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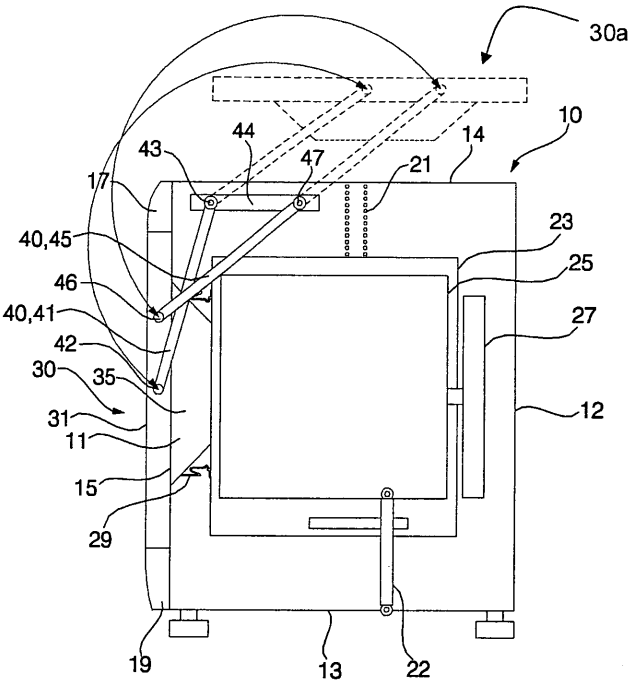
(54) Drum washing machine with upwardly-openable door

(57) A drum washing machine includes a cabinet including an opening at a front wall of the cabinet to allow laundry to be put into or taken out of the cabinet, a door at the front wall of the cabinet to open or close the opening of the cabinet, and a door opening/closing mechanism connected between the cabinet and the door to move the door above the cabinet when opening the door such that a front surface of the door is upwardly directed when the door is open, and to move the door toward the front wall of the cabinet when closing the door. The door is usable as a laundry holder when the door is open.

FIG. 3



EP 1 650 341 A1

Description

CROSS REFERENCE TO PRIORITY DOCUMENT

[0001] This application claims the benefit of priority to Korean Patent Application No. 2004-0085419, filed with the Korean Patent Office on October 25, 2004, and which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a drum washing machine with an upwardly-openable door, in which the door can be used as a laundry holder when the door is upwardly opened.

Description of the Related Art

[0003] Referring to FIG. 1, for example, a conventional drum washing machine is illustrated which includes a cabinet 1, in which a tub and a drum are installed extending horizontally. An opening 3 is formed at a front wall of the cabinet 1 to communicate with the tub and drum. A door 5 is mounted to the cabinet 1 to open and close the opening 3.

[0004] The door 5 is hingably mounted, at one side thereof, to a portion of the cabinet 1 corresponding to a side of the opening 3 by a hinge mechanism 7. A handle (not shown) is provided at the other side of the door 5. In accordance with this structure, the door 5 is hingably movable when the user pulls the handle to open the opening 3 or pushes the handle to close the opening 3.

[0005] The door 5 includes an annular door rim 5a, and a door window 5b surrounded by the annular door rim 5a. The door window 5b is made of a transparent glass material, and has a convex structure protruding into the interior of the washing machine to come into contact with a gasket 9 mounted in the cabinet 1.

[0006] However, the above-mentioned conventional drum washing machine has a deficiency because the door 5 cannot be fully opened where the washing machine 1 is installed close to a wall W, as shown in FIG. 2, for example, because the door 5 is horizontally hingably opened. When the door 5 is partially opened, the convex door window 5b is positioned toward the opening 3, so that there may be an inconvenience because the convex door window 5b may interfere with laundry when the laundry is put into or taken out of the washing machine 1 through the opening 3.

[0007] After completion of a laundry washing cycle, the user takes the laundry out of the washing machine. In the process of taking the laundry out of the washing machine, however, the user may drop the laundry to the floor because the laundry is in an entangled condition. Such a situation occurs frequently. In this case, there is a problem in that the dropped laundry must be washed again.

[0008] When the laundry is to be taken out of the washing machine after the laundry washing cycle is completed, the user puts some items of laundry into, for example, an additional laundry basket (or other such separate laundry container; not shown in the drawings), and then takes other items of laundry out of the washing machine while the previously-removed laundry is stored in the laundry basket, to complete the process of taking the laundry out of the washing machine. Such a requirement to use the laundry basket may cause the user inconvenience when taking the laundry out of the washing machine.

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above problems, among others, and it is an object of the present invention to provide a drum washing machine with an upwardly-openable door which is upwardly movable to a position above a cabinet of the drum washing machine, and which is usable as a laundry holder when opened, thereby facilitating the opening of the door and a convenient laundry loading or unloading process, even where the drum washing machine is installed in a limited space.

[0010] In accordance with the present invention, the above and other objects can be accomplished by, for example, a drum washing machine including a cabinet having an opening formed at a front wall of the cabinet to allow the laundry to be put into and/or taken out of the cabinet, a door (referred to herein as an "upwardly-openable door" or simply "door" when discussed in regards to the features of the various embodiments of the present invention, but different from the "conventional door" discussed in connection with the conventional washing machine) disposed at the front wall of the cabinet to open and/or close the opening of the cabinet, and a door opening/closing mechanism connected between the cabinet and the door to move the door to a position above the cabinet when opening the door, such that the door is opened with a front surface of the door directed upwardly, and to move the door toward the front wall of the cabinet when closing the door.

[0011] According to another aspect of the present invention, for example, a washing machine for washing at least one item may include a cabinet having an opening at a front wall of the cabinet to allow the item to be put into or taken out of the cabinet, a door disposed at the front wall of the cabinet to open or close the opening of the cabinet, and a door opening/closing mechanism connected between the cabinet and the door to move the door to a position above the cabinet when opening the door such that a front surface of the door is upwardly directed when the door is opened, and to move the door toward the front wall of the cabinet when closing the door.

