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(54) **SPRINKLING DEVICE**

(57) To provide a spraying apparatus capable of reducing adhesion of contaminants in a housing section.

The present invention is directed to a spraying apparatus 100 including a nozzle section 1 capable of spraying a fluid, a fluid tube 20 for supplying the fluid to the nozzle section 1, a cableveyor 21 having the fluid tube 20 accommodated in its hollow portion 211, a support section 10 on which the nozzle section 1 is supported and fixed, a driving section 22 for reciprocating the support section 10 in a width direction of a traveling body R, a driving source M for driving the driving section 22, and a housing section 2 that accommodates at least the cableveyor 21 and the driving section 22, in which the housing section 2 has an elongated shape extending in the width direction of the traveling body R, an opening portion K extending in the width direction of the traveling body R is provided in a bottom portion or a side wall portion of the housing section 2, the support section 10 in the housing section 2 supports and fixes the nozzle section 1 through the opening portion K, and the fluid tube 20 accommodated in the cableveyor 21 is attached to the nozzle section 1 through the opening portion K.

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FIG. 1(a)

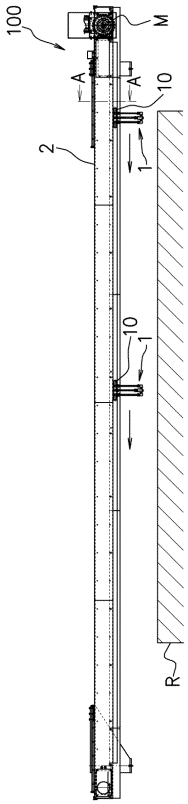
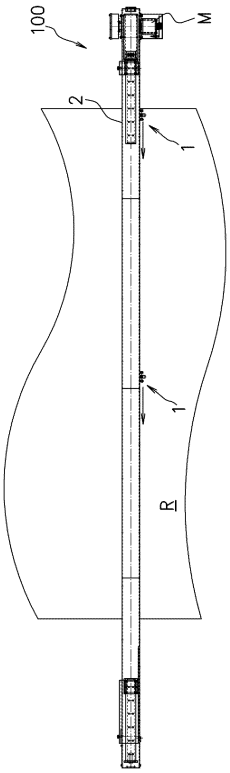



FIG. 1(b)



## Description

### Technical Field

**[0001]** The present invention relates to a spraying apparatus, and more specifically to a spraying apparatus capable of reducing adhesion of contaminants in a housing section.

### Background Art

**[0002]** A paper making process in a paper making machine generally includes a wire part for placing a liquid in which pulp is dispersed in water on a net (wire) for paper making and naturally dropping excess water to form wet paper, a press part for passing the wet paper between paired press rolls and pressing the wet paper by the press rolls via felt to transfer the water in the wet paper to the felt, and thus dehydrating the wet paper, a dry part for making the wet paper that has passed through the press part contact a drier roll with the wet paper pressed against canvas, to dry the wet paper into paper, a calendar part for passing the paper between calendar rolls to smooth unevenness of a surface of the paper, and a reel part for winding the paper around a stick called a spool.

**[0003]** In the paper making machine, a spraying apparatus for applying a fluid such as air, water, or a chemical solution is generally attached thereto for purposes such as a purpose of preventing a foreign substance derived from a pulp raw material from adhering to a traveling body such as paper, a press roll, felt, a drier roll, canvas, a canvas roll, or a calendar roll that is traveling (operating) and a purpose of improving releasability of wet paper from the traveling body.

**[0004]** An example of a known spraying apparatus that applies a chemical solution is one that sprays a chemical solution from a nozzle device while reciprocating the nozzle device in a width direction of the traveling body to efficiently apply a fluid.

**[0005]** For example, a spraying apparatus that sprays a solid lubricant atomized by a discharge pressure from a spray port of a spray unit that travels in a spraying apparatus main body installed 5 cm or more away from a paper making drier surface while moving a nozzle unit to the drier surface has been known (see, e.g., Patent Literature 1). In such a spraying apparatus, a liquid feed pipe and an air feed pipe that support the nozzle unit (nozzle section) are extended from an upper surface of the spraying apparatus main body (housing section). Accordingly, an upper surface of the housing section is open.

**[0006]** A spraying apparatus that includes a nozzle device that sprays a fluid onto a traveling body in a paper making machine while reciprocating in a longitudinal direction and in which a driving transmission section and a cableveyor (registered trademark) are provided side by side not to overlap each other in an up-down direction and the nozzle device moves via a base portion when a driving section drives the driving transmission section has been known (see, e.g., Patent Literature 2). In such a spraying apparatus, the nozzle device (nozzle section) protrudes from an upper surface of a housing (housing section). Accordingly, the upper surface of the housing section is open.

### Citation List

#### Patent Literature

**[0007]**

PTL 1: Japanese Patent Application Laid-Open No. 6-280181
PTL 2: Japanese Patent Application Laid-Open No. 2016-204797

### Summary of Invention

#### Technical Problem

**[0008]** In each of the spraying apparatuses described in Patent Literature 1 and Patent Literature 2, the nozzle section is made to protrude from the upper surface of the housing section, as described above, to cause the housing section to support the nozzle section.

**[0009]** However, in each of the spraying apparatuses described in Patent Literature 1 and Patent Literature 2, the upper surface of the housing section is open. Thus, there is a problem that contaminants such as a scattered chemical solution and floating pitch easily enter the housing section and adhere to components such as the driving section and the cableveyor accommodated in the housing section.

**[0010]** As a result, the component to which the contaminants have adhered cannot be precisely driven. In some cases, a malfunction may occur. This also leads to deterioration of the component itself.

**[0011]** Accordingly, in each of the spraying apparatuses described in Patent Literature 1 and Patent Literature 2, a frequency of maintenance is high, and it takes time and effort because all the components need to be taken out when the inside of the housing is maintained.

**[0012]** The present invention has been made in view of the above-described circumstances, and is directed to providing a spraying apparatus capable of reducing adhesion of contaminants in a housing section.

#### Solution to Problems

**[0013]** The inventors of the present invention have intensively studied to solve the above-described problem and found out that the above-described problem can be solved by providing a bottom portion or a side wall portion of a housing section with an opening portion, passing a support section in the housing section through the open-

ing portion to support and fix a nozzle section and passing a fluid tube accommodated in a cableveyor through the opening portion to attach the fluid tube to the nozzle section, to complete the present invention.

**[0014]** The present invention resides in (1) a spraying apparatus used while being attached to a paper making machine to spray a fluid onto a traveling body in the paper making machine, the spraying apparatus including a nozzle section capable of spraying the fluid, a fluid tube for supplying the fluid to the nozzle section, a cableveyor having the fluid tube accommodated in its hollow portion, a support section on which the nozzle section is supported and fixed, a driving section for reciprocating the support section in a width direction of the traveling body, a driving section rail section extending in the width direction of the traveling body, a driving source for driving the driving section, and a housing section that accommodates at least the cableveyor and the driving section, in which the housing section has an elongated shape extending in the width direction of the traveling body, an opening portion extending in the width direction of the traveling body is provided in a bottom portion or a side wall portion of the housing section, the support section in the housing section supports and fixes the nozzle section through the opening portion, the fluid tube accommodated in the cableveyor is attached to the nozzle section through the opening portion, the driving section rail section is attached to an inner wall of the side wall portion of the housing section, and the driving section rail section supports the driving section to sandwich the driving section from above and below.

**[0015]** The present invention resides in (2) a spraying apparatus used while being attached to a paper making machine to spray a fluid onto a traveling body in the paper making machine, the spraying apparatus including a nozzle section capable of spraying the fluid, a fluid tube for supplying the fluid to the nozzle section, a cableveyor having the fluid tube accommodated in its hollow portion, a support section on which the nozzle section is supported and fixed, a driving section for reciprocating the support section in a width direction of the traveling body, a driving source for driving the driving section, and a housing section that accommodates at least the cableveyor and the driving section, in which the housing section has an elongated shape extending in the width direction of the traveling body, an opening portion extending in the width direction of the traveling body is provided in a bottom portion or a side wall portion of the housing section, the support section in the housing section supports and fixes the nozzle section through the opening portion, the fluid tube accommodated in the cableveyor is attached to the nozzle section through the opening portion, and the driving section includes a loop-shaped endless body to which the support section is attached and a pair of sprockets between which the endless body is hung.

**[0016]** The present invention resides in (3) the spraying apparatus described in the above item (2) in which a tension adjustment tool is attached to the sprocket.

**[0017]** The present invention resides in (4) the spraying apparatus described in the above item (2) or (3), further including a driving section rail section extending in the width direction of the traveling body, in which the driving section rail section is attached to the inner wall of the side wall portion of the housing section, and the driving section rail section support the driving section to sandwich the driving section from above and below.

**[0018]** The present invention resides in (5) the spraying apparatus described in any one of the above items (1) to (4), further including a rail section extending in the width direction of the traveling body, and a guide section attached to the support section, in which the rail section is attached to the inner wall of the side wall portion of the housing section, and the guide section is slidable along the rail section.

**[0019]** The present invention resides in (6) the spraying apparatus described in any one of the above items (1) to (5), in which an auxiliary lower wall portion attached to the side wall portion on one side and a lower wall portion attached to the side wall portion on the other side are provided in the bottom portion of the housing section, and the opening portion is provided between the auxiliary lower wall portion and the lower wall portion.

**[0020]** The present invention resides in (7) the spraying apparatus described in the above item (6), in which an auxiliary side wall portion is provided to stand in an end portion, on the opposite side to the side wall portion on the other side, of the lower wall portion, and the cableveyor is placed on the lower wall portion between the side wall portion on the other side and the auxiliary side wall portion.

**[0021]** The present invention resides in (8) the spraying apparatus described in the above item (6) or (7), in which a placement section for placing the cableveyor folded upward is attached to the support section, and the placement section is located just above the lower wall portion.

**[0022]** The present invention resides in (9) the spraying apparatus described in the above item (8), in which an air spraying device for spraying air is attached to the placement section.

