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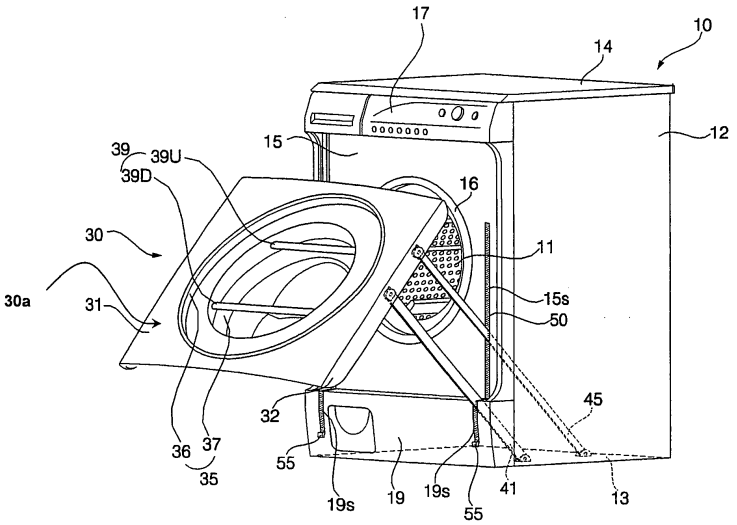
## (54) Drum type washing machine having vertically openable door

(57) A drum type washing machine having a vertically openable door includes a cabinet having an opening formed at a front wall of the cabinet to allow laundry to be put into or removed from the opening, a door provided at the front wall of the cabinet to open or close the opening, and a link opening/closing mechanism having links connected between the cabinet and the door to allow the door to be opened when the door is moved downwardly, and to be closed when the door is moved upwardly, such that an outer surface of the door faces upwardly when the door is opened. The door can be utilized as a laundry holder when the door is open, and even when the drum type washing machine is located in a narrow space, the door can be easily opened or closed while allowing the laundry to be conveniently put into or taken out of the washing machine.

FIG. 5




EP 1 650 340 A1

## Description

CROSS REFERENCE TO PRIORITY DOCUMENT

**[0001]** This application claims the benefit of priority to Korean Patent Application No. 2004-0085422, filed in 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 type washing machine having a vertically openable door, which can be utilized as a laundry holder when the door is opened downwardly.

Description of the Related Art

**[0003]** Referring to FIG. 1, a conventional drum type washing machine is illustrated which includes a cabinet 6, in which a tub and a drum are installed extending horizontally. An opening 3 is formed at a front wall of the cabinet 6 to communicate with the tub and drum. A door 5 is mounted to the cabinet 6 to open and close the opening 3.

**[0004]** The door 5 is hingably mounted by a hinge mechanism 7, at one side portion of the door 5, to a portion of the cabinet 6 corresponding to one side of the opening 3. A handle (not shown) is provided at the other side portion 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 and which comes into contact with a gasket 9 mounted in the cabinet 6.

**[0006]** However, the above-mentioned conventional drum type washing machine has a problem in that the door 5 cannot be fully opened where the washing machine 1 is installed in close contact with a wall W, as shown in FIG. 2, for example, because the door 5 opens horizontally about the axis of the hinge mechanism 7. 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 removed from the washing machine 4 through the opening 3.

**[0007]** After completion of a laundry washing cycle, the user typically 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 at least some of the laundry to the floor because the laundry is entangled. Such a situation occurs frequently. As such, there is inconvenience for the user because the dropped laundry must be washed again.

**[0008]** Also, after completion of washing the laundry, the user typically proceeds to take the laundry out of the washing machine while storing the laundry temporarily in an additional container for later transport. Accordingly, requiring the additional container may further inconvenience the user when taking the laundry out of the washing machine.

SUMMARY OF THE INVENTION

**[0009]** The present invention has been made in light of the above-described problems, among others, and it is an object of an aspect of the present invention to provide a drum type washing machine having a vertically openable door, which can be opened and/or closed by moving the door vertically using a four-link structure, and which can be utilized as a laundry holder when the door is open, so that, even if the washing machine is located in a narrow space, the door of the washing machine can be relatively easily opened and/or closed, and laundry can be conveniently put into or removed from the washing machine, thus enhancing the convenience of the drum type washing machine for a user.

**[0010]** In accordance with at least one aspect of the present invention, the above and other objects may be accomplished by a drum type washing machine having a vertically openable door, the drum type washing machine including a cabinet having an opening formed at a front wall of the cabinet to allow laundry to be put into or removed from the opening, a door provided at the front wall of the cabinet to open and/or close the opening, and a link opening/closing mechanism including links connected between the cabinet and the door to allow the door to be opened when the door is moved downwardly, or to be closed when the door is moved upwardly, such that an outer surface of the door faces upwardly when the door is opened.

**[0011]** The drum type washing machine may further include an automatic opening/closing mechanism to allow the door to be automatically opened and/or closed by lifting or lowering the link opening/closing mechanism.

