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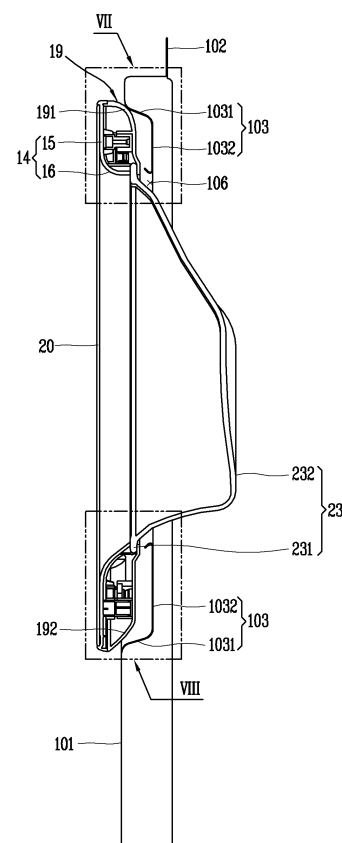
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(54) **LAUNDRY TREATING APPARATUS COMPRISING A DOOR**

(57) The present disclosure relates to a laundry treating apparatus including: a main body (10) provided with a front panel (101) having a laundry inlet port (106), and a recess part (103) into the front panel to surround the laundry inlet port; and a door (12) to open and close the laundry inlet port, wherein the door includes: an outer frame (14) having an outer circumferential portion and disposed to protrude outward of the recess part; a door window (23) disposed to correspond to the laundry inlet port; an inner frame (19) disposed toward the recess part (103); and a contact portion (191) provided between outer side and inner side of the inner frame (19) to be in contact with a recessed portion (1031) of the recess part (103) when the door (12) is closed, whereby the door can be prevented from being lifted.

FIG. 4



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Description

BACKGROUND

Technical Field

[0001] The present disclosure relates to a laundry treating apparatus capable of preventing a door from being lifted.

Description of the Related Art

[0002] In general, a laundry treating apparatus may include an apparatus having a function of washing or drying laundry. In addition, the laundry treating apparatus may be configured to have both a washing function and a drying function of the laundry.

[0003] Laundry treating apparatuses may be classified, according to a laundry loading method, into a front-load type (also called drum type) in which the laundry is loaded through a front surface of a main body, and a top-load type (also called "top-load washer") in which the laundry is loaded through a top surface of a main body.

[0004] A laundry treating apparatus may include a main body having a laundry inlet port formed through a front surface, a tub provided inside the main body to store wash water therein, a drum rotatably provided in the tub, and a door installed on the main body to open and close the laundry inlet port.

[0005] The door may be provided with a door frame, and a door window provided on the door frame to view inside of the drum.

[0006] A front portion of the door frame may protrude outward from a recess part, and a rear portion of the door frame may be accommodated in the recess part.

[0007] The door window may protrude from a rear surface of the door frame into the drum through the laundry inlet port.

[0008] However, the related art drum type laundry treating apparatus has the following problems.

[0009] When a large amount of clothes is put into the drum, the clothes soaked with water repetitively hit a lower portion of the door window, which protrudes into the drum, as the clothes spin together with the drum. For this reason, a lower side of the door is pushed forward and an upper side of the door is in contact with the recess part of the main body to periodically apply an impact to the main body, thereby causing vibration and noise in the main body.

[0010] Meanwhile, a drum type washing machine is disclosed in Korean Laid-Open Patent Publication No. KR 10-2011-0028899A (published on March 22, 2011; hereinafter, referred to as Patent Document 1). A support unit is installed on a rear surface of a door. When the door opens and closes a laundry inlet port, the support unit maintains a spaced distance between the door and a main body.

[0011] More specifically, the support unit is brought into

contact with a flat surface of a recess part recessed into a front surface of the main body, such that the spaced distance between the door and the main body is maintained. Accordingly, a ventilation gap is formed between the door and the main body. The support unit serves to ventilate an inner space of the main body and outside through the ventilation gap (see FIG. 4A of Patent Document 1).

[0012] The support unit contacts the flat surface of the recess part of the main body when the door is opened and closed, thereby alleviating an impact transferred to the main body through the door.

[0013] However, Patent Document 1 has the following problems.

[0014] First, since the support unit has a structure protruding separately from a rear surface of a door frame, appearance of the door is spoiled.

[0015] In particular, since the door frame protrudes outward from the recess part of the main body and is spaced apart from the recess part with the ventilation gap therebetween, the protruding structure of the door is exposed to outside through the ventilation gap even when the door is closed, thereby degrading appearance quality of the door.

[0016] In addition, the support unit protrudes so as to contact the flat surface inside the recess part. This causes an increase in size of the support unit and adversely affects appearance quality.

[0017] Second, if a separate buffer member or elastic member for mitigating an impact is provided between the door and the main body in order to solve the problem of vibration and noise caused between the door and the main body, an installation space for the buffer member is needed between the door and the main body, which further increases a gap between the door and the main body due to thickness of the buffer member.

[0018] In addition, when wear or failure of the buffer member occurs due to friction between the buffer member and the main body, the buffer member should be replaced, causing user's inconvenience.

[0019] Third, the support unit includes a support body and a magnet provided inside the support body, so that the support body is coupled to the main body by magnetic force. As a result, the user should pull the door harder to open the door because of attraction force of the magnet.

[0020] Korean Laid-Open Patent Publication No. 10-2010-0042984 A (published on April 27, 2010; hereafter, referred to as Patent Document 2) discloses a drum type washing machine.

[0021] According to contents disclosed in Patent Document 2, an elastic member is provided on a rear surface of a door (see FIG. 3 of Patent Document 2). The elastic member may alleviate an impact by elastically compressing the door in a closing process.

[0022] However, Patent Document 2 has the following problems.

[0023] First, the separate elastic member protrudes from a rear surface of a door frame, appearance of the

door is spoiled.

[0024] Second, when the elastic member has a protruding structure made of a rubber material, problems such as wear and the like are caused.

[0025] Third, when the elastic member is made by combination of a coil spring and a cap member, its structure becomes complicated and a fabricating cost increases.

SUMMARY

[0026] The present disclosure has been made to solve one or more of those problems of the related art. A first objective of the present disclosure is to provide a laundry treating apparatus capable of preventing periodic vibration and noise caused between a door and a main body due to collision between laundry, which spins together with a drum, and a door window, when the laundry is loaded in a large quantity inside the drum.

[0027] A second objective of the present disclosure is to provide a laundry treating apparatus having a door with beautiful appearance, because of no need to form a protruding structure on a rear surface of the door for mitigating an impact applied to the door.

[0028] A third objective of the present disclosure is to provide a laundry treating apparatus capable of alleviating an impact transferred to a main body from a door even without a separate buffer member, simplifying a structure, and reducing a cost.

[0029] A fourth objective of the present disclosure is to provide a laundry treating apparatus capable of minimizing an occurrence of wear caused due to friction between a door and a main body.

[0030] A fifth objective of the present disclosure is to provide a laundry treating apparatus capable of alleviating an impact applied to a main body due to a contact between a door and the main body even in a closed state of the door.

[0031] One or more of the above objectives and/or any other objective(s) are achieved by the subject-matter of the independent claim(s).

[0032] A contact portion which comes in contact with a main body may be provided at an upper portion on a rear surface of a door frame. With this configuration, even though an impact is transferred to a lower side of a door through a door window, an upper side of the door can be maintained in a contact state with the main body by virtue of the contact portion when the door is closed, which may result in preventing vibration and noise caused between the door and the main body.

[0033] The contact portion may be formed in a curved shape with a preset curvature at the upper portion on the rear surface of the door frame along a circumferential direction so as to come in contact with the main body. With this configuration, when viewed with the naked eye, the door frame does not have a structure in which one side portion protrudes compared to another side portion, thereby realizing the door with beautiful appearance.

[0034] The contact portion may be formed integrally at the upper portion on the rear surface of the door frame so as to come in contact with the upper portion of the main body, thereby alleviating an impact by the contact portion even without a separate buffer member, simplifying a structure, and reducing a material cost.

[0035] The contact portion may be formed in a shape curved with a preset curvature, and a recessed portion where the recess part in contact with the contact portion starts to be recessed may be formed in a shape curved in an opposite direction to the contact portion. Accordingly, the contact portion can be externally brought into point contact or line contact with the recess part of the main body, so as to minimize a contact area between the door and the main body, thereby minimizing an occurrence of wear due to friction between the door and the main body.

[0036] The contact portion may have a cross section in an arcuate shape, and a recessed portion where the recess part accommodating part of the door starts to be recessed may be formed in a round shape, which may result in mitigating an impact transferred to the door upon the contact between the contact portion and the recess part even while the door is closed.

[0037] A laundry treating apparatus disclosed herein may include a main body and a door. A front panel of the main body may define a front surface of the main body. The front panel may be provided with a laundry inlet port. The front panel may be provided with a recess part recessed therein. The recess part may surround the laundry inlet port.

[0038] The door may be rotatably mounted to the front panel to open and close the laundry inlet port.

[0039] The door may include an outer frame, a door window, an inner frame, and a contact portion.

[0040] The outer frame may be provided with a transparent front panel, e.g. a front glass, on a front surface thereof. The transparent front panel/plate may be formed of glass or any other substantially transparent material. The transparent front plate may comprise of a region that is transparent and that may be surrounded by a non-transparent region. The non-transparent region may be completely or substantially impervious to light. The non-transparent region may be formed of the same material as the transparent region but may be rendered non-transparent by a surface modification such as coating, e.g. black coating, or etching, etc. The non-transparent region may be like a border frame surrounding the transparent region. In the present disclosure, the front panel has been referred to as front glass, for sake of simplicity. However, it may be noted that the front panel, even when referred to as front glass, may be formed of a material other than glass, unless otherwise specified. An outer circumferential portion of the outer frame may protrude to outside of the recess part to surround an outer surface of the front glass.

[0041] The door window may be disposed to correspond to the laundry inlet port, and an outer edge portion

of the door window may be accommodated inside the recess part.

[0042] The inner frame may be disposed toward the recess part. An outer side of the inner frame may be connected to the outer circumferential portion of the outer frame. An inner side of the inner frame may be connected to the outer edge portion of the door window.

[0043] The contact portion may be provided between the outer side and the inner side of the inner frame. The contact portion may come in contact with the recessed portion of the recess part, when the door is closed.

[0044] According to this configuration, the contact portion can absorb an impact transferred from a large quantity of laundry to the door when the large quantity of laundry is loaded. This may result from that an upper side of the door with respect to a horizontal center line horizontally passing through a center of the door in a radial direction can be in contact with the main body so as to be supported by the main body, and a lower side of the door can absorb the impact by being pushed forward by the impact transferred from the laundry. If the contact portion is spaced apart from the main body without contacting it, the same problems as in the related art may occur.

[0045] The inner frame may be formed in a ring shape. The contact portion may be located at an upper portion of the inner frame based on a horizontal center line horizontally passing through a center of the inner frame in a radial direction.

[0046] Because a protruding portion is formed at a lower portion of the door window with respect to the horizontal center line, the contact portion may preferably be located at the upper portion of the inner frame, in view of structural characteristics of the door window.

[0047] The contact portion may be formed in a shape curved from the outer side of the inner frame to the inner side of the inner frame in a direction toward the recess part.

[0048] The contact portion may have a cross section in an arcuate shape.

[0049] The contact portion may extend in a circumferential direction.

[0050] With this configuration, the contact portion may extend along the circumferential direction, without protruding from the rear surface of the inner frame when a user visually looks at the rear surface of the inner frame, thereby obtaining better appearance.

[0051] The contact portion may have a greater curvature than a lower portion of the inner frame.

[0052] Accordingly, the contact portion can come in contact with a recessed portion where the recess part starts to be recessed, and the lower portion of the inner frame cannot come in contact with the recess part.

[0053] A top end of the outer side of the inner frame may be located higher than a contact point of the contact portion.

[0054] The outer side of the inner frame may have a diameter greater than that of the recess part, and the inner side of the inner frame may have a diameter smaller

than that of the recess part.

[0055] The outer side of the inner frame may be spaced forward apart from a contact point of the contact portion.

[0056] With this configuration, the door can be larger than the recess part in size.

[0057] A handle may be provided on an upper portion of the outer side of the inner frame.

[0058] The handle may be recessed into the inner frame toward the front glass.

