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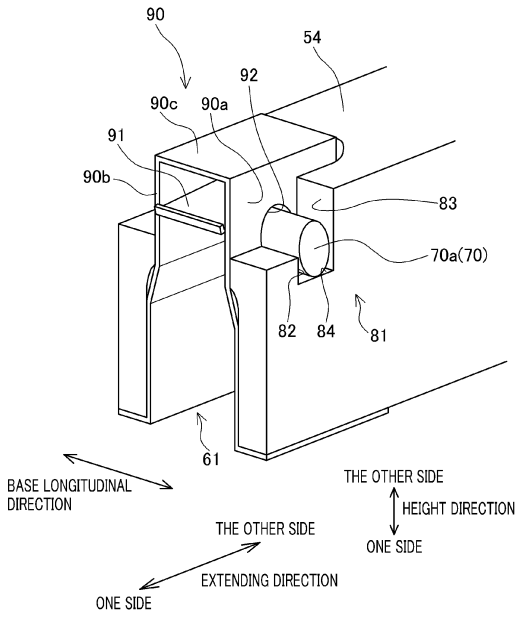
(54) YARN HEATER

(57) An object of the present invention is to easily and accurately provide a yarn guide so that the contact length of a yarn in contact with a yarn contacted surface is appropriate.

A first heater 13 includes: a heat source 51; a yarn contacted portion 54 which is heated by the heat source 51 and has a yarn running space 61 extending in a yarn running direction in which a yarn Y runs and a yarn contacted surface 56 with which the yarn Y running in the yarn running space 61 is able to make contact; and a yarn guide 70 which guides the yarn Y running in the yarn running space 61. The yarn guide 70 is attached to the yarn contacted portion 54.

FIG.7



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a heater configured to heat a yarn.

[0002] A known false-twist texturing machine is provided with a contact-type heater configured to heat a yarn by allowing the yarn to make contact with a yarn contacted portion whose temperature is high. For example, Patent Literature 1 (Japanese Laid-Open Patent Publication No. H9-296330) discloses a contact-type heater (secondary heater in Patent Literature 1) which includes a heat source and a yarn contacted portion (heat transmitter in Patent Literature 1) and in which a yarn running space is provided. The yarn contacted portion has a yarn contacted surface with which a running yarn makes contact. The yarn contacted surface extends in a yarn running direction in which the yarn runs, and heat generated by the heat source is transmitted from the yarn contacted surface to the yarn through the yarn contacted portion.

[0003] In the heater of Patent Literature 1, a yarn guide is provided to guide the yarn at a yarn inlet of the yarn running space. The yarn introduced into the yarn running space from the yarn inlet is guided by the yarn guide so as to make contact with the yarn contacted surface of the yarn contacted portion.

SUMMARY OF THE INVENTION

[0004] The contact length, which is the length of the yarn guided by the yarn guide while being in contact with the yarn contacted surface, may be too long or too short depending on a position of the yarn guide. In this case, the yarn may not be properly heated and yarn quality may be deteriorated. Therefore, the yarn guide needs to be provided at a position where the yarn guide is able to guide the yarn so that the yarn properly makes contact with the yarn contacted surface.

[0005] However, when the position of the yarn guide slightly deviates, the contact length of the yarn may significantly vary. It is therefore necessary to accurately provide the yarn guide so that the contact length of the yarn is appropriate. In a typical heater, however, a yarn guide tends to be provided in a housing of the heater, etc. In this case, plural members are interposed between the yarn guide and a yarn contacted portion. Because each member may have a manufacturing error or an assembling error, it is difficult to accurately provide the yarn guide in the yarn contacted portion. In this regard, an operator may adjust the position of the yarn guide by using a tool. However, this is very troublesome for the operator.

[0006] An object of the present invention is to provide a heater in which a yarn guide is easily and accurately provided so that the length of a yarn in contact with a yarn contacted surface is appropriate.

[Solution to Problem]

[0007] A heater of the present invention includes: a heat source; a yarn contacted portion which is heated by the heat source and has a yarn running space extending in a yarn running direction in which a yarn runs and a yarn contacted surface with which the yarn running in the yarn running space is able to make contact; and at least one yarn guide which guides the yarn running in the yarn running space. The at least one yarn guide is attached to the yarn contacted portion.

[0008] According to the present invention, the at least one yarn guide is attached to the yarn contacted portion. With this arrangement, the at least one yarn guide is integrated with the yarn contacted portion. It is therefore possible to omit members interposed between the at least one yarn guide and the yarn contacted portion, or to significantly decrease the number of these members. This suppresses the influence of manufacturing or assembling errors of these members. The at least one yarn guide is therefore provided easily and accurately so that the length of the yarn in contact with the yarn contacted surface (hereinafter, this length will be referred to as contact length) is appropriate.

[0009] In the heater of the present invention, preferably, the at least one yarn guide is attached directly to the yarn contacted portion.

[0010] According to the present invention, the members interposed between the at least one yarn guide and the yarn contacted portion are omitted. This prevents the influence of the manufacturing or assembling errors of these members. As a result, the at least one yarn guide is further accurately provided so that the contact length of the yarn in contact with the yarn contacted surface is appropriate.

[0011] In the heater of the present invention, preferably, the yarn contacted portion is provided with a positioning portion configured to determine where the at least one yarn guide is positioned.

[0012] According to the present invention, where the at least one yarn guide is positioned is defined by the positioning portion. It is therefore possible to further easily provide the at least one yarn guide at a position where the contact length of the yarn in contact with the yarn contacted surface is appropriate.

[0013] In the heater of the present invention, preferably, the positioning portion includes a regulatory portion configured to regulate movement of the at least one yarn guide in the yarn running direction.

[0014] According to the present invention, the at least one yarn guide attached to the yarn contacted portion is prevented from being significantly deviated in the yarn running direction. It is therefore possible to reduce the difference between (i) the contact length of the yarn in contact with the yarn contacted surface and (ii) an appropriate length. In this regard, the yarn is guided by the at least one yarn guide.

[0015] In the heater of the present invention, prefera-

bly, the regulatory portion is a pair of wall portions provided to be spaced apart from each other in the yarn running direction, and the at least one yarn guide is provided between the pair of the wall portions.

[0016] According to the present invention, the movement of the at least one yarn guide toward both sides in the yarn running direction is regulated by the pair of the wall portions. It is therefore possible to further reliably prevent the at least one yarn guide from being significantly deviated in the yarn running direction. This further reduces the difference between (i) the contact length of the yarn in contact with the yarn contacted surface and (ii) an appropriate length. In this regard, the yarn is guided by the at least one yarn guide.

[0017] In the heater of the present invention, preferably, a gap between the pair of the wall portions in the yarn running direction is larger than the maximum size of each of the at least one yarn guide in the yarn running direction.

[0018] According to the present invention, even when the maximum size of the at least one yarn guide in the yarn running direction varies because of the manufacturing errors, the at least one yarn guide is reliably provided between the at least one pair of the wall portions.

[0019] In the heater of the present invention, preferably, the positioning portion further includes: a contact part with which the at least one yarn guide makes contact with; and a pressing unit configured to press the at least one yarn guide onto the contact part, and the pressing unit is configured to press the at least one yarn guide onto the contact part in an opposite direction from a first direction in which the yarn is pressed onto the yarn contacted surface.

[0020] The force of tension of the yarn acts in the first direction. Therefore, because of the tension of the yarn, the at least one yarn guide in contact with the yarn moves away from the contact part. According to the present invention, the pressing unit is configured to press the at least one yarn guide onto the contact part in the opposite direction. With this arrangement, the at least one yarn guide is prevented from moving away from the contact part. It is therefore possible to reliably guide the yarn by means of the at least one yarn guide.

[0021] In the heater of the present invention, preferably, the pressing unit is a plate spring.

[0022] According to the present invention, the at least one yarn guide is prevented from moving away from the contact part with a simple structure.

[0023] In the heater of the present invention, preferably, the at least one yarn guide is provided outside one of edge points of the yarn contacted surface in the yarn running direction.

[0024] According to the present invention, the yarn is guided by the at least one yarn guide provided outside the one of the edge points of the yarn contacted surface in the yarn running direction. Because of this, the contact length of the yarn in contact with the yarn contacted surface is maximized. It is therefore possible to suppress the heating of the yarn from being insufficient.

[0025] In the heater of the present invention, preferably, yarn guides include a first yarn guide provided outside one of the edge points of the yarn contacted surface on one side in the yarn running direction and a second yarn guide provided outside the other of the edge points of the yarn contacted surface on the other side in the yarn running direction.

[0026] According to the present invention, the yarn is guided by (i) the first yarn guide provided outside the one of the edge points of the yarn contacted surface on the one side in the yarn running direction and (ii) the second yarn guide provided outside the other of the edge points of the yarn contacted surface on the other side in the yarn running direction. Because of this, the contact length of the yarn in contact with the yarn contacted surface is further reliably maximized. It is therefore possible to further suppress the heating of the yarn from being insufficient.

[0027] In the heater of the present invention, preferably, the yarn contacted surface is curved to protrude toward a side on which the yarn running space is provided in a cross section taken along the yarn running direction and, when a contact point between the yarn and each of the yarn guides is viewed in an orthogonal direction orthogonal to the cross section taken along the yarn running direction, the contact point between the yarn and each of the yarn guides is on the side on which the yarn running space is provided as compared to a tangent at each of the edge points of the yarn contacted surface in the yarn running direction.

[0028] The yarn tends to be worn by making contact with the edge points of the yarn contacted surface. According to the present invention, the yarn guided by the yarn guides is lifted up from the edge points. It is therefore possible to allow the yarn to make contact with the yarn contacted surface from an intermediate part of the yarn contacted surface. With this arrangement, the yarn guided while passing the contact point of each of the yarn guides is avoided from making contact with the edge points of the yarn contacted surface. This suppresses the wearing of the yarn.

