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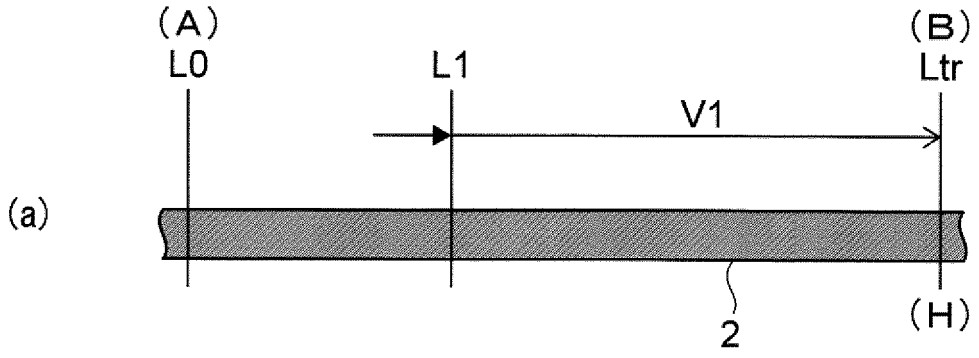
(54) TURRET-TYPE YARN WINDING APPARATUS

(57) The present invention aims to provide a yarn winding apparatus capable of efficiently producing a wound yarn body with stable quality. In a turret-type yarn winding apparatus, in order for the traverse guide 32 to reach the gripping position of the yarn member L when the switching between a spindle 2 at a winding position and a spindle 2 at a standby position has been completed, a control unit 4 calculates a moving speed and/or a moving path of the traverse guide 32 based on a time for switching between the spindle 2 at the winding position and the spindle 2 at the standby position by rotation of a turret unit 1, and moves the traverse guide 32 at the moving speed and/or along the moving path.



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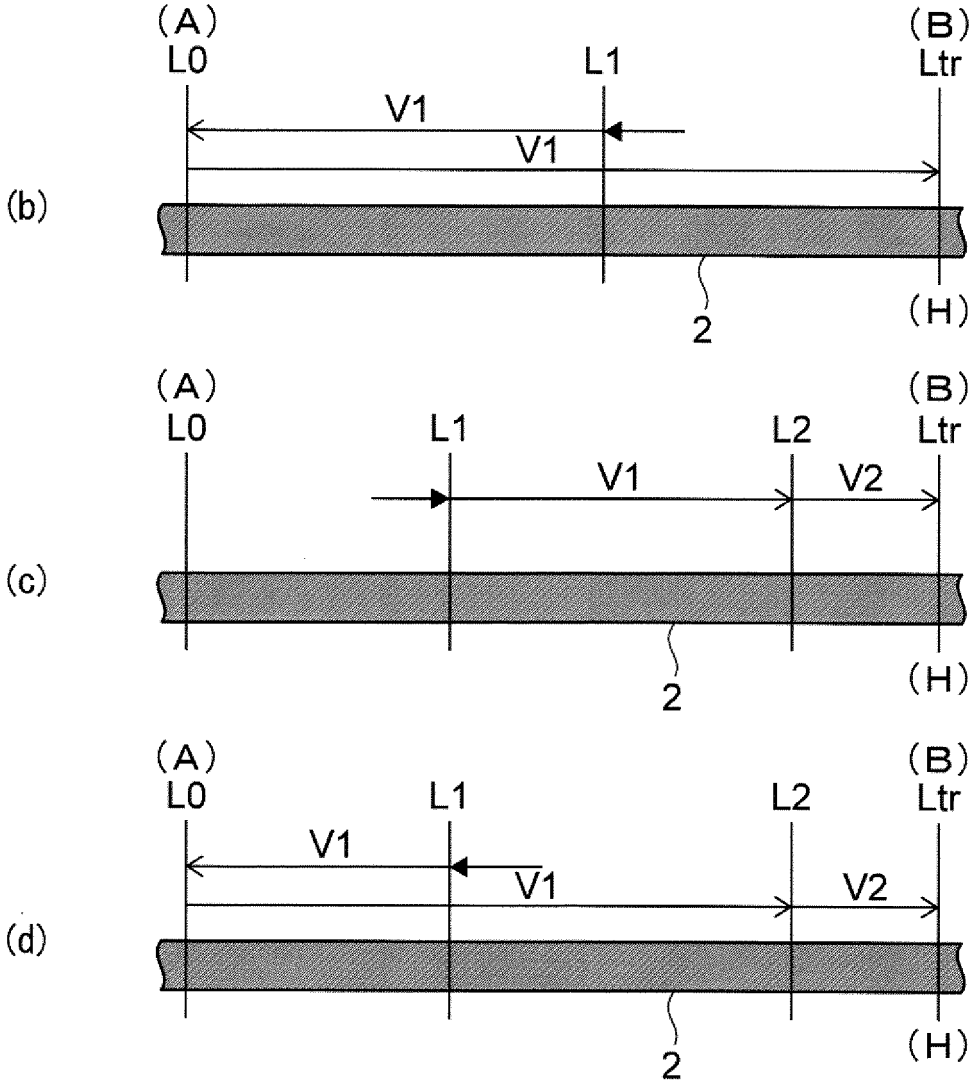
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(H)
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L0
L1
L2
(B)
Ltr
V1
V1
V2
2
(H)

FIG. 6

Description

Technical Field

[0001] The present invention relates to a turret-type yarn winding apparatus.

Background of the Invention

[0002] Conventionally, a so-called turret-type yarn winding apparatus is known in which a pair of spindles is switched between a winding side and a standby side by rotating a turret unit to automatically wind a yarn member sequentially on bobbins attached to the spindles.

[0003] Specifically, the turret-type yarn winding apparatus is provided with a turret unit, a plurality of spindles, a traverse guide, and a gripping mechanism. The turret unit is rotatably mounted on a machine frame. The plurality of spindles is provided on the turret unit so as to be arranged in parallel to each other to wind a yarn member on a bobbin attached to the spindle by the axial rotation thereof. The traverse guide traverses the yarn member with respect to the bobbin attached to the spindle on the winding side while reciprocating between a first turn-back position on the tip end side of the spindle and a second turn-back position on the base end side of the spindle along the axial direction of the spindle. The gripping mechanism is provided to the spindle to grip the yarn member fed from the traverse guide at a predetermined gripping position. The yarn member is wound on the bobbin attached to the spindle on the winding side. When the bobbin has reached a predetermined wound yarn amount and the bobbin has become full, the turret unit rotates to switch the spindle on the winding side and the spindle on the standby side. After gripping the yarn member fed from the traverse guide by the gripping mechanism of the newly provided spindle on the winding side, the yarn member is wound on the empty bobbin attached to the newly provided spindle on the winding side. This makes it possible to automatically wind the yarn member on a plurality of bobbins sequentially.

