



(11) **EP 4 474 542 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.12.2024 Bulletin 2024/50

(51) International Patent Classification (IPC):
D02G 1/02^(2006.01) D02G 1/08^(2006.01)

(21) Application number: **24174806.0**

(52) Cooperative Patent Classification (CPC):
D02G 1/0266; D02G 1/0273; D02G 1/082

(22) Date of filing: **08.05.2024**

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

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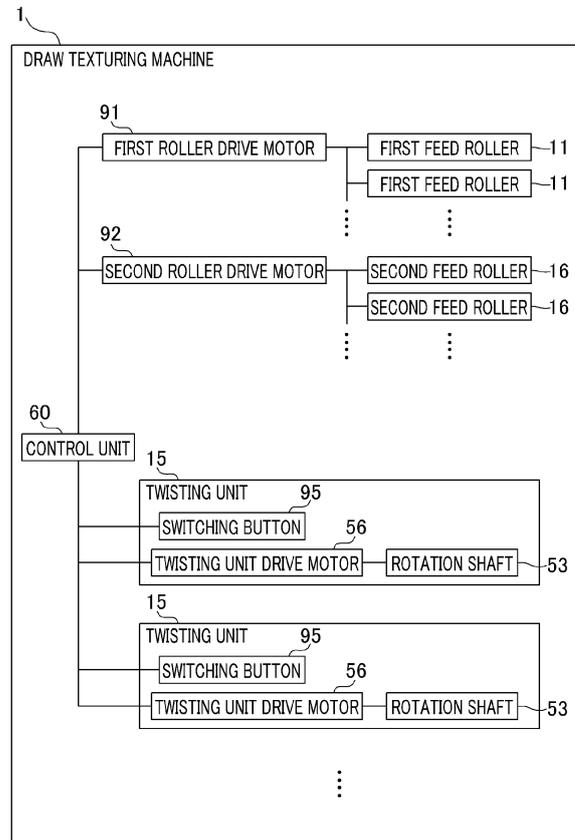
(30) Priority: **05.06.2023 JP 2023092462**

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(54) **DRAW TEXTURING MACHINE AND YARN THREADING METHOD**

(57) A draw texturing machine 1 includes a plurality of spindles 25 each including a twisting unit 15, a plurality of twisting unit drive motors 56 individually provided for the twisting units 15 of the plurality of spindles 25, a control unit 60, and a plurality of switching buttons 95 individually provided for the twisting units 15 of the plurality of spindles 25. The twisting unit 15 has a plurality of disc units 51 each including a plurality of discs 55 and a rotation shaft 53 that rotates the plurality of discs 55. Each twisting unit drive motor 56 rotates the rotation shaft 53 of each disc unit 51 of the corresponding twisting unit 15. The control unit 60 controls each twisting unit drive motor 56. Each switching button 95 generates, by a manual operation, a switching signal for switching a rotation speed of each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 at least between a first rotation speed that is a rotation speed at a time of producing the yarn Y and a second rotation speed that is a rotation speed slower than the first rotation speed, and transmits the switching signal to the control unit 60.

FIG.7



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a draw texturing machine that has a disc-type twisting unit in which a plurality of discs are arranged, and to a yarn threading method for the draw texturing machine.

Related Art

[0002] In the related art, a draw texturing machine having a configuration in which a yarn is false-twisted and wound by a winding unit is known. Such a draw texturing machine has a configuration in which a plurality of twisting units for applying twists to a running yarn are arranged in a predetermined direction.

[0003] As the twisting unit, for example, a fixed disc-type twisting unit described in JP 2001-303373 A (triaxial friction false-twisting device in JP 2001-303373 A) is often used. The disc-type twisting unit is a twisting unit that includes a plurality of discs (friction discs in JP 2001-303373 A) arranged in a spiral shape and that is configured to apply twists to a running yarn while making contact with the circumferential surface of each rotating disc.

[0004] The yarn threading to the disc-type twisting unit as described above is usually carried out in a state where the disc is rotating. Specifically, for example, an operator operates a holding unit holding the yarn to pass the yarn between the plurality of rotating discs, whereby the yarn threading to the disc-type twisting unit is carried out.

SUMMARY OF THE INVENTION

[0005] However, when the yarn threading to the disc-type twisting unit is carried out, the tension of the yarn fluctuates due to the contact between the yarn and the circumferential surface of the rotating disc, and the holding unit operated by the operator is pulled by the fluctuation of the tension. Then, it becomes difficult for the operator to operate the holding unit, and a problem that the holding unit comes into contact with the disc to damage the disc easily occurs. Such a problem is particularly noticeable when the operator is not accustomed to the yarn threading.

[0006] In order to facilitate the yarn threading, it is also conceivable to adopt an opening and closing twisting unit in which a space between the plurality of discs is opened at the time of yarn threading so that the yarn can be easily passed between the plurality of discs. However, in the case of such an opening and closing twisting unit, it is necessary to secure a space for moving the disc, which leads to an increase in size of the draw texturing machine and a decrease in production efficiency for the site.

[0007] An object of the present invention is to easily carry out yarn threading to a disc-type twisting unit while suppressing an increase in size of a draw texturing ma-

chine.

[0008] A draw texturing machine according to an aspect of the present invention includes a plurality of spindles each including a twisting unit, a first yarn feed roller that is arranged on an upstream side of the twisting unit in a yarn running direction in which a yarn runs, a second yarn feed roller that is arranged on a downstream side of the twisting unit in the yarn running direction; a plurality of twisting unit drive mechanisms that are individually provided for the twisting units of the plurality of spindles; a first yarn feed roller drive mechanism that is provided in common for the first yarn feed rollers of the plurality of spindles and rotationally drives the plurality of first yarn feed rollers; a second yarn feed roller drive mechanism that is provided in common for the second yarn feed rollers of the plurality of spindles and rotationally drives the plurality of second yarn feed rollers; a control unit; and a plurality of switching units that are individually provided for the twisting units of the plurality of spindles, in which the twisting unit has a plurality of disc units each including a plurality of discs and a rotation shaft that rotates the plurality of discs, the rotation shaft of each disc unit rotates to apply twists to the yarn running between the plurality of disc units, each twisting unit drive mechanism rotationally drives the rotation shaft of each disc unit of the corresponding twisting unit, the control unit controls each twisting unit drive mechanism, the first yarn feed roller drive mechanism, and the second yarn feed roller drive mechanism, and each switching unit generates, by a manual operation, a switching signal for switching a rotation speed of each rotation shaft driven by the corresponding twisting unit drive mechanism at least between a first rotation speed that is a rotation speed at a time of producing the yarn and a second rotation speed that is a rotation speed slower than the first rotation speed, and transmits the switching signal to the control unit.

[0009] According to the present invention, the following advantages are obtained in a manner that the operator manually operates the switching unit to switch the rotation speed of the rotation shaft of each disc unit of the twisting unit as the yarn threading target among the twisting units of the plurality of spindles from the first rotation speed, which is the rotation speed at the time of producing the yarn, to the second rotation speed, which is the rotation speed slower than the first rotation speed, and then carries out the yarn threading. That is, since the rotation speed of the rotation shaft is slower as compared with a case where yarn threading is carried out when the rotation shaft is at the first rotation speed at the time of producing the yarn, the tension of the yarn can be suppressed from strongly fluctuating due to the contact of the yarn with the rotating disc along with the rotation of the rotation shaft. Similarly, even in a case where the yarn threading is carried out while the rotation speed of the rotation shaft is decelerating from the first rotation speed toward the second rotation speed, or while the rotation speed of the rotation shaft is accelerating toward the second rotation speed, the tension of the yarn can

be suppressed from strongly fluctuating as compared with a case where the yarn threading is carried out when the rotation shaft is at the first rotation speed. Thus, when the operator operates a holding unit holding the yarn at the time of yarn threading to the twisting unit, the pulling of the holding unit by the yarn tension is suppressed. Thus, the yarn threading can be easily carried out by passing the yarn between the plurality of disc units while avoiding the contact between the holding unit and the disc. Furthermore, according to the present invention, since the rotation speed of the rotation shaft of the twisting unit other than the yarn threading target can be maintained at the first rotation speed, a decrease in the production efficiency of the yarn as a whole of the draw texturing machine can be suppressed. Further, in the present invention, since the yarn can be passed between the plurality of discs without opening a space between the plurality of discs, it is not necessary to secure a space for moving the discs as in the opening and closing twisting unit. Therefore, as compared with the case of using the opening and closing twisting unit, the draw texturing machine can be downsized, and the production efficiency for the site is increased. In general, it is difficult to carry out the yarn threading to the twisting unit without opening a space between the discs as compared with the opening and closing twisting unit. However, in the present invention, the yarn threading can be easily carried out by carrying out the yarn threading in a state where the rotation shaft rotates at the second rotation speed that is a low speed, or in a state where the rotation shaft is decelerating or accelerating toward the second rotation speed, so that the advantage of using the twisting unit of a type in which the space between the discs is not opened can be fully utilized.

[0010] According to the present invention, each twisting unit drive mechanism, the first yarn feed roller drive mechanism, and the second yarn feed roller drive mechanism are independently controlled. Therefore, even in a case where the rotation speed of each rotation shaft of the twisting unit as the yarn threading target is switched to the second rotation speed, the rotation speeds of the plurality of first yarn feed rollers and the plurality of second yarn feed rollers are not reduced. Therefore, a decrease in the production efficiency of the entire draw texturing machine at the time of yarn threading can be suppressed.

[0011] It is preferable that the draw texturing machine of the present invention includes a plurality of notification units individually provided for the twisting units of the plurality of spindles, in which each notification unit notifies that the rotation speed of each rotation shaft driven by the corresponding twisting unit drive mechanism has reached the second rotation speed.

[0012] According to the present invention, the operator can ascertain whether or not the rotation speed of the rotation shaft has reached the second rotation speed for each twisting unit. Therefore, the operator can avoid erroneously carrying out the yarn threading when the rota-

tion shaft of the twisting unit as the yarn threading target is at the first rotation speed.

[0013] In the draw texturing machine of the present invention, it is preferable that the notification unit notifies that the rotation speed of each rotation shaft has reached the second rotation speed by a turning-on or blinking pattern of a lamp.

[0014] According to the present invention, the operator can visually and quickly determine the rotation speed of the rotation shaft for each twisting unit.

[0015] In the draw texturing machine of the present invention, it is preferable that the switching signal includes a signal for switching each rotation shaft driven by the corresponding twisting unit drive mechanism to a stop state in which rotation is stopped.

[0016] According to the present invention, in a case where the yarn is entangled in the disc, the rotation of the rotation shaft can be individually stopped for each twisting unit. Therefore, in the twisting unit in which the yarn is not entangled in the disc, the rotation speed of the rotation shaft can be maintained at the first rotation speed, and thus a decrease in the production efficiency of the yarn as a whole of the draw texturing machine can be suppressed.

[0017] A yarn threading method according to another aspect of the present invention is a yarn threading method of threading a yarn to a draw texturing machine that includes a plurality of spindles each including a twisting unit that has a plurality of disc units each including a plurality of discs and a rotation shaft rotating the plurality of discs, and in which the rotation shaft of each disc unit rotates to apply twists to the yarn running between the plurality of disc units, the draw texturing machine being configured to switch a rotation speed of the rotation shaft of each disc unit of the twisting units of the plurality of spindles at least between a first rotation speed that is a rotation speed at a time of producing the yarn and a second rotation speed that is a rotation speed slower than the first rotation speed, the yarn threading method including a switching process of switching the rotation speed of each rotation shaft to the second rotation speed for the twisting unit as a yarn threading target among the twisting units of the plurality of spindles; and a twisting unit yarn threading process of threading the yarn to the twisting unit as the yarn threading target by passing the yarn between the plurality of disc units when each rotation shaft is rotating at the second rotation speed, when each rotation shaft is decreasing its speed from the first rotation speed to the second rotation speed, or when each rotation shaft is increasing its speed toward the second rotation speed.

