(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 360 831 A1

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**15.08.2018 Bulletin 2018/33**

(51) Int Cl.:
***B65H 54/88*** *(2006.01)* ***B65H 54/70*** *(2006.01)*

(21) Application number: **17208855.1**

(22) Date of filing: **20.12.2017**

(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:
**MA MD TN**

(30) Priority: **10.02.2017 JP 2017022879**

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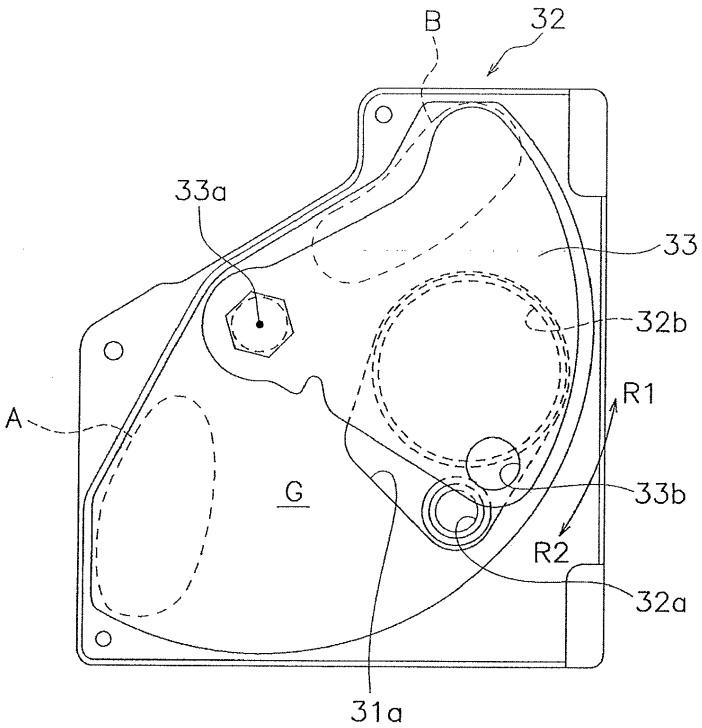
## (54) TEXTILE MACHINE

(57) A shutter device (29) includes a shutter (33) and a casing (30). The shutter (33) switches conduction of air between a plurality of suction mechanisms and a blower (61). The casing 30 internally seals the shutter 33. The shutter device (29) operates the shutter (33) to be switchable to a negative pressure position of conducting air between at least one of the plurality of suction mechanisms and the blower (61), and an accumulated substance removing position of removing fiber waste accumulated in the casing (30) .

FIG. 16

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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to a textile machine such as an automatic winder.

#### 2. Description of the Related Art

**[0002]** In each yarn winding unit configuring an automatic winder, foreign substances attached to a travelling yarn need to be removed, and a yarn end needs to be caught from a package. Thus, the automatic winder usually includes a negative pressure source, and each yarn winding unit is mounted with, for example, a cleaning pipe configured to suck and remove the foreign substances attached to the travelling yarn, a suction mouth configured to suck and catch the yarn end from the package, and the like.

**[0003]** The cleaning pipe and the suction mouth do not need to continuously suck the foreign substances/yarn end all the time during the operation, and rather it is preferable that the foreign substances and the yarn end are sucked only when a predetermined condition is met from the standpoint of saving energy.

**[0004]** A shutter device configured to switch conduction of the negative pressure source and each suction mechanism is thus used (see JP 2009-242036 A).

### BRIEF SUMMARY OF THE INVENTION

**[0005]** The shutter device includes a casing, and a shutter arranged in the casing. The suction mechanism conducting to a suction source is switched when the shutter is moved. The inventor of the present application focused on a problem that fiber waste accumulates in the casing and thus the shutter cannot be smoothly moved, and contrived the following invention.

**[0006]** It is an object of the present invention to resolve the accumulation of fiber waste inside a shutter device used in a textile machine.

**[0007]** This object is achieved by a textile machine according to claim 1.

**[0008]** Hereinafter, a plurality of modes will be described as means for solving the problem. Such modes can be arbitrarily combined as necessary.

**[0009]** A textile machine according to one aspect of the present invention includes a unit, a negative pressure generating source, and a shutter device. The unit includes a plurality of suction mechanisms configured to suck air to carry out processing of a yarn or cleaning. The negative pressure generating source generates a negative pressure. The shutter device is arranged between the plurality of suction mechanisms and the negative pressure generating source. The shutter device includes a switching plate and a casing. The switching plate switches conduction of air between the plurality of suction mechanisms and the negative pressure generating source. The casing internally seals the switching plate. The shutter device operates the switching plate so as to be switchable to a negative pressure position of conducting air between at least one of the plurality of suction mechanisms and the negative pressure generating source, and an accumulated substance removing position of removing fiber waste accumulated in the casing. In such a textile machine, when the switching plate is at the negative pressure position, the air is conducted between at least one of the plurality of suction mechanisms and the negative pressure generating source. The suction operation is thereby executed. Next, when the switching plate is at the accumulated substance removing position, the fiber waste accumulated in the casing is removed. As a result, the accumulation of the fiber waste in the shutter device used in the textile machine is resolved.

**[0010]** A space through which the fiber waste can pass may be formed between the switching plate and the casing. In such a textile machine, when the switching plate is at the accumulated substance removing position and the fiber waste accumulated in the casing is removed, the fiber waste is moved through the space between the switching plate and the casing. Therefore, the fiber waste in the casing is more reliably removed.

**[0011]** The shutter device may operate the switching plate so as to move the switching plate to a suction stop position at which the negative pressure from the negative pressure generating source does not act to the inside of the casing. In such a textile machine, when the switching plate is at the suction stop position, the negative pressure does not act to the inside of the casing. Therefore, the operation of all the suction mechanisms is stopped. Energy saving can be realized by allowing the operation of all the suction mechanisms to be stopped.

**[0012]** The shutter device may further include a driving source configured to drive the switching plate, and the driving source may be a stepping motor. In such a textile machine, the switching plate is driven by the stepping motor. Therefore, the control of the driving source is simplified.

**[0013]** The textile machine may be an automatic winder configured to wind a yarn unwound from a yarn supplying bobbin around a winding tube while traversing to form a package, and the plurality of suction mechanisms may be an upper yarn sucking, catching, and guiding mechanism and a cleaning pipe. In such a textile machine, according to the operation of the switching plate, the foreign substances attached to the travelling yarn are sucked and removed by the cleaning pipe at the time of steady operation of the automatic winder, and the upper yarn is sucked and caught, and guided to a yarn joining device by the upper yarn sucking, catching, and guiding mechanism in the yarn joining operation.

**[0014]** The switching plate may be swingable in the casing. The accumulated substance removing position

of the switching plate may be a position of removing the fiber waste accumulated in at least one of the ends in a swinging direction of the switching plate of a space region in the casing. In such a textile machine, when the switching plate is at the accumulated substance removing position, the first opening, and the second opening, and the third opening are conducted to each other. As a result, the fiber waste accumulated in at least one of the ends in the swinging direction of the switching plate in the casing is sucked from the first opening. The plurality of suction mechanisms may include a first suction mechanism and a second suction mechanism. The casing may include a first opening, to which a basal end of the negative pressure generating source is connected, a second opening, to which a basal end of the first suction mechanism is connected, and a third opening, to which a basal end of the second suction mechanism is connected. The negative pressure position of the switching plate may include a first negative pressure position of conducting the first opening and the second opening to operate the first suction mechanism, and a second negative pressure position of conducting the first opening and the third opening to operate the second suction mechanism. When the switching plate is at the accumulated substance removing position, the first opening, and the second opening, and the third opening may be conducted to each other. When the switching plate is at the accumulated substance removing position, the switching plate may conduct the first opening and the second opening, but may be at a position of shielding air linearly flowing from the second opening toward the first opening. In this case, turbulence of air flow occurs by a bent flow path, and the cleaning effect of at least one of the ends spaced apart in the swinging direction of the switching plate from the second opening of the casing is enhanced.

**[0015]** According to one aspect, the accumulated substance removing position of the switching plate is a position of conducting all the openings of the casing with each other to suck the fiber waste in the casing. According to one aspect, the switching plate is swung to close or open the openings of the casing. According to one aspect, the switching plate is moved among a plurality of positions of allowing sucking by one of the plurality of suction mechanisms, and prohibiting sucking by other suction mechanisms. According to one aspect, a plurality of openings for the plurality of suction mechanisms in the casing are aligned in a direction that the switching plate is swung. According to one aspect, the switching plate has a hole corresponding to only a specific opening. According to one aspect, the space in the casing is sealed other than the openings. According to one aspect, the space in the casing is a flat plate shaped space having a thin thickness. According to one aspect, the plurality of openings for the plurality of suction mechanisms in the casing and the opening for the negative pressure generating source are faced to each other.

**[0016]** In a textile machine according to the present invention, accumulation of the fiber waste inside the shutter device is resolved.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0017]**

FIG. 1 is a schematic front view and a block diagram illustrating a yarn winding unit of an automatic winder according to a first embodiment;
FIG. 2 is a perspective view of a shutter device;
FIG. 3 is a plan view of the shutter device;
FIG. 4 is a plan view of a case of the shutter device;
FIG. 5 is a plan view of a shutter of the shutter device;
FIG. 6 is a plan view of a base member of the shutter device;
FIG. 7 is a cross-sectional view taken along line VII-VII of FIG. 3;
FIG. 8 is a cross-sectional view taken along line VIII-VIII of FIG. 3;
FIG. 9 is a flowchart illustrating a basic control operation of the shutter device;
FIG. 10 is a plan view illustrating one state of an operation of the shutter device;
FIG. 11 is a schematic cross-sectional view illustrating one state of the operation of the shutter device;
FIG. 12 is a plan view illustrating one state of the operation of the shutter device;
FIG. 13 is a schematic cross-sectional view illustrating one state of the operation of the shutter device;
FIG. 14 is a plan view illustrating one state of the operation of the shutter device;
FIG. 15 is a schematic cross-sectional view illustrating one state of the operation of the shutter device;
FIG. 16 is a plan view illustrating one state of the operation of the shutter device; and
FIG. 17 is a schematic cross-sectional view illustrating one state of the operation of the shutter device.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

### 1. First Embodiment

#### (1) Basic structure of automatic winder

**[0018]** An automatic winder 1 will be described using FIG. 1. FIG. 1 is a schematic front view and a block diagram illustrating a yarn winding unit of an automatic winder according to a first embodiment. The automatic winder (textile machine) 1 includes a yarn winding unit 2 (one example of unit). The yarn winding unit 2 is a device configured to wind a yarn 4 unwound from a yarn supplying bobbin 3 around a winding tube 6 while traversing the yarn 4 with a traverse drum 5 to form a yarn layer, and form a predetermined conical package 7 with a predetermined length. In FIG. 1, only one yarn winding unit 2 is illustrated, but such a yarn winding unit 2 is arranged in plurals on a machine (not illustrated) to configure the

automatic winder 1.