**[0012]** According to another aspect of the present invention, for example, a washing machine which has a vertically openable door for washing at least one item may include a cabinet having an opening formed at a front wall of the cabinet to allow the item to be put into or removed from the opening, a door disposed at the front wall of the cabinet and capable of opening or closing the opening, and a link opening/closing mechanism including links connected between the cabinet and the door, the link opening/closing mechanism being capable of allowing the door to open when the door is moved downwardly, and/or to close when the door is moved upwardly, in which an outer surface of the door faces upwardly when the door is opened.

**[0013]** The washing machine may further include a container-shaped portion that may contain the item when the door is opened. Also, the link opening/closing mechanism may include at least first and second link members respectively connected to opposite side portions of the door to form a four-link structure; and the washing machine may further include an automatic opening/closing mechanism that can automatically open or close the door by lifting or lowering the link opening/closing mechanism.

**[0014]** 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 link opening/closing mechanism having links connected between the cabinet and the vertically openable door, the link opening/closing mechanism being capable of allowing the vertically openable door to open when the vertically openable door is moved downwardly, and/or to close when the vertically openable door is moved upwardly, in which an outer surface of the vertically openable door faces upwardly when the vertically openable door is opened.

**[0015]** The vertically openable door may further include a container-shaped portion that can contain an item to be placed within the cabinet when the vertically openable door is opened, and the link opening/closing mechanism may include at least first and second link members respectively connected to opposite side portions of the vertically openable door to form a four-link structure. The vertically openable door may also include a stopper that can prevent the vertically openable door from opening beyond a completely opened position of the vertically openable door, and/or an automatic opening/closing mechanism that can automatically open and/or close the vertically openable door by lifting or lowering the link opening/closing mechanism.

**[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 foregoing and other objects and features of the present invention will be more clearly understood in view of the following detailed description taken in conjunction with the accompanying drawings, in which:

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

Fig. 2 is a schematic view illustrating the conventional drum type washing machine with an open door;

Fig. 3 is a schematic side view of a drum type washing machine according to a first embodiment of the present invention;

Fig. 4 is a perspective view illustrating the drum type washing machine according to the first embodiment of the present invention in which the door of the drum type washing machine is closed;

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

Fig. 6 is a perspective view illustrating the drum type washing machine according to the first embodiment of the present invention, in which the door is opened; and

Fig. 7 is a schematic side view illustrating the drum type washing machine according to a second embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0018]** Preferred embodiments of the present invention are described below in further detail, with reference to the accompanying drawings.

**[0019]** Fig. 3 illustrates a drum type washing machine 1 according to a first embodiment of the present invention, and Figs. 4 through 6 show a door 30 of the drum type washing machine according to the first embodiment of the present invention when opened or closed. For example, Fig. 4 shows the door closed and Fig. 5 shows the door being opened, and Fig. 6 shows the door completely opened.

**[0020]** Referring to Figs. 3 through 6, for example, the drum type washing machine 1, which may be provided with a vertically openable door 30 in accordance with the first embodiment of the invention, may include a cabinet 10 to form an outer structure of the drum type washing machine. An opening 11 may be provided at a front wall of the cabinet 10 to allow laundry to be put into or removed from the drum type 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 type washing machine may include a tub 23 supported by a spring 21 and a damper 22 in the cabinet 10 to contain wash water, 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 removed from the drum 25. A gasket 29 may be interposed between the openings of the cabinet 10 and tub 23 to prevent wash water or the like from penetrating the interior of the cab-

inet 10 during a washing process.

**[0023]** The cabinet 10 may have a substantially hexahedral structure. For example, as shown in Figs. 3 and 4, 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, for example, and may include various operating switches to operate the drum type washing machine, and a display device to display an operating state (or other salient information, such as water temperature, the stage of the wash cycle, *etc.*) of the drum type washing machine. Alternatively, for example, the control panel 17 may otherwise be arranged on the top wall of the cabinet 10, such as the top cover 14, for example.

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

**[0026]** A door 30 may be provided on the front wall of the cabinet 10 to open and/or close the opening 11. For example, the front cover 15 may be coupled to the cabinet body 12, the control panel 17, and the lower cover 19 while being retracted into the cabinet 10 with respect to the control panel 17 and the clean door 19, such that, when the door 30 is closed, an outer surface of the front door 15 is flush with outer surfaces of the lower cover 19 and the control panel 17.

**[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. For example, as illustrated in Figs. 3 and 4, the door 30 may have a substantially quadrangular planar or plate-like structure, and may include a door frame 31 having a shape 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 generally "L" shape, for example. The side portions 32 typically form opposite side walls of the door 30, respectively. A link opening/closing mechanism, which can function as a door opening/closing mechanism, may be connected to the opposite side portions 32.

**[0030]** The container-shaped door window 35 may have laundry container structure can come into contact with the gasket 29 when the door 30 is closed, and which can receive laundry when the door 30 is open. 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 laundry container structure to contain the 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 or synthetic resin material, for example, or any other material suitable for such a structure. The container-shaped window 37 may be made of any suitable transparent or translucent material (such as glass, clear plastic, or carbon fiber, for example) to allow the user to view the interior of the drum 25 through the container-shaped window 37.

