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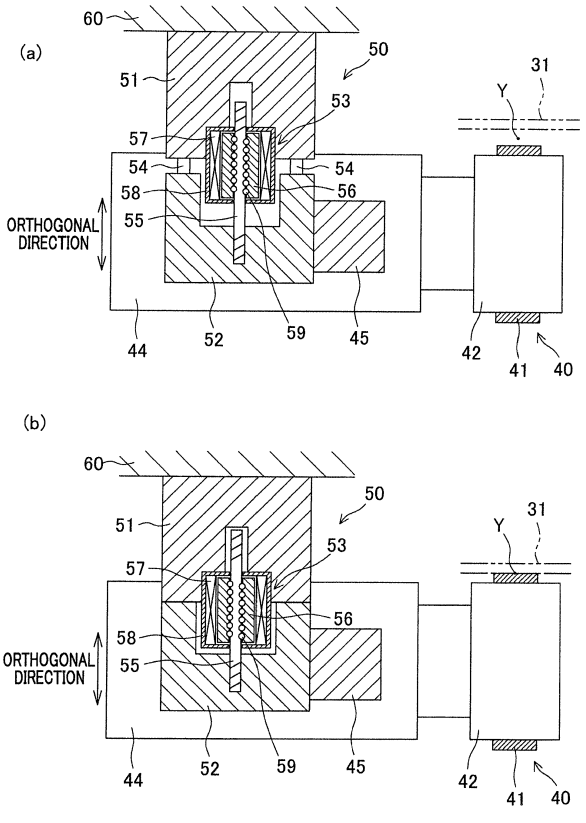
(54) BELT-TYPE FALSE-TWISTING DEVICE

(57) A variation in contact pressure is restrained and the tension of a yarn is suitably controlled in a belt-type false-twisting device. A belt-type false-twisting device is configured to false-twist a yarn Y by running a first belt 41 and a second belt 31 intersecting with each other while nipping the yarn Y by intersecting surfaces of the first belt 41 and the second belt 31, the belt-type false-twisting device including a mover 50 configured to move the first belt 41 relative to the second belt 31, the mover 50 including a feed screw mechanism 53 which includes a male screw part 55 extending in an axial direction and a female screw part 56 with which the male screw part 55 is screwed, and the first belt 41 being attached to be movable together with the male screw part 55, and the first belt 41 moving in the axial direction together with the male screw part 55 as the female screw part 56 rotates about an axis.

FIG.4



EP 3 312 319 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a belt-type false-twisting device which is configured to false-twist a yarn by running belts while nipping the yarn by the two belts intersecting with each other.

Background Art

[0002] As shown in, for example, Patent Literatures 1 to 3, a belt-type false-twisting device which is configured to false-twist a yarn by running belts while nipping the yarn by the two belts intersecting with each other has been known. In such a belt-type false-twisting device, the yarn is held between the two belts in such a way that one belt is pressed onto the other belt with a predetermined contact pressure. An air-type method utilizing air pressure is used for generating the contact pressure in Patent Literatures 1 and 2 (Japanese Unexamined Patent Publication No. 2009-13524 and Japanese Unexamined Patent Publication No. H6-228836). In Patent Literature 3 (Japanese Unexamined Patent Publication No. H6-81234), the contact pressure is applied from a feed screw portion via a spring (hereinafter, a spring type).

SUMMARY OF THE INVENTION

[0003] When the contact pressure is generated based on the air-type method or the spring-type method as described above, the belts tend to be disadvantageously moved by vibrations or an external force, and the contact pressure tends to be varied. Furthermore, it is necessary to control the tension of a yarn to fall within an appropriate range in false-twisting. In this connection, the air type method and the spring type method are disadvantageous in terms of the tension control.

[0004] Methods of controlling the tension of a yarn include adjustment of a contact pressure applied to a belt and adjustment of the running speed of a belt. In case of the adjustment of the contact pressure applied to the belt, when the air type method or the spring type method is employed to generate the contact pressure, the response speed is varied depending on whether the air pressure or the stretch of the spring is around the upper limit value, around the lower limit value, or around the medium value. On this account, it is difficult to constantly perform the control. In case of the adjustment of the running speed of the belt, when the air type method or the spring type method is employed to generate the contact pressure, the yarn becomes slippery and not easily held when the running speed is increased. On this account, it is difficult to properly perform the control.

[0005] When the air type method or the spring type method is employed to generate the contact pressure, the contact pressure tends to be low as compared to the rigidity of the yarn when the yarn to be false-twisted is thick. The problems above tend to be particularly conspicuous in such a case.

[0006] The present invention has been done to solve the problems above. An object of the present invention is therefore to restrain variations in a contact pressure and to cause the tension of a yarn to be appropriately controllable in a belt-type false-twisting device which is configured to false-twist a yarn by running belts while nipping the yarn by the two belts intersecting with each other.

[0007] The present invention relates to a belt-type false-twisting device which is configured to false-twist a yarn by running a first belt and a second belt intersecting with each other while nipping the yarn by intersecting surfaces of the first belt and the second belt, the belt-type false-twisting device including a mover configured to move the first belt relative to the second belt, the mover including a feed screw mechanism which includes a male screw part extending in an axial direction and a female screw part with which the male screw part is screwed, and the first belt being attached to be movable together with one of the male screw part and the female screw part, and the first belt moving in the axial direction together with that one of the male screw part and the female screw part as the other one of the male screw part and the female screw part rotates about an axis.

