



(11)

EP 4 155 437 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.03.2023 Bulletin 2023/13

(51) International Patent Classification (IPC):
D01D 13/02 ^(2006.01) **D01D 5/096** ^(2006.01)

(21) Application number: **22197032.0**

(52) Cooperative Patent Classification (CPC):
D01D 13/02; D01D 5/096

(22) Date of filing: **22.09.2022**

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

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(30) Priority: **28.09.2021 JP 2021157593**
09.03.2022 JP 2022036278

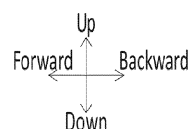
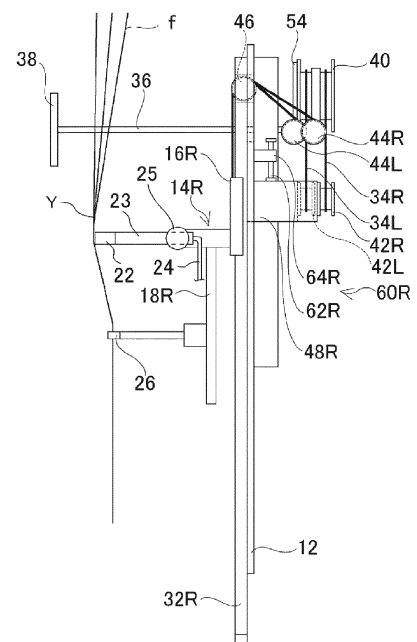
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(54) SPINNING SYSTEM

(57) A spinning system capable of causing an oil-agent application unit to move up and down favorably despite its simple configuration is provided. Such a spinning system comprises: a spinning unit configured to allow a plurality of yarns to be spun downward through a plurality of spinnerets, respectively; an oil-agent application unit 20 arranged below the spinning unit including a plurality of oil supply guides 22 for supplying oil agent to the plurality of yarns Y spun through the plurality of spinnerets, respectively; a support member 14L, 14R for supporting the plurality of oil supply guides 22; and a lifting up and down unit 30 configured to cause the oil-agent application unit 20 to move up and down with respect to the spinning unit. The lifting up and down unit 30 includes at least two wires 34L, 34R connected to the support member 14L, 14R at two or more positions so as to support the support member 14L, 14R from an upward side; and a handle 38 for causing the support member 14L, 14R connected with the at least two wires 34L, 34R to move up and down.

FIG. 3



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DescriptionBACKGROUND OF THE INVENTION

5 FIELD OF THE INVENTION

[0001] The present invention relates to a spinning system.

DESCRIPTION OF THE BACKGROUND ART

10 [0002] The spinning system includes a spinning unit configured to spin a plurality of yarns made of molten polymer. The spinning unit includes a plurality of spinning packs having spinnerets at their respective lower ends. Yarns spun through the spinnerets are cooled by a cooling unit. Oil agent is applied through an oil supply guide of an oil-agent application unit.

15 [0003] For such a type of spinning system, there has been well known that a distance from the spinneret to the oil supply guide is changed by causing the oil-agent application unit to move up and down in accordance with a yarn type. Patent Document 1, e.g., discloses a technique of an apparatus capable of lifting up and down an oil-supply nozzle apparatus for discharging a measured amount of oil thereby to apply oil agent to thread lines of molten spun yarns so as to change a height at which oil is supplied. There is disclosed, in Patent Document 1, the technique that: a bracket
20 is arranged securely to a bearing of a ball screw so as to rotate the ball screw via a motor, gear, and chain in a forward or reverse orientation as a result of the controlled rotation of the motor; and thereby, the oil-supply nozzle apparatus for discharging the measured amount of oil can be selectively caused to move up or down.

(Prior Art Documents)

25 (Patent Documents)

[0004] Patent Document 1: Japanese Patent Application Publication No. 2003-013323

30 (Problems to be Solved)

[0005] In the technique disclosed in Patent Document 1, however, the rotation of the motor in a forward or reverse orientation has been controlled by a controller, which has needed a large-scaled oil-supply nozzle apparatus for discharging the measured amount of oil serving as the oil-agent application unit, and has also caused the risk of a high cost.

35 SUMMARY OF THE INVENTION

[0006] The present invention has been made in view of the above-described technical problems. It is the objective of the present invention to provide a spinning system capable of causing an oil-agent application unit to move up and down favorably despite its simple configuration.

(Means for Solving Problems)

45 [0007] A first aspect of the present invention is a spinning system comprising:

a spinning unit configured to allow a plurality of yarns to be spun downward through a plurality of spinnerets, respectively;
an oil-agent application unit arranged below the spinning unit including a plurality of oil supply guides for applying oil agent to the plurality of yarns spun through the plurality of spinnerets, respectively;
50 a support member for supporting the plurality of oil supply guides; and
a lifting up and down unit configured to cause the oil-agent application unit to move up and down with respect to the spinning unit, wherein
the lifting up and down unit includes
at least two wires connected to the support member at two or more positions of the support member so as to support
55 the support member from an upward side, and
an operation section operable of causing the support member connected with the at least two wires to move up and down.

[0008] According to the above-described first aspect of the spinning system, the oil-agent application unit can be caused to move up and down by a simple configuration configured merely to lift up and down wires connected to the support member. Further, the support member connected with wires at two or more positions thereof enables the plurality of oil supply guides to move up and down while maintaining a good balance in comparison with a case of the support member connected with a wire at one position.

[0009] A second aspect of the present invention is the spinning system characterized more preferably in that

the lifting up and down unit further includes

a winding member for winding up in part or as a whole the at least two wires through rotation so as to cause the support member connected with the at least two wires to move up and down, and

a lock mechanism for locking the rotation of the winding member.

[0010] According to the above-described second aspect of the spinning system, the wire can be set at an arbitrary position, which is more preferred. In particular, there is a case where the oil-agent application unit should be caused to move up and down not only for a purpose of changing a yarn type but also for other purposes than changing the yarn type. In such a case, a range within which the oil-agent application unit is caused to move up and down is narrower in comparison with a range of movement for the purpose of changing the yarn type. In this regard, the above configuration enabling the wire to be set at an arbitrary position is applicable to a request that the oil-agent application unit should move up and down in a small amount.

[0011] A third aspect of the present invention is the spinning system characterized more preferably in that the operation section is configured such that the winding member can be rotated by operating the operation section at a location within a range of 1 m separated forward from the oil-agent application unit.

[0012] According to the above-described third aspect of the spinning system, one can operate the operation section at a location separated away from the oil-agent application unit while confirming a travel distance of the oil-agent application unit in an up-and-down direction, which is more preferred. As a result, even during the operation of the spinning system, the oil-agent application unit can be caused to move up and down without stopping the operation of the spinning system. The "location within a range of 1 m separated forward from" the oil-agent application unit may be any location at which an operator can operate the operation section while confirming a travel distance of the oil-agent application unit in an up-and-down direction.

[0013] A fourth aspect of the present invention is the spinning system characterized more preferably in that

the lock mechanism is a worm gearing having a worm and a worm wheel, wherein

the operation section is configured such that a bar-like member, which is the same in axis direction as the worm, coupled to the worm can be rotated, and wherein

the winding member is configured such that the winding member is rotated coaxially with the worm wheel.

[0014] According to the above-described fourth aspect of the spinning system, when the bar-like member is rotated by operating the operation section, the worm is rotated, which is more preferred. As a result, the worm can be rotated, and thereby, the worm wheel can be rotated, and further thereby, the winding member can be rotated coaxially with the worm wheel so as to cause the wire to move up and down. The oil-agent application unit can be caused by such a simple configuration to move up and down. Further, through the use of the bar-like member, the operation section can be operated at a location separated away from the oil-agent application unit even during the operation of the spinning system.

[0015] A fifth aspect of the present invention is the spinning system characterized more preferably in that

the support member has a first connection section connected with one wire of at least two wires and a second connection section connected with another wire different from the one wire, and wherein

the lifting up and down unit further includes

a first sheave for winding the one wire connected to the first connection section so as to apply tension to the one wire,

a second sheave for winding the another wire connected to the second connection section so as to apply tension to the another wire, and

a tension adjuster for changing a position of at least one of the first sheave and the second sheave.

[0016] According to the above-described fifth aspect of the spinning system, a position of at least one of the first sheave and the second sheave can be changed so as to change tension applied to at least one of the one wire and the another wire, which is more preferred. As a result, height positions of the support member for supporting the plurality of oil supply guides along a left-and-right direction can be adjusted, and thereby, distances from the plurality of spinnerets to the plurality of oil supply guides can be rendered substantially uniform without causing any deviation among the plurality of oil supply guides in a left-and-right direction.

[0017] A sixth aspect of the present invention is the spinning system characterized more preferably in that

the support member has a first connection section connected with one wire of at least two wires and a second connection section connected with another wire different from the one wire, and wherein
 5 the lifting up and down unit further includes
 a first outer-fit member interposed between the first connection section and the winding member so as to have the one wire fit into the first outer-fit member; and
 a second outer-fit member interposed between the second connection section and the winding member so as to have the another wire fit into the second outer-fit member.

[0018] According to the above-described sixth aspect of the spinning system, the oil-agent application unit can be caused, by a simple structure having a reduced number of components, to move up and down thereby resulting not only in a reduced cost but also in a suppressed breakage of the oil-agent application unit having such components. Further, one wire and another wire are fit into the first outer-fit member and the second outer-fit member, respectively, without,
 15 e.g., providing a member such as a sheave. As a result, the lifting up and down unit can easily be installed on a spinning system even in a case where, e.g., an installation site is limited to an existing spinning system.

[0019] A seventh aspect of the present invention is the spinning system characterized more preferably in that the first outer-fit member and the second outer-fit member are arranged such that the one wire and the another wire are connected in a substantially vertical direction to the support member, respectively.

[0020] According to the above-described seventh aspect of the spinning system, the one wire and the another wire are connected in a substantially vertical direction to the support member, respectively, and thereby, the oil-agent application unit can be caused to move up and down smoothly via the support member. When causing the oil-agent application unit to move up in particular, the dispersion of a required force can be suppressed, and therefore, the oil-agent application unit can be caused efficiently to move up.

[0021] A eighth aspect of the present invention is the spinning system characterized more preferably by further comprising wherein

a tension adjuster capable of changing tension of at least one of the one wire and the another wire.

[0022] According to the above-described eighth aspect of the spinning system, tension of at least one of the one wire and the another wire can be changed, which is more preferred. As a result, the oil-agent application unit can be caused
 30 by a simple configuration to move up and down while distances from their respective spinnerets to oil supply guides can be rendered substantially the same as one another without causing any deviation from among the plurality of oil supply guides arranged in a left-and-right direction.

[0023] A ninth aspect of the present invention is the spinning system characterized more preferably in that

35 the plurality of oil supply guides are arranged in one direction in a regular manner when seen in a predetermined direction,

the support member can support the plurality of oil supply guides arranged in the one direction in a regular manner, the at least two wires support the support member so as to prevent any deviation from a weight balance in the one direction.

[0024] According to the above-described ninth aspect of the spinning system, the support member supporting the plurality of oil supply guides is supported by at least two wires so that any deviation from a weight balance in one direction can be prevented, which is more preferred. In such a manner, distances from their respective spinnerets to oil supply guides can be rendered substantially the same as one another without causing any deviation from among the plurality
 45 of oil supply guides arranged in a left-and-right direction.

