

DESCRIPTION

FRONT-LOADING WASHING MACHINE

5 TECHNICAL FIELD

[0001] The present disclosure relates to a front-loading washing machine configured to wash laundry accommodated in a rotary drum.

BACKGROUND ART

10 [0002] For the above-mentioned type of conventional front-loading washing machines, a configuration has been proposed in which, in order to prevent water stored in a water tub from leaking to the inside or the outside of a main body of the washing machine during washing or dewatering, a packing member is provided between an opening of the water tub corresponding to an opening of
15 a rotary drum and an opening provided in the front face of the main body to couple these openings (for example, see Patent Literature 1).

[0003] FIG. 6 is an expanded sectional view of a packing member and its surroundings of a conventional front-loading washing machine.

[0004] In FIG. 6, front plate opening 43a having a circular shape and
20 corresponding to a drum opening of rotary drum 34 is formed in front plate 43 positioned inside panel member 37 serving as a front-face-side member constituting the main body (not illustrated). The front part of front plate 43 is covered with panel member 37. Note that, in FIG. 6, the rotation axis of rotary drum 34 is present so as to extend in an approximately right-left direction in
25 the upper part of the figure.

[0005] Water tub 35 contains rotary drum 34. Water tub opening 35a of water tub 35 is disposed at a position inside opening member 38 having front opening

38a for putting clothes so as to face front plate opening 43a of front plate 43. A gap between water tub opening 35a of water tub 35 and front plate opening 43a of front plate 43 is sealed with tubular ring-shaped packing member 46 made from an elastic material, such as rubber, to prevent the entry of water from the gap into the main body.

[0006] It is configured that, when cover 39 is closed, the outer periphery of inner cover 53 comes into contact with the inner peripheral surface of lip 46a of packing member 46 to seal a gap between inner cover 53 and lip 46a, whereby leakage of water and steam from the outer periphery of cover 39 is prevented.

[0007] An end of packing member 46, the end being closer to water tub 35, is mounted onto the outer peripheral portion of water tub opening 35a and fixed with wire 52. Flange 46b is formed at an end of packing member 46, the end being closer to front plate 43. When mounting plate 47 is screw-fixed to front plate 43 with screw 51 from the front side, flange 46b of packing member 46 is sandwiched and fixed by recess portion 43b provided in front plate 43 and protruding portion 47a provided in mounting plate 47.

Citation List

[0008] Patent Literature 1: Unexamined Japanese Patent Publication No. 2005-143795

SUMMARY OF INVENTION

[0009] However, as illustrated in FIG. 7, the conventional configuration has a problem in which there is a risk that, during washing, small-sized laundry such as socks for children comes out of rotary drum 34, runs onto packing member 46, and stays on packing member 46, so that laundry 19 is not washed, dewatered, or dried.

[0010] The present disclosure provides a front-loading washing machine configured to substantially prevent the occurrence of a problem in which, during washing or on completion of washing, the laundry runs onto the packing member and stays in the packing member.

5 [0011] A front-loading washing machine according to the present disclosure includes: a main body including a front panel member disposed on the front side of the main body; a water tub swingably and elastically supported inside the main body and including a water tub opening disposed on the front side of the water tub; a rotary drum rotatably contained in the water tub and including a
10 drum opening disposed on the front side of the rotary drum; and a motor configured to rotate the rotary drum. The front-loading washing machine further includes: an opening member disposed in a substantially central portion of the front panel member and including a front opening; a front plate disposed inside the front panel member and including a front plate opening; a cover
15 configured to openably and closably cover the front plate opening; an inner cover provided in the cover and protruding inward of the front plate opening; and a packing member being tubular ring-shaped, made from an elastic material, and configured to be disposed between the front plate opening and the water tub opening to couple the front plate opening to the water tub opening.
20 Furthermore, in the packing member, a protruding rib protruding to be closer to the rotation axis of the rotary drum than to the inner periphery of the drum opening is formed in the vicinity of the drum opening.

[0012] The above-described configuration can substantially prevent the occurrence of a problem in which laundry comes out of the rotary drum, runs
25 onto the packing member, and stays on the packing member.

