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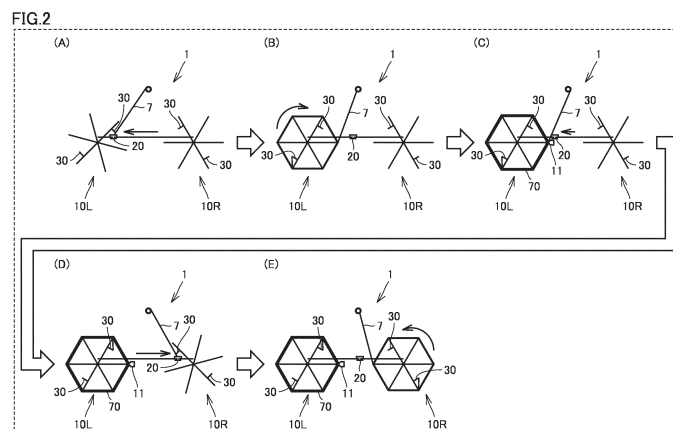
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(54) **TAKE-UP DEVICE AND TAKE-UP METHOD**

(57) A reeling device (1) includes: a left spool body (10L); a right spool body (10R); and a yarn transfer mechanism (20) capable of moving a yarn-shaped body (7) between the left spool body (10L) and the right spool body (10R). A first rotation axis (CL1) of the left spool body (10L) and a second rotation axis (CL2) of the right spool body (10R) are parallel to each other, and a position of the left spool body (10L) around which the yarn-shaped body (7) is to be wound and a position of the right spool

body (10R) around which the yarn-shaped body (7) is to be wound are arranged side by side on a first imaginary plane (VS1) orthogonal to the first rotation axis (CL1) and the second rotation axis (CL2). After a hollow yarn collection (70) is formed in the left spool body (10L), a yarn-shaped body leading portion (20d) of the yarn transfer mechanism (20) moves the yarn-shaped body (7) from the left spool body (10L) to the right spool body (10R) along the first imaginary plane (VS 1).



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a reeling device and a reeling method. More particularly, the present disclosure relates to device and method for continuously and automatically forming a yarn-shaped body sent continuously from a preceding step, into a collection of the yarn-shaped body. Here, the term "yarn-shaped body" refers to one or two or more solid yarns or one or two or more hollow yarns.

BACKGROUND ART

[0002] It has been conventionally known that a device for forming a collection of a yarn-shaped body employs a method of rotating a polygonal spool body to reel the yarn-shaped body and moving the yarn-shaped body to another spool body after the yarn-shaped body is reeled a predetermined number of times. PTL 1 discloses a device in which a plurality of spool bodies are supported to each have a rotation axis in parallel with a rotation member and the rotation member is rotated to replace a spool body located at a reeling position. Further, PTL 2 discloses a device in which two spool bodies are arranged side by side so as to be coaxial to a rotation axis, and a yarn-shaped body is moved in the rotation axis direction. In each of the devices, the rotation of the spool body having the yarn-shaped body reeled a predetermined number of times is stopped, and then the collection of the yarn-shaped body is cut off from the spool body, thus resulting in a state in which reeling can be started again. By repeating this, a continuous process can be performed.

CITATION LIST

PATENT LITERATURE

[0003]

PTL 1: Japanese Patent No. 6371079

PTL 2: Japanese Patent No. 4343633

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] From a viewpoint of production efficiency, it is important to attain a small ratio of wasted yarn. When removing the collection of the yarn-shaped body from the polygonal spool, a certain length of the collection of the yarn-shaped body needs to be discarded in the vicinity of a vertex of the polygon. This ratio can be made smaller as the spool body is made larger; however, in the case of the reeling device disclosed in PTL 1, structurally, when the spool body is made large, the reeling device becomes extremely large, which is not economical.

[0005] In the reeling device disclosed in PTL 2, the two spool bodies need to be disposed face to face each other. On this occasion, a sufficient space cannot be secured in front of each spool body, thus resulting in problems in terms of arrangement of a device in a subsequent step, operability, and maintainability. When a configuration is employed as means for solving this problem to temporarily convey, to a wide space, the spool body having the yarn-shaped body reeled the predetermined number of times, a device mechanism becomes complicated.

[0006] It is an object of the present disclosure to provide a reeling device and a reeling method so as to continuously and automatically form a yarn-shaped body sent from a preceding step into a collection of the yarn-shaped body while attaining such features that a ratio of wasted yarn is small, a device mechanism is simple, a device for a subsequent step is readily arranged, and operability and maintainability are excellent.

SOLUTION TO PROBLEM

[0007] According to an aspect of a reeling device of the present disclosure, a reeling device that reels a yarn-shaped body includes: a first spool body rotatable about a first rotation axis; a second spool body rotatable about a second rotation axis; and a yarn transfer portion capable of moving the yarn-shaped body between the first spool body and the second spool body, wherein the first rotation axis of the first spool body and the second rotation axis of the second spool body are parallel to each other, and a position of the first spool body around which the yarn-shaped body is to be wound and a position of the second spool body around which the yarn-shaped body is to be wound are arranged side by side on an imaginary plane orthogonal to the first rotation axis and the second rotation axis, and after a collection of the yarn-shaped body reeled a predetermined number of times is formed in the first spool body, a yarn-shaped body leading portion of the yarn transfer portion moves a yarn from the first spool body to the second spool body along the imaginary plane.

[0008] Each of the first spool body and the second spool body has a polygonal shape.

[0009] Each vertex of the first spool body and the second spool body is provided with a vertex grasping mechanism that grasps the collection of the yarn-shaped body having been reeled.

[0010] An internal grasping mechanism that grasps the yarn-shaped body sent from the yarn transfer portion is provided in each of the first spool body and the second spool body.

[0011] The reeling device reels the yarn-shaped body by rotating the first spool body and the second spool body in opposite rotation directions when viewed in a direction in which each of the first rotation axis and the second rotation axis extends.

[0012] Each of the first spool body and the second spool body is capable of simultaneously switching the

reeling of the yarn-shaped body in two or more rows.

[0013] According to an aspect of a reeling method of the present disclosure, a method of reeling a yarn-shaped body includes: a first step of reeling the yarn-shaped body in the first spool body; a second step of moving the yarn-shaped body to the second spool body by the yarn transfer portion; and a third step of reeling the yarn-shaped body in the second spool body.

ADVANTAGEOUS EFFECTS OF INVENTION

[0014] According to the present disclosure, there can be provided a reeling device and a reeling method so as to continuously and automatically form a yarn-shaped body sent from a preceding step into a collection of the yarn-shaped body while attaining such features that a ratio of wasted yarn is small, a device mechanism is not complicated, a device for a subsequent step is readily arranged, and operability and maintainability are excellent.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

Fig. 1 is a schematic diagram for illustrating a configuration of a reeling unit according to a first embodiment.

Fig. 2 is a schematic diagram for illustrating an operation of the reeling device according to the first embodiment.

Fig. 3 is a front view of the reeling device according to the first embodiment.

Fig. 4 is a schematic diagram for illustrating an operation of the reeling device according to the first embodiment when viewed in plan.

Fig. 5 is a diagram for illustrating a vertex clamping mechanism in a non-fixed state in the first embodiment.

Fig. 6 is a diagram for illustrating the vertex clamping mechanism in a fixed state in the first embodiment.

Fig. 7 is a plan view of a yarn transfer mechanism according to the first embodiment.

Fig. 8 is a side view of the yarn transfer mechanism according to the first embodiment.

Fig. 9 is a diagram for illustrating an internal clamping mechanism in a fixed state in the first embodiment.

Fig. 10 is a diagram for illustrating the internal clamping mechanism in a non-fixed state in the first embodiment.

DESCRIPTION OF EMBODIMENTS

[0016] A reeling device and a reeling method according to embodiments of the present disclosure will be described below with reference to figures. In the embodiments described below, when reference is made to a number, an amount, or the like, the scope of the present

disclosure is not necessarily limited to the number, the amount, or the like unless otherwise stated particularly. The same components and corresponding components are denoted by the same reference characters, and the same explanation may not be described repeatedly. It has been initially expected to appropriately combine configurations in the embodiments.

[0017] In the description below, the left hand side when reeling unit 100 is viewed from the front side is described as "left" and the right hand side when reeling unit 100 is viewed from the front side is described as "right"; however, this is intended to facilitate understanding of the contents of the present disclosure and is not construed as limiting to the "left" and "right".

[First Embodiment]

[0018] Fig. 1 is a schematic diagram for illustrating a configuration of a reeling unit 100 according to a first embodiment. Reeling unit 100 is constituted of a reeling device 1, a looseness absorption device 2, a tension control device 3, a film winding device 4, a yarn collection cutting device 5, and a yarn collection processing device 6. An operation of each device is controlled by a PLC (Programmable Logic Controller) (not shown). In Fig. 1, for ease of understanding, part of the facility is omitted.

[0019] Looseness absorption device 2 is a device that absorbs looseness of a yarn-shaped body sent from a yarn production device (not shown). In the first embodiment, it will be illustratively described that the yarn-shaped body sent from the yarn production device is a bundle of a plurality of hollow yarns (for example, ten and several hollow yarns); however, the yarn-shaped body sent from the yarn production device may be one hollow yarn. The yarn-shaped body sent from the yarn production device may be one or two or more solid yarns. Thus, the yarn-shaped body is a reference amount of yarns sent from the yarn production device. Tension control device 3 is a device that controls an amount of feeding of the yarn-shaped body to reel the yarn-shaped body with a constant tension in reeling device 1.

[0020] Reeling device 1 is a device that reels, using two spool bodies each having a polygonal shape, the yarn-shaped body having passed through tension control device 3. Film winding device 4 is a device that winds a film around a hollow yarn collection, which is a collection of the yarn-shaped body reeled by reeling device 1. Yarn collection cutting device 5 is a device that cuts, using a rounded cutting edge, the hollow yarn collection around which the film has been wound.

