



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.05.2011 Bulletin 2011/21

(51) Int Cl.:
D02G 1/04 (2006.01)

(21) Application number: **09812999.2**

(86) International application number:
PCT/JP2009/064915

(22) Date of filing: **27.08.2009**

(87) International publication number:
WO 2010/029852 (18.03.2010 Gazette 2010/11)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

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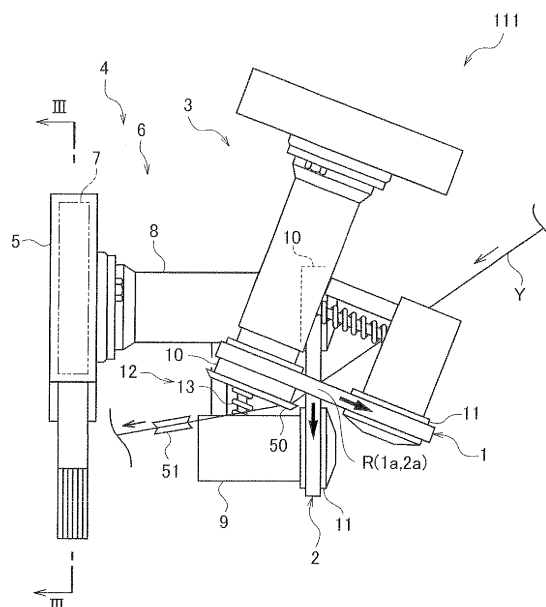
(30) Priority: **12.09.2008 JP 2008234266**

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(54) **BELT TYPE FALSE TWISTER**

(57) The present invention provides a technique for further stabilizing an unwinding point relative to a belt crossing portion, while simultaneously making a device compact. A belt type false twist device 111 nips and twists yarn Y by allowing a reference belt 1 and a movable belt 2 to travel so as to cross and compressively contact each other. A driving pulley 10 around which the reference belt 1 is wound includes an untwisting disk 50 with an outer peripheral edge 50a. The untwisting disk 50 is configured to rotate together with the driving pulley 10. The outer diameter D of the untwisting disk 50 at the outer peripheral edge 50a thereof is set to be equal to or larger than a value obtained by adding the thickness of the reference belt 1 to the outer diameter of the driving pulley 10. A part of the yarn path of the yarn Y located downstream of a crossing portion R is bent by the contact of the yarn Y with the outer peripheral edge 50a of the untwisting disk 50.

FIGURE 2



Description

Technical Field

5 **[0001]** The present invention relates to a belt type false twisting device, and more specifically, to a technique to fix an untwisting point.

Background Art

10 **[0002]** The Patent Document 1 (the Unexamined Japanese Patent Application Publication (Tokkai) No. 2002-266179) discloses, as a technique of this kind, a false twist texturing machine including a yarn guide provided immediately downstream side of a nip point in a false twist texturing machine to untwist a yarn. In the false twist texturing machine, as shown in Figure 5 of the Patent Document 1, a guide roller 8 is positioned downstream side of a nip twister 7 (false twist device) and offset from the nip point N. With the presence of the guide roller 8, "even with an untwisting tension T2 reduced, an untwisting point can be stably set at the position of the guide roller 8 to eliminate a variation in an untwisting condition in the longitudinal direction of a yarn Y and to allow a possible failure to untwist the yarn Y to be prevented".

15 **[0003]** Furthermore, the Patent Document 2 (the Unexamined Japanese Patent Application Publication (Tokkai-Sho) No. 58-23924) discloses a technique to prevent a variation of untwisting point by bending yarn immediately after the yarn has passed through a belt. Specifically, the technique provides a guide positioned on a surface of a belt crossing portion which is different from a belt contact surface, to bend the yarn having passed through the belt. With the guide, "the untwisting point of the yarn is set at the final point of the belt crossing portion in a regulatory manner and is prevented from being moved inside the belt crossing portion".

25 Disclosure of the Invention

Problems to be Solved by the Invention

30 **[0004]** Both techniques in Patent Documents 1 and 2 described above beneficially exert specific effects for stabilizing the untwisting point relative to the crossing portion.

[0005] The present invention has been made in view of the above-described points. A main object of the present invention is to provide a totally new configuration for fixing an untwisting point.

Means for Solving the Problems and Advantages of the Means

35 **[0006]** The problems to be solved by the present invention have been described. Now, a means for solving the problems and the advantages of the means will be described below.

40 **[0007]** An aspect of the present invention provides a belt type false twist device configured as follows. That is, the belt type false twist device nips and twists a yarn by allowing paired endless belts to travel so as to cross and compressively contact each other. A pulley around which the endless belt is wound includes an untwisting portion with an outer peripheral edge. The untwisting portion is configured to rotate together with the pulley. An outer diameter of the untwisting portion at the outer peripheral edge thereof is set to be equal to or larger than a value obtained by adding a thickness of the endless belt to an outer diameter of the pulley. A part of a yarn path of the yarn located downstream side of a crossing portion in which the paired endless belts cross is bent by contact of the yarn with the outer peripheral edge of the untwisting portion. In the above-described configuration, a peripheral speed of the untwisting portion at the outer peripheral edge thereof is higher than a peripheral speed of a part of the yarn located inside the crossing portion. Thus, the twist applied to the yarn in the crossing portion can be maintained until the twist reaches the outer peripheral edge of the untwisting portion. Hence, an untwisting point of the yarn is fixed on the outer peripheral edge of the untwisting portion. Furthermore, the outer diameter of the untwisting portion at the outer peripheral edge thereof projects toward the outer peripheral side of the endless belt. Consequently, a part of the yarn path of the yarn in an interval between the crossing portion and the untwisting portion can be substantially aligned with the part of the yarn path of the yarn located inside the crossing portion. If such a substantially straight yarn path is adopted, the endless belts are prevented from being locally worn at a downstream side terminal of the crossing portion.

50 **[0008]** The above-described belt type false twist device can adopt the following configuration. That is, the unwinding portion may be configured to be separate from or integral with the pulley. The former configuration excellently enables the untwisting portion to be exclusively replaced. The latter configuration contributes to reducing the number of required components.

55 **[0009]** The above-described belt type false twist device can adopt the following configuration. That is, a bending guide

is provided which is configured to guide the yarn so as to enhance bending of the yarn at the outer peripheral edge of the untwisting portion. The above-described configuration enhances the bending of the part of the yarn path of the yarn located at the outer peripheral edge of the untwisting portion. Thus, the untwisting point of the yarn achieved by the bending is stabilized at a higher level.

Brief Description of the Drawings

[0010]

Figure 1 is a schematic diagram of the configuration of a draw texturing machine according to an embodiment of the present invention.

Figure 2 is a side view of a belt type false twist device according to an embodiment of the present invention.

Figure 3 is a sectional view taken along line III-III in Figure 2.

Figure 4 is a schematic diagram of a yarn path in the belt type false twist device.

Figure 5 is a diagram showing an untwisting point used when an untwisting tension T2 is low.

Figure 6 is a diagram showing the untwisting point used when an untwisting tension T2 is high.

Figure 7 is a diagram which is similar to Figure 2 and which shows another embodiment of the present invention.

Best Mode for Carrying Out the Invention

[0011] Embodiments of the present invention will be described below with reference to the drawings. Figure 1 is a schematic diagram of the configuration of a draw texturing machine according to an embodiment of the present invention.