[0012] The vertically openable door may further include a container-shaped portion to contain the item

when the door is open, a door frame mounted to the front wall of the cabinet, and/or a container-shaped door window mounted to the door frame, in which the container-shaped door window may have a convex structure which protrudes into the opening of the cabinet when the door is closed. Further, the door opening/closing mechanism may have at least first and second sets of link members disposed at opposite first and second sides of the door, respectively, each set of link members including at least first and second link members and being connected to each other in a quadric link fashion, and the washing machine may further include an automatic opening/closing mechanism to move the door opening/closing mechanism vertically in order to automatically open or close the door.

[0013] In addition, according to another aspect of the present invention, for example, a vertically openable door for opening or closing an opening at a front wall of a cabinet may include a door opening/closing mechanism connected between the cabinet and the vertically openable door to move the vertically openable door to a position above the cabinet when opening the vertically openable door such that a front surface of the vertically openable door is upwardly directed when the vertically openable door is opened, and to move the vertically openable door toward the front wall of the cabinet when closing the vertically openable door.

[0014] The vertically openable door may further include a container-shaped portion to contain an item to be placed within the cabinet when the vertically openable door is open, a door frame mounted to the front wall of the cabinet, and/or a container-shaped door window mounted to the door frame, in which the container-shaped door window includes a convex structure which protrudes into the opening of the cabinet when the vertically openable door is closed.

[0015] Further, the door opening/closing mechanism may include at least first and second sets of link members disposed at opposite first and second sides of the door, respectively, each set of link members having at least first and second link members and being connected to each other in a quadric link fashion, and the vertically openable door may also include an automatic opening/closing mechanism to move the door opening/closing mechanism vertically in order to automatically open or close the vertically openable door.

[0016] In any of the aspects of the present invention noted above, although the washing machine or drum washing machine is exemplified to simplify discussion of certain features of the present invention, it should be understood that the present invention is not limited only to a washing machine for washing laundry, but also contemplates washing machines for washing any appropriate item, such as dishes and/or eating utensils, medical and/or scientific instruments (e.g., an autoclave), or any other item to be washed, for example. Further, the vertically openable door may also function with any sort of cabinet or other such approximately cubic container (such as a filing cabinet, computer case, clothes dresser, or coal hopper, for example), and is not necessarily limited to use with washing machines, for example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating a conventional drum washing machine;

FIG. 2 is a schematic plan view illustrating a door of the conventional drum washing machine shown in FIG. 1 when opened;

FIG. 3 is a schematic side view illustrating a drum washing machine according to a first embodiment of the present invention having an upwardly-openable door;

FIG. 4 is a perspective view of the drum washing machine according to the first embodiment of the present invention shown in FIG. 3, illustrating the door of the drum washing machine in a closed position;

FIG. 5 is a perspective view of the drum washing machine according to the first embodiment of the present invention shown in FIG. 3, illustrating the door of the drum washing machine being opened;

FIG. 6 is a perspective view of the drum washing machine according to the first embodiment of the present invention shown in FIG. 3, illustrating the door of the drum washing machine in a fully opened position; and

FIG. 7 is a schematic side view showing a drum washing machine according to a second embodiment of the present invention having a door which can be automatically opened.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Now, preferred embodiments of the present invention will be described in detail with reference to the above-described accompanying drawings.

[0019] FIG. 3 is a schematic side view showing a drum washing machine 1 according to a first embodiment of the present invention, and FIGS. 4 through 6 respectively illustrate how a door 30 of the drum washing machine 1 according to the first embodiment of the present invention (for example, as shown in FIG. 3) is opened and/or closed. FIG. 4 illustrates the door 30 of the drum washing machine in a closed position, FIG. 5 illustrates the door 30 of the drum washing machine partially opened, and FIG. 6 illustrates the door 30 of the drum washing machine in a fully opened position, above the cabinet 10 of the drum washing machine.

[0020] Referring to FIGS. 3 and 6, for example, the drum washing machine, which is provided with the up-

wardly-openable door 30 in accordance with the first embodiment of the present invention, may include a cabinet 10 to form an outer structure of the drum washing machine. An opening 11 may be provided at a front wall of the cabinet 10 to allow laundry (not shown) to be put into or taken out of the drum washing machine.

[0021] Devices to perform a washing operation may be installed in the cabinet 10. For example, as shown in FIG. 3, the drum washing machine may include a tub 23 supported by a spring 21 and a damper 22 in the cabinet 10 to contain washing water (not shown), a drum 25 arranged in the tub 23 to wash laundry while rotating, and a drive motor 27 to rotate the drum 25.

[0022] The opening 11 of the cabinet 10 may communicate with respective openings of the tub 23 and drum 25 to allow laundry to be put into or taken out of the drum 25. A gasket 29 may be interposed between the openings of the cabinet 10 and tub 23 to prevent washing water or the like from penetrating the interior of the cabinet 10 when washing the laundry.

[0023] The cabinet 10 may have a substantially hexahedral structure, among various possible structures. As illustrated in FIG. 5, for example, the cabinet 10 may include a cabinet body 12 to form side walls and a rear wall of the cabinet 10, a base 13 to form a bottom wall of the cabinet 10, a top cover 14 to form a top wall of the cabinet 10, and a front cover 15 to form a front wall of the cabinet 10. The opening 11 may be formed at the front cover 15.

[0024] A control panel 17 may be arranged on a top portion of the front cover 15. The control panel 17 may include various operating switches, dials, or other user-operable control devices (for example) to operate the drum washing machine, and a display device to display an operating state of the drum washing machine, or other salient information (such as, for example, wash water temperature or the stage of the washing cycle). Alternatively, the control panel 17 may be arranged at a position other than the top portion of the front cover 15. For example, the control panel 17 may be arranged on the top wall of the cabinet 10, such as the top cover 14.

[0025] A lower cover 19 may be coupled to the cabinet body 12 and base 13 to form a lower portion of the front cover 15.