**[0023]** The present invention resides in (10) the spraying apparatus described in any one of the above items (1) to (9), in which units each including the nozzle section and the support section are provided side by side with predetermined spacing.

## Advantageous Effects of Invention

**[0024]** In the spraying apparatus according to the present invention, a fluid to be supplied from the fluid tube can be sprayed onto the traveling body in the paper making machine while the nozzle section is reciprocated in the width direction of the traveling body. Therefore, a desired fluid can also be efficiently applied to the traveling body that is operating.

**[0025]** At this time, in the spraying apparatus, the opening portion is daringly provided in the bottom portion or

the side wall portion of the housing section. Thus, contaminants such as a scattered chemical solution and floating pitch do not easily enter the housing section. Therefore, the contaminants can be prevented from adhering to a component such as the driving section or the cableveyor accommodated in the housing section. As a result, the component such as the driving section or the cableveyor can be kept being precisely driven. Thus, a fluid can be uniformly applied at an appropriate position for the traveling body.

**[0026]** The component itself can be prevented from deteriorating.

**[0027]** The inside of the housing section is not easily contaminated. Thus, the frequency of maintenance can be reduced, and the quality of the spraying apparatus can be maintained by simple cleaning.

**[0028]** The spraying apparatus according to the present invention includes the guide section and the rail section, in which the guide section attached to the support section is made slidable along the rail section attached to the inner wall of the side wall portion of the housing section, whereby stability obtained when the nozzle section reciprocates can be improved.

**[0029]** Similarly, the spraying apparatus according to the present invention includes the driving section rail section, in which the driving section rail section supports the driving section to sandwich the driving section from above and below, whereby stability obtained when the nozzle section reciprocates can be improved.

**[0030]** In the spraying apparatus, the bottom portion or the side wall portion of the housing section is provided with the opening portion, as described above. Thus, the housing section does not directly support the nozzle section. Accordingly, the spraying apparatus in these cases has a structure in which guidance is provided by a plurality of rails such as a driving section rail section and a rail section, whereby stability obtained when the nozzle section reciprocates is prevented from being deteriorated due to the weight of the nozzle section itself.

**[0031]** In the spraying apparatus according to the present invention, when the bottom portion of the housing section is provided with the opening portion, the auxiliary lower wall portion attached to the side wall portion on one side and the lower wall portion attached to the side wall portion on the other side are provided in the bottom portion of the housing section, whereby the opening portion between the auxiliary lower wall portion and the lower wall portion can be made as narrow as possible. As a result, contaminants can be more prevented from entering the housing section.

**[0032]** In this case, when the auxiliary lower wall portion is provided, a component in the housing section can be prevented from dropping and colliding with the traveling body, for example.

**[0033]** In this case, when the auxiliary side wall portion is provided to stand at the end, on the opposite side to the side wall portion on the other side, of the lower wall portion, the cableveyor to be placed on the lower wall portion can be prevented from randomly dropping.

**[0034]** In this case, the contaminants can be further prevented from entering the housing section.

**[0035]** In this case, when the placement section is attached to the support section to be located just above the lower wall portion, and the cableveyor folded upward is placed in the placement section, the spraying apparatus itself can have a compact structure.

**[0036]** In this case, when the cableveyor and the folded cableveyor are vertically arranged, the nozzle section can be smoothly reciprocated.

**[0037]** In the spraying apparatus according to the present invention, when the air spraying device for spraying air is attached to the placement section, contaminants can be prevented from entering the housing section, and contaminants can be prevented from being sprayed and adhering to a component even if the contaminants enter the housing section.

**[0038]** In the spraying apparatus according to the present invention, when the driving section includes the endless body and the sprockets, the driving section can be smoothly moved even in a simple structure.

**[0039]** At this time, when the tension adjustment tool is attached to the sprocket, tension can be easily maintained. In the spraying apparatus, the housing section does not directly support the nozzle section, as described above. Thus, it is important to maintain the tension of the driving section that drives the nozzle section.

**[0040]** In the spraying apparatus according to the present invention, when the units each including the nozzle section and the support section are provided side by side with predetermined spacing, a fluid can be efficiently applied to the traveling body particularly if the traveling body is large in size.

Brief Description of Drawings

**[0041]**

Figure 1(a) is a side view illustrating an embodiment of a spraying apparatus according to the present invention.

Figure 1(b) is a top view of the spraying apparatus illustrated in Figure 1(a).

Figure 2 is a cross-sectional view taken along a line A - A of the spraying apparatus illustrated in Figure 1(a).

Figure 3 is a transmission side view for describing an installation state of a driving section with respect to a housing section in the spraying apparatus according to the present embodiment.

Figure 4(a) is a transmission side view illustrating a portion P1 of the spraying apparatus illustrated in Figure 3 in an enlarged manner.

Figure 4(b) is a transmission top view of Figure 4(a).

Figure 5 is a transmission side view for describing an installation state of a rail section and a guide section with respect to the housing section in the spray-

ing apparatus according to the present embodiment.

Figure 6 is a transmission side view illustrating a portion P2 of the spraying apparatus illustrated in Figure 5 in an enlarged manner.

Figure 7 is an explanatory view for describing a positional relationship of a cableveyor with respect to the housing section in the spraying apparatus according to the present embodiment.

Figure 8(a) is a schematic side view illustrating a housing section in a spraying apparatus according to another example of the embodiment.

Figure 8(b) is a schematic side view illustrating a housing section in a spraying apparatus according to another example of the embodiment.

Figure 9(a) is an explanatory view for describing a positional relationship of a cableveyor with respect to a housing section in a spraying apparatus according to another example of the embodiment.

Figure 9(b) is an explanatory view for describing a positional relationship of a cableveyor with respect to a housing section in a spraying apparatus according to another example of the embodiment.

Figure 10 is a cross-sectional view illustrating a spraying apparatus according to another example of the embodiment.

Figure 11(a) is a cross-sectional view illustrating a housing section and a receiving section in a spraying apparatus according to another example of the embodiment.

Figure 11(b) is a cross view illustrating a housing section and a receiving section in a spraying apparatus according to another example of the embodiment.

Description of Embodiments

**[0042]** Preferred embodiments of the present invention will be described in detail below with reference to the drawings, as needed. In the drawings, the same elements are respectively assigned the same reference numerals, and overlapping description is omitted. A positional relationship among the top, the bottom, the left, and the right, for example, is based on a positional relationship illustrated in the drawings, unless otherwise noted. Further, dimensional proportions in the drawings are not necessarily limitative.

**[0043]** The spraying apparatus according to the present invention is an apparatus used with it being attached to a paper making machine for applying a fluid to a traveling body in the paper making machine.

**[0044]** In the present specification, the traveling body means one that travels during an operation of the paper making machine, and specifically means paper, felt, or canvas that travels while being guided by a roll or the like, or a press roll, a drier roll, a canvas roll, or a calendar roll that rotates and travels in a peripheral direction for guiding the paper, the felt, or the canvas.

**[0045]** The fluid means air, water, or a chemical solution. Examples of the chemical solution include a wet paper strength agent, a detergent, a pitch control agent, an antifouling agent, and a release agent.

**[0046]** Figure 1(a) is a side view illustrating an embodiment of a spraying apparatus according to the present invention, and Figure 1(b) is a top view of the spraying apparatus illustrated in Figure 1(a).

**[0047]** As illustrated in Figure 1(a) and Figure 1(b), a spraying apparatus 100 according to the present embodiment includes a housing section 2 having an elongated shape extending in a width direction of a traveling body R and two nozzle sections 1 that can reciprocate with respect to the housing section 2. That is, in the housing section 2, units each including the nozzle section 1 and a support section 10 are provided side by side with predetermined spacing in the width direction of the traveling body R.

**[0048]** The two units have substantially the same structure.

**[0049]** In the spraying apparatus 100, the two nozzle sections 1 can respectively independently spray fluids toward the traveling body R, and can reciprocate in a longitudinal direction of the housing section 2 in synchronization. Accordingly, in the spraying apparatus 100, the fluids can be efficiently sprayed onto the traveling body R even if the traveling body R is large in size.

**[0050]** A method for reciprocating the nozzle section 1 is not particularly limited. For example, control may be performed to reciprocate the nozzle section 1 every time the nozzle section 1 is detected by providing the housing section 2 with a proximity sensor, a limit switch, a tactile switch, or the like, or may be performed to reciprocate the nozzle section 1 in response to the number of revolutions of a motor (driving source), for example.

**[0051]** The spraying apparatus 100 is supported on a frame not illustrated, and is installed at a predetermined distance from the traveling body R on the fluid spray side of the traveling body R. For example, the spraying apparatus 100 is installed above the traveling body R.

**[0052]** At this time, the spraying apparatus 100 is preferably detachably attached to a frame not illustrated from the viewpoint of easy maintenance.

**[0053]** Figure 2 is a cross-sectional view taken along a line A - A of the spraying apparatus illustrated in Figure 1(a).

**[0054]** As illustrated in Figure 2, the spraying apparatus 100 includes the nozzle section 1 for spraying a fluid, a fluid tube 20 for supplying the fluid to the nozzle section 1, a cableveyor 21 that accommodates the fluid tube 20, the support section 10 on which the nozzle section 1 is supported and fixed, a driving section 22 for reciprocating the support section 10 in the width direction of the traveling body R, a driving section rail section 24 for supporting the driving section 22, a driving source M for driving the driving section 22, a rail section 23a attached to the housing section 2, a guide section 23b attached to the support section 10, and the housing section 2 that accommodates at least the cableveyor 21, the driving

section 22, the rail section 23a, and the guide section 23b.

**[0055]** The housing section 2 has a hollow square columnar shape, and includes an upper wall portion 2a, a side wall portion 2b1 on one side (hereinafter also conveniently referred to as a "first side wall portion 2b1") and a side wall portion 2b2 on the other side (hereinafter also conveniently referred to as a "second side wall portion 2b2") respectively hanging from end portions at the front and the rear (on the upstream side and the downstream side in a traveling direction of the traveling body) of the upper wall portion 2a, an auxiliary lower wall portion 2c1 provided at a lower end of the first side wall portion 2b1, a lower wall portion 2c provided at a lower end of the second side wall portion 2b2, and an auxiliary side wall portion 2d provided to stand in an end portion, on the opposite side to the second side wall portion 2b2, of the lower wall portion 2c.