[0012] In the present embodiment, a draw texturing machine 100 includes a plurality of units 105 each with a yarn supplying section 102 configured to supply a yarn Y contained in yarn supplying packages 101, a yarn processing section 103 configured to carry out a draw texturing process on the yarn Y supplied by the yarn supplying section 102, and a winding section 104 configured to wind the yarn Y subjected to the draw texturing process by the yarn processing section 103 to form a winding package P with a predetermined diameter. The plurality of units 105 are arranged in a direction perpendicular to the sheet of Figure 1. As shown in Figure 1, the yarn supplying sections 102 and the winding sections 104 are laid on top of one another in the vertical direction in order to make the draw texturing machine 100 compact.

[0013] The yarn supplying packages 101 are held on respective pegs 107 on a creed stand 106 shared by the plurality of units 105.

[0014] The yarn processing section 103 includes a first feed roller 108, a primary heater 109, a cooler 110, a belt type false twist device 111, a second feed roller 114, an interlace nozzle 115, a secondary heater 116, and a third feed roller 117; these components are arranged in this order along a direction in which the yarn Y travels.

[0015] The yarn feed speed of the second feed roller 114 is set to be higher than that of the first feed roller 108 so as to allow the yarn Y to be drawn between the first feed roller 108 and the second feed roller 114. On the other hand, the yarn feed speed of the third feed roller 117 is set to be lower than that of the second feed roller 114 so as to allow the yarn Y to be loosened between the second feed roller 114 and the third feed roller 117.

[0016] The belt type false twist device 111 nips and twists the traveling yarn Y by allowing the paired endless belts to travel so as to cross and compressively contact each other. The twist applied to the yarn Y propagates from the belt type false twist device 111 toward an upstream side in the traveling direction of the yarn Y until the twist reaches the first feed roller 108. The drawn and twisted yarn Y is thermally set by the primary heater 109 and then cooled by the cooler 110. The yarn Y is then untwisted while passing through the belt type false twist device 111. In the interlace nozzle 115, an interlaced portion is appropriately formed on the yarn Y subjected to the false twist texturing process. Thus, the yarn Y becomes as convergent as twisted yarn. Thereafter, the yarn Y is loosened and subjected to a predetermined thermal treatment by the secondary heater 116. Then, in the winding section 104, the yarn Y is wound into a winding package P.

[0017] Now, the belt type false twist device 111 will be described. Figure 2 is a side view of the belt type false twist device according to the embodiment of the present invention. Figure 3 is a sectional view taken along line 3-3 in Figure 2. Figure 4 is a schematic diagram of a yarn path in the belt type false twist device.

[0018] As shown in Figure 2, the belt type false twist device 111 includes a reference belt 1 serving as a reference and a movable belt 2 that is movable with respect to the reference belt 1. The reference belt 1 and the movable belt 2 are allowed to travel and approach each other to twist the yarn Y traveling while being sandwiched between the reference belt 1 and the movable belt 2. That is, the belt type false twist device 111 includes a reference belt unit 3 with the reference belt 1 and a movable belt unit 4 with the movable belt 2. The structures of the reference belt unit 3 and the movable belt unit 4 are generally symmetric. Thus, mainly the structure of the movable belt unit will be described below in detail.

[0019] The movable belt unit 4 includes a unit base 5 fixed to the draw texturing processing machine 100 main body,

a movable belt support 6 configured to be slideable with respect to the unit base 5, and the movable belt 2. The movable belt support 6 includes, as main components, a driving section 7 accommodated in the unit base 5, a pulley driving shaft accommodating cylinder 8 projected from the driving section 7, a driving pulley 10 disposed at the tip of the pulley driving shaft accommodating cylinder 8 and rotationally driven by a driving shaft (not shown in the drawings) accommodated in the pulley driving shaft accommodating cylinder 8, a driven pulley 11 paired with the driving pulley 10 and around which the movable belt 2 is passed, the movable belt 2 also being passed around the driving pulley 10, and a tension applying section 12 configured to apply a predetermined tension to the movable belt 2 passed around the driving pulley 10 and the driven pulley 11. The tension applying section 12 includes a compression coil spring 13 (not shown in the drawings) interposed between a driven pulley support 9 configured to rotatably support the driven pulley 11 and the pulley driving shaft accommodating cylinder 8.

[0020] In the present embodiment, the movable belt 2 passed around the driving pulley 10 and the driven pulley 11 is a flexible endless belt. The movable belt 2 has a belt width of about 8 to 12 [mm]. The pulley driving shaft accommodating cylinder 8 extends generally toward the reference belt unit 3. The movable belt 2 supported by the movable belt unit 4 is configured to be able to come into contact with the reference belt 1 supported by the reference belt unit 3. When the yarn Y is sandwiched between the reference belt 1 and the movable belt 2, a reference belt opposite surface 1a that is a part of the reference belt 1 located opposite the movable belt 2 is substantially parallel to a movable belt opposite surface 2a that is a part of the movable belt 2 located opposite the reference belt 1 as shown in Figure 2. In the present embodiment, the movable belt 2 is configured to be able to approach and leave the reference belt 1 while maintaining a parallel relationship between the reference belt opposite surface 1a and the movable belt opposite surface 2a. That is, the driving section 7 of the movable belt support 6 supporting the movable belt 2 is configured to slide in a direction perpendicular to the movable belt opposite surface 2a in the unit base 5.

[0021] As shown in Figure 3, a simplified guide shaft 15 extending along a direction perpendicular to the movable opposite surface 2a is inserted into the unit base 5. The driving section 7 is coupled to the unit base 5 via the guide shaft 15 and a linear bushing (not shown in the drawings). In this configuration, the movable belt 2 can approach and leave the reference belt 1 while maintaining a parallel relationship between the reference belt opposite surface 1a and the movable belt opposite surface 2a. In addition, a key seat 16 extending parallel to the direction in which the guide shaft 15 is inserted is engraved in the driving section 7. A key 17 accommodated in the key groove 16 is provided in the unit base 5. The presence of the key seat 16 and the key 17 serves to regulate rotation of the driving section 7 around the guide shaft 15. As shown in Figure 2, the pulley driving shaft accommodating cylinder 8 is fitted in the driving section 7. The driving shaft 9 coupled to the driving pulley 10 has a substantially coaxial relationship with the pulley driving shaft accommodating cylinder 8.

[0022] The unit base 5 includes a movable belt approaching bias section 18 (movable belt approaching bias means) configured to bias the movable belt 2 in a direction A in which the movable belt 2 approaches the reference belt 1, a movable belt leaving bias section 19 configured to bias the movable belt 2 in a direction B in which the movable belt 2 leaves the reference belt 1, and a movable belt moving section 20 (movable belt moving means) configured to move the movable belt 2 in the direction B in which the movable belt 2 leaves the reference belt 1.

[0023] In the present embodiment, the movable belt approaching bias section 18 is configured to operate pneumatically and thus to be able to increase and reduce the biasing force applied to the movable belt 2. Specifically, the movable belt approaching bias section 18 includes an air supply port connected to a compressed air supply device (not shown in the drawings), a movable belt approaching bias section main body 22 containing a bellows (not shown in the drawings) driven by compressed air supplied via the air supply port, and an output rod 23 operating in conjunction with operation of the bellows. The output rod 23 is located parallel to the insertion direction of the guide shaft 15. The output rod 23 is configured as follows. When the movable belt approaching bias section main body 22 is supplied with compressed air via the air supply port 21, the output rod 23 comes into abutting contact with a rod abutting surface 7a formed on the driving section 7. The compressed air causes pressure to be exerted on the output rod 23 via the bellows and transmitted to the driving section 7. The movable belt approaching bias section 18 is configured such that the pressure (air pressure) transmitted to the driving section 7 is used to bias the movable belt 2 in the direction A in which the movable belt 2 approaches the reference belt 1. That is, a direction from the movable belt 2 toward the reference belt 1 is the same as a direction from the movable belt approaching bias section main body 22 toward the output rod 23 or the rod abutting surface 7a.

