

DRUM TYPE WASHING MACHINE

Field of the Invention

5 The present invention relates to a drum type washing machine; and, more particularly, to a door configured to prevent laundry articles from inadvertently escaping from a housing thereof.

10 Background of the Invention

 A conventional drum type washing machine has, retained on their housing, a door that can be freely opened or closed for preventing laundry articles or detergent contained
15 within the housing from inadvertently escaping from the body of the machine (see Japanese Patent Laid-open Application No. 2004-8683).

 FIG. 4 is a cross sectional view of major parts briefly showing a configuration of a door of a conventional drum
20 type washing machine. Referring to FIG. 4, washing machine housing 101 includes rotary drum 102 for containing therein laundry articles and water tub 103 for rotatably accommodating therein rotary drum 102. Washing machine housing 101 is provided with opening 104 formed on its front
25 surface so that laundry articles can be put into and removed from washing machine housing 101 via opening 104. Door 105

is retained on the front surface of washing machine housing 101 by rotation shaft portion 106 and joint member 107 so that opening 104 can be opened and closed freely. Recess 108 is formed on the front surface of washing machine housing 101, allowing opening 104 to be positioned on the bottom portion of recess 108. The outer diameter of door 105 is smaller than the inner diameter of recess 108 and door 105 is configured in such a manner that, when door 105 is closed, it is received in recess 108. Recess 108 is provided with hole portion 109 formed on its bottom portion 108a, allowing joint member 107 to pass through hole portion 109.

However, the conventional drum type washing machine is saddled with a problem as follows: since side wall 108b of recess 108 of washing machine housing 101 is approximately perpendicular to bottom portion 108a thereof, and outer peripheral wall 105a of door 105 is approximately parallel to side wall 108b, when washing machine housing 101 is viewed from the front, there is a gap between side wall 108b of recess 108 of washing machine housing 101 and outer peripheral wall 105a of door 105, and any dimensional deviation during attachment may result in gap irregularity which, in turn, may lead to appearance irregularity.

In addition, hole portion 109, through which joint member 107 passes, can be observed in the gap between side wall 108b of recess 108 of washing machine housing 101 and

outer peripheral wall 105a of door 105 when viewed from a position corresponding to joint member 107, thereby degrading the washing machine aesthetically. Furthermore, the gap may allow alien substances, e.g. water, to easily enter into washing machine housing 101, which, in turn, may degrade the overall quality.

Summary of the Invention

10 Embodiments of the present invention seek to provide a drum type washing machine incorporating therein a door, the door being configured so as to prevent alien substances, e.g. water, from entering into a housing while providing excellent appearance and quality.

15 In example embodiments, there is provided a drum type washing machine including: a rotary drum for being driven to rotate while containing therein laundry articles; a water tub for accommodating therein the rotary drum; a washing machine housing, for accommodating therein the water tub,

20 provided with an opening for loading the laundry articles into the rotary drum; a door pivotally supported on the washing machine housing and adapted to open and close the opening; a rotation shaft portion positioned at the washing machine housing, the door being rotated about the rotation

25 shaft portion; and one or more joint members for connecting the rotation shaft portion to an inner side

of the door in an approximately arc shape about the rotation shaft portion, wherein an inclined portion is formed on an outer peripheral part of the door such that an outer peripheral edge of the inner side of the door is closer to a center of the door than an outer peripheral edge of an outer side of the door is; and wherein the washing machine housing has a recess and at a bottom portion of the recess, there are provided with the opening and one or more holes through which the joint members pass, the door being received in the recess when the door is closed; and wherein an slanted portion corresponding to the inclined portion of the door is formed on a side wall of the recess.