**[0056]** An opening portion K extending in the width direction of the traveling body is provided between the auxiliary lower wall portion 2c1 and the lower wall portion 2c. That is, a bottom portion of the housing section 2 includes the auxiliary lower wall portion 2c1, the opening portion K, and the lower wall portion 2c.

**[0057]** In this way, in the spraying apparatus 100, the opening portion K is daringly provided in the bottom portion of the housing section 2. Thus, contaminants such as a scattered chemical solution and floating pitch do not easily enter the housing section 2. As a result, the inside of the housing section 2 can be prevented from being contaminated.

**[0058]** When the auxiliary lower wall portion 2c1 is provided, even if a component attached to the first side wall portion 2b1 has dropped, the component can be received.

**[0059]** The opening portion K is formed to extend in the width direction of the traveling body R in the bottom portion of the housing section. Thus, the support section 10 that passes through the opening portion K and the fluid tube 20 attached to the nozzle section 1 are not prevented from reciprocating in the width direction of the traveling body.

**[0060]** The driving section 22 is attached to an inner wall of the first side wall portion 2b1 in the housing section 2 via the driving section rail section 24.

**[0061]** Figure 3 is a transmission side view for describing an installation state of a driving section with respect to a housing section in the spraying apparatus according to the present embodiment. In Figure 3, description of the rail section 23a, the guide section 23b, the cableveyor 21, and the like is omitted.

**[0062]** As illustrated in Figure 3, the driving section 22 includes a loop-shaped endless body 22a and a pair of sprockets 22b between which the endless body 22a is hung. As a result, the driving section 22 can be smoothly moved while having a simple structure.

**[0063]** The driving source M is attached to the sprocket 22b on one side (see Figure 1(a) and Figure 1(b)).

**[0064]** For example, a chain, a belt, or the like can be adopted as the endless body 22a, and a motor or the like can be adopted as the driving source M. Among them, the chain is favorably used as the endless body 22a.

**[0065]** In the spraying apparatus 100, the above-described two support sections 10 are attached and fixed with predetermined spacing to the endless body 22a on the lower side in the loop-shaped endless body 22a. In the spraying apparatus 100, to cause the support section 10 to protrude from the opening portion K in the bottom portion of the housing section 2, the support section 10 is daringly attached to the endless body 22a on the lower side, whereby an inner configuration of the housing section 2 can be simplified, as described below (see Figure 2).

**[0066]** In the spraying apparatus 100, when the driving source M drives the driving section 22, the support sections 10 with predetermined spacing reciprocate in synchronization. Based thereon, the nozzle sections 1 to be respectively supported by the support sections 10 also reciprocate.

**[0067]** Figure 4(a) is a transmission side view illustrating a portion P1 of the spraying apparatus illustrated in Figure 3 in an enlarged manner, and Figure 4(b) is a transmission top view of Figure 4(a).

**[0068]** As illustrated in Figure 4(a) and Figure 4(b), in the spraying apparatus 100, a tension adjustment tool 25 is attached to the sprocket 22b on the other side.

**[0069]** The tension adjustment tool 25 includes a shaft section 25a extending in a longitudinal direction of the housing section 2 (the width direction of the traveling body R) attached to the sprocket 22b, a stopper 25b attached to the shaft section 25a, a fixing section 25c attached to the housing section 2 for supporting and fixing the shaft section 25a, and a spring section 25d sandwiched between the stopper 25b and the fixing section 25c.

**[0070]** In the tension adjustment tool 25, the spring section 25d elastically urges the stopper 25b toward the sprocket 22b. As a result, in the spraying apparatus 100, even if the nozzle section 1 and the support section 10 are attached to the endless body 22a on the lower side, the endless body 22a is prevented from being slack downward so that the tension of the endless body 22a can be maintained.

**[0071]** Referring to Figure 2 again, the spraying apparatus 100 includes the pair of driving section rail sections 24 extending in the longitudinal direction of the housing section 2 (the width direction of the traveling body R).

**[0072]** The pair of driving section rail sections 24 is attached to the inner wall of the first side wall portion 2b1 in the housing section 2 via the rail section 23a. That is, the driving section rail section 24 is attached to a main body of the rail section 23a attached to the inner wall of the first side wall portion 2b1. The paired driving section rail sections 24 are parallel to each other.

**[0073]** The driving section rail section 24 on the upper side supports the endless body 22a on the upper side to sandwich the endless body 22a on the upper side from

above and below, and the driving section rail section 24 on the lower side supports the endless body 22a on the lower side to sandwich the endless body 22a on the lower side from above and below.

**[0074]** The driving section rail section 24 is structured to contact a roller portion of the endless body 22a, and the roller portion freely rotates, thereby not to prevent the driving section 22 from reciprocating.

**[0075]** As a result, in the spraying apparatus 100, stability obtained when the nozzle section reciprocates can be improved.

**[0076]** The support section 10 is for supporting the nozzle section 1, and includes a first support piece 10a attached and fixed to the endless body 22a on the lower side (the driving section 22) and having an inverted L shape in a side view, a plate-shaped second support plate 10b having the first support piece 10a attached thereto and extending in an up-down direction in a side view, and a plate-shaped third support plate 10c attached to the second support plate 10b and extending in a horizontal direction in a side view.

**[0077]** The first support piece 10a, the second support plate 10b, and the third support plate 10c are integrated with one another.

**[0078]** In the support section 10, the first support piece 10a is directly attached to the endless body 22a on the lower side. Thus, the first support piece 10a, together with the driving section 22, reciprocates based on the driving of the driving section 22. As a result, the entire support section 10 reciprocates in the width direction of the traveling body.

**[0079]** In the support section 10, the second support plate 10b is located at substantially the center of the inside of the housing section 2, and partitions the inside of the housing section 2 into front and rear parts (the upstream side and the downstream side in the traveling direction of the traveling body).

**[0080]** In the housing 2, the above-described driving section 22 or the like is arranged on the one side of the second support plate 10b, and the cableveyor 21 or the like, described below, is arranged on the other side thereof. As a result, there is an advantage that when the cableveyor 21 is taken out of the housing section 2 to maintain the cableveyor 21, the driving section 22 or the like is not obstructive, for example.

**[0081]** In the spraying apparatus 100, the guide section 23b is attached to the first side wall portion 2b1 side (the driving section 22 side) of the second support plate 10b.

**[0082]** On the other hand, the pair of rail sections 23a is attached to the inner wall of the first side wall portion 2b1 in the housing section 2.

**[0083]** The pair of rail sections 23a is arranged on substantially the same (vertical) surface as the driving section 22, and is arranged inside the driving section 22 and the driving section rail section 24. That is, on such a (vertical) surface, the endless body 22a on the upper side, the rail section 23a on the upper side, the guide section 23b, the rail section 23a on the lower side, and the endless body 22a on the lower side are arranged in this order from above. As a result, an arrangement of components in the housing section 2 can be made compact.

**[0084]** Figure 5 is a transmission side view for describing an installation state of the rail section and the guide section with respect to the housing section in the spraying apparatus according to the present embodiment, and Figure 6 is a transmission side view illustrating a portion P2 of the spraying apparatus illustrated in Figure 5 in an enlarged manner. In Figure 5 and Figure 6, description of the housing section 2, the driving section 22, the cableveyor 21, and the like is omitted.

**[0085]** As illustrated in Figure 5, the spraying apparatus 100 includes the pair of rail sections 23a extending in the longitudinal direction of the housing section 2.

**[0086]** The paired rail sections 23a are vertically located, and are parallel to each other.

**[0087]** On the other hand, as illustrated in Figure 6, three guide sections 23b are provided in the support section 10 (the second support plate 10b). Among them, the guide sections 23b on both sides abut on the rail section 23a on the lower side, and the guide section 23b at the center abuts on the rail section 23b on the upper side via a spring B for upward urging (see Figure 2).

**[0088]** In the spraying apparatus 100, when the nozzle section 1 and the support section 10 reciprocate, they are guided by the guide sections 23b on both sides sliding along the rail section 23a on the lower side and are guided by the guide section 23b at the center sliding along the rail section 23a on the upper side. As a result, in the spraying apparatus 100, stability obtained when the nozzle section 1 reciprocates can be improved. That is, positional accuracy in the reciprocation can be improved. The spraying apparatus 100 includes the three guide sections 23b, as described above, whereby the stability is particularly improved.

**[0089]** Referring to Figure 2 again, in the support section 10, a placement section 10d for placing the cableveyor 21 folded upward is attached to the second side wall portion 2b2 side (the cableveyor 21 side) of the second support plate 10b. Details of the cableveyor 21 will be described below.

**[0090]** The placement section 10d is integrated with the first support piece 10a, the second support plate 10b, and the third support plate 10c, described above.

**[0091]** Therefore, when the support section 10 reciprocates, the placement section 10d, together with the cableveyor 21 on the upper side, also reciprocates.

**[0092]** In the spraying apparatus 100, an air spraying device 27 for spraying air is attached to an end of the placement section 10d (see Figure 6).

**[0093]** In the spraying apparatus 100, when the air spraying device 27 sprays air, contaminants that attempt to enter the housing section 2 can be sprayed from the opening portion K, and the contaminants can be prevented from adhering to the component (particularly, the cableveyor 21). The air spraying device 27 is attached to the placement section 10d, whereby the air spraying de-

vice 27, together with the support section 10, reciprocates, like in the foregoing.

**[0094]** In the support section 10, the second support plate 10b is arranged to protrude out of the housing section 2 through the opening portion K in the housing section 2, and the third support plate 10c is attached to a lower end of the second support plate 10b. That is, the first support piece 10a is attached and fixed to the second support plate 10b inside the housing section 2, and the third support plate 10c is attached and fixed thereto outside the housing section 2.