[0021] Yarn collection processing device 6 is an device that performs processes such as: a process of supplying a film to film winding device 4; a process of moving film winding device 4 to a position of a spool body; and a process of fixing (attaching a tape to) overlapping portions of the film wound around the hollow yarn collection.

[0022] Reeling device 1 according to the first embodiment will be described with reference to Figs. 2 to 4. Fig.

2 is a schematic diagram for illustrating an operation of reeling device 1 according to the first embodiment, Fig. 3 is a front view of reeling device 1 according to the first embodiment, and Fig. 4 is a schematic diagram for illustrating the operation of reeling device 1 according to the first embodiment when viewed in plan.

[0023] Reeling device 1 includes: a left spool body 10L serving as a first spool body and provided on the left side when viewed in the front view; and a right spool body 10R serving as a second spool body and provided on the right side when viewed in the front view. Between left spool body 10L and right spool body 10R, a yarn transfer mechanism 20 is disposed to serve as a yarn transfer portion capable of moving yarn-shaped body 7 in the leftward/rightward direction. Each of left spool body 10L and right spool body 10R is operated by a servo motor provided with a speed reducer (not shown). In each of left spool body 10L and right spool body 10R, internal clamping mechanisms 30 each serving as an internal grasping mechanism are provided to grasp yarn-shaped body 7 having been moved by yarn transfer mechanism 20. Two internal clamping mechanisms 30 are disposed in each of left spool body 10L and right spool body 10R at positions facing each other. One internal clamping mechanism 30 may be disposed in each of left spool body 10L and right spool body 10R; however, consideration needs to be taken to achieve a weight balance of the spool body. Further, the number of the internal grasping mechanisms (internal clamping mechanisms 30) disposed therein may be the same number as the number of (the vertices of) the polygon.

[0024] Reeling device 1 is operated in the order of Fig. 2 (A) to Fig. 2 (E). As shown in Fig. 2 (A), at the time of starting the reeling, reeling device 1 moves yarn transfer mechanism 20 grasping yarn-shaped body 7 from a center position to left spool body 10L. Yarn-shaped body 7 having been moved to left spool body 10L by yarn transfer mechanism 20 is grasped by internal clamping mechanism 30 of left spool body 10L. After yarn-shaped body 7 is grasped by internal clamping mechanism 30 of left spool body 10L, yarn transfer mechanism 20 releases yarn-shaped body 7 having been grasped by yarn transfer mechanism 20, and is moved to the center position.

[0025] As shown in Fig. 2 (B), reeling device 1 reels yarn-shaped body 7 around the vertexes of left spool body 10L by rotating left spool body 10L rightward (clockwise). Reeling device 1 stops the rotation after reeling yarn-shaped body 7 a predetermined number of times in left spool body 10L so as to form a hollow yarn collection 70 that is a collection of the yarn-shaped body reeled the predetermined number of times. Hollow yarn collection 70 is, for example, a collection of a hollow yarn reeled about 10,000 times and used as a product. Reeling device 1 then grasps hollow yarn collection 70 at the vertexes of left spool body 10L using vertex clamping mechanisms 11 each serving as a vertex grasping mechanism. Details of vertex clamping mechanisms 11 will be described later. Fig. 2 (C) shows only a vertex clamping

mechanism 11 at a position at which yarn transfer mechanism 20 grasps among vertex clamping mechanisms 11 located at the positions of the vertexes.

[0026] As shown in Fig. 2 (C), reeling device 1 moves yarn transfer mechanism 20 from the center position to left spool body 10L. Yarn transfer mechanism 20 grasps yarn-shaped body 7 and cuts yarn-shaped body 7 at a position below the grasping position. As shown in Fig. 2 (D), reeling device 1 moves yarn transfer mechanism 20 grasping yarn-shaped body 7, from left spool body 10L to right spool body 10R.

[0027] Yarn-shaped body 7 having been moved to right spool body 10R by yarn transfer mechanism 20 is grasped by internal clamping mechanism 30 of right spool body 10R. After yarn-shaped body 7 is grasped by internal clamping mechanism 30 of right spool body 10R, yarn transfer mechanism 20 releases yarn-shaped body 7 having been grasped by yarn transfer mechanism 20, and is moved to the center position.

[0028] As shown in Fig. 2 (E), reeling device 1 reels yarn-shaped body 7 around the vertexes of right spool body 10R by rotating right spool body 10R leftward (counterclockwise). Reeling device 1 stops the rotation after reeling yarn-shaped body 7 a predetermined number of times in right spool body 10R so as to form a hollow yarn collection 70. Reeling device 1 forms hollow yarn collections 70 in left spool body 10L and right spool body 10R by the series of operations shown in Figs. 2 (A) to 2 (E).

[0029] As shown in Fig. 3, in reeling device 1, left spool body 10L and right spool body 10R are disposed adjacent to each other on the front side with respect to a wall surface 50 when viewed in a front view. Vertex clamping mechanisms 11 are provided at the respective vertexes of each of the regular hexagonal shape of left spool body 10L and the regular hexagonal shape of right spool body 10R. Internal clamping mechanisms 30 are disposed at positions facing each other in each of left spool body 10L and right spool body 10R.

[0030] In each of left spool body 10L and right spool body 10R, six arm portions 10Y are connected to a main body portion 10X. Notches 10Z are formed in main body portion 10X at positions corresponding to the positions of arm portions 10Y having internal clamping mechanisms 30 disposed thereon. Each of notches 10Z prevents blocking of movement of yarn transfer mechanism 20 when yarn transfer mechanism 20 is translated between left spool body 10L and right spool body 10R to transfer yarn-shaped body 7 to internal clamping mechanism 30. Yarn-shaped body 7 to be reeled by reeling device 1 is adjusted by tension control device 3 so as to be reeled with a constant tension.

[0031] As shown in Fig. 4, in reeling device 1, left spool body 10L is rotated about a first rotation axis CL1, and right spool body 10R is rotated about a second rotation axis CL2. First rotation axis CL1 of left spool body 10L and second rotation axis CL2 of right spool body 10R are parallel to each other. A first groove portion 11b, which is a position of left spool body 10L around which yarn-

shaped body 7 is to be wound, and a first groove portion 11b, which is a position of right spool body 10R around which yarn-shaped body 7 is to be wound, are arranged side by side along a first imaginary plane VS1 orthogonal to first rotation axis CL1 and second rotation axis CL2. A second groove portion 11e, which is a position of left spool body 10L around which yarn-shaped body 7 is to be wound, and a second groove portion 11e, which is a position of right spool body 10R around which yarn-shaped body 7 is to be wound, are arranged side by side along a second imaginary plane VS2 orthogonal to first rotation axis CL1 and second rotation axis CL2. First imaginary plane VS1 and second imaginary plane VS2 are located in a direction perpendicular to a plane of sheet. As shown in Fig. 4, left spool body 10L and right spool body 10R are arranged in rows orthogonal to first imaginary plane VS1 and second imaginary plane VS2.

[0032] Yarn transfer mechanism 20 includes a first yarn transfer portion 20F located on the front side and a second yarn transfer portion 20R located on the rear side. First yarn transfer portion 20F includes a first right leading portion 20d and a first left leading portion 20f. Second yarn transfer portion 20R includes a second right leading portion 20h and a second left leading portion 20j. First yarn transfer portion 20F is moved leftward/rightward along first imaginary plane VS1. Second yarn transfer portion 20R is moved leftward/rightward along second imaginary plane VS2. For example, after hollow yarn collection 70 is formed in left spool body 10L along first imaginary plane VS1, first right leading portion 20d of first yarn transfer portion 20F moves yarn-shaped body 7 from left spool body 10L to right spool body 10R. Vertex clamping mechanism 11 includes a first vertex clamping portion 11F located on the front side and a second vertex clamping portion 11R located on the rear side.

[0033] After hollow yarn collection 70 is formed in left spool body 10L, reeling device 1 grasps hollow yarn collection 70 at first vertex clamping portion 11F and second vertex clamping portion 11R located on the rear side. After hollow yarn collection 70 is formed in left spool body 10L and hollow yarn collection 70 is grasped by vertex clamping mechanism 11, yarn transfer mechanism 20 grasps yarn-shaped body 7 sent from the tension control device 3 side and cuts yarn-shaped body 7. First yarn transfer portion 20F of yarn transfer mechanism 20 is moved leftward/rightward along first imaginary plane VS1. Second yarn transfer portion 20R of yarn transfer mechanism 20 is moved leftward/rightward along second imaginary plane VS2.

[0034] As shown in Figs. 2 to 4, each of left spool body 10L and right spool body 10R can simultaneously reel yarn-shaped body 7 in two rows. As shown in Figs. 2 to 4, yarn transfer mechanism 20 can simultaneously move yarn-shaped body 7 in two rows. In this way, reeling device 1 can simultaneously switch the reeling of yarn-shaped body 7. It should be noted that reeling device 1 may be configured to simultaneously switch the reeling of yarn-shaped body 7 in three or more rows.

(Vertex Clamping Mechanism 11)

[0035] Each of vertex clamping mechanisms 11 of the first embodiment will be described with reference to Figs. 5 and 6. Fig. 5 is a diagram for illustrating vertex clamping mechanism 11 in a non-fixed state in the first embodiment, and Fig. 6 is a diagram for illustrating vertex clamping mechanism 11 in a fixed state in the first embodiment.

[0036] Referring to Fig. 5, vertex clamping mechanism 11 includes: a vertex clamping main body portion 11a connected to each of arm portion 10Y of left spool body 10L and arm portion 10Y of right spool body 10R; a first vertex clamping portion 11F located on the front side; and a second vertex clamping portion 11R located on the rear side. First vertex clamping portion 11F includes: first groove portion 11b; a front vertex clamping member 11c rotatable about a first supporting portion 11d; and a front auxiliary member 11t rotatable about first supporting portion 11d. Second vertex clamping portion 11R includes: second groove portion 11e; a rear vertex clamping member 11f rotatable about a second supporting portion 11g; and a rear auxiliary member 11u rotatable about second supporting portion 11g.