[0029] In the heater of the present invention, preferably, the yarn guides are attachable to and detachable from the yarn contacted portion.

[0030] This facilitates the replacement of each of the yarn guides which is deteriorated because of continuous contact with the yarn.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

FIG. 1 is a profile of a false-twist texturing machine of an embodiment.

FIG. 2 is a schematic diagram of the false-twist texturing machine, expanded along paths of yarns.

FIG. 3 illustrates a first heater.

FIG. 4 is a cross section taken along a line IV-IV in FIG. 3.

FIG. 5 shows a surface of the first heater, which extends along a line V-V in FIG. 3.

FIG. 6 is a cross section taken along a line VI-VI in FIG. 4.

FIG. 7 is a perspective view of a part of a yarn contacted portion, to which a yarn guide is attached.

FIG. 8 shows FIG. 7 in a base longitudinal direction.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of False-Twist Texturing Machine)

[0033] FIG. 1 is a profile showing the overall structure of a false-twist texturing machine 1 of the present embodiment. Hereinafter, a vertical direction to the sheet of FIG. 1 is defined as a base longitudinal direction, and a left-right direction to the sheet is defined as a base width direction. A direction orthogonal to the base longitudinal direction and the base width direction is defined as an up-down direction (vertical direction) in which the gravity acts. In this regard, the base longitudinal direction and the base width direction are substantially in parallel to a horizontal direction. These definitions of the directions will be suitably used hereinbelow.

[0034] The false-twist texturing machine 1 is able to perform false twisting of yarns Y (i.e., false-twist the yarns Y) made of, e.g., synthetic fibers such as nylon (polyamide fibers) . The false-twist texturing machine 1 includes a yarn supplying unit 2 provided for supplying yarns Y, a processing unit 3 configured to false-twist the yarns Y supplied from the supplying unit 2, and a winding unit 4 configured to wind the yarns Y processed by the processing unit 3 onto bobbins Bw. The yarn supplying unit 2, the processing unit 3, and the winding unit 4 include structural elements, and the structural elements are provided to form plural lines in a base longitudinal direction orthogonal to a yarn running surface (surface orthogonal to the direction in which FIG. 1 is viewed) in which yarn paths are provided to extend from the yarn supplying unit 2 to the winding unit 4 via the processing unit 3.

[0035] The yarn supplying unit 2 includes a creel stand 7 retaining yarn supply packages Ps, and is configured to supply the yarns Y to the processing unit 3. In the processing unit 3, the following members are placed in this order from the upstream side in a yarn running direction in which the yarns Y run: each first feed roller 11; each twist-stopping guide 12; each first heater 13 (heater of the present invention); each cooler 14; each false-twisting device 15; each second feed roller 16; each interlacing device 17; each third feed roller 18; each second heater 19; and each fourth feed roller 20. The winding unit 4 is configured to wind the yarns Y for which the false winding has been performed by the processing unit 3 onto the bobbins Bw by means of winding devices 21, so as to form wound packages Pw.

[0036] The false-twist texturing machine 1 further includes a main base 8 and a winding base 9 which are spaced apart from each other in the base width direction. The main base 8 and the winding base 9 are provided to extend in a substantially same length in the base longitudinal direction, and provided to oppose each other. An upper part of the main base 8 is connected to an upper part of the winding base 9 by a supporting frame 10. Each device forming the processing unit 3 is mainly attached to the main base 8 or the supporting frame 10. The main base 8, the winding base 9, and the supporting frame 10 form a working space 22 in which an operator performs an operation such as yarn threading to each device. The yarn paths are formed so that the yarns Y mainly run around the working space 22.

[0037] The false-twist texturing machine 1 includes units which are termed spans each including a pair of the main base 8 and the winding base 9 provided to oppose each other. In one span, each device is provided so that the yarns Y running while being aligned in the base longitudinal direction can be simultaneously false-twisted. For example, sixteen winding devices 21 provided to form four rows and four columns are provided in the winding base 9 included in one span. In the false-twist texturing machine 1, the spans are provided in a left-right symmetrical manner to the sheet of FIG. 1, with a center line C of the base width direction of the main base 8 as a symmetry axis (i.e., the main base 8 is shared between the left span and the right span). Furthermore, these spans are aligned in the base longitudinal direction.

(Processing Unit)

[0038] The following will describe the structure of the processing unit 3 with reference to FIG. 1 and FIG. 2. Each first feed roller 11 is configured to unwind a yarn Y from one yarn supply package Ps attached to the yarn supplying unit 2, and to send the yarn Y to one first heater 13. Each first feed roller 11 is provided above the winding base 9 (see FIG. 1). For example, each first feed roller 11 is configured to send a single yarn Y to the first heater 13 as shown in FIG. 2. Alternatively, each first feed roller 11 may be able to send plural adjacent yarns Y to the downstream side in the yarn running direction.

[0039] Each twist-stopping guide 12 prevents twisting which is applied to a yarn Y by one later-described false-twisting device 15 from being propagated to the upstream of each twist-stopping guide 12 in the yarn running direction. Each twist-stopping guide 12 is provided downstream of one first feed roller 11 in the yarn running direction, and provided upstream of one first heater 13 in the yarn running direction. For example, as shown in FIG. 2, the twist-stopping guides 12 are provided for the respective yarns Y supplied from the yarn supplying unit 2. Furthermore, the twist-stopping guides 12 are aligned in the base longitudinal direction.

[0040] Each first heater 13 is configured to heat yarns Y sent from some first feed rollers 11 to a predetermined processing temperature, and provided at the supporting frame 10 (see FIG. 1). As shown in FIG. 2, each first heater 13 is able to heat, e.g., two yarns Y. Each first heater 13 will be detailed later.

[0041] Each cooler 14 is configured to heat one yarn Y heated by the first heater 13. Each cooler 14 is provided downstream of the first heater 13 in the yarn running direction, and provided upstream of one false-twisting device 15 in the yarn running direction. As shown in FIG. 2, each cooler 14 is configured to heat, e.g., a single yarn Y. Furthermore, the coolers 14 are aligned in the base longitudinal direction. Alternatively, each cooler 14 may be able to simultaneously cool plural yarns Y.

[0042] Each false-twisting device 15 is configured to twist one yarn Y. Each false-twisting device 15 is provided directly downstream of one cooler 14 in the yarn running direction. As shown in FIG. 2, each false-twisting device 15 is configured to twist, e.g., a single yarn Y. Furthermore, the false-twisting devices 15 are aligned in the base longitudinal direction. For example, sixteen false-twisting devices 15 are provided for one span.

[0043] Each second feed roller 16 is configured to send a yarn Y twisted by one false-twisting device 15 toward one interlacing device 17. Each second feed roller 16 is provided downstream of the false-twisting device 15 in the yarn running direction at the main base 8. The conveyance speed of conveying the yarn Y by each second feed roller 16 is higher than the conveyance speed of conveying the yarn Y by each first feed roller 11. The yarn Y is therefore drawn between the first feed roller 11 and the second feed roller 16.

[0044] Each interlacing device 17 is configured to interlace one yarn Y by injecting air thereto. Each interlacing device 17 is provided below one second feed roller 16 at the main base 8.

[0045] Each third feed roller 18 is configured to send a yarn Y interlaced by one interlacing device 17 toward the second heater 19. Each third feed roller 18 is provided below the interlacing device 17 at the main base 8. The conveyance speed of conveying the yarn Y by each third feed roller 18 is lower than the conveyance speed of conveying the yarn Y by each second feed roller 16. The yarn Y is therefore relaxed between the second feed roller 16 and the third feed roller 18.

[0046] The second heater 19 is configured to heat yarns Y supplied from some third feed rollers 18. The second heater 19 is provided below the third feed rollers 18 at the main base 8. As shown in FIG. 1, the second heater 19 extends along the up-down direction. A single second heater 19 is provided for each span. Furthermore, the second heater 19 extends along the base longitudinal direction as shown in FIG. 2 and is able to simultaneously heat plural yarns Y.

[0047] Each fourth feed roller 20 is configured to send one yarn Y thermally treated by the second heater 19 toward one winding device 21. Each fourth feed roller 20 is provided at a lower part of the winding base 9. The conveyance speed of conveying the yarn Y by each fourth feed roller 20 is lower than the conveyance speed of conveying the yarn Y by each third feed roller 18. The yarn Y is therefore relaxed between the third feed roller 18 and the fourth feed roller 20.

[0048] In the processing unit 3 arranged as described above, each yarn Y drawn between the first feed roller 11 and the second feed roller 16 is twisted by the false-twisting device 15. The twist formed by the false-twisting device 15 is propagated to the twist-stopping guide 12, but is not propagated to the upstream side in the yarn running direction of the twist-stopping guide 12. The yarn Y which is twisted and drawn is heated by the first heater 13 to be thermally set. After that, the yarn Y is cooled by the cooler 14. The yarn Y is untwisted at the downstream of the false-twisting device 15. However, each filament is maintained to be wavy in shape on account of the thermal setting described above. After being false-twisted by the false-twisting device 15, the yarn Y is interlaced by the interlacing device 17 while being relaxed between the second feed roller 16 and the third feed roller 18. The yarn Y is then guided to the downstream side in the yarn running direction. Subsequently, the yarn Y is thermally set by the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y sent from the fourth feed roller 20 is wound by the winding device 21, so as to form a wound package Pw.