[0025] The spinning system according to the present invention does not necessarily include all the above-described first aspect to ninth aspect. The invention in the above-described first aspect of the spinning system does not need to encompass all the inventions of the above-described second aspect to ninth aspect. Further, the present invention may be obtained as an arbitrary combination of the above-described first aspect of the spinning system and a part or the entirety of the above-described second aspect to ninth aspect to such an extent that consistency can be achieved. The spinning system according to the present invention may be obtained as a combination of, e.g., the above-described first aspect of the spinning system and the above-described second aspect. The spinning system according to the present invention may be obtained as a combination of, e.g., the above-described first aspect of the spinning system, the above-described second aspect, and the above-described sixth aspect. Combining the above-described fifth aspect with any
 55 of the above-described sixth aspect to eighth aspect, however, falls beyond such an extent that consistency can be achieved. For this reason, such a combination should not provide any spinning system according to the present invention.

(Advantageous Effects of the Invention)

[0026] According to the present invention, a spinning system capable of causing an oil-agent application unit to move up and down favorably with a simple configuration can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a schematic view of a spinning system shown as an embodiment.

FIG. 2 is a front view taken schematically of an oil-agent apparatus shown as an embodiment.

FIG. 3 is a right-side view taken schematically of an oil-agent apparatus shown as an embodiment.

FIG. 4 is a rear view taken schematically of an oil-agent apparatus shown as an embodiment.

FIG. 5 is a schematic view of up-and-down movement of an oil-agent application unit shown as an embodiment.

FIG. 6 is a schematic view of a lifting up and down unit shown as a second modified example.

FIG. 7 is a schematic view of an oil-agent apparatus seen from a rear side as an explanatory view of a lifting up and down apparatus shown as a third modified example.

FIG. 8 is a schematic view of a periphery of an opening formed in a base member as an explanatory view of a lifting up and down apparatus shown as a third modified example.

DESCRIPTIONS OF EMBODIMENTS OF THE INVENTION

[0028] The following section will describe an embodiment of the present invention with reference to the drawings. For the convenience of the description, an up-and-down direction, a left-and-right direction, and a forward-and-backward direction are as shown in their respective drawings described later.

[1. Outline of Spinning System]

[0029] First, the following section will describe the outline of a spinning system 1 according to an embodiment of the present invention with reference to FIG. 1. FIG. 1 is a schematic view of a spinning system 1. The spinning system 1 according to an embodiment of the present invention is a system to produce yarns Y made of synthetic fibers. The spinning system 1 includes a spinning unit 2, a cooling unit 3, a slow cooling section (not shown), and an oil-agent apparatus 10.

[0030] The spinning unit 2 is a melt spinning unit configured to spin a plurality of yarns Y made of molten polymer. The spinning unit 2 has a heating cabinet 6 having a substantially rectangular parallelepiped-like shape and a plurality of spinning packs 7 attached to a plurality of pack housings formed in the heating cabinet 6, respectively.

[0031] The plurality of spinning packs 7 are arranged in a left-and-right direction in a staggered manner (*i.e.*, arranged to be alternately shifted in a forward-and-backward direction) (not shown). Each spinning pack 7 receives liquid-like molten polymer (yarn material) having a high temperature supplied from a piping (not shown). The lower end of each spinning pack 7 has a spinneret 8. A plurality of spinnerets 8 have a plurality of nozzles (not shown) for example, respectively. The spinning pack 7 discharges the yarn material through a plurality of nozzles of the spinneret 8, respectively. The yarn material discharged through their respective nozzles is cooled by the cooling unit 3 to produce one yarn Y consisting of a plurality of filaments f. Specifically, one yarn Y is spun through one spinneret 8. Each spinneret 8 does not necessarily have to include a plurality of nozzles and also may have only one nozzle. In this case, the yarn Y is generated as a monofilament yarn.

[0032] The cooling unit 3 is arranged below the spinning unit 2 and allows the yarn material discharged through a plurality of spinnerets 8 to be cooled and solidified by cooling air. The cooling unit 3 is configured such that it can be caused by an air cylinder (not shown) for example to move up and down. When the operation of the spinning system 1 is stopped to perform a service operation to the spinneret 8 and the like, for example, the cooling unit 3 is caused to move down by an air cylinder (not shown) for example.

[0033] Although not shown, the slow cooling section is arranged in an up-and-down direction between the spinning unit 2 and the cooling unit 3. The slow cooling section is configured so as to slowly cool (slow cooling) the yarn material while the yarn material discharged through the spinning unit 2 is being cooled by the cooling unit 3.

[0034] The oil-agent apparatus 10 is arranged below the cooling unit 3 and includes an oil-agent application unit 20 including a plurality of oil supply guides 22 for supplying oil agent to a plurality of yarns spun through a plurality of spinnerets 8. In this embodiment, this oil-agent application unit 20 can be caused to move up and down with respect to the spinning unit 2.

[2. Detailed Configuration of Oil-agent Apparatus]

[0035] Next, the following section will describe the detailed configuration of the oil-agent apparatus 10. FIG. 2 is a front view taken schematically of an oil-agent apparatus 10. FIG. 3 is a right-side view taken schematically of an oil-agent apparatus 10. FIG. 4 is a rear view taken schematically of an oil-agent apparatus 10.

[0036] When a left-and-right direction is herein referred to with reference to FIG. 4, a base direction is assumed to be seen in a front view. Specifically, since FIG. 4 is seen in a rear view, a left side on a sheet of FIG. 4 will be described as a right side, and a right side on a sheet of FIG. 4 will be described as a left side.

[0037] As shown in FIG. 2 to FIG. 4, the oil-agent apparatus 10 mainly includes: a base member 12 consisting of a rectangular plate-like member; the oil-agent application unit 20; support members 14L and 14R for supporting the oil-agent application unit 20; and an lifting up and down unit 30 for causing the support members 14L and 14R to move up and down with respect to the base member 12. So long as a spatial relation is maintained between the spinning unit 2 and the base member 12, the support members 14L and 14R can be caused to move up and down with respect to the base member 12 to thereby allow the oil-agent application unit 20 supported by the support members 14L and 14R to be caused to move up and down with respect to the spinning unit 2.

[0038] It is to be noted that the support member 14L is a member arranged so as to correspond to a rail 32L (which will be described later). The support member 14R is a member arranged so as to correspond to a rail 32R (which will be described later).

[2-1. Oil-agent application unit]

[0039] The oil-agent application unit 20 is supported by the support members 14L and 14R at a forward side with respect to the base member 12. The oil-agent application unit 20 includes a plurality of oil supply guides 22 (or 32 oil supply guides 22 for example in this embodiment); a plurality of oil supply tubes 24 (or 32 oil supply tubes 24 for example in this embodiment) corresponding to their respective oil supply guides 22; and a plurality of yarn regulating guides 26 (or 32 yarn regulating guides 26 for example in this embodiment). The oil-agent application unit 20 also includes a plurality of support bars 23 (or 32 support bars 23 for example in this embodiment) for supporting their respective oil supply guides 22; a support bracket 25 for supporting the plurality of support bars 23 in a left-and-right direction as a longitudinal direction; and an oil droplet collection holder and an oil droplet collection holder support bracket (any of which is not shown) and the like.

[0040] The plurality of oil supply guides 22 are arranged immediately below the cooling unit 3 (see FIG. 1). Their respective oil supply guides 22 correspond to a plurality of spinning packs 7 (see FIG. 1), respectively to have a one-to-one relation therebetween. Their respective oil supply guides 22 are configured to supply oil agent to the yarn Y downwardly spun from the corresponding spinning pack 7 among a plurality of spinning packs 7 (see FIG. 1). The plurality of oil supply guides 22 are arranged in a regular manner so that the oil supply guides 22 form one line in a left-and-right direction when seen in a front view from a forward side, and are arranged in a staggered manner in a forward-and-backward direction when seen in a planar view from an upward side.

[0041] The plurality of oil supply tubes 24 are connected to their respective oil supply guides 22 via their respective support bars 23. The oil supply tube 24 are configured by a hose for example and can supply oil agent to the corresponding oil supply guide 22 via the support bar 23.

[0042] A plurality of yarn regulating guides 26 are used to define the yarn routes of the yarn Y having thereon the oil agent supplied from the plurality of oil supply guides 22, respectively. The yarn regulating guides 26 correspond to the plurality of oil supply guides 22, respectively. As in the plurality of oil supply guides 22, the plurality of yarn regulating guides 26 are arranged in a regular manner so that the yarn regulating guides 26 form one line in a left-and-right direction when seen in a front view from a forward side, and are arranged in a staggered manner in a forward-and-backward direction when seen in a planar view from an upward side.

[2-2. Support member]

[0043] The support members 14L and 14R mainly support the support bracket 25 and a plurality of yarn regulating guides 26. The support bracket 25 supports the support bar 23 as described above and supports, via this support bar 23, the plurality of oil supply guides 22 and a plurality of oil supply tubes 24 connected to their respective oil supply guides 22. The support members 14L and 14R support, at two positions of symmetrical parts in a left-and-right direction when seen in a front view from a forward side, the support bracket 25 and a plurality of yarn regulating guides 26 in a balanced manner in a left-and-right direction so as to prevent the oil-agent application unit 20 from being inclined upward or downward with respect to a substantially horizontal left-and-right direction.

[0044] The support member 14L includes: a sliding section 16L movable in an up-and-down direction with respect to the rail 32L (which will be described later); and a coupling section 18L coupled to the oil-agent application unit 20 to

support the oil-agent application unit 20. The up-and-down move of the sliding section 16L causes the proportional movement of the coupling section 18L in an up-and-down direction.

[0045] Similarly, a support member 14R includes: a sliding section 16R movable in an up-and-down direction with respect to the rail 32R (which will be described later); and a coupling section 18R coupled to the oil-agent application unit 20 so as to support the oil-agent application unit 20. The up-and-down move of the sliding section 16R causes the proportional move of the coupling section 18R in an up-and-down direction.

[2-3. Lifting up and down unit]

[0046] The lifting up and down unit 30 mainly includes: the rails 32L and 32R (see FIG. 2); wires 34L and 34R (see FIG. 2 to FIG. 4); a winch 40 (see FIG. 3 and FIG. 4); A sheaves 42L and 42R, B sheaves 44L and 44R, and C sheaves 46L and 46R (see FIG. 4 for their respective ones); a power transmission shaft 36 operated by an operator to transmit power to the winch 40 (see FIG. 3 and FIG. 4); a worm gearing 50; and tension adjusters 60L and 60R.

[0047] The wire 34L, the A sheave 42L, the B sheave 44L, the C sheave 46L, and the tension adjuster 60L are members arranged so as to correspond to the rail 32L. The wire 34R, the A sheave 42R, the B sheave 44R, the C sheave 46R, and the tension adjuster 60R are members arranged so as to correspond to the rail 32R.

[0048] It is to be noted that "the wires 34L and 34R" correspond to the "two wires" of the present invention and the "wire 34L" and the "wire 34R" correspond to the "one wire" and "another wire" of the present invention, respectively. Specifically, when the "wire 34L" corresponds to the "one wire" of the present invention, the "wire 34R" corresponds to "another wire" of the present invention. When the "wire 34R" corresponds to the "one wire" of the present invention, the "wire 34L" corresponds to "another wire" of the present invention. The "winch 40" corresponds to the "winding member" of the present invention.

[Rail]

[0049] As shown in FIG. 2 and FIG. 3, the rails 32L and 32R are fixed to the front-side face of the base member 12 so that a substantially vertical direction is in a longitudinal direction. The rail 32L and the rail 32R are fixed to the base member 12 so as to be symmetrical in a left-and-right direction.

[0050] The rails 32L and 32R have the above-described sliding sections 16L and 16R slidably arranged in an up-and-down direction. The sliding sections 16L and 16R are slid with respect to the rails 32L and 32R so that the sliding sections 16L and 16R can be caused to move up and down with respect to the base member 12 in a substantially vertical direction (*i.e.*, in an up-and-down direction). The front face side of the rails 32L and 32R has a 1 mm scale to show a travel distance in an up-and-down direction.