In accordance with an aspect of the present invention, there is provided a drum type washing machine comprising: a rotary drum for being driven to rotate while containing therein laundry articles; a water tub for accommodating therein the rotary drum; a washing machine housing, for accommodating therein the water tub, provided with an opening for loading the laundry articles into the rotary drum; a door pivotally supported on the washing machine housing and adapted to open and close the opening; a rotation shaft portion positioned at the washing machine housing, the door being rotated about the rotation shaft portion; and one or more joint members for connecting the rotation shaft portion to an inner side of the door, each of

the joint members having an approximately arc-shaped portion about the rotation shaft portion, wherein an outer peripheral part of the door includes an outer peripheral wall approximately perpendicular to a rear portion of the door and an inclined portion by which an outer peripheral edge of an inner side of the door is closer to a center of the door than an outer peripheral edge of an outer side of the door is; wherein the washing machine housing has a recess and a side wall of the recess includes a normal portion approximately parallel to the outer peripheral wall of the door with a gap and a slant portion approximately parallel to the inclined portion of the door, the slant portion being formed between a front surface of the washing machine housing and the side wall of the recess; and wherein at the bottom portion of the recess, there are provided with the opening and one or more holes through which the joint member pass, the door being received in the recess when the door is closed, and each of the joint members has an approximately flat portion connected to the inner side of the door; and the approximately arc-shaped portion is connected to the rotation shaft portion and a nodal line of the approximately flat portion and the approximately arc-shaped portion is located adjacent to the outer peripheral edge of the inner side of the door.

Brief Description of the Drawings

FIG. 1 is a perspective view showing an external configuration of a drum type washing machine in accordance with a preferred embodiment of the present invention;

5 FIG. 2 is a cross sectional view briefly showing major parts near a door of the drum type washing machine shown in FIG. 1;

FIG. 3 is a cross sectional view briefly showing major parts of the door of the drum type washing machine shown in
10 FIG. 1; and

FIG. 4 is a cross sectional view briefly showing a conventional drum type washing machine.

Detailed Description of the Preferred Embodiments

Hereinafter, preferred embodiments of the present
5 invention will be described with reference to the
accompanying drawings. It is to be noted that the present
invention is not limited in any manner by the following
description.

FIG. 1 is a perspective view showing an external
10 configuration of a drum type washing machine in accordance
with a preferred embodiment of the present invention; FIG. 2
is a cross sectional view briefly showing major parts near a
door of the drum type washing machine; and FIG. 3 is a cross
sectional view briefly showing major parts of the door.

15 Referring to FIG. 1, washing machine housing 1 includes
upwardly inclined surface 1a formed on the upper portion of
the front surface thereof and recess 3 formed on upwardly
inclined surface 1a, recess 3 including circular opening 2
formed on the bottom portion thereof, allowing laundry
20 articles to be put into and removed from washing machine
housing 1 via opening 2. Door 4 is positioned in recess 3
of upwardly inclined surface 1a of washing machine housing 1
via one or more joint members 5, allowing door 4 to
pivotally be opened and closed to open and cover opening 2.

25 Referring to FIG. 2, water tub 6 for collecting washing
water is suspended inside washing machine housing 1 such

that it is allowed to rock therein. Rotary drum 7 for containing therein laundry articles and washing the laundry articles while it is rotated is positioned inside water tub 6 such that rotary drum 7 can rotate pivotally. Rotary drum 5 7 is driven to rotate by a motor (not shown).

Door 4 is connected to flat portion 5a of each of joint members 5, which are pivotally supported on rotation shaft portion 8 provided inside washing machine housing 1, and door 4 is pivotally retained in order to open and close opening 2. Door 4 includes door main body 9 made of 10 polypropylene; door rear plate 10 made of polypropylene having strong resistance to chemicals; transparent window 11 made of glass; door cover 12 made of transparent ABS (Acrylonitrile Butadiene Styrene); and veneer 13 made of ABS 15 having resistance to chemicals.

Door main body 9 has an approximately ring shape. Inner wall 9a of door main body 9 has an approximately ring shape and is positioned approximately at the center of door main body 9 in an upright position and extends from outside 20 of washing machine housing 1 to inside of rotary drum 7. Door rear plate 10 has an approximately ring shape and is positioned at the side of door main body 9 facing toward the rear side of washing machine housing 1. Outer wall 10a of door rear plate 10 is positioned on the outer periphery of 25 door rear plate 10 in an upright position and extends from inside of washing machine housing 1 to outside of washing

machine housing 1.