[0018] According to the present invention, the following advantages are obtained by switching the rotation speed of the rotation shaft of each disc unit of the twisting unit as the yarn threading target among the twisting units of the plurality of spindles from the first rotation speed, which is the rotation speed at the time of producing the yarn, to the second rotation speed, which is the rotation

speed slower than the first rotation speed, and then performing the yarn threading. That is, since the rotation speed of the rotation shaft is slower as compared with a case where yarn threading is carried out when the rotation shaft is at the first rotation speed at the time of producing the yarn, the tension of the yarn can be suppressed from strongly fluctuating due to the contact of the yarn with the rotating disc along with the rotation of the rotation shaft. Similarly, even in a case where the yarn threading is carried out while the rotation speed of the rotation shaft is decelerating from the first rotation speed toward the second rotation speed, or while the rotation speed of the rotation shaft is accelerating toward the second rotation speed, the tension of the yarn can be suppressed from strongly fluctuating as compared with a case where the yarn threading is carried out when the rotation shaft is at the first rotation speed. Thus, when the operator operates the holding unit holding the yarn at the time of yarn threading to the twisting unit, the pulling of the holding unit by the yarn tension is suppressed. Thus, the yarn threading can be easily carried out by passing the yarn between the plurality of disc units while avoiding the contact between the holding unit and the disc. Furthermore, according to the present invention, since the rotation speed of the rotation shaft of the twisting unit other than the yarn threading target can be maintained at the first rotation speed, a decrease in the production efficiency of the yarn as a whole of the draw texturing machine can be suppressed. Further, in the present invention, since the yarn can be passed between the plurality of discs without opening a space between the plurality of discs, it is not necessary to secure a space for moving the discs as in the opening and closing twisting unit. Therefore, as compared with the case of using the opening and closing twisting unit, the draw texturing machine can be downsized, and the production efficiency for the site is increased. In general, it is difficult to carry out the yarn threading to the twisting unit without opening a space between the discs as compared with the opening and closing twisting unit. However, in the present invention, the yarn threading can be easily carried out by carrying out the yarn threading in a state where the rotation shaft rotates at the second rotation speed that is a low speed, or in a state where the rotation shaft is decelerating or accelerating toward the second rotation speed, so that the advantage of using the twisting unit of a type in which the space between the discs is not opened can be fully utilized.

[0019] In the yarn threading method of the present invention, it is preferable that the twisting unit yarn threading process is carried out after the rotation speed of each rotation shaft reaches the second rotation speed.

[0020] According to the present invention, the twisting unit yarn threading process is carried out in a state where the rotation speed of each rotation shaft is constant at the second rotation speed. Thus, the yarn tension generated due to the contact between the yarn and the circumferential surface of the disc is stabilized, so that the

holding unit can be avoided from becoming difficult to operate due to a large fluctuation in the yarn tension, and the yarn threading becomes easy.

[0021] In the yarn threading method of the present invention, it is preferable that each spindle arranged in the draw texturing machine includes a second yarn feed roller arranged on a downstream side of the twisting unit in a yarn running direction in which the yarn runs, the yarn threading method further includes a roller yarn threading process of threading the yarn to the rotating second yarn feed roller arranged on the downstream side of the twisting unit as the yarn threading target, and the twisting unit yarn threading process is carried out after the roller yarn threading process.

[0022] According to the present invention, by threading the yarn first to the rotating second yarn feed roller, the yarn is pulled by the second yarn feed roller, and the yarn is in a state of being stretched in the yarn running direction. The yarn in the stretched state is less likely to swing as compared with the yarn in the relaxed state. Therefore, the yarn threading to the twisting unit is further facilitated.

[0023] In the yarn threading method of the present invention, it is preferable that the roller yarn threading process is started until the rotation speed of each rotation shaft reaches the second rotation speed after the switching process is carried out.

[0024] According to the present invention, the operation time can be shortened by starting the roller yarn threading process until the rotation speed of each rotation shaft reaches the second rotation speed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a schematic profile of a draw texturing machine according to the present embodiment;
 FIG. 2 is a schematic view of the draw texturing machine developed along a path of a yarn;
 FIG. 3 is a view taken in a direction of arrow III in FIG. 1;
 FIG. 4 is a perspective view of a twisting unit;
 FIG. 5 is a view of the twisting unit as viewed from a direction orthogonal to both a base longitudinal direction and an axial direction;
 FIG. 6 is a view of the twisting unit as viewed from the axial direction;
 FIG. 7 is a block diagram illustrating an electrical configuration of the draw texturing machine;
 FIG. 8 is a flowchart illustrating a procedure of yarn threading to the draw texturing machine;
 FIGS. 9A and 9B are graphs illustrating a state of fluctuation of a rotation speed of a rotation shaft with advancement of yarn threading and a transition of a yarn tension, in which FIG. 9A is a graph in a case of carrying out yarn threading when an operation of the draw texturing machine starts, and FIG. 9B is a graph in a case of carrying out yarn threading in the

middle of winding of the yarn by a winding unit; and FIG. 10 is a view illustrating an example of a holding unit used for yarn threading.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. Note that a direction perpendicular to the paper surface of FIG. 1 is defined as a base longitudinal direction, and a left-right direction of the paper surface is defined as a base width direction. A direction orthogonal to both the base longitudinal direction and the base width direction is defined as an up-down direction (vertical direction) in which gravity acts. Hereinafter, these directions will be described as appropriate.

(Overall Configuration of Draw Texturing Machine)

[0027] First, an overall configuration of a draw texturing machine will be described with reference to FIGS. 1 to 3. FIG. 1 is a profile of a draw texturing machine 1 according to the present embodiment. FIG. 2 is a schematic view of the draw texturing machine 1 developed along a path of a yarn Y (yarn path). FIG. 3 is a view taken in a direction of arrow III in FIG. 1.

[0028] The draw texturing machine 1 is configured to be able to false-twist the yarn Y made of synthetic fiber such as nylon (polyamide fiber), for example. The draw texturing machine 1 includes a yarn supplying unit 2 for supplying the yarn Y, a processing unit 3 that false-twists the yarn Y supplied from the yarn supplying unit 2, and a winding unit 4 that winds the yarn Y processed by the processing unit 3 around a winding bobbin Bw. A plurality of constituent elements (to be described later) of the yarn supplying unit 2, the processing unit 3, and the winding unit 4 are arranged in the base longitudinal direction orthogonal to a running surface (paper surface of FIG. 1) of the yarn on which a yarn path from the yarn supplying unit 2 to the winding unit 4 through the processing unit 3 is arranged (refer to FIG. 2).

[0029] The yarn supplying unit 2 includes a creel stand 7 that holds a plurality of yarn supply packages Ps, and supplies the yarns Y to the processing unit 3. The processing unit 3 has a configuration in which a first feed roller 11 (first yarn feed roller of the present invention), a twist-stopping guide 12, a first heater 13, a cooler 14, a twisting unit 15, a second feed roller 16 (second yarn feed roller of the present invention), an interlacing device 17, a third feed roller 18, a second heater 19, and a fourth feed roller 20 are arranged in this order from the upstream side in a yarn running direction in which the yarn Y runs. The winding unit 4 winds the yarn Y false-twisted by the processing unit 3 around the winding bobbin Bw using a winding device 21 to form a wound package Pw.

[0030] The draw texturing machine 1 has a unit called a span. In one span, each unit is arranged so that the yarns Y running in a state of being arranged in the base

longitudinal direction can be simultaneously false-twisted.

[0031] In the draw texturing machine 1, a plurality of (for example, 12 spindles) spindles 25 are arranged in parallel. Each spindle 25 includes one yarn supply package Ps, a single first feed roller 11, one twist-stopping guide 12, a single first heater 13, one cooler 14, one twisting unit 15, a single second feed roller 16, one interlacing device 17, a single third feed roller 18, a single second heater 19, a single fourth feed roller 20, and one winding device 21 (refer to FIG. 2). In the present embodiment, the single first heater 13 is disposed across two spindles 25, and the single second heater 19 is disposed across a plurality of spindles 25 (for example, four spindles 25). However, the present invention is not limited thereto. In one spindle 25, the yarn Y fed from the yarn supply package Ps is wound by the winding device 21 to form the wound package Pw.

(Configuration of Processing Unit)

[0032] Next, the configuration of the processing unit 3 will be described with reference to FIGS. 1 and 2.

[0033] The first feed roller 11 is configured to unwind the yarn Y from the yarn supply package Ps attached to the yarn supplying unit 2 and to feed the yarn Y to the first heater 13. The rotation of the plurality of first feed rollers 11 is driven by a single first roller drive motor 91 (first yarn feed roller drive mechanism of present invention, refer to FIG. 7) provided in common for the first feed rollers 11 of all the spindles 25 arranged in the draw texturing machine 1.

[0034] The twist-stopping guide 12 is for preventing the twist applied to the yarn Y by the twisting unit 15 to be described later from being propagated to the upstream side of the twist-stopping guide 12 in the yarn running direction.

[0035] The first heater 13 is for heating the yarn Y fed from the first feed roller 11 to a predetermined processing temperature (refer to FIG. 1).

[0036] The cooler 14 is for cooling the yarn Y heated by the first heater 13.

[0037] The twisting unit 15 is a type of so-called disc friction type twisting unit, and is configured to apply twists to the yarn Y. More details of the twisting unit 15 will be described later.

[0038] The second feed roller 16 is a roller that feeds the yarn Y twisted by the twisting unit 15 toward the interlacing device 17. The rotation of the plurality of second feed rollers 16 is driven by a single second roller drive motor 92 (second yarn feed roller drive mechanism of present invention, refer to FIG. 7) provided in common for the second feed rollers 16 of all the spindles 25 arranged in the draw texturing machine 1.

[0039] The interlacing device 17 is a system that applies interlacement by injecting air to the yarn Y.

[0040] The third feed roller 18 is a roller that feeds the yarn Y interlaced by the interlacing device 17 toward the

second heater 19. The third feed roller 18 is driven by a motor (not illustrated).

[0041] The second heater 19 is a system for heating the yarn Y fed from the third feed roller 18.

[0042] The fourth feed roller 20 is for feeding the yarn Y heated by the second heater 19 to the winding device 21. The fourth feed roller 20 is driven by a motor (not illustrated).

[0043] In the processing unit 3 configured as described above, twists are applied by the twisting unit 15 to the yarn Y drawn between the first feed roller 11 and the second feed roller 16. The twists formed by the twisting unit 15 propagate up to the twist-stopping guide 12, but do not propagate to the upstream side of the twist-stopping guide 12 in the yarn running direction. The yarn Y twisted while being drawn is heated and thermally fixed by the first heater 13, and then cooled by the cooler 14. The yarn Y is untwisted on the downstream side of the twisting unit 15, but a state in which each filament is false-twisted in a wave shape is maintained by the heat fixation. The yarn Y false-twisted by the twisting unit 15 is interlaced by the interlacing device 17 while being relaxed between the second feed roller 16 and the third feed roller 18, and is guided to the downstream side in the yarn running direction. Furthermore, the yarn Y is thermally fixed by the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y fed from the fourth feed roller 20 is wound by the winding device 21 to form the wound package Pw.

(Configuration of Winding Unit)

[0044] Next, the configuration of the winding unit 4 will be described with reference to FIG. 2. The winding unit 4 includes a plurality of winding devices 21 each winding the yarn Y around the winding bobbin Bw. In the winding unit 4 configured as described above, the yarn Y fed from the above-described fourth feed roller 20 is wound around the winding bobbin Bw by each winding device 21 to form the wound package Pw.

(Configuration of Twisting Unit)

[0045] Next, the configuration of the twisting unit 15 will be described with reference to FIGS. 4 to 6. FIG. 4 is a perspective view of the twisting unit 15. FIG. 5 is a view of the twisting unit 15 as viewed from a direction orthogonal to both the base longitudinal direction and an axial direction of a rotation shaft 53 to be described later (hereinafter, simply referred to as axial direction). FIG. 6 is a view of the twisting unit 15 as viewed from the axial direction.

[0046] The twisting unit 15 is configured to apply twists to the yarn Y. A plurality of the twisting units 15 are arranged in the base longitudinal direction (refer to FIG. 2). As shown in FIGS. 4 to 6, each twisting unit 15 includes a plurality of disc units 51 (three in the present embodi-

ment), a supporting table 54, and a twisting unit drive motor 56 (twisting unit drive mechanism of the present invention). Each disc unit 51 includes a plurality of discs 55 (three in the present embodiment) and the rotation shaft 53 that rotates the plurality of discs 55.

[0047] The rotation shaft 53 of each disc unit 51 is a shaft member extending in the axial direction substantially orthogonal to the base longitudinal direction. The axial direction may not be necessarily substantially orthogonal to the base longitudinal direction. As shown in FIG. 6, the three rotation shafts 53 are arranged such that the axial centers form vertices of a virtual equilateral triangle T when viewed from the axial direction.

[0048] The plurality of discs 55 of the disc unit 51 are members for applying twists to the yarn Y when the circumferential surface makes contact with the yarn Y. As shown in FIGS. 4 to 6, the plurality of discs 55 are attached to each rotation shaft 53. In the present embodiment, three discs 55 are attached to each rotation shaft 53 (refer to FIG. 4 and the like), but the number of discs 55 attached to each rotation shaft 53 is not limited thereto. In the present embodiment, each rotation shaft 53 and the plurality of discs 55 attached to the rotation shaft 53 are fixedly arranged so as not to move from the position of FIG. 4. The twisting unit 15 can apply twists to the yarn Y running between the plurality of disc units 51 as the rotation shaft 53 of each disc unit 51 rotates.