[0026] Also, a door 30 may be mounted to the outer surface of the front cover 15 to open and/or close the opening 11. The front cover 15 may be coupled with the cabinet body 12, control panel 17 and lower cover 19 while recessed into the cabinet 10 with respect to the control panel 17 and lower cover 19, so that the outer surface of the front cover 15 is flush with respective outer surfaces of the control panel 17 and lower cover 19 when the door 30 is closed.

[0027] Referring to FIG. 5, for example, an annular opening rim 16 may be provided at a central portion of the front cover 15 to define the opening 11. The gasket 29 may be fitted in the opening rim 16.

[0028] The door 30 may have a substantially quadrangular shape similar to the shape of the front cover 15. As illustrated in FIG. 6, for example, the door 30 may have a generally quadrangular planar or plate-like structure and include a door frame 31 conforming to the shape of the outer surface of the front cover 15, and a container-shaped door window 35 having a convex structure which protrudes into the opening 11 of the cabinet 10 when the door 30 is closed, such that the container-shaped door window 35 comes into close contact with the gasket 29.

[0029] The door frame 31 may have opposite side portions 32 each formed by bending a corresponding side end portion of the door frame 31 into a shape substantially similar to a letter "L". At the opposite side portions 32 of the door frame 31, a link opening/closing mechanism 40 to open/close the door 30 may be provided.

[0030] The container-shaped door window 35 described above may include a container structure to come into contact with the gasket 29 when the door 30 is closed, and to receive laundry when the door 30 is open. Furthermore, referring to FIG. 5, for example, the container-shaped door window 35 may include an annular window rim 36 mounted to the door frame 31, and a container-shaped window 37 having a concave container structure to receive laundry. The container-shaped window 37 may be fitted in the window rim 36.

[0031] The window rim 36 may be made of a metal and/or synthetic resin material, for example. The container-shaped window 37 may be made of a transparent or translucent material (such as, for example, glass, transparent plastic, carbon fiber, or any other transparent or translucent material suitable for constructing a window that can function as a laundry container) to allow the user to view the interior of the drum 25 through the container-shaped window 37.

[0032] At least one handle 39 may be provided at the door 30 to allow the user to open and/or close the door 30 while grasping the handle 39, for example. Preferably, an upper handle 39U and a lower handle 39D are provided at the door, with the upper handle 39U and the lower handle 39D spaced apart from each other by an appropriate distance (for example, the distance separating the upper handle 39U and lower handle 39D may be selected to allow the user to conveniently view the laundry inside the drum 25).

[0033] The door 30 is vertically movable such that the door 30 can be opened when the door 30 moves upwardly, and closed when the door 30 moves downwardly, for example. When the door 30 is opened, the outer surface 30a of the door 30 may face upwardly (see FIG. 6, for example) so that, when taking laundry out of the drum 25, the laundry taken out of the drum 25 may be temporarily stored in the container-shaped door window 35 of the door 30.

[0034] For such an opening/closing operation of the door 30, a door opening/closing mechanism may be arranged between the top cover 14 of the cabinet 10 and the door 30 at opposite sides of the door 30. For example, the door opening/closing mechanism may include a link opening/closing mechanism 40 having at least two links

(such as, for example, two pairs of link members 41 or 45). Inside the top cover 14 a link bracket 44 may be disposed, shaped substantially similarly to an elongated rod or a plate, to which the link opening/closing mechanism 40 may be connected.

[0035] The link opening/closing mechanism 40 may include, for example, the two pairs of link members 41 and 45 respectively disposed at opposite sides of the door 30. Furthermore, according to at least one aspect of the first embodiment, each pair of link members 41 and 45 may be connected to each other in a quadric link fashion.

[0036] For example, as illustrated in FIGS. 5 and 6, the link opening/closing mechanism 40 may include first link members 41 and second link members 45 respectively connected between the opposite side portions 32 of the door 30 and the link bracket 44. Each of the first link members 41 may be connected between the middle part of the corresponding side portion 32 of the door 30 and the front part of the corresponding side of the link bracket 44, and each of the second link members 45 may be connected between the upper part of the corresponding side portion 32 of the door 30, which is relatively higher than the middle part of the corresponding side portion 32 of the door 30, and the rear part of the corresponding side of the link bracket 44.

[0037] At the opposite side portions 32 of the door 30, door connection shafts 42 and 46 may be disposed, to which one end of each of the first link members 41 and the second link members 45 are respectively connected, for example. At the link bracket 44, which may be mounted in the cabinet 10, hinge shafts 43 and 47 can be disposed, to which the other ends of the first link members 41 and the second link members 45 are connected, respectively.

[0038] Slits 15s, 17s, and 14s, which extend along the height and/or depth directions of the cabinet 10, may be disposed at the front cover 15, the control panel 17, and the top cover 14, which together form the front and top walls of the cabinet 10 (as shown in FIG. 5, for example), such that link members 41 and 45 can be moved along the slits 15s, 17s, and 14s.

[0039] The slits 15s, 17s, and 14s may include foreign matter shields 50, respectively, which allow smooth movement of the link members 41 and 45 while preventing foreign matter (such as lint, debris, dust, laundry, or similar such materials) from being introduced into the slits 15a, 17s, and/or 14s. The foreign matter shields 50 may be made of soft brushes or split rubber members (not shown), for example, or any other suitable item or structure which at least partially prevents foreign matter from entering the slits 15s, 17s, or 14s, while permitting movement of the link members 41 and/or 45.

[0040] Hereinafter, operation of the drum washing machine with the upwardly-openable door 30 according to the first embodiment of the present invention will be described.

[0041] When the user pushes the door 30 upwardly while grasping the upper handle 39U when the door 30 is closed (as shown in FIG. 4, for example) to open the door 30, the door 30 may move away from the cabinet 10, passing through the intermediate, partially open position illustrated in FIG. 5, for example, such that the door 30 is opened while the top portion of the door 30 is inclined toward the cabinet 10. As the door 30 is pushed toward the rear of the cabinet 10, the door 30 may move to a position above the drum washing machine, while rotating toward a generally horizontal alignment relative to the top cover 14. As a result, the door 30 may reach a fully opened position while having a generally horizontal alignment, as shown in FIG. 6, for example.