**[0019]** The yarn winding unit 2 includes a cradle 8 on which the winding tube 6 is removably supported, and the traverse drum 5 that rotates at a predetermined rotation number in contact with a peripheral surface of the winding tube 6 or a peripheral surface of the package 7. The cradle 8 sandwichingly hold and rotatably support the winding tube 6 at the opposite ends thereof. Furthermore, the cradle 8 is configured to freely tilt around a swing shaft 10. The cradle 8 moves pivotally to allow absorption of an increase in thickness (increase in diameter of yarn layer) associated with the winding of the yarn 4 around the winding tube 6 or into the package 7. A traverse groove 9 in which the yarn 4 is traverse with respect to the winding tube 6 or the package 7 is engraved on a peripheral surface of the traverse drum 5. The winding tube 6 or the package 7 is driven rotated by coming into rolling contact with the traverse drum 5. A unit control section 50 configured to control the yarn winding unit 2 is arranged for every yarn winding unit 2.

**[0020]** Next, a description will be made on a yarn joining device 14, a yarn clearer 15, a waxing device 24, and a cleaning pipe 25. The yarn winding unit 2 has a configuration in which the yarn joining device 14, the yarn clearer 15, the waxing device 24, and the cleaning pipe 25 are arranged in order from the yarn supplying bobbin 3 on a yarn travelling path between the yarn supplying bobbin 3 and the traverse drum 5.

**[0021]** The yarn joining device 14 is configured to join a lower yarn 4L serving as the yarn 4 from the yarn supplying bobbin 3 and an upper yarn 4U serving as the yarn 4 from the package 7 when the yarn clearer 15 detects a yarn defect and the yarn is cut, or when the yarn 4 from the yarn supplying bobbin 3 is broken. The yarn clearer 15 detects a thickness defect in the yarn 4, and detects the thickness of the yarn 4 passing through a portion of a detection section of the yarn clearer 15 with an appropriate sensor and analyzes a signal from the relevant sensor with an analyzer 23 to detect a yarn defect such as slub. The yarn clearer 15 includes a cutter 16 configured to immediately cut the yarn 4 when the yarn defect is detected.

**[0022]** A lower yarn sucking, catching, and guiding mechanism 17 configured to suck and catch the lower yarn 4L from the yarn supplying bobbin 3 and guide the lower yarn 4L to the yarn joining device 14, and an upper yarn sucking, catching, and guiding mechanism 20 configured to suck and catch the upper yarn 4U from the package 7 and guide the upper yarn 4U to the yarn joining device 14 are provided on a lower side and an upper side of the yarn joining device 14, respectively. The upper yarn sucking, catching, and guiding mechanism 20 is shaped in a pipe and includes a suction mouth 22 at a distal end. The upper yarn sucking, catching, and guiding mechanism 20 is configured by a pipe 20a extending from the suction mouth 22 and a shaft 21 configured to support the pipe 20a in a freely swinging manner, and a coupling pipe 20b configured to couple the pipe 20a and a shutter device 29 (described later). In other words, a basal end 20c of the upper yarn sucking, catching, and guiding mechanism 20 is connected to the shutter device 29.

**[0023]** The lower yarn sucking, catching, and guiding mechanism 17 is also shaped like a pipe and includes an air intake port 19 at a distal end. The lower yarn sucking, catching, and guiding mechanism 17 is configured by a relay pipe 17a arranged so as to be vertically swingable with a shaft 18 as a center, and a coupling pipe (not illustrated) configured to couple the relay pipe 17a and a blower duct 60. The waxing device 24 is a device configured to apply an appropriate wax on the travelling yarn 4.

**[0024]** The cleaning pipe 25 is a device configured to suck and remove foreign substances attached to the travelling yarn 4. A basal end 25b of the cleaning pipe 25 is connected to the shutter device 29 (described later), and a suction port 25a is formed at a distal end of the cleaning pipe 25. The suction port 25a of the cleaning pipe 25 is located in proximity to the travelling yarn 4 travelling between the waxing device 24 and the traverse drum 5.

**[0025]** As described above, in the present embodiment, the yarn winding unit 2 includes a plurality of suction mechanisms configured to suck at least one of the yarn 4 and the foreign substance. Specifically, the yarn winding unit 2 includes the cleaning pipe 25 serving as a yarn trap configured to suck the foreign substances attached to the travelling yarn 4, and the upper yarn sucking, catching, and guiding mechanism 20 (i.e., suction mouth 22) configured to suck and catch the upper yarn 4U and guide the upper yarn 4U to the yarn joining device 14 as the suction mechanism.

(2) Schematic description of configuration of shutter device

**[0026]** The shutter device 29 and other devices will be schematically described using FIG. 1. Each yarn winding unit 2 includes the shutter device 29. The shutter device 29 is connected to the blower duct 60 by way of a blower pipe 70. The blower duct 60 is extended along an arranging direction in which the plurality of yarn winding units 2 are arranged. The blower duct 60 is coupled to a blower 61 serving as a negative pressure generating source. The blower 61 is common among the plurality of yarn winding units 2 arranged. The shutter device 29 is arranged between the cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20, and the blower 61.

**[0027]** Next, a structure of the shutter device 29 will be schematically described using FIGS. 2 and 3. FIG. 2 is a perspective view of the shutter device. FIG. 3 is a plan view of the shutter device. In FIG. 3, however, a shutter 33, to be described later, is omitted. The shutter device 29 includes the shutter 33 (one example of switching plate), and a casing 30 (one example of casing) . The shutter 33 switches the conduction of air between the

cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20, and the blower 61. The shutter device 29 can be switched to a negative pressure position of conducting the air between the blower 61 and at least one of the cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20, and an accumulated substance removing position of removing the fiber waste accumulated in the casing 30 by operating the shutter 33.

**[0028]** When the shutter 33 is at the negative pressure position, air is conducted between the blower 61 and at least one of the cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20. The suction operation is thereby executed. Specifically, the foreign substances attached to the travelling yarn are sucked and removed by the cleaning pipe 25 at the time of steady operation of the automatic winder 1, and the upper yarn is sucked and caught, and guided to the yarn joining device 14 by the upper yarn sucking, catching, and guiding mechanism 20 in the yarn joining operation. When the shutter 33 is at the accumulated substance removing position, the fiber waste accumulated in the casing 30 is removed. As a result, the accumulation of the fiber waste inside the shutter device 29 used in the automatic winder 1 is resolved.

**[0029]** The shutter device 29 can move the shutter 33 to a suction stop position at where the negative pressure from the blower 61 does not act to the inside of the casing 30 by operating the shutter 33. In the automatic winder 1, when the shutter 33 is at the suction stop position, the negative pressure does not act to the inside of the casing 30. Therefore, the operations of the cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20 are stopped.

(3) Detailed description of configuration of shutter device

**[0030]** Next, a configuration of the shutter device 29 will now be described in detail using FIGS. 4 to 8. FIG. 4 is a plan view of a case of the shutter device. FIG. 5 is a plan view of the shutter of the shutter device. FIG. 6 is a plan view of a base member of the shutter device. FIG. 7 is a cross-sectional view taken along line VII-VII of FIG. 3. FIG. 8 is a cross-sectional view taken along line VIII-VIII of FIG. 3. The casing 30 includes a base member 31 fixed to a frame (not illustrated) of the yarn winding unit 2, and a case member 32 attached to the base member 31.

**[0031]** The shutter device 29 includes the shutter 33 interposed between the base member 31 and the case member 32. The casing 30 internally seals the shutter 33. The shutter device 29 includes a shutter driving mechanism 34 serving as a driving source configured to swing the shutter 33.

**[0032]** As illustrated in FIG. 6, the base member 31 is formed with a blower hole 31a (first opening) to which the basal end of the blower 61 is connected. As illustrated in FIG. 4, the case member 32 is formed with a suction hole 32b (third opening), to which a basal end 20c of the upper yarn sucking, catching, and guiding mechanism 20 is connected, and a cleaning hole 32a (second opening), to which a basal end 25b of the cleaning pipe 25 is connected. The cleaning hole 32a, the suction hole 32b, and the blower hole 31a are formed between the base member 31 and the case member 32, and are communicated to each other through an internal space G where the shutter 33 is swung.

**[0033]** As illustrated in FIG. 5, the shutter 33 is formed to a substantially fan shape, and is swingable with a swing shaft 33a as a center so as to close or open each cleaning hole 32a and suction hole 32b between the base member 31 and the case member 32. A hole 33b is formed on one side in an arc direction on an outer peripheral side of the shutter 33.

**[0034]** As illustrated in FIGS. 1 and 2, the shutter driving mechanism 34 is configured by a stepping motor 35 arranged on the base member 31, and a drive transmitting mechanism (not illustrated) (e.g., pulley fixed to swing shaft of shutter 33, and flat belt wound around output shaft of stepping motor 35 and pulley). An output of the stepping motor 35 is transmitted to the shutter 33 through a timing belt and the pulley. Since the shutter 33 is driven by the stepping motor 35, the control of the driving source is simplified.