[0037] In vertex clamping mechanism 11, two tension springs (not shown) are disposed at a lower portion on the rear surface side. A tension spring located on the front side is connected at a position below front auxiliary member 11t, and is disposed to be rotatable about a third supporting portion 11p. A tension spring located on the rear side is connected at a position below rear auxiliary member 11u, and is disposed to be rotatable about a fourth supporting portion 11s.

[0038] Vertex clamping mechanism 11 includes: a first locking member 11q rotatable about third supporting portion 11p; a second locking member 11r rotatable about fourth supporting portion 11s; and a vertex stem portion 11o that connects between first locking member 11q and second locking member 11r.

[0039] Vertex clamping mechanism 11 includes: a clamping cylinder 11h disposed inside wall surface 50; and a release cylinder 11i disposed inside wall surface 50. Clamping cylinder 11h includes a first pushing member 11j that can protrude frontward. Release cylinder 11i includes a second pushing member 11k that can protrude frontward. Second locking member 11r includes: a first receiving member 11m to be brought into abutment with first pushing member 11j having protruded frontward; and a second receiving member 11n to be brought into abutment with second pushing member 11k having protruding frontward.

[0040] Referring to Figs. 5 and 6, the following describes: an operation of vertex clamping mechanism 11 grasping hollow yarn collection 70; and an operation of vertex clamping mechanism 11 releasing hollow yarn collection 70 having been grasped by vertex clamping mechanism 11. Vertex clamping mechanism 11 operates clamping cylinder 11h in the non-fixed state shown in Fig. 5 so as to protrude first pushing member 11j frontward.

First pushing member 11j is brought into abutment with first receiving member 11m by the frontward movement. As shown in Fig. 6, first receiving member 11m connected to second locking member 11r is moved frontward with respect to fourth supporting portion 11s.

[0041] First pushing member 11j pushes first receiving member 11m and then returns to the initial position. As shown in Fig. 6, second receiving member 11n connected to second locking member 11r is moved rearward by a distance corresponding to a distance in which first receiving member 11m has been moved frontward. As second receiving member 11n is moved rearward, vertex stem portion 11o connected to second locking member 11r is moved rearward with respect to fourth supporting portion 11s. As vertex stem portion 11o is moved, first locking member 11q connected to vertex stem portion 11o is moved rearward with respect to third supporting portion 11p.

[0042] In vertex clamping mechanism 11, by the series of operations of first locking member 11q and second locking member 11r, the tension spring located on the front side and the tension spring located on the rear side are moved upward while being rotated. Front auxiliary member 11t is moved upward with respect to first supporting portion 11d by the tension of the tension spring located on the front side. As front auxiliary member 11t is moved, front vertex clamping member 11c is moved from the non-fixed position shown in Fig. 5 to the fixed position shown in Fig. 6 with respect to first supporting portion 11d.

[0043] Rear auxiliary member 11u is moved upward with respect to second supporting portion 11g by the tension of the tension spring on the rear side. As rear auxiliary member 11u is moved, rear vertex clamping member 11f is moved from the non-fixed position shown in Fig. 5 to the fixed position shown in Fig. 6 with respect to second supporting portion 11g. Since each of front vertex clamping member 11c and rear vertex clamping member 11f is moved from the non-fixed position to the fixed position, vertex clamping mechanism 11 can grasp hollow yarn collection 70 at two positions in the frontward/rearward direction.

[0044] Vertex clamping mechanism 11 performs the operation of releasing hollow yarn collection 70 having been grasped by vertex clamping mechanism 11, in the following order. Vertex clamping mechanism 11 operates release cylinder 11i in the fixed state shown in Fig. 6 to protrude second pushing member 11k frontward. Second pushing member 11k is brought into abutment with second receiving member 11n by the frontward movement. As shown in Fig. 5, second receiving member 11n connected to second locking member 11r is moved frontward with respect to fourth supporting portion 11s.

[0045] Second pushing member 11k pushes second receiving member 11n and then returns to the initial position. As shown in Fig. 5, first receiving member 11m connected to second locking member 11r is moved rearward by a distance corresponding to a distance in which

second receiving member 11n has been moved frontward. As second receiving member 11n is moved frontward, vertex stem portion 11o connected to second locking member 11r is moved frontward with respect to fourth supporting portion 11s. As vertex stem portion 11o is moved, first locking member 11q connected to vertex stem portion 11o is moved frontward with respect to third supporting portion 11p.

[0046] In vertex clamping mechanism 11, by the series of operations of first locking member 11q and second locking member 11r, the tension spring located on the front side and the tension spring located on the rear side are moved downward while being rotated. Front auxiliary member 11t is moved downward with respect to first supporting portion 11d by the tension of the tension spring located on the front side. As front auxiliary member 11t is moved, front vertex clamping member 11c is moved from the fixed position shown in Fig. 6 to the non-fixed position shown in Fig. 5 with respect to first supporting portion 11d.

[0047] Rear auxiliary member 11u is moved downward with respect to second supporting portion 11g by the tension of the tension spring located on the rear side. As rear auxiliary member 11u is moved, rear vertex clamping member 11f is moved from the fixed position shown in Fig. 6 to the non-fixed position shown in Fig. 5 with respect to second supporting portion 11g. In vertex clamping mechanism 11, front vertex clamping member 11c and rear vertex clamping member 11f are moved from the fixed position to the non-fixed position, thereby releasing hollow yarn collection 70 at the two positions in the frontward/rearward direction.

(Yarn Transfer Mechanism 20)

[0048] Referring to Figs. 7 and 8, yarn transfer mechanism 20 according to the first embodiment will be described. Fig. 7 is a plan view of yarn transfer mechanism 20 according to the first embodiment. Fig. 8 is a side view of yarn transfer mechanism 20 according to the first embodiment.

[0049] Yarn transfer mechanism 20 includes: a main body portion 20a extending from wall surface 50 toward the front side; first yarn transfer portion 20F located on the front side; and second yarn transfer portion 20R located on the rear side. First yarn transfer portion 20F includes a first right guiding portion 20c, first right leading portion 20d, a first left guiding portion 20e, and first left leading portion 20f. Second yarn transfer portion 20R includes a second right guiding portion 20g, second right leading portion 20h, a second left guiding portion 20i, and second left leading portion 20j. Yarn transfer mechanism 20 is operated by a robot cylinder disposed in wall surface 50.

[0050] When yarn transfer mechanism 20 is moved rightward, yarn-shaped body 7 located on frontward on the right side is moved along first right guiding portion 20c and is led to first right leading portion 20d. When

yarn transfer mechanism 20 is moved leftward, yarn-shaped body 7 located frontward on the left side is moved along first left guiding portion 20e and is led to first left leading portion 20f. When yarn transfer mechanism 20 is moved rightward, yarn-shaped body 7 located rearward on the right side is moved along second right guiding portion 20g and is led to second right leading portion 20h. When yarn transfer mechanism 20 is moved leftward, yarn-shaped body 7 located rearward on the left side is moved along second left guiding portion 20i and is led to second left leading portion 20j.

[0051] Yarn transfer mechanism 20 includes a cylinder portion 20k, and a yarn transfer stem portion 20q connected to cylinder portion 20k. First yarn transfer portion 20F includes a first fixed clamping portion 20m, a first movable clamping portion 20n, and a first yarn cutting edge 20p. Second yarn transfer portion 20R includes a second fixed clamping portion 20r, a second movable clamping portion 20s, and a second yarn cutting edge 20t. Yarn transfer stem portion 20q is operated integrally with first movable clamping portion 20n, first yarn cutting edge 20p, second movable clamping portion 20s, and second yarn cutting edge 20t.

[0052] Yarn transfer mechanism 20 performs the operation of grasping and moving yarn-shaped body 7 in the following order. After hollow yarn collection 70 is formed in left spool body 10L, yarn transfer mechanism 20 is moved from the center position to a vertex position of left spool body 10L in the horizontal direction. Before moving yarn transfer mechanism 20, the rotation of left spool body 10L is stopped at an appropriate position detected by a sensor that detects an angle of the rotation axis of left spool body 10L disposed inside wall surface 50.

[0053] Between first fixed clamping portion 20m and first movable clamping portion 20n and between second fixed clamping portion 20r and second movable clamping portion 20s, yarn transfer mechanism 20 grasps yarn-shaped body 7 sent from tension control device 3 and having reached the vertex position of left spool body 10L. Yarn transfer mechanism 20 can grasp yarn-shaped body 7 by an operation in which first movable clamping portion 20n and second movable clamping portion 20s are moved rearward as yarn transfer stem portion 20q is moved rearward by controlling cylinder portion 20k. Yarn-shaped body 7 grasped is cut by first yarn cutting edge 20p and second yarn cutting edge 20t at a position below the grasping position.

[0054] Yarn transfer mechanism 20 is horizontally moved while grasping yarn-shaped body 7, and transfers yarn-shaped body 7 to internal clamping mechanism 30 of right spool body 10R. Before moving yarn transfer mechanism 20, the rotation of right spool body 10R is stopped at an appropriate position detected by a sensor that detects an angle of the rotation axis of right spool body 10R disposed inside wall surface 50. The appropriate position is a position at which internal clamping mechanism 30 of right spool body 10R can grasp yarn-shaped

body 7 conveyed from yarn transfer mechanism 20.

(Internal Clamping Mechanism 30)

[0055] Internal clamping mechanism 30 according to the first embodiment will be described with reference to Figs. 9 and 10. Fig. 9 is a diagram for illustrating internal clamping mechanism 30 in the fixed state according to the first embodiment.

[0056] Internal clamping mechanism 30 includes: a pair of coupling portions 30f fixed to arm portions 10Y of left spool body 10L and right spool body 10R; a main body portion 30a connected to the pair of coupling portions 30f; a first internal clamping portion 30F located on the front side; a second internal clamping portion 30R located on the rear side; and an internal stem portion 30g.

