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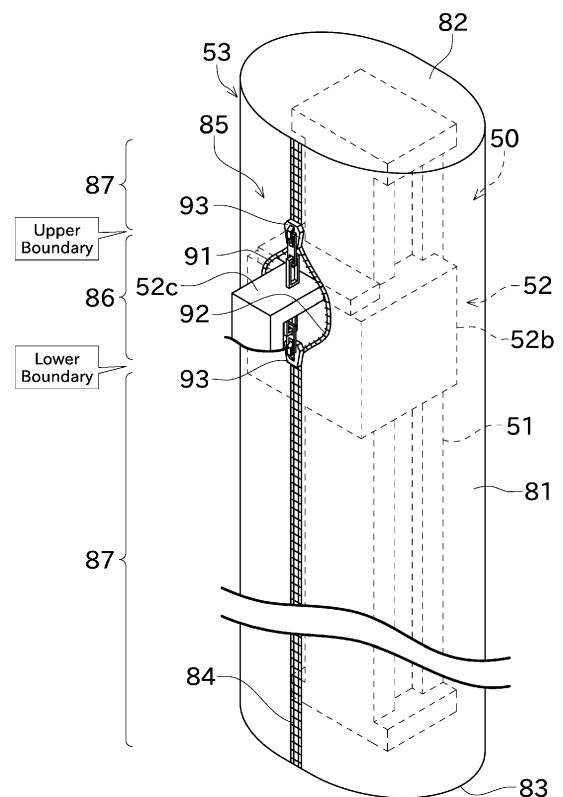
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(54) **YARN BRING-DOWN APPARATUS**

(57) A yarn bring-down apparatus includes a yarn holding portion, a rail (51), a sliding portion (52), and a cover (53). The cover (53) covers at least a part of a side surface portion of the rail (51). The cover (53) has a slit (84) and an open/close mechanism (85). The slit (84) extends in up-down direction. The open/close mechanism (85) opens or closes the slit (84) so that an open portion (86) and a closed portion (87) are formed in the cover (53). The sliding portion (52) is at least partially exposed to the outside of the cover (53) through the open portion (86) of the cover (53). As the sliding portion (52) slides, the sliding portion (52) acts on the open/close mechanism (85) so that an upper boundary moves together with the sliding portion (52), the upper boundary referring to a boundary between the open portion (86) through which the sliding portion (52) is exposed and the closed portion (87) located above the open portion (86).

FIG. 5



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn bring-down apparatus for bringing down a yarn from a tier in which a spinning device is disposed to a tier in which a winding device is disposed.

2. Description of the Related Art

[0002] Japanese Unexamined Patent Application Publication No. 2018-178318 discloses a yarn bring-down apparatus. The yarn bring-down apparatus includes a yarn bring-down member, which hooks and holds a yarn spun out by a spinning device. A wire is connected to the yarn bring-down member, so that the yarn bring-down member is lowered as the wire is pulled out. The yarn bring-down member is raised as the wire is wound. This makes it possible that the yarn bring-down member is raised and lowered between an upper tier and a lower tier. Disposed in a region where the yarn bring-down member is raised and lowered is a guide member that guides the yarn bring-down member at a time of the raising and lowering.

[0003] Japanese Unexamined Patent Application Publication No. H5-177499 (1993) discloses a covering apparatus for covering a processed head of a processing machine. The covering apparatus has plural covers. As the plural covers overlap or the overlap is removed, the covering apparatus extends or contracts. This makes it possible to keep covering the processed head even when the processed head is moved.

SUMMARY OF THE INVENTION

[0004] Yarn waste generated in a spinning device is present around each part, such as a yarn bring-down member, of a yarn bring-down apparatus. In the yarn bring-down apparatus according to Japanese Unexamined Patent Application Publication No. 2018-178318, therefore, yarn waste may adhere to the guide member or the like. If a rail structure instead of the wire is used to raise and lower the yarn bring-down member (yarn threading portion), frequent maintenance is required because yarn waste accumulates on the rail. The extension/contraction type covering apparatus shown in Japanese Unexamined Patent Application Publication No. H5-177499 (1993) is configured to achieve contraction by making the covers overlap each other, and therefore is effective only for a structure having a small amount of movement, as exemplified by a processed head. This is why such an extension/contraction type covering apparatus is not applicable to a rail of a yarn bring-down apparatus.

[0005] The present invention has been made in view of

the circumstances described above, and primarily aims to provide a yarn bring-down apparatus that raises and lowers a yarn threading portion by using a rail, the yarn bring-down apparatus being configured to require less frequent maintenance on the rail.

[0006] The foregoing has described problems to be solved by the present invention. The following will describe solutions to the problems and advantageous effects thereof.

[0007] An aspect of the present invention provides a yarn bring-down apparatus configured as follows. The yarn bring-down apparatus brings down a yarn from a second tier to a first tier, the second tier being a tier in which a spinning device for spinning out the yarn is disposed, the first tier being a tier in which a winding device for winding the yarn is disposed. The yarn bring-down apparatus includes a yarn holding portion, a rail, a sliding portion, and a cover. The yarn holding portion holds the yarn spun out by the spinning device. The rail is disposed so as to extend in up-down direction from the first tier to the second tier. The sliding portion is connected to the yarn holding portion, and is configured to slide together with the yarn holding portion along the rail. The cover covers at least a part of a side surface portion of the rail. The cover has a slit and an open/close mechanism. The slit extends in the up-down direction. The open/close mechanism opens or closes the slit so that an open portion and a closed portion are formed in the cover. The sliding portion is at least partially exposed to the outside of the cover through the open portion of the cover. As the sliding portion slides, the sliding portion acts on the open/close mechanism so that an upper boundary moves together with the sliding portion, the upper boundary referring to a boundary between the open portion through which the sliding portion is exposed and the closed portion located above the open portion.

[0008] Accordingly, the movement of the upper boundary follows the sliding of the sliding portion. This makes it less likely that the open portion is generated above the sliding portion. It therefore is less likely that yarn waste accumulates in the rail. Consequently, the frequency of maintenance on the rail can be lowered.

[0009] The yarn bring-down apparatus is preferably configured as follows. As the sliding portion slides, the sliding portion acts on the open/close mechanism so that a lower boundary moves together with the sliding portion, the lower boundary referring to a boundary between the open portion through which the sliding portion is exposed and the closed portion located below the open portion.

[0010] Accordingly, the movement of the lower boundary follows the sliding of the sliding portion. This makes it less likely that the open portion is generated below the sliding portion. It therefore is even less likely that yarn waste accumulates in the rail. Consequently, the frequency of maintenance on the rail can further be lowered.

[0011] In the yarn bring-down apparatus, it is preferable that the cover has a tubular shape, with an upper side thereof closed.

[0012] With this, entry of yarn waste from the upper side of the cover is difficult. It therefore is even less likely that yarn waste accumulates in the rail. Consequently, the frequency of maintenance on the rail can further be lowered.

[0013] In the yarn bring-down apparatus, it is preferable that the slit of the cover is continuous from an upper end to a lower end of the cover.

[0014] This configuration can address a case where the sliding portion is movable over a wide range.

[0015] The yarn bring-down apparatus is preferably configured as follows. The yarn bring-down apparatus further includes a fixing member for fixing the rail by connecting the rail to a base body. The cover has an opening portion disposed in a portion of the cover different from where the slit is disposed. The fixing member connects the rail to the base body via the opening portion.

[0016] This can achieve both fixing of the rail and suppression of accumulation of yarn waste in the rail.

[0017] The yarn bring-down apparatus is preferably configured as follows. The open/close mechanism includes a first member, a second member, and an open/close member. The first member is disposed in a first portion of portions separated by the slit, the first member being provided along the slit. The second member is disposed in a second portion of the portions separated by the slit, the second member being provided along the slit. The open/close member connects the first member to the second member. The open/close member is fixed to the sliding portion, and the open/close member moves integrally with the sliding portion.

[0018] With this, a configuration for moving the upper boundary along with sliding of the sliding portion can be obtained easily.

[0019] The yarn bring-down apparatus is preferably configured as follows. The open/close mechanism includes a first member and a second member. The first member is disposed in a first portion of portions separated by the slit, the first member being provided along the slit. The second member is disposed in a second portion of the portions separated by the slit, the second member being provided along the slit, the second member being capable of joining with the first member. The sliding portion comes into contact with a joining portion of the first member and the second member, so that the first member and the second member are separated away. When the sliding portion goes away from a separated portion of the first member and the second member, the first member and the second member are joined.