**[0035]** Next, an arrangement mode of the cleaning hole 32a and the suction hole 32b, and a shape of the shutter 33 will be described in detail. The internal space G configured by the casing 30 will be described. As illustrated in FIGS. 2 and 3, the internal space G is formed between the base member 31 and the case member 32. The internal space G is a flat plate shaped space having a predetermined thickness formed between two flat plates. The flat plate shaped internal space G has a fan shape or a half moon shape when seen from a thickness direction (plan view) of a virtual flat plate. That is, the internal space G has a shape including one part of an arc in plan view. The blower hole 31a is formed at a middle in the arc direction of an outer peripheral side portion in the internal space G.

**[0036]** The suction hole 32b is a hole of a relatively large diameter, and is arranged at the outer peripheral side portion of the internal space G. The suction hole 32b corresponds to the blower hole 31a in plan view, and is located in a region on a counterclockwise side (first swinging direction R1 side, to be described later) of the arc direction of the blower 31a. The cleaning hole 32a is a hole of a relatively small diameter, and is arranged at the outer peripheral side portion of the internal space G. The cleaning hole 32a is arranged proximate to the suction hole 32b, and is arranged on a clockwise side (second swinging direction R2 side, to be described later) of the arc direction in the figure. The cleaning hole 32a corresponds to the blower hole 31a in plan view, and is located in a region on a clockwise side (second swinging direction R2 side, to be described later) of the arc direction of the blower 31a. The positional relationship in the

shutter swinging direction of each hole is opposite to the case of the embodiment when the rotating direction of the motor is different. As described above, the cleaning hole 32a and the suction hole 32b are both arranged so as to be shifted in the swinging direction of the shutter 33. The shutter device 29 is configured in such manner so as to be able to selectively control the sucking by the cleaning pipe 25 and the upper yarn sucking, catching, and guiding mechanism 20.

**[0037]** As illustrated in FIG. 11, as will be described later, the shutter 33 is arranged at a position proximate to or making contact with an inner side surface of the base member 31 in the internal space G. Therefore, the shutter 33 is spaced apart from the case member 32, that is, the internal space G is ensured between the shutter 33 and the case member 32. However, a tubular section 36 extending toward the base member 31 is formed at the periphery of the cleaning hole 32a, and a distal end of the tubular section 36 is extended to a position making contact with or in proximity to the shutter 33.

**[0038]** As illustrated in FIGS. 2 and 10, the shutter 33 is swingable with the swing shaft 33a as the center. Specifically, the shutter 33 has the swing shaft 33a arranged on a side opposite to the arc side of the internal space G in plan view, and therefore, the shutter 33 can be swung in the first swinging direction R1 and the second swinging direction R2 along a state in which an arc edge is proximate to an arc edge of the internal space G. The hole 33b of the shutter 33 is formed at a second swinging direction R2 side portion of the outer peripheral side portion of the shutter 33. The hole 33b is formed at the same radial position as the cleaning hole 32a and with a large diameter. According to such a configuration, when the shutter 33 is swung in the first swinging direction R1 or the second swinging direction R2, only the cleaning hole 32a is opened or only the suction hole 32b is opened.

**[0039]** A position that can be taken by the shutter 33 will be described using FIGS. 10 to 17. FIGS. 10, 12, 14, and 16 are plan views illustrating one state of an operation of the shutter device. FIGS. 11, 13, 15, and 17 are schematic cross-sectional views illustrating one state of the operation of the shutter device. As illustrated in FIGS. 10 and 11, when the shutter 33 is at the fully-closed position, the shutter 33 closes the blower hole 31a. Describing a specific position of the shutter 33, the fully-closed position of the shutter 33 is a position in the middle in the swinging direction, and the shutter 33 closes the blower hole 31a at the position, as illustrated in FIG. 10.

**[0040]** As illustrated in FIGS. 12 and 13, when the shutter 33 is at the first negative pressure position, the blower hole 31a and the cleaning hole 32a are conducted or in fluidic connection to operate the cleaning pipe 25. Describing the specific position of the shutter 33, as illustrated in FIG. 12, the first negative pressure position of the shutter 33 is a state in which the shutter 33 is further swung in the first swinging direction R1 than the fully-closed position, and although the shutter 33 closes the majority of the blower hole 31a, the hole 33b of the shutter 33 is overlapped with the cleaning hole 32a. Therefore, only the cleaning hole 32a is opened.

**[0041]** As illustrated in FIGS. 14 and 15, when the shutter 33 is at the second negative pressure position, the shutter 33 closes the cleaning hole 32a and conducts or provides a fluidic connection between the blower hole 31a and the suction hole 32b to operate the upper yarn sucking, catching, and guiding mechanism 20. Describing the specific position of the shutter 33, as illustrated in FIG. 14, the second negative pressure position of the shutter 33 is a state in which the shutter 33 is swung the most in the second swinging direction R2, and although the first swinging direction R1 side end of the shutter 33 closes the cleaning hole 32a, the blower hole 31a is not closed. More specifically, a projection 33c of the shutter 33 closes the cleaning hole 32a, and the shutter 33 is not overlapped with the suction hole 32b in plan view. Therefore, only the suction hole 32b is opened. At the time of operation, a flow rate of the suction hole 32b and the periphery of the suction hole 32b (i.e., half on first swinging direction R1 side in internal space G) is higher than a flow rate of other portions in plan view in the internal space G, and thus the fiber waste is effectively removed. Furthermore, as the distal end of the tubular section 36 is brought into contact with or in proximity with the shutter 33, air leakage from the cleaning hole 32a is reduced.

**[0042]** As illustrated in FIGS. 16 and 17, when the shutter 33 is at the accumulated substance removing position, the blower hole 31a, and the suction hole 32b, and the cleaning hole 32a are conducted with each other, so that the fiber waste in the internal space G of the casing 30 is removed. Specifically, the fiber waste accumulated in a first region A and a second region B of FIG. 16 is effectively removed. The first region A is one part of the internal space G in the casing 30, and is an end spaced apart in the second swinging direction R2 from the suction hole 32b. The second region B is one part of the internal space G in the casing 30, and is an end spaced apart in the first swinging direction R1 from the suction hole 32b. The second region B is close to the suction hole 32b in the swinging direction, and thus can be cleaned to a certain extent even in the state (second negative pressure position) of FIG. 14. The first region A, on the other hand, is distant from the suction hole 32b in the swinging direction, and thus is not sufficiently cleaned in the state (second negative pressure position) of FIG. 14.

**[0043]** The reason the fiber waste accumulated in the first region A and the second region B of FIG. 16 is effectively removed when the shutter 33 is at the accumulated substance removing position will be described below. As illustrated in FIG. 16, the accumulated substance removing position of the shutter 33 is a state in which the shutter 33 is swung the most in the first swinging direction R1, and the peripheral portion of the cleaning hole 32a of the blower 31a is opened. The blower hole 31a and the suction hole 32b are conducted with each other but are not linearly conducted, and thus the air forms a bent

flow path and turbulence of air flow occurs in the casing 30, as illustrated in FIG. 17. As a result, the flow rate of the region further to the cleaning hole 32a from the suction hole 32b and the region on the inner peripheral side of the region (i.e., middle portion in internal space G in swinging direction) is higher than the flow rate of other portions in plan view in the internal space G, and thus the removing effect of the fiber waste is obtained, and the cleaning effect of the first region A and the second region B is enhanced. More specifically, since the region of high flow rate is spread further to the portion on the second swinging direction R2 side than the blower 31a, the cleaning effect of the first region A is enhanced.

**[0044]** As illustrated in FIG. 17, a space where the fiber waste can pass through is formed as the internal space G between the shutter 33 and the casing 30. Thus, when the shutter 33 is at the accumulated substance removing position and the fiber waste accumulated in the casing 30 is removed, the fiber waste is moved through the space between the shutter 33 and the casing 30. Therefore, the fiber waste in the casing 30 is more reliably removed.

(4) Control configuration

**[0045]** In FIG. 1, the automatic winder 1 includes the unit control section 50. The unit control section 50 is a computer system that includes a processor (e.g., CPU), a storage device (e.g., ROM, RAM, HDD, SSD, etc.), and various types of interfaces (e.g., A/D converter, D/A converter, communication interface, etc.). The unit control section 50 executes a program saved in the storage section (corresponds to one part of or all of storage region of storage device) to carry out various types of control operations. The unit control section 50 may be configured by a single processor, but may be configured by a plurality of processors independent for each control.

**[0046]** Some or all of the functions of each element of the unit control section 50 may be realized as a program executable with the computer system configuring the unit control section 50. Specifically, control software for causing the CPU, and the like to fulfill the function of a shutter control means 51 is stored in the ROM of the unit control section 50. In addition, some of the functions of each element of the control section may be configured by a custom IC. Although not illustrated, a sensor configured to detect size, shape, and position of a target, a sensor and a switch configured to detect the state of each device, as well as an information input device are connected to the unit control section 50.

(5) Control operation

**[0047]** Control by the unit control section 50 and the shutter control means 51 will be described below according to FIG. 9. FIG. 9 is a flowchart illustrating a basic control operation of the shutter device. The control flowchart described below is illustrative, and each step may be omitted and interchanged, as necessary. Furthermore, a plurality of steps may be simultaneously executed, or some or all of the steps of may be executed in an overlapping manner. Moreover, each block of the control flowchart is not limited to a single control operation, and can be replaced with a plurality of control operations represented with the plurality of blocks.

**[0048]** First, the power of the automatic winder 1 is turned ON. Immediately after the power is turned ON, the shutter 33 is in the fully-closed position (FIGS. 10 and 11). In step S1, the shutter 33 is moved to the first negative pressure position (FIGS. 12 and 13), and the yarn trap operation is carried out. Specifically, the shutter control means 51 transmits a control signal to the stepping motor 35 to swing the shutter 33 to the first position. An automatic doffing device (not illustrated) winds the yarn 4 from the yarn supplying bobbin 3 around the winding tube 6, whereby the winding of the yarn 4 by the yarn winding unit 2 is started. During the winding, the basal end 25b of the cleaning pipe 25 is not closed by the shutter 33, and hence the foreign substances (e. g. , wax powder, yarn waste, or the like attached to the yarn 4) attached to the travelling yarn 4 are sucked and removed by the blower duct 60 upon passing near the suction port 25a.