**[0095]** In the support section 10, the third support plate 10c is provided to be substantially parallel to the bottom portion of the housing section 2, and a support tube section 1b in the nozzle section 1 is attached to a distal end of the third support plate 10c.

**[0096]** Therefore, the support section 10 in the housing section 2 passes through the opening portion K, to support and fix the nozzle section 1.

**[0097]** The nozzle section 1 includes a nozzle main body section 1a having a nozzle port at its distal end and the support tube section 1b having an inverted L shape in a front view that supports the nozzle main body section 1a and through which a fluid can flow.

**[0098]** In the spraying apparatus 100, the nozzle section 1 is provided such that the nozzle main body section 1a is directed toward the traveling body R located therebelow and the support tube section 1b hangs from the housing section 2.

**[0099]** In the nozzle section 1, the fluid that flows through the support tube section 1b flows into the nozzle main body section 1a, and the fluid is sprayed from the nozzle port of the nozzle main body section 1a.

**[0100]** In the spraying apparatus 100, the fluid tube 20 is attached to the support tube section 1b in the nozzle section 1 such that the inside thereof is in fluid communication with the support tube section 1b.

**[0101]** The fluid tube 20 passes through the opening portion of the housing section 2, and is accommodated in a hollow portion 211 of the cableveyor 21 in the housing section 2. Accordingly, when the nozzle section 1 reciprocates, the fluid tube 20 is prevented from being damaged, for example, upon being rubbed against the other component by the cableveyor 21.

**[0102]** In the spraying apparatus 100, the cableveyor 21 has a long chain shape obtained by connecting a plurality of ringshaped small pieces to one another, and is bendable.

**[0103]** Figure 7 is an explanatory view for describing a positional relationship of the cableveyor with respect to the housing section in the spraying apparatus according to the present embodiment.

**[0104]** As illustrated in Figure 7, in the spraying apparatus 100, the cableveyor 21 is bent in a U shape, and is attached such that one end 21a of the cableveyor 21 located on the upper side is detachably attached to the support section 10, and is fixed such that the other end 21b of the cableveyor 21 located on the lower side is detachably attached to an end portion S in the bottom portion of the housing section 2. Accordingly, the cableveyor 21 follows the reciprocation of the nozzle section 1 when a bent position sequentially changes.

**[0105]** In the spraying apparatus 100, when the cableveyor 21 is maintained, only the cableveyor 21 can be simply taken out of the spraying apparatus 100 without peripheral components such as the nozzle section 1 being removed by removing the other end of the cableveyor 21 in the end portion S of the housing section 2, pulling the cableveyor 21 at a removal position, and removing one end of the cableveyor 21 from the support section 10 that has moved forward.

**[0106]** At this time, a takeoff port that can be opened and closed is preferably provided in the end portion S in the bottom portion of the housing section 2.

**[0107]** Referring to Figure 2 again, in the spraying apparatus 100, the cableveyors 21 on the lower side in the adjacent units are installed in the housing section 2 with they overlapping each other in the up-down direction.

**[0108]** Specifically, both the cableveyors 21 are placed on the lower wall portion 2c between the second side wall portion 2b2 and the auxiliary side wall portion 2d.

**[0109]** At this time, the housing section 2 includes the auxiliary side wall portion 2d, and thus can prevent the cableveyor 21 from dropping from the opening portion K.

**[0110]** As described above, the cableveyor 21 folded upward is placed in the placement section 10d.

**[0111]** In the spraying apparatus 100, the placement section 10d is located just above the lower wall portion 2c.

**[0112]** In this way, when the cableveyor 21 and the folded cableveyor 21 are vertically arranged, the nozzle section 1 can be smoothly reciprocated without a load being applied to the cableveyor 21.

**[0113]** The spraying apparatus 100 itself can be made compact.

**[0114]** Although the preferred embodiment of the present invention has been described above, the present invention is not limited to the embodiment.

**[0115]** Although the two nozzle sections 1 (units) are attached to the housing section 2 in the spraying apparatus 100 according to the present embodiment, the number of nozzle sections or units including the nozzle sections is not limited to this.

**[0116]** Although the housing section 2 has a hollow square columnar shape in the spraying apparatus 100 according to the present embodiment, the present invention is not limited to this if it can accommodate the cableveyor 21 and the driving section 22.

**[0117]** Although the housing section 2 includes the upper wall portion 2a, the first side wall portion 2b1 and the second side wall portion 2b2, the auxiliary lower wall portion 2c1, the lower wall portion 2c, and the auxiliary side wall portion 2d, and is provided with the opening portion K between the auxiliary lower wall portion 2c1 and the lower wall portion 2c, the present invention is not limited to this shape.

**[0118]** Figure 8(a) and Figure 8(b) are schematic side

views each illustrating a housing section in a spraying apparatus according to another example of the embodiment.

**[0119]** As illustrated in Figure 8(a), a housing section 4a may include an upper wall portion 2a, a first side wall portion 2b1 and a second side wall portion 2b2, and a lower wall portion 2c, and an opening portion K may be provided between the first side wall portion 2b1 and the lower wall portion 2c. That is, the auxiliary lower wall portion 2c1 and the auxiliary side wall portion 2d need not be provided.

**[0120]** As illustrated in Figure 8(b), a housing section 4b may include an upper wall portion 2a, a first side wall portion 2b1 and a second side wall portion 2b2, a lower wall portion 2c, and an auxiliary side wall portion 2d, and an opening portion K may be provided between the first side wall portion 2b1 and the lower wall portion 2c. That is, the auxiliary lower wall portion 2c1 need not be provided.

**[0121]** Although the driving section 22 includes the endless body 22a and the pair of sprockets 22b in the spraying apparatus 100 according to the present embodiment, the present invention is not limited to this.

**[0122]** For example, a chain, a belt, or the like having a linear shape (not a loop shape) can also be adopted instead of the endless body 22a.

**[0123]** A pulley or the like can also be adopted instead of the sprocket 22b.

**[0124]** A servo cylinder, a ball screw, a rack pinion, a linear motor, or the like can also be adopted instead of the endless body 22a and the sprocket 22b.

**[0125]** Although the driving section rail section 24 and the rail section 23a are separately provided in the spraying apparatus 100 according to the present embodiment, they may be integrated with each other.

**[0126]** Although the tension adjustment tool 25 includes the shaft section 25a, the stopper 25b, the fixing section 25c, and the spring section 25d in the spraying apparatus 100 according to the present embodiment, the present invention is not limited to this.

**[0127]** For example, a bolt or the like can be adopted instead of the spring section 25d. In this case, tension can be adjusted depending on how the bolt is fastened.

**[0128]** Although the three guide sections 23b are provided in the support section 10 (the second support plate 10b) in the spraying apparatus 100 according to the present embodiment, the number of guide sections 23b is not limited to this.

**[0129]** Although the air spraying device 27 for spraying air is attached to the end portion of the placement section 10d in the spraying apparatus 100 according to the present embodiment, the air spraying device 27 is not essential.

**[0130]** Although the cableveyors 21 on the lower side in the adjacent units are installed in the housing section 2 with they overlapping each other in the up-down direction in the spraying apparatus 100 according to the present embodiment, the present invention is not limited to this.

**[0131]** Figure 9(a) and Figure 9(b) are explanatory views for each describing a positional relationship of a cableveyor with respect to a housing section in a spraying apparatus according to another example of the embodiment.

**[0132]** As illustrated in Figure 9(a), cableveyors 21 on the lower side in adjacent units may be installed in a housing section 2 with they being provided side by side in a left-right direction.

**[0133]** As illustrated in Figure 9(b), cableveyors 41 in adjacent units may be common to each other. That is, two units may be attached to one cableveyor 41.

**[0134]** Although the opening portion extending in the width direction of the traveling body is provided in the bottom portion of the housing section in the spraying apparatus 100 according to the present embodiment, an opening portion extending in the width direction of the traveling body may be provided in the side wall portion of the housing section.

**[0135]** Figure 10 is a cross-sectional view illustrating a spraying apparatus according to another example of the embodiment.

**[0136]** As illustrated in Figure 10, a spraying apparatus 101 according to the example is substantially the same as the spraying apparatus 100 according to the present embodiment except that it differs in a structure of a housing section 6.

**[0137]** The housing section 6 in the spraying apparatus 101 has a hollow square columnar shape, and has an opening portion K1 extending in a width direction of a traveling body provided in its side wall portion.

**[0138]** In this way, in the spraying apparatus 101, the opening portion K1 is provided in the side wall portion of the housing section 6. Thus, contaminants such as a scattered chemical solution and floating pitch can be prevented from entering the housing section 6 as much as possible.

**[0139]** The opening portion K1 is formed to extend in the width direction of the traveling body in the side wall portion of the housing section 6. Thus, a fluid tube, which is attached to a support section and a nozzle section, passing through the opening portion K1, is not prevented from reciprocating in the width direction of the traveling body.

**[0140]** In the spraying apparatus 100 according to the present embodiment, a receiving section 5 may be provided below the housing section 2.

**[0141]** Figure 11(a) and Figure 11(b) are cross-sectional views each illustrating a housing section and a receiving section in the spraying apparatus according to another example of the embodiment. An internal structure of the housing section is the same as that in the spraying apparatus 100 according to the present embodiment, and hence is omitted.

**[0142]** As illustrated in Figure 11(a), in the spraying apparatus according to the example, a receiving section 5a has an L shape in a side view, and may be attached

to a side wall portion of the housing section to be located below the housing section. As a result, components in the housing section can be prevented from dropping from the housing section and colliding with a traveling body.

**[0143]** As illustrated in Figure 11(b), in the spraying apparatus according to the example, a receiving section 5b has a U shape in a side view, and may be provided to be located below the housing section independently of the housing section. In this case, a roller 5c for supporting the housing section may be installed in the receiving section 5b.

Industrial Applicability

**[0144]** The spraying apparatus according to the present invention is favorably used as an apparatus for applying a fluid to a traveling body in a paper making machine.

**[0145]** The spraying apparatus according to the present invention can reduce adhesion of contaminants in a housing section.