[0024] In the present embodiment, the above-described movable belt leaving bias section 19 is configured to serve as a spring. Specifically, the movable belt leaving bias section 19 includes a spring accommodating member 24 supported in the unit base 5 so as to be slidable in a direction parallel to the insertion direction of the guide shaft 15, a compression coil spring 25 interposed between the spring accommodating member 24 and the driving section 7, and a screw-type eccentric cam 26 configured to move the spring accommodating member 24 so that the spring accommodating member 24 moves forward and backward in the direction parallel to the insertion direction of the guide shaft 15. The spring accommodating member 24, the compression coil spring 25, and the driving section 7 are arranged such that the self elastic resilience of the compression coil spring 25 interposed between the spring accommodating member 24 and the

driving section 7 is used to bias the movable belt 2 in the direction B in which the movable belt 2 leaves the reference belt 1. Thus, the bias force applied to the movable belt 2 by the movable belt approaching bias section 18 acts in a direction opposite to that in which the bias force applied to the movable belt 2 by the movable belt leaving bias section 19. The screw-type eccentric cam 26 moves the spring accommodating member 24 forward and backward in the direction parallel to the insertion direction of the guide shaft 15, to adjust the bias force applied to the movable belt 2 by the movable belt leaving bias section 19.

[0025] In the present embodiment, the above-described movable belt driving section 20 is configured to provide a cam driving type. Specifically, the movable belt driving section 20 includes an advancing rod 27 supported by the unit base 5 so as to be slidable in the direction parallel to the insertion direction of the guide shaft 15, and a cam type knob 28 with a cutout formed at the tip thereof and with which the advancing rod 27 is engaged, the cam type knob 28 being configured to advance the advancing rod 27. The direction in which the advancing rod 27 is advanced by the cam type knob 28 is set to be the same as that in which the movable belt 2 leaves the reference belt 1. Thus, upon advancing in engagement with the cam type knob 28, the advancing rod 27 comes into abutting contact with the driving section 7 to allow the movable belt 2 to leave the reference belt 1 via the driving section 7. The compression coil spring 29 is interposed between the advancing rod 27 and the unit base 5 so that the advancing rod 27 can withdraw in the direction in which the advancing rod 27 leaves the driving section 7 in a short time when the advancement of the advancing rod 27 by the cam type knob 28 is deactivated.

[0026] As shown in Figure 2 and Figure 4, an untwisting disk 50 (untwisting portion) with an outer peripheral edge 50a is fixedly coupled to the driving pulley 10 of the reference belt unit 3 by a fastening means such as a bolt (not shown in the drawings). The untwisting disk 50 is, for example, a rigid body such as stainless steel or ceramics and is fixed to the driving pulley 10 so as to rotate together with the driving pulley 10. In other words, the untwisting disk 50 is adapted to rotate positively. The outer diameter D of the untwisting disk 50 at the outer peripheral edge 50a thereof is set to at least a value obtained by adding double the thickness of the reference belt 1 to the outer diameter of the driving pulley 10. In other words, the outer diameter D of the untwisting disk 50 at the outer peripheral edge 50a thereof is set such that the outer peripheral edge 50a projects (sticks) further toward the outer peripheral side of the reference belt 1 passed around the driving pulley 10. In this configuration, a part of the yarn path of the yarn Y located downstream side of a crossing portion R where the paired reference belt 1 and movable belt 2 cross is bent by the contact of the yarn with the outer peripheral edge 50a of the untwisting disk 50 as shown in Figure 4. The contact is not a line contact along the outer peripheral edge 50a of the untwisting disk 50 but a point contact characterized by the crossing between the yarn Y and the outer peripheral edge 50a as shown in Figure 4. Moreover, in the present embodiment, a tapered outer peripheral surface 50b narrowed toward the downstream side of the yarn path of the yarn Y is formed near the outer peripheral edge 50a of the untwisting disk 50 as shown in Figure 4. The yarn Y can be contacted and frictioned with the tapered outer peripheral surface 50b. The contact between the tapered outer peripheral surface 50b and the yarn Y is microscopically a line contact. Furthermore, the untwisting disk 50 is configured such that the outer peripheral edge 50a has a radius of curvature of $0.1R$ to $0.4R$. When the outer peripheral edge 50a has such a small radius of curvature, a possible variation of an untwisting point can be inhibited.

[0027] Moreover, as shown in Figure 2, on the downstream side of the untwisting disk 50, a bending guide 51 is provided which has a substantially V-shaped cross section and which rotates in conjunction with the traveling yarn Y. The bending guide 51 enhances the bending of the yarn path of the yarn Y at the outer peripheral edge 50a of the untwisting disk 50. That is, as shown in Figure 4, the yarn Y fed while being nipped by the reference belt 1 and the movable belt 2 travels a short distance and is then bent on the outer peripheral edge 50a of the untwisting disk 50. The yarn Y further travels a short distance and is then bent by the bending guide 51 in a direction substantially opposite to that in which the yarn Y is bent on the outer peripheral edge 50a.

[0028] Now, the operation of the belt type false twist device 111 according to the present embodiment will be described.

[0029] First, it is assumed that a gap sufficiently larger than the thickness of the yarn Y to be untwisted is present between the reference belt 1 and the movable belt 2 and that the yarn Y travels in a direction shown by a thick arrow in Figure 2.

<Start of Twisting>

[0030] In this condition, twisting of the yarn Y is started. First, the driving pulley 10 is rotated at a predetermined rotation number by a motor (not shown in the drawings) to allow the movable belt 2 to travel at a predetermined speed. The movable belt 2 travels in the direction shown by the thick arrow in Figure 2. This also applies to the reference belt unit 3.

[0031] Then, compressed air of a predetermined pressure is introduced into the movable belt approaching bias section 18 shown in Figure 3 to advance the output rod 23. Then, the output rod 23 comes into abutting contact with the rod abutting surface 7a of the driving section 7 to transmit pressure received by the output rod 23 from the movable belt approaching bias section main body 22, to the driving section 7. The driving section 7 thus slides along the insertion direction of the guide shaft 15, against the self elastic resilience of the compression coil spring 25 belonging to the

movable belt leaving bias section 19. Hence, the movable belt 2 approaches the reference belt 1. Then, when the movable belt 2 comes into abutting contact with the yarn Y, the pressure received by the output rod 23 from the movable belt approaching bias section 22 is converted into a contact pressure exerted on the yarn Y by the movable belt 2 (a contact pressure exerted on the yarn Y by the reference belt 1).

[0032] The traveling directions of the reference belt 1 and the movable belt 2 have respective predetermined angles to the yarn Y. Hence, the traveling of the reference belt 1 and the movable belt 2 provides a function to feed the yarn Y and a function to apply a twisting torque to the yarn Y.

<Stoppage of Twisting: 1>

[0033] In the above-described condition, when the twisting of the yarn Y is stopped, the supply of compressed air to the movable belt approaching bias section 18 is stopped. Furthermore, compressed air already supplied to the movable belt approaching bias section 18 is removed. Thus, the bias force applied to the driving section 7 by the movable belt approaching bias section 18 is eliminated. Then, the contact pressure exerted on the yarn Y by the movable belt 7 is eliminated. Additionally, the movable belt leaving bias section 19 applies a bias force to the driving section 7, which thus moves (withdraws) in a direction in which the driving section 7 allows the movable belt 2 to leave the reference belt 1. Then, a gap sufficiently large compared to the thickness of the yarn Y is generated between the reference belt 1 and the movable belt 2. As a result, the twisting of the yarn Y is stopped.