[0013] In the front-loading washing machine according to the present disclosure, a rib is added to the packing member in the vicinity of a rotary drum

inlet, whereby the laundry can be substantially prevented from staying on the packing member.

BRIEF DESCRIPTION OF DRAWINGS

5 [0014] FIG. 1 is a perspective diagram of the appearance of a front-loading washing machine in an embodiment.

FIG. 2 is a longitudinal cross-sectional diagram of the front-loading washing machine in the embodiment.

FIG. 3 is an expanded sectional view of a packing member and its
10 surroundings of the front-loading washing machine in the embodiment.

FIG. 4A is a view in the direction of arrow A in FIG. 3.

FIG. 4B is a view in the direction of arrow B in FIG. 3.

FIG. 5 is a cross-sectional view illustrating a state in which the laundry
in the front-loading washing machine in the embodiment has run onto the
15 packing member.

FIG. 6 is an expanded sectional view of a packing member and its surroundings of a conventional front-loading washing machine.

FIG. 7 is a cross-sectional view in a state in which the laundry of the
conventional front-loading washing machine has run onto the packing member.
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DESCRIPTION OF EMBODIMENTS

[0015] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. Note that the present invention is not limited by the embodiment.

25 [0016] (Embodiment)

FIG. 1 is a perspective diagram of the appearance of a front-loading washing machine in an embodiment. FIG. 2 is a longitudinal cross-sectional

diagram of the front-loading washing machine in the embodiment.

[0017] In FIG. 1 and FIG. 2, main body 1 has a front face being a gently curved face whose upper part extends rearward, and includes: separated right and left side plates 2 each made of a metal sheet; attachable and detachable back plate 3; a plurality of coupling plates (partially described later) each made of a metal sheet and configured to couple right and left side plates 2; top plate 4 made from synthetic resin; and front panel member 5. Operation panel 8 including switch operation unit 6 configured to perform various types of setting and display 7 configured to display, for example, setting contents is formed above front panel member 5.

[0018] Inside main body 1, water tub 9 is swingably and elastically supported by a suspension structure (not illustrated). Inside water tub 9, rotary drum 10 formed in a cylindrical shape with a bottom is rotatably supported, with a rotation axis being inclined downward from the front side toward the back side.

[0019] The peripheral wall of rotary drum 10 has many holes 10a, and a plurality of baffles 11 for stirring the laundry protrudes from the inner periphery of rotary drum 10. Rotary drum 10 is driven to rotate in normal and reverse rotation directions by motor 12 mounted on the back side of water tub 9.

[0020] Water tub 9 is connected to water supply pipe 13 and drain pipe 14 so that water is supplied to or drained from water tub 9 by controlling a not-illustrated water supply valve or a not-illustrated drain valve.

[0021] During a washing operation, the laundry accommodated in rotary drum 10 is lifted up by baffles 11, and comes off baffles 11 at a predetermined position and falls on the surface of water accumulated in rotary drum 10, whereby what is called "beating washing" is performed.

[0022] Front panel member 5 having a curved face and disposed on the front side of main body 1 includes opening member 15 having front opening 15a for

putting the laundry. Drum opening 10b of rotary drum 10 faces opening member 15. Front opening 15a of opening member 15 is opened and closed by cover 16 having inner cover 16a made from a hard transparent material (for example, a glass material) and positioned inward. Inner cover 16a protrudes
5 toward rotary drum 10, and is formed so that a portion thereof closer to the rear side is more inclined toward the center.

[0023] Among the coupling plates constituting main body 1, front plate 17 positioned inside front panel member 5 is provided with circular front plate opening 17a having a circular shape and corresponding to drum opening 10b of
10 rotary drum 10. The front part of front plate 17 is covered with front panel member 5. Inner cover 16a protrudes toward the inner side of rotary drum 10 beyond front plate opening 17a.

