(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 976 982 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.01.2016 Bulletin 2016/04

(21) Application number: **14768212.4**

(22) Date of filing: **18.03.2014**

(51) Int Cl.:
A47L 15/44 *(2006.01)*

(86) International application number:
PCT/JP2014/001533

(87) International publication number:
WO 2014/148042 (25.09.2014 Gazette 2014/39)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **22.03.2013 JP 2013059515**

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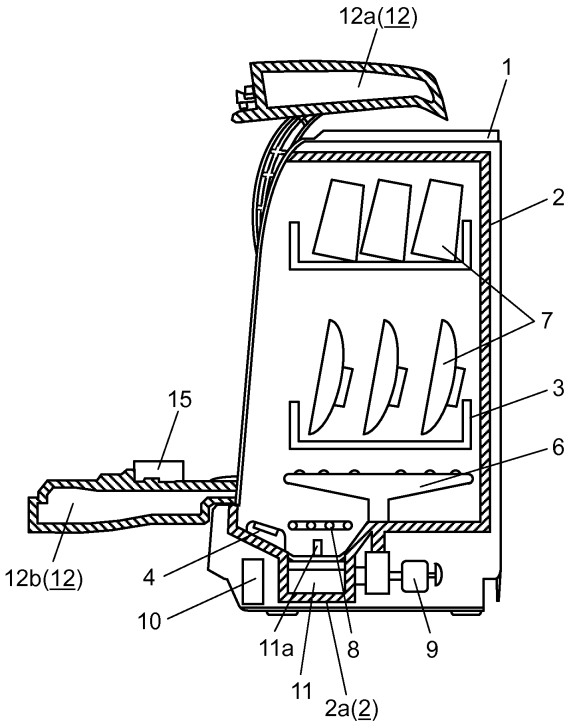
(54) **DISHWASHING MACHINE**

(57) A dish washing machine includes the following elements: a main body (1); a washing tank (2); a tableware basket (3) for holding target objects to be washed; a washing device for spraying washing water onto the target objects; an atomizer (4) for atomizing the washing water; a door (12); a detergent automatic insertion device (15); and a controller (10) for performing at least a pre-washing step, an atomizing step, and a washing step. After the pre-washing step, the controller (10) causes the detergent automatic insertion device (15) to supply detergent to the atomizer (4), and controls and performs the atomizing step and the washing step. Thus, after the pre-washing step, the step of atomizing a detergent solution can be performed. This enables the dish washing machine to reduce the amount of detergent to be used and to exert high washing performance through the step of atomizing the detergent solution at the same time.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a dish washing machine for housing and washing target objects to be washed, such as tableware.

BACKGROUND ART

[0002] Conventionally, as this type of dish washing machine, a dish washing machine for spraying washing water from a washing nozzle toward tableware, for example, to wash the tableware is proposed (see Patent Literature 1, for example).

[0003] Hereinafter, a configuration of a dish washing machine described in Patent Literature 1 is explained with reference to FIG. 7. FIG. 7 is a longitudinal sectional view of a conventional dish washing machine.

[0004] As shown in FIG. 7, the conventional dish washing machine includes the following elements: main body 1; door 12 for opening and closing the front face of main body 1; and washing tank 2, tableware basket 3, atomizer 4, and detergent insertion part 5 provided in main body 1. Door 12 is composed of upper door 12a and lower door 12b divided into the upper and lower parts, and opens and closes the front face of main body 1. Tableware basket 3 moves forward and backward from main body 1 through door 12, and receives and holds tableware 7, i.e. target objects to be washed. Specifically, tableware basket 3 is configured to be withdrawn forward of main body 1 in the state where door 12 is opened. Atomizer 4 atomizes the washing water reserved in the bottom portion of washing tank 2. Detergent insertion part 5 is placed on atomizer 4 and used to supply detergent into atomizer 4. At this time, detergent insertion part 5 is disposed in a position lower than tableware basket 3 so as not to hinder the movement of tableware basket 3 when tableware basket 3 is withdrawn forward. Further, tableware basket 3 is disposed in a position not overlapping detergent insertion part 5 so as not to hinder supply of the detergent.

[0005] Hereinafter, the operation and action of the conventional dish washing machine is described.

[0006] First, when using the dish washing machine, the user supplies detergent from detergent insertion part 5. The supplied detergent is guided from detergent insertion part 5 to atomizer 4, and accumulates on the periphery of atomizer 4.

[0007] Next, when the user starts the operation of the dish washing machine, a predetermined amount of tap water covering atomizer 4 is supplied to washing tank 2, as washing water. At this time, the detergent accumulated on the periphery of atomizer 4 dissolves in the washing water supplied and becomes a detergent solution. The detergent solution is atomized by atomizer 4 at the start of an atomizing step.

[0008] Next, the atomizing step moves on to a washing step, in which tableware 7, for example, is washed.

[0009] Typically, when target objects to be washed with much dirt are washed with a dish washing machine without an atomizer, a large amount of detergent needs to be supplied. Then, in order to reduce the amount of detergent to be used, a pre-washing step in which the dirt on the target objects to be washed is removed to a degree is added before the step of washing the target objects to be washed with a detergent solution.

[0010] However, in the configuration of the conventional dish washing machine, when the user supplies detergent into detergent insertion part 5, the detergent accumulates directly in atomizer 4. When the operation of the dish washing machine is started at this time, the detergent dissolves in the washing water supplied first after the operation and becomes a detergent solution. Thus, the pre-washing step in which tableware is washed only with washing water cannot be provided. As a result, washing the target objects to be washed with much dirt requires more detergent.

Citation List

Patent Literature

[0011] **PTL1:** Japanese Patent Unexamined Publication No. 2005-224486

SUMMARY OF THE INVENTION

[0012] The present invention provides a dish washing machine that includes an atomizer capable of performing a pre-washing step, as a step prior to an atomizing step, when target objects to be washed with much dirt are washed.