[0049] The plurality of discs 55 attached to the respective rotation shafts 53 are arranged to draw a spiral extending in the axial direction. In the present embodiment, when viewed from the leading end side in the axial direction, the discs 55 attached to the respective rotation shafts 53 are arranged to draw a spiral in a clockwise direction. Thus, the plurality of discs 55 can apply the S-twists to the yarn Y. Note that, when viewed from the leading end side in the axial direction, the discs 55 attached to the respective rotation shafts 53 may be arranged to draw a spiral in a counterclockwise direction. In this case, the plurality of discs 55 can apply the Z-twists to the yarn Y.

[0050] A portion of the plurality of discs 55 to be in contact with the yarn Y is formed of, for example, polyurethane. However, the portion of the plurality of discs 55 to be in contact with the yarn Y may be formed of, for example, ceramic. Further, a portion of some discs 55 to be in contact with the yarn Y may be formed of polyurethane, and a portion of the other discs 55 in contact with the yarn Y may be formed of ceramic.

[0051] The supporting table 54 is a table that rotatably supports the rotation shaft 53 via a bearing (not illustrated). The supporting table 54 supports three rotation shafts 53 in a cantilever manner. The upper side of the paper surface in FIGS. 4 and 5 is the leading end side in the axial direction, and the lower side of the paper surface is the base end side in the axial direction. The yarn Y runs from the leading end side to the base end side in the axial direction of the rotation shaft 53. That is, the leading end side in the axial direction is the upstream

side in the yarn running direction. The base end side in the axial direction is the downstream side in the yarn running direction. The supporting table 54 supports the base end side of each rotation shaft 53 in the axial direction. Each rotation shaft 53 is attached to the supporting table 54 so as not to move from the position of FIG. 4.

[0052] The twisting unit drive motor 56 is for rotating the rotation shaft 53 of each disc unit 51 of the corresponding twisting unit 15. In other words, the twisting unit drive motor 56 is a mechanism that rotationally drives three rotation shafts 53 in the same direction. The power of the twisting unit drive motor 56 is transmitted to each rotation shaft 53 via a belt (not illustrated). The twisting unit drive motor 56 rotationally drives each rotation shaft 53 clockwise when viewed from the leading end side in the axial direction (refer to the arrow in FIG. 6).

[0053] As shown in FIGS. 4 and 5, a plurality of switching buttons 95 (switching unit of the present invention) are individually provided for the twisting unit 15 of the plurality of spindles 25. In other words, one switching button 95 is provided for one twisting unit 15 (refer to FIG. 7). The switching button 95 generates a switching signal for switching the rotation speed of each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 by a manual operation between a first rotation speed, which is a rotation speed at the time of producing the yarn Y, a second rotation speed, which is a rotation speed slower than the first rotation speed, and a stop state in which the rotation is stopped. Then, the switching button 95 transmits the generated switching signal to a control unit 60 (described later). The time of producing the yarn Y refers to when the yarn Y is wound around the winding bobbin Bw by the winding device 21 of the winding unit 4 to form the wound package Pw. Specifically, when the operator manually operates the switching button 95, a switching signal for switching the rotation speed of the rotation shaft 53 rotationally driven by the twisting unit drive motor 56 is generated. Although described in detail later, the control unit 60 receives the switching signal transmitted from the switching button 95 to control the twisting unit drive motor 56 such that the rotation speed of each rotation shaft 53 is one of the first rotation speed, the second rotation speed, and the stop state. For example, a switching signal for switching the rotation speed of each rotation shaft 53 to the first rotation speed is generated when the operator presses the switching button 95 once, a switching signal for switching the rotation speed of each rotation shaft 53 to the second rotation speed is generated when the operator presses the switching button 95 once again, and a switching signal for switching the rotation speed of each rotation shaft 53 to the stop state is generated when the operator presses and holds the switching button 95 for a predetermined period of time or longer.

[0054] In the present embodiment, the switching button 95 incorporates a monochrome lamp. The switching button 95 can notify the operator that the rotation speed of each rotation shaft 53 of the corresponding twisting

unit 15 has reached the second rotation speed according to the lighting pattern of the lamp. That is, the switching button 95 corresponds to a notification unit of the present invention in addition to the switching unit of the present invention. The switching button 95 indicates any of turning on, blinking, and turning off. For example, when the rotation speed of the rotation shaft 53 reaches the second rotation speed, the switching button 95 blinks. Further, when the rotation speed of the rotation shaft 53 reaches the first rotation speed, the switching button 95 is continuously turned on. When the rotation shaft 53 is in the stop state, the switching button 95 is turned off. Furthermore, when the rotation shaft 53 is rotating and the rotation speed is neither the first rotation speed nor the second rotation speed, the switching button 95 is turned on, blinks, or is turned off corresponding to the state immediately before the rotation shaft 53. For example, in a case where the state immediately before the rotation shaft 53 rotating at a rotation speed other than the first rotation speed and the second rotation speed is the second rotation speed, the switching button 95 blinks corresponding to the second rotation speed.

(Electrical Configuration of Draw Texturing Machine)

[0055] Subsequently, an electrical configuration of the draw texturing machine 1 is illustrated in FIG. 7. The draw texturing machine 1 includes the control unit 60. The control unit 60 controls the plurality of twisting unit drive motors 56, the first roller drive motor 91, and the second roller drive motor 92. The control unit 60 is electrically connected to the plurality of twisting unit drive motors 56, the first roller drive motor 91, the second roller drive motor 92, and the switching button 95. The single first roller drive motor 91 is provided in common for the first feed rollers 11 of the plurality of spindles 25. The single first roller drive motor 91 is connected to the plurality of first feed rollers 11. The single second roller drive motor 92 is provided in common for the second feed rollers 16 of the plurality of spindles 25. The single second roller drive motor 92 is connected to the plurality of second feed rollers 16. The first roller drive motor 91 and the second roller drive motor 92 are arranged, for example, at the end portion of the draw texturing machine 1 in the base longitudinal direction. In FIG. 7, only a part of the plurality of first feed rollers 11 is illustrated, and the other description is omitted. The same applies to the second feed rollers 16.

[0056] The twisting unit drive motor 56 is connected to the rotation shaft 53. When a switching signal for switching the rotation speed of the rotation shaft 53 is transmitted from the switching button 95, the control unit 60 controls the twisting unit drive motor 56 corresponding to the switching button 95 to drive the rotation of the rotation shaft 53. In FIG. 7, only a part of the plurality of twisting units 15 is illustrated, and the other description is omitted. In the present embodiment, the twisting unit drive motor 56 is incorporated in the twisting unit 15, but the twisting

unit drive motor 56 may be provided outside the twisting unit 15. Further, one control unit 60 is provided in common for the plurality of twisting units 15, but a plurality of control units 60 may be individually provided for the plurality of twisting units 15.

[0057] In the present embodiment, each twisting unit drive motor 56, the first roller drive motor 91, and the second roller drive motor 92 are independently controlled by the control unit 60. In other words, the rotational driving of the plurality of rotation shafts 53 by the twisting unit drive motor 56, the driving of the plurality of first feed rollers 11 by the first roller drive motor 91, and the driving of the plurality of second feed rollers 16 by the second roller drive motor 92 are independently performed.

(Yarn Threading to Draw Texturing Machine)

[0058] Next, a procedure of treading the yarn Y to the draw texturing machine 1 will be described below with reference to FIGS. 8 and 9. FIG. 8 is a flowchart illustrating a procedure of yarn threading to the draw texturing machine 1. FIG. 9A is a graph illustrating a state of fluctuation of the rotation speed of the rotation shaft 53 with advancement of yarn threading and transition of the yarn tension when the yarn threading is carried out at the time of starting the operation of the draw texturing machine 1. FIG. 9B is a graph illustrating the fluctuation of the rotation speed of the rotation shaft 53 with advancement of yarn threading and the transition of the yarn tension when the yarn threading is carried out in the middle of the winding of the yarn Y by the winding unit 4. The yarn tension is a measured value of the tension of the yarn Y running between the twisting unit 15 and the second feed roller 16. The rotation speed of the rotation shaft 53 in FIG. 9 is the rotation speed of the rotation shaft 53 of three disc units 51 of the twisting unit 15 as a yarn threading target. The rotation speeds of the three rotation shafts 53 provided in one twisting unit 15 are the same. In FIGS. 9A and 9B, the rotation speed of the rotation shaft 53 is indicated by a solid line, and the yarn tension is indicated by a two-dot chain line. FIGS. 9A and 9B relatively illustrate the rotation speed of the rotation shaft 53 and the yarn tension in each step (refer to FIG. 8 described below) of the yarn threading, and the description of specific numerical values of the rotation speed of the rotation shaft 53 and the yarn tension is omitted. Hereinafter, a procedure for threading the yarn Y to the twisting unit 15 as the yarn threading target among the plurality of twisting units 15 and the constituent elements of the processing unit 3 and the winding unit 4 arranged on the upstream and downstream sides of the twisting unit 15 in the yarn running direction will be described. Note that, at the time of yarn threading, the first feed roller 11, the second feed roller 16, the third feed roller 18, and the fourth feed roller 20 are assumed to be rotating.

[0059] First, the operator sucks and holds the yarn Y supplied from the yarn supplying unit 2 using a suction gun (not illustrated) that sucks and holds the yarn Y (step

S1). Note that step S1 is performed when the rotation shaft 53 is in the stop state or when the rotation shaft 53 is rotating at the first rotation speed (refer to FIGS. 9A and 9B). Next, the operator operates the switching button 95 to switch the rotation speeds of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target to the second rotation speed (step S2). Step S2 corresponds to a switching process of the present invention. In a case where yarn threading is carried out at the time of starting the operation of the draw texturing machine 1, the plurality of rotation shafts 53 are switched from the stop state to the second rotation speed. In this case, the operator presses the switching button 95 twice. As a result, the plurality of rotation shafts 53 start to accelerate from the stop state to the second rotation speed (refer to S2a in FIG. 9A). Further, when the yarn Y is being wound by the winding unit 4 and the plurality of rotation shafts 53 are rotating at the first rotation speed, for example, in a case where yarn breakage or the like occurs and the yarn needs to be threaded again to the plurality of discs 55, the rotation speeds of the plurality of rotation shafts 53 are switched from the first rotation speed to the second rotation speed. In this case, the operator presses the switching button 95 once. As a result, the plurality of rotation shafts 53 start to decelerate from the first rotation speed to the second rotation speed (refer to S2b in FIG. 9B).

[0060] Next, the operator operates the suction gun to thread the yarn Y to the second feed roller 16 (step S3). Step S3 corresponds to a roller yarn threading process of the present invention. Step S3 starts until the rotation speeds of the plurality of rotation shafts 53 reach the second rotation speed after step S2 is performed. That is, step S3 is performed while the plurality of rotation shafts 53 are accelerating from the stop state to the second rotation speed or while the plurality of rotation shafts 53 are decelerating from the first rotation speed to the second rotation speed (refer to FIGS. 9A and 9B).

[0061] Subsequently, the suction gun is placed at a predetermined position, and the yarn threading to the twisting unit 15 is carried out using a rod-shaped holding unit 101 (refer to FIG. 10) (step S4). Hereinafter, a specific description will be given. The holding unit 101 is configured such that the yarn Y can be threaded to a leading end thereof. The operator first causes the holding unit 101 to hold a portion of the yarn Y on the upstream side of the suction gun. Then, the operator operates the holding unit 101 holding the yarn to pass the yarn Y between the plurality of rotating discs 55 of each disc unit 51, thereby carrying out the yarn threading to the twisting unit 15. Step S4 corresponds to a twisting unit yarn threading process of the present invention. Step S4 may be performed when the rotation speeds of the plurality of rotation shafts 53 are accelerating toward the second rotation speed, or when the rotation speeds of the plurality of rotation shafts 53 are decelerating from the first rotation speed toward the second rotation speed. However, step S4 is preferably performed after the rotation speeds of

the plurality of rotation shafts 53 reach the second rotation speed.

[0062] Next, the operator operates the switching button 95 to switch the rotation speeds of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target to the first rotation speed (step S5). Specifically, the operator presses the switching button 95 once. As a result, the rotation speeds of the plurality of rotation shafts 53 start to accelerate from the second rotation speed to the first rotation speed.