[0008] As disclosed in the present invention, because the first belt is attached to be movable together with the male screw part or the female screw part of the feed screw mechanism, it is possible to prevent unintentional movement of the first belt in response to vibrations or an external force, and hence variations in the contact pressure are restrained. When the tension control is carried out by adjusting the contact pressure, because the first belt is movable in proportion to the operation of the feed screw mechanism, the response speed is maintained to be constant and the tension control is easily done. Furthermore, when the tension control is carried out by adjusting the running speeds of the belts, because the position of the first belt is fixed by means of the feed screw mechanism, slipping of the yarn is advantageously restrained. As such, the present invention makes it possible to restrain the variations of the contact pressure and properly control the tension of the yarn.

[0009] The present invention is preferably arranged so that the first belt is attached to be movable together with the male screw part, and the first belt moves in the axial direction together with the male screw part as the female screw part rotates about the axis.

[0010] Because the male screw part is smaller in diameter than the female screw part, a space required for the movement of the male screw part is small, and hence downsizing of the feed screw mechanism is possible.

[0011] The present invention is preferably arranged so that the feed screw mechanism is a ball screw mechanism in which balls are provided between the male screw part and the female screw part.

[0012] As the ball screw mechanism is employed as

the feed screw mechanism, the torque required for rotationally driving the feed screw mechanism is small, and hence the decrease in size and cost of the mover is possible.

[0013] The present invention is preferably arranged so that the male screw part is provided to extend in a direction orthogonal to the intersecting surface of the second belt.

[0014] With this arrangement, the moving direction of the first belt is identical with the direction orthogonal to the intersecting surface of the second belt, with the result that the first belt is movable while the intersecting surface of the first belt and the intersecting surface of the second belt are maintained to be parallel to each other. Because the belts do not make unnecessary contact with each other, abrasion of the belts is restrained and power required for driving the belts is reduced.

[0015] The present invention is particularly suitable for false-twisting a yarn with the thickness of 600 denier or more.

[0016] When the yarn is thick, i.e., 600 denier or more, because the first belt is pushed back by the rigidity of the yarn, the yarn may not be properly held. In this connection, with the present invention employing the feed screw mechanism, it is possible to prevent the first belt from being moved due to the repulsive force of the yarn, and hence false-twisting is properly done even if the yarn is thick.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic diagram of a draw texturing machine of an embodiment of the present invention.
FIG. 2 is a perspective view schematically showing a belt-type false-twisting device.
FIG. 3 shows the belt-type false-twisting device in an orthogonal direction.
FIG. 4 is a cross section taken along the IV-IV line in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The following will describe a preferred embodiment of the present invention.

[0019] As shown in FIG. 1, a draw texturing machine 1 of the present embodiment is configured to false-twist a yarn Y which run along a yarn path from a creel stand 11 to a winding unit 13 via a yarn processing unit 12. In the draw texturing machine 1, creel stands 11, yarn processing units 12, and winding units 13 are provided to be symmetrical in the left-right direction in FIG. 1 so that the creel stands 11 are on the outer sides.

[0020] Each creel stand 11 includes a plurality of creels 11a. Each creel 11a holds a yarn supply package S.

[0021] The yarn processing unit 12 includes members such as a primary feed roller 20, a primary heater 21, a cooler 23, a belt-type false-twisting device 24, a secondary feed roller 25, a secondary heater 26, and a tertiary feed roller 27. These members are provided in this order from the upstream side of the yarn path. These members constituting the yarn processing unit 12 are lined up in the direction orthogonal to the plane of FIG. 1 (hereinafter, a frame longitudinal direction). On the whole, the draw texturing machine 1 is long in the frame longitudinal direction.

[0022] The primary feed roller 20 conveys the yarns Y supplied from each of the yarn supply packages S toward the primary heater 21. The primary heater 21 heats the yarns Y supplied from the primary feed roller 20. On the immediate upstream of the primary heater 21, a twist-stopping guide 22 is provided. As described later, the twist-stopping guide 22 is provided to prevent the twist from reaching the upstream of the twist-stopping guide 22, when the yarn Y is twisted by the belt-type false-twisting device 24.

[0023] The cooler 23 cools the yarns Y heated by the primary heater 21. The belt-type false-twisting device 24 false-twists the yarn Y. In this regard, the yarn Y is twisted between the twist-stopping guide 22 and the belt-type false-twisting device 24 and are untwisted between the belt-type false-twisting device 24 and the secondary feed roller 25. Furthermore, the yarn Y is twisted while being heated by the primary heater 21. The twisted yarn Y is cooled by the cooler 23, and hence the twist is thermally set. On this account, after being untwisted, the yarn Y is false-twisted so that each filament is wavy in shape. The details of the belt-type false-twisting device 24 will be given later.

[0024] The secondary feed roller 25 conveys the yarn Y having been false-twisted by the belt-type false-twisting device 24 toward the secondary heater 26. The conveyance speed of conveying the yarn Y by the secondary feed roller 25 is higher than the conveyance speed of the primary feed roller 20. The yarn Y is drawn on account of the difference in conveyance speed between the primary feed roller 20 and the secondary feed roller 25. The conveyance speed of conveying the yarn Y by the later-described tertiary feed roller 27 is lower than the conveyance speed of the secondary feed roller 25. The yarn Y is relaxed on account of the difference in conveyance speed between the secondary feed roller 25 and the tertiary feed roller 27. The secondary heater 26 provided between the secondary feed roller 25 and the tertiary feed roller 27 performs predetermined relaxation heat treatment for the yarn Y which have been drawn and false-twisted.

