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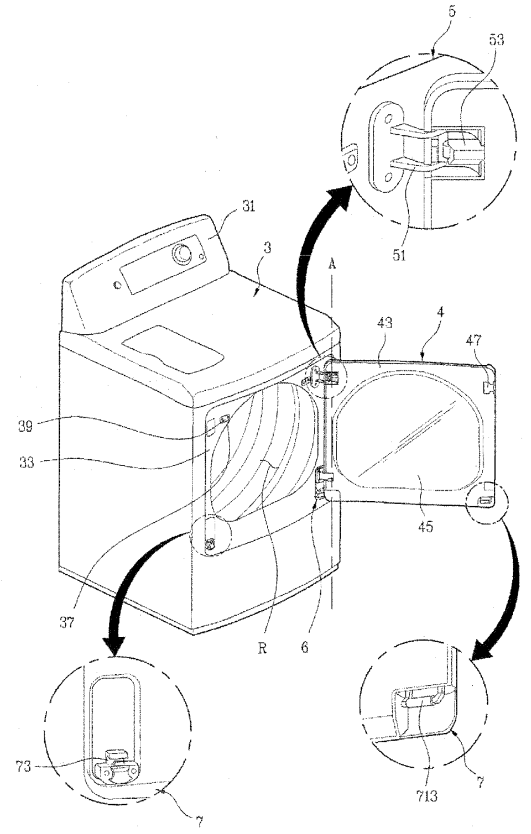
(54) Laundry treating apparatus

(57) There may be disclosed a laundry treating apparatus including a cabinet (3) configured to define a profile thereof, the cabinet (3) comprising a laundry introduction opening (37) formed therein, a door (4) configured to open and close the laundry introduction opening (37), a fixing member configured to support the door for the door to maintain a state of being rotated a predetermined angle with respect to the laundry introduction opening (37), wherein the angle of the door maintained by the fixing member is less than 90 degrees such that laundry may be loaded into the accommodating room (R) via the laundry introduction opening (37) after colliding with the door (4).

【Figure 2】



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Description

[0001] Embodiments may relate to a laundry treating apparatus, more particularly, to a laundry treating apparatus which can secure an open door at various angles. Generally, a laundry treating apparatus may be categorized into a washing-only apparatus only having a washing function, a drying-only apparatus only having a drying function and a laundry washing/drying apparatus having both of the washing and drying functions. Also, based on a structure and a type, the laundry treating apparatuses may be categorized into a drum type laundry treating apparatus which dries laundry while tumbling the laundry by using a rotatable drum and a cabinet type laundry treating apparatus which dries laundry while hanging the laundry therein.

[0002] In a conventional washing/drying apparatus, a laundry introduction opening is formed in a front of a cabinet to introduce laundry there through. Also, a door may be installed to the front of the cabinet to open and close the laundry introduction opening. Here, the door includes a single shaft capable of rotating along a right and left direction to open and close the opening.

[0003] In the meanwhile, the laundry treating apparatus that is the drying-only apparatus may be arranged next to a lateral side of the washing-only apparatus in a line. To dry the laundry washed in the washing-only apparatus, a user may typically unload the washed laundry out of the washing-only apparatus and he or she may load it into the drying-only apparatus via the laundry introduction opening.

[0004] In the conventional laundry treating apparatus including the washing/drying apparatus or the drying-only apparatus, the door is able to be fixed in a state of closing the opening through which the laundry is introduced, not enough to be secured to maintain a state of partially opening the opening, which may be a disadvantage.

[0005] Accordingly, the embodiments may be directed to a laundry treating apparatus. To achieve these objects and other advantages and in accordance with the purpose of the embodiments, as embodied and broadly described herein, a laundry treating apparatus includes a laundry treating apparatus includes a cabinet configured to define a profile thereof, the cabinet comprising a laundry introduction opening formed therein; a door configured to open and close the laundry introduction opening; a fixing member configured to support the door for the door to maintain a state of being rotate a predetermined angle with respect to the laundry introduction opening, wherein the angle of the door maintained by the fixing member is an angle at which laundry moves to the laundry introduction opening along a guide of the door.

[0006] The laundry treating apparatus may further include a pivot provided in a lower portion of the laundry introduction opening along a traverse direction of the cabinet, to form a center of rotation of the door.

[0007] The fixing member may enable the door fixed at least two angles.

[0008] The at least two angles may be approximately 35 degrees and 85 degrees.

[0009] The fixing member may include a recessed piece provided in a lower portion of the door, with being recessed a predetermined depth; and a projected piece inserted in the recessed piece, once the door closes the laundry introduction opening, and supporting the door, once the door opens the laundry introduction opening, the projected piece projected from the cabinet.

[0010] The projected piece may contact with a lower end of the door, only to stop the rotation of the door, once the door opens the laundry introduction opening.

[0011] A plurality of projected pieces and a plurality of recessed pieces may be arranged in symmetry with respect to a center of the door.

[0012] The fixing member may include a tilted piece provided in a lower end of the door, with a predetermined tilted angle, and when the door rotates, the tilted piece surface-contacts with the cabinet to stop the rotation of the door.

[0013] The fixing member may further include a damper provided in the tilted piece to absorb a shock generated by the contact between the tilted piece and the cabinet.

[0014] The fixing member may include a guide part provided in the cabinet, the guide part comprising a guide groove divided into a plurality of portions, in communication with each other; a connection part arranged in the door, the connection part comprising a guide projection accommodated by the guide groove to allow a moving passage thereof guided, and an angle at which the door opens the laundry introduction opening is changed according to which portion of the divided portions provided in the guide groove accommodates the guide projection.

[0015] The guide groove may be divided into at least three portions.

[0016] The fixing member may include a first adjusting plate provided in the pivot, first and second grooves provided along an outer circumferential surface of the first adjusting plate, spaced apart a predetermined distance from each other; and a first detaching part comprising a first body provided in the door to move along the outer circumferential surface of the first adjusting plate, when the door rotates, and a first body elastic supporting part having an end coupled to the first body and the other end coupled to the door to elastically support the first body.

[0017] The fixing member may further include a second adjusting plate provided in the pivot, spaced apart a predetermined distance from the first adjusting plate; a stopper projected from an outer circumferential surface of the second adjusting plate; and a second detaching part provided in the door to move along the outer circumferential surface of the second adjusting plate, when the door rotates, the second detaching part comprising a second body contacting with the stopper, when the first body is inserted in the second groove, and a second elastic body supporting part having an end coupled to the second body and the other end coupled to the door to elastically

support the second body.

[0018] The fixing member may further include a torsion spring provided in an outer circumferential surface of the pivot, the torsion spring having an end fixed to the door and the other end fixed to the pivot.

[0019] The first groove and the second groove may be spaced apart 30 degrees from each other.

[0020] The fixing member may include a supporting body fixed to the cabinet; a rotating body having the door fixed thereto; an inserting body having the pivot inserted thereto to rotatably couple the supporting body to the rotating body; a plurality of fixing holes spaced apart a predetermined distance from each other along a circumferential direction of the pivot; and a fixing projection member provided in the inserting body to be detachably inserted in the fixing hole.

[0021] The fixing member may include a cabinet fixing part fixed to an outer surface of the cabinet; a door fixing part fixed to the door and rotatably coupled to the cabinet fixing part via the pivot; a door tilting adjustment part provided in the cabinet, the door tilting adjustment part comprising a plurality of projection receiving grooves spaced apart a predetermined distance from each other; and a hinge supporter extended from the door fixing part to pass through the cabinet, the hinge supporter comprising a projection detachably inserted in the projection receiving groove when the door rotates.

[0022] It is to be understood that both the foregoing general description and the following detailed description of the embodiments or arrangements are exemplary and explanatory and are intended to provide further explanation of the embodiments as claimed.

[0023] Arrangements and embodiments may be described in detail with reference to the following drawings in which like reference numerals refer to like elements and wherein:

[0024] FIG. 1 is a perspective view illustrating a laundry treating apparatus according to an exemplary embodiment;

[0025] FIG. 2 is a diagram illustrating a door shown in FIG. 1 which is rotated along a first rotational direction;

[0026] FIG. 3 is a diagram illustrating the door shown in FIG. 1 which is rotated along a second rotational direction;

[0027] FIG. 4 is a diagram illustrating a second hinge which is rotated along a first rotational direction;

[0028] FIG. 5 is a diagram illustrating the second hinge which is rotated along a second rotational direction;

[0029] FIG. 6 is a conceptual diagram illustrating an open stat of the door;

[0030] FIG. 7 is a perspective view illustrating key parts of the laundry treating apparatus according to the embodiment;

[0031] FIG. 8 is a diagram specifically illustrating a guide part shown in FIG. 7;

[0032] FIG. 9 is a diagram illustrating a laundry treating apparatus according to another embodiment;

[0033] FIG. 10 is an enlarged view partially illustrating a guide part shown in FIG. 9;

[0034] FIG. 11 is an enlarged view partially illustrating a connection part;

[0035] FIG. 12 is a diagram illustrating a converted example of the connection part;

[0036] FIG. 13 is a diagram illustrating a converted example of the embodiment;

[0037] FIG. 14 is a diagram illustrating an inner surface of FIG. 13;

[0038] FIG. 15 is a diagram illustrating key parts of a laundry treating apparatus according to a further embodiment;

[0039] FIG. 16 is a sectional view illustrating a center region of FIG. 15;

[0040] FIG. 17 is a perspective view illustrating the laundry treating apparatus according to the further embodiment;

[0041] FIG. 18 is a diagram illustrating an inner structure of a door provided in the laundry treating apparatus;

[0042] FIG. 19 is a perspective view illustrating a second hinge provided in the laundry treating apparatus;

[0043] FIGS. 20 and 21 are diagrams illustrating a first hinge provided in the laundry treating apparatus;

[0044] FIGS. 22 to 26 are diagrams illustrating a fourth hinge provided in the laundry treating apparatus;

[0045] FIG. 27 is a diagram illustrating a structure of a cabinet detaching part provided in the fourth hinge;

[0046] FIG. 28 is a diagram illustrating a fixing structure of a twisted spring provided in a door;

[0047] FIGS. 29 and 30 are diagrams illustrating a fifth shaft detecting part having a fifth shaft of the fourth hinge detachable there from;

[0048] FIG. 31 is a perspective view illustrating a dryer according to a still further embodiment and a washing machine having the dryer;

[0049] FIG. 32 is a perspective view partially illustrating a door provided in the dryer shown in FIG. 31, which is open and closed along a vertical direction;

[0050] FIG. 33a is a perspective view illustrating a coupling relation between a second hooking member and a second shaft of a second hinge located in the door and FIG. 33b is a perspective view illustrating a vertical rotation state of the second hooking member shown in FIG. 32 and FIG. 33c is a sectional view illustrating a fixing projection member elastically inserted in and separated from a fixing hole;

[0051] FIG. 34a is a perspective view illustrating a hingedly connecting relation between a rotation member shown in FIG. 32 and a rotation member in the door and FIG. 34b is a perspective view illustrating a vertical rotation state of the rotation member shown in FIG. 34a;

[0052] FIG. 35 is a perspective view illustrating a coupling relation between a first hooking member located in a dryer cabinet shown in FIG. 32 and a first hinge member located in a door;

[0053] FIG. 36 is a perspective view illustrating a dryer having a door which is open along a horizontal direction as shown in FIG. 32 and a washing machine having the

door;

[0054] FIG. 37 is a perspective view illustrating the door of the dryer shown in FIG. 36, which is open and closed along the horizontal direction;

[0055] FIG. 38 is a perspective view illustrating a rotation state of a second hooking member and a second hinge member, when the door shown in FIG. 37 is open along the horizontal direction;

[0056] FIG. 39 is a perspective view illustrating a rotation state of a first hooking member and a first hinge member, when the door shown in FIG. 37 is open along the horizontal direction;

[0057] FIG. 40 is a perspective view illustrating a hingedly connecting relation between the rotation member shown in FIG. 37 and a rotation member of the door;

[0058] FIG. 41 is a perspective view illustrating a laundry treating apparatus according to a still further embodiment;

[0059] FIG. 42 is a diagram illustrating a door and a hinge unit provided in the laundry treating apparatus according to the embodiment shown in FIG. 41;

[0060] FIG. 43 is a diagram illustrating the motion of a first hinge according to the embodiment;

[0061] FIGS. 44 to 46 are diagrams illustrating movement of second and third hinges consisting of the hinge unit;

[0062] FIG. 47 is a diagram illustrating another embodiment of the second and third hinges;

[0063] FIG. 48 is a diagram illustrating another embodiment of a door slope adjusting part provided in the laundry treating apparatus according to the embodiment;

[0064] FIG. 49 is a conceptual diagram illustrating a door securing part provided in the laundry treating apparatus according to the embodiment of FIG. 41 to prevent downward movement of the door;

[0065] FIG. 50 is a sectional diagram illustrating the door according to the embodiment of FIG. 41 that is rotated in a second direction;

[0066] FIG. 51 is a diagram specifically illustrating a damper unit of FIG. 50;

[0067] FIG. 52 is a conceptual diagram illustrating another embodiment of the damper unit;

[0068] FIG. 53 is a conceptual diagram illustrating a further embodiment of the damper unit;

[0069] FIG. 54 is a conceptual diagram illustrating a still further embodiment of the damper unit; and

[0070] FIG. 55 is a conceptual diagram illustrating a still further embodiment of the damper unit.

[0071] To solve the disadvantages mentioned above, embodiments may provide a laundry treating apparatus including a door which is able to be secured in a state of partially opening a laundry introduction opening.

[0072] Furthermore, the embodiments may provide a laundry treating apparatus which is able to adjust an opening degree of the door with respect to the laundry introduction opening variously and to fix the rotated degree that is changed variously.

[0073] As follows, exemplary embodiments will be described in detail in reference to the accompanying drawings. Reference may now be made in detail to specific embodiments, examples of which may be illustrated in the accompanying drawings. Wherever possible, same reference numbers may be used throughout the drawings to refer to the same or like parts.

[0074] FIG. 1 is a perspective view illustrating a laundry treating apparatus according to an exemplary embodiment. FIG. 2 is a diagram illustrating a door shown in FIG. 1 which is rotated along a first rotational direction. FIG. 3 is a diagram illustrating the door shown in FIG. 1 which is rotated along a second rotational direction. As follows, the laundry treating apparatus according to the embodiment will be described in reference to FIGS. 1 to 3.

[0075] The laundry treating apparatus according to the embodiment may include a cabinet 3 having a laundry accommodating room (R) and a laundry introduction opening 37 enabling laundry loaded into the laundry accommodating room, a door 4 provided to open and close the opening 37, and a hinge unit 5, 6, and 7 configured to rotate the door 4 to open and close the opening, along different directions.

[0076] The cabinet 3 may define a profile of the laundry treating apparatus and the laundry introduction opening 37 may be provided through an outer panel 33 provided in a side of the cabinet to communicate with the laundry accommodating room (R).

[0077] A locking projection receiving part 39 may be provided in the outer panel 33 to receive a locking projection 47 provided in the door 4. The locking projection 47 of the door 4 may be received in the locking projection receiving part 39 provided in the cabinet, such that the door 4 may open and close the laundry introduction opening.

[0078] In the meanwhile, a control panel 31 may be provided on the cabinet 3 to enable a user to input a control command to the laundry treating apparatus.

[0079] The hinge unit 5, 6 and 7 may form a first pivot (A) to rotate the door to open and close the opening 37 and a second pivot (B) to rotate the door 4 to open and close the opening 37 along a different direction from a direction of the first pivot (A). The first pivot (A) may be vertical to the cabinet 3 and the second pivot (B) may be horizontal to the cabinet 3.

[0080] The first pivot may be formed by a first hinge 5 and a second hinge 6. The second pivot may be formed by the second hinge 6 and a third hinge 7.

[0081] In FIGS. 2 and 3, the first pivot (A) may be formed along a longitudinal direction of the cabinet 3 (A vertical pivot) and the second pivot (B) may be formed along a width direction of the cabinet (A horizontal pivot). However, the location of the first pivot and the location of the second pivot may not be limited to what shown in FIG. 2 necessarily.

[0082] In other words, the first pivot and the second pivot may be located at various positions of the cabinet only if they enable the door to be rotated along various directions to open the opening (only if the first pivot and

the second pivot form a preset angle). Here, the direction of the first pivot (the first direction) may be different from the direction of the second pivot (the second direction).

[0083] Here, as shown in FIG. 3, the second pivot may be provided along the width direction of the cabinet to enable the door to be tilted with respect to a lower end of the opening 37. In this case, there may be an effect of efficient laundry loading caused by adjusting a tilting angle of the door, which will be described later.

[0084] The hinge unit may include the first hinge 5 having a first shaft consisting of the first pivot (A) to couple and detach the door to and from the cabinet 3, the second hinge 6 having a second shaft consisting of the first pivot (A) together with the first shaft and a third shaft consisting of the second pivot (B), and the third hinge 7 having a fourth shaft consisting of the second pivot (B) together with the third shaft to couple and detach the door 4 to and from the cabinet 3.

[0085] The first hinge 5 may include the first shaft 51 forming the first pivot and a first shaft detaching part 53 having a first receiving groove formed therein to receive the first shaft 51. The first shaft 51 may be installed in the cabinet 3 and the first shaft detaching part 53 may be provided in the door 4. Alternatively, the first shaft 51 may be installed in the door 4 and the firs shaft detaching part 53 may be installed in the cabinet 3.

[0086] The third hinge 7 may include the fourth shaft 713 to form the second pivot (B) and a fourth shaft detaching part 73 having a second receiving groove formed therein to receive the fourth shaft 713. The fourth shaft 713 may be installed in the door 4 and the fourth shaft detaching part 73 may be provided in the cabinet 3. Alternatively, the fourth shaft 713 may be installed in the cabinet 3 and the fourth shaft detaching part 73 may be installed in the door 4.

[0087] As shown in FIG. 2, when the door is rotated along a first direction, the first hinge 5 and the second hinge 6 may rotatably couple the door 4 to the cabinet 3. At this time, the fourth shaft 713 of the third hinge 7 is detached from the fourth shaft detaching part 73, such that the door 4 may be detached from the cabinet 3.

[0088] In contrast, as shown in FIG. 3, when the door is rotated along a second direction, the second hinge 6 and the third hinge 7 may be connected so as to rotate the door 4. At this time, the first shaft detaching part 3 may be detached from the first shaft 51, such that the door 4 may be separated from the cabinet 3.

[0089] In other words, when the door 4 is rotated along one of the first and second directions, the second hinge 6 may always couple the cabinet to the door but the first hinge 5 and the third hinge 7 may couple or detach the door to or from the cabinet.

[0090] The door 4 may include an inner frame 43 provided toward the outer panel 33 and an outer frame 41 coupled to the inner frame to from a profile of the door 4.

[0091] The door may further include a transparent part 45 insertedly provided in the opening 37. The transparent part 45 may prevent the laundry located in the laundry accommodating room (R) from coming out through the laundry introduction opening and it may also allow the user to see the laundry accommodating room (R) during the operation of the laundry treating apparatus.

[0092] As shown in FIG. 3, a recessed part 992 recessed a preset distance along a longitudinal direction may be provided at an upper end of the door 4. The recessed part 992 may be longitudinally extended along a width direction of the door 4 and it may be extended as long as the horizontal length of the door 4.

[0093] A pressing piece 990 that is able to be grasped by the user may be provided at a center of the recessed part 992. The pressing piece 990 may be installed at the center of the door 4 to allow the user to press the door 4 when rotating it along the second rotational direction. When the user is pressing the pressing piece 990, the door 4 may be stably rotated along the rotational direction the user selects by a variety of elements installed in the door 4 which will be described later.

[0094] In the meanwhile, the user may grasp the recessed part 992 to rotate the door 4, without grasping the pressing piece 990 located at the center of the recessed part 992. When trying to rotate the door 4 along the first rotational direction, not the second rotational direction, the user may grasp not the pressing piece 990 but other portions of the recessed part 992 where the pressing piece 990 is not located, to rotate the door 4. For example, when the trying to rotate the door along the first rotational direction, the user may grasp a portion located in opposite to the first pivot (A) of the first rotational direction and he or she may open the door 4 after that.

[0095] FIG. 4 is a diagram illustrating the second hinge which is rotated along a second rotational direction. FIG. 5 is a conceptual diagram illustrating an open stat of the door. As follows, the embodiment will be described in reference to FIGS. 4 and 5.

[0096] The second hinge 6 may couple the cabinet 3 to the door 4, to secure the door 4 in a state of being selectively rotatable along the first and second rotational directions. The second hinge 6 may allow the door 4 to be rotatably coupled to the cabinet 3 when the door 4 is rotated on both of the first and second pivots.

[0097] The second hinge 6 may include a cabinet securing part 61 secured to the cabinet 3 and a door securing part 65 secured to the door 4.

[0098] A second shaft 651 composing the first pivot may be provided in the door securing part 65. The door 4 may be rotated on the second shaft 651 along the first rotational direction

[0099] The door securing part 65 and the cabinet securing part 61 may be rotatable on a third shaft 63. The third shaft 63 may compose the second pivot. Accordingly, the door 4 may be rotated on the third shaft 63 along the second rotational direction.

[0100] As shown in FIG. 4, the door securing part 65 and the cabinet securing part 61 may not be bent at the third shaft 63 when the door 4 is rotated along the first

rotational direction. When the door 4 is rotated along the first rotational direction, no relative motion is generated between the door securing part 65 and the cabinet securing part 61. Because of that, the coupling between the door securing part 65 and the cabinet securing part 61 may be maintained without change.

[0101] A recess 42 recessed to a preset depth may be formed at a lower end of the door 4 and the recess 42 may provide a predetermined space where the cabinet securing part 61 is received. As shown in FIG. 5, the recess 42 may form a sufficient space not to generate interference between the cabinet securing part 61 and the lower end of the door 4 and the door 4 is rotated along the second rotational direction.

[0102] When the door 4 is rotated along the second rotational direction, the lower end of the door 4 may be moved toward the cabinet 3. As a result, a predetermined space has to be provided between the door 4 and the cabinet 3 to rotate the door 4 along the second rotational direction. For that, the recess 42 may be formed at the lower end of the door 4 and the door 4 may be rotated as far as the space provided by the recess 42 accordingly.

[0103] As shown in FIG. 5, when the door 4 is rotated along the second rotational direction, the door securing part 65 is rotated on the third shaft 63. in other words,

[0104] In other words, when the door 4 is rotated along the second rotational direction, the door 4 may not be rotated along the first rotational direction and the door 4 may not be rotated on the second shaft 651 accordingly.

[0105] FIG. 6 is a conceptual diagram illustrating an open state of the door. As follows, the embodiment will be described in reference to FIG. 5.

[0106] The door 4 may open the laundry introduction 37 at two angles with respect to the cabinet 3. In other words, as shown in FIG. 6, the door 4 may be coupled at a position of opening the laundry introduction opening 37 relatively less and a position of opening the laundry introduction opening 37 relatively more, in a state of having opened the laundry introduction opening 37. At this time, an angle at which the door 4 is opening the laundry introduction opening 37 relatively less may be referenced to as 'a first angle (θ 1)' and an angle at which the door 4 is opening the laundry introduction opening 37 relatively more may be referenced to as 'a second angle (θ 2)'.

[0107] The first angle may be approximately 30 degrees and the second angle may be approximately 85 ~ 90 degrees. Here, the first angle and the second angle may be changed into other values from the values mentioned above.

[0108] Based on the embodiment, it may be possible to stop the door 4 at other angles rather than the first and second angles. For explanation convenience, an angle at which the door 4 closes the opening 37, that is, an angle of the door 4 standing vertically may be referenced to as 'a third angle'.

[0109] According to the embodiment, the door 4 may be open the laundry introduction opening 37 at two positions to introduce the laundry via the opening 37.

[0110] For example, the angle of the door 4 may be relatively close to being perpendicular at a position at which the door 4 opens the opening 37 less. As a result, when the user tries to load the laundry into the opening 37, the laundry may be introduced into the laundry accommodating room smoothly via the laundry introduction opening 37 because of a tilted angle of the door 4, even if the laundry collides against the door 4.

[0111] In contrast, when the door 4 opens the opening 37 less in case the user tries to unload the laundry accommodated in the laundry accommodating room (R) via the laundry introduction opening 37, inconvenience might be given to the user. For the user to unload the laundry smoothly after putting his or her arm into the laundry accommodating room (R), it is necessary for the door 4 to open the laundry introduction opening 37 sufficiently. As a result, the door 4 has to be coupled in a state of having opened the laundry introduction opening 37 relatively more.

[0112] FIG. 7 is a perspective view illustrating key parts of the laundry treating apparatus according to the embodiment.

[0113] The laundry treating apparatus according to the embodiment may include a guide part 1300 installed in the cabinet 3 and a connection part 1320 installed in the door 4.

[0114] A guide groove 1301 recessed a predetermined depth may be formed in the guide part 1300. A guide projection 1322 may be provided in the connection part 1320 to be received in the guide groove 1301 to have a moving path thereof guided. The guide projection 1322 may be guided according to the shape of the guide groove 1301.

[0115] In the meanwhile, the guide projection 1322 may be stopped at various positions of the guide groove 1301 while being moved along the shape of the guide groove 1301 in the guide groove 1301. At this time, an opening degree of the laundry introduction opening 37 may be differentiated based on the positions of the guide projection 1322.

[0116] Especially, the guide groove 1301 may be recessed toward the pivot of the door 4. In other words, the guide groove 1301 may be recessed toward the center of the pivot, that is, along an opposite direction to a radial direction of the pivot. The pivot of the door 4 may be arranged underneath the door 4 and it may be the center of the rotation of the door 4 along a clockwise direction or a counter-clockwise direction with respect to FIG. 6. When the door 4 is rotated along the clockwise direction, an opening degree of the laundry introduction opening 37 may be increased. When the door 4 is rotated along the counter-clockwise direction, the opening degree may be decreased.

[0117] The guide projection 1322 may be projected correspondingly toward the recessed direction of the guide groove 1301 to be moved in a state of received in the guide groove 1301.

[0118] The connection part 1320 may be rotatably

shaft-coupled to the door 4. As shown in an arrow line of FIG. 6, the connection part 1320 may be moved with being freely rotatable with respect to the door 4 and it may be moved along the shape of the guide groove 1301.

[0119] FIG. 8 is a diagram specifically illustrating the guide part shown in FIG. 7 and the guide part will be described in reference to FIG. 8 as follows.

[0120] The guide groove 1301 may include three guide grooves of a first guide groove 1302, a second guide groove 1306 and a third guide groove 1310. The first guide groove 1302, the second guide groove 1306 and the third guide groove 1310 may be connected with each other, such that the guide projection 1322 may be movable from each of the guide grooves to another.

[0121] The first guide groove 1302 may guide the guide projection 1322 to stop the door 4 at the first angle and a first seating protrusion 1304 may be formed at an end of the first guide groove 1302 to seat the guide projection 1322 at the first angle.

[0122] The first seating protrusion 1304 may reduce the width of the first guide groove 1302 by a predetermined value. Here, the first seating protrusion 1304 may be upwardly projected a predetermined distance from a lower end of the first guide groove 1302. That is, the guide projection 1322 may be stopped at the moment when meeting the first seating protrusion 1304 in the middle of passing the first guide groove 1302, such that the door 4 may be stopped at the first angle.

[0123] The second guide groove 1306 may guide the guide projection 1322 to stop the door at the second angle and a second seating protrusion 1308 may be formed at an end of the second guide groove 1306 to seat the guide projection 1322 at the second angle.

[0124] The second seating protrusion 1308 may finish the end of the second guide groove 1306 and the guide projection 1322 may not move downwardly after stopped by the second seating protrusion 1308.

[0125] The third guide groove 1310 may guide the guide projection 1322 to stop the door 4 at the third angle at this time, the third angle may be the angle at which the door 4 is arranged perpendicularly to close the opening 37 airtight, different from the first and second angles.

[0126] In the meanwhile, a guide piece 1312 projected from the guide groove 1301 may be provided at a center of the guide groove 1301 to limit the motion of the guide protrusion 1322. The guide piece 1312 may be projected toward an opposite direction to the recessed direction of the guide groove 1301. The guide piece 1312 may be moved along a path formed in the guide groove 1301 receiving the guide projection 1322.

[0127] The first guide groove 1302 may be divided into a portion located beyond the guide piece 1312 and a portion located below the guide piece 1312.

[0128] At this time, the first guide groove 1302 located beyond the guide piece 1312 may be inclined a predetermined angle to move downwardly along the direction of the moving guide projection 1322. This is to move the guide projection 1322 in the first guide groove 1302 even without a large force applied by the user, because the door 4 has a self weight.

[0129] An operation method of the laundry treating apparatus according to the embodiment will be described, referring to FIGS. 1 to 8.

[0130] First of all, the door 4 may be stopped at the end (S3) of the first guide groove 1302 shown in FIG. 8, in a state of being arranged at the third angle, that is, a state of having closed the opening 37.

[0131] When the user rotate the door 4 in a direction of getting far from the cabinet 3 to rotate the door 4, in the state where the door 4 is stopped at the end (S3) of the first guide groove 1302, the guide projection 1322 may move along the first guide groove 1302 and the door 4 may gradually increase an opening angle with respect to the opening 37.

[0132] The guide projection 1322 may be moved along the first guide groove 1302 arranged beyond the guide piece 1312. At this time, the guide piece 1312 may be tilted downwardly with respect to the moving direction of the guide projection 1322 such that the guide projection 1322 may be smoothly moved along the first guide groove 1302 by the weight of the door 4.

[0133] When the guide projection 1332 is moving along the first guide groove 1302 arranged below the guide piece 1312, the opening angle of the laundry introduction opening 37 opened by the door may is increasing the guide projection 1322 may stop at a position (S1) where the first seating protrusion 1304 is provided.

[0134] The first seating protrusion 1304 is projected from the first guide groove 1302 so as to stop the movement of the guide projection 1322.

[0135] When the user desires for the door 4 to open the opening 37 at the second angle that is larger than the first angle, the user may apply an additional force to the door 4.

[0136] Because of the force applied by the user, the guide projection 1322 may be getting out of the first seating protrusion 1304 and it may move along the second guide groove 1306 after that. The guide projection 1322 may move along the second guide groove 1306 after getting out of the first guide groove 1306, because an end of the first guide groove 1302 is connected with the second guide groove 1306.

[0137] The second guide groove 1306 may be formed along a longitudinal direction of the door. Accordingly, the guide projection 1322 may move downward along the formation direction of the second guide groove 1306.

[0138] When the guide projection 1322 moves to a position (S2) where it can contact with the second seating protrusion 1308 within the second guide groove 1306, the rotation of the door stops and the door 4 opens the laundry introduction opening 37 in a state of being tilted at the second angle.

[0139] Meanwhile, when desiring for the door 4 to close the laundry introduction opening 37, the user may apply a force to the door 4 to rotate the door 4 along the counterclockwise direction. In this case, the guide projection

1322 may be moved to the third guide groove 1310, with being moved upwardly in the second guide groove 1306. An end of the second guide groove 1306 may be connected with the third guide groove 1310. Because of that, the guide projection 1322 may be moved to the third guide groove 1310 out of the second guide groove 1306.

[0140] While the guide projection 1322 is moving upwardly in the third guide groove 1310, the door 4 may decrease the opening angle of the opening 37. When the guide projection 1322 reaches a position (S3) where the third guide groove 1310 is connected with the first guide groove 1302, the motion of the guide projection 1322 may be stopped and the door 4 may be stopped at the third angle. As a result, the door 4 may close the laundry introduction opening 37 airtight.

[0141] Entirely, the position of the guide projection 1322 may be changed from S1 -> S2 -> S3 -> within the guide groove 1301 and it may be fixed at each of the positions.

[0142] At this time, an auxiliary securing member may be used in securing the door 4 in a state where the door closes the laundry introduction opening 37 airtight (at s third angle). In other words, a locking projection 47 may be provided in the door 4 and a locking projection accommodating part 39 may be provided in the cabinet 3.

[0143] Meanwhile, when the user desires to move the door from the first angle to the third angle, not passing the second angle (in other words, rotate the door at the angle at which the door closes the laundry introduction opening 37), the user may rotate the door 4 toward the cabinet to move the guide projection 1322 toward the third guide groove 1310 from the first guide groove 1302.

[0144] At this time, the guide projection 1322 may move along the third guide groove 1310 from the first guide groove 1302 (S1 -> S3).

[0145] FIG. 9 is a diagram schematically illustrating a laundry treating apparatus according to another embodiment. As follows, the laundry treating apparatus according to the embodiment will be described, referring to FIG. 9.

[0146] According to this embodiment, the guide groove 1301 may be recessed along a longitudinal direction of the second pivot (B). Assuming that the second pivot (B) of the door 4 is located at a lower end of the door 4, the guide groove 1301 may be formed in a wall installed along a longitudinal direction (namely, a direction of the door height) of the door.

[0147] The guide groove 1301 may be installed in an auxiliary perpendicular wall provided in the cabinet along the longitudinal direction of the door (namely, the door height direction), or it may be installed in a side wall composing the cabinet 3.

[0148] The connection part 1320 may be rotatably coupled to the door 4 and the door 4 is rotatably coupled to the second shaft 651.

[0149] To make the drawing look simple, FIG. 9 shows some elements of the door, not the entire elements thereof.

[0150] The connection part 1320 may be coupled to the second shaft 651 via a connection joint 1326 and it may be hingedly connected to the second shaft 651 via the connection joint 1326.

[0151] The guide groove 1301 may include the three guide grooves of the first guide groove 1302, the second guide groove 1306 and the third guide groove 1310. The first guide groove 1302, the second guide groove 1306 and the third guide groove 1310 may be connected with each other.

[0152] The first guide groove 1302 may guide the guide projection 1322 to stop the door 4 at the first angle and the first seating protrusion 1304 may be formed at an end of the first guide groove 1302 to seat the guide projection 1322 at the first angle.

[0153] The first seating protrusion 1304 may reduce the width of the first guide groove 1302 by a predetermined value. Here, the first seating protrusion 1304 may be upwardly projected a predetermined height from a lower end of the first guide groove 1302. In other words, the guide projection 1322 may be stopped at the moment of meeting the first seating protrusion 1304, while passing through the first guide groove 1302. Because of that, the door 4 may be stopped at the first angle.

[0154] The second guide groove 1306 may guide the guide projection 1322 to stop the door 4 at the second angle and a second seating protrusion 1308 may be formed at an end of the second guide groove 1306 to seat the guide projection therein at the second angle.

[0155] The guide projection 1322 is configured not to move downward after stopping at the second seating protrusion 1308.

[0156] The third guide groove 1310 may guide the guide projection 1322 to stop the door 4 at the third angle. At this time, the third angle may be an angle at which the door is arranged perpendicularly to close the laundry introduction opening 37 airtight, different from the first and second angles.

[0157] Meanwhile, a guide piece 1312 may be provided at a center of the guide groove 1301 to limit the motion of the guide projection 1322. The guide piece 1312 may be projected from the guide groove 1301.

[0158] FIG. 10 is an enlarged view partially illustrating a guide part.

[0159] The guide piece 1312 may have a predetermined thickness to prevent the guide projection 1322 from directly moving to the second guide groove 1306, without stopping at the first seating protrusion 1304.

[0160] The guide piece 1312 can make the width of the first guide groove 1302 entirely uniform such that the guide projection 1322 guiding the first guide groove 1302 can be guided toward the first seating protrusion 1304 by the guide piece.

[0161] FIG. 11 is an enlarged view partially illustrating the connection part.

[0162] The connection joint 1326 that is the end of the connection part 1320 may be formed in a semicircular shape. Especially, an interference piece 1330 may be

provided in a predetermined portion (α) of the connection joint 1326 and the inference piece 1330 may be projected from a surface of the connection joint 1326. The interference piece 1330 may have a radius that is larger than a radius of the connection joint 1326.

