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(54) DOOR FOR WASHING MACHINE AND WASHING MACHINE HAVING SAME

(57) The present invention discloses a door (10) for a washing machine (100), including a first component (13) and a second component (11a) pressed against each other and non-fixedly engaged with each other, where the first component has a first surface (201), the second component has a second surface (202), the first surface and the second surface are in contact and constitute a friction pair, one of the first surface and the second surface has a lower surface roughness, and the other one has a higher surface roughness. The present invention further provides a washing machine, including a case body (2), where an opening (4) is provided in the case body, and a door is mounted on the opening of the case body.

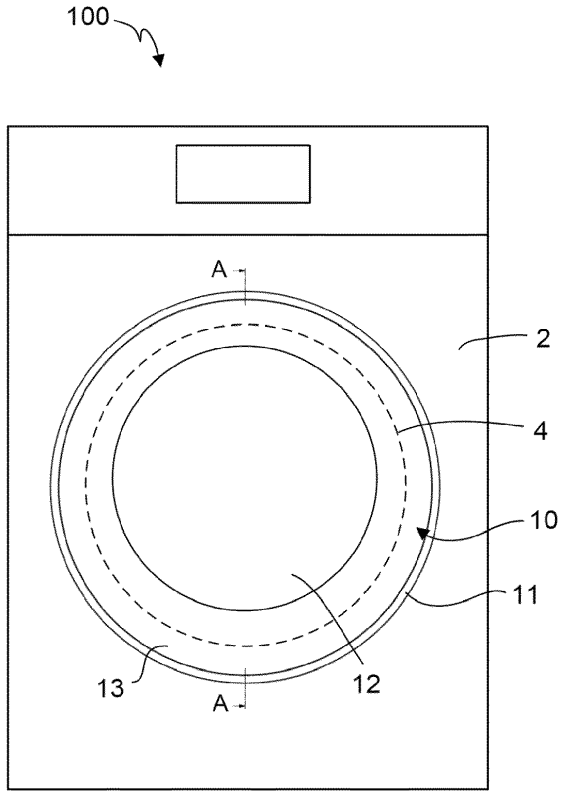

FIG. 1

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Description

[0001] The present invention relates to a door for a washing machine and a washing machine having the door.

[0002] A stick-slip phenomenon is a common phenomenon in life, and noises such as a sharp noise of chalk scraping on a blackboard and a squeak of a sole rubbing against a floor are all generated due to stick-slip. The stick-slip is essentially a negative damping phenomenon due to an excessive difference between a dynamic friction coefficient and a static friction coefficient of an object surface, and a decrease in the dynamic friction coefficient with an increase in a moving speed. Consequently, a speed of an object presents a serrated fluctuation with time during relative sliding, and therefore a disturbing sharp noise is generated. For a washing machine, when a user presses a protection cover of a door of the washing machine or pulls a handle, a squeak is usually heard. This is due to a relative displacement caused by pressure deformation of components of a door assembly, that is, a micro stick-slipping movement.

[0003] To reduce or eliminate a stick-slip noise, relative movements of contact surfaces may be limited. Alternatively, a lubricant may be applied to the contact surfaces or a self-lubricating material may be used to reduce a static friction coefficient of a friction pair, to enable the static friction coefficient to approximate to a dynamic friction coefficient, thereby reducing the stick-slip theoretically. However, both the solutions have limitations in applications: limiting the relative movement means limiting a design idea or increasing process costs; and increasing lubrication means increasing material costs and increasing production processes.

[0004] An objective of the present invention is to overcome disadvantages of the prior art.

[0005] A technical solution used in the present invention is a door for a washing machine, including a first component and a second component pressed against each other and non-fixedly engaged with each other, where the first component has a first surface, the second component has a second surface, the first surface and the second surface are in contact and constitute a friction pair, one of the first surface and the second surface has a lower surface roughness, and the other one has a higher surface roughness.

[0006] Different surface roughnesses are used for contact surfaces, thereby reducing a static friction coefficient between the surfaces and avoiding a phenomenon of a rasping noise caused by a stick-slip phenomenon. A washing machine door using the friction pair does not generate a rasping noise when a user operates the washing machine door, for example, presses a cover of the washing machine door or pulls a handle, thereby improving user experience in use. In addition, the friction pair provided in the present invention changes only the surface roughnesses of the contact surfaces, and does not affect a product design. A production process is simple and mature, so that material costs cannot be increased. Compared with a conventional method of applying a lubricant, the present invention can save costs, is not easily stained, and has a longer service life. Compared with a method of using a self-lubricating material, the present invention does not need to use special materials and has less limitation on the production process.