**[0049]** In step S2, the unit control section 50 determines whether a yarn joining request is made. When the yarn joining request is not made (No in S2), the process proceeds to step S5. When the yarn joining request is made (Yes in S2), the process proceeds to step S3. In step S3, the shutter 33 is moved to the second negative pressure position (FIGS. 14 and 15), and the suction operation is carried out. Specifically, the shutter control means 51 transmits a control signal to the stepping motor 35 to move the shutter 33 to the second negative pressure position. Thus, the suction mouth 22 of the upper yarn sucking, catching, and guiding mechanism 20 is in a sucking state, and the yarn end from the outer periphery of the package 7 is sucked and caught when the unit control section 50 swings the upper yarn sucking, catching, and guiding mechanism 20. In step S4, the unit control section 50 waits until receiving a signal associated with completion of the yarn joining operation from the yarn joining device 14. When the unit control section 50 receives the signal, the shutter control means 51 transmits an appropriate control signal to the stepping motor 35, and the process of the unit control section 50 proceeds to S5.

**[0050]** In step S5, the unit control section 50 determines whether or not a predetermined number of knots is reached. When the predetermined number of knots is not reached (No in S5), the process returns to S1. When the predetermined number of knots has been reached (Yes in S5), the process proceeds to step S6. The predetermined number of knots is not particularly limited, and may be every constant time or may be appropriately changed.

**[0051]** In step S6, the shutter 33 is moved to the accu-

mulated substance removing position (FIGS. 16 and 17), and the cleaning operation of the shutter 29 is executed. Specifically, the shutter control means 51 transmits a control signal to the stepping motor 35 so as to move the shutter 33 to the accumulated substance removing position. The fiber waste accumulated in the shutter device 29 is thereby sucked and collected by the blower duct 60.

2. Other Embodiment

**[0052]** One embodiment of the present invention has been described, but the present invention is not limited to the above-described embodiment, and various changes can be made within a scope not departing from the gist of the invention. In particular, a plurality of examples and alternative embodiments described in the specification can be arbitrarily combined, as necessary.

(1) The type of textile machine to which the shutter device is applied is not limited to the automatic winder.
(2) The type and number of suction mechanism are not limited to the embodiment described above.
(3) The number, position, and mutual relationship of the holes formed in the shutter device are not limited to the embodiment described above.

**[0053]** The present invention can be widely applied to the textile machine such as the automatic winder.

## Claims

**1.** A textile machine (1) comprising:

a yarn winding unit (2) including a plurality of suction mechanisms (20, 25) configured to carry out processing of a yarn or cleaning;
a negative pressure generating source (61) configured to generate a negative pressure; and
a shutter device (29) arranged between the plurality of suction mechanisms (20, 25) and the negative pressure generating source (61) and including a switching plate (33) configured to switch conduction of air between the plurality of suction mechanisms (20, 25) and the negative pressure generating source (61), and a casing (30) configured to interiorly seal the switching plate (33)
wherein the shutter device (29) is configured to operate the switching plate (33) to switch to a negative pressure position of conducting air between at least one of the plurality of suction mechanisms (20, 25) and the negative pressure generating source (61), and an accumulated substance removing position of removing fiber waste accumulated in the casing (30).

**2.** The textile machine (1) according to claim 1, wherein a space (G) through which the fiber waste passes is formed between the switching plate (33) and the casing (30).

**3.** The textile machine (1) according to claim 2, wherein the space (G) is a flat plate shaped space having a predetermined thickness.

**4.** The textile machine (1) according to claim 3, wherein the flat plate shaped space (G) has a fan shape or a half moon shape when seen from a thickness direction of a flat plate.

**5.** The textile machine (1) according to any one of claims 1 to 4, wherein the shutter device (29) is configured to operate the switching plate (33) to move the switching plate (33) to a suction stop position at which negative pressure from the negative pressure generating source (61) does not act to the inside of the casing (30).

**6.** The textile machine (1) according to any one of claims 1 to 5, wherein the shutter device (29) further includes a driving source configured to drive the switching plate (33), and the driving source is a stepping motor (35).

**7.** The textile machine (1) according to any one of claims 1 to 6, wherein the textile machine (1) is an automatic winder (1) configured to wind a yarn unwound from a yarn supplying bobbin around a winding tube (6) while traversing to form a package (7), and the plurality of suction mechanisms are an upper yarn sucking, catching, and guiding mechanism (20) and a cleaning pipe (25).

**8.** The textile machine according to any one of claims 1 to 7, wherein the switching plate (33) is swingable in the casing (30), and the accumulated substance removing position of the switching plate (33) is a position of removing the fiber waste accumulated in at least one of the ends in a swinging direction of the switching plate (33) of a space (G) region in the casing (30).

**9.** The textile machine (1) according to any one of claims 1 to 8, wherein
the plurality of suction mechanisms include a first suction mechanism (25) and a second suction mechanism (20);
the casing (30) includes a first opening (31a), to which a basal end of the negative pressure generating source (61) is connected, a second opening (32a), to which a basal end of the first suction mechanism (25) is connected, and a third opening (32b), to which a basal end of the second suction mechanism (20) is connected;

the negative pressure position of the switching plate (33) includes a first negative pressure position of conducting the first opening (31a) and the second opening (32a) to operate the first suction mechanism (25), and a second negative pressure position of conducting the first opening (31a) and the third opening (32b) to operate the second suction mechanism (20); and

when the switching plate (33) is at the accumulated substance removing position, the first opening (31a), and the second opening (32a) and the third opening (32b) are conducted to each other.

**10.** The textile machine (1) according to claim 9, wherein when the switching plate (33) is at the accumulated substance removing position, the first opening (31a) and the second opening (32a) are conducted, and the switching plate (33) is at a position of shielding air linearly flowing from the second opening (32a) toward the first opening (31a).

FIG. 1

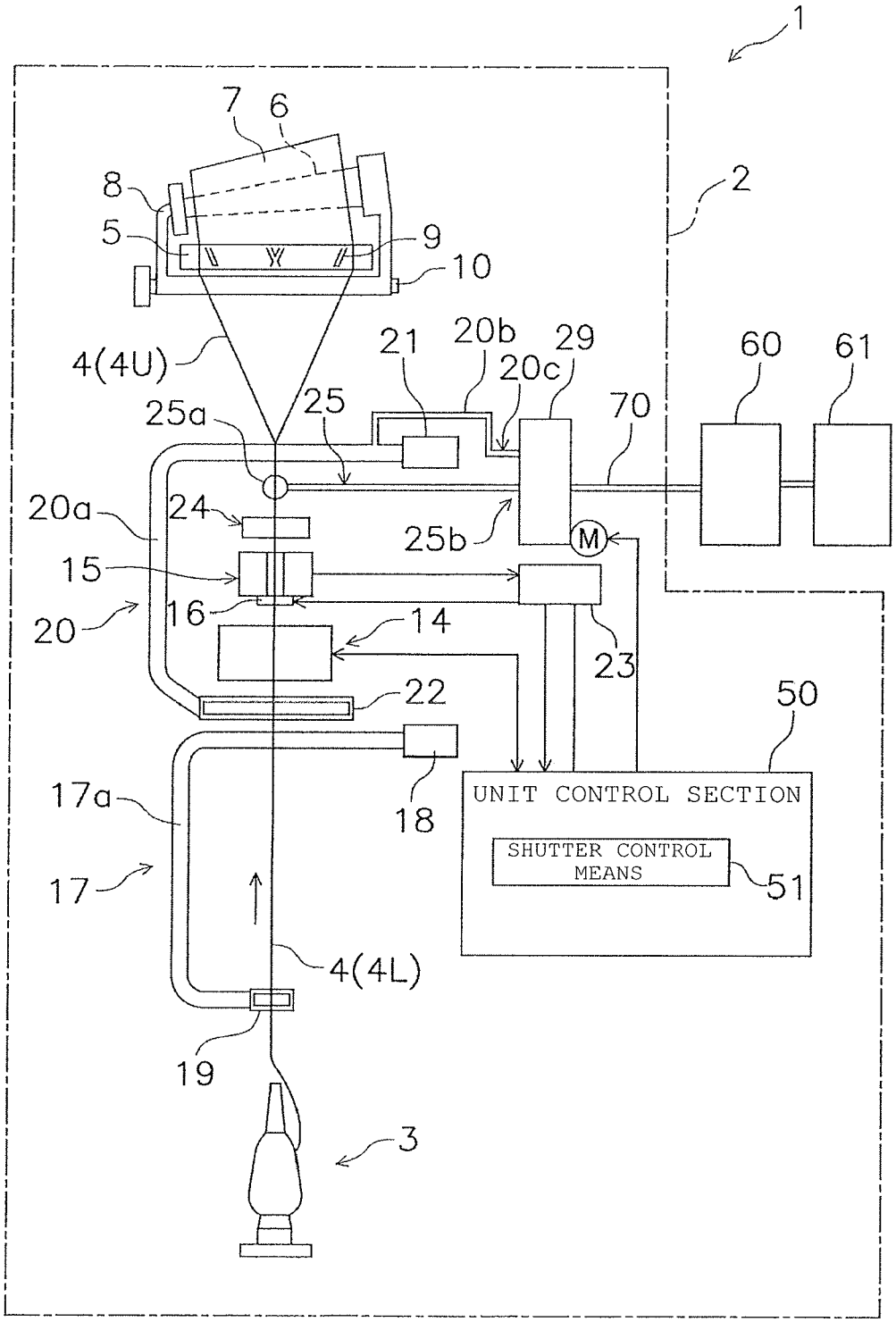

1
2
7
6
8
5
9
10
4(4U)
21
20b
20c
29
60
61
25a
25
70
20a
24
25b
M
15
16
14
23
20
22
50
17a
18
UNIT CONTROL SECTION
SHUTTER CONTROL MEANS
51
17
4(4L)
19
3

