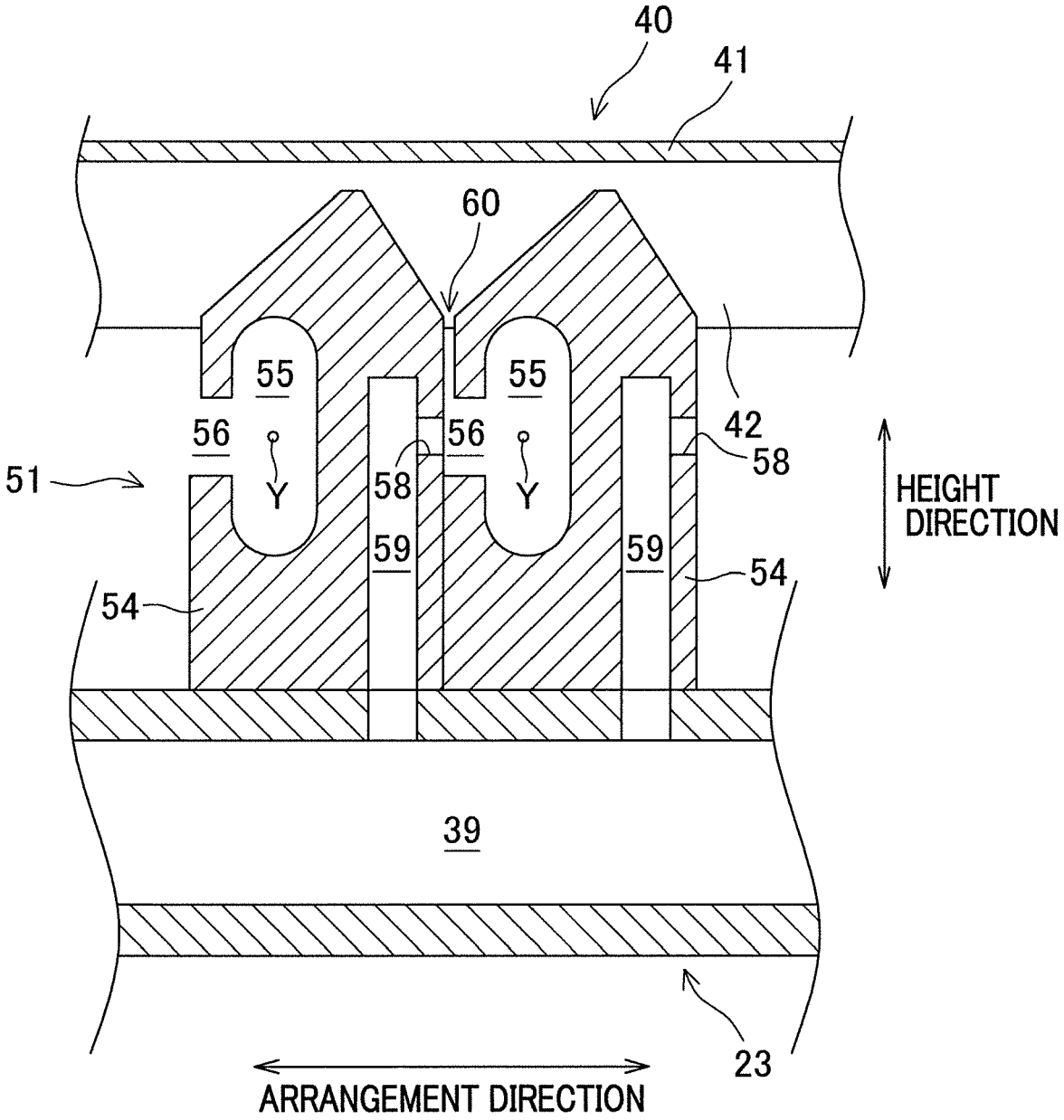
FIG.7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ARRANGEMENT DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 18 18 0367

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 1 463 238 A (SCHWARZA CHEMIEFASER) 2 February 1977 (1977-02-02) * page 2, lines 10-52; claim 6; figures 1,2,3 * -----	1,2,4,5 3,6-8	INV. D02J1/08
X	CN 201 530 898 U (YAN CHEN) 21 July 2010 (2010-07-21) * paragraph [0006]; figures 1-4 * -----	1,2,5	
Y	US 2010/257710 A1 (STUENDL MATHIAS [DE] ET AL) 14 October 2010 (2010-10-14) * paragraphs [0024], [0035], [0036], [0037]; figures 5,6 * -----	3	
Y,D A	EP 3 064 624 A1 (TMT MACHINERY INC [JP]) 7 September 2016 (2016-09-07) * paragraphs [0029] - [0035]; figure 3 * -----	6-8 1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			D02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 November 2018	Van Beurden-Hopkins

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22-11-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1463238 A	02-02-1977	BG 22604 A1	20-04-1977
		CS 177629 B1	31-08-1977
		DD 129272 A3	11-01-1978
		DE 2515471 A1	06-11-1975
		FR 2268881 A1	21-11-1975
		GB 1463238 A	02-02-1977
		RO 71832 A	30-04-1981
CN 201530898 U	21-07-2010	NONE	
US 2010257710 A1	14-10-2010	AT 524585 T	15-09-2011
		CN 101765683 A	30-06-2010
		EP 2179084 A2	28-04-2010
		JP 5091317 B2	05-12-2012
		JP 2010534284 A	04-11-2010
		KR 20100051054 A	14-05-2010
		US 2010257710 A1	14-10-2010
		WO 2009013107 A2	29-01-2009
EP 3064624 A1	07-09-2016	CN 105937075 A	14-09-2016
		EP 3064624 A1	07-09-2016
		JP 2016160550 A	05-09-2016

EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016160550 A **[0002]**
- JP 2009133018 A **[0003]**
- DE 10038855 A1 **[0003]**