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(54)

FRONT-LOADING WASHING MACHINE

(57) The present disclosure provides a front-loading washing machine (1). The front-loading washing machine (1) includes: a cabinet (100) having a front panel (110) which is provided with an opening (111); a tub having an access port for loading and unloading laundry which is disposed in the cabinet (100) and configured in such a manner that the access port is capable of being moved up and down in the opening (111); a rotatable drum disposed in the tub; a door unit (300) mounted to the tub and configured to cover the access port; and a driving mechanism provided in the cabinet (100) coupled to the tub and configured to drive the tub to rotate.

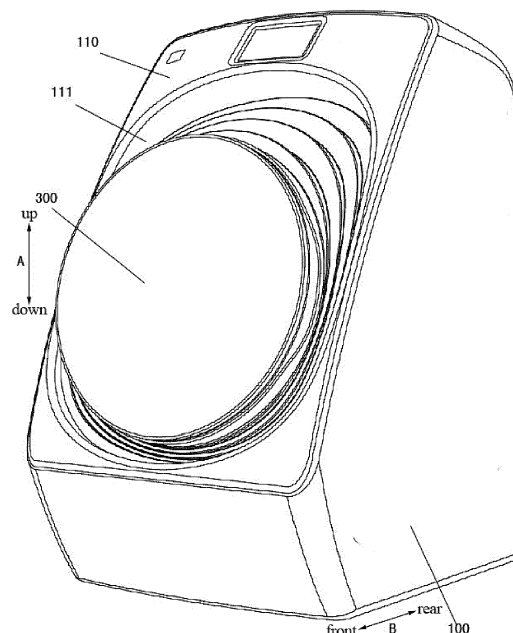


Fig. 1

## Description

### FIELD

**[0001]** The present disclosure relates to a technology field of a washing machine, and more particularly to a front-loading washing machine.

### BACKGROUND

**[0002]** In the related art, a washing machine includes a front-loading washing machine and a pulsator washing machine. A door unit of the front-loading washing machine is opened in a unidirectional manner of leftward or rightward opening, i.e., the door unit is fixed to the washing machine, and an opening direction of the door unit cannot be optionally adjusted due to restraint of an original mounting position thereof, and thus different requirements in different usage environments cannot be satisfied. Moreover, when the pulsator washing machine operates, the laundry needs to be completely immersed in water, so that the water saving effect is poor. Furthermore, when loading and unloading the laundry with the front-loading washing machine, a user needs to bend and squat down, and thus it is much inconvenient for use and is particularly difficult for operations of special populations, such as the aged.

### SUMMARY

**[0003]** The present disclosure seeks to solve at least one of the problems existing in the related art to at least some extent. Accordingly, the present disclosure provides a front-loading washing machine, and a door opening direction of the front-loading washing machine and a position of an access port of the front-loading washing machine are adjustable, so that the front-loading washing machine has advantages of an easy usage, a low laundry abrasion and a less water cost.

**[0004]** The front-loading washing machine according to embodiments of the present disclosure includes: a cabinet having a front panel, wherein the front panel is provided with an opening; a tub having a access port for loading and unloading laundry, wherein the tub is disposed in the cabinet and configured in such a manner that the access port is capable of being moved up and down in the opening; a rotatable drum disposed in the tub; a door unit mounted to the tub and configured to cover the access port; and a driving mechanism provided in the cabinet, coupled with the tub and configured to drive the tub to rotate.

**[0005]** Compared to a front-loading washing machine having an access port disposed in a front surface thereof in the related art, the front-loading washing machine according to embodiments of the present disclosure can move the access port to a position suitable for a user to load and unload laundry when the user needs to load or unload the laundry, and also can move the access port

to a position suitable for washing the laundry, thus facilitating loading, unloading and washing of the laundry. A structure of the front-loading washing machine is simple and compact, and the front-loading washing machine further has advantages of an easy usage, a low laundry abrasion and a less water cost.

**[0006]** In addition, the front-loading washing machine according to embodiments of the present disclosure may further include following additional features.

**[0007]** According to an embodiment of the present disclosure, the driving mechanism is configured to drive the access port to move up and down between a washing position and a non-washing position in the opening.

**[0008]** According to an embodiment of the present disclosure, when the access port is located at the non-washing position, the access port is driven to move close to an upper edge of the front panel, and when the access port is located at the washing position, the access port is driven to move close to a lower edge of the front panel.

**[0009]** According to an embodiment of the present disclosure, the driving mechanism is configured to drive the access port to move upwards close to an upper edge of the front panel and move downwards close to a lower edge of the front panel.

**[0010]** According to an embodiment of the present disclosure, a motion range of the access port in the opening is configured in such a manner that an included angle between a central axis of the access port and a horizontal plane ranges from 0° to 90°.

**[0011]** According to an embodiment of the present disclosure, the driving mechanism includes a longitudinal pushrod disposed at a front side of the tub; a transverse shaft disposed at a rear side of the tub and coupled to the tub; and a support frame disposed in the cabinet and having an hole, wherein the transverse shaft is configured to rotate in the hole of the support frame.

**[0012]** According to an embodiment of the present disclosure, the tub is provided with a carrying platform, and the door unit is rotatably mounted on the carrying platform along a circumferential direction of the access port.

**[0013]** According to an embodiment of the present disclosure, the door unit includes a door base rotatably mounted on the carrying platform along the circumferential direction of the access port; and a door body hinged to the door base.

**[0014]** According to an embodiment of the present disclosure, the door base and the carrying platform are configured as circular rings fitted with each other and having axes coincident with each other.

**[0015]** According to an embodiment of the present disclosure, the door base is provided with a plurality of base mounting holes spaced apart from each other by an equal interval along a circumferential direction of the door base, and the carrying platform is provided with a plurality of platform mounting holes spaced apart from each other by an equal interval along a circumferential direction of the carrying platform, wherein the door base and the carrying platform are fastened by threaded fasteners fitted

in the base mounting holes and the platform mounting holes.

**[0016]** According to an embodiment of the present disclosure, a central angle corresponding to two adjacent base mounting holes is integer times or one part in an integer as large as a central angle corresponding to two adjacent platform mounting holes.

**[0017]** According to an embodiment of the present disclosure, the door body is provided with a door lock opposite to the door hinge in a radial direction of the door body, and the door base is provided with a door hook configured to be fitted with the door lock.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0018]** These and other aspects and advantages of embodiments of the present disclosure will become apparent and more readily appreciated from the following descriptions made with reference to the drawings, in which:

Fig. 1 is a schematic view of a front-loading washing machine according to embodiments of the present disclosure, in which the access port is in a washing position;

Fig. 2 is a partial schematic view of a front-loading washing machine according to embodiments of the present disclosure, in which the access port is in a washing position;

Fig. 3 is a partial schematic view of a front-loading washing machine according to embodiments of the present disclosure, in which the access port is in a non-washing position;

Fig. 4 is a partial assembly view of a front-loading washing machine according to embodiments of the present disclosure;

Fig. 5 is an exploded view of a structure shown in Fig. 4;

Fig. 6 is a schematic view of a door unit of a front-loading washing machine according to embodiments of the present disclosure;

Fig. 7 is a schematic view of a door unit of a front-loading washing machine according to embodiments of the present disclosure, in which the door unit is completely opened;

Fig. 8 is a perspective view of a carrying platform of a front-loading washing machine according to embodiments of the present disclosure;

Fig. 9 is a front view of a structure shown in Fig. 8;

Fig. 10 is a front view of a door base of a front-loading washing machine according to embodiments of the present disclosure;

Fig. 11 is a schematic view of a front-loading washing machine according to embodiments of the present disclosure, in which the door unit is opened in a manner of leftward opening; and

Fig. 12 is a schematic view of a front-loading washing machine according to embodiments of the present

disclosure, in which the door unit is opened in a manner of rightward opening.

### **[0019] Reference numerals:**

front-loading washing machine 1;  
cabinet 100; front panel 110; opening 111;  
tub 200; carrying platform 210; platform mounting hole 211; counterweight 212; access port 220;  
door unit 300; door base 310; base mounting hole 311; door hook 312; door body 320; door lock 321; door hinge 330;  
driving mechanism 400; longitudinal pushrod 410; transverse shaft 420; support frame 430; hole 431; rotatable drum 500.

### **DETAILED DESCRIPTION**

**[0020]** Reference will be made in detail to embodiments of the present disclosure. The embodiments described herein with reference to drawings are explanatory, illustrative, and used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions.

**[0021]** A front-loading washing machine 1 will be described with reference to Figs. 1-12 in the following.

**[0022]** As shown in Figs. 1-3, the front-loading washing machine 1 according to embodiments of the present disclosure includes a cabinet 100, a tub 200, a rotatable drum 500, a door unit 300 and a driving mechanism 400.

**[0023]** The cabinet 100 includes a front panel 110 (a front-rear direction is represented by arrow B in Figs. 1-3), and an opening 111 is formed in the front panel 110. The tub 200 has an access port 220 for loading and unloading laundry, and the tub 200 is disposed in the cabinet 100 and configured in such a manner that the access port 220 is capable of moving up and down in the opening 111 (an up-and-down direction is represented by arrow A in Figs. 1-3). The drum 500 is disposed in the tub 200. The door unit 300 is mounted to the tub 200 and configured to cover the access port 220. The driving mechanism 400 is provided in the cabinet 100, coupled to the tub 200 and used to drive the tub 200 to move.