Prior Art Document

Patent Document

[0004] Patent Document 1: Japanese Unexamined Patent Application Publication No. 2002-137869

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0005] However, when the bobbin has reached a predetermined wound yarn amount and has become full and that the spindle on the winding side and the spindle on the standby side are switched by the rotation of the turret unit, the position of the traverse guide is random depending on the situation. Thus, the time for the traverse guide to reach the gripping position differs. For this reason, there are problems that variations occur in the quality, such as, e.g., the wound yarn amount and the wound yarn shape of the wound yarn body in which the yarn member is wound on the bobbin.

[0006] In particular, in a case where the traverse guide reaches the gripping position of the yarn member after completion of switching between the spindle on the winding side and the spindle on the standby side, the time to start winding the yarn member on the newly provided empty bobbin attached to the spindle on the winding side is delayed. This deteriorates the productivity of the wound yarn body.

[0007] The present invention has been made in view of the above-described problems. The present invention aims to provide a yarn winding apparatus capable of efficiently producing a wound yarn body with stable quality.

Means for Solving the Problem

[0008] In order to attain the above-described object, in the present invention, a turret-type yarn winding apparatus includes:

a turret unit rotatably mounted on a machine frame;
a plurality of spindles provided on the turret unit with an axial direction arranged in parallel to each other, the spindle being configured to wind a yarn member on a bobbin attached to the spindle by axial rotation;
a traverse guide configured to traverse the yarn member with respect to the bobbin attached to the spindle on a winding side while reciprocating between a first turn-back position on a tip end side of the spindle and a second turn-back position on a base end side of the spindle along an axial direction of the spindle;

a gripping mechanism provided to the spindle to grip the yarn member fed from the traverse guide at a predetermined gripping position; and

a control unit configured to control rotation of the turret unit, axial rotation of the spindle, a reciprocating motion of the traverse guide, and gripping of the yarn member by the gripping mechanism,

wherein when a yarn member is wound on the bobbin attached to the spindle on the winding side and the bobbin has reached a predetermined wound yarn amount and the bobbin has become full, the turret unit rotates to switch between the spindle on the winding side and the spindle on the standby side, the yarn member is gripped by the gripping mechanism of a newly provide spindle on the winding side, and then the yarn member is wound on an empty bobbin attached to the newly provided spindle on the winding side, and

wherein in order for the traverse guide to reach a gripping position of the yarn member when switching between the spindle on the winding side and the spindle on the standby side has been completed,

the control unit

calculates a moving speed and/or a moving path of the traverse guide, based on a time for switching between the spindle on the winding side and the spindle on the standby side when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, and

moves the traverse guide at the moving speed and/or along the moving path.

[0009] According to this configuration, the traverse guide reaches the gripping position of the yarn member when switching between the spindle on the winding side and the spindle on the standby side has been completed. Therefore, it is possible to unify the time for the traverse guide to reach the gripping position, which in turn can reduce or prevent variations in the quality, such as, the wound yarn amount and the wound yarn shape of the wound yarn body in which the yarn member is wound on the bobbin. Also, it is possible to prevent a case in which the traverse guide reaches the gripping position of the yarn member after completion of switching between the spindle on the winding side and the spindle on the standby side. This enables a quick start of winding the yarn member, thereby improving the productivity of the wound yarn body.

[0010] Further, it may be configured such that when the yarn member wound on the bobbin attached to the spindle on the winding side has reached the predetermined wound yarn amount and the bobbin has become full,

the control unit calculates the time for switching between the spindle on the winding side and the spindle on the standby side, based on a winding position of the spindle on the winding side at a time of completion of winding, a standby position of the spindle on the standby side at a time of start of winding, and a rotational speed of the turret unit.

[0011] According to this configuration, even in a case where the diameter of the wound yarn body increases as the yarn member is wound and the winding position on the spindle at the winding position is advanced in phase, it is possible to assuredly calculate the time for switching between the spindle on the winding side and the spindle on the standby side.

[0012] Further, it may be configured such that the control unit moves the traverse guide at a constant speed for a predetermined distance immediately before the yarn member fed from the traverse guide is gripped by the gripping mechanism.

[0013] This prevents the yarn member from accumulating due to the slow moving speed of the traverse guide, or the yarn member from being supplied on the outside of the bobbin due to the fast moving speed of the traverse guide, thereby allowing the yarn member to be stably wound on the bobbin to the end.

[0014] Further, it may be configured such that in a case where the traverse guide is moving in a direction approaching the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,

the control unit calculates the moving path along which the traverse guide moves at a predetermined speed to the gripping position of the yarn member.

[0015] According to this, the traverse guide can be moved to the gripping position of the yarn member as it is.

[0016] Further, it may be configured such that in a case where the traverse guide is moving in a direction away from the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,

the control unit calculates the moving path along which the traverse guide moves at a predetermined speed to a first turn-back position, turns back at the first turn-back position, and then moves at a predetermined moving speed to the gripping position of the yarn member.

[0017] This allows the traverse guide to move to the gripping position of the yarn member after turning back at the first turn-back position in the same way as a normal traverse.

[0018] Further, it may be configured such that in a case where the traverse guide is moving in a direction away from the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,

the control unit calculates the moving path along which the traverse guide turns back in a direction approaching the

gripping position of the yarn member at the same time of rotation of the turret unit and moves at a predetermined moving speed to the gripping position of the yarn member.

[0019] According to this, the traverse guide turns back in the direction approaching the gripping position at the same time as the turret unit rotates, and therefore, the traverse guide can move quickly to the gripping position of the yarn member.

[0020] Further, it may be configured such that in a case where the traverse guide is moving in a direction approaching the gripping position of the yarn member between a predetermined shift position and the second turn-back position when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide moves at a predetermined moving speed to the second turn-back position and turns back at the second turn-back position.

[0021] According to this, even in a case where the traverse guide is moving in a direction approaching the gripping position of the yarn member beyond the shift position for changing the moving speed, the traverse guide turns back at the second turn-back position as it is. Therefore, after reaching the shift position, the moving speed can be changed.

[0022] Further, it may be configured such that when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide turns back at a third turn-back position between the first turn-back position and the second turn-back position and moves in a direction approaching the gripping position of the yarn member.

[0023] According to this, the traverse guide turns back at the third-turn back position during the movement and moves in a direction approaching the gripping position of the yarn member. This allows the quick movement of the traverse guide to the gripping position of the yarn member.

Effects of the Invention

[0024] According to the present invention, the traverse guide reaches the gripping position of the yarn member when switching between the spindle on the winding side and the spindle on the standby side has been completed. For this reason, it is possible to unify the time for the traverse guide to reach the gripping position, which enables to reduce or prevent variations in the quality, such as, e.g., the wound yarn amount and the wound yarn shape of the wound yarn body in which the yarn member is wound on the bobbin. Also, it is possible to avoid a case in which the traverse guide reaches the gripping position of the yearn member after completion of switching between the spindle on the winding side and the spindle on the standby side. Therefore, the winding of the yarn member can be quickly started, which can improve the productivity of the wound yarn body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a front view of a turret-type yarn winding apparatus according to an embodiment of the present invention.
FIG. 2 is a side view of a spindle of the apparatus of FIG. 1.
FIG. 3 is a side view of a traverse guide of the apparatus of FIG. 1.
FIG. 4 is a diagram showing an electrical configuration of the apparatus of FIG. 1.
FIG. 5 is a diagram showing the process of switching spindles by rotating a turret unit.
FIG. 6 is a schematic diagram showing moving paths of the traverse guide (Calculation Example 1 to Calculation Example 4).
FIG. 7 is a schematic diagram showing moving paths of the traverse guide (Calculation Example 5 to Calculation Example 7).

