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(54) **FRONT-LOADING WASHING MACHINE**

(57) The present disclosure discloses a front-loading washing machine (100) including a cabinet (10) having a front panel (11), in which the front panel is provided with an opening (111); a tub having an access port (21) for loading and unloading clothes, in which the tub (20) 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 (30) disposed

in the tub; a door unit (40) mounted to the tub and configured to cover the access port; and a driving mechanism (50) configured to drive the tub to rotate, in which the driving mechanism is provided in the cabinet and coupled with the tub.. The front-loading washing machine according to embodiments of the present disclosure has advantages of being convenient to use, low abrasion of clothes and water saving.

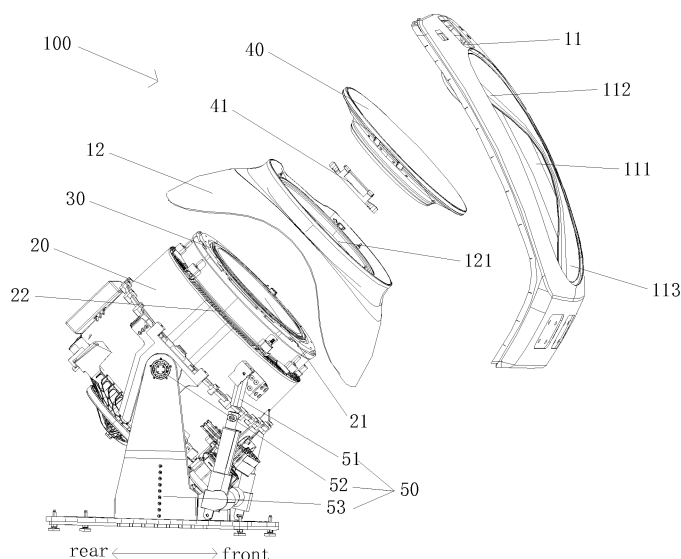


Fig. 1

Description

FIELD

[0001] The present disclosure relates to a technical field of household appliances, 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 type washing machine. When a pulsator type washing machine is used for washing clothes, the clothes need to be fully soaked in water, so the pulsator type washing machine is poor in water conservation. A user has to stoop and crouch for loading the clothes or unloading them when using the front-loading washing machine, so the front-loading washing machine is very inconvenient to use, particularly difficult for elderly people and other special populations to operate.

SUMMARY

[0003] The present disclosure seeks to solve at least one of the problems existing in the related art to at least some extent.

[0004] Therefore, the present disclosure provides a front-loading washing machine which is convenient to use.

[0005] The front-loading washing machine according to embodiments of the present disclosure includes a cabinet having a front panel, in which the front panel is provided with an opening; a tub having an access port for loading and unloading clothes, in which 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 configured to drive the tub to rotate, in which the driving mechanism is provided in the cabinet and coupled with the tub.

[0006] With the front-loading washing machine according to the embodiments of the present disclosure, the driving mechanism can drive the tub to move up and down in the opening to change a position of the access port, such that a user can load clothes or unload them conveniently, and the washing machine has advantages of being convenient to use, low clothes abrasion and water saving.

[0007] In addition, the front-loading washing machine according to the embodiments of the present disclosure may further have following additional technical features.

[0008] 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.

[0009] 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.

[0010] According to an embodiment of the present disclosure, the driving mechanism is configured to drive the access port to move upwards to close to an upper edge of the front panel and move downwards to close to a lower edge of the front panel.

[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 a hole, in which 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 spherical hood located in the cabinet and close to the front panel, the door unit is mounted to the spherical hood, and the front panel has an internal surface configured to be spherical to match an external surface of the spherical hood.

[0013] According to an embodiment of the present disclosure, the external surface of the spherical hood is spaced apart from the internal surface of the front panel.

[0014] According to an embodiment of the present disclosure, the external surface of the spherical hood and the internal surface of the front panel keep a constant distance from each other when the access port moves up and down in the opening.

[0015] According to an embodiment of the present disclosure, the driving mechanism includes a transverse shaft coupled with the tub, and a center of sphere of the spherical hood and a middle point of a central axis of the transverse shaft coincide.

[0016] Additional aspects and advantages of embodiments of present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] 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 partially exploded view of a front-loading washing machine according to embodiments of the present disclosure;

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

Fig. 3 is a front view of a front-loading washing machine

chine according to embodiments of the present disclosure;

Fig. 4 is a partially perspective view of a front-loading washing machine according to embodiments of the present disclosure at another angle, in which a spherical hood and a door unit are not connected with a tub;

Fig. 5 is a schematic view of a front-loading washing machine according to embodiments of the present disclosure in a non-washing state;

Fig. 6 is a schematic view of a front-loading washing machine according to embodiments of the present disclosure in a washing state.

[0018] Reference numerals:

front-loading washing machine 100;
cabinet 10; front panel 11; opening 111; upper edge 112; lower edge 113; spherical hood 12; through hole 121;
tub 20; access port 21; step structure 122;
drum 30;
door unit 40; door hinge 41;
driving mechanism 50; longitudinal pushrod 51;
transverse shaft 52; support frame 53; hole 531;

DETAILED DESCRIPTION

[0019] Reference will be made in detail to embodiments of the present disclosure. Examples of the embodiments are shown in the drawings. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions. 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.