[0025] The tertiary feed roller 27 conveys the yarn Y after being subjected to the relaxation heat treatment toward the winding unit 13. The tertiary feed roller 27 is provided to be distanced from the secondary heater 26 in the left-right direction in FIG. 1. In the space between the secondary heater 26 and the tertiary feed roller 27, a working bench or a working wagon, which is not illustrated, is provided. On this working bench or working

wagon, an operator performs operations such as yarn threading.

[0026] The winding unit 13 includes a plurality of winding devices 14. The winding devices 14 are lined up in the frame longitudinal direction and the vertical direction. To each of the winding devices 14, a bobbin is attached so that the axial direction of the bobbin is in parallel to the frame longitudinal direction. The winding device 14 forms a package P by winding a yarn Y supplied from the tertiary feed roller 27 onto the bobbin while traversing the yarn Y in the axial direction of the bobbin (i.e., the frame longitudinal direction).

[0027] Now, the belt-type false-twisting device 24 will be detailed. FIG. 2 is a perspective view schematically showing the belt-type false-twisting device 24. FIG. 3 shows the belt-type false-twisting device 24 in a later-described orthogonal direction. In FIG. 2, later-described supporting members 35 and 45 and a later-described mover 50 are not shown.

[0028] The belt-type false-twisting device 24 includes a fixed belt unit 30 and a movable belt unit 40. The fixed belt unit 30 is fixed to an unillustrated frame. In the meanwhile, the movable belt unit 40 is arranged to be movable by the later-described mover 50 (see FIG. 3) so that a movable belt 41 (equivalent to a first belt of the present invention) of the movable belt unit 40 is able to move relative to a fixed belt 31 (equivalent to a second belt of the present invention) of the fixed belt unit 30. The yarn Y nipped between the fixed belt 31 and the movable belt 41 which intersect with each other is false-twisted. The belt-type false-twisting device 24 of the present embodiment is configured to false-twist a relatively-thick yarn Y with the thickness of 600 denier or more. As a matter of course, the belt-type false-twisting device 24 is able to false-twist a thinner yarn.

[0029] The fixed belt unit 30 includes the fixed belt 31, a driving pulley 32, a driven pulley 33, a motor 34, and the supporting member 35 (see FIG. 3). The fixed belt 31 is an endless belt made of a rubber material or the like, and is wound onto the driving pulley 32 and the driven pulley 33. The driving pulley 32 is connected to the motor 34. As the motor 34 is driven and the driving pulley 32 is rotated, the fixed belt 31 moves and the driven pulley 33 is rotated by this movement. The driving pulley 32 and the driven pulley 33 are connected to each other by and supported by the supporting member 35.

[0030] The movable belt unit 40 includes the movable belt 41, a driving pulley 42, a driven pulley 43, a motor 44, and a supporting member 45 (see FIG. 3). The movable belt 41 is an endless belt made of a rubber material or the like, and is wound onto the driving pulley 42 and the driven pulley 43. The driving pulley 42 is connected to the motor 44. As the motor 44 is driven and the driving pulley 42 is rotated, the movable belt 41 moves and the driven pulley 43 is rotated by this movement. The driving pulley 42 and the driven pulley 43 are connected to each other by and supported by the supporting member 45.

[0031] When the movable belt 41 is arranged to be close to the fixed belt 31, the fixed belt 31 and the movable belt 41 intersect with each other at intersecting surfaces 31a and 41a, respectively. The yarn Y is nipped between the intersecting surface 31a and the intersecting surface 41a. As the driving pulley 32 and the driving pulley 42 are rotated in the direction indicated by the arrow in FIG. 2, the yarn Y is twisted while being forwarded in the yarn running direction. Hereinafter, the direction orthogonal to the intersecting surface 31a of the fixed belt 31 will be referred to as an orthogonal direction.

[0032] The fixed belt unit 30 is fixed to the frame in such a way that the supporting member 35 is attached to the frame. In the meanwhile, the movable belt unit 40 is arranged to be movable in the orthogonal direction by the mover 50 attached to the supporting member 45. As the movable belt unit 40 moves in the orthogonal direction, the intersecting surface 41a of the movable belt 41 is moved relative to the intersecting surface 31a of the fixed belt 31 while the intersecting surface 41a and the intersecting surface 31a are maintained to be parallel to each other. Now, the mover 50 will be detailed below.

[0033] FIG. 4 is a cross section taken along the IV-IV line in FIG. 3. In FIG. 4, the fixed belt unit 30 is omitted and only the movable belt unit 40 and the mover 50 are illustrated. The up-down direction in FIG. 4 is identical with the orthogonal direction.

[0034] The mover 50 includes a fixed block 51 fixed to the frame 60, a movable block 52 movable in the orthogonal direction relative to the fixed block 51, and a feed screw mechanism 53 provided between the fixed block 51 and the movable block 52. To the fixed block 51, a plurality of (or one) guide members 54 extending in the orthogonal direction are attached. As the movable block 52 is guided by the guide members 54, the movable block 52 is movable in the orthogonal direction. The movable block 52 is attached to the supporting member 45 of the movable belt unit 40. As the movable block 52 moves in the orthogonal direction, the movable belt unit 40 moves in the orthogonal direction.

