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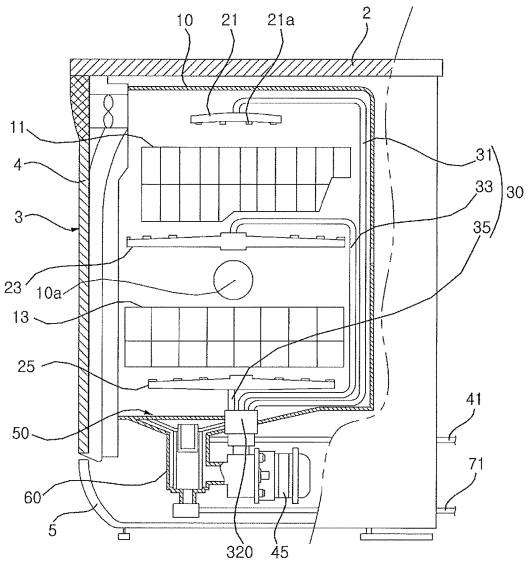
EP 2510865 A **WO 2014/097157 A1**
US 20120145200 A

(58) Field of Search:
INT CL **A47L**
Other: **WPI, EPODOC**

(54) Title of the Invention: **Dishwasher and method of controlling the same**
Abstract Title: **A dishwasher and a method of controlling the dishwasher**

(57) A dishwasher according to comprises a tub 10 forming a dishwashing space, a plurality of wash arms 21, 23, 25 disposed in the tub 10 and spraying wash water, a plurality of wash arm pipes 31, 33, 35 connected with the wash arms 21, 23, 25, respectively and arranged to supply wash water to the wash arms 21, 23, 25, a reusing pipe (150, fig 3) diverging from at least any one of the wash arm pipes 31, 33, 35 and a reusing section or tank (110, fig 3) arranged for storing wash water supplied from the reusing pipe (150, fig 3). The reusing section or reservoir (110, fig 3) stores wash water that has been collected in the sump 60 and the reusing pipe (150, fig 3) can diverge from the upper arm pipe 31 connected with the uppermost wash arm 21. The dishwasher saves wash water by reusing and recycling the wash water. The dishwasher also reduces the energy required to heat the wash water since the temperature stored in the reusing section (110, fig 3) will reach room temperature.

[FIG. 2]



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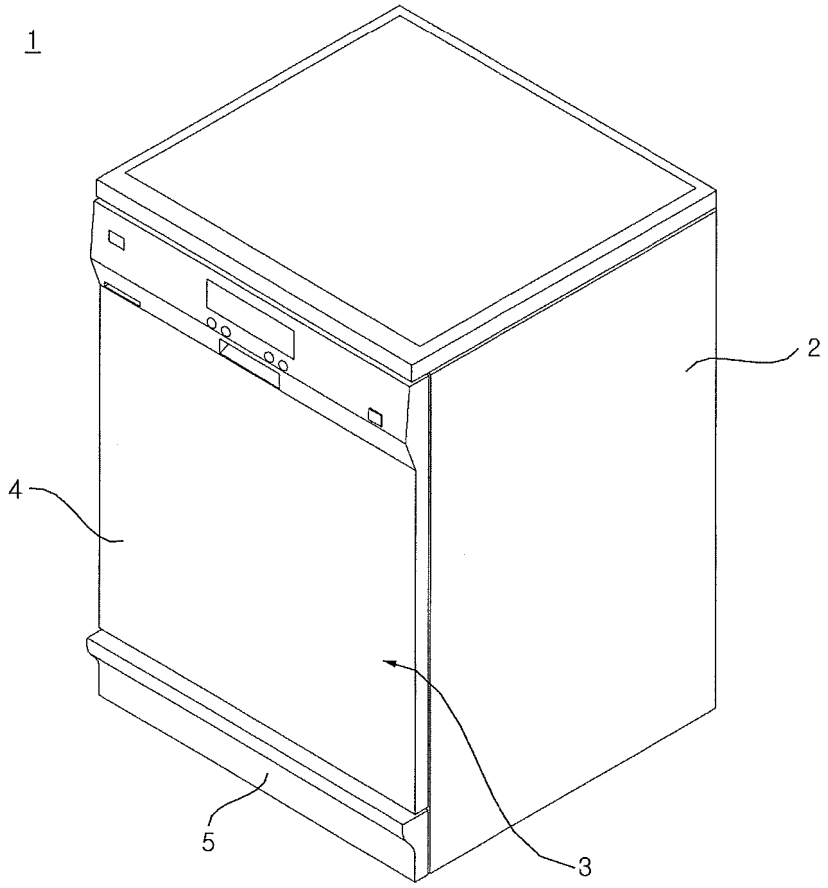
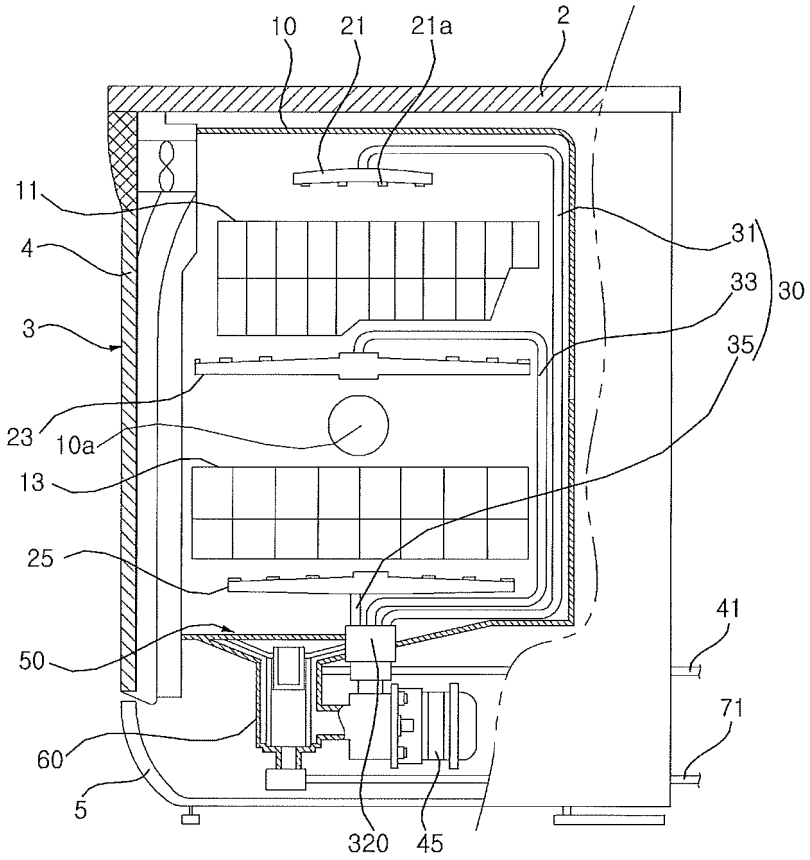
[Drawings]

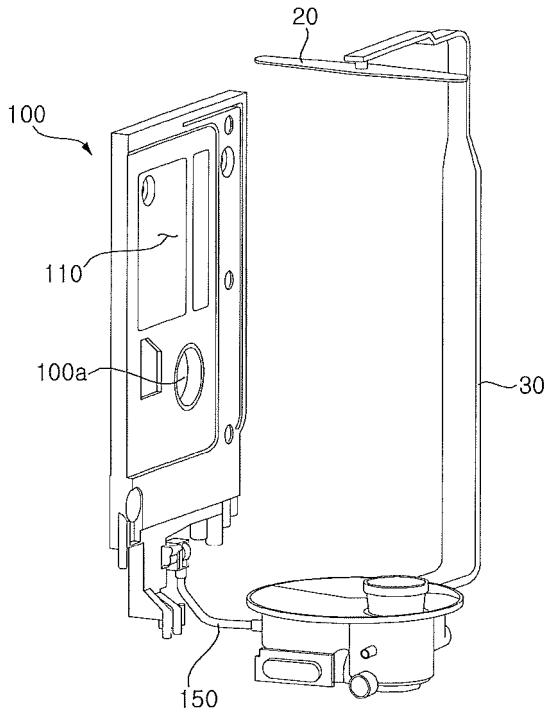
[FIG. 1]



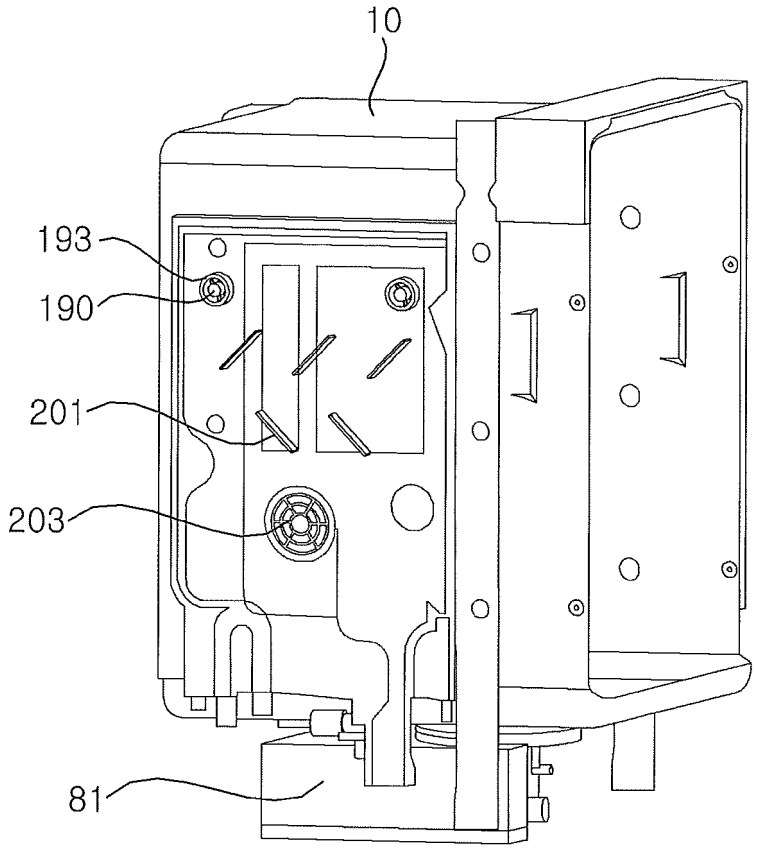
[FIG. 2]