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0026] Next, an embodiment of a turret-type yarn winding apparatus (hereinafter referred to as "this apparatus") according to the present invention will be described with reference to the attached drawings.

[0027] The apparatus is provided with a machine frame 10, a turret unit 1 mounted on the machine frame 10, a pair of spindles 2 attached to the turret unit 1, and a traverse mechanism 3 mounted on the machine frame 10, as shown in FIG. 1.

[0028] Note that in FIG. 1, the reference symbol "12" denotes a guide roller for guiding a yarn member L to the traverse mechanism 3. A plurality of additional guide rollers may be provided between the guide roller 12 and the traverse mechanism 3. Further, the reference symbol "35" denotes a pressure contact roller for pressing the wound yarn body

M of the yarn member L on the bobbin 21 attached to the spindle 2.

[0029] The turret unit 1 is a disk rotatably mounted on the front side of the machine frame 10. The turret unit 1 is supported by four rollers 11 provided therearound. The center portion of the rear surface of the turret unit is pivotally supported by the machine frame 10 in such a manner as to be rotated in a planar direction by a drive motor (not shown) provided inside the machine frame 10 on the rear side.

[0030] The spindle 2 is provided in such a manner as to protrude perpendicularly on the front side of the turret unit 1 and is axially rotated by a drive motor (not shown) provided on the rear side of the turret unit 1.

[0031] Further, the spindle 2 is configured to detachably attach a circular tubular bobbin 21 along the axial direction to wind a yarn member L on the bobbin in accordance with the axial rotation thereof.

[0032] Further, the spindle 2 is provided with a gripping mechanism 22 for gripping a yarn member L at the base end and is configured to grip the yarn member L supplied from the traverse guide 32, which will be described later, when winding of the yarn member L on the bobbin 21 is started on a predetermined winding side. In this embodiment, as shown in FIG. 2, the gripping mechanism 22 is configured to be openable and closable at the base end portion of the spindle 2. The gripping mechanism 22 opens in the axial direction of the spindle 2 to introduce the yarn member L and then grips the yarn member L by closing in the axial direction of the spindle 2 in accordance with a command of the control unit 4, which will be described later.

[0033] Further, the spindles 2 are provided on the turret unit 1 with a phase difference of 180 degrees. The spindle 2 on the winding side for winding the yarn member L and the spindle 2 on the standby side for detaching/attaching the bobbin 21 are switched by the rotation of the turret unit 1.

[0034] The traverse mechanism 3 is provided in the vicinity of the spindle 2 on the winding side. As shown in FIG. 3, the traverse mechanism 3 is provided with a traverse body 31 and a traverse guide 32 provided on the traverse body 31.

[0035] The traverse guide 32 is configured to reciprocate along the axial direction of the spindle 2 between a first turn-back position A on the tip end side of the spindle 2 and a second turn-back position B on the base end side of the spindle 2 while keeping a predetermined distance from the spindle 2 on the winding side, by a drive motor (not shown) provided in the machine frame 10.

[0036] In this embodiment, the second turn-back position B is set as a gripping position H of the yarn member L at which winding of the yarn member L is started. The position of the traverse guide 32 is measured from the degree of rotation of the drive motor of the traverse guide 32 or the like.

[0037] In FIG. 3, the reference symbol "33" indicates a sensor for detecting a reference (origin) for switching the yarn member L. The reference symbol "34" indicates a sensor for detecting the yarn member L when gripping the yarn member L.

[0038] Thus, in this apparatus, as shown in FIG. 5(a), the yarn member L is wound on the bobbin 21 attached to the spindle 2 on the winding side (left side). As shown in FIG. 5(b), when the bobbin 21 has reached a predetermined wound yarn amount and has become full, the turret unit 1 rotates to switch between the spindle 2 on the winding side (left side) and the spindle 2 on the standby side (right side). Then, as shown in FIG. 5 (c), the yarn member L guided by the traverse guide 32 is gripped by the gripping mechanism 22 of the spindle 2 on the winding side (left side) after the switching. Then, the yarn member L between the spindle 2 on the winding side (left side) and the spindle on the standby side (right side) is cut. Then, the yarn member L is wound on the empty bobbin 21 of the spindle 2 on the winding side (left side) after the switching. Further, the fully wound bobbin 21 is detached from the spindle 2 on the standby side (right side), and then an empty bobbin 21 is attached to the spindle 2. By repeating the series of the operations, the yarn member L can be wound sequentially on the bobbins 21 attached to the spindles.

[0039] The rotation of the turret unit 1, the axial rotation of the spindle 2, the reciprocating motion of the traverse guide 32, and the griping of the yarn member L by the gripping mechanism 22 are controlled by a control unit 4 as shown in FIG. 4.

[0040] The control unit 4 controls such that the traverse guide 32 reaches the gripping position H of the yarn member L when switching between the spindle 2 on the winding side and the spindle 2 on the standby side has been completed. Specifically, as shown in FIG. 5(b)and (c), after the yarn member L on the bobbin 21 attached to the spindle 2 at the winding position $\theta 0$ at the start of winding has reached a predetermined wound yarn amount and the bobbin has become full, when the spindle 2 in a fully wound state is switched from the winding position $\theta 1$ at the time of the completion of the winding to the standby position $\theta 2$ at the time of the start of the winding and that switching of the empty spindle 2 from the standby position ($\theta 1+180°$) at the time of the completion of the winding to the winding position $\theta 0$ at the time of the start of the winding has been completed, the control unit 4 moves the traverse guide 32 at a predetermined moving speed and/or along a predetermined moving path such that the traverse guide 32, which is randomly positioned on the traverse mechanism 3, reaches the gripping position H of the yarn member L. The moving speed and/or the moving path of the traverse guide 32 is calculated by the control unit 4 as follows. That is, the control unit 4 calculates the moving speed and/or the moving path of the traverse guide 32, based on the time for switching between the spindle 2 on the winding side and the spindle 2 on the standby side by rotating the turret unit 1 when the yarn member L on the bobbin 21 attached to the spindle 2 at the winding position θ at the time of the completion of the winding has reached a predetermined wound yarn amount and the bobbin has become full (during a period from when the control unit 4 has

received a signal indicating the fully wound state until when the turret unit 1 starts moving).