[0020] With this, a configuration for moving the upper boundary along with sliding of the sliding portion can be obtained further easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 is a schematic diagram showing a configura-

tion of a spun yarn winding apparatus;

FIG. 2 is a block diagram showing a control configuration of the spun yarn winding apparatus in a simplified manner;

FIG. 3 is a cross-sectional view showing configurations of a yarn bring-down apparatus and peripheral members;

FIG. 4 is a perspective view showing a raising/lowering mechanism and a yarn holding portion;

FIG. 5 is a perspective view showing a state of a cover while a sliding portion is at a first height; and

FIG. 6 is a perspective view showing a state of the cover while the sliding portion is at a second height.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] An embodiment of the present invention will now be described with reference to the drawings. In the following description, "upstream" and "downstream" refer to the upstream and the downstream with respect to the direction in which a produced yarn Y travels.

[0023] First, an outline of a spun yarn winding apparatus 1 will be described with reference to FIG. 1. The spun yarn winding apparatus 1 shown in FIG. 1 is an apparatus that spins out a synthetic fiber yarn Y, and winds the spun-out yarn Y to form packages P.

[0024] The spun yarn winding apparatus 1 includes a spinning device 3, a yarn bring-down apparatus 5, a yarn threading device 2, a receiving unit 6, and a winding device 7. A yarn Y is spun out by the spinning device 3, and then is lowered from a second tier to a first tier by the yarn bring-down apparatus 5. The yarn Y lowered to the first tier is threaded by the yarn threading device 2, and then is received by the receiving unit 6. The winding device 7 winds the yarn Y received by the receiving unit 6, to form the packages P. The spun yarn winding apparatus 1 is installed in a building having plural tiers. In the description below, a tier in which the spinning device 3 is disposed will be referred to as the second tier, and a tier in which the winding device 7 is disposed will be defined as the first tier. The second tier is provided at a position higher than the first tier. The first tier and the second tier are partitioned from each other by a partition floor 9.

[0025] Although FIG. 1 shows one spinning device 3, one receiving unit 6, and one winding device 7, the number of these devices may be plural. In such a case, plural yarn threading devices 2 or plural yarn bring-down apparatuses 5 may be provided. Alternatively, one yarn threading device 2 or one yarn bring-down apparatus 5 may be provided for plural spinning devices 3 or the like.

[0026] As shown in FIG. 2, the spun yarn winding apparatus 1 includes a centralized control device 101, a winding control device 102, and a yarn threading control device 103. The centralized control device 101, the winding control device 102, and the yarn threading control device 103 are each a known computer including a CPU, an ROM, and an RAM, for example, and the CPU exe-

cutes a program stored in the ROM so that various controls are carried out. The centralized control device 101 carries out a control related to each part of the spun yarn winding apparatus 1. The winding control device 102 carries out a control related to each part of the receiving unit 6 and the winding device 7. The yarn threading control device 103 carries out a control related to each part of the yarn threading device 2. Here, a combination of a control device and a control target to be controlled by the control device is just an example, and can be changeable. For example, it may be possible that the centralized control device 101 controls each part of the yarn threading device 2, or that a control device for controlling the receiving unit 6 is separately provided.

[0027] In the following, each device included in the spun yarn winding apparatus 1 will be described in detail. The spinning device 3 includes plural spun yarn ports (not shown). To the spun yarn ports, a molten polymer in a high-temperature state is supplied by a polymer feeder (not shown) including a gear pump and the like. The spinning device 3 extrudes the molten polymer from each spun yarn port. Consequently, the yarn Y is spun out from each spun yarn port of the spinning device 3.

[0028] Disposed downstream of the spinning device 3 are a cooling device 10 and an oil agent guide 11. The cooling device 10 is disposed immediately below the spinning device 3. The cooling device 10 includes plural cooling cylinders (not shown). To each of the cooling cylinders, cooling air is supplied via a cooling air pipe (not shown). The yarn Y passing through the cooling cylinder is cooled by the cooling air, to be solidified. The oil agent guide 11 is disposed below the cooling device 10. The oil agent guide 11 applies an oil agent to each of passing yarns Y. After the oil agent guide 11 applies the oil agent to the yarn Y, the yarn Y is fed to the first tier.

[0029] The partition floor 9 has a yarn passage hole 9a for feeding the yarn Y to the first tier. A duct-like inter-floor tube 8 is provided upstream and downstream of the partition floor 9, so as to surround the yarn passage hole 9a. The inter-floor tube 8 prevents or reduces occurrence of yarn swing, which may otherwise be caused by an external factor such as wind, in the course of the yarn Y traveling from the second tier to the first tier. The inter-floor tube 8 may be provided only in the first tier. The inter-floor tube 8 may be omitted.

[0030] The yarn bring-down apparatus 5, which is disposed so as to span the first and second tiers, performs an action of bringing the yarn Y from the second tier down to the first tier. As shown in FIG. 3, the yarn bring-down apparatus 5 includes a raising/lowering mechanism 50, a cover 53, a yarn holding portion 54, and a fixing member 55.

[0031] The raising/lowering mechanism 50 includes a rail 51 and a sliding portion 52. The rail 51 is disposed so as to extend in up-down direction, from the first tier to the second tier. The rail 51 extending in the up-down direction means the rail 51 having its longitudinal direction sub-

stantially coincident with the up-down direction. The sliding portion 52 is disposed so as to be slidable along the rail 51. As shown in FIG. 2, the raising/lowering mechanism 50 is driven with power of a yarn bring-down actuator 59, so that the sliding portion 52 is raised and lowered along the rail 51. In this embodiment, the raising/lowering mechanism 50 is a magnet slider mechanism, including a magnet gear. The yarn bring-down actuator 59 is a motor for rotating the magnet gear. The raising/lowering mechanism is not limited to the magnet slider mechanism. For instance, the raising/lowering mechanism may be a ball screw mechanism. The yarn bring-down actuator 59 is not limited to a rotary motor, but may be a linear motor. The yarn bring-down actuator 59 is controlled by the centralized control device 101, but instead a control device dedicated to the yarn bring-down apparatus 5 may be provided.

[0032] The cover 53 covers at least a part (in this embodiment, the whole) of the rail 51. The cover 53 is provided for the purpose of making it difficult for yarn waste to adhere to the rail 51. A detailed configuration of the cover 53 will be given later.

[0033] The yarn holding portion 54 is attached to the sliding portion 52. The yarn holding portion 54 is raised and lowered integrally with the sliding portion 52. In this embodiment, the sliding portion 52 is a portion that slides along the rail 51, and also is a portion to which the yarn holding portion 54 is attached.

[0034] The yarn holding portion 54 includes two yarn threading rollers 54a. Each of the yarn threading rollers 54a is, for example, a roller that is supported in a rotatable manner. The yarn threading roller 54a has, on its outer circumferential surface, a ring-shaped groove portion formed along the outer circumferential surface. The yarn holding portion 54 holds the yarn Y by having the yarn Y enter the groove portion of the yarn threading roller 54a. This configuration allows the raising/lowering mechanism 50 to move from the second tier to the first tier with the yarn Y threaded and held on the two yarn threading rollers 54a, so that the yarn Y can be lowered to the first tier.

[0035] The fixing member 55 is a member for fixing the rail 51 by connecting the rail 51 to a base body 9b. This is how the raising/lowering mechanism 50, the cover 53, the yarn holding portion 54, and the like, can be supported. The base body 9b is a structure or a heavy load disposed on the partition floor 9. The base body 9b may be a mechanical frame disposed in the second tier. The number of fixing members 55 provided is at least one. The fixing member 55 connects the rail 51 to the base body 9b via an opening portion 89 formed in the cover 53. In this manner, the rail 51 can be supported by the base body 9b while the rail 51 is covered with the cover 53.

[0036] The yarn threading device 2 is disposed in the first tier. The yarn threading device 2 performs a yarn threading operation. The yarn threading operation means an operation in which the yarn Y having been lowered by the yarn bring-down apparatus 5 is set on the

receiving unit 6 and then fixed to a bobbin B of the winding device 7. As a result of the yarn threading operation, it becomes possible for the winding device 7 to wind the yarn Y to form the package P. The yarn threading device 2 includes the yarn threading control device 103 mentioned

above, an arm drive motor 21, and an arm 22. **[0037]** The arm 22, which is of articulated type, is driven by the arm drive motor 21. The arm drive motor 21 is controlled by the yarn threading control device 103. Disposed at a distal end portion of the arm 22 is a yarn catching member (not shown) for catching the yarn Y. The yarn catching member is, for example, a suction device for sucking the yarn Y, or a hook-shaped member for hooking the yarn Y. The arm 22 is driven with the yarn Y being caught in the distal end portion of the arm 22, so that the yarn catching member can guide the caught yarn Y.