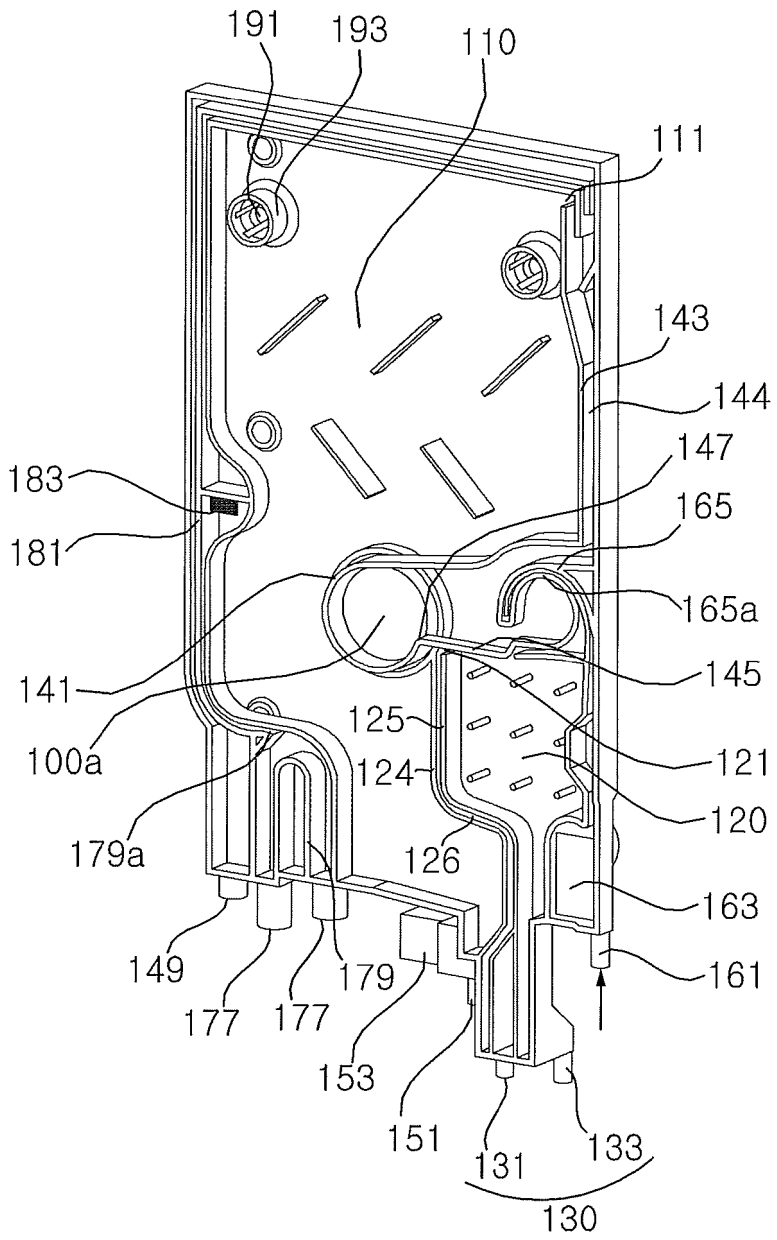
[FIG. 3]



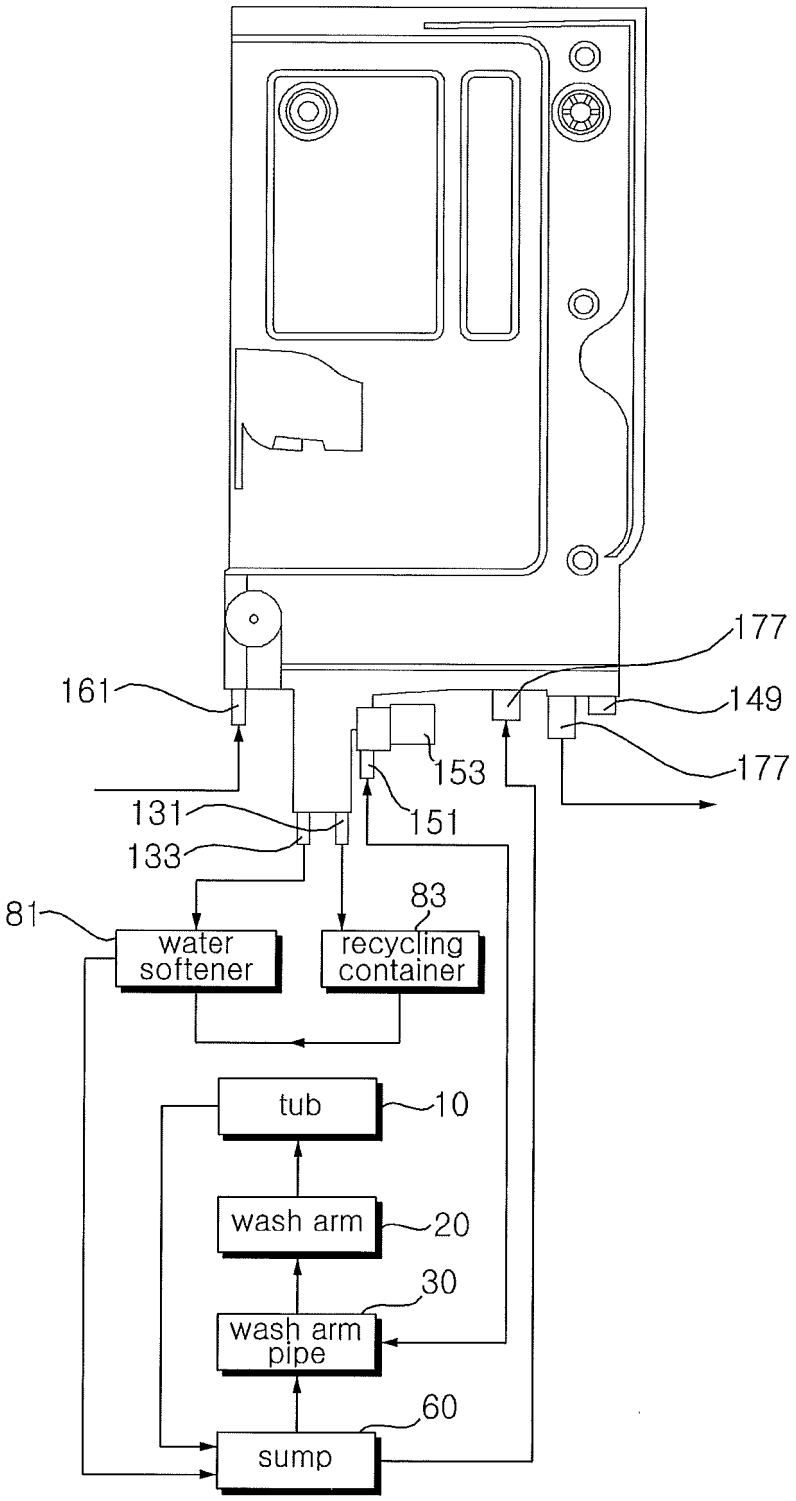
[FIG. 4]



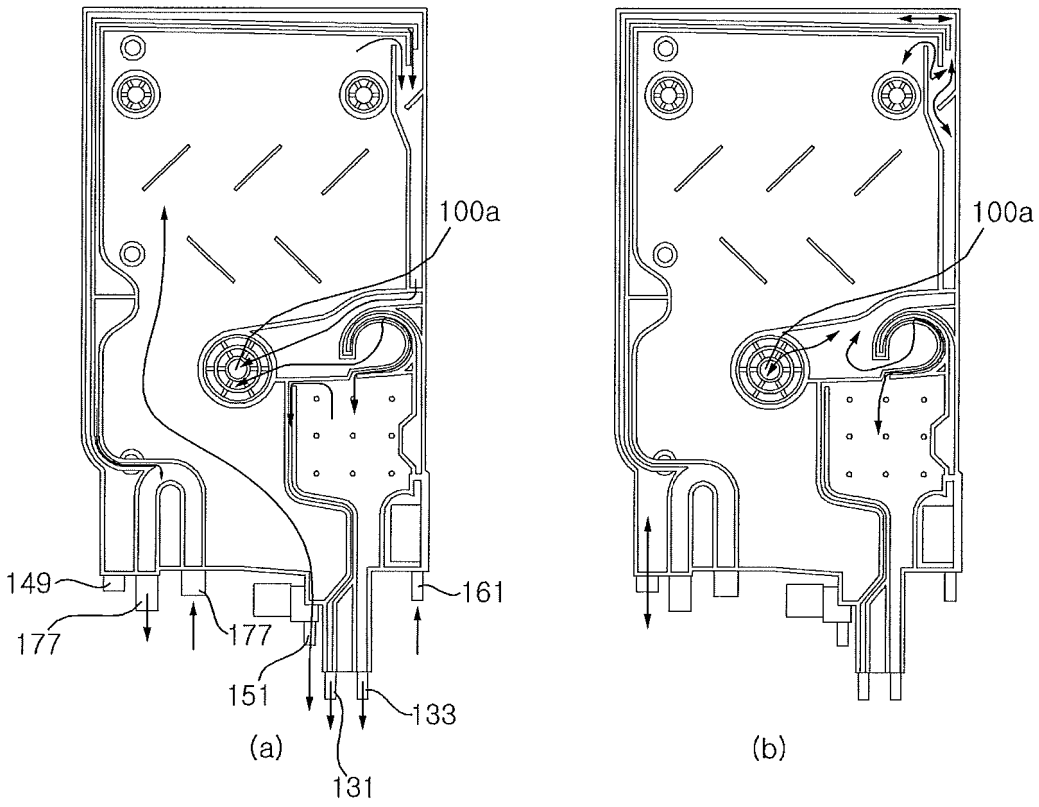
[FIG. 5]


191
193
110
111
143
144
147
165
183
181
165a
141
145
125
100a
124
121
120
179a
126
163
149
179
161
177
177
153
151
131
133
130

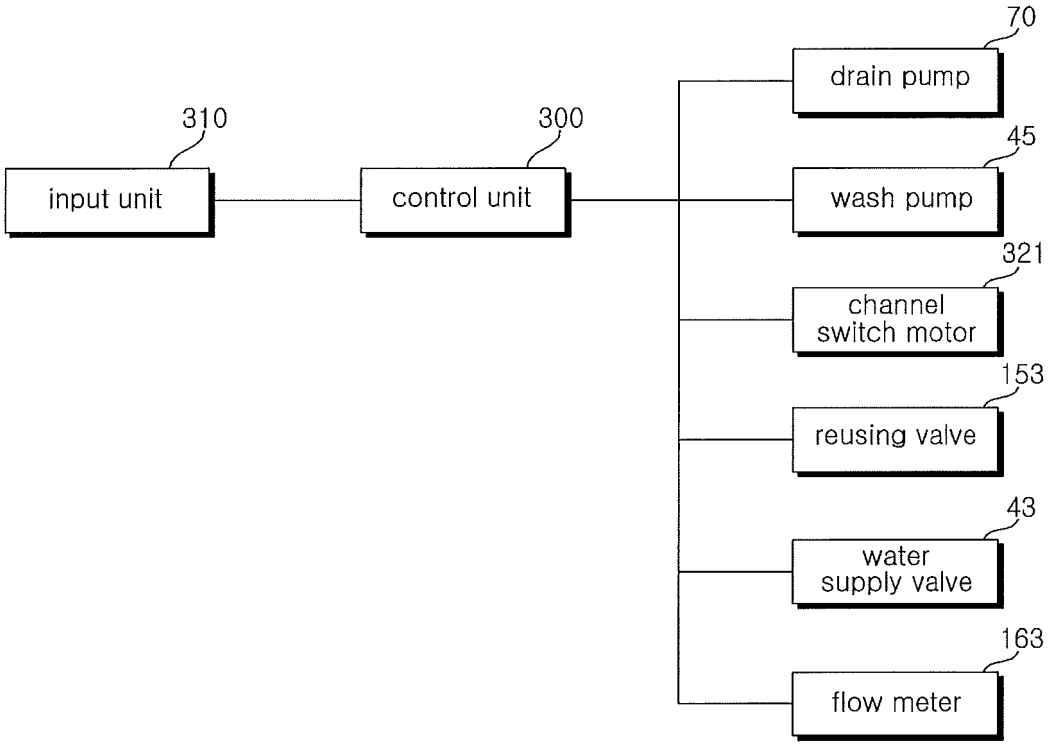
[FIG. 6]