[0163] The door 4 is rotatably coupled to the second shaft 651 and the second shaft 651 is rotatably coupled to the cabinet via the third shaft 653. In addition, the connection joint 1326 is coupled to the second shaft 651. Accordingly, once the interference piece 1330 contacts with the second shaft 651, the rotation of the second shaft 651 with respect to the third shaft 653 is temporarily restricted and the opening angle of the door 4 can be temporarily maintained.

[0164] Referring to FIG. 4 and 9, the operation of the laundry treating apparatus according to another embodiment will be described as follows.

[0165] The guide projection 1322 may stop at the position of S3, in the state where the door 4 has closed the laundry introduction opening 37. To fix the guide projection at the position (S3), auxiliary securing members may be provided in the door 4 and the cabinet 3, respectively. Such auxiliary securing members may include a locking projection and a locking projection accommodating part.

[0166] It is necessary that the user should rotate the door to unload or load the laundry from or into the laundry introduction opening 37.

[0167] In case of rotating the door 4 to open the laundry introduction opening 37, the guide projection 1322 may move from the position of S3 along the first guide groove 1302.

[0168] The first guide groove 1302 may be divided into a portion located beyond the guide piece 1312 and a portion located below the guide piece 1312. As shown in FIG 11, when the guide projection 1322 moves along the first guide groove 1302 positioned beyond the guide piece 1312, the interference piece 1330 may contact with the second shaft 651.

[0169] The interference piece 1330 may temporarily restrict the rotation of the connection part 1320 such that the guide projection 1322 may move upward along the first guide groove 1302 positioned beyond the guide piece 1312. In other words, the guide projection 1322 positioned at S3 is prevented from moving to the second guide groove 1306 by the interference piece 1330 and the guide piece 1312.

[0170] The interference piece 1330 may not have a large resistance such that the contact between the interference piece 1330 and the second shaft 651 may be relieved when the door 4 is rotated additionally.

[0171] In the meanwhile, as passing along the portion of the first guide groove 1302 located below the guide piece 1312, the guide projection 1322 may be stopped by the first seating protrusion 1304. The door 4 may be stopped at the position (S1) where the guide projection 1322 is stopped by the first seating protrusion 1304. Because of that, the rotation of the door 4 may be stopped at the first angle.

[0172] After that, when the user rotates the door 4 additionally, the guide projection 1322 moves to the second guide groove 1306 from the first guide groove 1302. Once the guide projection 1322 is seated in the second seating protrusion 1308 formed in the end of the second guide groove 1306, the movement of the guide projection 1322 stops and the rotation of the door 4 also stops. Accordingly, the door 4 may stop the rotation at the second angle, with maintaining the fixed state.

[0173] Meanwhile, the second guide groove 1306 may be gently curved for the end of the second guide groove 1306 to be extended toward the door 4 to rotate the door 4 smoothly, not perpendicularly straight. As the door 4 is rotated, the connection joint 1326 may be moved along an approximately circular locus with respect to the guide projection 1322.

[0174] In case the connection joint 1326 is secured to the second shaft 651, the connection joint 1326 may move in a direction getting far from the cabinet with the rotation of the door.

[0175] When desiring to move the door 4 from the second angle to the third angle, the only have to do is that the user move the guide projection 1322 from the second seating protrusion 1308 to the third guide groove 1310 after rotating the door 4 toward the cabinet.

[0176] Once the door is rotated in the direction toward the cabinet, the guide projection 1322 may move upward along the second guide groove 1306 toward the third guide groove 1310 such that the door may close the laundry introduction opening.

[0177] FIG. 12 is a diagram illustrating a converted example of the connection part.

[0178] As the door is rotated multiple times, the interference piece 1330 of the connection joint 1326 might be worn out. If the projected length of the interference piece 1330 is reduced because of the wear, the interference piece 1330 cannot sufficiently limit the rotation of the connection part 1320 during the motion of the first projection 1322 within the first guide groove 1302. In this case, the guide projection 1322 cannot be moved upwardly along the upper portion of the first guide groove 1302 located beyond the guide piece 1312 and it might be moved from the first guide groove 1302 to the third guide groove 1310.

[0179] In other words, the user tries to rotate the door 4 to the first angle to stop the door 4 but the interference piece 1330 may fail to perform the proper function. Because of that, the door 4 happens to be rotated to the second angle over the first angle and the opening 37 might be opened much unnecessarily and disadvantageously.

[0180] To prevent that, an elastic support piece 1332 capable of providing an elastic supporting force may be provided at a portion where the interference is generated to the interference piece 1330 and the door 4. The elastic support piece 1332 may be a plate spring and it may prevent the abrasion of the interference piece 1330. As a result, the interference piece 1330 may perform the function within the first guide groove 1302 consistently.

[0181] FIG. 13 is a diagram illustrating a converted example of the embodiment. FIG. 14 is a diagram illustrating an inner surface of FIG. 13.

[0182] Two guide projections 1322 may be symmetrically arranged in opposite sides with respect to the connection part 1320. Two guide parts 1300 may be symmetrically arranged in opposite sides with respect to the connection part 1320.

[0183] In other words, according to the example of FIG. 13, one of the two guide projections 1322 arranged with respect to the connection part 1320 may be guided along the guide groove as shown in FIG. 9 and the other one of the two guide projections 1322 with respect to the connection part 1320 may be guided along the guide groove shown in FIG. 14. In other words, an inner structure of the portion shown in FIG. 13 is shown in FIG. 9 and an inner structure of the other portion shown in FIG. 13 is shown in FIG. 14.

[0184] The operation of the embodiment shown in FIG. 9, 13 and 14 may be identical to the operation of other embodiments described above and detailed description of the operation will be omitted accordingly. According to the embodiment in reference to FIG. 9, 13 and 14, the moving passage of the door 4 may be limited by the two guide projections and the securing forces may be provided at positions where the door 4 is stopped. As a result, the door 4 may be moved stably and fixed by a strong securing force.

[0185] FIG. 15 is a diagram illustrating key parts of a laundry treating apparatus according to a further embodiment. FIG. 16 is a sectional view illustrating a center region of FIG. 15. As follows, the key parts will be described in reference to FIGS. 15 and 16. In FIG. 15, hinges provided in both sides of the door 4 are omitted and only a center portion of the door 4 is illustrated.

[0186] This embodiment shows a structure supporting the door 4 in a state where the door is rotated at the second angle. As mentioned above, when the guide projection 1322 is seated in the second seating protrusion 1308, the door 4 may not be rotated any further. However, if an unexpected force such as laundry falling to the door 4 is applied to the door 4, it may be necessary to secure the door 4 more stably.

[0187] A recessed piece 44 recessed a predetermined depth may be formed at a lower portion of the door 4 and a projected piece 32 projected to be inserted in the recessed piece may be formed in a lower portion of the cabinet 3.

[0188] Accordingly, the projected piece is accommodated by the recessed piece 44 in a state where the door 4 has closed the laundry introduction opening 37 (in other words, a state where the door 4 is positioned at the third angle).

[0189] In contrast, when the door 4 is rotated at the second angle, the door is supported by the projected piece 32.

[0190] A single projected piece 32 may be formed at a center of the cabinet 3. Alternatively, a plurality of projected pieces 32 may be symmetrically arranged with respect to the center of the cabinet 3, to reinforce the strength for supporting the door 4. In the latter case, the number of the recessed pieces 4 has to be identical to the number of the projected pieces such that the recessed pieces can accommodate the projected pieces, respectively.

[0191] A laundry treating apparatus 100 according to a further embodiment may include a cabinet 3 configured to define a profile thereof, having a laundry introduction opening 37, an accommodating room (R) arranged in the cabinet to treat (wash and dry) laundry (washing objects or drying objects) and a door 4 configured to open and close the laundry introduction opening 37.

[0192] In case the laundry treating apparatus 100 is structured only to dry, only a drum (not shown) rotatably provided in the cabinet 3 may be provided as the accommodating room (R).

[0193] However, in case the laundry treating apparatus 100 is structured to perform a washing function as well as the drying function, a tub (not shown) provided in the cabinet to hold wash water therein and a drum (not shown) rotatably provided in the tub may be provided as the accommodating room (R).

[0194] The door 4 may be rotated by a hinge unit 5 and 6 provided perpendicular to a bottom surface of the cabinet 3 or a hinge unit 6 and 7000 provided in parallel to the bottom surface of the cabinet 3. The door 4 may include an outer frame 43 having the hinges fixed thereto and an inner frame 41 coupled to the outer frame 43.

[0195] The outer frame 43 may include a first handle 4311 and a second handle 4315. The first handle 4311 may be provided on an upper surface of the outer frame 43, with being bent, and the second handle 4315 may be provided each of both opposite lateral surfaces of the door.

[0196] The first handle 4311 may be used as means for rotating the door with respect to a second hinge 6 and a fourth hinge 7000, which will be described later. The second handle 4315 may be used as means for rotating the door 4 with respect to the second hinge 6 and a first hinge 5, which will be described later.

[0197] In the meanwhile, the door 4 may further include a through hole 4330 provided in a position thereof, corresponding to the laundry introduction opening 37 of the cabinet 3, and a transparent plate 4330 located in the through hole to enable the user to see the inside of the accommodating room (R).

[0198] In this case, the through hole 4330 may be include a frame through hole provided in the outer frame 43 and a cover through hole provided in the inner frame 41. The transparent plate 4340 may include a cover transparent plate provided in the cover through hole and a frame transparent plate provided in the frame through hole.

[0199] A locking unit may be further provided in the door 4 to couple the door to the cabinet 3. The locking unit may include a hook 41 provided in either of the outer

frame 43 and the cabinet 3 and a hook receiving groove 43 provided in the other one of the inner frame 41 and the cabinet 3 to receive the hook.

[0200] Moreover, as shown in FIG. 18, the laundry treating apparatus 100 may include a first hinge 5 having a first shaft (51, see FIGS. 20 and 21) provided perpendicular to the bottom surface of the cabinet 3, a fourth hinge 7000 having a fifth shaft (7100, see FIG. 22) provided in parallel to the bottom surface of the cabinet 3 and a second hinge 6 having a third shaft (63, see FIG. 19) provided in parallel to the fifth shaft 7100 and a second shaft (631, see FIG. 19) provided in parallel to the first shaft 51.

[0201] The second hinge 6 and the fourth hinge 7000 may define a pivot (H) that makes the door open with forming a predetermined angle with respect to a front surface of the cabinet 3 (an opening type shown in FIG. 17 (c)). The second hinge 6 and the first hinge 5 may form a pivot (V) that makes the door 4 open toward a lateral surface of the cabinet 3 (an opening state shown in FIG. 17 (b)).

[0202] Accordingly, the third shaft 63 of the second hinge 6 and the fifth shaft 7100 of the fourth hinge 7000 may be located at the same pivot (H). The second shaft 651 of the second hinge 6 and the first shaft 51 of the first hinge 5 may be located at the same pivot (V).

[0203] In addition, the fourth hinge 7000 and the first hinge 5 may be detachably provided in the door 4 and the detailed structure thereof will be described as follows.

[0204] First of all, the second hinge 6 will be described in reference to FIG. 19.

[0205] The second hinge 6 may include a cabinet securing part 61 secured to the cabinet 3 and a door securing part 65 secured to the door 4.

[0206] In this case, the door securing part 65 may be rotatably provided in the cabinet securing part 61 via the third shaft 63 provided in parallel to the bottom surface of the cabinet.

[0207] In other words, the cabinet securing part 61 may include a cabinet securing plate 611 secured to the cabinet 3 and a rotating plate 613 rotatably coupled to the cabinet securing plate 611 via the third shaft 63, with the door securing part 65 coupled thereto.

[0208] The door securing part 65 may include a securing part connection plate 631 secured to the rotating plate 613, the second shaft 651 fixed to the securing part connection plate 631, in parallel to the bottom surface of the cabinet 3, and a door securing plate 633 rotatably provided in the securing part connection plate 631 by the second shaft 651, with being secured to the door 4.

[0209] In this case, the second shaft 651 may be fixed to the securing part connection plate 631 by a shaft fixing rib 637 and the shaft fixing rib 637 may not be bent, different from FIG. 19.

[0210] The first hinge 5 may include the first shaft (51, which is fixed to the cabinet 3 to have the same pivot as that of the fourth shaft) provided in perpendicular to the bottom surface of the cabinet 3, with passing a center of the second shaft 651, and a first shaft detaching part 53 provided in the door 4, with being detachable from the first shaft 51.

[0211] As shown in FIG. 20, the first shaft detaching part 53 may include a housing 532 provided in the door 4, a first shaft receiving groove 531 provided in the housing 532 to receive the first shaft 51 therein, a fixing body 5330 having an end located in the housing 532 and the other end located in the first shaft receiving groove 531, and a fixing body elastically supporting part 5340 located in the housing 532 to elastically support the fixing body 5330.

[0212] The first shaft 51 may include cut-surfaces 511 provided in opposite (facing each other symmetrically) along a longitudinal direction.

[0213] In this case, the first shaft receiving groove 531 may include a cut-surface receiving groove 5311 having a corresponding width to a distance between the cut-surfaces 511 of the first shaft 51 and a circular groove 5313 having a radius that is identical to a curvature (r) of a connecting surface 513 connecting the cut-surfaces with each other.

[0214] The circular groove 5313 may be connected to the cut-surface receiving groove 5311 and a diameter of the circular groove 5313 may be longer than the distance between the cut-surfaces 511.

[0215] Thus, there may be an effect that the first shaft 51 can be connected to or detached from the first shaft detaching part 53 smoothly, when the door 4 is rotated on the third shaft 63 and the fifth shaft 7100, and that the first shaft detaching part 63 can be prevented from being separated from the first shaft 51, when the door 4 is rotated on the first shaft 51 and the second shaft 651.

[0216] In other words, when the door 4 is rotated on the third shaft 63 of the second hinge and the fifth shaft 7100 of the fourth hinge, a cut-away surface 511 of the third shaft maintains parallel to a cut-away surface receiving groove 5311. Accordingly, the first shaft detaching part 53 may be detachable from the first shaft 51.

[0217] However, once the door 4 starts to be rotated on the first shaft 51 and the second shaft 651 of the second hinge, the connecting surface 513 of the first shaft may contact with the circular groove 5313. The first shaft 51 may be prevented from separated from the first shaft receiving groove 531, because the diameter (2r) of the circular groove 5313 is larger than the width (w) of the cut-surface receiving groove 5311.

[0218] In the meanwhile, at least one inclined surface may be provided in the first shaft receiving groove 531 to guide the first shaft 51 to the cut-surface receiving groove 5311, when the first shaft detaching part 53 is coupled to the first shaft 51. FIG. 20 illustrates a first inclined surface 5381 and a second inclined surface 5383.

[0219] The fixing body 5330 may be means for supporting the shaft 51 received in the circular groove 5313 may be supported by the fixing body elastically supporting part 5340.

[0220] As a result, the fixing body 5330 may be moved to the housing 532, when the first shaft 51 is inserted in the cut-surface receiving groove 5311, and it may be exposed to the cut-surface receiving groove 5311, when the first shaft 51 is inserted in the circular groove 5313, such that the fixing body 5330 may be support the first shaft 51 to prevent the first shaft 51 from being separated from the circular groove 5313.

[0221] FIG. 21 illustrates another example of the first hinge 5 described above this example of the first hinge 5 may include a first shaft 51 fixed to the cabinet 3 and a first shaft detaching part 53 provided in the door 4, being detachable from the first shaft 4.

[0222] The first shaft detaching part 53 may include a housing 532 fixed to the door 4, a first shaft receiving body 535 rotatably coupled to the housing and a receiving body elastically supporting part 537 configured to elastically support the first shaft receiving body.

[0223] The first shaft receiving body 535 may include a first shaft receiving groove (R1) to receive the first shaft 51 therein and a first shaft guider 5353 to guide the first shaft toward the first shaft receiving groove (R1), when the first shaft is coupled to the first shaft detaching part.

[0224] In the meanwhile, the first shaft receiving groove (R1) may be formed by a projection 5351 and the first shaft guider 5353, as shown in FIG. 21. In this case, the length of the first shaft guider 5353 may be larger than the length of the projection 5351.

[0225] The receiving body elastically supporting part 537 may include a piston 5371 provided in the housing 532, in contact with the first shaft receiving body 535, and a spring 5373 configured to elastically support the piston 5371.

[0226] In this case, at least one body inclined surface 5355 may be provided in the first shaft receiving body 535 to contact the piston 5371 and the housing 532, in case of rotating. Because of the body inclined surface, there may be an effect of controlling a rotational angle of the first shaft receiving body 535 when the first shaft 51 is coupled to or separated from the first shaft detaching part 53.

[0227] Also, the body inclined surface 5355 may generate a sound when contacting with the piston 5371 or the piston 5371 in the rotation of the first shaft receiving body 535, such that the user may be effectively informed of the completion of coupling or detaching between the first shaft 51 and the first shaft detaching part 53.

[0228] In the meanwhile, the laundry treating apparatus 100 may have a structure in that the second hinge 6 and the first hinge 5 may be selectively coupled to a right or left side of the door, to enable the user to change a rotational direction of the door 4 conveniently.

[0229] As shown in FIG. 18, the inner frame 41 provided in the door 4 may include two first securing parts 4321 provided at symmetrical positions with respect to a straight line (D) passing the center (G) of the door 4, respectively, to secure the first shaft detaching part 53 thereto, and two second securing parts 4323 provided at other symmetrical positions with respect to the straight line (d) passing the center (G) of the door, respectively, to secure the door securing part 65 of the second hinge 6 thereto. The cabinet 3 may include two first shaft securing parts (317, see FIG. 17 (b)) provided at corresponding positions to the first securing parts 4321, respectively, to secure the first shaft 51 of the first hinge 5 secured thereto, and two securing plate fastening parts (319, see FIG. 17 (b)) provided at corresponding positions to the second securing parts (4323, see FIG. 18) to fasten the cabinet securing plate 611 of the second hinge 6 thereto.

[0230] In this case, the first detaching part 53 of the first shaft 51 may be in parallel to the first shaft 61 of the first hinge, in symmetry with respect to a straight line (K1) passing a center of the first shaft 51. Also, the securing part connection plate 631, the second shaft 651 and the door securing plate 633 may be in parallel to the third shaft 63, in symmetry with respect to a straight line (k2) passing through a center of the second shaft 651.

[0231] As a result, in case the user is right-handed, the second hinge 6 and the first hinge 5 may be located on the right side of the cabinet (as shown in FIG. 18). In case the user is left-handed, the second hinge 6 and the first hinge 5 may be located on the left side of the cabinet 3.

[0232] When the second hinge 6 and the first hinge 5 are located on the left side of the cabinet 3 as shown in FIG. 18, the second hinge 6 is rotated to change the upper and lower portions of the securing part connection plate 631 shown in FIG. 19 to secure the securing part connection plate 631 to the rotation plate 613. After that, the second hinge 6 may secure the securing part connection plate 631 to the securing part fastening portion (319, see FIG. 17(b)).

[0233] When the second hinge 6 and the first hinge 5 are located on the left side of the cabinet 3 as shown in FIG. 18, the first hinge 5 may be rotated to change the first shaft 51 of Fig. 20 up and down and it may be secured to the first shaft securing part (317, see FIG. 17(b)) located on the left side of the cabinet 3. Here, the first shaft detaching part 53 of FIG. 20 may be rotated to changed up and down and it may be secured to the first securing part 4321 located on the left side of the inner frame 41.

[0234] Meanwhile, a securing cover (4211, see FIG. 18) may be further provided in the inner frame 41 to prevent exposure of the other one of the first securing parts 4321 without the first hinge 5 secured thereto.

[0235] As follows, the fourth hinge 7000 provided in the laundry treating apparatus 100 will be described in reference to FIG. 22.

[0236] The fourth hinge 7000 may be used as means for rotating the door 4 on the pivot (H) located in parallel to the bottom surface of the cabinet 3, together with the second hinge 6.

[0237] For that, the fourth hinge 7000 may be provided in the outer frame 43 of the door. The fourth hinge 7000 may include the fifth shaft 7100 having the same pivot as the pivot of the third shaft 63 provided in the second

hinge 6 and the cabinet detaching part configured to detachably couple the fifth shaft 7100 to the cabinet 3.

[0238] At least one fourth hinge 7000 may be provided in the door 4 and FIG. 22 illustrates two fourth hinges 7000 are provided.

[0239] In the meanwhile, the cabinet detaching part may include a connecting shaft 7300 provided in the fifth shaft 7100 and a shaft receiving part 7400 provided in the cabinet 3 to receive the connecting shaft 7300.

[0240] The connecting shaft 7300 may be projected from an outer circumferential surface of the fifth shaft 7100 toward the cabinet 3, to be exposed outside the cover via the inner frame 41 of the door 4.

[0241] The shaft receiving part 7400 may include a receiving body 7410 fixed to the cabinet 3 and a receiving groove 7430 provided in the receiving body 7410 to receive the connecting shaft 7300 therein.

[0242] As a result, when the door 4 opens the opening 37 after rotated on the pivot (V) passing the center of the second shaft 651 and the first shaft 51, the fifth shaft 7100 may be detached from the cabinet 3. However, when the door 4 closes the opening 37 after rotating on the pivot (H), the connecting shaft 7300 may be inserted in the receiving groove 7430 to be secured to the cabinet 3.

[0243] Once the fifth shaft 7100 is secured by the connecting shaft 7300 and the shaft receiving part 7400, the door 4 may rotate on the pivot (H, see FIG. 18) passing the center of the third shaft 63 of the first hinge and the center of the fifth shaft 7100 of the fourth hinge, to open the laundry introduction opening 37. This is because the first shaft 51 of the third hinge can be detached from the first shaft detaching part 53.

[0244] Meanwhile, the fourth hinge 7000 may further include a door elastically supporting part configured to control the rotational speed of the door 4 when the door 4 is rotated to open the opening 37 and to reduce the force for rotating the door 4 when the door closes the opening 37.

[0245] The door elastically supporting part may be varied only if it can realize the function mentioned above and FIG. 22 illustrates a torsion spring 7200 as the door elastically supporting part.

[0246] When the torsion spring 7200 is provided as the door elastically supporting part, the torsion spring 7200 may be provided in the door 4 and an end of the torsion spring 7200 may be fixed to the fifth shaft 7100 and the other end thereof may be fixed to the door 4.

[0247] For that, a spring holder 4313 fixed to the outer frame 43 may be further provided in the door 4.

[0248] Moreover, the fourth hinge 7000 may further include an angle adjusting part configured to adjust the rotational angle of the door 4 when the door 4 rotates on the third shaft 63 of the second hinge and the fifth shaft 7100 of the fourth hinge (when the door rotates on the pivot (H)).

[0249] The angle adjusting part may include at least one of first and second angle adjusting parts 7500 and 7600. As follows will be described a case in that both of the first and second angle adjusting parts 7500 and 7600 are provided.

[0250] As shown in FIG. 23, the first angle adjusting part 7500 may include a first adjusting plate 7510 fixed to the fifth shaft 7100 and a first detaching part 7530 provided in the door to be coupled to the first adjusting plate 7510 to secure the position of the door 4.

[0251] The first adjusting plate 7510 may have a fastening part fastened to the first detaching part 7530 and the fastening part may be configured of a plurality of recesses concavely recessed from an outer circumferential surface of the first adjusting plate 7510 or a plurality of projections projected from the outer circumferential surface of the first adjusting plate 7510.

[0252] If the fastening part is the plurality of the recesses, the first detaching part 7530 may be formed to be inserted in one of the recesses. If the fastening part is the plurality of the projections, the first detaching part 7530 may be formed to receive one of the projections.

[0253] If the case of providing the plurality of the recesses as the fastening part is adapted, the fastening part may include a first groove 7511 and a second recess 7512 curvedly recessed from the outer circumferential surface of the first adjusting plate 7510.

[0254] In this case, the second recess 7512 may be spaced apart a predetermined angle from the first recess 7511. FIG. 23 illustrates the angle between the first recess 7511 and the second recess 7512 is 30 degrees.

[0255] In the meanwhile, the first detaching part 7530 may include a first body 7531 in contact with the outer circumferential surface of the first adjusting plate 7510 and a first body elastically supporting part 7533 having an end fixed to the door 4 and the other end fixed to the first body 7531 to elastically support the first body.

[0256] The first body elastically supporting part 7533 may enable the first body 7531 to maintain contact with the surface of the first adjusting plate 7510, even when the first body 7531 is moved together with the door during the rotation of the door 4.

[0257] In case of the door 4 closing the opening 37 (see FIG. 17(a)), the first body 7531 may be received in the first recess 7511. Unless an external force is applied to the door 4 via the first handle (311, see FIG. 17), the first body 7531 may prevent the door 4 from being rotated on the third shaft 63 of the second hinge and the fifth shaft 7100 of the fourth hinge (See FIG. 24(a)).

[0258] Also, even when the door 4 opens the opening 37 by the external force applied thereto via the first handle 4311, the first body 7531 may be inserted in the second recess 7512 and the door 4 may then maintain the rotated state on the fifth shaft 7100 of the fourth hinge at 30 degrees (see FIG. 24(b)).

[0259] As a result, the opening angle of the door 4 may adjusted by the first angle adjusting part 7500.

[0260] Moreover, the torsion spring 7200 provided in the fourth hinge 7000 may provide an elastic force capable of locating the first body 7531 within an angle range

of more than 30 degrees to 90 degrees or less from the first recess 7511, when the door 4 is rotated on the fifth shaft 7100 of the fourth hinge.

[0261] This is to realize the effect of securing the door 4 being rotated 30 to 90 degrees with respect to the fifth shaft of the fourth hinge (See FIG. 24(c)).

[0262] In the meanwhile, the end of the torsion spring 7200 may be fixed to the spring holder 4313 and the other end thereof may be insertedly fixed to the spring fixing hole 7513 provided in the first adjusting plate 7510.

[0263] As a result, the door 4 provided in the laundry treating apparatus 100 may be open to 30 degrees with respect to the fifth shaft 7100 (this is enabled by the first angle adjusting part), to more than 30 degrees to less than 90 degrees (for example, 60 degrees and this is enabled by the torsion spring) or to 90 degrees.

[0264] When the laundry placed on the door 4 opened 30 degrees or 60 degrees with respect to the fifth shaft 7100, the laundry can be loaded into the accommodating room (R) naturally and the user may not bend his or her waist to load the laundry.

[0265] Also, when the door 4 is open at 90 degrees with respect to the fifth shaft 7100, the door 4 may be used as a shelf and the user may place the laundry unloaded from the accommodating room (R) temporarily (see FIG. 24(d)).

[0266] In the meanwhile, when the door 4 is utilized as a shelf (when the door 4 is rotated 90 degrees with respect to the fifth shaft 7100), an external force generated by the weight of the laundry will be concentrated on the fourth hinge 7000 and the second hinge 6.

[0267] As a result, to prevent breakage of the second hinge 6 and the fourth hinge 7000, a door supporting part 313 projected toward the door 4 may be further provided in the cabinet 3. A supporting part receiving recess 4325 may be further provided in the door 4 to receive the door supporting part 313 (see FIG. 18).

[0268] In this case, the door supporting part 313 may be provided at a predetermined position to support the inner frame 41 of the door 4, when the door 4 is rotated 90 degrees on the fifth shaft 7100 (see FIG. 18(b)).

[0269] The second angle adjusting part 7600 may be further provided in the fourth hinge 7000 and it may be means for fixing the position of the door 4 rotated a predetermined angle on the fifth shaft 7100.

[0270] In other words, the laundry treating apparatus 100 mentioned above may secure the position of the door 4 by using the first adjusting plate 7510 and the first detaching part 7530 provided in the first angle adjusting part 7500 of the fourth hinge 7000. However, when an external force (for example, the weight of the laundry and the like) is applied to the door 4, there might be danger of failing to maintain the position of the door 4.

[0271] The second angle adjusting part 7600 may be means for prevent the danger mentioned above. As shown in FIG. 25, the second angle adjusting part 7600 may include a second adjusting plate 7610 provided in the fifth shaft 7100 and a second detaching part 7630 provided in the door 4, in contact with the second adjusting plate 7610.

[0272] The second detaching part 7630 may include a second body 7631 provided in the door, in contact with an outer circumferential surface of the second adjusting plate 7610, a second body elastic supporting part 7633 having an end fixed to the door 4 and the other end thereof fixed to the second body 7631.

[0273] In this case, a stopper 7611 may be provided in the outer circumferential surface of the second adjusting plate 7610 to be coupled to the second body 7631, when the first body 7531 of the first detaching part 7531 is coupled to the second recess 7512 of the first angle adjusting part 7500.

[0274] As a result, when the door 4 is rotated 30 degrees on the fifth shaft 7100, the first body 7531 may be inserted in the second recess 7511 as shown in FIG. 26 (b) and the second body 7631 may contact with the stopper 7611, such that the open angle of approximately 90 degrees may be maintained even if the external force is applied to the door 4.

[0275] Also, the door 4 may maintain a state of being open 60 degrees on the fifth shaft 7100 by the elastic force of the torsion spring 7200. When the weight of the door 4 is larger than the elastic force of the torsion spring 7200 (when the door is rotated 60 degrees or more on the second shaft), the door may maintain a state of being open 90 degrees or more on the fifth shaft 7100.

[0276] Here, a lifter 4350 may be further provided in the door 4 to release the coupling between the second body 7631 and the stopper 7611 to open the door 60 degrees (a representative value of the door rotation angles in the range of more than 30 degrees to less than 90 degrees) or 90 degrees.

[0277] The lifter 4350 may have a structure shown in FIG. 25.

[0278] In other words, the lifter 4350 may include a pressing part 4351 provided in the door 4, a lever 4353 rotatably provided in the inner frame 41 of the door 4 via a lever rotation shaft 4351, with an end in contact with the pressing part 4351, and a wire 4355 having an end fixed to the lever 4353 and the other end fixed to the second body 7631 of the second detaching part 7630.

[0279] In this case, the pressing part 4351 may be located in the first handle (4311, see FIG. 17(c)) provided in the door 4.

[0280] As a result, when trying to rotate the door 4, that is open 3 degrees on the fifth shaft 7100, 60 degrees or 90 degrees, the user may release the coupling between the second body 7631 and the stopper 7611 by using the pressing part 4351 and the wire 4355 located in the first handle 4311.

[0281] In other words, when the pressing part 4351 is pressed by the user, the lever may be rotated on the lever rotation shaft 4531 and the wire fixed to the end of the lever 4353 may detach the second body 7631 of the second detaching part 7630 from the stopper 7611.

[0282] In the meanwhile, the cabinet detaching part

provided in the fourth hinge 7000 may have a structure shown in FIGS. 27 and 28.

[0283] The cabinet detaching part shown in FIGS. 27 and 27 may have a characteristic of having no resistance transmitted from the torsion spring 7200 while the door 4 is rotated a predetermined angle on the third shaft 63 of the second hinge and the fifth shaft 7100 of the fourth hinge.

[0284] This characteristic is configured to improve user convenience and it may enable the door 4 to be rotated 30 degrees on the fifth shaft 7100 of the fourth hinge, which is very efficient in loading the laundry into the accommodating room (R).

[0285] The cabinet detaching part shown in FIG. 27(a) has a characteristic of a gap (g) formed between the receiving groove 7430 provided in the shaft receiving part 7400 and the connecting shaft 7300.

[0286] In other words, the thickness (t) of the connecting shaft 7300 may be smaller than the height (h) of the receiving groove 7430. In this case, the thickness (t) of the connecting shaft 7300 and the height (h) of the receiving groove may be set to enable the connecting shaft 7300 to contact with the receiving groove 7430 when the door rotated 30 to 40 degrees on the fifth shaft 7100.

[0287] Moreover, a receiving groove projection 7431 may be provided in the receiving groove 7430 to secure the coupling between the connecting shaft 7300 and the receiving groove 7430. A connecting shaft projection 7310 may be provided in the connecting shaft 7300 to be coupled to the receiving groove projection 7431.

[0288] As a result, the door 4 may be rotated on the fifth shaft 7100 in the angle range of 30 to 40 degrees, with no interference of the torsion spring 7200, and it may be slowly getting open in an angle range of more than 40 degrees, with the interference of the torsion spring 7200.

[0289] The reason why the door 4 is getting open with the interference of the torsion spring 7200 in the angle range of more than 40 degrees is that breakage of the second hinge 6 and the fourth hinge 7000 generated by the weight of the door has to be prevented when the door 4 is rotated rapidly.

[0290] FIG. 28 illustrates an embodiment that realizes the effects mentioned above with the fixing structure of the torsion spring 7200.

[0291] In other words, the torsion spring fixing hole 7513 may be provided in the fifth shaft 7100 of the fourth hinge 7000 and an end of a torsion spring is fixed to the torsion spring fixing hole 1513. A hole projection 7515 may be provided in an inner circumferential surface of the torsion spring fixing hole 7513 to secure the position of the torsion spring 7200.

[0292] Accordingly, when the door 4 rotates on the fifth shaft 7100, the torsion spring is connected to a spring holder 4313 of which an end is fixed to the door, only to rotate together with the door 4.

[0293] Meanwhile, the other end of the torsion spring 7200 inserted in the spring fixing hole 7513 may be rotated along the inner circumferential surface of the spring fixing hole 7513 until it contacts with the hole projection 7515.

[0294] As a result, if the position of the hole projection 7515 is provided to support the torsion spring 7200 when the door 4 is rotated 30 to 40 degrees on the fifth shaft 7100, the same effect may be expected as the effect of the embodiment shown in FIG. 27.

[0295] FIG. 28 illustrates a case in that an auxiliary spring fixing hole 7513 is provided in the second shaft 72. If the spring fixing hole 7513 of FIG. 28 is applied to the embodiment shown in FIG. 23 or FIG. 25, the spring fixing hole 7513 of FIG. 28 may be provided in each of the first and second adjusting plates 7510 and 7610 or either of them.

[0296] In the above structure of providing the restitution force to the door 4 by using the torsion spring 7200, there might be danger of the fifth shaft 7100 getting out of its original position when the door 4 is rotated.

[0297] In other words, the end of the torsion spring 7200 may be fixed to the door by the spring holder 4313 and the other end of the torsion spring may be fixed to the fifth shaft 7100. Because of that, when the door 4 is rotated on the fifth shaft 7100, an external force generated by the torsion spring 7200 might be applied to the fifth shaft 7100 and the fifth shaft 7100 might fail to maintain an original position.

[0298] To prevent the danger mentioned above, the door 4 may further include a fifth shaft supporting rib 436 provided therein to support the fifth shaft 7100 and a rib elastically supporting part 437 having an end fixed to the door 4 and the other end fixed to the fifth shaft supporting rib 436.

[0299] FIGS. 29 and 30 illustrate that the fifth shaft detaching part 315 detachably secures the fifth shaft 7100 of the fourth hinge to the cabinet 3, when the door 4 is rotated on the first shaft 51 and the second shaft 651.

[0300] The fifth shaft detaching part 315 may include a case 3151 fixed to the cabinet 3 and a fifth shaft receiving body 3153 rotatably provided in the case 3151 to detach the fifth shaft 7100 there from.

[0301] In this case, a receiving body through hole 327 may be further provided in the inner frame 41 of the door 4, to enable the fifth shaft receiving body 3153 to be inserted in the door.

[0302] In the meanwhile, the fifth shaft receiving body 3153 may include a fifth shaft receiving groove (R2) configured to receive the fifth shaft 7100 and a fifth shaft guider 31533 configured to guide the fifth shaft 7100 toward the second shaft receiving groove (R2).

[0303] In other words, the fifth shaft receiving groove (R2) may be formed by projections 31531 provided in both opposite ends of the fifth shaft receiving body 3153 and the fifth shaft guider 31533. Here, the length of the fifth shaft guider 31533 may be larger than the length of the projection 31531.

[0304] As a result, the laundry treating apparatus 100 including the fifth shaft detaching part 315 may realize

an effect of coupling the fifth shaft 7100 to the cabinet 3 more stably by the cabinet detaching part of the second hinge.

[0305] As follows, a structure of a dryer according to a further embodiment will be described.