[0020] In the following, a front-loading washing machine 100 according to embodiments of the present disclosure will be described with reference to the drawings.

[0021] As shown in Fig. 1 to Fig. 6, the front-loading washing machine 100 according to the embodiments of the present disclosure may include a cabinet 10, a tub 20, a rotatable drum 30, a door unit 40 and a driving mechanism 50.

[0022] The cabinet 10 has a front panel 11, and the front panel 11 has an opening 111 formed therein. The tub 20 has the access port 21, and is disposed in the cabinet 10 and configured to make the access port 21 move up and down (an up-and-down direction as shown in Fig. 2 to Fig. 4) in the opening 111. The drum 30 is disposed in the tub 20. The door unit 40 is mounted to the tub 20 and covers the access port 21. The driving mechanism 50 is used for driving the tub 20 to move, and the driving mechanism 50 is configured in the cabinet 10 and coupled with the tub 20.

[0023] In the front-loading washing machine 100 ac-

cording to the embodiments of the present disclosure, the tub 20 is configured to make the access port 21 move up and down in the opening 111. Hence, compared with a front-loading washing machine having an access port fixedly disposed in a front surface in the related art, the front-loading washing machine 100 according to the embodiments of the present disclosure can make the access port 21 move upwards to a suitable position for a user to load clothes or unload them. The user does not need to stoop or crouch when loading clothes or unloading them, and particularly, the front-loading washing machine 100 according to the embodiments of the present disclosure has a great practicality for people who cannot stoop and crouch easily.

[0024] As the access port 21 may move up and down in the opening 111, the access port 21 can be moved to a position suitable for washing clothes after the clothes are loaded. For example, the access port 21 can be moved downwards. When the clothes are washed, the drum 30 can roll to drive the clothes to be beaten up and down so as to be washed, which not only reduces abrasion on the clothes, but also no longer needs to fully soak the clothes in water - instead, only needs a small amount of water for washing, thus reducing water consumption and facilitating environment protection.

[0025] In addition, the driving mechanism 50 is provided to drive the tub 20. The user can operate the driving mechanism 50 to adjust the position of the tub 20 and thus change the position of the access port 21, when the user needs to adjust the position of the access port 21. The user can easily and effortlessly adjust the position of the tub 20, to facilitate adjusting the position of the access port, so as to further improve convenience of the front-loading washing machine.

[0026] That is, in the front-loading washing machine 100, the tub 20 is configured to make the access port 21 move up and down in the opening 111, and the driving mechanism 50 is provided to drive the tub 20 to move up and down. In such a way, the front-loading washing machine 100 can not only achieve a washing effect as a common front-loading washing machine when washing clothes, but also adjust the access port 21 to a suitable position for loading clothes or unloading them, which overcomes the problem that clothes cannot be conveniently loaded or unloaded from a front-loading washing machine in the related art.

[0027] Accordingly, the front-loading washing machine 100 according to the embodiments of the present disclosure makes it convenient to load clothes or unload them by the driving mechanism 50 that drives the tub 20 to move up and down in the opening 111 so as to change the position of the access port 21, and has the advantages of being convenient to use, low abrasion of clothes, water saving and the like.

[0028] In the following, the front-loading washing machine 100 according to specific embodiments of the present disclosure will be described with reference to the drawings.

[0029] In some specific embodiments of the present disclosure, as shown in Fig. 1 to Fig. 6, the front-loading washing machine 100 according to the embodiments of the present disclosure includes the cabinet 10, the tub 20, the rotatable drum 30, the door unit 40 and the driving mechanism 50.

[0030] The driving mechanism 50 drives the access port 21 to move up and down between a non-washing position and a washing position in the opening 111. Thus, the driving mechanism 50 can be used for driving the tub 20 to make the access port 21 move to the washing position so as to wash clothes, when the clothes need washing; and the driving mechanism 50 can be used for driving the tub 20 to make the access port 21 move to the non-washing position convenient for the user to add clothes or take clothes out, when the clothes do not need washing.

[0031] Specifically, as shown in Fig. 1 to Fig. 3, when the access port 21 is located at the non-washing position (as shown in Fig. 2 and Fig. 5), the access port 21 is driven to move close to an upper edge 112 of the front panel 11. When the access port 21 is located at the washing position (as shown in Fig. 3 and Fig. 6), the access port 21 is driven to move close to a lower edge 113 of the front panel 11. Hence, when the user needs to load or unload the clothes, the access port 21 can be moved close to the upper edge 112 of the front panel 11 to make it convenient for the user to load the clothes or unload them from above; and when the user needs to wash the clothes, the access port 21 can be moved close to the lower edge 113 of the front panel 11 to wash the clothes through rolling of the drum 30.

[0032] Specifically, as shown in Fig. 2, the front panel 11 can incline backwards from the bottom up, so as to further make it convenient for the user to load the clothes or unload them when the access port 21 moves to the non-washing position.

[0033] Advantageously, as shown in Fig. 1 and Fig. 2, the driving mechanism 50 is configured to drive the access port 21 to move upwards to approach the upper edge 112 of the front panel 11 and move downwards to approach the lower edge 123 of the front panel 11. When the user needs to load the clothes or unload them, the user can operate the driving mechanism 50 to make the access port 21 move upwards to approach the upper edge 112 of the front panel 11, so as to adjust the position of the access port 21 conveniently; and when the user needs to wash the clothes, the user can operate the driving mechanism 50 to make the access port 21 move downwards to approach the lower edge 113 of the front panel 11, so as to wash the clothes through rolling of the drum 30.