**[0024]** In the front-loading washing machine 1 according to embodiments of the present disclosure, the tub 200 is configured in such a manner that the access port 220 is capable of being moved up and down in the opening 111, and thus the front-loading washing machine 1 can move the access port 220 to a position suitable for a user to load and unload laundry when the user needs to load or unload the laundry, compared with a front-loading washing machine having the access port 220 disposed in a front surface thereof in the related art. For example, the access port 220 may be moved upwards. In this way, when loading or unloading laundry, the user

does not need to squat down or bend, which facilitates loading and unloading laundry through the access port 220 by the user, and also enables the user inconvenient to bend (such as the aged) to load and unload laundry successfully, thus improving the use convenience of the front-loading washing machine 1.

**[0025]** Moreover, since the access port 220 can be moved up and down in the opening 111, the access port 220 may be moved to a position suitable for washing laundry after the laundry has been loaded. For example, the access port 220 may be moved downwards. In this way, when washing laundry, the drum 500 may roll to tumble the laundry up and down so as to achieve the washing of laundry, thus reducing abrasion of the laundry during washing thereof. Moreover, because the laundry needs not to be completely immersed in water when being washed, but only a small amount of water is needed to accomplish the washing thereof, a corresponding water cost is reduced, which is more environmentally friendly.

**[0026]** In addition, by disposing the driving mechanism 400, the tub 200 may be driven by using the driving mechanism 400. In this way, when the user needs to adjust a position of the access port 220, the driving mechanism 400 may be used to drive the tub 200. Thereby, the user can adjust the position of the tub 200 with less effort, so that it is convenient for the user to adjust the position of the tub 200, and further for the user (such as the aged) to use the front-loading washing machine 1.

**[0027]** That is to say, by providing the tub 200 configured in such a manner that the access port 220 is capable of being moved up and down in the opening 111 and providing the driving mechanism 400 configured to drive the tub 200 to move, the front-loading washing machine 1 can achieve a desired effect of an ordinary front-loading washing machine when washing the laundry, and the access port 220 can be adjusted to the position suitable for loading and unloading laundry when the laundry needs to be loaded or unloaded or additional laundry needs to be loaded during the washing, so that a problem that it is inconvenient to load and unload laundry for the traditional front-loading washing machine in the related art is overcome, thereby facilitating use for the user.

**[0028]** Therefore, the front-loading washing machine 1 according to embodiments of the present disclosure has advantages of the convenient use, the low laundry abrasion and the reduced water cost.

**[0029]** The front-loading washing machine 1 according to embodiments of the present disclosure will be described with reference to accompanying drawings in the following.

**[0030]** In some specific embodiments of the present disclosure, as shown in Figs. 1-3, the front-loading washing machine 1 according to embodiments of the present disclosure includes a cabinet 100, a tub 200, a rotatable drum, a door unit 300 and a driving mechanism 400.

**[0031]** The driving mechanism 400 drives the access port 220 to move up and down between the washing po-

sition and the non-washing position in the opening 111. In this way, when the laundry needs to be washed, the driving mechanism 400 may be used to drive the tub 200, so that the access port 220 can be moved to the washing position, thus facilitating washing the laundry. When the laundry does not need to be washed, the driving mechanism 400 may be used to drive the tub 200, so that the access port 220 can be moved to the non-washing position, thus facilitating loading and unloading the laundry by the user.

**[0032]** Specifically, as shown in Figs. 1-3, when the access port 220 is at the non-washing position (as shown in Fig. 3), the access port 220 is driven to move close to an upper edge of the front panel 110. When the access port 220 is at the washing position (as shown in Figs. 1 and 2), the access port 220 is driven to move close to a lower edge of the front panel 110. Thereby, when the user needs to load or unload laundry, the access port may be moved close to the upper edge of the front panel 110, so as to facilitate loading and unloading laundry from top by the user, and when the user needs to wash laundry, the access port may be moved close to the lower edge of the front panel 110, so as to facilitate washing the laundry through the rolling of the drum 500.

**[0033]** Specifically, as shown in Fig. 1, the front panel 110 may be inclined backwards from bottom to top. Thereby, it may be further convenient for the user to load and unload laundry when the access port 220 is moved to the non-washing position.

**[0034]** Advantageously, as shown in Figs. 2 and 3, the driving mechanism 400 is configured to drive the access port 220 to move upwards to close to the upper edge of the front panel 110 and move downwards to close to the lower edge of the front panel 110. In this way, when the laundry needs to be loaded or unloaded, the driving mechanism 400 may be operated to move the access port upwards close to the upper edge of the front panel 110, thereby facilitating loading and unloading the laundry; and when the laundry needs to be washed, the driving mechanism 400 may be operated to move the access port downwards close to the lower edge of the front panel 110, thereby facilitating washing the laundry through the rolling of the drum 500.

**[0035]** Optionally, a motion range of the access port 220 in the opening 111 is configured in such a manner that an included angle between a central axis of the access port 220 and a horizontal plane ranges from 0° to 90°. In other words, the access port may be moved between a horizontal position and a vertical position of the central axis thereof. Specifically, when the access port is located at the non-washing position suitable for loading and unloading laundry, the central axis of the access port is oriented in a vertical direction; and when the access port is at the washing position suitable for washing laundry, the central axis of the access port is oriented in a horizontal direction. Thereby, it is convenient for the user to load and unload the laundry through the access port from top, and also to wash the laundry by the rolling of

the drum 500.

**[0036]** It can be understood by those skilled in the art that, the motion range of the access port may be adjusted according to the actual conditions. For example, when the access port is at the non-washing position (as shown in Fig. 3), the central axis of the access port may be inclined forwards from bottom to top, and thus it is convenient for the user to load and unload the laundry as well. When the access port is at the washing position (as shown in Figs. 1 and 2), the central axis of the access port may be oriented at a predetermined angle with respect to the horizontal direction, in condition of ensuring the laundry in the drum 500 to be washed in a rolling manner.

**[0037]** The front-loading washing machine 1 according to a specific example of the present disclosure is shown in Figs. 1-3. As shown in Figs. 1-3, the driving mechanism 400 includes a longitudinal pushrod 410 disposed at a front side of the tub 200, a transverse shaft 420 disposed at a rear side of the tub 200 and coupled to the tub 200, and a support frame 430 disposed in the cabinet 100 and having a hole 431, in which the transverse shaft 420 may rotate in the hole 431 of the support frame 430. In this way, the tub 200 may be disposed rotatably to the support frame 430 by the transverse shaft 420, so that the access port is capable of being moved up and down in the opening 111; moreover, the tub 200 may be driven to move by the longitudinal pushrod 410, so as to achieve a position adjustment of the access port.

**[0038]** Optionally, as shown in Figs. 4 and 5, the tub 200 is provided with a counterweight 212, and the counterweight 212 may be fixed at a side wall or somewhere else of the tub 200, thus playing the role of balancing loads, and further ensuring the running stability of the front-loading washing machine 1.

**[0039]** According to an embodiment of the present disclosure, the tub 200 is provided with a carrying platform 210, and the door unit 300 is rotatably mounted to the carrying platform 210 along a circumferential direction of the access port 220. With reference to Fig. 5, the tub 200 of the front-loading washing machine 1 is provided with a spherical cover at a front end of the tub 200, the carrying platform 210 is provided at a side of the spherical cover facing the user, and the door unit 300 is rotatably disposed to the carrying platform 210. Preferably, a center of the spherical cover has a vertical projection in the central axis of the transverse shaft 420, and the vertical projection coincides with a center of the transverse shaft 420. The user may choose a proper door opening angle, i.e. an angle of mounting the door unit 300 to the carrying platform 210 can be adjusted by hands, thus meeting requirements of the user.

**[0040]** As shown in Figs. 6 and 7, the door unit 300 includes a door base 310 and a door body 320. The door base 310 is rotatably mounted to the carrying platform 210 along the circumferential direction of the access port 220, and the door body 320 is hinged to the door base 310.

**[0041]** That is to say, the door unit 300 mainly includes the door base 310, the door body 320 and a door hinge 330. The door base 310 may have a circular-ring shape and be connected to the carrying platform 210 mounted at the access port 220, the door body 320 may have a disc shape, and the door hinge 330 may be connected with same sides of the door body 320 and the door base 310 respectively, so that the door body 320 can be rotated about a central shaft of the door hinge 330, and thus the access port 220 can be opened and closed.

**[0042]** Preferably, according to an embodiment of the present disclosure, the door base 310 and the carrying platform 210 are configured as circular rings, and the circular rings are fitted with each other and have axes coincident with each other.

**[0043]** With reference to Figs. 8-10, the door base 310 and the carrying platform 210 are configured as circular rings respectively. The carrying platform 210 is mounted at a front end (which faces the user) of tub 200, the door base 310 is detachably mounted to the carrying platform 210, and a central axis of the door base 310 is coincident with a central axis of the carrying platform 210, so that the position of mounting the door base 310 to the carrying platform 210 can be adjusted through rotating the door base 310 by hands.

**[0044]** Therefore, in the front-loading washing machine 1 according to embodiments of the present disclosure, the door unit 300 is configured by means of characteristics of a circular structure member, and the door base 310 and the carrying platform 210 are configured as the circular rings respectively, so that it is easy to achieve the position adjustment with multiple angles, thus attaining the door opening manner with multiple directions. The front-loading washing machine 1 has a simple structure, various parts compactly connected with one another, the easy assembly and disassembly, and the convenient position adjustment, thus satisfying the using requirements of the user.

