

DESCRIPTION

WASHING MACHINE

5 TECHNICAL FIELD

The present invention relates to a washing machine having a function to ventilate air inside an inner tub.

BACKGROUND ART

10 Conventional washing machines include those which have a ventilation opening facing upward in an outer lid provided above an inner tub that is disposed inside a machine body. Such a conventional washing machine ventilates the inner tub by taking air into the inner tub from an outside of the machine body and exhausting air inside the inner tub to the
15 outside of the machine body through the ventilation opening (for example, see Patent Literature (PTL) 1).

Hereinafter, a structure of the conventional washing machine will be described with reference to FIG. 8.

FIG. 8 is a side cross-sectional view of the conventional washing
20 machine.

As shown in FIG. 8, the conventional washing machine includes at least main body 1, base 2 provided to a bottom portion of main body 1, outer frame 3 attached to base 2, exterior cover 5 provided on a top of outer frame 3 and having clothing loading opening 4, etc.

25 An inside of main body 1 includes outer tub 6 and inner tub 7. Outer tub 6 is suspended from outer frame 3, and inner tub 7 is rotatably disposed inside outer tub 6. Furthermore, an inner bottom of inner tub 7

includes agitator 8 for agitating clothing.

Moreover, clothing loading opening 4 is positioned above inner tub 7, and outer lid 9 is provided above clothing loading opening 4. Furthermore, a rear end of outer lid 9 is pivotally supported by exterior cover 5.

5 When doing laundry, a user opens or closes outer lid 9 to load or unload the clothing through clothing loading opening 4. At this time, in order to ensure the user's safety, the washing machine is configured to operate in a state in which outer lid 9 is closed.

10 Moreover, a top surface of outer lid 9 has ventilation opening 10 for ventilating the air inside inner tub 7. Ventilation through ventilation opening 10 accelerates drying of the clothing and prevents high humidity in outer tub 6. At this time, rotational motions of inner tub 7 and agitator 8 agitate the air in outer tub 6, thereby increasing the above effect.

15 That is, the conventional washing machine agitates the air in inner tub 7 in a rotational direction about a central axis of the inner tub by the rotation of inner tub 7. However, since ventilation opening 10 is disposed in a vertical direction above a rotational axis of inner tub 7, the ventilation is not performed satisfactory, thereby decreasing ventilation efficiency. As a result, there is a problem that the humidity in outer tub 6 is not decreased
20 and thus efficiency in drying the clothing is decreased.

25 Moreover, ventilation opening 10 is provided in the top surface of outer lid 9, that is, at a top of the washing machine. Therefore, water, dust, etc. enters the inner tub from ventilation opening 10, which decreases washing performance and washing efficiency. Furthermore, ventilation opening 10 provided to the top of the washing machine restricts a design, which causes a problem that design flexibility is lost.

Citation List

Patent Literature

PTL 1: Japanese Unexamined Patent Application Publication No. 2009-89952

5 SUMMARY OF THE INVENTION

A washing machine according to an aspect of the present disclosure comprising: a main body; an outer tub disposed inside the main body; an inner tub rotatably disposed in the outer tub and having an opening; an exterior cover disposed above the inner tub; a clothing loading opening
10 provided to the exterior cover and through which clothing is loaded; an outer lid for opening and closing the clothing loading opening; and a ventilation opening provided in a side surface of the outer lid; wherein the inner tub is ventilated through the ventilation opening; and wherein the clothing loading opening further comprises an air exhaust guiding wall configured to
15 direct air flowing along a rotational direction of the inner tub to flow out of the ventilation opening, and an air intake guiding wall configured to direct air flowing in from the ventilation opening to flow along the rotational direction of the inner tub.

The clothing loading opening may cover a part of the opening.

20 With this, the inner tub is efficiently ventilated and the drying of the clothing can be accelerated.

Moreover, providing the ventilation opening in the side surface of the outer lid can prevent water, dust, etc. from entering the inner tub.

Moreover, the design restriction for the top surface of the outer lid is
25 cleared, so that a good washing machine in terms of quality in an outer view can be implemented.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side cross-sectional view of a washing machine according to a first exemplary embodiment of the present invention.