177
161
149
153
177
131
151
133
83
81
water softener
recycling container
tub
10
wash arm
20
30
wash arm pipe
60
sump

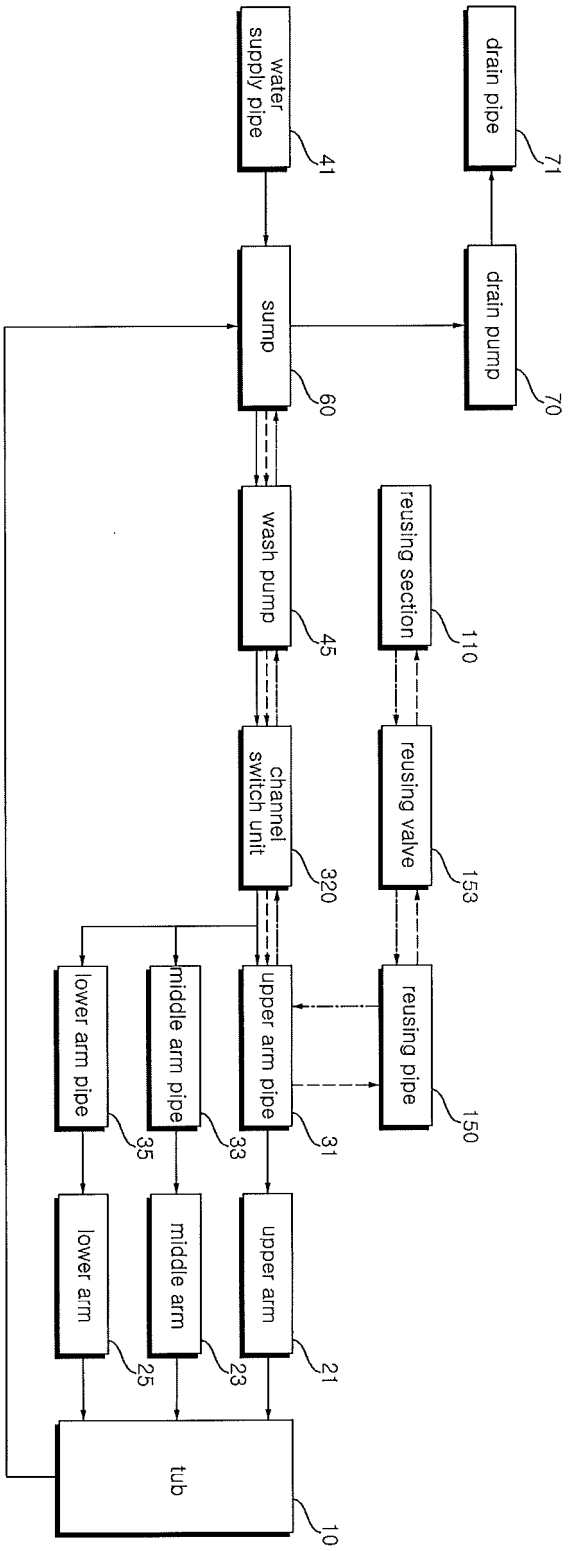
[FIG. 7]



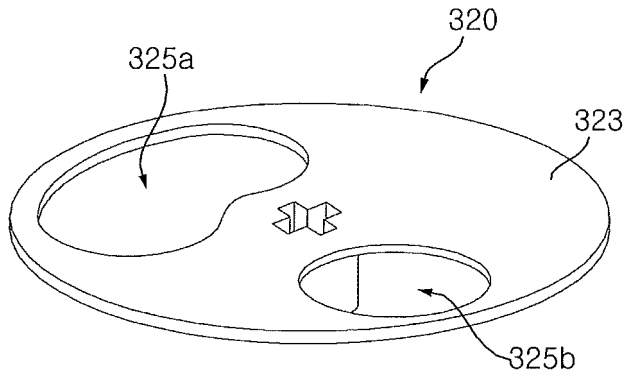
[FIG. 8]


310
input unit
300
control unit
70
drain pump
45
wash pump
321
channel
switch motor
153
reusing valve
43
water
supply valve
163
flow meter

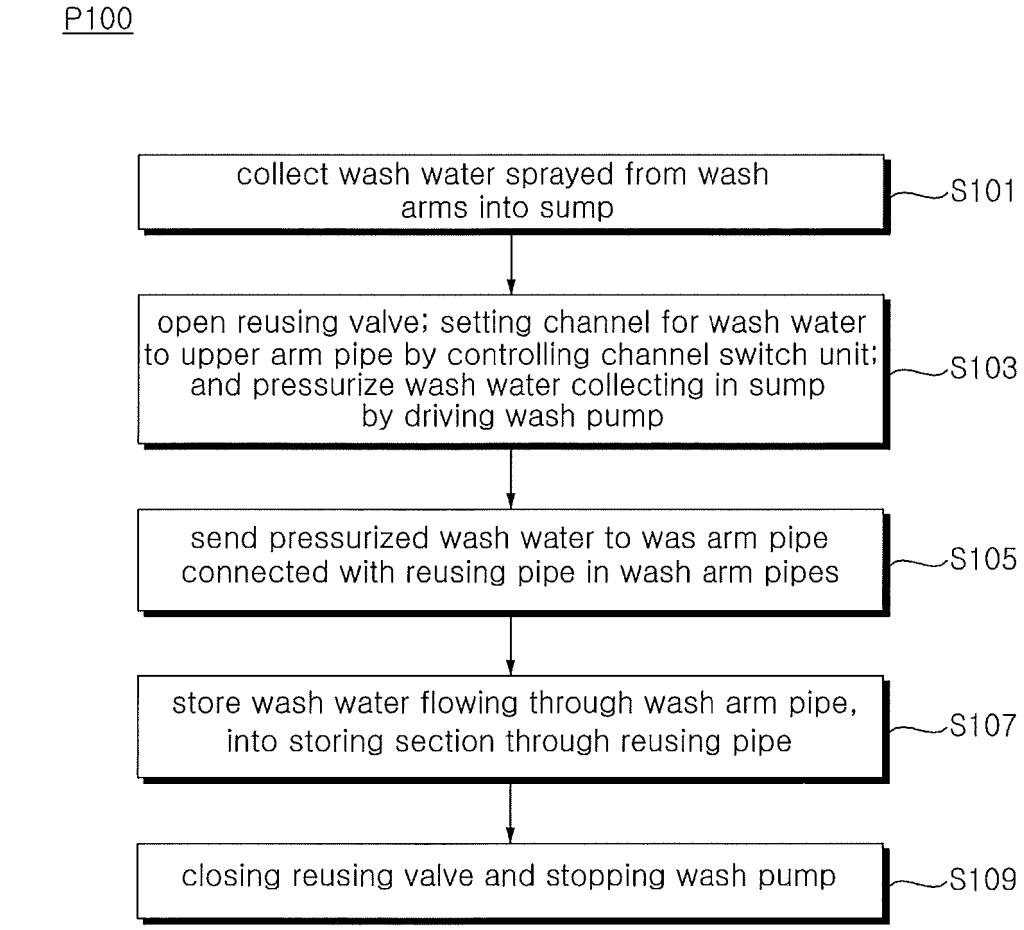
[FIG. 9]


water supply pipe
41
drain pipe
71
sump
60
drain pump
70
wash pump
45
reusing section
110
channel switch unit
320
reusing valve
153
lower arm pipe
35
middle arm pipe
33
upper arm pipe
31
reusing pipe
150
lower arm
25
middle arm
23
upper arm
21
tub
10

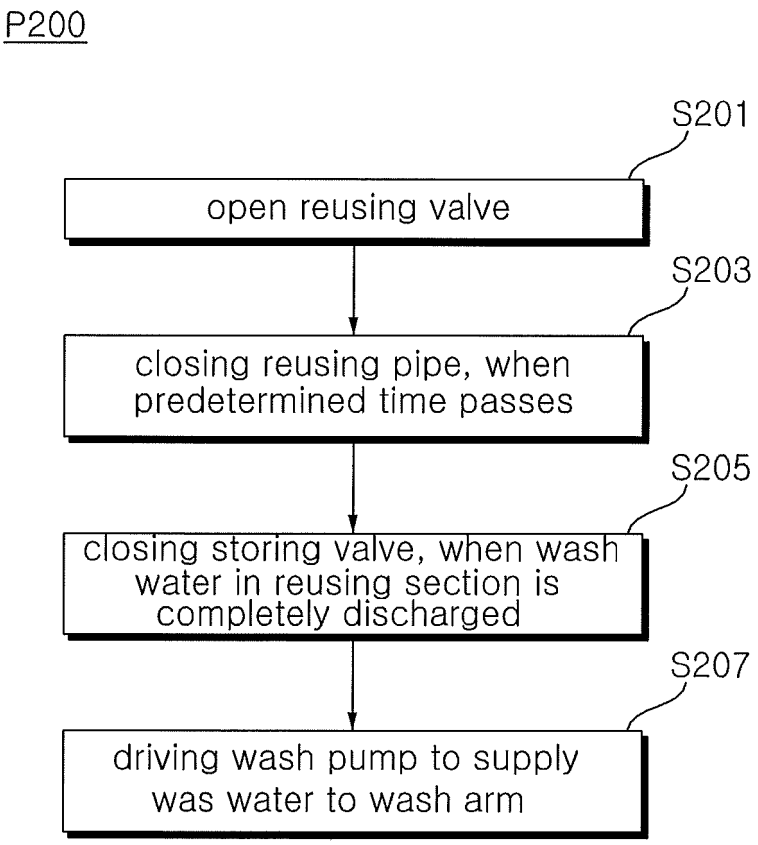
[FIG. 10]



[FIG. 11]


P100
collect wash water sprayed from wash arms into sump
S101
open reusing valve; setting channel for wash water to upper arm pipe by controlling channel switch unit; and pressurize wash water collecting in sump by driving wash pump
S103
send pressurized wash water to was arm pipe connected with reusing pipe in wash arm pipes
S105
store wash water flowing through wash arm pipe, into storing section through reusing pipe
S107
closing reusing valve and stopping wash pump
S109

[FIG. 12]


P200
S201
open reusing valve
S203
closing reusing pipe, when predetermined time passes
S205
closing storing valve, when wash water in reusing section is completely discharged
S207
driving wash pump to supply was water to wash arm

SPECIFICATION

TITLE OF THE INVENTION

DISHWASHER AND METHOD OF CONTROLLING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Disclosure

The present invention relates to a dishwasher and a method of controlling the same, particularly a dishwasher with a reusing section that stores used wash water and, if necessary, discharges it.

2. Description of the Related Art

Dishwashers are appliances that remove food residue on dishes with high-pressure wash water sprayed from wash arms.

Dishwashers usually include a tub forming a cleaning compartment and a sump mounted on the bottom of the tub and storing wash water. The wash water is pumped to wash arms by a wash pump in the sump and the wash water pumped to the wash arms is sprayed at high pressure through an ejection hole formed in the wash arms. The wash water sprayed at high pressure hits on dishes and the dirt such as food residue on the dishes falls down to the bottom of the tub. The used wash water is separated from the dust, and then collected to the sump and

discharged to the outside.