[0063] Subsequently, the operator operates the holding unit 101 holding the yarn Y to thread the yarn Y to the twist-stopping guide 12 (step S6). The yarn is threaded to the first heater 13 and the cooler 14 from when the yarn Y is threaded to the twisting unit 15 to when the yarn Y is threaded to the twist-stopping guide 12, but the description thereof will be omitted in the present embodiment. After step S6, the operator operates the holding unit 101 holding the yarn Y to thread the yarn Y to the first feed roller 11 (step S7). Steps S6 and S7 may be performed after the rotation speeds of the plurality of rotation shafts 53 reach the first rotation speed, or may be performed before the rotation speeds of the plurality of rotation shafts 53 reach the first rotation speed.

[0064] After step S7 is completed and the rotation speeds of the plurality of rotation shafts 53 reach the first rotation speed, the operator operates the suction gun placed at the predetermined position to thread the yarn Y to each constituent element of the processing unit 3 and the winding unit 4 arranged on the downstream side of the second feed roller 16 (step S8). That is, in step S8, the yarn Y is threaded to the interlacing device 17, the third feed roller 18, the second heater 19, the fourth feed roller 20, the winding device 21 in this order.

[0065] Thus, the yarn threading to the draw texturing machine 1 is completed.

(Effects)

[0066] As described above, in the draw texturing machine 1 of the present embodiment, the plurality of spindles 25 each including the twisting unit 15, the first feed roller 11 arranged on the upstream side of the twisting unit 15 in the yarn running direction, and the second feed roller 16 arranged on the downstream side of the twisting unit 15 in the yarn running direction are arranged. The draw texturing machine 1 includes the plurality of twisting unit drive motors 56 individually provided for the twisting units 15 of the plurality of spindles 25, the first roller drive motor 91 commonly provided for the first feed rollers 11 of the plurality of spindles 25 to rotationally drive the plurality of first feed rollers 11, the second roller drive motor 92 commonly provided for the second feed rollers 16 of the plurality of spindles 25 to rotationally drive the plurality of second feed rollers 16, the control unit 60, and the plurality of switching buttons 95 individually provided for the twisting units 15 of the plurality of spindles 25. The twisting unit 15 includes the plurality of disc units 51 each

including the plurality of discs 55 and the rotation shaft 53 that rotates the plurality of discs 55, and can apply twists to the yarn Y running between the plurality of disc units 51 by the rotation of the rotation shaft 53 of each disc unit 51. Each twisting unit drive motor 56 rotates the rotation shaft 53 of each disc unit 51 of the corresponding twisting unit 15. The control unit 60 controls each twisting unit drive motor 56, the first roller drive motor 91, and the second roller drive motor 92. Each switching button 95 generates the switching signal for switching the rotation speed of each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 by the manual operation at least between the first rotation speed, which is the rotation speed at the time of producing the yarn Y, and the second rotation speed, which is the rotation speed slower than the first rotation speed, and transmits the switching signal to the control unit 60. According to the present embodiment, the following advantages are obtained in a manner that the operator manually operates the switching button 95 to switch the rotation speed of the rotation shaft 53 of the disc unit 51 of the twisting unit 15 as the yarn threading target among the twisting units 15 of the plurality of spindles 25 from the first rotation speed, which is the rotation speed at the time of producing the yarn Y, to the second rotation speed, which is the rotation speed slower than the first rotation speed, and then carries out the yarn threading. That is, since the rotation speed of the rotation shaft 53 is slower as compared with the case where yarn threading is carried out when the rotation shaft 53 is at the first rotation speed at the time of producing the yarn Y, the tension of the yarn Y can be suppressed from strongly fluctuating due to the contact of the yarn Y with the rotating disc 55 (refer to FIGS. 9A and 9B). Similarly, even in a case where the yarn threading is carried out while the rotation speed of the rotation shaft 53 is decelerating from the first rotation speed toward the second rotation speed, or while the rotation speed of the rotation shaft 53 is accelerating toward the second rotation speed, the tension of the yarn Y can be suppressed from strongly fluctuating as compared with a case where the yarn threading is carried out when the rotation shaft 53 is at the first rotation speed. Thus, when the operator operates the holding unit 101 holding the yarn Y at the time of yarn threading to the twisting unit 15, the pulling of the holding unit 101 by the yarn tension is suppressed. Thus, the yarn threading can be easily carried out by passing the yarn Y between the plurality of disc units 51 while avoiding the contact between the holding unit 101 and the disc 55. Furthermore, according to the present embodiment, since the rotation speed of the rotation shaft 53 of the twisting unit 15 other than the yarn threading target can be maintained at the first rotation speed, a decrease in the production efficiency of the yarn Y as a whole of the draw texturing machine 1 can be suppressed.

[0067] Further, in the present embodiment, since the yarn Y can be passed between the plurality of discs 55 without opening a space between the plurality of discs

55, it is not necessary to secure a space for moving the discs 55 as in the opening and closing twisting unit. Therefore, as compared with the case of using the opening and closing twisting unit, the draw texturing machine 1 can be downsized, and the production efficiency for the site is increased. In general, it is difficult to carry out the yarn threading to the twisting unit 15 without opening a space between the discs 55 as compared with the opening and closing twisting unit. However, in the present embodiment, the yarn threading can be easily carried out by carrying out the yarn threading in a state where the rotation shaft 53 rotates at the second rotation speed that is a low speed, or in a state where the rotation shaft 53 is decelerating or accelerating toward the second rotation speed, so that the advantage of using the twisting unit 15 of a type in which the space between the discs 55 is not opened can be fully utilized.

[0068] Furthermore, in the present embodiment, each twisting unit drive motor 56, the first roller drive motor 91, and the second roller drive motor 92 are independently controlled. In other words, the twisting unit drive motor 56 drives the rotation of the plurality of rotation shafts 53 independently of the drive of the plurality of first feed rollers 11 by the first roller drive motor 91 and the drive of the plurality of second feed rollers 16 by the second roller drive motor 92. Therefore, even in a case where the rotation speed of the rotation shaft 53 of the twisting unit 15 as the yarn threading target is switched to the second rotation speed, the rotation speeds of the plurality of first feed rollers 11 and the plurality of second feed rollers 16 are not reduced. Therefore, a decrease in the production efficiency of the entire draw texturing machine 1 at the time of yarn threading can be suppressed.

[0069] Further, the draw texturing machine 1 of the present embodiment includes the switching buttons 95 as a plurality of notification units individually provided for the twisting units 15 of the plurality of spindles 25. Each switching button 95 notifies that the rotation speeds of the plurality of rotation shafts 53 of the twisting unit 15 have reached the second rotation speed. According to the present embodiment, the operator can ascertain whether or not the rotation speed of the rotation shaft 53 has reached the second rotation speed for each twisting unit 15. Therefore, the operator can avoid erroneously carrying out the yarn threading when the rotation shaft 53 of the twisting unit 15 as the yarn threading target is at the first rotation speed.

[0070] In the draw texturing machine 1 of the present embodiment, the switching button 95 as the notification unit notifies that the rotation speed of each rotation shaft 53 has reached the second rotation speed by the turning-on or blinking pattern of the lamp. According to the present embodiment, the operator can visually and quickly determine the rotation speed of the rotation shaft 53 for each twisting unit 15.

[0071] Furthermore, in the draw texturing machine 1 of the present embodiment, the switching buttons 95 are individually provided for the twisting units 15 of the plu-

5 rality of spindles 25. Each switching button 95 transmits, to the control unit 60, the switching signal for switching rotation speed of each rotation shaft 53 by the corresponding twisting unit drive motor 56. In the present embodiment, in a case where the operator tries to transmit the switching signal for switching the rotation speed of the rotation shaft 53 rotationally driven by the arbitrary twisting unit drive motor 56 to the control unit 60, the operator may operate the switching button 95 provided corresponding to the twisting unit drive motor 56. Therefore, a mistake of erroneously changing the rotation speed of the rotation shaft 53 of another twisting unit 15 that is not the yarn threading target can be suppressed.

[0072] In the draw texturing machine 1 of the present embodiment, the switching signal includes a signal for switching each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 to the stop state in which the rotation is stopped. According to the present embodiment, in a case where the yarn Y is entangled in the disc 55, the rotation of the rotation shaft 53 can be individually stopped for each twisting unit 15. Therefore, in the twisting unit 15 in which the yarn Y is not entangled in the disc 55, the rotation speed of the rotation shaft 53 can be maintained at the first rotation speed, and thus a decrease in the production efficiency of the yarn Y as a whole of the draw texturing machine 1 can be suppressed.

[0073] The yarn threading method of the present embodiment is a yarn threading method of threading the yarn Y to the draw texturing machine 1 configured to be able to switch the rotation speed of the rotation shaft 53 of each disc unit 51 of the twisting units 15 of the plurality of spindles 25 at least between the first rotation speed, which is the rotation speed at the time of producing the yarn Y, and the second rotation speed, which is the rotation speed slower than the first rotation speed. Each spindle 25 includes the twisting unit 15 that includes the plurality of disc units 51 each including the plurality of discs 55 and the rotation shaft 53 that rotates the plurality of discs 55, and that can apply twists to the yarn Y running between the plurality of disc units 51 by the rotation of the rotation shaft 53 of each disc unit 51. The yarn threading method includes a switching process and a twisting unit yarn threading process. The switching process is a process of switching the rotation speed of each rotation shaft 53 to the second rotation speed for the twisting unit 15 as the yarn threading target among the twisting units 15 of the plurality of spindles 25. The twisting unit yarn threading process is a process of threading the yarn Y to the twisting unit 15 as the yarn threading target by passing the yarn Y between the plurality of disc units 51 when each rotation shaft 53 is rotating at the second rotation speed, when the rotation speed of each rotation shaft 53 is decreasing its speed from the first rotation speed to the second rotation speed, or when the rotation speed of each rotation shaft 53 is increasing its speed toward the second rotation speed. According to the present embodiment, the following advantages are ob-

tained by switching the rotation speed of the rotation shaft 53 of each disc unit 51 of the twisting unit 15 as the yarn threading target among the twisting units 15 of the plurality of spindles 25 from the first rotation speed, which is the rotation speed at the time of producing the yarn Y, to the second rotation speed, which is the rotation speed slower than the first rotation speed, and then performing the yarn threading. That is, since the rotation speed of the rotation shaft 53 is slower as compared with the case where yarn threading is carried out when the rotation shaft 53 is at the first rotation speed at the time of producing the yarn Y, the tension of the yarn Y can be suppressed from strongly fluctuating due to the contact of the yarn Y with the rotating disc 55 (refer to FIGS. 9A and 9B). Similarly, even in a case where the yarn threading is carried out while the rotation speed of the rotation shaft 53 is decelerating from the first rotation speed toward the second rotation speed, or while the rotation speed of the rotation shaft 53 is accelerating toward the second rotation speed, the tension of the yarn Y can be suppressed from strongly fluctuating as compared with a case where the yarn threading is carried out when the rotation shaft 53 is at the first rotation speed. Thus, when the operator operates the holding unit 101 holding the yarn Y at the time of yarn threading to the twisting unit 15, the pulling of the holding unit 101 by the yarn tension is suppressed. Thus, the yarn threading can be easily carried out by passing the yarn Y between the plurality of disc units 51 while avoiding the contact between the holding unit 101 and the disc 55. Furthermore, according to the present embodiment, since the rotation speed of the rotation shaft 53 of the twisting unit 15 other than the yarn threading target can be maintained at the first rotation speed, a decrease in the production efficiency of the yarn Y as a whole of the draw texturing machine 1 can be suppressed.

[0074] Further, in the present embodiment, since the yarn Y can be passed between the plurality of discs 55 without opening a space between the plurality of discs 55, it is not necessary to secure a space for moving the discs 55 as in the opening and closing twisting unit. Therefore, as compared with the case of using the opening and closing twisting unit, the draw texturing machine 1 can be downsized, and the production efficiency for the site is increased. In general, it is difficult to carry out the yarn threading to the twisting unit 15 without opening a space between the discs 55 as compared with the opening and closing twisting unit. However, in the present embodiment, the yarn threading can be easily carried out by carrying out the yarn threading in a state where the rotation shaft 53 rotates at the second rotation speed that is a low speed, or in a state where the rotation shaft 53 is decelerating or accelerating toward the second rotation speed, so that the advantage of using the twisting unit 15 of a type in which the space between the discs 55 is not opened can be fully utilized.

[0075] In addition, in the present embodiment, the yarn threading to the twisting unit 15 is carried out when the

disc 55 is rotating. The portion of the circumferential surface of the disc 55 to be in contact with the yarn Y can be changed by carrying out the yarn threading when the disc 55 is rotating. Therefore, local wear of the circumferential surface of the disc 55 can be suppressed. As a result, the fluctuation of the contact state between the yarn Y and the circumferential surface of the disc 55 can be suppressed, and the degradation of the yarn quality can be suppressed.