**[0032]** One or more handles 39 may be provided on the door 30 to allow the user to open and/or close the door 30 while grasping the handle or handles 39. The handles 39 may include two handles, such as an upper handle 39U and a lower handle 39D, respectively positioned at upper and lower portions of the door 30, for example.

**[0033]** When the above-described door 30 is fully opened for example, an outer surface 30a of the door 30 faces upwardly so that laundry removed from the drum may be temporarily stored in the interior of the container-shaped door window 35 when taking the laundry out of the drum 25. Accordingly, the door 30 may be opened while moving downwardly to a lower portion of the cabinet 10, and may be closed while moving upwardly to an upper portion of the cabinet 10.

**[0034]** For such an opening or closing operation of the door 30, the link opening/closing mechanism 40 may include links (for example, at least two link members 41 and 45) connected between the base 13 of the cabinet 10 and the door 30 at the opposite side portions of the door 30.

**[0035]** The link opening/closing mechanism 40 may include the at least two link members 41 and 45 connected to each side portion of the door 30, having a four-link structure.

**[0036]** For example, the link opening/closing mechanism 40 may include a first link member 41 and a second link member 45 connected to the side portion 32 of the door 30 and the base 13 of the cabinet 10, respectively. The first link member 41 may have opposite ends connected to the center of the side portion 32 and to a front portion of the base 13, respectively, and the second link member 45 may have opposite ends connected above the center of the side portion 32 and to a rear portion of the base 13, respectively.

**[0037]** The side portion 32 of the door 30 may be provided with door connecting shafts 42 and 46, to which the upper ends of the first and second link members 41 and 45 may be connected, and the base 13 of the cabinet 10 may be provided with link brackets 43 and 47, to which the lower ends of the first and second link members 41 and 45 may be connected. Alternatively, for example, the link brackets 43 and 47 may have hinge shafts 44 and 48 to which the first and second link members 41 and 45 are hingably connected.

**[0038]** The front cover 15 and the lower cover 19 forming the front wall of the cabinet 10 may be formed with elongated slits 15s and 19s in the longitudinal direction to form paths for the link members 41 and 45, respectively, as shown in Fig. 5, for example.

**[0039]** Each of the slits 15s and 19s may be provided with a shield 50 for preventing foreign matter from entering the slits 15s or 19s, while allowing each of the link members 41 and 45 to move freely along the slits 15s or 19s. The shield 50 may be made from a soft brush, a rubber member (not shown) bifurcated to both sides, or any other such suitable technology for preventing debris from entering while permitting movement along the slits 15s or 19s, for example.

**[0040]** Additionally, a stopper 55 may be provided on the clean door 19 to stop the door 30 at the lower end of the slit 19s when opened in a substantially horizontal alignment, for example. As an alternative, for example, the stopper 55 may be provided on any of various other components, such as connecting portions of the link members 41 and 45 of the door 30, the link brackets 43 and 47 of the cabinet 10, or the link members 41 and 45, so as to prevent the door 30 and the link members 41 and 45 from moving downwardly to a lower position exceeding a predetermined distance.

**[0041]** Exemplary modes of operation of the drum type washing machine 1 having the vertically openable door 30 according to the first embodiment of the present invention as described above will now be described.

**[0042]** As shown in Fig. 4, for example, when the door 30 is urged downwardly by the lower handle 39D in order to open the door 30 from a closed state, the upper end of the door 30 may be moved to a lower position while the lower end of the door 30 is moved away from the drum type washing machine 1 in a substantially horizontal direction via the path shown in Fig. 5, for example, allowing the door 30 to be completely opened as shown in Fig. 6, for example.

**[0043]** The door 30 connected to the base 13 via the two pairs of link members 41 and 45 may be slopingly moved to the front of the drum type washing machine 1, as shown in Fig. 5, for example, by a user pulling the door 30, and may be then opened while being moved to the lower position until the door 30 is horizontally disposed. At that time, the link members 41 and 45 may be hingably moved along the slits 15s and 19s formed on the front wall of the cabinet 10 until the link members 41 and 45 are engaged with the stoppers 55.

**[0044]** As described above, for example, when the door 30 is open, laundry can be put into the drum 25 through the opening of the cabinet 10, or removed from the drum 25, and the laundry removed from the drum 25 can also be contained within the container-shaped door window 35, for example.

**[0045]** After removing the laundry when the door 30 is open, as mentioned above, when the door 30 is pulled upwardly by the upper side handle 39U, the door 30 may be moved upwardly along with the link members 41 and 45, and may come into close contact with the front cover 15, thereby completely closing the drum type washing machine.

**[0046]** The drum type washing machine according to the second embodiment of the present invention, as shown in Fig. 7, for example, may be provided with an automatic opening/closing mechanism including an electric motor 70 (or other suitable actuator, such as a pneumatic system or spring-loaded mechanical actuator, for example) to automatically lift and/or lower the door 30.

**[0047]** For example, the automatic opening/closing mechanism may include an automatic door-opening button 61 and an automatic door-closing button 62 installed in the control panel 17 provided on the front wall of the cabinet 10, and a motor controller 65 installed inside the cabinet 10 to control operations of the electric motor 70 to open and/or close the door 30 according to actuation of the buttons 61 or 62 while supplying electrical power to the electric motor 70.