[0059] The handle may be spaced apart from a top end of the contact portion in a circumferential direction of the inner frame.

[0060] The front glass may have front and rear surfaces in a shape of a circular plate.

[0061] The outer frame may include a mounting guide protruding from the outer circumferential portion to surround an outer surface of the front glass.

[0062] The outer frame may include an adhesive filling groove and a flat portion. The adhesive filling groove may be formed in the flat portion for adhering the front glass. The flat portion may be formed inside the mounting guide. The outer frame may include a curved portion. The curved portion may extend with a preset curvature from inside of the flat portion toward the outer edge portion of the door window. An opening may be formed inside the curved portion.

[0063] The outer frame may have a ring shape, and the outer circumferential portion of the outer frame may have a diameter larger than that of the recess part.

[0064] A portion where the recessed portion starts to be recessed may be curved to be externally brought into contact with the contact portion.

[0065] The contact portion may come in point contact or line contact with the recess part.

[0066] A laundry treating apparatus may include a main body provided with a front panel having a laundry inlet port, and a recess part recessed into the front panel to surround the laundry inlet port, and a door rotatably mounted to the front panel to open and close the laundry inlet port

[0067] The door may include an outer frame protruding outward from the recess part and having an outer circumferential portion with a larger diameter than the recess part, and an inner frame provided with a contact portion in contact with a recessed portion of the recess part, and having an outer side protruding to outside of the recess part to be coupled to the outer circumferential portion of the outer frame, and an inner side accommodated inside the recess part.

[0068] The contact portion may extend in a curved shape from the outer side to the inner side of the inner frame, so as to come in contact with a portion where the recess part starts to be recessed, when the door is closed.

[0069] The outer frame and the inner frame may be disposed to cover the recess part.

[0070] Effects of a laundry treating apparatus according to the present disclosure will be described as follows.

[0071] First, a contact portion is provided at an upper portion on a rear surface of a door frame, to come in contact with one side of an upper portion of a front panel provided on a main body when a door is closed, thereby preventing lifting of the door even if a door window collides with laundry, which rotates along an inner circumferential surface of a drum, when the laundry is loaded in a large amount.

[0072] Left and right sides of the door frame are fixed to a flat portion by a hinge unit and a locking unit. Here, the contact portion provided on the upper portion of the rear surface of the door frame comes in contact with a recessed portion where a recess part formed in a front panel starts to be recessed, so as to resist the lifting of the door. With this configuration, even if an impact is repeatedly applied from the rotating laundry to a lower portion of the door frame through the door window, the contact portion can be kept in contact with the main body, thereby remarkably reducing vibration and noise between the door and the main body.

[0073] Second, the contact portion extends to be curved in an arcuate shape along a circumferential direction of the door frame. According to this, the contact portion does not protrude from one side of the rear surface of the door frame but forms a curved surface smoothly connected to its adjacent portions without a bent portion, thereby allowing the door to have beautiful appearance.

[0074] In particular, a rear surface of the door is brought into contact with the portion where the recess part starts to be recessed, by virtue of the contact portion. According to this, the contact portion covers inside of the recess part. Therefore, the door window protruding from the rear surface of the door to the inner space of the main body can be covered, thereby improving appearance of the door.

[0075] In addition, the contact portion of the door comes in contact with the recessed portion where the recess part starts to be recessed without protruding from the rear surface of the door and also contacting a flat surface of the recess part, thereby preventing an increase in an unnecessary material cost due to an increase in size of the contact portion.

[0076] Third, the contact portion has a cross section in an arcuate shape and is curved toward the front panel or recess part, so as to come in point contact or line contact with an outer circumference of the recess part. According to this, a contact area of the contact portion can be minimized when the door is closed, thereby distributing an impact, which is applied to the main body when the contact portion of the door comes in contact with the recess part of the main body, along the circumferential direction of the recess part, which may result in minimizing an impact applied to the main body.

[0077] Fourth, even if the lower portion of the door frame is lifted inside the drum due to an impact applied to the door window, the hinge unit and the locking unit are coupled to the main body and the contact portion

comes in contact with an upper end of the recess part when the door is closed. Accordingly, at least three support points, like an equilateral triangle, a rectangle, and a polygon, can be formed by the contact between the door and the main body, thereby reducing vibration or shaking of the door and absorbing an impact applied to the door.

[0078] Fifth, since an arcuate curved surface of the contact portion and an arcuate curved surface of an outer circumference of the recess portion can come in point contact or line contact with each other between the door and the main body, thereby minimizing friction between the door and the main body.

[0079] Sixth, even if the door is lifted due to an impact transferred from laundry, the contact portion and the recess part are externally brought into contact with each other. Accordingly, a contact point between the contact portion and the recess part can move on the arcuate curved surface of the contact portion, thereby preventing separation between the contact portion of the door frame and the recess part of the main body so as to realize stable contact between them.

[0080] Seventh, by the stable contact between the contact portion of the door frame and the recess part of the main body, an impact transferred from inside of the drum through the door window can be mitigated. In addition, a separate buffer member between the door and the main body and an installation space of the buffer member are not needed. Accordingly, the door can be more accommodated in the recess part, thereby implementing compact arrangement of the door.

BRIEF DESCRIPTION OF THE DRAWINGS

[0081]

FIG. 1 is a perspective view illustrating a laundry treating apparatus according to the present disclosure.

FIG. 2 is a front view of a door in FIG. 1, viewed from the front.

FIG. 3 is an exploded view of the door in FIG. 2.

FIG. 4 is a cross-sectional view illustrating a state that a door is mounted to a front panel of a main body to close a laundry inlet port, taken along the line IV-IV in FIG. 1.

FIG. 5 is a rear view of the door in FIG. 2, viewed from the rear.

FIG. 6 is a front view illustrating a state that a recess part is recessed in a front panel to surround a laundry inlet port in FIG. 4.

FIG. 7 is an enlarged cross-sectional view illustrating a part "VII" in FIG. 4, in which a contact portion is in contact with a recess part of a main body.

FIG. 8 is an enlarged cross-sectional view illustrating a part "VIII" in FIG. 4, in which a non-contact portion is spaced apart from the recess part of the main body.

FIG. 9 is a conceptual view illustrating a state that a

contact portion protrudes from one side of a rear surface of a door frame in accordance with another embodiment.

FIG. 10 is a conceptual view illustrating a shape of the contact portion of FIG. 9, viewed from the rear of the door frame.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0082] Hereinafter, the embodiments disclosed herein will be described in detail with reference to the accompanying drawings, and the same or similar elements are designated with the same numeral references regardless of the numerals in the drawings and their redundant description will be omitted. In general, a suffix such as "module" and "unit" may be used to refer to elements or components. Use of such a suffix herein is merely intended to facilitate description of the specification, and the suffix itself is not intended to give any special meaning or function. In describing the present disclosure, if a detailed explanation for a related known technology or construction is considered to unnecessarily divert the gist of the present disclosure, such explanation has been omitted but would be understood by those skilled in the art. Also, it should be understood that the accompanying drawings are merely illustrated to easily explain the concept of the disclosure, and therefore, they should not be construed to limit the technological concept disclosed herein by the accompanying drawings, and the concept of the present disclosure should be construed as being extended to all modifications, equivalents, and substitutes included in the concept and technological scope of the disclosure.

[0083] Though the terms including an ordinal number such as first, second, etc. may be used herein to describe various elements, the elements should not be limited by those terms. The terms are used merely for the purpose to distinguish an element from another element.

[0084] It will be understood that when an element is referred to as being "connected with" another element, the element can be directly connected with the other element or intervening elements may also be present. On the contrary, in case where an element is "directly connected" or "directly linked" to another element, it should be understood that any other element is not existed therebetween. Generally, an external appearance of the laundry treating apparatus may be formed by four side-walls or panels - including a front side wall or front panel at which the door is installed, a back side wall or rear panel which is opposite to the front side wall or the front panel, and two side side-walls or side panels which extend between the front side wall and the back side wall i.e. between the front panel and the rear panel. In addition to the front panel, rear panel, and two side panels, the external appearance of the laundry treating apparatus may further be defined by a top panel and a bottom panel, which may also be referred to as top side or bottom side or simply as a top and a bottom, i.e. base, of the laundry treating apparatus. The bottom panel or bottom side or

bottom may be understood as a surface of the laundry treating apparatus which faces the surface on which the laundry treating apparatus may be installed, for normal use i.e. when the laundry treating apparatus is in intended upright position. The top panel or top side or top may be the surface opposite to the bottom panel or base of the laundry treating apparatus. Generally, the bottom and the top of the laundry treating apparatus may be disposed substantially parallel to each other. Generally, the front panel and the rear panel of the laundry treating apparatus may be disposed substantially parallel to each other. Generally, the two side panels of the laundry treating apparatus may be disposed substantially parallel to each other. Unless otherwise specified, any references to direction(s) or position(s) or orientation(s) or location(s) or like expressed by use of terms such as 'up', 'upward', 'upper', 'top', 'above', 'vertical', 'up-down', 'down', 'downward', 'lower', 'bottom', 'below', 'beneath', and like terms, may be understood with respect to the base and/or with respect to the top of the laundry treating apparatus, preferably with the door in a closed state. Unless otherwise specified, any reference to direction(s) or position(s) or orientation(s) or location(s) or like expressed by use of terms such as 'horizontal' or 'side' or like terms may be understood as a direction extending between the two side panels of the laundry treating apparatus, preferably with the door in a closed state. Unless otherwise specified, any reference to direction(s) or position(s) or orientation(s) or location(s) or like expressed by use of terms such as 'front', 'in-front', 'behind', 'before', 'outer', 'outward', 'outwardly', 'inner', 'inward', 'inwardly', 'back', 'rear' or like terms may be understood with respect to the front panel and/or with respect to the rear panel of the laundry treating apparatus, preferably with the door in a closed state. Unless otherwise specified, any reference to direction(s) or position(s) or orientation(s) or location(s) or like expressed by use of terms such as 'radial', 'radially', 'circumferential', 'circumferentially', 'axial', 'axially' or like terms may be understood with respect to an axis of a laundry accommodating portion, e.g. drum, of the laundry treating apparatus, preferably with the door in a closed state. When referring to a component or element or body having a substantially circular substantially planar shape or having a shape with a substantially circular cross-section - unless otherwise specified, any reference to direction(s) or position(s) or orientation(s) or location(s) or like, expressed by use of terms such as 'radial', 'radially', 'circumferential', 'circumferentially', 'axial', 'axially', 'inner', 'outer', or like terms may be understood with respect to a center of the shape or cross-section or axis disposed normal to such center. Any references to thickness of the outer frame, the inner frame, the transparent front panel (the front glass), etc. may be understood to be along an axial direction of the door; or simply put along axial direction of the laundry accommodating portion when the door is closed, unless otherwise specified.

[0085] A singular representation may include a plural

representation as far as it represents a definitely different meaning from the context.

[0086] Terms "include" or "has" used herein should be understood that they are intended to indicate the existence of a feature, a number, a step, a constituent element, a component or a combination thereof disclosed in the specification, and it may also be understood that the existence or additional possibility of one or more other features, numbers, steps, constituent elements, components or combinations thereof are not excluded in advance.

[0087] FIG. 1 is a perspective view illustrating a laundry treating apparatus in accordance with the present disclosure.

[0088] A laundry treating apparatus disclosed herein may include a main body 10, a laundry accommodating portion, and a door 12.

[0089] The main body 10 may define an outer shape of the laundry treating apparatus. The main body 10 may be defined in a rectangular parallelepiped shape.

[0090] The main body 10 may include a front panel 101 defining a front surface of the laundry treating apparatus, a rear panel defining a rear surface of the laundry treating apparatus, side panels defining both side surfaces of the laundry treating apparatus, a top panel defining a top surface of the laundry treating apparatus, and a bottom panel defining a bottom surface of the laundry treating apparatus. A laundry inlet port 106 (see FIG. 4) may be formed in the front panel 101.

[0091] The rear panel and the left and right side panels may be defined in a "C" shape by bending one rectangular plate, thereby improving structural rigidity of the main body 10.

[0092] The laundry inlet port 106 may be formed in a circular shape through the front panel 101 so as to put laundry into the laundry accommodating portion through the laundry inlet port 106.

[0093] The door 12 is rotatably coupled to the laundry inlet port 106 by a hinge 25 (see FIG. 3), so as to open and close the laundry inlet port 106.