FIG. 2

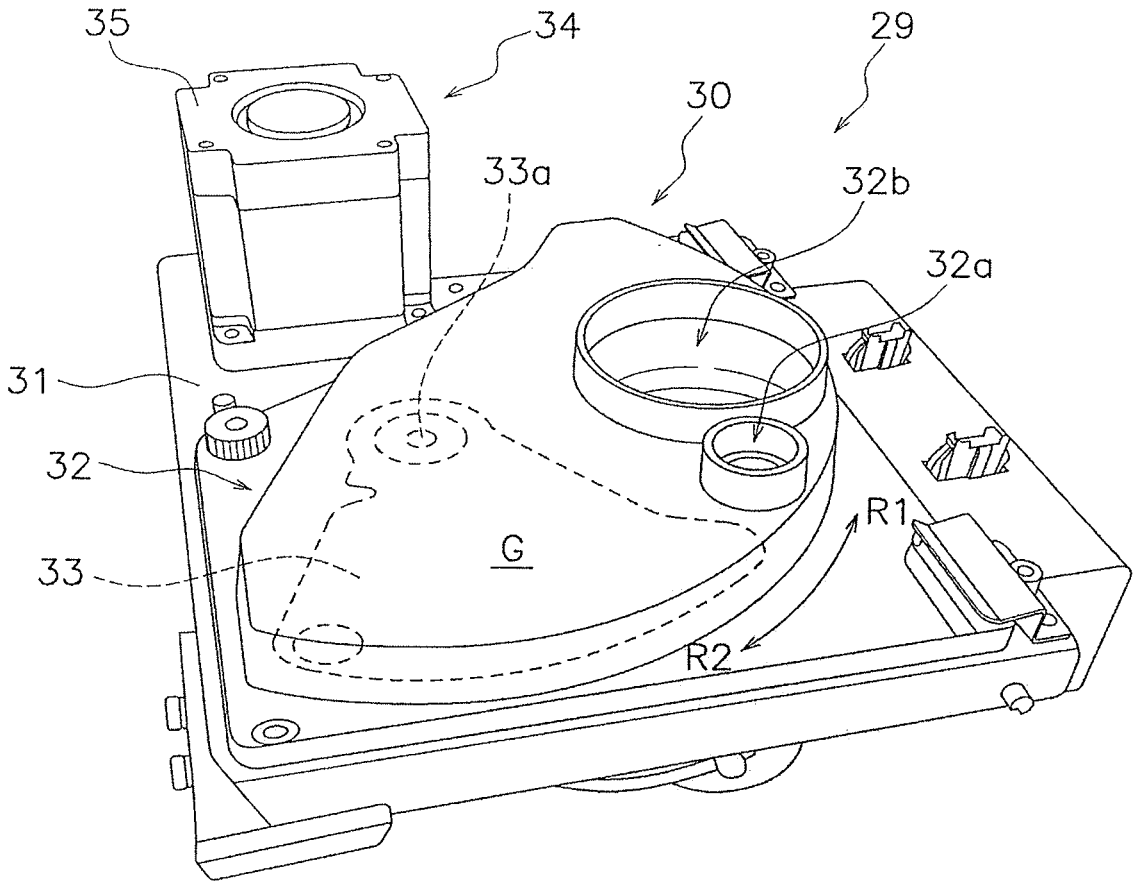


FIG. 3

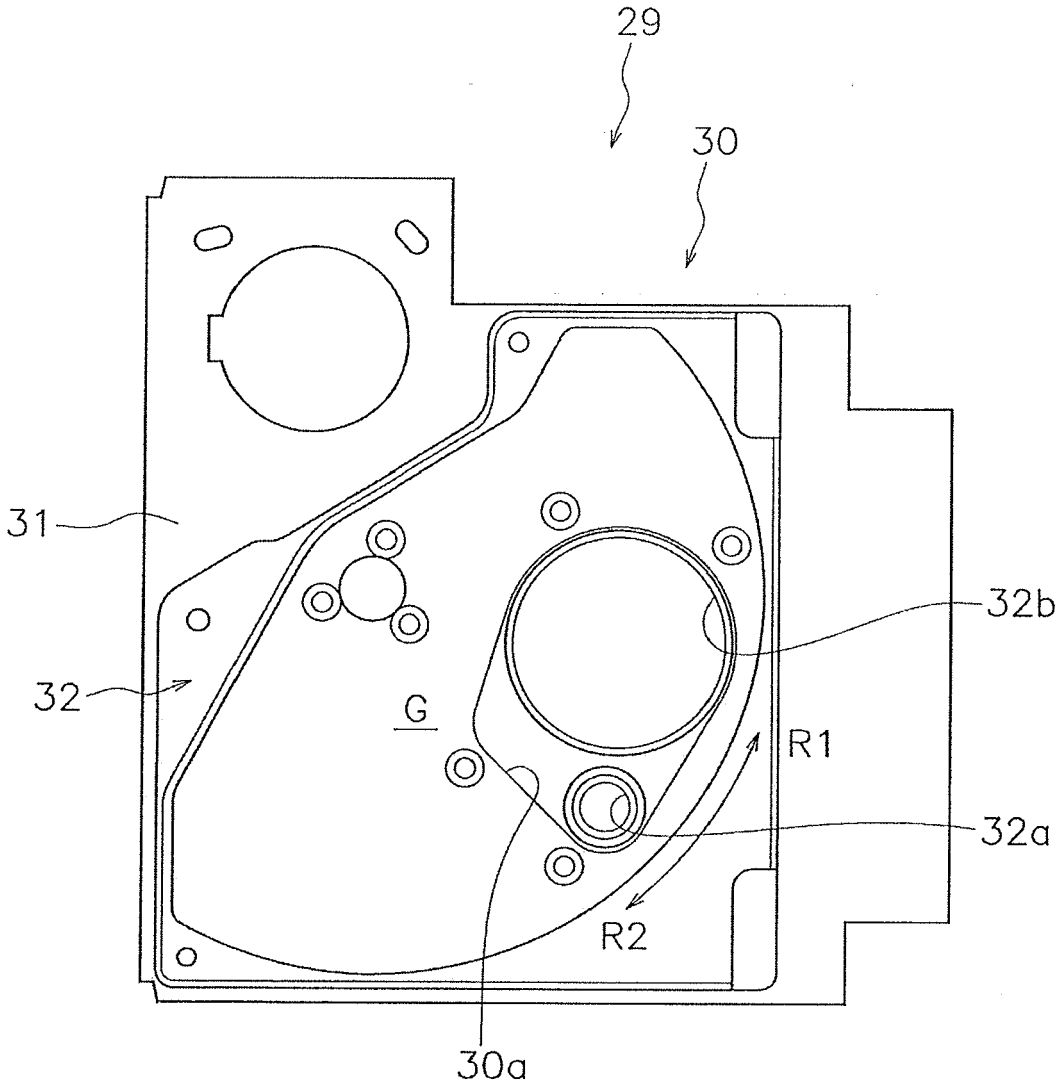


FIG. 4

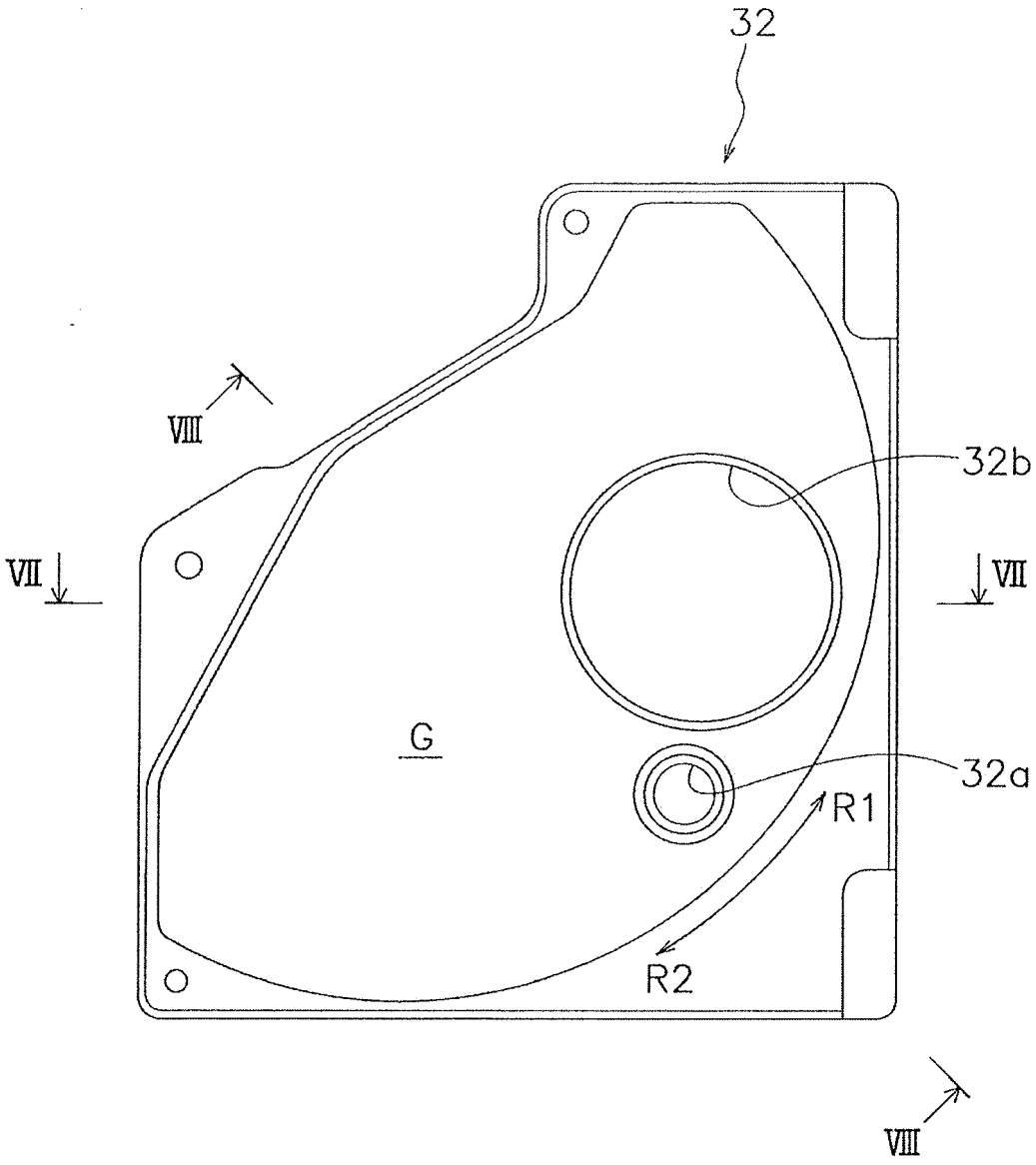


FIG. 5

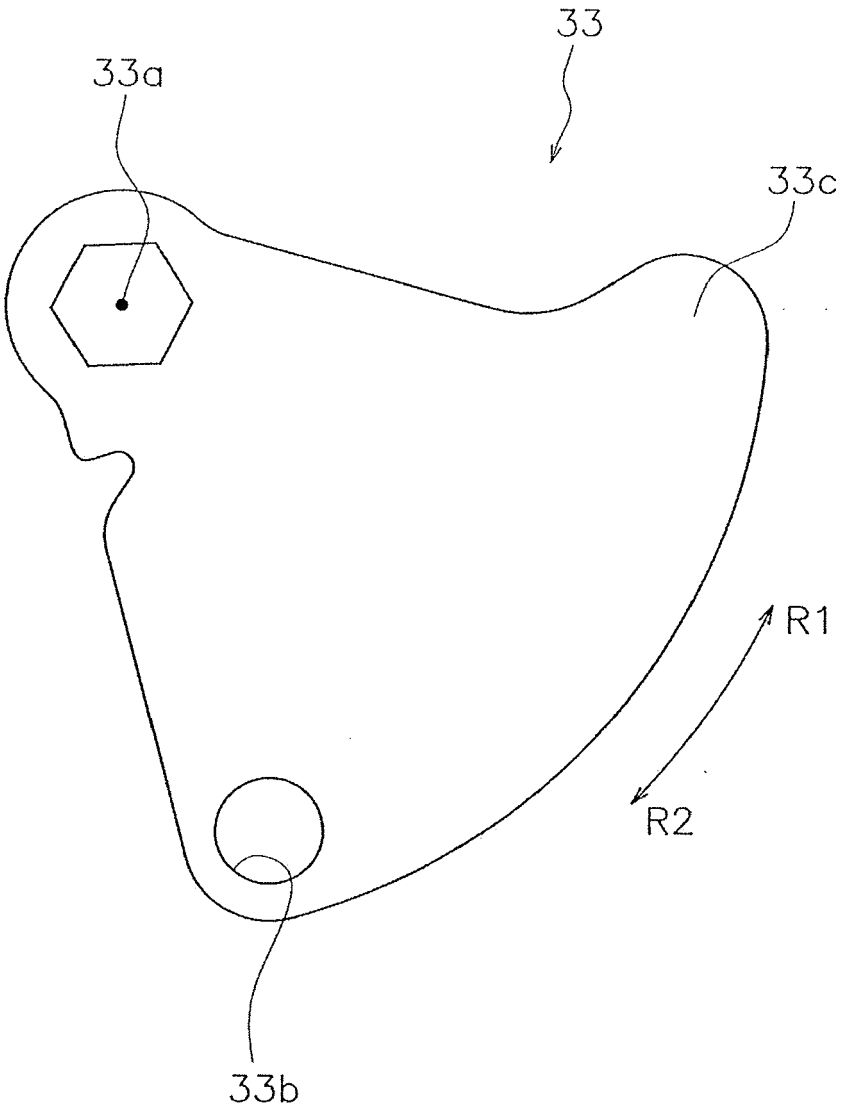


FIG. 6

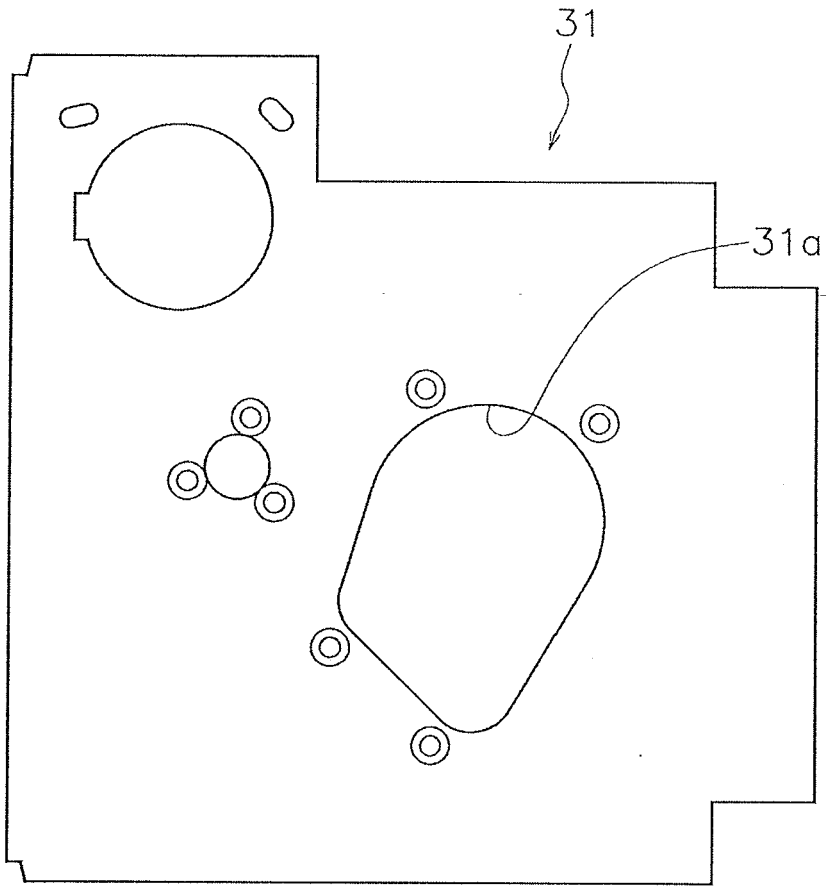


FIG. 7

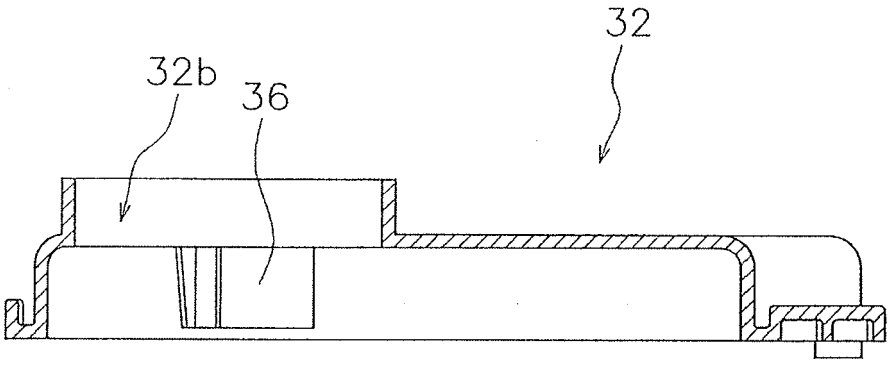