**[0045]** In some specific embodiments of the present disclosure, the door base 310 is provided with a plurality of base mounting holes 311 spaced apart from one another by an equal interval along a circumferential direction of the door base 310, the carrying platform 210 is provided with a plurality of platform mounting holes 211 spaced apart from one another by an equal interval along a circumferential direction of the carrying platform 210, and the door base 310 and the carrying platform 210 are fastened by threaded fasteners fitted in the base mounting holes 311 and the platform mounting holes 211.

**[0046]** With reference to Fig. 10, the door base 310 has a circular-ring shape, and the door base 310 is provided with the plurality of base mounting holes 311 spaced apart from one another along the circumferential direction thereof. Each two adjacent base mounting holes 311 have an equal distance therebetween, i.e. the plurality of base mounting holes 311 are evenly and equidistantly arranged in the door base 310.

**[0047]** With reference to Figs. 8 and 9, the carrying

platform 210 has a circular-ring shape corresponding to the door base 310, and the carrying platform 210 is provided with the plurality of platform mounting holes 211 spaced apart from one another along the circumferential direction thereof. Each two adjacent platform mounting holes 211 have an equal distance therebetween, i.e. the plurality of platform mounting holes 211 are evenly and equidistantly arranged in the carrying platform 210.

**[0048]** The plurality of platform mounting holes 211 in the carrying platform 210 are in one to one correspondence with at least a certain number of the base mounting holes 311 in the door base 310. Certainly, the present disclosure is not limited to this, each platform mounting hole 211 in the carrying platform 210 may be in one to one correspondence with each base mounting hole 311 in the door base 310, i.e. a radial dimension of a supposed circle in which the plurality of base mounting holes 311 are located is equal to a radial dimension of a supposed circle in which the plurality of platform mounting holes 211 are located.

**[0049]** For example, in some specific examples of the present disclosure, the plurality of base mounting holes 311 and the plurality of platform mounting holes 211 are centrosymmetrically disposed in the door base 310 and the carrying platform 210, respectively. Connecting lines between a center of the corresponding supposed circle and the two adjacent base mounting holes 311 in the door base 310 has an included angle of  $36^\circ$  therebetween, and also, connecting lines between a center of the corresponding supposed circle and the two adjacent platform mounting holes 211 in the carrying platform 210 has an included angle of  $36^\circ$  therebetween.

**[0050]** If the door base 310 is to be mounted to the carrying platform 210, the door base 310 may be rotated by hands, the base mounting holes 311 in the door base 310 are in one to one correspondence with the platform mounting holes 211 in the carrying platform 210 per  $36^\circ$  rotation of the door base 310, and then the door base 310 is fixedly connected with the carrying platform 210 by the threaded fasteners. If the opening direction of the door body 320 needs to be adjusted, the threaded fasteners first may be removed, then the door base 310 may be adjusted by a needed angle, and the threaded fasteners may be passed through the base mounting holes 311 and the platform mounting holes 211 again, so as to fixedly connect the door base 310 with the carrying platform 210.

**[0051]** Thus, by respectively providing the plurality of base mounting holes 311 and the plurality of platform mounting holes 211 in the door base 310 and the carrying platform 210 evenly, when the door base 310 is adjusted to a position with a proper angle, the door base 310 can be fastened with the carrying platform 210, which thus provides the easy assembly and disassembly, the convenient position adjustment and the good user experience.

**[0052]** In some other specific embodiments of the present disclosure, a central angle corresponding to the

two adjacent base mounting holes 311 is integer times or one part in an integer as large as a central angle corresponding to the two adjacent platform mounting holes 211. Therefore, the user may adjust the position of the door base 310 with respect to the carrying platform 210 according to a habit of door opening direction or other using requirements, thus achieving an objective of adjusting the opening direction of the door body 320.

**[0053]** For example, the number of the plurality of platform mounting holes 211 evenly arranged in the carrying platform 210 may be 2, 3, 4, 5, 6, 8, 9, 10, 15, 18, 20, 24, i.e. a central angle  $\alpha$  corresponding to each two adjacent platform mounting holes 211 is  $180^\circ$ ,  $120^\circ$ ,  $90^\circ$ ,  $72^\circ$ ,  $60^\circ$ ,  $45^\circ$ ,  $40^\circ$ ,  $36^\circ$ ,  $30^\circ$ ,  $24^\circ$ ,  $20^\circ$ ,  $18^\circ$ ,  $15^\circ$ . And, the number of the plurality of base mounting holes 311 evenly arranged in the door base 310 may be 2, 3, 4, 5, 6, 9, i.e. a central angle  $\beta$  corresponding to each two adjacent base mounting holes 311 is  $180^\circ$ ,  $120^\circ$ ,  $90^\circ$ ,  $72^\circ$ ,  $60^\circ$ ,  $40^\circ$ .

**[0054]** In some specific examples of the present disclosure, the carrying platform 210 is provided with twelve platform mounting holes 211, i.e. the central angle  $\alpha$  corresponding to each two adjacent platform mounting holes 211 is  $30^\circ$ , and the door base 310 is provided with four base mounting holes 311, i.e. the central angle  $\beta$  corresponding to each two adjacent base mounting holes 311 is  $90^\circ$ . After the door base 310 is rotated by  $90^\circ$  each time by hands, all the four base mounting holes 311 in the door base 310 correspond to four of the platform mounting holes 211 in the carrying platform 210, and then the door base 310 is fixedly connected to the carrying platform 210, thus achieving one opening direction of the door body 320.

**[0055]** As shown in Fig. 11, if the door hinge 330 between the door base 310 and the door body 320 is located on the left in an initial mounting position of the door base 310 on the carrying platform 210, the opening direction of the door body 320 is from right to left at this time, i.e. the opening manner of the door unit 300 is a leftward opening manner. However, if the door base 310 is rotated by  $180^\circ$  clockwise by hands, and then the door base 310 is fixedly connected to the carrying platform 210, the door hinge 330 between the door base 310 and the door body 320 is located on the right at this time, and the opening direction of the door body 320 is from left to right, i.e. the door unit 300 is located at a position as shown in Fig. 12, and thus a rightward opening manner of the door unit 300 is achieved.

**[0056]** Thus, a connection manner between the door unit 300 and the tub 200 of the front-loading washing machine 1 breaks a fixed structure of a traditional door component. By providing the corresponding base mounting holes 311 and platform mounting holes 211 in the door base 310 and the carrying platform 210 respectively, a multi-angle fit between the door base 310 and the carrying platform 210 is achieved, thus easily achieving a multiple-angle opening direction of the door body 320.

**[0057]** Advantageously, as shown in Fig. 5, according to an embodiment of the present disclosure, the door

body 320 is provided with a door lock 321 opposite to the door hinge 330 in a radial direction of the door body 320, and the door base 310 is provided with a door hook 312 configured to be fitted with the door lock 321. Thus, by providing the door lock 321 to the door body 320, and providing the door hook 312 configured to be fitted with the door lock 321 to the door base 320, it may be ensured that the door body 320 can be fitted with the door base 310 reliably when the door body 320 is closed, and thus the using reliability of the front-loading washing machine 1 is improved.

**[0058]** Other components and operations of the front-loading washing machine 1 according to embodiments of the present disclosure are known to those skilled in the art, which will not be described in detail herein.

**[0059]** In the specification, it is to be understood that terms such as "central," "longitudinal," "lateral," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," and "counterclockwise" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present disclosure be constructed or operated in a particular orientation.

**[0060]** In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may comprise one or more of this feature. In the description of the present disclosure, "a plurality of" means two or more than two, unless specified otherwise.

**[0061]** In the present disclosure, unless specified or limited otherwise, the terms "mounted," "connected," "coupled," "fixed" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications of two elements, which can be understood by those skilled in the art according to specific situations.

**[0062]** In the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of" a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of" a second feature may include an embodiment in which the first feature is right

or obliquely "below," "under," or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

**[0063]** Reference throughout this specification to "an embodiment," "some embodiments," "one embodiment," "another example," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases such as "in some embodiments," "in one embodiment," "in an embodiment," "in another example," "in an example," "in a specific example," or "in some examples," in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

**[0064]** Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that the above embodiments cannot be construed to limit the present disclosure, and changes, alternatives, and modifications can be made in the embodiments without departing from spirit, principles and scope of the present disclosure.

## Claims

### 1. A front-loading washing machine (1), comprising:

a cabinet (100) having a front panel (110), wherein the front panel (110) is provided with an opening (111);  
a tub (200) having an access port (220) for loading and unloading laundry, wherein the tub (200) is disposed in the cabinet (100) and configured in such a manner that the access port (220) is capable of being moved up and down in the opening (111);  
a rotatable drum (500) disposed in the tub (200);  
a door unit (300) mounted to the tub (200) and configured to cover the access port (220); and  
a driving mechanism (400) provided in the cabinet (100), coupled with the tub (200) and configured to drive the tub (200) to rotate.

2. The front-loading washing machine (1) according to claim 1, wherein the driving mechanism (400) is configured to drive the access port (220) to move up and down between a washing position and a non-washing position in the opening (111).

3. The front-loading washing machine (1) according to claim 2, wherein when the access port (220) is located at the non-washing position, the access port

(220) is driven to move close to an upper edge of the front panel (110), and when the access port (220) is located at the washing position, the access port (220) is driven to move close to a lower edge of the front panel (110).

4. The front-loading washing machine (1) according to claim 1, wherein the driving mechanism (400) is configured to drive the access port (220) to move upwards to close to an upper edge of the front panel (110) and move downwards to close to a lower edge of the front panel (110).

5. The front-loading washing machine (1) according to claim 1, wherein a motion range of the access port (220) in the opening (111) is configured in such a manner that an included angle between a central axis of the access port (220) and a horizontal plane ranges from 0° to 90°.