[Wire]

[0051] The wires 34L and 34R are respectively connected to the upper ends of the sliding sections 16L and 16R so that the sliding sections 16L and 16R are upwardly supported (or suspended) at a forward side with respect to the base member 12.

[0052] The terms "a part at which the wire 34L and the sliding section 16L are connected" and "a part at which the wire 34R and the sliding section 16R are connected" correspond to "the first connection section" or "the second connection section" of the present invention. Specifically, when the "wire 34L" corresponds to the "one wire" of the present invention, "a part at which the wire 34L and the sliding section 16L are connected" corresponds to "the first connection section" and "a part at which the wire 34R and the sliding section 16R are connected" corresponds to "the second connection section". When the "wire 34R" corresponds to the "one wire" of the present invention, then "a part at which the wire 34R and the sliding section 16R are connected" corresponds to "the first connection section" and "a part at which the wire 34L and the sliding section 16L are connected" corresponds to "the second connection section".

[Winch]

[0053] As shown in FIG. 3 and FIG. 4, the winch 40 is arranged at the rear side of the base member 12. The winch 40 is a 2 wire type (see FIG. 3) around which the wire 34L and the wire 34R are wound, respectively. The winch 40 applies tension to the wires 34L and 34R to thereby move, in an up-and-down direction, the sliding sections 16L and 16R connected with the wires 34L and 34R (see FIG. 3 but see FIG. 2 for the sliding section 16L) along the rails 32L and 32R (see FIG. 3 but see FIG. 2 for the rail 32L) or to retain the position in an up-and-down direction. Specifically, the winch 40 allows the oil-agent application unit 20 supported by the coupling sections 18L and 18R via the sliding sections 16L and 16R to move in an up-and-down direction. The winch 40 is arranged so as to be rotatable in a direction substantially orthogonal to the plane of the base member 12 (*i.e.*, a substantially horizontal forward-and-backward

direction) as a rotation center. The winch 40 is arranged at an upward left side at a rear side of the base member 12 and outputs the wires 34L and 34R in a direction toward a right-oblique downward direction.

[A Sheave]

[0054] As shown in FIG. 3 and FIG. 4, the A sheaves 42L and 42R are arranged between the winch 40 and the sliding sections 16L and 16R, respectively. The A sheaves 42L and 42R can wind the wires 34L and 34R to apply tension thereto and can change directions of the wires 34L and 34R. The A sheaves 42L and 42R are arranged so as to be rotatable in a direction substantially orthogonal to the plane of the base member 12 (*i.e.*, a substantially horizontal forward-and-backward direction) as a rotation center.

[0055] As shown in FIG. 4, the A sheaves 42L and 42R are arranged at the rear side of the base member 12 and at a downward right side of the winch 40. The A sheaves 42L and 42R have a similar rotation axis direction as in the winch 40 and is arranged so as to be rotatable in a direction substantially orthogonal to the plane of the base member 12 (*i.e.*, a substantially horizontal forward-and-backward direction) as a rotation center. The A sheave 42L and the A sheave 42R are arranged at substantially the same height position. The tension adjusters 60L and 60R (which will be described later) allow their respective A sheaves 42L and 42R to be moved in the up-and-down direction. The A sheaves 42L and 42R change a direction of the wires 34L and 34R outputted from the winch 40 from a direction toward a right-oblique downward direction to a direction toward an upward direction.

[0056] The terms "A sheave 42L" and "A sheave 42R" correspond to "the first sheave" or "the second sheave" of the present invention, respectively. Specifically, when the "wire 34L" correspond to the "one wire" of the present invention, the "A sheave 42L" corresponds to "the first sheave" and the "A sheave 42R" corresponds to "the second sheave". When the "wire 34R" corresponds to the "one wire" of the present invention, the "A sheave 42R" corresponds to "the first sheave" and the "A sheave 42L" corresponds to "the second sheave".

[B sheave]

[0057] As shown in FIG. 3 and FIG. 4, the B sheaves 44L and 44R are arranged between the A sheaves 42L and 42R and the sliding sections 16L and 16R, respectively. The B sheaves 44L and 44R can wind the wires 34L and 34R to apply tension thereto and can change directions of the wires 34L and 34R. The B sheaves 44L and 44R are arranged immediately above the A sheaves 42L and 42R at the rear side of the base member 12, respectively. The B sheave 44L and the B sheave 44R are arranged at substantially the same height position. The B sheaves 44L and 44R are placed so as to be rotatable in a substantially horizontal left-and-right direction as a rotation center. The B sheaves 44L and 44R change a direction of the wires 34L and 34R outputted from the A sheaves 42L and 42R from a direction toward an upward direction to a direction toward a forward-oblique upward direction (see FIG. 3).

[C Sheave]

[0058] As shown in FIG. 3 and FIG. 4, the C sheaves 46L and 46R are arranged between the B sheaves 44L and 44R and the sliding sections 16L and 16R, respectively. The C sheaves 46L and 46R can wind the wires 34L and 34R to apply tension thereto and can change a direction of the wires 34L and 34R. The C sheaves 46L and 46R are arranged in holes formed at a forward-oblique upward direction from the B sheaves 44L and 44R so as to extend over the base member 12 and the rails 32L and 32R, respectively. The C sheaves 46L and 46R are arranged, as in the B sheaves 44L and 44R, so as to be rotatable around a substantially horizontal left-and-right direction as a rotation center. The C sheaves 46L and 46R change a direction of the wires 34L and 34R outputted from the B sheaves 44L and 44R from a direction toward a forward-oblique upward direction to a direction toward a downward direction (see FIG. 2 and FIG. 3).

[Power transmission shaft]

[0059] As shown in FIG. 3 and FIG. 4, the power transmission shaft 36 is a longitudinal bar-like member having a direction substantially orthogonal to the plane of the base member 12 (*i.e.*, a substantially horizontal forward-and-backward direction) as an axial direction and penetrating through the base member 12. The power transmission shaft 36 has, at a front tip end thereof, a handle 38 operable by an operator (see FIG. 2 and FIG. 3). When the handle 38 is rotated in a direction shown by the rail circular arc arrow in FIG. 2, the power transmission shaft 36 is rotated in an axial direction as a rotation center. The term "handle 38" corresponds to the "operation section" of the present invention.

[Worm gearing]

[0060] As shown in FIG. 4, the power transmission shaft 36 and the winch 40 have therebetween the worm gearing

50. The worm gearing 50 has a worm (screw gear) 52 and a worm wheel (helical gear) 54 screwed with this worm 52. The worm 52 is coupled to a rear tip end of the power transmission shaft 36 so as to be coaxial with the power transmission shaft 36. When the power transmission shaft 36 is rotated in an axial direction as a rotation center, the worm 52 is rotated coaxially with the power transmission shaft 36. The worm wheel 54 is coaxial with the winch 40 and is integrated with the winch 40. Thus, the rotation of the worm wheel 54 causes the rotation of the winch 40.

[0061] The worm gearing 50 of this embodiment has a self-locking function to suppress the rotating force from being transmitted from the worm wheel 54 side to the worm 52 side. This self-locking function can prevent a situation where the winch 40 is undesirably rotated due to the gravitation from the oil-agent application unit 20 even when no operation is performed through the handle 38. The term "worm gearing 50" corresponds to the "lock mechanism" of the present invention.

[Tension adjuster]

[0062] [2-4. Tension adjuster] As shown in FIG. 3 and FIG. 4, the tension adjusters 60L and 60R are arranged at the rear side of the base member 12 to correspond to the A sheaves 42L and 42R, respectively. The tension adjusters 60L and 60R can allow the A sheaves 42L and 42R to move in an up-and-down direction to thereby adjust the tension applied to the wires 34L and 34R, respectively. The tension adjusters 60L and 60R can allow the A sheaves 42L and 42R in an up-and-down direction to thereby adjust the tension applied to their respective wires 34L and 34R in an independent manner.

[0063] The tension adjusters 60L and 60R include bolts 62L and 62R and fixed blocks 64L and 64R, respectively. The fixed blocks 64L and 64R are attached to a plane at the rear side of the base member 12 in a fixed manner. The fixed blocks 64L and 64R have female screws screwed with the bolts 62L and 62R. The tension adjusters 60L and 60R are arranged so that lower ends of the bolts 62L and 62R are abutted to the upper face of brackets 48L and 48R. The brackets 48L and 48R are arranged so as to be movable in an up-and-down direction with respect to the base member 12. The brackets 48L and 48R support the A sheaves 42L and 42R, respectively.

[0064] When the bolts 62L and 62R are turned, the bolts 62L and 62R are moved in an upward or downward direction with respect to the fixed blocks 64L and 64R. The limit of position of the brackets 48L and 48R in an upward direction is determined by positions of the lower ends of the bolts 62L and 62R in an up-and-down direction. Thus, when the bolts 62L and 62R are moved in a downward direction with respect to the fixed blocks 64L and 64R, the tension applied to the wires 34L and 34R can be increased when compared with a timing prior to the move of the bolts 62L and 62R. On the other hand, when the bolts 62L and 62R are moved in an upward direction with respect to the fixed blocks 64L and 64R, tension applied to the wires 34L and 34R can be decreased when compared with a timing prior to the move of the bolts 62L and 62R. In this manner, the tension adjusters 60L and 60R can adjust positions of the lower ends of the bolts 62L and 62R in an up-and-down direction to thereby adjust the tension applied to the wires 34L and 34R. As a result, the plurality of oil supply guides 22 arranged in a left-and-right direction can have an adjusted balance in a left-and-right direction and thus can be prevented from being inclined upward or downward with respect to a substantially horizontal left-and-right direction. Furthermore, the sliding sections 16L and 16R can be smoothly slid with respect to the rails 32L and 32R. Thus, the plurality of oil supply guides 22 arranged in a left-and-right direction can both have a substantially fixed distance from the spinneret 8 (see FIG. 1) to the oil supply guide 22, thus contributing to a stable quality.

[0065] In this embodiment, the tension adjuster 60L and the tension adjuster 60R are arranged so that the A sheave 42L and the A sheave 42R can be both moved in an up-and-down direction. However, the invention is not limited to this. For example, only any one of the tension adjuster 60L and the tension adjuster 60R may be arranged. When at least any one of the A sheave 42L and the A sheave 42R can be moved in an up-and-down direction, the plurality of oil supply guides 22 arranged in a left-and-right direction can have an adjusted balance in a left-and-right direction and thus can be prevented from being inclined upward or downward in any one of the left or right side.

[3. Function of Lifting Up and Down Unit]

[0066] The following section will describe the action of the lifting up and down unit 30 with reference to FIG. 2 to FIG. 5. FIG. 5 is a schematic view of up-and-down movement of an oil-agent application unit 20. In FIG. 5, the oil-agent application unit 20 prior to being caused to move down (the oil supply guide 22, the support bracket 25, and the yarn regulating guide 26) is shown by the two-dot chain line and the oil-agent application unit 20 after being caused to move down is shown by the continuous line.

[0067] When the operator desires to change the position of the oil-agent application unit 20 in an up-and-down direction, then operator rotates the handle 38 (see FIG. 2) in a right orientation or in a left orientation. When the handle 38 is rotated, the power transmission shaft 36 (see FIG. 3) is rotated in an axial direction as a rotation center. When the power transmission shaft 36 is rotated in an axial direction as a rotation center, the worm 52 (see FIG. 4) is rotated coaxially with a power transmission shaft 36. The rotation of the worm 52 causes the rotation of the worm wheel 54 (see FIG. 4)

screwed with the worm 52 to thereby cause the rotation of the winch 40.