<stoppage of Twisting: 2>

[0034] For example, when the reference belt 1 or the movable belt 2 is replaced, the cam type knob 28 may be appropriately rotated. This is because the advancing rod 27 advances in engagement with the rotated cam type knob 28 to move (withdraw) the driving section 7 in the direction in which the movable belt 2 leaves the reference belt 1, resulting in a sufficiently large gap between the reference belt 1 and the movable belt 2. In addition, while the movable belt approaching bias section 18 is applying a bias force to the driving section 7, the forward and backward movement of the driving section 7 along the insertion direction of the guide shaft 15 is selectively dominated by the amount by which the advancing rod 27 advances or the bias force applied to the driving section 7 by the compression coil spring 25. On the other hand, while the movable belt approaching bias section 18 is applying no bias force to the driving section 7, the forward and backward movement of the driving section 7 along the insertion direction of the guide shaft 15 is dominated by the bias force applied to the driving section 7 by the compression coil spring 25.

<Adjustment of the Contact Force>

[0035] The screw type eccentric cam 26 may be rotated in either direction in order to adjust the contact pressure exerted on the yarn Y by the movable belt 2 (the contact pressure exerted on the yarn Y by the reference belt 1) as a result of the supply of compressed air of a predetermined pressure to the movable belt approaching bias section 18. That is, when the yarn is twisted, the bias force applied to the driving section 7 by the movable belt approaching bias section 18 is equal to the resultant force of the contact pressure executed on the yarn Y by the moveable belt 2 and the bias force applied to the driving section 7 by the movable belt leaving bias section 19. Thus, under this relationship, rotation of the screw type eccentric cam 26 in either direction increases or reduces the bias force applied to the driving section 7 by the movable belt leaving bias section 19. This results in a relative change in the contact pressure exerted on the yarn Y by the movable belt 2. The general adjustment of the contact pressure (for 240 units in one machine, for example; the adjustment depends on the type of the yarn) is concurrently carried out on all the units by varying the air pressure. The adjustment with the screw type eccentric cam 26 is used when the contact pressure is measured after the concurrent adjustment and determined to vary among the units.

<Operation of the Untwisting Disk 50>

[0036] Now, the operation of the untwisting disk 50 will be described in detail with reference to Figure 5 and Figure 6. Figure 5 is a diagram showing an untwisting point used when an untwisting tension T2 is low. Figure 6 is a diagram showing an untwisting point used when the untwisting tension T2 is high. In Figure 5 and Figure 6, a part of the yarn Y present in the above-described crossing section R is daringly drawn in front of the reference belt in order to illustrate the position of the untwisting point, though this part of the yarn Y is normally invisibly.

[0037] When the untwisting tension T2 is low, the untwisting point is positioned at the downstream side end of the crossing portion R between the reference belt 1 and the movable belt 2 as shown in Figure 5A. However, when the untwisting tension T2 is high, the untwisting point is placed inside the crossing portion R between the reference belt 1 and the movable belt 2 as shown in Figure 6A. As a result, the untwisted yarn Y rubs against the reference belt 1 and

the movable belt 2 and filament is broken. In contrast, in the configuration of the above-described embodiment including the untwisting disk 50, the untwisting point is always fixed on the outer peripheral edge 50a of the untwisting disk 50 regardless of the magnitude of the untwisting tension T2 as shown in Figure 5B and Figure 6B. Thus, the untwisting point is prevented from being placed inside the crossing portion between the reference belt 1 and the movable belt 2. This enables possible broken filament to be inhibited.

[0038] Moreover, since the presence of the bending guide 51 enhances the bending of the yarn path of the yarn Y at the untwisting disk 50, the untwisting point for the yarn Y is stabilized at a higher level.

[0039] Now, tests for confirming the technical effects of the untwisting disk 50 will be described. In Table 1, "Example" relates to the configuration shown in Figure 5A and in which the untwisting disk 50 is additionally provided. "Comparative Example" relates to the configuration shown in Figure 5A. In Test Nos. 1 to 3 in Table 1, a yarn type is 75 den/144 f, and a yarn speed is 600 m/min. In Test Nos. 4 to 6, the yarn type is 150 den/288 f, and the yarn speed is 600 m/min. In Table 1, "Untwisting tension T2 gr" means the tension of a part of the yarn Y located downstream of the belt type false twisting device 111. The unit gr means gram. "B. F/1,000 m" means the number of broken filament per 1,000 m.

[0040]

[Table 1]

Test No.	Untwisting tension T2 gr	Example B.F/1,000m	Comparative Example B.F/1,000m
1	14	99	143
2	19	149	457
3	26	271	1167
4	24	230	414
5	36	369	816
6	44	512	1253

[0041] According to Comparative Example in Table 1, a high untwisting tension T2 results in a significantly large number of B.F. In Example in which the untwisting disk 50 is adopted, the number of B.F is reduced to substantially half that in the Comparative Example regardless of the magnitude of the untwisting tension T2. B.F is generally generated when the untwisting point is placed between the belts. Thus, in Example, the placement of the untwisting point between belts is inhibited. This is expected to be precisely because the untwisting point is stabilized and fixed.

[0042] As described above, in the above-described embodiment, the belt type false twist device 111 is configured as follows. The belt type false twist device 111 nips and twists the yarn Y by allowing the reference belt 1 and the movable belt 2 to travel so as to cross and compressively contact each other. The driving pulley 10 around which the reference belt 1 is wound includes the untwisting disk 50 with the outer peripheral edge 50a. The untwisting disk 50 is configured to rotate together with the driving pulley 10. The outer diameter D of the untwisting disk 50 at the outer peripheral edge 50a thereof is set to be equal to or larger than a value obtained by adding the thickness of the reference belt 1 to the outer diameter of the driving pulley 10. A part of the yarn path of the yarn Y located downstream side of the crossing portion R is bent by the contact of the yarn Y with the outer peripheral edge 50a of the untwisting disk 50. In the above-described configuration, the peripheral speed of the untwisting disk 50 at the outer peripheral edge 50a thereof is higher than that of a part of the yarn A located inside the crossing portion R. Thus, the twist applied to the yarn Y in the crossing portion R can be maintained until the twist reaches the outer peripheral edge 50a of the untwisting disk 50. Hence, the untwisting point of the yarn Y is fixed on the outer peripheral edge 50a of the untwisting disk 50. Furthermore, the outer diameter D of the untwisting disk 50 at the outer peripheral edge 50a thereof projects toward the outer peripheral side of the reference belt 1. Consequently, a part of the yarn path of the yarn Y located in the interval between the crossing portion R and the untwisting disk 50 can be substantially aligned with the part of the yarn path of the yarn Y located inside the crossing portion R. If such a substantially straight yarn path is adopted, the reference belt 1 and the movable belt 2 are prevented from being locally worn at the downstream terminal of the crossing portion R.

[0043] In the above-described embodiment, the outer diameter D of the untwisting disk 50 at the outer peripheral edge thereof is set such that the part of the yarn path of the yarn Y located in the interval between the crossing portion R and the untwisting disk 50 is substantially aligned with the part of the yarn path of the yarn Y located inside the crossing portion, R.

[0044] If the untwisting disk 50 is configured to rotate in contact with the yarn Y instead of rotating positively, the peripheral speed of the untwisting disk 50 at the outer peripheral edge 50a thereof fails to exceed that of the part of the yarn Y inside the crossing portion R. This completely prevents the twist applied to the yarn Y in the crossing portion R from being maintained until the twist reaches the outer peripheral edge 50a of the untwisting disk 50. Furthermore, even

when the untwisting disk 50 is configured to rotate positively, if the untwisting disk 50 is prevented from rotating fast enough to make the peripheral speed of the untwisting disk 50 at the outer peripheral edge 50a thereof exceed that of the part of the yarn Y inside the crossing portion R, the twist applied to the yarn Y in the crossing portion R cannot completely be maintained until the twist reaches the outer peripheral edge 50a of the untwisting disk 50.