[0042] During the opening of the door 30, for example, the link members 41 and 45 may be moved upward and rearward along the slits 15s, 17s, and 14s formed at the front and top walls of the cabinet 10, respectively, until the door 30 is fully opened.

[0043] When the door 30 is opened, the user can put laundry into the drum 25 through the opening 11 of the cabinet 10, and can take laundry out of the drum 25. Furthermore, the user can also temporarily store the laundry taken out of the drum 25 in the container-shaped door window 35, if necessary or convenient.

[0044] When the user pulls the door 30 forwardly and downwardly while grasping the lower handle 39D after the laundry is taken out of the drum 25 when the door 30 is open, the door 30 may move downwardly along with the link members 41 and 45, and eventually come into contact with the front cover 15, for example. Thus, the door 30 can be closed according to the procedure discussed above, or any other suitable process corresponding to the features of the first embodiment.

[0045] Regarding the second embodiment of the present invention, those features not in contrast with the following description of the drum washing machine according to the second embodiment may be selected to be substantially similar to the examples of the first embodiment, for example; or, alternatively, may be selected to be similar to any equivalents thereto or any other suitable implementation in accordance with the features of the second embodiment. The drum washing machine according to the second embodiment of the present invention includes the door 30 which may be automatically moved vertically by an automatic opening/closing mechanism, which may include an electric motor 70 (or other suitable actuator, such as, for example, hydraulic and/or pneumatic systems, a spring-based actuator, or an electrically activated polymer), as shown in FIG. 7, for example.

[0046] According to at least one aspect of the second embodiment, for example, the automatic opening/closing mechanism may further include an automatic door-opening button 61 and/or an automatic door-closing button 62 respectively disposed at the control panel 18, which may form the front wall of the cabinet 10; and a motor control unit 65 disposed in the cabinet 10 for supplying electrical current to the electric motor 70 and/or for controlling the operation of the electric motor 70 according to the actu-

ation of the automatic door-opening and/or closing buttons 61 and/or 62.

[0047] The electric motor 70 may be connected to the first link member 41 and mounted to the link bracket 44 for rotating the first link member 41, for example, such that the door 30 is moved along a substantially vertical direction to open and/or close the door 30. Alternatively, the electric motor 70 may be connected to the second link member 45.

[0048] For example, according to at least one aspect of the second embodiment of the present invention, when the door 30 is automatically opened and/or closed by actuation of the automatic door-opening and/or closing buttons 61 and/or 62, the first link member 41 may be rotated by the electric motor 70 such that the door 30 is moved substantially vertically along with the second link member 45. As a result, the door 30 may be automatically opened and/or closed.

[0049] As apparent from the above description, the present invention can provide, for example, a drum washing machine with an upwardly-openable door which is connected to a cabinet of the washing machine by a door opening/closing mechanism such that the door is moved upwardly above the cabinet and can be used as a laundry holder when the upwardly-openable door is opened. Consequently, the opening of the door and/or the loading or unloading of laundry may be facilitated, even where the drum washing machine is installed in a limited or narrow space, and thus, the drum washing machine according to the present invention may improve the convenience of such processes for the user.

[0050] Furthermore, the door of the drum washing machine may be automatically opened and/or closed by an electric motor in accordance with at least the second embodiment of the present invention. Consequently, further improvement in the convenience for the user may be achieved.

[0051] Although several embodiments and examples of the present invention have been disclosed and described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and/or substitutions thereto are possible, without departing from the spirit of the present invention, the scope of which is set forth in the accompanying claims and their equivalents.

Claims

1. A drum washing machine comprising:

a cabinet including an opening at a front wall of the cabinet, configured to allow laundry to be put into or taken out of the cabinet;
a door disposed at the front wall of the cabinet and configured to open or close the opening of the cabinet; and
a door opening/closing mechanism connected between the cabinet and the door and configured to move the door to a position above the cabinet when opening the door such that a front surface of the door is upwardly directed when the door is opened, and to move the door toward the front wall of the cabinet when closing the door.

2. The drum washing machine according to claim 1, wherein the door has a container-shaped portion configured to contain the laundry when the door is open.

3. The drum washing machine according to claim 1, wherein the door comprises:

a door frame mounted to the front wall of the cabinet; and
a container-shaped door window mounted to the door frame,
wherein the container-shaped door window includes a convex structure configured to protrude into the opening of the cabinet when the door is closed.

4. The drum washing machine according to claim 1, wherein the door opening/closing mechanism comprises at least first and second sets of link members disposed at opposite first and second sides of the door, respectively, each set of link members including at least first and second link members and being connected to each other in a quadric link fashion.

5. The drum washing machine according to claim 4, wherein the door opening/closing mechanism comprises:

the first and second link members connected between first and second positions of first and second opposite side portions of the door and first and second positions of an upper part of the cabinet, respectively; and
third and fourth link members connected between third and fourth positions of the first and second opposite side portions of the door and third and fourth positions of the upper part of the cabinet, respectively, wherein the third and fourth positions of the first and second opposite side portions of the door to which the third and fourth link members are connected are higher than the first and second positions of the first and second opposite side portions of the door to which the first link members are connected, and

wherein the third and fourth positions of the upper part of the cabinet to which the second link members are connected are rearward of the first and second

positions of the upper part of the cabinet to which the first and second link members are connected.

6. The drum washing machine according to claim 5, wherein the cabinet includes a link bracket disposed at the upper part of the cabinet, and
wherein the first through fourth link members are connected to the link bracket.

7. The drum washing machine according to claim 4, wherein the cabinet includes a plurality of slits in the front wall and a top wall of the cabinet, extending in a direction substantially vertical with respect to the cabinet, and
wherein at least one of the first, second, third or fourth link members is moved along at least one of the slits.