[0068] When the winch 40 is rotated in a direction around which the wires 34L and 34R are wound, the rotation amount causes the proportional move of the sliding sections 16L and 16R connected with the wires 34L and 34R along the rails 32L and 32R in the upward direction. When the sliding sections 16L and 16R are upwardly moved along the rails 32L and 32R, the oil-agent application unit 20 is upwardly moved (*i.e.*, the oil-agent application unit 20 is moved from the position shown by the continuous line of FIG. 5 to the position shown by the two-dot chain line).

[0069] When the winch 40 is rotation in a direction opposite to a direction in which the wires 34L and 34R are wound on the other hand, the rotation amount causes the proportional move of the sliding sections 16L and 16R connected with the wires 34L and 34R in a downward direction along the rails 32L and 32R. The downward move of the sliding sections 16L and 16R along the rails 32L and 32R causes the downward move of the oil-agent application unit 20 (*i.e.*, the move of the oil-agent application unit 20 from a position shown by the two-dot chain line of FIG. 5 to a position shown by the continuous line).

[4. Effects]

[0070] According to the spinning system 1 of this embodiment, the simple configuration allows the handle 38 to be operated to wind, in an upward or downward direction, the wires 34L and 34R connected to the sliding sections 16L and 16R to thereby cause the oil-agent application unit 20 (the oil supply guide 22 and oil supply tube 24 and the yarn regulating guide 26 and the like supported by the support bracket 25 via the support bracket 25 and the support bar 23) to move up and down. Furthermore, the wire 34L is connected to the sliding section 16L while the wire 34R is connected to the sliding section 16R. Specifically, the wires 34L and 34R connected to the sliding sections 16L and 16R at two left and right positions respectively allow, when compared with a case where the sliding sections and the wires are connected at one position, the oil-agent application unit 20 to be caused to move up and down while having a balance in a left-and-right direction.

[0071] Furthermore, according to the spinning system 1 of this embodiment, the winch 40 can partially or entirely wind the wires 34L and 34R, respectively. How much the wires 34L and 34R are wound by the winch 40 is determined depending on the rotation amount of the winch 40. The power transmission shaft 36 and the winch 40 have therebetween the worm gearing 50 having a self-locking function. Thus, depending on how much the handle 38 is operated (*i.e.*, the rotation amount of the winch 40), the oil-agent application unit 20 can be stopped at an arbitrary position in an up-and-down direction. In particular, there may be a case where the oil-agent application unit 20 is caused to move up and down not only for a purpose of the changing a yarn type but also for other purposes than changing the yarn type. In this case, a range within which the oil-agent application unit 20 is caused to move up and down is narrower in comparison with a range of movement for the purpose of changing the yarn type. In this regard, according to the spinning system 1 of this embodiment, the wires 34L and 34R can be set at an arbitrary position, which is thus applicable to a case where the oil-agent application unit 20 should move up and down in a small amount.

[0072] Furthermore, according to the spinning system 1 of this embodiment, the operation of the handle 38 causes the rotation of the power transmission shaft 36 and this force is transmitted via the worm gearing 50 to the winch 40 to thereby rotate the winch 40. The rotation of the winch 40 causes the oil-agent application unit 20 to move up and down via the sliding sections 16L and 16R connected with the wires 34L and 34R (*i.e.*, the support members 14L and 14R). According to the spinning system 1 of this embodiment, such a simple configuration allows the oil-agent application unit 20 to move up and down. Furthermore, the power transmission shaft 36 is a longitudinal member extending in a direction substantially orthogonal to the plane of the base member 12 and the handle 38 is arranged at a front tip end of the power transmission shaft 36. Thus, the handle 38 can be arranged at a position that is at the front side of the oil-agent application unit 20 and that is away from the oil-agent application unit 20. Thus, an operator can operate the handle 38 at a position away from the oil-agent application unit 20 while visually confirming the travel distance of the oil-agent application unit 20 in an up-and-down direction based on the scale described in the rails 32L and 32R. Thus, even during the operation of the spinning system 1, the oil-agent application unit 20 can be caused to move up and down without stopping the operation of the spinning system 1. The "position away from the oil-agent application unit 20" means a position within a range in which the operator can operate the handle 38 while confirming the travel distance of the oil-agent application unit 20 in an up-and-down direction. More specifically, the "position away from the oil-agent application unit 20" means a position within a range in which the operator can operate the handle 38 while visually confirming the scale described in the rails 32L and 32R (the rail 32L in this embodiment), including a location within a range of 1 m separated forward from the oil-agent application unit 20 for example.

[0073] According to the spinning system 1 of this embodiment, the plurality of oil supply guides 22 are arranged in a regular manner in a left-and-right direction when seen from a forward side. When seen from a forward side, the plurality of oil supply guides 22 arranged in a regular manner in a left-and-right direction are supported by the support members 14L and 14R. The wires 34L and 34R support the oil-agent application unit 20 at the connection section to the sliding sections 16L and 16R so as to prevent the deviation of the weight balance in a left-and-right direction. Thus, the sliding

sections 16L and 16R can be slid smoothly with respect to the rails 32L and 32R. Furthermore, the distance from the spinneret 8 to the oil supply guide 22 (*i.e.*, a position in a height direction) can be substantially equal among a plurality of oil supply guides arranged in a left-and-right direction. In particular, the spinning system 1 of this embodiment having the tension adjusters 60L and 60R can change a position in an up-and-down direction of at least any one of the A sheave 42L and the A sheave 42R to thereby change the tension of at least any one of the wire 34L and wire 34R. Thus, such an adjustment can be arranged that allows the plurality of oil supply guides 22 to have substantially the same height position in a left-and-right direction. Thus, the distance from the spinneret 8 to the oil supply guide 22 can be substantially the same among the plurality of oil supply guides 22 arranged in a left-and-right direction without causing any deviation.

[0074] There is a risk where the deviation of the weight balance of the oil-agent application unit 20 in a left-and-right direction is caused even when a difference of 1 mm is caused between a position of the oil supply guide 22 in the rail 32L in a height direction and a position of the oil supply guide 22 in the rail 32R in a height direction. Thus, a position of the oil supply guide 22 in the rail 32L in a height direction is preferably the same as a position of the oil supply guide 22 in the rail 32R in a height direction. In this embodiment, the support members 14L and 14R (more particularly the sliding sections 16L and 16R) and the oil supply guide 22 are configured in an integrated manner. Thus, the wires 34L and 34R support the oil-agent application unit 20 via the sliding sections 16L and 16R so that a difference of 1 mm or less is caused between the value of the scale at the upper end of the sliding section 16L and the value of the scale at the upper end of the sliding section 16R (more particularly the value of the scale at the upper end of the sliding section 16L and the value of the scale at the upper end of the sliding section 16R are the same).

[5. Modified Examples]

[0075] Next, the following section will describe a modified example obtained by changing the lifting up and down unit 30 of this embodiment. In the first modified example to the third modified example described below, what is different from the above-described embodiment will be described other than what is similar to the above-described embodiment.

[5-1. First modified example]

[0076] In this embodiment, the winch 40 and the sliding sections 16L and 16R have therebetween the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R. However, the invention is not limited to the above number and layout of the sheaves.

[0077] For example, the winch 40 and the sliding sections 16L and 16R may have therebetween a part of the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R.

[0078] Alternatively, the winch 40 and the sliding sections 16L and 16R may have therebetween a sheave different from the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R (hereinafter referred to as a "D sheave"). When the winch 40 and the sliding sections 16L and 16R have therebetween a D sheave, the D sheave may be arranged in addition to the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R or a part of the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R and the D sheave may be arranged, or only the D sheave may be arranged without any of the A sheaves 42L and 42R, the B sheaves 44L and 44R, and the C sheaves 46L and 46R.

[0079] Specifically, the rotation of the winch 40 can be used to move the oil-agent application unit 20 supported by the coupling sections 18L and 18R via the sliding sections 16L and 16R in an up-and-down direction in a balanced manner in a left-and-right direction. The number and layout of the sheaves arranged between the winch 40 and the sliding sections 16L and 16R are not limited to an embodiment described herein.

[5-2. Second modified example]

[0080] Next, the following section will describe the second modified example obtained by changing the lifting up and down unit 30 of this embodiment with reference to FIG. 6. FIG. 6 is a schematic view of a lifting up and down unit 70 according to the second modified example. In the description of the lifting up and down unit 70 according to the second modified example, configurations similar to those of the above-described embodiment are denoted with the same reference numerals and will not be further described.

[0081] As shown in FIG. 6, the lifting up and down unit 70 is arranged above the base member 12 and includes an axis member 72, a rotation roller 74, and a rotation operation section 76.

[0082] The axis member 72 is a longitudinal axis member extending in a substantially horizontal left-and-right direction and is a rotation axis of the rotation roller 74. The rotation operation section 76 is a disc-shaped member integrated with the axis member 72 so as to be substantially concentric with the axis member 72. The operator can rotate the rotation operation section 76 to thereby rotate the rotation roller 74 around the axis member 72 as a rotation center.

[0083] Although not shown, the lifting up and down unit 70 has a lock mechanism to stop the rotation of the rotation

roller 74. In order to rotate the rotation operation section 76, the operator cancels the lock by the lock mechanism to perform the operation.

[0084] The wires 34L and 34R are wound around the rotation roller 74. When the operator rotates the rotation operation section 76, the sliding sections 16L and 16R connected with the tip ends of the wires 34L and 34R are moved in an up-and-down direction along the rails 32L and 32R. When the sliding sections 16L and 16R are moved in an up-and-down direction, the support bracket 25, and the yarn regulating guide 26 are moved in an up-and-down direction. In this manner, the oil-agent application unit 20 (e.g., the oil supply guide 22 and the oil supply tube 24 and the yarn regulating guide 26 and the like supported by the support bracket 25 via the support bracket 25 and the support bar 23) can be caused to move up and down.

[0085] Although not shown in FIG. 6, the rotation roller 74 may have a groove around which the wire 34L and the wire 34R can be wound.

[0086] According to lifting up and down unit 70 according to the second modified example, the oil-agent application unit 20 can be caused by a simple configuration to move up and down through which the operator merely operates the rotation operation section 76 to rotate the rotation roller 74. Furthermore, the wire 34L connected to the sliding section 16L and the wire 34R connected to the sliding section 16R allows, when compared with a case where the wires and the sliding sections are connected at one position, the oil-agent application unit 20 to move up and down in a balanced manner in a left-and-right direction.

[0087] Furthermore, according to the lifting up and down unit 70 according to the second modified example, how much the wires 34L and 34R are wound is determined depending on the rotation amount of the rotation roller 74. Furthermore, the lifting up and down unit 70 having a lock mechanism to stop the rotation of the rotation roller 74 can stop the oil-agent application unit 20 at an arbitrary position in an up-and-down direction depending on how much the rotation operation section 76 is operated (i.e., the rotation amount of the rotation roller 74). Thus, such a case can be handled where the oil-agent application unit 20 should move up and down without a change of the yarn type for example.

[0088] According to the lifting up and down unit 70 according to the second modified example, the rotation operation section 76 is arranged at a position above the base member 12 (i.e., at a position away from the oil-agent application unit 20). Thus, the operator can operate the rotation operation section 76 at a position away from the oil-agent application unit 20. Thus, even during the operation of the spinning unit, the oil-agent application unit 20 can be caused to move up and down without stopping the operation of the spinning unit.

[5-3. Third modified example]

[0089] Next, the following section will describe the third modified example obtained by changing the lifting up and down unit 30.

[0090] FIG. 7 is a schematic view of an oil-agent apparatus 100 seen from a rear side as an explanatory view of a lifting up and down unit 300 according to the third modified example.