[0024] Water tub opening 9a of water tub 9 is positioned inside opening member 15 having front opening 15a for putting the laundry and faces front
15 plate opening 17a of front plate 17. Water tub opening 9a of water tub 9 and front plate opening 17a of front plate 17 are coupled through packing member 18 being tubular ring-shaped and made from an elastic material, such as rubber, so that a gap between water tub opening 9a and front plate opening 17a is sealed, whereby water leakage from water tub 9 into main body 1 is prevented.

[0025] Lip 18a is formed in the inner periphery of packing member 18, and lip
20 18a protrudes toward the inner periphery of front plate opening 17a of front plate 17. When cover 16 is closed, lip 18a comes into contact with the outer periphery of inner cover 16a of cover 16 to establish watertight sealing, whereby leakage of water and steam from the outer periphery of cover 16 is prevented.
25 Note that the shape of packing member 18 illustrated in FIG. 2 is seemingly different from the shape of packing member 18 illustrated in FIG. 3 to FIG. 5. FIG. 2 mainly illustrates an installation position of packing member 18 in main

body 1 of the washing machine, meanwhile FIG. 3 to FIG. 5 illustrates the shape of packing member 18.

[0026] FIG. 3 is an expanded sectional view of the packing member and its surroundings of the front-loading washing machine in the embodiment. FIG. 4A is a view in the direction of arrow A in FIG. 3. FIG. 4B is a view in the direction of arrow B in FIG. 3.

[0027] Note that, as for lip 18a configured to be deformed for sealing, a normal state of lip 18a before deformation is illustrated. In the upper part of FIG. 3, the rotation axis of rotary drum 10 is present so as to extend in an approximately right-left direction.

[0028] As illustrated in FIG. 3, FIG. 4A, and FIG. 4B, packing member 18 includes: cylindrical section 18b extending rearward from front plate opening 17a of front plate 17; lip 18a formed in the inner periphery of a front end of cylindrical section 18b; and bulging section 18c having flexibility and turning forward and outward from the vicinity of a rear end of cylindrical section 18b to bulge on the outer periphery side and be coupled to water tub opening 9a.

[0029] Lip 18a protrudes toward the inner periphery of front plate opening 17a of front plate 17, and, when cover 16 is closed, lip 18a comes into contact with the outer periphery of inner cover 16a disposed on the inner side of cover 16 to establish watertight sealing, whereby leakage of water and steam from the outer periphery of cover 16 is prevented.

[0030] On the inner periphery side of cylindrical section 18b of packing member 18, protruding rib 18d having a triangular cross-section is formed in the vicinity of drum opening 10b of rotary drum 10. In the vicinity of drum opening 10b, protruding rib 18d protrudes so as to be closer to the rotation axis of rotary drum 10 than to the inner periphery of drum opening 10b, and also a face of protruding rib 18d, the face being closer to rotary drum 10, is formed as

perpendicular face 18e perpendicular to the rotation axis of rotary drum 10, meanwhile a face of protruding rib 18d, the face being closer to front plate opening 17a, is formed as slope 18f that is inclined more rearward as being closer to the inner periphery. Furthermore, in the present embodiment, height
5 e of protruding rib 18d from the inner face of cylindrical section 18b is set to 10 mm. Height e, 10 mm, of protruding rib 18d is set in such a manner that, with cover 16 closed, protruding rib 18d is not in contact with inner cover 16a and a clearance is present between protruding rib 18d and inner cover 16a. Furthermore, protruding rib 18d is provided so as to be approximately distance
10 h away from drum opening 10b of rotary drum 10. In the present embodiment, distance h is set to 10 mm, for example.

[0031] Protruding rib 18d is formed so as not to be in contact with inner cover 16a in a state in which cover 16 is closed. In the present invention, minimum gap i between an end of protruding rib 18d and inner cover 16a is set to 10 mm.
15 This configuration prevents protruding rib 18d from coming into contact with cover 16 when cover 16 is opened or closed and thereby giving a user to any discomfort, and prevents an impact on sealing performance between lip 18a and inner cover 16a.