[0094] The laundry accommodating portion is provided inside the main body 10. The laundry accommodating portion may include (accommodate) a drum to perform a drying function, or a tub and a drum to perform washing and drying functions together.

[0095] In the embodiment disclosed herein, in order to perform washing and drying functions together, a tub and a drum may be provided inside the main body 10. The tub may be defined in a cylindrical shape, and disposed such that a central axis of the tub is horizontal or inclined at a preset angle in a lengthwise direction of the tub. Wash water may be stored inside the tub.

[0096] A gasket may be provided at a front end portion of the tub to communicate with the laundry inlet port 106, thereby preventing the wash water stored inside the tub from being leaked into an accommodation space of the main body 10.

[0097] The drum may be provided in the tub to be ro-

tatable with respect to the tub. A plurality of through holes may be formed through a circumferential surface of the drum to allow a fluid such as wash water to enter and exit the drum through the plurality of through holes.

[0098] A front portion of the drum may be open to be connected in communication with the laundry inlet port 106, and laundry may be accommodated inside the drum through the laundry inlet port 106.

[0099] A driving motor is installed on a rear surface of the tub. The driving motor may be connected to the rear surface of the drum through a rotating shaft. As the driving motor is driven, power of the driving motor is transmitted to the drum through the rotating shaft, thereby rotating the drum.

[0100] The drum may be provided with a plurality of lifters therein to rotate laundry accommodated inside the drum, thereby performing washing and drying functions.

[0101] For example, when the lifters rotate along with the drum so as to spin the laundry from bottom to top of the drum along an inner circumferential surface of the drum, the laundry may fall to the bottom of the drum by gravity, thereby acquiring an effect of washing dirty laundry by beating the laundry with a paddle.

[0102] A control unit 11 is configured to display information related to a stroke processed by the laundry treating apparatus to a user and to receive the user's manipulation. To this end, the control unit 11 may include a display for displaying visual information.

[0103] The control unit 11 may also include a circular knob and a plurality of buttons for receiving the user's manipulation.

[0104] The control unit 11 may be provided on the main body 10 or provided on the door 12. In the embodiment disclosed herein, it is shown that the control unit 11 is located on an upper portion of the front panel 101 of the main body 10.

[0105] FIG. 2 is a front view of the door 12 in FIG. 1, viewed from the front, and FIG. 3 is an exploded view of the door 12 of FIG. 2.

[0106] The door 12 may include a door frame 13, a door window 23, front glass 20, a hinge unit 24, and a locking unit 30.

[0107] The door frame 13 may be defined in a ring shape.

[0108] The door frame 13 may include an outer frame 14 and an inner frame 19. The outer frame 14 and the inner frame 19 may be formed of a synthetic resin material (for example, an acrylonitrile butadiene styrene (ABS) material, a polycarbonates (PC) material, or the like).

[0109] Each of the outer frame 14 and the inner frame 19 may be manufactured by injection molding when made of a synthetic resin material.

[0110] The outer frame 14 and the inner frame 19 may be respectively defined in a ring shape, and coupled to each other in an overlapping manner in a front-rear direction. Each of the outer frame 14 and the inner frame 19 may be provided with a hook 36 (see FIG. 7) at an outer circumference thereof to be engaged with each oth-

er.

[0111] Describing the reason for the naming of the outer frame 14 and the inner frame 19, the outer frame 14 and the inner frame 19 are named as such since the outer frame 14 is disposed toward outside of the main body 10 and the inner frame 19 is disposed toward inside of the main body 10 based on a state in which the door 12 is closed. The outer frame 14 may be referred to as a first frame, and the inner frame 19 may be referred to as a second frame.

[0112] A circular opening 18 is formed inside each of the outer frame 14 and the inner frame 19. The openings 18 may be eccentrically positioned from centers of the outer frame 14 and the inner frame 19, respectively. For example, a center of the opening 18 may be positioned above the center of each of the outer frame 14 and the inner frame 19.

[0113] According to this configuration, each of the outer frame 14 and the inner frame 19 may vary in width along a circumferential direction. In other words, a distance (width) between an outer diameter and an inner diameter (a diameter of the opening 18) of each of the outer frame 14 and the inner frame 19 may increase (widen) from a top end to a bottom end.

[0114] A center of the drum may be disposed higher than a center of height (1/2) of the main body 10.

[0115] The drum is fixed in a height direction of the main body 10 aside from minute vibration due to rotation.

[0116] Consumers tend to prefer a larger size of the door 12 with respect to the same capacity and size of the washing machine when looking at the main body 10 from the front.

[0117] In addition, consumers are able to look into the drum through the door 12 and, if possible, prefer to have a wide field of view with regard to an inner space of the drum.

[0118] In order to satisfy the needs of the consumers, the door 12 may be enlarged downward to increase the size of the door 12 while the position of the drum is fixed. A center of the door frame 13 may move below the center of the laundry inlet port 102 or the opening 18. Similarly, the center of the door frame 13 may move downward with respect to the door window 23 positioned to correspond to the opening 18.

[0119] In addition, in order to increase the size of the door 12, it is preferable that part of the door 12 protrudes outward from a recess part 103 and the door 12 has a larger diameter.

[0120] The front glass 20 is defined in a circular shape. The front glass 20 is made of a glass material. The front glass 20 is formed flat on front and rear surfaces thereof.

[0121] The front glass 20 is defined in a disc shape having a constant thickness, without bending even when viewed from anywhere up, down, left, or right.

[0122] As described above, the front and rear surfaces of the front glass 20 made of the glass material are formed flat in the circular shape, thereby enhancing quality grade of the door 12, compared to a door cover in the related

art made of a synthetic resin material that has a convex front surface in an incomplete circular shape.

[0123] The front glass 20 may be disposed to cover the opening 18 of the door frame 13. The front glass 20 may be bonded to a front surface of the outer frame 14 by a sealant or an adhesive.

[0124] Due to the nature of the glass material, the front glass 20 is easily broken when a coupling hole is drilled in the front glass 20, and thus the front glass 20 is attached to the outer frame 14 using an adhesive or the like to prevent the glass from being broken.

[0125] On the other hand, the front glass 20 made of the glass material occupies a relatively large load compared to a total load of the door 12. In order to support the load of the front glass 20, a mounting guide 34 for mounting the front glass 20 is provided on a front surface of the outer frame 14.

[0126] In particular, the front glass 20 may be made of tempered glass. Due to the nature of the tempered glass, the front and rear surfaces of the front glass 20 have a high strength, but it has a disadvantage that a circular outer circumferential surface, which is a side surface of the front glass 20, has a low strength.

[0127] To compensate for this, the mounting guide 34 may protrude forward from a front outer circumferential end of the outer frame 14 to surround an outer circumferential surface of the front glass 20, so as to support the load of the front glass 20 as well as to protect the side surface of the front glass 20 from an external impact.

[0128] A protruding length of the mounting guide 34 may be defined to cover at least 2/3 of a thickness of the front glass 20.

[0129] This is because an external impact may be applied to the outer circumferential surface of the front glass 20 and the load of the front glass 20 may not be sufficiently supported when the protruding length of the mounting guide 34 is too short.

[0130] For example, a straight portion 202 and a plurality of curved portions 201, 203 may be arranged on a thickness surface, which is cut in a diameter (radial) direction at the outer circumferential surface of the front glass 20. The plurality of curved portions 201, 203 may include a first curved portion 201 connected to the front surface of the front glass 20 and a second curved portion 203 connected to the rear surface of the front glass 20. Both sides of the straight portion 202 are disposed between the first and second curved portions 201, 203 and connected to the first and second curved portions 201, 203, respectively. Each of the first curved portion 201, the straight portion 202, and the second curved portion 203 may be 1/3 of the thickness of the front glass 20.

[0131] The mounting guide 34 may be configured to cover the second curved portion 203 and the straight portion 202 of the front glass 20.

[0132] The mounting guide 34 may protrude from a front edge portion of the outer frame 14. The mounting guide 34 is formed in a ring shape to define a space in which the front glass 20 is accommodated.

[0133] The mounting guide 34 has a preset inner diameter to define a circle. The inner diameter of the mounting guide 34 corresponds to an outer diameter of the front glass 20, and thus the mounting guide 34 is configured to surround the outer circumferential surface of the front glass 20.

[0134] The mounting guide 34 may protrude by a predetermined length so as to be flush with the front surface of the front glass 20. According to this configuration, a step between the mounting guide 34 and the front glass 20 may be eliminated to implement simpler appearance.

[0135] A transparent region 21 and a non-transparent region 22 may be disposed at inner and outer sides of the front glass 20, respectively.

[0136] The transparent region 21 denotes a region configured to transmit at least part of light so that an opposite side or the inside can be seen. Therefore, the transparent region 21 is a concept including a translucent region 21.

[0137] The transparent region 21 may be disposed to correspond to the opening 18 of the outer frame 14, the opening 18 of the inner frame 19, and the door window 23. Therefore, while the door 12 is closed, the user can look into the laundry accommodating portion through the transparent region 21.

[0138] A center of the transparent region 21 is located at a position corresponding to a center of the opening 18 of each of the outer frame 14 and the inner frame 19. Here, the corresponding position includes not only perfect coincidence of the center, but also the same in the eccentric direction of the center. In other words, the center of the transparent region 21 and the center of the opening 18 may coincide with each other, or the eccentric direction of the transparent region 21 may be the same as the eccentric direction of the opening 18.

[0139] In the embodiment disclosed herein, it is shown that the center of the opening 18 is eccentrically located from the center of the door frame 13 to an upper side (12 o'clock direction), and correspondingly, the center of the transparent region 21 is also eccentrically located from the center of the front glass 20 to the upper side (12 o'clock direction). Here, the center of the transparent region 21 and the center of the opening 18 may alternatively coincide with each other.

[0140] The non-transparent region 22 is disposed to surround the transparent region 21. Also, the non-transparent region 22 does not transmit light therethrough, and the glass itself may appear black.

[0141] The non-transparent region 22 may be disposed to cover the remaining portion except for the opening 18 and part of the door frame 13.

[0142] A boundary line between the transparent region 21 and the non-transparent region 22 surrounding the transparent region 21 may be clearly distinguished by the non-transparent region 22.

[0143] Alternatively, the boundary between the transparent region 21 and the non-transparent region 22 may be blurred through a halftone technique, thereby allowing

a movement from the transparent region 21 to the non-transparent region 22 to be visually transitioned. To this end, the non-transparent region 22 may include a plurality of shielding dots arranged around the transparent region 21, and the plurality of shielding dots may be arranged to have lower density toward the transparent region 21.

[0144] The outer frame 14 may include a flat portion 15 and a curved portion 16.

[0145] The flat portion 15 may be in contact with the rear surface of the front glass 20, and part of the flat portion 15 may be disposed to overlap the non-transparent region 22. An adhesive may be applied to the flat portion 15 so that the front glass 20 can be adhered to the flat portion 15.

[0146] An adhesive filling groove 37 is formed concave in a ring shape in a front surface of the flat portion 15 facing the front glass 20, so that an adhesive is filled therein. The rear surface of the front glass 20 may be adhered to the flat portion 15 by the adhesive.

[0147] The adhesive may overflow to outside or inside of the adhesive filling groove 37 when the adhesive is filled in the adhesive filling groove 37. In order to accommodate the adhesive overflowing from the adhesive filling groove 37, adhesive overflow grooves 38 may be formed in a ring shape at inside and outside of the adhesive filling groove 37, respectively.

[0148] The adhesive filling groove 37 and the adhesive overflow grooves 38 are formed in an outer side of the flat portion 15, and the non-transparent region 22 of the front glass 20 may be disposed to cover the adhesive filling groove 37 and the adhesive overflow grooves 38.

[0149] A plurality of drain holes 39 may be formed through a lower side of the flat portion 15 in a thickness direction of the flat portion 15. Accordingly, water or moisture generated between the rear surface of the front glass 20 and a front surface of the outer frame 14 can be discharged to outside through the drain holes 39.

[0150] The curved portion 16 may be curved in an arc shape having a preset curvature toward an outer circumference of the opening 18 formed in the inner frame 19 from an inner end of the flat portion 15. An inner part of the flat portion 15 and the curved portion 16 may be disposed to overlap an outer edge portion of the transparent region 21. The opening 18 may be located at an inner side of the curved portion 16 in a radial direction.