[0045] The above-described belt type false twist device 111 can adopt the following configuration. That is, the bending guide 51 is provided which is configured to guide the yarn Y so as to enhance bending of the yarn at the outer peripheral edge 50a of the untwisting disk 50. This configuration enhances the bending of the part of the yarn path of the yarn Y located at the outer peripheral edge 50a of the untwisting disk 50. Thus, the untwisting point of the yarn Y achieved by the bending is stabilized at a higher level.

[0046] The preferred embodiment has been described above. The above-described embodiment may be modified as described below.

[0047] Figure 7 is a figure which is similar to Figure 2 and which shows another embodiment of the present invention. As shown in Figure 7, instead of the untwisting disk 50 according to the above-described embodiment, an annular projecting portion 52 (untwisting portion) may be projected from the outer peripheral surface of the driven pulley 11 of the movable belt unit 4. In other words, instead of the untwisting disk 50 separate from the driving pulley 10, the projecting portion 52 integral with the driving pulley 11 may be adopted. That is, the untwisting portion such as the untwisting disk 50 or the projecting portion 52 may be separate from or integral with the pulley (10, 11). The configuration with the separate untwisting portion excellently enables the untwisting portion to be exclusively replaced. The configuration with the integral untwisting portion contributes to reducing the number of required components. In either case, the untwisting point can be fixed when the untwisting tension T2 is high as shown in Figure 6B. Furthermore, even in this case, a bending guide is preferably provided which is configured to guide the yarn Y so as to enhance the bending of the yarn path of the yarn achieved by the projecting portion 52 as is the case with the above-described embodiment.

Claims

1. A belt type false twist device configured to nip and twist yarn by allowing paired endless belts to travel so as to cross and compressively contact each other, the belt type false twisting device being **characterized in that**:

a pulley around which said endless belt is wound includes an untwisting portion with an outer peripheral edge, the untwisting portion is configured to rotate together with said pulley, an outer diameter of the untwisting portion at the outer peripheral edge thereof is set to be equal to or larger than a value obtained by adding a thickness of said endless belt to an outer diameter of said pulley, and a part of a yarn path of the yarn located downstream side of a crossing portion in which the paired endless belts cross is bent by contact of the yarn with the outer peripheral edge of said untwisting portion.

2. The belt type false twist device according to Claim 1, **characterized in that** a part of the yarn path of the yarn in an interval between said belt crossing portion and said untwisting portion is substantially aligned with the part of said yarn path located inside the crossing portion.

3. The belt type false twist device according to Claim 1, **characterized in that** said untwisting portion is configured to be separate from said pulley.

4. The belt type false twist device according to Claim 1, **characterized in that** said untwisting portion is configured to be integral with said pulley.

5. The belt type false twist device according to Claim 1, **characterized in that** said untwisting portion is configured as a disk formed to include an outer peripheral edge with a radius of curvature of 0.1R to 0.4R.

6. The belt type false twist device according to any one of Claims 1 to 5, **characterized in that** on a downstream side of the untwisting portion, a bending guide is provided which guides said yarn so as to enhance bending of said yarn at the outer peripheral edge of said untwisting portion.