[0013] A dish washing machine of the present invention includes the following elements: a main body; a washing tank; a tableware basket for holding target objects to be washed; a washing device for spraying washing water onto the target objects to be washed; an atomizer, provided in the bottom portion of the washing tank, for atomizing the washing water; a door for opening and closing the front face of the main body; a detergent automatic insertion device provided above the atomizer and inside the door; and a controller for performing at least a pre-washing step, an atomizing step, and a washing step. The controller is configured to cause the detergent automatic insertion device to supply detergent to the atomizer, after performing the pre-washing step.

[0014] With this configuration, particularly when target objects to be washed with much dirt are washed, after the pre-washing step, the step of atomizing a detergent solution using the atomizer can be performed. This allows removal of the dirt on the target objects to be washed to a degree before the atomizing step and the washing step. As a result, this configuration enables a dish washing machine to reduce the amount of detergent to be used and to exert high washing performance through the step

of atomizing the detergent solution.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a longitudinal sectional view of a dish washing machine in a state where a door thereof is opened in accordance with an exemplary embodiment of the present invention.

FIG. 2 is a longitudinal sectional view of the dish washing machine in a state where the door is closed in accordance with the exemplary embodiment.

FIG. 3 is a longitudinal sectional view of a dish washing machine having a detergent guiding path on a door thereof in a state where the door is opened in another example in accordance with the exemplary embodiment.

FIG. 4 is a longitudinal sectional view of the dish washing machine having the detergent guiding path on the door in a state where the door is closed in another example described above in accordance with the exemplary embodiment.

FIG. 5 is a longitudinal sectional view of a dish washing machine having a detergent guiding path on a tableware basket in a state where a door thereof is opened in still another example in accordance with the exemplary embodiment.

FIG. 6 is a longitudinal sectional view of the dish washing machine having the detergent guiding path on the tableware basket in a state where the door is closed in still another example described above in accordance with the exemplary embodiment.

FIG. 7 is a longitudinal sectional view of a conventional dish washing machine.

DESCRIPTION OF EMBODIMENT

[0016] Hereinafter, a description is provided for an exemplary embodiment of the present invention with reference to the accompanying drawings. Elements similar to those in the conventional example have the same reference marks and the descriptions of those elements are omitted. The exemplary embodiment does not limit the present invention.

EXEMPLARY EMBODIMENT

[0017] Hereinafter, a description is provided for the configuration of a dish washing machine in accordance with the exemplary embodiment of the present invention with reference to FIG. 1 and FIG. 2.

[0018] FIG. 1 is a longitudinal sectional view of a dish washing machine in a state where a door thereof is opened in accordance with the exemplary embodiment. FIG. 2 is a longitudinal sectional view of the dish washing machine in a state where the door is closed in accordance with the exemplary embodiment.

[0019] As shown in FIG. 1 and FIG. 2, the dish washing machine of the exemplary embodiment includes at least the following elements: main body 1; door 12 for opening and closing the front face of main body 1; washing tank 2, tableware basket 3, atomizer 4, a washing device, and controller 10 provided inside main body 1; and detergent automatic insertion device 15.

[0020] Door 12 is composed of upper door 12a and lower door 12b divided into the upper part and the lower part on the front face side of main body 1, and opens and closes the font face of main body 1. Upper door 12a opens so as to lift up, and lower door 12b opens so as to fall forward with the bottom end of the lower door as a fulcrum. Detergent automatic insertion device 15 is provided on the inner surface of lower door 12b.

[0021] Washing nozzle 6 is roratably disposed in bottom portion 2a inside washing tank 2, and sprays washing water to tableware 7, for example, held in tableware basket 3. At this time, tableware basket 3 is disposed above washing nozzle 6 and holds tableware 7 as the target objects to be washed. Tableware basket 3 can be moved forward and backward via opened door 12 so as to move inside and outside of washing tank 2. Specifically, tableware basket 3 is capable of holding tableware 7 when being withdrawn above opened lower door 12b.

[0022] The washing device is configured by connecting at least water reserving part 11, residue filter 11a, washing nozzle 6, and washing pump 9. Water reserving part 11 is disposed in bottom portion 2a of washing tank 2 and reserves washing water. Residue filter 11a is disposed to cover the top part of water reserving part 11 and prevents the residue from flowing into water reserving part 11. Washing pump 9 is connected, via piping, in a position halfway between water reserving part 11 and washing nozzle 6, and sends washing water or a detergent solution under pressure to washing nozzle 6.

[0023] Heater 8 is disposed in the vicinity of bottom portion 2a of washing tank 2, and heats the washing water, the detergent solution, or the air in washing tank 2.

[0024] Atomizer 4 is disposed on the front side (the side of door 12) of bottom portion 2a of washing tank 2. Atomizer 4 dissolves the detergent in a small amount of washing water, generates a detergent solution with high concentration, atomizes the detergent solution, and sprays the atomized detergent solution onto the target objects to be washed.

[0025] Controller 10 is disposed in a front outward lower position relative to bottom portion 2a of washing tank 2, controls and performs a series of operations of the dish washing machine, such as a pre-washing step, an atomizing step, and a washing step.

[0026] The dish washing machine of the exemplary embodiment is thus configured.

[0027] Next, a description is provided for the operation and action of the dish washing machine of the exemplary embodiment. The dish washing machine of the exemplary embodiment washes the target objects to be washed, such as tableware 7, through a pre-washing step, an at-

omizing step, a washing step, a rinsing step, and a drying step controlled by controller 10. Hereinafter, the pre-washing step, the atomizing step, and the washing step are outlined.

[0028] First, before starting the operation of the dish washing machine, the user withdraws tableware basket 3 from washing tank 2, and places tableware 7 with dirt in tableware basket 3. After the placement, the user places tableware basket 3 into washing tank 2.

[0029] Next, the user supplies a predetermined amount of detergent to detergent automatic insertion device 15 using a measuring spoon, for example, closes door 12, and starts the operation of the dish washing machine.