[0151] The mounting guide 34 may be formed on an outermost part of the flat portion 15 in a circumferential direction to protrude more than the flat portion 15. The mounting guide 34 of the outer frame 14 may be configured to surround an outer edge of the front glass 20, thereby preventing the outer edge of the front glass 20 from being released radially outward from the flat portion 15 of the outer frame 14.

[0152] A protection layer 17 may be disposed on front and outer circumferential surfaces of the outer frame 14 by chromium plating. The outer frame 14 is completely immersed in a chromium plating solution, followed by the

chromium plating, so that the protection layer 17 is formed on the entire surface of the outer frame 14.

[0153] The inner frame 19 is completely immersed in a chromium plating solution, followed by the chromium plating, so that the protection layer 17 is formed on the entire surface of the inner frame 19.

[0154] The protection layer 17 is configured to coat the outer frame 14 with a silver polished metal color. According to this, the protection layer 17 may obtain an effect that it looks like circular droplet by bright silver. In addition, the protection layer 17 may cause a sense of high quality and the like when viewed with the naked eye.

[0155] The door window 23 may be disposed to correspond to the laundry inlet port 106 while the door 12 is closed. The door window 23 may be mounted to the door frame 13 to correspond to the opening 18 of the inner frame 19.

[0156] The door window 23 may be made of a transparent material, for example, a synthetic resin material having a light transmitting property, so that an inner space of the laundry accommodating portion such as the drum can be visually seen through the door window 23. The door window 23 may not be necessarily limited to such synthetic material but may alternatively be made of a glass material. An outer edge portion 231 of the door window 23 may be inserted and coupled between the outer frame 14 and the inner frame 19.

[0157] The outer edge portion 231 of the door window 23 may have a flat shape, and may be fixedly disposed between a rear end of the curved portion 16 of the outer frame 14 and an inner end of the inner frame 19. The door 12 may be rotatably provided in a front-rear direction with respect to the main body 10 by the hinge unit 24.

[0158] The hinge unit 24 may include a hinge 25, a hinge holder 28, and a bush 29.

[0159] The hinge 25 may be fixed to the main body 10, and rotatably coupled to the door frame 13. The hinge 25 may include a plate-shaped base portion 26 coupled to the main body 10, and a rotation coupling portion 27 protruding from the base portion 26 and rotatably coupled to the door frame 13. The rotation coupling portion 27 may be provided in plurality spaced apart from each other in an up-down direction.

[0160] The hinge holder 28 may be coupled to the door frame 13 to support the rotation coupling portions 27 to prevent the rotation coupling portions 27 from being released from the door frame 13.

[0161] The bush 29 may be inserted into a rotating shaft of each rotation coupling portion 27 to smoothly rotate the rotating shaft.

[0162] The hinge unit 24 may be mounted at one side of the door 12, and a locking unit 30 may be provided at another side of the door 12. The locking unit 30 is configured to lock or unlock the door 12 to or from the main body 10.

[0163] The locking unit 30 may include a shaft 31, a door latch 32 (door latch) and a spring 33.

[0164] The shaft 31 may be configured to pass through

the door latch 32, and mounted on the door frame 13. The spring 33 has an elastic force to be retractable during the rotation of the door latch 32.

[0165] According to this configuration, the door latch 32 may be configured to be rotatable and restorable with respect to the door frame 13 so as to lock or unlock the door 12 with respect to the main body 10.

[0166] FIG. 4 is a cross-sectional view taken along the IV-IV in FIG. 1, illustrating that the door 12 is mounted on the front panel 101 of the main body 10 to close the laundry inlet port 106. FIG. 5 is a rear view of the door in FIG. 2, viewed from the rear. FIG. 6 is a front view illustrating that the recess part 103 is recessed in the front panel 101 to surround the laundry inlet port 106 in FIG. 4. FIG. 7 is an enlarged cross-sectional view of part "VII" in FIG. 4, illustrating that a contact portion 191 is in contact with the recess part 103 of the main body. FIG. 8 is an enlarged cross-sectional view of part "VIII" in FIG. 4, illustrating that a non-contact portion 192 is spaced apart from the recess part 103 of the main body 10.

[0167] FIG. 4 illustrates a state in which the control unit of FIG. 1 is removed from the upper side of the front panel 101.

[0168] A plurality of ribs 102 may protrude upward from an upper end portion of the front panel 101. The control unit may be mounted on the upper end portion of the front panel 101. A rear surface of the control unit and the plurality of ribs 102 may be coupled by coupling elements such as screws.

[0169] Referring to FIGS. 4 and 5, a handle 35 is formed in a manner of recessing a rear upper side of the inner frame 19, so that the user can open the door 12 by pulling the handle 35.

[0170] The rear surface of the inner frame 19 may be formed to be convex rearward in an arcuate shape.

[0171] The handle 35 is provided on the door 12 for the user to open and close the door 12. In the related art, the handle is generally provided on a front side of the door. However, in the present disclosure, since the front glass 20 is provided to cover the front surface of the door 12, it is difficult to provide the handle 35 on the front glass 20.

[0172] Thus, the handle 35 is not provided on the front surface of the door 12 due to the front glass 20, and is preferably provided on a rear surface of the door 12. The handle 35 is provided on the inner frame 19.

[0173] In addition, the handle 35 is preferably provided at an upper portion of the door 12 for the user to easily pull the door 12. This is because, when the handle 35 is provided at a lower portion of the door 12, the user has to bend his or her waist and knees more to pull the handle 35.

[0174] Moreover, since the hinge unit 24 and the locking unit 30 are respectively provided at left and right sides of the door frame 13, respectively, along a horizontal center line CL-CL that horizontally passes through the center of the door frame 13 in a radial direction, they, i. e. the hinge unit 24 and the locking unit 30, are preferably

positioned higher than the horizontal center line.

[0175] In addition, the handle 35 is preferably disposed on the upper side of the door frame 13 to be higher than the locking unit 30 in order to open and close the door 12 with less force.

[0176] The handle 35 may be disposed on the upper side of the rear surface of the inner frame 19. More specifically, when the door 12 is closed, the handle 35 may be located at a right upper portion, namely, between one o'clock and three o'clock, when viewed from the front of the main body 10.

[0177] The handle 35 may be formed to be recessed into the convex rear surface of the inner frame 19 toward the outer frame. The handle 35 may be formed in an arcuate shape on the rear surface of the inner frame 19 along a partial section of the rear surface in a circumferential direction.

[0178] The handle 35 may be formed thin and flat compared to an outer circumference of the inner frame 19 (a portion of the inner frame except for the handle 35).

[0179] According to this configuration, when the door 12 is closed by the user, the handle 35 is recessed forward in the flat shape, compared with the outer circumference on the rear surface of the inner frame, when viewed from the front of the main body 10, thereby facilitating insertion of the user's hand into the handle 35 as well as facilitating identification of a position of the handle 35 in the closed state of the door 12.

[0180] Referring to FIGS. 4 and 6, the recess part 103 may be provided on the front panel 101 of the main body 10.

[0181] The recess part 103 accommodates part of the door 12, particularly, part of the door frame 13, more particularly, part of the inner frame 19.

[0182] The recess part 103 may include a recessed portion 1031, and a flat portion 1032.

[0183] The recessed portion 1031 may be recessed rearward into the front surface of the front panel 101 toward the inside of the main body 10. The recessed portion 1031 may have a larger diameter than the laundry inlet port 106 and may be formed in a curved shape along the circumferential direction.

[0184] The recessed portion 1031 may be formed in a circular shape to surround an outer circumference of the flat portion 1032.

[0185] The recessed portion 1031 may have both sides connected to the front surface of the front panel 101 and the flat portion 1032, i.e. one side connected to the front surface of the front panel 101 and the other side connected to the flat portion 1032, so that the flat portion 1032 is stepped toward the inside of the main body 10 with respect to the front surface of the front panel 101. The recessed portion 1031 may be bent backward from the front surface of the front panel 101.

[0186] The recessed portion 1031 may be inclined while its diameter gradually decreases from front end to rear end thereof. The flat portion 1032 may be disposed toward the inside of the main body more rearward than

the front surface of the front panel 101.

[0187] The flat portion 1032 may extend perpendicularly in the form of a flat plate, and the laundry inlet port 106 may penetrate through the inside of the flat portion 1032 in a thickness direction. The flat portion 1032 may be defined in a ring shape.

[0188] The laundry inlet port 106 may be formed eccentrically from the center of the recess part 103. For example, the center of the laundry inlet port 106 may be located higher than the center of the recess part 103. As a result, a width (a radial distance) of the flat portion 1032 becomes wider (longer) from an upper portion to a lower portion of the flat portion 1032.

[0189] A hinge portion 104 for coupling with the hinge unit 24 may be provided at a left side of the flat portion 1032, so that the hinge unit 24 can be hinged to the hinge portion 104. A locking portion 105 for coupling with the locking unit 30 may be provided at a right side of the flat portion 1032, so that the locking unit 30 can be coupled to the locking portion 105.

[0190] The door 12 is fixed to the left and right sides of the flat portion 1032 by the hinge unit 24 and the locking unit 30 when the laundry inlet port 106 is closed. The hinge portion 104 and the locking portion 105 may be disposed on a horizontal center line CL-CL horizontally passing through a center of the flat portion 1032 in a radial direction, when looking at the circular flat portion 1032 from the front of the main body 10.

[0191] A curling portion may be formed on an inner end of the flat portion 1032. The curling portion may have a form in which an end of the flat portion 1032 is curled into a round shape, thereby removing a sharp portion of the inner end of the flat portion 1032. According to this, damage on laundry due to friction with the inner end of the flat portion 1032 can be prevented when the laundry is loaded or unloaded through the laundry inlet port 106 located at the inner end of the flat portion 1032, and injury of a hand or the like which may be caused due to a contact with the inner end of the flat portion 1032 can be avoided.

[0192] Referring to FIGS. 4 and 5, the door window 23 may include an outer edge portion 231 formed in a circular shape on a front end thereof, and a protruding portion 232 protruding toward the inside of the drum from the outer edge portion 231.

[0193] The protruding portion 232 may be in a curved shape. The protruding portion 232 may have an upper surface, side surfaces, a lower surface, and a rear surface. Both the side surfaces and the rear surface of the protruding portion 232 are configured to connect the upper and lower surfaces of the protruding portion 232.

[0194] The upper and lower surfaces of the protruding portion 232 may be formed asymmetrically.

[0195] For example, the upper surface of the protruding portion 232 may be inclined smoothly relative to the lower surface of the protruding portion 232, and the lower surface of the protruding portion 232 may be inclined sharply relative to the upper surface of the protruding portion 232.

[0196] The rear surface of the protruding portion 232 may be formed almost in a perpendicularly flat surface.

[0197] With this configuration, the door window 23 may be disposed to cover the opening of the inner frame 19, and the protruding portion 232 may protrude into the drum through the laundry inlet port 106 when the door 12 is closed.

[0198] When a large quantity of laundry is loaded into the drum, the laundry may collide with the door window 23 protruding into the drum while rotating along the inner circumferential surface of the drum.

[0199] The present disclosure is configured to prevent the door 12 from being lifted towards the outside of the main body 10 due to the collision between the laundry and the door window 23.

[0200] To this end, a contact portion 191 may be provided on the rear surface of the door frame 13. The contact portion 191 may be made to be brought into contact with the main body 10 when the door 12 is closed. The contact portion 191 may be formed integrally with the rear surface of the inner frame 19.

[0201] The contact portion 191 may be in contact with a front end of a front panel 101, a front end of the recess part 103, or a boundary portion between the front panel 101 and the recess part 103. The boundary portion between the front panel 101 and the recess part 103 is a portion where the recess part 103 starts to be recessed.

[0202] In this specification, the recessed portion 1031 may be understood as a concept including the portion where the recess part 103 starts to be recessed.

[0203] The contact portion 191 is preferably brought into contact with the recessed portion 1031 of the recess part 103. When the contact portion 191 is in contact with the recessed portion 1031 of the recess part 103, a contact area between the contact portion 191 and the main body 10 may be minimized.

[0204] When the contact portion 191 is in contact with the recessed portion 1031 of the recess part 103, the contact portion 191 may be smoothly connected in a curved shape to the rear surface of the inner frame 19 without protruding.

[0205] In the embodiment disclosed herein, the rear surface of the inner frame 19 may have an arcuate cross section and may be convex toward the front surface of the front panel 101 and the flat portion 1032. The rear surface of the inner frame 19 may have an arcuate cross section.