Reference Signs List

**[0146]**

1...nozzle section,
10...support section,
100, 101...spraying apparatus,
10a...first support piece,
10b...second support plate,
10c...third support plate,
10d...placement section,
1a...nozzle main body section,
1b...support tube section,
2, 4a, 4b, 6...housing section,
20...fluid tube,
21, 41...cableveyor,
211...hollow portion,
21a...one end of cableveyor,
21b...other end of cableveyor,
22...driving section,
22a...endless body,
22b...sprocket,
23a...rail section,
23b...guide section,
24...driving section rail section,
25...tension adjustment tool,
25a...shaft section,
25b...stopper,
25c...fixing section,
25d...spring section,
27...air spraying device,
2a...upper wall portion,
2b1...side wall portion on one side (first side wall portion),
2b2...side wall portion on other side (second side wall portion),
2c...lower wall portion,
2c1...auxiliary lower wall portion,
2d...auxiliary side wall portion,
5a, 5b...receiving section,
5c...roller,
K, K1...opening portion,
M...driving source,
R...traveling body,
S...end portion in bottom portion of housing section.

## Claims

1. A spraying apparatus used while being attached to a paper making machine to spray a fluid onto a traveling body in the paper making machine, the spraying apparatus comprising:

   a nozzle section capable of spraying the fluid;
   a fluid tube for supplying the fluid to the nozzle section;
   a cableveyor having the fluid tube accommodated in its hollow portion;
   a support section on which the nozzle section is supported and fixed;
   a driving section for reciprocating the support section in a width direction of the traveling body;
   a driving section rail section extending in the width direction of the traveling body;
   a driving source for driving the driving section; and
   a housing section that accommodates at least the cableveyor and the driving section, wherein
   the housing section has an elongated shape extending in the width direction of the traveling body,
   an opening portion extending in the width direction of the traveling body is provided in a bottom portion or a side wall portion of the housing section,
   the support section in the housing section supports and fixes the nozzle section through the opening portion,
   the fluid tube accommodated in the cableveyor is attached to the nozzle section through the opening portion,
   the driving section rail section is attached to an inner wall of the side wall portion of the housing section, and
   the driving section rail section supports the driving section to sandwich the driving section from above and below.

2. A spraying apparatus used while being attached to a paper making machine to spray a fluid onto a traveling body in the paper making machine, the spraying apparatus comprising:

a nozzle section capable of spraying the fluid;
a fluid tube for supplying the fluid to the nozzle section;
a cableveyor having the fluid tube accommodated in its hollow portion;
a support section on which the nozzle section is supported and fixed;
a driving section for reciprocating the support section in a width direction of the traveling body;
a driving source for driving the driving section; and
a housing section that accommodates at least the cableveyor and the driving section, wherein
the housing section has an elongated shape extending in the width direction of the traveling body,
an opening portion extending in the width direction of the traveling body is provided in a bottom portion or a side wall portion of the housing section,
the support section in the housing section supports and fixes the nozzle section through the opening portion,
the fluid tube accommodated in the cableveyor is attached to the nozzle section through the opening portion, and
the driving section includes a loop-shaped endless body to which the support section is attached and a pair of sprockets between which the endless body is hung.

**3.** The spraying apparatus according to claim 2, wherein a tension adjustment tool is attached to the sprocket.

**4.** The spraying apparatus according to claim 2 or 3, further comprising

a driving section rail section extending in the width direction of the traveling body, wherein
the driving section rail section is attached to the inner wall of the side wall portion of the housing section, and
the driving section rail section support the driving section to sandwich the driving section from above and below.

**5.** The spraying apparatus according to any one of claims 1 to 4, further comprising

a rail section extending in the width direction of the traveling body, and
a guide section attached to the support section, wherein
the rail section is attached to the inner wall of the side wall portion of the housing section, and the guide section is slidable along the rail section.

**6.** The spraying apparatus according to any one of claims 1 to 5, wherein an auxiliary lower wall portion attached to the side wall portion on one side and a lower wall portion attached to the side wall portion on the other side are provided in the bottom portion of the housing section, and the opening portion is provided between the auxiliary lower wall portion and the lower wall portion.

**7.** The spraying apparatus according to claim 6, wherein

an auxiliary side wall portion is provided to stand in an end portion, on the opposite side to the side wall portion on the other side, of the lower wall portion, and
the cableveyor is placed on the lower wall portion between the side wall portion on the other side and the auxiliary side wall portion.

**8.** The spraying apparatus according to claim 6 or 7, wherein

a placement section for placing the cableveyor folded upward is attached to the support section, and
the placement section is located just above the lower wall portion.

**9.** The spraying apparatus according to claim 8, wherein an air spraying device for spraying air is attached to the placement section.

**10.** The spraying apparatus according to any one of claims 1 to 9, wherein units each including the nozzle section and the support section are provided side by side with predetermined spacing.

FIG. 1(a)

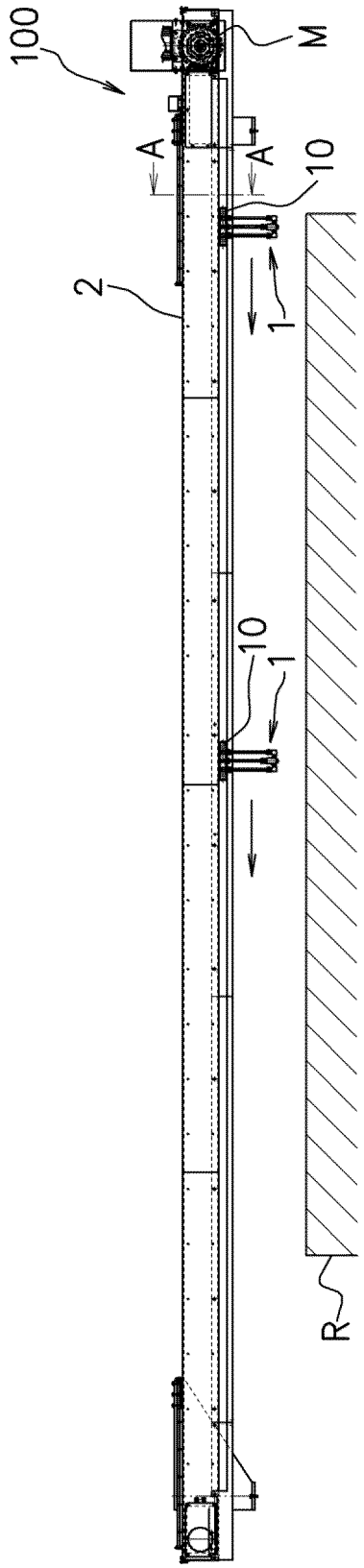


FIG. 1(b)