[0035] The feed screw mechanism 53 includes a male screw part 55 extending in the axial direction, a female screw part 56 with which the male screw part 55 is screwed, a stator coil 57 provided radially outside the female screw part 56, and a housing 58 in which the female screw part 56 and the stator coil 57 are housed. In the present embodiment, the axial direction in which the male screw part 55 extends is identical with the orthogonal direction. The feed screw mechanism 53 of the present embodiment is a ball screw mechanism in which balls 59 are provided between the male screw part 55 and the female screw part 56.

[0036] One end of the male screw part 55 (i.e., the lower end in FIG. 4) is fixed to the movable block 52, whereas the other end is a free end. In other words, the movable belt 41 is indirectly attached to the male screw part 55 via the supporting member 45 and the movable block 52, and hence the movable belt 41 and the male screw part 55 are integrally movable. To put it differently,

members that obstructs the integral movement of the movable belt 41 and the male screw part 55, e.g., an air-type driving unit such as an air cylinder and a spring component, are not provided between the movable belt 41 and the male screw part 55. Furthermore, a central part in the axial direction of the male screw part 55 is screwed with the female screw part 56. To the stator coil 57, a current is supplied in response to an instruction from an unillustrated controller. As the current is supplied to the stator coil 57, the female screw part 56 made of a magnetic material rotates about the axis of the male screw part 55, on account of an electromagnetic effect of the stator coil 57. In short, the female screw part 56 functions as a rotor of a motor.

[0037] The female screw part 56 is rotatably supported by an unillustrated bearing attached to the housing 58 so that movement in the orthogonal direction is restricted. On this account, when the female screw part 56 rotates about the axis, the female screw part 56 does not move in the orthogonal direction whereas the male screw part 55 moves in the orthogonal direction. At this stage, as the movable block 52 fixed to one end of the male screw part 55 moves in the orthogonal direction together with the male screw part 55, the movable belt unit 40 moves in the orthogonal direction.

[0038] By the mover 50 arranged in this way, the movable belt unit 40 is moved in two directions along the orthogonal direction as the direction of the current supplied to the stator coil 57 is changed. On this account, the movable belt 41 is freely movable between a far position (see FIG. 4(a)) which is far from the fixed belt 31 and a near position (see FIG. 4(b)) which is close to the fixed belt 31 and where the yarn Y can be nipped between the movable belt 41 and the fixed belt 31. When the yarn Y is nipped between the fixed belt 31 and the movable belt 41 at the near position, the fixed belt 31 is in contact with the movable belt 41 when the yarn Y is thin, but the fixed belt 31 may not be in contact with the movable belt 41 when the yarn Y is thick.

[0039] In the belt-type false-twisting device 24, to control the tension of the yarn Y for proper false-twisting, the contact pressure between the belts 31 and 41 is adjusted or the running speeds of the belts 31 and 41 are adjusted.

[0040] To be more specific, to adjust the contact pressure of the belts 31 and 41, when the tension of the yarn Y is too high, the tension is lowered in such a way that the contact pressure is increased by moving, by the mover 50, the movable belt 41 toward the fixed belt 31 (i.e., in the direction from the far position to the near position). In the meanwhile, when the tension of the yarn Y is too low, the tension is increased in such a way that the contact pressure is decreased by moving, by the mover 50, the movable belt 41 away from the fixed belt 31 (i.e., in the direction from the near position to the far position).

[0041] To adjust the running speeds of the belts 31 and 41, when the tension of the yarn Y is too high, the tension is lowered in such a way that the rotation speeds of the motors 34 and 44 are increased to increase the running speeds of the belts 31 and 41. In the meanwhile, when the tension of the yarn Y is too low, the tension is increased in such a way that the rotation speeds of the motors 34 and 44 are decreased to decrease the running speeds of the belts 31 and 41.

(Advantageous Effects)

[0042] According to the present embodiment, the movable belt 41 is attached to be movable together with the male screw part 55. As the female screw part 56 rotates about the axis, the movable belt 41 moves in the axial direction together with the male screw part 55. This prevents unintentional movement of the movable belt 41 in response to vibrations or an external force, and hence variations in the contact pressure are restrained. When the tension control of the yarn Y is carried out by adjusting the contact pressure of the belts 31 and 41, because the movable belt 41 is movable in proportion to the operation of the feed screw mechanism 53 (i.e., the moving distance of the male screw part 55), the response speed is maintained to be constant and the tension control is easily done. When the tension control is carried out by adjusting the running speeds of the belts 31 and 41, because the position of the movable belt 41 is fixed by means of the feed screw mechanism 53, slipping of the yarn Y is advantageously restrained. As such, the belt-type false-twisting device 24 of the present embodiment makes it possible to restrain the variations of the contact pressure and properly control the tension of the yarn Y.

[0043] According to the present embodiment, the movable belt 41 is attached to be movable together with the male screw part 55. As the male screw part 55 rotates about the axis, the male screw part 55 moves in the axial direction. Because the male screw part 55 is smaller in diameter than the female screw part 56, a space required for the movement of the male screw part 55 is small, and hence downsizing of the feed screw mechanism 53 is possible.

[0044] In the present embodiment, the feed screw mechanism 53 is a ball screw mechanism in which balls 59 are provided between the male screw part 55 and the female screw part 56. The torque required for rotationally driving the feed screw mechanism 53 is therefore small, and hence the decrease in size and cost of the mover 50 is possible.