[0076] In the yarn threading method of the present embodiment, the twisting unit yarn threading process is preferably carried out after the rotation speed of each rotation shaft 53 has reached the second rotation speed. Thus, the twisting unit yarn threading process is carried out in a state where the rotation speeds of the plurality of rotation shafts 53 are constant at the second rotation speed. Thus, the yarn tension generated due to the contact between the yarn Y and the circumferential surface of the disc 55 is stabilized, so that the holding unit 101 can be avoided from becoming difficult to operate due to a large fluctuation in the yarn tension, and the yarn threading becomes easy.

[0077] In the yarn threading method of the present embodiment, each of the spindles 25 arranged in the draw texturing machine 1 includes the second feed roller 16 arranged on the downstream side of the twisting unit 15 in the yarn running direction, and the roller yarn threading process of threading the yarn Y to the rotating second feed roller 16 arranged on the downstream side of the twisting unit 15 as the yarn threading target is further included. The twisting unit yarn threading process is carried out after the roller yarn threading process. According to the present embodiment, by threading the yarn Y first to the rotating second feed roller 16, the yarn Y is pulled by the second feed roller 16, and the yarn Y is in a state of being stretched in the yarn running direction. The yarn Y in the stretched state is less likely to swing as compared with the yarn in the relaxed state. Therefore, the yarn threading to the twisting unit 15 is further facilitated.

[0078] Furthermore, in the yarn threading method of the present embodiment, the roller yarn threading process is started until the rotation speed of each rotation shaft 53 reaches the second rotation speed after the switching process is carried out. According to the present embodiment, the operation time can be shortened by starting the roller yarn threading process until the rotation speed of each rotation shaft 53 reaches the second rotation speed.

(Modifications)

[0079] Hereinafter, modifications in which changes are made to the above embodiment will be described. However, constituent elements having the same configurations as those of the above embodiment are denoted by the same reference numerals, and the description thereof will be appropriately omitted.

[0080] In the embodiment described above, the switch-

ing buttons 95 as the switching units of the present invention are individually provided for the twisting unit drive motors 56 of the plurality of spindles 25. Each switching button 95 is configured to transmit the generated predetermined switching signal to the control unit 60. However, the switching unit of the present invention is not limited to the configuration of the above embodiment. For example, the switching unit may be included in one central operating panel connected to the plurality of twisting unit drive motors 56. The central operating panel has a plurality of switching units individually corresponding to the twisting unit drive motors 56 of the plurality of spindles 25. As a specific example, the switching unit is, for example, a signal input unit such as an icon displayed on the central operating panel, and is a plurality of signal input units individually corresponding to the twisting unit drive motors 56 of the plurality of spindles 25. In this case, in a case where the plurality of signal input units displayed on the central operating panel are individually operated by the operator, a switching signal for switching the rotation speed of the rotation shaft 53 driven by the corresponding twisting unit drive motor 56 between the first rotation speed, the second rotation speed, and the stop state is generated.

[0081] In the embodiment described above, the switching signal includes a signal for switching each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 to the stop state in which the rotation is stopped. However, the switching signal may not include a signal for switching each rotation shaft 53 driven by the corresponding twisting unit drive motor 56 to the stop state in which the rotation is stopped. In this case, for example, the switching of each rotation shaft 53 provided in each twisting unit 15 to the stop state is collectively performed for all the twisting units 15.

[0082] In the embodiment described above, the switching button 95 incorporates a single-color lamp indicating any of turning on, blinking, and turning off. However, the switching button 95 may be a lamp indicating a plurality of types of colors. In this case, for example, the switching button 95 indicates the rotation speed of the rotation shaft 53 using the color of the lamp to be turned on.

[0083] Furthermore, the lamp may not be incorporated in the switching button 95, and for example, a lamp as the notification unit of the present invention may be provided for each twisting unit 15 separately from the switching button 95. In this case, for example, the lamp is turned on when the rotation speed of the rotation shaft 53 reaches the second rotation speed. Furthermore, a plurality of (for example, three) lamps may be provided for each twisting unit 15. In this case, the plurality of lamps include a first lamp that is turned on when the rotation speed of the rotation shaft 53 reaches the second rotation speed, and a second lamp that is turned on when the rotation speed of the rotation shaft 53 reaches the first rotation speed.

[0084] In the embodiment described above, the yarn Y is threaded to the second feed roller 16 (step S3), and

then the yarn Y is threaded to the twisting unit 15 (step S4). However, the yarn Y may be first threaded to the twisting unit 15 and then threaded to the second feed roller 16. In this case, before threading the yarn Y to the twisting unit 15, the operator operates the switching button 95 to switch the rotation speeds of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target to the second rotation speed.

[0085] In the embodiment described above, the rotation speed of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target is switched to the first rotation speed (step S5), and then the yarn Y is threaded to the twist-stopping guide 12 (step S6). However, after threading the yarn Y to the twist-stopping guide 12, the rotation speed of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target may be switched to the first rotation speed. In addition, in the embodiment described above, the rotation speed of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target is switched to the first rotation speed (step S5), and then the yarn Y is threaded to the first feed roller 11 (step S7). However, after threading the yarn Y to the first feed roller 11, the rotation speed of the plurality of rotation shafts 53 of the twisting unit 15 as the yarn threading target may be switched to the first rotation speed. However, the yarn Y needs to be threaded to the first feed roller 11 after being threaded to the twist-stopping guide 12.

[0086] In the embodiment described above, in step S6, the yarn Y is threaded to the twist-stopping guide 12. However, in a case where the twist-stopping guide 12 is configured to be movable between a retracted position at the time of threading the yarn Y to the twisting unit 15 and an operation position at the time of winding the yarn Y by the winding unit 4, the following operation is carried out. That is, in step S6, after threading the yarn Y to the twist-stopping guide 12, the twist-stopping guide 12 is further moved to the operation position.

[0087] In the embodiment described above, the yarn is threaded to the first heater 13 and the cooler 14 from when the yarn Y is threaded to the twisting unit 15 to when the yarn Y is threaded to the twist-stopping guide 12. However, after the yarn Y is threaded to the twisting unit 15, the yarn Y may be further threaded to the twist-stopping guide 12, and then the yarn may be threaded to the first heater 13 and the cooler 14. The order of yarn threading of the twist-stopping guide 12, the first heater 13, and the cooler 14 varies depending on the type of yarn and the system configuration.

[0088] In the embodiment described above, the twisting unit 15 is a three-axis twisting unit 15 having three rotation shafts. However, the twisting unit may be a five-axis twisting unit having five rotation shafts.

[0089] In the twisting unit 15 in the embodiment described above, each rotation shaft 53 and the plurality of discs 55 attached to the rotation shaft 53 are fixedly arranged so as not to move from the position of FIG. 4. However, the twisting unit 15 is not limited to such a con-

figuration. For example, in the twisting unit, the rotation shaft 53 and the disc 55 may be configured to be movable from the position of FIG. 4. In this case, the yarn Y can be passed between the plurality of discs 55 without opening a space between the plurality of discs 55 by applying the configuration of the present invention. As a result, it becomes unnecessary to secure a space for moving the disc 55, and the draw texturing machine 1 can be downsized and the production efficiency for the site is increased as compared with the case of opening and closing the twisting unit by moving the disc 55.

[0090] In the embodiment described above, a single first roller drive motor 91 is provided in common for the first feed rollers 11 of all the spindles 25 arranged in the draw texturing machine 1. However, a single first roller drive motor 91 may be provided in common for the first feed rollers 11 of at least two spindles 25 among all the spindles 25 arranged in the draw texturing machine 1. For example, in a case where 12 spindles 25 are arranged, a single first roller drive motor 91 may be provided in common for every four spindles 25. In this case, three first roller drive motors 91 are provided for the first feed rollers 11 of the 12 spindles 25. The same applies to the second roller drive motor 92. That is, a single second roller drive motor 92 may be provided in common for the second feed rollers 16 of at least two spindles 25 among all the spindles 25 arranged in the draw texturing machine 1.

[0091] In the twisting unit 15 of the embodiment described above, the plurality of discs 55 are arranged to draw a spiral. However, the twisting unit 15 is not limited to one in which the plurality of discs 55 are arranged to draw a spiral.

Claims

1. A draw texturing machine (1) comprising:

a plurality of spindles (25) each including a twisting unit (15),
 a first yarn feed roller (11) that is arranged on an upstream side of the twisting unit (15) in a yarn running direction in which a yarn (Y) runs,
 a second yarn feed roller (16) that is arranged on a downstream side of the twisting unit (15) in the yarn running direction;
 a plurality of twisting unit drive mechanisms (56) that are individually provided for the twisting units (15) of the plurality of spindles (25);
 a first yarn feed roller drive mechanism (91) that is provided in common for the first yarn feed rollers (11) of the plurality of spindles (25) and rotationally drives the plurality of first yarn feed rollers (11);
 a second yarn feed roller drive mechanism (92) that is provided in common for the second yarn feed rollers (16) of the plurality of spindles (25)

and rotationally drives the plurality of second yarn feed rollers (16);
 a control unit (60); and
 a plurality of switching units (95) that are individually provided for the twisting units (15) of the plurality of spindles (25), wherein the twisting unit (15) has a plurality of disc units (51) each including a plurality of discs (55) and a rotation shaft (53) that rotates the plurality of discs (55),
 the rotation shaft (53) of each disc unit (51) rotates to apply twists to the yarn (Y) running between the plurality of disc units (51),
 each twisting unit drive mechanism (56) rotationally drives the rotation shaft (53) of each disc unit (51) of the corresponding twisting unit (15),
 the control unit (60) controls each twisting unit drive mechanism (56), the first yarn feed roller drive mechanism (91), and the second yarn feed roller drive mechanism (92), and
 each switching unit (95) generates, by a manual operation, a switching signal for switching a rotation speed of each rotation shaft (53) driven by the corresponding twisting unit drive mechanism (56) at least between a first rotation speed that is a rotation speed at a time of producing the yarn (Y) and a second rotation speed that is a rotation speed slower than the first rotation speed, and transmits the switching signal to the control unit (60).

2. The draw texturing machine (1) according to claim 1, further comprising a plurality of notification units (95) individually provided for the twisting units (15) of the plurality of spindles (25), wherein each notification unit (95) notifies that the rotation speed of each rotation shaft (53) driven by the corresponding twisting unit drive mechanism (56) has reached the second rotation speed.

3. The draw texturing machine (1) according to claim 2, wherein the notification unit (95) notifies that the rotation speed of each rotation shaft (53) has reached the second rotation speed by a turning-on or blinking pattern of a lamp.

4. The draw texturing machine (1) according to any one of claims 1 to 3, wherein the switching signal includes a signal for switching each rotation shaft (53) driven by the corresponding twisting unit drive mechanism (56) to a stop state in which rotation is stopped.

5. A yarn threading method of threading a yarn (Y) to a draw texturing machine (1) that includes a plurality of spindles (25) each including a twisting unit (15) that has a plurality of disc units (51) each including a plurality of discs (55) and a rotation shaft (53) ro-

tating the plurality of discs (55), and in which the rotation shaft (53) of each disc unit (51) rotates to apply twists to the yarn (Y) running between the plurality of disc units (51), the draw texturing machine (1) being configured to switch a rotation speed of the rotation shaft (53) of each disc unit (51) of the twisting units (15) of the plurality of spindles (25) at least between a first rotation speed that is a rotation speed at a time of producing the yarn (Y) and a second rotation speed that is a rotation speed slower than the first rotation speed, the yarn threading method comprising:

a switching process of switching the rotation speed of each rotation shaft (53) to the second rotation speed for the twisting unit (15) as a yarn threading target among the twisting units (15) of the plurality of spindles (25); and
 a twisting unit yarn threading process of threading the yarn (Y) to the twisting unit (15) as the yarn threading target by passing the yarn (Y) between the plurality of disc units (51) when each rotation shaft (53) is rotating at the second rotation speed, when each rotation shaft (53) is decreasing its speed from the first rotation speed to the second rotation speed, or when each rotation shaft (53) is increasing its speed toward the second rotation speed.

6. The yarn threading method according to claim 5, wherein the twisting unit yarn threading process is carried out after the rotation speed of each rotation shaft (53) reaches the second rotation speed.

7. The yarn threading method according to claim 5 or 6, wherein

each spindle (25) arranged in the draw texturing machine (1) includes a second yarn feed roller (16) arranged on a downstream side of the twisting unit (15) in a yarn running direction in which the yarn (Y) runs,
 the yarn threading method further includes a roller yarn threading process of threading the yarn (Y) to the rotating second yarn feed roller (16) arranged on the downstream side of the twisting unit (15) as the yarn threading target, and
 the twisting unit yarn threading process is carried out after the roller yarn threading process.

