United States Patent

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[54] **DISHWASHER WITH IMPROVED MEANS FOR REDUCING LIQUID CARRYOVER**
9 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **239/251,** 137/519
[51] **Int. Cl.** **B05b 3/06**
[50] **Field of Search** ..... 239/251, 262, 569, 570; 137/107, 519; 251/(Inquired)

[56] **References Cited**

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ABSTRACT: A dishwasher is provided with improved means for reducing the amount of wash or rinse water carried over from one cleaning operation to the next. A valve positioned in the conduit leading to the spray means of the dishwasher opens after each cleaning operation while the wash or rinse water is being emptied to the drain. The opening of the valve allows the spray means and the supply conduit to empty so that very little water is trapped in them for mixing with the fresh water introduced for the next cleaning operation. The illustrated valve comprises a resilient member which is held over an opening in the conduit wall by the water pressure during each cleaning operation but which drops away from the opening and permits drainage therethrough when the water pressure in the conduit is relieved.

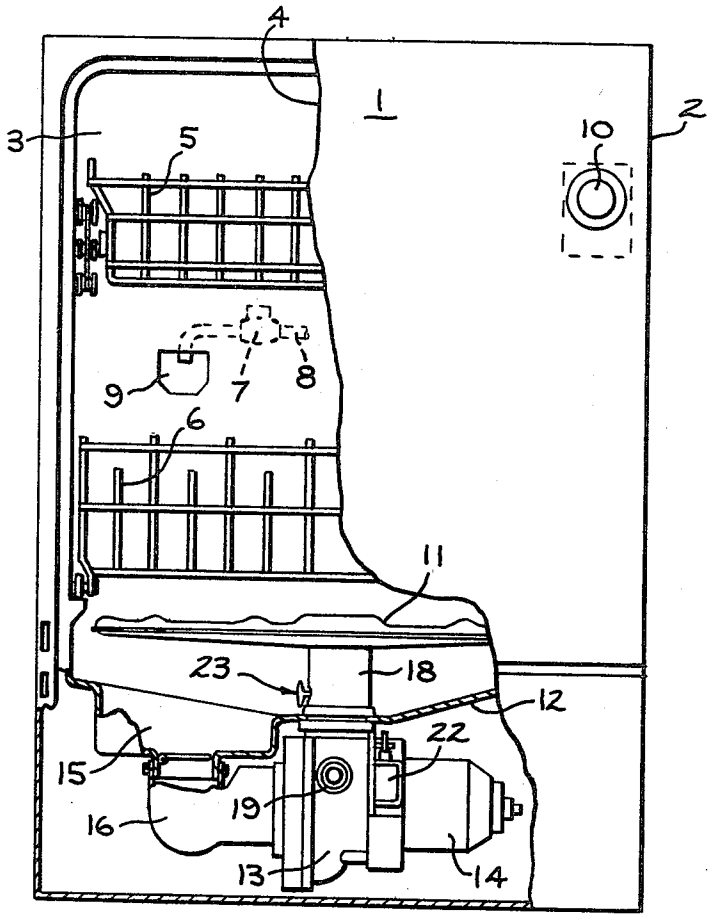


FIG. 1