[0057] First internal clamping portion 30F includes a first fixed clamping portion 30c, a first movable clamping portion 30b, and a first spring portion 30m. Second internal clamping portion 30R includes a second fixed clamping portion 30e, a second movable clamping portion 30d, and a second spring portion 30n. Internal stem portion 30g is operated integrally with first movable clamping portion 30b and second movable clamping portion 30d. Internal clamping mechanism 30 includes a cylinder 30h disposed inside wall surface 50. Cylinder 30h includes a pushing member 30i that can protrude frontward.

[0058] Internal clamping mechanism 30 performs an operation of grasping yarn-shaped body 7 in the following order. Internal clamping mechanism 30 operates cylinder 30h in the fixed state shown in Fig. 9 to protrude pushing member 30i frontward. Pushing member 30i is brought into abutment with an end portion of internal stem portion 30g by the frontward movement.

[0059] In first internal clamping portion 30F, internal stem portion 30g is moved frontward against a restoring force of first spring portion 30m, thereby forming a clearance between first fixed clamping portion 30c and first movable clamping portion 30b as shown in Fig. 10. In second internal clamping portion 30R, internal stem portion 30g is moved frontward against a restoring force of second spring portion 30n, thereby forming a clearance between second fixed clamping portion 30e and second movable clamping portion 30d as shown in Fig. 10.

[0060] Yarn transfer mechanism 20 moves yarn-shaped body 7 to the clearance formed in each of first internal clamping portion 30F and second movable clamping portion 30d. Internal clamping mechanism 30 operates cylinder 30h to return pushing member 30i rearward. Internal clamping mechanism 30 is changed from the non-fixed state shown in Fig. 10 to the fixed state shown in Fig. 9 by the restoring forces of first spring portion 30m and second spring portion 30n. Since internal clamping mechanism 30 is brought into the fixed state, internal clamping mechanism 30 grasps yarn-shaped body 7 at each of first internal clamping portion 30F and second internal clamping portion 30R.

[As to Reeling Method]

[0061] Referring to Fig. 2 again, a method of reeling yarn-shaped body 7 will be described. The reeling method includes: a first step of reeling yarn-shaped body 7 in left spool body 10L; a second step of moving yarn-shaped body 7 to right spool body 10R by yarn transfer mechanism 20; and a third step of reeling yarn-shaped body 7 in right spool body 10R.

[0062] The first step includes a step of moving, at the time of starting the reeling, yarn transfer mechanism 20 grasping yarn-shaped body 7 from the center position to left spool body 10L, and grasping the moved yarn-shaped body 7 by internal clamping mechanism 30 of left spool body 10L. The first step includes a step of releasing, after yarn-shaped body 7 is grasped by internal clamping mechanism 30 of left spool body 10L, yarn-shaped body 7 having been grasped by yarn transfer mechanism 20, and moving yarn transfer mechanism 20 to the center position. The first step includes a step of reeling yarn-shaped body 7 around the vertexes of left spool body 10L a predetermined number of times by rotating left spool body 10L rightward (clockwise), so as to form hollow yarn collection 70 and then stopping the rotation.

[0063] The second step includes a step of moving yarn transfer mechanism 20 from the center position to left spool body 10L, grasping yarn-shaped body 7, and cutting yarn-shaped body 7 at a position below the grasping position. The second step includes a step of grasping yarn-shaped body 7 by yarn transfer mechanism 20 and moving yarn transfer mechanism 20 from left spool body 10L to right spool body 10R.

[0064] The third step includes a step of grasping, by internal clamping mechanism 30 of right spool body 10R, yarn-shaped body 7 having been moved to right spool body 10R by yarn transfer mechanism 20. The third step includes a step of releasing, after yarn-shaped body 7 is grasped by internal clamping mechanism 30 of right spool body 10R, yarn-shaped body 7 having been grasped by yarn transfer mechanism 20, and moving yarn transfer mechanism 20 to the center position. The third step includes a step of reeling yarn-shaped body 7 around the vertexes of right spool body 10R a predetermined number of times by rotating right spool body 10R leftward (counterclockwise), so as to form hollow yarn collection 70, and then stopping the rotation.

[Functions and Effects]

[0065] Reeling device 1 according to the present embodiment includes: left spool body 10L rotatable about first rotation axis CL1; right spool body 10R rotatable about second rotation axis CL2; and yarn transfer mechanism 20 capable of moving yarn-shaped body 7 between left spool body 10L and right spool body 10R. First rotation axis CL1 of left spool body 10L and second rotation axis CL2 of right spool body 10R are parallel to each other. First groove portion 11b, which is a position

of left spool body 10L around which yarn-shaped body 7 is to be wound, and first groove portion 11b, which is a position of right spool body 10R around which yarn-shaped body 7 is to be wound are arranged side by side along first imaginary plane VS1 orthogonal to first rotation axis CL1 and second rotation axis CL2. Second groove portion 11e, which is a position of left spool body 10L around which yarn-shaped body 7 is to be wound, and second groove portion 11e, which is a position of right spool body 10R around which yarn-shaped body 7 is to be wound, are arranged side by side along second imaginary plane VS2 orthogonal to first rotation axis CL1 and second rotation axis CL2. First yarn transfer portion 20F is moved leftward/rightward along first imaginary plane VS1. Second yarn transfer portion 20R is moved leftward/rightward along second imaginary plane VS2. For example, after hollow yarn collection 70 is formed in left spool body 10L by reeling a predetermined number of times, first right leading portion 20d of first yarn transfer portion 20F moves yarn-shaped body 7 from left spool body 10L to right spool body 10R along first imaginary plane VS1.

[0066] Reeling device 1 is configured such that left spool body 10L and right spool body 10R are arranged in rows orthogonal to first imaginary plane VS1 and second imaginary plane VS2, and yarn transfer mechanism 20 is moved between left spool body 10L and right spool body 10R. Thus, since reeling device 1 does not have a rotation member that supports a spool body, the spool body is designed to be large readily, with the result that a ratio of wasted yarn can be reduced. Further, since a sufficient space can be secured in front of the spool body in reeling device 1, a device for a subsequent step is readily disposed (without employing a configuration for temporarily conveying, to a wide space, a spool body having yarn-shaped body 7 reeled a predetermined number of times), and operability and maintainability are excellent. Further, reeling device 1 can continuously and automatically form, into hollow yarn collection 70, yarn-shaped body 7 sent from the preceding step.

[0067] Each of left spool body 10L and right spool body 10R has a hexagonal shape. With such a polygonal shape in reeling device 1, internal clamping mechanism 30 can be disposed on an internal side with respect to the reeling position as compared with a two-point reeling method or a circular reeling method, thereby reducing such a risk that a starting portion of yarn-shaped body 7 is introduced into a product. Further, when the speed of yarn-shaped body 7 is fast, the number of the vertexes of the polygon is preferably large in the reeling device; however, when the number of the vertexes of the polygon is too large, there is a risk of occurrence of the following problem or the like: yarn-shaped body 7 is brought into contact with the spool body when taking the position shown in Fig. 2 (D), with the result that the yarn is cut. In view of such a problem, reeling device 1 employs the hexagonal shape as an appropriate shape in which yarn-shaped body 7 is not brought into contact with the spool

body and the number of sides is as large as possible.

[0068] At each vertex of left spool body 10L and right spool body 10R, vertex clamping mechanism 11 is provided to grasp hollow yarn collection 70 having been reeled. Therefore, reeling device 1 can appropriately grasp hollow yarn collection 70 at each vertex.

[0069] Internal clamping mechanism 30 that grasps yarn-shaped body 7 sent from yarn transfer mechanism 20 is provided in each of left spool body 10L and right spool body 10R. Therefore, reeling device 1 can appropriately grasp yarn-shaped body 7 in each of left spool body 10L and right spool body 10R.

[0070] Reeling device 1 reels yarn-shaped body 7 by rotating left spool body 10L and right spool body 10R in opposite directions when viewed in the direction in which each of first rotation axis CL1 and second rotation axis CL2 extends. Therefore, reeling device 1 can transfer yarn-shaped body 7 from left spool body 10L to right spool body 10R in a short moving distance. Further, since reeling device 1 can reel yarn-shaped body 7 in an internal direction, yarn-shaped body 7 can be reeled suitably without damaging yarn-shaped body 7.

[0071] Reeling device 1 is capable of simultaneously switching the reeling of yarn-shaped body 7 in two or more rows. In reeling device 1, left spool body 10L and right spool body 10 are arranged in rows orthogonal to first imaginary plane VS1 and second imaginary plane VS2. Therefore, in reeling device 1, since no jump stitch is not generated at the time of the simultaneous switching of yarn-shaped body 7 in the plurality of rows, wasted yarns are not increased, with the result that an interval between the spool bodies can be appropriately designed. Accordingly, reeling device 1 can increase production efficiency when forming hollow yarn collection 70.

[0072] The reeling method includes: the first step of reeling yarn-shaped body 7 in left spool body 10L; the second step of moving yarn-shaped body 7 to right spool body 10R by yarn transfer mechanism 20; and the third step of reeling yarn-shaped body 7 in right spool body 10R. By such a reeling method, a ratio of wasted yarn can be reduced, a device mechanism can be simplified, a device for a subsequent step can be disposed readily, and operability and maintainability can be improved. Further, by such a reeling method, yarn-shaped body 7 sent from the preceding step can be continuously and automatically formed into hollow yarn collection 70.

[Other Embodiments]

[0073] For each of left spool body 10L and right spool body 10R, a spool body having a polygonal shape other than the spool body having the hexagonal shape may be used. For each of left spool body 10L and right spool body 10R, a two-point spool body that reels at two points may be used. For each of left spool body 10L and right spool body 10R, a spool body having a circular shape may be used.

[0074] It has been illustratively described that each of

left spool body 10L and right spool body 10R is capable of simultaneously reeling yarn-shaped body 7 in two rows. Each of left spool body 10L and right spool body 10R may be configured to reel yarn-shaped body 7 in one row. Each of left spool body 10L and right spool body 10R may be configured to simultaneously reel yarn-shaped body 7 in three or more rows.