[0306] In reference to FIGS. 31 and 32, a dryer 2 according to this embodiment may include a dryer cabinet 21 having a drying room (20a) formed therein to dry drying objects (not shown) therein. Here, the drying room 20a may be a predetermined space where a drum rotated at a rotation speed set in a preset drying condition is arranged and an opening of the drying room may be exposed to outside by a drying object introduction opening 20 formed in a lateral surface of the cabinet 21.

[0307] The drying object introduction opening 20 may be opened and closed by a door 200 formed in a rectangular plate shape. A window may be installed in a center portion of the door 200 to enable the drying room 20a to be visible outside.

[0308] The door 200 may be multi-hingedly coupled to the cabinet 210 by a hinge unit and it may be selectively rotated to be open and closed along different directions.

[0309] As shown in FIGS. 31 and 36, the door 200 may be selectively open and closed along a vertical (an up and down direction) or horizontal direction (a right and left direction).

[0310] Here, the hinge unit configured to rotatably open and close the door 200 along the vertical or horizontal direction will be described.

[0311] The hinge unit may include a horizontal hinge part configured to open and close the door horizontally and a vertical hinge part configured to vertically open and close the door 200. In the meanwhile, an area adjacent to the drying object introduction opening 20 formed in the cabinet 21 may be stepped from an outer circumferential surface of the cabinet 210 and a guide plate 22 may be formed in the stepped portion to be in close contact with an inner surface of an outside of the door 200.

[0312] In reference to FIGS. 32 to 35, the vertical hinge part may include a second hooking member 120 installed in a predetermined portion of a lower end adjacent to the drying object introduction opening 20, with being vertically rotatable and hinge-connected and with a second hook 122 formed therein to insert and detach a second shaft 221 of the second hinge 220 installed in a lower end of the door, which will be described later, therein and there from, a rotation hole member 130 installed in the other lower end adjacent to the drying object introduction opening 20, with a rotation hole member body 131 to form a rotation hole 132 therein, and rotation member 230 installed in the other lower end of the door 200, with a spherical-shaped rotation ball 230 formed therein to be inserted in the rotation hole 132 to freely rotate and with a rotation member body 231 fixed to a lower end of the door.

[0313] As shown in FIGS. 32 and 36, a single hooking projection or a plurality of hooking projections 250 may be formed in the door 200. A single hooking groove or a plurality of hooking grooves 23 may be formed in the guide plate 22 consisting of the cabinet 21 near the drying object introduction opening 20 to insertedly hook the single one or the plurality of the hooking projections 250 thereto.

[0314] In the meanwhile, a vertical opening/closing angle of the door 200 may form a perpendicular angle or less.

[0315] A horizontal opening/closing angle of the door 200 may be a preset single value or a plurality of values selectively.

[0316] In this case, in reference to FIGS. 33a to 33c, the second hooking member 120 may include a rotation shaft 120a having fixing holes 120b formed in an outer circumferential surface thereof, spaced apart a predetermined distance from each other, a supporting body 121 hingedly connected to the rotation shaft 120a, with a surface fixed to the guide plate 22, and a rotation body 120 hingedly connected to the rotation shaft 120a, with a fixing projection member 124 formed an end thereof to elastically inserted and detached in and from the fixing hole 120b and with the second hook 123 projected outwardly there from.

[0317] Here, in reference to FIGS. 33b and 33c, the fixing projection member 124 may include a fixing holes 120b spaced apart a predetermined distance from each other along a circumferential direction of the rotation shaft 120a, a hole 124c formed in an inner circumferential surface of an inserting body 122a formed in the rotation body 120 to insert the rotation shaft 120a therein, a spring 124b installed in the hole 124c, and a fixing ball 124a connected to the spring 124b to be inserted in one of the fixing holes 120b.

[0318] As a result, when the rotation body 122 is rotated, the fixing ball 124a may be inserted in one of the fixing holes 2120b and an opening/closing angle of the door with respect to the guide plate 22 may be maintained.

[0319] In reference to FIGS. 37 to 39, the horizontal hinge part may include a first hook body 111 installed in an upper end portion of the guide plate 22 adjacent to the drying object introduction opening 20, with a first hook body 111 having a first hook 112 formed therein, a first hinge member 210 installed in an upper end portion of the door 200, with a first rotation shaft 211 inserted in and detached from the first hook 112, and a second hinge member 220 installed in a lower end portion of the door 200, with a second rotation shaft 221. Here, the second rotation shaft 221 may be rotated, with being hooked to the second hook 123 of the second hooking member 120 mentioned above.

[0320] Next, the rotational opening/closing operation of the door along a vertical or horizontal direction will be described in reference to the configuration described above.

[0321] [Vertical Opening/closing of Door]

[0322] In reference to FIGS. 31 to 35, when the door is vertically opened and closed, the door 200 may be

rotated to be open and closed on a lower end thereof as a pivot. In other words, both lower ends of the door may be rotated.

[0323] In detail, in reference to FIGS. 32, 34a and 34b, the rotation ball 232 of the rotation member 230 provided in the other end of the door 200 inserted in the rotation hole 132 provided in the other end of the guide plate 22 may perform free rotation. In reference to FIGS. 33a and 33b, the second rotation shaft 221 of the second hinge member 220 provided in the end of the door 200 may be insertedly hooked to the second hook 123 of the second hooking member 120 hingedly provided in the end of the guide plate 22 and it may perform vertical rotation.

[0324] The door 200 may be rotated on the pivot passing the lower end of the door to be opened and closed vertically.

[0325] When the door 200 which can be vertically opened and closed closes the drying object introduction opening 20 airtight, the door 200 may maintain the airtight state (the closed state).

[0326] In other words, as shown in FIG. 35, the first rotation shaft 211 of the first hinge member 210 provided in the upper end of the door 200 may be insertedly hooked to the first hook 112 of the first hooking member 110 formed in the end of the guide plate 22. In reference to FIG. 36, the plurality of the hooking projections 250 provided inner surface of the door 200 may be hooked to the plurality of the hooking grooves 23 formed in the guide plate 22 and the door 200 may maintain the closed state.

[0327] [Horizontal Opening/closing Operation of Door]

[0328] In reference to FIGS. 36 to 40, when the door 200 is horizontally opened and closed, a lateral side of the door may be a pivot of the door rotation to open and close the door horizontally.

[0329] more specifically, the first rotation shaft 211 of the first hinge member 210 provided in the upper end of the door 200 may be rotated in a state of being insertedly hooked to the first hook 112 of the first hooking member 110 provided in the upper end of the guide plate 22. Also, as shown in FIGS. 33a and 38, the second rotation shaft 221 of the second hinge member 220 provided in the lower end of the door 200 may be rotated in a state of being insertedly hooked to the second hook 123 of the second hooking member 120 provided in the lower end of the guide plate. As a result, the first and second rotation shafts 211 and 221 may form the same pivot.

[0330] As a result, the door 200 may be rotated on the pivot passing the lateral side of the door 200 to be horizontally opened and closed.

[0331] When the horizontally openable and closable door 200 closes the drying object introduction opening 20 airtight, the door 200 may maintain the airtight state (the closed state).

[0332] In other words, as mentioned above, the first rotation shaft 211 of the first hinge member 210 provided in the upper end of the door 200 may be insertedly hooked to the first hook 112 of the first hooking member 110 formed in the upper end of the guide plate 22. Also, as shown in FIG. 36, the plurality of the hooking projections 250 provided in the inner lateral surface of the door 200 may be hooked to the plurality of the hooking grooves 23 formed in the guide plate 22, such that the door 200 may maintain the closed state.

[0333] As follows, a laundry treating apparatus configured of the dryer 2 having the configuration mentioned above and the washer 1 connected with each other will be described.

[0334] In reference to FIG. 31, a conventional washer 1 may include a washer cabinet 10 having a washing room formed therein. A washing object introduction opening 12 may be formed in an upper portion of the cabinet 10, to expose the washing room outside upwardly and a cover 11 may be coupled to the washing object introduction opening 12 to open and close the opening 12.

[0335] The dryer 2 according to the embodiment mentioned above may be installed next to the washer cabinet 10. Here, the washer cabinet 10 and the dryer cabinet 21 may be integrally formed with each other or they may be connected with each other by auxiliary connection means (not shown).

[0336] In reference to the configuration described above, washing objects may be loaded into the washing room via the washing object introduction opening 12. In other words, the washing objects may be loaded along a vertical (up and down) path.

[0337] The washing objects may be unloaded via the washing object introduction opening 12 along the vertical path, after a washing process including a washing cycle and a spinning cycle.

[0338] Hence, the washed washing objects may be loaded into the dryer 2 as the drying objects to have the drying process.

[0339] At this time, the drying objects may be loaded into the drying room via the drying object introduction opening 20 exposed outside by the opening of the door 200 coupled to the lateral surface of the dryer cabinet 21 according to the embodiment.

[0340] At this time, the door 200 may be rotated to be open and closed on the lower end thereof as the pivot. When the drying objects are loaded into the drying room 20a, the door may be opened in state of being tilted downwardly. Here, the vertical opening/closing structure and method of the door 200 is described above and the description thereof will be omitted accordingly.

[0341] When the door 200 is rotated in a state of forming a preset opening/closing angle downwardly, the inner surface of the door 200 may form a tilted slope.

[0342] As a result, the drying objected washed in the washer 1 may fall from the upper portion of the tiltedly open door 200 and the falling drying objects may be introduced into the drying room 20a via the drying object introduction opening 20 along the inner surface of the door 200 tilted toward the drying object introduction opening 20 smoothly.

[0343] In other words, the reason why the door 200 opened and closed vertically is rotated downwardly to

form the tilted angle is to guide the drying objects toward the drying object introduction opening 20 along the inner surface of the tilted door 200 smoothly.

[0344] Although not shown in the drawings, a guide partition wall may be further formed in each side portion of the inner surface of the door 200 to guide the drying objects sliding toward the drying object introduction opening 20, without falling outside. When the door 200 is closed, an inserting hole may be formed in the guide plate 22 to insert therein the guide partition wall projected from each side portion of the inner surface of the door 200.

[0345] After the drying objects are loaded into the drying room 20a according to the sliding method along the downward direction, the door 200 may be closed to close the drying object introduction opening 20 airtight.

[0346] The dryer 2 may perform drying for the drying objects loaded in the drying room 20a according to set drying conditions.

[0347] After the drying, the drying objects may be unloaded outside via the drying object introduction opening 20.

[0348] At this time, referring to FIG. 36, the door 200 according to the embodiment may be rotated to be open and closed along the horizontal direction. Because of that, the door may be opened along the horizontal direction in case of unloading the drying objects.

[0349] As a result, in case of unloading the dried objects, the user may unload the dried objects located in the drying room 20a via the drying object introduction opening 20 smoothly.

[0350] FIG. 41 is a perspective view illustrating a laundry treating apparatus according to a still further embodiment. The laundry treating apparatus 100 according to the embodiment may include a cabinet 3 having a laundry accommodating room (R) and a laundry introduction opening 37 configured to introduce the laundry into the laundry accommodating room, a door 4 configured to open and close the opening 37, and a hinge unit 5, 6 and 7 configured to enable the door to rotate the opening along different directions.

[0351] The cabinet 3 may define a profile of the laundry treating apparatus and the laundry introduction opening 37 may be provided through an outer panel 33 provided in a side of the cabinet to communicate with the laundry accommodating room (R).

[0352] A locking projection receiving part 39 may be provided in the outer panel 33 to receive a locking projection 47 provided in the door 4. The locking projection 47 of the door 4 may be received in the locking projection receiving part 39 provided in the cabinet, such that the door 4 may open and close the laundry introduction opening.

[0353] In the meanwhile, a control panel 31 may be provided on the cabinet 3 to enable a user to input a control command to the laundry treating apparatus.

[0354] The hinge unit 5, 6 and 7 may form a first pivot (A) to rotate the door to open and close the opening 37 and a second pivot (B) to rotate the door 4 to open and close the opening 37 along a different direction from a direction of the first pivot (A).

[0355] The first pivot may be formed by a first hinge 5 and a second hinge 6. The second pivot may be formed by the second hinge 6 and a third hinge 7.

[0356] In FIG. 41, the first pivot (A) may be formed along a longitudinal direction of the cabinet 3 (A vertical pivot) and the second pivot (B) may be formed along a width direction of the cabinet (A horizontal pivot). However, the location of the first pivot and the location of the second pivot may not be limited to what shown in FIG. 2 necessarily.

[0357] In other words, the first pivot and the second pivot may be located at various positions of the cabinet only if they enable the door to be rotated in various directions to open the opening (only if the first pivot and the second pivot form a preset angle).

[0358] Here, as shown in FIG. 31 (b), the second pivot may be provided along the width direction of the cabinet to enable the door to be tilted with respect to a lower end of the opening 37. In this case, there may be an effect of efficient laundry loading caused by adjusting a tilting angle of the door, which will be described later.

[0359] The door 4 may include an inner frame 43 provided toward the outer panel 33 and an outer frame 41 coupled to the inner frame to from a profile of the door 4.

[0360] The door may further include a transparent part 45 insertedly provided in the opening 37. The transparent part 45 may prevent the laundry located in the laundry accommodating room (R) from coming out through the laundry introduction opening and it may also allow the user to see the laundry accommodating room (R) during the operation of the laundry treating apparatus.

[0361] As follows, the coupling structure between the hinge unit and the door according to this embodiment will be described in detail in reference to FIG. 42.

[0362] The inner frame 43 and the transparent part 45 are omitted from the door shown in FIG. 42 for the description of the coupling structure between the hinge unit and the door.

[0363] The hinge unit may include a first hinge 5 having a first shaft consisting of a first pivot (A) to couple and detach the door to and from the cabinet 3, a second hinge 6 having a second shaft consisting of the first pivot (A) together with the first shaft and a third shaft consisting of a second pivot (B), and a third hinge 7 having a fourth shaft consisting of the second pivot (B) together with the third shaft to couple and detach the door 4 to and from the cabinet 3.

[0364] In other words, the second hinge 6 may be secured to the cabinet and the door. The first hinge 5 and the third hinge 7 may selectively couple the door 4 to the cabinet.

[0365] As a result, the door 4 may be rotated on the first pivot (A) based on the user's selecting, to open and close the opening 37 (see FIG. 41 (a)) or it may be rotated on the second pivot (B) to open and close the opening

(see FIG. 41 (b)).

[0366] The first hinge 5 may include the first shaft provided in either of the cabinet 3 and the door 4 and a first shaft detaching part 53 provided in the other one of the cabinet and the door, to detach the first shaft there from.

[0367] FIG. 42 illustrates the first shaft 51 provided in the outer panel 33 of the cabinet and the first shaft detaching part 53 provided in the door.

[0368] The first shaft 51 may be located in a right upper end of the outer panel 33, to form the first pivot (A).

[0369] The first shaft detaching part 53 may include a shaft receiving groove 531 to receive the first shaft 51 therein, a groove opening/closing part 533 to open and close the shaft receiving groove, an opening/closing part elastically supporting part 535 to elastically support the groove opening/closing part. The opening/closing part elastically supporting part 535 may be received in the groove opening/closing part 533 in FIG. 43. The first shaft 51 and the first shaft detaching part 53 will be described later in reference to FIG. 43.

[0370] The second hinge 6 may include a second shaft 651 provided corresponding to the first shaft of the first hinge 5 to form the first pivot (A) and a third shaft 63 forming the second pivot (B).

[0371] In detail, the second hinge 6 may be provided an intersection between the first pivot (A) and the second pivot (B). The second hinge 6 may include a cabinet securing part 61 secured to the outer panel 33 and a door securing part 65 secured to the door 4, with being rotatably connected to the cabinet securing part 61 via the third shaft 63.

[0372] The second shaft 651 may be provided in the door securing part 65 and the door 4 may be rotatably secured the second shaft 651.

[0373] As a result, the door 4 may be rotatable on the first pivot (A) formed by the first shaft 51 and the second shaft 651.

[0374] In the meanwhile, the door securing part 65 may be connected to the cabinet securing part 61 by the third shaft 63 forming the second pivot (B).

[0375] The second hinge 6 may further include a hinge supporter 653 having an end located in the cabinet and the other end connected with the door securing part 65 to be movable forwardly from the cabinet. The hinge supporter 653 may be extended from the door securing part 65 backwardly and downwardly, with forming a gentle curvature.

[0376] The hinge supporter 653 may be configured to adjust an opening angle of the door when the door 4 is rotated on the second pivot (B) to open the opening 37 and it may be coupled to a door tilting adjusting part (8, see FIG. 44) which will be described later.

[0377] In the meanwhile, the hinge supporter 653 may include a hinge supporter flange 657 to prevent the hinge supporter 653 from separated from the cabinet (the outer panel), when the door 4 is rotated on the second pivot (B).

[0378] The third hinge 7 may include a shaft forming part 71 fixed to either of the outer panel 33 and the door and a shaft detaching part 73 provided in other one of them, with the shaft forming part being detachable there from.

[0379] FIG. 42 illustrates the shaft forming part provided in the outer panel 33 and the shaft detaching part 73 provided in the door 4. As follows, the structure of the third hinge according to the embodiment will be described.

[0380] The shaft forming part 71 may include a body 711 fixed to the outer panel 33 and a fourth shaft 713 projected from the body 711 to form the second pivot (B) together with the third shaft 63.

[0381] The shaft detaching part 73 may include a fourth shaft receiving groove 731 located between the outer frame 41 and the inner frame 33 to receive the fourth shaft therein and a fourth shaft supporting projection 733 configured to support the fourth shaft 713 received in the fourth shaft receiving groove 731.

[0382] As a result, when the door 4 is rotated on the first pivot (A) toward the outer panel 33, the fourth shaft 713 may be received in the fourth shaft receiving groove 731 and supported by the fourth shaft supporting projection 733 after that.

[0383] The laundry treating apparatus having the configuration mentioned above may enable the user to rotate the door 4 on the first pivot (A) or the second pivot (B).

[0384] In other words, in the state of the door closing the opening 37, the first shaft 51 of the first hinge may be inserted in the shaft receiving groove 731 provided in the first shaft detaching part and the fourth shaft 713 of the third hinge may be inserted in the fourth shaft receiving groove 731 of the shaft detaching part.

[0385] As a result, when the user pulls the lateral surface (S) of the door 4, the fourth shaft 713 may be detached from the shaft detaching part 73 and it may be rotated on the first pivot (A). When the user pulls the top surface (T) of the door 4, the first shaft 51 may be detached from the first shaft detaching part 53 and it may be rotated on the second pivot (B).

[0386] In the meanwhile, when the door is rotated on the second pivot (B), the third hinge 7 may further include a door supporter 75 to adjust an opening angle of the door 4.

[0387] An end of the door supporter 75 may be located in the cabinet and the other end thereof may be detachably provided in the shaft detaching part 73.

[0388] A flange 754 may be provided at the end of the door supporter located in the cabinet, to prevent the door supporter 75 from separated from the cabinet (the outer panel) when the door is rotated on the second pivot (B). A detaching shaft 751 may be provided in the door supporter to be detachable from the shaft detaching part 73.

[0389] In this case, the shaft detaching part 73 may further include a detaching shaft receiving groove 735 to receive the detaching shaft 751 and a detaching shaft supporting projection 737 to support the detaching shaft 751 received in the detaching shaft receiving groove.

[0390] Moreover, the shaft detaching part 73 may fur-

ther include a supporting projection elastically supporting part (739, see FIG. 44) to elastically support the fourth shaft supporting projection 733 and the detaching shaft supporting projection 737.

[0391] The door supporter 75 and the hinge supporter 653 may enable the door tilting adjusting part 8 provided in the cabinet 3 to control the opening angle of the door 4, when the door 4 is rotated on the second pivot.

[0392] Adjusting the opening angle of the door when the door 4 is rotated on the second pivot (B) may realize an effect of smoothly loading the laundry into the laundry treating apparatus 100 which is configured to dry laundry.

[0393] The laundry treating apparatus 100 according to this embodiment is installed adjacent to the laundry treating apparatus only for washing will be described.

[0394] It will be very efficient to load the laundry into the laundry accommodating room (R), if the door is opened 30 to 60 degrees on the second pivot (B) when the user is moving the washed laundry to dry to the laundry treating apparatus according to the embodiment.

[0395] Especially, if the laundry treating apparatus only for washing is a top loading type capable of loading or unloading laundry via a top thereof, the effect mentioned above may be maximized.

[0396] A supporter projection 753 and a hinge supporter projection 655 detachable from the door tilting adjusting part 8 may be provided in the door supporter 75 and the hinge supporter 653, respectively, to be coupled to the door tilting adjusting part 8 to enable the door tilting adjusting part 8 to adjust the opening angle of the door.

[0397] FIG. 43 illustrates the motion of the first hinge applied to the embodiment. As follows, the motion of the first hinge will be described in reference to FIG. 43.

[0398] In FIG. 43(a), the door 4 is rotated on the second pivot (B). Because of that, the first shaft 51 may not be received in the shaft receiving groove 531 and it may be located outside the shaft receiving groove 531, not in the shaft receiving groove 531.

[0399] The first shaft 51 may be a D-cut circular-section pole. Here, the D-cut circular section pole means that a cut-surface is provided in each of opposite ends of an outer circumferential surface of the first shaft or an end of the outer circumferential surface.

[0400] FIG. 43(b) illustrates that the door 4 closes the opening 37 airtight and the first shaft 51 may be received in the shaft receiving groove 531.

[0401] When the first shaft 51 is received in the shaft receiving groove 531 in the state shown in FIG. 43(a), the cut-surface of the first shaft 51 may press the opening/closing part elastically supporting part 535 of the groove opening/closing part 533. In other words, while the first shaft is getting inserted in the shaft receiving groove 531, the opening/closing part elastically supporting part 535 may be compressed. Once the first shaft 51 is completely inserted in the shaft receiving groove 531, the opening/closing part elastically supporting part 535 may be restituted and the first shaft 51 may be stopped from being separated from the shaft receiving groove 531 by a predetermined force as shown in FIG. 43(b).

[0402] In other words, when the door is rotated to close the opening 37 in the state of opening the opening 37 after rotated on the second pivot (B) (see FIG. 41 (b) and FIG. 43(a)), the first shaft detaching part 53 provided in the door may be moved toward the first shaft 51 and the first shaft may be inserted in the shaft receiving groove 531 of the first shaft detaching part, to change the state into the state shown in FIG. 43(b).

[0403] In this case, an entrance of the shaft receiving groove 531 where the first shaft is inserted may have a corresponding shape to the shape of the first shaft 51. When the door 4 is rotated on the second pivot (B) to close the opening 37, the first shaft 51 may be inserted in the shaft receiving groove 531. However, when the door is rotated on the first pivot (A) after the first shaft is inserted in the shaft receiving groove, the first shaft 51 may be prevented from separated from the shaft receiving groove 531.

[0404] FIG. 43(c) illustrates the door 4 rotated on the first pivot (A).

[0405] When the door 4 is rotated on the first pivot (A) in the state of FIG. 43(b), the first shaft 51 installed in the door 4 may not be rotated but maintain the state. However, the first shaft detaching part 53 may be rotated along the door 4 and the first shaft 51 may be rotated a predetermined angle within the shaft receiving groove 531 accordingly. At this time, the opening/closing part elastically supporting part 535 may elastically support the groove opening/closing part 533. Because of that, the first shaft 51 may be rotated within the shaft receiving groove 531, without being separated from the shaft receiving groove 531.

[0406] In other words, when the door 4 is rotated on the second pivot (B), the first hinge 5 may be in the state shown in FIG. 43(a). When the door 4 closes the opening 37, it may be changed into the state shown in FIG. 43(b). When the door 4 is rotated on the first pivot (A), it may be changed into the state shown in FIG. 43(c).

[0407] As follows, the specific structure of the door tilting adjusting part 8 will be described in reference to FIG. 44.

[0408] FIG. 44 illustrates that the door supporter 75 includes a door tilting adjusting part having the door supporter 75 detachable there from and a door tilting adjusting part having the hinge supporter 653 detachable there from (two door tilting adjusting parts). Alternatively, one of the door tilting adjusting parts 8 may be provided to be detachable from the door supporter 75 or the hinge supporter 653.

[0409] For explanation convenience, when describing the structures of the door tilting adjusting part having the door supporter detachable there from and the door tilting adjusting part having the hinge supporter 653 detachable there from, the structure of the door tilting adjusting part having the hinge supporter 653 detachable there from as shown in FIG. 44(b) will be described. In other words, the door tilting adjusting part 8 applied to the hinge sup-

porter 653 may be identically applied to the door tilting adjusting part 8 applied to the door supporter 75.

[0410] The door tilting adjusting part 8 may be located in the cabinet 3, with being fixed to the inner panel 35 provided behind the outer panel 33.

[0411] In this case, the door tilting adjusting part 8 may include a fixing body 81 fixed to the inner panel 35, a detaching body 83 movably provided in the fixing body 81 and a projection receiving groove 85a and 85b provided in the detaching body to receive the hinge supporter projection 655.

[0412] A plurality of projection receiving grooves 85a and 85b may be provided in the detaching body 83, spaced apart a predetermined distance from each other.

[0413] One of the projection receiving grooves and another one of them may be spaced apart a predetermined distance from each other, to realize a preset opening angle when the hinge supporter projection 655 is received in the projection receiving grooves.

[0414] FIG. 44(b) illustrates that a projection receiving groove 85a receiving the hinge supporter projection 655 when the door is closed and another projection receiving groove 85b receiving the hinge supporter projection 655 when an opening angle of the door is approximately 30 or 60 degrees.

[0415] In the meanwhile, the detaching body 83 may be supported by the elastically supporting part 87 with respect to the fixing body 81. This is for the hinge supporter projection 655 to be detachable from the detaching body 83 smoothly.

[0416] As follows, the motion of the door supporter 75, the hinge supporter 653 and the door tilting adjusting part 8 will be described, when the door 4 is rotated on the second pivot (B) in the laundry treating apparatus having the door tilting adjusting part 8.

[0417] First of all, in reference to FIGS. 44(a), 45(a) and 46(a), the motion of the third hinge 7 and the door tilting adjusting part 8 will be described. In FIG. 44(a), the door 4 may be perpendicularly secured in the state of closing the opening 37. In FIG. 45(a), the door 4 may be rotated approximately 30 degrees on the second pivot (B). In FIG. 46(a), the door 4 is rotated approximately 85 degrees on the second pivot (B).

[0418] As mentioned above, the door tilting adjusting part 8 may be applied only to the hinge supporter 653, not to the door supporter 75. However, the structure applying the door tilting adjusting part 8 even to the door supporter 75 will be described in FIGS. 44(a), 45(a) and 46(a).

[0419] When the door 4 closes the opening 37 as shown in FIG. 44(a), the fourth shaft 713 of the third hinge and the detaching shaft 751 of the door supporter may be received in the fourth shaft receiving groove 731 and the detaching shaft receiving groove 735, respectively. The elastic force may be provided to the fourth shaft supporting projection 733 and the detaching shaft supporting projection 737 by the supporting projection elastically supporting part 739 and the fourth shaft supporting projection 733 and the detaching shaft supporting projection may support the fourth shaft and the detaching shaft, respectively.

[0420] Also, the supporter projection 753 of the door supporter 75 may be received in the projection receiving groove 85a of the door tilting adjusting part 8.

[0421] At this time, when the user pulls the top surface (T, see FIG. 42) of the door, the door 4 may be rotated on the fourth shaft 713 forming the second pivot and the end of the door supporter 75 fixed to the shaft detaching part 73 may be rotated.

[0422] When the end of the door supporter 75 is rotated approximately 30 degrees, the supporter projection 753 may be seated in the projection receiving groove 85b provided in the detaching body, as moving along the detaching body of the door tilting adjusting part 8 (the state shown in FIG. 45a). In other words, the supporter projection 753 may be fixed to the projection receiving groove 85b and the rotation of the door 4 may be then stopped.

[0423] Hence, when the user rotates the door 4 a larger angle, in other words, when he or she applies a predetermined force enough to detach the supporter projection 753 from the projection receiving groove 85b, the supporter projection 753 may be detached from the projection receiving groove 85b and the door 4 may be rotated. Once the door supporter 75 is detached from the door tilting adjusting part 8 to open the door completely, the flange 754 provided in the door supporter may contact with the rear surface of the outer panel 33, to support the door 4 (the state shown in FIG. 46(a)).

[0424] In other words, when the user rotates the door on the second pivot (B), the supporter projection 753 may be received in or detached from the projection receiving grooves 85a and 85b sequentially, to fix the rotational angle of the door 4.

[0425] In reference to FIGS. 44(b), 45(b) and 46(b), the motion of the second hinge 6 and the door tilting adjusting part 8 will be described. In FIG. 44(b), the door 4 may be perpendicularly secured in the state of closing the opening 37. In FIG. 44(b), the door 4 may be rotated approximately 30 degrees on the second pivot (B). In FIG. 46(b), the door 4 may be rotated approximately 85 degrees on the second pivot (B).

[0426] When the door 4 closes the opening 37, the hinge supporter projection 655 may maintain the state of being received in the projection receiving groove 85a of the door tilting adjusting part 8 (the state shown in FIG. 44(b)).

[0427] When the user pulls the top (T) of the door, the door 4 may be rotated on the third shaft 63 forming the second pivot (B). When the door 4 is rotated, the hinge supporter projection 655 of the hinge supporter 653 may be detached from the projection receiving groove 85a and it may be moved toward the outer panel 33 accordingly. After that, the hinge supporter projection 655 may be seated in the projection receiving groove 85b (the state shown in FIG. 45(b)). At this time, if other ones are

formed rather than the projection receiving groove 85b, the rotated angle of the door 4 may be fixed at various angles, rather than approximately 30 degrees.

[0428] When the user rotates the door 4 a larger angle, that is, when the user applies a predetermined force enough to detach the hinge supporter projection 655 from the projection receiving groove 85b, the hinge supporter projection 655 may be detached from the projection receiving groove 85b and the door 4 may be rotated. Once the hinge supporter 653 is detached from the door tilting adjusting part 8 to open the door completely, the supporter flange 657 provided in the door supporter may contact with the rear surface of the outer panel 33, to support the door 4 (the state shown in FIG. 46(b)).

[0429] In other words, when the user rotates the door 4 on the second pivot (B), the hinge supporter projection 655 may be received in or detached from the projection receiving grooves 85a and 85b sequentially and the rotation angle of the door 4 may be fixed.

[0430] Moreover, the laundry treating apparatus according to the embodiment may further include a supporter elastically supporting part to supplement the door supporting force of the flanges 657 and 754 provided in the supporters 653 and 75, respectively, when the door 4 is open completely.

[0431] FIG. 47 illustrates only the supporter elastically supporting part provided in the door supporter 75 and the supporter elastically supporting part may be provided in each of the door supporter and the hinge supporter. As follows, the supporter elastically supporting part 771 and 773 provided in the door supporter will be described for explanation convenience.

[0432] The supporter elastically supporting part may include an elastic part 773 to provide a restitution force to the door supporter 75 toward the inside of the cabinet when the door supporter 75 is detached out of the outer panel 33.

[0433] In this case, a rib 771 may be further provided at an end of the door supporter 75 to couple the elastic part 773 thereto. This is to prevent the elastic part 773 from interfering with other devices provided in the door, which might be generated when the elastic part 773 is directly coupled to the door supporter 75.

[0434] In the meanwhile, the door tilting adjusting part may be variable in variable ways and FIG. 48 illustrates another embodiment of the door tilting adjusting part.

[0435] The door tilting adjusting part according to this embodiment may include a fixing part 82 located in the cabinet and a fixing part receiving groove 84 provided in the door supporter 75 to receive the fixing part 82.

[0436] The fixing part 82 may include a first fixing projection 821 having a predetermined diameter and a second fixing projection 823 projected from the first fixing projection, having a smaller diameter than the diameter of the first fixing projection.

[0437] Also, the first fixing projection 821 may be supported by the elastically supporting part 825 provided in a space formed between the outer panel 13 and the inner panel 15 of the cabinet 1.

[0438] The fixing part receiving groove 84 may include a first projection receiving groove 84 to receive the first fixing projection 821 and a second projection receiving groove 843 to receive the second fixing projection 821.

[0439] The second projection receiving groove 843 may be configured to receive only the second fixing projection 823 and the first projection receiving groove 841 may be configured to receive only an outer circumferential surface of the first fixing projection 821.

[0440] Also, at least 42 first projection receiving grooves 841 may be provided and one of them may be spaced apart a predetermined distance from another one.

[0441] The fixing part receiving groove 84 shown in FIG. 48 may include a second projection receiving groove 843 to support the door supporter when the opening is closed by the door, a first projection receiving groove 841a to support the door supporter when the door is opened 30 degrees on the second pivot, and a first projection receiving groove 841b to support the door supporter when the door 4 is opened 90 degrees on the second pivot (B).

[0442] The reason why the diameter of the second projection 823 is smaller than that of the first projection 821 is that it is difficult to form a groove capable of supporting the weight of the door in a gap between the second projection receiving groove 843 and the first projection receiving groove 841a, when the opening angle of the door is controlled only by the first projection 821.

[0443] FIG. 48 illustrates that the fixing part receiving groove 84 is provided only in the door supporter 75. However, in the door tilting adjusting part mentioned above, the fixing part receiving groove 84 may be provided in the hinge supporter 653 and the fixing part 82 may be detachable from the fixing part receiving groove provided in the hinge supporter.

[0444] In the laundry treating apparatus having the configuration mentioned above, the door 4 rotated on the second pivot may be supported by the flanges 754 and 657 provided in the door supporter and the hinge supporter, respectively. However, there might be danger of the detaching shaft 751 of the door supporter being separated from the shaft detaching part 73 because of the weight of the door.

[0445] As a result, the laundry treating apparatus according to the embodiment may further include a door fixing part to prevent the separation of the shaft detaching part 73 and the detaching shaft 751 of the door supporter. As follows, the door fixing part 9 will be described in reference to FIG. 9.

[0446] The door fixing part 9 may include a supporter coupling projection 93 located in the door 4, being movable to be fixed to the door supporter when the door is rotated on the second pivot.

[0447] At this time, a coupling projection seating part 755 may be provided in the door supporter 75 to seat the supporter coupling projection 93 thereon. The coupling

projection seating part 755 may be projected from the door supporter 75, to be seated on the coupling projection seating part 755 in contact when the door is rotated.

[0448] In the meanwhile, the motion of the supporter coupling projection 93 may be enabled by a cam 91 provided in the shaft forming part 71 of the third hinge and the coupling projection elastically supporting part 95 provided in the door 4 to elastically support the supporter coupling projection 93.

[0449] In other words, the supporter coupling projection 93 may be provided adjacent to the shaft detaching part 73 and it may be supported by the elastically supporting part 95 (see FIG. 42). The cam 91 may be located outer to the fourth shaft receiving groove 731 provided in the shaft detaching part 73 and it may be located lower than the supporter coupling projection 93, when the door 4 is closed.

[0450] Also, the cam 91 may be formed in a shape enabling the supporter coupling projection 93 to move toward the door supporter 75, when the door 4 is rotated on the second pivot. At this time, the cam 91 may not be rotated but fixedly extended along a horizontal direction.

[0451] When the door fixing part 9 includes the configuration mentioned above, the door 4 may be rotated on the second pivot (B) and the supporter coupling projection 93 may be moved along an outer circumferential surface of the cam 91 within the door 4 almost horizontally as shown in FIG. 49(b). As a result, as the elastically supporting part 95 is pressed, the supporter coupling projection 93 may be moved toward the door supporter 75.

[0452] When the door is opened completely, the supporter coupling projection 93 may contact with the coupling projection seating part 755 provided in the door supporter and it may be stopped. As a result, the supporter coupling projection 93 may prevent the door 4 from being rotated a larger angle.

[0453] Also, even when the door 4 is rotated on the second pivot (B) only to open the opening 37 completely, the laundry treating apparatus may prevent the separation of the shaft detaching part 73 provided in the door and the detaching shaft 751 provided in the door supporter. This is because the door 4 might be separated from the laundry treating apparatus, when the door 4 is rotated a larger angle.