[0032] Since the laundry falls downward under its own weight, it is not
20 necessary to form protruding rib 18d all around cylindrical section 18b of packing member 18, and, as illustrated in FIG. 4B, protruding rib 18d is beneficially formed at least in a range corresponding to the lower semicircle of packing member 18, the lower semicircle facing the lower semicircle of drum opening 10b of rotary drum 10.

25 [0033] Protruding rib 18d is formed so as to be divided into right and left portions at the lowest point of a central portion of protruding rib 18d when viewed from the front, and gap 18g is formed at the lowest point. This

configuration prevents water from remaining in protruding rib 18d after the completion of washing, so that water is prevented from adhering again to the laundry when the laundry is taken out after the completion of washing.

[0034] Hereinafter, operations and effects of the front-loading washing machine configured as described above will be described.

[0035] FIG. 5 is a cross-sectional view illustrating a state in which the laundry in the front-loading washing machine in the embodiment has run onto the packing member.

[0036] When a washing operation or a drying operation is performed at a rated capacity, rotary drum 10 becomes full of the laundry. Therefore, as illustrated in FIG. 5, when small-sized laundry 19, such as socks for children, comes forward out of rotary drum 10 during the operation, small-sized laundry 19 is likely to enter between inner cover 16a and packing member 18.

[0037] At this time, protruding rib 18d having a triangular cross-section and provided in the vicinity of drum opening 10b of rotary drum 10 on the inner periphery side of cylindrical section 18b of packing member 18 so as to be closer to the rotation axis of rotary drum 10 than to the inner periphery of drum opening 10b acts as a protective wall to prevent small-sized laundry 19 from entering a rear side portion between inner cover 16a and packing member 18. Particularly, in protruding rib 18d, a face of protruding rib 18d, the face being closer to rotary drum 10, is formed as perpendicular face 18e perpendicular to the rotation axis of rotary drum 10, so that the entry of small-sized laundry 19 can be strongly prevented.

[0038] Furthermore, when a part of small-sized laundry 19 is in contact with rotary drum 10 serving as an movable part, small-sized laundry 19 is drawn into rotary drum 10 during the rotation of rotary drum 10, and thus, the effect of making small-sized laundry 19 move from packing member 18 toward rotary

drum 10 can be achieved.

[0039] Note that, in the present embodiment, protruding rib 18d is disposed to be approximately distance h (for example, 10 mm) away from drum opening 10b of rotary drum 10, but, even when protruding rib 18d is disposed in packing member 18 at the closest position to drum opening 10b of rotary drum 10, an effect equivalent to the effect described above can be achieved.

[0040] As described above, in the present embodiment, packing member 18 tubular ring-shaped, made from an elastic material, such as rubber, and coupled between front plate opening 17a and water tub opening 9a includes: cylindrical section 18b extending rearward from front plate opening 17a; lip 18a formed in the inner periphery of the front end of cylindrical section 18b and configured to, when cover 16 is closed, come into contact with inner cover 16a to perform watertight sealing; and bulging section 18c having flexibility and turning forward and outward from the vicinity of the rear end of cylindrical section 18b to bulge on the outer periphery side and be coupled to water tub opening 9a. Furthermore, in the vicinity of drum opening 10b, protruding rib 18d protrudes so as to be closer to the rotation axis of rotary drum 10 than to the inner periphery of drum opening 10b, and has a face closer to rotary drum 10, the face being formed as perpendicular face 18e perpendicular to the rotation axis of rotary drum 10.

[0041] This configuration can prevent the occurrence of a problem in which, during washing or on completion of washing, small-sized laundry 19, such as socks for children, comes out of rotary drum 10, completely runs onto packing member 18, and stays on packing member 18, and, as a result, the laundry is not washed, dewatered, or dried.

[0042] Protruding rib 18d has a configuration in which a face closer to drum opening 10b is formed so as to be perpendicular face 18e, and a face closer to

front plate opening 17a is formed so as to be slope 18f, and furthermore, protruding rib 18d is formed not to come into contact with inner cover 16a when cover 16 is closed.