[0091] In the third modified example, the lifting up and down unit 300 has a configuration different from that of the above-described lifting up and down unit 30. Thus, the lifting up and down unit 300 has reference numerals different from those of the lifting up and down unit 30. The oil-agent apparatus 100 has the lifting up and down unit 300 having a different configuration from that of the above-described lifting up and down unit 30 and thus has reference numerals different from those of the oil-agent apparatus 10. The base member 120 also has reference numerals different from those of the above-described base member 12.

[0092] The lifting up and down unit 300 is similar to the lifting up and down unit 30 in including the rails 32L and 32R (see FIG. 2), the wires 34L and 34R, the winch 40, the power transmission shaft 36 (see FIG. 3 and FIG. 4), and the worm gearing 50 (see FIG. 4). However, the lifting up and down unit 300 does not include their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R owned by the lifting up and down unit 30 (see FIG. 3 and FIG. 4). The lifting up and down unit 300 includes tension adjusters 94L and 94R instead of the tension adjusters 60L and 60R owned by the lifting up and down unit 30.

[0093] In the third modified example, the winch 40 has the same configuration as that of the winch 40 described with reference to FIG. 3 and FIG. 4. However, as described with reference to FIG. 3 and FIG. 4, the winch 40 is not arranged so as to be rotatable in a direction substantially orthogonal to the plane of the base member 12 (see FIG. 3) but is arranged so as to be rotatable in a substantially vertical direction as a rotation center. The wires 34L and 34R are outputted from the winch 40 in a substantially horizontal direction. The invention is not limited to a rotational direction of the winch 40.

[0094] The worm gearing 50 (see FIG. 4) is arranged so that the winch 40 is rotated when the handle 38 (see FIG. 3) is operated to rotate the power transmission shaft 36 (see FIG. 3) in an axial direction as a rotation center.

[0095] As shown in FIG. 7, the winch 40 is placed on a bracket 84. The bracket 84 has: a winch support section 841 on which the winch 40 is placed; and a planar section 842 substantially orthogonal to the plane of the base member 120 in a vertical direction. The planar section 842 is substantially orthogonal to a direction along which the wires 34L and

34R are outputted from the winch 40.

[0096] As has been described for the C sheaves 46L and 46R described with reference to FIG. 3 and FIG. 4, the C sheaves 46L and 46R are arranged in holes formed to cover the base member 12 (see FIG. 3 and FIG. 4) and the rails 32L and 32R (see FIG. 2), respectively. The base member 120 of this third modified example is configured to include holes in the base member 12 in which the C sheaves 46L and 46R are arranged and openings 121L and 121R arranged at substantially the same positions as those of the holes.

[0097] The upper ends of the rails 32L and 32R shown in FIG. 2 for example are arranged at positions higher than the positions of the holes in which the C sheaves 46L and 46R are arranged. In contrast with this, in this third modified example, the upper ends of the rails 32L and 32R are arranged at positions lower than positions of the openings 121L and 121R. However, the invention is not limited to particular positions of the upper ends of the rails 32L and 32R.

[0098] The rear face of the base member 120 is attached with vertically long rectangular support plates 88L and 88R at in substantially the same positions as positions of the rails 32L and 32R (see FIG. 2) in a left-and-right direction. The upper ends of the support plates 88L and 88R are attached with fixation member 92L and 92R (which will be described later).

[0099] A flexible outer cable 86L for being fit onto the wire 34L is arranged between a portion at which the wire 34L the sliding section 16L (see FIG. 2) are connected (the first connection section) and the winch 40 (more particularly between the planar section 842 of the bracket 84 and the fixation member 92L). Similarly, a flexible outer cable 86R for being fit onto the wire 34R is arranged between a portion at which the wire 34R and the sliding section 16R (see FIG. 2) are connected (the second connection section) and the winch 40 (more particularly between the planar section 842 of the bracket 84 and the fixation member 92R).

[0100] One end 861L of the outer cable 86L (hereinafter referred to as an "input-side end 861L") is connected to the planar section 842 so that the inner-fit wire 34L is outputted in a direction substantially orthogonal to the planar section 842 of the bracket 84. The other end 862L of the outer cable 86L (hereinafter referred to as an "output-side end 862L") is connected to the fixation member 92L.

[0101] As in the input-side end 861L of the outer cable 86L, one end 861R of the outer cable 86R (hereinafter referred to as an "input-side end 861R") is connected to the planar section 842 so that the inner-fit wire 34R is outputted in a direction substantially orthogonal to the planar section 842 of the bracket 84. The other end 862R of the outer cable 86R (hereinafter referred to as an "output-side end 862R") is connected to the fixation member 92R. The details for the connection of the output-side end 862R and the fixation member 92R will be described later.

[0102] The outer cables 86L and 86R are obtained by coating a base winding of metal (e.g., a hard steel wire such as SWRH62A) for example with resin (e.g., polyvinylchloride, polyethylene). However, the invention is not limited to this.

[0103] The wire 34L can be slid with respect to the outer cable 86L in the outer cable 86L. The inner side of the outer cable 86L in a radial direction preferably has a tubular member having a low frictional coefficient (e.g., a polyethylene liner tube added with molybdenum) in order to provide the improved sliding with the wire 34L. However, this is not always required.

[0104] The wire 34R can be slid with respect to the outer cable 86R in the outer cable 86R. As in the outer cable 86L, the inner side of the outer cable 86R in a radial direction preferably has a tubular member having a low frictional coefficient in order to provide the improved sliding with the wire 34R. However, this is not always required.

[0105] The support plates 88L and 88R are attached with relay members 90L and 90R below the fixation members 92L and 92R. The relay member 90L supports the outer cable 86L at a position in the middle of a range from the planar section 842 of the bracket 84 to the fixation member 92L. Similarly, the relay member 90R supports the outer cable 86R at a position in the middle of a range from the planar section 842 of the bracket 84 to the fixation member 92R.

[0106] FIG. 8 is a schematic view of a periphery of an opening 121R formed in a base member 120 as an explanatory view of a lifting up and down unit 300 according to the third modified example. FIG. 8 shows a cross section of a substantially-center part of the opening 121R in a left-and-right direction taken in a vertical direction orthogonal to the plane of the base member 120 when seen from a right side. FIG. 8 is a cross-sectional view of the base member 120, a part of the wire 34R, a part of the outer cable 86R, a part of the fixation member 92R, and the tension adjuster 94R.

[0107] As shown in FIG. 8, the fixation member 92R has: a body 921R attached to the support plate 88R; and a planar section 922R substantially horizontal while the body 921R being attached to the support plate 88R.

[0108] The tension adjuster 94R has an adjuster bolt 941R and an adjustment nut 946R. The adjuster bolt 941R has: a head 942R; and an axis section 944R whose outer periphery has a screw section. The head 942R has a groove 943R. The axis section 944R includes a penetration hole 945R through which the wire 34R can be penetrated. The inner periphery of the adjustment nut 946R has a screw section screwed with a screw section formed in the outer periphery of the axis section 944R. The axis section 944R penetrates a through hole 923R formed in the planar section 922R of the fixation member 92R in a substantially vertical direction. The inner periphery of through hole 923R has a screw section screwed with a screw section formed in the outer periphery of the axis section 944R. When the adjustment nut 946R is rotated, the adjuster bolt 941R is moved with respect to the planar section 922R in a substantially vertical direction. Thus, the rotation of the adjustment nut 946R can change the distance of the wire 34R between the planar

section 842 of the bracket 84 (see FIG. 7) and the planar section 922R of the fixation member 92R to thereby change the tension of the wire 34R.

[0109] The output-side end 862R of the outer cable 86R is fit into the groove 943R formed in the head 942R of the adjuster bolt 941R. During this, the output-side end 862R is preferably pressed-in to the groove 943R so that the output-side end 862R of the outer cable 86R is prevented from being dislocated from the groove 943R. The inner periphery face of the groove 943R and the outer periphery face of the output-side end 862R of the outer cable 86R preferably have therebetween a tubular member composed of an elastic member such as rubber for example because such a tubular member can suppress the output-side end 862R of the outer cable 86R from being dislocated from the groove 943R. In this manner, the output-side end 862R of the outer cable 86R is connected to the fixation member 92R via the adjuster bolt 941R.

[0110] The wire 34R fit into the outer cable 86R penetrates through the penetration hole 945R formed in the axis section 944R and has a tip end connected to the sliding section 16R (see FIG. 2 and FIG. 3).

[0111] The outer cable 86R is upwardly curved at the winch 40 side (see FIG. 7) with respect to the output-side end 862R so as to have a predetermined curvature radius. The output-side end 862R of the outer cable 86R is fit into the groove 943R formed in the head 942R of the adjuster bolt 941R in a substantially vertical direction.

[0112] In FIG. 8, the periphery of the opening 121R formed in the base member 120 has been described. This also applies to the periphery of the opening 121L formed in the base member 120. Specifically, various configurations at the periphery of the opening 121L (e.g., the fixation member 92L, the tension adjuster 94L, and the tension adjuster 94L and the like) are similar to various configurations at the periphery of the opening 121R (e.g., the fixation member 92R, the tension adjuster 94R, and the tension adjuster 94R and the like). The relation among various configurations at the periphery of the opening 121L (e.g., a method of connecting the outer cable 86L to the fixation member 92L and the like) is also similar to the relation among various configurations at the periphery of the opening 121R. Thus, no further description will be provided for the periphery of the opening 121L.

[0113] As has been described, the lifting up and down unit 300 of the third modified example does not include their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R as has been described with reference to FIG. 3 and FIG. 4 and instead includes the outer cables 86L and 86R into which the wires 34L and 34R are fit. Thus, the lifting up and down unit 300 can have a simple configuration. Furthermore, no need is no more required to wind the wires 34L and 34R around their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R for example. Thus, only required is to place the outer cables 86L and 86R into which the wires 34L and 34R are fit, thus providing improved workability. Furthermore, improved productivity can be provided because the wires 34L and 34R are prevented from being dislocated from their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R and their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R are prevented from being damaged. Furthermore, the outer cables 86L and 86R provide a higher degree of freedom for an installation site when compared with their respective sheaves 42L, 42R, 44L, 44R, 46L, and 46R. Thus, even when the installation site is limited (e.g., when the lifting up and down unit is arranged in an existing spinning unit), the lifting up and down unit 300 can be arranged easily.

[0114] Furthermore, the output-side end 862R of the outer cable 86R is curved so as to have a predetermined curvature radius and is subsequently fit into the groove 943R formed in the head 942R of the adjuster bolt 941R in a substantially vertical direction. This also applies to the output-side end 862L of the outer cable 86L. Thus, the oil-agent application unit 20 (see FIG. 2) can be slid smoothly via the sliding sections 16L and 16R (see FIG. 2 and FIG. 3). In particular, when the oil-agent application unit 20 is caused to move up, the force required to move up the oil-agent application unit 20 can be suppressed from being undesirably dispersed in directions other than a vertical direction, thus causing the oil-agent application unit 20 to move up in an efficient manner.

[0115] Furthermore, the tension adjuster 94L or the tension adjuster 94R can change the tension of at least any of the wire 34L and the wire 34R. Thus, the lifting up and down unit 300 having a simple configuration can be used to cause the oil-agent application unit 20 to move up and down while providing substantially the same distance from the spinneret 8 (see FIG. 1) to the oil supply guide 22 (see FIG. 2) without causing any deviation among the plurality of oil supply guides 22 arranged in a left-and-right direction.

[0116] The terms "outer cable 86L" and "outer cable 86R" correspond to "the first outer-fit member" and "the second outer-fit member" of the present invention, respectively.