[0454] In the meanwhile, when the door 4 is rotated on the second pivot (B) to close the opening 37, the supporter coupling projection 93 may be moved within the door by the elastically supporting part 95, with maintaining the contact with the outer circumferential surface of the cam. At this time, the external force applied by the outer circumferential surface of the cam 91 may be eliminated from the elastically supporting part 95. Because of that, the elastically supporting part 95 may be restituted by the restitution force, without compressed. As a result, the supporter coupling projection 93 may be detached from the coupling projection seating part 755 and it may be changed as shown in FIG. 49(a).

[0455] FIG. 50 is a still further embodiment of the present invention.

[0456] According to this embodiment, a tilted piece 431 is formed in a lower end of the door 4. Especially, it is preferred that the tilted piece 431 is formed in a lower end of the inner frame 43 of the door 4. The recess 42 mentioned above is formed in the portion where the second hinge 6 is formed. In contrast, the tilted piece 431 may be formed broadly in a lower end portion of the door 4.

[0457] As shown in FIG. 50, when the door 4 rotates a predetermined angle on a shaft formed along a traverse direction of the cabinet, the tilted piece 431 contacts with the cabinet 3. In other words, the tilted piece 431 contacts with the outer panel 33 of the cabinet 3 and the rotation of the door 4 stops. In other words, the door may rotate on the shaft formed in the traverse direction of the cabinet until the tilted piece 431 and the outer panel 33 contact with each other. Especially, the tilted piece 431 may be a surface having a predetermined area to surface-contact with the cabinet 3.

[0458] The tilted piece 431 is provided in the lower end of the door 4 and the lower end of the door may not have rectangular corners such that the door 4 may rotate a predetermined angle along a second rotational direction.

[0459] Meanwhile, a damper 1240 is provided in the tilted piece 431 to absorb a shock generated by the door 4 and the cabinet 3. The damper 1240 may be formed of a rubber material. The damper 1240 can have a flat surface similar to a flat surface of the tilted piece 431 and it may have various shapes only unless interfering with the rotation of the door 4.

[0460] FIG. 51 is a diagram illustrating the damper of FIG. 50 and the damper will be described in detail as follows, referring to FIG. 51.

[0461] A plurality of dampers 1240 may be longitudinally arranged along a longitudinal direction of the tilted piece 431. Different from what is shown in FIG. 51, the damper 1240 may be provided in the cabinet 3, not in the tilted piece 431. The damper 1240 can absorb the shock when it is provided in a position where the tilted piece 431 can collide with the cabinet 3 and the damper can be provided in various positions.

[0462] FIGS. 52 to 55 are conceptual diagrams illustrating various embodiments of the damper. Referring to FIGS. 52 to 55, the various embodiments will be described.

[0463] The damper 1240 shown in FIG. 52 includes a damping bar that contacts with the outer panel 33 of the cabinet 3, when the door rotates on a shaft formed along a traverse direction of the cabinet. One surface of the damping bar 433 may be a flat surface. The damper 1240 may further include a torsion spring 435 to elastically support a gap between the tilted piece 431 and the damping bar 433. When a rotational force is applied to the torsion spring 435, the torsion spring 435 provides a pressure force generated as a repulsive force of the rotational force such that it can lower the rotation number of the door 4, while the door 4 is rotating.

[0464] As shown in FIG. 52, while the door is rotating on the shaft formed along the traverse direction of the cabinet, the damping bar 433 is in contact with the outer panel 33 and the torsion spring 435 is pressed such that the shock generated by the collision between the door 4 and the cabinet 3 can be reduced.

[0465] An embodiment of the damper 1240 shown in FIG. 53 is a gas or fluid spring. In other words, a compressible or expandable gas or fluid is provided in a casing. When the tilted piece 431 of the damper 1240 collides with the damper 1240, the gas or fluid provided in the casing is compressed and the rotation of the door 5 on the shaft formed along the traverse direction of the cabinet may be reduced. Accordingly, the shock generated between the door 4 and the cabinet 3 can be reduced.

[0466] An embodiment of the damper 1240 shown in FIG. 54 is a compression spring. Silicon to the damper 1240 according to the embodiment of FIG. 53, when the door rotates on the shaft formed along the traverse direction of the cabinet, the tilted piece 431 may contact with the damper 1240 and the tilted piece 431 presses the compression spring. After that, the shock generated between the door 4 and the cabinet 3 can be reduced while the compression spring is compressed.

[0467] An embodiment of the damper 1240 shown in FIG. 55 is installed in the second hinge 6, not in the tilted piece 431.

[0468] The second hinge 6 includes the door securing part 65 secured to the door 4 and the cabinet securing part 61 secured to the cabinet 3. At this time, a plain washer 1244 and a spring washer 1242 may be provided in an end of the cabinet securing part 61.

[0469] In the embodiment of FIG. 55, when the door rotates in the second rotational direction, a frictional force is generated in the spring washer 1242. That is, the shape of the spring washer 1242 may generate the frictional force in the second hinge 6, when the door is rotating, and the generated frictional force can reduce the rotation number of the door 4. Accordingly, the shock generated by the collision between the tilted piece 431 and the cabinet 3, when the door 4 is rotating in the second rotational direction at a high rotation number, can be prevented.

[0470] Any reference in this specification to "none embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A laundry treating apparatus comprising:

   a cabinet configured to define a profile thereof, the cabinet comprising a laundry introduction opening formed therein;
   a door configured to open and close the laundry introduction opening;
   a fixing member configured to support the door for the door to maintain a state of being rotate a predetermined angle with respect to the laundry introduction opening,
   wherein the angle of the door maintained by the fixing member is an angle at which laundry moves to the laundry introduction opening along a guide of the door.

2. The laundry treating apparatus according to claim 1, further comprising:

   a pivot provided in a lower portion of the laundry introduction opening along a traverse direction of the cabinet, to form a center of rotation of the door.

3. The laundry treating apparatus according to claim 2, wherein the fixing member enables the door fixed at least two angles.

4. The laundry treating apparatus according to claim 3, wherein the at least two angles are approximately 35 degrees and 85 degrees.

5. The laundry treating apparatus according to any of claims 1 to 4, wherein the fixing member comprises, a recessed piece provided in a lower portion of the door, with being recessed a predetermined depth; and
   a projected piece inserted in the recessed piece, once the door closes the laundry introduction opening, and supporting the door, once the door opens the laundry introduction opening, the projected piece projected from the cabinet.

6. The laundry treating apparatus according to claim 5, wherein the projected piece contacts with a lower end of the door, only to stop the rotation of the door, once the door opens the laundry introduction opening.

7. The laundry treating apparatus according to claim 5, wherein a plurality of projected pieces and a plurality of recessed pieces are arranged in symmetry with respect to a center of the door.

8. The laundry treating apparatus according to any of claims 1 to 7, wherein the fixing member comprises

a tilted piece provided in a lower end of the door, with a predetermined tilted angle, and
when the door rotates, the tilted piece surface-contacts with the cabinet to stop the rotation of the door.

9. The laundry treating apparatus according to claim 8, wherein the fixing member further comprises,
a damper provided in the tilted piece to absorb a shock generated by the contact between the tilted piece and the cabinet.

10. The laundry treating apparatus according to any of claims 1 to 9, wherein the fixing member comprises,
a guide part provided in the cabinet, the guide part comprising a guide groove divided into a plurality of portions, in communication with each other;
a connection part arranged in the door, the connection part comprising a guide projection accommodated by the guide groove to allow a moving passage thereof guided, and
an angle at which the door opens the laundry introduction opening is changed according to which portion of the divided portions provided in the guide groove accommodates the guide projection.

11. The laundry treating apparatus according to claim 10, wherein the guide groove is divided into at least three portions.

12. The laundry treating apparatus according to claim 2, wherein the fixing member comprises,
a first adjusting plate provided in the pivot,
first and second grooves provided along an outer circumferential surface of the first adjusting plate, spaced apart a predetermined distance from each other; and
a first detaching part comprising a first body provided in the door to move along the outer circumferential surface of the first adjusting plate, when the door rotates, and a first body elastic supporting part having an end coupled to the first body and the other end coupled to the door to elastically support the first body.

13. The laundry treating apparatus according to claim 12, wherein the fixing member further comprises,
a second adjusting plate provided in the pivot, spaced apart a predetermined distance from the first adjusting plate;
a stopper projected from an outer circumferential surface of the second adjusting plate; and
a second detaching part provided in the door to move along the outer circumferential surface of the second adjusting plate, when the door rotates, the second detaching part comprising a second body contacting with the stopper, when the first body is inserted in the second groove, and a second elastic body supporting part having an end coupled to the second body and the other end coupled to the door to elastically support the second body.

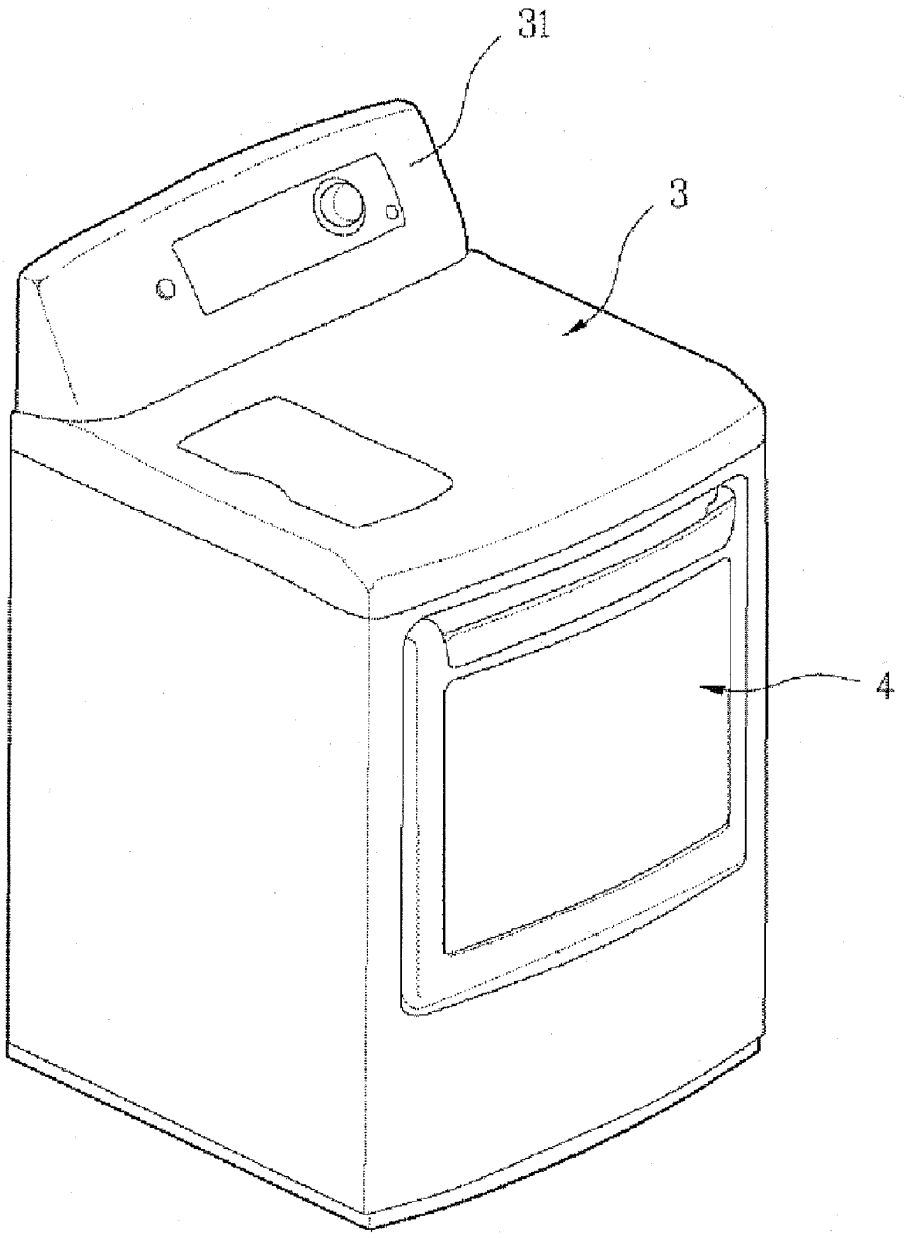
14. The laundry treating apparatus according to claim 12, wherein the fixing member further comprises,
a torsion spring provided in an outer circumferential surface of the pivot, the torsion spring having an end fixed to the door and the other end fixed to the pivot.

15. The laundry treating apparatus according to claim 13, wherein the first groove and the second groove are spaced apart 30 degrees from each other.

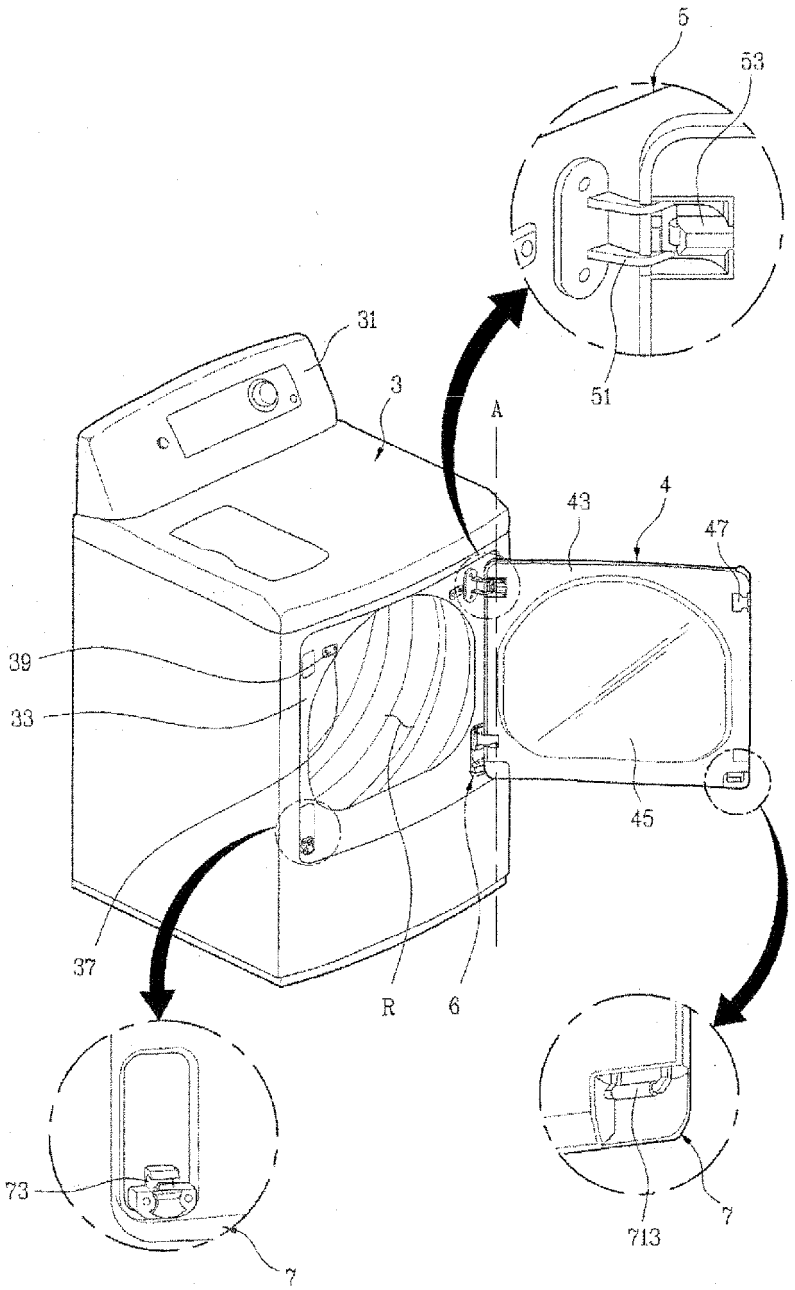
16. The laundry treating apparatus according to claim 2, wherein the fixing member comprises,
a supporting body fixed to the cabinet;
a rotating body having the door fixed thereto;
an inserting body having the pivot inserted thereto to rotatably couple the supporting body to the rotating body;
a plurality of fixing holes spaced apart a predetermined distance from each other along a circumferential direction of the pivot; and
a fixing projection member provided in the inserting body to be detachably inserted in the fixing hole.

17. The laundry treating apparatus according to claim 2, wherein the fixing member comprises,
a cabinet fixing part fixed to an outer surface of the cabinet;
a door fixing part fixed to the door and rotatably coupled to the cabinet fixing part via the pivot;
a door tilting adjustment part provided in the cabinet, the door tilting adjustment part comprising a plurality of projection receiving grooves spaced apart a predetermined distance from each other; and
a hinge supporter extended from the door fixing part to pass through the cabinet, the hinge supporter comprising a projection detachably inserted in the projection receiving groove when the door rotates.