[0043] With this configuration, protruding rib 18d acts as a protective wall for
5 small-sized laundry 19 coming out of rotary drum 10 toward inner cover 16a, and thereby can prevent small-sized laundry 19 from staying on the inner cover 16a side.

[0044] Protruding rib 18d is configured to be formed at least in a range corresponding to the lower semicircle of packing member 18, the lower
10 semicircle facing the lower semicircle of drum opening 10b.

[0045] With this configuration, protruding rib 18d acts as a protective wall for small-sized laundry 19 only in an area in which there is a possibility that small-sized laundry 19 actually comes out of rotary drum 10 toward inner cover 16a, whereby protruding rib 18d can prevent small-sized laundry 19 from
15 staying on the inner cover 16a side.

[0046] Protruding rib 18d is formed so as to be divided into right and left portions at the lowest point of the central portion of protruding rib 18d when viewed from the front.

[0047] This configuration can prevent water from remaining in protruding rib
20 18d, thereby preventing water from adhering again to the laundry when the laundry is taken out after the completion of washing.

[0048] As described above, a front-loading washing machine according to a first disclosure includes: a main body including a front panel member on the front side of the main body; a water tub swingably and elastically supported
25 inside the main body and including a water tub opening on the front side of the water tub; a rotary drum rotatably contained in the water tub and including a drum opening disposed on the front side of the rotary drum; and a motor

configured to rotate the rotary drum. The front-loading washing machine further includes: an opening member provided in a central portion of the front panel member and including a front opening; a front plate disposed inside the front panel member and including a front plate opening; a cover configured to
5 openably and closably cover the front plate opening; an inner cover provided in the cover and protruding inward of the front plate opening; and a packing member tubular-ring-shaped, made from an elastic material, and coupled between the front plate opening and the water tub opening. Furthermore, in the packing member, a protruding rib protruding to be closer to the rotation
10 axis of the rotary drum than to the inner periphery of the drum opening is formed in the vicinity of the drum opening.

[0049] This configuration can prevent the occurrence of a problem in which, during washing or on completion of washing, small-sized laundry, such as socks for children, comes out of the rotary drum, runs onto the packing member, and
15 stays on the packing member.

[0050] According to a second disclosure, in particular, the protruding rib according to the first disclosure may be formed in such a manner that a face of the protruding rib, the face being closer to the rotary drum, is formed to be perpendicular to the rotation axis of the rotary drum.

20 [0051] With this configuration, the protruding rib acts as a protective wall for small-sized laundry coming out of the rotary drum, whereby the protruding rib can prevent the small-sized laundry from staying on the packing member.

[0052] According to a third disclosure, in particular, the protruding rib according to the first disclosure may be formed at least in a range
25 corresponding to the lower semicircle of the packing member.

[0053] With this configuration, the protruding rib acts as a protective wall for small-sized laundry only in an area in which there is a possibility that

small-sized laundry actually comes out of the rotary drum toward the inner cover, whereby the protruding rib can prevent the small-sized laundry from staying on the inner cover side.

[0054] According to a fourth disclosure, the protruding rib according to the
5 second disclosure may be formed at least in a range corresponding to the lower semicircle of the packing member.

[0055] With this configuration, the protruding rib acts as a protective wall for small-sized laundry only in an area in which there is a possibility that small-sized laundry actually comes out of the rotary drum toward the inner
10 cover, whereby the protruding rib can prevent the small-sized laundry from staying on the inner cover side.

[0056] According to a fifth disclosure, the protruding rib according to any one of the first to fourth disclosures may be formed so as to be divided at the lowest point of the central portion of the protruding rib.

15 [0057] This configuration can prevent water from remaining in the protruding rib, and thereby prevent water from adhering again to the laundry when the laundry is taken out after the completion of washing.

[0058] According to a sixth disclosure, the packing member according to any one of the first to fourth disclosures may include: a cylindrical section extending
20 rearward from the front plate opening; a lip formed in the inner periphery of the front end of the cylindrical section and configured to, when the cover is closed, come into contact with the inner cover; and a bulging section having flexibility and turning forward and outward from the vicinity of the rear end of the cylindrical section to bulge on the outer periphery side and be coupled to the
25 water tub opening.