However, in the related art, the wash water was used one time and discharged, so there was a problem in that wash water was used too much. Therefore, it is required to find a plan of recycling wash water in order to use wash water as less as possible.

SUMMARY

An object of the present invention is to reduce the consumption of water by storing used wash water, and if necessary, reusing it.

Another object of the present invention is to store wash water that is stored in a sump, using an existing wash pump without a specific pump.

The objects of the present invention are not limited to those described above and other objects may be made apparent to those skilled in the art from claims.

In order to achieve the objects, a dishwasher according to an exemplary embodiment of the present invention includes: a tub forming a dishwashing space; a plurality of wash arms disposed in the tub and spraying wash water; a plurality of wash arm pipes connected with the wash arms, respectively, and supplying wash water; a reusing pipe

diverging from at least any one of the wash arm pipes; and a reusing section storing wash water supplied from the reusing pipe.

The wash arm pipes may include an upper arm pipe connected with an upper arm at the highest position in the wash arms, and the reusing pipe may diverge from the upper arm pipe

The dishwasher according to an exemplary embodiment of the present invention may include a channel switch unit that connects the channel, through which wash water flows, with the upper arm pipe, when wash water is stored into the reusing section.

The dishwasher according to an exemplary embodiment of the present invention may include a wash pump that pressurizes and sends wash water to the wash arm pipe; and an upper arm nozzle that is disposed on the upper arm and sprays wash arm, in which the wash pump may pump up wash water lower than the upper arm nozzle, when the wash water is stored into the reusing section.

The dishwasher according to an exemplary embodiment of the present invention may include a reusing valve that is disposed in the reusing pipe and opens/closes the channel between the wash arm pipe and the reusing section.

The dishwasher according to an exemplary embodiment of the

present invention may include: a tub forming a dishwashing space; a sump where wash water sprayed to the tub collects; a wash arm spraying the wash water collecting in the sump to the tub; a reusing section having a storage space for storing the wash water in the sump; and a wash pump pressurizing wash water up a pressure at which wash water is not sprayed from the wash arm, and sending the wash water to the wash arm and the reusing section.

A method of controlling a dishwasher is a method of controlling a dishwasher including a plurality of wash arms disposed in a tub and spraying wash water, a plurality of wash arm pipes connected with the wash arms, respectively, and a channel switch unit selectively supplying wash water to at least any one of the wash arm pipes, and the method includes: collecting wash water, which is sprayed from the wash arms, into a sump; pressurizing the wash water collecting in the sump by driving the wash pump; sending the wash water to the wash arm pipe connected with a reusing pipe in the wash arm pipes; and storing the wash water, which flows through the wash arm pipe, into a reusing section connected with the reusing pipe.

The method of controlling a dishwasher according to an exemplary embodiment of the present invention may include opening a

reusing valve that opens/closes the channel of the reusing pipe.

The method of controlling a dishwasher according to an exemplary embodiment of the present invention may include closing the reusing valve after the storing of wash water into the reusing section.

The method of controlling a dishwasher according to an exemplary embodiment of the present invention may include stopping the wash pump after the storing of wash water into the reusing section.

The method of controlling a dishwasher according to an exemplary embodiment of the present invention may include supplying the wash water, which is discharged from the wash pump, to the upper arm pipe connected with the upper arm at the highest position in the wash arms by driving the channel switch unit.

The driving of the wash pump may be to drive the wash pump such that wash water is not sprayed from the upper arm.

The details of other exemplary embodiments are included in the following detailed description and the accompanying drawings.

[Effect of invention]

According to a dishwasher and a method of controlling the dishwasher of the present invention, one or more effects can be achieved

as follows.

First, since it is possible to store used wash water and reuse it, if necessary, consumption of wash water is reduced.

Second, it is possible to save energy for heating wash water by keeping wash water at a room temperature.

Third, it is possible to perform both of spraying of wash water and storing of wash water, using a wash pump.

The effects of the present invention are not limited to those described above and other effects not stated herein may be made apparent to those skilled in the art from claims.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing the external shape of a dishwasher according to an exemplary embodiment of the present invention.

FIG. 2 is a cross-sectional view showing the inside of the dishwasher according to an exemplary embodiment of the present invention.

FIG. 3 is a perspective view schematically showing a case and

other components of the dishwasher according to an exemplary embodiment of the present invention.

FIG. 4 is a perspective view showing the case with one side on a tub, according to an exemplary embodiment of the present invention.

FIG 5 is a perspective view showing the internal configuration of the case according to an exemplary embodiment of the present invention.

FIG. 6 is a view schematically showing the flow of wash water among the case and the other components according to an exemplary embodiment of the present invention.

FIG. 7A is a view showing the flow direction of wash water inside the case according to an exemplary embodiment of the present invention and FIG. 7B is a view showing the flow direction of air inside the case.

FIG. 8 is a block diagram showing the relationship between a control unit and other components according to an exemplary embodiment of the present invention.

FIG. 9 is a block diagram schematically showing the channel of wash water in a dishwasher according to an exemplary embodiment of the present invention.

FIG. 10 is perspective view showing a rotary plate of a flow switch unit according to an exemplary embodiment of the present

invention.

FIG. 11 is a flowchart illustrating a control method for storing wash water in a method of controlling a dishwasher according to an exemplary embodiment of the present invention.

FIG. 12 is a flowchart illustrating a control method for reusing wash water in the method of controlling a dishwasher according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

The advantages and features of the present invention, and methods of achieving them will be clear by referring to the exemplary embodiments that will be describe hereafter in detail with reference to the accompanying drawings. However, the present invention is not limited to the exemplary embodiments described hereafter and may be implemented in various ways, and the exemplary embodiments are provided to complete the description of the present invention and let those skilled in the art completely know the scope of the present invention and the present invention is defined by claims. Like reference numerals indicate like components throughout the specification.

Hereinafter, the present invention will be described with

reference to the drawings illustrating a dishwasher and a method of controlling the dishwasher according to exemplary embodiments of the present invention.

FIG. 1 is a perspective view showing the external shape of a dishwasher 1 according to an exemplary embodiment of the present invention, FIG. 2 is a cross-sectional view showing the inside of the dishwasher 1 according to an exemplary embodiment of the present invention, FIG. 3 is a perspective view schematically showing a case 100 and other components of the dishwasher 1 according to an exemplary embodiment of the present invention, and FIG. 4 is a perspective view showing the case 100 with one side on a tub 10, according to an exemplary embodiment of the present invention.

Referring to FIGS. 1 to 4, the dishwasher 1 according to an exemplary embodiment of the present invention includes: a tub 10 defining a dishwashing space; a case 100 disposed outside the tub 10 and storing wash water; a reusing section 110 disposed inside the case 100 and defining a space for storing the wash water sprayed into the tub 10; and a water storing section 120 disposed inside the case 100, defining a space separated from the space defined by the reusing section 110, and storing wash water supplied from the outside.

A cabinet 2 forms the external appearance of the dishwasher 1 and provides a structure for accommodating parts. The front of the cabinet 2 is open. The tub 10 into which wash water is sprayed is disposed in the cabinet 2. A user puts dishes into the tub 10. A door 3 opens/closes the front of the cabinet 2. The door 3 closes the tub 10. The door 3 is pivotably coupled to the front of the cabinet 2. A front cover 4 making the external appearance beautiful is disposed on the front of the door 3.

A lower cover 5 is disposed under the door 3. The tub 10 is disposed inside the cabinet 2. The front of the tub 10 is closed by the door 3. Wash water is sprayed into the tub 10. A wash arm 20 spraying wash water into the tub 10 is disposed in the tub 10. A rack that holds dishes is disposed in the tub 10. The rack can move forward/backward in the tub 10. It is preferable that a plurality of racks is provided.

The rack includes a top rack 11 and a bottom rack 13. The wash water sprayed into the tub 10 collects into the sump 60. A filter assembly 50 filters foreign substances in wash water. A drain pipe 71 is connected with the sump 60. The drain pipe 71 is provided to discharge the water collecting in the sump 60 to the outside. The drain pipe 71 is

connected with a drain pump 70. The drain pump 70 pressurizes and sends wash water to the drain pipe 71.

The sump 60 is supplied with wash water from the outside. The sump 60 is connected with a wash arm pipe 30 through which the collecting wash water flows to the wash arm 20. The sump 60 is disposed at the bottom of the tub 10. The sump 60 is equipped with the filter assembly 50 filtering foreign substances in wash water. The case 100 is disposed outside the tub 10. Preferably, the case 100 may be fastened to a side of the tub 10. In an exemplary embodiment of the present invention, the case 100 is fastened to a side of the tub 10.

The reusing section 110 is formed inside the case 100. The reusing section 110 may be defined by walls inside the case 100. The reusing section 110 stores the wash water flowing from the sump 60 after collecting therein. The reusing section 110 discharges the stored wash water back to the sump 60. The reusing section 110 may be connected with a reusing pipe 150. The reusing pipe 150 is a pipe that is disposed between the reusing section 110 and the sump 60 and through which wash water flows.

The water storing section 120 is formed inside the case 100. The water storing section 120 may be defined by walls. The water

storing section 120 is separated from the reusing section 110. The water storing section 120 stores wash water supplied from the outside. The water storing section 120 may be connected with a water supply pipe 41. The water supply pipe 41 is a pipe through which water supplied from the water equipment of a house flows. The water storing section 120 is connected with a supply pipe connection port 130. The supply pipe connection port 130 is a pipe through which the wash water in the water storing section 120 flows to the sump 60.

The case 100 may have a structure with two sides, of which any one is fastened to the tub 10 and the other covers it. A communicating hole 100a may be formed through the side fastened to the tub 10. The supply pipe connection port 130 will be described in detail below.

The wash pump 45 pressurizes and sends the wash water in the sump 60 to the wash arm pipe 30. The wash arm pipe 30 is connected with the wash arm 20. The wash arm 20 includes nozzles spraying wash water. The wash water sprayed from the wash arm 20 washes dishes. The wash arm pipe 30 is connected with the wash pump 45. It is preferable that a plurality of wash arms 20 is provided at predetermined heights.

For example, the wash arm 20 may include an upper arm 21 at the

highest position, a lower arm 25 at the lowest position, and a middle arm 23 between the upper arm 21 and the lower arm 25. The wash arm pipe 30 may include an upper arm pipe 31, a middle arm pipe 33, and a lower arm pipe 35. The upper arm 21 receives wash water through the upper arm pipe 31 from the wash pump 45. The middle arm 23 receives wash water through the middle arm pipe 33 from the wash pump 45. The lower arm 25 receives wash water through the lower arm pipe 35 from the wash pump 45.

The wash water discharged from the wash pump 45 can be guided to at least one of the wash arm pipes 30 by a flow switch unit 320. The flow switch unit 320 is disposed between the wash arm pipes 30 and the wash pump 45. The case 100 can be divided into the front and the rear. The front and the rear may be symmetrically formed, in which walls may be formed on any one of them and the other one may have a sealing shape for preventing wash water from flowing in unintended directions, corresponding to the walls. A plurality of ribs 201 is disposed inside the case 100. The rib 201 keeps the external shape of the case 100. The ribs 201 are shaped such that they are in contact with the front and the rear of the case 100.