[0075] Yarn-shaped body 7 may be reeled in the following order: yarn-shaped body 7 is reeled in right spool body 10R, yarn-shaped body 7 is then moved to left spool body 10L by yarn transfer mechanism 20, and yarn-shaped body 7 is reeled in left spool body 10L.

[0076] The embodiments disclosed herein are illustrative and non-restrictive in any respect. The scope of the present disclosure is defined by the terms of the claims, rather than the embodiments described above, and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

REFERENCE SIGNS LIST

[0077] 1: reeling device; 2: looseness absorption device; 3: tension control device; 4: film winding device; 5: yarn collection cutting device; 6: yarn collection processing device; 7: yarn-shaped body; 10L: left spool body; 10R: right spool body; 10X: main body portion; 10Y: arm portion; 10Z: notch; 11: vertex clamping mechanism; 11F: first vertex clamping portion; 11R: second vertex clamping portion; 20: yarn transfer mechanism; 20F: first yarn transfer portion; 20R: second yarn transfer portion; 30: internal clamping mechanism; 30F: first internal clamping portion; 30R: second internal clamping portion; 50: wall surface; 70: hollow yarn collection; 100: reeling unit; CL1: first rotation axis; CL2: second rotation axis; VS1: first imaginary plane; VS2: second imaginary plane.

Claims

1. A reeling device that reels a yarn-shaped body, the reeling device comprising:
 - a first spool body rotatable about a first rotation axis;
 - a second spool body rotatable about a second rotation axis; and
 - a yarn transfer portion capable of moving the yarn-shaped body between the first spool body and the second spool body, wherein the first rotation axis of the first spool body and the second rotation axis of the second spool body are parallel to each other, and a position of the first spool body around which the yarn-shaped body is to be wound and a position of the second spool body around which the yarn-shaped body is to be wound are arranged side by side on an imaginary plane orthogonal to the first rotation axis and the second rotation axis,

and

after a collection of the yarn-shaped body reeled
a predetermined number of times is formed in
the first spool body, a yarn-shaped body leading
portion of the yarn transfer portion moves a yarn 5
from the first spool body to the second spool
body along the imaginary plane.

2. The reeling device according to claim 1, wherein
each of the first spool body and the second spool 10
body has a polygonal shape.
3. The reeling device according to claim 2, wherein
each vertex of the first spool body and the second
spool body is provided with a vertex grasping mech- 15
anism that grasps the collection of the yarn-shaped
body having been reeled.
4. The reeling device according to any one of claims 1
to 3, wherein an internal grasping mechanism that 20
grasps the yarn-shaped body sent from the yarn
transfer portion is provided in each of the first spool
body and the second spool body.
5. The reeling device according to any one of claims 1 25
to 4, wherein the reeling device reels the yarn-
shaped body by rotating the first spool body and the
second spool body in opposite rotation directions
when viewed in a direction in which each of the first
rotation axis and the second rotation axis extends. 30
6. The reeling device according to any one of claims 1
to 5, wherein the reeling device is capable of simul-
taneously switching the reeling of the yarn-shaped
body in two or more rows. 35
7. A method of reeling a yarn-shaped body using the
reeling device according to any one of claims 1 to 6,
the method comprising: 40
 - a first step of reeling the yarn-shaped body in
the first spool body;
 - a second step of moving the yarn-shaped body
to the second spool body by the yarn transfer
portion; and 45
 - a third step of reeling the yarn-shaped body in
the second spool body.