[0059] With this configuration, sealing can be maintained.

[0060] According to a seventh disclosure, the packing member according to the

fifth disclosure may include: a cylindrical section extending rearward from the front plate opening; a lip formed in the inner periphery of the front end of the cylindrical section and configured to, when the cover is closed, come into contact with the inner cover; and a bulging section having flexibility and turning
5 forward and outward from the vicinity of the rear end of the cylindrical section to bulge on the outer periphery side and be coupled to the water tub opening.
[0061] With this configuration, sealing can be maintained.

INDUSTRIAL APPLICABILITY

10 [0062] The front-loading washing machine according to the present invention includes a packing member provided with a protruding rib, and therefore can prevent the occurrence of a problem in which small-sized laundry comes out of a rotary drum, runs onto the packing member, and stays on the packing member, whereby the small-sized laundry is not washed, dewatered, or dried on
15 completion of an operation, and hence, this configuration can be applied to other types of washing machines, such as a top-loading washing machine.

REFERENCE MARKS IN THE DRAWINGS

[0063] 1...main body
20 5...front panel member
9...water tub
9a...water tub opening
10...rotary drum
10b...drum opening
25 12...motor
15...opening member
15a...front opening

	16...cover
	16a...inner cover
	17...front plate
	17a...front plate opening
5	18...packing member
	18a...lip
	18b...cylindrical section
	18c...bulging section
	18d...protruding rib
10	18e...perpendicular face
	18f...slope

CLAIMS

1. A front-loading washing machine, comprising:
 - a main body including a front panel member disposed on a front side of the main body;
 - 5 a water tub swingably and elastically supported inside the main body and including a water tub opening disposed on a front side of the water tub;
 - a rotary drum rotatably contained in the water tub and including a drum opening disposed on a front side of the rotary drum;
 - a motor configured to rotate the rotary drum;
 - 10 an opening member disposed in a central portion of the front panel member and including a front opening;
 - a front plate disposed inside the front panel member and including a front plate opening;
 - a cover configured to openably and closably cover the front plate opening;
 - 15 opening;
 - an inner cover provided in the cover and protruding inward of the front plate opening; and
 - a packing member tubular-ring-shaped, made from an elastic material, and coupled between the front plate opening and the water tub opening,
 - 20 wherein, in the packing member, a protruding rib protruding to be closer to a rotation axis of the rotary drum than to an inner periphery of the drum opening is formed in a vicinity of the drum opening.
2. The front-loading washing machine according to claim 1, wherein the
 - 25 protruding rib is formed to have a face closer to the rotary drum, the face being perpendicular to the rotation axis of the rotary drum.

3. The front-loading washing machine according to claim 1, wherein the protruding rib is formed at least in a range corresponding to a lower semicircle of the packing member.
- 5 4. The front-loading washing machine according to claim 2, wherein the protruding rib is formed at least in a range corresponding to a lower semicircle of the packing member.
- 10 5. The front-loading washing machine according to any one of claims 1 to 4, wherein the protruding rib is divided at a lowest point of a central portion of the protruding rib.
6. The front-loading washing machine according to any one of claims 1 to 4,
- 15 wherein the packing member comprises:
a cylindrical section extending rearward from the front plate opening;
a lip formed in an inner periphery of a front end of the cylindrical section, and configured to, when the cover is closed, come into contact with the inner cover; and
- 20 a bulging section having flexibility, and turning forward and outward from a vicinity of a rear end of the cylindrical section to bulge on an outer periphery side of the cylindrical section and be coupled to the water tub opening.
- 25 7. The front-loading washing machine according to claim 5, wherein the packing member comprises:
a cylindrical section extending rearward from the front plate opening;

a lip formed in an inner periphery of a front end of the cylindrical section, and configured to, when the cover is closed, come into contact with the inner cover; and

5 a bulging section having flexibility, and turning forward and outward from a vicinity of a rear end of the cylindrical section to bulge on an outer periphery side of the cylindrical section and be coupled to the water tub open