**[0048]** The electric motor 70 may be coupled to a lower end of the first link member 41, and can open or close the door 30 by hingably operating the first link member 41. Alternatively, for example, the electric motor 70 may be installed on the second member 45.

**[0049]** In the drum type washing machine 1 according to the second embodiment of the present invention, for example, when automatically opening and/or closing the door 30 by actuating the automatic door-opening button 61 or the automatic door-closing button 62, the first link member 41 may be hingably operated according to the driving of electric motor 70, and the door 30 is then moved vertically along with the second link member 45, so that the door 30 can be automatically opened and/or closed while moving along a substantially vertical direction.

**[0050]** As apparent from the above description, since the drum type washing machine 1 having the vertically openable door connected to the cabinet by the four-link structure, so that the door can open and/or close the drum type washing machine 1 while moving along a substantially vertical direction, the door 30 can be utilized as a laundry holder upon opening of the door, for example, and even where the drum type washing machine 1 is located in a narrow space, the door 30 can be easily opened and/or closed while allowing the laundry to be conveniently put into or removed from the drum type washing machine 1, thereby enhancing the convenience of the laundry washing process for the user.

**[0051]** Furthermore, the drum type washing machine of the present invention may be structured such that the door 30 can be automatically opened and/or closed while being moved by the electric motor 70, thereby further enhancing the convenience for the user, for example.

**[0052]** 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.

## Claims

1. A drum type washing machine having a vertically openable door, comprising:

   a cabinet having an opening formed at a front wall of the cabinet to allow laundry to be put into or removed from the opening;
   a door disposed at the front wall of the cabinet and configured to open or close the opening; and
   a link opening/closing mechanism including a plurality of links connected between the cabinet and the door, the link opening/closing mechanism being configured to allow the door to open when the door is moved downwardly, and to close when the door is moved upwardly,

   wherein an outer surface of the door faces upwardly when the door is opened.

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

3. The drum type washing machine according to claim 1, wherein the door includes a door frame disposed at the front wall of the cabinet, and a container-shaped door window provided on the door frame and which has a convex structure protruding into the opening of the cabinet.

4. The drum type washing machine according to claim 1, wherein the link opening/closing mechanism includes at least first and second link members respectively connected to opposite side portions of the door to form a four-link structure.

5. The drum type washing machine according to claim 4, wherein the first link member includes first and second opposite ends respectively connected to a lower portion of the first side portion of the door and to a forward position of the bottom surface of the cabinet, and the second link member includes first and second opposite ends respectively connected to an upper portion of the second side portion of the door above the lower portion of the first side portion the first link member is connected, and to a rearward portion of the bottom surface of the cabinet behind the forward position of the bottom surface to which the first link member is connected.

6. The drum type washing machine according to claim 5, wherein the bottom surface of the cabinet includes at least first and second link brackets to which the first and second link members are respectively connected.

7. The drum type washing machine according to claim 1, wherein at least one of the cabinet, the door, or the link opening/closing mechanism includes a stopper configured to prevent the door from opening beyond a completely opened position of the door.

8. The drum type washing machine according to claim 1, wherein the cabinet includes at least one longitudinally elongated slit configured to allow the link opening/closing mechanism to move along the slit, the slit positioned at the front wall of the cabinet.

9. The drum type washing machine according to claim 8, wherein each slit includes a shield configured to prevent foreign matter from entering the slit.

10. The drum type washing machine according to claim 1, further comprising an automatic opening/closing mechanism configured to automatically open or close the door by lifting or lowering the link opening/closing mechanism.

11. The drum type washing machine according to claim 10, wherein the automatic opening/closing mechanism includes an electric motor configured to rotate the link opening/closing mechanism.

12. A washing machine having a vertically openable door for washing at least one item, comprising:

   a cabinet having an opening formed at a front wall of the cabinet to allow the item to be put into or removed from the opening;
   a door disposed at the front wall of the cabinet and configured to open or close the opening; and
   a link opening/closing mechanism including a plurality of links connected between the cabinet and the door, the link opening/closing mechanism being configured to allow the door to open when the door is moved downwardly, and to close when the door is moved upwardly,

   wherein an outer surface of the door faces upwardly when the door is opened.

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

14. The washing machine according to claim 12, wherein the link opening/closing mechanism includes at least first and second link members respectively connected to opposite side portions of the door to form a four-link structure.

**15.** The washing machine according to claim 12, further comprising an automatic opening/closing mechanism configured to automatically open or close the door by lifting or lowering the link opening/closing mechanism.

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

a link opening/closing mechanism including a plurality of links connected between the cabinet and the vertically openable door, the link opening/closing mechanism being configured to allow the vertically openable door to open when the vertically openable door is moved downwardly, and to close when the vertically openable door is moved upwardly,

wherein an outer surface of the vertically openable door faces upwardly when the vertically openable door is opened.

**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 opened.

**18.** The vertically openable door according to claim 16, wherein the link opening/closing mechanism includes at least first and second link members respectively connected to opposite side portions of the vertically openable door to form a four-link structure.

**19.** The vertically openable door according to claim 16, further comprising a stopper configured to prevent the vertically openable door from opening beyond a completely opened position of the vertically openable door.