8. The drum washing machine according to claim 7, wherein the slits include a foreign matter shield configured to prevent foreign matter from entering the slits.

9. The drum washing machine according to claim 1, further comprising:

an automatic opening/closing mechanism configured to move the door opening/closing mechanism vertically to automatically open or close the door.

10. The drum washing machine according to claim 9, wherein the door opening/closing mechanism includes at least first and second pairs of link members disposed at first and second sides of the door, respectively, each pair of link members being connected to each other, and
wherein the automatic opening/closing mechanism includes an electric motor configured to rotate the link members.

11. A washing machine for washing at least one item, comprising:

a cabinet including an opening at a front wall of the cabinet, configured to allow the item to be put into or taken out of the cabinet;
a door disposed at the front wall of the cabinet and configured to open or close the opening of the cabinet; and
a door opening/closing mechanism connected between the cabinet and the door and configured to move the door to a position above the cabinet when opening the door such that a front surface of the door is upwardly directed when the door is opened, and to move the door toward the front wall of the cabinet when closing the door.

12. The washing machine according to claim 11, wherein the door has a container-shaped portion configured to contain the item when the door is open.

13. The washing machine according to claim 11, wherein the door comprises:

a door frame mounted to the front wall of the cabinet; and
a container-shaped door window mounted to the door frame,
wherein the container-shaped door window includes a convex structure configured to protrude into the opening of the cabinet when the door is closed.

14. The washing machine according to claim 11, wherein the door opening/closing mechanism comprises at least first and second sets of link members disposed at opposite first and second sides of the door, respectively, each set of link members including at least first and second link members and being connected to each other in a quadric link fashion.

15. The washing machine according to claim 11, further comprising:

an automatic opening/closing mechanism configured to move the door opening/closing mechanism vertically to automatically open or close the door.

16. A vertically openable door for opening or closing an opening at a front wall of a cabinet, the vertically openable door comprising:

a door opening/closing mechanism connected between the cabinet and the vertically openable door and configured to move the vertically openable door to a position above the cabinet when opening the vertically openable door such that a front surface of the vertically openable door is upwardly directed when the vertically openable door is opened, and to move the vertically openable door toward the front wall of the cabinet when closing the vertically openable door.

17. The vertically openable door according to claim 16, further comprising a container-shaped portion configured to contain an item to be placed within the cabinet when the vertically openable door is open.

18. The vertically openable door according to claim 16, further comprising:

a door frame mounted to the front wall of the cabinet; and
a container-shaped door window mounted to the

door frame,

wherein the container-shaped door window includes a convex structure configured to protrude into the opening of the cabinet when the vertically openable door is closed.

19. The vertically openable door according to claim 16, wherein the door opening/closing mechanism comprises at least first and second sets of link members disposed at opposite first and second sides of the door, respectively, each set of link members including at least first and second link members and being connected to each other in a quadric link fashion.

20. The vertically openable door according to claim 16, further comprising:

an automatic opening/closing mechanism configured to move the door opening/closing mechanism vertically to automatically open or close the vertically openable door.

FIG. 1 (Prior Art)

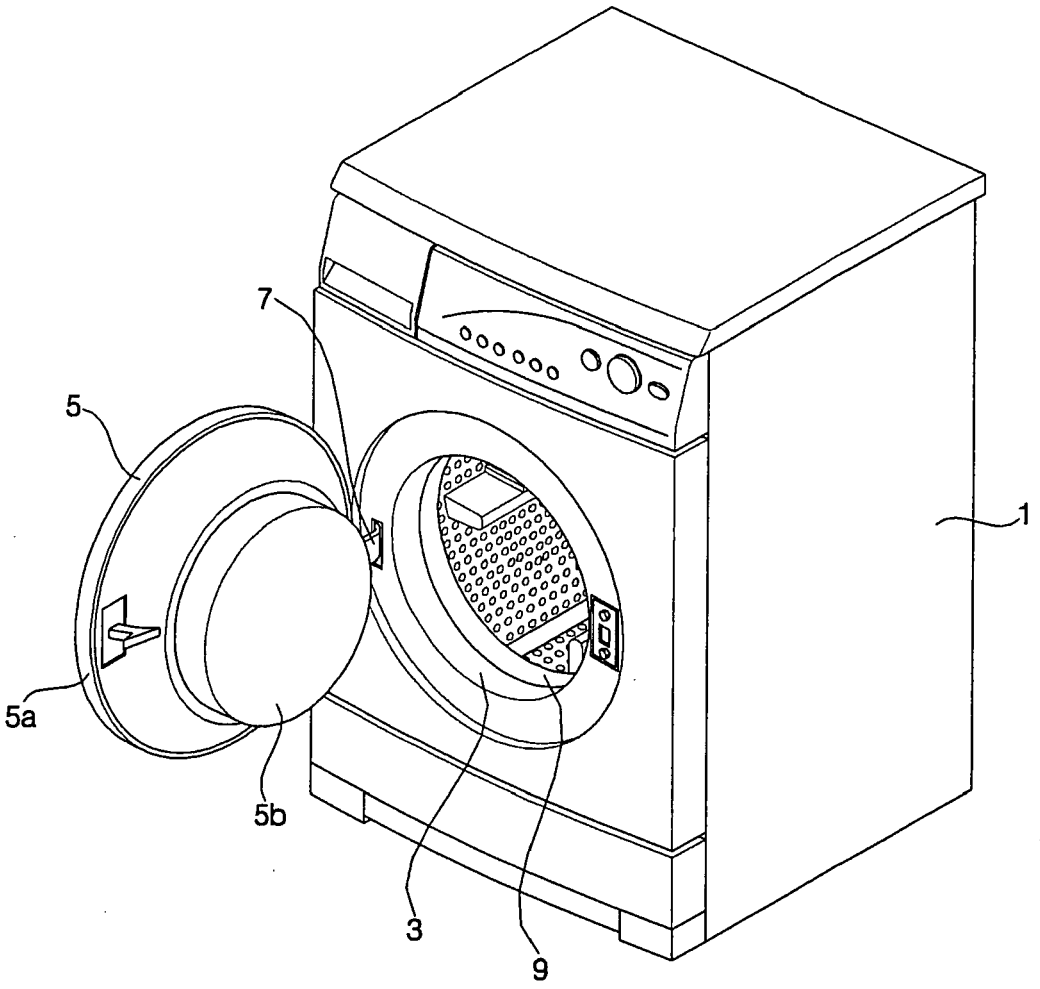


FIG. 2 (Prior Art)