[0007] A surface having a higher surface roughness can use a corresponding process to form a frosted surface or an etched surface.

[0008] In an implementation of the present invention, patterns on the etched surface are uniformly distributed.

[0009] A component having the higher surface roughness in the first component and the second component is formed by plastic injection molding. Forming a higher surface roughness on plastic only needs to reconstruct a mold, thereby requiring relatively low costs, and being applicable to batch production.

In one of the implementations, the first component and a third component are pressed against each other and non-fixedly engaged with each other, where the first component has a third surface, the third component has a fourth surface, and the third surface and the fourth surface are in contact and constitute a friction pair. The first surface and the third surface have a higher surface roughness, and the second surface and the fourth surface have a lower surface roughness. This allows a relatively rough surface to be formed on one component or fewer components as far as possible, so that surface roughness processing needs to be performed on as few molds as possible, thereby reducing manufacturing costs.

[0010] The present invention further provides a washing machine, including a case body, where an opening is provided in the case body, and a door is mounted on the opening of the case body according to the foregoing implementations.

[0011] The following describes specific implementations of the present invention with reference to accompanying drawings.

FIG. 1 is a schematic front view of a washing machine;

FIG. 2 is a partial cross-sectional view of a door in FIG. 1 along an A-A direction;

FIG. 3 is an enlarged view of an etched surface;

FIG. 4 is a schematic diagram of a contact between a smooth surface and an etched surface;

FIG. 5 is a partial cross-sectional view of a door having a lamp set; and

FIG. 6 is a partial cross-sectional view near a pull handle of a door.

[0012] A friction theory suggests that a magnitude of a friction between two objects moving relative to each other is positively correlated to an actual contact area. The actual contact area herein refers to an area in which concave portions of two surfaces are in contact with each other at a micro level, and is far less than a visually macro area.

[0013] For a rigid plastic used for a washing machine door, an actual contact area can be effectively reduced by making a contact surface into a frosted surface or adding etching lines to the contact surface. Theoretically, a contact area between two contact surfaces of a friction pair can be minimized by making one surface as smooth as possible and processing the other surface by etching.

[0014] As shown in FIG. 1, a washing machine 100 includes a case body 2. An opening 4 is provided in the case body 2. A user places clothes in and removes clothes from the washing machine through the opening 4. A door 10 is hinged to a position in which the opening 4 of the case body 2 is located, so that the opening 4 of the case body 2 can be closed or open.

[0015] With reference to FIG. 1 and FIG. 2, it can be seen that the door 10 has an annular framework 11, a window portion 12 made of glass mounted in the framework 11, and a protection cover 13 mounted on an outer side of the frame 11 to isolate the window part 12 to protect the user against a scald due to high-temperature glass.

[0016] As shown in FIG. 2, the framework 11 includes a decoration ring 11a and a spacer ring 11b. The protection cover 13 has an edge portion 131. The edge portion 131 is clamped between the decoration ring 11a and the spacer ring 11b for fastening. There is no other connection mechanism between the protection cover 13 and both the decoration ring 11a and the spacer ring 11b to fasten the decoration ring 11a and the spacer ring 11b. Therefore, the protection cover 13 may slightly slide relative to the decoration ring 11a and the spacer ring 11b under force.

[0017] A part of the protection cover 13 that is in contact and engaged with the decoration ring 11a has a first surface 201, a corresponding position on the decoration ring 11a has a second surface 202, and the first surface 201 and the second surface 202 are in contact and constitute a friction pair. A part of the protection cover that is in contact and engaged with the spacer ring 11b has a third surface 203, a corresponding position on the spacer ring 11b has a fourth surface 204, and the third surface 203 and the fourth surface 204 are in contact and constitute a friction pair. Surface roughnesses of the first surface 201 and the third surface 203 are increased in a process of manufacturing the protection cover, so that the surface roughnesses are higher than those of the second surface 202 and the fourth surface 204 that are relatively smooth and that are in contact with the first surface 201 and the third surface 203, as shown in FIG. 3 and FIG. 4.