Transparent window 11 is approximately concaved, particularly, concaved towards rotary drum 7 and has flange portion 11a formed on the upper end thereof along approximately the entire circumference while protruding in the outer peripheral direction. Flange portion 11a is interposed between the front end of inner wall 9a of door main body 9 and the inner surface of the inner periphery of door rear plate 10. Boss 9c is positioned on the inner surface of door main body 9 in an upright position and is provided with hole portion 9b formed on the front end of boss 9c. Door rear plate 10 is provided with through hole 10b positioned so as to correspond to boss 9c. Door main body 9 and door rear plate 10 are securely fixed to each other by fastening screw 14 into hole portion 9b of boss 9c via through hole 10b while flange portion 11a of transparent window 11 is interposed therebetween.

Inner peripheral end 9d of door main body 9 is formed on a basal side of inner wall 9a of door main body 9 toward the outer surface of washing machine housing 1, inner peripheral end 9d being provided with a step. Flange portion 12a of door cover 12 is formed on the outer peripheral part of door cover 12 at a position lower than the surface of door cover 12 by a step and received in inner peripheral end 9d. Veneer 13 is positioned on door main body 9 toward the outside of washing machine housing 1 in an

approximately ring shape while flange portion 12a of door cover 12 is received in inner peripheral end 9d. The inner surface of the inner periphery of veneer 13, which has the approximately ring shape, covers flange portion 12a of door cover 12 from outside thereof, thereby interposing door cover 12.

Referring to FIG. 3, veneer 13 has veneer outer peripheral wall 13a protruding towards door rear plate 10, veneer outer peripheral wall 13a being formed on an outer peripheral edge of veneer 13. Outer wall 10a of door rear plate 10 has outer peripheral end 10c formed on its front end, outer wall 10a of door rear plate 10 being provided with a step, allowing it to correspond to veneer outer peripheral wall 13a. Veneer outer peripheral wall 13a is provided with hitching hook 13b formed inwardly at a plurality of places on its inner surface. Outer peripheral end 10c is provided with recessed engagement 10g formed on its outer peripheral surface so as to correspond to hitching hook 13b. By latching hitching hook 13b on recessed engagement 10g, veneer 13 is allowed to be fitted on the surface of door main body 9.

Outer wall 10a of door rear plate 10 is provided with inclined portion 10d formed thereon in such a manner that the outer peripheral edge of the inner side of door 4, particularly outer peripheral edge 10e of the bottom portion of door rear plate 10, is closer to the center of door 4

than the outer peripheral edge of the outer side of door 4, particularly the outer peripheral edge of veneer outer peripheral wall 13a and the front end of outer wall 10a of door rear plate 10.

5 Recess 3 has side wall 3a positioned on inclined surface 1a of washing machine housing 1 in such a manner that side wall 3a is approximately parallel to inclined portion 10d of the outer peripheral edge of door 4. As a result, the nodal line between side wall 3a and bottom
10 portion 3b of recess 3 is closer to the center of door 4 than the outer peripheral edge of door 4, allowing bottom portion 3b of recess 3 to become not visible, when washing machine housing 1 is viewed from the front with door 4 closed.

15 Each of joint members 5 includes approximately planar connector 5b connected to rotation shaft portion 8; approximately arc-shaped portion 5c having an end connected to connector 5b in an approximately arc shape about rotation shaft portion 8; and approximately flat portion 5a connected
20 to the outer end of approximately arc-shaped portion 5c and elongated in the outer diametric direction of rotation shaft portion 8.

25 Joint members 5 are inserted into one or more holes 3c, which are formed on bottom portion 3b of recess 3, and extend from the inside to the outside of washing machine housing 1. Particularly, approximately arc-shaped portion

5c of each of joint members 5 passes through hole 3c.

Door main body 9 has boss 9f formed on its inner surface corresponding to flat portion 5a of each of joint members 5 in an upright position, boss 9f being provided with hole portion 9e formed on its front end. Door rear plate 10 has attachment portion 10h formed thereon with a step corresponding to flat portion 5a of each of joint members 5. Flat portion 5a of each of joint members 5 and attachment portion 10h of door rear plate 10 have through holes 5d and 10f formed thereon, respectively, so as to correspond to hole portion 9e of boss 9f. Regarding door main body 9, attachment portion 10h of door rear plate 10 and flat portion 5a of each of joint members 5, screw 15 is securely fastened to hole portion 9e of boss 9f via the through holes 5d and 10f, allowing door 4 and joint members 5 to be fixed to each other.