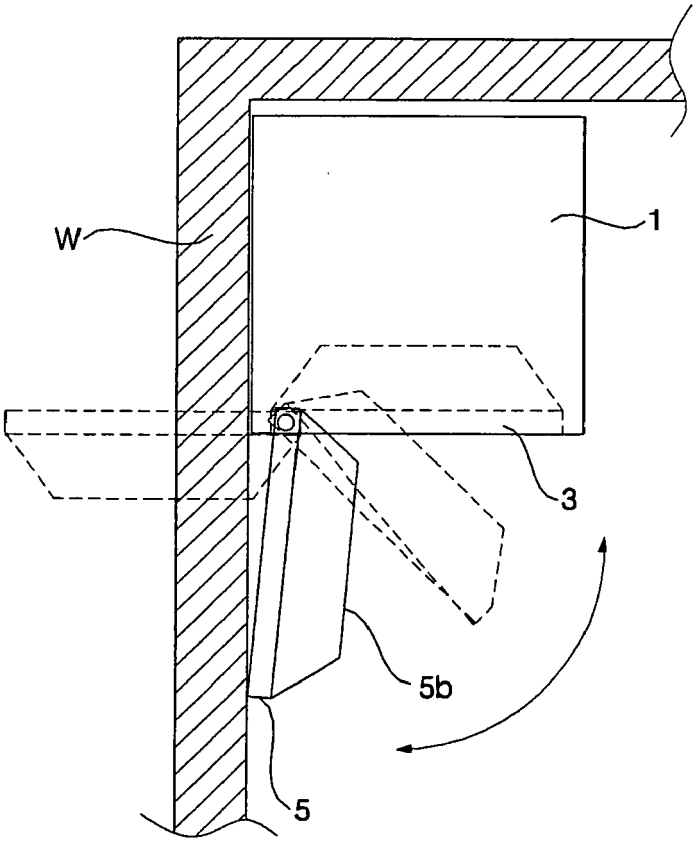


FIG. 3

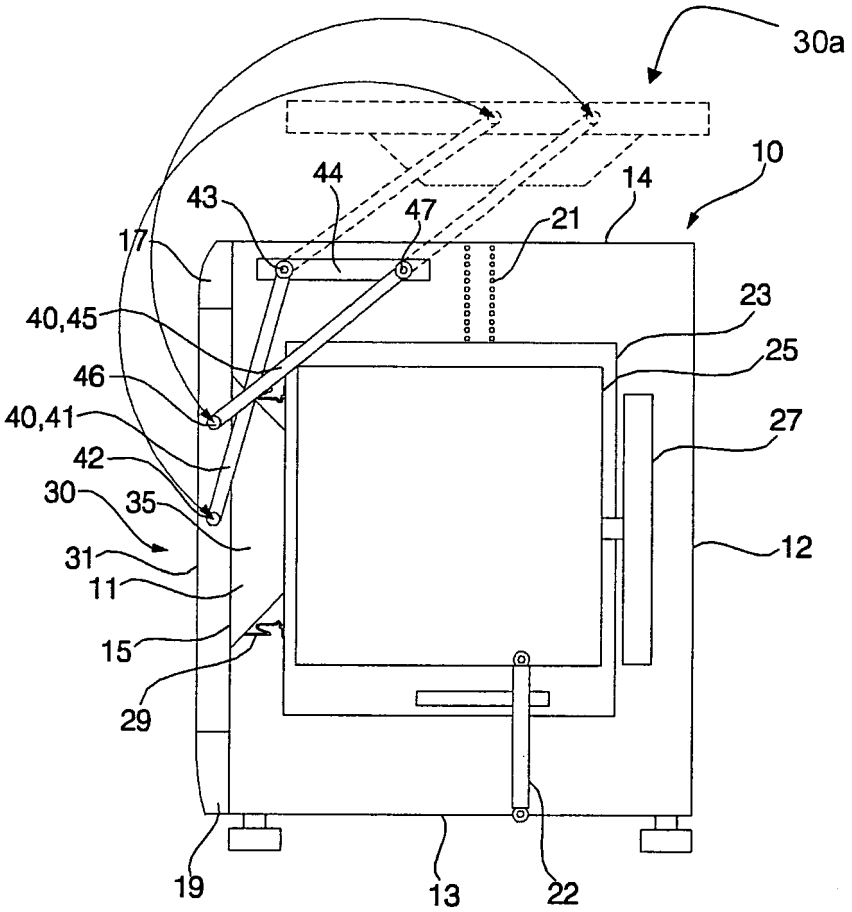

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FIG. 4

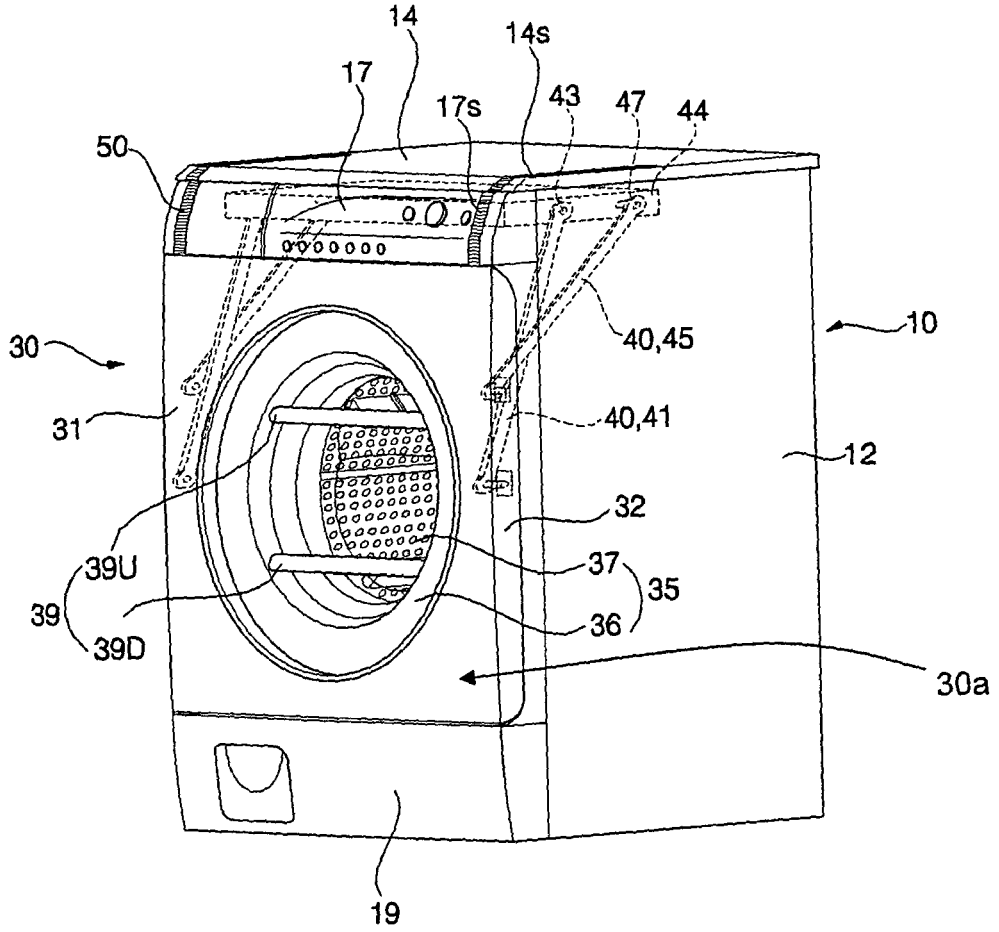
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FIG. 5