[0018] Therefore, an actual contact area between the surfaces that are in contact with each other is reduced, so that a stick-slip noise can be eliminated.

[0019] The protection cover 13 is formed by rigid plastic injection molding. Therefore, the surface roughness may be increased by frosting or etching on a mold. The etching may be implemented by using sandblasting, an electric spark, a laser, etching, chemical etching, and other methods. Therefore, a specific surface roughness is formed in advance in the mold. Therefore, the protection cover 13 made in the mold has the first surface 201 and the third surface 203 having surface roughnesses higher than other areas. Patterns on an etched surface are uniformly distributed.

[0020] In other implementations, a surface having a higher surface roughness may alternatively be formed on the second surface 202 or the fourth surface 204. In this case, the first surface 201 or the third surface 203 in contact with the second surface 202 or the fourth surface 204 has a lower surface roughness.

[0021] As shown in FIG. 5, other components of the door 10 are also in contact and engaged with each other. For example, a lamp assembly 14 is mounted in a first wall 11c and a second wall 11d of the framework 11 by using a fastening ring 15. Surface roughness processing is performed between the fastening ring 15 and the lamp assembly 14, the first wall 11c and the second wall 11d, and a contact surface between the first wall 11c and the second wall 11d, so that a surface roughness of the fastening ring is higher than a surface roughness of a corresponding contact surface, and basic principles thereof is consistent with the description provided above about the structure in FIG. 2. A dashed line in FIG. 5 represents that the surface roughness of the contact surface is increased.

[0022] As shown in FIG. 6, the framework 11 is provided with a handle 16. The handle 16 is concave to form a grip portion. Components of the handle 16 and the framework 11 are pressed against each other and non-fixedly engaged with each other, and have surfaces in contact with each other. The surface roughness processing is performed on contact surfaces of both the handle 16 and the framework 11, so that a surface roughness of the handle is higher than a surface roughness of a corresponding contact surface, as shown by a dashed line.

[0023] The various specific implementations described above and shown in the accompanying drawings are merely used for describing the present invention, and are not all of the present invention. Within the scope of the basic technical idea of the present invention, any form of changes made by a person of ordinary skill in the related technical field to the present invention falls within the protection scope of the present invention.

Claims

1. A door for a washing machine, comprising a first component and a second component pressed against each other and non-fixedly engaged with

each other, wherein the first component has a first surface, the second component has a second surface, the first surface and the second surface are in contact and constitute a friction pair, one of the first surface and the second surface has a lower surface roughness, and the other one has a higher surface roughness.

2. The door for a washing machine according to claim 1, **characterized in that** a surface having the higher surface roughness is a frosted surface or an etched surface.

3. The door for a washing machine according to claim 2, **characterized in that** patterns on the etched surface are uniformly distributed.

4. The door for a washing machine according to claim 1, **characterized in that** a component having the higher surface roughness in the first component and the second component is formed by plastic injection molding.

5. The door of a washing machine according to claim 1, **characterized in that** the first component and a third component are pressed against each other and non-fixedly engaged with each other, the first component has a third surface, the third component has a fourth surface, the third surface and the fourth surface are in contact and constitute a friction pair, the first surface and the third surface have a higher surface roughness, and the second surface and the fourth surface have a lower surface roughness.

6. A washing machine, comprising a case body (2), wherein an opening (4) is provided in the case body, **characterized in that** the door (10) according to any one of claims 1 to 4 is mounted on the opening of the case body.