(Winding Unit)

[0049] The following will describe the winding unit 4 with reference to FIG. 2. The winding unit 4 includes plural winding devices 21. Each winding device 21 is able to wind one yarn Y onto one bobbin Bw. The winding device 21 includes a fulcrum guide 41, a traverse unit 42, and a cradle 43. The fulcrum guide 41 is a guide functioning as a fulcrum when the yarn Y is traversed. The traverse unit 42 is able to traverse the yarn Y by means of a traverse guide 45. The cradle 43 is configured to rotatably support the bobbin Bw. A contact roller 46 is provided in the vicinity of the cradle 43. The contact roller 46 is configured to make contact with a surface of one wound package Pw so as to apply a contact pressure to the surface of the wound package Pw. In the winding unit 4 arranged as described above, the yarn Y which is sent from the fourth feed roller 20 described above is wound onto the bobbin Bw by each winding device 21 so as to form the wound package Pw.

(First Heater)

[0050] The following will detail each first heater 13 with reference to FIG. 3 to FIG. 8. FIG. 3 illustrates one first heater 13 viewed in the base longitudinal direction. In FIG. 3, a direction in which the first heater 13 extends (hereinafter, this direction will be referred to as the ex-

tending direction) is the left-right direction of the sheet. In the present embodiment, the yarn running direction is substantially identical with the extending direction. FIG. 4 is a cross section taken along a line IV-IV in FIG. 3. FIG. 5 shows a surface of the first heater 13, which extends along the extending direction. FIG. 6 is a cross section taken along a line VI-VI in FIG. 4. FIG. 7 is a perspective view of a part of one yarn contacted portion 54, to which a yarn guide 70 is attached. FIG. 8 shows FIG. 7 in the base longitudinal direction. A direction orthogonal to both the base longitudinal direction and the extending direction is defined as a height direction (see FIG. 3, etc.). In the present embodiment, the left side of the sheet of each of FIG. 3 and FIG. 6 is defined as one side in the extending direction, and the right side of the sheet is defined as the other side in the extending direction. In this regard, for example, one side in the extending direction may be the upstream side in the yarn running direction. However, the disclosure is not limited to this. In the present embodiment, the lower side of the sheet of FIG. 4 is defined as one side in the height direction, and the upper side of the sheet is defined as the other side in the height direction.

[0051] The first heater 13 is configured to heat at least one running yarn Y. In the present embodiment, the first heater 13 is able to heat, e.g., two yarns Y (see FIG. 4). The first heater 13 extends in a predetermined extending direction orthogonal to the base longitudinal direction (see FIG. 3, etc.). The first heater 13 includes a heat source 51, a heating unit 52, each yarn guide 70, and each guide fixing member 90. The first heater 13 is configured to simultaneously heat two yarns Y by allowing the running yarns Y to make contact with the heating unit 52 heated by the heat source 51.

[0052] The heat source 51 is, e.g., a known sheathed heater (electric heater). The sheathed heater includes a heating wire (such as a coil) and a pipe surrounding the heating wire. The sheathed heater is configured to generate Joule heat when an electrical current flows in the heating wire. The heat source 51 extends along the extending direction (see FIG. 3). The heat source 51 is electrically connected to a controller 100 (see FIG. 3) configured to control a heating temperature. The controller 100 is able to set the heating temperature of the first heater 13. The controller 100 is configured to control the first heater 13 based on a set value of this heating temperature. For example, the controller 100 may control the first heater 13 by taking into account: a set value of the heating temperature; and a detection result by a temperature sensor (not illustrated) configured to detect an actual temperature of the heating unit 52. The controller 100 may be electrically connected not only to the first heater 13, but also to other devices forming the false-twist texturing machine 1.

[0053] The heating unit 52 is heated by the heat generated by the heat source 51. The heating unit 52 extends in the extending direction (see FIG. 3) along the heat source 51. The heating unit 52 includes, e.g., two heating members 53 and two yarn contacted portions 54 (yarn contacted portions of the present invention). As shown in FIG. 4, two heating members 53 are provided to oppose each other over the heat source 51 in the base longitudinal direction. In this regard, two yarn contacted portions 54 are similarly provided. In the base longitudinal direction, one heating member 53 and one yarn contacted portion 54 provided on one side (the left side of the sheet of FIG. 4) are members provided for heating one of the yarns Y which is on one side. In the base longitudinal direction, the other heating member 53 and the other yarn contacted portion 54 provided on the other side (the right side of the sheet of FIG. 4) are members provided for heating the other of the yarns Y which is on the other side.

[0054] Each heating member 53 is made of a metal material such as yellow copper whose specific heat is high. Each heating member 53 extends in the extending direction along the heat source 51. As shown in FIG. 4, each heating member 53 is provided to be in contact with the heat source 51. Each heating member 53 has a slit 55 formed to extend in the extending direction. As shown in FIG. 4, each slit 55 is reverse U-shaped in a cross section orthogonal to the extending direction. Each slit 55 is open on one side in the height direction. In each slit 55, a corresponding yarn contacted portion 54 is housed.

[0055] Each yarn contacted portion 54 forms a yarn running space 61 in which a corresponding yarn Y runs and which extends in the yarn running direction. Each yarn contacted portion 54 is a long member made of, e.g., SUS. Each yarn contacted portion 54 extends in the extending direction. As shown in FIG. 4, each yarn contacted portion 54 is reverse U-shaped in the cross section orthogonal to the extending direction. As shown in FIG. 4, each yarn contacted portion 54 is housed in a corresponding slit 55. Each yarn contacted portion 54 is fixed to a corresponding heating member 53 while being in contact with the heating member 53. The temperature of each yarn contacted portion 54 is increased by the heat transmitted from the heat source 51 via the heating member 53. Each yarn contacted portion 54 is detachably attached to the heating unit 52.

[0056] Each yarn contacted portion 54 has a yarn contacted surface 56 for allowing a corresponding yarn Y to make contact therewith. Each yarn contacted surface 56 faces at least one side in the height direction. Each yarn Y running in a corresponding yarn running space 61 is pressed onto the yarn contacted surface 56 toward the other side in the height direction. In this regard, a direction toward the other side in the height direction is equivalent to a first direction of the present invention. Each yarn contacted surface 56 is gently curved (see FIG. 6) to be substantially U-shaped in a cross section orthogonal to the base longitudinal direction. That is, in a cross section orthogonal to the base longitudinal direction, each yarn contacted surface 56 is curved to protrude toward one side in the height direction, i.e., toward the side on which a corresponding yarn running space 61 is provided. In

other words, when viewed in the base longitudinal direction, each yarn contacted surface 56 is curved so that both ends of the yarn contacted surface 56 in the extending direction are on the other side in the height direction as compared to a central part of the yarn contacted surface 56 in the extending direction. In this regard, the cross section orthogonal to the base longitudinal direction is equivalent to a cross section along the yarn running direction of the present invention. Each yarn contacted surface 56 is curved to be, e.g., reverse U-shaped in a cross section orthogonal to the extending direction (see FIG. 4).

[0057] As shown in FIG. 6 and FIG. 8, an edge point 74 of the yarn contacted surface 56 on one side in the extending direction is on the other side in the extending direction as compared to one end portion of the first heater 13 on one side in the extending direction. Meanwhile, an edge point 75 of the yarn contacted surface 56 on the other side in the extending direction is on one side in the extending direction as compared to the other end portion of the first heater 13 on the other side in the extending direction. Both end portions of the yarn contacted portion 54 in the extending direction are open on both sides in the height direction.

[0058] Each yarn contacted portion 54 is provided with positioning portions 81 (see FIG. 7 and FIG. 8). Each positioning portion 81 is provided for determining a position where a corresponding yarn guide 70 is provided. The positioning portions 81 are formed at both end portions of the yarn contacted portion 54 in the extending direction. To be more specific, the positioning portions 81 are formed at: one part of the yarn contacted portion 54, which is on one side in the extending direction as compared to the edge point 74 of the yarn contacted surface 56; and another part of the yarn contacted portion 54, which is on the other side in the extending direction as compared to the edge point 75 of the yarn contacted surface 56.

[0059] As shown in FIG. 7 and FIG. 8, each positioning portion 81 includes a pair of wall portions 82 and 83 functioning as a regulatory portion configured to regulate the movement of the yarn guide 70 in the extending direction. The paired wall portions 82 and 83 are provided to be spaced apart from each other in the extending direction. A gap between the paired wall portions 82 and 83 is larger than the maximum size of the yarn guide 70 in the extending direction.

[0060] As shown in FIG. 7 and FIG. 8, each positioning portion 81 has a contact part 84. A part of the yarn guide 70 is in contact with the contact part 84 on one side in the height direction. The contact part 84 is flat and extends to be in parallel to the extending direction. The contact surface 84 faces the other side in the height direction. In the present embodiment, both ends of the contact surface 84 in the extending direction are respectively connected to the paired wall portions 82 and 83.

[0061] Each yarn guide 70 guides the yarn Y running in the yarn running space 61. Each yarn guide 70 is attached directly to the yarn contacted portion 54. To be more specific, each yarn guide 70 is attached to the yarn contacted portion 54 to be in contact with the yarn contacted portion 54. Each yarn guide 70 is detachably attached to the yarn contacted portion 54. Each yarn guide 70 is made of, e.g., ceramic. For example, each yarn guide 70 is column-shaped (see FIG. 7) and its axial center extends in the base longitudinal direction. The diameter of each yarn guide 70 is, e.g., 2 mm. As shown in FIG. 7 and FIG. 8, each yarn guide 70 is provided between a corresponding pair of the wall members 82 and 83. Furthermore, each yarn guide 70 is in contact with the contact part 84 on one side in the height direction.