[0041] In this embodiment, the control unit 4 calculates the time for switching between the spindle 2 on the winding side and the spindle 2 on the standby side by rotating the turret unit 1 by the following Expression.

$$t = (\theta 2 - \theta 1) / \omega \qquad ...[1]$$

$\theta 1$: the winding position (angle) of the spindle 2 at the time of the completion of the winding
$\theta 2$: the standby position (angle) of the spindle 2 at the time of the start of the winding ω: the angular velocity of the turret unit

[0042] Note that the diameter of the wound yarn body M increases by winding the yarn member L, and therefore, the winding position $\theta 1$ of the spindle 2 at the time of the completion of the winding advances by ($\theta 1$ - $\theta 0$) clockwise than a predetermined winding position $\theta 0$ at the time of the start of the winding. Therefore, the control unit 4 measures the winding position $\theta 1$ of the spindle 2 at the time of the completion of the winding based on the rotational degree of the turret unit 1 (the drive motor). The winding position $\theta 0$ and the standby position $\theta 2$ of the spindle 2 at the start of the winding is predetermined. Further, the angular velocity co of the turret unit is also predetermined.

[0043] Hereinafter, the calculation example of the moving speed and/or the moving path of the traverse guide 32 will be described. Note that in each of the following calculation examples, the definitions of the moving speeds V1 and V2 and the positions L0-L4, Ltr of the traverse guide 32 are as follows.

VI: the first moving speed of the traverse guide 32
V2: the second moving speed (constant) of the traverse guide 32
L0: the first turn-back position A (home position) of the traverse guide 32 on the tip end side of the spindle 2
L1: the position of the traverse guide 32 at the time when the spindle 2 on the winding side is full
L2: the switching position of the moving speed of the traverse guide 32
L3: the shift position at which the moving speed can be changed (the same position as L2 or the position on the L0 side)
L4: the preset third turn-back position C
Ltr: the second turn-back position B of the traverse guide 32 on the tip end side of the spindle 2 (in this embodiment, the gripping position H of the yarn member L is also at the same position)

(Calculation Example 1)

[0044] As shown in FIG. 6(a), in a case where the traverse guide 32 is moving in a direction approaching the position Ltr between the position L0 and the position Ltr when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position Ltr (the gripping position H of the yarn member L) at the first moving speed V1. At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [2].

$$V1 = (Ltr - L1) / t \qquad ...[2]$$

(Calculation Example 2)

[0045] As shown in FIG. 6(b), in a case where the traverse guide 32 is moving in a direction away from the position Ltr between the position L0 and the position Ltr when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position L0 at the first moving speed VI, turns back at the position L0 (first turn-back position A) and then moves from the position L0 to the position Ltr (the gripping position H of the yarn member L) at the first moving speed V1. At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [3].

$$(L1 - L0) / V1 + (Ltr - L0) / V1 = t \qquad ...[3]$$

(Calculation Example 3)

[0046] As shown in FIG. 6(c), in a case where the traverse guide 32 is moving in a direction approaching the position Ltr between the position L0 and the position L2 when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position L2 at the first moving speed VI, and then moves from the position L2 to the position Ltr (the gripping position H of the yarn member L) at the second moving speed V2 (constant). At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [4].

$$(L2 - L1) / V1 + (Ltr - L2) / V2 = t \quad \ldots[4]$$

(Calculation Example 4)

[0047] As shown in FIG. 6(d), in a case where the traverse guide 32 is moving in a direction away from the position Ltr between the position L0 and the position L2 when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position L0 at the first moving speed VI, turns back at the position L0 (first turn-back position A), moves from the position L0 to the position L2 at the first moving speed VI, and then moves from the position L2 to the position Ltr (the gripping position H of the yarn member L) at the moving speed V2. At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [5].

$$(L1 - L0) / V1 + (L2 - L0) / V1 + (Ltr - L2) / V2 = t \quad \ldots[5]$$

(Calculation Example 5)

[0048] As shown in FIG. 7(a), in a case where the traverse guide 32 is moving in a direction away from the position Ltr between the position L0 and the position L2 when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 turns back in a direction approaching the position Ltr at the position L1 at the same time of the rotation of the turret unit 1, moves from the position L1 to the position L2 at the first moving speed VI, and then moves from the position L2 to the position Ltr (the gripping position H of the yarn member L) at the second moving speed V2 (constant). At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [6].

$$(L2 - L1) / V1 + (Ltr - L2) / V2 = t \quad \ldots[6]$$

(Calculation Example 6)

[0049] As shown in FIG. 7(b), in a case where the traverse guide 32 is moving in a direction approaching the position Ltr between the position L3 (shift position) and the position L2 when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position Ltr at the first moving speed V1, turns back at the position Ltr (second turn-back position B), then moves from the position Ltr to the position L0 at the first moving speed VI, turns back at the position L0 (first turn-back position A), then moves from the position L0 to the position L2 at the first moving speed VI, and moves from the position L2 to the position Ltr (the gripping position H of the yarn member L) at the second moving speed V2 (constant). At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [7].

$$(Ltr - L1) / V1 + (Ltr - L0) / V1 + (L2 - L0) / V1 + (Ltr - L2) / V2 = t \quad \ldots[7]$$

(Calculation Example 7)

[0050] As shown in FIG. 7(c), in a case where the traverse guide 32 is moving in a direction approaching the position Ltr between the position L3 and the position L2 when the yarn member L wound on the bobbin 21 attached to the spindle 2 on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, the control unit 4 calculates the moving path along which the traverse guide 32 moves from the position L1 to the position Ltr at the first moving speed VI, turns back at the position Ltr (the second turn-back position B), then moves from the position Ltr to the position L4 at the first moving speed VI, turns back at the position L4 (the third turn-back position C), moves from the position L4 to the position L2 at the first moving speed VI, and then moves from the position L2 to the position Ltr (the gripping position H of the yarn member L) at the second moving speed V2. At this time, the control unit 4 calculates the first moving speed V1 by the following Expression [8].

$$(Ltr - L1) / V1 + (Ltr - L4) / V1 + (L2 - L4) / V1 + (Ltr - L2) / V2 = t \quad ...[8]$$

[0051] As described above, the traverse guide 32 reaches the gripping position H of the yarn member L when switching between the spindle 2 on the winding side and the spindle 2 on the standby side has been completed. Therefore, it is possible to unify the time required for the traverse guide 32 to reach the gripping position H, thereby enabling the reduction or the prevention of variations in the quality, such as, e.g., the wound yarn amount and the winding yarn shape of the wound yarn body M on which the yarn member L is wound on the bobbin 21. Further, it is possible to avoid the case in which the traverse guide 32 reaches the gripping position H of the yarn member L after the completion of switching between the spindle 2 on the winding side and the spindle 2 on the standby side. Therefore, the winding of the yarn member L can be quickly started, which in turn can improve the productivity of the wound yarn body M.

[0052] Note that in this embodiment, the above-described calculation Examples 1 to 7 are exemplified, but the present invention is not limited to these moving paths and moving speeds. In short, any moving path and any moving speed can be used as long as the traverse guide 32 reaches the gripping position H of the yarn member L at the time of the completion of switching between the spindle 2 on the winding side and the spindle 2 on the standby side.