[0030] When the operation of the dish washing machine is started, first, controller 10 starts the pre-washing step. When the pre-washing step is started, controller 10 causes a predetermined amount of tap water, as washing water, to be supplied to water reserving part 11 in washing tank 2. The supplied washing water is sucked from water reserving part 11 by washing pump 9, and sent under pressure to washing nozzle 6. The washing water sent under pressure is sprayed from washing nozzle 6 forcibly. Thus, tableware 7, for example, placed in tableware basket 3 and housed in washing tank 2 is pre-washed with washing water. At this time, the washing water used to wash tableware 7 in the pre-washing step flows into water reserving part 11 again, is sucked into washing pump 9, and circulates. The pre-washing step is performed for a predetermined time period.

[0031] Next, after the pre-washing step for the predetermined time period is completed, controller 10 causes the dirty washing water to be discharged and the step to move on to the atomizing step so that the atomizing step is performed.

[0032] When the atomizing step is started, controller 10 causes detergent automatic insertion device 15 to supply the detergent to atomizer 4.

[0033] Then, controller 10 causes a predetermined amount of tap water covering heater 8 and atomizer 4 to be supplied, as the washing water, to washing tank 2. At this time, the detergent supplied to the periphery of atomizer 4 dissolves in a small amount of washing water on the periphery of the detergent and becomes a detergent solution with high concentration.

[0034] Thereafter, controller 10 causes atomizer 4 to atomize the high-concentration detergent solution so that washing tank 2 is filled with the detergent solution.

[0035] Then, the state where the atomized detergent solution adheres to tableware 7 is maintained for a predetermined time period. Thereafter, without the washing water containing the detergent (hereinafter being referred to as "washing water") discharged, the step moves on to the washing step so that the washing step is performed.

[0036] When the washing step is started, controller 10 causes heater 8 to heat the washing water. Simultaneously with heating, controller 10 causes washing pump 9 to suck the washing water from water reserving part 11 and to send the washing water under pressure to washing nozzle 6. The washing water sent under pressure is sprayed forcibly onto tableware 7, for example, from washing nozzle 6. Thereby, tableware 7 placed in tableware basket 3 and housed in washing tank 2 is washed with the washing water. At this time, the washing water used to wash tableware 7, for example, in the washing step flows into water reserving part 11 again, is sucked into washing pump 9, and circulates. The washing step is performed for a predetermined time period.

[0037] Next, after tableware 7 is washed in the washing step for a predetermined time period, controller 10 causes the dirty washing water to be discharged, the step to move on to the rinsing step so that the rinsing step is performed in a manner similar to the conventional manner.

[0038] Thus, the operation of the pre-washing step, the atomizing step, and the washing step of the dish washing machine of the exemplary embodiment is performed.

[0039] That is, when the dish washing machine of the exemplary embodiment washes tableware 7 with much dirt, the dish washing machine first performs the pre-washing step. The pre-washing step may be performed in the state where the detergent is supplied or not supplied. In this case, to reduce the amount of detergent, it is preferable to perform the pre-washing step in the state where the detergent is not supplied.

[0040] Thereafter, atomizer 4 performs the step of atomizing the washing water made of the high-concentration detergent solution. This allows removal of dirt on the target objects to be washed to a degree in the pre-washing step before the atomizing step and the washing step. As a result, while the amount of detergent to be used is reduced, high washing performance can be exerted through the step of atomizing the high-concentration detergent solution.

[0041] Hereinafter, a description is provided for the configuration of guiding detergent from detergent automatic insertion device 15 to atomizer 4 in a dish washing machine in another example in the exemplary embodiment with reference to FIG. 3 and FIG. 4.

[0042] FIG. 3 is a longitudinal sectional view of a dish washing machine having a detergent guiding path on a door thereof in a state where the door is opened in another example described above in accordance with the exemplary embodiment. FIG. 4 is a longitudinal sectional view of the dish washing machine having the detergent guiding path on the door in a state where the door is closed in another example described above in accordance with the exemplary embodiment.

[0043] That is, the above exemplary embodiment is configured so that the detergent is guided to atomizer 4 by free fall of the detergent. However, this example differs from the above exemplary embodiment in that, as shown in FIG. 3 and FIG.4, the detergent supplied from detergent automatic insertion device 15 is guided to atomizer 4 through detergent guiding path 13 provided on lower

door 12b of door 12.

[0044] That is, in the configuration of another example described above in the exemplary embodiment, detergent automatic insertion device 15 and detergent guiding path 13 are successively disposed, for example, inside lower door 12b constituting door 12. At this time, it is preferable to provide, at top end 13a of detergent guiding path 13, an opening (not shown) in a shape that covers at least the opening of detergent automatic insertion device 15 for discharging detergent. Further, it is preferable that the opening (not shown) at bottom end 13b of detergent guiding path 13 has a shape substantially as large as top face 4a of atomizer 4 and larger than the opening at top end 13a. It is preferable that the inner peripheral surface of detergent guiding path 13 is configured to have a surface to which detergent hardly adheres, or has a configuration of preventing adhesion of detergent by anti-adhesion treatment, such as water-repellent treatment.

[0045] Hereinafter, the operation and action of the dish washing machine configured as above are outlined.

[0046] First, as shown in FIG. 4, by starting the operation in the state where door 12 is closed, a pre-washing step similarly to the above description is performed.

[0047] Next, after the pre-washing step has been completed, an atomizing step is started. At this time, the detergent supplied from detergent automatic insertion device 15 is supplied to atomizer 4 through detergent guiding path 13. This can ensure the supply of a predetermined amount of detergent to atomizer 4. Thus, atomizer 4 can generate a mist of a detergent solution with stable detergent concentration. As a result, this configuration enables a dish washing machine to exert stable washing performance.

[0048] Hereinafter, a description is provided for the configuration of guiding detergent from detergent automatic insertion device 15 to atomizer 4 in a dish washing machine in still another example in the exemplary embodiment with reference to FIG. 5 and FIG.6.