A dishwasher 1 according to an exemplary embodiment of the

present invention includes fastening members 190 fixing the case 100 to the tub 10, the case 100 has fastening holes 191 in which the fastening members are inserted, waterproofing walls 193 formed in the radial direction of the fastening holes 191 may be disposed around the fastening holes 191 to prevent the wash water in the reusing section 110 or the water storing section 120 from flowing inside.

The fastening members 190 may be screws or bolts. The waterproofing wall prevents the fastening member 190 from coming in contact with wash water. The waterproofing wall 193 isolates the reusing section 110 and/or the water storing section 120 and the fastening hole 191 such wash water does not leak through the fastening hole 191. Preferably, the fastening holes 191 and the waterproofing walls 193 are formed at the reusing section 110.

The front of the tub 10 is open so that dishes can be received. The door 3 that can pivot forward/backward is disposed ahead of the tub 10. The door 3 opens/closes the open front of the tub 10. An input unit 310 is disposed ahead of the tub 10. The case 100 is disposed on the right side or the left side of the tub 10. A tub hole 10a is formed through the right side or the left side of the tub 10. It is preferable that the tub hole 10a is formed through the side on which the case 100 is

disposed.

The cabinet 2 covers the tub 10 and the case 10. The case 100 is disposed inside the cabinet 2. One side of the case 100 faces the tub 10 and the other side faces the inside of the cabinet 2. The case 100 is inserted in the space between the cabinet 2 and the side of the tub 10. The case 100 is relatively small in thickness and may be wide enough to correspond to the left side or the right side of the tub 10.

FIG 5 is a perspective view showing the internal configuration of the case 100 according to an exemplary embodiment of the present invention, FIG. 6 is a view schematically showing the flow of wash water among the case 100 and the other components according to an exemplary embodiment of the present invention, FIG. 7A is a view showing the flow direction of wash water inside the case 100 according to an exemplary embodiment of the present invention, and FIG. 7B is a view showing the flow direction of air inside the case 100.

Referring to FIGS. 5 to 7, the reusing section 110 and the water storing section 120 are spaced from each other and an oversupplied-water channel 126 is formed between the reusing section 110 and the water storing section 120, such that the wash water overflowing the water storing section 120 due to oversupplying can be discharged out of

the case 100 through the oversupplied-water channel 126. The oversupplied-water channel 126 is defined in the gap between the reusing section 110 and the water storing section 120.

The reusing section 110 is disposed apart from the water storing section 120. The wash water in the reusing section 110 and the wash water in the water storing section 120 are separated by walls. Since the capacities of the reusing section 110 and the water storing section 120 are fixed, the oversupplied wash water is discharged. The oversupplied-water channel 126 is defined between the reusing section 110 and the water storing section 120. The oversupplied-water channel 126 may be defined by a division wall 124 for separation from the reusing section 110 and a supplied water guide wall 125 for separation from the water storing section 120.

The oversupplied-water channel 126 is formed between the division wall 124 and the supplied water guide wall 125. The wash water oversupplied into the water storing section 120 flows down from the top. The wash water flowing down from the water storing section 120 drops through the oversupplied-water channel 126. The wash water flowing through thee oversupplied-water channel 126 is discharged from the supply pipe connection port 130. The supply pipe

connection port 130 includes a water softener connection port 131 and a recycling container connection port 133. Preferably, the oversupplied-water channel 126 is connected with the water softener connection port 131.

The tub 10 according to an exemplary embodiment of the present invention has the tub hole 10 formed through the side facing the case 100, the case 100 has the communicating hole 100a that communicates with the tub hole 10a, and the reusing section 110 and the water storing section 120 may be formed separately from the communicating hole 100a. The tub 10 has the tub hole 10a. The tub 10 is closed by the door 3. The air in the tub 10 is discharged to the outside. The air in the tub 10 is discharged to the outside through the tub hole 10a.

The case 100 has the communicating hole 100a that communicates with the tub hole 10a. The communicating hole 100a communicates with the tub hole 10a. The communicating hole 100a and the tub hole 10a may be connected by a pipe or a hose. For example, the tub hole 10a and the communicating hole 100a are connected by bringing the case 100 in contact with the tub 10. Air or wash water can flow through the tub hole 10a and the communicating hole 100a. It is preferable to dispose a sealing member between the tub hole 10a and the

communicating hole 100a to prevent leakage of air of wash water.

The reusing section 110 and the water storing section 120 are separated from the communicating hole 100a. For example, the communicating hole 100a is partially covered by the reusing section 110. It is preferable that the reusing section 110 has a storage space larger than the water storing section 120. The communication hole 100a, the reusing section 110, and the water storing section 120 are separated by walls. For example, one side of the reusing section 110 may be recessed. The communicating hole 100a is formed at the recession. The wall surrounding the reusing section 110 has an inward-bending wall 141 that is curved to surround the communicating hole 100a.

One end of the inward-bending wall 141 may be extended upward and connected with a communicating wall 143 defining the reusing section 110. The upper portion of the communicating wall 143 is partially open and vertically formed such that the wash water oversupplied to the reusing section 110 can flow down. The inward-bending wall 141 extends to the communicating hole 100a and surrounds the communicating hole 100a. The communication hole 100a may be connected with a leaking water guide wall 145 formed over the water storing section 120.

A fixing cap 203 may be disposed between the tub hole 10a and the communicating hole 100a. The fixing cap 203 filters foreign substances that can flow between the tub hole 10a and the communicating hole 100a. The fixing cap 203 may be disposed in the tub hole 10a or the communicating hole 100a.

The reusing section 110 according to an exemplary embodiment of the present invention has a reusing-communicating portion 111 with a side open so that oversupplied wash water or air is discharged, and the communicating hole 100a may be formed lower than the reusing-communicating portion 111 so that the wash water overflowing the reusing-communicating unit 110 flows to the communicating hole 100a.

The communicating wall 143 vertically elongated is disposed along a side of the reusing section 100. The communicating wall 143 defines a side of the reusing section 110. The communicating wall 143 defines the reusing section 110 and an over-stored water discharge channel 144. The communicating wall 143 has the reusing-communicating portion 111 with a side open to allow wash water to overflow. The height of the reusing-communicating portion 111 depends on the capacity of the reusing section 110. Preferably, the reusing-communicating portion 111 is formed at the upper end of the

communicating wall 143. The communicating wall 143 may be formed with the reusing-communicating portion 111 at a predetermined distance away from the top of the case 100.

The wash water flowing down from the reusing-communicating portion 111 is dropped and then discharged through the communicating hole 100a. The communicating hole 100a is formed lower than the reusing-communicating portion 111. The reusing-communicating portion 111 may be positioned higher than the communicating hole 100a or at least at the same height. The lower end of the communicating wall 143 may be connected with the inward-bending wall 141. The inward-bending wall 141 defines the reusing section 110 and the communicating wall 100a. The inward-bending wall 141 is connected with the water storing section 120, turning around the communicating hole 100a.

The leaking water guide wall 145 is disposed over the water storing section 120. The water leakage wall 145 is connected with the inward-bending wall 141. The water storing section 120 has an anti-siphon hole 165a to be described below. The wash water discharged through the anti-siphon hole 165a is guided to the communicating hole 100a by the leaking water guide wall 145. A wall joint 147 is where the inward-bending wall 141 and the leaking water guide wall 145 meet.

The case 100 according to an exemplary embodiment of the present invention may include a water supply wall 165 that bends so that wash water supplied from the outside can drop into the water storing section 120 after flowing upward. The water supply wall 165 partially bends. The water supply wall 165 forms a channel through which the wash water supplied from the outside flows to the water storing section 120. The water supply wall 165 is formed over thee water storing section 120. The leaking water guide wall 145 is disposed under the water supply wall 165.

The water supply wall 165 according to an exemplary embodiment of the present invention has the anti-siphon hole 165a for preventing a siphon phenomenon and the anti-siphon hole 165a may be formed higher than or at the same height as the communicating hole 100a so that the wash water leaking through the anti-siphon hole 165a is dropped and discharged through the communicating hole 100a. The anti-siphon hole 165a can pass both of air and wash water through it.

When wash water stops flowing inside from the outside, wash water can be discharged by a siphon effect. In order to prevent the siphon effect, the water supply wall 165 has the anti-siphon hole 165a through which the inside and the outside communicate with each other

and air flows. The anti-siphon hole 165a is formed through the water supply wall 165. The wash water flowing through the water supply wall 165 may leak through the anti-siphon hole 165a. The leaking wash water flows to the communicating hole 100a.

Since the anti-siphon hole 165a is formed higher than the communicating hole 100a or at least at the same height, wash water can flow to the communicating hole 100a. Preferably, the leaking water guide wall 145 is formed to guide leaking water. The leaking water guide wall 145 defines the top of the water storing section. The leaking water guide wall 145 is disposed under the anti-siphon hole 165a. One side of the leaking water guide wall 145 is connected with the water supply wall 165 and the other side is connected with the inward-bending wall 141.

The case 100 according to an exemplary embodiment of the present invention has an air discharge port 149 to discharge the air discharged from the reusing section 110, the air discharged from the water storing section 120, and the air discharged from the tub 10 through the communicating hole 100a, to the outside. The air in the reusing section 110 is discharged through the reusing-communicating portion 111. The air in the water storing section 120 is discharged through the

anti-siphon hole 165a. The air in the tub 10 is discharged to the tub hole 10a and flows into the communicating hole 100a. The air discharged from the anti-siphon hole 165a and the communicating hole 100a is guided upward by the inward-bending wall 141.

The case 100 has the air discharge port 149. For example, the air discharge port 149 is formed at the lower portion of the case 100. The air in the case 100 can be discharged to the air discharge port 149 through between a condensing wall1 81, which is described below, and the wall formed along the edge of the case 100.

Further, the external air may flow inside through the air discharge port 149 and flow into the tub 10 through the communicating hole 100a and may flow into the reusing section 110 or the water storing section 120. Since wash water is repeatedly supplied/discharged into/out of the reusing section 110 and the water storing section 120, air can also flow into/out of them. On the other hand, the air in the case 100 can flow into the tub 10 through the tub hole 10a and be discharged to the outside, when the door 3 is open.

The dish washer 1 according to an exemplary embodiment of the present invention includes the reusing pipe 150 formed so that the wash water discharged from the reusing unit 110 flows to the sump 60 and the

case 100 may include a reusing pipe connection portion 151 connected with the reusing pipe 150 and a reusing valve 153 opening/closing the reusing pipe connection portion 151.

The wash water discharged from the reusing section 110 flows through the reusing pipe 150. The wash water flowing through the reusing pipe 150 flows to the sump 60. The reusing pipe 150 guides the wash water in the reusing unit 110 to the sump 60. The reusing pipe 150 may be connected with the wash arm pipe 30. The wash arm pipe 30 communicates with the sump 60. The case 100 may include the reusing pipe connection portion 151 to which the reusing pipe 150 is connected. The reusing pipe connection portion 151 may be formed at the lower portion of the reusing section 110. The case 100 may have a reusing pipe 153 opening/closing the reusing pipe connection portion 151. The reusing valve 153 controls opening/closing of the reusing pipe connection portion 151.

The case 100 according to an exemplary embodiment of the present invention may include a water inlet port 161 connected with a pipe so that wash water supplied from the outside flows into the water storing section 120 and the supply pipe connection port 130 connected with a pipe so that the wash water in the water storing section 120 is

discharged to the sump 60.