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FIG.1

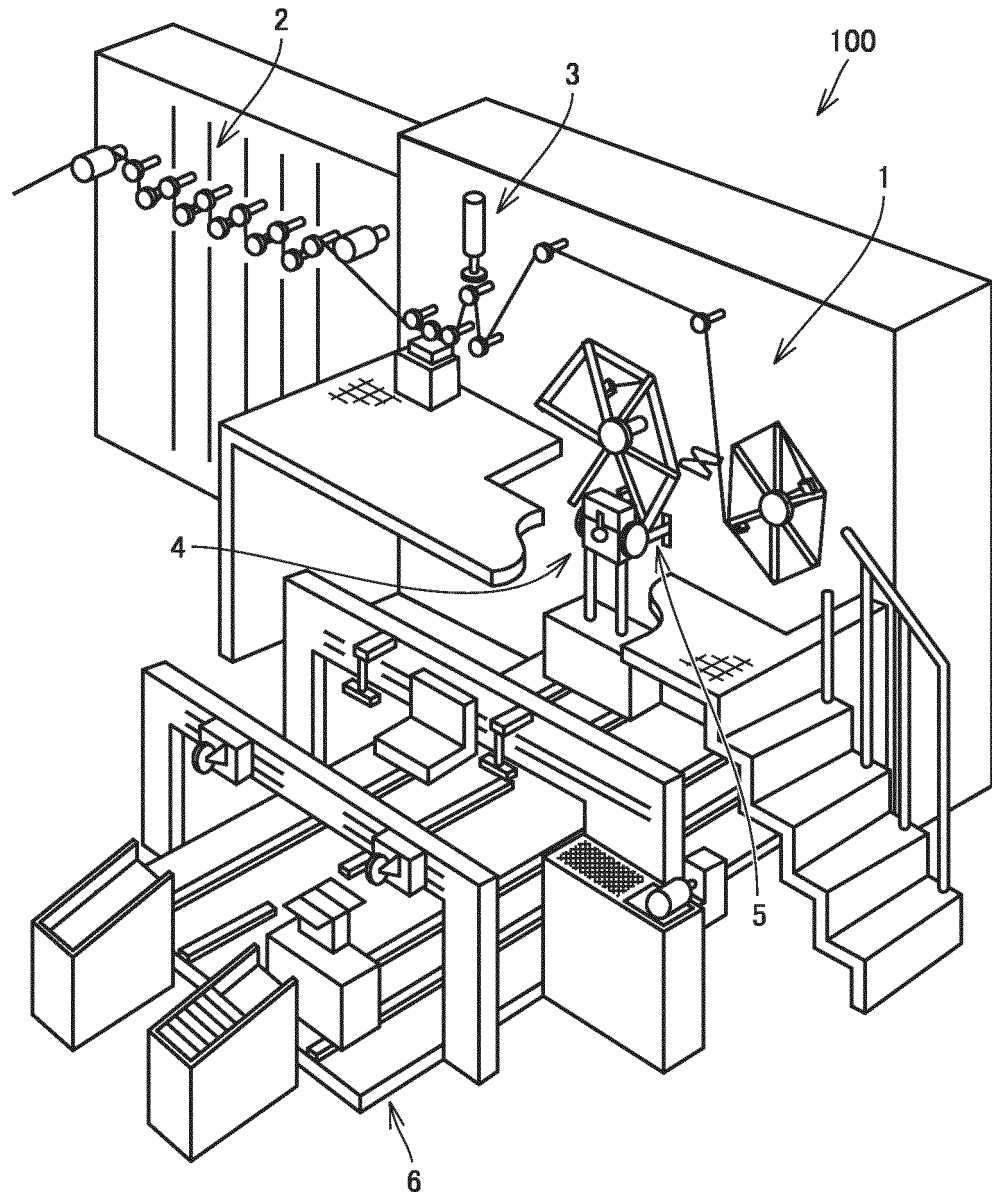


FIG.2

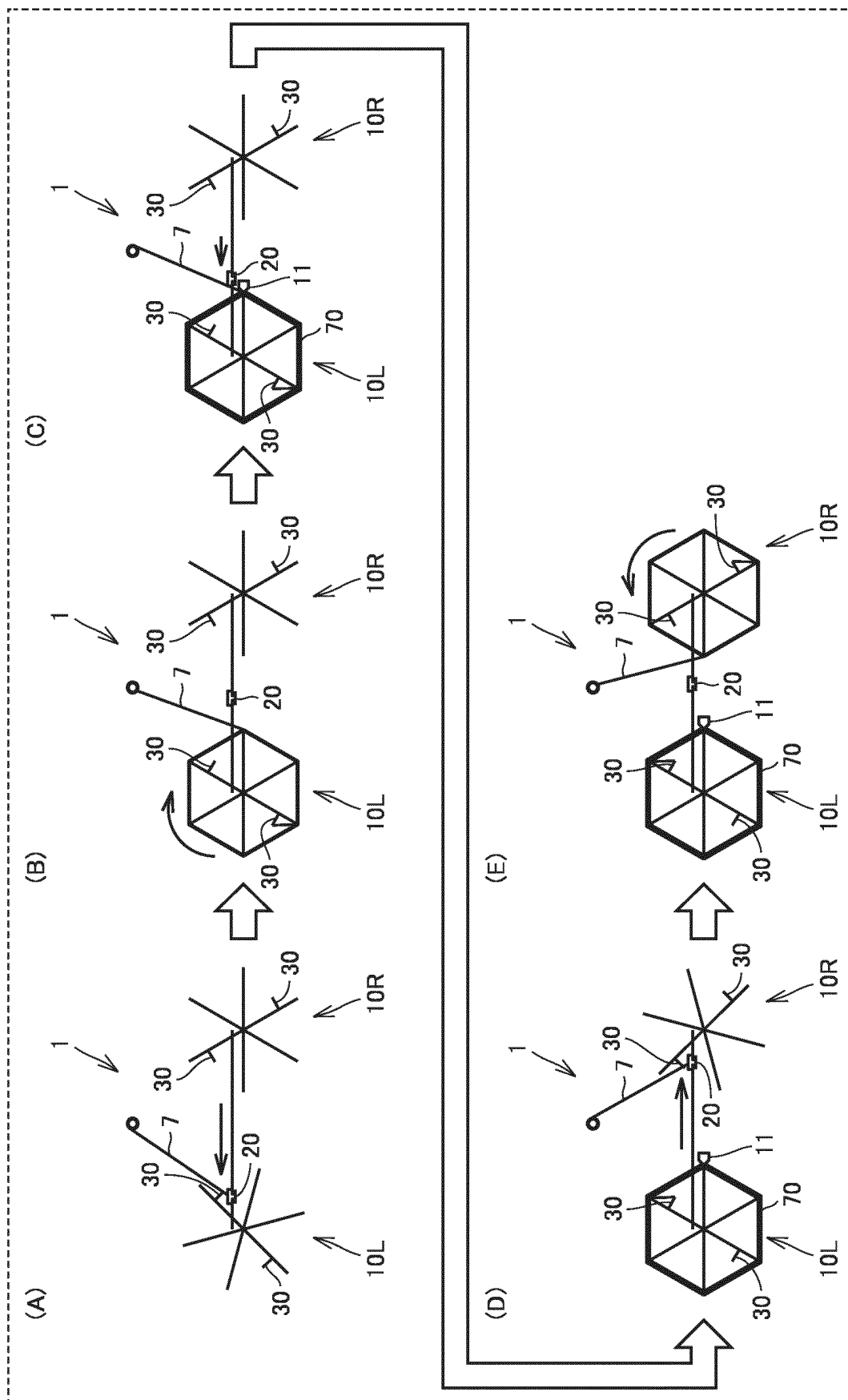


FIG.3

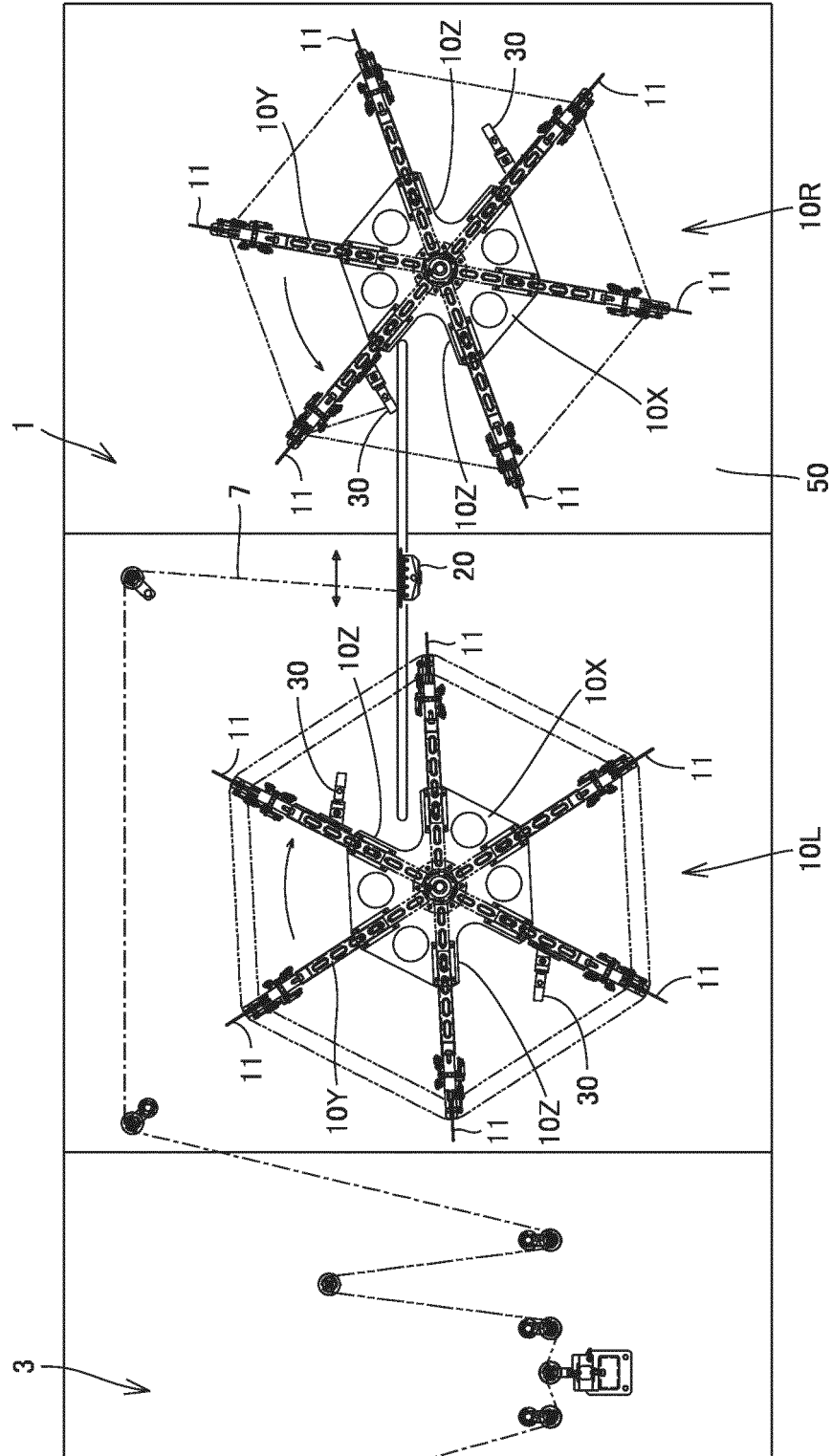


FIG.4

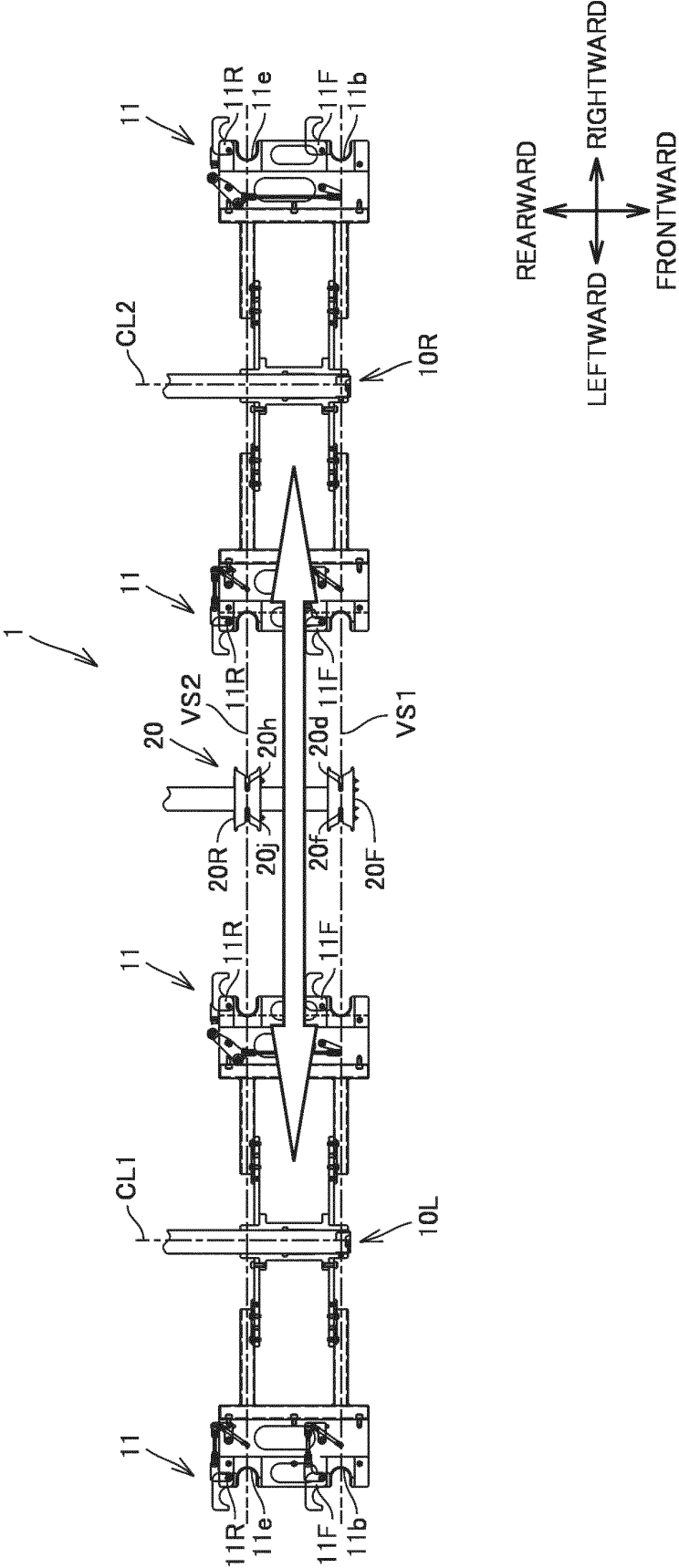


FIG.5

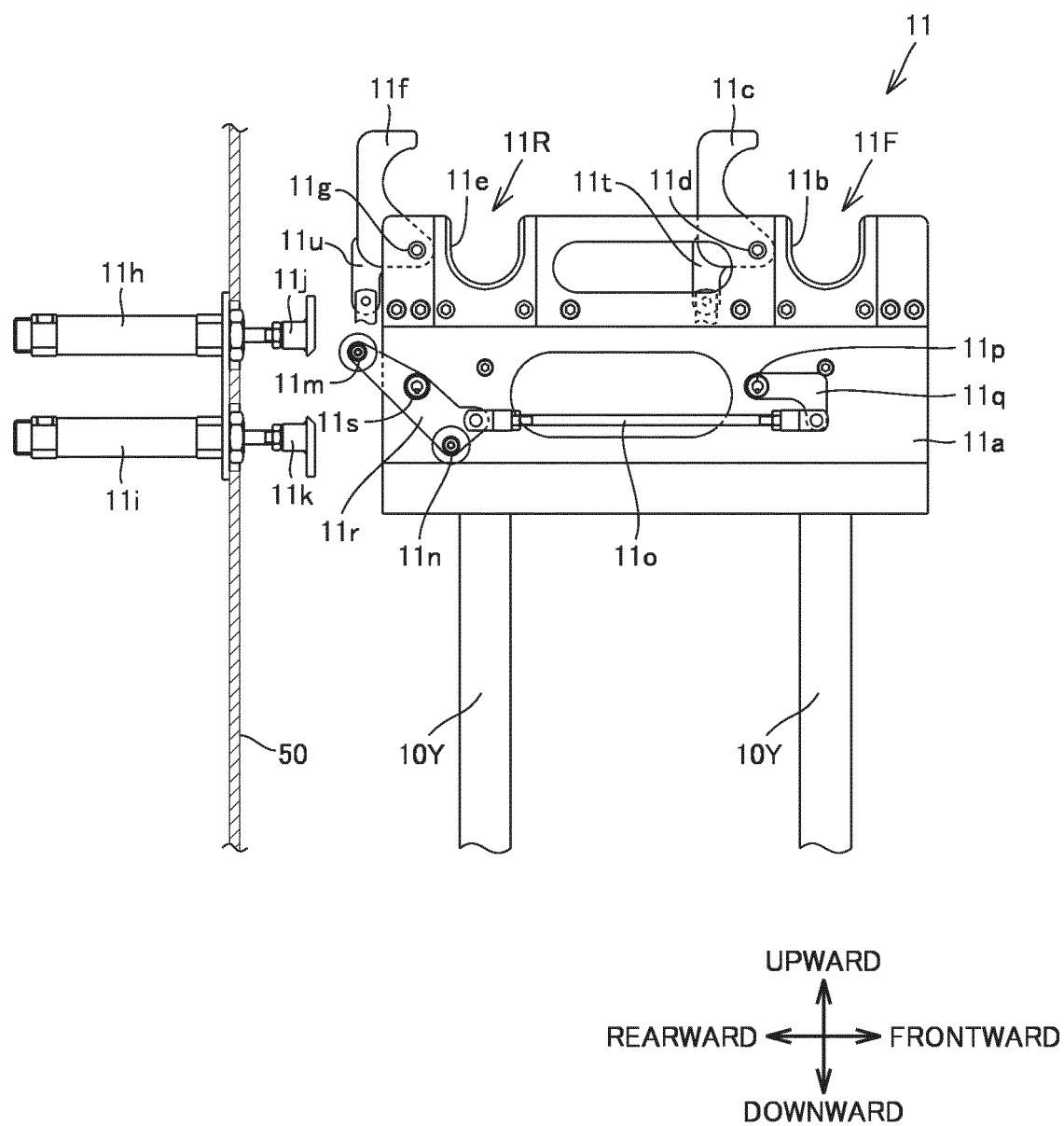


FIG.6

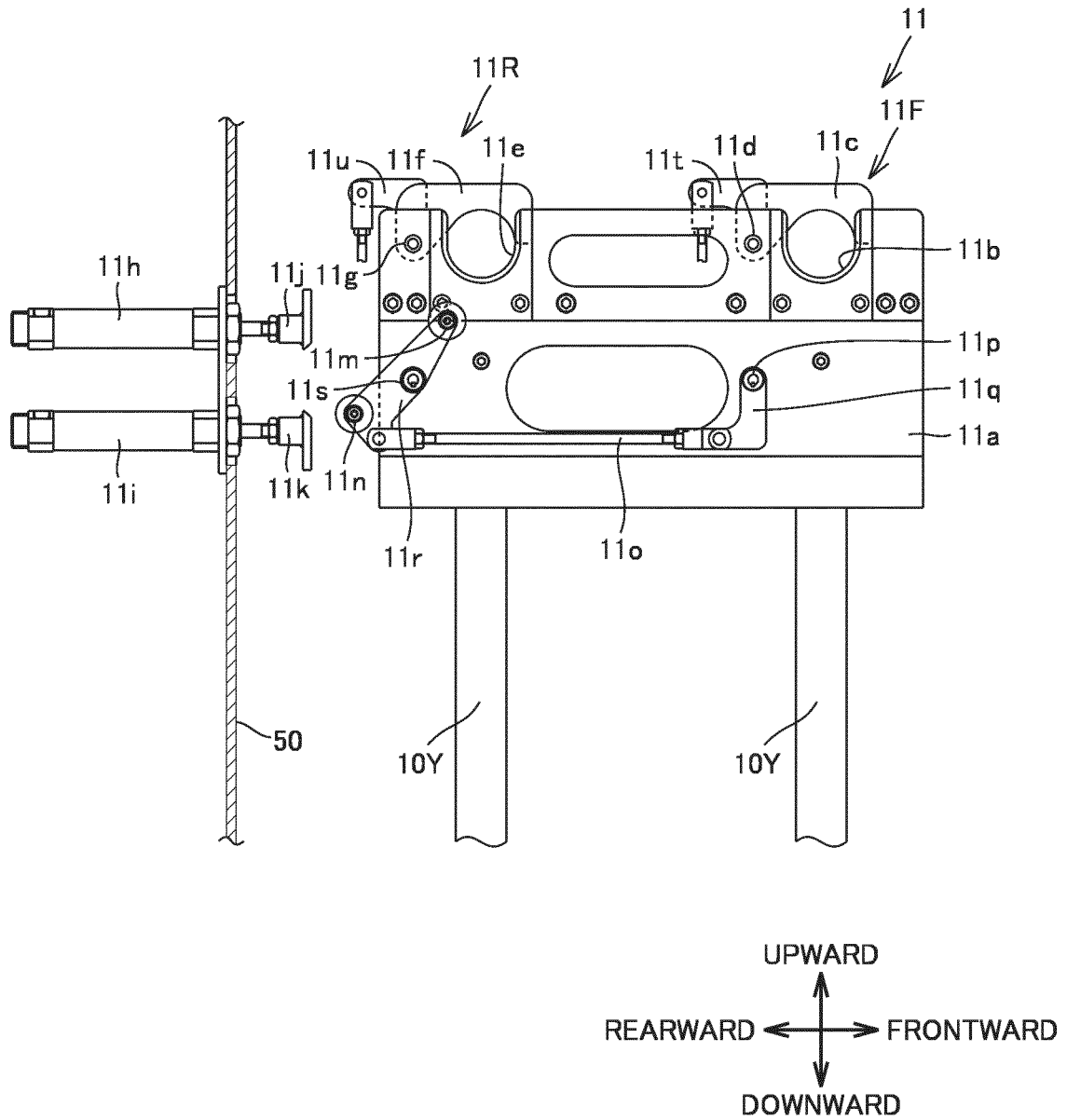


FIG.7

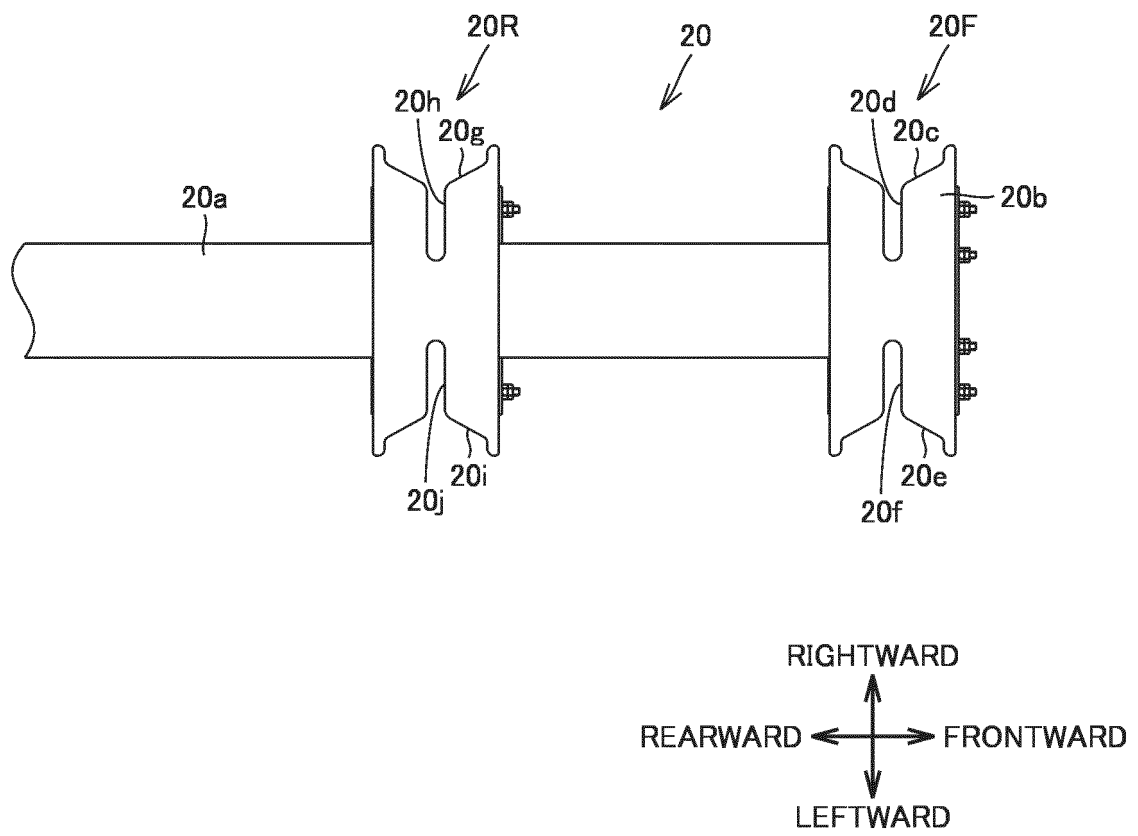


FIG.8

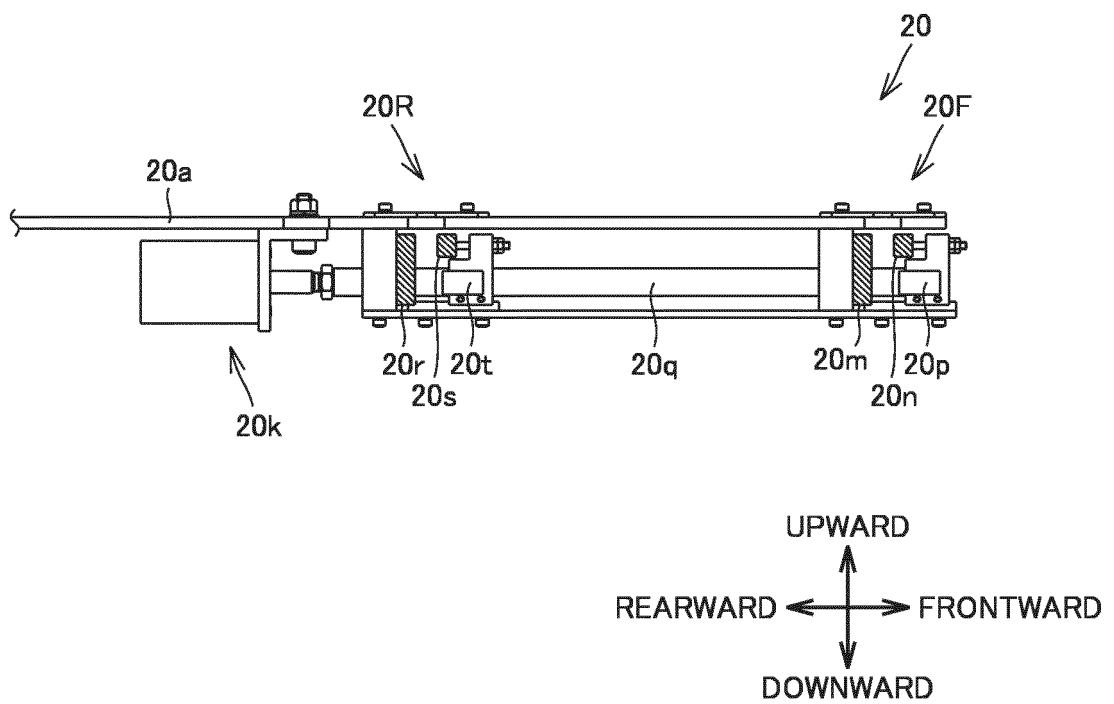


FIG.9

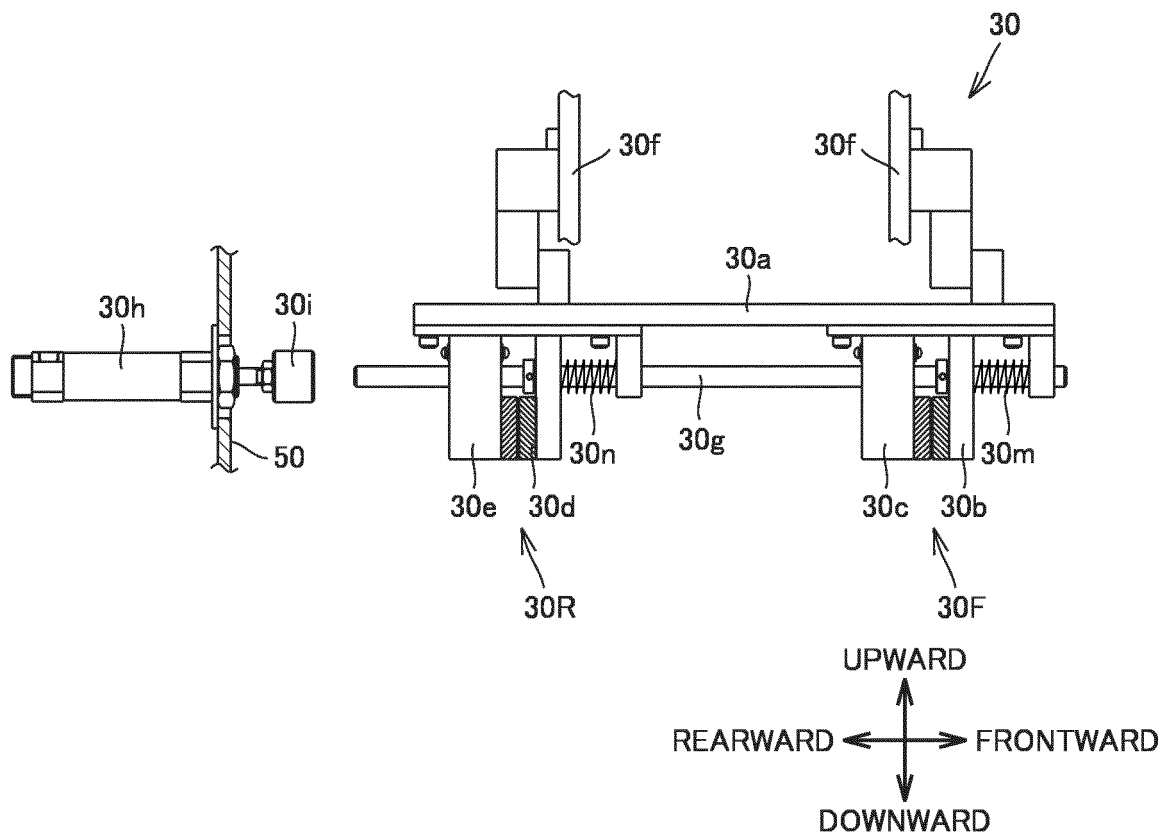
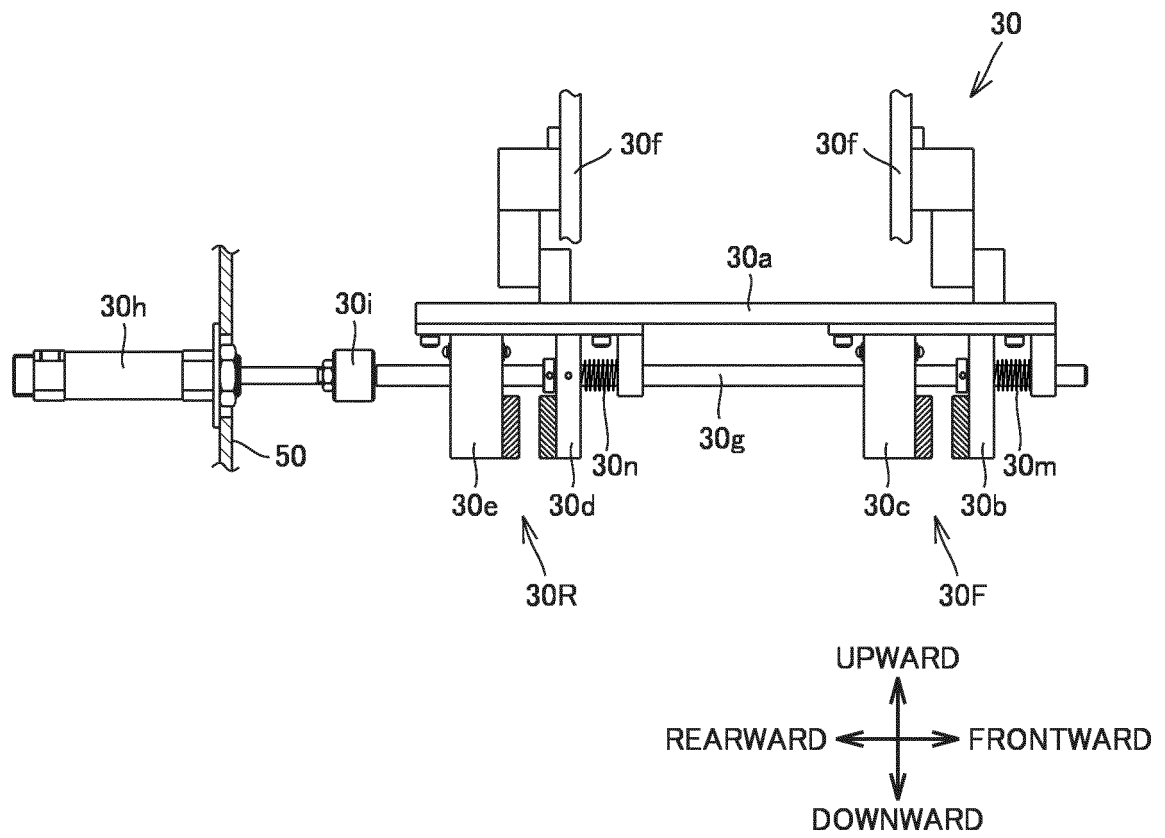


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/040013

A. CLASSIFICATION OF SUBJECT MATTER

B65H 54/56(2006.01)i; **B65H 67/044**(2006.01)i
FI: B65H67/044; B65H54/56 Z

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)

B65H54/28; B65H54/56; B65H67/00-67/08; B65H75/00-75/32