[0053] Further, although the second turn-back position B is set as the gripping position H of the yarn member L, it may be set at a position different from the second turn-back position B, such as, e.g., a position between the second turn-back position B and the machine frame 10.

[0054] Further, although the control unit 4 calculates the time for switching the spindle 2 on the winding side and the spindle 2 on the standby side based on the above-described Expression [1], the time may be calculated by another calculation expression. Alternatively, a switching time calculated in advance may be used as the time.

[0055] Although the spindle 2 on the winding side advances to the right side in accordance with the degree of winding of the yarn member L, the winding position $\theta 0$ at the time of the start of the winding may be maintained from the start of the winding to the completion of the winding.

[0056] Further, Expressions [2] to [8] described above are not limited to the above formats and may be other formats such as a format for directly calculating the first moving speed V1.

[0057] Further, the traverse of the traverse guide 32 of the traverse mechanism 3 has been described for winding the yarn member L on the bobbin 21 by fixing the turn-back position, but the yarn member L may be wound on the bobbin 21 while changing the turn-back position depending on the winding diameter of the wound yarn body M.

[0058] Further, although the control unit 4 calculates the moving speed and the moving path of the traverse guide 32 based on the the time for switching the spindle 2 on the winding side and the spindle 2 on the standby side, the control unit may calculate only the moving speed of the traverse guide 32 or only the moving path of the traverse guide 32.

[0059] An embodiment of the present invention has been described above with reference to the attached drawings, but the present invention is not limited to the illustrated embodiment. It should be understood that various modifications and variations can be made to the illustrated embodiment falling within the same or equivalent scope of the present invention.

Description of Symbols

[0060]

1: Turret unit
11: Roller

2: Spindle
21: Bobbin

22: Gripping mechanism

3: Traverse mechanism
31: Traverse body
32: Traverse guide

4: Control unit
10: Machine frame

Claims

1. A turret-type yarn winding apparatus comprising:

a turret unit rotatably mounted on a machine frame;
a plurality of spindles provided on the turret unit with an axial direction arranged in parallel to each other, the spindle being configured to wind a yarn member on a bobbin attached to the spindle by axial rotation;
a traverse guide configured to traverse the yarn member with respect to the bobbin attached to the spindle on a winding side while reciprocating between a first turn-back position on a tip end side of the spindle and a second turn-back position on a base end side of the spindle along an axial direction of the spindle;
a gripping mechanism provided to the spindle to grip the yarn member fed from the traverse guide at a predetermined gripping position; and
a control unit configured to control rotation of the turret unit, axial rotation of the spindle, a reciprocating motion of the traverse guide, and gripping of the yarn member by the gripping mechanism,
wherein when a yarn member is wound on the bobbin attached to the spindle on the winding side and the bobbin has reached a predetermined wound yarn amount and the bobbin has become full, the turret unit rotates to switch between the spindle on the winding side and the spindle on the standby side, the yarn member is gripped by the gripping mechanism of a newly provided spindle on the winding side, and then the yarn member is wound on an empty bobbin attached to the newly provided spindle on the winding side, and
wherein in order for the traverse guide to reach a gripping position of the yarn member when switching between the spindle on the winding side and the spindle on the standby side has been completed,
the control unit
calculates a moving speed and/or a moving path of the traverse guide, based on a time for switching between the spindle on the winding side and the spindle on the standby side when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full, and
moves the traverse guide at the moving speed and/or along the moving path.

2. The turret-type yarn winding apparatus as recited in claim 1,

wherein when the yarn member wound on the bobbin attached to the spindle on the winding side has reached the predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the time for switching between the spindle on the winding side and the spindle on the standby side, based on a winding position of the spindle on the winding side at a time of completion of winding, a standby position of the spindle on the standby side at a time of start of winding, and a rotational speed of the turret unit.

3. The turret-type yarn winding apparatus as recited in claim 1,
wherein the control unit moves the traverse guide at a constant speed for a predetermined distance immediately before the yarn member fed from the traverse guide is gripped by the gripping mechanism.

4. The turret-type yarn winding apparatus as recited in claim 1,

wherein in a case where the traverse guide is moving in a direction approaching the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide moves at a predetermined speed to the gripping position of the yarn member.

5. The turret-type yarn winding apparatus as recited in claim 1,

wherein in a case where the traverse guide is moving in a direction away from the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide moves at a predetermined speed to a first turn-back position, turns back at the first turn-back position, and then moves at a predetermined moving speed to the gripping position of the yarn member.

6. The turret-type yarn winding apparatus as recited in claim 1,

wherein in a case where the traverse guide is moving in a direction away from the gripping position of the yarn member when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide turns back in a direction approaching the gripping position of the yarn member at the same time of rotation of the turret unit and moves at a predetermined moving speed to the gripping position of the yarn member.

7. The turret-type yarn winding apparatus as recited in claim 1,

wherein in a case where the traverse guide is moving in a direction approaching the gripping position of the yarn member between a predetermined shift position and the second turn-back position when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide moves at a predetermined moving speed to the second turn-back position and turns back at the second turn-back position.

8. The turret-type yarn winding apparatus as recited in claim 1,

wherein when the yarn member wound on the bobbin attached to the spindle on the winding side has reached a predetermined wound yarn amount and the bobbin has become full,
the control unit calculates the moving path along which the traverse guide turns back at a third turn-back position between the first turn-back position and the second turn-back position and moves in a direction approaching the gripping position of the yarn member.