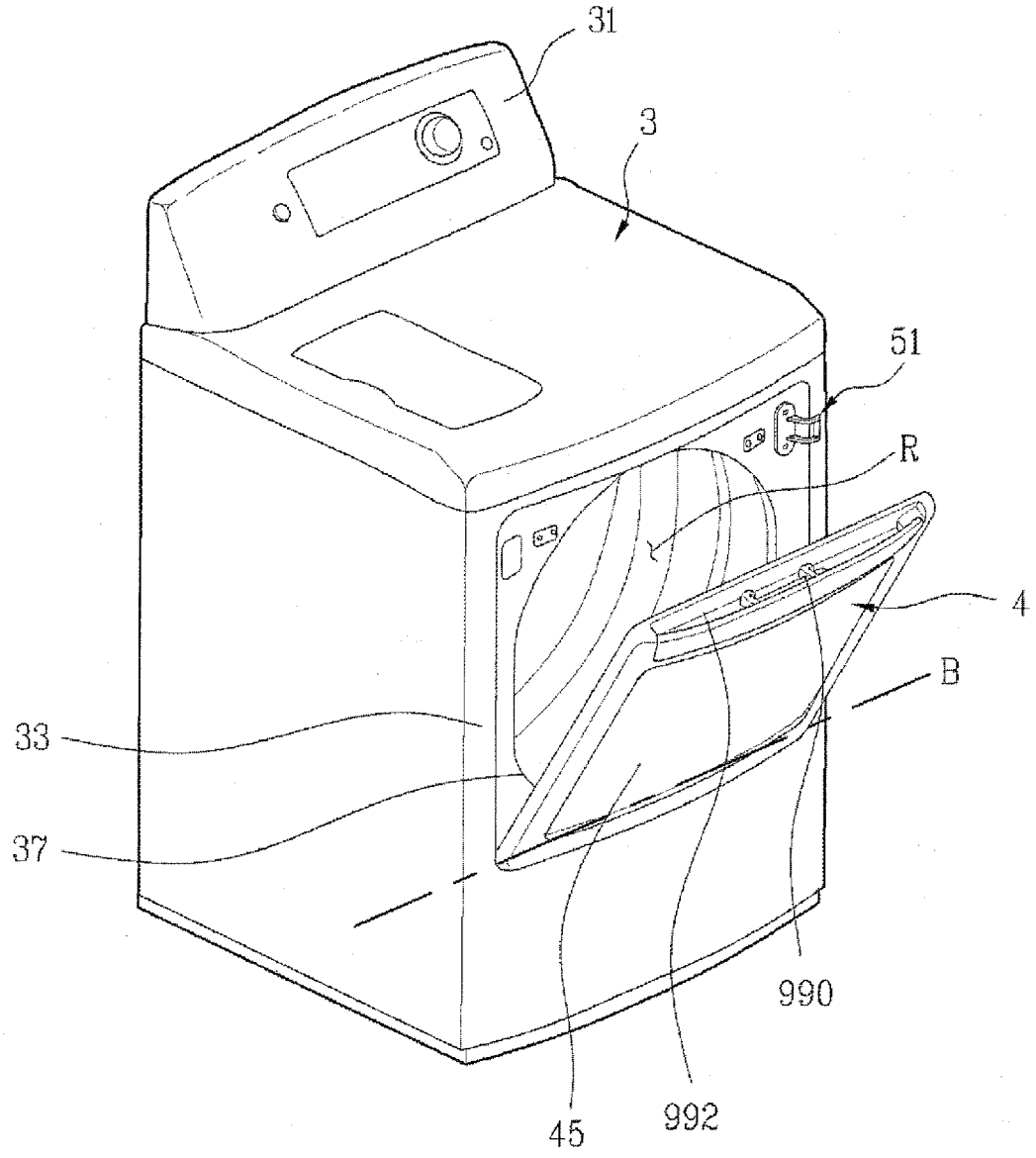
【Figure 1】



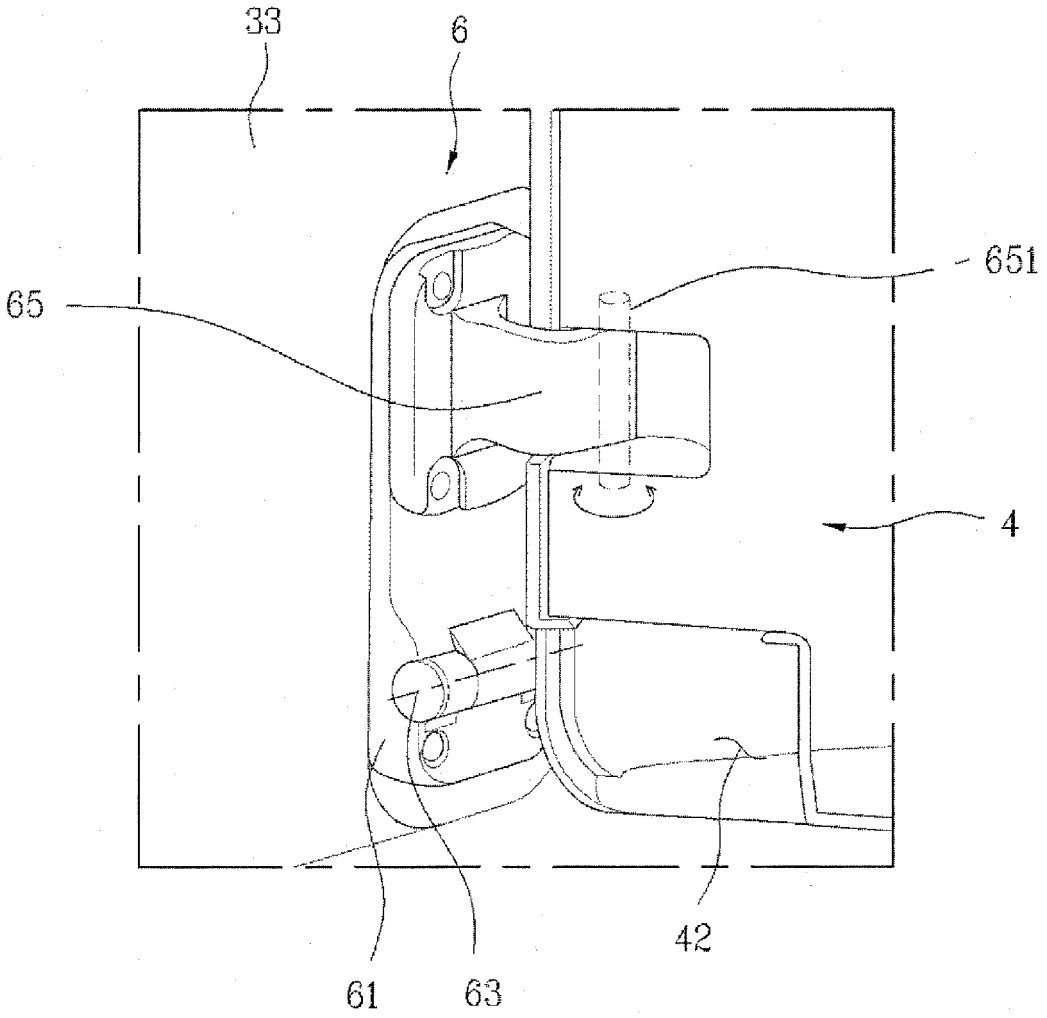
【Figure 2】



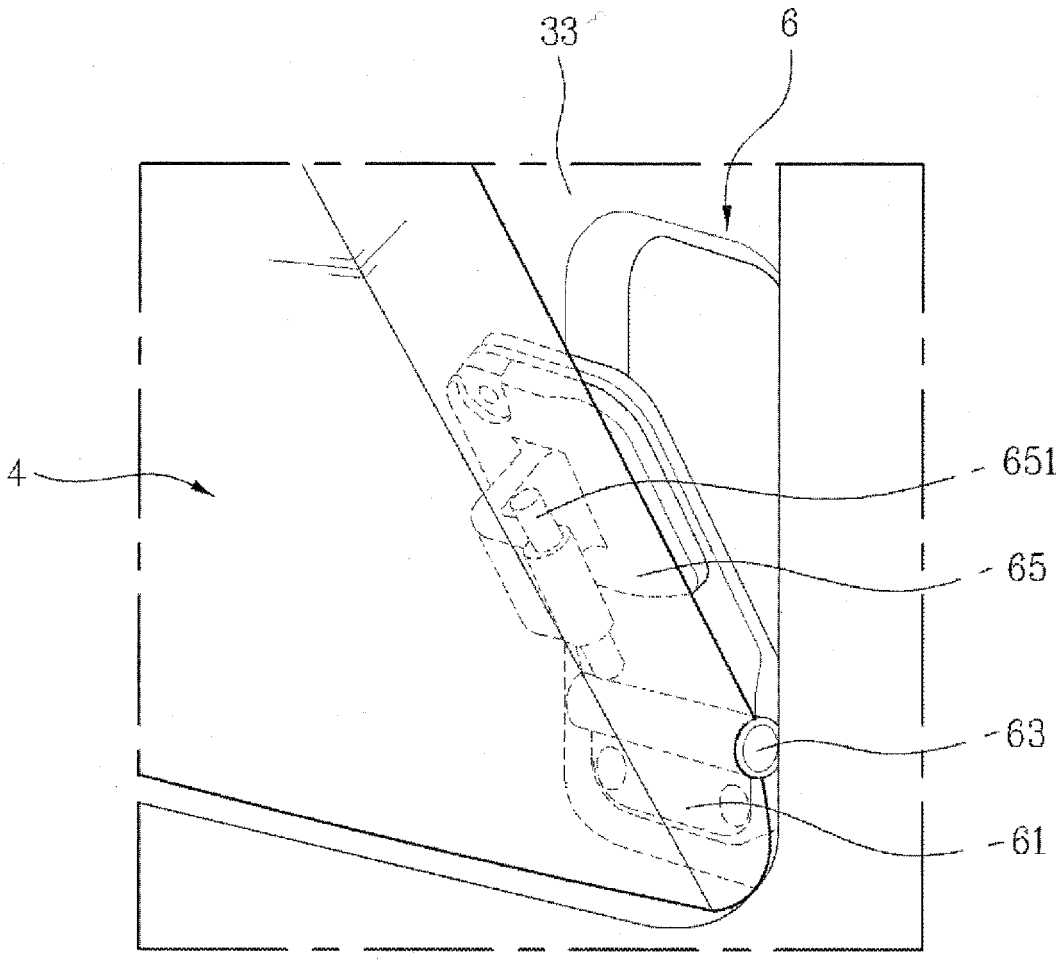
【Figure 3】



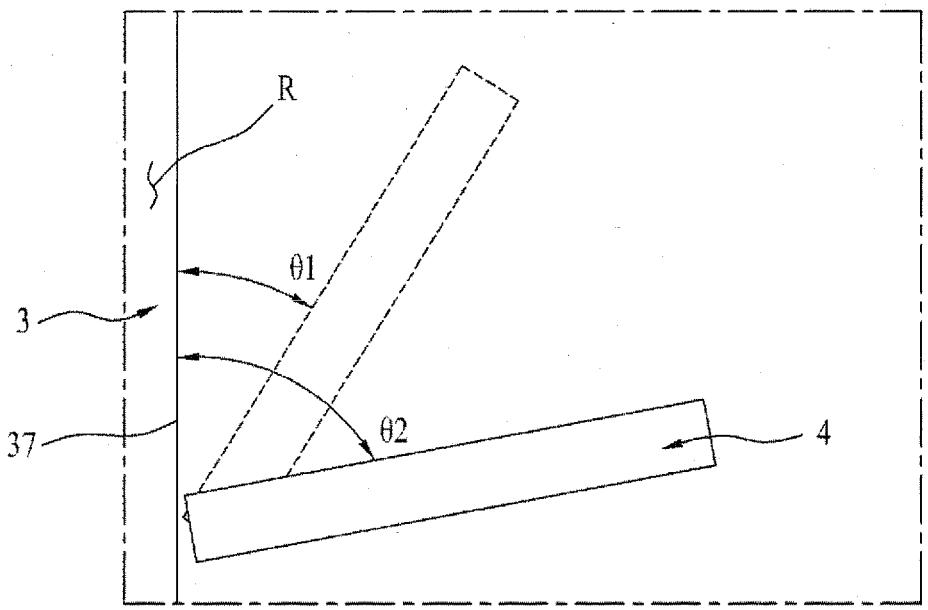
【Figure 4】



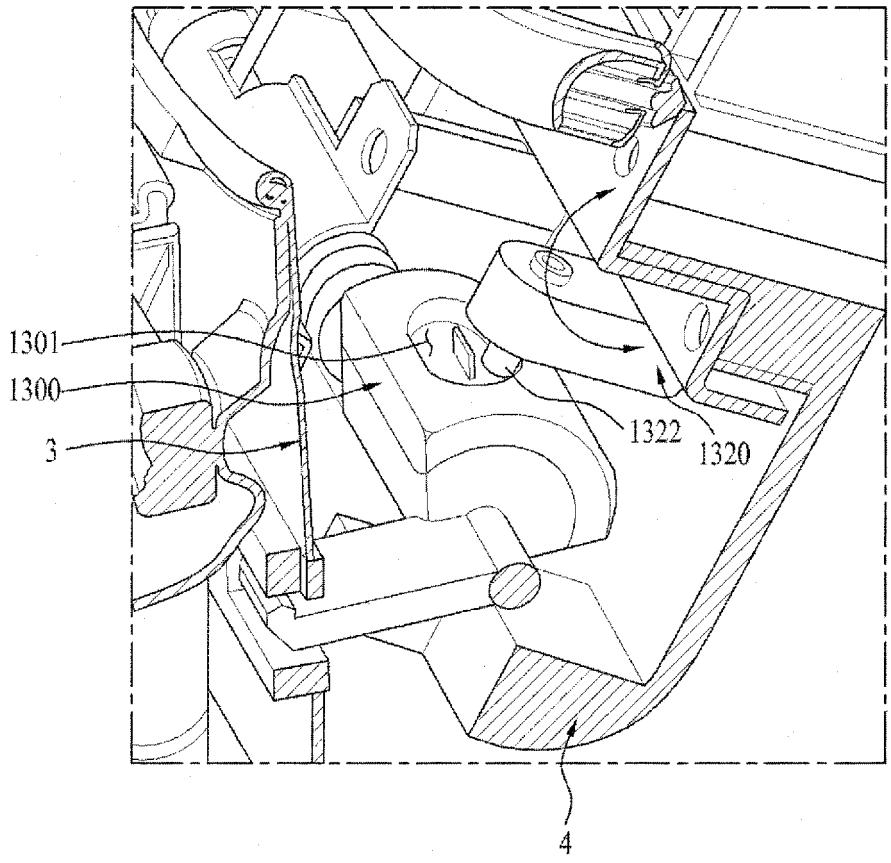
【Figure 5】



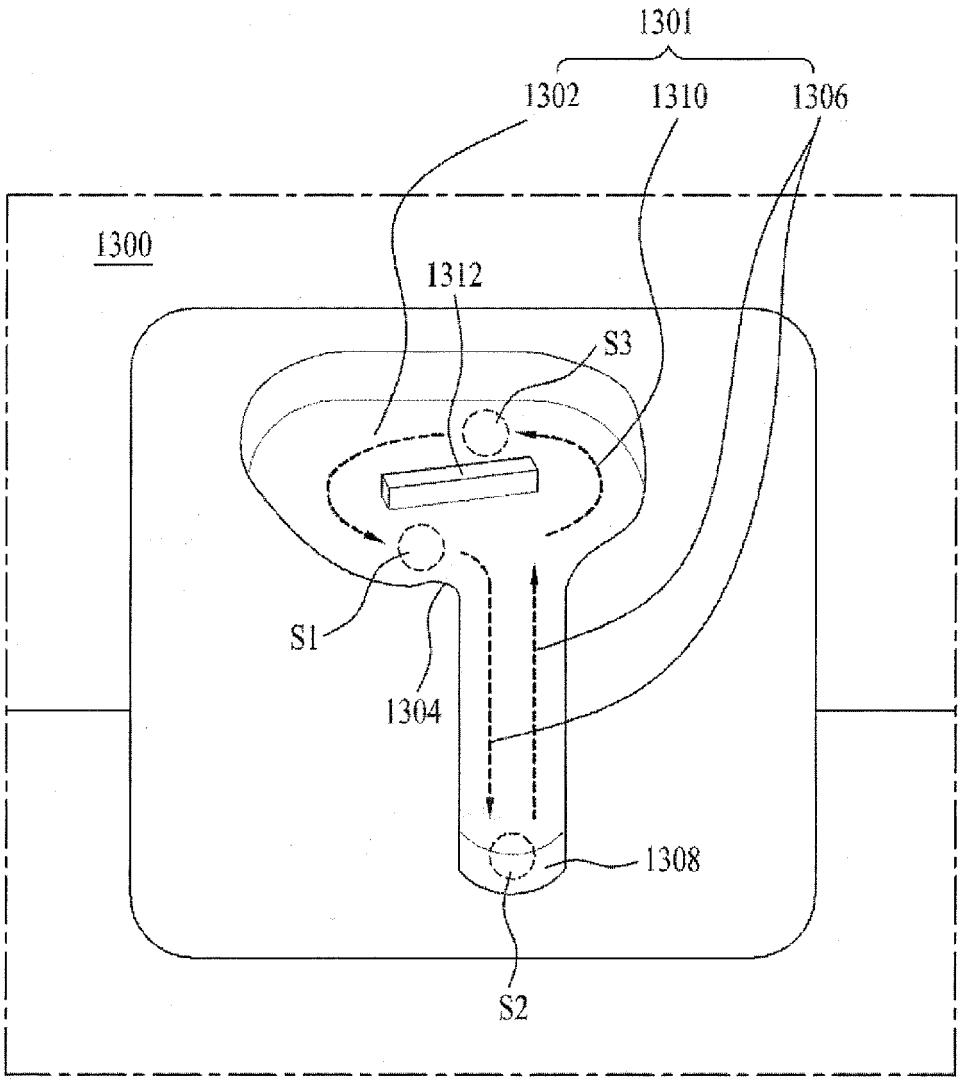
【Figure 6】



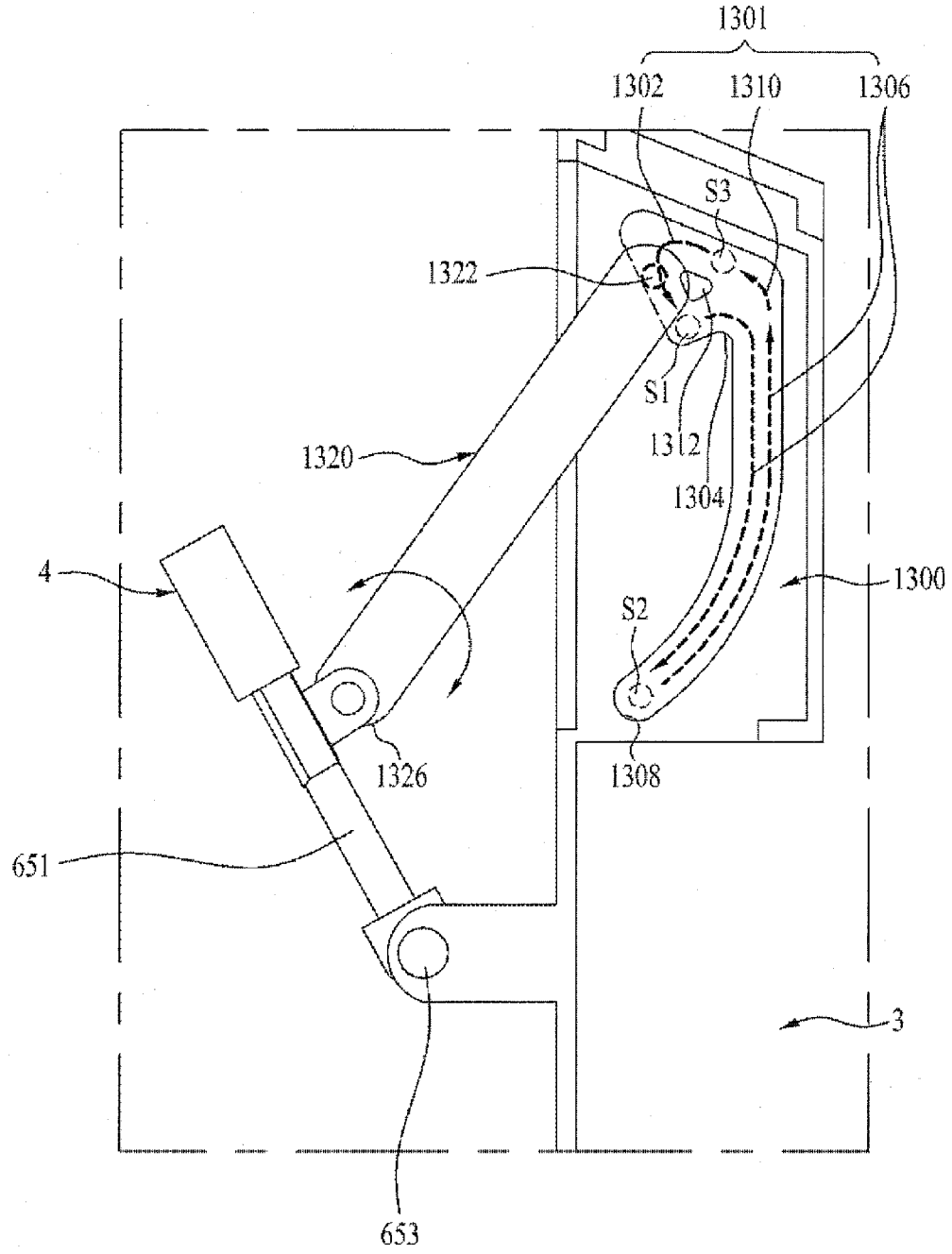
【Figure 7】



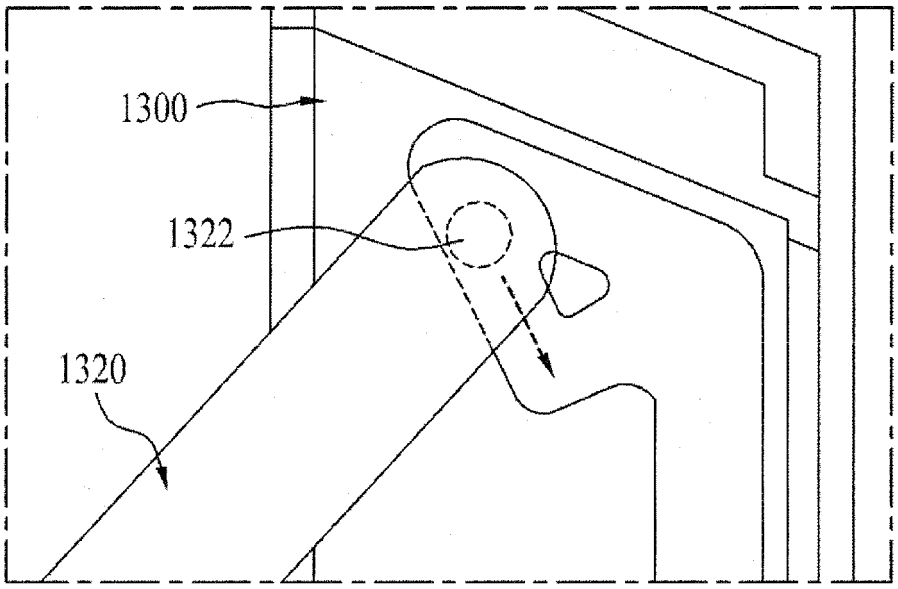
【Figure 8】



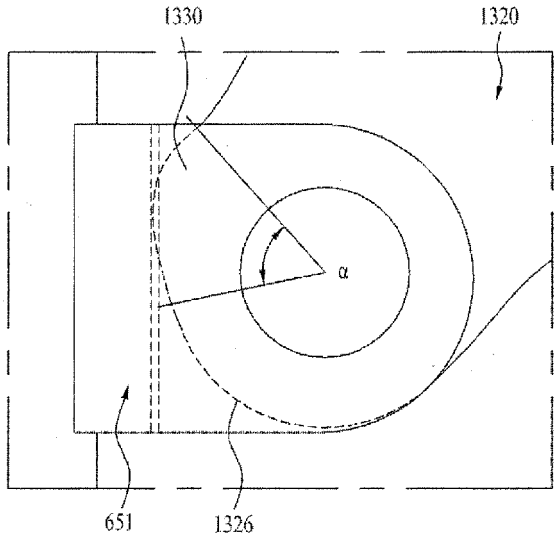
【Figure 9】


1301
1302
1310
1306
S3
1322
S1
1312
1320
1304
4
1300
S2
1326
1308
651
3
653

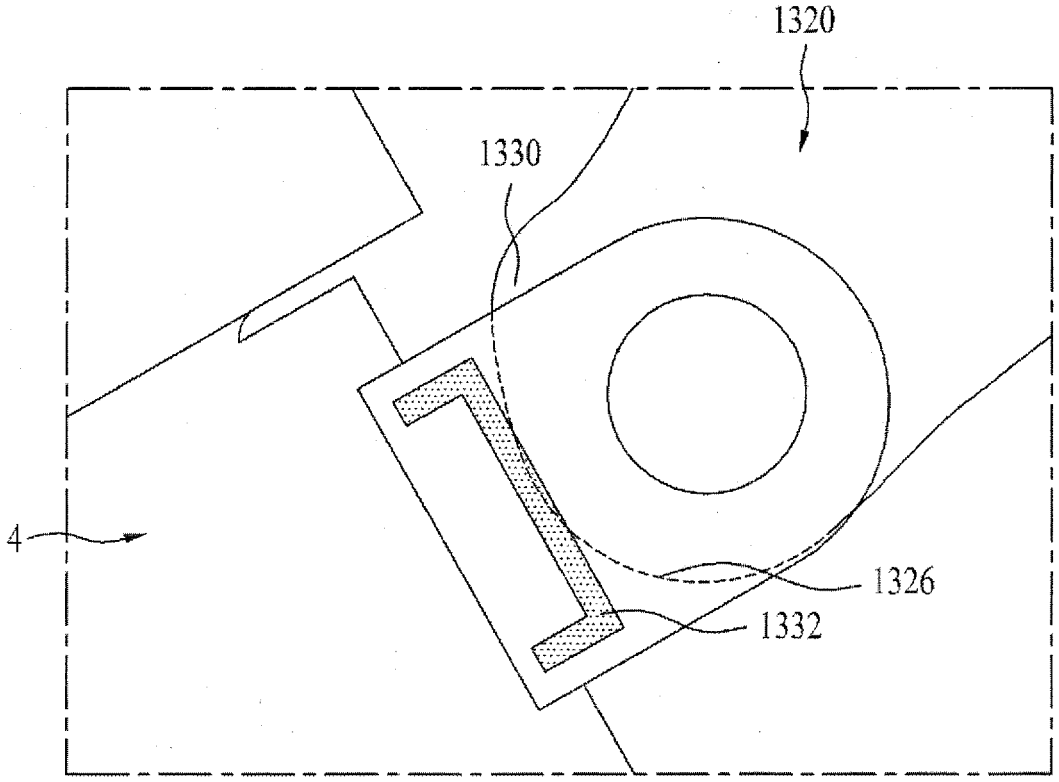
【Figure 10】



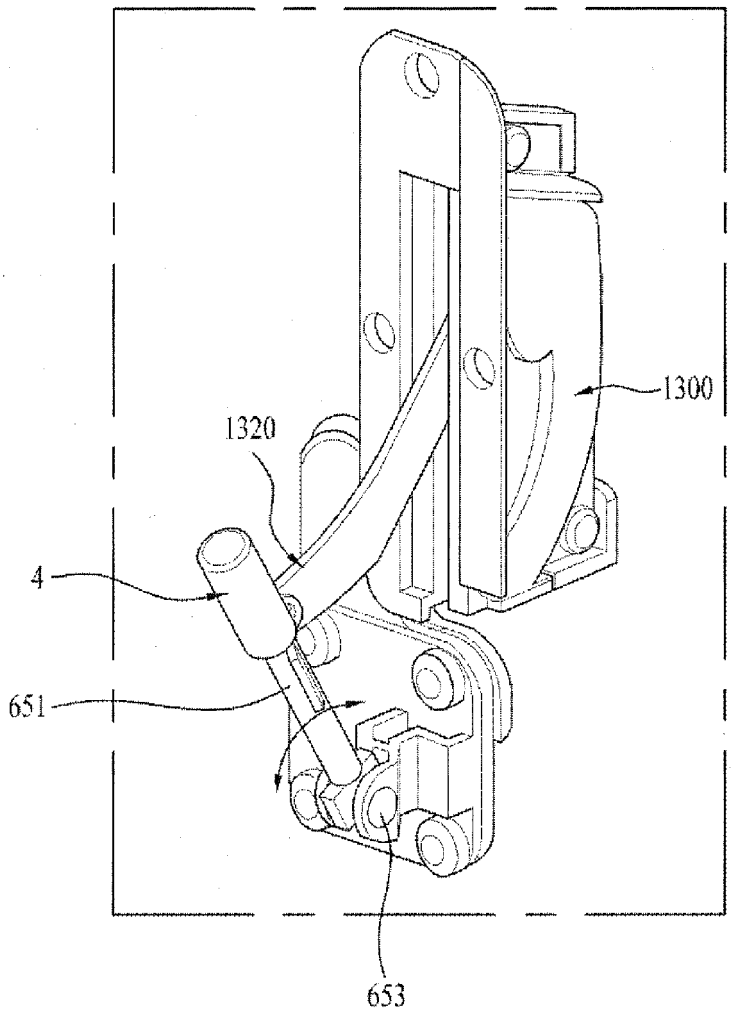
【Figure 11】



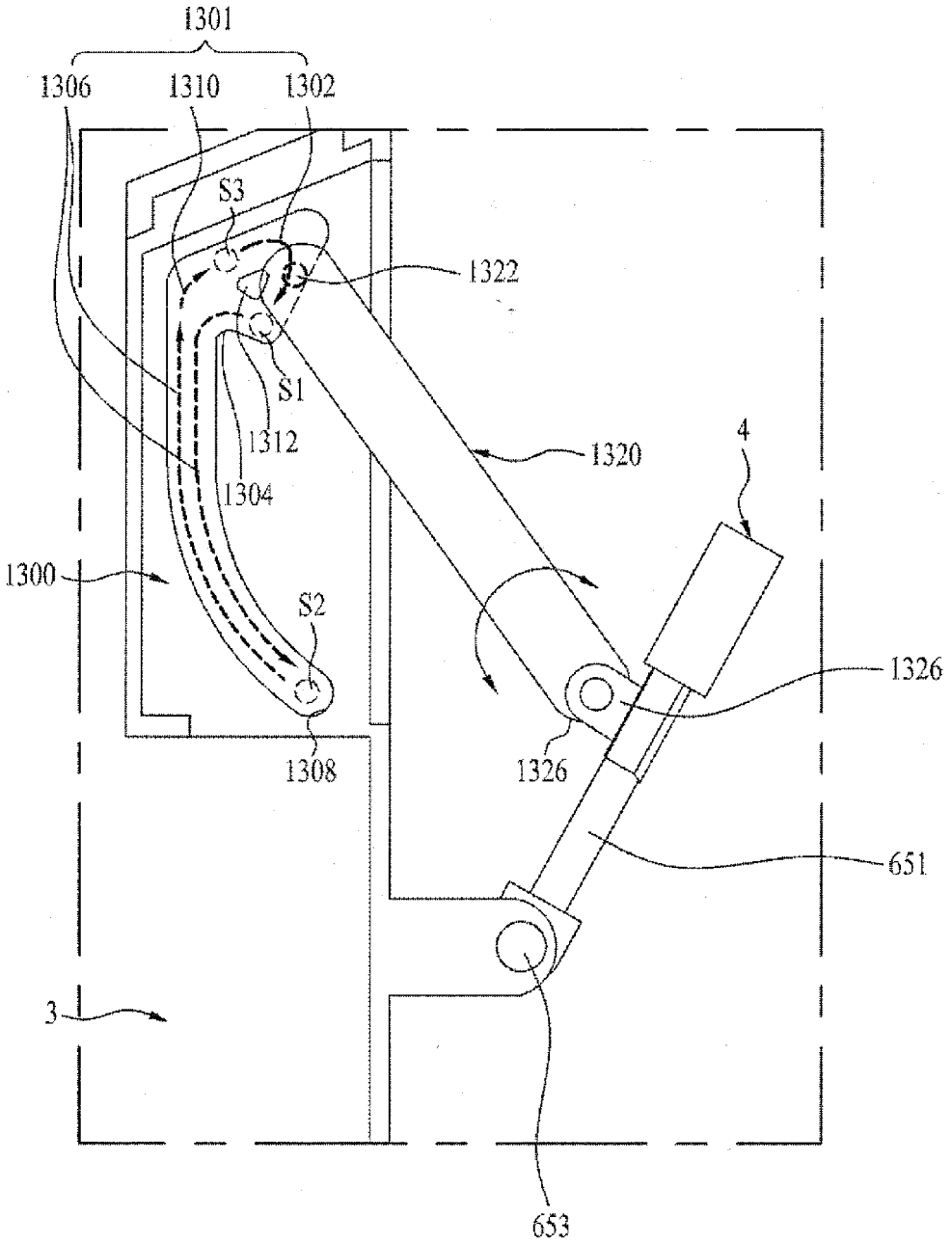
【Figure 12】



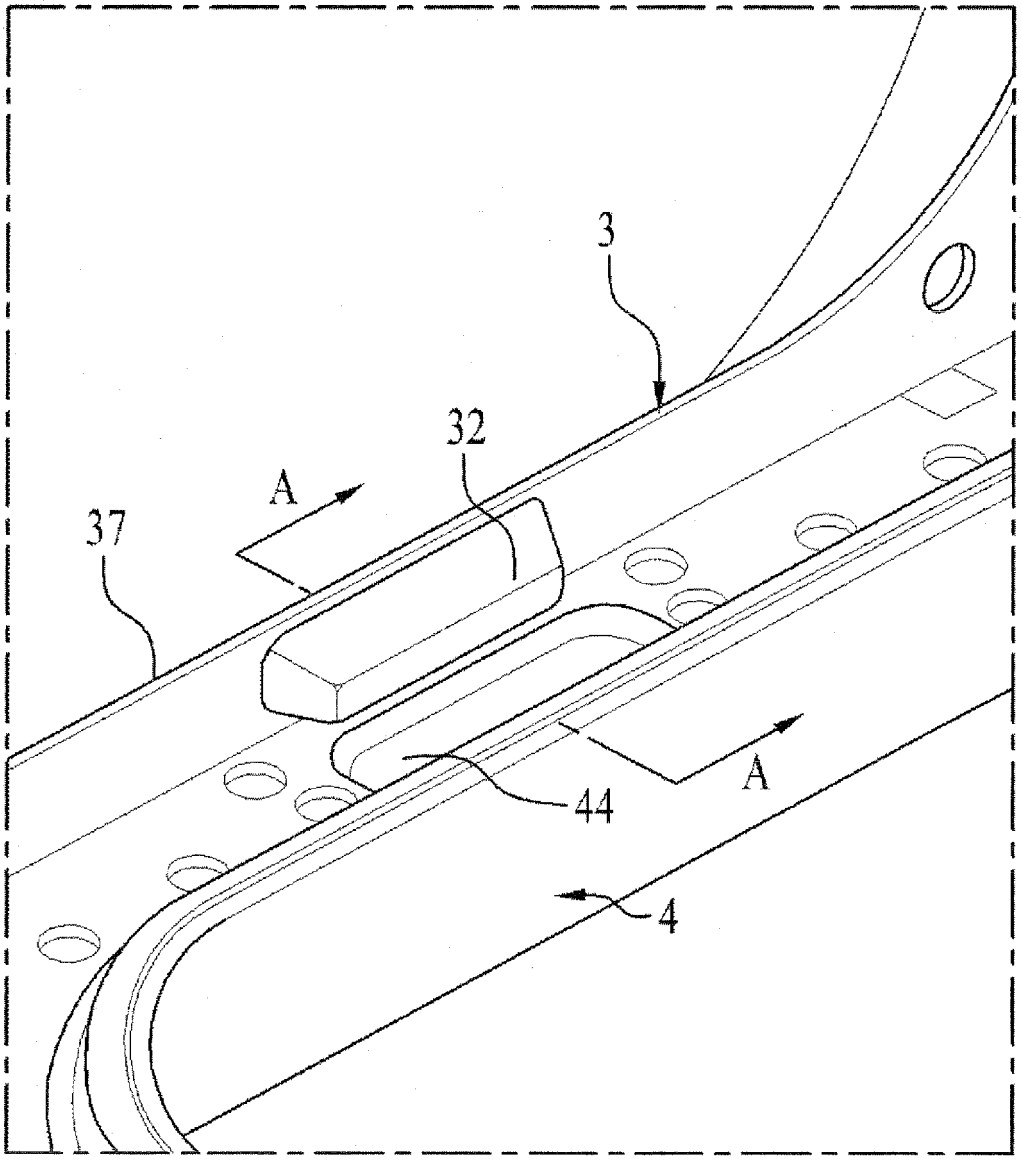
【Figure 13】



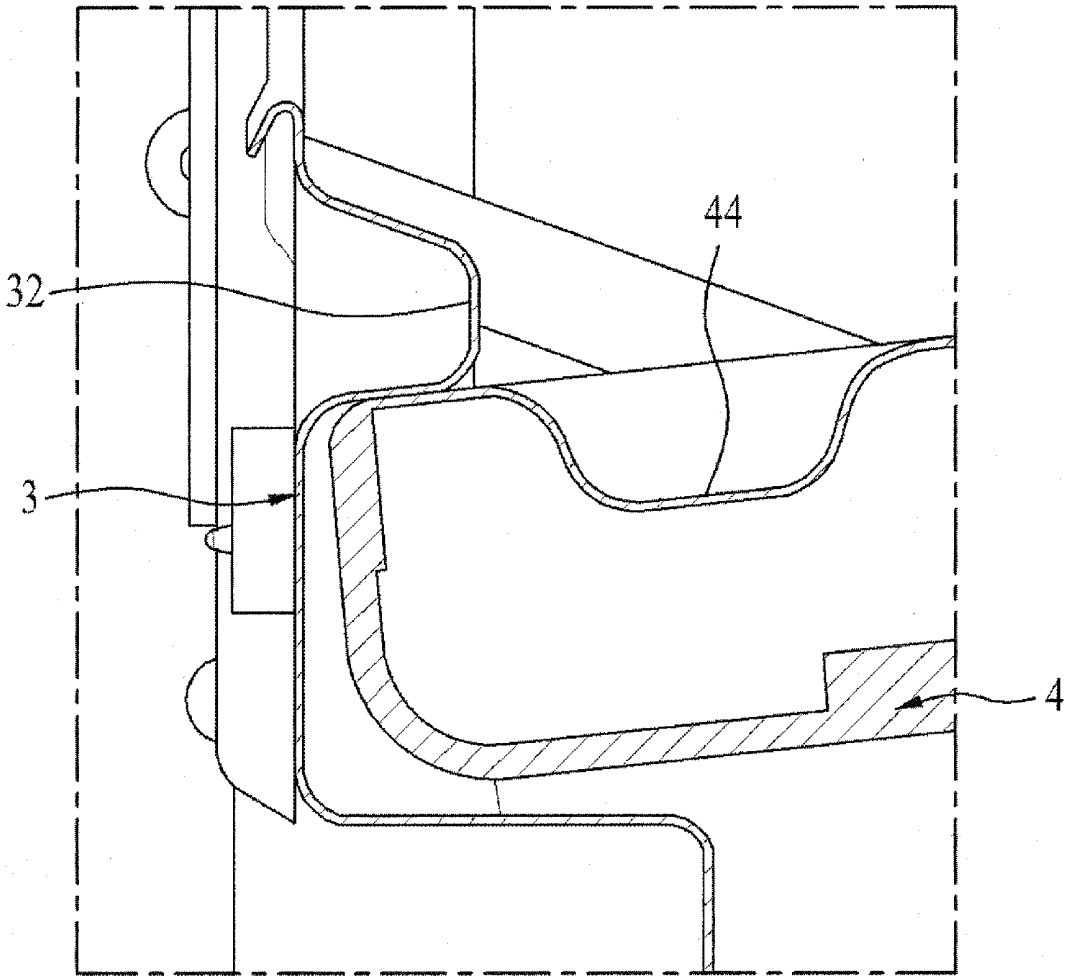
【Figure 14】


1301
1306
1310
1302
S3
1322
S1
1312
1304
1320
4
1300
S2
1326
1308
1326
651
3
653

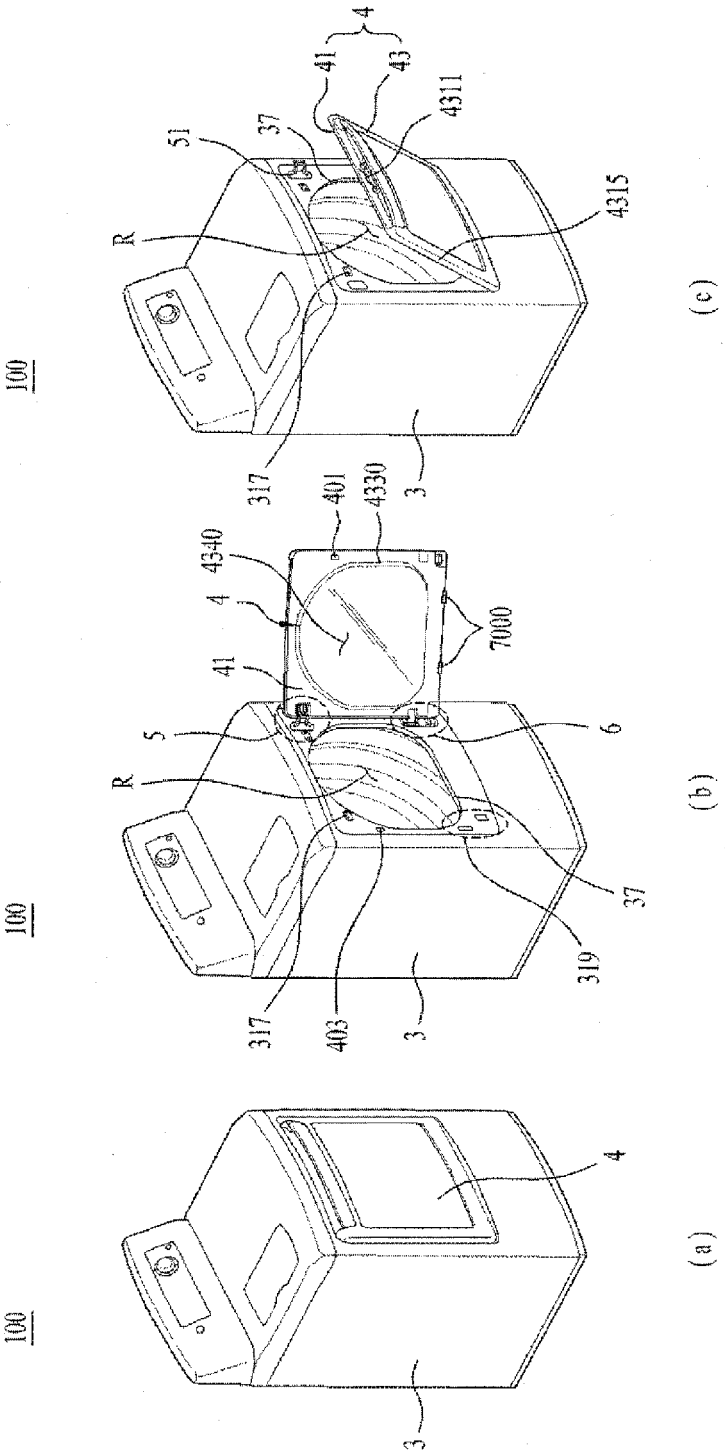
【Figure 15】



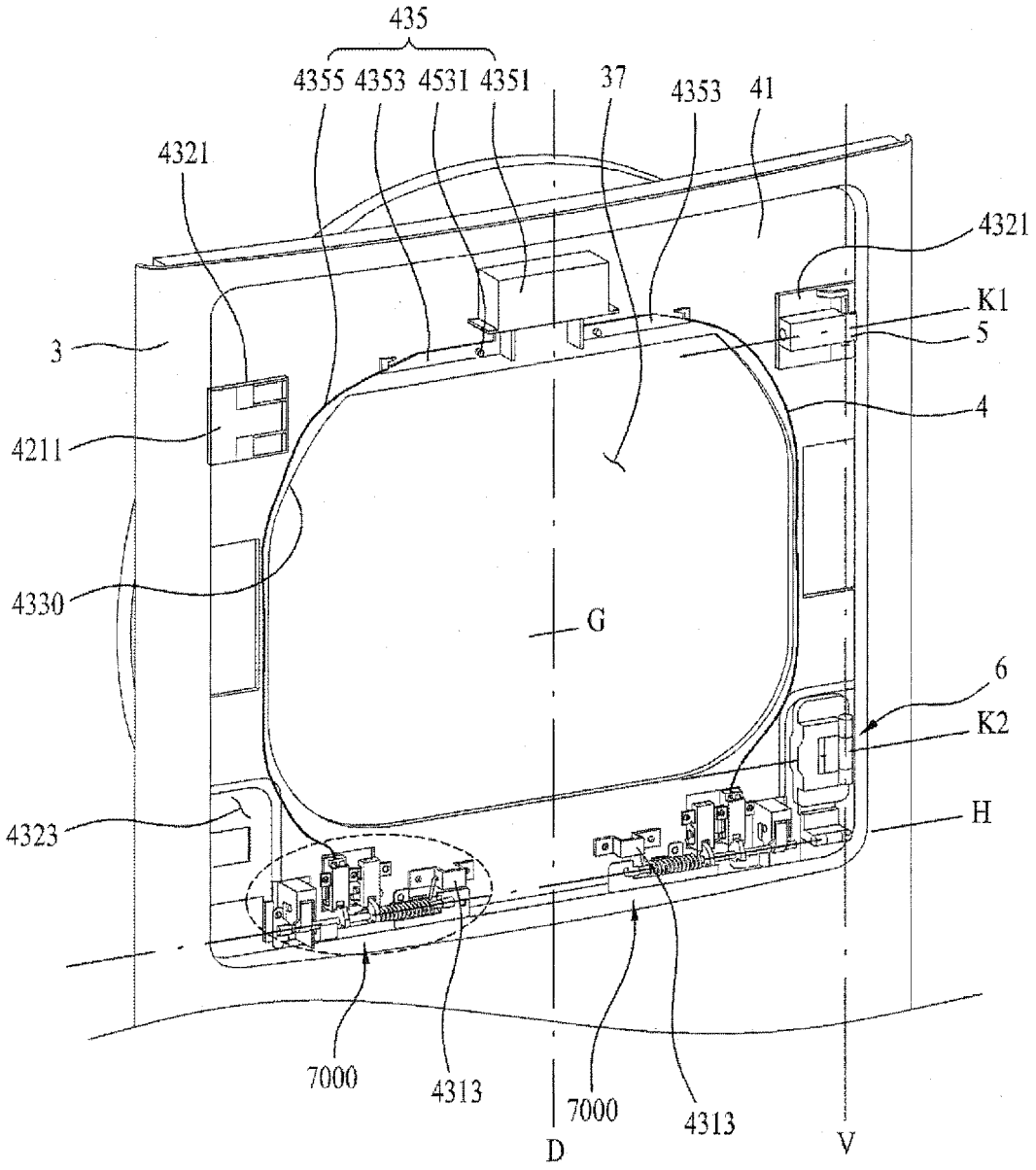
【Figure 16】



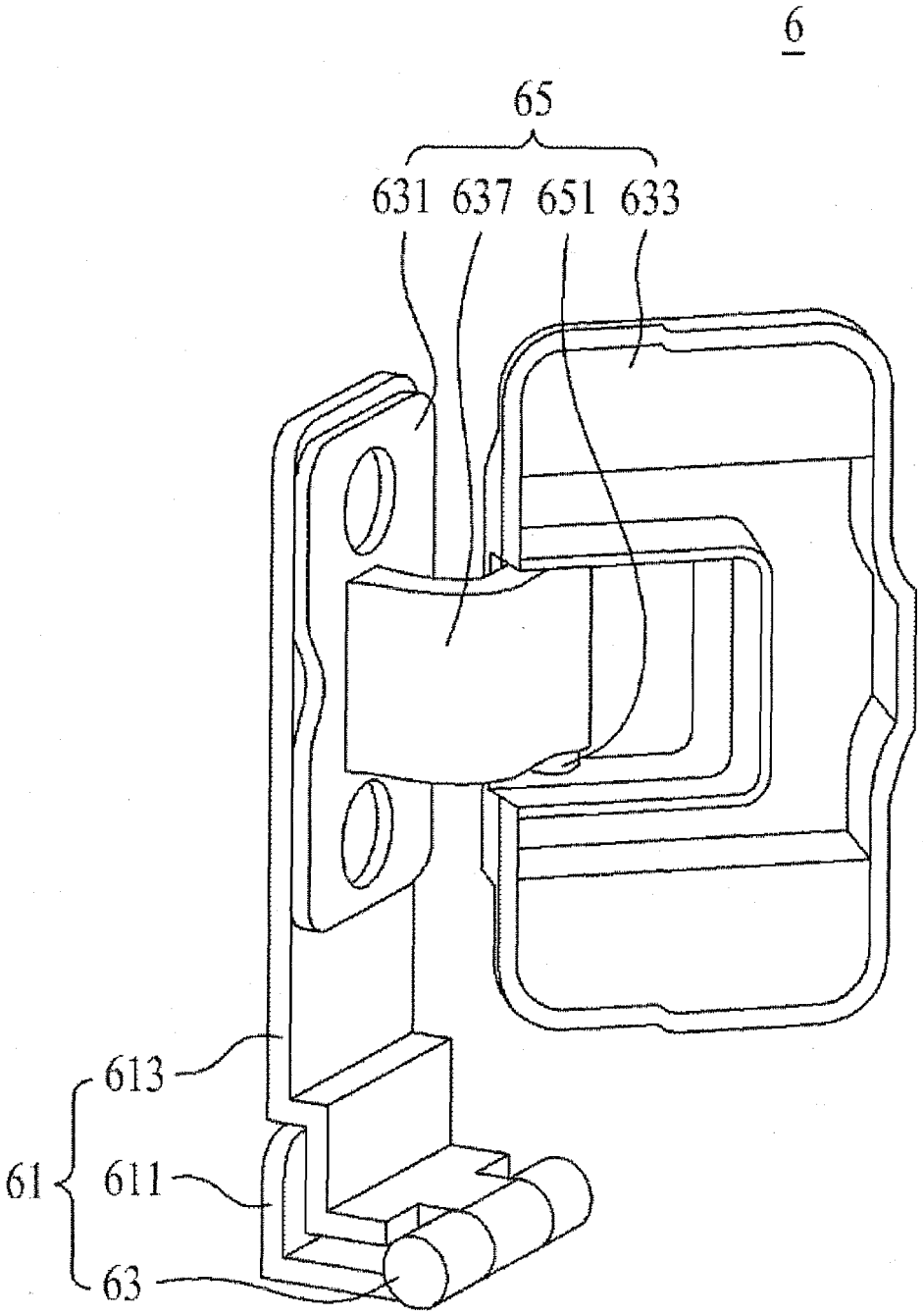
【Figure 17】


100
100
100
(a)
(b)
(c)
4
41
43
4311
51
37
R
4315
317
3
401
4330
4340
7000
5
6
319
403