[0049] FIG. 5 is a longitudinal sectional view of a dish washing machine having a detergent guiding path on a tableware basket in a state where a door thereof is opened in still another example described above in accordance with the exemplary embodiment. FIG. 6 is a longitudinal sectional view of the dish washing machine having the detergent guiding path on the tableware basket in a state where the door is closed in still another example described above in the exemplary embodiment.

[0050] That is, as shown in FIG. 5 and FIG. 6, the configuration of this example differs from those of the other example or the exemplary embodiment in that detergent supplied from detergent automatic insertion device 15 is guided to atomizer 4 through detergent guiding path 23 provided on tableware basket 3.

[0051] That is, in the configuration of still another example described above in the exemplary embodiment, detergent guiding path 23 is disposed at the front outside of tableware basket 3 in a position that is below the detergent discharging opening in detergent automatic insertion device 15 provided inside lower door 12b and faces the detergent discharging opening.

[0052] Hereinafter, the operation and action of the dish washing machine configured as above are outlined.

[0053] First, as shown in FIG. 6, by starting the operation in the state where door 12 is closed, a pre-washing step similarly to the above description is performed.

[0054] Next, after the pre-washing step has been completed, an atomizing step is started. At this time, the detergent supplied from detergent automatic insertion device 15 is supplied to atomizer 4 through detergent guiding path 23 placed on tableware basket 3. This can ensure the supply of a predetermined amount of detergent to atomizer 4. Thus, atomizer 4 can generate a mist of a detergent solution with stable detergent concentration. As a result, this configuration enables a dish washing machine to exert stable washing performance.

[0055] In the configuration of still another example described above in the exemplary embodiment, along with tableware basket 3, detergent guiding path 23 can be taken out of the unit. Thus, detergent guiding path 23 likely to become dirty with detergent or residue is cleaned easily. This can ensure the supply of detergent from detergent automatic insertion device 15 to atomizer 4.

[0056] Detergent guiding path 23 may be configured to be attachable to and detachable from tableware basket 3. With this configuration, detergent guiding path 23 is cleaned more easily, and ensured supply of detergent to atomizer 4 can be maintained.

[0057] It is preferable to make the opening on the side of top end 23a of detergent guiding path 23 larger than the opening on the side of bottom end 23b. At this time, it is also preferable that the opening on the side of bottom end 23b has an area substantially equal to or smaller than that of top face 4a of atomizer 4. This configuration can ensure the guiding of detergent falling from detergent automatic insertion device 15 to detergent guiding path 23 and the supply of the falling detergent onto atomizer 4. Further, in a rinsing step, for example, this configuration can ensure efficient removal of the detergent remaining inside detergent guiding path 23 with the washing water flowing from the opening on the side of top end 23a. As a result, detergent guiding path 23 can always be kept in a hygienic state and easy to guide the detergent in one washing operation.

[0058] As described above, a dish washing machine includes the following elements: a main body: a washing tank; a tableware basket for holding target objects to be washed; a washing device for spraying washing water onto the target objects to be washed; an atomizer, provided in the bottom portion of the washing tank, for atomizing the washing water; a door for opening and closing the front face of the main body; a detergent automatic insertion device provided above the atomizer and inside the door; and a controller for performing at least a pre-washing step, an atomizing step, and a washing step. The controller may be configured to cause the detergent automatic insertion device to supply detergent to the at-

omizer, after performing the pre-washing step.

[0059] With this configuration, particularly when the target objects to be washed with much dirt are washed, after the pre-washing step, the step of atomizing a detergent solution using the atomizer can be performed. This can remove the dirt on the target objects to be washed to a degree before the atomizing step and the washing step. As a result, this configuration allows a dish washing machine to reduce the amount of detergent to be used and to exert high washing performance through the step of atomizing the detergent solution with high concentration.

[0060] The dish washing machine of the present invention may further include, on the door thereof, a detergent guiding path for guiding detergent supplied from the detergent automatic insertion device to the atomizer. This configuration can further ensure guiding of the detergent to the atomizer.

[0061] The dish washing machine of the present invention may further include, on the tableware basket thereof, a detergent guiding path for guiding detergent supplied from the detergent automatic insertion device to the atomizer. This configuration can further ensure guiding of the detergent to the atomizer.

[0062] The dish washing machine of the present invention is composed of an upper door openable upward and a lower door openable downward, and the detergent automatic insertion device may be provided on the lower door. With this configuration, detergent is easily supplied to the detergent automatic insertion device. Further, reducing the distance to the atomizer can ensure the supply of detergent to the atomizer.

[0063] In the dish washing machine of the present invention, the detergent guiding path may be provided detachably. This configuration allows the detergent guiding path to be cleaned easily. As a result, the detergent guiding path is hygienic, and clogging of detergent, for example, can be prevented.

[0064] In the dish washing machine of the present invention, the detergent guiding path may be configured to be washable in a rinsing step. This can securely prevent the detergent from remaining in the detergent guiding path in one washing operation.

INDUSTRIAL APPLICABILITY

[0065] In the present invention, when target objects to be washed with much dirt are washed, after a pre-washing step, a step of atomizing a detergent solution using an atomizer can be performed. Thus, the present invention is useful in the technical field of a dish washing machine, for example, in which reduction in the amount of detergent to be used and high washing performance are required at the same time.

REFERENCE MARKS IN THE DRAWINGS

[0066]

1	Main body
2	Washing tank
2a	Bottom portion
3	Tableware basket
4	Atomizer
4a	Top face
5	Detergent insertion part
6	Washing nozzle (washing device)
7	Tableware (target objects to be washed)
8	Heater
9	Washing pump (washing device)
10	Controller
11	Water reserving part
11a	Residue filter
12	Door
12a	Upper door
12b	Lower door
13, 23	Detergent guiding path
13a, 23a	Top end
13b, 23b	Bottom end
15	Detergent automatic insertion device

Claims

1. A dish washing machine comprising:

   a main body;
   a washing tank;
   a tableware basket for holding a target object to be washed;
   a washing device for spraying washing water onto the target object to be washed;
   an atomizer, provided in a bottom portion of the washing tank, for atomizing the washing water;
   a door for opening and closing a front face of the main body;
   a detergent automatic insertion device provided above the atomizer and inside the door; and
   a controller for performing at least a pre-washing step, an atomizing step, and a washing step,
   wherein, after performing the pre-washing step, the controller causes the detergent automatic insertion device to supply detergent to the atomizer.