[0034] Optionally, the access port 21 has a motion scope in the opening 111 configured in such a way that an included angle between a central axis of the access port and a horizontal plane is 0 degree to 90 degrees. In other words, the access port 21 can move between a first position where the central axis thereof lies horizontally

and a second position where the central axis thereof stands vertically. Specifically, when the access port 21 is located at the non-washing position suitable for loading the clothes or unloading them, the central axis of the access port can be oriented along a vertical direction; and when the access port 21 is located at the washing position suitable for washing the clothes, the central axis of the access port 21 can be oriented along a horizontal direction. Thus, it is convenient for the user to load or unload the clothes from above and to wash the clothes through rolling of the drum 30.

[0035] Those skilled in the related art should understand that a motion standard of the access port 21 can be adjusted according to actual needs. For example, when the access port 21 is located at the non-washing position (as shown in Fig. 2 and Fig. 5), the central axis of the access port 21 can incline forwards from the bottom up, which can also make it convenient for the user to load or unload the clothes. When the access port 21 is located at the washing position (as shown in Fig. 4 and Fig. 6), the central axis of the access port 21 can also have a predetermined included angle relative to the horizontal direction on the premise that the clothes in the drum 30 can be washed in a rolling way.

[0036] Figs. 1-6 show the front-loading washing machine 100 according to a specific embodiment of the present disclosure. As shown in Fig. 1 to Fig. 5, the driving mechanism 50 may include a longitudinal pushrod 51 disposed at a front side of the tub 20, a transverse shaft 52 disposed at a rear side of the tub 20 and coupled with the tub 20, and a support frame 53 disposed to the cabinet 10 and having a hole 531, in which the transverse shaft 52 rotates in the hole 531 of the support frame 53. The tub 20 can be rotatably disposed to the support frame 53 by the transverse shaft 52, to make the access port 21 move up and down in the opening 111, and the tub 20 can be driven to move by the longitudinal pushrod 51, to adjust the position of the access port 21.

[0037] In some embodiments of the present disclosure, the tub 20 is provided with a spherical hood 12 located in the cabinet 10 and close to the front panel 11, the door unit 40 is mounted to the spherical hood 12, and the front panel 11 has an internal surface configured to be spherical to match an external surface of the spherical hood 12. As shown in Fig. 1, the spherical hood 12 protrudes from the rear to the front to form a spherical concave structure, and a through hole 121 is formed in a middle portion of the spherical concave structure and communicates with the opening 111 and the access port 21. A step structure 122 is formed at a front end face of the tub 20 and fitted with an internal side face of the spherical hood 12. That is, the spherical hood 12 has a front end connected with a front end of the tub 20, and an umbrella-type rear end covering an outer circumferential surface of the tub 20. The door unit 40 is fixed to the spherical hood 12 by a door hinge 41 and rotates along with a central shaft of the door hinge 41. The driving mechanism 50 drives the tub 20 to move up and down,

so as to enable the access port 21 to move up and down in the opening 111, to drive the spherical hood 12 and the door unit 40 to move up and down synchronously in the opening 111.

[0038] In other words, when the access port 21 is in the non-washing position, the access port 21 moves to the upper edge 112 of the front panel 11, and the spherical hood 12 and the door unit 40 synchronously move to the upper edge 112 of the front panel 11, such that the user can open the door unit 40 to take clothes out. When the access port 21 is in the washing position, the access port 21 moves to the lower edge 112 of the front panel 11, and the spherical hood 12 and the door unit 40 synchronously move to the lower edge 113 of the front panel 11, such that the door unit 40 closes the access port 21 and the washing machine enters the washing state.

[0039] Further, the external surface of the spherical hood 12 is spaced apart from an internal surface of the front panel 11. Therefore, the spherical hood 12 will not scrape the internal surface of the front panel 11 during its up-and-down movement in the opening 111, to guarantee smooth movements of the tub 20, the spherical hood 12 and the door unit 40 in the opening 111.

[0040] In some embodiments of the present disclosure, the external surface of the spherical hood 12 and the internal surface of the front panel 11 keep a constant distance from each other when the access port 21 moves up and down in the opening 111. For example, the driving mechanism 50 includes a transverse shaft 52 coupled with the tub 20, and a center of sphere of the spherical hood 12 and a middle point of a central axis of the transverse shaft 52 coincide, such that the spherical hood 12 will not scrape the internal surface of the front panel 11 during its up-and-down movement in the opening 111, and hence the tub 20, the spherical hood 12 and the door unit 40 can smoothly move in the opening 111.

[0041] Other configurations and operation of the front-loading washing machine 100 according to embodiments of the present disclosure are known for those skilled in the art, which will not be described in detail herein.

[0042] In the specification, it is to be understood that terms such as "upper," "lower," "bottom," "inner," "outer," "longitudinal," "transverse," "front," and "rear," 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.

[0043] 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 include one or more of this feature. In the description of the present disclosure, "a plurality of" means at least two, e.g. two or three and etc., unless specified otherwise.

[0044] 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 or interaction of two elements, which can be understood by those skilled in the art according to specific situations.

[0045] 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.