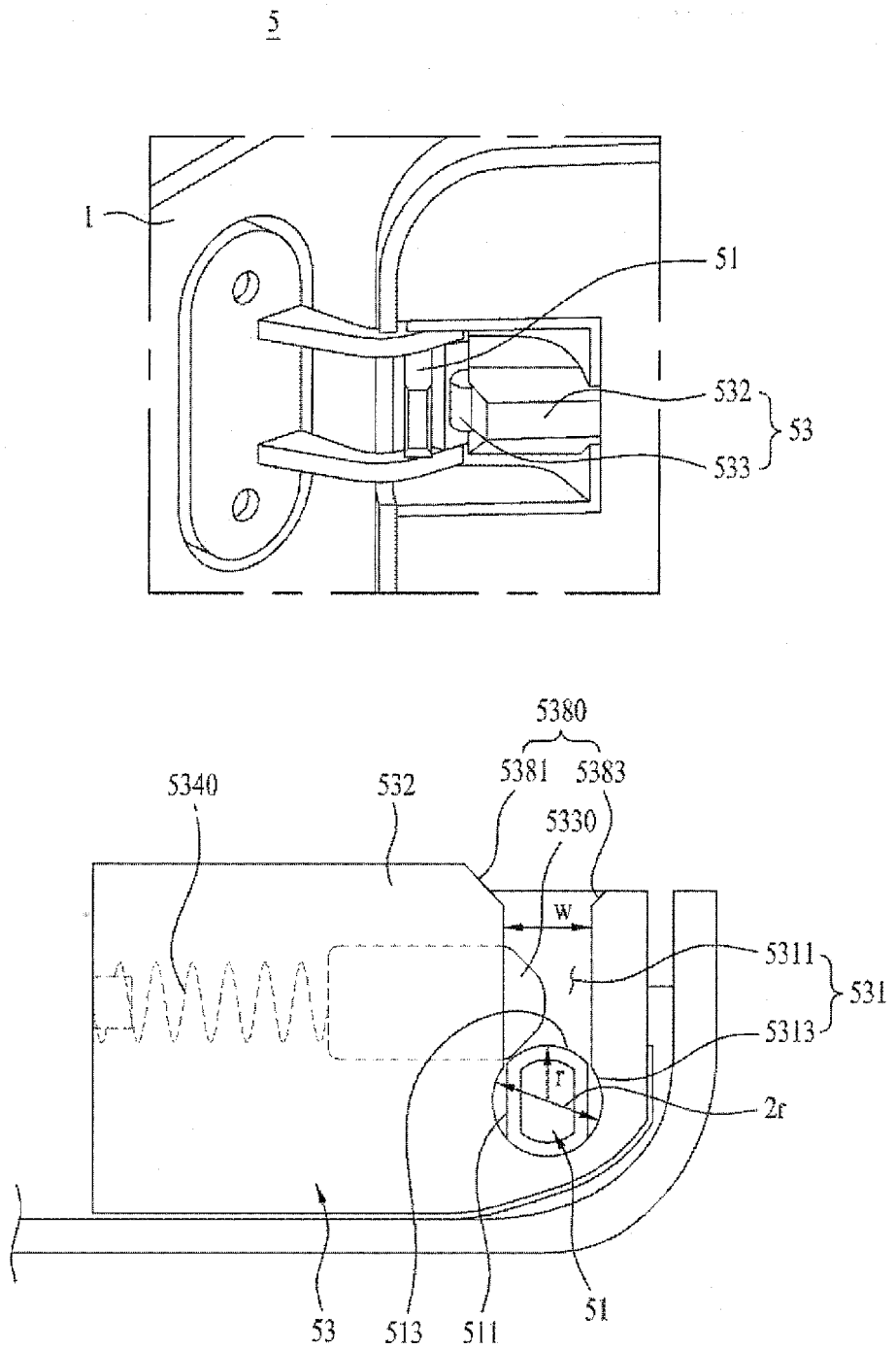
【Figure 18】


435
4355
4353
4531
4351
37
4353
41
4321
4321
K1
5
3
4
4211
4330
G
6
K2
4323
H
7000
4313
7000
4313
D
V

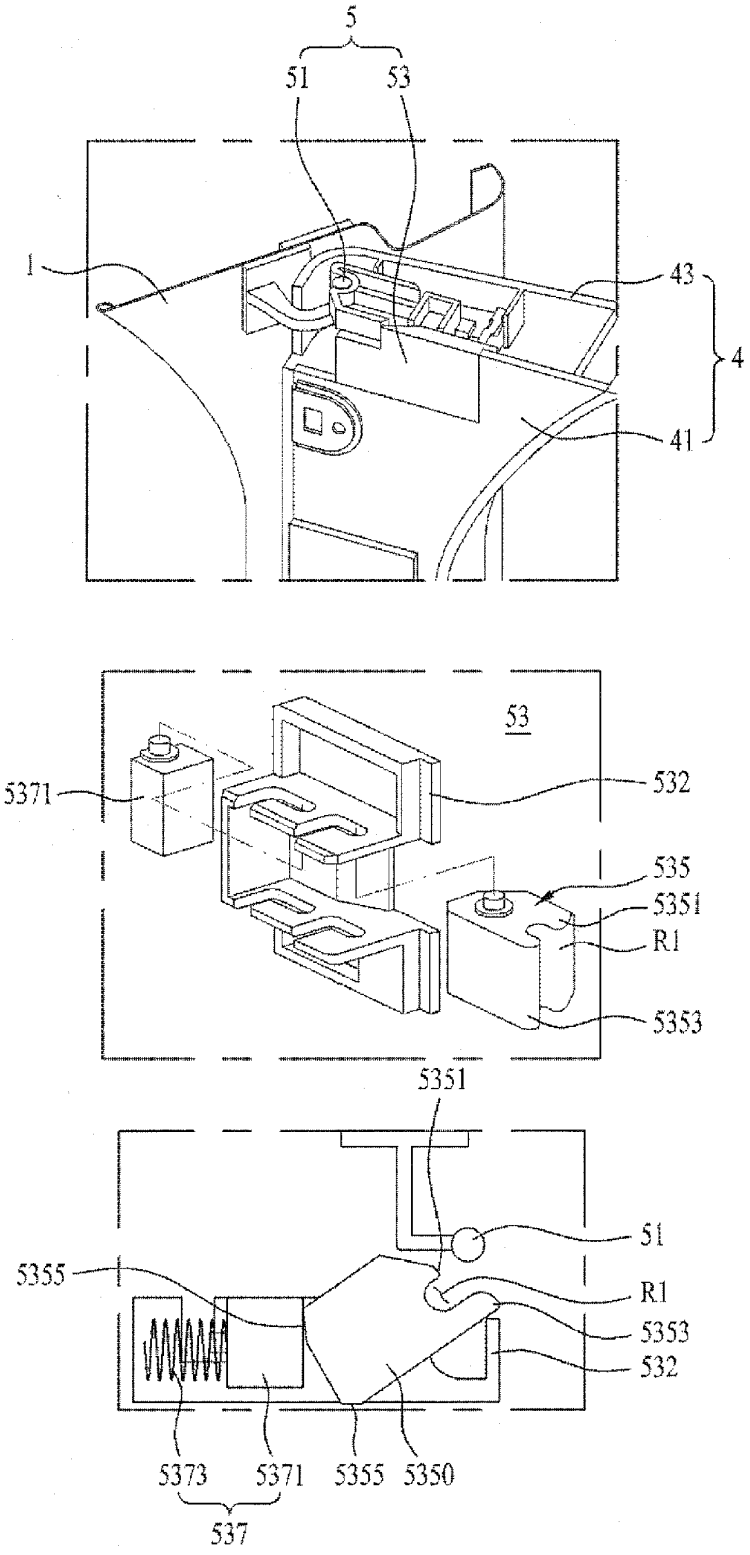
【Figure 19】



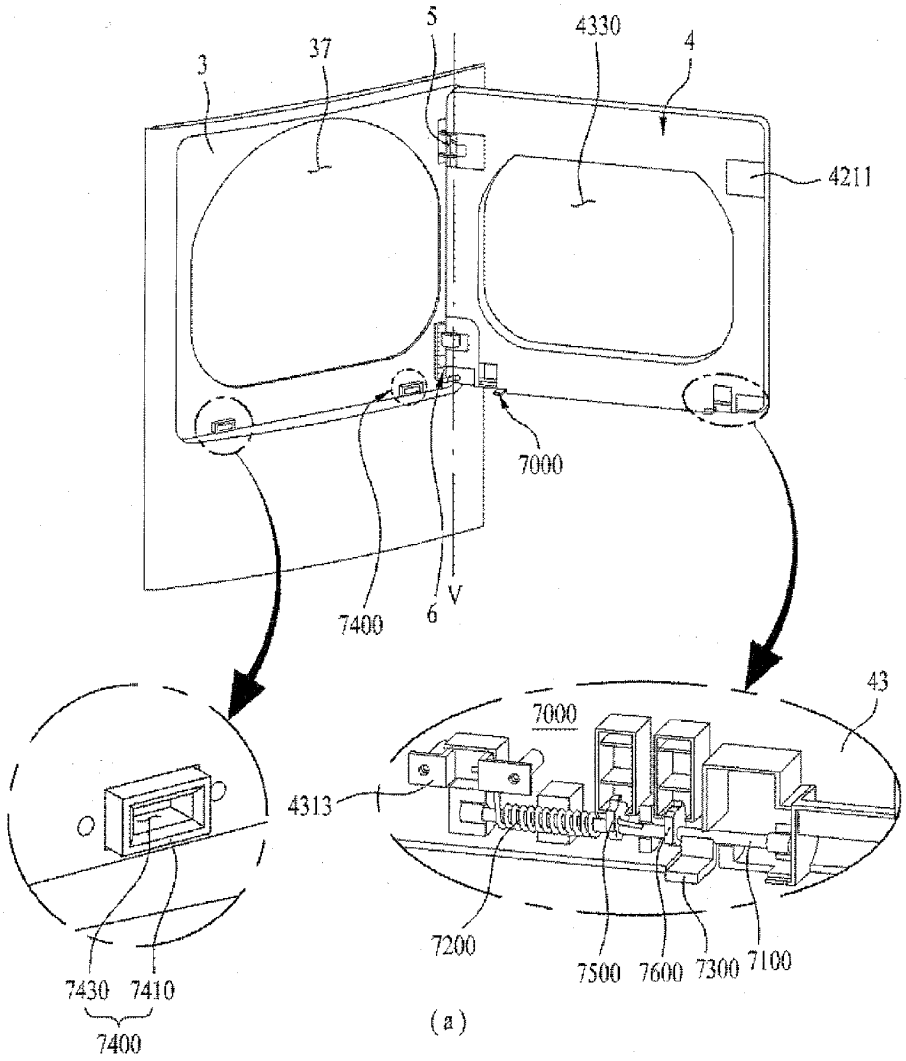
【Figure 20】


5
1
51
532
53
533
5380
5381
5383
5340
532
5330
W
5311
531
5313
r
2r
53
513
511
51

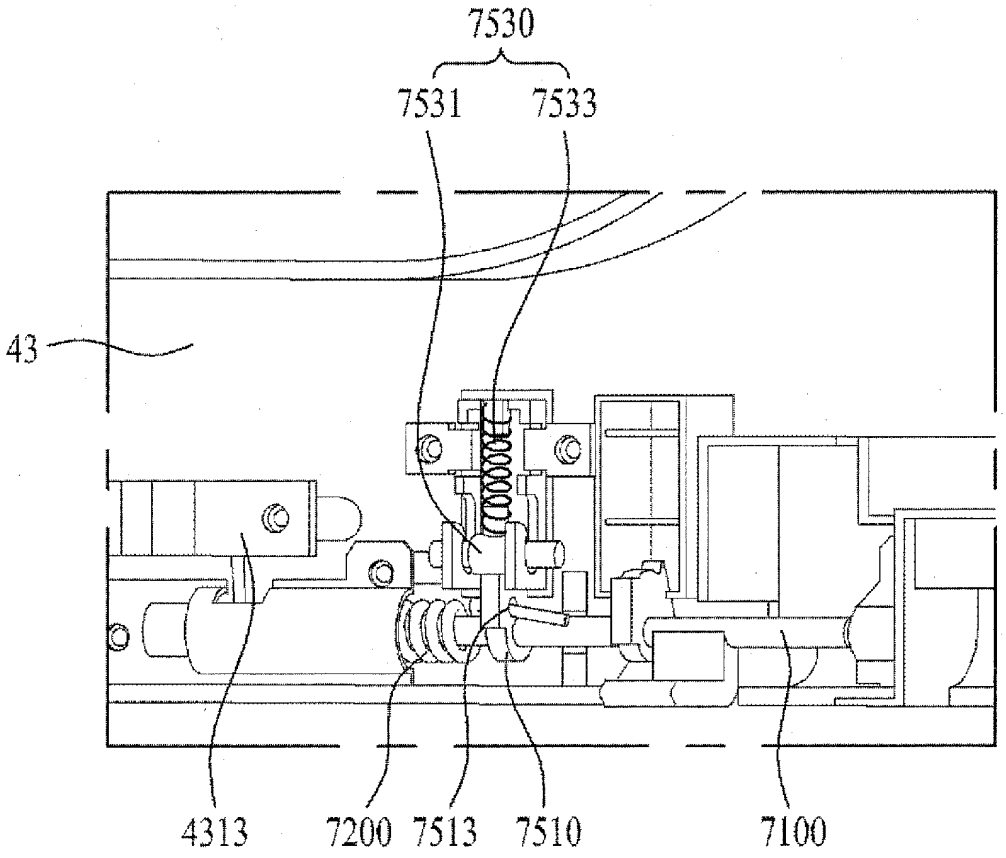
【Figure 21】


5
51
53
1
43
4
41
53
5371
532
535
5351
R1
5353
5351
51
5355
R1
5353
532
5373
5371
5355
5350
537

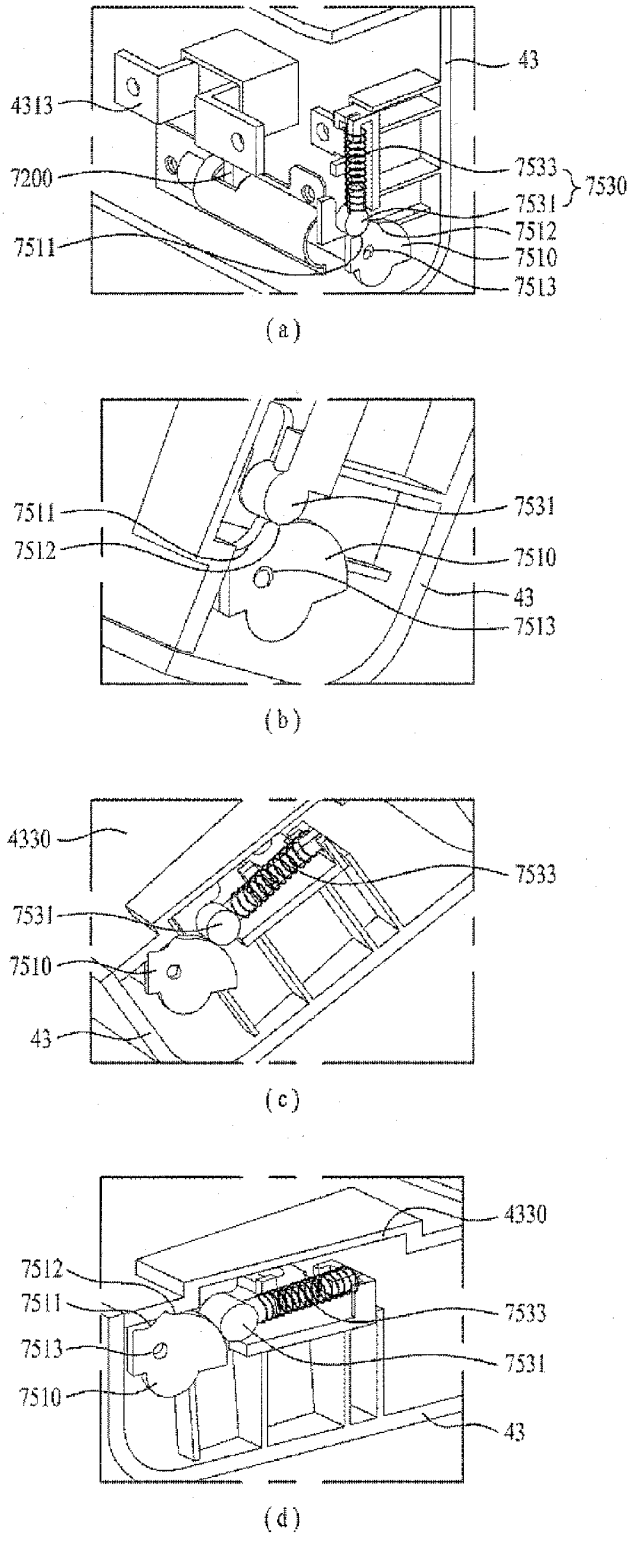
【Figure 22】


5
4330
4
37
3
4211
7000
7400
6
V
43
7000
4313
7200
7500
7600
7300
7100
7430
7410
7400
(a)
7100
41
43
7300
7400
(b)

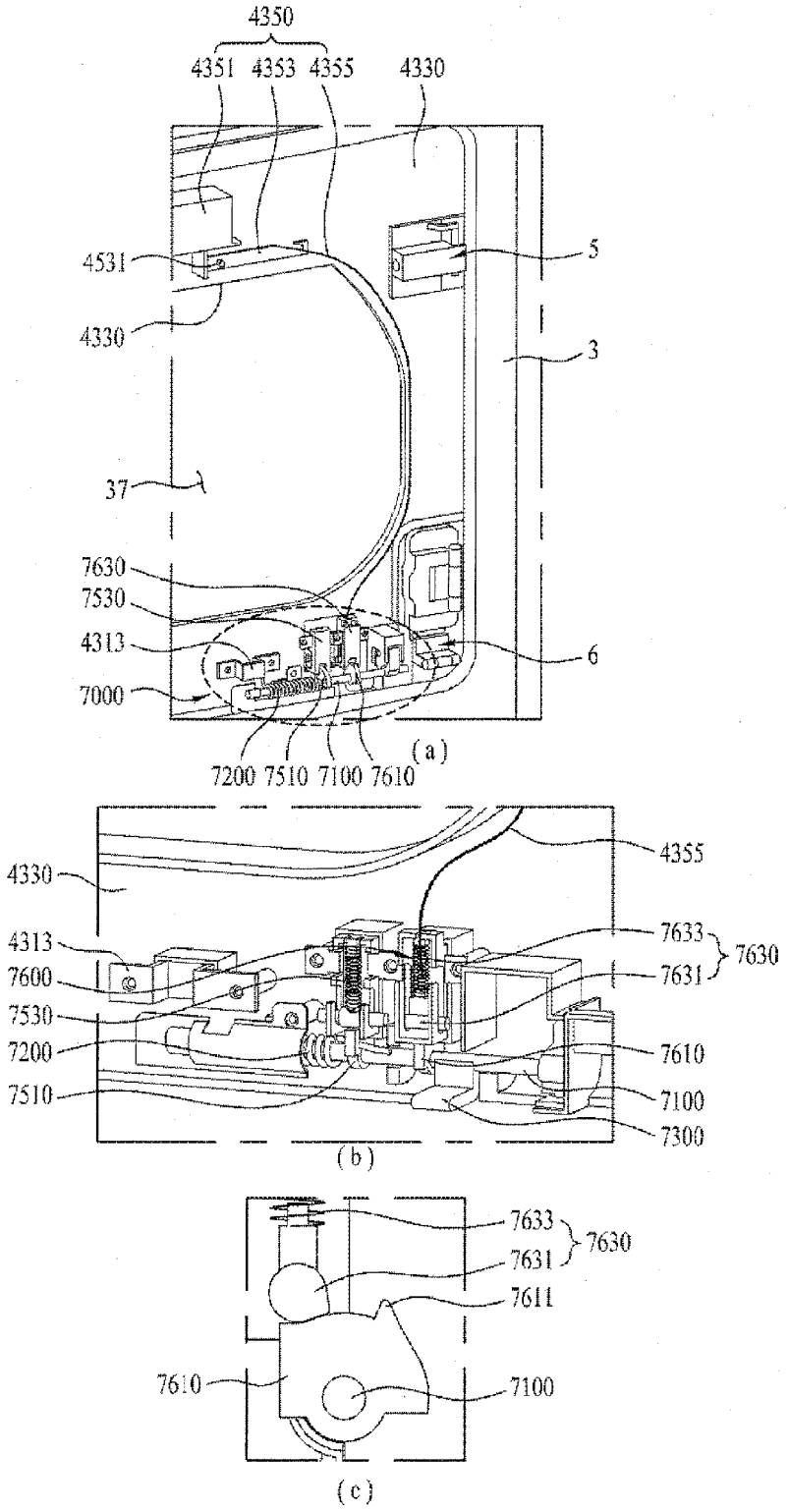
【Figure 23】



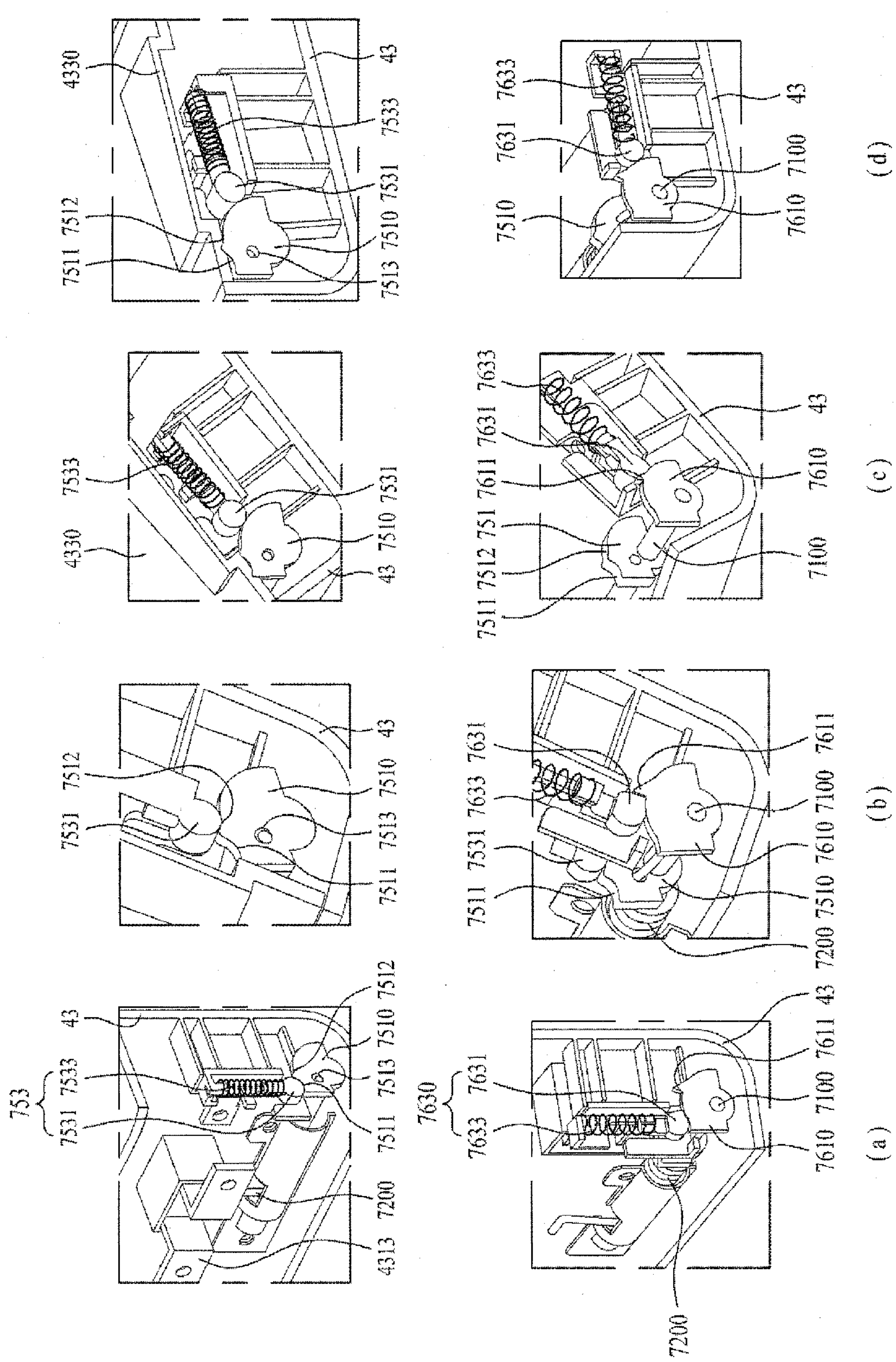
【Figure 24】


43
4313
7533
7530
7200
7531
7512
7511
7510
7513
(a)
7511
7531
7512
7510
43
7513
(b)
4330
7533
7531
7510
43
(c)
4330
7512
7511
7533
7513
7531
7510
43
(d)

【Figure 25】

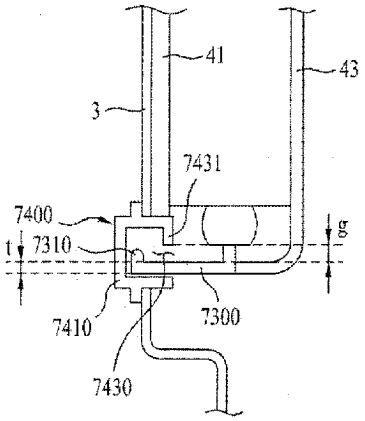

4350
4351
4353
4355
4330
4531
5
4330
3
37
7630
7530
4313
6
7000
7200
7510
7100
7610
(a)
4330
4355
4313
7633
7630
7600
7631
7530
7610
7200
7100
7510
7300
(b)
7633
7630
7631
7611
7610
7100
(c)

【Figure 26】

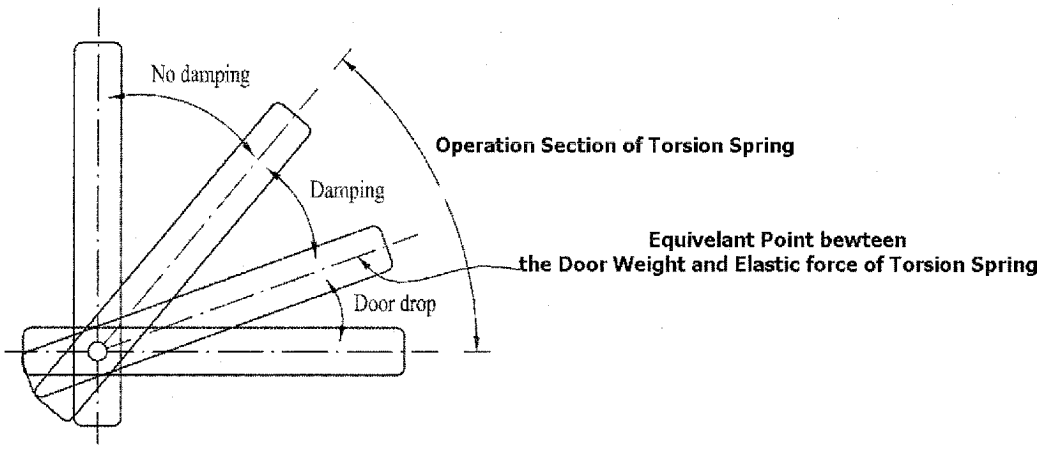


753
7531 7533 43
7511 7513 7510 7512
7200
4313
7630
7633 7631
7610 7100 7611 43
7200
(a)
7531 7512
7511 7513 7510 43
7631
7511 7531 7633
7200 7510 7610 7100 7611
(b)
7533
4330
43 7510 7531
7511 7512 751 7611 7631 7633
7100 7610 43
(c)
4330
7511 7512
7513 7510 7531 7533 43
7510 7631 7633
7610 7100 43
(d)

【Figure 27】

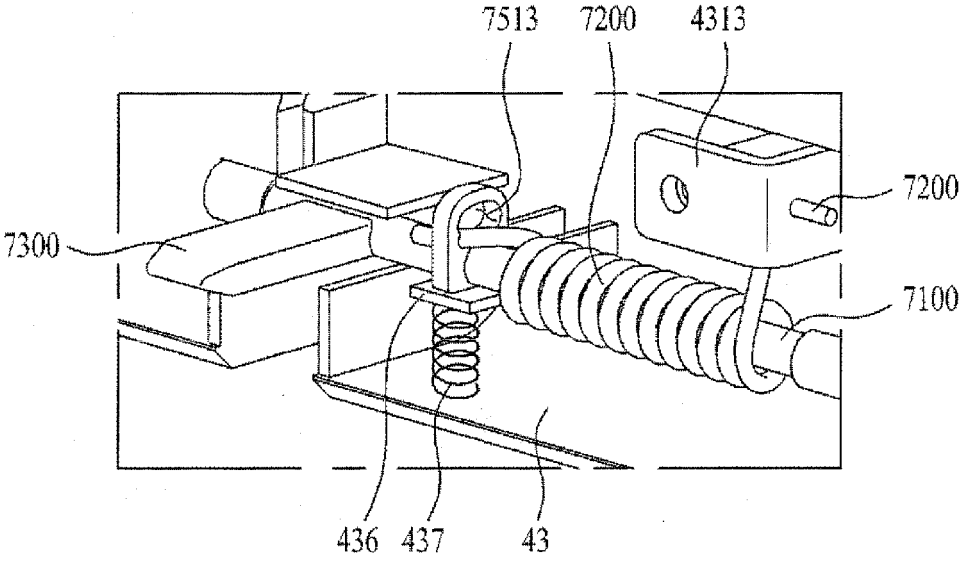

41
43
3
7431
7400
7310
g
t
7410
7300
7430

(a)

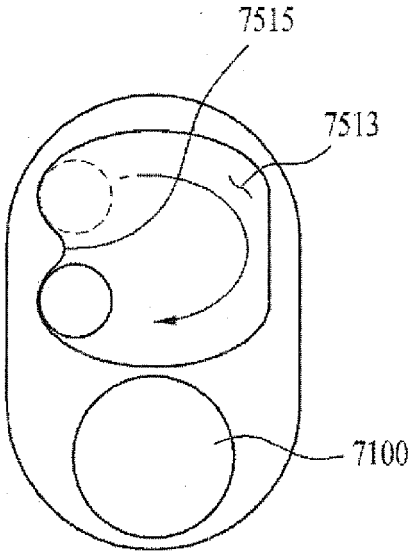

No damping
Operation Section of Torsion Spring
Damping
Equivelant Point bewteen
the Door Weight and Elastic force of Torsion Spring
Door drop

(b)

【Figure 28】

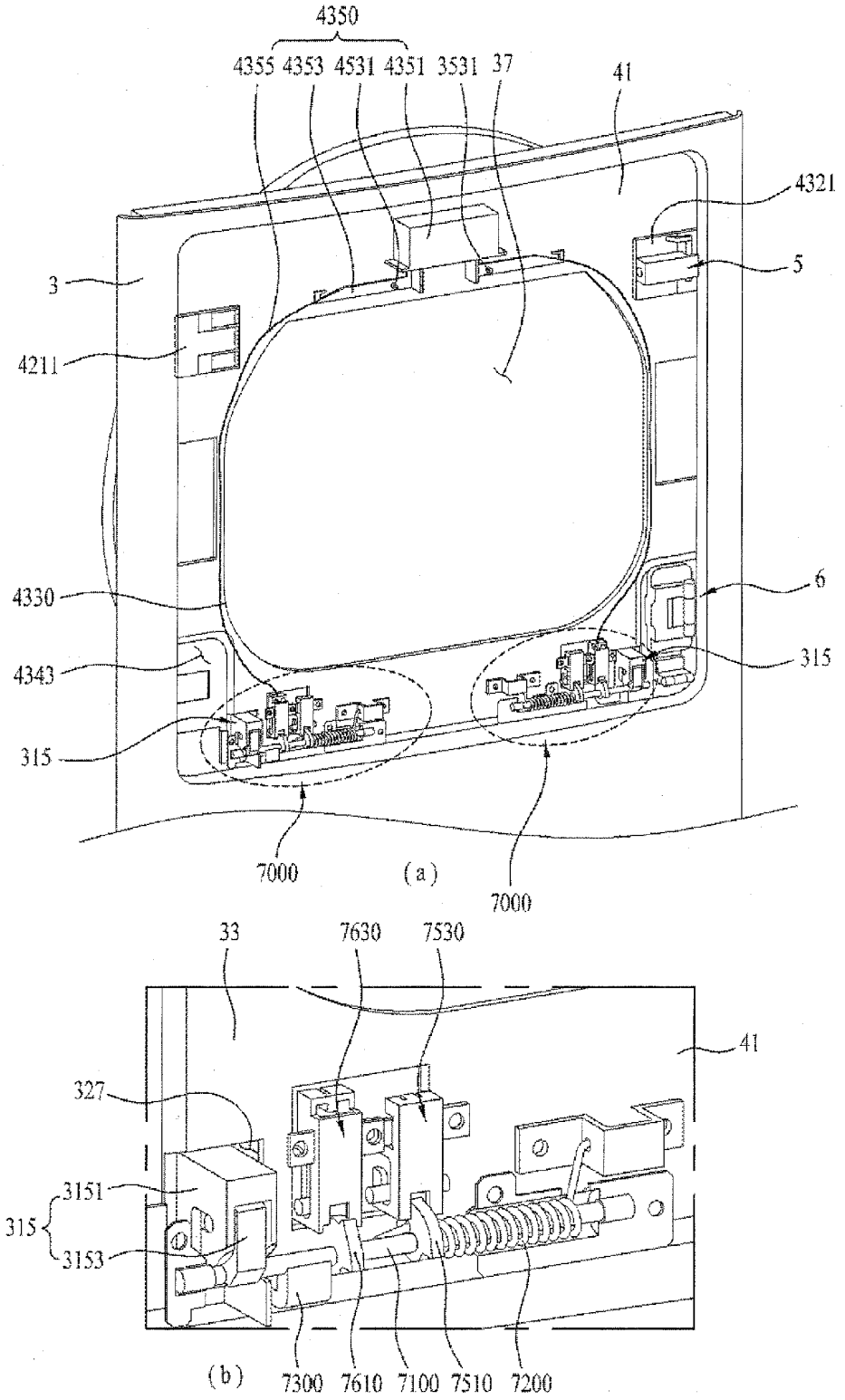


(a)

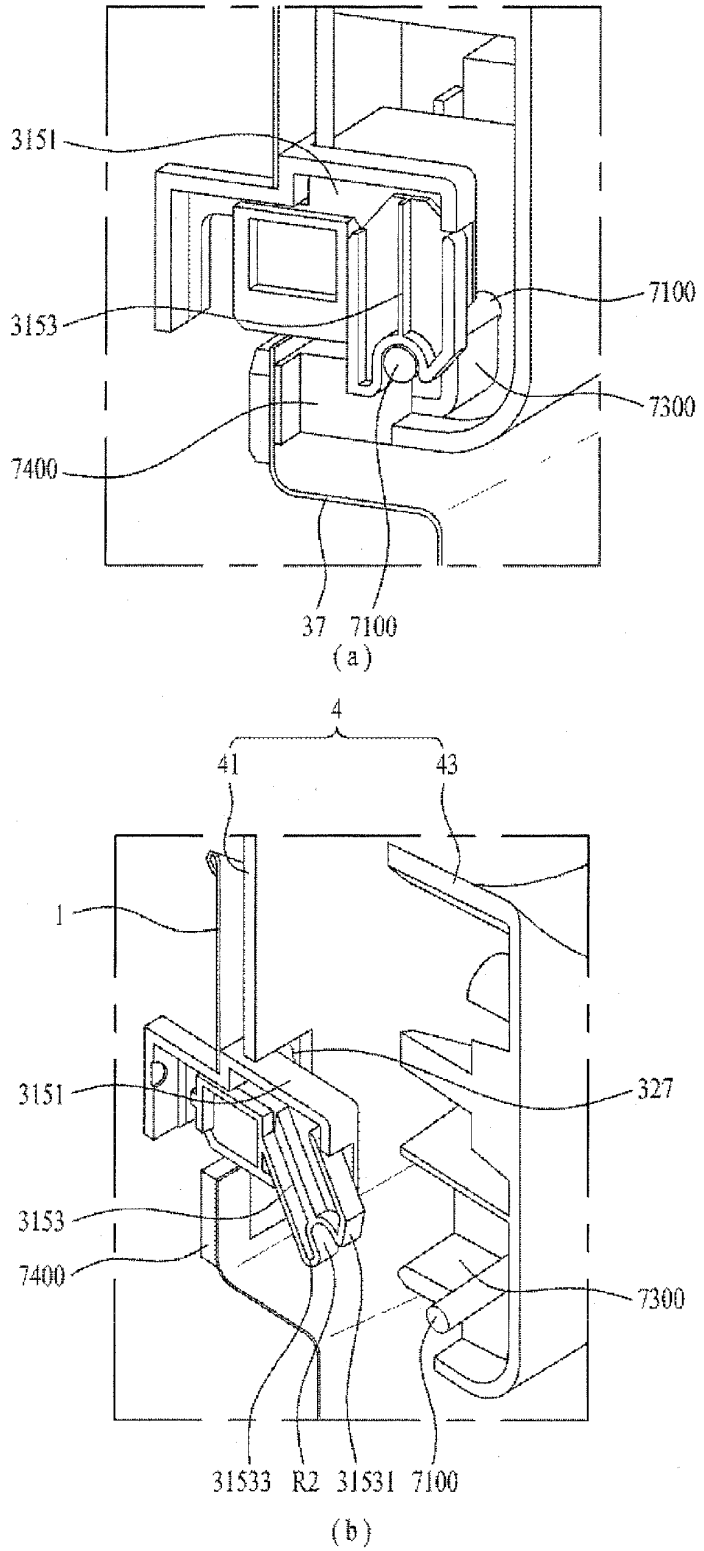


(b)