[0045] In the present embodiment, the male screw part 55 extends in the direction orthogonal to the intersecting surface 31a of the fixed belt 31. On this account, the moving direction of the movable belt 41 is identical with the direction orthogonal to the intersecting surface 31a of the fixed belt 31, with the result that the movable belt 41 is movable while the intersecting surface 41a of the movable belt 41 and the intersecting surface 31a of the fixed belt 31 are maintained to be parallel to each other. Because the belts 31 and 41 do not make unnecessary contact with each other, abrasion of the belts 31 and 41 is restrained and power required for driving the belts 31

and 41 is reduced.

[0046] The belt-type false-twisting device 24 of the present embodiment is particularly suitable for false-twisting a yarn Y with the thickness of 600 denier or more. When the yarn Y is thick, i.e., 600 denier or more, because the movable belt 41 is pushed back by the rigidity of the yarn Y, the yarn Y may not be properly held. In this connection, with the feed screw mechanism 53, it is possible to prevent the movable belt 41 from being moved due to the repulsive force of the yarn Y, and hence false-twisting is properly done even if the yarn Y is thick.

(Other embodiments)

[0047] Although the embodiment of the present invention has been described, the present invention is not limited to the above and can be suitably changed within the scope of the present invention as described below.

[0048] According to the embodiment above, the movable belt 41 is attached to be movable together with the male screw part 55. As the female screw part 56 rotates about the axis, the movable belt 41 moves in the axial direction (orthogonal direction) together with the male screw part 55. Alternatively, the feed screw mechanism 53 may be arranged such that the movable belt 41 is attached to be movable together with the female screw part 56, and as the male screw part 55 is rotated about the axis, the movable belt 41 moves in the axial direction together with the female screw part 56.

[0049] In the embodiment above, the movable belt 41 is indirectly attached to the male screw part 55 via another member. Alternatively, the movable belt 41 may be directly attached to the male screw part 55 (or the female screw part 56).

[0050] In the embodiment above, as the feed screw mechanism 53 moves the movable belt 41 in the orthogonal direction, the intersecting surface 41a of the movable belt 41 and the intersecting surface 31a of the fixed belt 31 are maintained to be parallel to each other. Alternatively, for example, the movable belt 41 is arranged to be swingable about the central axis of the driving pulley 42, and as the feed screw mechanism 53 is driven to swing the movable belt 41, the movable belt 41 moves relative to the fixed belt 31. When the movable belt 41 is of a swing type in this way, however, a contact state (e.g., a contact angle) between the movable belt 41 and the yarn Y is varied depending on the thickness of the yarn Y when the movable belt 41 swings, and hence the yarn Y may not be properly held by the intersecting surfaces 31a and 41a when the yarn Y is thick. In this regard, the embodiment above in which the movable belt 41 is moved while the intersecting surfaces 31a and 41a are maintained to be parallel to each other is advantageous, because the yarn Y is stably held irrespective of the thickness of the yarn Y.

[0051] While in the embodiment above the feed screw mechanism 53 is a ball screw mechanism, the feed screw mechanism 53 may be a sliding screw mechanism.

Claims

1. A belt-type false-twisting device configured to false-twist a yarn by running a first belt and a second belt intersecting with each other while nipping the yarn by intersecting surfaces of the first belt and the second belt, comprising
   a mover configured to move the first belt relative to the second belt,
   the mover including a feed screw mechanism which includes a male screw part extending in an axial direction and a female screw part with which the male screw part is screwed, and
   the first belt being attached to be movable together with one of the male screw part and the female screw part, and the first belt moving in the axial direction together with that one of the male screw part and the female screw part as the other one of the male screw part and the female screw part rotates about an axis.

2. The belt-type false-twisting device according to claim 1, wherein, the first belt is attached to be movable together with the male screw part, and the first belt moves in the axial direction together with the male screw part as the female screw part rotates about the axis.

3. The belt-type false-twisting device according to claim 1 or 2, wherein, the feed screw mechanism is a ball screw mechanism in which balls are provided between the male screw part and the female screw part.

4. The belt-type false-twisting device according to any one of claims 1 to 3, wherein, the male screw part is provided to extend in a direction orthogonal to the intersecting surface of the second belt.

5. The belt-type false-twisting device according to any one of claims 1 to 4, wherein, the yarn to be false-twisted is 600 denier or more in thickness.