[0038] The receiving unit 6 is disposed in the first tier. The receiving unit 6 is used to receive plural yarns Y traveling downward from the second tier. The receiving unit 6 has two godet rollers 61, 62. In the following description, the godet roller positioned upstream with respect to the traveling direction of the yarn Y will be called upstream godet roller 61, and the godet roller positioned downstream with respect to the traveling direction of the yarn Y will be called downstream godet roller 62.

[0039] As shown in FIG. 2, the upstream godet roller 61 is driven by an upstream godet motor 61a. The downstream godet roller 62 is driven by a downstream godet motor 62a. The downstream godet roller 62 is capable of moving between a yarn threading position, which is adjacent to the upstream godet roller 61, and a package forming position, which is located directly above the winding device 7, as illustrated with the dashed arrow in FIG. 1. The upstream godet motor 61a and the downstream godet motor 62a are controlled by the winding control device 102.

[0040] The winding device 7 winds the plural yarns Y traveling from the receiving unit 6, to form the packages P. The winding device 7 includes a turret 71, two bobbin holders 72, a traversing device 73, and a contact roller 74.

[0041] The turret 71 is installed in a rotatable manner. Each of the two bobbin holders 72 is rotatably supported by the turret 71. Each bobbin holder 72 is formed in a shape elongated in front-back direction. The two bobbin holders 72 are disposed on opposite sides across the rotation axis of the turret 71. As the turret 71 rotates, the positions of the two bobbin holders 72 interchange with each other.

[0042] To be specific, one of the two bobbin holders 72 is located in a winding position, which is on the upstream side, and the other of the two bobbin holders 72 is located in a standby position, which is on the downstream side. The bobbin holder 72 in the winding position is adjacent to the contact roller 74, while the bobbin holder 72 in the standby position is distant from the contact roller 74. Plural bobbins B are mounted on each bobbin holder

72. The plural bobbins B are arranged side by side in the longitudinal direction of the bobbin holder 72.

[0043] The traversing device 73 includes plural traverse guides 73a corresponding to the plural bobbins B. Each traverse guide 73a is disposed corresponding to each bobbin B. The traverse guide 73a is driven by a traverse motor 73b, which acts in response to a control command from the winding control device 102. As each traverse guide 73a moves back and forth in the direction parallel to the longitudinal direction of the bobbin holder 72, the yarn Y is wound on the bobbin B while being traversed.

[0044] The contact roller 74 comes into contact with outer circumferential surfaces of the plural packages P formed on the respective bobbins B, and thus applies a contact pressure to each of the plural packages P. The contact roller 74 is driven by a winding motor 70. The winding motor 70 is controlled by the winding control device 102.

[0045] Next, a yarn bring-down operation by the yarn bring-down apparatus 5 and a yarn threading operation by the yarn threading device 2 will be briefly described.

[0046] In the spun yarn winding apparatus 1, for example in a preparation stage before formation of the packages P is started or in a case where a yarn breakage occurs due to some cause, the yarn bring-down operation and the yarn threading operation are performed for the purpose of allowing the winding device 7 to start (resume) the winding of the yarn Y. In this embodiment, the yarn bring-down operation is performed by an operator manipulating the yarn bring-down apparatus 5. The yarn threading operation is performed automatically by the yarn threading device 2.

[0047] Initially, the operator uses a yarn suction part such as a suction gun (not shown) to suck and hold plural yarns Y spun out from the spinning device 3, the sucking and holding taking place upstream of the oil agent guide 11. Then, the operator hooks, onto the oil agent guide 11, the plural yarns Y sucked and held by the yarn suction part.

[0048] Then, the operator uses a yarn threading tool (not shown) to hook portions of the yarns Y onto the yarn threading tool, the portions being located between the yarn suction part and the oil agent guide 11. Then, the operator moves the yarn threading tool such that portions of the yarns Y located between the yarn suction part and the yarn threading tool come to a position directly below the two yarn threading rollers 54a. If the operator removes the yarn threading tool in this state, the portions of the yarns Y located between the oil agent guide 11 and the yarn suction part are hooked on the two yarn threading rollers 54a. The yarns Y are held by the yarn holding portion 54 accordingly.

[0049] After completion of a yarn bring-down preparation operation, the operator manipulates a manipulation switch or the like (not shown), to instruct that the yarn bring-down apparatus 5 start a yarn bring-down action. In response to this, the centralized control device 101 con-

trols the yarn bring-down actuator 59, so that the sliding portion 52 moves downward along the rail 51. Consequently, the yarn holding portion 54 moves to a delivery position in the first tier. In this manner, the yarn bring-down operation is completed.

[0050] Then, the yarn threading control device 103 controls the arm drive motor 21, to drive the arm 22 so that the distal end of the arm 22 comes to a location near the yarn threading rollers 54a. Then, the distal end of the arm 22 catches the yarns Y hooked on the yarn threading rollers 54a. Then, the arm 22 is further driven, to hook the yarns Y onto the receiving unit 6 (the upstream godet roller 61 and the downstream godet roller 62) and plural branch point guides 13 in this order. Then, the arm 22 is further driven, so that the distal end of the arm 22 moves to a predetermined position below the upper bobbin holder 72, to bring the yarns Y into contact with the bobbins B.

[0051] Concurrently with or shortly before the arm 22 guiding the yarns Y to the bobbins B, a winding action of the winding device 7 is started. The yarns Y are wound on end portions of the rotating bobbins B, and thereby end portions of the yarns Y can be fixed to the bobbins B. Upon the start of the winding action, the traverse guides 73a move back and forth in the direction parallel to the axial direction of the bobbins B, along with the rotation of the bobbins B. While the traverse guides 73a are moving back and forth, the yarns Y are hooked on the respective traverse guides 73a. Thereafter, thanks to the guiding by the traverse guides 73a, the yarns Y can be traversed while being wound on the bobbins B. Consequently, the packages P can be formed.

[0052] It should be noted that the flow of the yarn bring-down operation and the yarn threading operation is just an example, and it may be acceptable that the operations performed by the operator may at least partially be carried out by using a machine, or that the operations performed by the machine (such as the yarn threading device 2) may at least partially be carried out by the operator.

[0053] Next, with reference to FIG. 4, a detailed configuration and a problem of the raising/lowering mechanism 50 of the yarn bring-down apparatus 5 will be described.

[0054] As shown in FIG. 4, the rail 51 has a rail groove 51a. The sliding portion 52 has a sliding protrusion 52a, which enters the rail groove 51a. This configuration allows the sliding portion 52 to smoothly slide along the rail 51. The rail groove 51a and the sliding protrusion 52a are just an example, and alternatively it may be possible that the rail 51 has a protrusion while the sliding portion 52 has a groove. In order that the sliding portion 52 can smoothly slide along the rail 51, a combination structure including such a protrusion and a recess is required.

[0055] In a space where the raising/lowering mechanism 50 is disposed, yarn waste produced in the spinning device 3 is scattered. If no measures are taken, the yarn waste is likely to accumulate in the rail groove 51a. Even

when the rail groove 51a is not provided, the yarn waste accumulates in a portion including the protrusion and the recess of the combination structure. Furthermore, in this embodiment, the oil agent applied by the oil agent guide 11 may be scattered in this space. If so, the oil agent may adhere to the rail groove 51a, which makes the yarn waste more likely to accumulate in the rail groove 51a. This hinders smooth sliding of the sliding protrusion 52a along the rail groove 51a. As a result, the operator has to stop the yarn bring-down apparatus 5, disassemble it as necessary, and clean the rail groove 51a. This operation will hereinafter be referred to simply as maintenance. An increase in frequency of the maintenance leads to a decrease in productivity, and also is a burden on the operator. Improvement is desired, therefore.

[0056] For example, providing the sliding portion 52 with a scraper is a conceivable measure against accumulation of yarn waste in the rail groove 51a. This measure, however, can only collect, not remove, the yarn waste. After all, the maintenance needs to be carried out frequently. Other conceivable measures include: injecting compressed air to blow off the yarn waste; or providing a sucking device to suck the yarn waste. These measures, however, make the configuration complicated, because it requires that a hose for guiding the compressed air or a suction flow be routed, and that plural injection ports or plural suction ports be provided. Especially, the rail 51, which is disposed so as to span the tiers, is long in the up-down direction, and thus a required length of the hose is large, and in addition, the number of injection ports or suction ports required is large, too.