[0206] The rear surface of the inner frame 19 may be asymmetric at upper and lower portions. The inner frame 19 may be formed such that an upper portion of the rear surface has a greater curvature than the lower portion of the rear surface. The rear surface of the inner frame 19 may be disposed to face the front panel 101 or the flat portion 1032. The upper portion of the rear surface of the inner frame 19 denotes a portion of the rear surface located above a horizontal center line CL-CL horizontally passing through the center of the inner frame 19 in a radial direction, when looking at the rear surface of the

inner frame 19 from the rear side.

[0207] The lower portion of the rear surface of the inner frame 19 denotes a portion of the rear surface located below the horizontal center line CL-CL.

[0208] The contact portion 191 may be located on the upper portion of the rear surface of the inner frame 19, so as to allow the upper portion of the rear surface of the inner frame 19 to be in contact with the recessed portion 1031 of the main body 10.

[0209] The contact portion 191 may be formed curved on the upper portion of the rear surface of the inner frame 19. The contact portion 191 may be in a curved shape having a greater curvature than that of the lower portion of the rear surface of the inner frame 19.

[0210] The contact portion 191 may be formed in an arcuate shape from the rear surface of the inner frame 19 toward the recessed portion 1031.

[0211] The contact portion 191 may circumferentially extend from the upper portion of the rear surface of the inner frame 19 so as to have an arcuate cross section. In this case, the contact portion 191 may have a circumferential length which is $1/2$ of or shorter than an entire circumference of the inner frame 19 along the circumferential direction of the inner frame 19. For example, when an outer diameter of the inner frame 19 is D (mm), the contact portion 191 may be $\pi D / 2$ or shorter.

[0212] The contact portion 191 may be formed on one side of the rear surface of the inner frame 19 or may be formed in plural to be spaced apart from the upper portion of the rear surface of the inner frame 19 in the circumferential direction.

[0213] In the embodiment disclosed herein, the single contact portion 191 having the arcuate cross section extends from the upper portion of the rear surface of the inner frame 19 along the circumferential direction.

[0214] Referring to FIG. 7, the recessed portion 1031 is inclined downward toward the flat portion 1032 with respect to the perpendicularly-formed front surface of the front panel 101.

[0215] An outer side of the front end of the recessed portion 1031 connected to the front surface of the front panel 101 may be rounded. The outer side of the front end of the recessed portion 1031 may be formed to have a radius of curvature which is significantly smaller than a radius of curvature of the contact portion 191.

[0216] A radius of an arc formed by the contact portion 191 may be much larger than a radius of an arc formed by the outer side of the front end of the recessed portion 1031. The arc of the contact portion 191 and the arc formed by the outer side of the front end of the recessed portion 1031 may be disposed to be adjacent to each other.

[0217] The contact portion 191 may be in contact with the outer side of the front end of the recessed portion 1031 when the door 12 is closed, and the contact between the contact portion 191 and the outer side of the front end of the recessed portion 1031 may be made on curved surfaces of the arcs externally brought into con-

tact with each other.

[0218] With this configuration, the contact portion 191 formed on the rear surface of the door frame 13 can be in contact with one side of the main body 10, namely, the outer side (rounded portion) of the front end of the recessed portion 1031 formed at the front panel 101, when the door 12 is closed.

[0219] In this case, the contact portion 191 may be in point contact or line contact with the one side of the main body 10.

[0220] A part of the door frame 13 may be disposed to protrude forward from the outer side of the recess part 103 based on the contact portion 191, and another part of the door frame 13 may be disposed to be accommodated in the recess part 103. In other words, a part of the door frame 13, i.e. say a first part that includes the contact portion 191, may be disposed to protrude forward from the outer side of the recess part 103, whereas the other part of the door frame 13, i.e. say a second part that does not include the contact portion 191, may be disposed to be accommodated in the recess part 103. In other words, the first part of the door frame 13 protrudes axially farther out from the recess part 103 than the second part of the door frame 13.

[0221] A non-contact portion 192 may be provided on the lower portion of the rear surface of the inner frame 19. The non-contact portion 192 may be formed with a curvature smaller than that of the contact portion 191. The non-contact portion 192 may be inclined smoothly relative to the contact portion 191.

[0222] According to this, the non-contact portion 192 may be spaced forward apart from the lower side of the recessed portion 1031 of the recess part 103.

[0223] Therefore, according to the present disclosure, the contact portion 191 may be provided at the upper portion on the rear surface of the door frame 13, and may be brought into contact with the recessed portion 1031 of the recess part 103 of the main body when the door 12 is closed, so that lifting of the door 12 can be prevented even if laundry spinning along the inner circumferential surface of the drum collides with the door window 23 when the laundry is loaded in a large quantity.

[0224] More specifically, when a large quantity of laundry is accommodated in the drum, the laundry may be moved down to the bottom of the drum by gravity and centrifugal force in a state of being wet in water, and hit the lower portion of the door window 23 during spinning.

[0225] At this time, when an impact is applied to the door window 23 due to the spinning of the laundry, the lower portion of the rear surface of the door frame 13 may be pressed from the inside to outside of the drum.

[0226] In the state in which the hinge unit 24 and the locking unit 30 respectively disposed at the left and right sides on the rear surface of the door frame 13 are fixed to the flat portion 1032, the contact portion 191 provided at the upper portion on the rear surface of the door frame 13 may be brought into contact with the recessed portion 1031 formed in the front panel 101 of the main body 10,

so as to resist lifting of the door 12, thereby preventing vibration or shaking of the door 12 even if an impact is applied to the lower portion of the door frame 13.

[0227] In addition, the contact portion 191 extends in an arcuate curved shape along the circumferential direction of the door frame 13. According to this, the contact portion 191 may not protrude from one side of the rear surface of the door frame 13 but may form a curved surface smoothly connected to its adjacent portions without a bent portion, thereby allowing the door to have beautiful appearance.

[0228] In particular, the rear surface of the door 12 may be brought into contact with the recessed portion 1031 where the recess part 103 starts to be recessed, by the contact portion 191. According to this, the contact portion 191 may cover the inside of the recess part 103. Therefore, the door window 23 protruding from the rear surface of the door to the inner space of the main body 10 can be covered, thereby improving appearance of the door 12.

[0229] In addition, the contact portion 191 of the door 12 may not protrude from the rear surface of the door 12, but may be brought into contact with the recessed portion 1031 where the recess part 103 starts to be recessed, without being in contact with the flat portion 1032 of the recess part 103, thereby preventing an increase in an unnecessary material cost due to an increase in size of the contact portion 191.

[0230] Also, the contact portion 191 can be formed curved toward the front panel 101 or the recess part 103 to have a cross section in an arcuate shape, so as to be in point contact or line contact with the recessed portion 1031, thereby minimizing a contact area of the contact portion 191 when the door 12 is closed. Accordingly, an impact applied to the main body 10 can be dispersed along the circumferential direction of the recess part 103 when the main body 10 is brought into contact with the contact portion 191 due to the rotation of the door 12, resulting in minimizing the impact applied to the main body 10.

[0231] The contact state between the contact portion 191 and the main body 10 can be maintained after the door 12 is closed, and thus vibration and noise occurred between the door 12 and the main body 10 can be minimized even though an impact is repetitively applied from the laundry accommodated in the drum through the door window 23.

[0232] In addition, even if the lower portion of the door frame 13 is lifted inside the drum due to the impact applied to the door window 23, left and right sides of the door 12 and an upper end of the door 12 may be supported at a plurality of points on the front panel 101. For example, the plurality of points may include at least three support points, such as each vertex of a triangle. Both left and right support points of the three support points may be formed as the hinge unit 24 and the locking unit 30 of the door 12 are coupled to the main body 10. The upper support point of the three support points may be formed

by the contact between the contact portion 191 and the main body 10. According to this, suppression force against vibration or shaking of the door 12 can be improved significantly.

[0233] In addition, since the arcuate curved surface of the contact portion 191 and the arcuate curved surface of the recessed portion 1031 where the door 12 and the main body 10 are in contact with each other can realize a point contact or a line contact with each other, thereby minimizing friction between the mutual contact surfaces.

[0234] Moreover, even if the lifting of the door 12 occurs, the contact point between the door frame 13 and the recess part 103 moves on the arcuate curved surface, so as to prevent the contact portion 191 of the door frame 13 from being spaced apart from the main body 10, thereby achieving stable contact.

[0235] In addition, an impact transferred from the inside of the drum through the door window 23 can be alleviated by virtue of the stable contact between the contact portion 191 of the door frame 13 and the recess part 103 of the main body 10. Accordingly, neither a separate buffer member between the door 12 and the main body 10 nor an installation space of the buffer member are needed, thereby accommodating more part of the door 12 in the recess part 103, resulting in implementing compact arrangement of the door 12.

[0236] FIG. 9 is a conceptual view illustrating that a contact portion 291 protrudes from one side of the rear surface of the door frame 13 in accordance with another embodiment, and FIG. 10 is a conceptual view illustrating a shape of the contact portion 291 of FIG. 9, viewed from the rear of the door frame 13.

[0237] This embodiment is different from the foregoing embodiment of FIGS. 4 to 8 in that the contact portion 291 integrally protrudes from one side of the rear surface of the door frame 13.

[0238] The contact portion 191 illustrated in FIGS. 4 to 8 protrudes in the curved shape from the upper portion (predetermined section) of the rear surface of the door frame 13 continuously along the circumferential direction so as to have the arcuate cross section (except for the handle), whereas the contact portion 291 according to this embodiment locally protrudes from the upper portion of the rear surface of the door frame 13.

[0239] In this embodiment, the contact portion 291 may protrude in various forms, such as oval, circle, rectangle, and the like. In addition, the contact portion 291 protruded may be provided in plurality, and the plurality of contact portions 291 may be spaced apart from each other in the circumferential direction.

[0240] The other components are the same/like as those of the foregoing embodiment, and thus a detailed description thereof will be omitted.

Claims

1. A laundry treating apparatus comprising:

a main body (10) provided with a front panel (101) having a laundry inlet port (106), and a recess part (103) recessed into the front panel (101) to surround the laundry inlet port (106); and

a door (12) mounted to the front panel to open and close the laundry inlet port (106), wherein the door (12) comprises:

an outer frame (14) having an outer circumferential portion and configured to protrude outward of the recess part (103) when the door (12) is closed;

a door window (23) disposed to correspond to the laundry inlet port (106) and having an outer edge portion (231) accommodated inside the recess part (103) when the door (12) is closed; and

an inner frame (19) disposed toward the recess part (103) and provided with a contact portion (191), and having an outer side connected to the outer circumferential portion of the outer frame (14) and an inner side connected to the outer edge portion (231) of the door window (23);

wherein the contact portion (191) is provided between the outer side and the inner side of the inner frame (19) and configured to be in contact with a recessed portion (1031) of the recess part (103) when the door (12) is closed.

2. The apparatus according to claim 1, wherein,

the inner frame (19) has a ring shape, and the contact portion (191) is located at an upper portion of the inner frame (19) with respect to a horizontal center line (CL-CL) horizontally passing through a center of the inner frame (19) in a radial direction of the inner frame (19).

3. The apparatus according to claim 1 or 2, wherein at least a part of the inner frame (19) at which the contact portion (191) is provided is in a shape curved from the outer side of the inner frame (19) to the inner side of the inner frame (19) in a direction toward the recess part (103).

4. The apparatus according to any one of claims 1 to 3, wherein a curvature of a rear surface of the inner frame (19) is constant or varying between the outer side and the inner side of the inner frame (19), and the contact portion (191) is formed integrally with the rear surface of the inner frame (19).

5. The apparatus according to any one of claims 1 to 4, wherein the contact portion (191) has a cross section having one of an arcuate shape, a hemispherical

shape, a triangular shape, a polygonal shape, a trapezoidal shape.