FIG.1

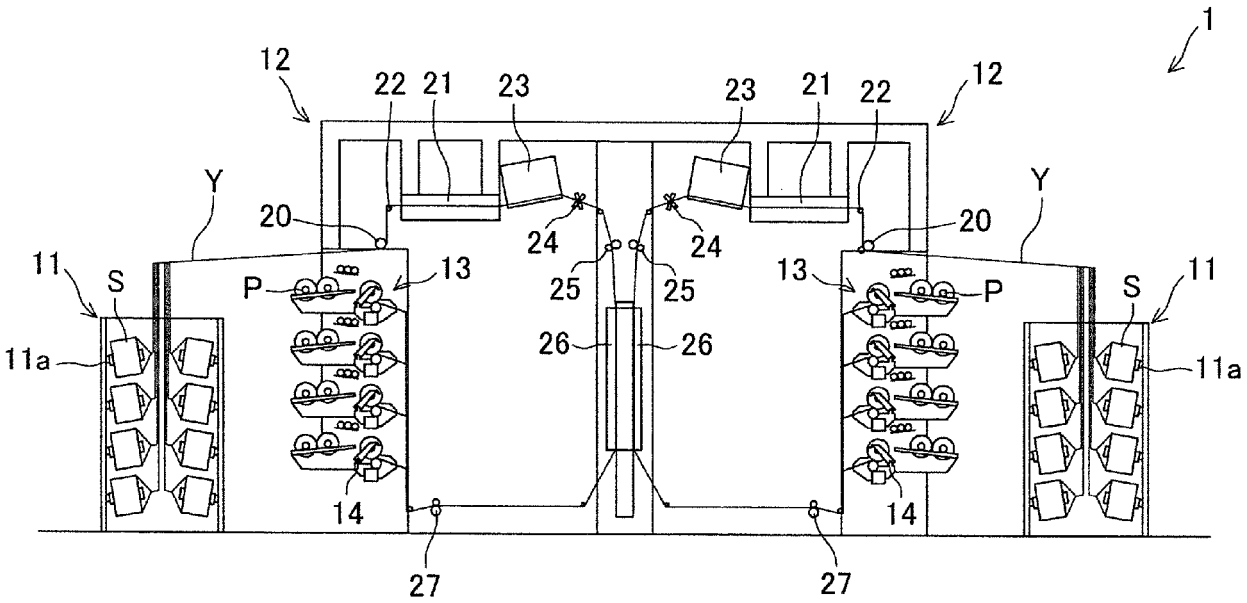

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FIG.2

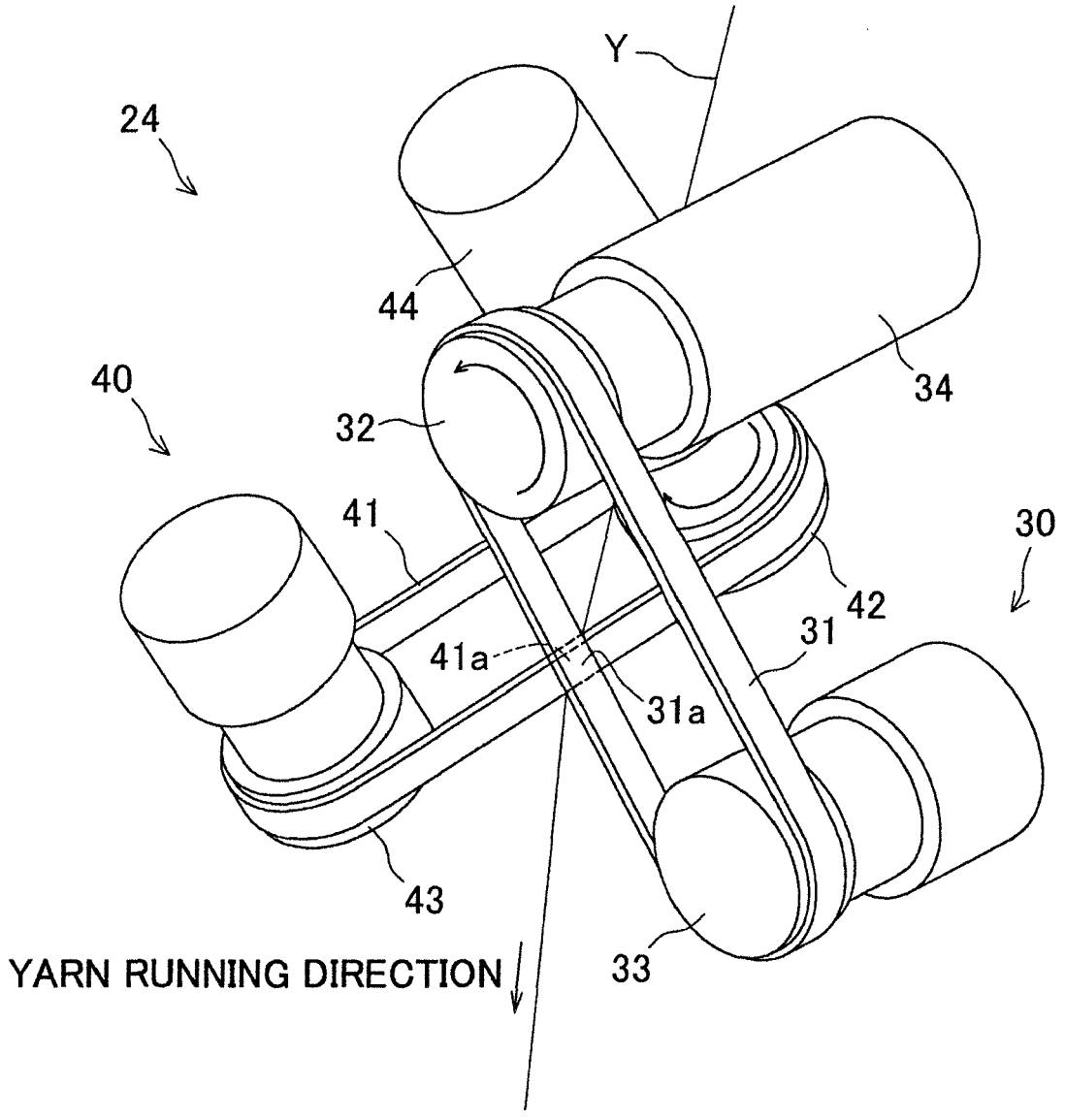
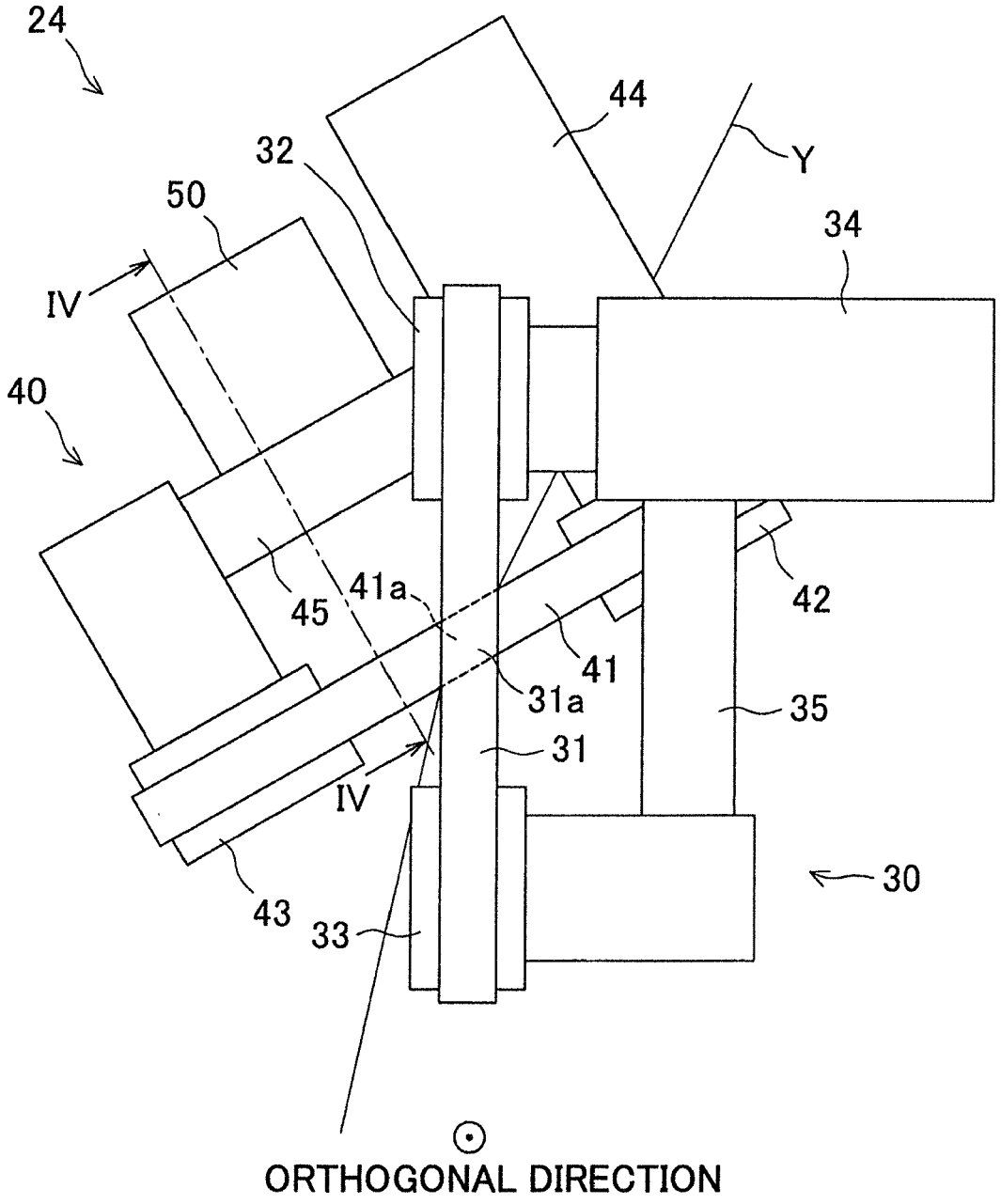