Flat portion 5a of each of joint members 5 and approximately arc-shaped portion 5c are connected to each other in approximately the same position as outer peripheral edge 10e of the bottom portion of door rear plate 10. Further, hole 3c, into which approximately arc-shaped portion 5c of each of joint members 5 is inserted and passes through, is formed on bottom portion 3b of recess 3 in approximately the same position as the portion of connection between flat portion 5a of each of joint members 5 and approximately arc-shaped portion 5c. As a result, when

washing machine housing 1 is viewed from the front with door 4 closed, holes 3c become not visible.

5 The above-mentioned configuration prevents alien substances (e.g. water) from entering into washing machine housing 1 from outside via holes 3c, when door 4 is closed, thereby improving the safety.

10 At least a portion of side wall 3d of recess 3, which faces approximately arc-shaped portion 5c of each of joint members 5, has an approximately arc shape about rotation shaft portion 8. In addition, side wall 3d has a predetermined spacing, e.g. a spacing smaller than the diameter of a child's finger (e.g. 6 mm or less), from approximately arc-shaped portion 5c of each of joint members 5, when door 4 is opened. As a result, washing machine housing 1 and door 4 can be maintained at an approximately constant spacing from rotation shaft portion 8 of door 4 regardless of opening/closing operations, allowing an aesthetic appearance to be preserved when door 4 is closed. The spacing between each of the joint members and the washing machine housing, which is equal to or smaller than the diameter of a child's finger, prevents the finger from being inserted between each of the joint members and the washing machine housing, thereby guaranteeing safe opening/closing operations.

25 Although recess 3 as well as door main body 9, door rear plate 10, transparent window 11, door cover 12 and

veneer 13, which constitute door 4, have the shape of a cylinder, ring or disk, they may have a different shape (e.g. polygon) while exhibiting the same effect.

5 As mentioned above, the drum type washing machine in accordance with the present invention has advantages of simple configuration, aesthetic appearance and resistance to chemicals. In addition, alien substances, e.g. water, can be prevented from entering into the housing, thereby improving the overall quality. Therefore, the present
10 invention can be widely applied to devices requiring a door configured so as to prevent alien substances from entering into the housing while providing excellent appearance.

What is claimed is:

1. A drum type washing machine comprising:
 - a rotary drum for being driven to rotate while containing therein laundry articles;
 - a water tub for accommodating therein the rotary drum;
 - a washing machine housing, for accommodating therein the water tub, provided with an opening for loading the laundry articles into the rotary drum;
 - a door pivotally supported on the washing machine housing and adapted to open and close the opening;
 - a rotation shaft portion positioned at the washing machine housing, the door being rotated about the rotation shaft portion; and
 - one or more joint members for connecting the rotation shaft portion to an inner side of the door, each of the joint members having an approximately arc-shaped portion about the rotation shaft portion,
 - wherein an outer peripheral part of the door includes an outer peripheral wall approximately perpendicular to a rear portion of the door and an inclined portion by which an outer peripheral edge of an inner side of the door is closer to a center of the door than an outer peripheral edge of an outer side of the door is;
 - wherein the washing machine housing has a recess and a side wall of the recess includes a normal portion approximately parallel to the outer peripheral wall of the door with a gap and a slant portion approximately parallel to the inclined portion of the door, the slant portion being formed between a front surface of the washing machine housing and the side wall of the recess; and
 - wherein at the bottom portion of the recess, there are provided with the opening and one or more holes through which the joint member pass, the door being received in the recess when the door is closed, and each of the joint members has an approximately flat portion connected to the inner side of the door; and the approximately arc-shaped portion is connected to the rotation shaft portion and a nodal line of the approximately flat portion and the approximately arc-shaped portion is located adjacent to the outer peripheral edge of the inner side of the door.

2. The drum type washing machine of claim 1, wherein at least a portion of the side wall of the recess of the washing machine housing facing the joint members when the door is opened has an approximately arc-shaped surface formed about the rotation shaft portion of the door with a predetermined spacing from the approximately arc-shaped portion of the joint member.

3. The drum type washing machine of claim 2, wherein the spacing between each of the joint members and the washing machine housing is about 6 mm or less.