2. The dish washing machine of claim 1, further comprising a detergent guiding path, provided on the door, for guiding the detergent supplied from the detergent automatic insertion device to the atomizer.

3. The dish washing machine of claim 1, further comprising a detergent guiding path, provided on the tableware basket, for guiding the detergent supplied from the detergent automatic insertion device to the atomizer.

4. The dish washing machine of claim 1, wherein the

door includes an upper door openable upward and a lower door openable downward, and the detergent automatic insertion device is provided on the lower door.

5. The dish washing machine of claim 2 or claim 3, wherein the detergent guiding path is provided detachably.

6. The dish washing machine of claim 3, wherein the detergent guiding path is configured to be washable in a rinsing step.

FIG. 1

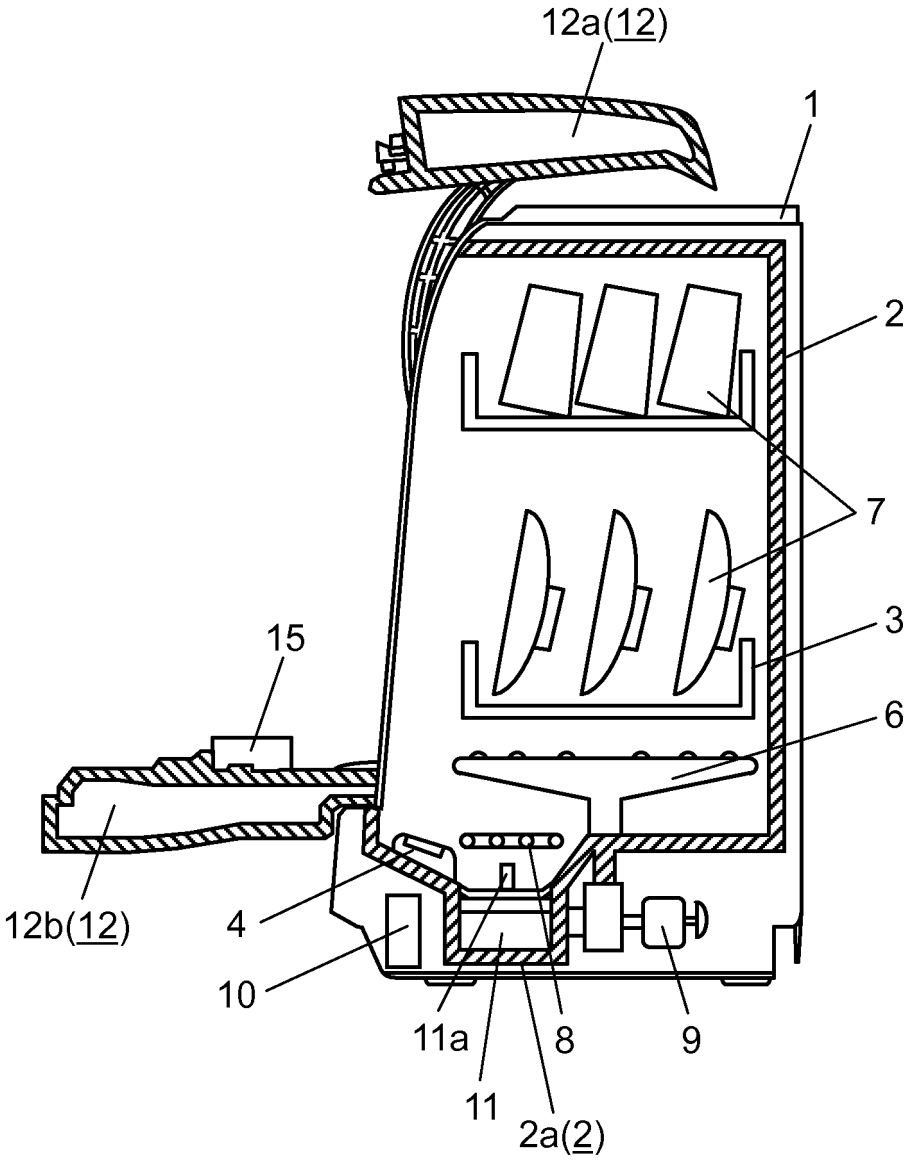


FIG. 2

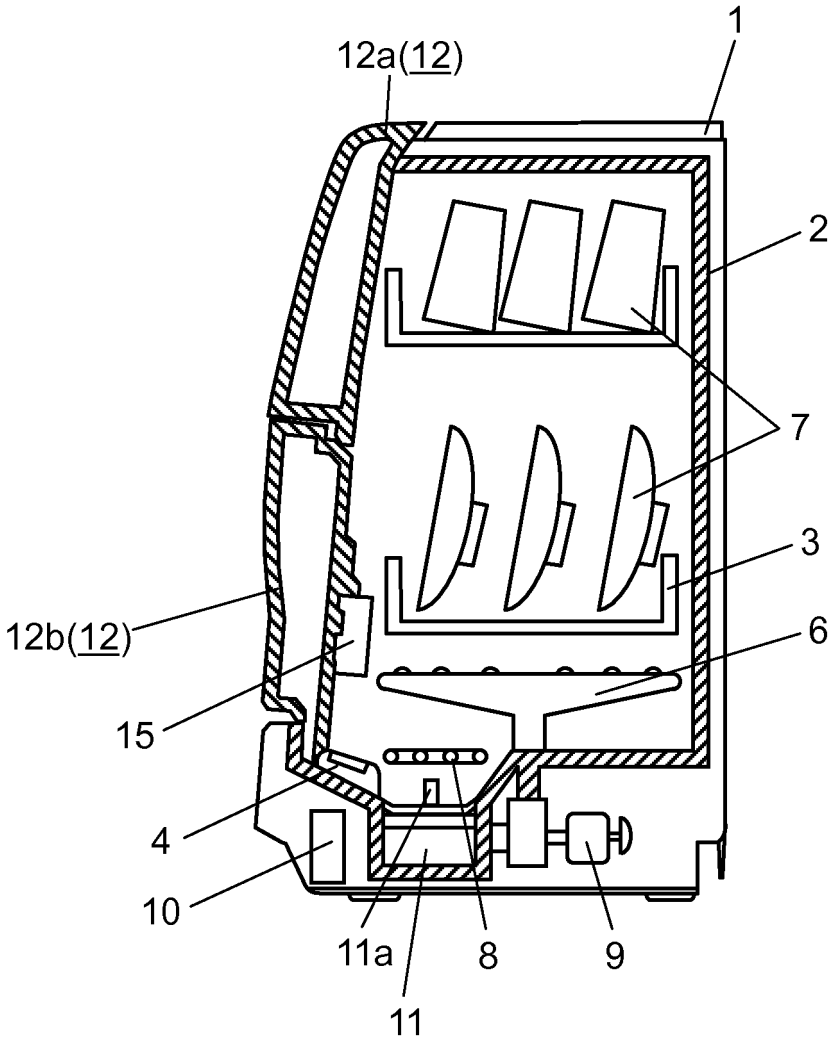


FIG. 3

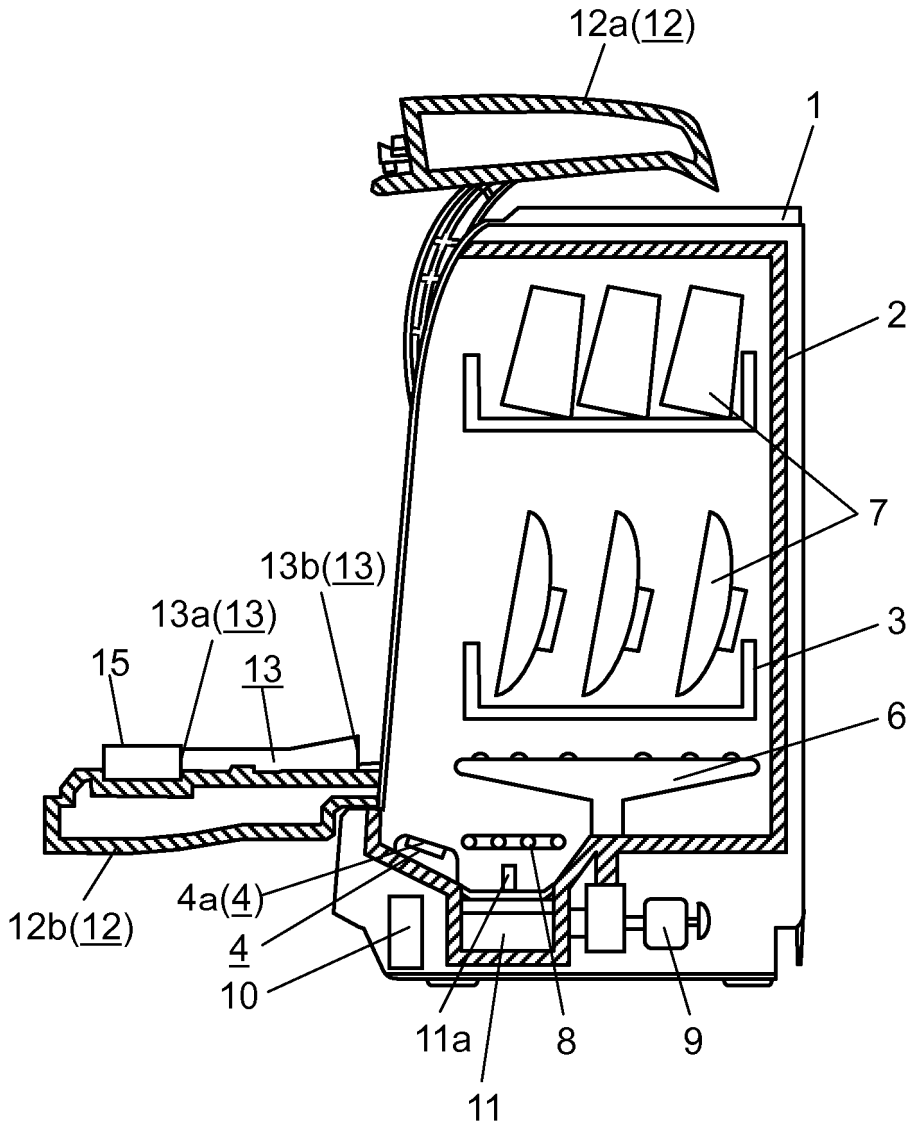


FIG. 4