FIGURE 1

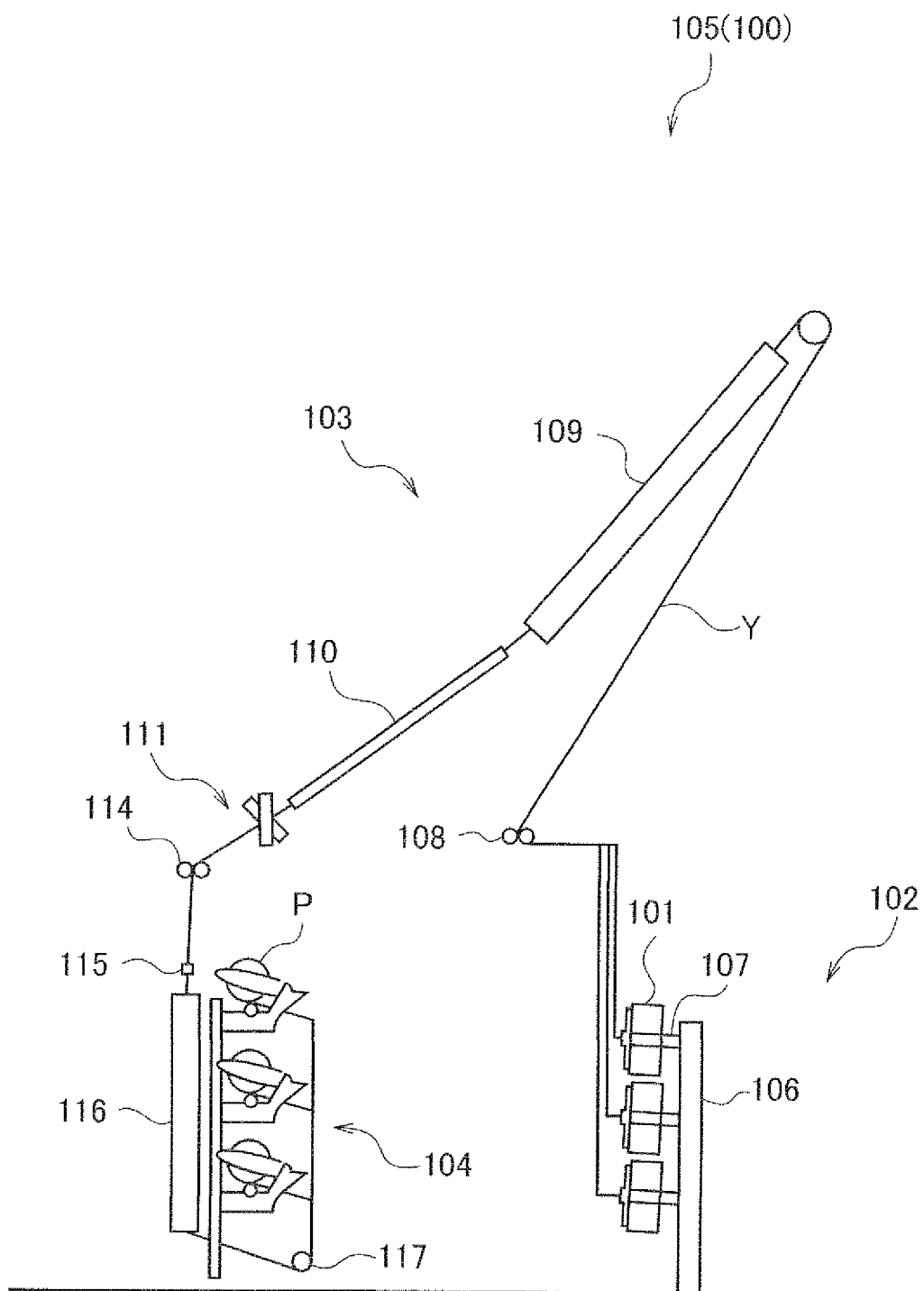


FIGURE 2

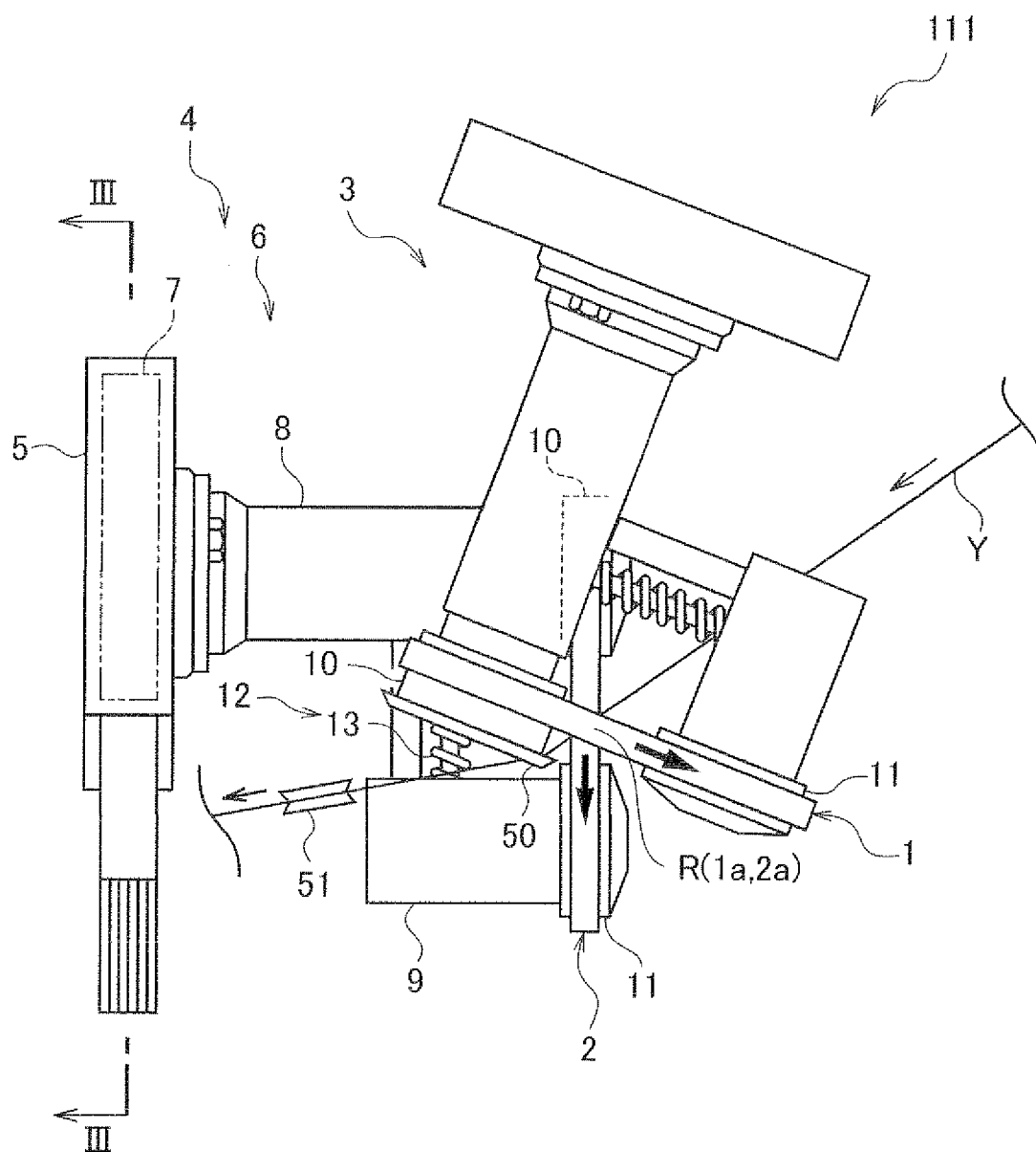


FIGURE 3

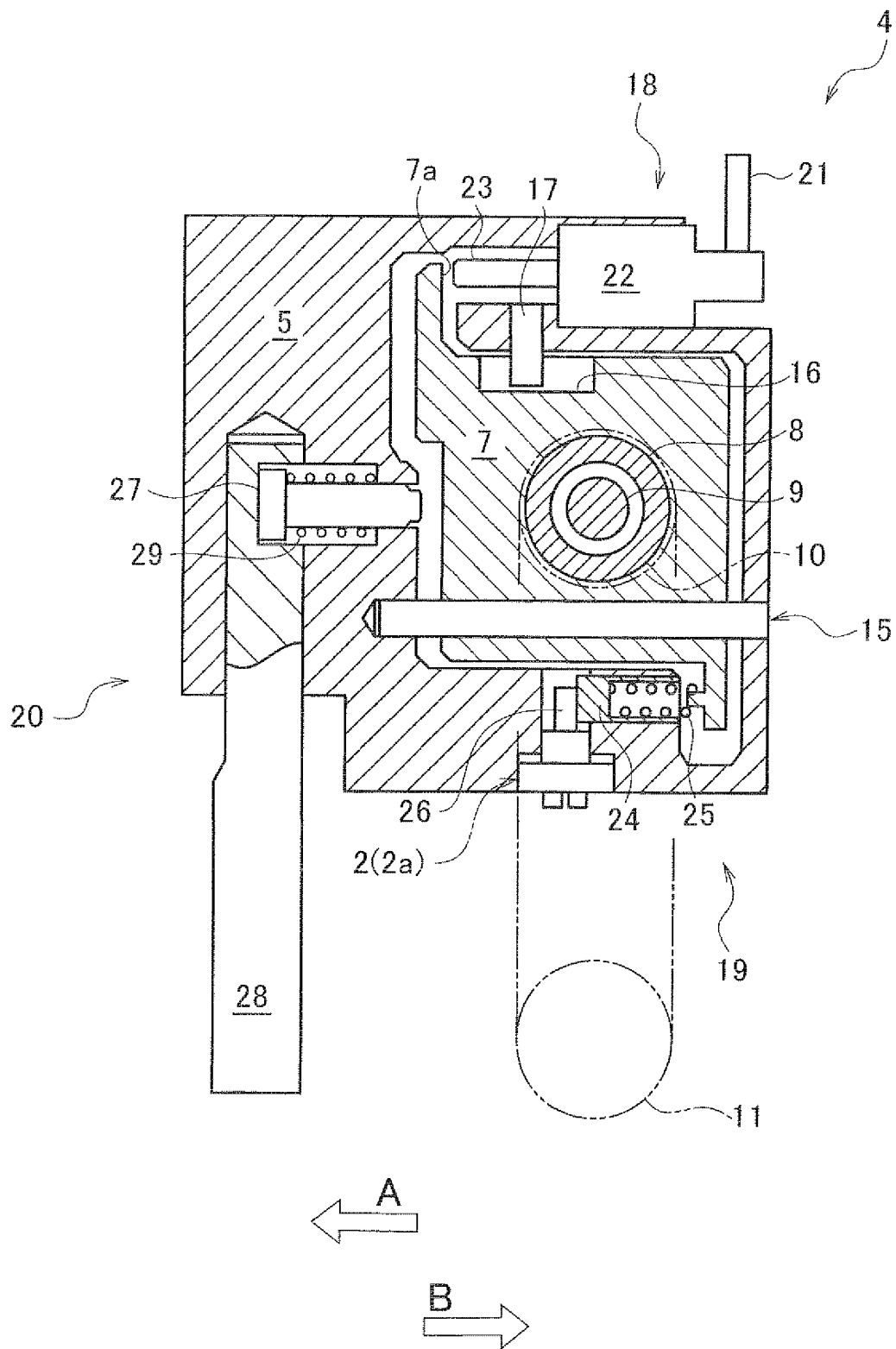


FIGURE 4

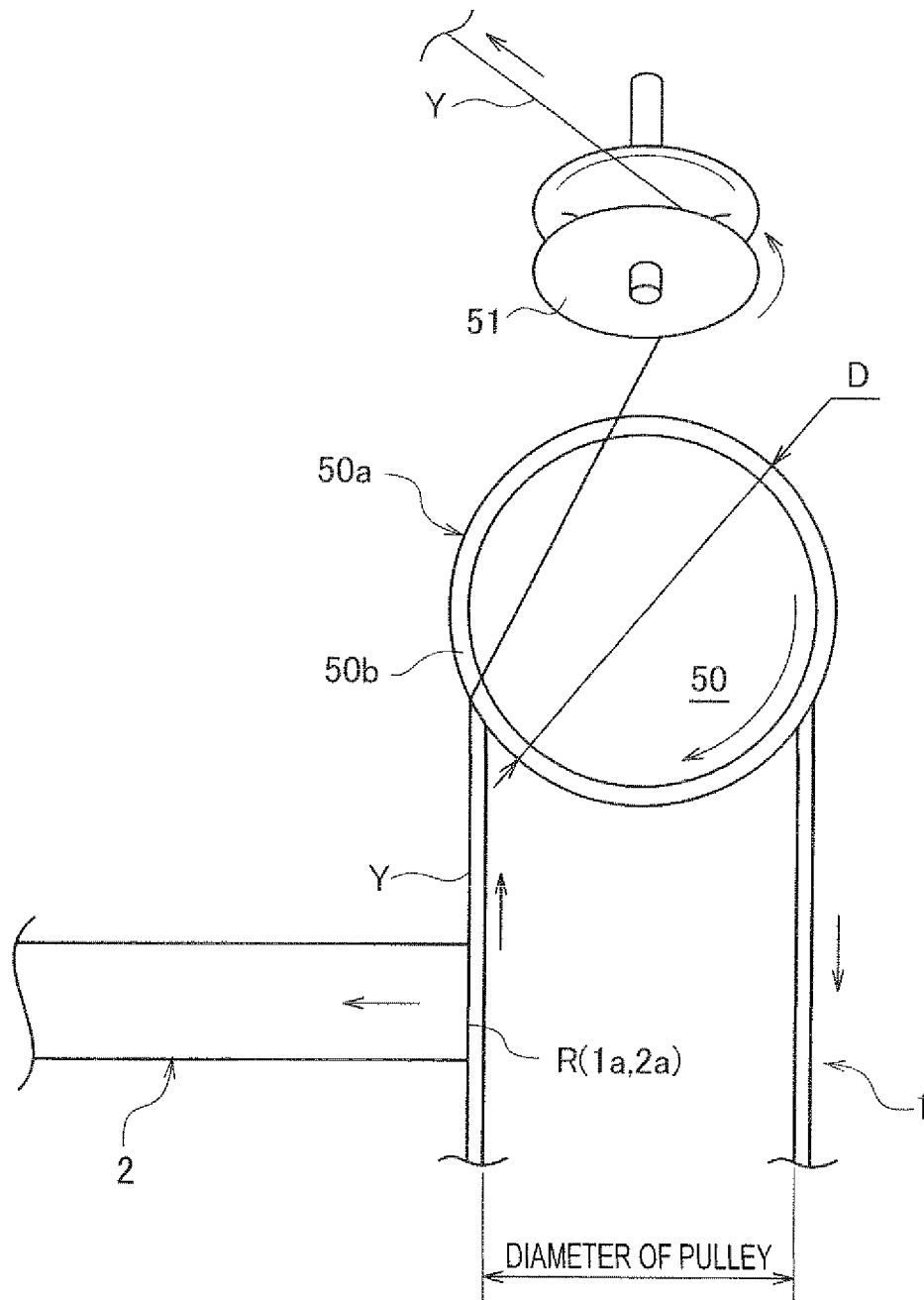


FIGURE 5A

COMPARATIVE EXAMPLE (CASE WHERE UNTWISTING TENSION T_2 IS LOW)