FIG. 2A is a perspective view of the washing machine according to
5 the first exemplary embodiment.

FIG. 2B is an enlarged diagram of a main part of a ventilation opening according to the first exemplary embodiment, illustrating a part A of FIG. 2A.

FIG. 3 is a top view showing a positional relationship between an inner tub and the ventilation opening of the washing machine according to the first exemplary embodiment.

FIG. 4 is a cross-sectional view of a main part along a line 4-4 shown in FIG. 3.

FIG. 5 is a top view showing a relationship between the inner tub and a clothing loading opening when an outer lid of the washing machine according to the first exemplary embodiment is opened.

FIG. 6 is a cross-sectional view of a main part along a line 6-6 shown in FIG. 4.

FIG. 7 is a top view of the washing machine according to a second exemplary embodiment of the present invention.

FIG. 8 is a side cross-sectional view of a conventional washing machine.

DESCRIPTION OF EMBODIMENTS

Hereinafter, a washing machine according to exemplary embodiments of the present invention will be described with reference to the drawings. It is to be noted that although directions are indicated in the description according to each diagrams for the purpose of illustration, the present invention is not limited to such directions. Moreover, the present invention is not limited to the exemplary embodiments.

FIRST EXEMPLARY EMBODIMENT

Hereinafter, a structure of a washing machine according to a first exemplary embodiment of the present invention will be described with reference to FIGs. 1 to 4.

FIG. 1 is a side cross-sectional view of the washing machine according to the first exemplary embodiment of the present invention. FIG. 2A is a perspective view of the washing machine according to the first exemplary embodiment. FIG. 2B is an enlarged diagram of a main part of a ventilation opening according to the first exemplary embodiment, illustrating a part A of FIG. 2A. FIG. 3 is a top view showing a positional relationship between an inner tub and the ventilation opening of the washing machine according to the first exemplary embodiment. FIG. 4 is a cross-sectional view of a main part along a line 4-4 shown in FIG. 3.

First, as shown in FIG. 1, the washing machine according to the first exemplary embodiment includes at least main body 20, base 21 provided to a bottom portion of main body 20, outer frame 22 attached to base 21, and exterior cover 24 having clothing loading opening 23 provided above outer frame 22, etc.

Moreover, an inside of main body 20 includes outer tub 25 and inner tub 26 having a substantially circular (including circular) opening 35. Outer tub 25 is elastically supported by outer frame 22, and inner tub 26 is rotatably disposed inside outer tub 25 about an axis in a vertical direction. Furthermore, an inner bottom of inner tub 26 includes agitator 27 for agitating clothing and having the same rotational axis as the inner tub 26. Agitator 27 agitates the clothing in a washing step, a rinsing step, and a drying step.

Moreover, clothing loading opening 23 in exterior cover 24 is positioned above opening 35 of inner tub 26, and outer lid 28 is provided

above the clothing loading opening 23. At this time, a rear end of outer lid 28 is pivotally supported by exterior cover 24.

Moreover, as shown in FIG. 2A, transparent window 29 is provided to a top surface of outer lid 28. Thus, visibility by a user for checking a state of the clothing in inner tub 26 can be increased. It is to be noted that
5 transparent window 29 is made of a material having high transparency such as glass and plastic.

When doing laundry, the user opens or closes outer lid 28 to load or unload the clothing through clothing loading opening 23. At this time, in
10 order to ensure the user's safety, the washing machine is controlled based on information obtained by a cover open/close detector (not shown) which determines an open/close status of outer lid 28, and operates when outer lid 28 is closed.

Moreover, as shown in FIGS. 2A to 4, ventilation opening 30 is provided in side surface 28a of outer lid 28. As shown in FIG. 4, ventilation
15 opening 30 has ventilation hole 312 opening toward side surface 28a of outer lid 28 and lower ventilation hole 311 opening downward (toward a side opposite exterior cover 24) at a side end portion of outer lid 28. At this time, lower ventilation hole 311 and ventilation hole 312 of ventilation opening 30
20 are linked with each other so that an intake and exhaust of air can be performed. With this, ventilation opening 30 is capable of exchanging air between an inside of inner tub 26 and an outside of main body 20 of the washing machine.