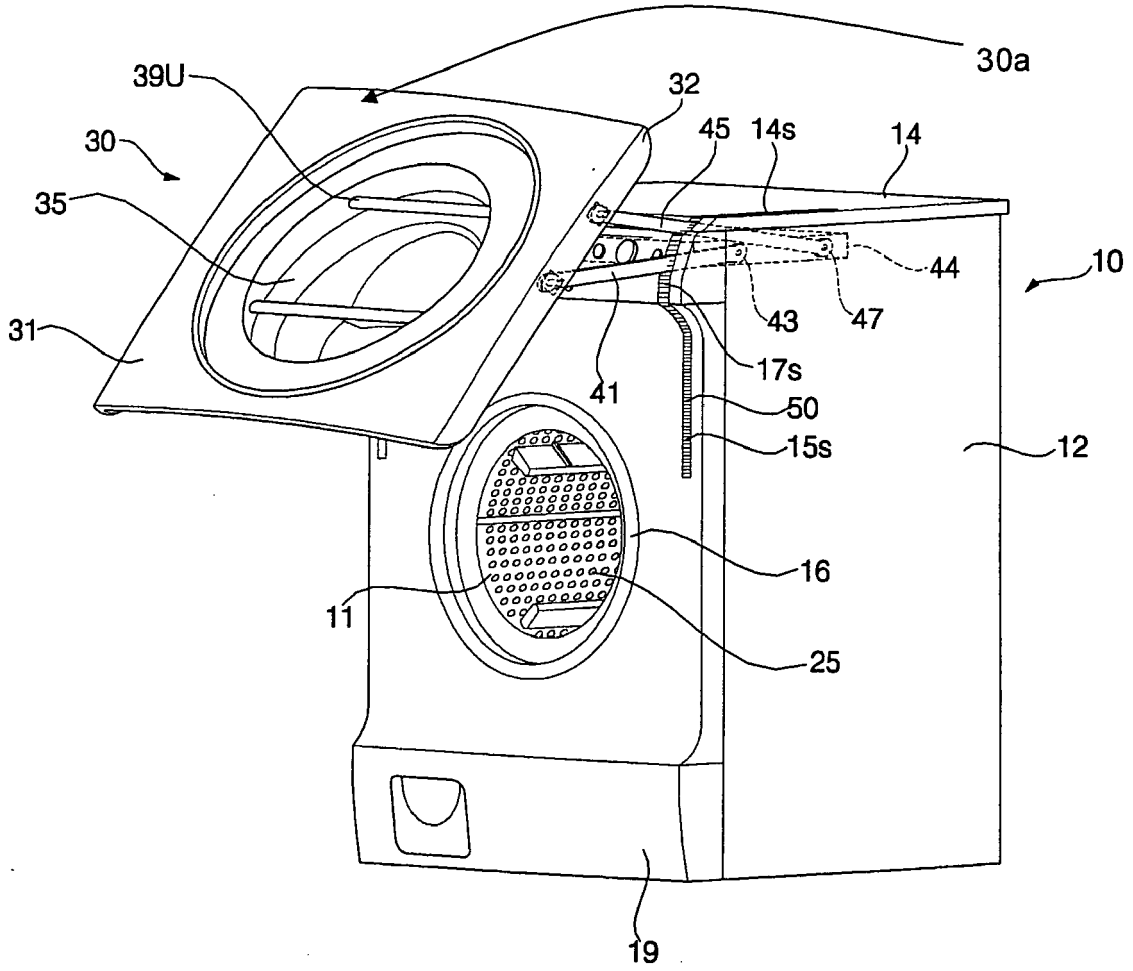


FIG. 6

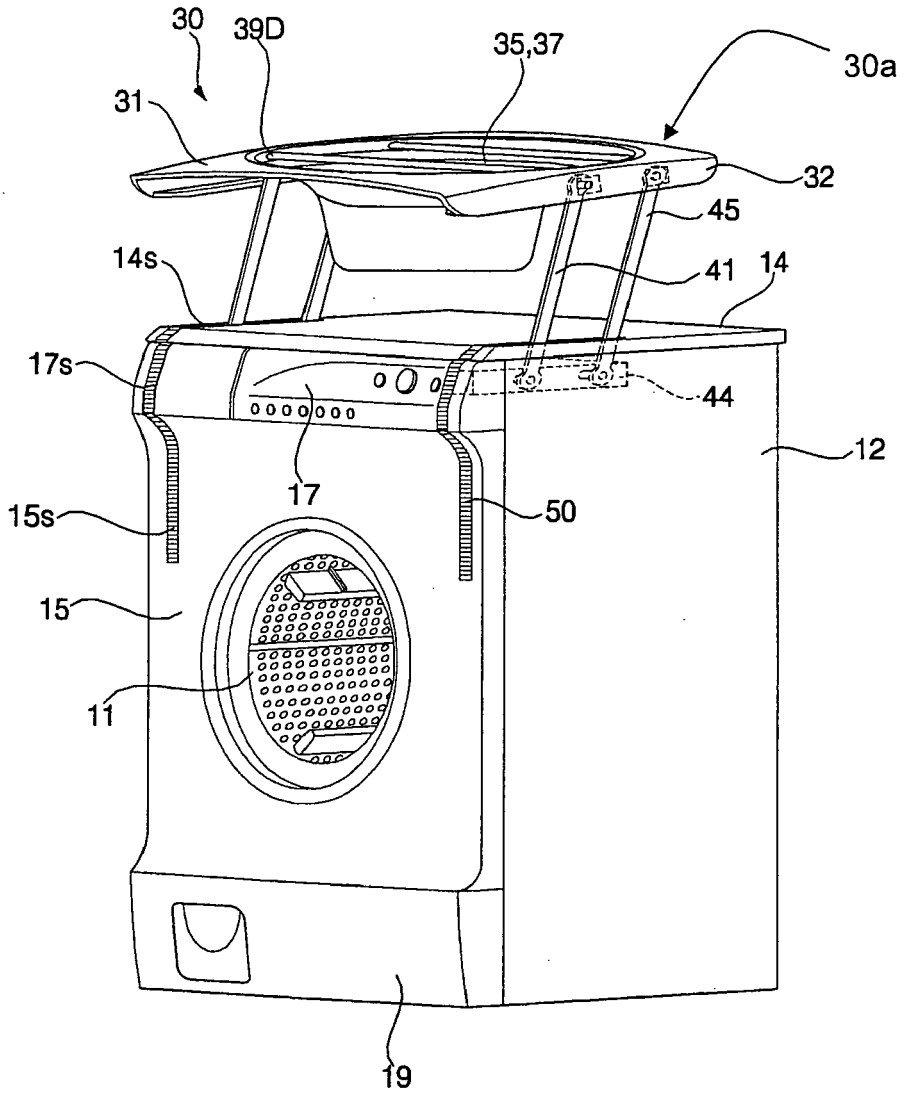