[0057] Still other conceivable measures include covering the upper side of the sliding portion 52 and the lower side of the sliding portion 52 by using the extension/contraction type covers disclosed in Japanese Unexamined Patent Application Publication No. H5-177499 (1993), for example. In the yarn bring-down apparatus 5, however, the sliding portion 52 moves over a long distance, and therefore a high extension/contraction ratio is demanded. This is why the configuration disclosed in Japanese Unexamined Patent Application Publication No. H5-177499 (1993), for example, cannot cope with the yarn bring-down apparatus 5.

[0058] Considering the above, this embodiment provides the cover 53, which covers the rail 51 while exposing at least a part of the sliding portion 52 to the outside. The cover 53 is structured such that its opening or closing follows raising or lowering of the sliding portion 52. The sliding portion 52 and the cover 53 will be detailed below.

[0059] Referring to FIG. 4, the sliding portion 52 includes a slide block 52b, a connecting member 52c, and a suspension member 52d. The slide block 52b is a portion to implement sliding. In this embodiment, which adopts the magnet slider mechanism, the slide block 52b includes a magnet. The slide block 52b is provided with the above-mentioned sliding protrusion 52a. The connecting member 52c and the suspension member 52d are members for connecting the slide block 52b to the yarn holding

portion 54.

[0060] As described above, the sliding portion 52 is a portion that slides along the rail 51, and also is a portion to which the yarn holding portion 54 is attached. Accordingly, a configuration that corresponds to the sliding portion 52 is not only the slide block 52b, but includes the slide block 52b, the connecting member 52c, and the suspension member 52d. The configuration of the sliding portion 52 of this embodiment is just an example. Its shape may be changed as appropriate in accordance with the type of the raising/lowering mechanism used, the positional relationship with the yarn holding portion 54, and the like.

[0061] The cover 53 is made of fibers, and has a flexibility. Here, various materials may be employed to make the cover 53, as long as the cover 53 is capable of shutting out yarn waste and also is compatible with an open/close mechanism 85, which will be described later. As shown in FIG. 5, the cover 53 includes a tubular portion 81, an upper surface portion 82, and a lower surface portion 83.

[0062] The tubular portion 81, which is a portion having a tube-like shape, covers a side surface portion of the rail 51. As the tubular portion 81 covers the side surface portion, and particularly the rail groove 51a, of the rail 51, the tubular portion 81 is necessary to suppress accumulation of yarn waste in the rail groove 51a. It however is not essential that the tubular portion 81 covers the whole of the rail groove 51a. It may be acceptable that the tubular portion 81 covers only a part of the rail groove 51a. The part is, for example, a part of the rail groove 51a in a range where yarn waste is likely to accumulate or in a range where the sliding portion 52 slides frequently. Although the tubular portion 81 of this embodiment has a circular or oval cross-section, it may have a rectangular cross-section.

[0063] The upper surface portion 82 is a portion located at the upper end of the tubular portion 81, and also is a portion that closes the upper side of the cover 53. The upper surface portion 82 covers an upper portion of the rail 51. In this embodiment, yarn waste is scattered from the spinning device 3, and the spinning device 3 is located above the rail 51. Accordingly, the presence of the upper surface portion 82 can make it less likely that yarn waste coming from above accumulates in the rail 51. Here, the upper surface portion 82 is not an essential element, but may be omitted.

[0064] The lower surface portion 83 is a portion located at the lower end of the tubular portion 81, and also is a portion that closes the lower side of the cover 53. The lower surface portion 83 covers a lower portion of the rail 51. Yarn waste is light, and therefore can fly in a space if receiving just a slight air flow. The presence of the lower surface portion 83 can make it less likely that yarn waste coming from below while flying in a space accumulates in the rail 51. Here, the lower surface portion 83 is not an essential element, but may be omitted.

[0065] The tubular portion 81 has a slit 84 extending in

the up-down direction. The slit 84 is a portion that splits the tubular portion 81 in an openable/closable manner. In this embodiment, the slit 84 is formed so as to be continuous from the upper end to the lower end of the tubular portion 81. The slit 84 may be formed only in a part of the tubular portion 81 in the up-down direction, however.

[0066] The cover 53 is provided with the open/close mechanism 85, which opens or closes the slit 84 so that an open portion 86 and a closed portion 87 are formed in the cover 53. The open/close mechanism 85 of this embodiment is a fastener mechanism (more specifically, a line fastener mechanism). The open/close mechanism 85 has a first member 91, a second member 92, and an open/close member 93.

[0067] The first member 91 is a protrusion (element) disposed in one (hereinafter, first portion) of two portions separated by the slit 84. The second member 92 is a protrusion (element) disposed in the other (hereinafter, second portion) of the two portions separated by the slit 84. Each of the first member 91 and the second member 92 is provided along the slit 84. The first member 91 and the second member 92 are capable of being connected to each other. A range where the first member 91 and the second member 92 are connected corresponds to the closed portion 87, and a range where they are not connected corresponds to the open portion 86.

[0068] The open/close member 93 is movable along the slit 84. By the open/close member 93 passing, the first member 91 can be connected to the second member 92, or the first member 91 can be disconnected from the second member 92. In detail, as the open/close member 93 passes in a range where the first member 91 is not connected to the second member 92, the first member 91 can get connected to the second member 92. As the open/close member 93 passes in a range where the first member 91 is connected to the second member 92, the first member 91 can get disconnected from the second member 92.

[0069] In this embodiment, two open/close members 93 are arranged for one slit 84. Thus, a range sandwiched between the two open/close members 93 is the open portion 86, and the rest is the closed portion 87. As shown in FIG. 5, through the open portion 86, a part of the sliding portion 52 is exposed to the outside of the cover 53. To be specific, the part of the sliding portion 52 exposed to the outside of the cover 53 is a part of the connecting member 52c and the whole of the suspension member 52d. Here, being exposed to the outside means being not covered with the cover 53. For instance, it means that there is a portion that protrudes outward beyond the cover 53 in a plan view or in a side view.

[0070] A part of the sliding portion 52 that passes across the boundary between the inside and outside of the cover 53 is the connecting member 52c. Preferably, the part that passes across the boundary between the inside and outside of the cover 53 has a small size in the up-down direction and in the width direction. This can make the open portion 86 small, to make yarn waste less

likely to enter the inside of the cover 53. In this respect, the connecting member 52c of this embodiment has a smaller size in the up-down direction and a smaller size in the width direction as compared to other portions (the slide block 52b, the suspension member 52d). The width direction refers to a direction that is perpendicular to the up-down direction and perpendicular to a direction of connection between the inside and outside of the cover 53.

[0071] Of the two open/close members 93 arranged, the upper open/close member 93 is fixed to an upper surface of the sliding portion 52 (in more detail, the connecting member 52c). The lower open/close member 93 is fixed to a lower surface of the sliding portion 52 (in more detail, the connecting member 52c). For the fixing, various methods may be employed, examples of which including: fixing a manipulation piece of the open/close member 93 to the connecting member 52c with interposition of a relay member; or adopting a dedicated, large-sized manipulation piece as the manipulation piece of the open/close member 93, and directly fixing this manipulation piece to the connecting member 52c.

[0072] A boundary between the open portion 86 and the closed portion 87 defined by the upper open/close member 93 will be referred to as upper boundary. A boundary between the open portion 86 and the closed portion 87 defined by the lower open/close member 93 will be referred to as lower boundary. Here, assume a situation where the sliding portion 52 is lowered from a first height, shown in FIG. 5, to a second height, shown in FIG. 6.

[0073] As the sliding portion 52 is lowered, the upper open/close member 93 is lowered together with the sliding portion 52. The upper boundary is lowered together with the sliding portion accordingly. As the sliding portion 52 is lowered, the lower open/close member 93 is also lowered together with the sliding portion 52. The lower boundary is lowered together with the sliding portion accordingly. The same is true when the sliding portion 52 is raised.

[0074] In this embodiment, the open portion 86 moves integrally with the sliding portion 52. This makes it possible that the sliding portion 52 (that is, the yarn holding portion 54) slides up and down with the open portion 86 occupying a reduced range, while the rail 51 is covered with the cover 53. A reduction in size of the open portion 86 can reduce the amount of yarn waste that enters through the open portion 86. Accordingly, the frequency of maintenance can be lowered.

[0075] Although the line fastener mechanism is adopted as the open/close mechanism 85 in this embodiment, this is just an example. Other open/close mechanisms 85 such as the following ones may be adoptable.