Furthermore, plural lower ventilation holes 311 and ventilation
25 holes 312 are provided adjacent to one another having partition walls 36 between the holes. At this time, partition walls 36 are disposed such that ventilation holes 312 open obliquely toward a back of main body 20.

Specifically, partition walls 36 provided between adjacent ventilation holes 312 are provided from inner tub 26 to side surface 28a of outer lid 28 such that outer end portion 312a of partition wall 36 inclines toward the back of main body 20.

5 With this, the air in inner tub 26 is exhausted obliquely toward the back of main body 20. Usually, the user works, for example, loads and unloads the clothing in front of main body 20 of the washing machine. At this time, since the air is exhausted from the side of main body 20 obliquely backward, the air is not exhausted toward the user. As a result, the
10 exhausted air does not contact the user, thereby reducing discomfort felt by the user.

Moreover, when the user observes ventilation opening 30 from a front side of main body 20, an inside of ventilation hole 312 cannot be directly seen because partition wall 36 which inclines toward the back of
15 main body 20 blocks a view of ventilation hole 312. Thus, with respect to design, quality in an outer view of the washing machine is improved.

Moreover, since ventilation opening 30 is not disposed in the top surface of outer lid 28, design flexibility for the top surface of outer lid 28 is increased. As a result, the quality in the outer view of the washing
20 machine is further improved.

Moreover, providing ventilation opening 30 in side surface 28a of the outer lid 28 can prevent water, dust, etc., from entering inner tub 26 through ventilation opening 30 from above ventilation opening 30. As a result, it is possible to prevent the water, dust, etc., from attaching to the
25 clothing in washing and drying, thereby preventing a decrease in washing performance and quality.

Moreover, as shown in FIG. 3, ventilation opening 30 is provided not

above the rotational axis of inner tub 26 but substantially above outer periphery of inner tub 26 in a top view of main body 20. Therefore, the air generated by a centrifugal action caused by rotation of inner tub 26 can be exhausted smoothly along the airflow. As a result, a decrease in ventilation efficiency can be prevented.

Hereinafter, the intake and exhaust of air which is airflow between inner tub 26 and the outside, and an effect of the intake and exhaust of air through ventilation opening 30 according to the first exemplary embodiment will be described with reference to FIGs. 4 to 6.

It is to be noted that arrows shown in FIG. 4 indicate airflow in the intake and exhaust of air.

The following specifically describes the exhaust of air as an example. First, when inner tub 26 rotates, airflow is generated outward by the centrifugal action as shown in FIG. 4. Subsequently, the generated air flows in space 37 between outer lid 28 and exterior cover 24. Furthermore, the inflow air in space 37 is exhausted out via lower ventilation hole 311 and ventilation hole 312 of ventilation opening 30 in stated order.

Next, an effect of the exhaust and intake of air in ventilation opening 30 will be described in detail with reference to FIGs. 5 and 6.

FIG. 5 is a top view showing a relationship between the inner tub and the clothing loading opening when the outer lid of the washing machine according to the first exemplary embodiment is opened. FIG. 6 is a cross-sectional view of a main part along a line 6-6 shown in FIG. 4.

As shown in FIG. 5, in the washing machine according to the first exemplary embodiment, clothing loading opening 23 provided to exterior cover 24 is substantially ellipsoidal (including ellipsoidal), while inner tub 26 has substantially circular (including circular) opening 35. Clothing

loading opening 23 covers part 35a of opening 35 of inner tub 26. Specifically, clothing loading opening 23 is provided to cover two portions of opening 35 of inner tub 26 in a front-back direction (areas between a part of opening 35 of inner tub 26 indicated by a dotted line in FIG. 5 and clothing
5 loading opening 23 indicated by a solid line in FIG. 5).

Moreover, an arrow shown in FIG. 5 indicates a rotational direction of inner tub 26. That is, the air generated by the centrifugal action of inner tub 26 flows in the rotational direction of inner tub 26.