6. The apparatus according to any one of claims 1 to 5, wherein the contact portion (191) is in point contact or in line contact with the recess part (103); or wherein a part of a surface area of the contact portion (191) is in contact with a part of a surface area of the recess part (103). 5
7. The apparatus according to any one claims 1 to 6, wherein the inner frame (19) comprises a non-contact portion (192) between the outer side and the inner side of the inner frame (19), wherein the non-contact portion (192) is circumferentially spaced apart from the contact portion (191) and is configured to be spaced apart from the recess part (103) when the door (12) is closed and while the contact portion (191) is in contact with the recessed portion (1031) of the recess part (103). 10 15 20
8. The apparatus according to claim 7, wherein the contact portion (191) and the non-contact portion (192) are positioned diametrically opposite to each other at the inner frame (19). 25
9. The apparatus according to claim 7 or 8, wherein the contact portion (191) has a greater curvature than the non-contact portion (192) of the inner frame (19). 30
10. The apparatus according to any one of claims 1 to 9, wherein the recess part (103) is curved inward from a front surface of the front panel (101) towards an inside of the main body (10) such that the recess part (103) is circumferentially surrounded by the front surface of the front panel (101), and wherein the recessed portion (1031) of the recess part (103) comprises a boundary portion of the recess part (103) formed adjoining the front surface of the front panel (101). 35 40
11. The apparatus according to claims 10, wherein the recessed portion (1031) of the recess part (103) has a curved shape. 45
12. The apparatus according to any one of claims 1 to 11, wherein the outer side of the inner frame (19) protrudes outside of the recess part (103); and/or wherein the outer side of the inner frame (19) has a diameter greater than that of the recess part (103), and the inner side of the inner frame (19) has a diameter smaller than that of the recess part (103). 50
13. The apparatus according to any one of claims 1 to 12, 55
 wherein the outer side of the inner frame (19) is spaced forward apart from a contact position of the contact portion (191) where the contact por-

tion (191) contacts the recessed part (103); and/or

wherein a radially outer end of the outer side of the inner frame is located radially outward than a contact position of the contact portion (191) where the contact portion (191) contacts the recessed part (103).

14. The apparatus according to any one of claims 1 to 13, comprising a handle (35) provided on an upper portion of the outer side of the inner frame (19); wherein the handle (35) is spaced apart from the contact portion (191) in a circumferential direction of the inner frame (19), and/or wherein the handle (35) is recessed into the inner frame (19) toward the outer frame (14). 10 15 20
15. The apparatus according to any one of claims 1 to 14, wherein the outer frame (14) has a ring shape and comprises:

a flat portion (15) at the outer circumferential portion of the outer frame (14); and
 a curved portion (16) radially inward of the flat portion and extending at a preset curvature from inside of the flat portion (15) toward the outer edge portion (231) of the door window (23); and
 wherein the outer edge portion (231) of the door window (23) is positioned between the curved portion (16) and the inner side of the inner frame (19).