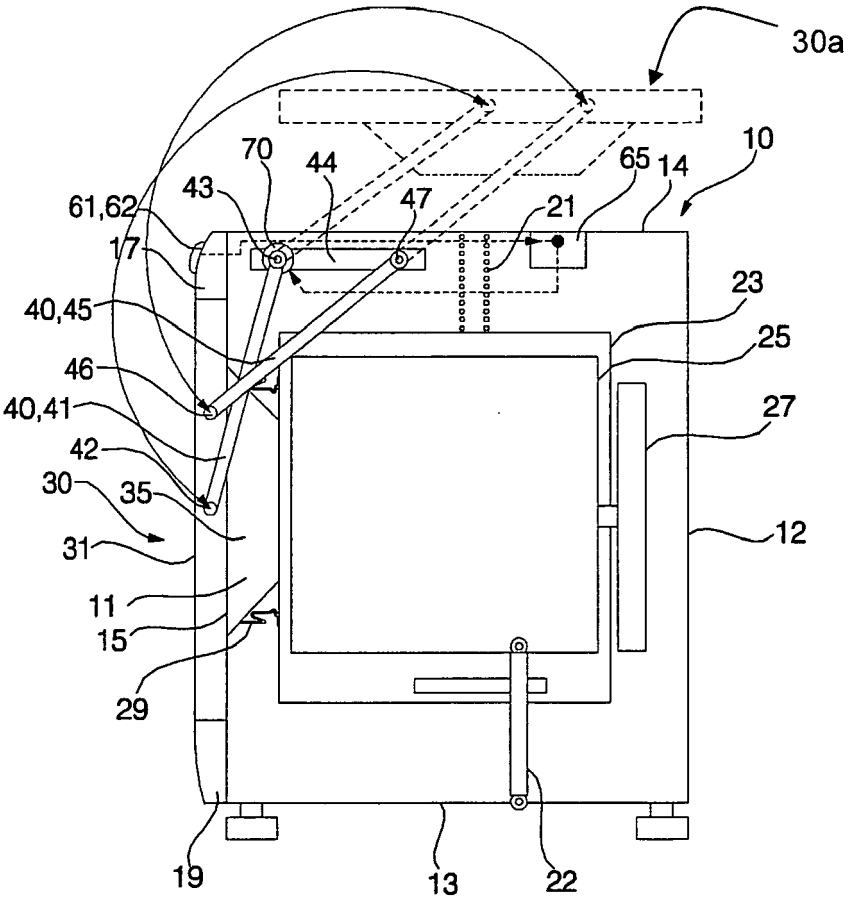


FIG. 7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