FIG.3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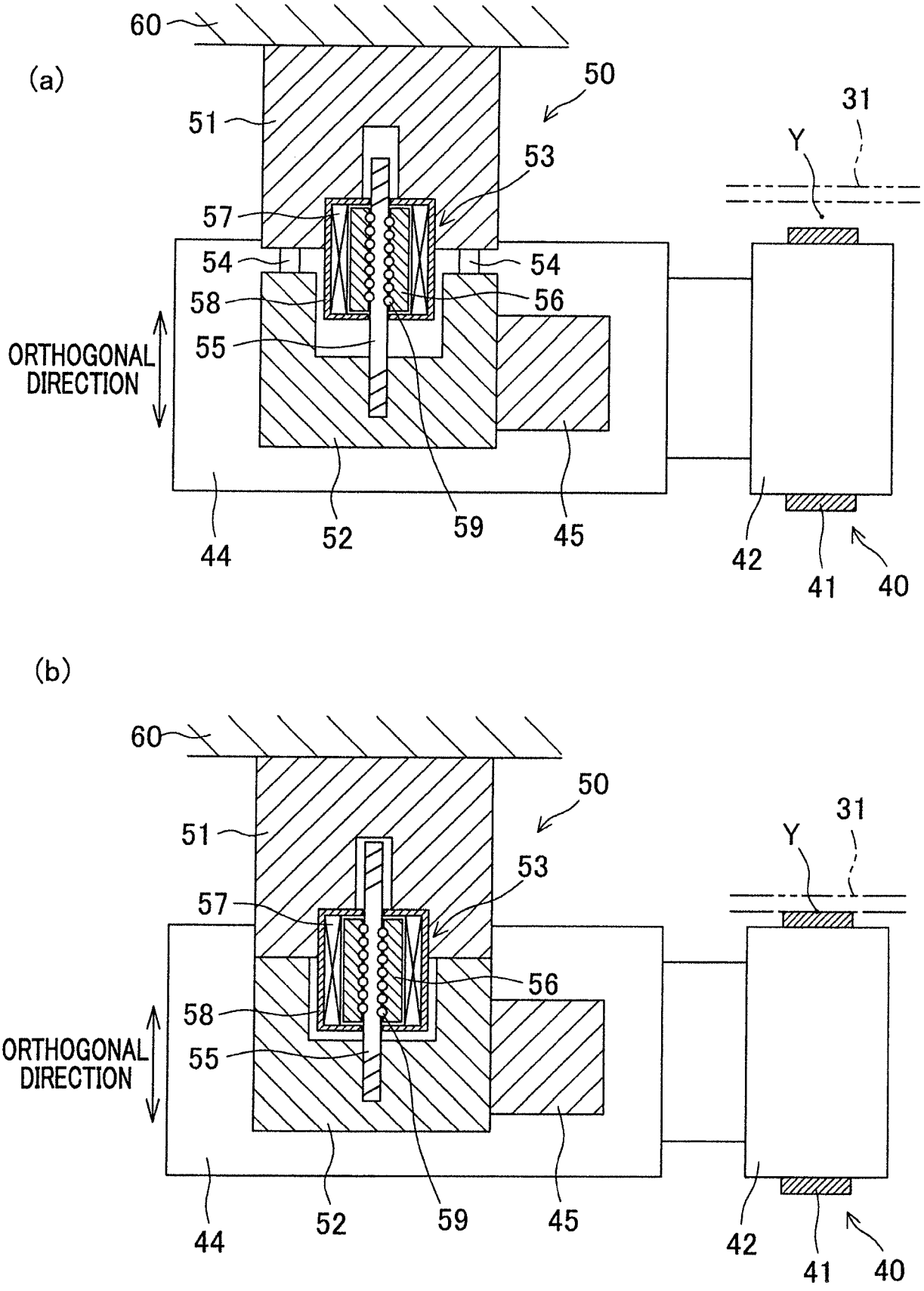
ORTHOGONAL DIRECTION