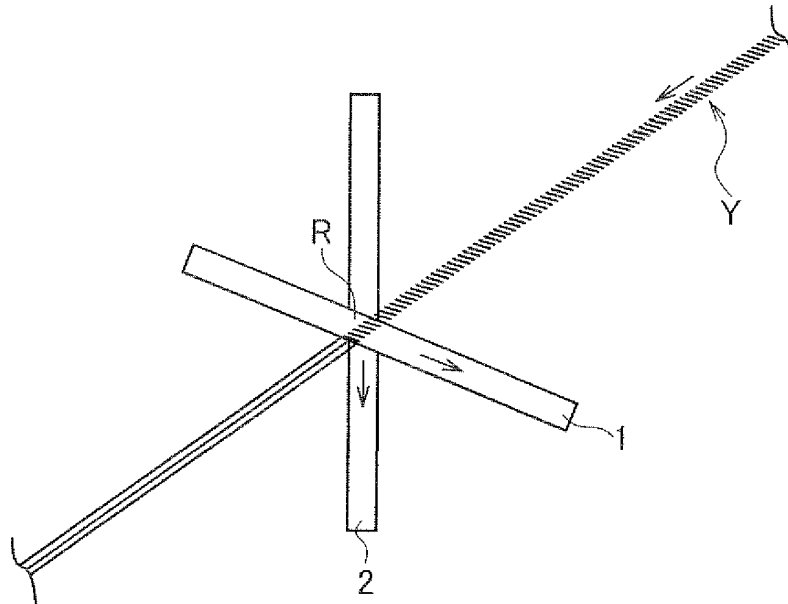


FIGURE 5B

EXAMPLE (CASE WHERE UNTWISTING TENSION T_2 IS LOW)

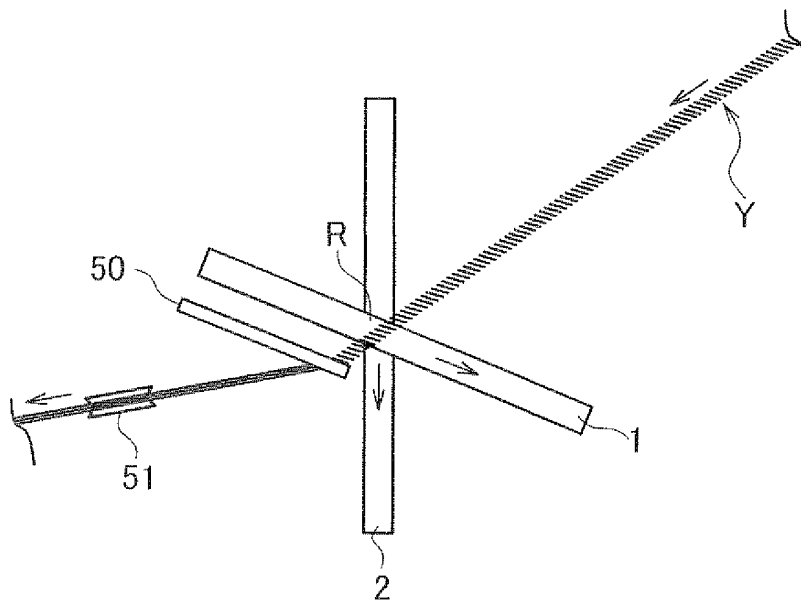


FIGURE 6A

COMPARATIVE EXAMPLE (CASE WHERE UNTWISTING TENSION T_2 IS HIGH)