(Reference Numerals)

[0117]

1	Spinning system
10, 100	Oil-agent apparatus
12, 120	Base member
14L, 14R	Support member

	20	Oil-agent application unit
	22	Oil supply guide
	30, 300	Lifting up and down unit
	34L, 34R	Wire
5	38	Handle
	40	Winch
	42L, 42R	A sheave
	50	Worm gearing
	60L, 60R, 94L, 94R	Tension adjuster
10	86L, 86R	Outer cable

Claims

15 1. A spinning system (1) comprising:

a spinning unit (2) configured to allow a plurality of yarns to be spun downward through a plurality of spinnerets (8), respectively;
 an oil-agent application unit (20) arranged below the spinning unit (2) including a plurality of oil supply guides (22) for applying oil agent to the plurality of yarns spun through the plurality of spinnerets (8), respectively;
 a support member (14L, 14R) for supporting the plurality of oil supply guides (22); and
 a lifting up and down unit (30) configured to cause the oil-agent application unit (20) to move up and down with respect to the spinning unit (2), wherein
 the lifting up and down unit (30) includes
 at least two wires (34L, 34R) connected to the support member (14L, 14R) at two or more positions of the support member (14L, 14R) so as to support the support member (14L, 14R) from an upward side, and
 an operation section (38) operable of causing the support member (14L, 14R) connected with the at least two wires (34L, 34R) to move up and down.

30 2. The spinning system (1) as claimed in claim 1, wherein

the lifting up and down unit (30) further includes
 a winding member (40) for winding up in part or as a whole the at least two wires (34L, 34R) through rotation so as to cause the support member (14L, 14R) connected with the at least two wires (34L, 34R) to move up and down, and
 a lock mechanism (50) for locking the rotation of the winding member (40).

3. The spinning system (1) as claimed in claim 2, wherein
 the operation section (38) is configured such that the winding member (40) can be rotated by operating the operation section (38) at a location within a range of 1 m separated forward from the oil-agent application unit (20).

4. The spinning system (1) as claimed in claim 2 or 3, wherein

the lock mechanism (50) is a worm gearing (50) having a worm (52) and a worm wheel (54), wherein
 the operation section (38) is configured such that a bar-like member (36), which is the same in axis direction as the worm (52), coupled to the worm (52) can be rotated, and wherein
 the winding member (40) is configured such that the winding member (40) is rotated coaxially with the worm wheel (54).

50 5. The spinning system (1) as claimed in any one of claims 2 to 4, wherein

the support member (14L, 14R) has a first connection section connected with one wire (34L) of at least two wires (34L, 34R) and a second connection section connected with another wire (34R) different from the one wire (34L), and wherein
 the lifting up and down unit (30) further includes
 a first sheave (42L) for winding the one wire (34L) connected to the first connection section so as to apply tension to the one wire (34L),
 a second sheave (42R) for winding the another wire (34R) connected to the second connection section so as

to apply tension to the another wire (34R), and
a tension adjuster (60L, 60R) for changing a position of at least one of the first sheave (42L) and the second sheave (42R).

6. The spinning system (1) as claimed in any one of claims 2 to 4, wherein

the support member (14L, 14R) has a first connection section connected with one wire (34L) of at least two wires (34L, 34R) and a second connection section connected with another wire (34R) different from the one wire (34L), and wherein
the lifting up and down unit (300) further includes
a first outer-fit member (86L) interposed between the first connection section and the winding member (40) so as to have the one wire (34L) fit into the first outer-fit member (86L); and
a second outer-fit member (86R) interposed between the second connection section and the winding member (40) so as to have the another wire (34R) fit into the second outer-fit member (86R).

7. The spinning system (1) as claimed in claim 6, wherein
the first outer-fit member (86L) and the second outer-fit member (86R) are arranged such that the one wire (34L) and the another wire (34R) are connected in a substantially vertical direction to the support member (14L, 14R), respectively.

8. The spinning system (1) as claimed in claim 6 or 7 further comprising wherein
a tension adjuster (94L, 94R) capable of changing tension of at least one of the one wire (34L) and the another wire (34R).

9. The spinning system (1) as claimed in any one of claims 1 to 8, wherein

the plurality of oil supply guides (22) are arranged in one direction in a regular manner when seen in a predetermined direction,
the support member (14L, 14R) can support the plurality of oil supply guides (22) arranged in the one direction in a regular manner,
the at least two wires (34L, 34R) support the support member (14L, 14R) so as to prevent any deviation from a weight balance in the one direction.