[0076] For example, a sealing structure used in a resin-made, zippered bag or the like can be used as the open/close mechanism 85. The sealing structure has a first member disposed in a first portion of portions separated

by a slit, and the first member includes a groove portion provided along the slit. The sealing structure has a second member disposed in a second portion of the portions separated by the slit, and the second member includes a projection that can enter the groove portion. The sealing structure has an open/close member, which spans the first and second members. The open/close member, by moving along the slit, can connect the first member to the second member. In a sealing structure of this type, the open/close member is used to connect the first member to the second member, but is not used to disconnect them. Thus, the sliding portion 52, in sliding, comes into contact with a connection portion of the first and second members, and presses the connection portion, to disconnect the first member from the second member. In this manner, the upper boundary and the lower boundary of the cover 53 can be moved as the sliding portion 52 slides. Except for this open/close mechanism, the same configuration as that of the above-described embodiment is adopted.

[0077] As another exemplary configuration, a magnet sheet mechanism can be used as the open/close mechanism 85. The magnet sheet mechanism is configured to connect two parts by using a sheet-shaped magnet. In a case of using the magnet sheet mechanism, a first member is a magnet sheet disposed in a first portion of portions separated by a slit, the magnet sheet being provided along the slit, while a second member is a magnet sheet disposed in a second portion of the portions separated by the slit, the magnet sheet being provided along the slit. In the magnet sheet mechanism, the first member and the second member are joined just by bringing the first member and the second member close to each other. In the magnet sheet mechanism, therefore, the open/close member is not an essential element. The first member and the second member are, in their initial positions, joined together. As the sliding portion 52 slides, the sliding portion 52 comes into contact with a joining portion of the first and second members, so that the first and second members are separated away. If the sliding portion 52 goes away from the separated portion of the first and second members, the first and second members return to their initial positions, so that the first member and the second member are joined. In this manner, the upper boundary and the lower boundary of the cover 53 can be moved as the sliding portion 52 slides. Except for this open/close mechanism, the same configuration as that of the above-described embodiment is adopted.

[0078] In this embodiment, both the upper boundary and the lower boundary are moved along with sliding of the sliding portion 52. Considering that yarn waste is dropping from above, moving the upper boundary together with the sliding portion 52 is a relatively important point. Considering the direction from which yarn waste is coming and that a part of the open portion 86 below the sliding portion 52 is slightly covered with the sliding portion 52 itself, moving the lower boundary together with the sliding portion 52 is of relatively low importance.

Thus, a configuration for moving the lower boundary (that is, the configuration in which the lower open/close member 93 is provided, and is fixed to the sliding portion 52) may be omitted.

[0079] As thus far described above, the yarn bring-down apparatus 5 according to this embodiment brings down the yarn Y from the second tier in which the spinning device 3 for spinning out the yarn Y is disposed to the first tier in which the winding device 7 for winding the yarn Y is disposed. The yarn bring-down apparatus 5 includes the yarn holding portion 54, the rail 51, the sliding portion 52, and the cover 53. The yarn holding portion 54 holds the yarn Y spun out by the spinning device 3. The rail 51 is disposed so as to extend in the up-down direction from the first tier to the second tier. The sliding portion 52 is connected to the yarn holding portion 54, and is configured to slide together with the yarn holding portion 54 along the rail 51. The cover 53 covers at least a part of the side surface portion of the rail 51. The cover 53 has the slit 84 and the open/close mechanism 85. The slit 84 extends in the up-down direction. The open/close mechanism 85 opens or closes the slit 84 so that the open portion 86 and the closed portion 87 are formed in the cover 53. The sliding portion 52 is at least partially exposed to the outside of the cover 53 through the open portion 86 of the cover 53. As the sliding portion 52 slides, the sliding portion 52 acts on the open/close mechanism 85 so that the upper boundary moves together with the sliding portion 52, the upper boundary referring to the boundary between the open portion 86 through which the sliding portion 52 is exposed and the closed portion 87 located above the open portion 86.

[0080] Accordingly, the movement of the upper boundary follows the sliding of the sliding portion 52. This makes it less likely that the open portion 86 is generated above the sliding portion 52. It therefore is less likely that yarn waste accumulates in the rail 51. Consequently, the frequency of maintenance on the rail 51 can be lowered.

[0081] In the yarn bring-down apparatus 5 according to this embodiment, as the sliding portion 52 slides, the sliding portion 52 acts on the open/close mechanism 85 so that the lower boundary moves together with the sliding portion 52, the lower boundary referring to the boundary between the open portion 86 through which the sliding portion 52 is exposed and the closed portion 87 located below the open portion 86.

[0082] Accordingly, the movement of the lower boundary follows the sliding of the sliding portion 52. This makes it less likely that the open portion is generated below the sliding portion 52. It therefore is even less likely that yarn waste accumulates in the rail 51. Consequently, the frequency of maintenance on the rail 51 can further be lowered.

[0083] In the yarn bring-down apparatus 5 according to this embodiment, the cover 53 has a tubular shape, with the upper side thereof closed.

[0084] With this, entry of yarn waste from the upper side of the cover 53 is difficult. It therefore is even less

likely that yarn waste accumulates in the rail 51. Consequently, the frequency of maintenance on the rail 51 can further be lowered.

[0085] In the yarn bring-down apparatus 5 according to this embodiment, the slit 84 of the cover 53 is continuous from the upper end to the lower end of the cover 53.

[0086] This configuration can address a case where the sliding portion 52 is movable over a wide range.

[0087] The yarn bring-down apparatus 5 according to this embodiment further includes the fixing member 55 for fixing the rail 51 by connecting the rail 51 to the base body 9b. The cover 53 has the opening portion 89 disposed in a portion of the cover 53 different from where the slit 84 is disposed. The fixing member 55 connects the rail 51 to the base body 9b via the opening portion 89.

[0088] This can achieve both fixing of the rail 51 and suppression of accumulation of yarn waste in the rail 51.

[0089] In the yarn bring-down apparatus 5 according to this embodiment, the open/close mechanism 85 includes the first member 91, the second member 92, and the open/close member 93. The first member 91 is disposed in the first portion of the portions separated by the slit 84, the first member 91 being provided along the slit 84. The second member 92 is disposed in the second portion of the portions separated by the slit 84, the second member 92 being provided along the slit 84. The open/close member 93 connects the first member 91 to the second member 92. The open/close member 93 is fixed to the sliding portion 52, and the open/close member 93 moves integrally with the sliding portion.

[0090] With this, a configuration for moving the upper boundary along with sliding of the sliding portion 52 can be obtained easily.

[0091] In the yarn bring-down apparatus 5 according to this embodiment, the open/close mechanism 85 includes the first member 91 and the second member 92. The first member 91 is disposed in the first portion of the portions separated by the slit 84, the first member 91 being provided along the slit 84. The second member 92 is disposed in the second portion of the portions separated by the slit 84, the second member 92 being provided along the slit 84, the second member 92 being capable of joining with the first member 91. The sliding portion comes into contact with the joining portion of the first member 91 and the second member 92, so that the first member 91 and the second member 92 are separated away. If the sliding portion goes away from the separated portion of the first member 91 and the second member 92, the first member 91 and the second member 92 are joined.

[0092] With this, a configuration for moving the upper boundary along with sliding of the sliding portion 52 can be obtained further easily.

Claims

1. A yarn bring-down apparatus (5) that brings down a

yarn (Y) from a second tier to a first tier, the second tier being a tier in which a spinning device (3) for spinning out the yarn (Y) is disposed, the first tier being a tier in which a winding device (7) for winding the yarn (Y) is disposed, the yarn bring-down apparatus (5) comprising:

a yarn holding portion (54) for holding the yarn (Y) spun out by the spinning device (3);
a rail (51) disposed so as to extend in up-down direction from the first tier to the second tier;
a sliding portion (52) connected to the yarn holding portion (54), the sliding portion (52) being configured to slide together with the yarn holding portion (54) along the rail (51); and
a cover (53) that covers at least a part of a side surface portion of the rail (51), the cover (53) having

a slit (84) extending in the up-down direction, and
an open/close mechanism (85) configured to open or close the slit (84) so that an open portion (86) and a closed portion (87) are formed in the cover (53),

the sliding portion (52) being at least partially exposed to the outside of the cover (53) through the open portion (86) of the cover (53), wherein as the sliding portion (52) slides, the sliding portion (52) acts on the open/close mechanism (85) so that an upper boundary moves together with the sliding portion (52), the upper boundary referring to a boundary between the open portion (86) through which the sliding portion (52) is exposed and the closed portion (87) located above the open portion (86).