FIG.4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Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 19 0559

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP S58 191234 A (MURATA MACHINERY LTD) 8 November 1983 (1983-11-08) * figure 5 *	1,2,4,5	INV. D02G1/08
A,D	JP H06 81234 A (MURATA MACHINERY LTD) 22 March 1994 (1994-03-22) * paragraphs [0005] - [0024]; claim 1; figure 1 * * abstract *	1-5	
A,D	JP 2009 013524 A (MURATA MACHINERY LTD; TMT MACHINERY INC) 22 January 2009 (2009-01-22) * paragraphs [0026], [0032] - [0036]; figures 2-4 * * abstract *	1-5	
A,D	JP H06 228836 A (MURATA MACHINERY LTD) 16 August 1994 (1994-08-16) * paragraphs [0008], [0014] - [0025]; figure 1 * * abstract *	1-5	
A	JP S55 45850 A (ODA GOSEN KOGYO KK) 31 March 1980 (1980-03-31) * figures 4,5 *	1-5	TECHNICAL FIELDS SEARCHED (IPC) D02G
A	US 4 144 701 A (TAKAI ISAO ET AL) 20 March 1979 (1979-03-20) * column 2, lines 35-46; figure 2 *	1-5	
A	US 4 400 931 A (MAEDA YOSHIYASU [JP]) 30 August 1983 (1983-08-30) * column 3, line 61 - column 4, line 3; figures 3,4 *	1-5	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 November 2017	Barathe, Rainier

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 102 844 A (RIETER SCRAGG LTD [GB]) 9 February 1983 (1983-02-09) * figure 1 * -----	1-5	
A	JP H10 168685 A (MURATA MACHINERY LTD) 23 June 1998 (1998-06-23) * figure 5b * -----	1	
A	JP S57 172083 U (MURATA MACHINERY) 29 October 1982 (1982-10-29) * figure 2 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 November 2017	Barathe, Rainier

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP S58191234 A	08-11-1983	NONE	
JP H0681234 A	22-03-1994	NONE	
JP 2009013524 A	22-01-2009	NONE	
JP H06228836 A	16-08-1994	JP 2663822 B2	15-10-1997
		JP H06228836 A	16-08-1994
JP S5545850 A	31-03-1980	JP S5545850 A	31-03-1980
		JP S6030766 B2	18-07-1985
US 4144701 A	20-03-1979	CH 623856 A5	30-06-1981
		DE 2755809 A1	06-07-1978
		FR 2374443 A1	13-07-1978
		JP S5383743 U	11-07-1978
		JP S5922125 Y2	02-07-1984
		US 4144701 A	20-03-1979
US 4400931 A	30-08-1983	CH 652763 A5	29-11-1985
		DE 3144228 A1	08-07-1982
		FR 2493882 A1	14-05-1982
		GB 2090293 A	07-07-1982
		IT 1171640 B	10-06-1987
		US 4400931 A	30-08-1983
GB 2102844 A	09-02-1983	NONE	
JP H10168685 A	23-06-1998	NONE	
JP S57172083 U	29-10-1982	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009013524 A **[0002]**
- JP H6228836 B **[0002]**
- JP H681234 B **[0002]**