[0062] As shown in FIG. 6, the yarn guides 70 include a first yarn guide 70a and a second yarn guide 70b. The first yarn guide 70a is provided for each yarn contacted portion 54. The second yarn guide 70b is provided for each yarn contacted portion 54. The first yarn guide 70a is provided outside the edge point 74 of each yarn contacted surface 56 on one side in the extending direction. The second yarn guide 70b is provided outside the edge point 75 of each yarn contacted surface 56 on the other side in the extending direction.

[0063] As shown in FIG. 7 and FIG. 8, the first yarn guide 70a is provided between the paired wall portions 82 and 83 of a positioning portion 81 provided at one end portion of the yarn contacted portion 54 on one side in the extending direction. In this regard, the first yarn guide 70a is in contact with the contact part 84 on one side in the height direction. As shown in FIG. 8, when viewed in the base longitudinal direction, a contact point X between the first yarn guide 70a and the yarn Y is on one side in the height direction as compared to a tangent T at the edge point 74 of the yarn contacted surface 56. In this regard, one side in the height direction is equivalent to a side of the present invention on which a yarn running space is provided.

[0064] Although not illustrated, the second yarn guide 70b is provided between the paired wall portions 82 and 83 of a positioning portion 81 provided at the other end portion of the yarn contacted portion 54 on the other side in the extending direction. In this regard, the second yarn guide 70b is in contact with the contact part 84 on one side in the height direction. Although not illustrated, when viewed in the base longitudinal direction, a contact point between the second yarn guide 70b and the yarn Y is on one side in the height direction as compared to a tangent at the edge point 75 of the yarn contacted surface 56.

[0065] Each guide fixing member 90 is provided for fixing a corresponding yarn guide 70. Each guide fixing member 90 is made of, e.g., SUS. As shown in FIG. 7 and FIG. 8, each guide fixing member 90 includes two side walls 90a and 90b extending in the extending direction and the height direction and a top plate 90c extending in the extending direction and the base longitudinal direction. The top plate 90c is connected to end portions of two side walls 90a and 90b on the other side in the height direction. The guide fixing members 90 are attached to both end portions of the yarn contacted portion

54 in the extending direction. As shown in FIG. 5, the guide fixing members 90 attached to each yarn contacted portion 54 are reverse U-shaped in a cross section orthogonal to the extending direction.

[0066] As shown in FIG. 7, each guide fixing member 90 further includes a pressing unit 91 configured to press the yarn guide 70 onto the contacted part 84 toward one side in the height direction. In this regard, a direction toward one side in the height direction is equivalent to an opposite direction of the present invention. Each pressing unit 91 is a plate spring. As shown in FIG. 8, each pressing unit 91 is formed integrally with the top plate 90c. When viewed in the base longitudinal direction, the pressing unit 91 is curved. For example, when viewed in the base longitudinal direction, a pressing unit 91 configured to press the first yarn guide 70a onto the contact part 84 is curved to be U-shaped (see FIG. 8) and is open to one side in the extending direction. Although not illustrated, when viewed in the base longitudinal direction, a pressing unit 91 configured to press the second yarn guide 70b onto the contact part 84 is curved to be U-shaped and is open to the other side in the extending direction.

[0067] As shown in FIG. 7, a through hole 92 is provided in the side walls 90a and 90b of each guide fixing member 90 to penetrate these side walls 90a and 90b in the base longitudinal direction. Each through hole 92 allows a corresponding yarn guide 70 in contact with the contact part 84 to penetrate the side walls 90a and 90b in the base longitudinal direction. The diameter of each through hole 92 is larger than the diameter of the yarn guide 70. For example, the diameter of each through hole 92 is 2.5 mm.

(Effects)

[0068] The first heater 13 of the present embodiment is heated by the heat source 51, and includes (i) each yarn contacted portion 54 which has a corresponding yarn running space 61 and a corresponding yarn contacted surface 56 and (ii) each yarn guide 70 which guides the yarn Y running in the yarn running space 61. Each yarn guide 70 is attached to the yarn contacted portion 54. With this arrangement, each yarn guide 70 is attached to and integrated with the yarn contacted portion 54. It is therefore possible to omit members interposed between each yarn guide 70 and the yarn contacted portion 54, or to significantly decrease the number of these members. This suppresses the influence of manufacturing or assembling errors of these members. Each yarn guide 70 is therefore provided easily and accurately so that the length of the yarn Y in contact with the yarn contacted surface 56 (hereinafter, this length will be referred to as contact length) is appropriate.

[0069] In the first heater 13 of the present embodiment, each yarn guide 70 is attached directly to the yarn contacted portion 54. With this arrangement, each yarn guide 70 is attached directly to the yarn contacted portion 54. It is therefore possible to omit the members interposed between each yarn guide 70 and the yarn contacted portion 54. This prevents the influence of the manufacturing or assembling errors of these members. As a result, each yarn guide 70 is further accurately provided so that the contact length of the yarn Y in contact with the yarn contacted surface 56 is appropriate.

[0070] In the first heater 13 of the present embodiment, the yarn contacted portion 54 is provided with each positioning portion 81 configured to determine where the yarn guide 70 is positioned. With this arrangement, the position of the yarn guide 70 is defined by each positioning portion 81. It is therefore possible to further easily provide the yarn guide 70 at a position where the contact length of the yarn Y in contact with the yarn contacted surface 56 is appropriate.

[0071] In the first heater 13 of the present embodiment, each positioning portion 81 includes the paired wall portions 82 and 83 functioning as the regulatory portion configured to regulate the movement of the yarn guide 70 in the yarn running direction. In this regard, the yarn guide 70 is provided between these paired wall portions 82 and 83. With this arrangement, the movement of the yarn guide 70 toward both sides in the yarn running direction (extending direction) is regulated by the paired wall portions 82 and 83. It is therefore possible to further reliably prevent the yarn guide 70 attached to the yarn contacted portion 54 from being significantly deviated in the yarn running direction. This reduces the difference between (i) the contact length of the yarn Y with the yarn contacted surface 56 and (ii) an appropriate length. In this regard, the yarn Y is guided by the yarn guide 70.

[0072] In the first heater 13 of the present embodiment, a gap between each pair of the wall portions 82 and 83 is larger than the maximum size of the yarn guide 70 in the yarn running direction (extending direction). With this arrangement, even when the maximum size of each yarn guide 70 in the yarn running direction varies because of the manufacturing errors, each yarn guide 70 is reliably provided between the paired wall portions 82 and 83.

[0073] In the first heater 13 of the present embodiment, each positioning portion 81 has the contact part 84 with which the yarn guide 70 makes contact. In this regard, the first heater 13 includes each pressing unit 91 configured to press the yarn guide 70 onto the contact part 84 toward one side in the height direction. Meanwhile, the force of tension of the yarn Y acts toward the other side in the height direction. Therefore, because of the tension of the yarn Y, the yarn guide 70 in contact with the yarn Y moves away from the contact part 84. In the present embodiment, each pressing unit 91 is configured to press the yarn guide 70 onto the contact part 84 toward one side in the height direction. With this arrangement, the yarn guide 70 is prevented from moving away from the contact part 84. It is therefore possible to reliably guide the yarn Y by means of the yarn guide 70.

[0074] In the first heater 13 of the present embodiment, each contact part 84 is flat and extends to be in parallel to the extending direction. When the contact part 84 is

not flat and the diameter of each yarn guide 70 varies because of the manufacturing errors, the position where each yarn guide 70 is in contact with the contact part 84 varies in the height direction. In this case, the position of each yarn guide 70 may be deviated from where the contact length of the yarn Y in contact with the yarn contacted surface 56 is appropriate. In the present embodiment, even when the diameter of each yarn guide 70 varies because of the manufacturing errors, the position where each yarn guide 70 is in contact with the contact part 84 does not vary in the height direction. It is therefore possible to accurately provide, irrespective of a manufacturing error of each yarn guide 70, each yarn guide 70 so that the contact length of the yarn Y in contact with the yarn contacted surface 56 is appropriate.

[0075] In the first heater 13 of the present embodiment, each pressing unit 91 is a plate spring. Because the temperature of the yarn contacted portion 54 is high, it is difficult to cause each yarn guide 70 to adhere to the yarn contacted portion 54. Furthermore, the size of each yarn guide 70 is small. Therefore, each yarn guide 70 may be broken by a bolt as attached to the yarn contacted portion 54 by the bolt. In the present embodiment, a simple structure, i.e., the plate spring prevents each yarn guide 70 from moving away from the contact part 84.

[0076] In the first heater 13 of the present embodiment, the yarn guides 70 provided at each yarn contacted portion 54 are the following members: the first yarn guide 70a provided outside the edge point 74 of the yarn contacted surface 56 on one side in the yarn running direction (extending direction); and the second yarn guide 70b provided outside the edge point 75 of the yarn contacted surface 56 on the other side in the yarn running direction (extending direction). With this arrangement, each yarn Y is guided by (i) the first yarn guide 70a provided outside the edge point 74 of the yarn contacted surface 56 on one side in the extending direction and (ii) the second yarn guide 70b provided outside the edge point 75 of the yarn contacted surface 56 on the other side in the extending direction. Because of this, the contact length of each yarn Y in contact with the yarn contacted surface 56 is maximized. It is therefore possible to suppress the heating of each yarn Y from being insufficient.