6. The front-loading washing machine (1) according to claim 1 or 2, wherein the driving mechanism (400) comprises:

a longitudinal pushrod (410) disposed at a front side of the tub (200);

a transverse shaft (420) disposed at a rear side of the tub (200) and coupled to the tub (200); and a support frame (430) disposed in the cabinet (100) and having a hole (431),

wherein the transverse shaft (420) is configured to rotate in the hole (431) of the support frame (430).

7. The front-loading washing machine (1) according to claim 1, wherein the tub (200) is provided with a carrying platform (210), and the door unit (300) is rotatably mounted on the carrying platform (210) along a circumferential direction of the access port (220).

8. The front-loading washing machine (1) according to claim 7, wherein the door unit (300) comprises:

a door base (310) rotatably mounted on the carrying platform (210) along the circumferential direction of the access port (220); and

a door body (320) hinged to the door base (310).

9. The front-loading washing machine (1) according to claim 8, wherein the door base (310) and the carrying platform (210) are configured as circular rings fitted with each other and having central axes coincident with each other.

10. The front-loading washing machine (1) according to claim 9, wherein the door base (310) is provided with a plurality of base mounting holes (311) spaced apart from one another by an equal interval along a cir-

cumferential direction of the door base (310), the carrying platform (210) is provided with a plurality of platform mounting holes (211) spaced apart from one another by an equal interval along a circumferential direction of the carrying platform (210), and the door base (310) and the carrying platform (210) are fastened by threaded fasteners fitted in the base mounting holes (311) and the platform mounting holes (211).

11. The front-loading washing machine (1) according to claim 10, wherein a central angle corresponding to two adjacent base mounting holes (311) is integer times or one part in an integer as large as a central angle corresponding to two adjacent platform mounting holes (211).

12. The front-loading washing machine (1) according to claim 9, wherein the door body (320) is provided with a door lock (321) opposite to the door hinge (330) in a radial direction of the door body (320), and the door base (310) is provided with a door hook (312) configured to be fitted with the door lock (321).