For example, the water supply pipe 41 is connected to the water pipe of the water equipment in a house. The water flows through the water supply pipe 41 flows to the water storing section 120. The case 100 includes a water supply connection portion to which the water supply pipe 41 is connected. The wash water flowing in the water supply connection portion flows to the water supply wall 165. The case 100 may include a flow meter 163. The flow meter 163 measures the flow rate of the wash water flowing in the water inlet port 161. The flow meter 163 may be disposed between the water inlet port and the water supply wall 165.

The supply pipe connection port 130 may include the water softener connection port 131 for discharging wash water to a water softener 81 with a filter controlling mineral in wash water and the recycling container connection port 133 for discharging wash water to a recycling container 83 purifying the filter of the water softener 81. The water softener 81 softens wash water by controlling mineral in the wash water. Soft water contains less calcium and magnesium than hard water. The water softener includes an ion resin filter. The recycling container 83 produces recycled water while periodically receiving wash water and

purifies the ion resin filter by sending the recycled water to the softener 81.

The supply pipe connection port 130 may include the water softener connection port 131 discharging wash water to the water softener 81 and the recycling container connection port 133 discharging wash water to the recycling container 82.

The water storing section 120 according to an exemplary embodiment of the present invention has a water discharge portion 121 that is open so that oversupplied wash water can overflow it, and the water softener connection port 131 may be formed lower than the water discharge portion 121 so that the wash water overflowing the water discharge portion 121 drops and flows to the discharge portion of the water softener 81.

The water discharge portion 121 is formed by partially opening the top of the water storing section 120. The wash water overflowing the water discharge portion 121 flows to the supply pipe connection port 130. Preferably, the wash water overflowing the water discharge portion 121 flows to the water softener connection port 131. The wash water overflowing the water discharge portion 121 flows to the oversupplied-water channel. The oversupplied-water channel 126 is

defined by the division wall 124 and the supplied water guide wall 125. The water discharge portion 121 is formed higher than the water softener connection port 131. The water discharge portion 121 is formed under the leaking water guide wall 145. The water discharge portion 121 is formed such that the upper end of the supplied water guide wall 125 is spaced from the leaking water guide wall 145.

A dishwasher 1 according to an exemplary embodiment of the present invention includes a sump 60 where the wash water sprayed to the tub 10 collects and a drain pipe 71 that guides the wash water collecting in the sump 60 and the case 100 may include a drain pipe connection port 177 connected with the drain pipe 77 so that condensed water in the case 100 drops and flows into the drain pipe 71.

The drain pipe 71 is connected with the sump 60. The drain pipe 71 discharges wash water to the outside of the cabinet 2. The drain pipe 71 may be connected with a sewer. The wash water flowing through the drain pipe 71 may be wash water that has been contaminated. The case 100 is connected with the drain pipe 71. The case 100 includes the drain pipe connection port 177 to which the drain pipe 71 is connected. For example, the drain pipe connection port 177 may be divided into a portion through which wash water flows inside and a

portion through which wash water is discharged. The drain pipe 71 may be a pipe connecting the sump 60 and the case 100. The drain pipe 71 may be a pipe connected with the case 100 and discharging wash water to the outside.

The drain pump 70 is connected with the drain pipe 71 and pressurizes wash water to discharge it. Condensed water is produced in the case 100. The condensed water may be discharged to the communicating hole 100a and flows into the tub 10. The condensed water can be discharged through the drain pipe 71. The condensed water can be discharged through the drain pipe 71.

The case 100 according to an exemplary embodiment of the present invention includes a drain wall 177 that bends so that the wash water supplied from the drain pipe connection port 177 flows upward and is then discharged downward and the drain wall 177 may have a condensed-water inlet 179a that is open so that the condensed-water in the case 100 flows inside through it.

The drain wall 177 through which the wash water flowing inside through the drain pipe connection port 177 flows is formed in the case 100. The drain wall 177 may be formed in the U-shape. The bending portion of the drain wall 177 is disposed upward. The condensed-water

inlet 179a is formed over the drain wall 177.

The case 100 according to an exemplary embodiment of the present invention may include a condensed-water wall 181 surrounding the outer side of the reusing section 110 and connected with the condensed-water inlet 179a so that the condensed-water produced on the side of the reusing section 110 flows down into the condensed-water inlet 179a. The condensed-water wall 181 may bend substantially in the L-shape. The condensed-water wall 181 extends downward around the top and the side of the reusing section 110. The lower end of the condensed-water wall 181 is connected with the drain wall 177. The condensed-water wall 181 guides the condensed-water produced in the case 100 to the condensed-water inlet 179a.

The case 100 according to an exemplary embodiment of the present invention may include a drain check valve 183 disposed between the condensed-water wall 181 and the reusing section 110 and stopping the wash water flowing through the drain pipe 171 from flowing inside the condensed-water wall 181. The drain check valve 183 is disposed between the condensed-water wall 181 and the reusing section 110.

The condensed-water produced outside the reusing section 110 flows to the drain wall 177 through the condensed-water channel formed

between the reusing section 110 and the condensed-water wall 181. The condensed-water check valve opens the condensed-water channel in order to allow condensed-water to flow down and keep flowing outside through the condensed-water inlet 179a. The condensed-water check valve stops the wash water flowing in the drain pipe connection port 177 from flowing into the condensed-water channel through the condensed-water inlet. The drain check valve 183 opens, when fluid flows down, and it closes, when fluid flows up.

A dishwasher 1 according to an exemplary embodiment of the present invention may include a tub 10 to which wash water is sprayed and which has a tub hole 10a open to discharge internal air to the outside, a sump 60 where the wash water sprayed to the tub 10 collects, and a case 100 that has a storage space, where the wash water collecting in the sump 60 and flowing therein is stored, and has a communicating hole 100a that communicates with the tub hole 10a so that wash water leaking from the storage space is discharged down to the tub 10.

The dish washer 1 according to an exemplary embodiment of the present invention includes a tub 10 having a tub hole 10a open to discharge internal air to the outside, a sump 60 collecting the wash water sprayed to the tub 10, a reusing section having a storage space for

storing the wash water collecting in the sump 60, and a case 100 having a communicating hole 100a, which communicates with the reusing section 110 and the tub hole 10a, and an over-stored water discharge channel 144 that guides wash water oversupplied to the reusing section 110 to the communicating hole 100a. A communicating wall 143 defines the reusing section 110 and the over-stored water discharge channel 144.

A dishwasher 1 according to an exemplary embodiment of the present invention includes a tub 10 forming a dishwashing space and a sump 60 collecting the wash water sprayed to the tub 10, in which the wash water supplied from the outside and the wash water collecting in the sump 60 are separately stored and the spaces for the separation storage communicates with the communicating hole 100a open at the side of the tub 10.

FIG. 1 is a perspective view showing the external shape of the dishwasher 1 according to an exemplary embodiment of the present invention, FIG. 2 is a cross-sectional view showing the inside of the dishwasher 1 according to an exemplary embodiment of the present invention, and FIG. 3 is a perspective view schematically showing the case 100 and other components of the dishwasher 1 according to an exemplary embodiment of the present invention.

Referring to FIGS. 1 to 3, a cabinet 2 forms the external appearance of the dishwasher 1 and provides a structure for accommodating parts. The front of the cabinet 2 is open. The tub 10 into which wash water is sprayed is disposed in the cabinet 2. A user puts dishes into the tub 10. The door 3 opens/closes the front of the tub 2. The door 3 closes the tub 10. The door 3 pivotably coupled to the front of the cabinet 2.

The tub 10 is disposed inside the cabinet 2. The front of the tub 10 is closed by the door 3. Wash water is sprayed into the tub 10. A wash arm 20 spraying wash water is disposed in the tub 10. A rack that holds dishes is disposed in the tub 10. The rack can be moved forward/backward in the tub 10.

It is preferable that a plurality of racks is provided. The rack includes a top rack 11 and a bottom rack 13. The wash water sprayed into the tub 10 collects into the sump 60. A filter assembly 50 filters foreign substances in wash water. The drain pipe 71 is connected with the sump 60. The drain pipe 71 discharges wash water collected in the sump 60. The drain pipe 71 is connected with the drain pump 70. The drain pump 70 pressurizes and sends wash water to the drain pipe 71.

The sump 60 is supplied with wash water from the outside. The

sump 60 is connected with a wash arm pipe 30 through which the collecting wash water flows to the wash arm 20. The sump 60 is disposed at the bottom of the tub 10. The sump 60 is equipped with the filter assembly 50 filtering foreign substances in wash water. The case 100 is disposed outside the tub 10. Preferably, the case 100 may be fastened to a side of the tub 10. In an exemplary embodiment of the present invention, the case 100 is fastened to a side of the tub 10. The reusing section 110 is formed inside the case 100. The reusing section 110 may be defined by walls inside the case 100.

The reusing section 110 stores the wash water flowing from the sump 60 after collecting therein. The reusing section 110 discharges the stored wash water back to the sump 60. The reusing section 110 may be connected with a reusing pipe 150. The recycling pipe 150 is a pipe that is disposed between the reusing section 110 and the sump 60 and through which wash water flows. The water storing unit 120 is formed inside the case 100. The water storing section 120 may be defined by walls. The water storing section 120 is separated from the reusing section 110.

The water storing section 120 stores wash water supplied from the outside. The water storing section 120 may be connected with a

water supply pipe 41. The water supply pipe 41 is a pipe through which water supplied from the water equipment of a house flows. The water storing section 120 is connected with a supply pipe connection port 130. The supply pipe connection port 130 is a pipe through which the wash water in the water storing section 120 flows to the sump 60. The case 100 may have a structure with two sides, of which any one is fastened to the tub 10 and the other covers it. A communicating hole 100a may be formed through the side fastened to the tub 10.

The wash pump 45 pressurizes and sends the wash water in the sump 60 to the wash arm pipe 30. The wash arm pipe 30 is connected with the wash arm 20. The wash arm 20 includes nozzles spraying wash water. The wash water sprayed from the wash arm 20 washes dishes. The wash arm pipe 30 is connected with the wash pump 45. It is preferable that a plurality of wash arms 20 is provided at predetermined heights.

For example, the wash arm 20 may include an upper arm 21 at the highest, a lower arm 25 at the lowest, and a middle arm 23 between the upper arm 21 and the lower arm 25. The wash arm pipe 30 may include an upper arm pipe 31, a middle arm pipe 33, and a lower arm pipe 35. The upper arm 21 receives wash water through the upper arm pipe 31

from the wash pump 45. The middle arm 23 receives wash water through the middle arm pipe 33 from the wash pump 45. The lower arm 25 receives wash water through the lower arm pipe 35 from the wash pump 45.

The wash water discharged from the wash pump 45 can be guided to at least one of the wash arm pipes 30 by a flow switch unit 320. The flow switch unit 320 is disposed between the wash arm pipes 30 and the wash pump 45.

FIG. 8 is a block diagram showing the relationship between a control unit 300 and other components according to an exemplary embodiment of the present invention and FIG. 9 is a block diagram schematically showing the channel of wash water in a dishwasher 1 according to an exemplary embodiment of the present invention, in which the solid lines show the channel of wash water in common wash cycle and rinse cycle, the dotted lines show the channel through which wash water is stored into the reusing section 110, and the one-dotted lines show the channel through which wash water is discharged from the reusing section 110 to be reused. Further, FIG. 10 is a perspective view showing a rotary plate 323 of the channel switch unit 320 according to an exemplary embodiment of the present invention.