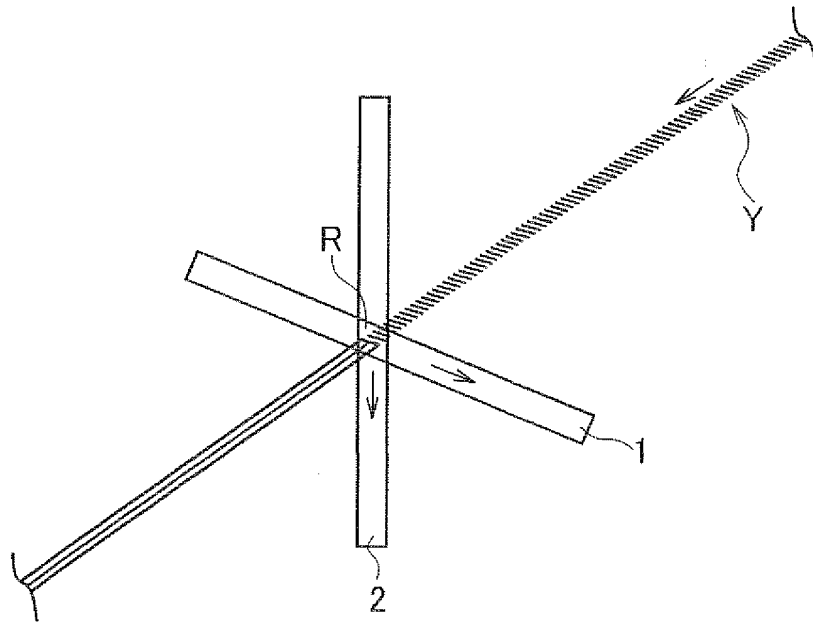


FIGURE 6B

EXAMPLE (CASE WHERE UNTWISTING TENSION T_2 IS HIGH)

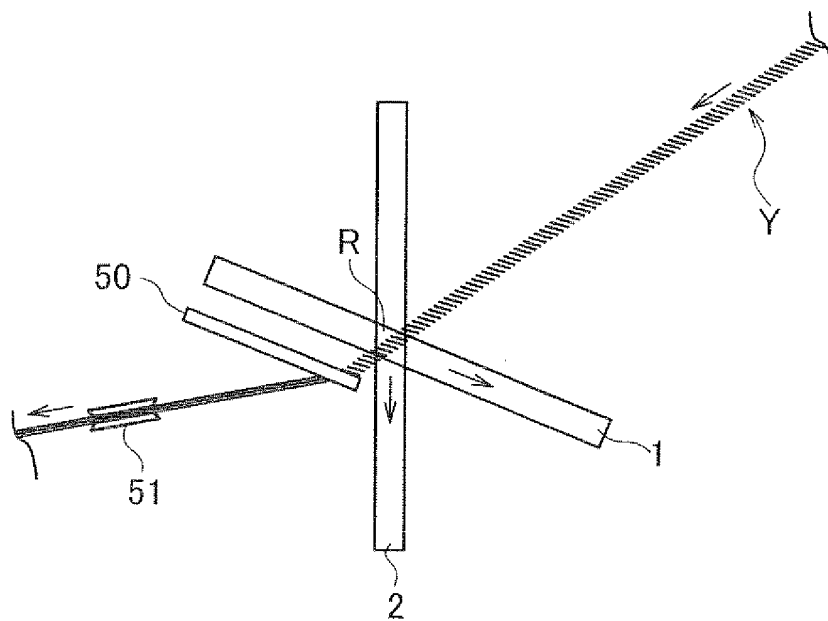
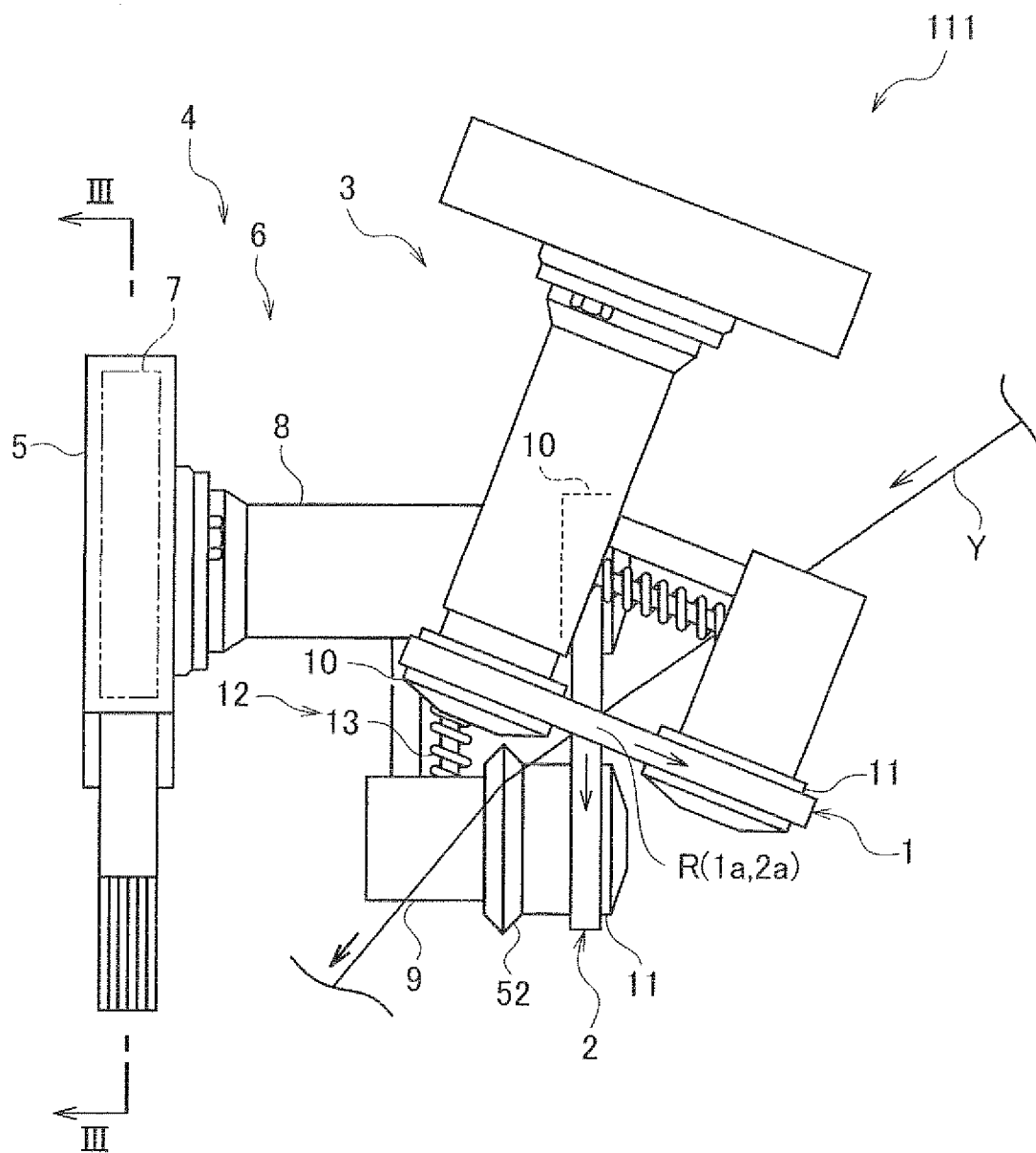


FIGURE 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/064915

A. CLASSIFICATION OF SUBJECT MATTER

D02G1/04 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D02G1/00-3/48, D02J1/00-13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-32502 B2 (Murata Machinery Ltd.), 17 May 1993 (17.05.1993), claims; drawings & JP 63-264922 A & US 4852341 A & DE 3812932 A	1-6
A	JP 2007-297764 A (TMT Machinery, Inc.), 15 November 2007 (15.11.2007), claims; drawings & CN 101050567 A	1-6
A	JP 2002-266179 A (Murata Machinery Ltd.), 18 September 2002 (18.09.2002), claims; drawings (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
07 October, 2009 (07.10.09)Date of mailing of the international search report
20 October, 2009 (20.10.09)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/064915

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 58-23924 A (Murata Machinery Ltd.), 12 February 1983 (12.02.1983), claims; drawings (Family: none)	1-6

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002266179 A [0002]
- JP 58023924 A [0003]