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 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

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.
X	JP 01-167188 A (SUMITOMO ELECTRIC IND LTD) 30 June 1989 (1989-06-30) p. 2, upper right column, line 4 to p. 3, lower right column, line 5, fig. 1-10	1
Y	p. 2, upper right column, line 4 to p. 3, lower right column, line 5, fig. 1-10	2, 5-7
A		3-4
Y	JP 06-305682 A (DAITO JUKI KOJI KK) 01 November 1994 (1994-11-01) paragraph [0008], fig. 1-2	2, 5-7
Y	JP 09-156834 A (NOK CORP) 17 June 1997 (1997-06-17) paragraphs [0014]-[0015], fig. 1	2, 5-7
Y	JP 2008-063148 A (TSTM CO LTD) 21 March 2008 (2008-03-21) paragraphs [0034]-[0035], fig. 5-6	6-7
Y	JP 2014-015314 A (NIPPON ELECTRIC GLASS CO LTD) 30 January 2014 (2014-01-30) paragraphs [0026]-[0027], fig. 1-3	6-7

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

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Date of the actual completion of the international search

25 November 2021

Date of mailing of the international search report

14 December 2021

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2021/040013

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP	01-167188	A	30 June 1989	(Family: none)	
JP	06-305682	A	01 November 1994	(Family: none)	
JP	09-156834	A	17 June 1997	(Family: none)	
JP	2008-063148	A	21 March 2008	(Family: none)	
JP	2014-015314	A	30 January 2014	(Family: none)	

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

REFERENCES CITED IN THE DESCRIPTION

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- JP 6371079 B [0003]
- JP 4343633 B [0003]