**20.** The vertically openable door according to claim 16, further comprising an automatic opening/closing mechanism configured to automatically open or close the vertically openable door by lifting or lowering the link opening/closing mechanism.

FIG. 1 (Prior Art)

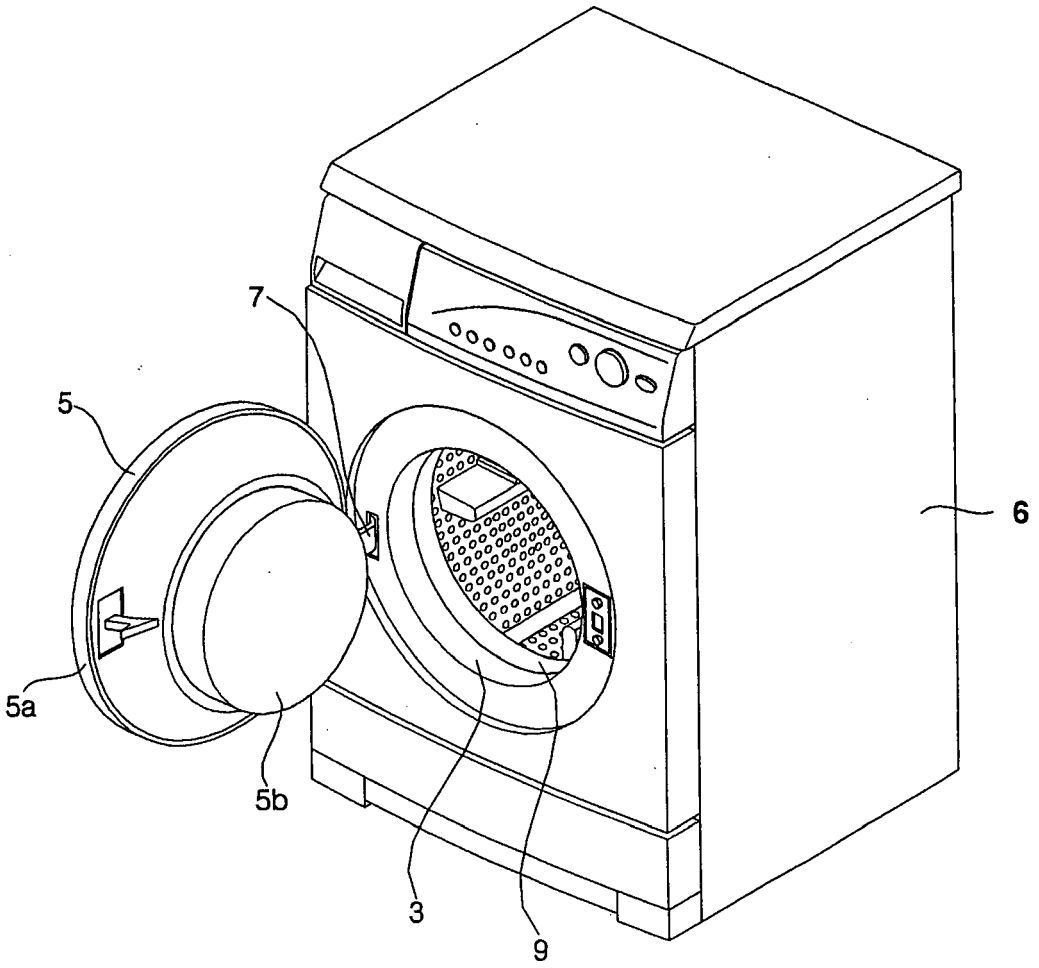


FIG. 2 (Prior Art)