[0046] Reference throughout this specification to "an embodiment," "some embodiments," "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 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. Furthermore, different embodiments or examples in this specification can be jointed and combined by those skilled in the art.

[0047] 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 (100), comprising:
a cabinet (10) having a front panel (11), wherein the front panel (11) is provided with an opening (111);

- a tub (20) having an access port (21) for loading and unloading clothes, wherein the tub (20) is disposed in the cabinet (10) and configured in such a manner that the access port (21) is capable of being moved up and down in the opening (111);
 a rotatable drum (30) disposed in the tub (20);
 a door unit (40) mounted to the tub (20) and configured to cover the access port (21); and
 a driving mechanism (50) configured to drive the tub (20) to rotate, wherein the driving mechanism (50) is provided in the cabinet (10) and coupled with the tub (20).
2. The front-loading washing machine (100) according to claim 1, wherein the driving mechanism (50) is configured to drive the access port (21) to move up and down between a washing position and a non-washing position in the opening (111).
 3. The front-loading washing machine (100) according to claim 2, wherein when the access port (21) is located at the non-washing position, the access port (21) is driven to move close to an upper edge of the front panel (11), and when the access port (21) is located at the washing position, the access port (21) is driven to move close to a lower edge of the front panel (11).
 4. The front-loading washing machine (100) according to claim 1, wherein the driving mechanism (50) is configured to drive the access port (21) to move upwards to close to an upper edge of the front panel (11) and move downwards to close to a lower edge of the front panel (11).
 5. The front-loading washing machine (100) according to claim 1, wherein a motion range of the access port (21) in the opening (111) is configured in such a manner that an included angle between a central axis of the access port (21) and a horizontal plane ranges from 0° to 90°.
 6. The front-loading washing machine (100) according to claim 1 or 2, wherein the driving mechanism (50) comprises:
 - a longitudinal pushrod (51) disposed at a front side of the tub (20);
 - a transverse shaft (52) disposed at a rear side of the tub (20) and coupled to the tub (20); and
 - a support frame (53) disposed in the cabinet (10) and having an hole (531),
 wherein the transverse shaft (52) is configured to rotate in the hole (531) of the support frame (53).
 7. The front-loading washing machine (100) according
- to claim 1, wherein the tub (20) is provided with a spherical hood (12) located in the cabinet (10) and close to the front panel (11), the door unit (40) is mounted to the spherical hood (12), and the front panel (11) has an internal surface configured to be spherical to match an external surface of the spherical hood (12).
8. The front-loading washing machine (100) according to claim 7, wherein the external surface of the spherical hood (12) is spaced apart from the internal surface of the front panel (11).
 9. The front-loading washing machine (100) according to claim 8, wherein the external surface of the spherical hood (12) and the internal surface of the front panel (11) keep a constant distance from each other when the access port (21) moves up and down in the opening (111).
 10. The front-loading washing machine (100) according to claim 7, wherein the driving mechanism (50) comprises a transverse shaft (52) coupled with the tub (20), and a center of sphere of the spherical hood (12) and a middle point of a central axis of the transverse shaft (52) coincide.