[0077] In the first heater 13 of the present embodiment, the yarn contacted surface 56 is curved to protrude toward one side in the height direction, and the contact point X between each yarn guide 70 and the yarn Y is on one side in the height direction as compared to the tangent T at the edge point 74 (or 75) of the yarn contacted surface 56. The yarn Y tends to be worn by making contact with the edge point 74 (or 75) of the yarn contacted surface 56. In the present embodiment, the yarn Y is lifted up from the edge point 74 (or 75) while being guided by each yarn guide 70. It is therefore possible to allow the yarn Y to make contact with the yarn contacted surface 56 from an intermediate part of the yarn contacted surface 56. With this arrangement, the yarn Y guided while passing the contact point X of each yarn guide 70 is avoided from making contact with the edge point 74 (or 75) of the yarn contacted surface 56. This suppresses the wearing of the yarn Y.

[0078] In the first heater 13 of the present embodiment, each yarn guide 70 is attachable to and detachable from the yarn contacted portion 54. This facilitates the replacement of each yarn guide 70 which is deteriorated because of continuous contact with the yarn Y.

(Modifications)

[0079] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals and the explanations thereof are not repeated.

[0080] In the embodiment above, each yarn guide 70 is attached directly to the yarn contacted portion 54. However, each yarn guide 70 may be attached indirectly to the yarn contacted portion 54. For example, each yarn guide 70 may be attached to the yarn contacted portion 54 via a suitable bracket.

[0081] In the embodiment above, the first yarn guide 70a is provided outside the edge point 74 of the yarn contacted surface 56 on one side in the extending direction while the second yarn guide 70b is provided outside the edge point 75 of the yarn contacted surface 56 on the other side in the extending direction. However, the positions of the first yarn guide 70a and second yarn guide 70b are not limited to this. For example, the first yarn guide 70a may be provided inside the above-described edge point 74 of the yarn contacted surface 56 in the extending direction and the second yarn guide 70b may be provided inside the above-described edge point 75 of the yarn contacted surface 56 in the extending direction. Alternatively, the first yarn guide 70a may be provided inside the edge point 74 of the yarn contacted surface 56 in the extending direction and the second yarn guide 70b may be provided outside the edge point 75 of the yarn contacted surface 56 in the extending direction. Alternatively, the first yarn guide 70a may be provided outside the edge point 74 of the yarn contacted surface 56 in the extending direction and the second yarn guide 70b may be provided inside the edge point 75 of the yarn contacted surface 56 in the extending direction. In these cases, each yarn guide 70 is preferably provided in the vicinity of a corresponding edge point of the yarn contacted surface 56 in the extending direction.

[0082] In the embodiment above, the yarn contacted portion 54 is provided with each positioning portion 81 configured to determine where the yarn guide 70 is positioned. However, the yarn contacted portion 54 may not be provided with each positioning portion 81. In this case, for example, the yarn guide 70 is provided at any part of the yarn contacted portion 54.

[0083] In the embodiment above, each positioning portion 81 includes the paired wall portions 82 and 83 functioning as the regulatory portion configured to regulate

the movement of the yarn guide 70 in the yarn running direction. However, as long as the regulatory portion is configured to regulate the movement of the yarn guide 70 in the yarn running direction, the regulatory portion is not limited to the paired wall portions 82 and 83. Each positioning portion 81 may not include the regulatory portion.

[0084] In the embodiment above, each pressing unit 91 is a plate spring. However, each pressing unit 91 is not limited to the plate spring. Each pressing unit 91 may be a spring such as a compression spring, a ball plunger, and a torsion spring. Alternatively, each pressing unit 91 may be an actuator configured to press the yarn guide 70 onto the contact part 84 toward one side in the height direction.

[0085] In the embodiment above, each contact part 84 is flat and extends to be in parallel to the extending direction. However, each contact part 84 may be V-shaped or U-shaped.

[0086] In the embodiment above, each yarn guide 70 is column-shaped and its axial center extends in the base longitudinal direction. However, each yarn guide 70 may be a column member which is elliptical in shape or semicircular in shape.

[0087] In the embodiment above, each guide fixing member 90 including the pressing unit 91 is independent from the yarn contacted portion 54. However, each pressing unit 91 may be formed integrally with the yarn contacted portion 54.

[0088] In the embodiment above, the first heater 13 is a sheathed heater. However, the heater of the present invention is applicable to a Dowtherm (Registered Trademark) heater (heat medium heater). The heater of the present invention is also applicable to each second heater 19.

[0089] The first heater 13 of the present embodiment is applicable not only to the false-twist texturing machine 1, but also to a known false-twist texturing machine (not illustrated) which is differently structured. Alternatively, the first heater 13 is applicable not only to a false-twist texturing machine but also to a yarn processor such as a known air texturing machine (not illustrated) which is configured to process a running yarn (not illustrated).

Claims

1. A heater (13) comprising: a heat source (51);

a yarn contacted portion (54) which is heated by the heat source (51) and has a yarn running space (61) extending in a yarn running direction in which a yarn (Y) runs and a yarn contacted surface (56) with which the yarn (Y) running in the yarn running space (61) is able to make contact; and

at least one yarn guide (70) which guides the yarn (Y) running in the yarn running space (61), the at least one yarn guide (70) being attached to the yarn contacted portion (54).

2. The heater (13) according to claim 1, wherein, the at least one yarn guide (70) is attached directly to the yarn contacted portion (54).

3. The heater (13) according to claim 1 or 2, wherein, the yarn contacted portion (54) is provided with a positioning portion (81) configured to determine where the at least one yarn guide (70) is positioned.

4. The heater (13) according to claim 3, wherein, the positioning portion (81) includes a regulatory portion (82, 83) configured to regulate movement of the at least one yarn guide (70) in the yarn running direction.

5. The heater (13) according to claim 4, wherein, the regulatory portion (82, 83) is a pair of wall portions (82, 83) provided to be spaced apart from each other in the yarn running direction, and
the at least one yarn guide (70) is provided between the pair of the wall portions (82, 83).

6. The heater (13) according to claim 5, wherein, a gap between the pair of the wall portions (82, 83) in the yarn running direction is larger than the maximum size of each of the at least one yarn guide (70) in the yarn running direction.

7. The heater (13) according to any one of claims 3 to 6, wherein, the positioning portion (81) further includes: a contact part (84) with which the at least one yarn guide (70) makes contact with; and

a pressing unit (91) configured to press the at least one yarn guide (70) onto the contact part (84), and
the pressing unit (91) is configured to press the at least one yarn guide (70) onto the contact part (84) in an opposite direction from a first direction in which the yarn (Y) is pressed onto the yarn contacted surface (56).

8. The heater (13) according to claim 7, wherein, the pressing unit (91) is a plate spring.

9. The heater (13) according to any one of claims 1 to 8, wherein, the at least one yarn guide (70) is provided outside one of edge points (74, 75) of the yarn contacted surface (56) in the yarn running direction.

10. The heater (13) according to claim 9, wherein, yarn guides (70) include a first yarn guide (70a) provided outside one (74) of the edge points (74, 75) of the yarn contacted surface (56) on one side in the yarn running direction and a second yarn guide (70b) pro-

vided outside the other (75) of the edge points (74, 75) of the yarn contacted surface (56) on the other side in the yarn running direction.

11. The heater (13) according to claim 9 or 10, wherein, the yarn contacted surface (56) is curved to protrude toward a side on which the yarn running space (61) is provided in a cross section taken along the yarn running direction and,
when a contact point (X) between the yarn (Y) and each of the yarn guides (70) is viewed in an orthogonal direction orthogonal to the cross section taken along the yarn running direction, the contact point (X) between the yarn (Y) and each of the yarn guides (70) is on the side on which the yarn running space (61) is provided as compared to a tangent (T) at each of the edge points (74, 75) of the yarn contacted surface (56) in the yarn running direction.

12. The heater (13) according to any one of claims 1 to 11, wherein, the yarn guides (70) are attachable to and detachable from the yarn contacted portion (54).