2. The yarn bring-down apparatus (5) according to claim 1, wherein
as the sliding portion (52) slides, the sliding portion (52) acts on the open/close mechanism (85) so that a lower boundary moves together with the sliding portion (52), the lower boundary referring to a boundary between the open portion (86) through which the sliding portion (52) is exposed and the closed portion (87) located below the open portion (86).
3. The yarn bring-down apparatus (5) according to claim 1 or 2, wherein
the cover (53) has a tubular shape, with an upper side thereof closed.
4. The yarn bring-down apparatus (5) according to any one of claims 1 to 3, wherein
the slit (84) of the cover (53) is continuous from an upper end to a lower end of the cover (53).

5. The yarn bring-down apparatus (5) according to any one of claims 1 to 4, further comprising a fixing member (55) for fixing the rail (51) by connecting the rail (51) to a base body (9b), wherein

the cover (53) has an opening portion (89) disposed in a portion of the cover (53) different from where the slit (84) is disposed, and
the fixing member (55) connects the rail (51) to the base body (9b) via the opening portion (89).

6. The yarn bring-down apparatus (5) according to any one of claims 1 to 5, wherein

the open/close mechanism (85) includes

a first member (91) disposed in a first portion of portions separated by the slit (84), the first member (91) being provided along the slit (84),
a second member (92) disposed in a second portion of the portions separated by the slit (84), the second member (92) being provided along the slit (84), and
an open/close member (93) configured to connect the first member (91) to the second member (92), and

the open/close member (93) is fixed to the sliding portion (52), and the open/close member (93) moves integrally with the sliding portion (52).

7. The yarn bring-down apparatus (5) according to any one of claims 1 to 5, wherein

the open/close mechanism (85) includes

a first member (91) disposed in a first portion of portions separated by the slit (84), the first member (91) being provided along the slit (84), and
a second member (92) disposed in a second portion of the portions separated by the slit (84), the second member (92) being provided along the slit (84), the second member (92) being capable of joining with the first member (91),

the sliding portion (52) comes into contact with a joining portion of the first member (91) and the second member (92), so that the first member (91) and the second member (92) are separated away, and
when the sliding portion (52) goes away from a separated portion of the first member (91) and the second member (92), the first member (91) and the second member (92) are joined.