FIG. 1

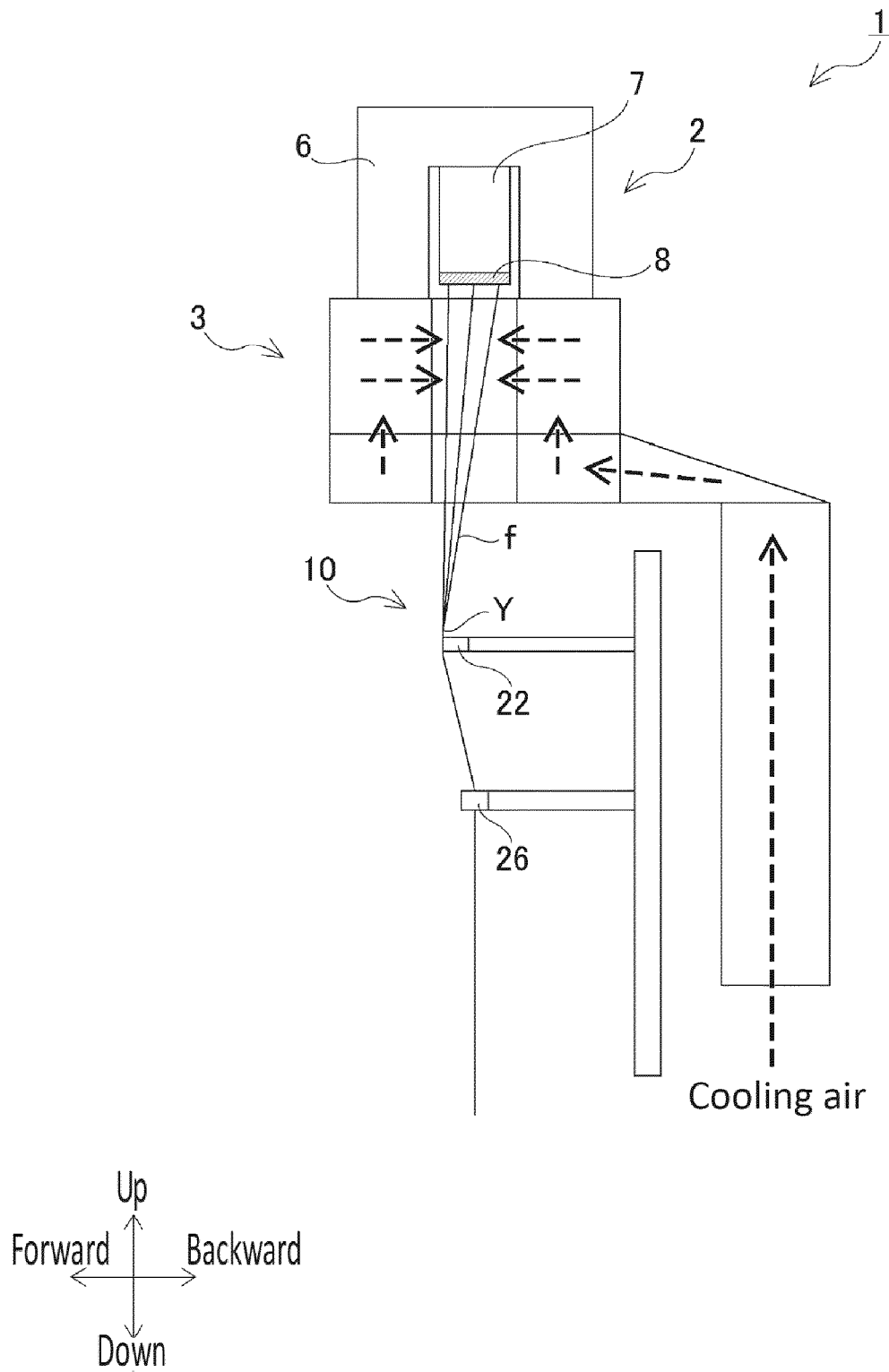


FIG. 2

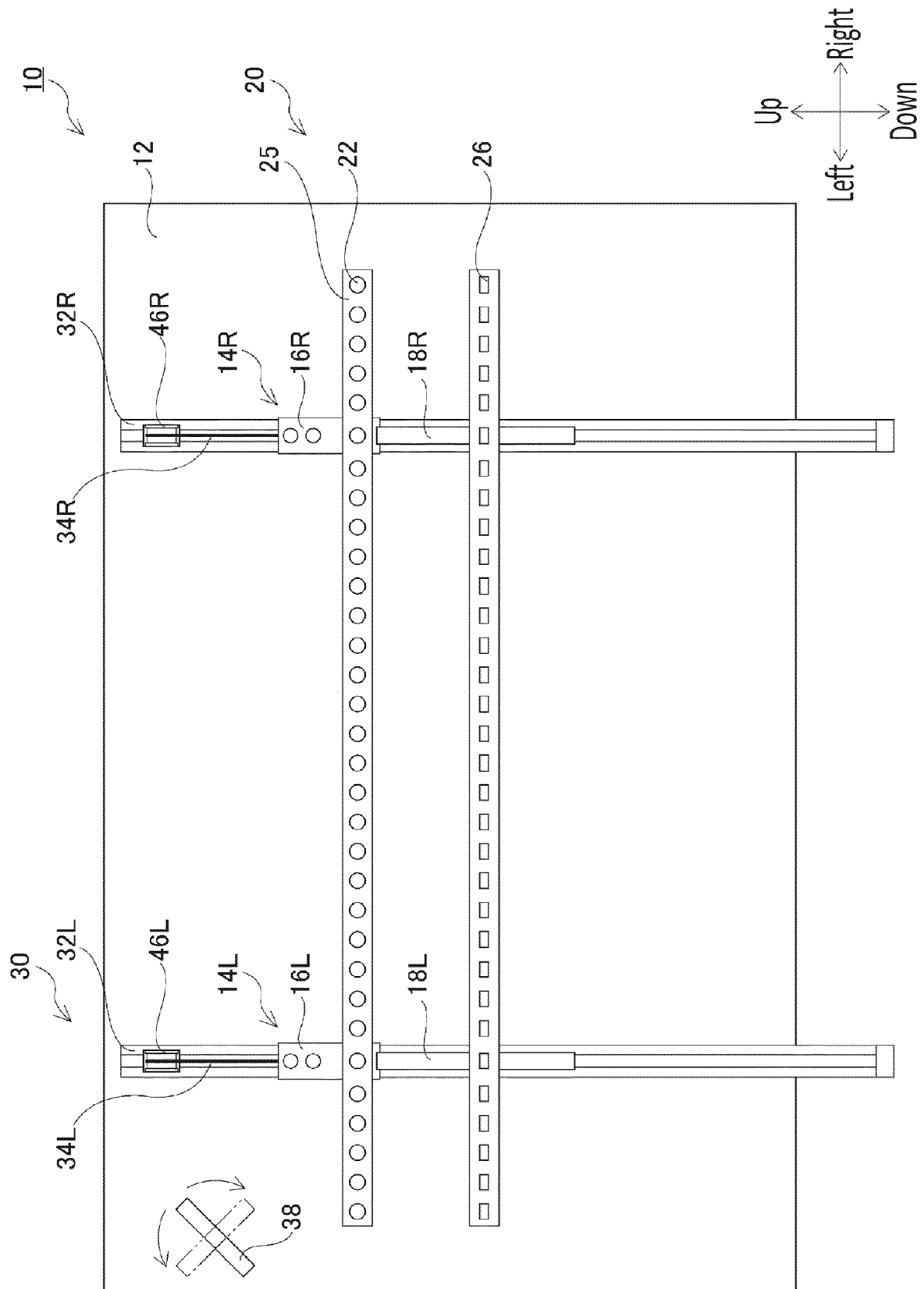


FIG. 3

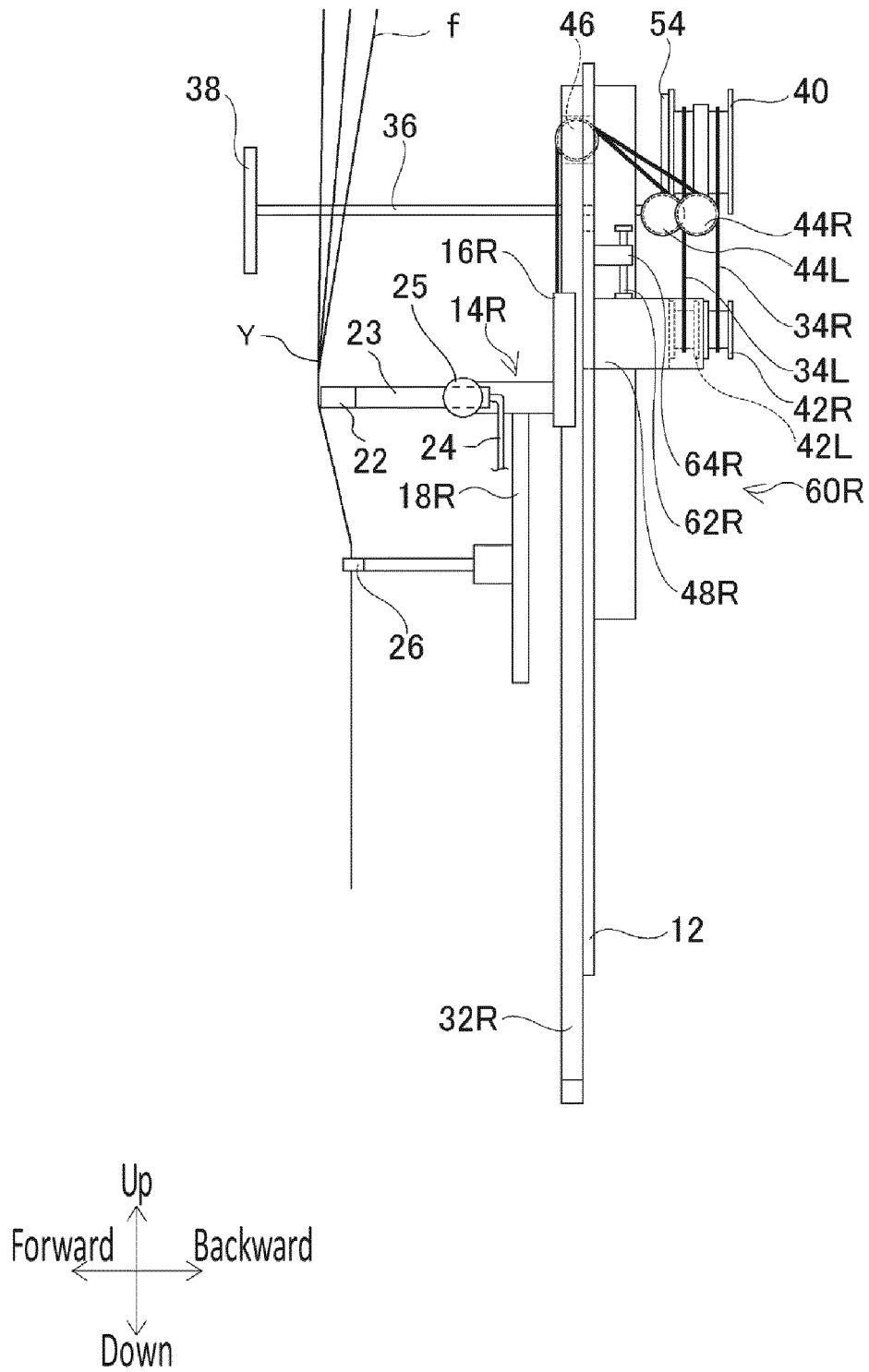


FIG. 4

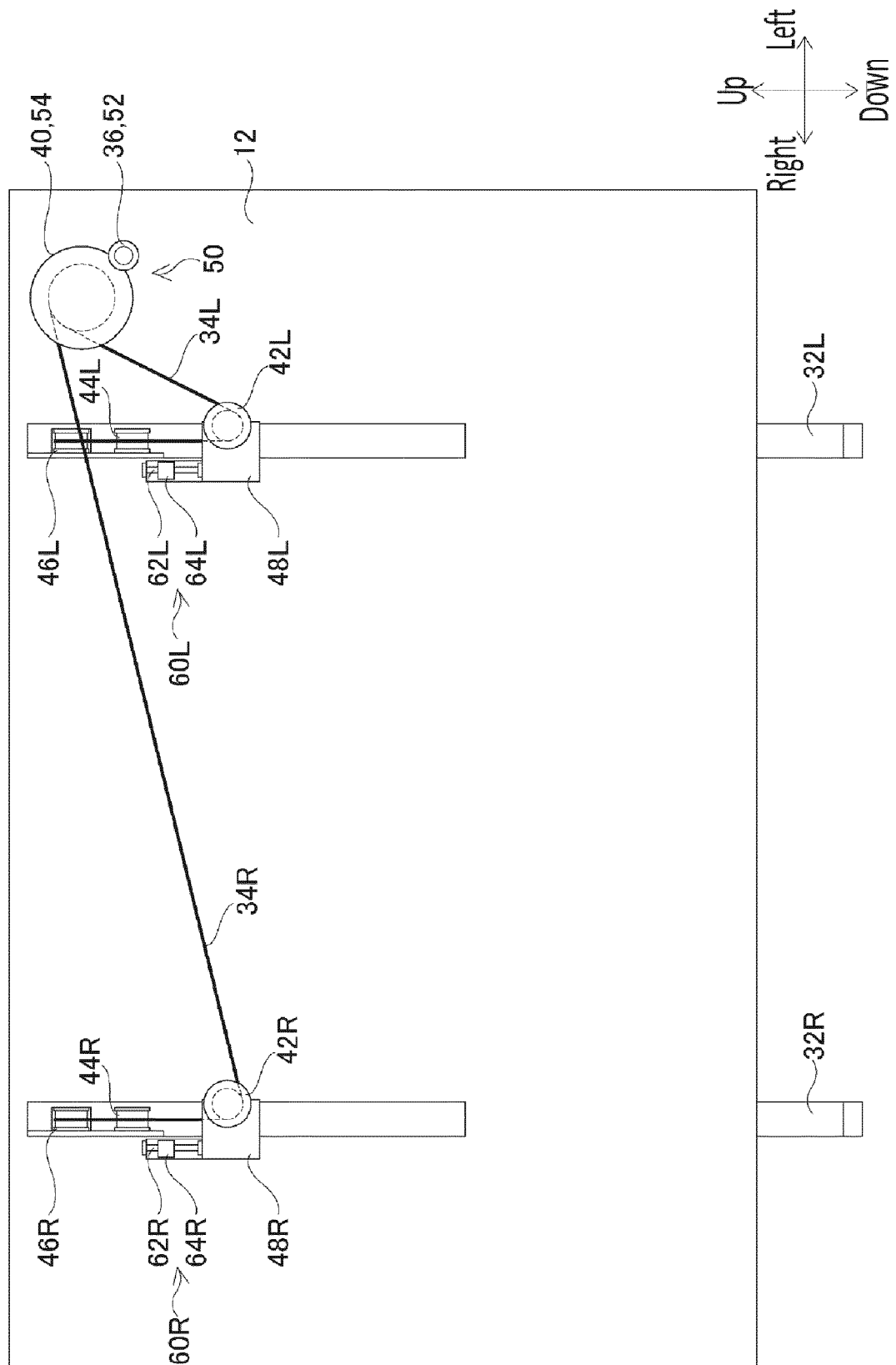


FIG. 5

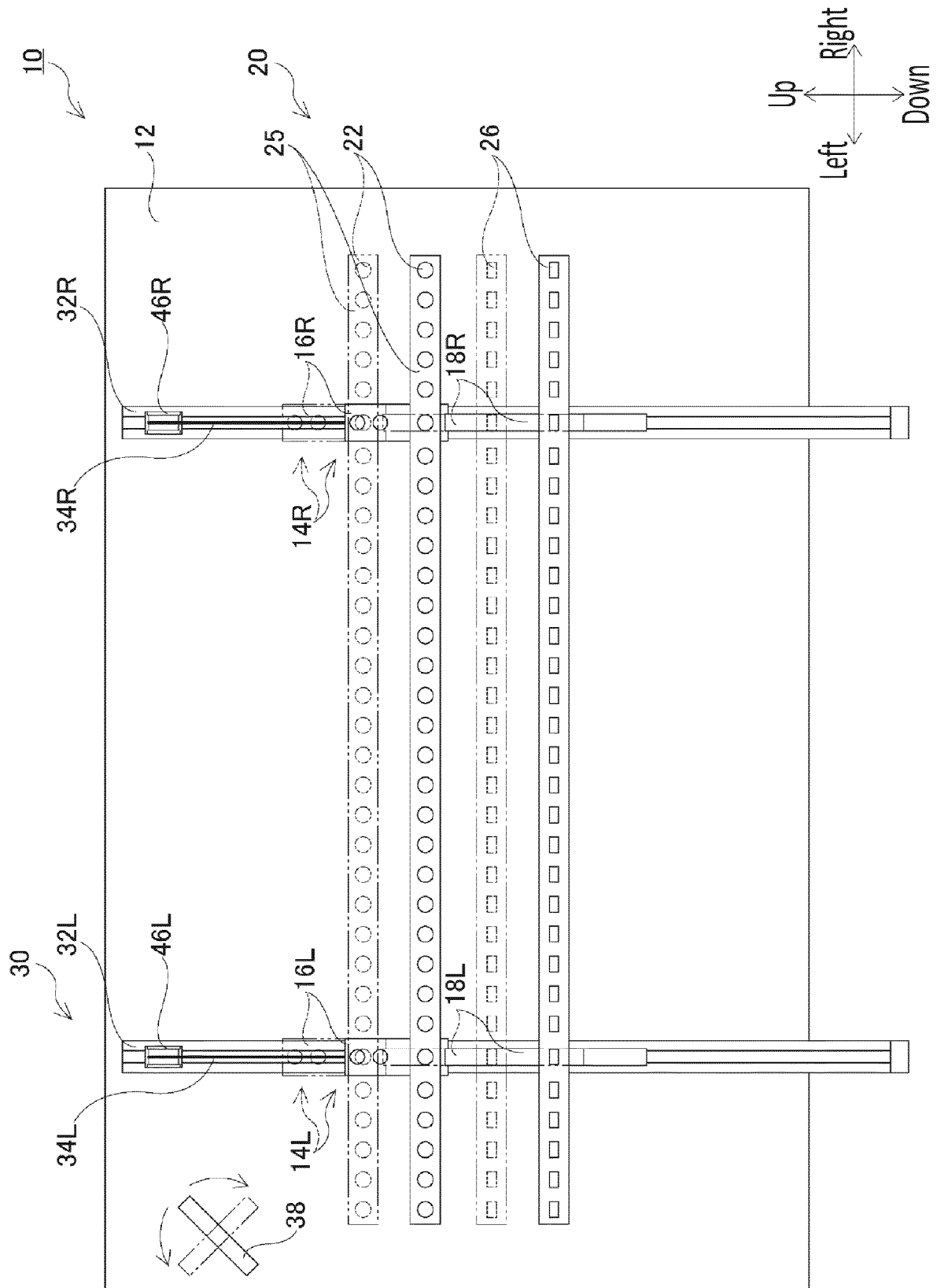