8. The yarn threading method according to claim 7, wherein the roller yarn threading process is started until the rotation speed of each rotation shaft (53) reaches the second rotation speed after the switching process is carried out.

FIG.1

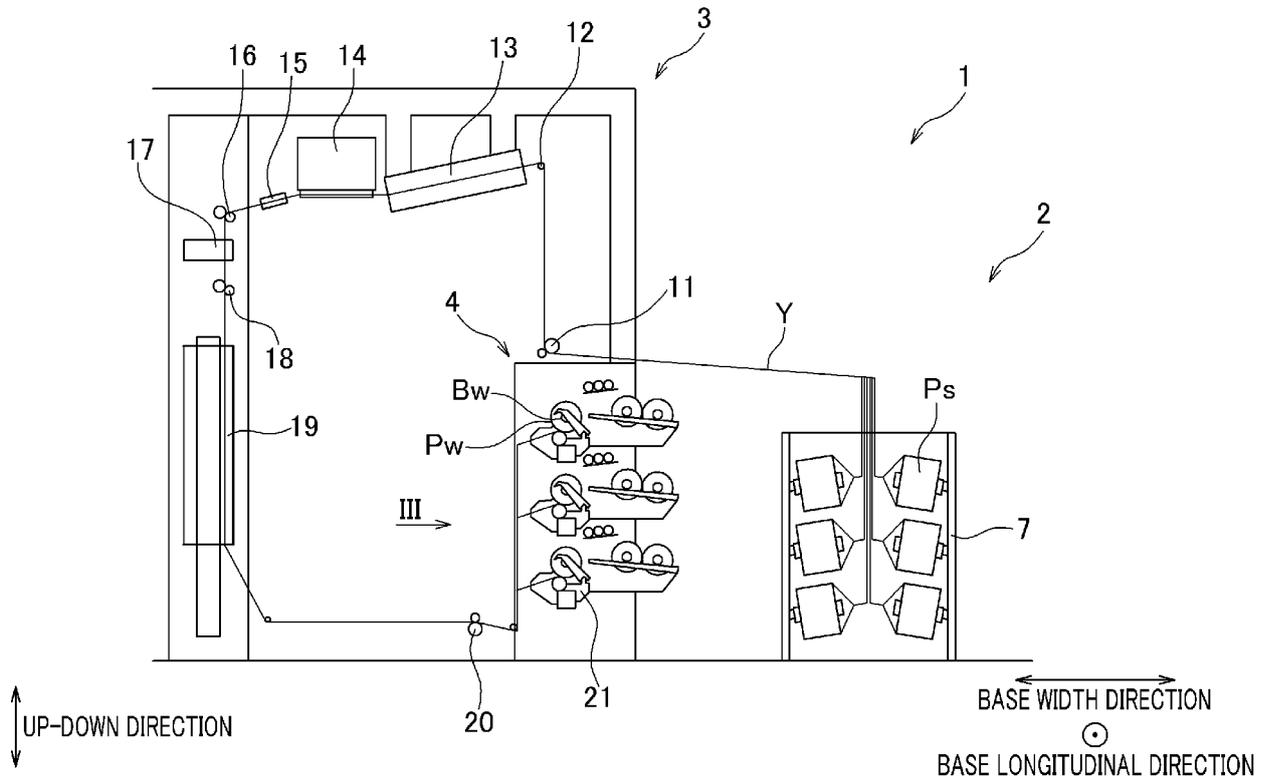


FIG.2

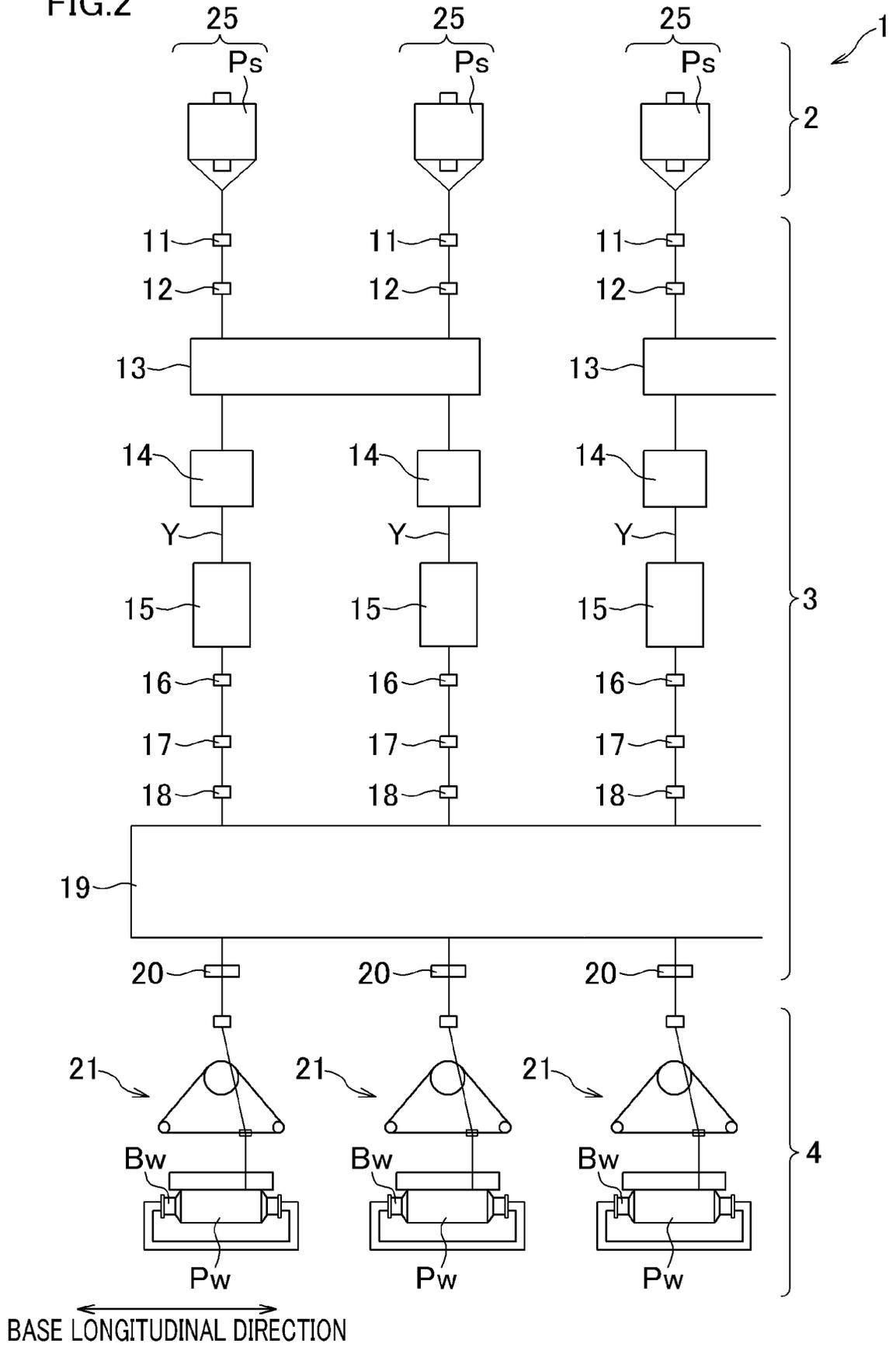


FIG.3

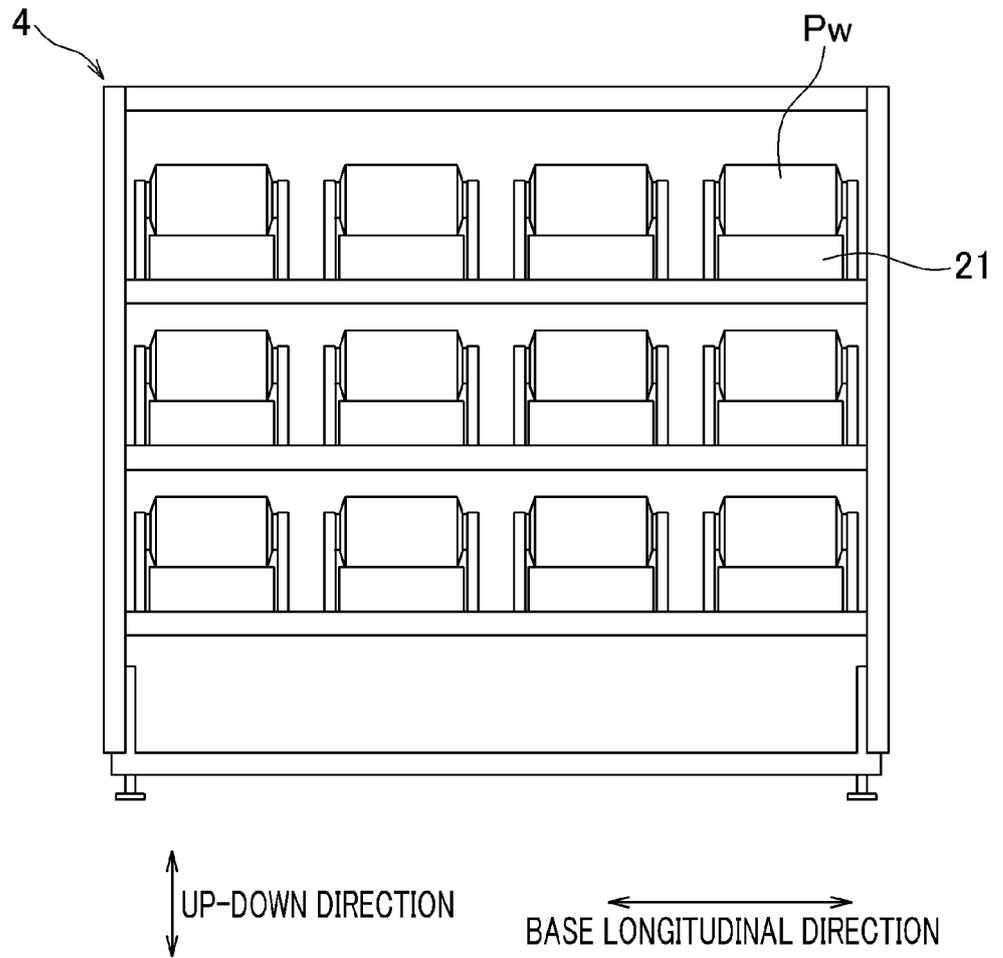


FIG.4

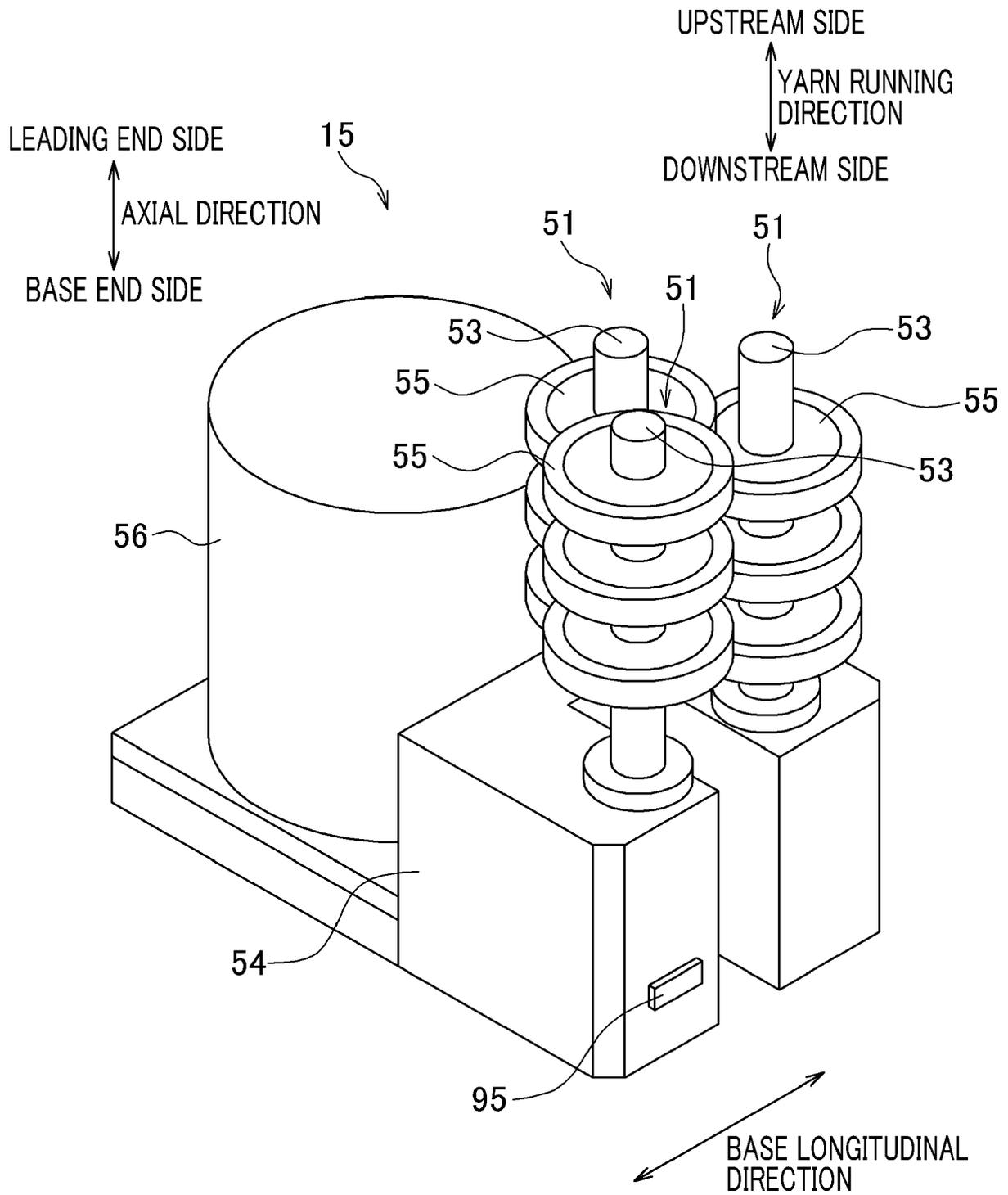


FIG.5

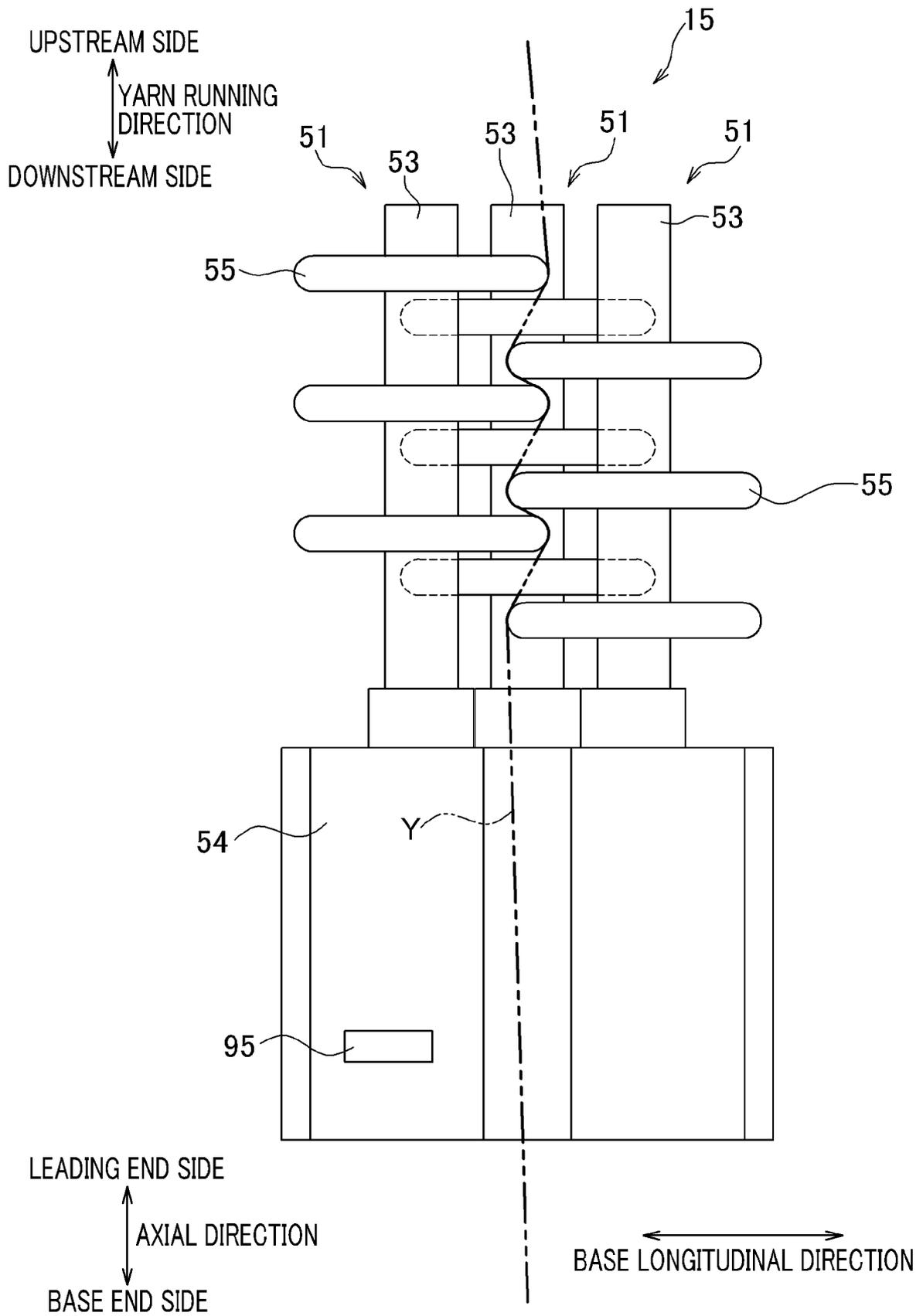


FIG.6

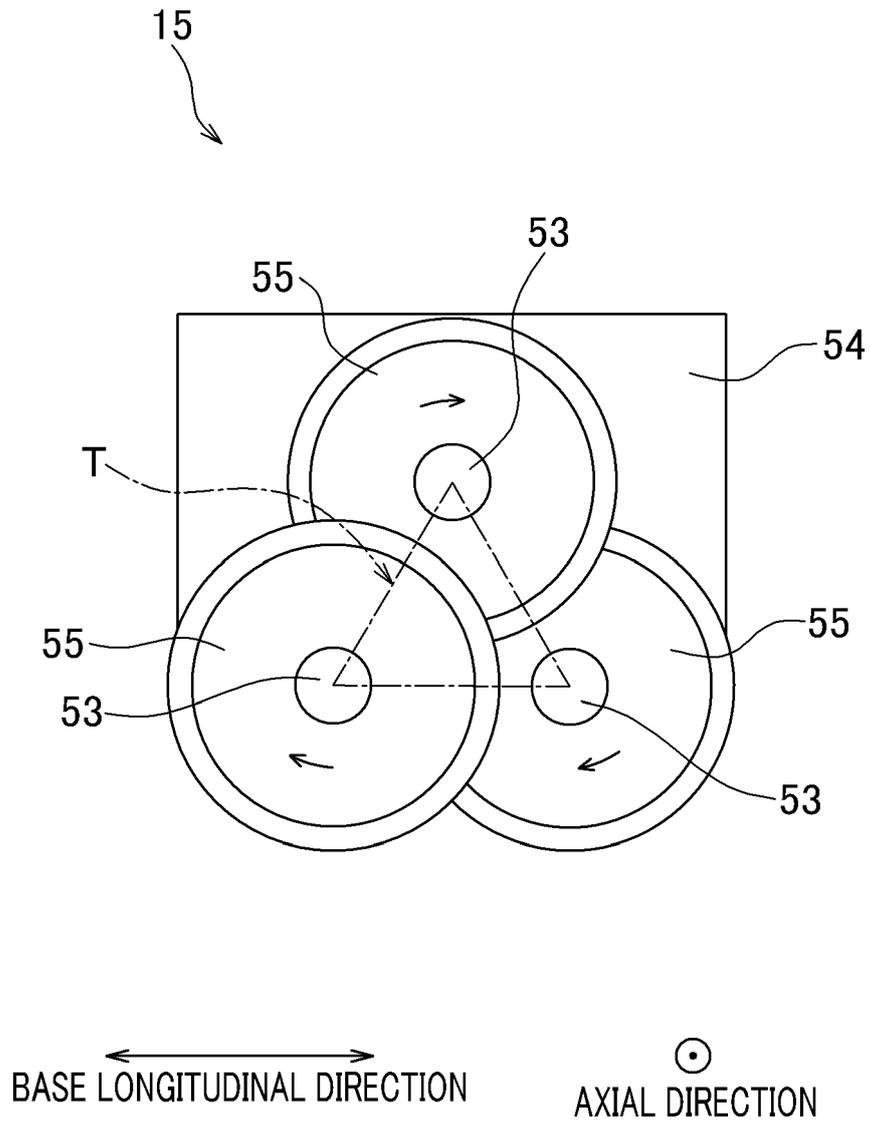


FIG. 7

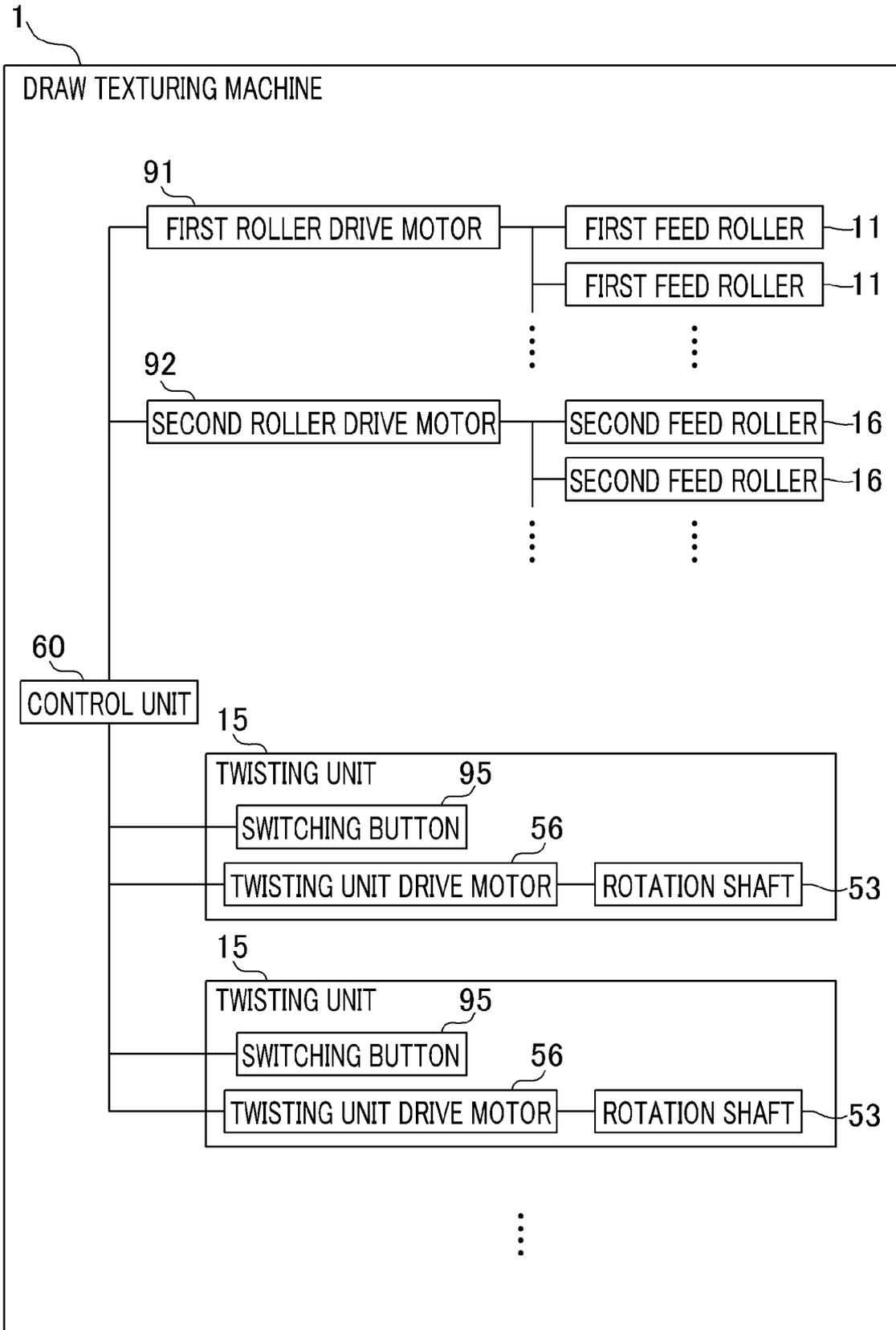


FIG.8

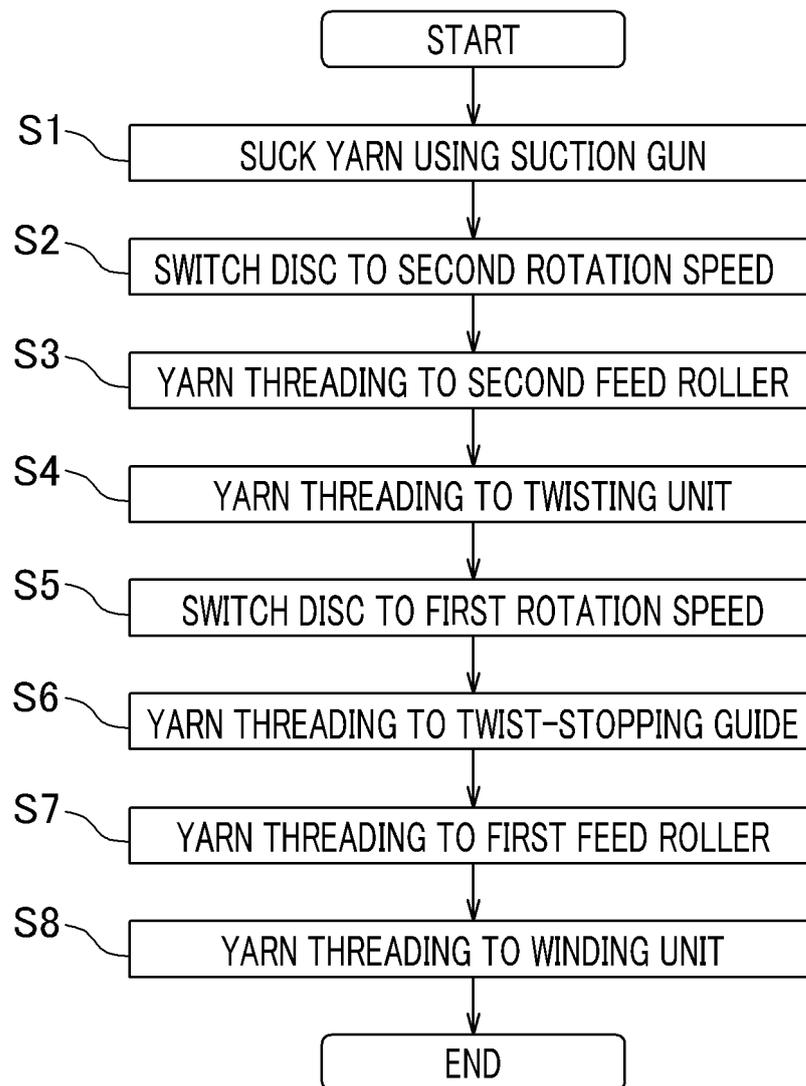
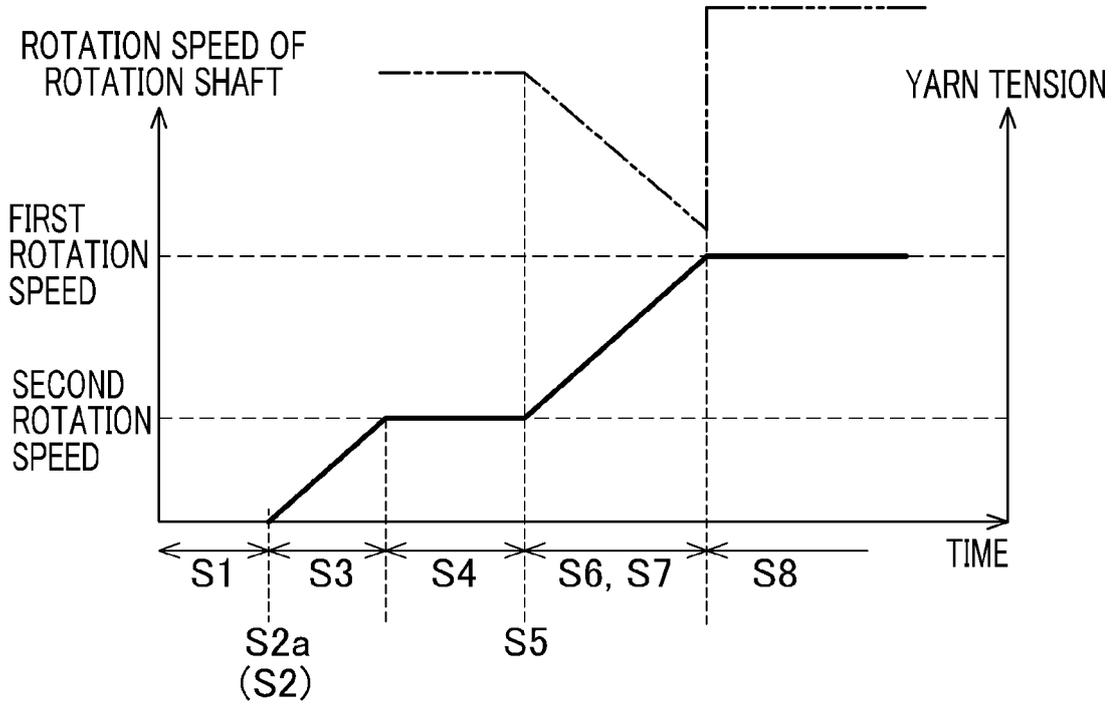


FIG.9

(a)



(b)

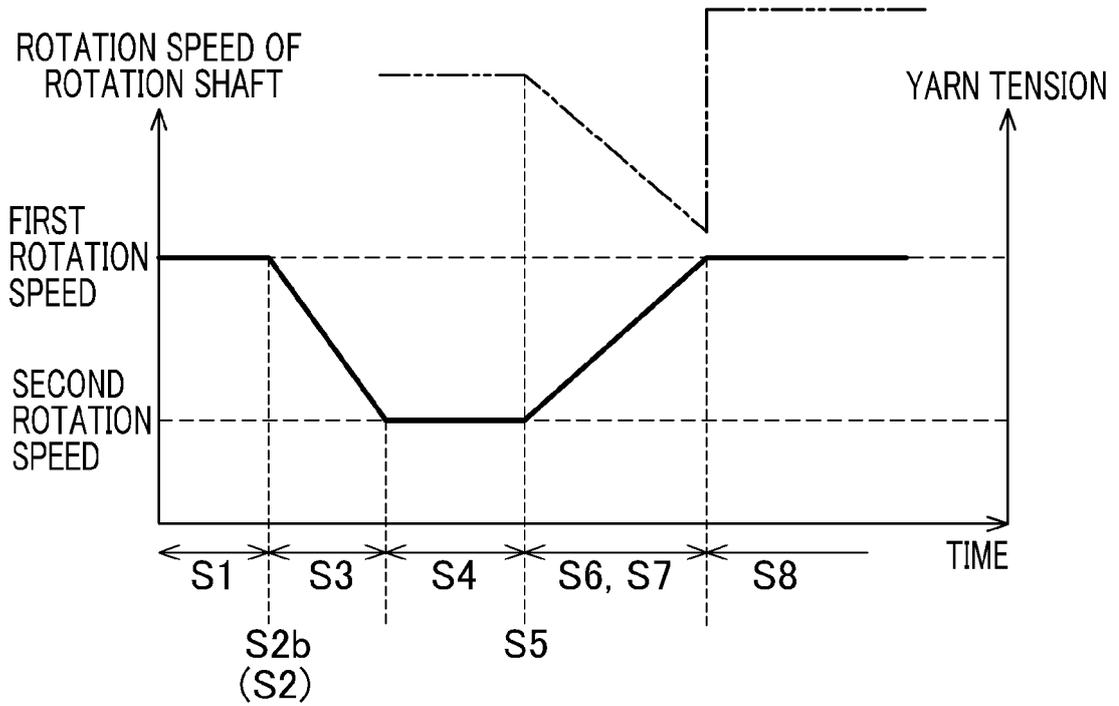