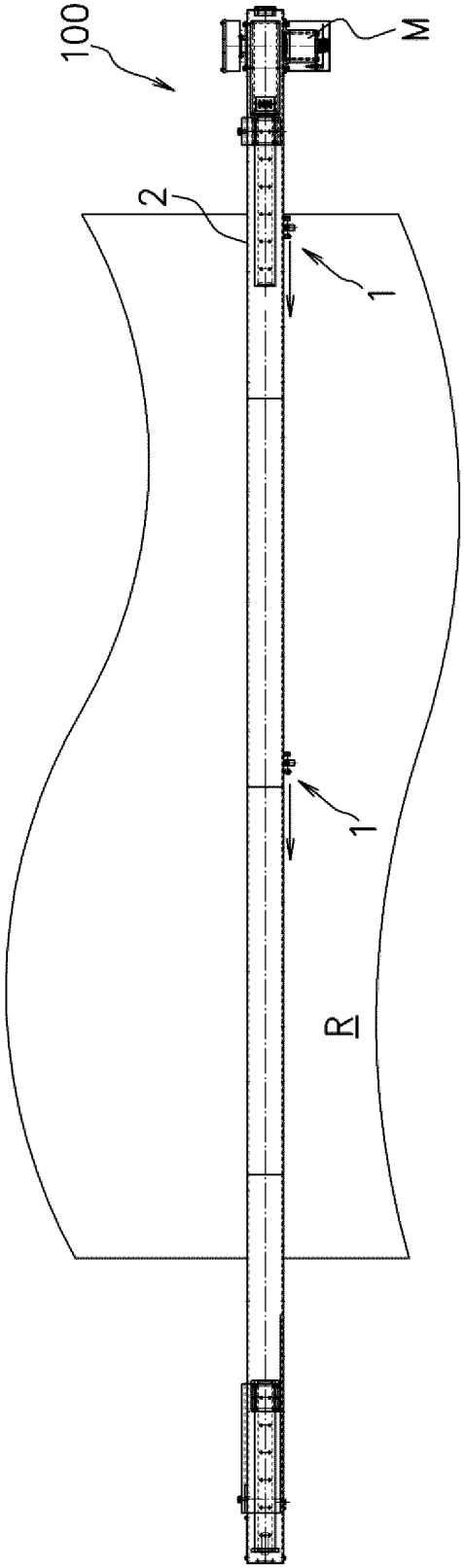


FIG. 2

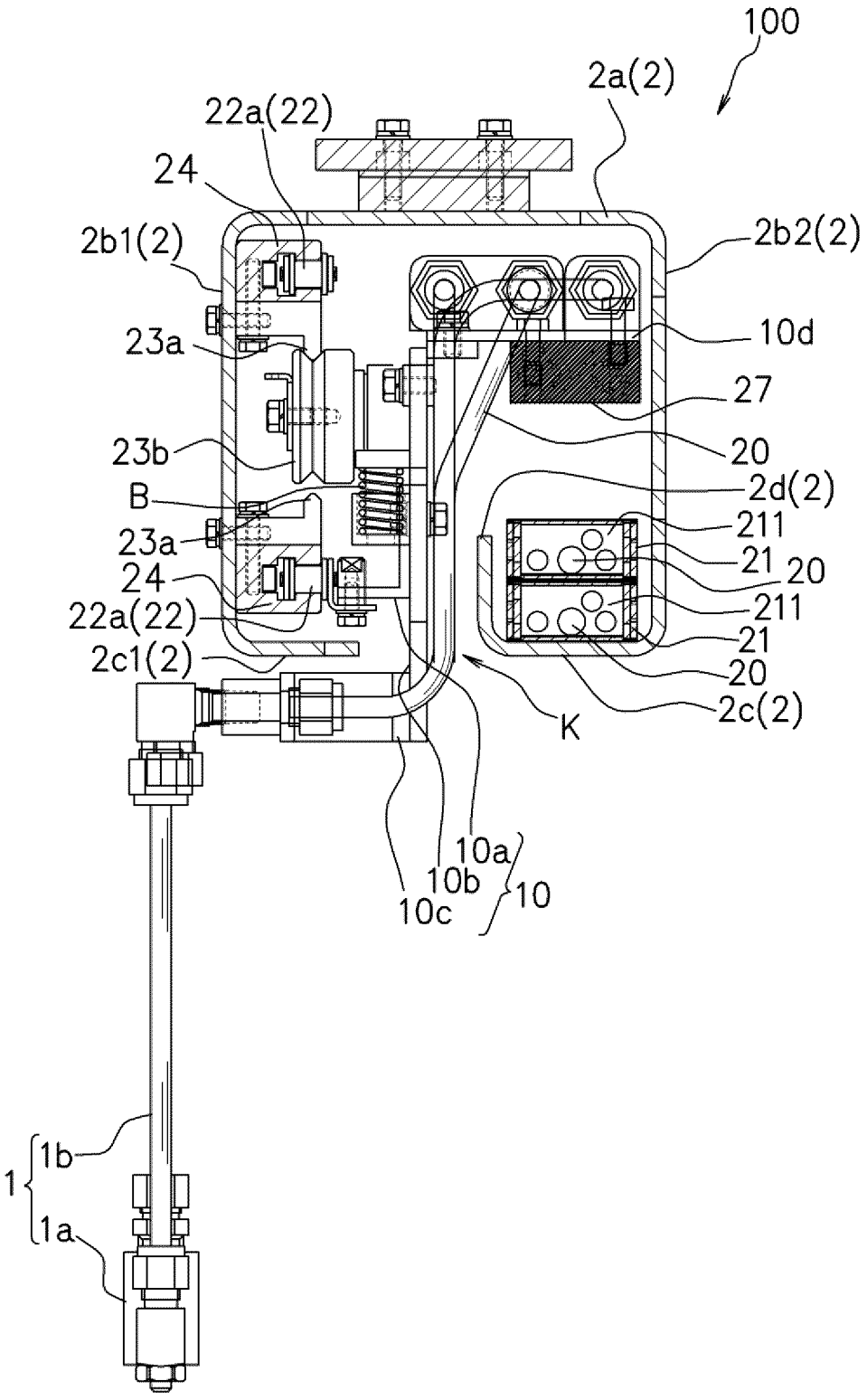

100
2a(2)
22a(22)
24
2b1(2)
2b2(2)
23a
10d
27
23b
20
B
2d(2)
211
23a
21
20
24
211
22a(22)
21
2c1(2)
20
2c(2)
K
10a
10b
10c
10
1
1b
1a

FIG. 3

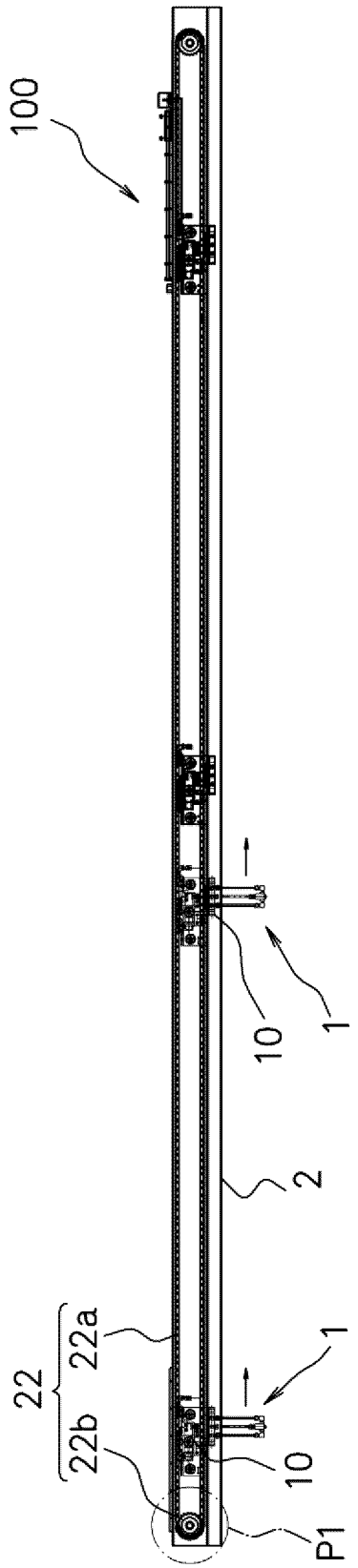


FIG. 4(a)

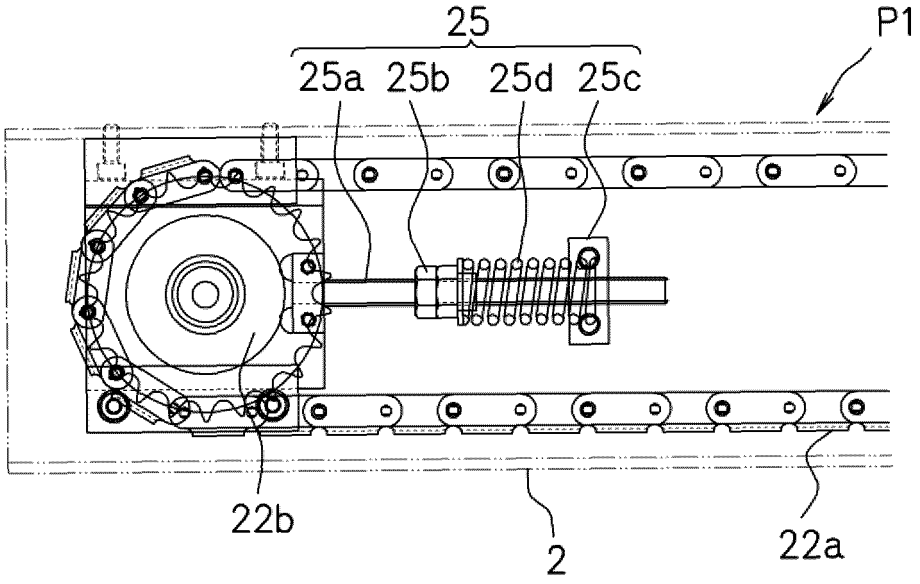


FIG. 4(b)