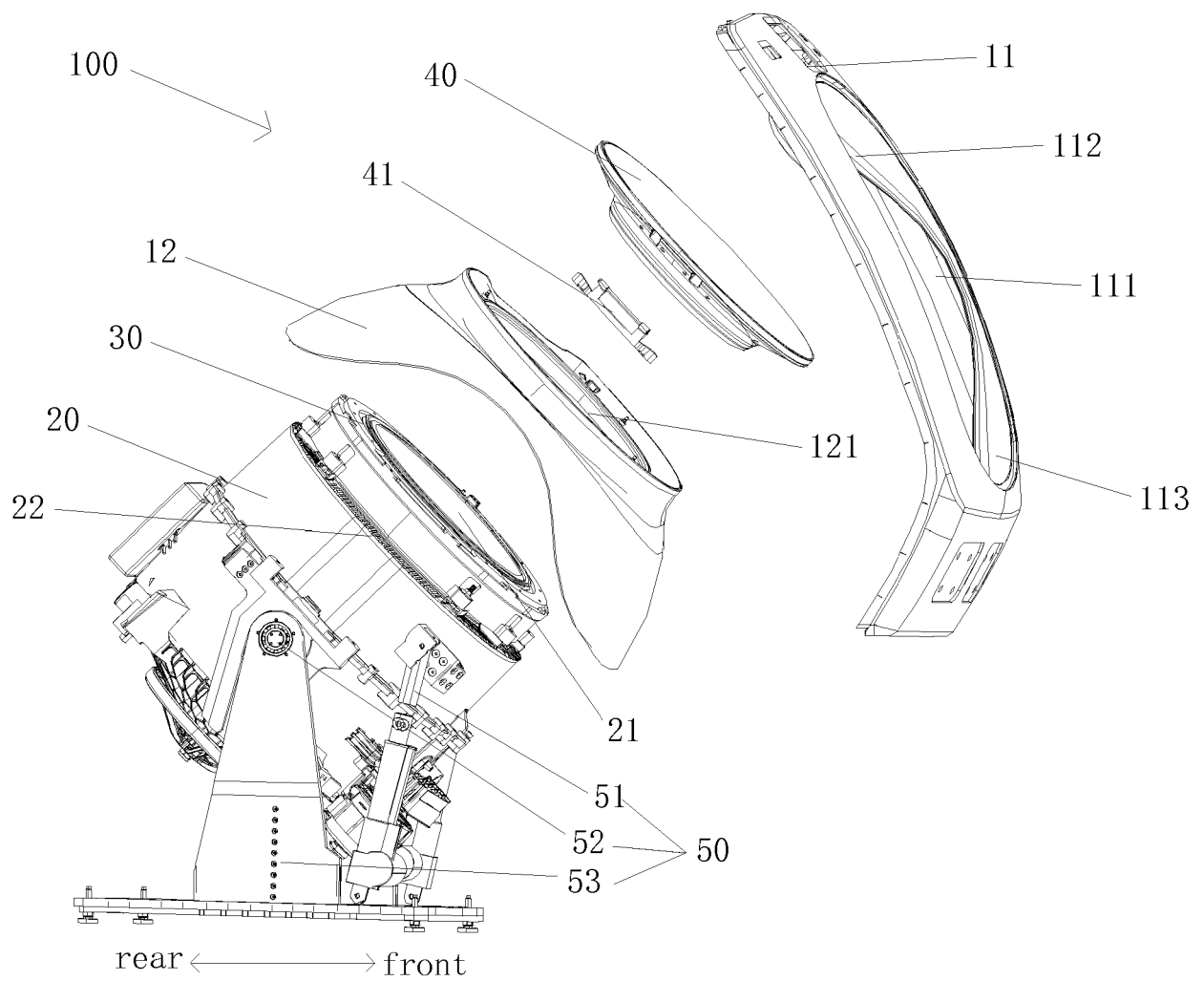


Fig. 1

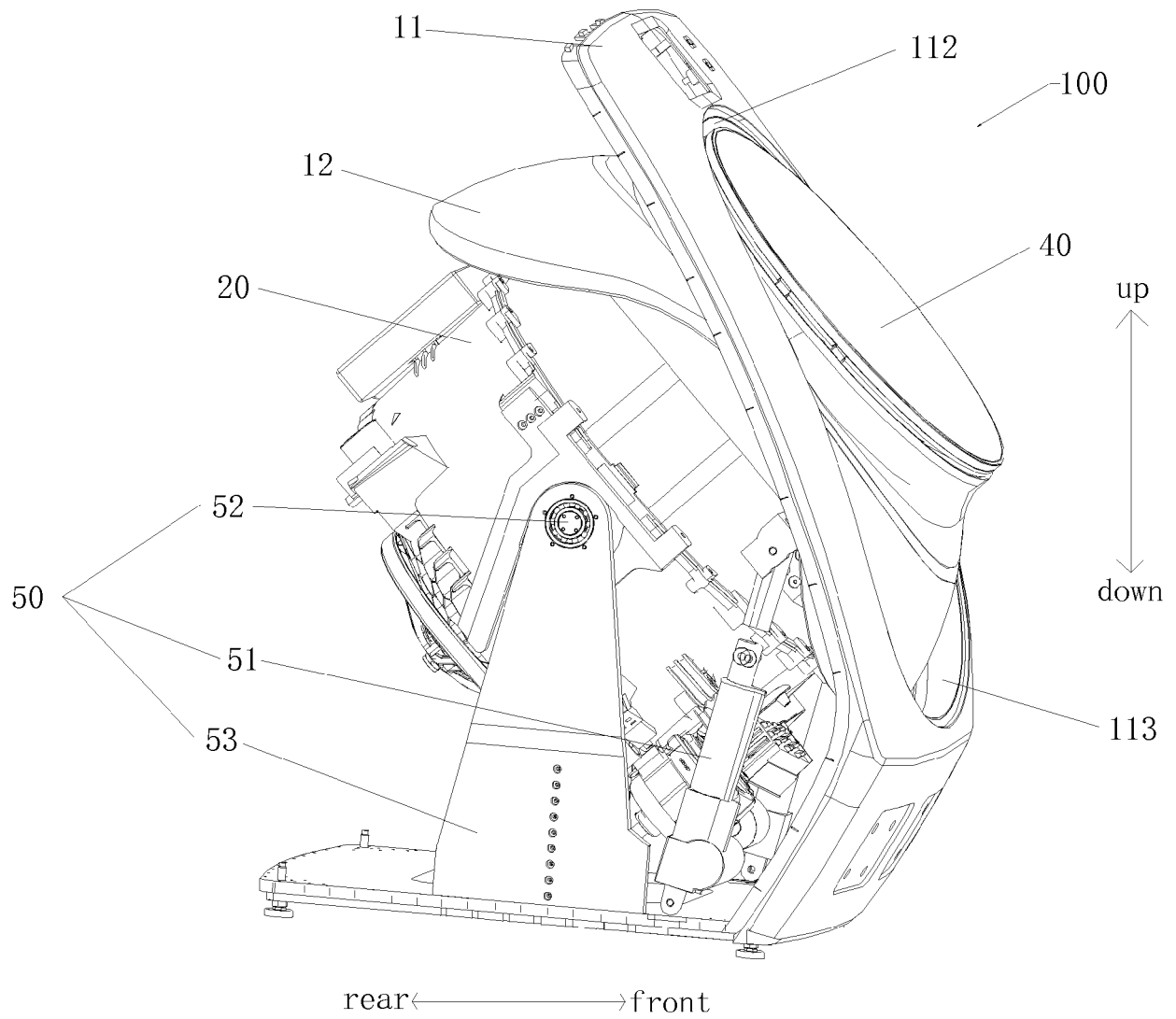


Fig. 2