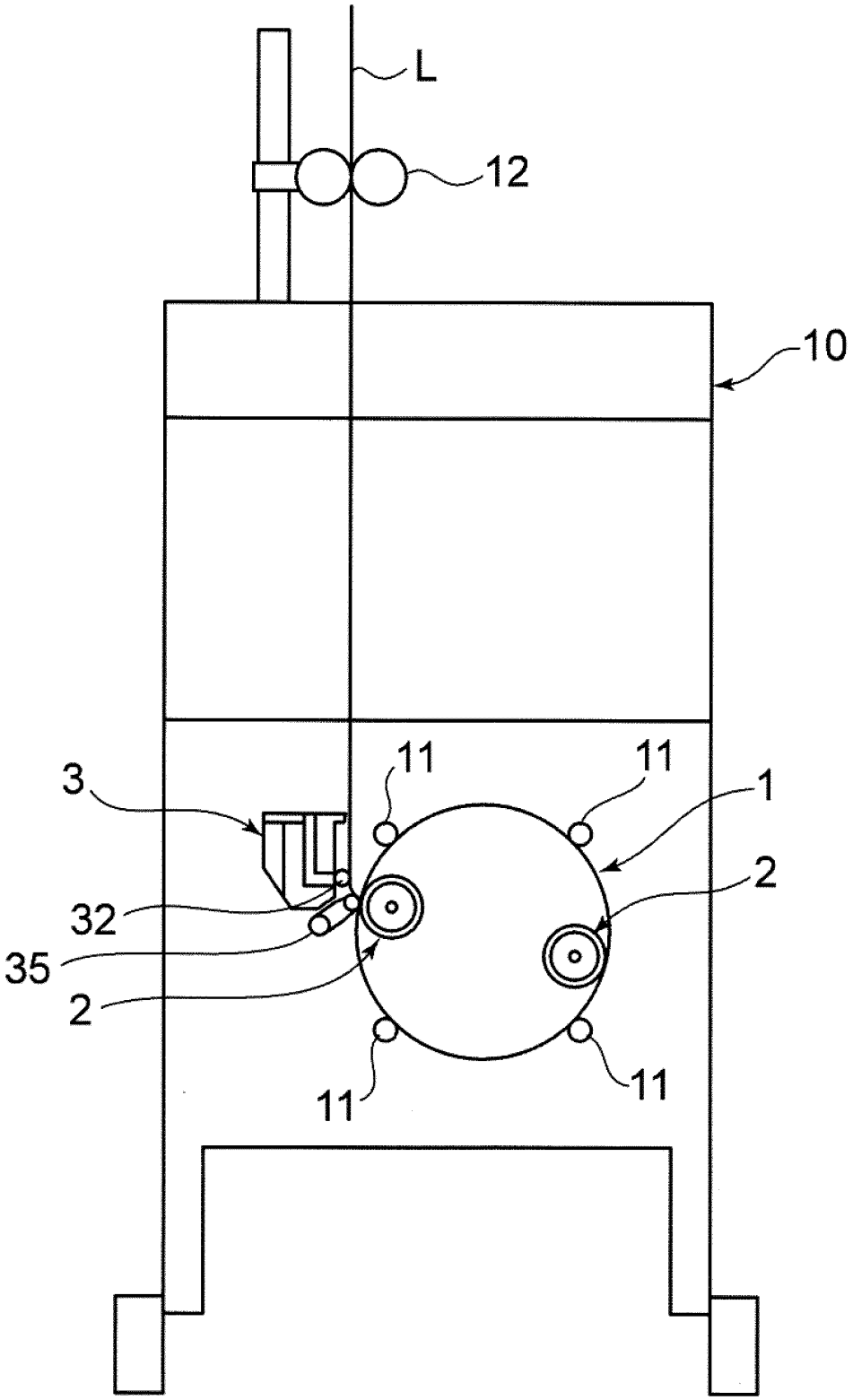


FIG. 1

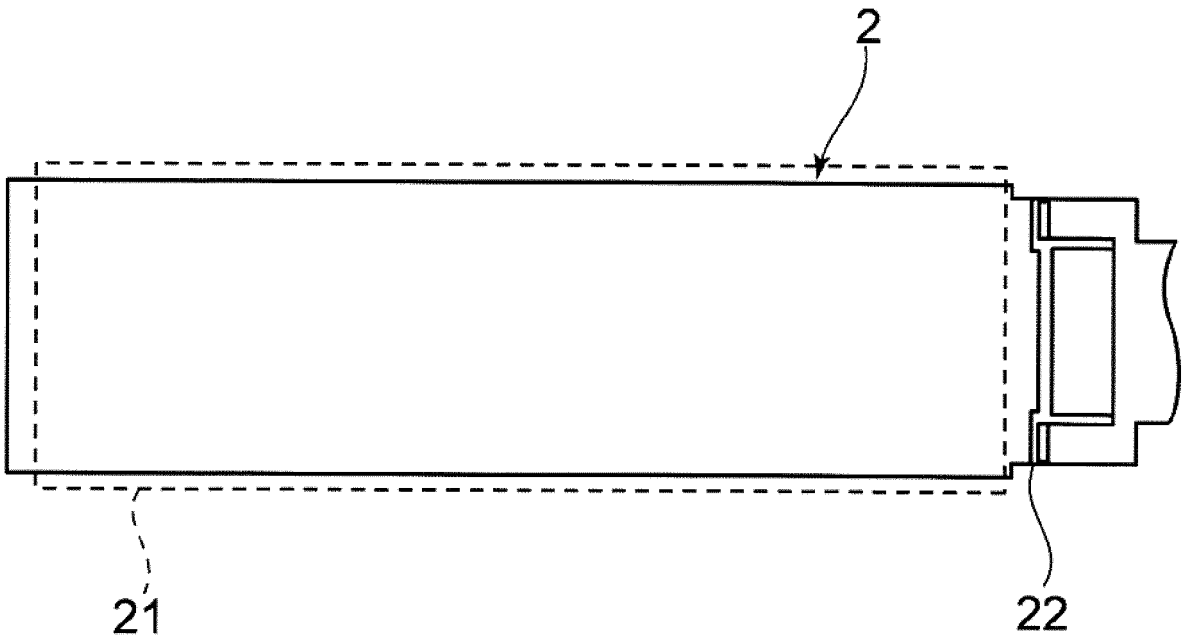


FIG. 2

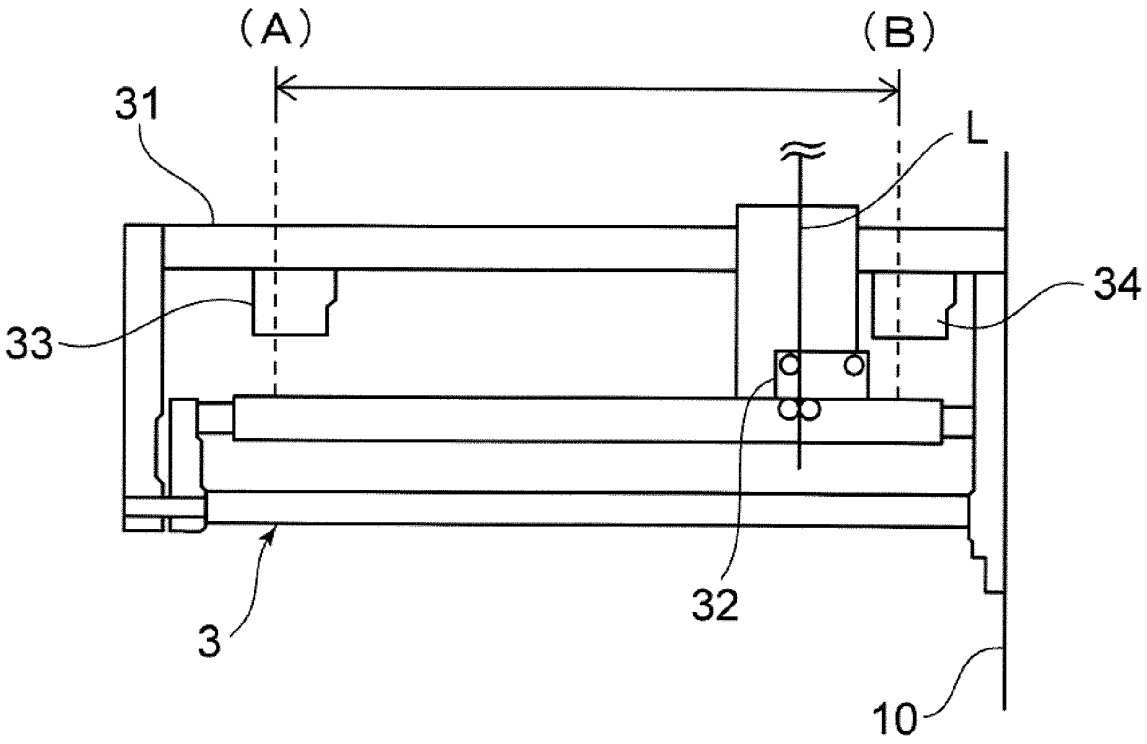

(A)
(B)
31
L
34
33
32
3
10

FIG. 3

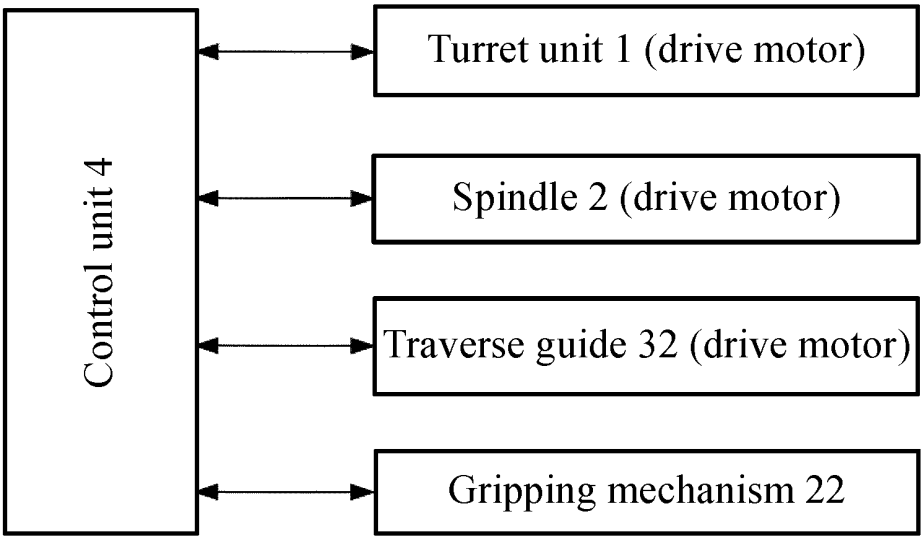
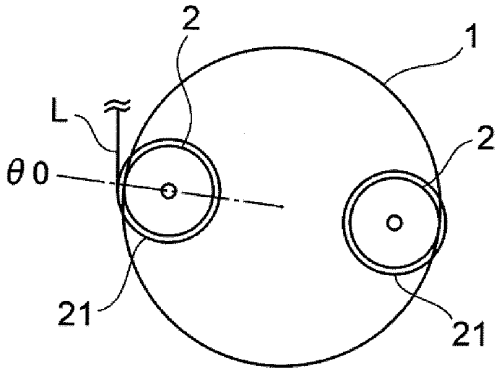