FIG. 8

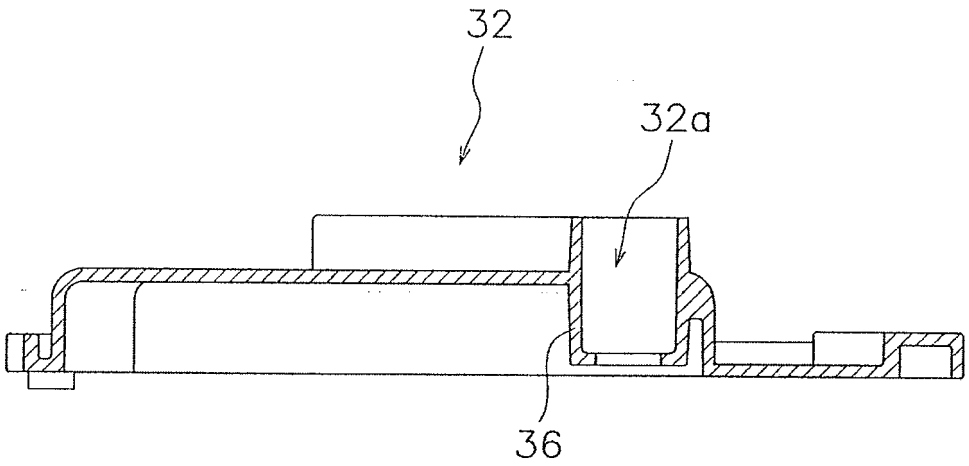


FIG. 9

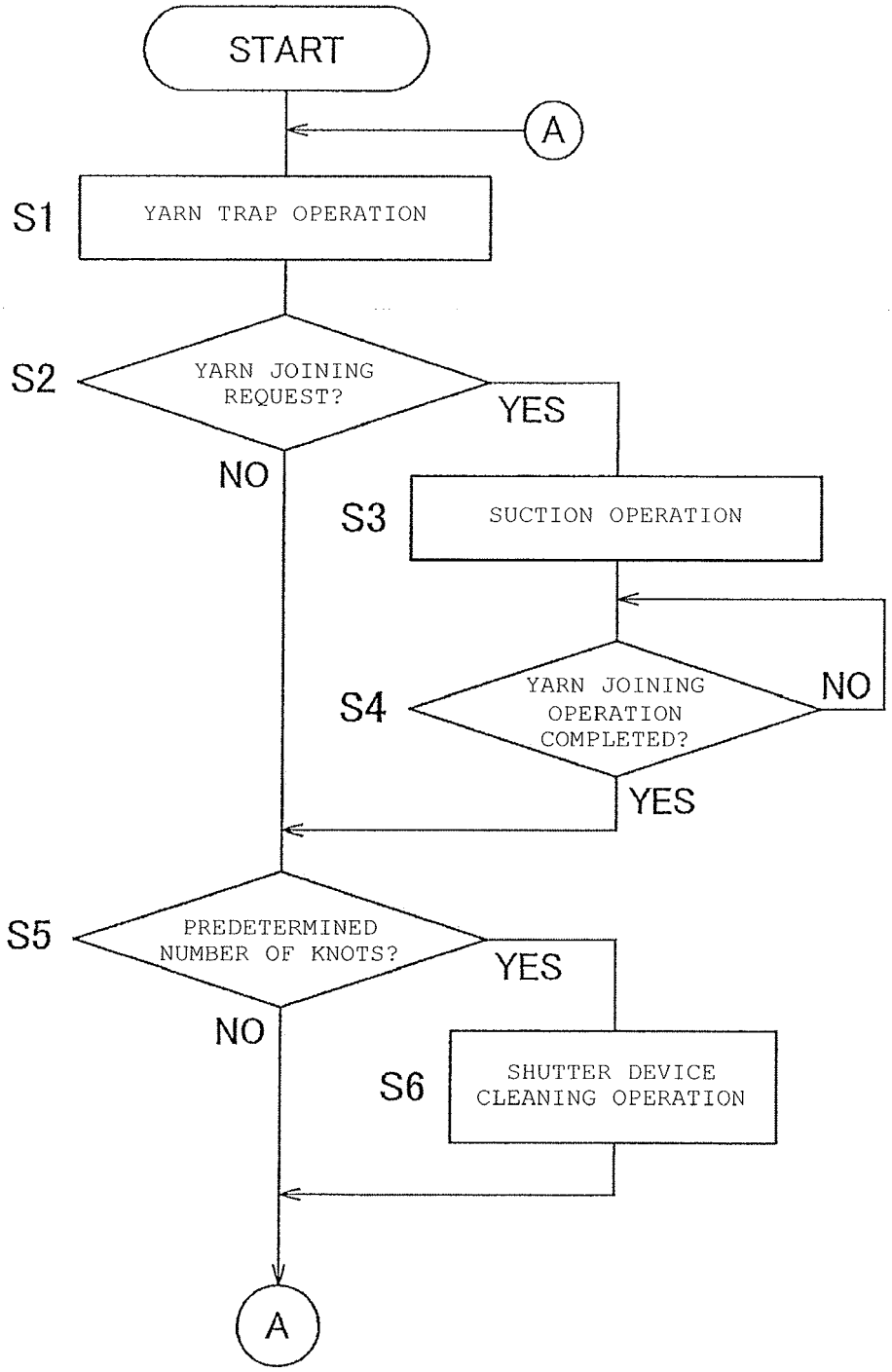

START
A
S1
YARN TRAP OPERATION
S2
YARN JOINING REQUEST?
YES
NO
S3
SUCTION OPERATION
S4
YARN JOINING OPERATION COMPLETED?
NO
YES
S5
PREDETERMINED NUMBER OF KNOTS?
YES
NO
S6
SHUTTER DEVICE CLEANING OPERATION
A