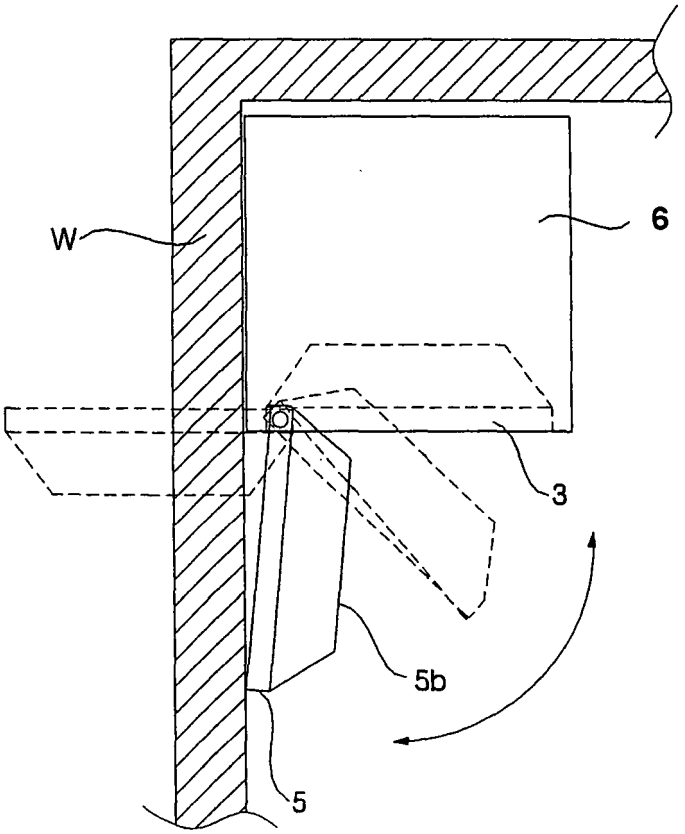


FIG. 3

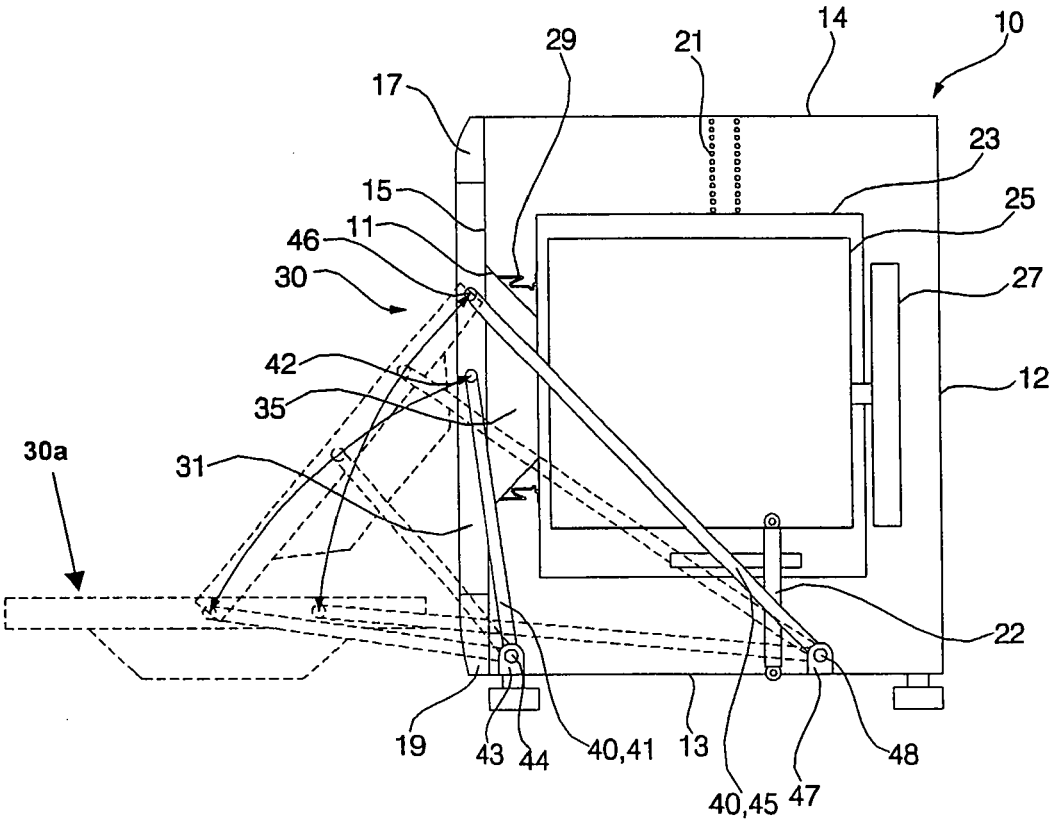

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FIG. 4

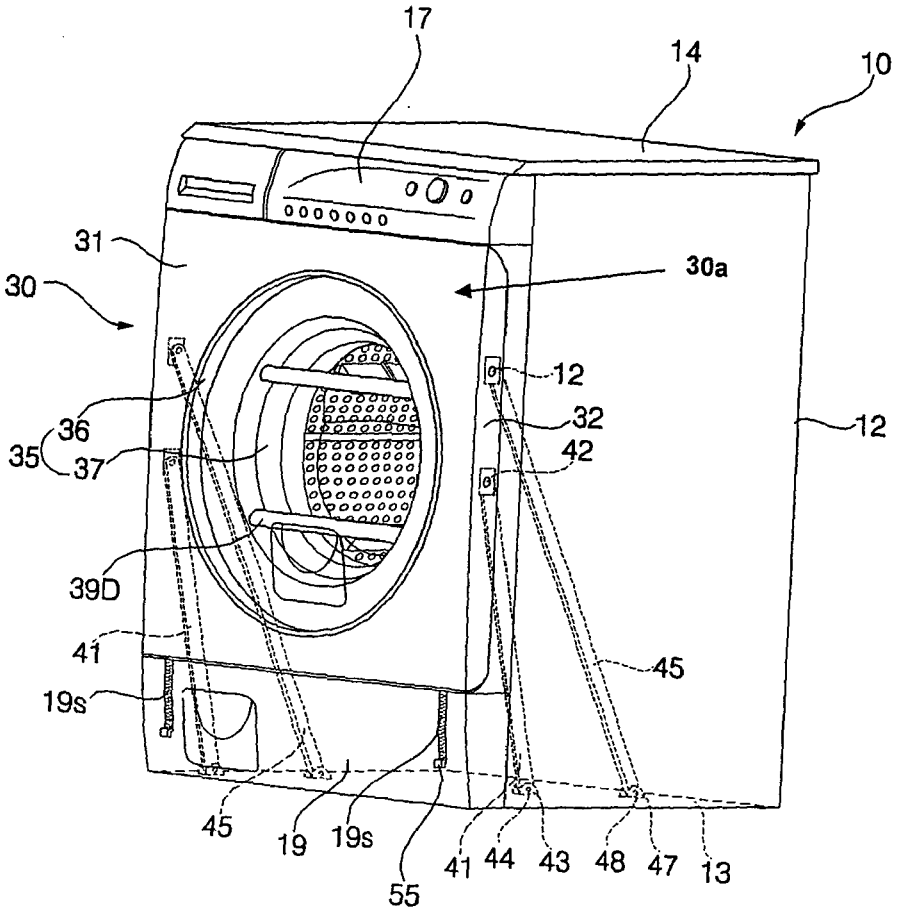
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FIG. 5