Next, the airflow will be described further in detail with reference to
10 FIG. 6. It is to be noted that air exhaust guiding wall 38 shown in FIG. 6 indicates a surface included in clothing loading opening 23 and standing in front in the rotational direction of inner tub 26. Moreover, air intake guiding wall 39 indicates a surface included in clothing loading opening 23 and standing in back in the rotational direction of inner tub 26. Likewise,
15 air exhaust openings 301 shown in FIG. 6 indicate a part of ventilation opening 30 disposed in front in the rotational direction of inner tub 26. Moreover, air intake openings 302 indicate a part of ventilation opening 30 disposed in back in the rotational direction of inner tub 26.

Specifically, as shown in FIG. 6, the air generated along the
20 rotational direction of inner tub 26 collides with air exhaust guiding wall 38 of clothing loading opening 23 standing in front in the rotational direction of inner tub 26 and flows upward. Subsequently, the air that has flowed upward is exhausted out from air exhaust opening 301 of ventilation opening 30. It is to be noted that arrows noted as exhaust of air in FIG. 6
25 indicate a state of the airflow that is exhausted.

On the other hand, as shown in FIG. 6, the airflow generated along the rotational direction of inner tub 26 sucks outer air from air intake

guiding wall 39 of clothing loading opening 23 standing in back in the rotational direction of inner tub 26. That is, the air is taken in from the outside to the inside of main body 20 through air intake opening 302 of ventilation opening 30. It is to be noted that arrows noted as intake of air
5 in FIG. 6 indicate a state of the airflow that is taken in.

At this time, the airflow generated along the rotational direction of inner tub 26 has a fastest speed at a periphery of inner tub 26. Thus, the above exhaust and intake of air can be efficiently performed from ventilation opening 30 disposed substantially above the periphery of inner
10 tub 26. Inner tub 26 rotates in a high speed especially in spinning, so that the exhaust and intake of air is performed further efficiently.

As described above, according to the first exemplary embodiment, the air generated by the rotational movement of inner tub 26 and agitator 27 can be changed efficiently through ventilation opening 30 provided to
15 side surface 28a of outer lid 28.

It is to be noted that although an example in which clothing loading opening 23 is substantially ellipsoidal (including ellipsoidal) is described, the shape of clothing loading opening 23 is not limited to substantially ellipsoidal (including ellipsoidal). For example, an elongated circle, an oval
20 shape, a shape including two parallel straight lines having the same length and ends connected by arcs, or rectangle may be applicable. Furthermore, as described with reference to FIG. 5, it is sufficient that the shape of clothing loading opening 23 is a shape to cover part 35a of opening 35 of inner tub 26, and such a shape provides the same effect.

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SECOND EXEMPLARY EMBODIMENT

Hereinafter, a structure of a washing machine according to a second

exemplary embodiment of the present invention will be described with reference to FIG. 7.

FIG. 7 is a top view of the washing machine according to the second exemplary embodiment of the present invention.

5 As shown in FIG. 7, the washing machine according to the second exemplary embodiment is different from the washing machine according to the first exemplary embodiment in that ventilation openings 30 are provided to left and right side surfaces 28a of outer lid 28. It is to be noted that other structures, airflow and effects in exhaust and intake of air are the
10 same as those in the first exemplary embodiment, so that detailed descriptions are omitted.

That is, as shown in FIG. 7, the washing machine according to the second exemplary embodiment includes ventilation openings 30 provided to opposite side surfaces 28a of outer lid 28.

15 With this, the total surface area (cross-sectional area) of ventilation opening 30 for the intake and exhaust of air is increased. As a result, ventilation can be performed further efficiently.

Moreover, for example, even when either one of left and right side surfaces 28a of the washing machine is adjacent to a wall, etc., in installing
20 the washing machine, the other one of ventilation openings 30 provided to the left and right sides of outer lid 28 can be used. Thus, flexibility in selecting an installation place for the washing machine is increased. Furthermore, even when one of ventilation openings 30 is adjacent to a wall, etc., it is possible to prevent a great decrease in ventilation efficiency.

25 As described above, the washing machine according to the present invention is capable of efficiently ventilating the outer tub and preventing water, duct, etc., from entering the inner tub from the ventilation opening,

and has a good quality in the outer view.