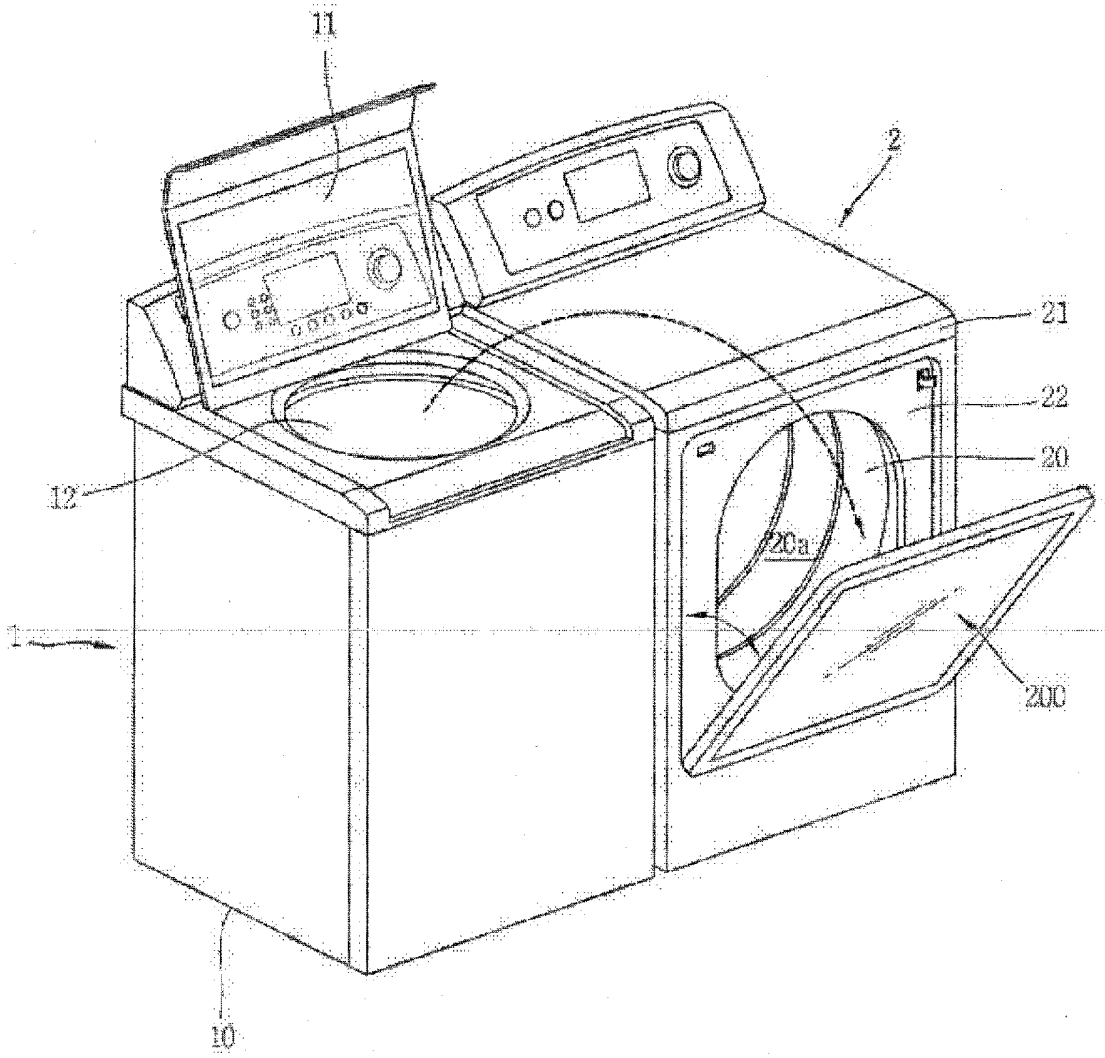
【Figure 29】


4350
4355
4353
4531
4351
3531
37
41
4321
5
3
4211
6
4330
315
4343
315
7000
(a)
7000
33
7630
7530
41
327
3151
315
3153
(b)
7300
7610
7100
7510
7200

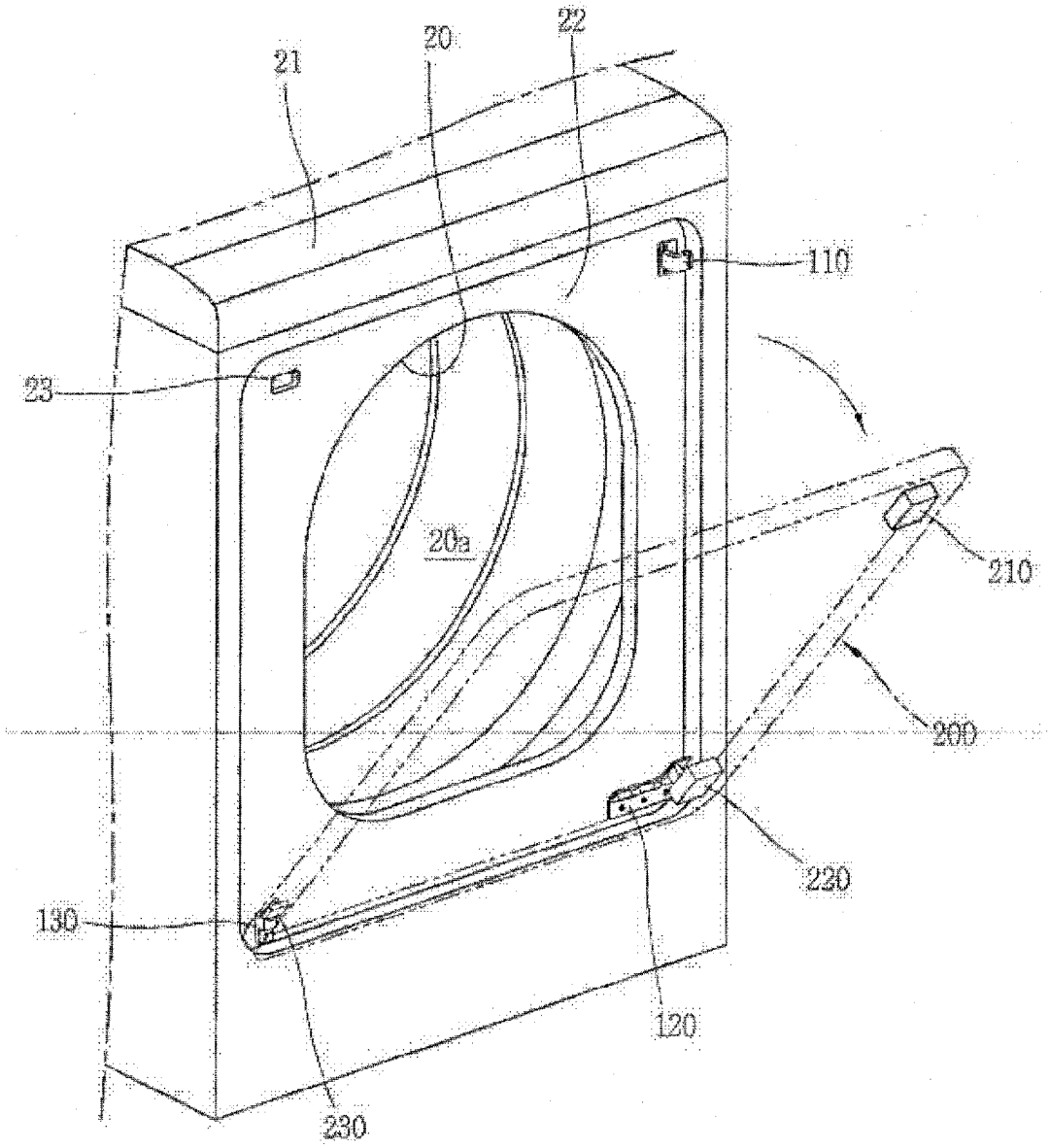
【Figure 30】


3151
3153
7400
7100
7300
37
7100
(a)
4
41
43
1
3151
327
3153
7400
7300
31533
R2
31531
7100
(b)

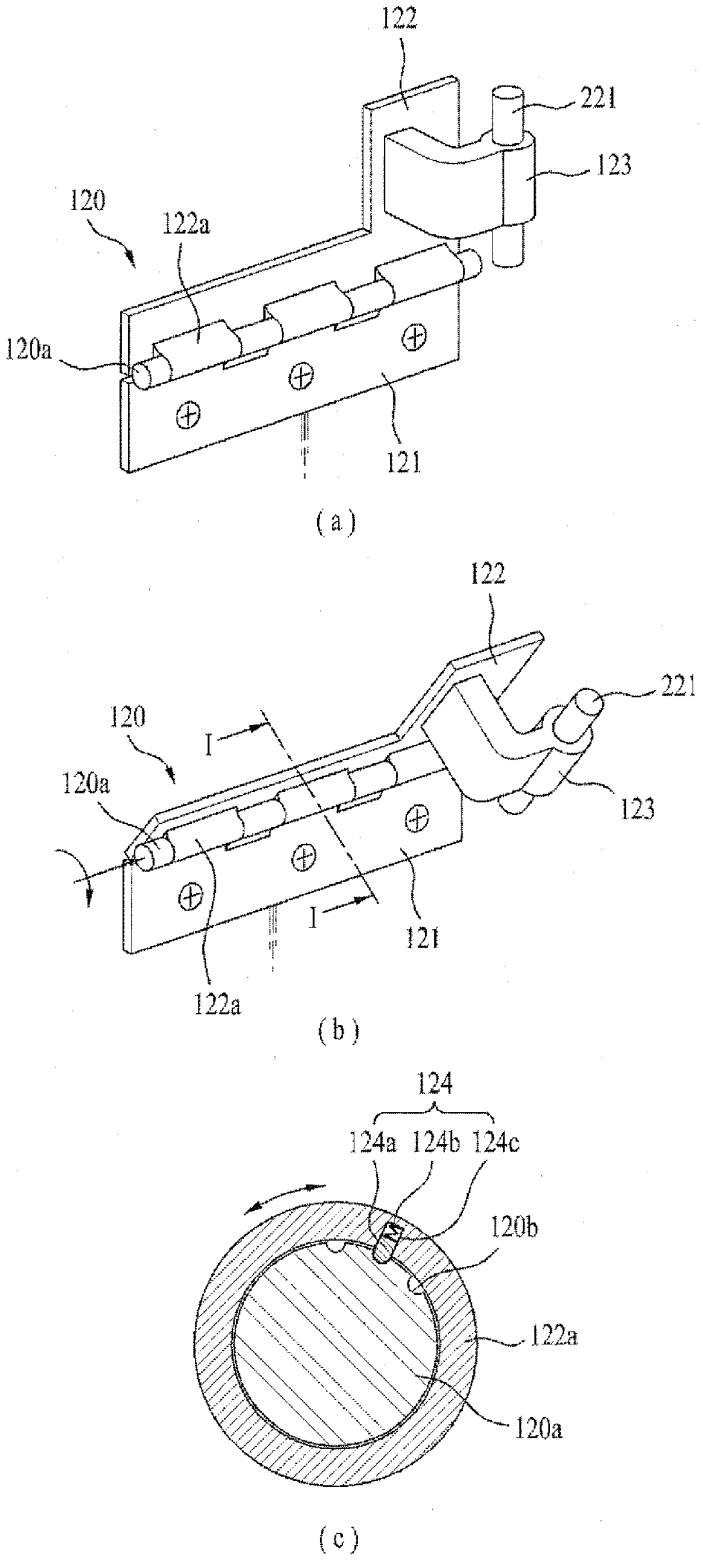
【Figure 31】



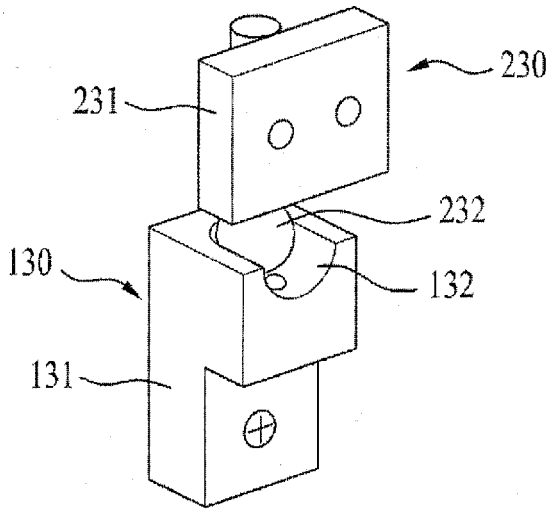
【Figure 32】



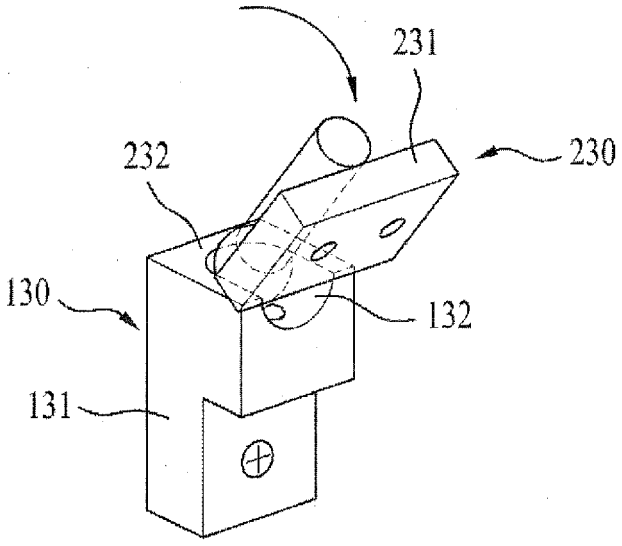
【Figure 33】


122
221
123
120
122a
120a
121
(a)
122
221
120
I
120a
123
I
121
122a
(b)
124
124a 124b 124c
120b
122a
120a
(c)

【Figure 34】

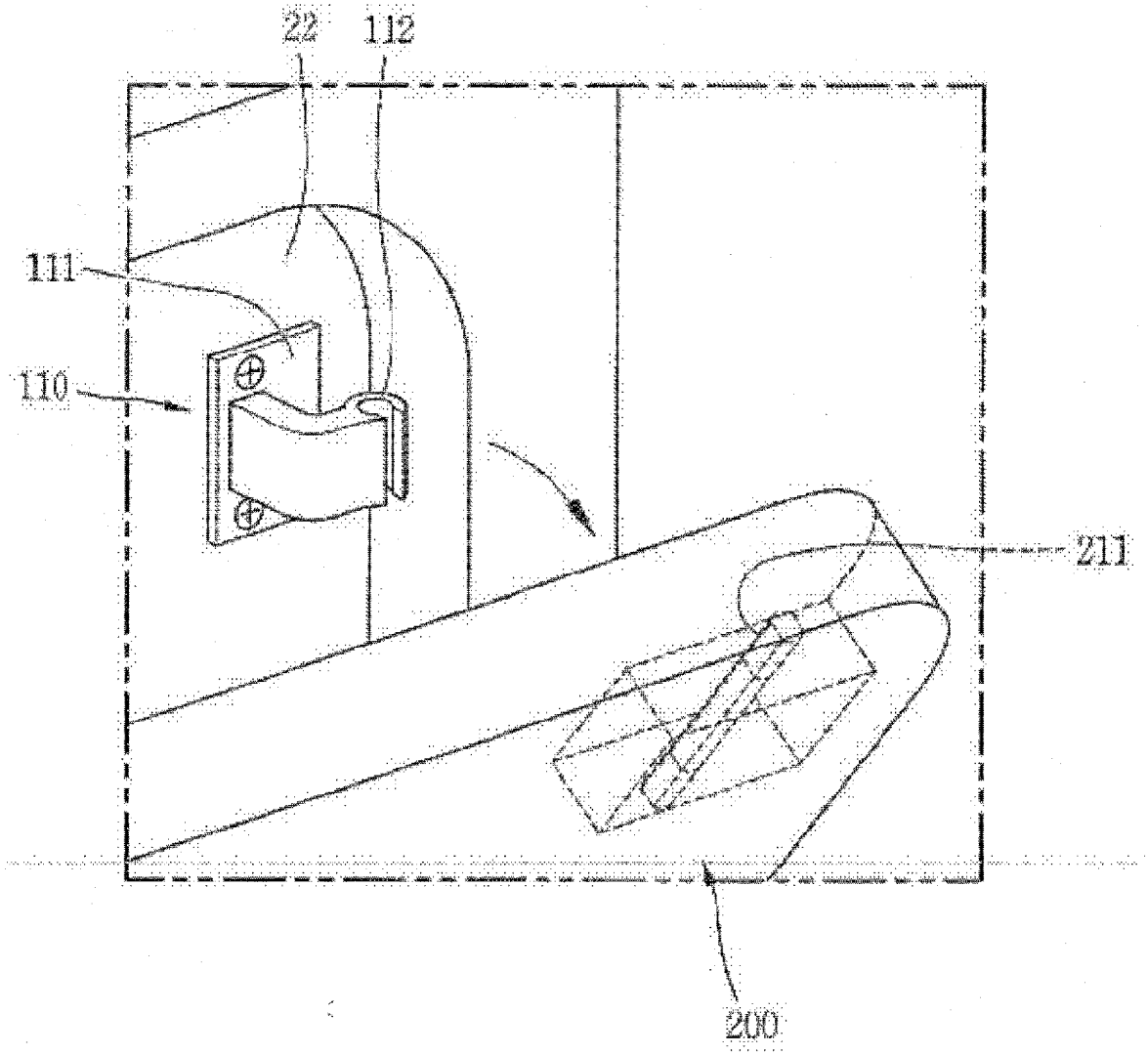


(a)

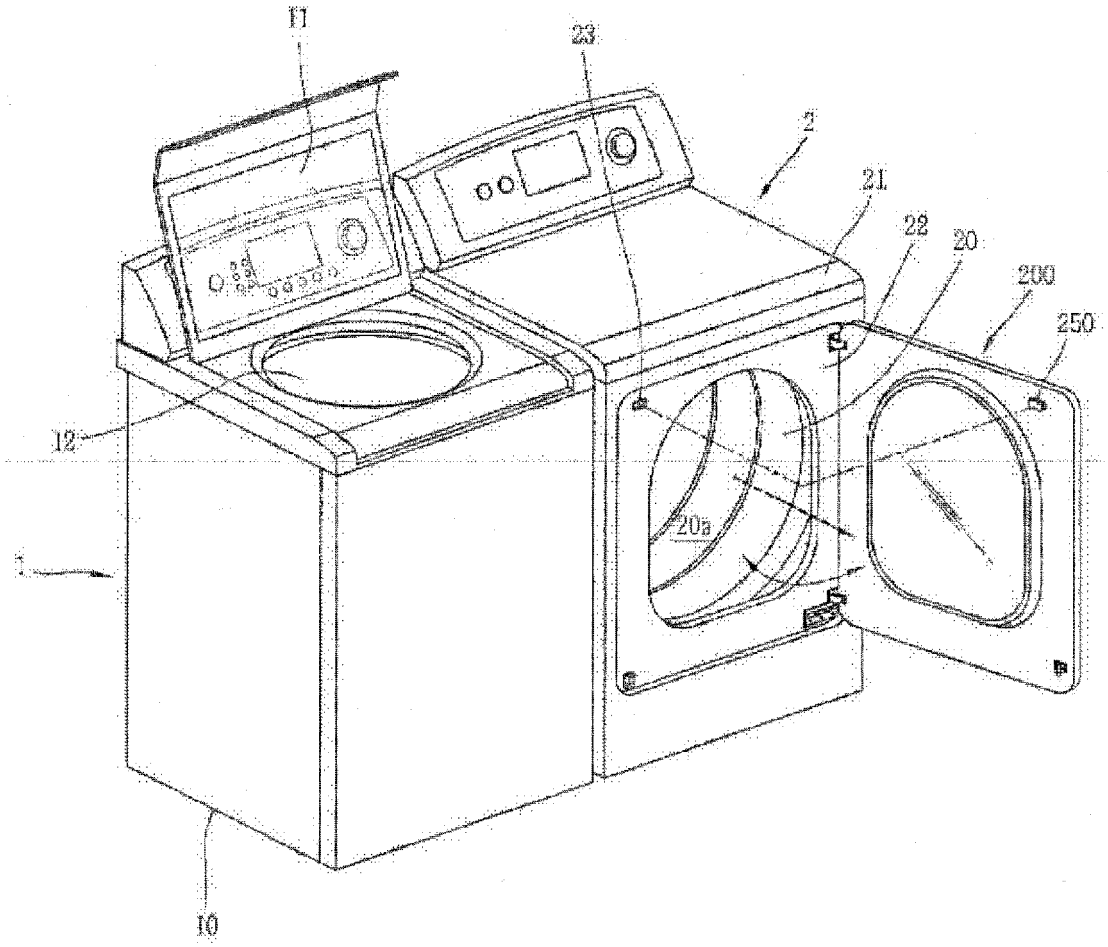


(b)

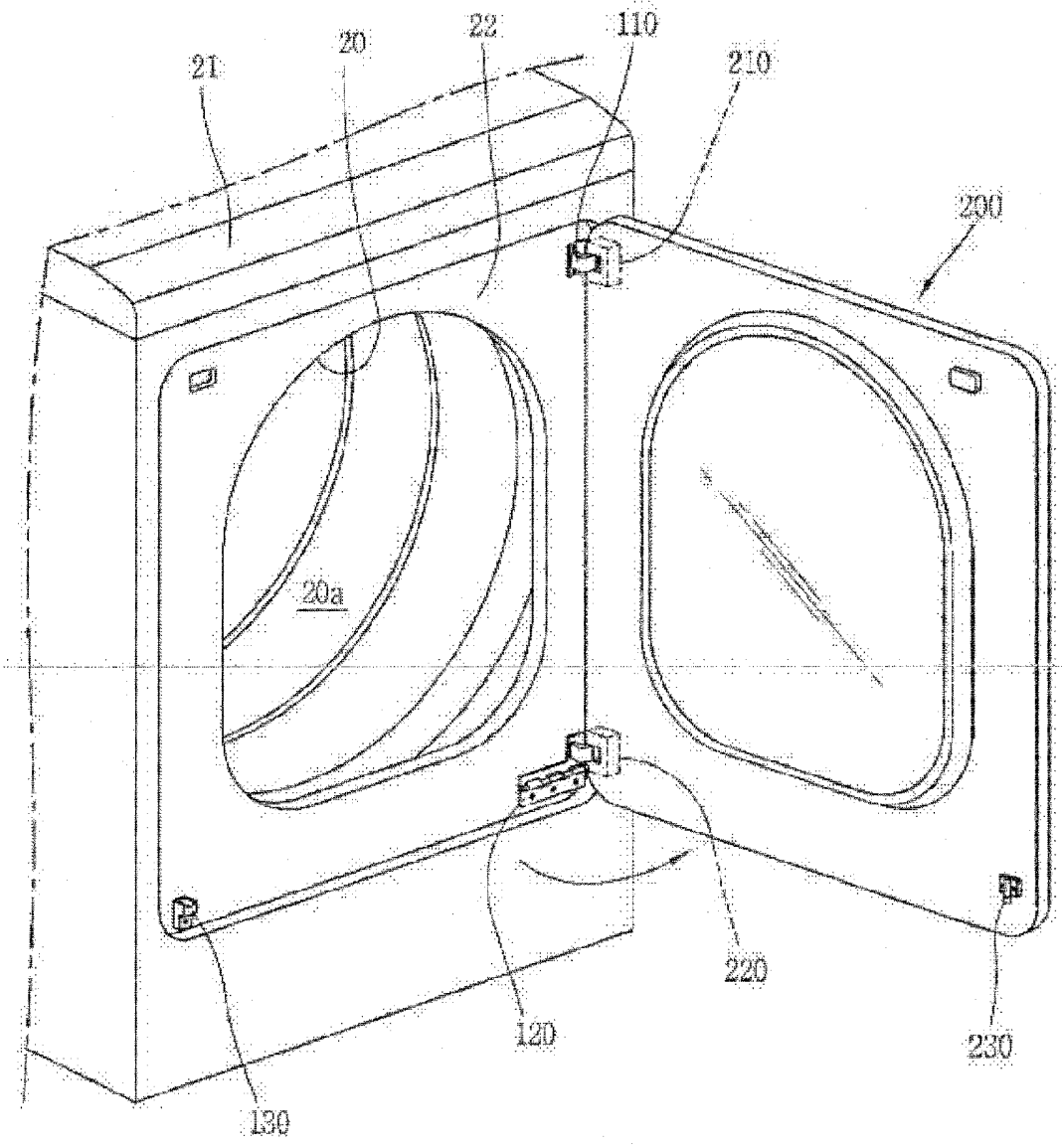
【Figure 35】



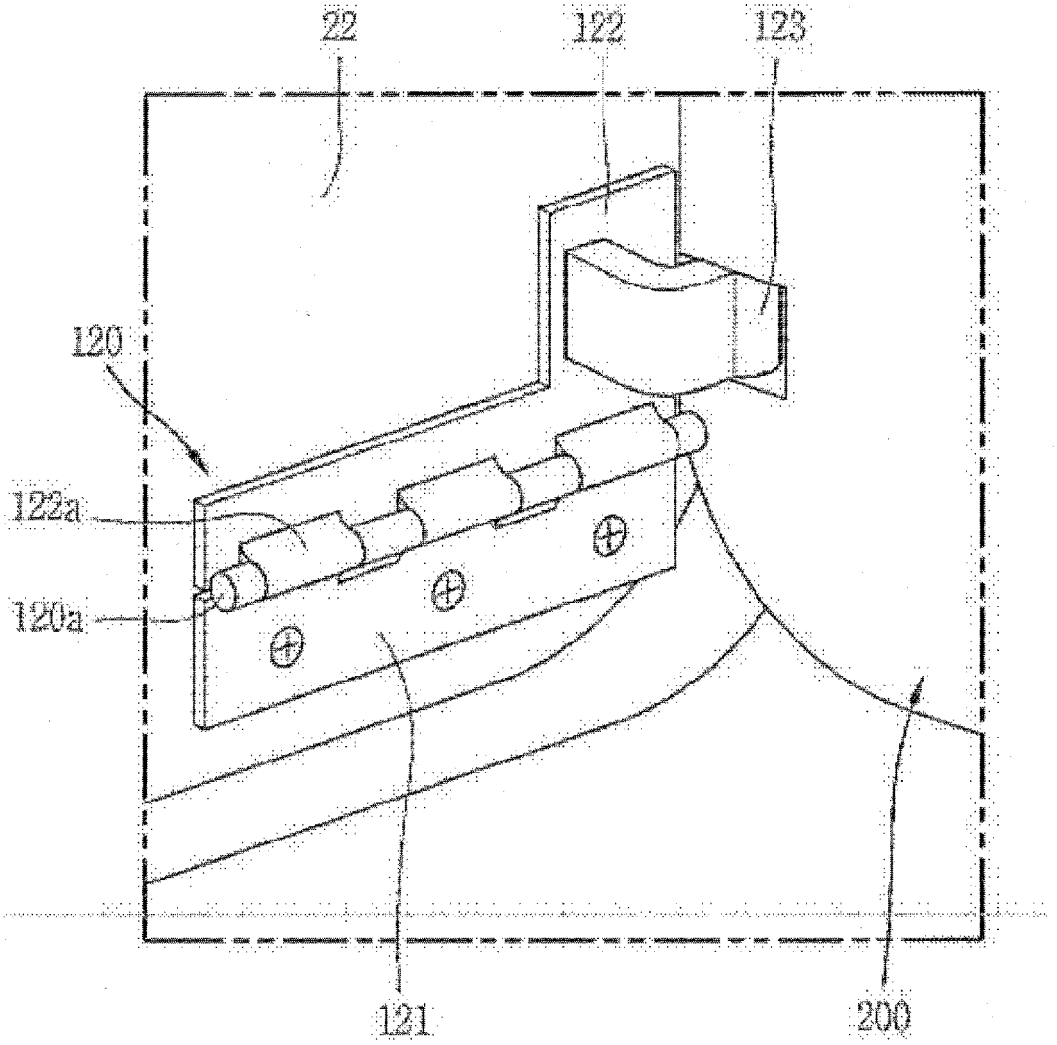
【Figure 36】



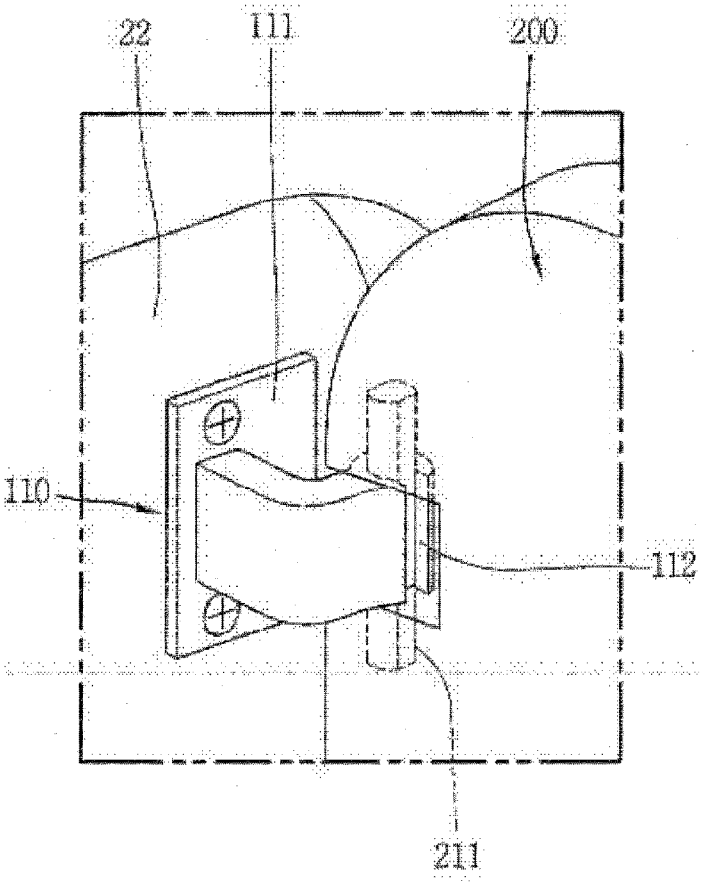
【Figure 37】



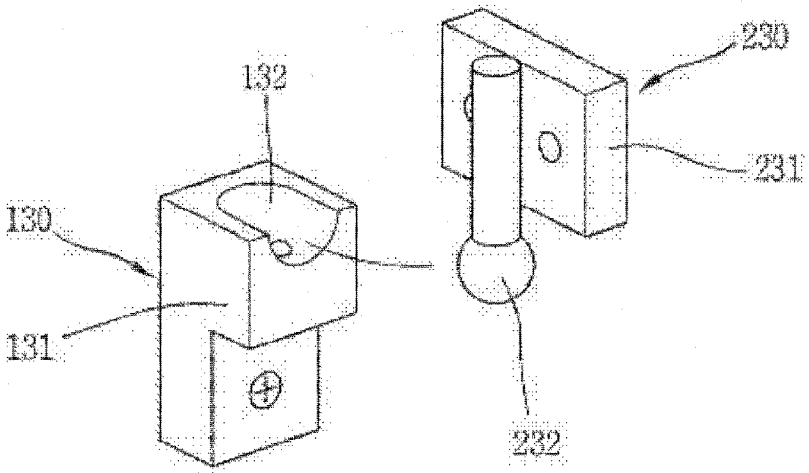
【Figure 38】



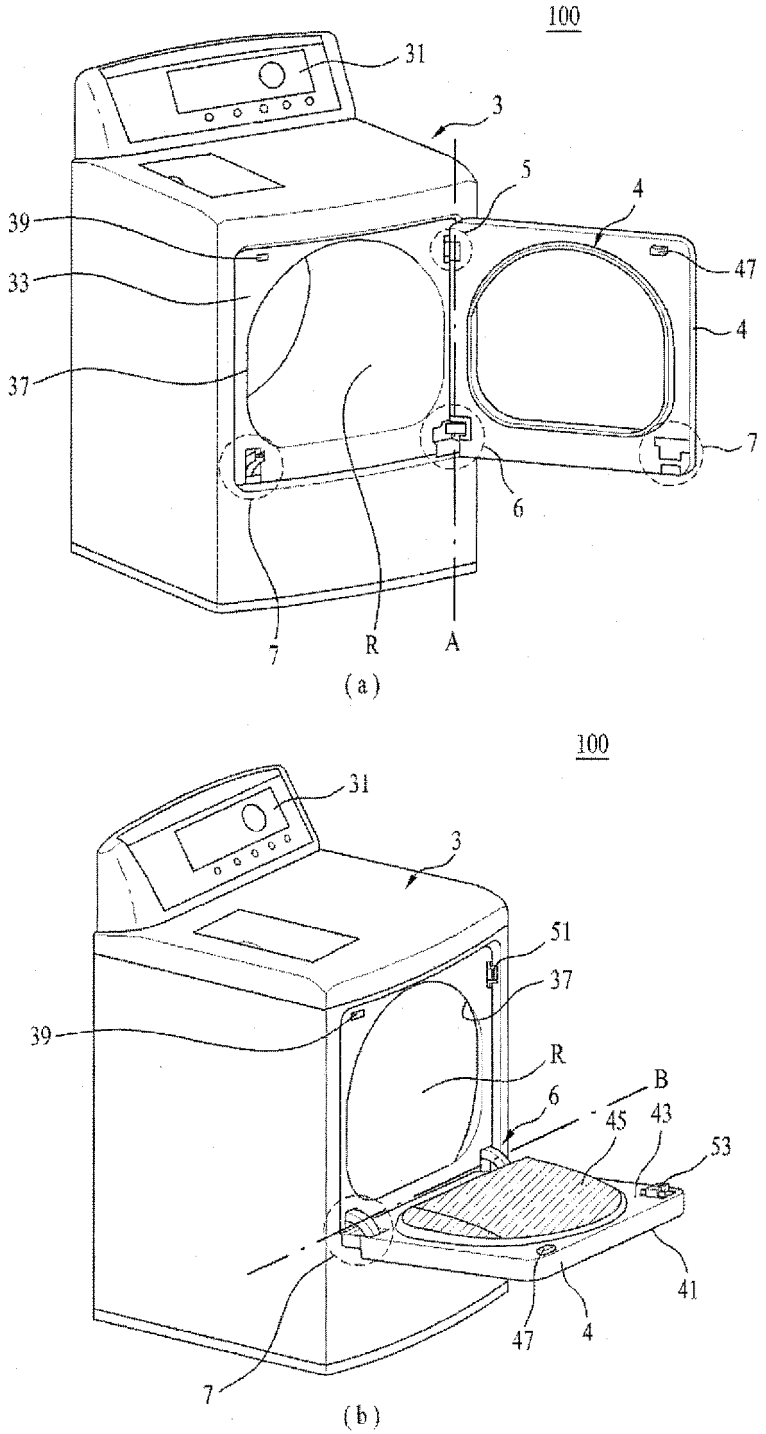
【Figure 39】



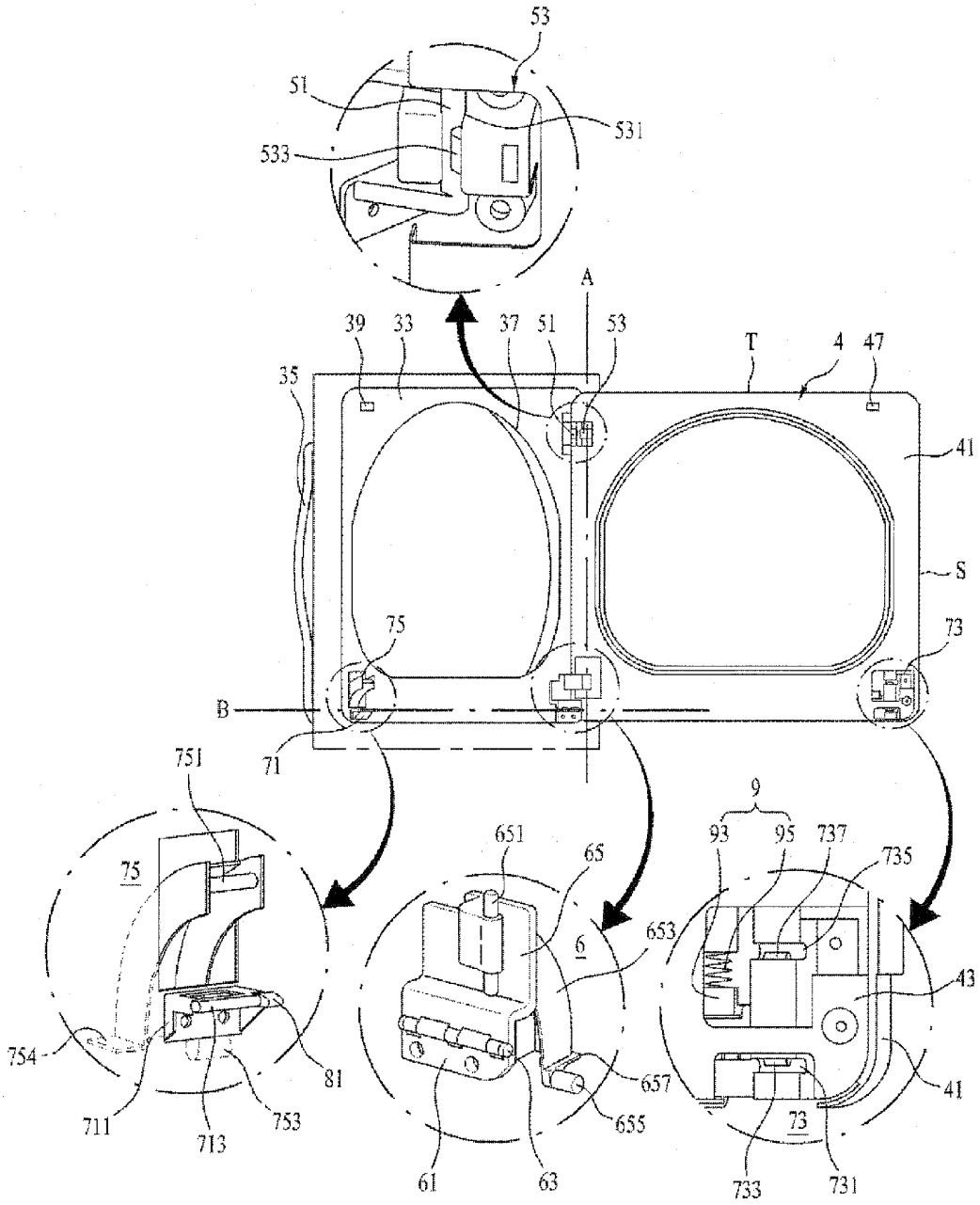
【Figure 40】



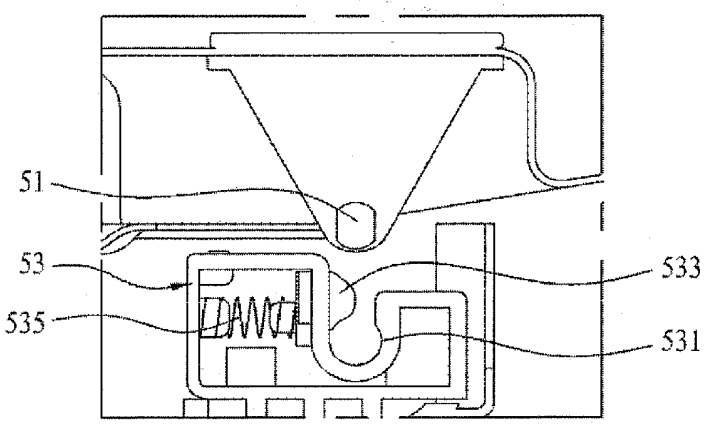
【Figure 41】


100
31
3
5
4
39
47
33
4
37
7
6
7
R
A
(a)
100
31
3
51
37
39
R
B
6
45
43
53
41
47
4
7
(b)