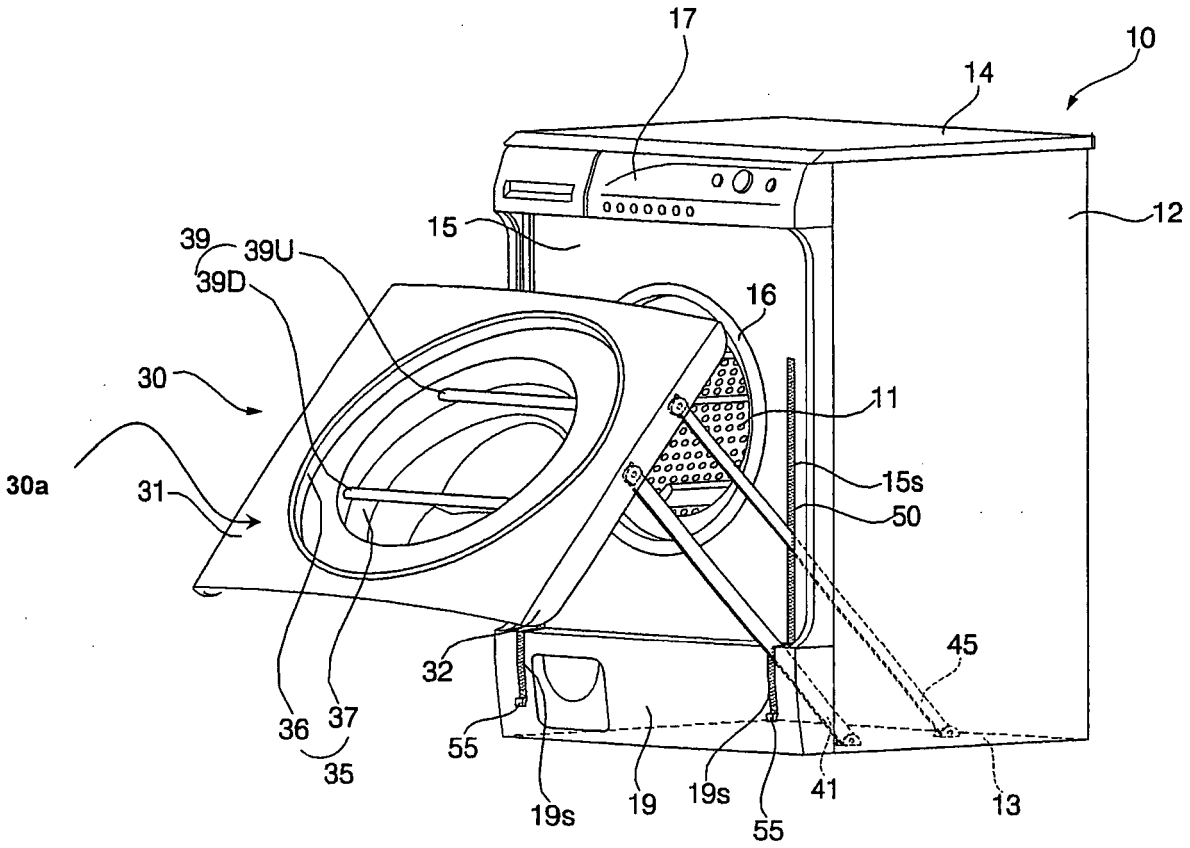
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FIG. 6