FIG. 1

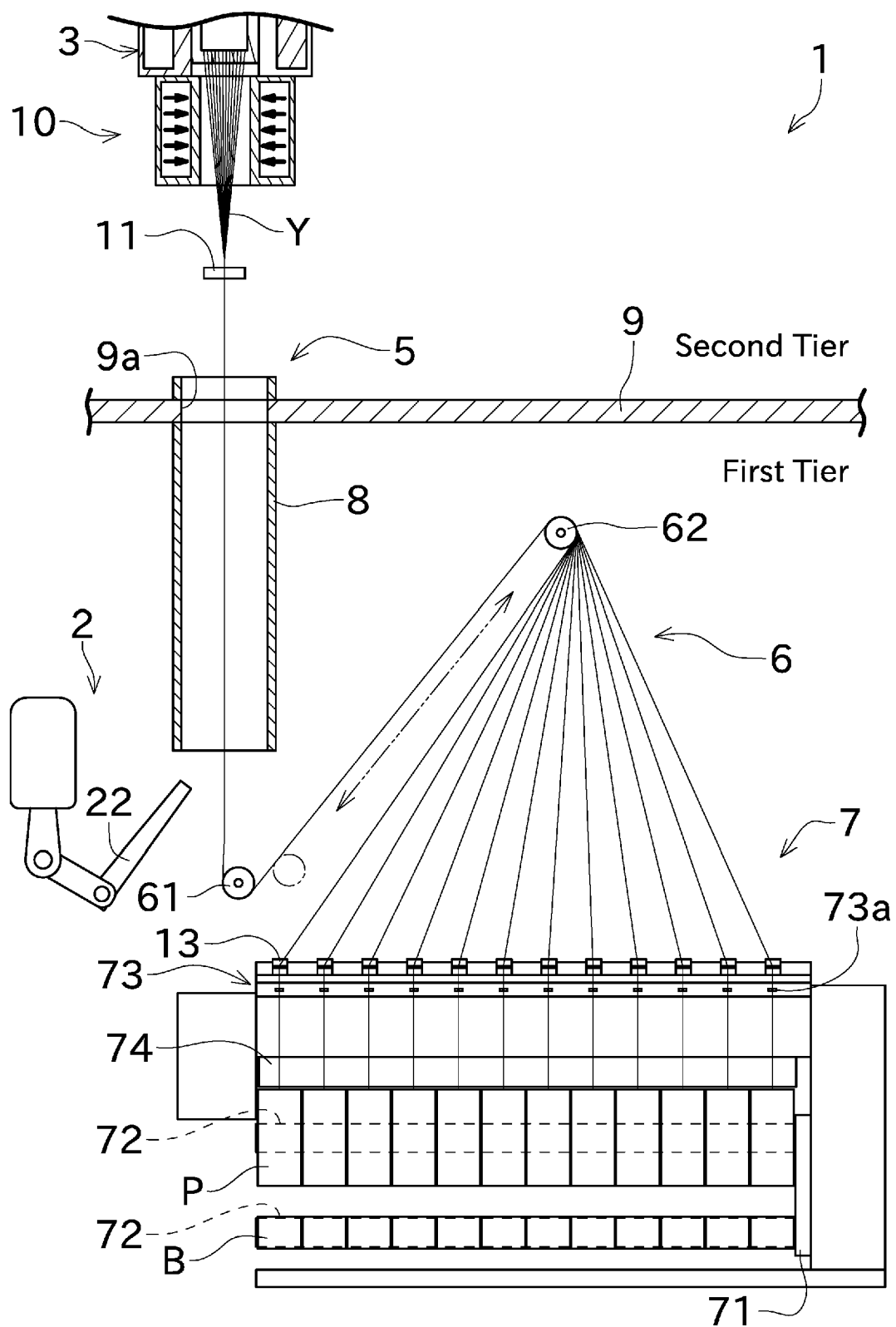


FIG. 2

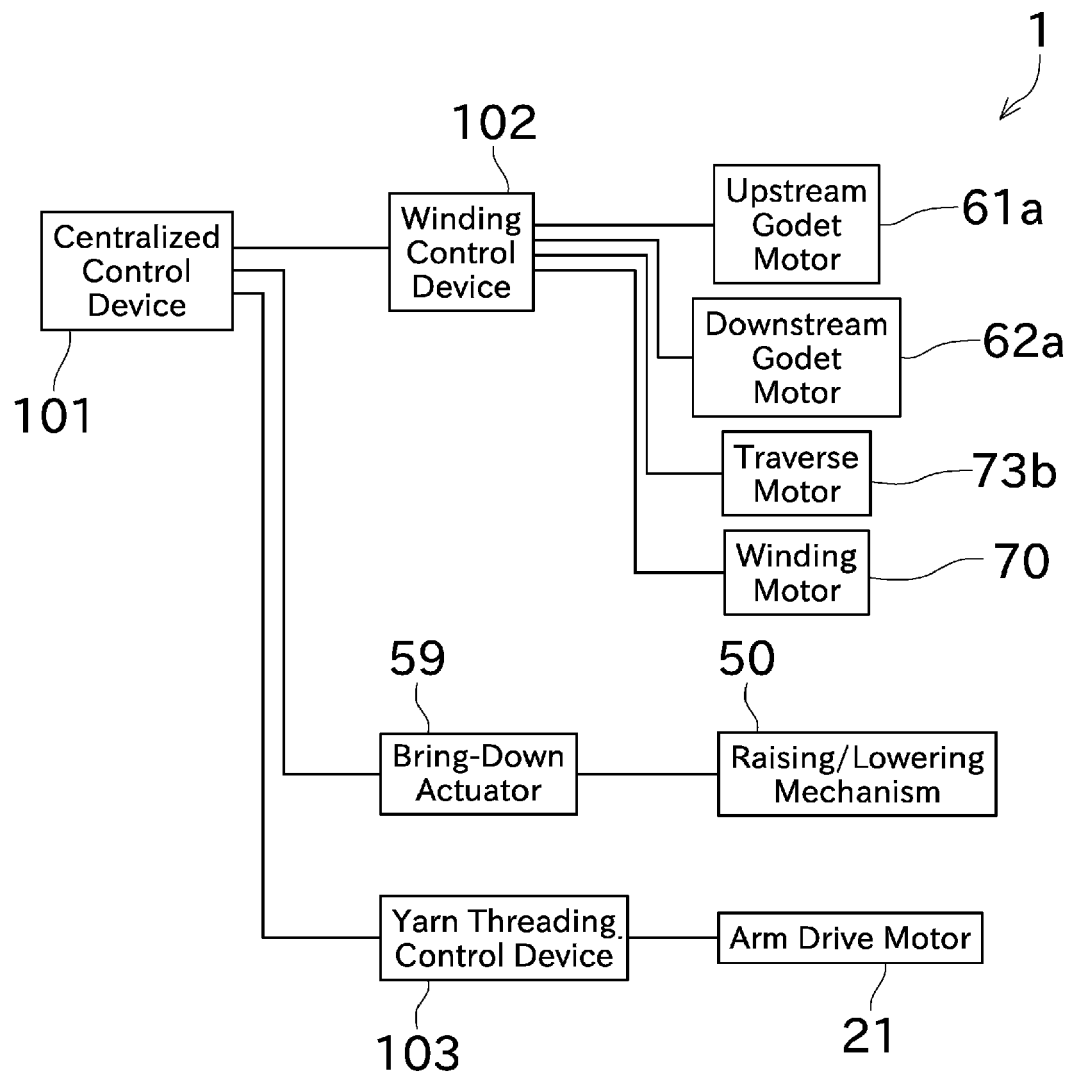


FIG. 3

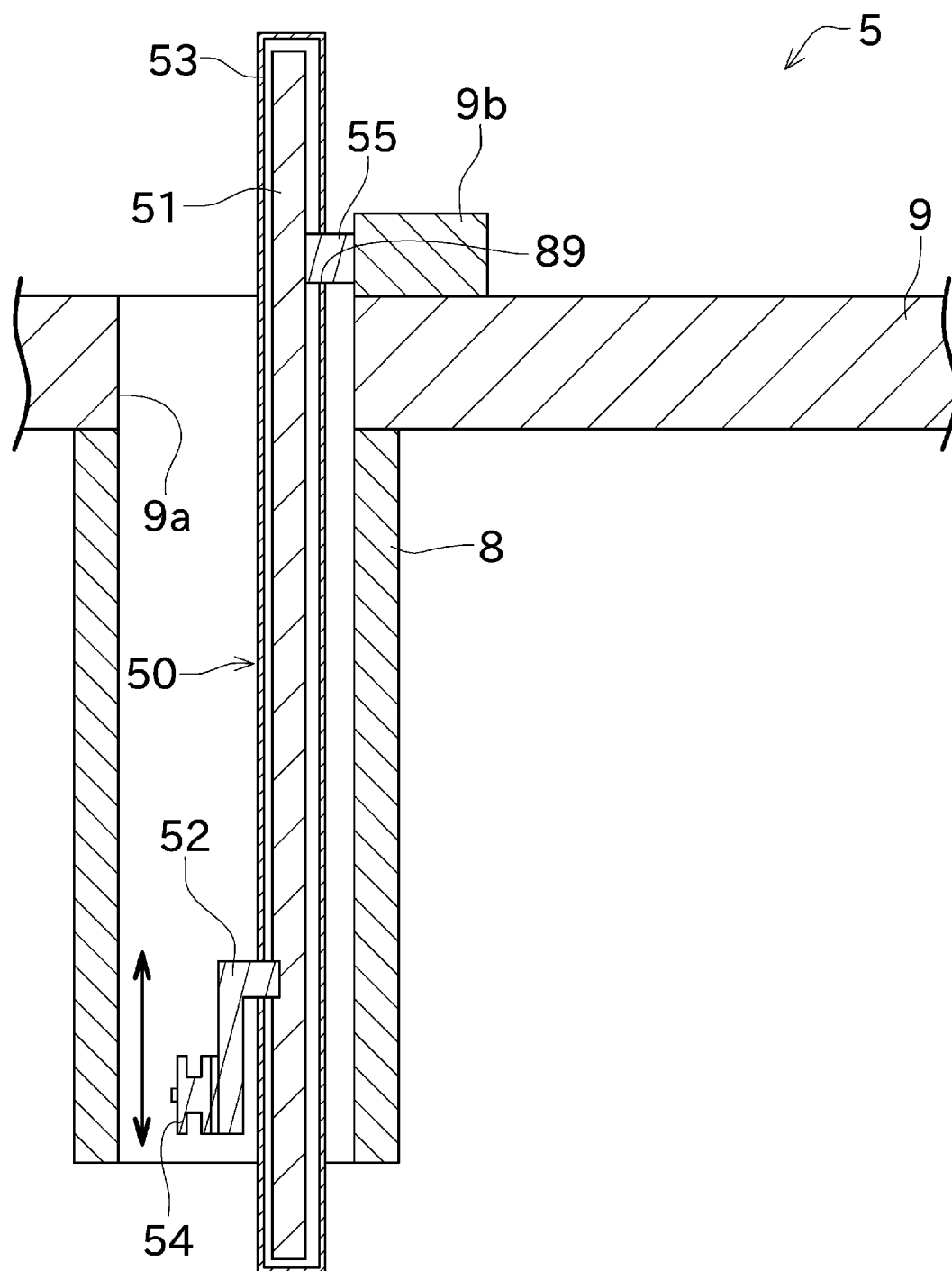


FIG. 4

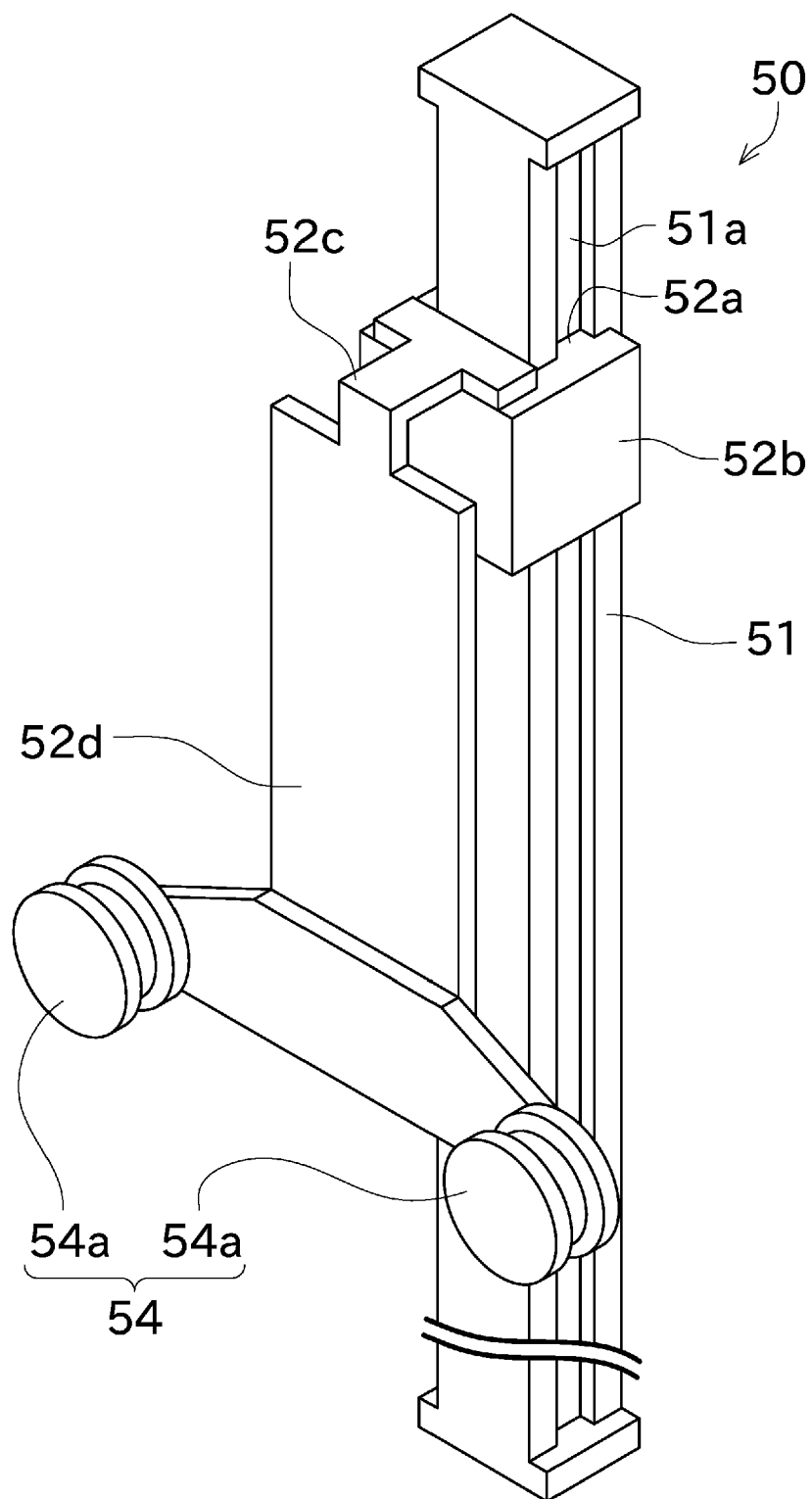


FIG. 5

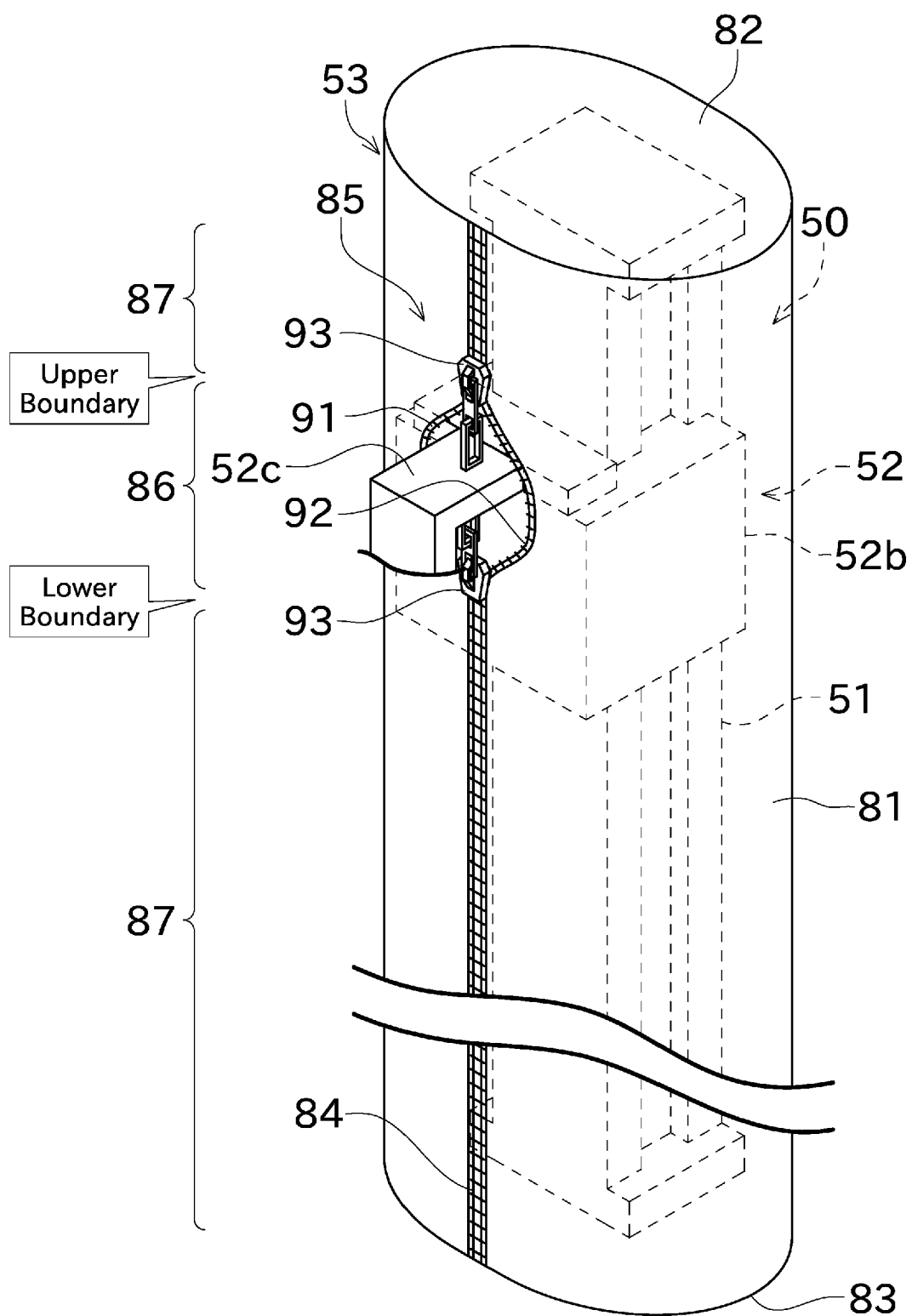