Referring to FIGS. 8 to 10, the dishwasher 1 according to an exemplary embodiment of the present invention includes a tub 10 forming a dishwashing space, a plurality of wash arms 20 disposed in the tub 10 and spraying wash water, a plurality of wash arm pipes 30 connected with the wash arms 20, respectively, and supplying wash water, a reusing pipe 150 diverging from at least any one of the wash arm pipes 30, and a reusing section 110 storing the wash water supplied through the reusing pipe 150.

The tub 10 is disposed inside the cabinet 2 and forms a space where dishes are washed. The wash arms 20 are disposed in the tub 10. The wash arms 20 is disposed at predetermined heights and spray wash water. The wash arms 20 have nozzles. The nozzles are disposed at the end of the channel through which wash water flows.

The wash arm pipes 30 are pipes provided to supply wash water to the wash arms 20. The wash arm pipes 30 are provided for the wash arms 20, respectively. The channel switch unit 320 to be described below can open or close any one of the wash arm pipes 30. The reusing pipe 150 is connected with any one of the wash arm pipes 30. The wash water flowing through the wash arm pipes 30 can flow to the reusing pipe 150.

The reusing section 110 is connected with the reusing pipe 150. The wash water flowing through the wash arm pipes 30 flows into the reusing section 110 through the reusing pipe 150. The control unit 300 measures the flow rate of wash water flowing inside from the water supply pipe 41 by controlling a flow meter 163. When the flow rate of wash water flowing inside is larger than a predetermined amount, the water supply pipe 43 is closed. The control unit 300 controls a drain pump 70. The control unit 300 makes the wash water, which collects in the sump 60, be discharged to the outside by driving the drain pump 70 at a predetermined time. The drain pump 70 is connected with a drain pipe 71.

An input unit 300 is connected with the control unit 300. The input unit 300 has a plurality of buttons and/or dials for a user to select operation options of the dishwasher 1.

The wash arm pipes 30 according to an exemplary embodiment of the present invention includes an upper arm pipe 31 connected with an upper arm 21 at the highest position in the wash arms 20 and the reusing pipe 150 can diverge from the upper arm pipe 31.

The wash arms 20 are provided at predetermined heights. The wash arms 20 are the upper arm 21 at the highest position, a lower arm

25 at the lowest position, and a middle arm 23 at the middle position. The wash arm pipes 30 are connected with the wash arms 20. The upper arm pipe 31 is a pipe for supplying wash water to the upper arm 21. The middle arm pipe 33 is a pipe for supplying wash water to the middle arm 23. The lower arm pipe 35 is a pipe for supplying wash water to the lower arm 25. The reusing pipe 150 may be connected with any one of the wash arm pipes 30. Preferably, the reusing pipe 150 is connected with the upper arm pipe 31.

The dishwasher 1 according to an exemplary embodiment of the present invention includes the channel switch unit 320 that controls the channel of wash water so that wash water is selectively supplied to the wash arm pipes 30 and the channel switch unit 320 can allow wash water to be supplied to the upper arm pipe 31, when the wash water is stored into the reusing section 110. The channel switch unit 320 connects the channel through which wash water flows with the upper arm pipe 31, when the wash water is stored into the reusing section 110.

The channel switching unit 320 controls wash water so that the wash water can selectively flow to the wash arms 20. The channel switch unit 320 selectively sends the wash water sent under pressure by the wash pump 450 to at least one of the upper arm pipe 31, the middle

arm pipe 33, and the lower arm pipe 35.

The channel switch unit 320 includes a channel switch motor 321 generating torque and a rotary plate 323 controlling the flow of wash water while rotated by the channel switch motor 321. The rotary plate 323 selectively opens/closes a plurality of connection taps (not shown) at the point where the wash arms 20 diverge.

A plurality of switch holes 325a and 325b is formed through the rotary plate 323. The switch holes 325a and 325b include a first switch hole 325a circumferentially extending and a second switch hole 325b formed in a circle. The rotary plate 323 is rotated in stages by the channel switch motor 321. As the rotary plate 323 is rotated by the channel switch motor 321, the switch holes 325a and 325b of the rotary plate 323 move to the position corresponding to at least one of the connection taps and the wash water from the wash pump 45 is sprayed through at least one of the wash are pipes 30.

The channel switch motor 321 rotates the rotary plate 323 in stages by generating torque. It is preferable that the channel switch motor 321 is a step motor that progresses at a predetermined angle with every change in excitation state responding to an input pulse signal and stops and keeps a predetermined position without the excitation state

changed. The control unit 300 controls the channel switch motor 321. The control unit 300 adjusts the position of the rotary plate 323 by driving the channel switch motor 321.

The dishwasher 1 according to an exemplary embodiment of the present invention includes the wash pump 45 that pressurizes and sends wash water to the wash arm pipes 30 and an upper arm nozzle 21a disposed on the upper arm 21 and spraying wash water, in which the wash pump 45 pumps wash water up to a height lower than the upper arm nozzle 21a, when the wash water is stored into the reusing section 110.

The wash pump 45 pressurizes the wash water collecting in the sump 60. The wash pump 45 pressurizes and sends the wash water to the channel switch unit 320. A plurality of upper arm nozzles 21a is disposed in the upper arm 21. The upper arm nozzles 21a are disposed at the end of the wash water channel through which wash water flows. The output of the wash pump 45 is controlled. The output of the wash pump 45 determines the flow rate of fluid that indicates the volume of liquid that can be sent out per unit time.

The output of the wash pump 45 determines the height to which wash water can be pumped up. The control unit 300 controls the output

of the wash pump 45. The control unit 300 controls the height of pumped-up height of wash water. The control unit 300 controls the lift of the wash pump 45 such that wash water is not sprayed from the upper arm nozzles 21a.

The dishwasher 1 according to an exemplary embodiment of the present invention may include a reusing valve 153 that is disposed in the reusing pipe 150 and opens/closes the channel between the wash arm pipe 30 and the reusing section 110.

The reusing valve 153 opens, when wash water flows to the reusing section 110. The reusing valve 153 opens, when wash water flows to the wash arm pipe 30. The reusing valve 153 closes, when storing of wash water is finished. The reusing valve 153 is controlled by the control unit 300. The control unit 300 opens the reusing valve 153, when wash water is stored. The control unit 300 opens the reusing valve 153, when wash water is discharged. The control unit 300 closes the reusing valve 153, when storing of wash water is finished. The control unit 300 closes the reusing valve 153, when wash water needs to be sprayed to the tub 10.

A dishwasher 1 according to an exemplary embodiment of the present invention includes a tub 10 forming a dishwashing space, a sump

60 where the wash water sprayed to the tub 10 collects, a reusing section 110 having a space for storing the wash water collecting in the sump 60, and a wash pump 45 pumping up wash water at a pressure, at which wash water is not sprayed from a wash arm 20, to the wash arm 20 and the reusing section 110.

The wash pump 45 pressurizes the wash water in the sump 60 and is connected with the wash arm 20 and the reusing section 110 so that the pressurized wash water can flow to both of the wash arm 20 and the reusing section 110. The dishwasher 1 may include a control unit 300 that controls the output of the wash pump 45 to pressurize wash water up to a pressure at which wash water is not sprayed from the wash arm 20, when wash water is stored in the reusing section 110.

FIG. 11 is a flowchart illustrating a method P100 of storing wash water in a method of controlling the dishwasher 1 according to an exemplary embodiment of the present invention. Referring to FIG. 11, a method of controlling the dishwasher 1 according to an exemplary embodiment of the present invention, which is a method of controlling the dishwasher 1 including a plurality of wash arms 20 disposed in a tub 10 and spraying wash water and a plurality of wash arm pipes 30 connected with the wash arms 20, respectively, includes a step of collecting wash

water sprayed from the wash arms 20 into a sump 60 (S101), a step of driving a wash pump 45 that pressurizes the wash water collecting in the sump 60 (S103), a step of sending the pressurized wash water to the wash arm pump 30 connected with a reusing pipe 150 in the wash arm pipes 30 (S105), and a step of storing the wash water flowing through the wash arm pipe 30 to a reusing section 110 connected with the reusing pipe 150 (S107).

The method P100 of storing wash water into the reusing section 110 may be performed after a wash cycle or a rinse cycle. Preferably, it is performed after the final rinse cycle in which relatively clean water collects in the sump 60.

The wash water pressurized by the wash pump 45 in the rinsing is discharged through the wash arm 20. The method P100 of storing wash water may start with the step (S101) in which the wash water sprayed from the wash arm 20 is sprayed to the tub 10 and collected into the sump 60. The control unit 300 recognizes a predetermined time to store wash water. For example, the control unit 300 can recognizes it as a step of storing wash water, after the final rinse cycle is finished.

The control unit 300 can determine that wash water has collected in the sump 60, when a predetermined time passes after the operation of

the wash pump 45 finishes. Thereafter, the control unit 300 performs a step (S103) of pumping up wash water by driving the wash pump 45. A plurality of wash arm pipe 30 is provided, and in an exemplary embodiment of the present invention, any one of the wash arm pipes 30 is connected with the reusing pipe 150. The pressurized wash water is discharged from the wash pump 45 and then undergoes the step S105 in which it flows through the wash arm pipe 30 connected with the reusing pipe 150. The wash water flowing through the wash arm pipe 30 flows to the reusing pipe 150 connected with the wash arm pipe 30 and undergoes the step S107 in which it is stored in the reusing section 110.

The method of controlling the dishwasher 1 according to an exemplary embodiment of the present invention may include the step S103 of opening the reusing valve 153 that opens/closes the channel of the reusing pipe 150 so that the wash water flowing through the wash arm pipe 30 can flow to the reusing pipe 150. The control unit 300 gives the reusing valve instructions to open and close. The control unit 300 opens the reusing valve 153, when recognizing that it is the time to store wash water, and it closes the reusing valve 153, when storing of wash water is finished.

The method of controlling the dishwasher 1 according to an

exemplary embodiment of the present invention may include a step of closing the reusing valve 153 and stopping the wash pump 45 (S109), after performing the step of storing wash water into the reusing section 110 (S107). The control unit 300 closes the reusing valve 153, when storing of wash water is finished (S203).

The control unit 300 can recognize that storing is finished, when a predetermined condition is satisfied. For example, the control unit may determine it by sensing the flow rate of wash water flowing through the reusing pipe 150. Further, for example, the control unit may determine that storing is finished, when a predetermined time passes.

The control unit 300 controls the operation of the wash pump 45. The control unit 300 may stop the wash pump 45, when a predetermined time passes. As another example, the control unit 300 stops the wash pump 45, when a predetermined amount of wash water flows into the reusing section 110 (S109).

The method of controlling the dishwasher 1 according to an exemplary embodiment of the present invention may include a switching step of controlling the channel switch unit 320 so that the wash water from the wash pump 45 flows to the upper arm pipe 31 connected with the upper arm 21 at the highest position in the wash arms 20 (S103). In

the step of driving the wash arm (S103), the control unit 300 controls the output of the wash pump 45 to a level at which wash water is not sprayed from thee upper arm 21.