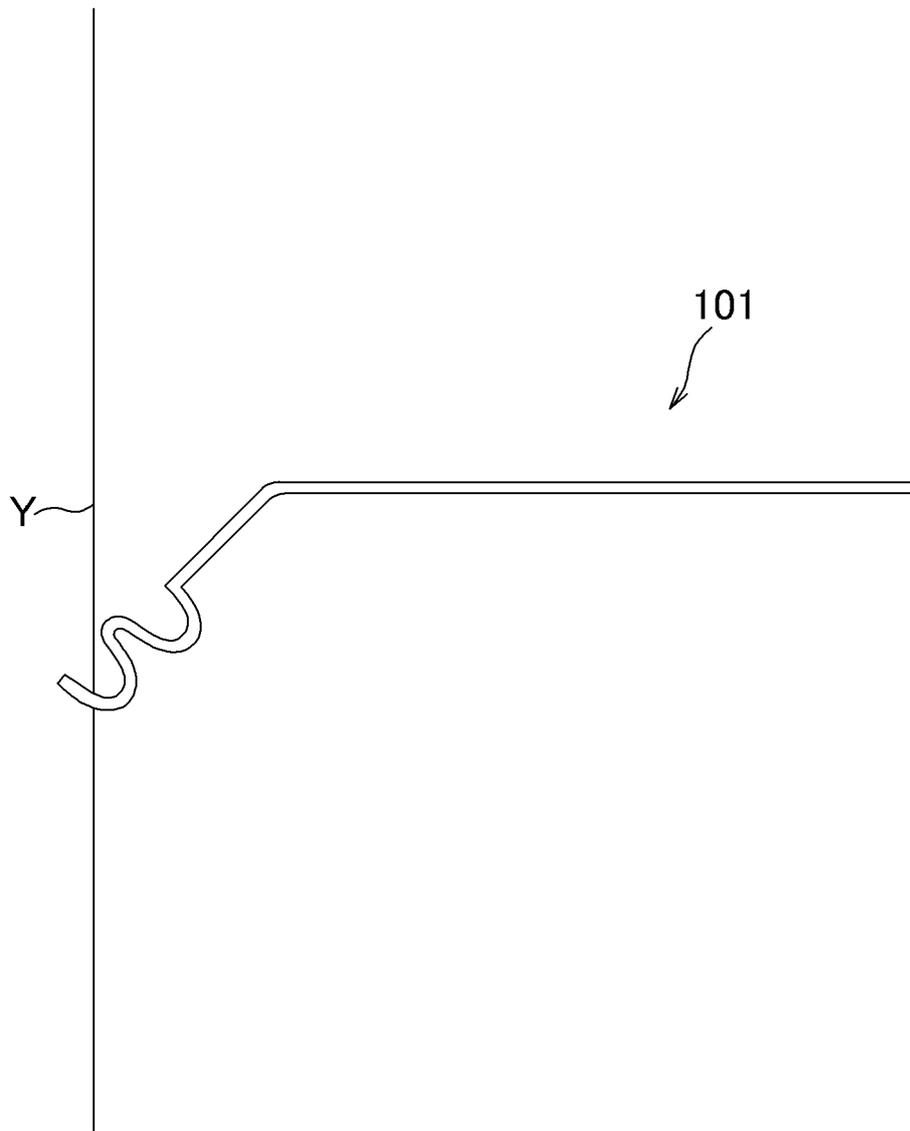


FIG.10





EUROPEAN SEARCH REPORT

Application Number

EP 24 17 4806

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 889 328 A1 (TMT MACHINERY INC [JP]) 6 October 2021 (2021-10-06)	1	INV. D02G1/02
Y	* paragraphs [0030] - [0041], [0063] * -----	1-8	D02G1/08
Y	DE 26 06 198 B1 (BARMAG BARMER MASCHF) 11 August 1977 (1977-08-11) * column 1, lines 54-67; figures 1-3 * * column 2, lines 28-38 * * column 3, lines 16-20, 27-32 * * column 3, line 47 - column 4, line 11 * -----	1-4	
Y	EP 1 092 795 B1 (MURATA MACHINERY LTD [JP]) 16 September 2009 (2009-09-16) * paragraph [0003] - paragraph [0007]; figures 1-4 * * paragraph [0009] - paragraph [0015] * * paragraph [0019] - paragraph [0023] * * paragraph [0027] - paragraph [0030] * * paragraph [0033] - paragraph [0034] * * paragraph [0038] - paragraph [0042] * * paragraph [0044] * * paragraph [0049] * * paragraph [0052] - paragraph [0054] * * paragraph [0063] * * paragraph [0071] - paragraph [0072] * * paragraph [0084] * * paragraph [0087] * * paragraph [0089] * * paragraph [0093] - paragraph [0097] * -----	5-8	
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			D02G D02J

The present search report has been drawn up for all claims

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Place of search Munich	Date of completion of the search 13 August 2024	Examiner Wendl, Helen
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13 - 08 - 2024

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