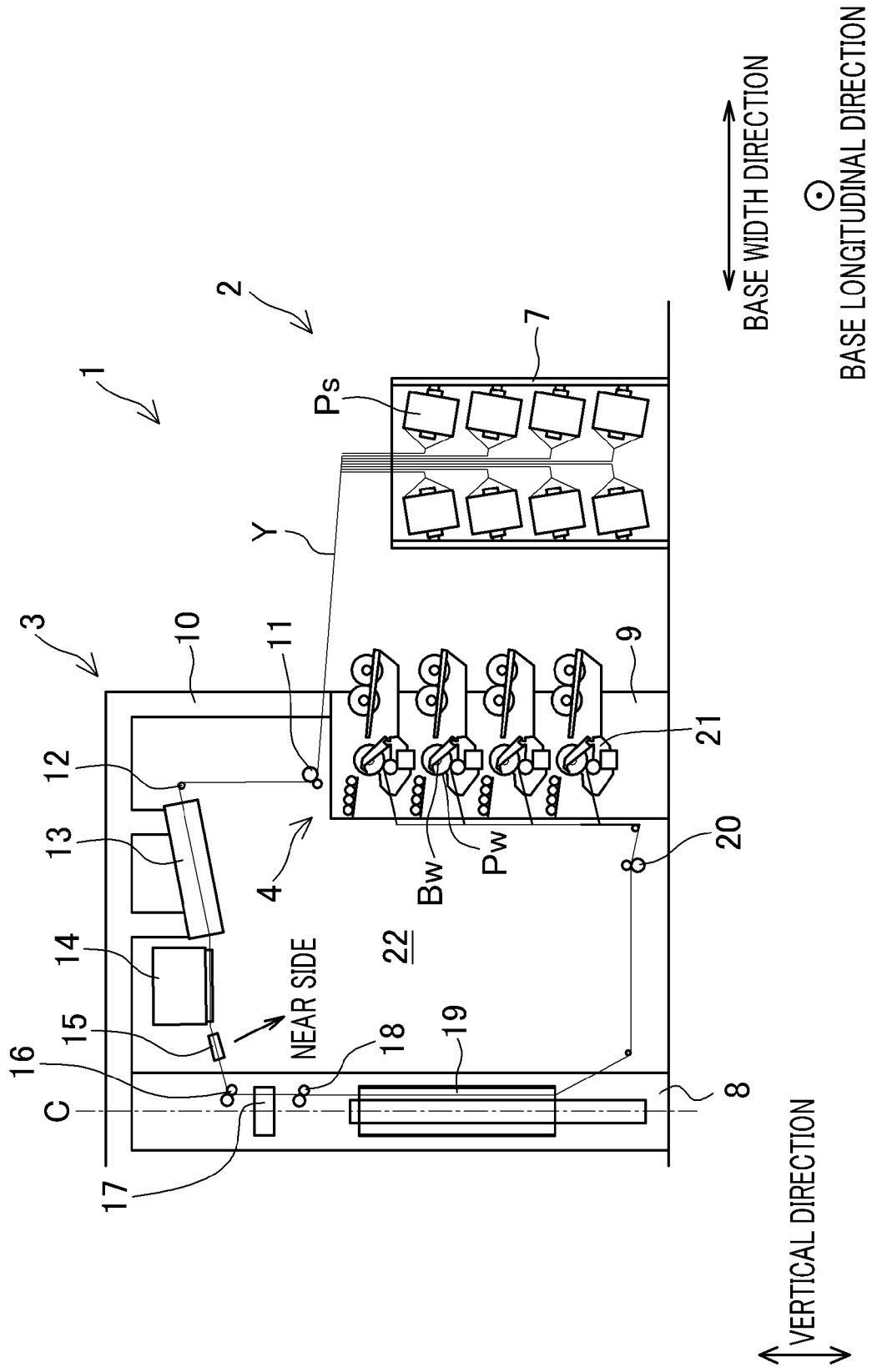

BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION
VERTICAL DIRECTION
NEAR SIDE
1
2
3
4
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Ps
Y
Bw
Pw
C

FIG.1

FIG.2

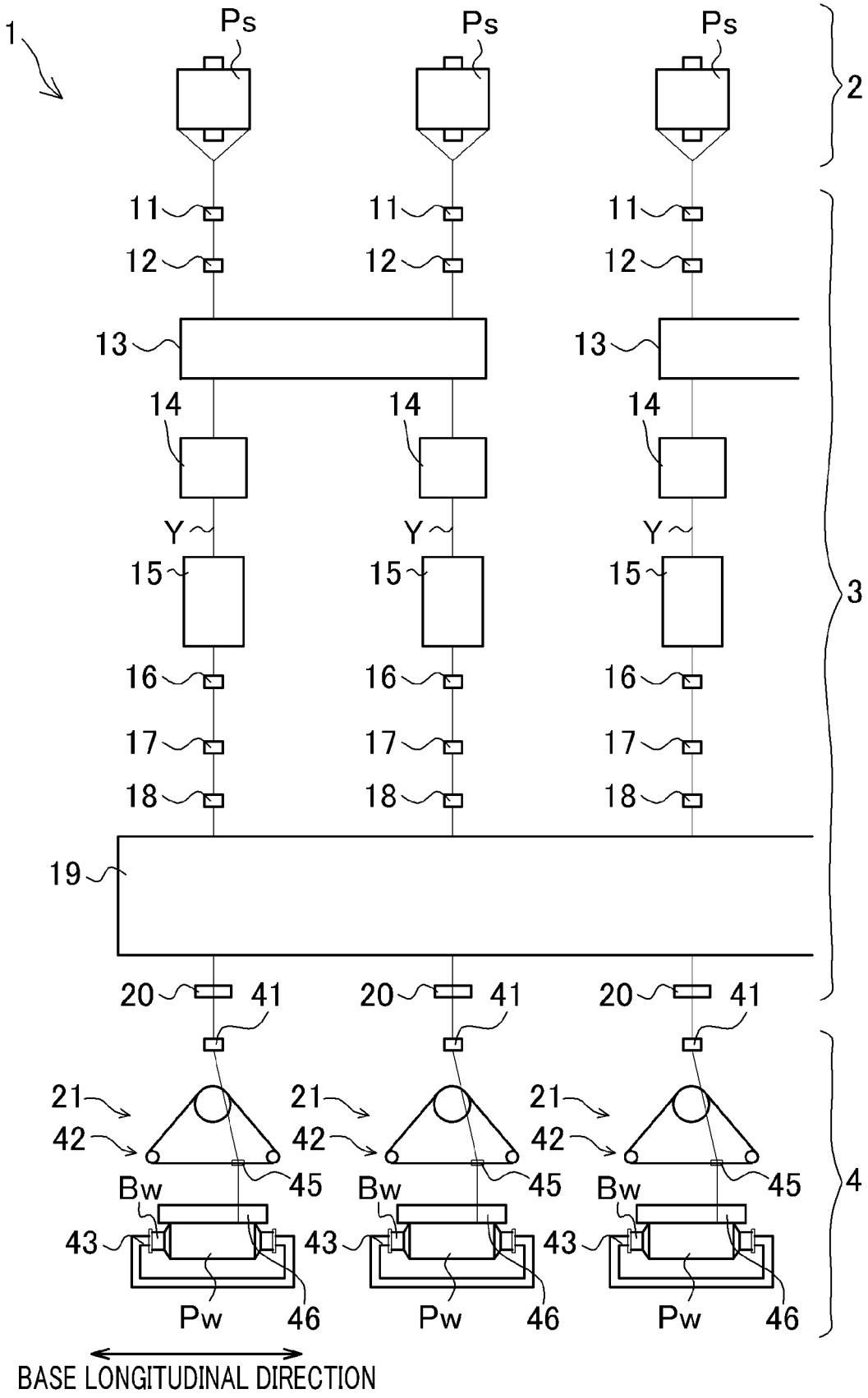

1
Ps
Ps
Ps
2
11
12
13
14
Y
15
16
17
18
19
20
41
3
21
42
45
Bw
43
Pw
46
4
BASE LONGITUDINAL DIRECTION

FIG.3

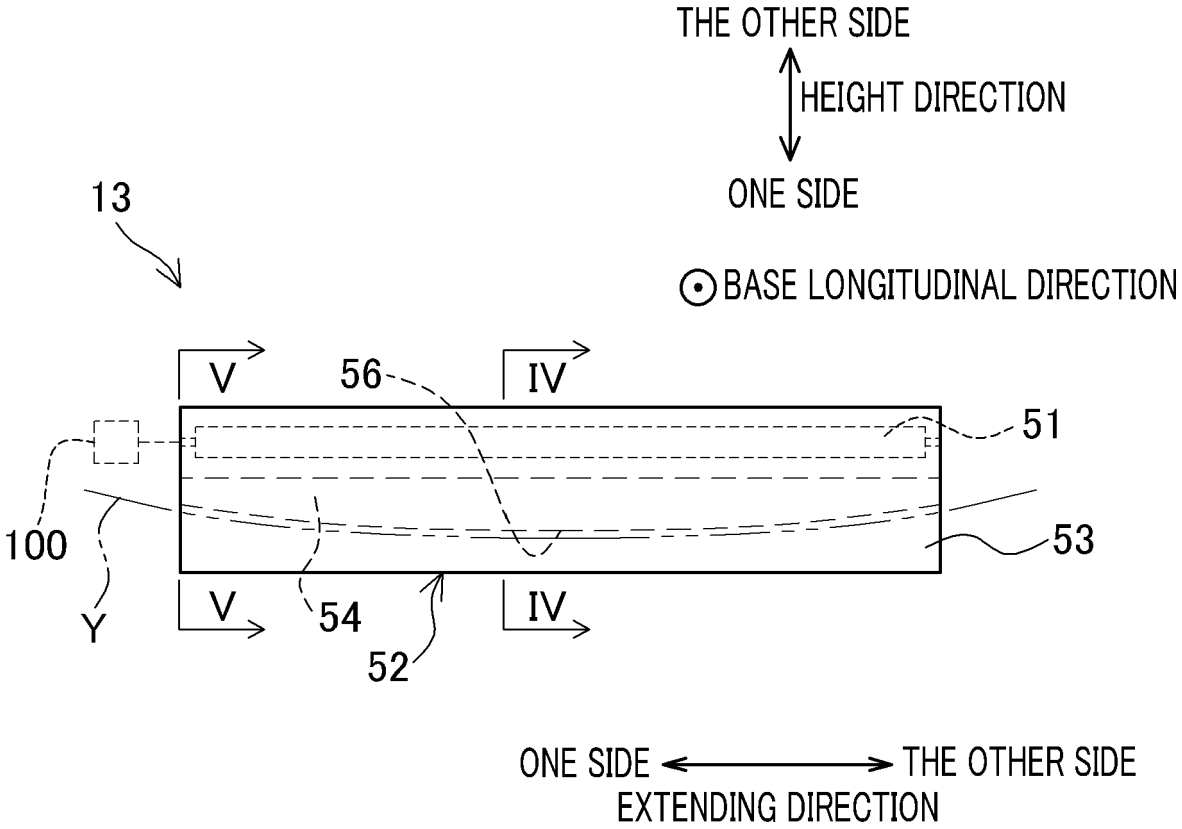
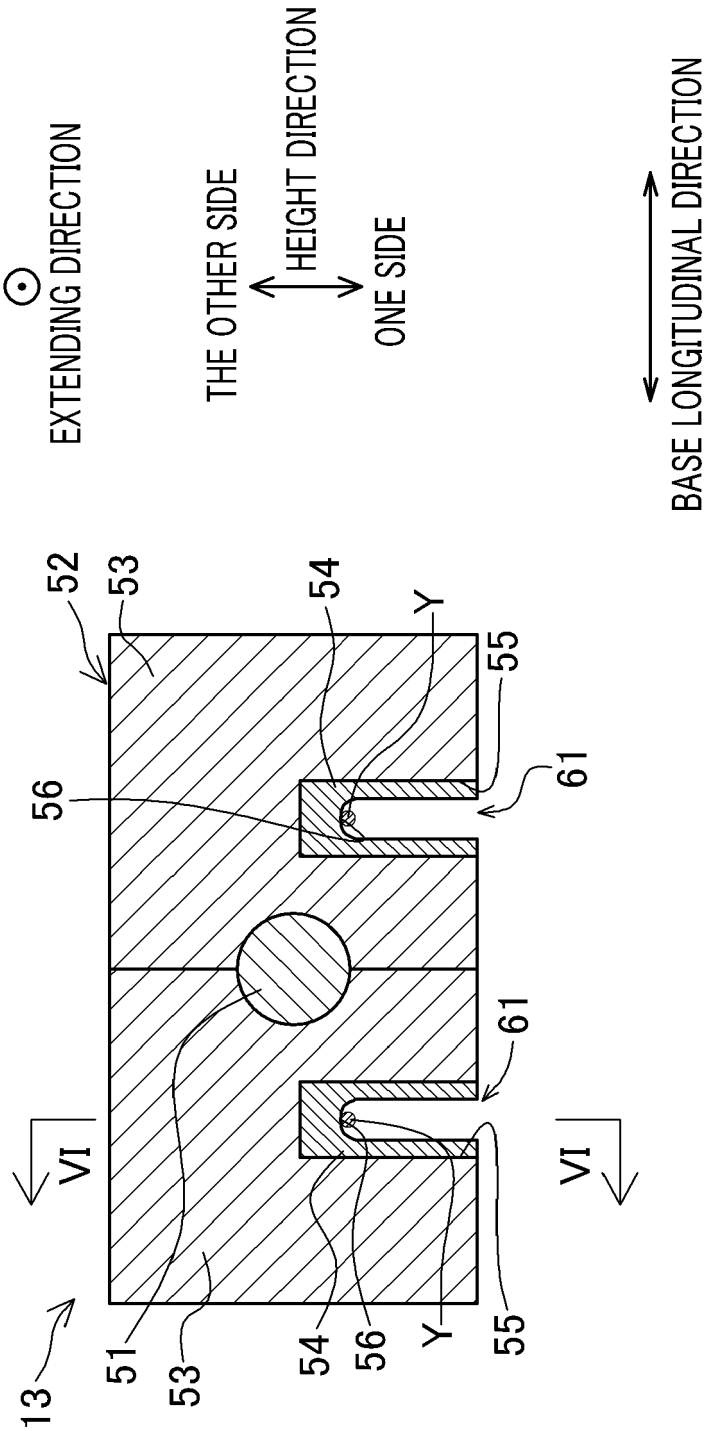

THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE
13
BASE LONGITUDINAL DIRECTION
V
56
IV
51
100
53
Y
V
54
IV
52
ONE SIDE
THE OTHER SIDE
EXTENDING DIRECTION

FIG.4


EXTENDING DIRECTION
THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE
BASE LONGITUDINAL DIRECTION
52
53
54
Y
55
56
61
61
VI
VI
13
51
53
54
56
Y
55

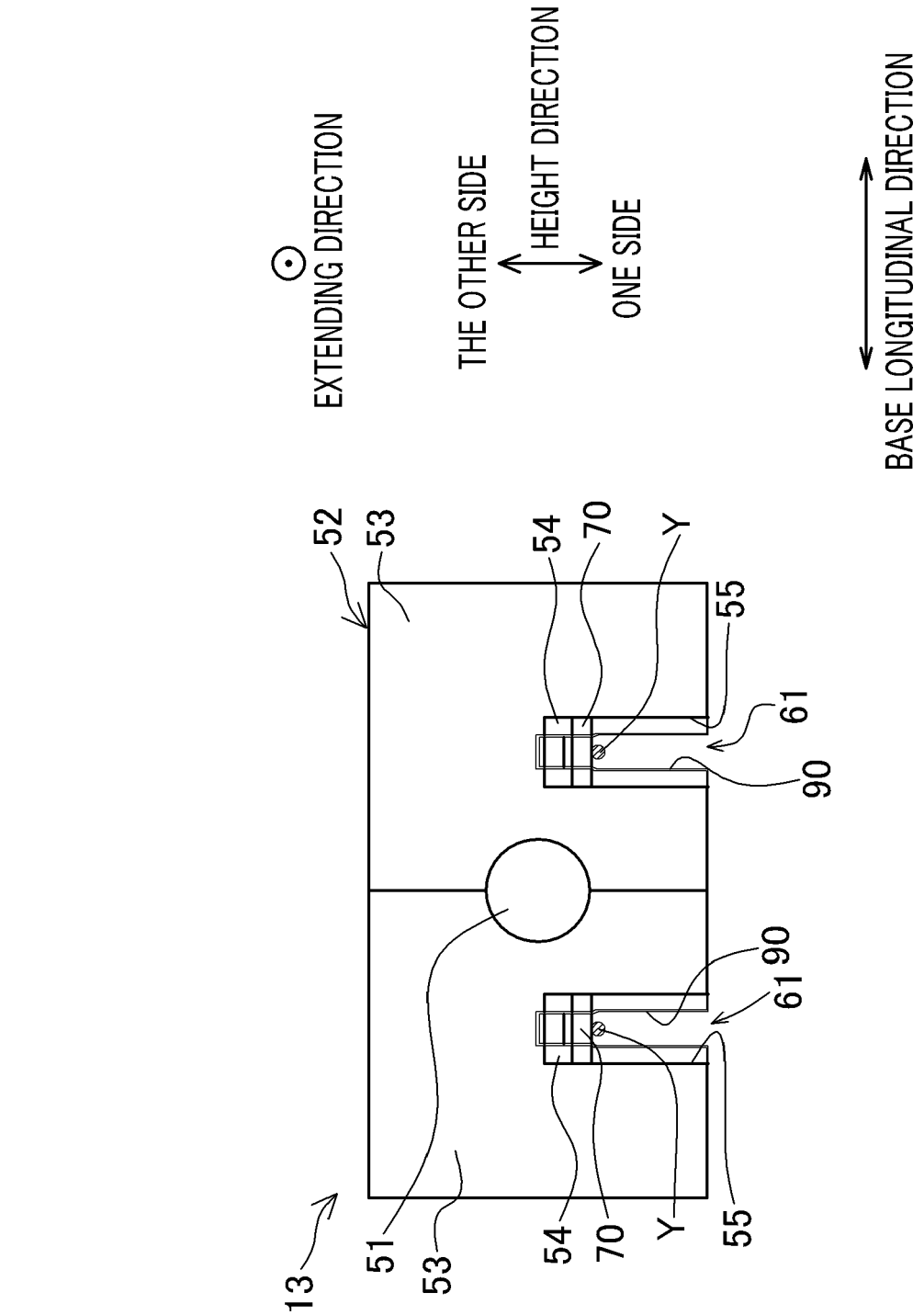

EXTENDING DIRECTION
THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE
BASE LONGITUDINAL DIRECTION
52
53
54
70
Y
55
61
90
13
51
53
54
70
Y
55
61
90

FIG.5

FIG.6

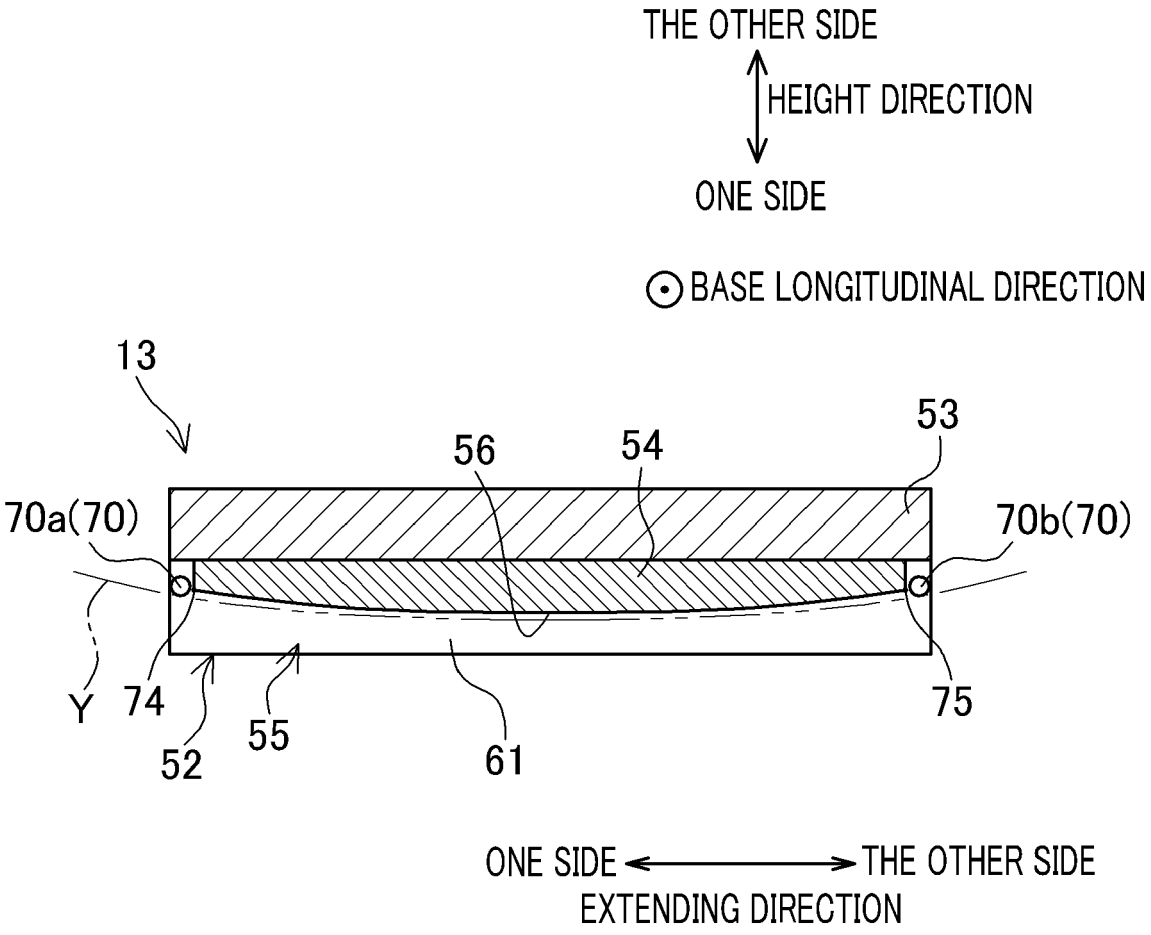

THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE
BASE LONGITUDINAL DIRECTION
13
53
56
54
70a(70)
70b(70)
Y
74
52
55
61
75
ONE SIDE
THE OTHER SIDE
EXTENDING DIRECTION