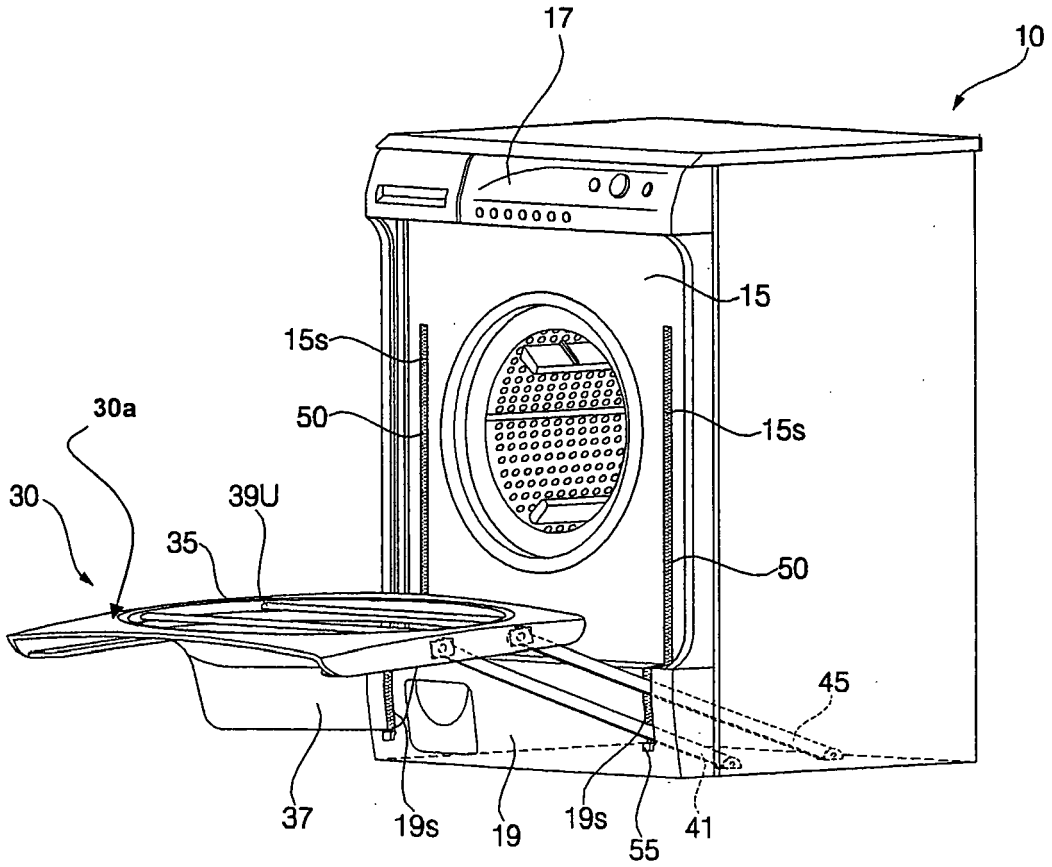
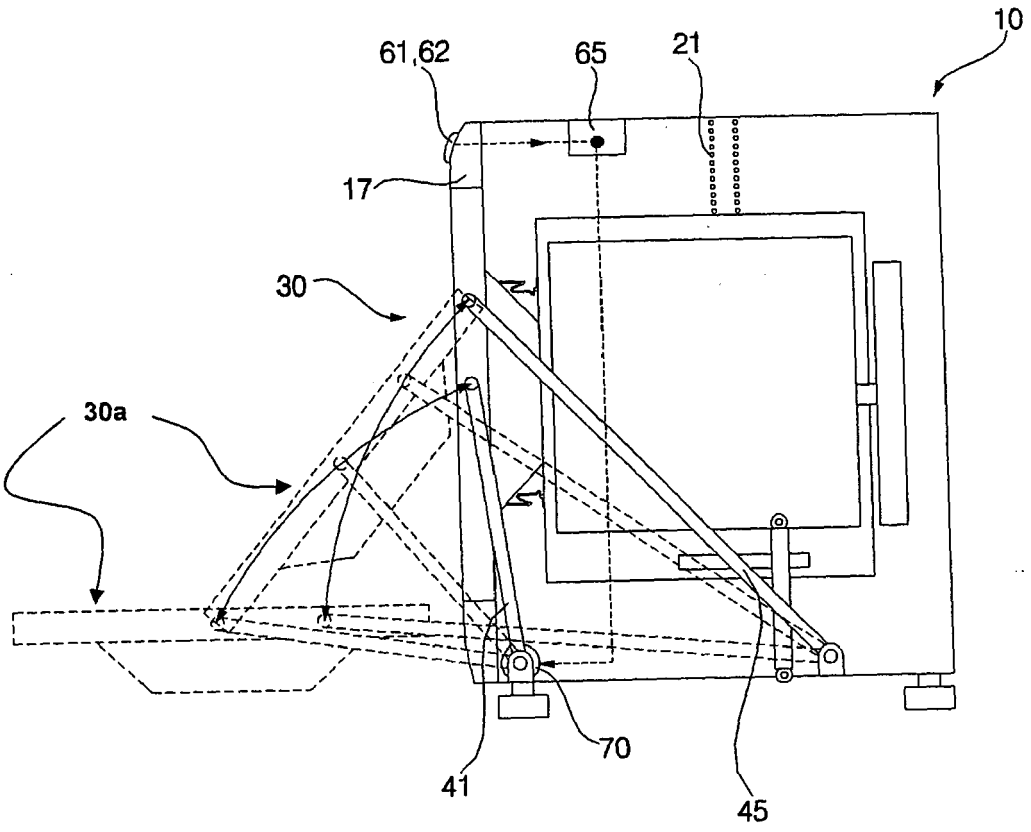


FIG. 7



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# EUROPEAN SEARCH REPORT

Application Number
EP 05 02 2707

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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The present search report has been drawn up for all claims

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| Munich | 31 January 2006 | Lodato, A |

CATEGORY OF CITED DOCUMENTS

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 02 2707

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