Moreover, the washing machine according to the present invention is capable of efficiently changing the air generated by the rotational movement of the inner tub. Therefore, in drying the clothing after the washing step, the rinsing step, and the spinning step, the effect of the air for the ventilation accelerating the drying is increased. As a result, the present invention is especially useful for a washing machine having a drying function, for example.

As described above, the washing machine according to the present invention includes: a main body; an outer tub disposed inside the main body; an inner tub rotatably disposed in the outer tub and having an opening; an exterior cover disposed above the inner tub; a clothing loading opening provided to the exterior cover and through which clothing is loaded; an outer lid for opening and closing the clothing loading opening; and a ventilation opening provided in a side surface of the outer lid. Moreover, the clothing loading opening may cover a part of the opening and the inner tub may be ventilated through the ventilation opening. With this, it is possible to efficiently ventilate the inner tub and prevent water, dust, etc., from entering the inner tub from the ventilation opening. Furthermore, the washing machine having a good quality in the outer view can be implemented.

Moreover, according to the washing machine in the present invention, the ventilation opening may ventilate the inner tub with rotation of the inner tub. With this, the air generated in the rotational direction can be efficiently changed by the rotational movement of the inner tub.

Moreover, according to the washing machine in the present invention, the ventilation opening may comprise ventilation openings

provided in opposite side surfaces of the outer lid. With this, the inner tub can be more efficiently ventilated. Furthermore, even when one of the side surfaces of the washing machine is adjacent to a wall in the installation place, the ventilation can be performed through the ventilation opening in the other side surface. As a result, a restriction on an installation place is loosened and a decrease in the ventilation efficiency can be prevented.

Moreover, according to the washing machine in the present invention, the ventilation opening may include a plurality of partition walls extending toward the side surface of the outer lid, the plurality of partition walls inclining toward a back of the main body. With this, the air is exhausted from the side of the main body obliquely backward, so that the air is not exhausted toward the user. As a result, the exhausted air does not contact the user, thereby reducing discomfort felt by the user.

15 INDUSTRIAL APPLICABILITY

The washing machine according to the present invention is capable of efficiently ventilating an inner tub, so that the present invention can be applicable to a washing machine not only for domestic use, but for industrial use.

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REFERENCE MARKS IN THE DRAWINGS

- 1, 20 main body
- 2, 21 base
- 3, 22 outer frame
- 25 4, 23 clothing loading opening
- 5, 24 exterior cover
- 6, 25 outer tub

	7, 26	inner tub
	8, 27	agitator
	9, 28	outer lid
	10, 30	ventilation opening
5	28a	side surface
	29	transparent window
	35	opening
	35a	part
	36	partition wall
10	37	space
	38	air exhaust guiding wall
	39	air intake guiding wall
	301	air exhaust opening
	302	air intake opening
15	311	lower ventilation hole
	312	ventilation hole
	312a	outer end portion

CLAIMS

1. A washing machine comprising:
a main body;
5 an outer tub disposed inside the main body;
an inner tub rotatably disposed in the outer tub and having an opening;
an exterior cover disposed above the inner tub;
a clothing loading opening provided to the exterior cover and through which
clothing is loaded;
10 an outer lid for opening and closing the clothing loading opening;
and
a ventilation opening provided in a side surface of the outer lid;
wherein the inner tub is ventilated through the ventilation opening; and
wherein the clothing loading opening further comprises an air exhaust guiding
15 wall configured to direct air flowing along a rotational direction of the inner tub to flow
out of the ventilation opening, and an air intake guiding wall configured to direct air
flowing in from the ventilation opening to flow along the rotational direction of the inner
tub,
wherein the air exhaust guiding wall stands in front in the rotational direction of
20 the inner tub, and the air intake guiding wall stands in back in the rotational direction of
the inner tub.

2. The washing machine according to claim 1,
wherein the ventilation opening ventilates the inner tub with rotation of the
25 inner tub.

3. The washing machine according to claim 1 or claim 2,
wherein the ventilation opening comprises ventilation openings provided in
opposite side surfaces of the outer lid.

4. The washing machine according to any one of claims 1 to 3,
wherein the ventilation opening includes a plurality of partition walls extending
toward the side surface of the outer lid, the plurality of partition walls inclining toward a
back of the main body.