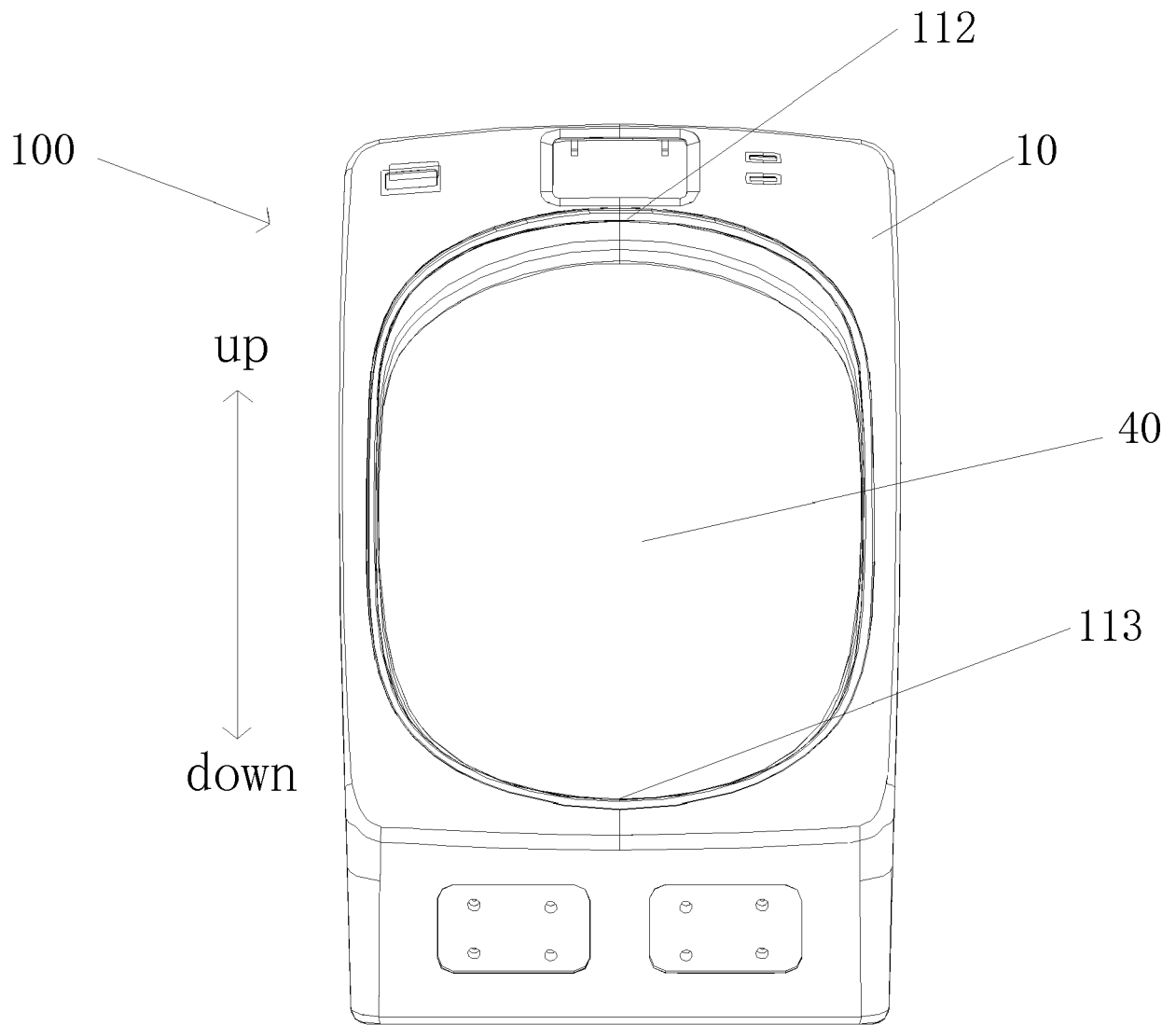


Fig. 3

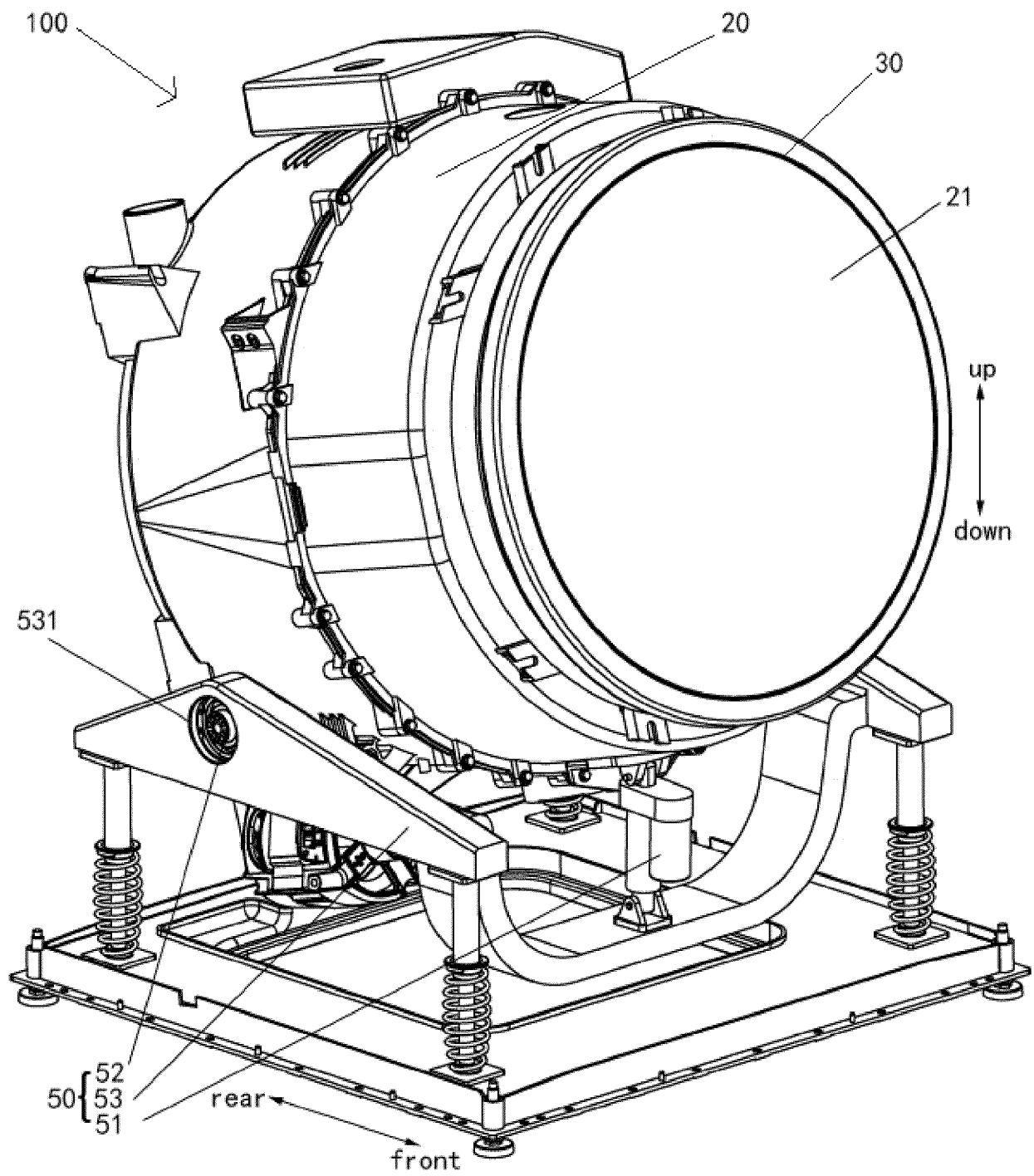


Fig. 4

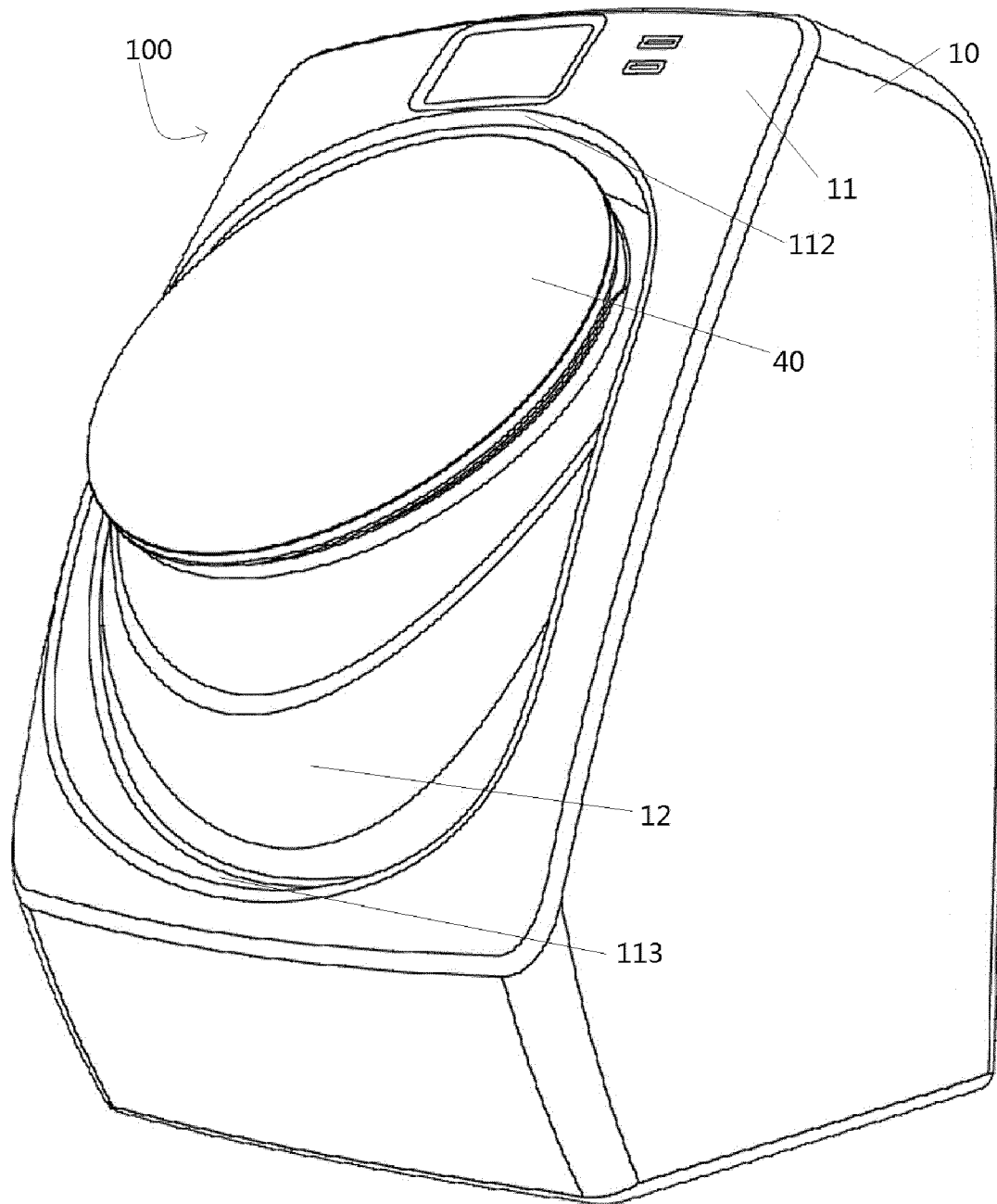