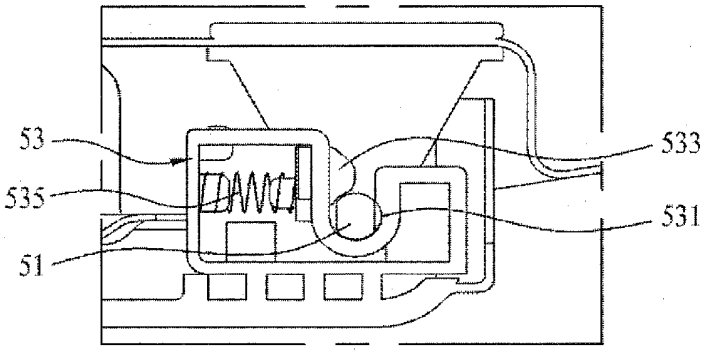
【Figure 42】


53
51
531
533
A
39
33
37
51
53
T
4
47
35
41
S
75
73
B
71
751
75
754
711
713
753
81
651
65
6
653
61
63
655
657
9
93
95
737
735
43
41
73
733
731

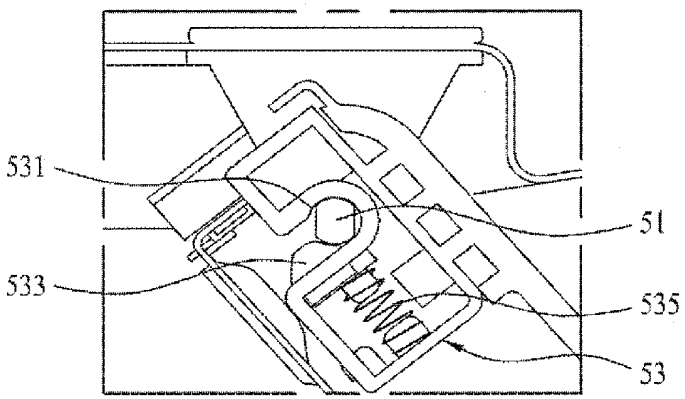
【Figure 43】



(a)

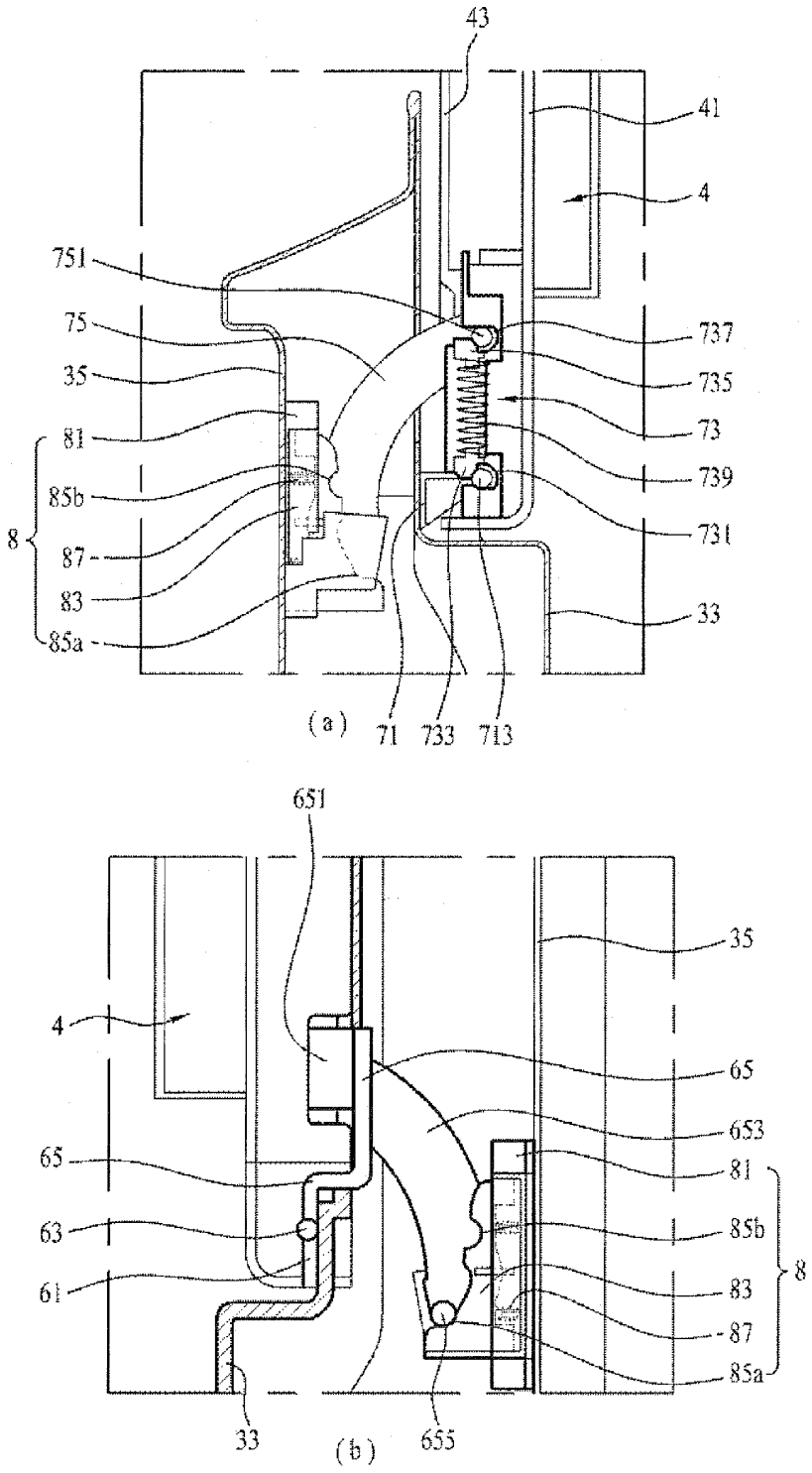


(b)

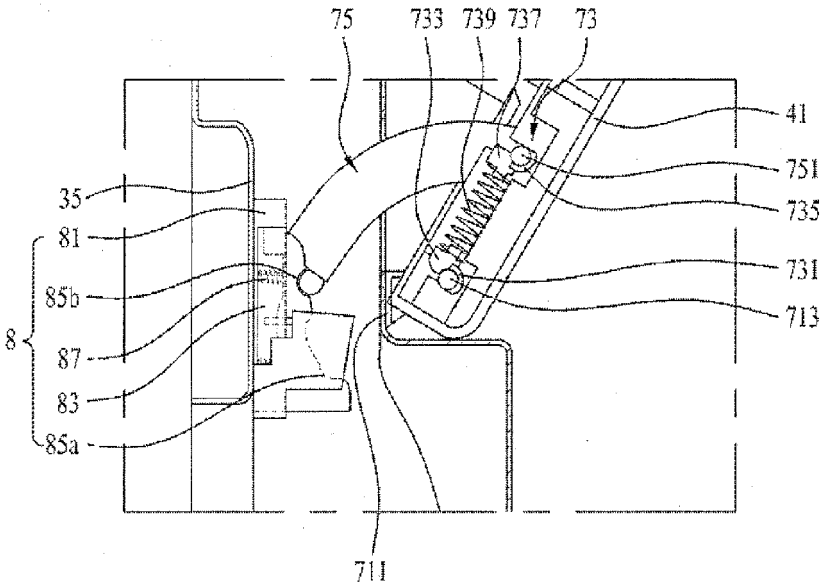


(c)

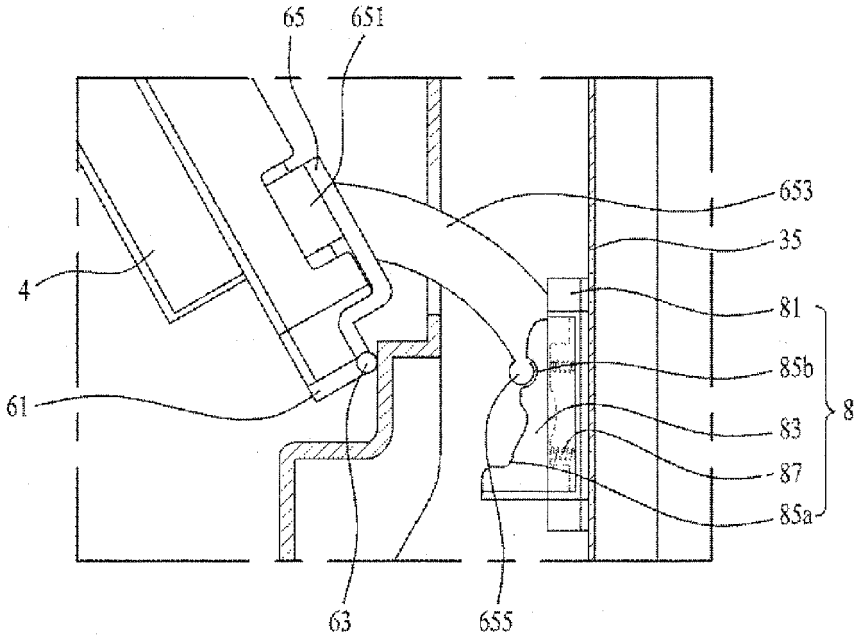
【Figure 44】


43
41
4
751
75
35
81
85b
8
87
83
85a
737
735
73
739
731
33
(a)
71
733
713
651
35
4
65
653
65
81
63
85b
61
83
87
85a
8
33
(b)
655

【Figure 45】

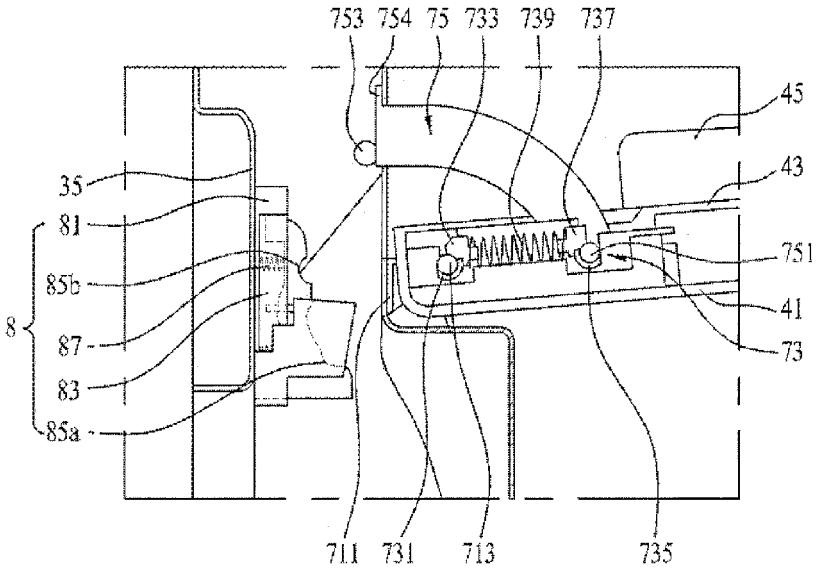

75
733
739
737
73
41
751
735
731
713
35
81
85b
87
83
85a
8
711

(a)

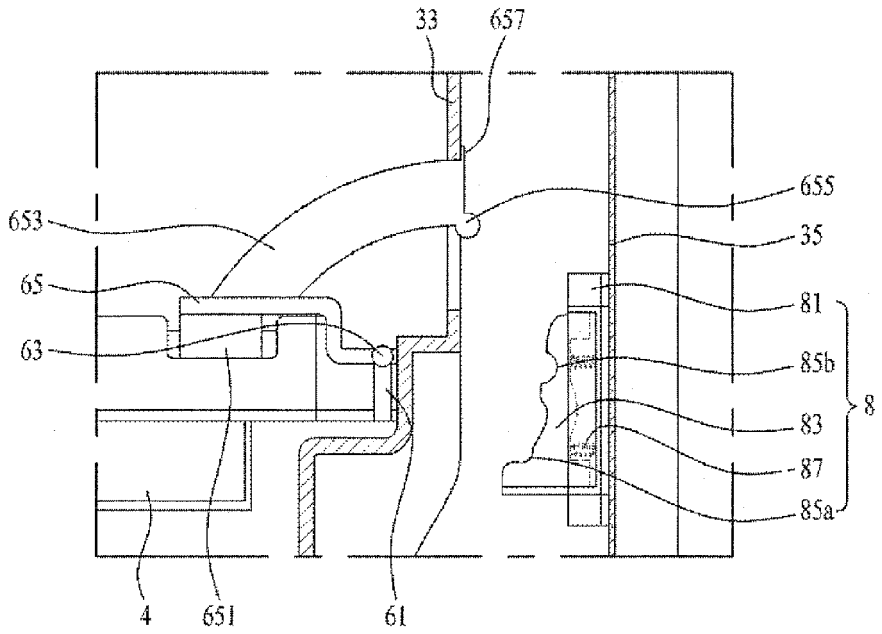

65
651
653
35
4
81
85b
61
83
87
85a
8
63
655

(b)

【Figure 46】

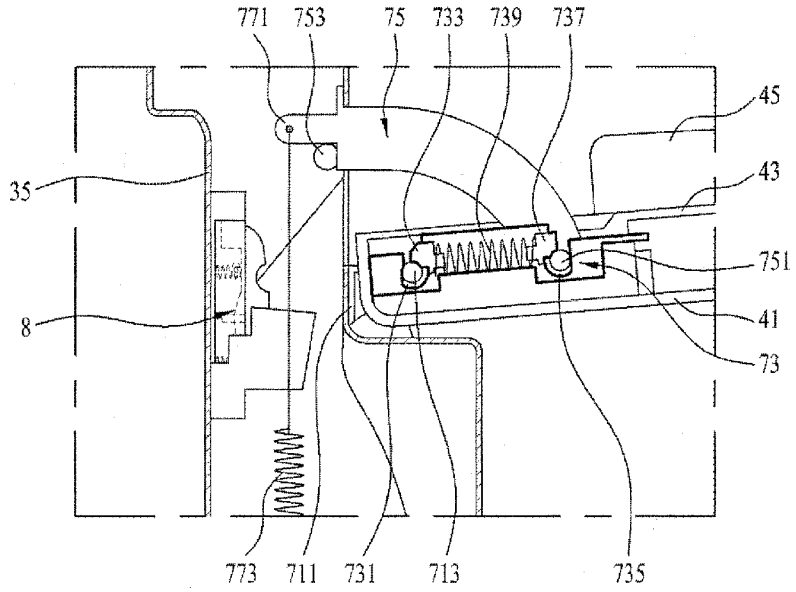

753
754
75
733
739
737
45
43
35
81
85b
87
83
85a
8
751
41
73
711
731
713
735

(a)

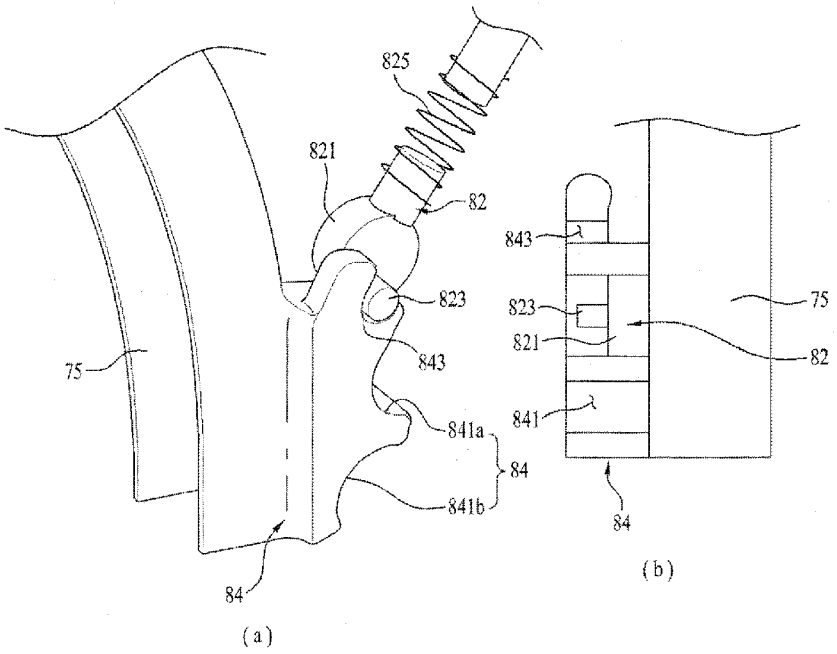

33
657
655
653
35
65
81
63
85b
83
8
87
85a
4
651
61

(b)

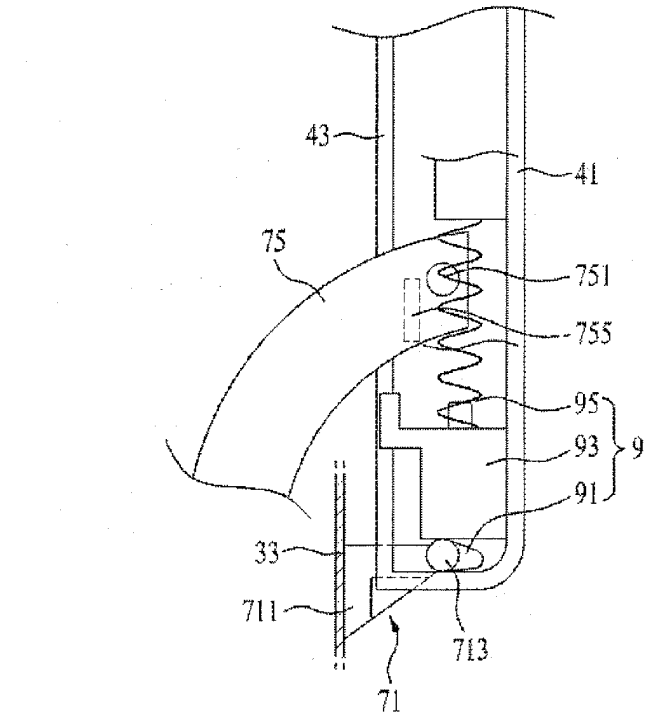
【Figure 47】



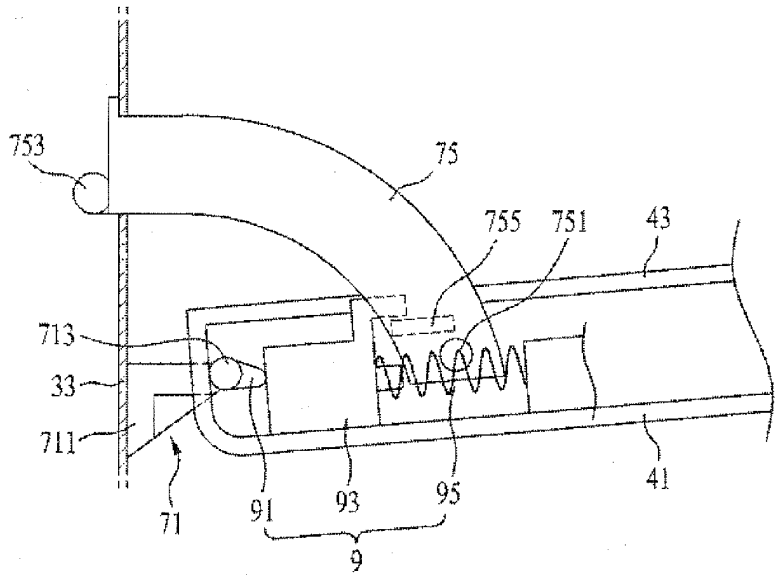
【Figure 48】



【Figure 49】

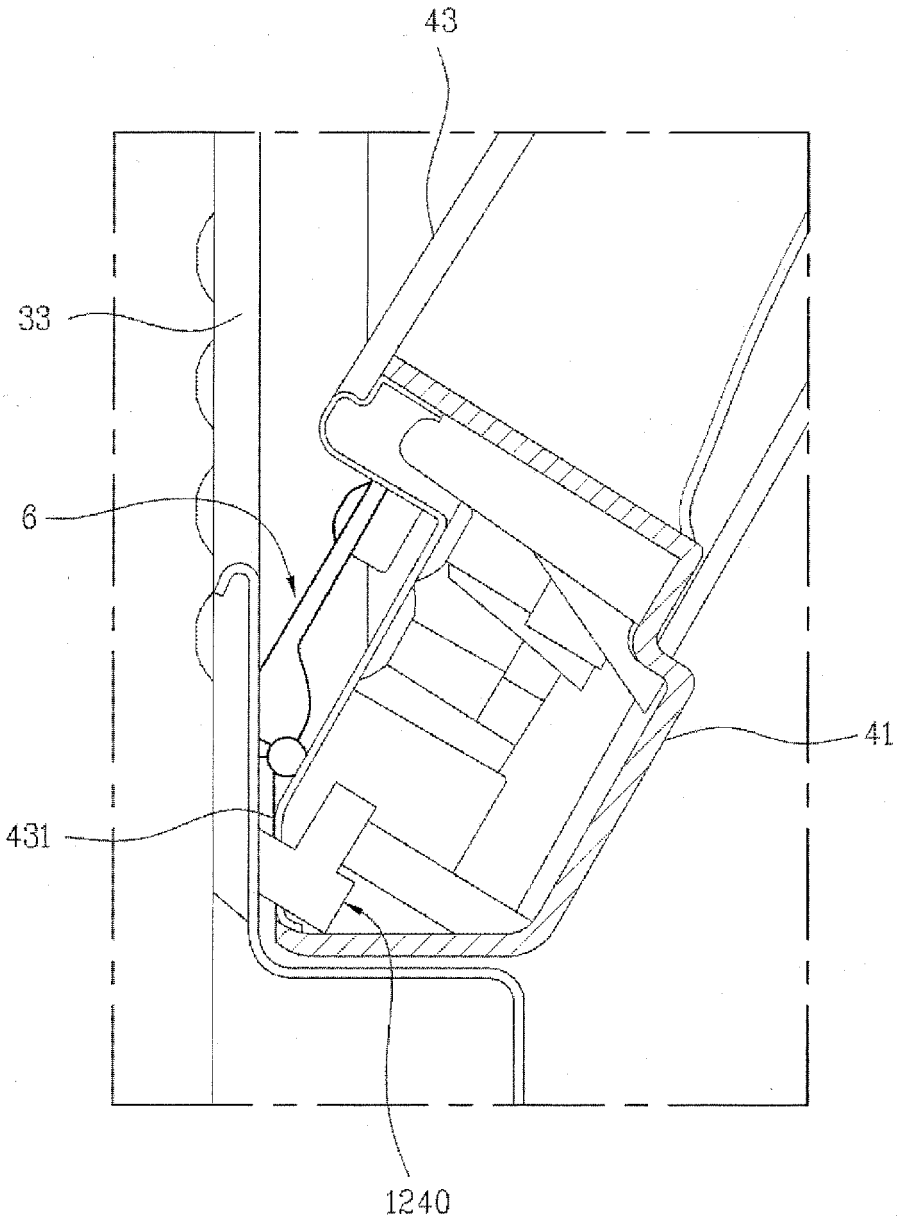

43
41
75
751
755
95
93
9
91
33
711
713
71

(a)

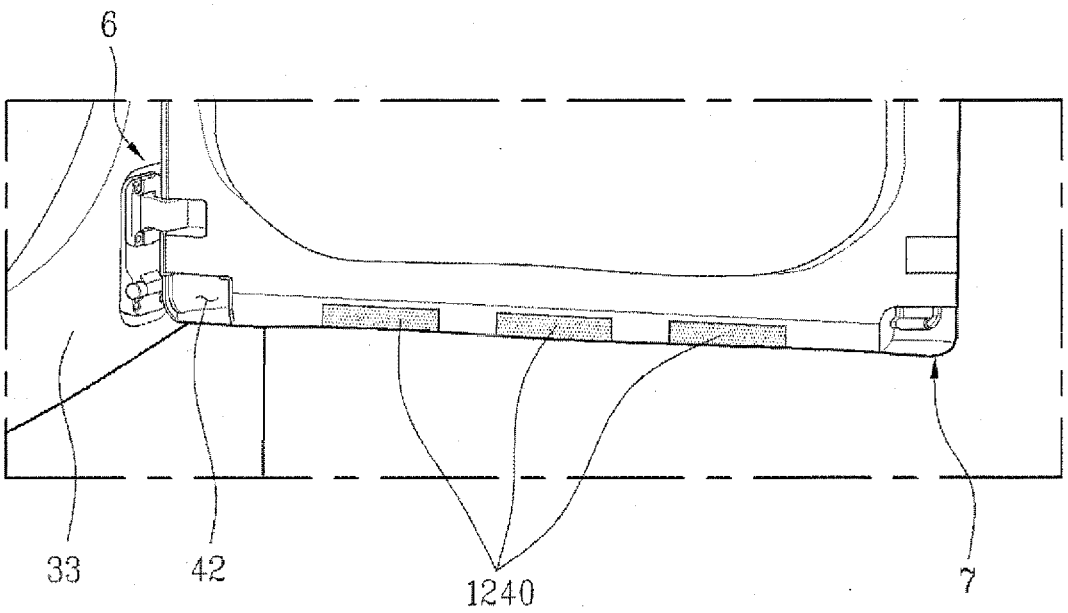

753
75
755
751
43
713
33
711
71
91
93
95
9
41

(b)

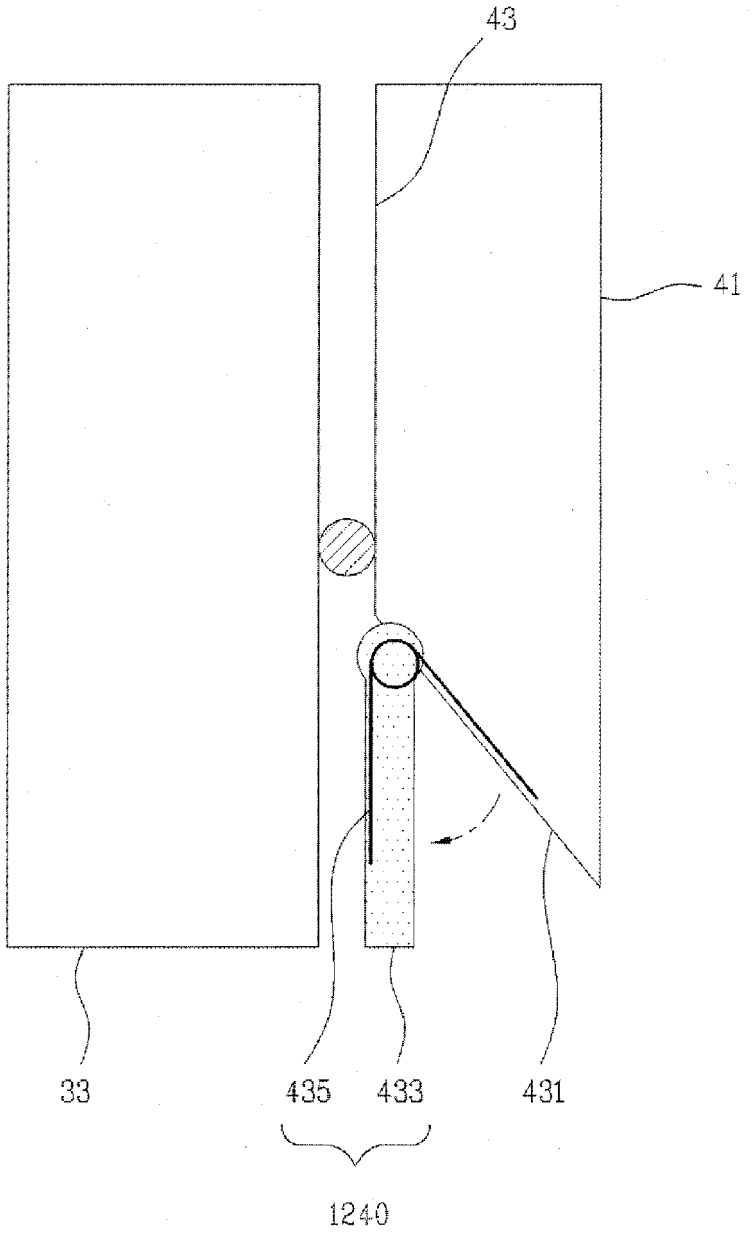
【Figure 50】



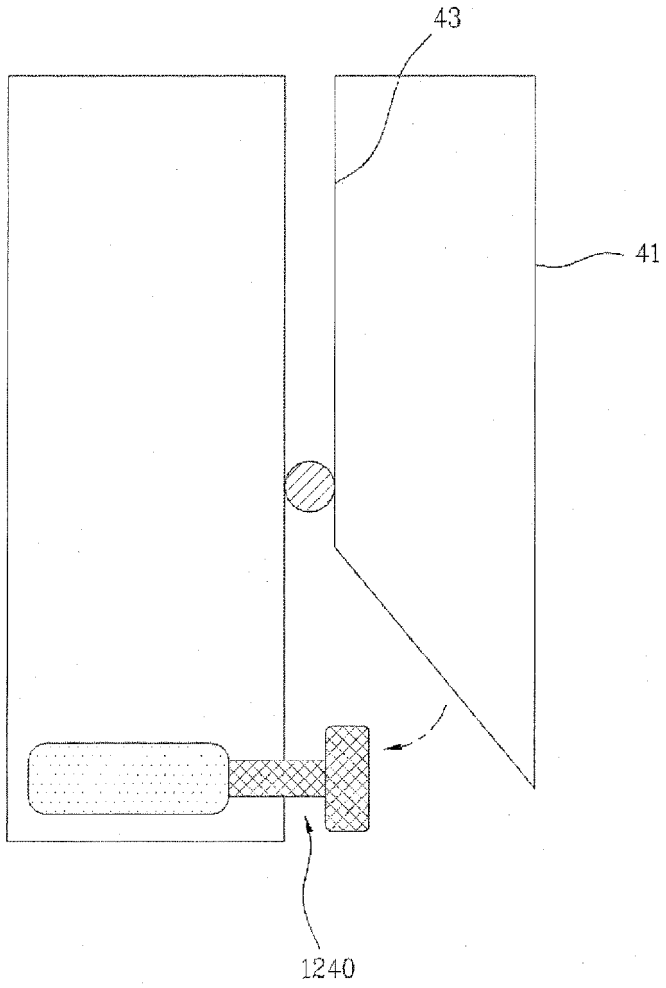
【Figure 51】



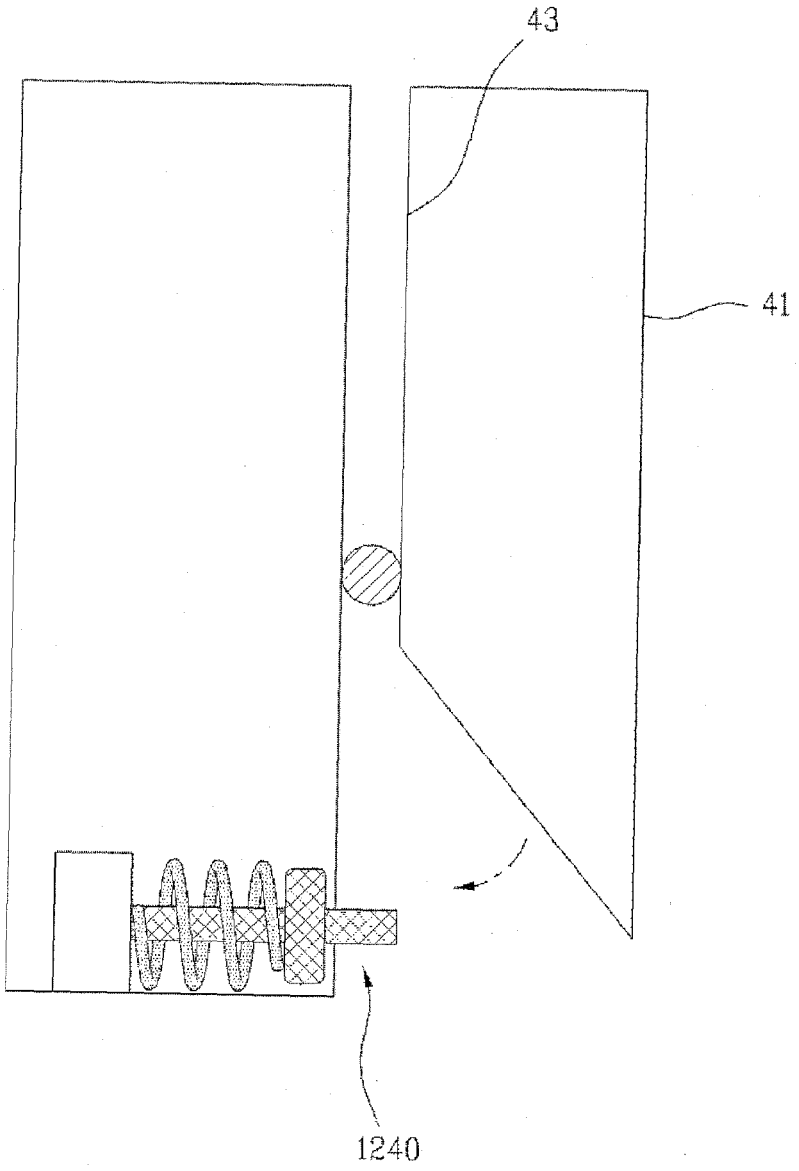
【Figure 52】



【Figure 53】



【Figure 54】



【Figure 55】