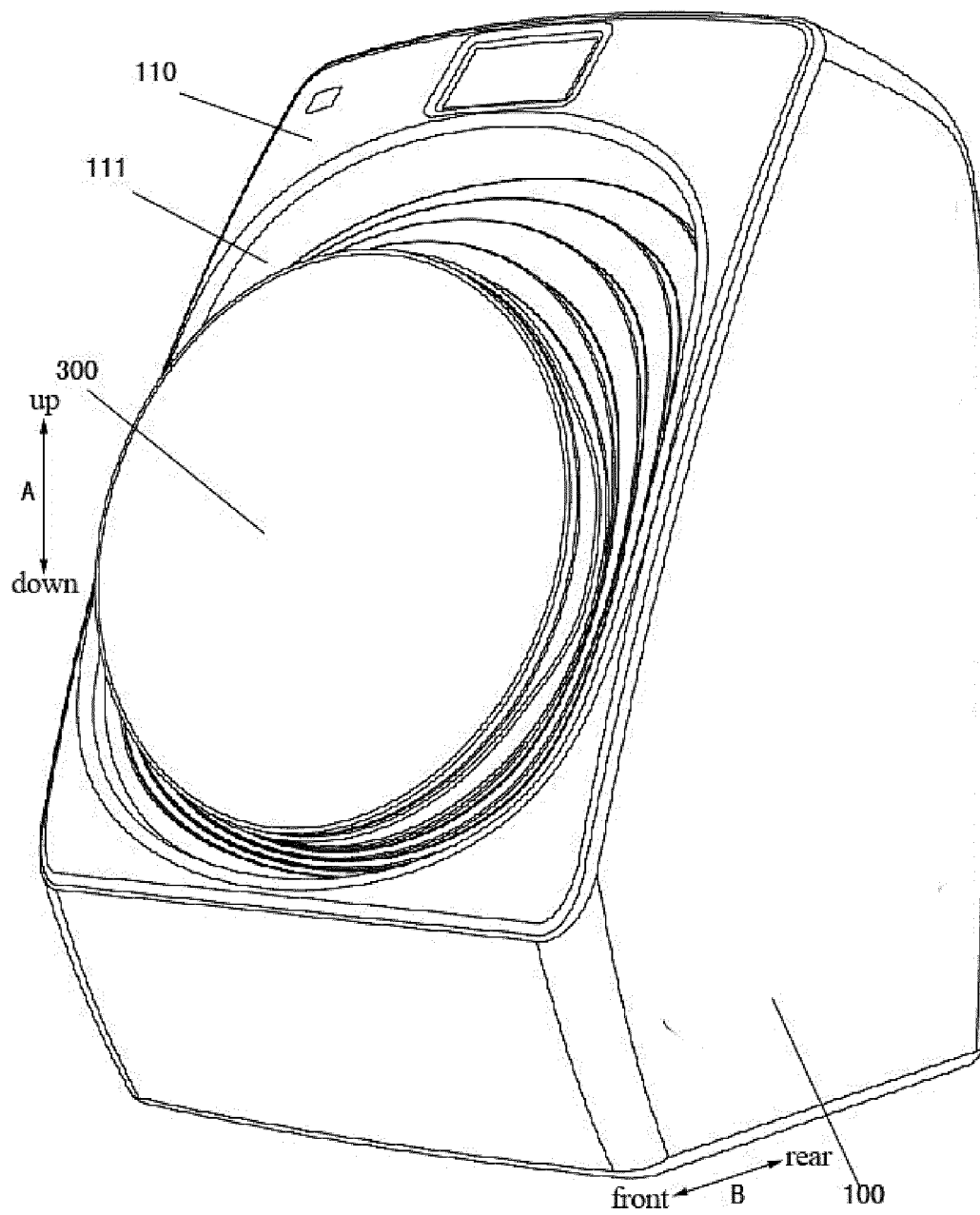


Fig. 1

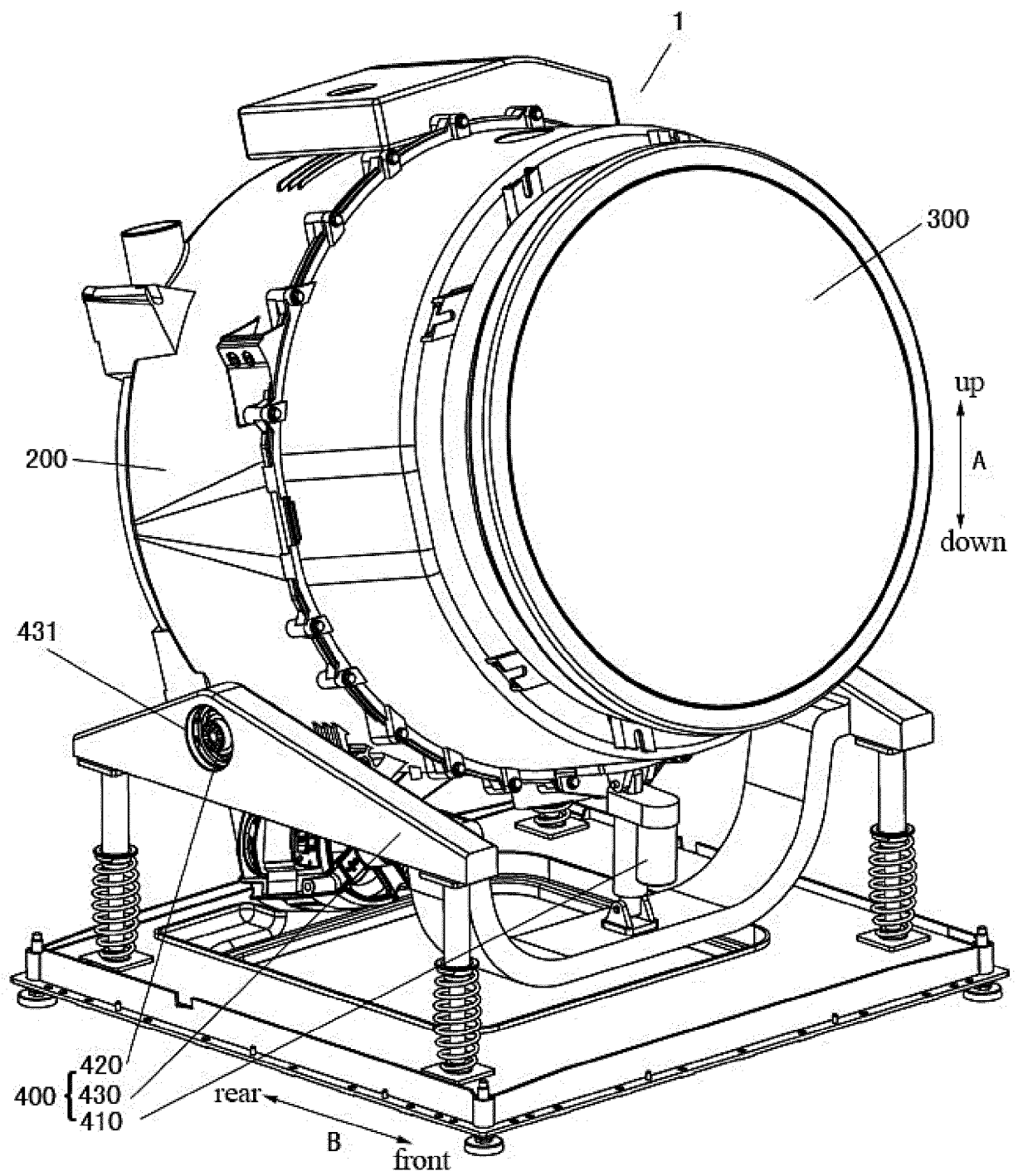


Fig. 2

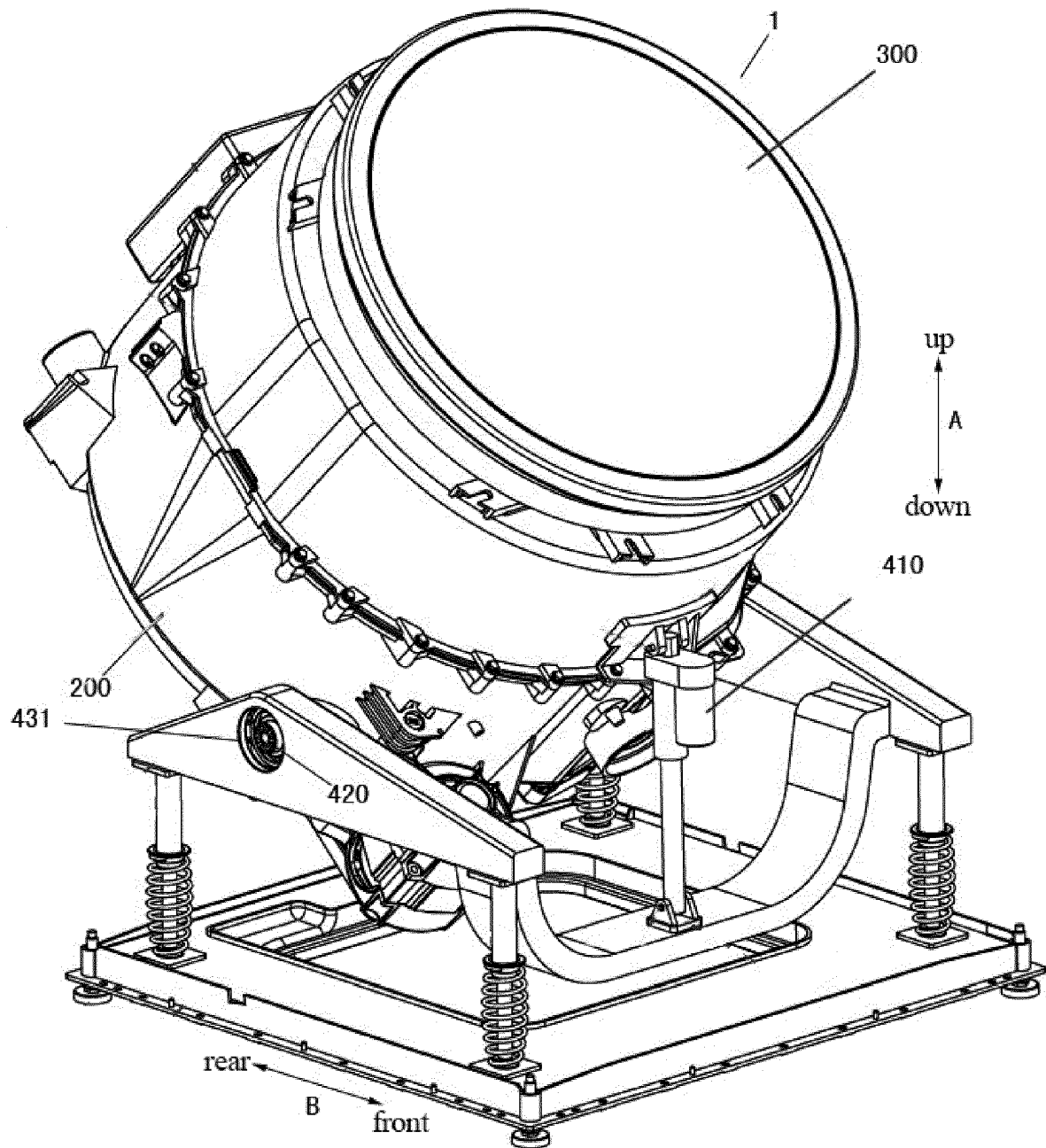


Fig. 3

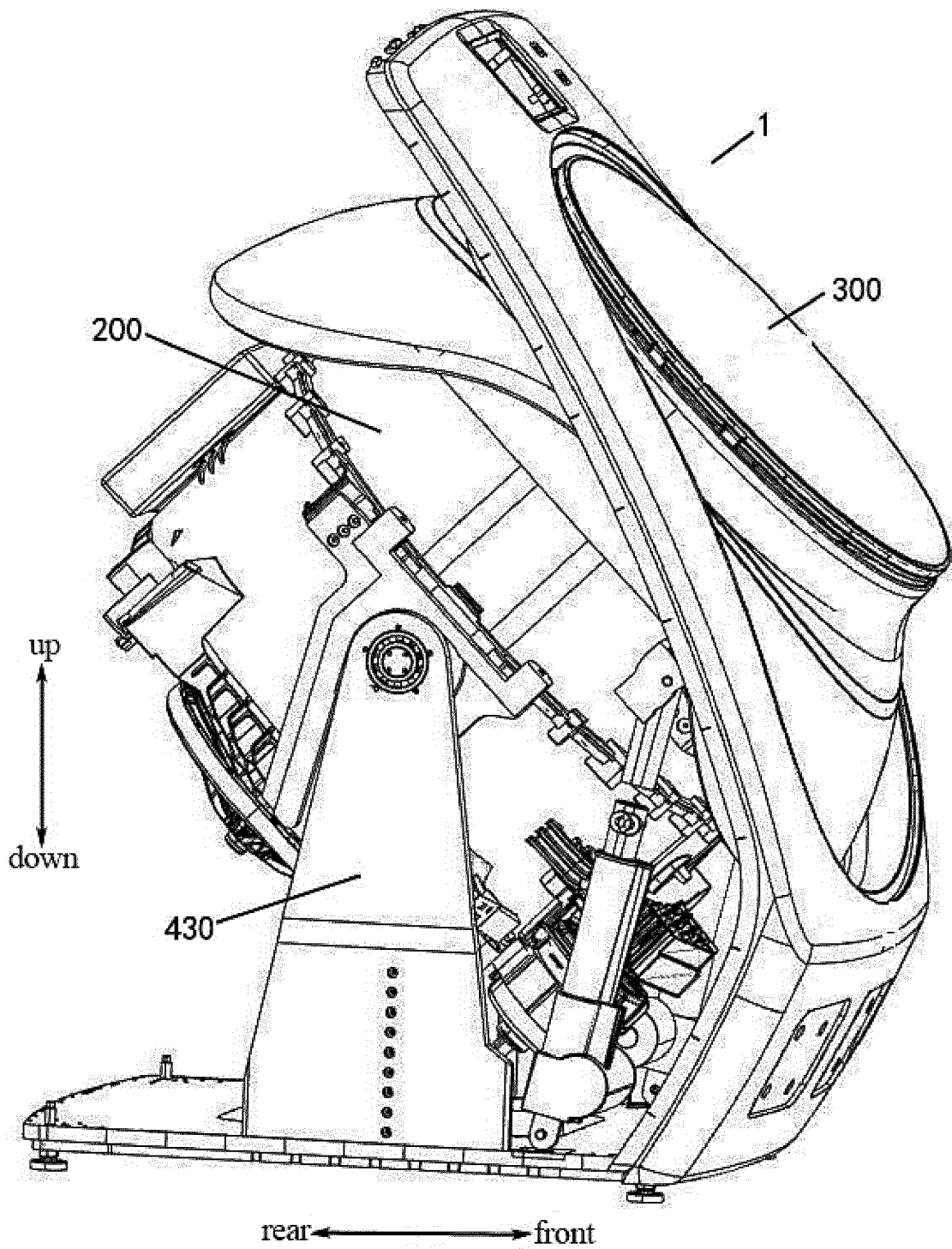


Fig .4

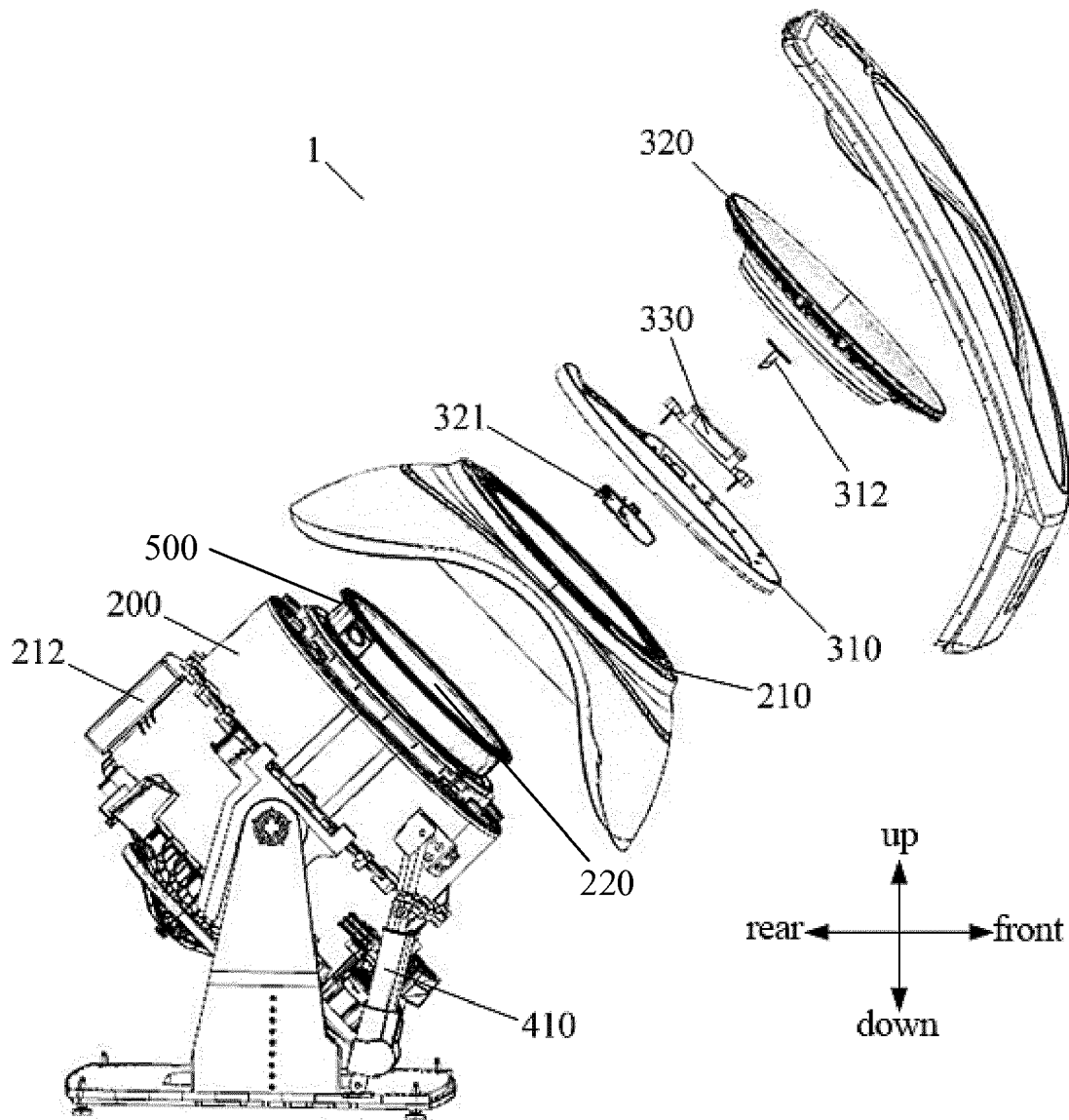


Fig. 5

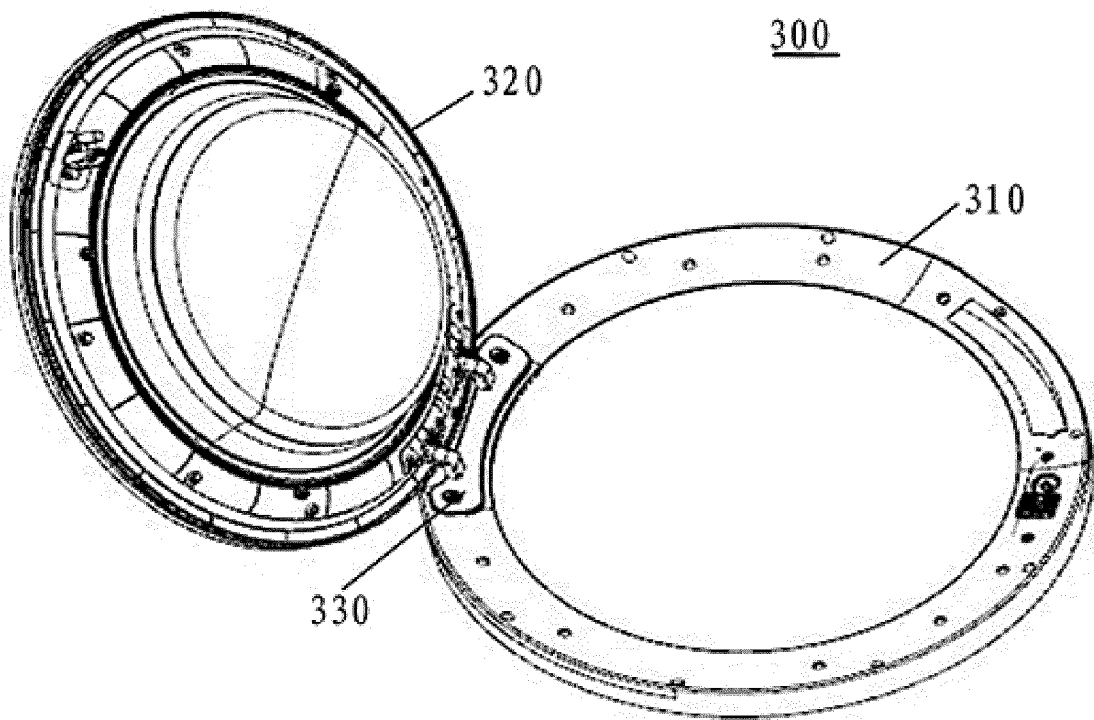


Fig. 6

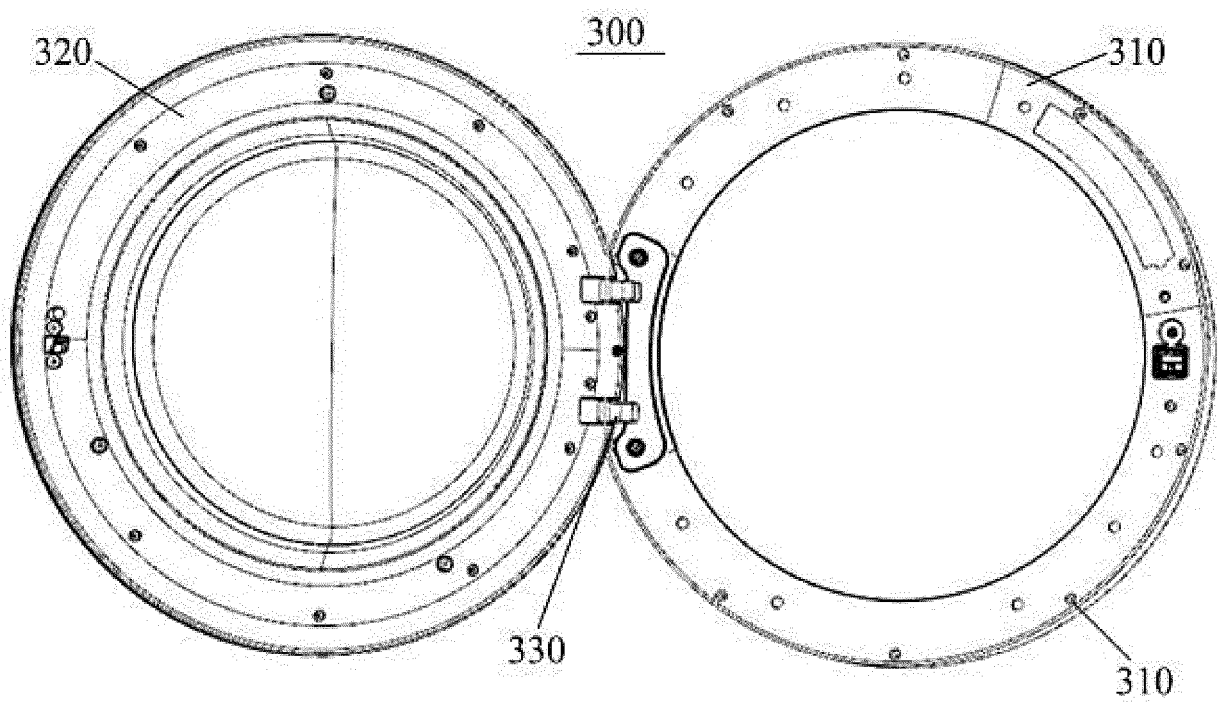


Fig. 7

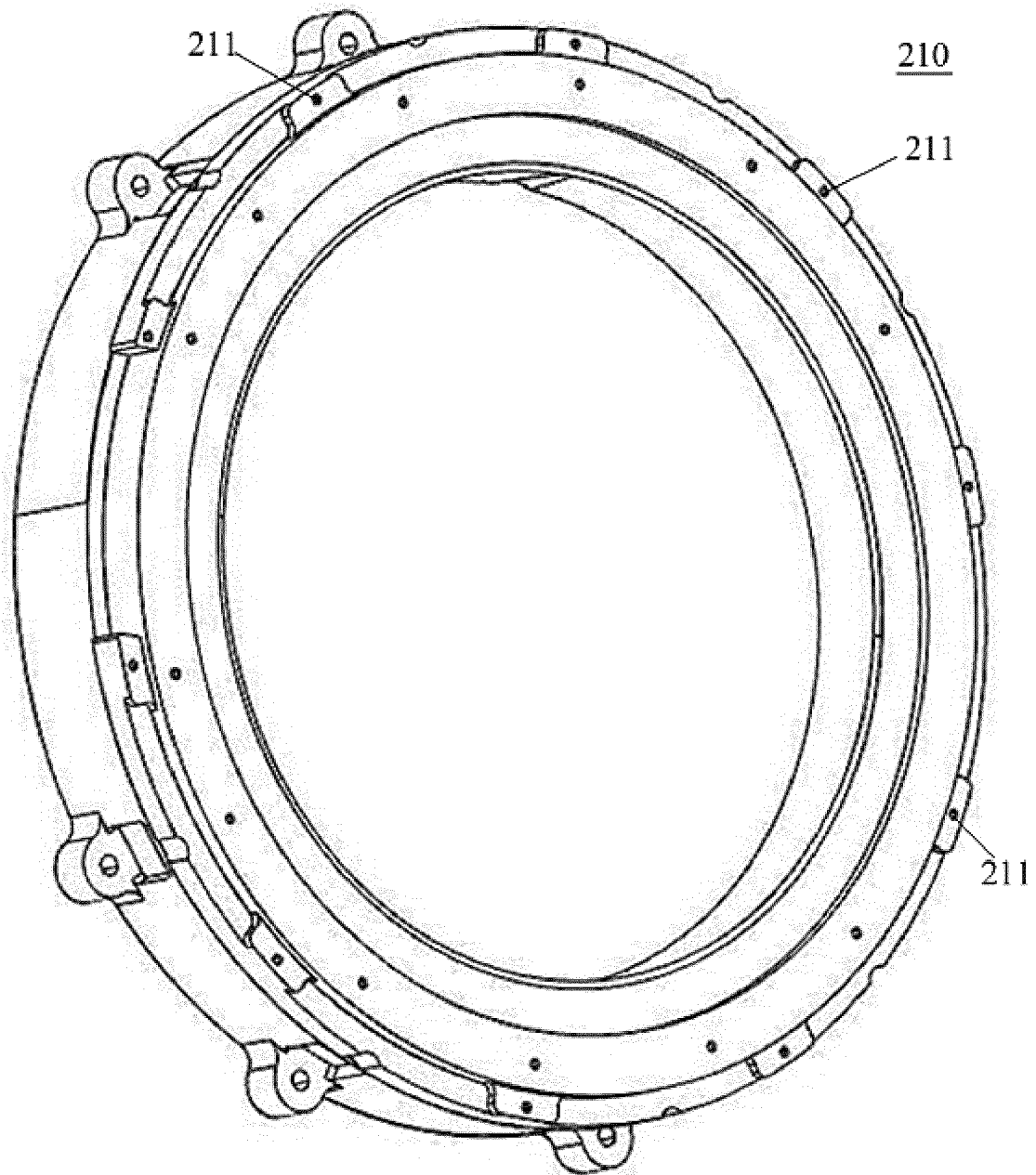


Fig. 8

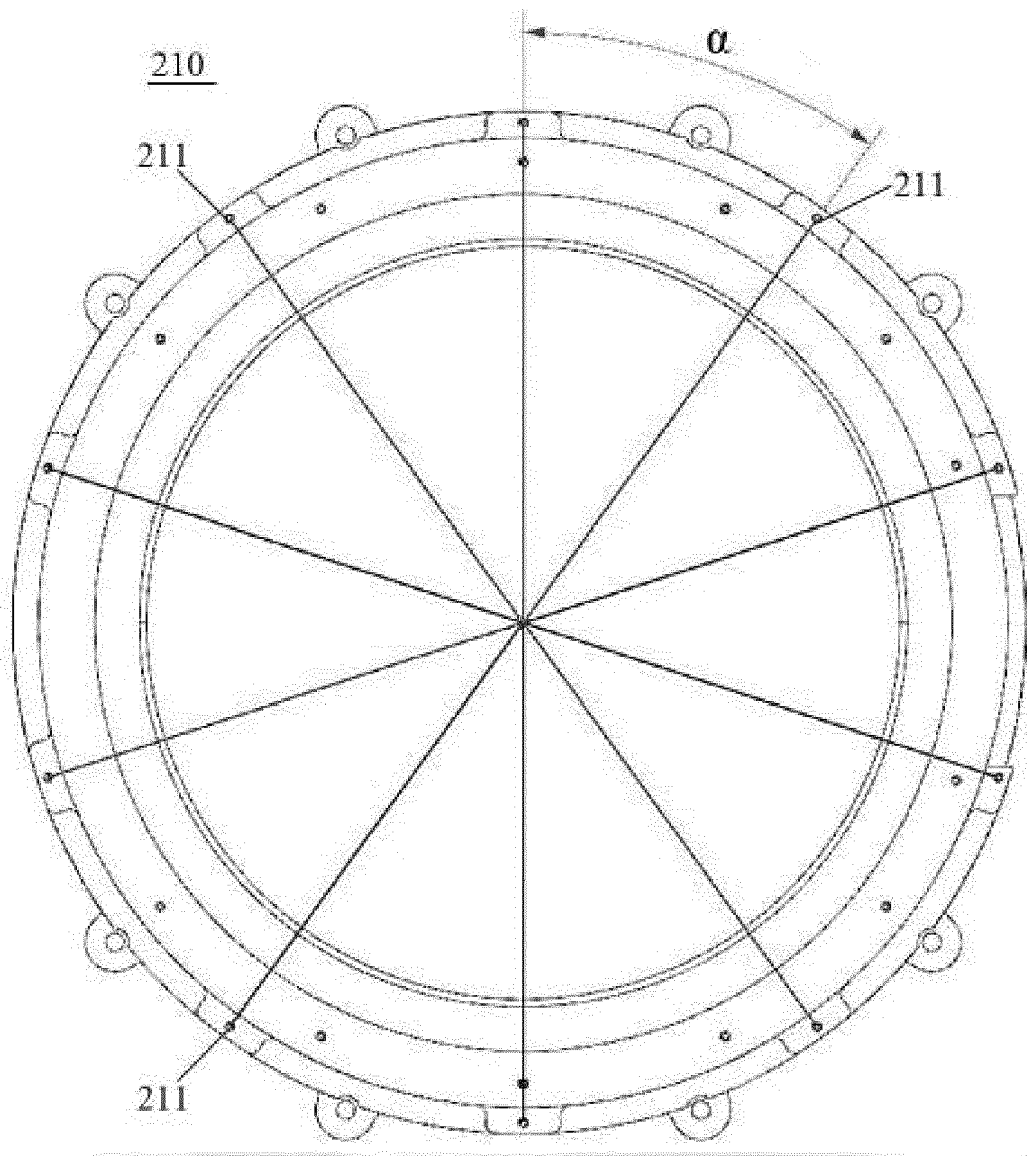


Fig. 9

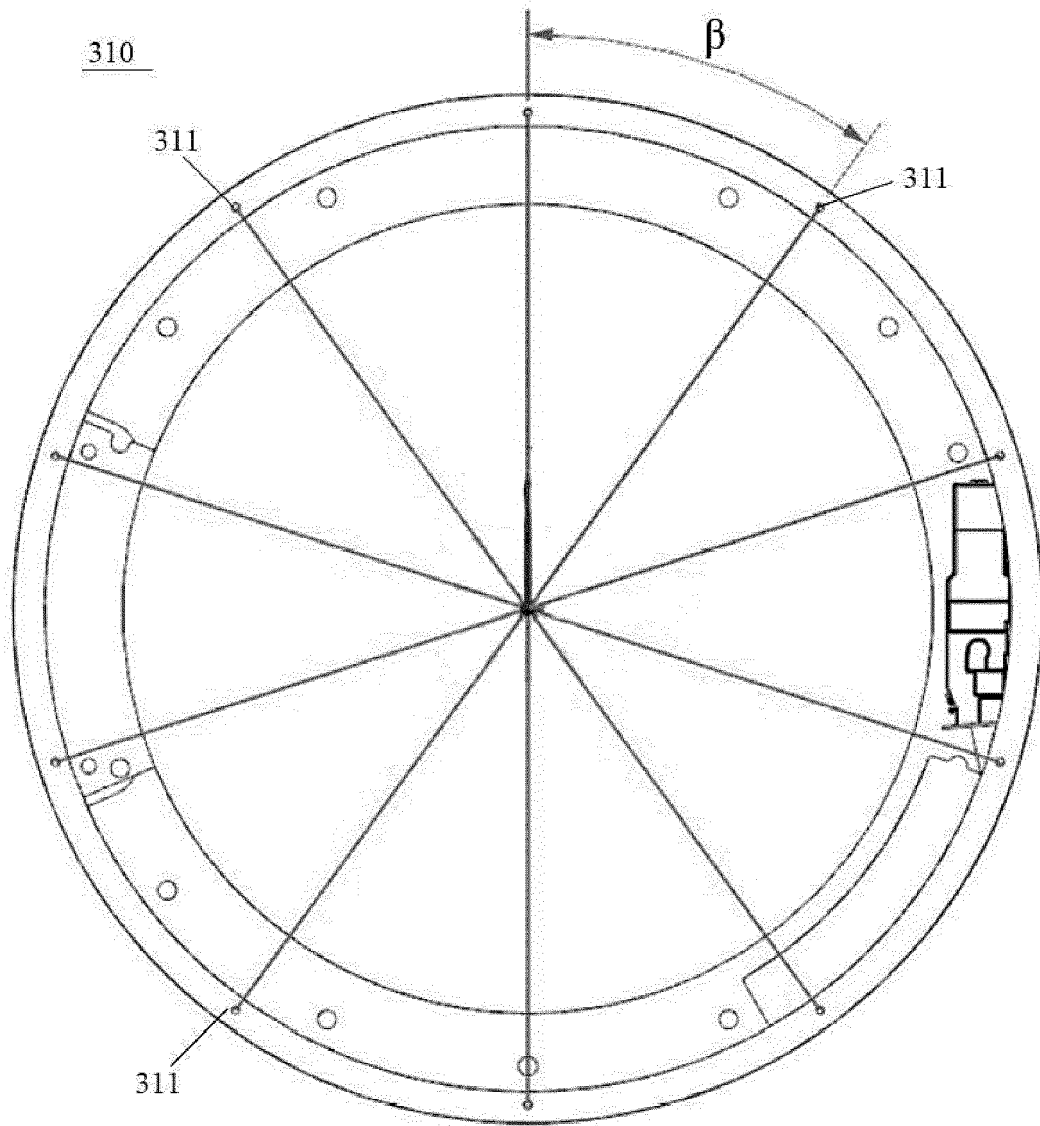


Fig. 10

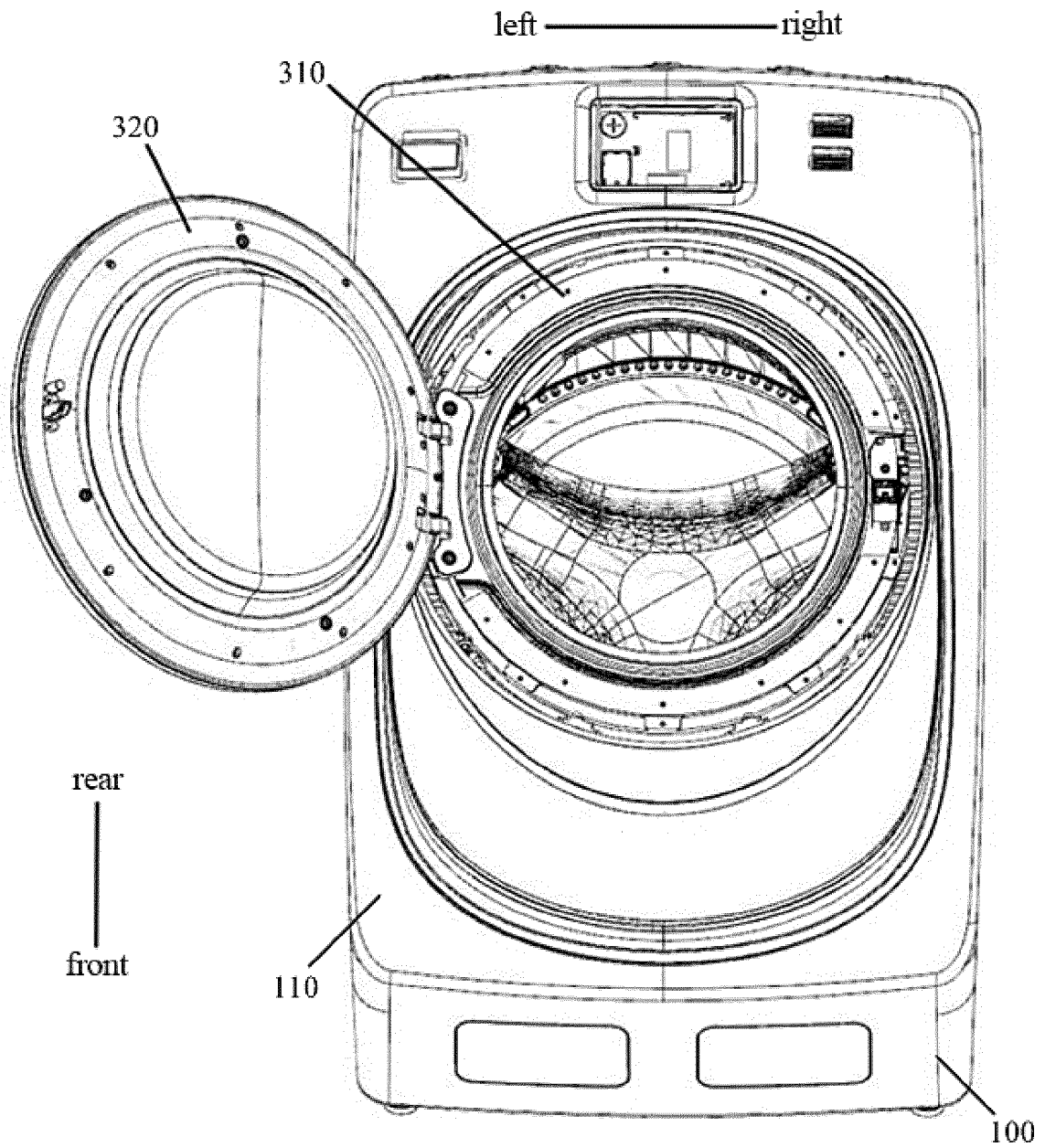


Fig. 11

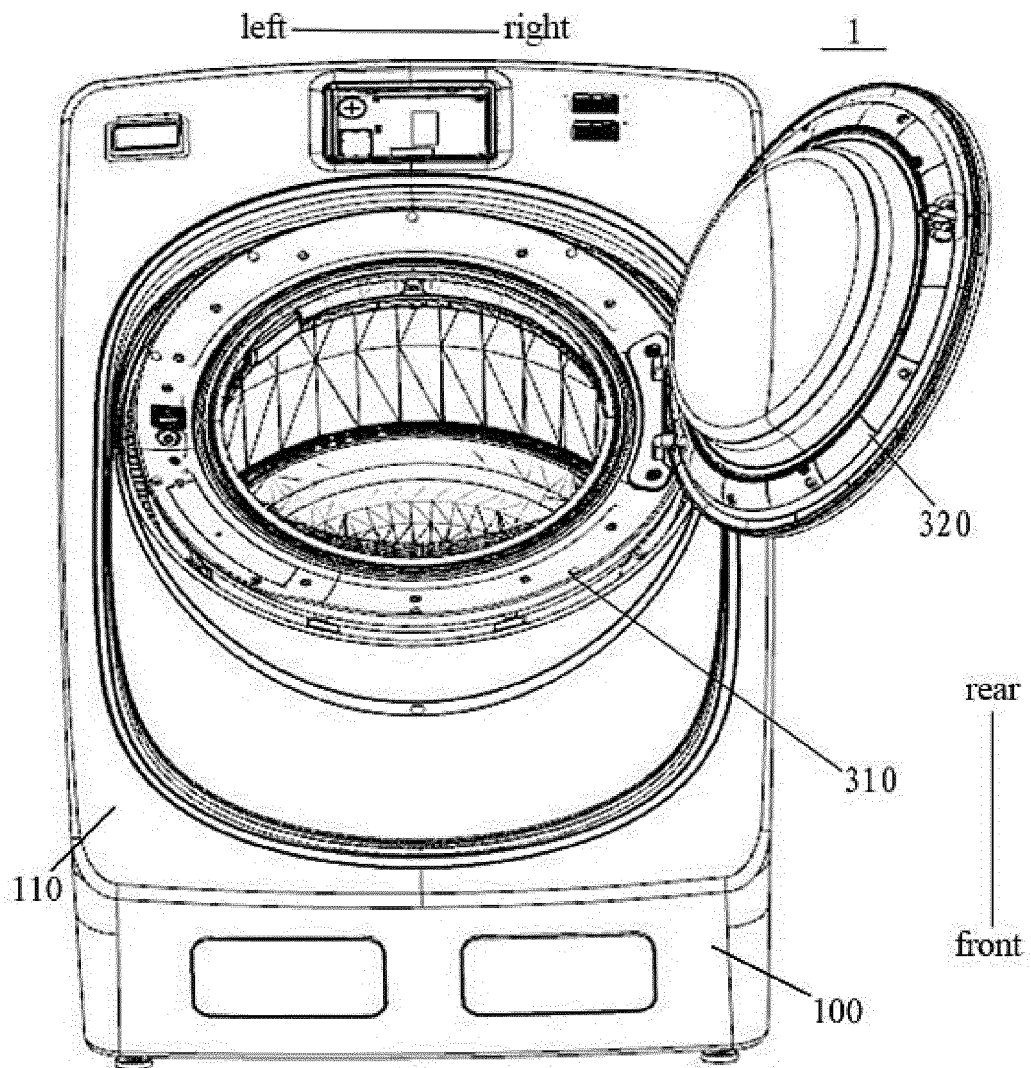


Fig. 12



## EUROPEAN SEARCH REPORT

Application Number  
EP 16 20 1034

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| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WO 2010/128734 A2 (LG ELECTRONICS INC [KR]; HONG SANG WOOK [KR]; CHANG JAE WON [KR]; PARK) 11 November 2010 (2010-11-11)                        | 1-12                                                   | INV.