Fig. 5

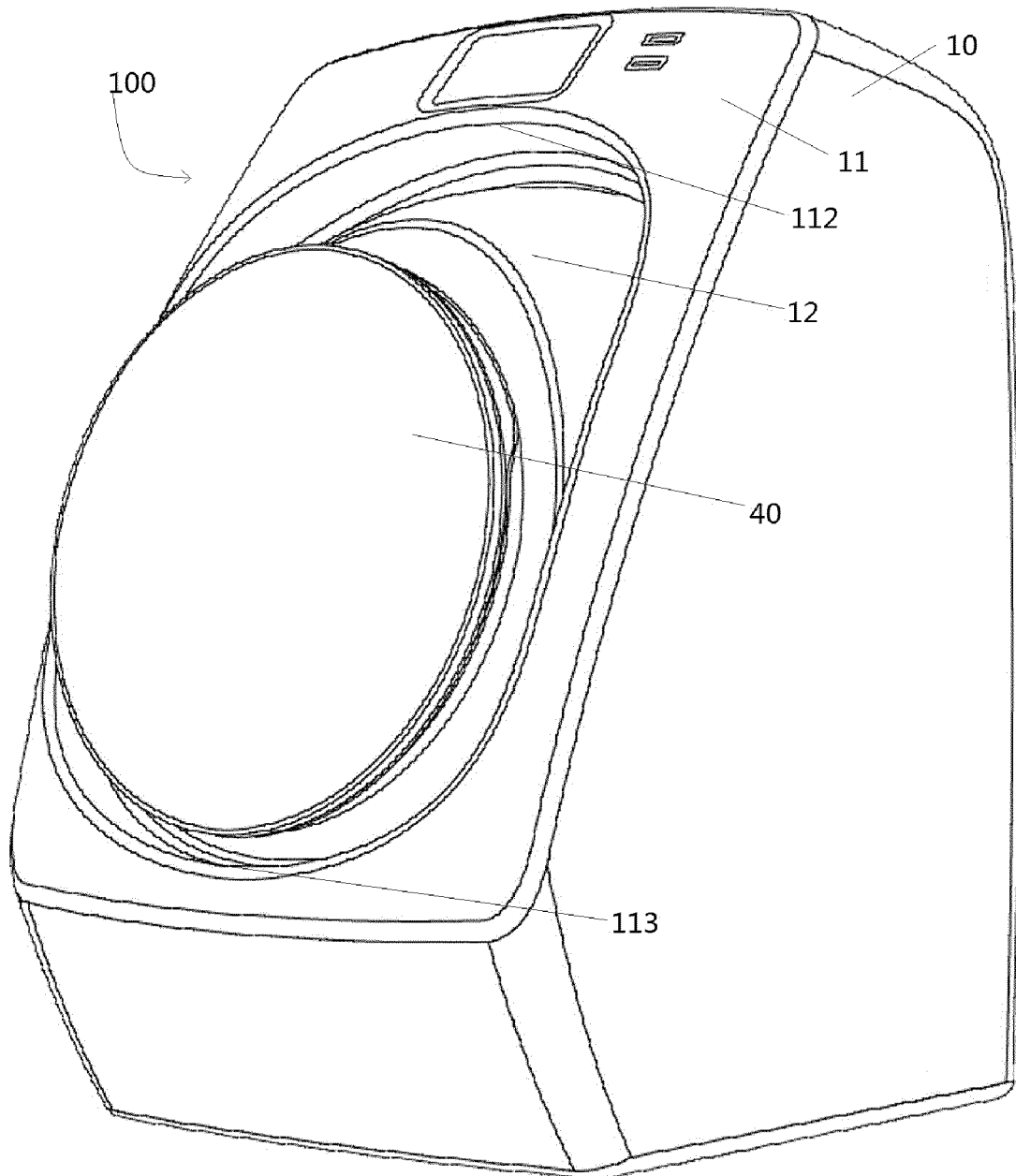


Fig. 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 20 1787

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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