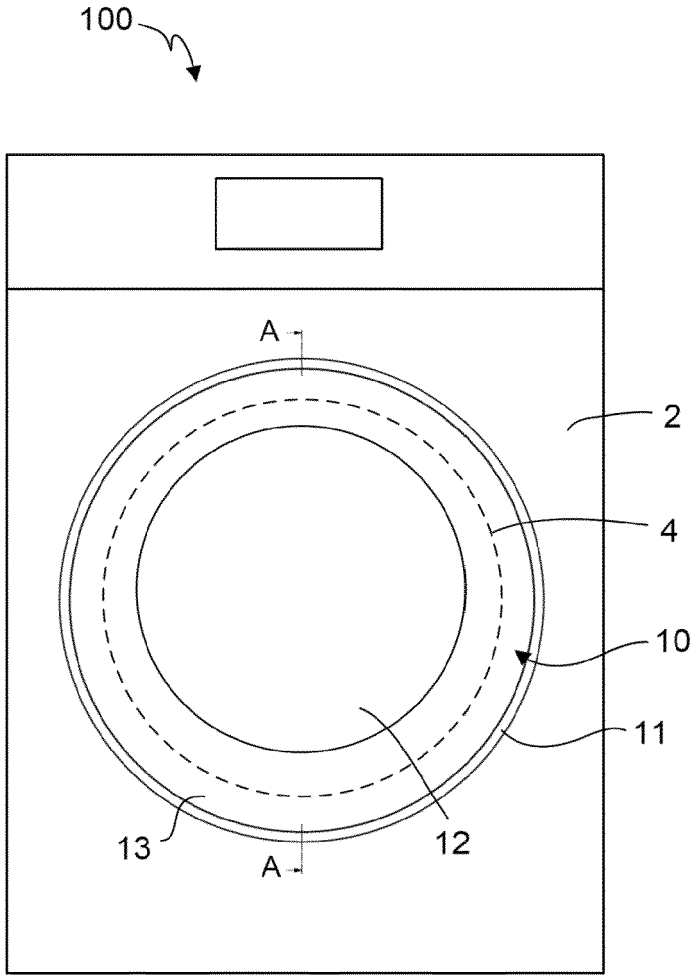

FIG. 1

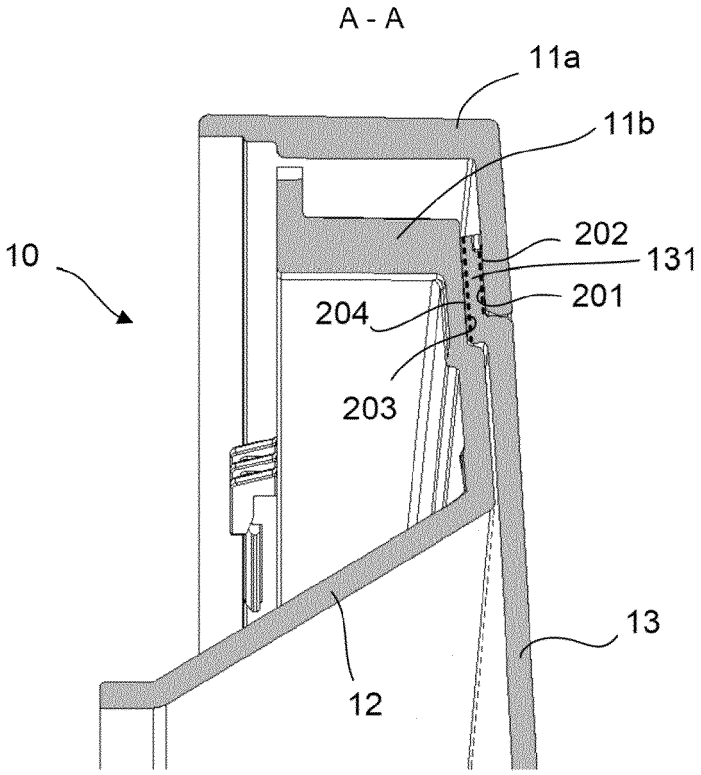

FIG. 2

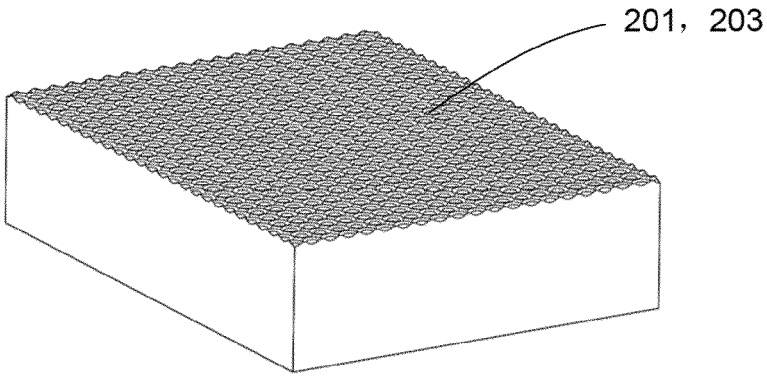

FIG. 3

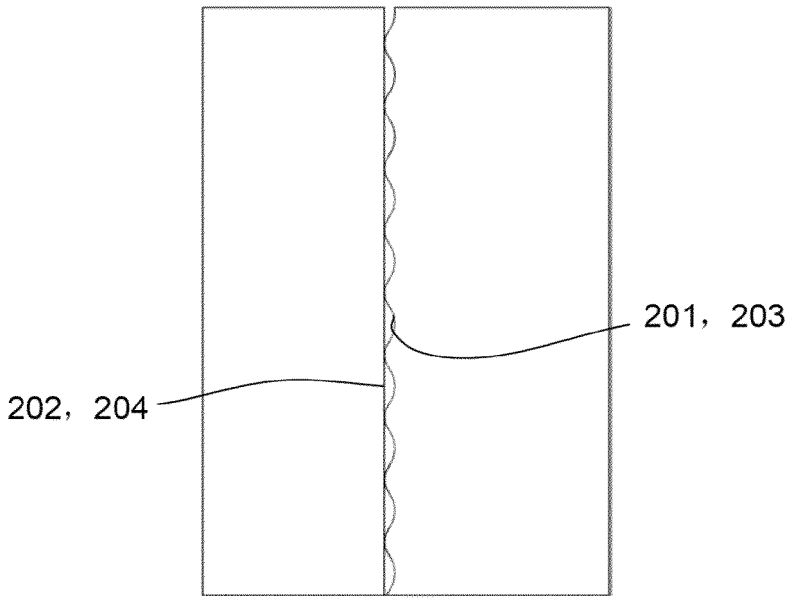

FIG. 4

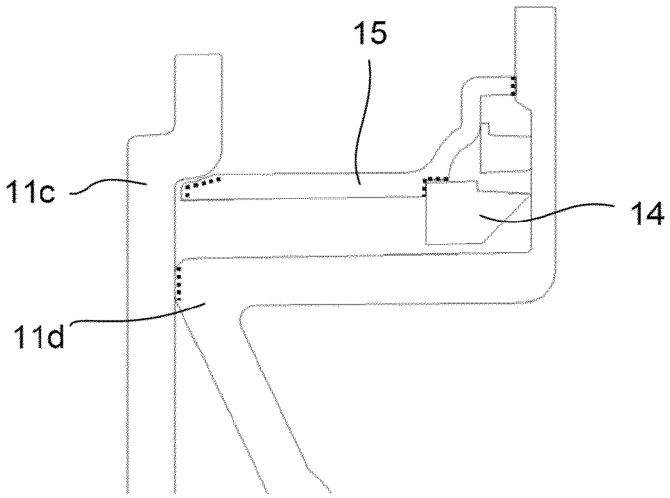

FIG. 5

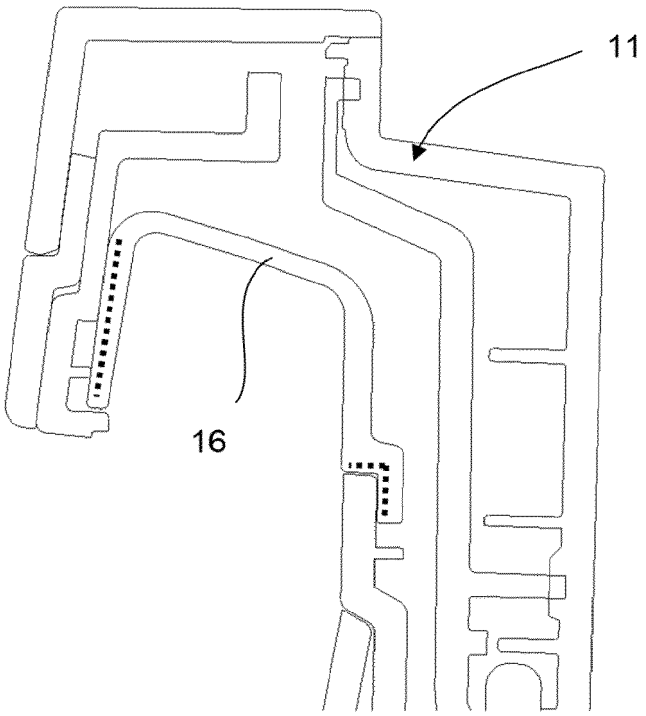

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 0459

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TECHNICAL FIELDS SEARCHED (IPC)

D06F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 March 2020	Diaz y Diaz-Caneja

CATEGORY OF CITED DOCUMENTS

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