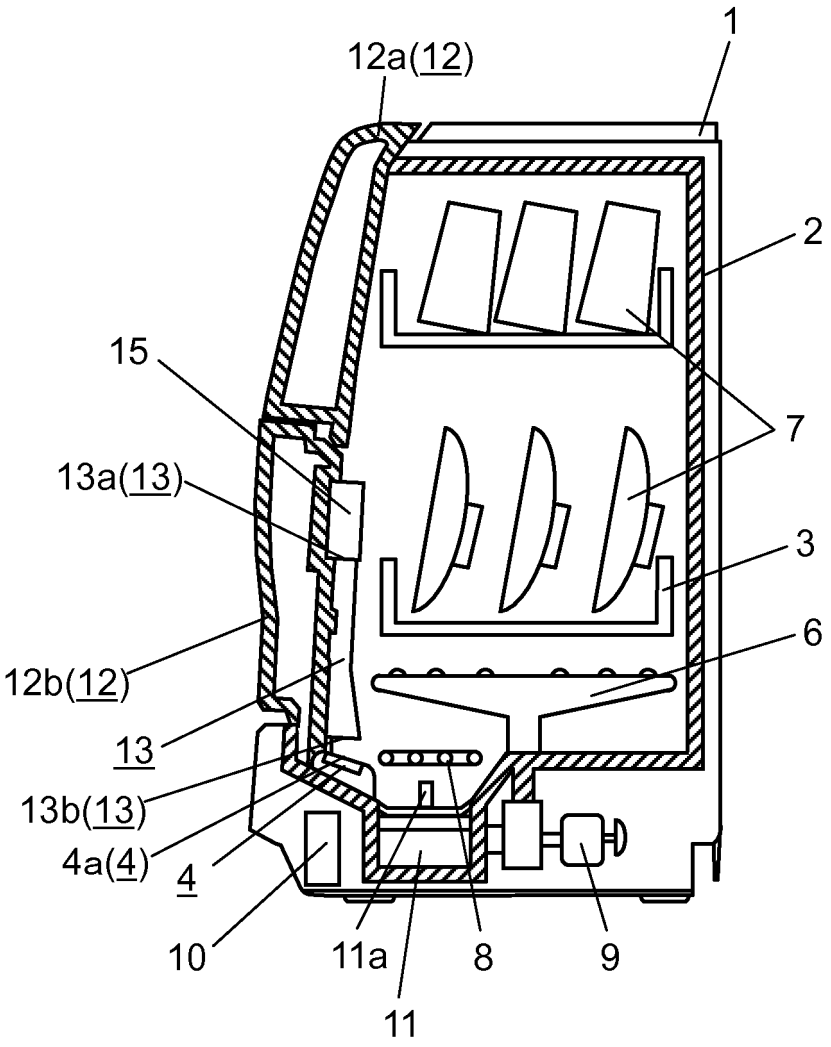


FIG. 5

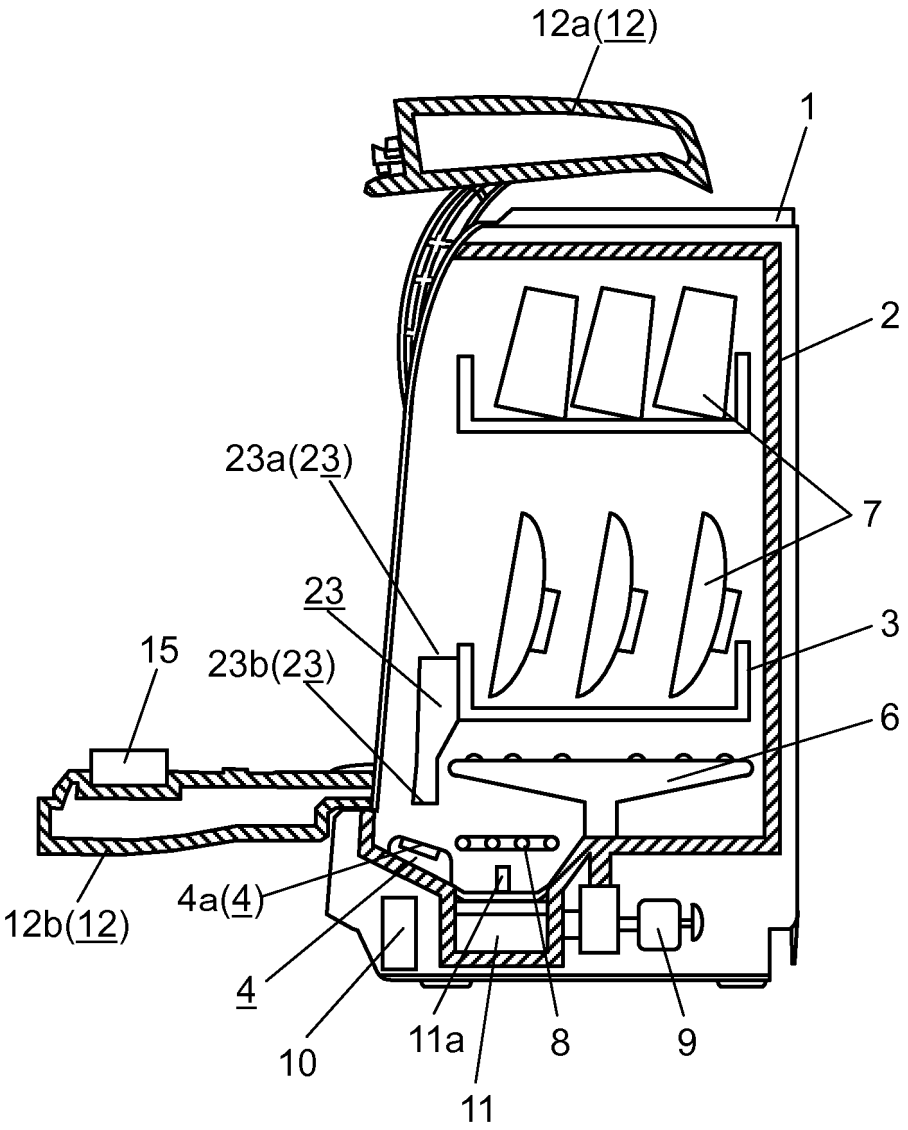


FIG. 6

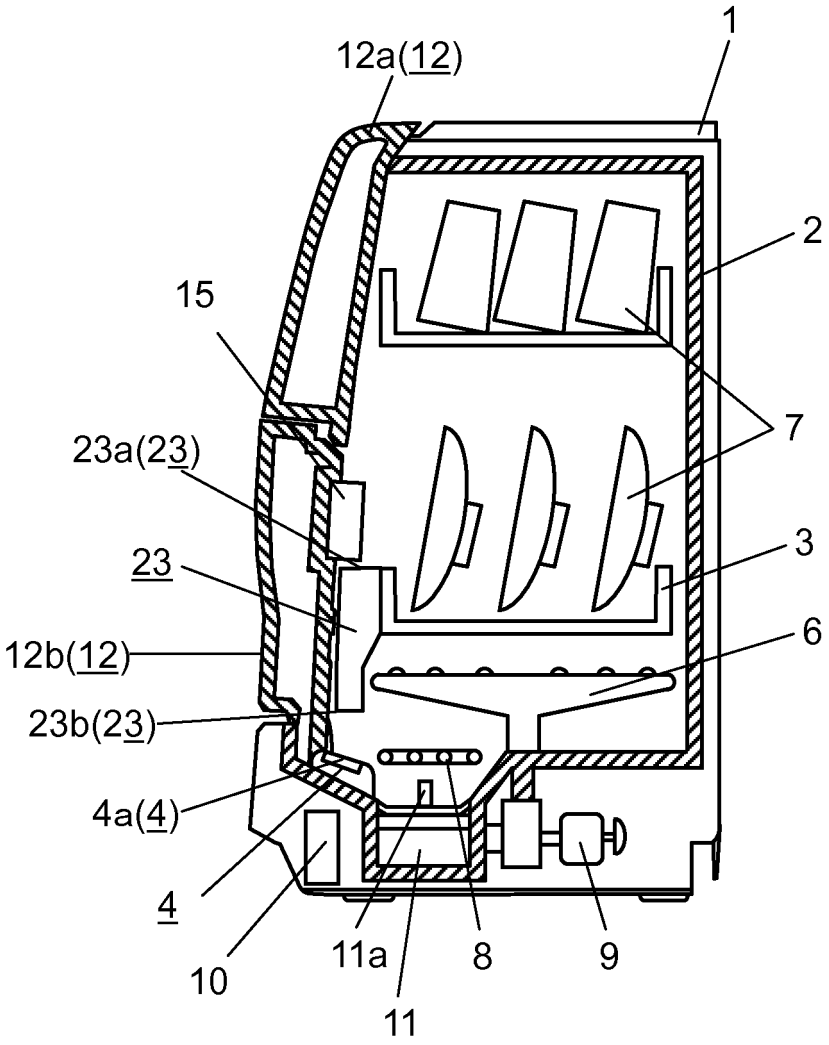
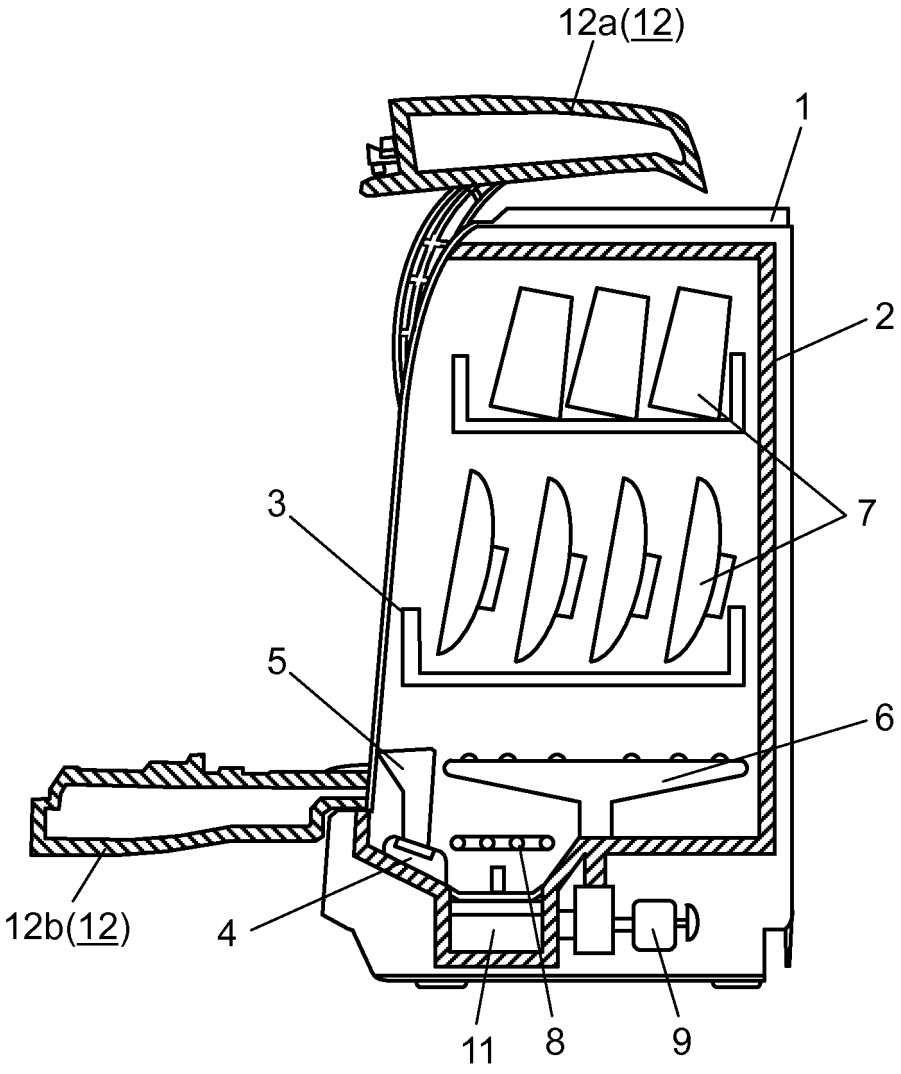


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/001533

A. CLASSIFICATION OF SUBJECT MATTER
A47L15/44(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L15/44

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 59-4606 Y2 (Sharp Corp.), 10 February 1984 (10.02.1984), entire text; all drawings (Family: none)	1-6
A	JP 2005-224486 A (Matsushita Electric Industrial Co., Ltd.), 25 August 2005 (25.08.2005), entire text; all drawings (Family: none)	1-6
A	JP 2007-229189 A (Hitachi Appliances, Inc.), 13 September 2007 (13.09.2007), entire text; all drawings (Family: none)	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
13 May, 2014 (13.05.14)	17 June, 2014 (17.06.14)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
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Patent documents cited in the description

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