<br>D06F95/00                          |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * paragraph [0058] - paragraph [0075];<br>figures 1, 2 *                                                                                        | 8-12                                                   | ADD.<br>D06F37/22<br>D06F37/28             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * paragraph [0086]; figures 2, 3 *                                                                                                              |                                                        |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * paragraph [0118] - paragraph [0129];<br>figure 4 *                                                                                            |                                                        |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * paragraph [0133] - paragraph [0136];<br>figure 5 *                                                                                            |                                                        |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * paragraph [0143] - paragraph [0145];<br>figure 7 *                                                                                            |                                                        |                                            |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -----<br>US 2016/017530 A1 (CHOI HAN KYU [KR] ET AL) 21 January 2016 (2016-01-21)<br>* paragraph [0048] - paragraph [0049];<br>figure 1 *       | 8-12                                                   |                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | * paragraph [0055] - paragraph [0068];<br>figures 2-4 *                                                                                         |                                                        |                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -----<br>EP 2 327 824 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 1 June 2011 (2011-06-01)<br>* paragraph [0029] - paragraph [0038];<br>figures 1, 2 * | 7-12                                                   | TECHNICAL FIELDS<br>SEARCHED (IPC)<br>D06F |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -----                                                                                                                                           |                                                        |                                            |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                 |                                                        |                                            |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                 | Date of completion of the search<br><b>18 May 2017</b> | Examiner<br><b>Sabatucci, Arianna</b>      |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                 |                                                        |                                            |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 16 20 1034

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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18-05-2017

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