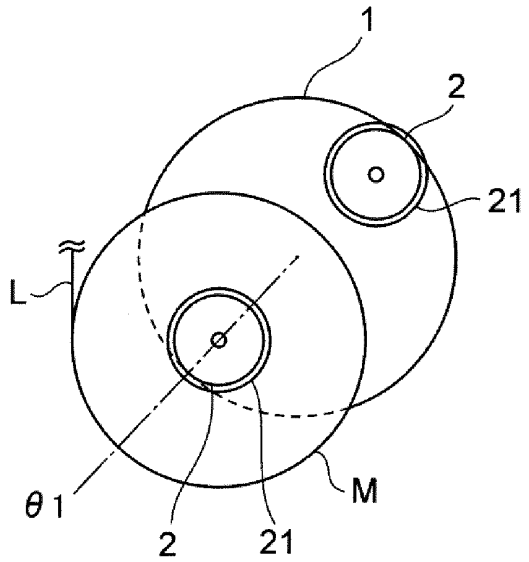

Control unit 4
Turret unit 1 (drive motor)
Spindle 2 (drive motor)
Traverse guide 32 (drive motor)
Gripping mechanism 22

FIG. 4

(a)



(b)



(c)

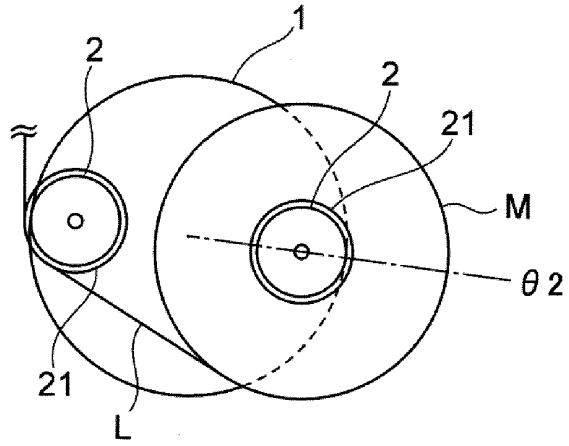
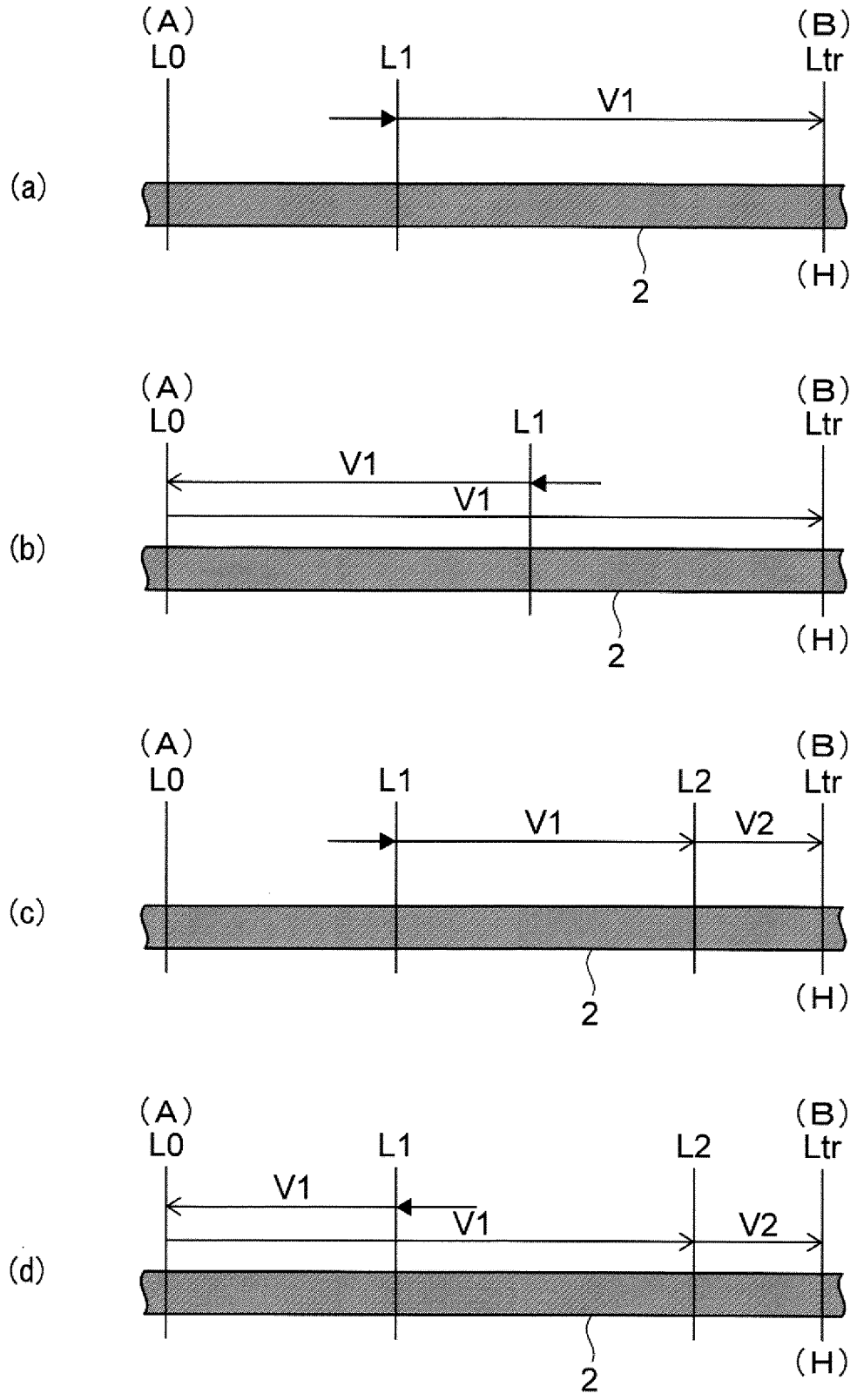