FIG. 10

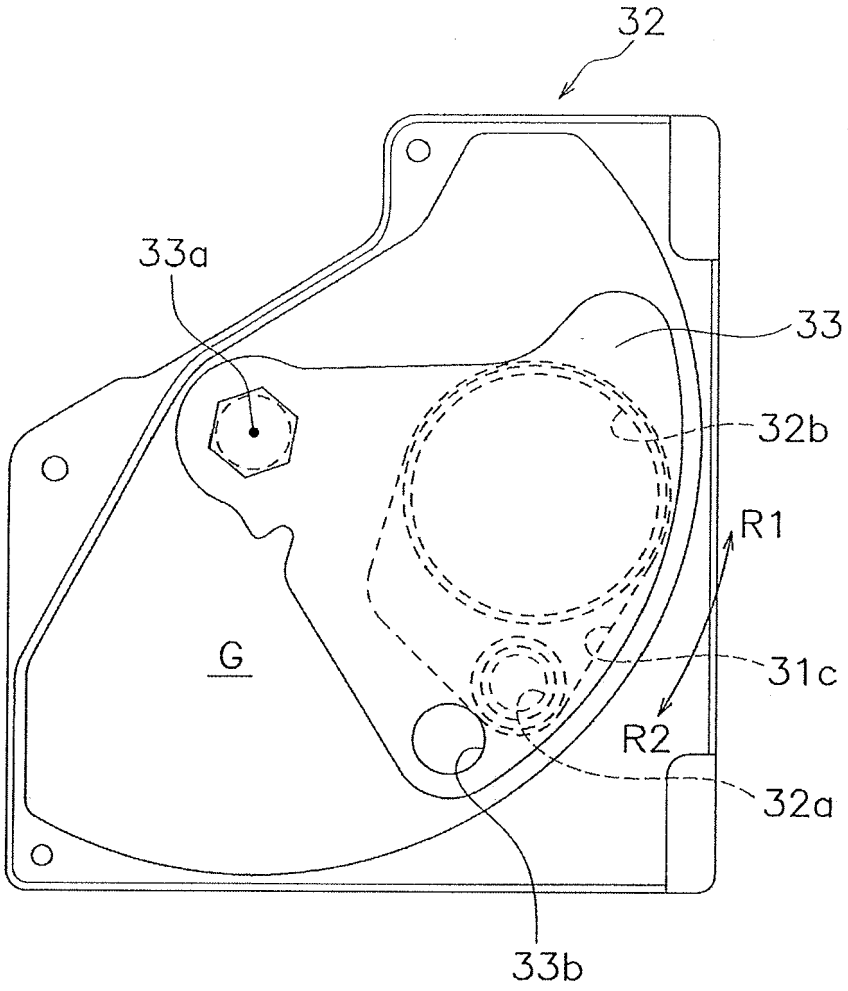


FIG. 11

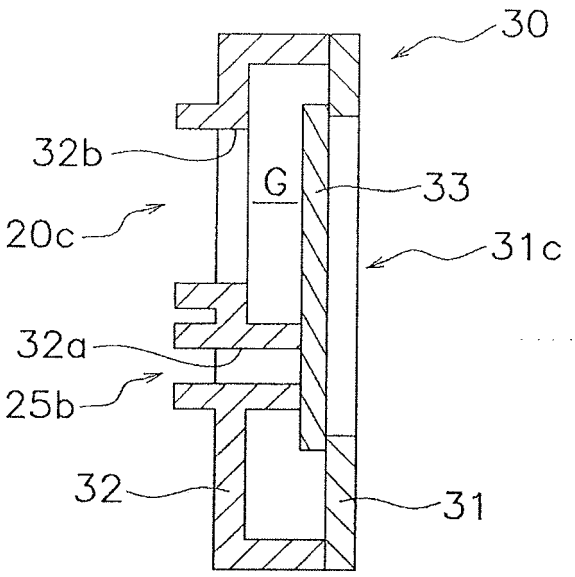


FIG. 12

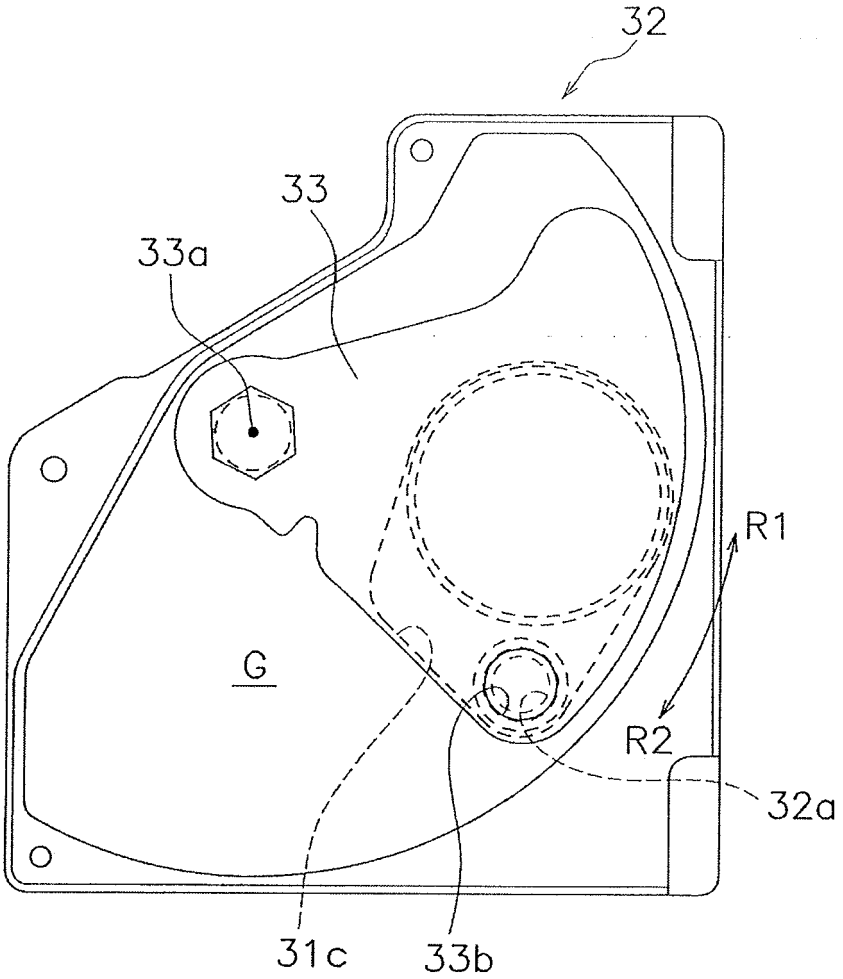


FIG. 13

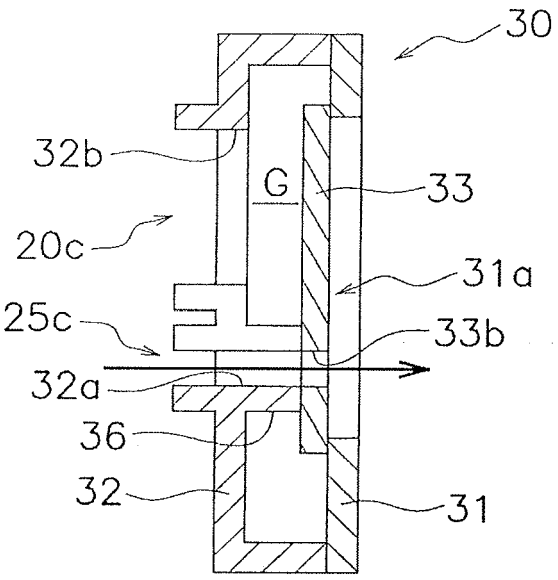


FIG. 14

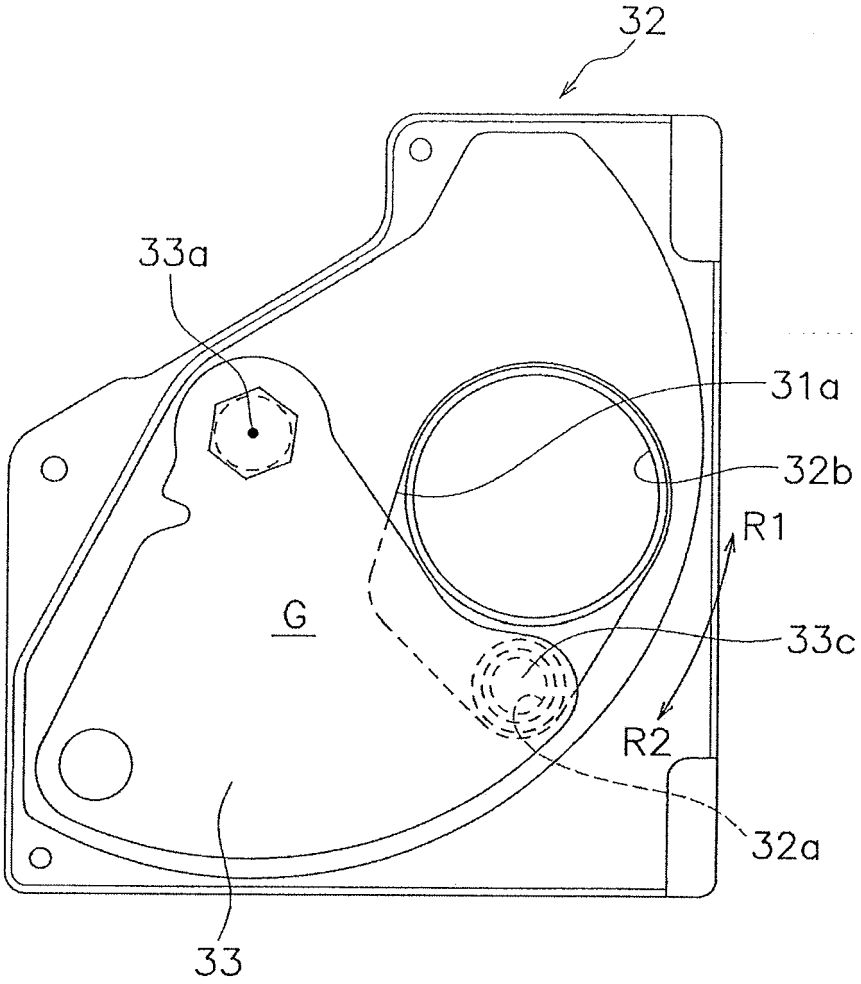


FIG. 15

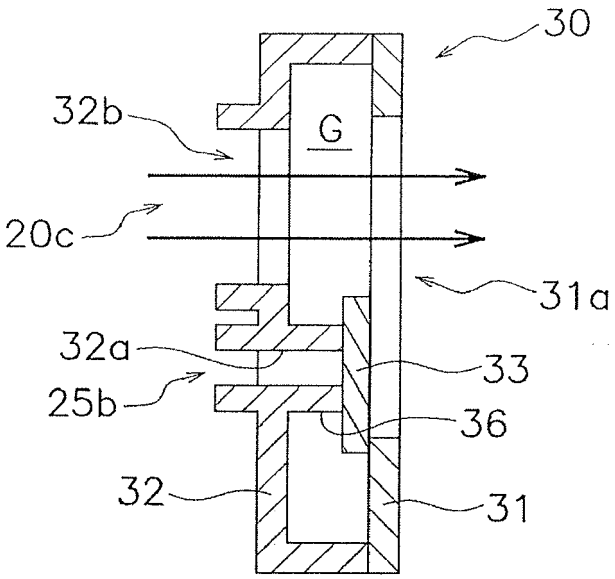


FIG. 16

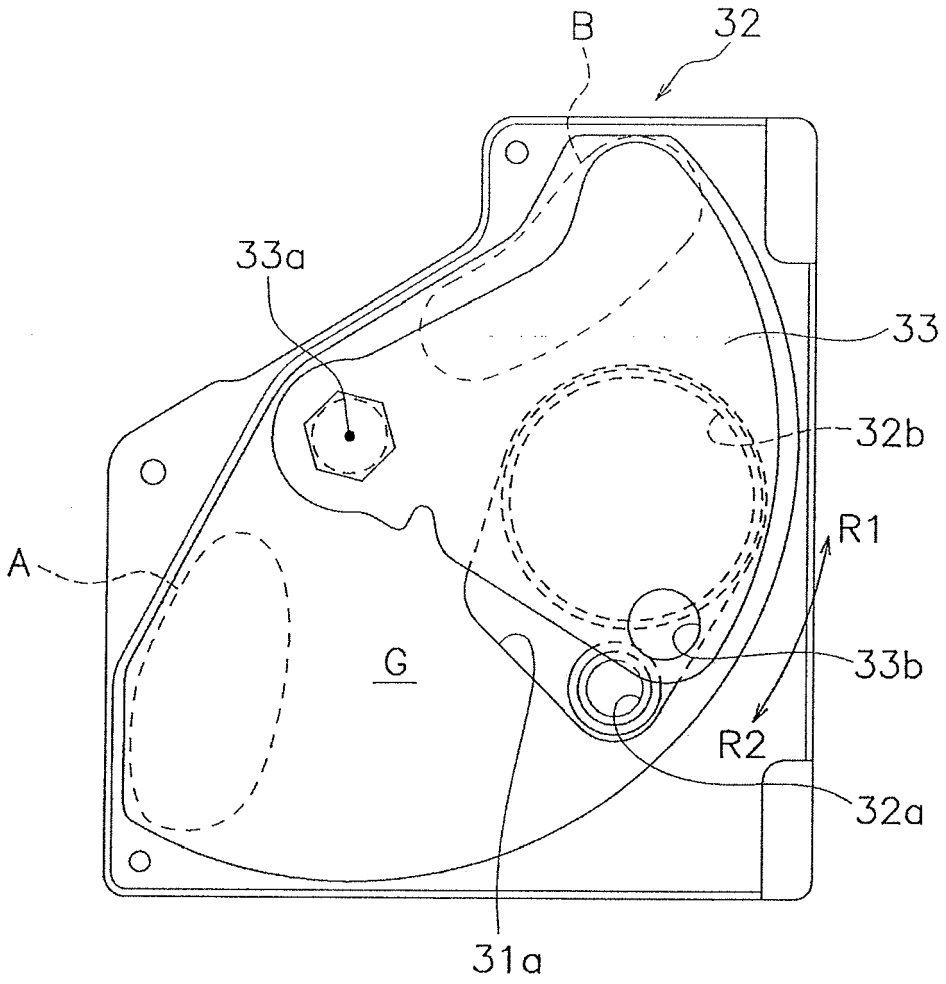
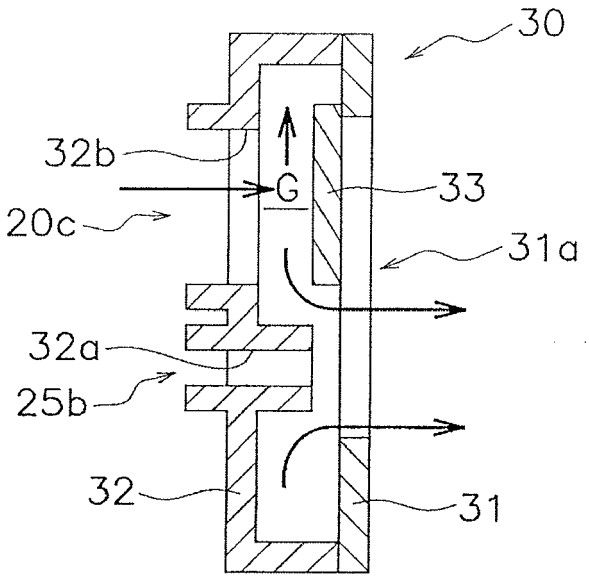


FIG. 17



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# EUROPEAN SEARCH REPORT

Application Number
EP 17 20 8855

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | DE 102 50 293 A1 (RIETER INGOLSTADT SPINNEREI [DE]) 13 May 2004 (2004-05-13) * paragraph [0015] - paragraph [0020]; figure 1 * | 1-10 | INV. B65H54/88 B65H54/70 |
| A,D | EP 2 107 026 A2 (MURATA MACHINERY LTD [JP]) 7 October 2009 (2009-10-07) * paragraph [0031] - paragraph [0037] * | 1-10 | |

TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 25 June 2018 | Guisan, Thierry |

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 8855

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25-06-2018

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| | | EP 2107026 A2 | 07-10-2009 |
| | | JP 2009242036 A | 22-10-2009 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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