FIG. 6

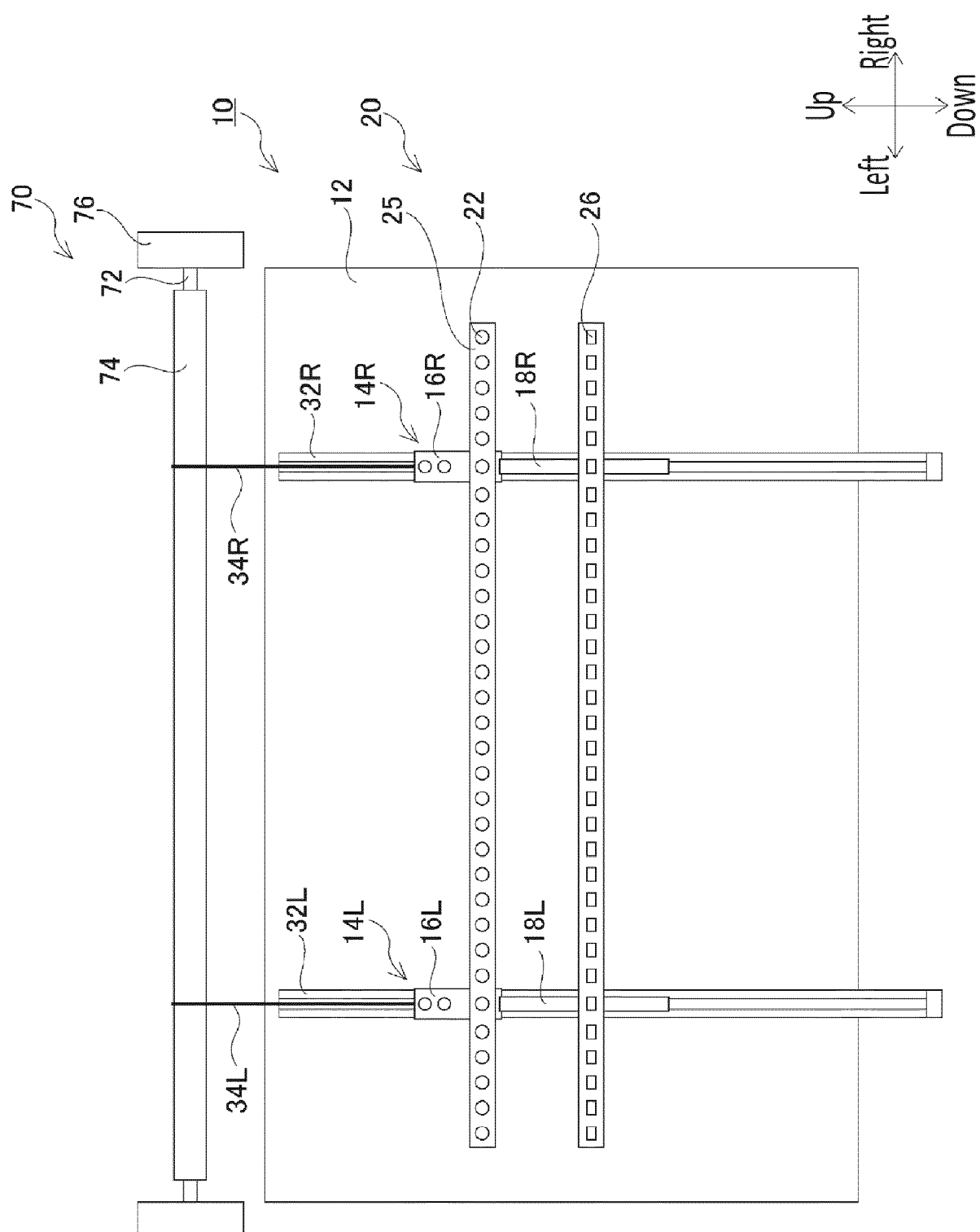


FIG. 7

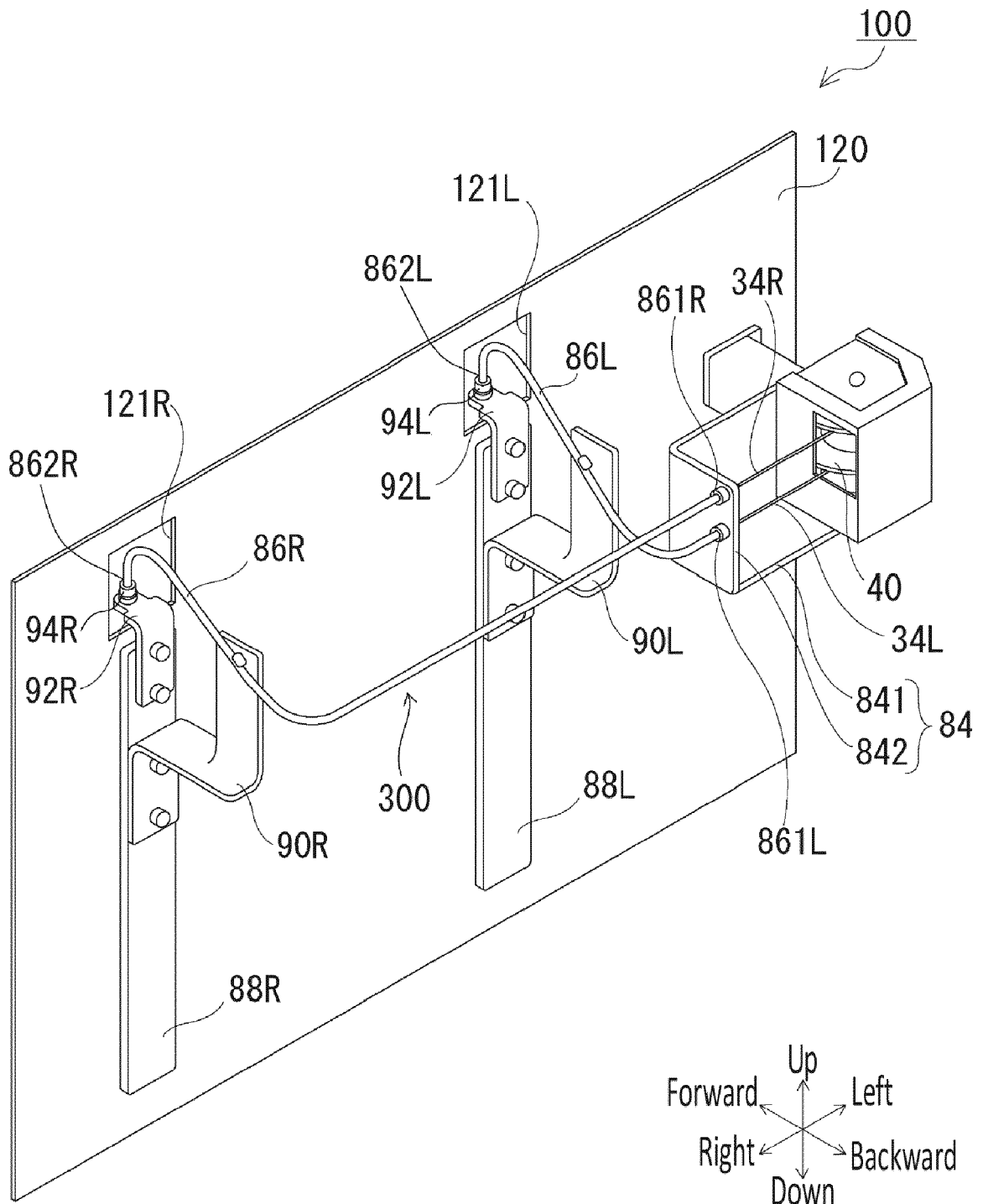
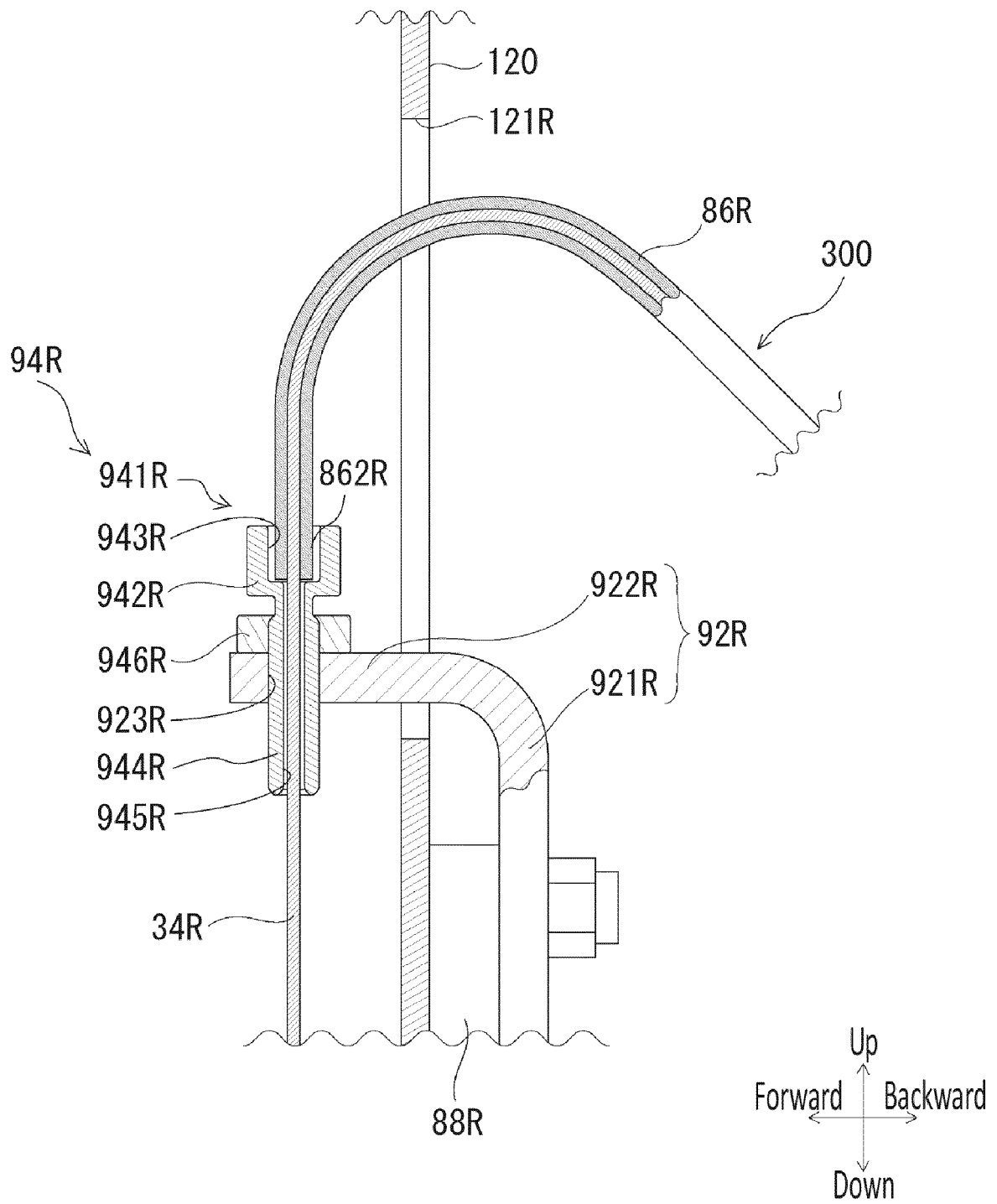


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003013323 A [0004]