FIG.7

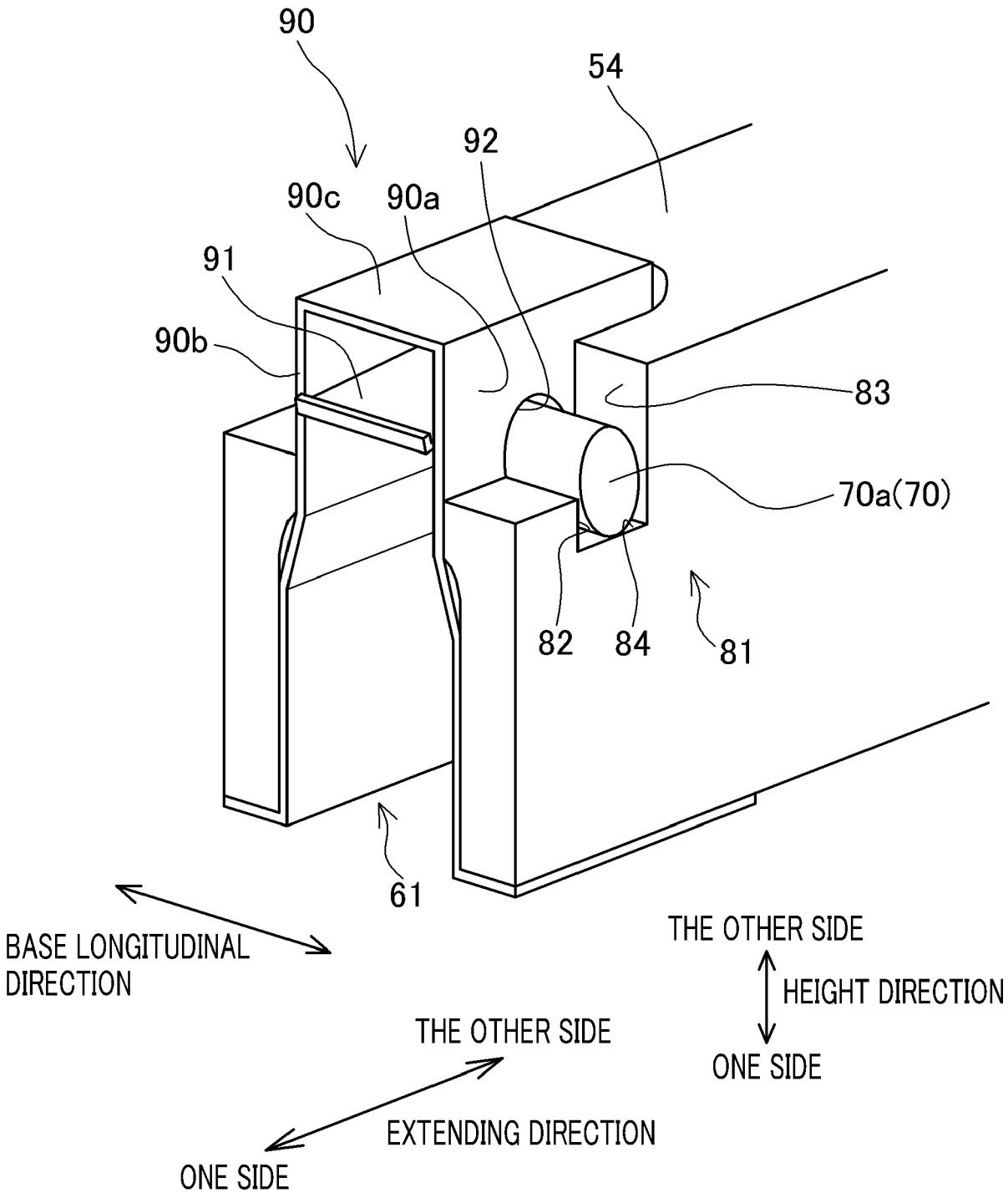
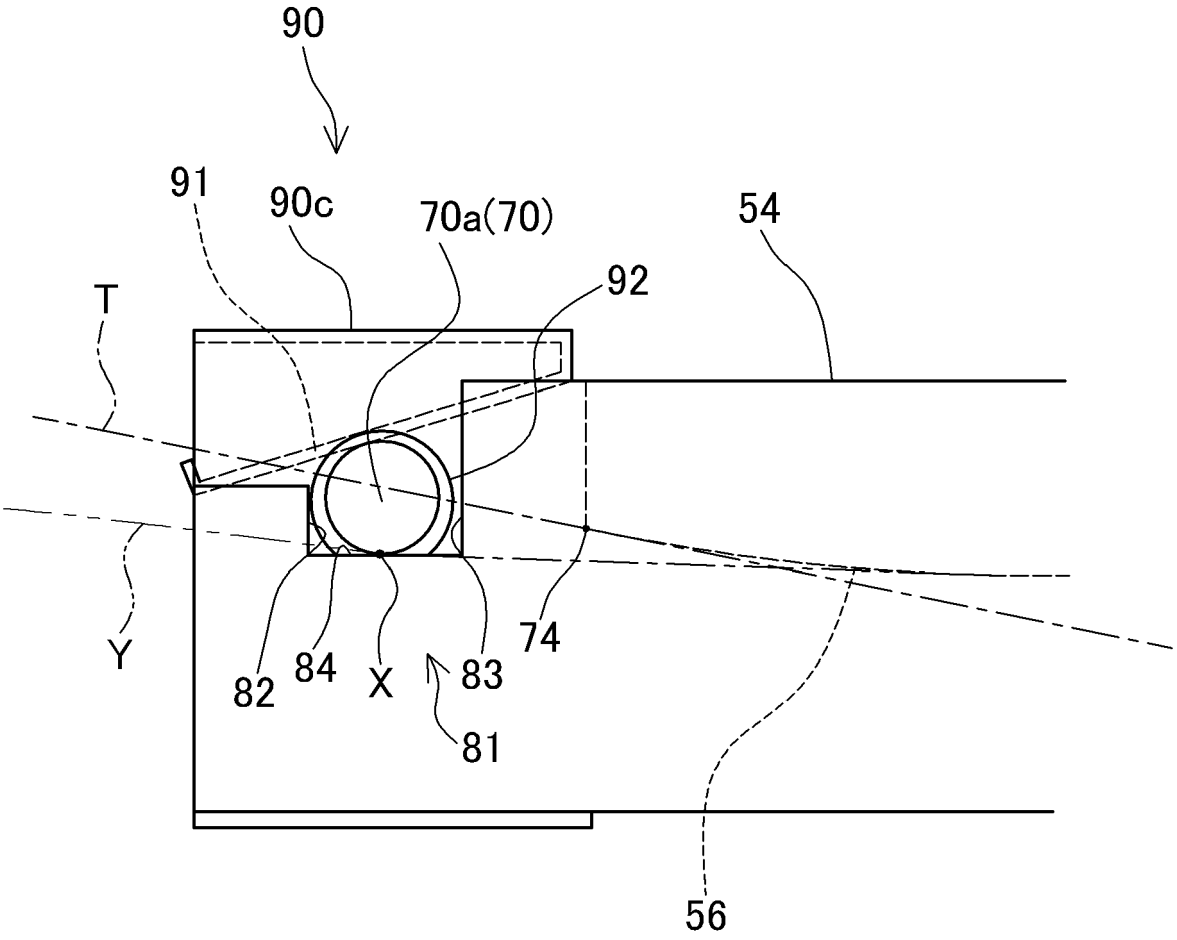

90
54
92
90c
90a
91
90b
83
70a(70)
82
84
81
61
BASE LONGITUDINAL DIRECTION
THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE
THE OTHER SIDE
EXTENDING DIRECTION
ONE SIDE

FIG.8


90
91
90c
70a(70)
54
92
T
Y
82
84
X
83
74
81
56
ONE SIDE
THE OTHER SIDE
EXTENDING DIRECTION
BASE LONGITUDINAL DIRECTION
THE OTHER SIDE
HEIGHT DIRECTION
ONE SIDE

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Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 16 0661

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 June 2023	Barathe, Rainier

CATEGORY OF CITED DOCUMENTS

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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 0661

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 June 2023	Barathe, Rainier

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X : particularly relevant if taken alone
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27-06-2023

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