FIG. 1

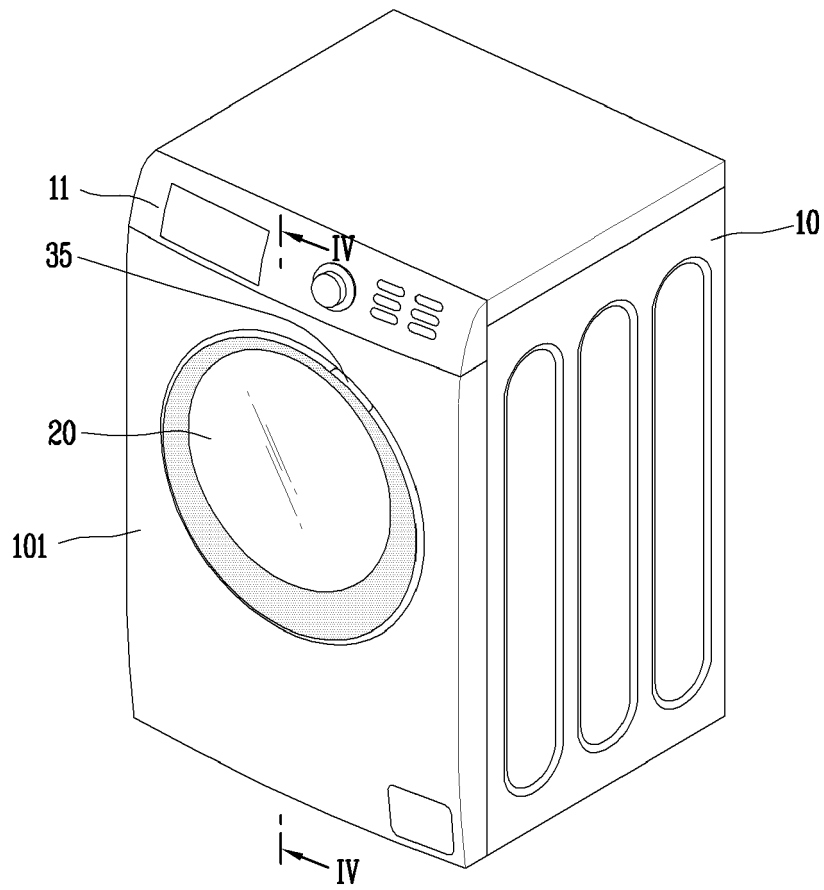


FIG. 2

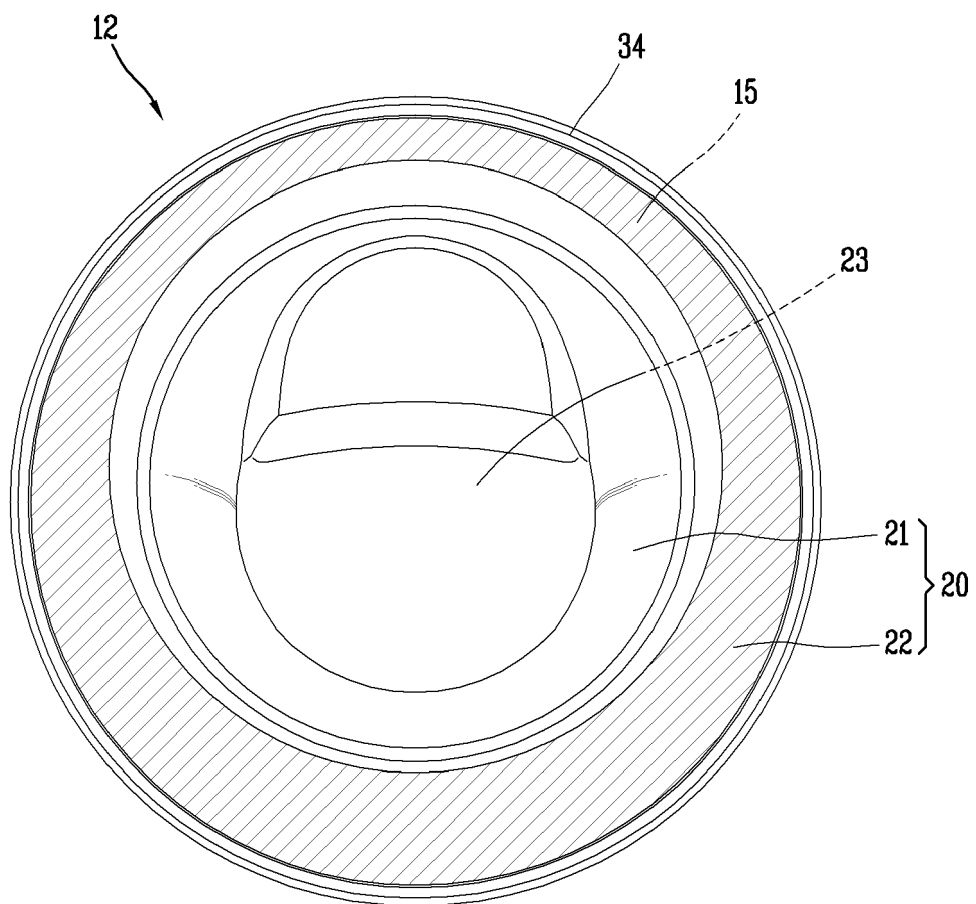


FIG. 3

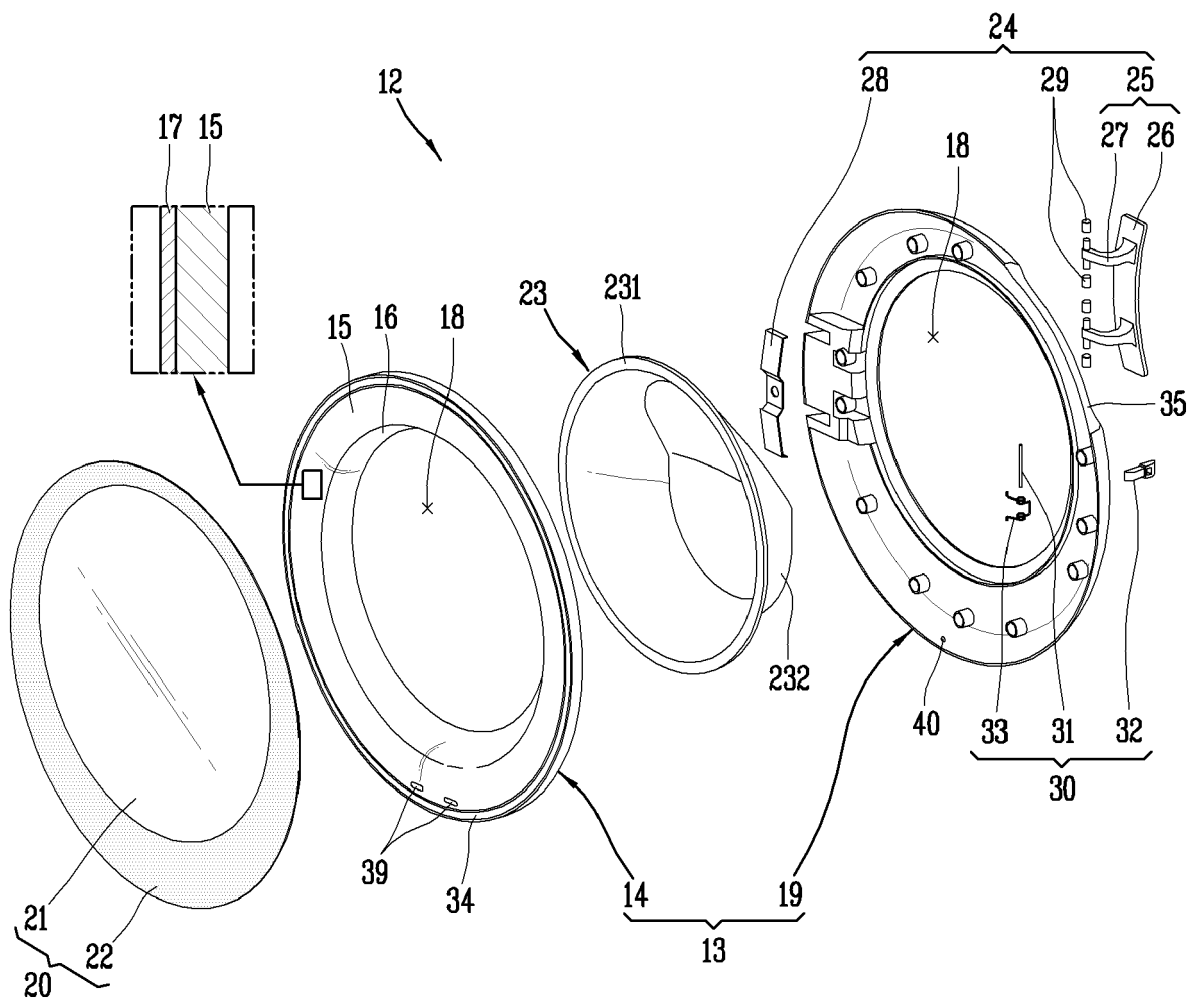


FIG. 4

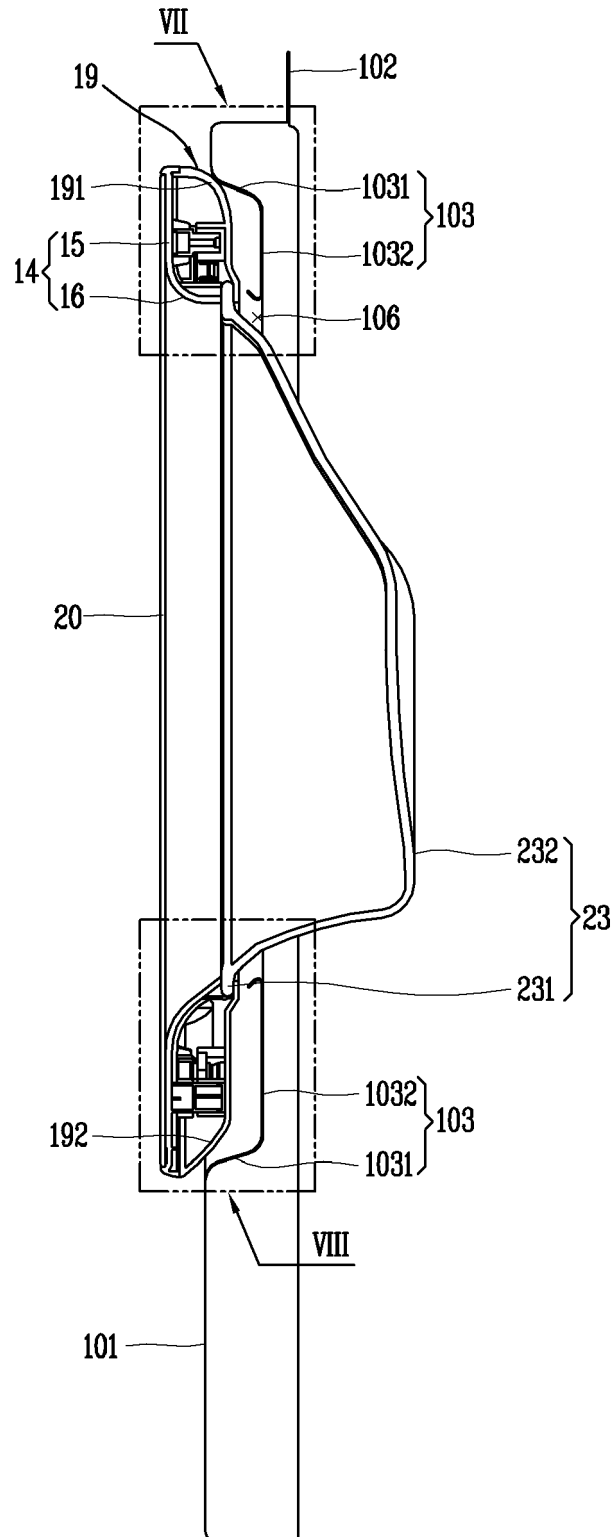


FIG. 5

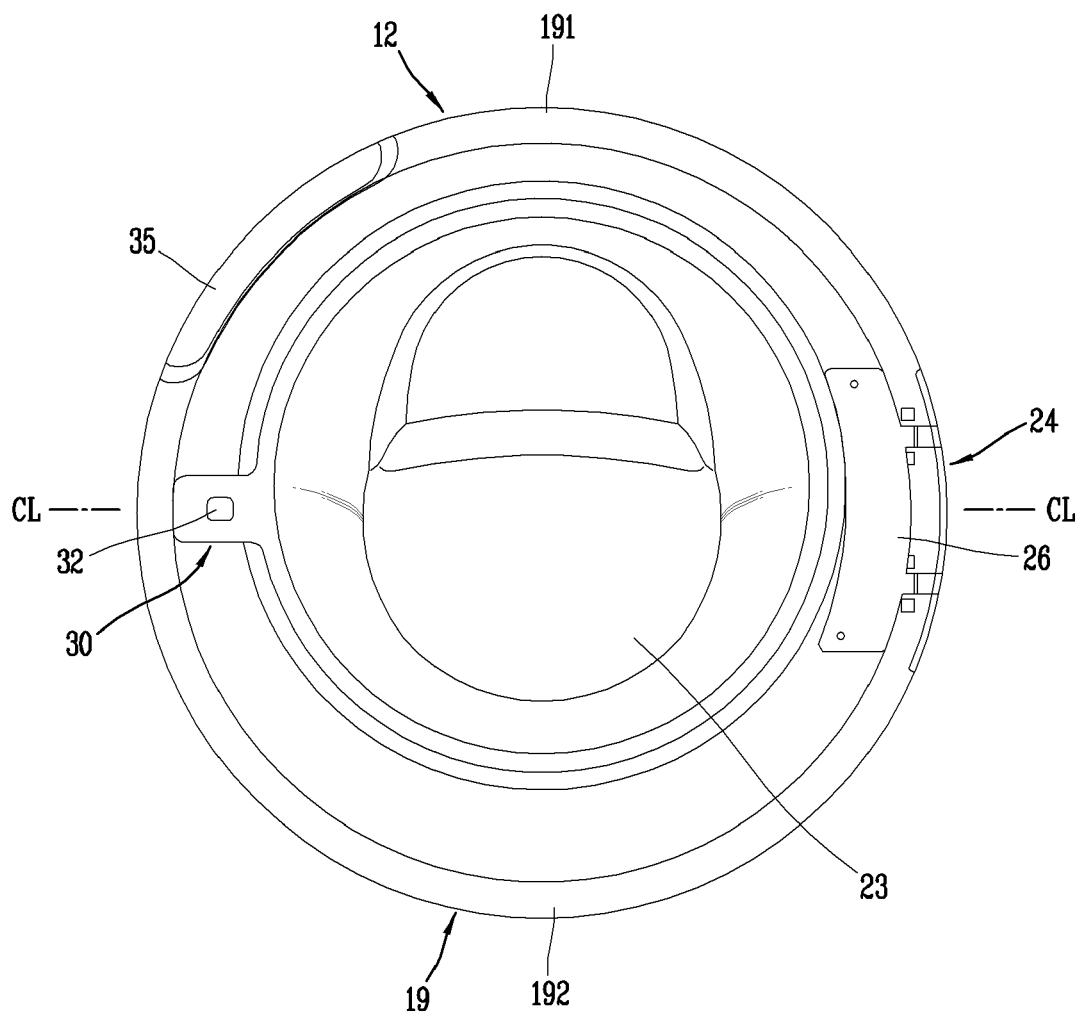


FIG. 6

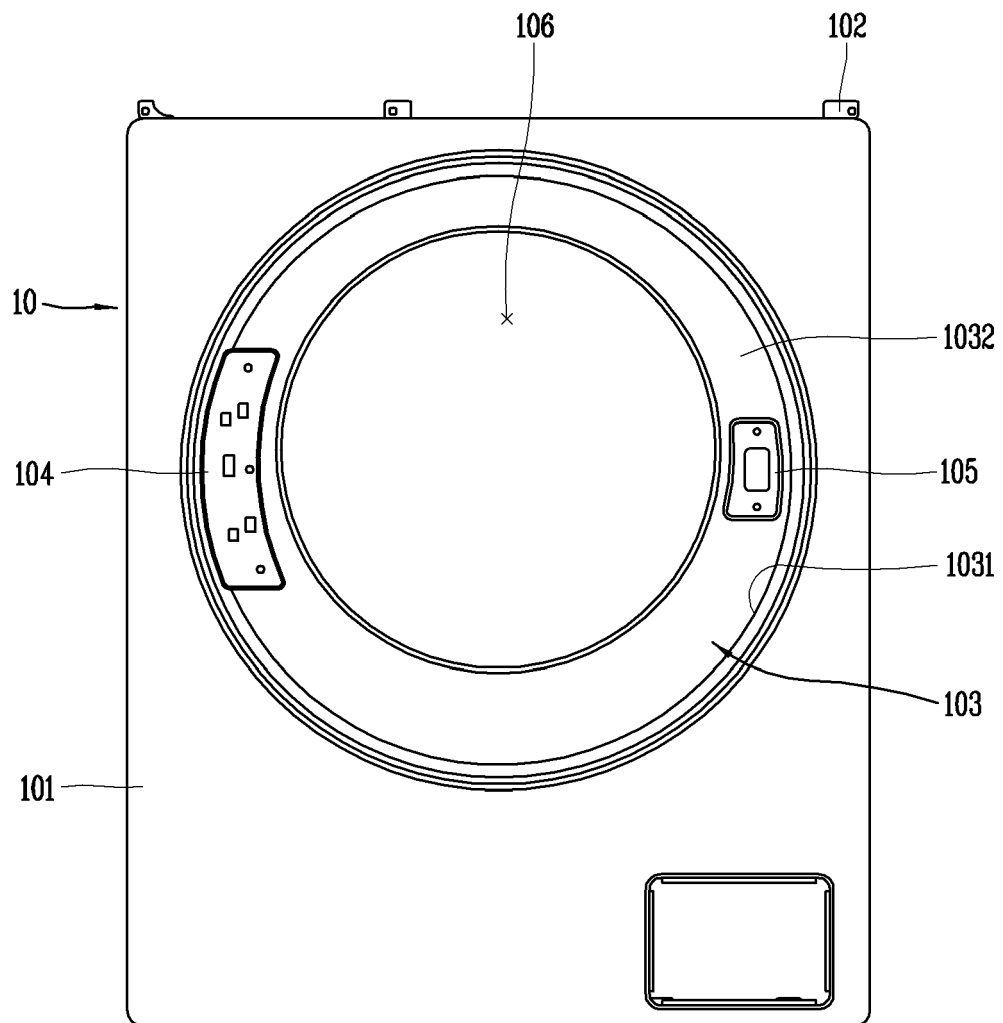


FIG. 7

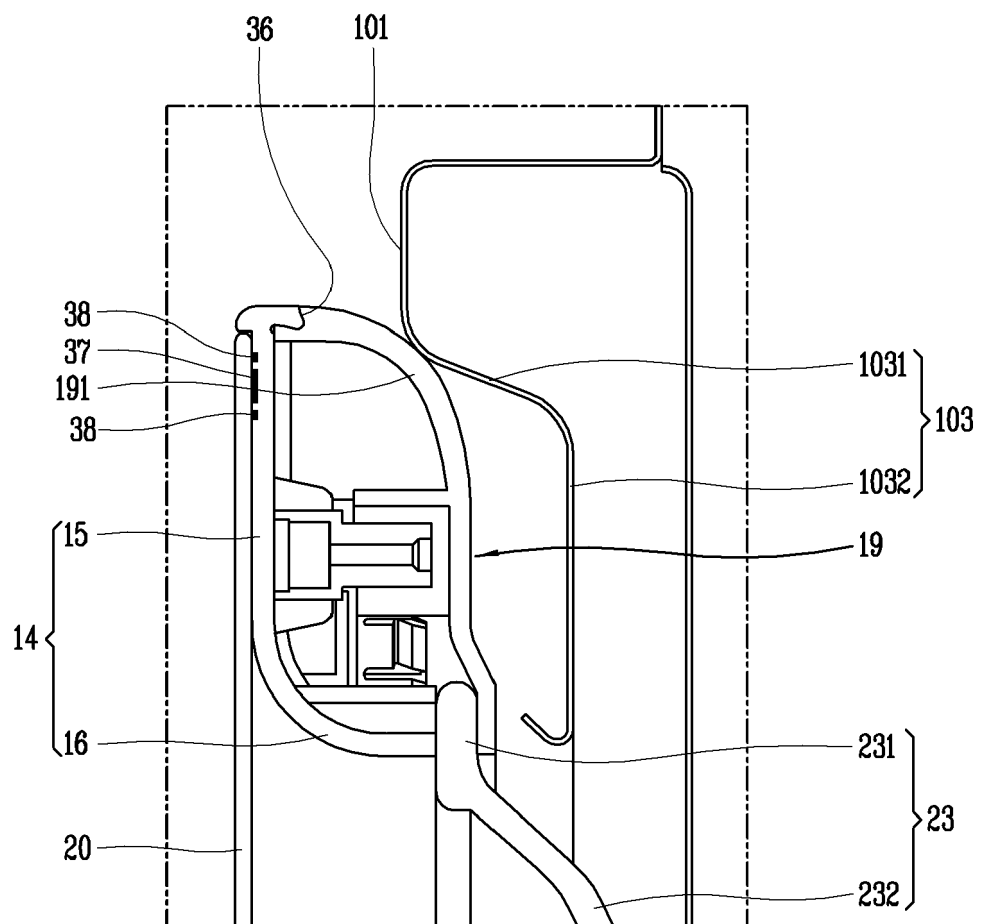


FIG. 8

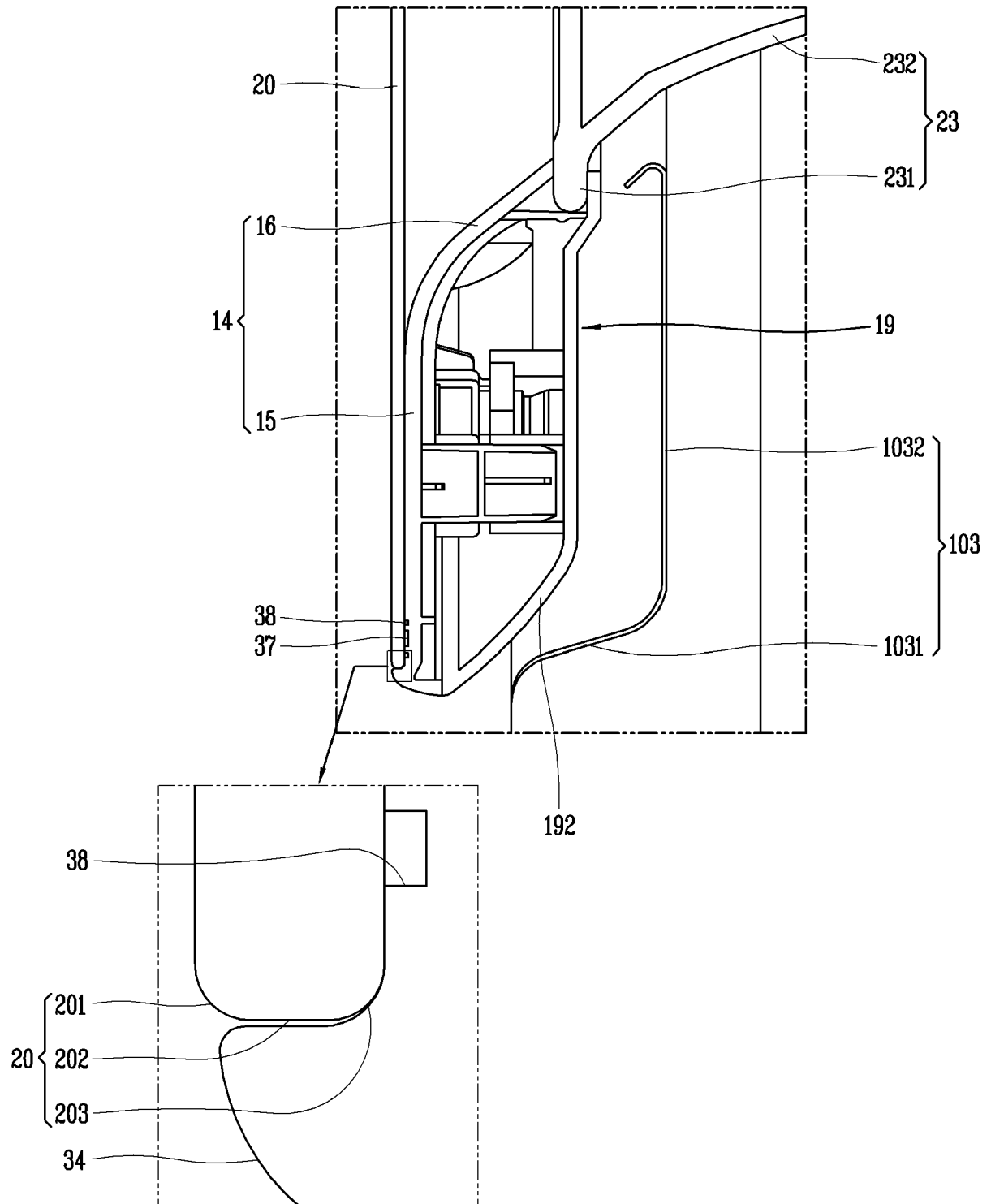


FIG. 9

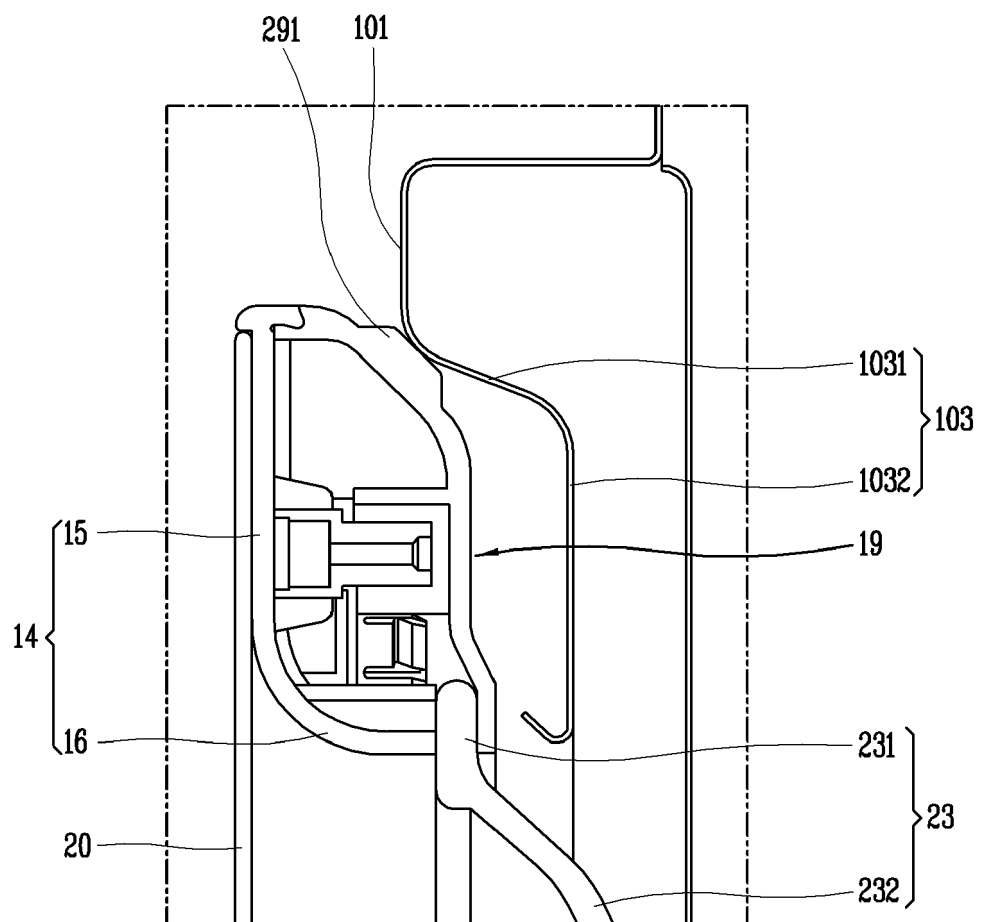
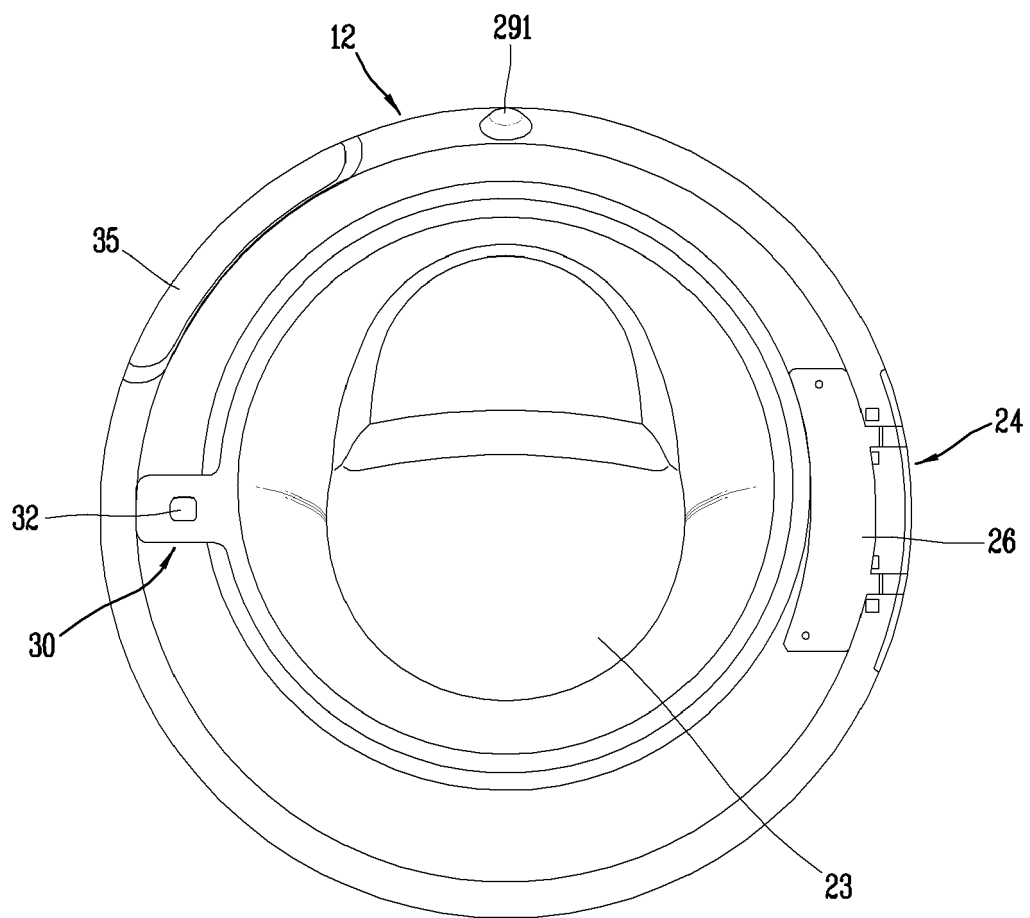


FIG. 10





EUROPEAN SEARCH REPORT

 Application Number
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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	CN 104 975 466 A (QINGDAO JIAONAN HAIER WASHING MACHINE CO LTD) 14 October 2015 (2015-10-14)	1-8, 10-15	INV. D06F39/14
A	* paragraphs [0039] - [0049]; figures * * abstract *	9	

X	US 6 256 823 B1 (KRONBETTER CLARENCE W [US] ET AL) 10 July 2001 (2001-07-10)	1-6,10, 11,13	
A	* abstract; figures 1,2 *	7-9,12, 14,15	

X	US 2007/137261 A1 (KWON DAE H [KR]) 21 June 2007 (2007-06-21)	1,5-8, 10,11, 13,14	
A	* paragraphs [0015] - [0020], [0054] - [0107]; figures 4-10 *	2-4,9, 12,15	

X	EP 2 740 833 A1 (ELECTROLUX HOME PROD CORP [BE]) 11 June 2014 (2014-06-11)	1-6,10, 11,13,15	TECHNICAL FIELDS SEARCHED (IPC) D06F
A	* abstract * * paragraphs [0046] - [0511]; figures 1-6 *	7-9,12, 14	

X	WO 2015/144236 A1 (ARCELIK ANONIM SIRKETI) 1 October 2015 (2015-10-01)	1,2,5-8, 10,11,13	
A	* abstract; figures *	3,4,9, 12,15	