FIG. 5


(a)
(A)
L0
L1
(B)
Ltr
V1
2
(H)
(b)
(A)
L0
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V1
V1
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(H)
(c)
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V1
V2
2
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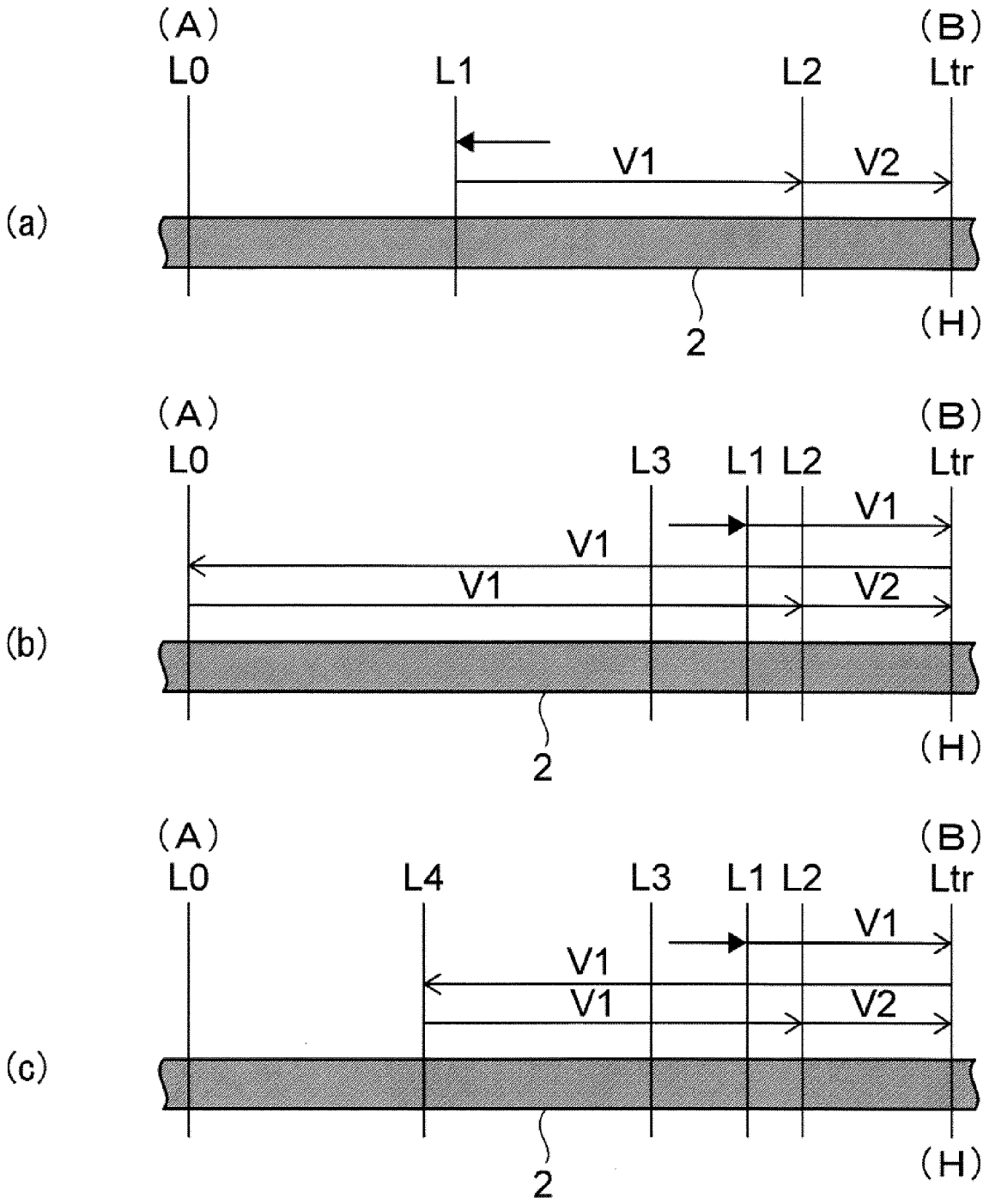
Ltr
V1
V1
V2
2
(H)

FIG. 6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(A)
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L2
(B)
Ltr
V1
V2
2
(H)
(b)
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L1
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(B)
Ltr
V1
V1
V1
V2
2
(H)
(c)
(A)
L0
L4
L3
L1
L2
(B)
Ltr
V1
V1
V1
V2
2
(H)

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/032334

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B65H54/30(2006.01)i, B65H67/048(2006.01)i
FI: B65H67/048A, B65H54/30

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. B65H54/30, B65H67/048

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2020
Registered utility model specifications of Japan 1996-2020
Published registered utility model applications of Japan 1994-2020

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2018-131301 A (TMT MACHINERY INC.) 23 August 2018 (2018-08-23)	1-8
A	JP 2018-83681 A (TORAY INDUSTRIES, INC.) 31 May 2018 (2018-05-31)	1-8
A	JP 2002-137869 A (KOUTSU SEISAKUSHO KK) 14 May 2002 (2002-05-14)	1-8

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 October 2020	02 November 2020
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/032334

JP 2018-131301 A	23 August 2018	EP 3363756 A1	
JP 2018-83681 A	31 May 2018	(Family: none)	
JP 2002-137869 A	14 May 2002	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002137869 A **[0004]**