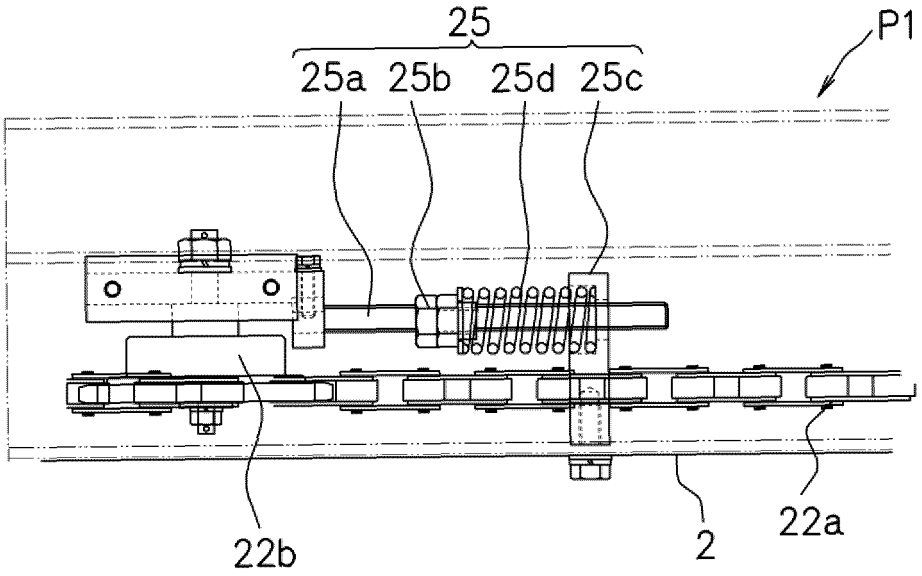


FIG. 5

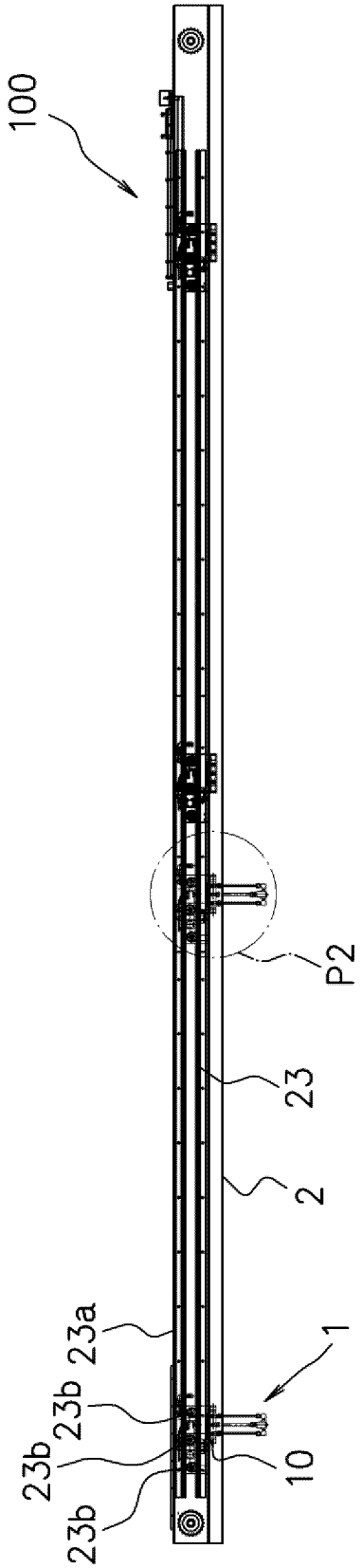


FIG. 6

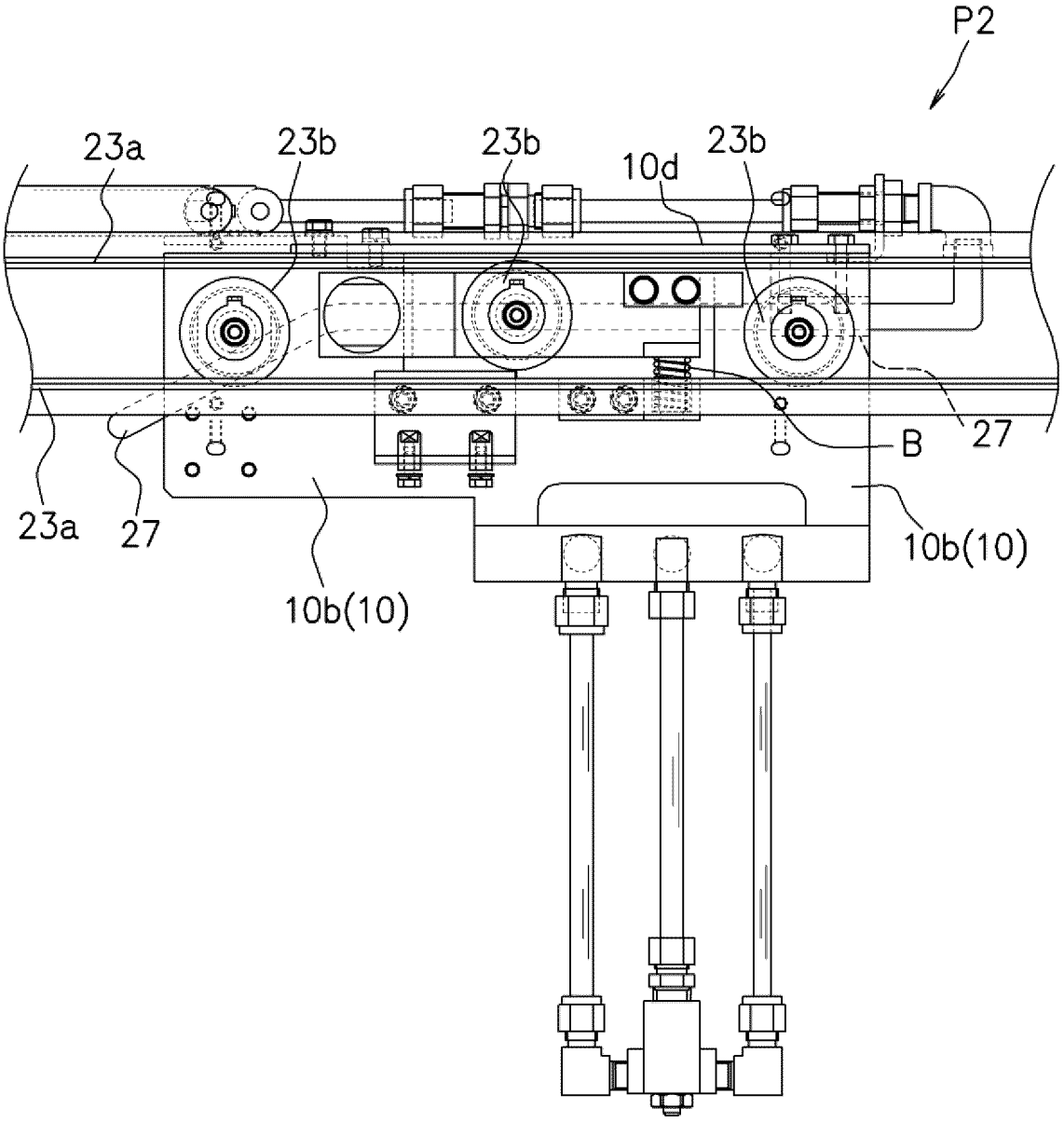


FIG. 7

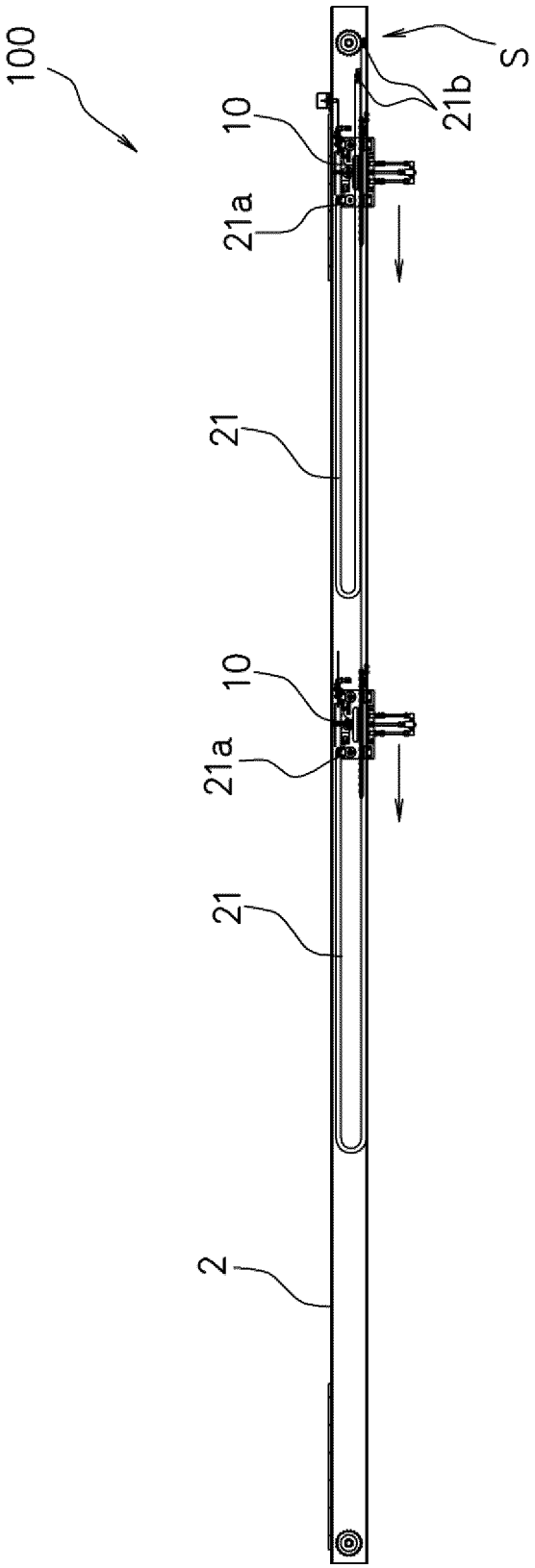


FIG. 8(a)

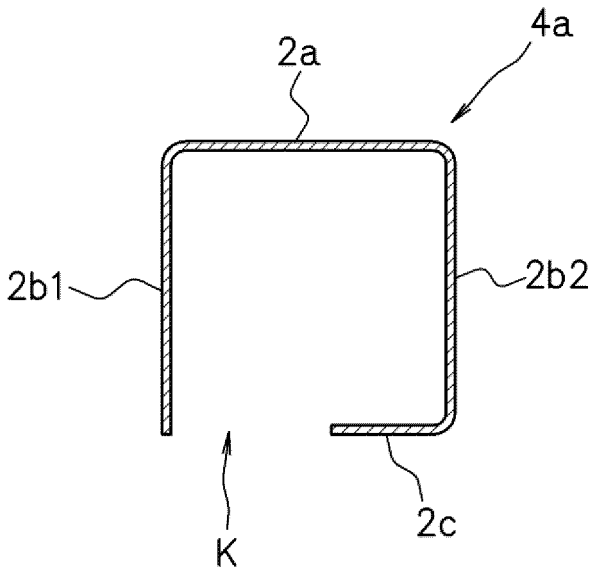


FIG. 8(b)

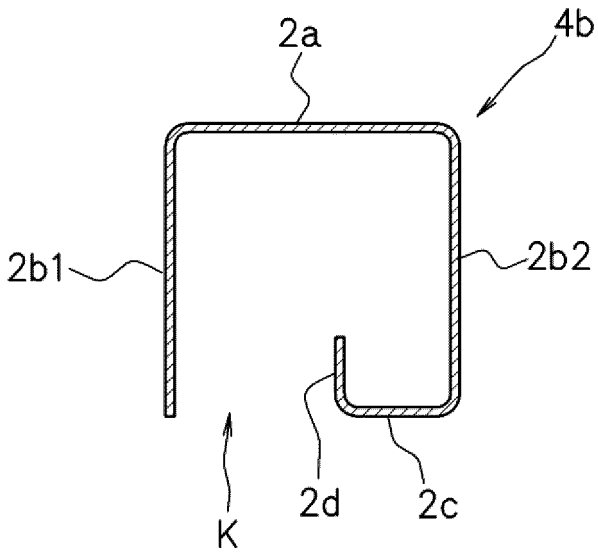


FIG. 9(a)

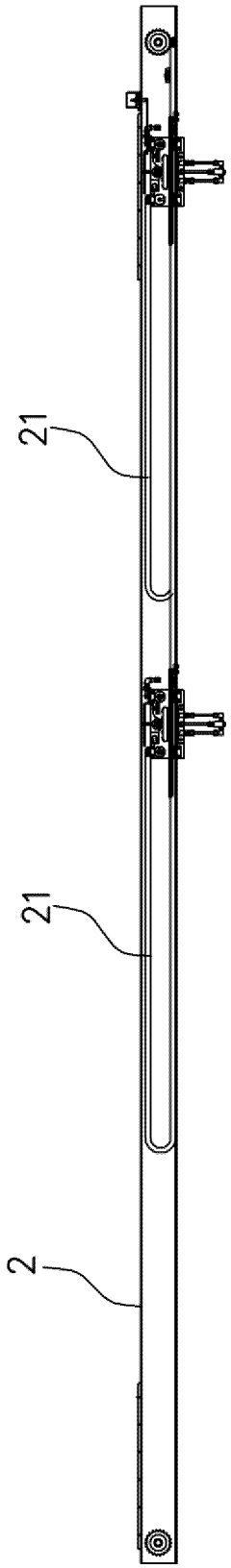


FIG. 9(b)