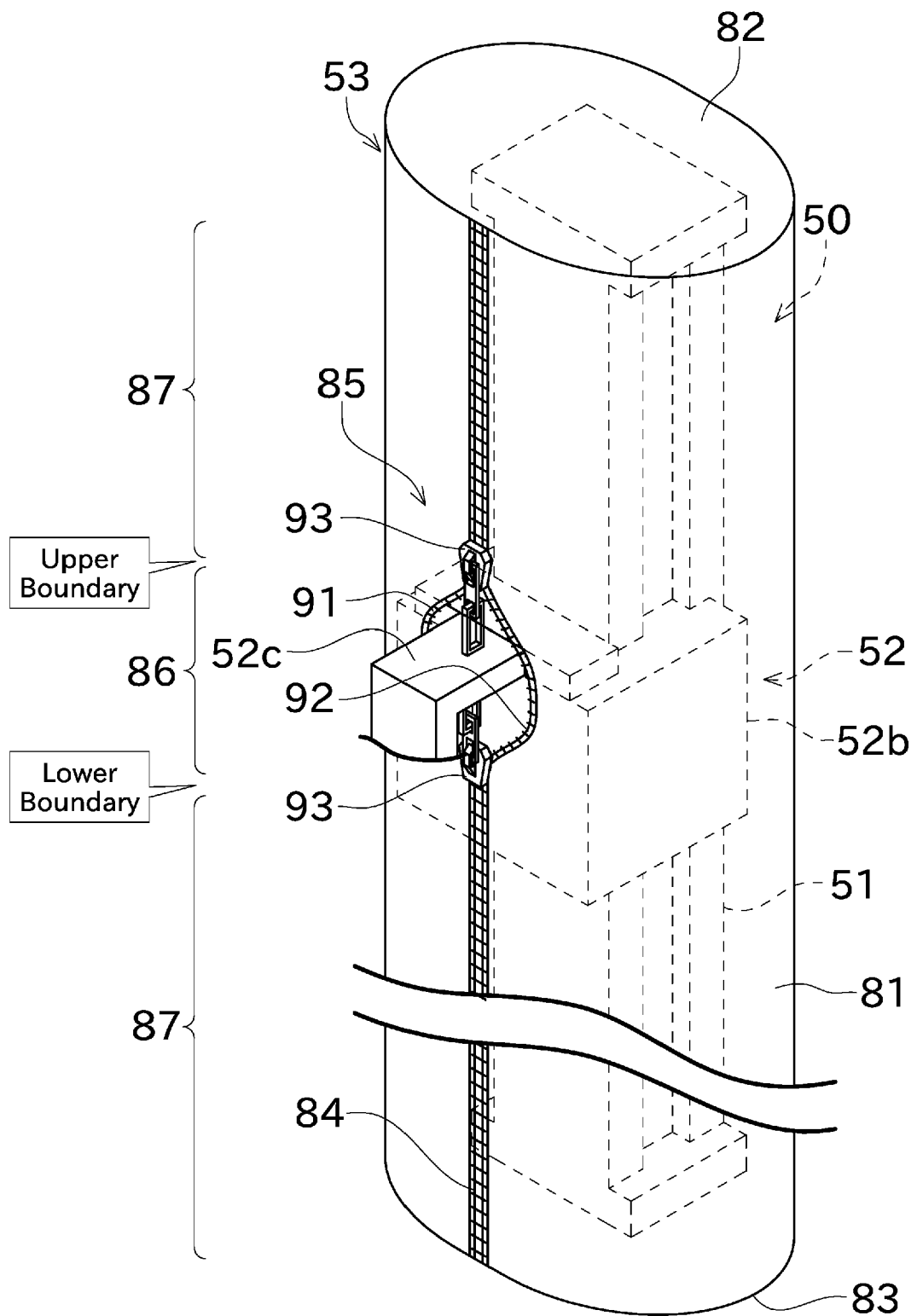


FIG. 6





EUROPEAN SEARCH REPORT

Application Number

EP 24 19 2044

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The Hague		14 January 2025	Pussemier, Bart
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