The channel switch unit 320 can be set such that wash water flows to the upper arm pipe 31. The control unit 300 drives the channel switch unit 320. The control unit 300 drives the channel switch motor 321. The control unit 300 sets the direction of a channel by operating the channel switch motor 321 as much as needed. In an exemplary embodiment of the present invention, when wash water is stored into the reusing section 110, the control unit 300 controls the channel switch unit 320 such that wash water flows to the upper arm pipe 31.

FIG. 12 is a flowchart illustrating a method P200 of reusing wash water in a method of controlling a dishwasher 1 according to an exemplary embodiment of the present invention.

Referring to FIG. 12, in a method of controlling the dishwasher 1 including a wash arm 20 disposed in a tub 10 and spraying wash water and a wash arm pipe 30 connected with the wash arm 20 to supply wash water to the wash arm 20, the method of controlling the dishwasher 1 according to an exemplary embodiment of the present invention includes a step of opening a reusing valve 153 that opens/closes a reusing pipe

150 connected with a reusing section 110 storing wash water, which is sprayed to the tub 10 and collected in a sump 60 (S201), a step of collecting the wash water, which flows in the reusing pipe 150, into the sump 60 through the wash arm pipe 30 connected with the reusing pipe 150 (S203), a step of closing the reusing valve 153 when a predetermined time passes (S205), and a step of driving a wash pump 45 to pressurize and send the wash water in the sump 60 to the wash arm 20 (S207).

The reusing section 110 is connected with the reusing pipe 150. The reusing pipe 150 is connected with the wash arm pipe 30. Preferably, the reusing pipe 150 is connected with the upper arm pipe 31. The method P200 of reusing wash water may start with the step of opening the reusing valve 153 (S201). For example, the point of time to reuse wash water may be a main wash step of putting in a detergent or may be a pre-wash step of removing foreign substances on dishes before putting in the detergent.

The point of time to reuse wash water is set in advance. The control unit 300 opens the reusing valve 153, when recognizing the point of predetermined reuse time. When the reusing valve 153 is opened, the wash water in the reusing section 110 flows through the reusing pipe 150.

The reusing pipe 150 is connected with the wash arm pipe 30 and the wash arm pipe 30 is connected with the sump 60. The wash water flowing through the reusing pipe 150 undergoes the step S203 in which it collects into the sump 60 through the wash arm pipe 30.

The control unit 300 recognizes that the wash water has been discharged, when a predetermined time passes after opening the reusing valve 153. The plan of using wash water may depend on the time to reuse it. Accordingly, not only the case of discharging wash water at a time, but also a way of discharging wash water in steps may be applied.

The control unit performs the step of closing the reusing valve 153 (S205), when a predetermined condition is satisfied. The step of closing the reusing valve 153 (S205) may be performed before the step of driving the wash pump 45 (S207).

The control unit 300 recognizes that wash water has collected in the sump 60, when predetermined conditions are satisfied. The predetermined condition may be the flow rate of wash water or the open time of the reusing valve 153. Thereafter, the control unit 300 performs a predetermined next cycle. For example, the predetermined next cycle may be a main wash cycle, a pre-wash cycle, or a rinse cycle. The control unit 300 performs the step of supplying wash water to the wash

arm 20 by driving the wash pump 45 (S207).

The operation of the dishwasher 1 with the configuration described above according to an exemplary embodiment of the present invention is described hereafter.

Wash water is sprayed and discharged to the tub 10 from the wash arm 20 by the wash pump. The wash water sprayed to the tub 10 drops and collects into the sump 60. The wash water collecting in the sump 60 can flow to the reusing pipe 150 by the wash pump 45. The wash water flowing through the reusing pipe 150 is stored into the reusing section 110 through the reusing pipe connection port 151.

When the wash water is stored in the reusing section 110, the air in the reusing section 110 is discharged through the reusing-communicating portion 111. On the other hand, the wash water oversupplied to the reusing section 110 overflows through the reusing-communicating portion 111. The wash water overflowing through the reusing-communicating section 111 flows down into the tub 10 through the communicating hole 100a. Further, the air discharged through the reusing-communicating portion 111 is discharged to the air discharge port 149.

The condensed-water on the side of the reusing section 110 flows

down along the condensed-water wall 181 and is then discharged to the condensed-water inlet 179a. Further, the wash water in the sump 60 may be pressurized and discharged to the outside by the drain pump 70. The wash water flows into the drain pipe connection port 177 through the drain pipe 71. The wash water is discharged to the outside together with the condensed-water flowing inside through the condensed-water inlet 179a. Further, the wash water supplied from the outside flows into the water inlet port 161 through the water supply pipe 41. The wash water flows along the water supply wall 165 and is then stored into the water storing section 120. A siphon effect can be prevented by the anti-siphon hole 165a. Wash water may leak through the anti-siphon hole 165a, but the leaking wash water is discharged to the tub 10 through the communicating hole 100a.

When the wash water stored in the water storing section 120 becomes over a predetermined water level, it drops through the water discharge portion 121 and flows to the water softener connection port 131. The wash water discharged from the water softener connection port 131 flows to the sump 60 through the water softener 81. The reusing container connection port 133 is formed at the bottom of the water storing section 120 and periodically supplies wash water to the

reusing container 83. The fastening holes 191 are formed at one side of the case 100 for fastening to the tub 10. Further, leakage of water through the fastening hole 191 can be prevented by the waterproofing walls 193.

The case 100 can store wash water collected in the sump 60 and can discharge it, if necessary, such that wash water can be reused. Accordingly, the consumption of wash water is reduced. Further, since the case 100 can be reduced in size and weight by integrally forming the water storing section 120 and the reusing section 110, the size of the entire dishwasher 1 can be reduced. Further, it is possible to save energy for heating wash water, because the wash water reaches the room temperature, when kept for a long time at the room temperature.

Further, the wash water pressurized by the wash pump 45 is sprayed from the wash arm 20 and discharged to the tub 10. The wash water sprayed to the tub 10 drops and collects into the sump 60. When the control unit 300 recognizes that it is the step of storing wash water, it opens the reusing valve 153 and sets a channel so that wash water can flow to the upper arm pipe 31 by driving the channel switch motor 321. Thereafter, the control unit 300 drives the wash pump 45.

However, the wash water can flow to both of the upper arm pipe

31 and the reusing pipe 150. That is, when the output of the wash pump 45 is too high, wash water is sprayed to the tub 10 through the upper arm 21. Further, when the output of the wash pump 45 is too low, a sufficient amount of water cannot be stored in the reusing section 110. Accordingly, the control unit 300 needs to drive the wash pump 45 such that water is not discharged from the upper arm pipe 31 or the water level is lower than the upper arm nozzle 21a.

The control unit 300 finishes storing, when a predetermined time passes or a predetermined amount of wash water is stored in the reusing section 110. The control unit 300 closes the channel by operating the reusing valve 153 and finishes storing by stopping the wash pump 45.

According to a method of reusing the stored wash water, the control unit 300 opens the reusing valve 153 at a predetermined time. For example, the control unit 300 opens the reusing valve 153, before the wash and/or rinse step starts. When the reusing valve 153 is opened, the wash water in the reusing section 110 is dropped and discharged by the gravity. The wash water is discharged to the sump 60 through the upper arm pipe 31. When the wash water is completely discharged from the reusing section 110, the control unit 300 closes the channel formed by the reusing pipe 150 by driving the reusing valve 153.

Thereafter, the control unit 300 performs the wash cycle by driving the wash pump 45.

It is possible to save wash water by reusing the wash water with the configuration described above. Further, it is possible to save energy for heating wash water, because the temperature of the wash water reaches the room temperature, when kept for a long time at the room temperature.

Although exemplary embodiments of the present invention are illustrated and described above, the present invention is not limited to the specific exemplary embodiments and may be modified in various ways by those skilled in the art without departing from the scope of the present invention described in claims, and the modified examples should not be construed independently from the spirit of the scope of the present invention.

What is claimed is;

1. A dishwasher comprising:

a tub forming a dishwashing space;

a plurality of wash arms disposed in the tub and arranged to spray wash water;

a plurality of wash arm pipes connected with the wash arms, respectively, and arranged to supply wash water;

a reusing pipe diverging from at least any one of the wash arm pipes; and

a reusing section arranged to store wash water supplied from the reusing pipe.

2. The dishwasher of claim 1, wherein the wash arm pipes include an upper arm pipe connected with an upper arm at the highest position in the wash arms, and

the reusing pipe diverges from the upper arm pipe.

3. The dishwasher of claim 2, comprising a channel switch unit that connects a channel, arranged for wash water to flow through, with the upper arm pipe, when wash water is stored into the reusing section.

4. The dishwasher of claim 2, further comprising:

a wash pump arranged to pressurize and send wash water to the wash arm pipe; and

an upper arm nozzle that is disposed on the upper arm and arranged to spray wash arm,

wherein the wash pump is arranged to pump up wash water lower than the upper arm nozzle, when the wash water is stored into the reusing section.

5. The dishwasher of any preceding claim, further comprising a reusing valve that is disposed in the reusing pipe and is arranged to open/close the channel between the wash arm pipe and the reusing section.

6. A dishwasher comprising:

a tub forming a dishwashing space;

a sump arranged for wash water sprayed to the tub to collect;

a wash arm arranged to spray the wash water collecting in the sump to the tub;

a reusing section having a storage space for storing the wash water in the sump; and

a wash pump pressurizing wash water up a pressure at which wash water is not sprayed from the wash arm, and sending the wash water to the wash arm and the reusing section.

7. A method of controlling a dishwasher including a plurality of wash arms disposed in a tub and arranged for spraying wash water, a plurality of wash arm pipes connected with the wash arms, respectively, and a channel switch unit arranged to selectively supply wash water to at least any one of the wash arm pipes, the method comprising:

collecting wash water, which is sprayed from the wash arms, into a sump;

pressurizing the wash water collecting in the sump by driving the wash pump;

sending the wash water to the wash arm pipe connected with a reusing pipe in the wash arm pipes; and

storing the wash water, which flows through the wash arm pipe, into a reusing section connected with the reusing pipe.

8. The method of claim 7, further comprising opening a reusing valve that opens/closes the channel of the reusing pipe.

9. The method of claim 8, further comprising closing the reusing valve after the storing of wash water into the reusing section.

10. The method of claim 8, further comprising stopping the wash pump after the storing of wash water into the reusing section.

11. The method of claim 7, further comprising supplying the wash water, which is discharged from the wash pump, to the upper arm pipe connected with the upper arm at the highest position in the wash arms by driving the channel switch unit.

12. The method of claim 11, wherein the driving of the wash pump is to drive the wash pump such that wash water is not sprayed from the upper arm.

13. A dishwasher or method of controlling a dishwasher substantially as hereinbefore described with reference to the accompanying drawings.

Intellectual Property Office

Application No:	GB1402332.9	**Examiner:**	Rhodri Evans
Claims searched:	1-13	**Date of search:**	11 August 2014

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-12	US 2012/145200 A (Jerg) figure 1 and paragraphs 0090-0096.
X	1-12	EP 2510865 A (Miele) all figures and WPI abstract accession number 2012-N23242.
X,E	1-5	WO 2014/097157 A1 (Bitron) all figures and lines 23-30 of page 3.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A47L

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
A47L	0015/42	01/01/2006