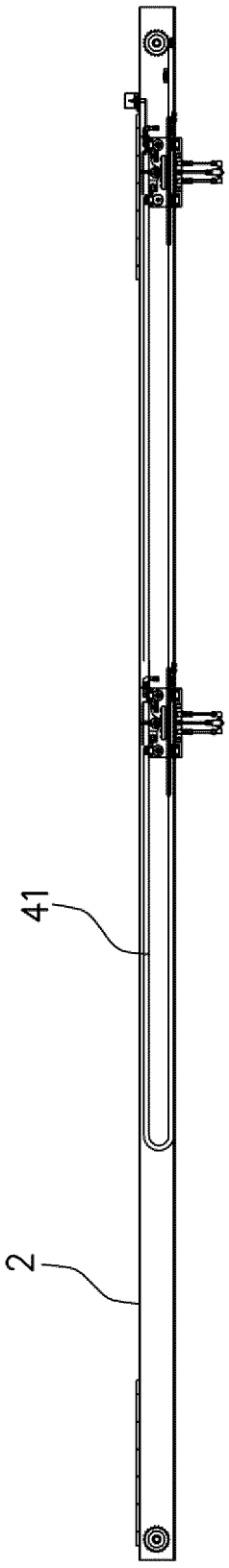


FIG. 10

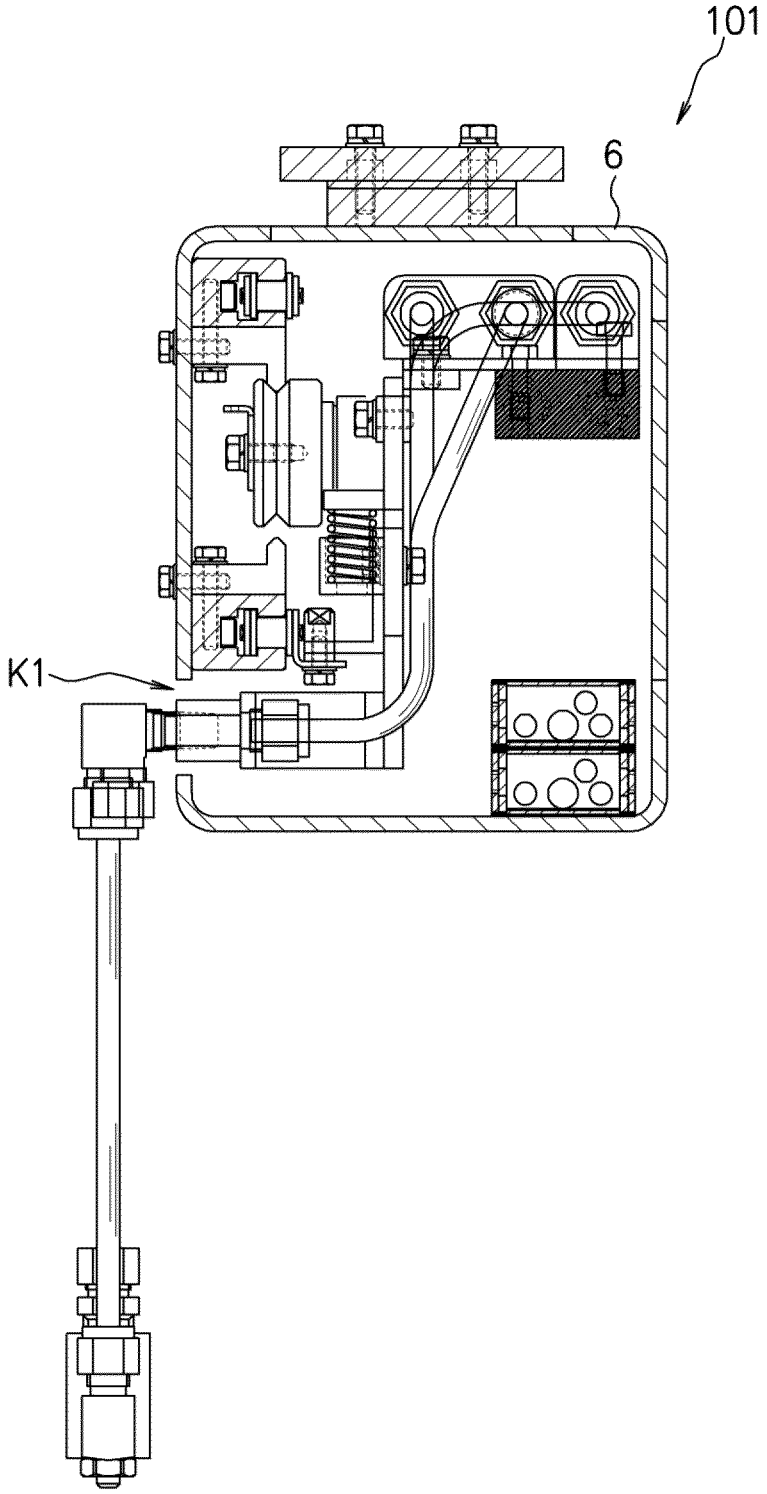


FIG. 11(a)

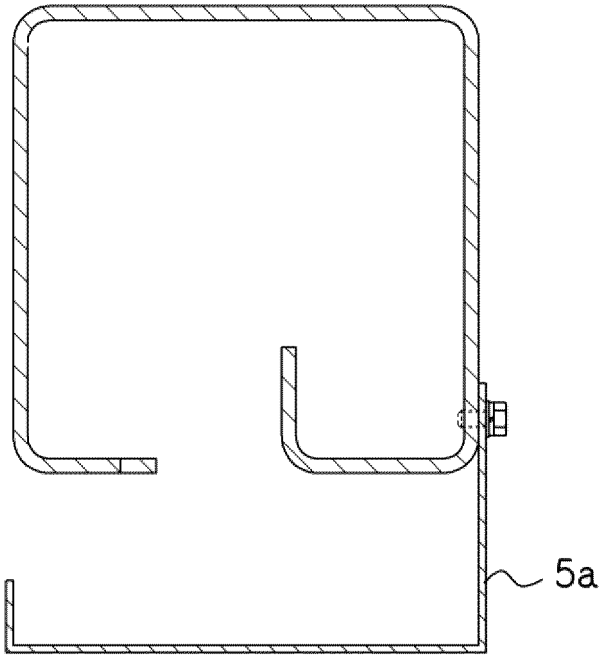
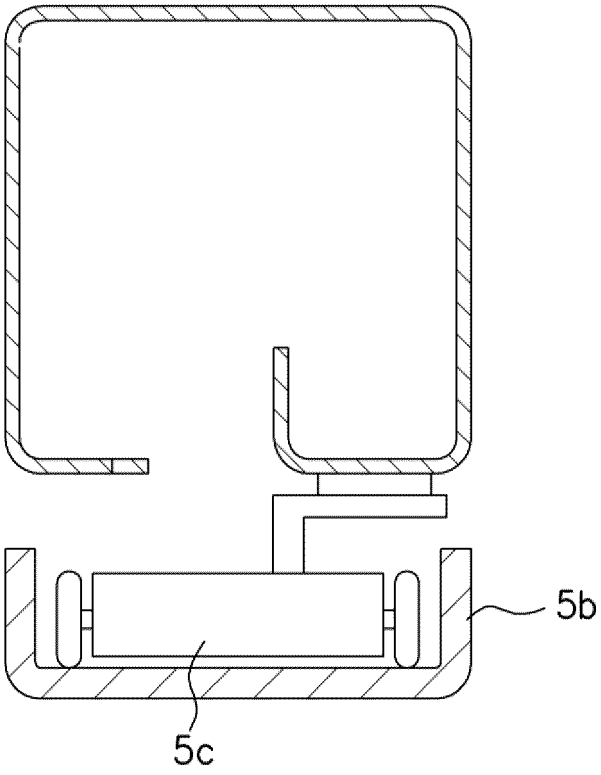



FIG. 11(b)



# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/006478

A. CLASSIFICATION OF SUBJECT MATTER
D21F 7/00(2006.01)i; B05B 15/00(2018.01)i; B05B 15/70(2018.01)i
FI: D21F7/00 Z; B05B15/70; B05B15/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D21F7/00; B05B15/00; B05B15/70

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

| | |
|---|---|
| Published examined utility model applications of Japan | 1922-1996 |
| Published unexamined utility model applications of Japan | 1971-2021 |
| Registered utility model specifications of Japan | 1996-2021 |
| Published registered utility model applications of Japan | 1994-2021 |

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | JP 9-122540 A (HORIKAWA ENGINEERING WORKS LTD.) 13 May 1997 (1997-05-13) paragraphs [0026]-[0028], fig. 4 | 2 |
| Y | paragraphs [0026]-[0028], fig. 4 | 1, 3-5, 10 |
| A | paragraphs [0026]-[0028], fig. 4 | 6-9 |
| Y | JP 2018-168498 A (MAINTECH CO., LTD.) 01 November 2018 (2018-11-01) claim 1, paragraph [0031] | 1, 4, 5 |
| Y | JP 2017-114571 A (DAIFUKU CO., LTD.) 29 June 2017 (2017-06-29) claims 1-5, paragraphs [0001], [0028] | 3 |
| Y | JP 2016-204797 A (MAINTECH CO., LTD.) 08 December 2016 (2016-12-08) fig. 1, paragraph [0032] | 10 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| | |
|---|---|
| Date of the actual completion of the international search<br>12 April 2021 (12.04.2021) | Date of mailing of the international search report<br>27 April 2021 (27.04.2021) |
| Name and mailing address of the ISA/<br>Japan Patent Office<br>3-4-3, Kasumigaseki, Chiyoda-ku,<br>Tokyo 100-8915, Japan | Authorized officer<br><br>Telephone No. |

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