X	EP 2 161 364 A2 (PANASONIC CORP [JP]) 10 March 2010 (2010-03-10)	1,3-6, 10,11, 14,15	
A	* abstract * * figures 1,2,3A,3B *	2,7-9, 12,13	

	-/--		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 June 2020	Examiner Prosig, Christina
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 2172

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 208 293 271 U (PANASONIC HOME APPLIANCES RANDD CENTER HANGZHOU CO LTD PHARADH ET AL.) 28 December 2018 (2018-12-28) * abstract * * paragraphs [0083] - [0095]; figures 1-4 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 June 2020	Examiner Prosig, Christina
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 15 2172

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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18-06-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 104975466 A	14-10-2015	NONE	
US 6256823 B1	10-07-2001	DE 60006616 T2 EP 1067231 A1 US 6256823 B1	30-09-2004 10-01-2001 10-07-2001
US 2007137261 A1	21-06-2007	DE 102006050095 A1 KR 20070044599 A US 2007137261 A1	24-05-2007 30-04-2007 21-06-2007
EP 2740833 A1	11-06-2014	EP 2740833 A1 EP 3181750 A1	11-06-2014 21-06-2017
WO 2015144236 A1	01-10-2015	EP 3122928 A1 WO 2015144236 A1	01-02-2017 01-10-2015
EP 2161364 A2	10-03-2010	CN 101671930 A CN 201520902 U EP 2161364 A2 JP 4636148 B2 JP 2010063522 A TW 201011136 A	17-03-2010 07-07-2010 10-03-2010 23-02-2011 25-03-2010 16-03-2010
CN 208293271 U	28-12-2018	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020110028899 A [0010]
- KR 1020100042984 A [0020]