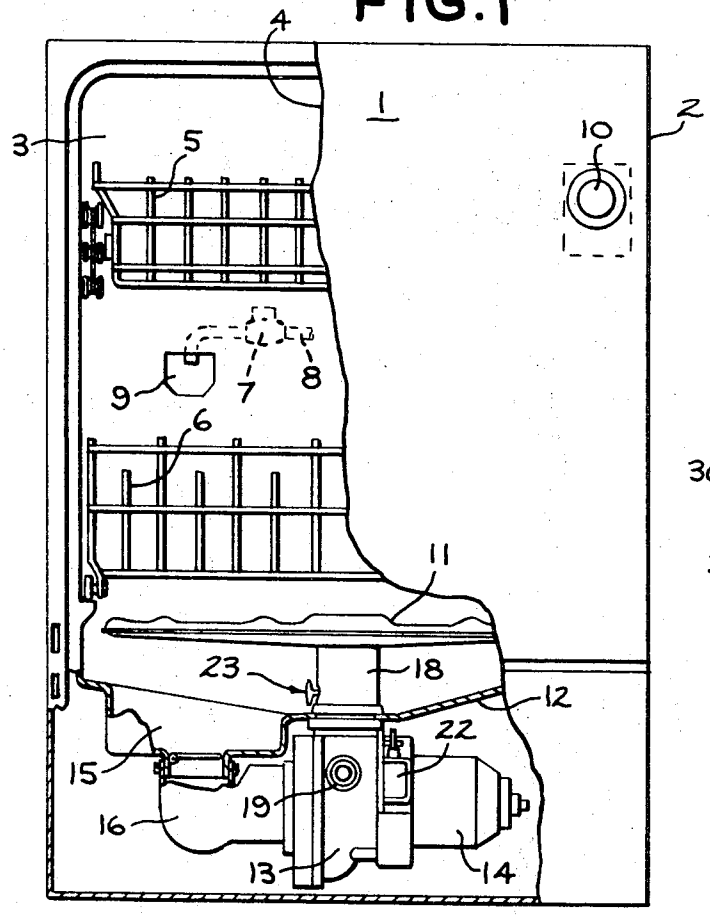


FIG. 5

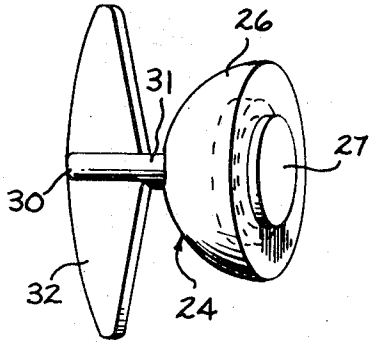


FIG. 6

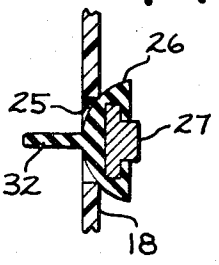
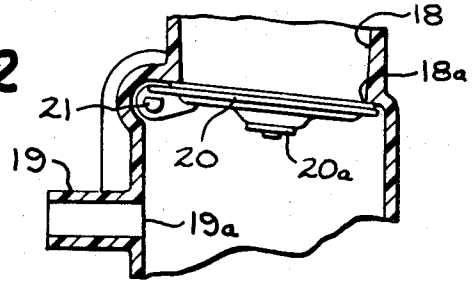


FIG. 2



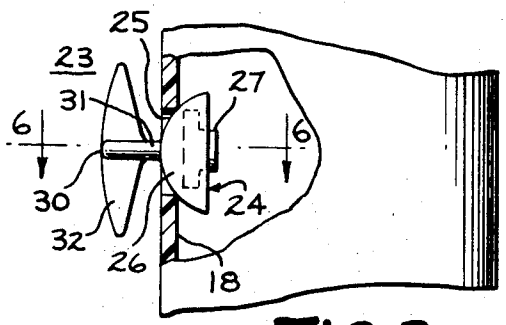
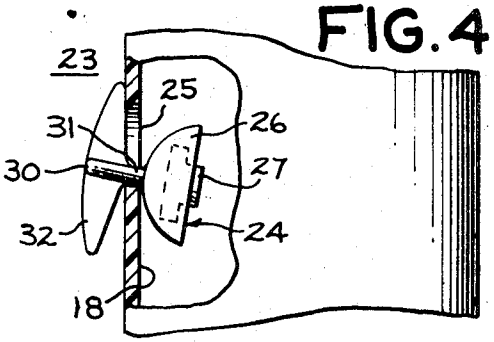


FIG. 3

FIG. 4



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DISHWASHER WITH IMPROVED MEANS FOR REDUCING LIQUID CARRYOVER

BACKGROUND OF THE INVENTION

This invention relates to automatic dishwashing machines and more particularly to such machines intended for household use.

In automatic dishwashing machines intended for household use, the cleaning of the dishes is ordinarily carried out in a single wash chamber. The dishes are placed in the chamber and then are subjected to a series of washing and rinsing operations, followed ordinarily by a drying operation. After each washing or rinsing step, the used water is emptied from the wash chamber and fresh water is then introduced into the machine for the next operation.

There is a problem, however, in this sequential draining and refilling of the machine in that a certain amount of the used water is trapped in the machine, particularly in the spray means and its supply line, and does not get emptied during the drain operation. The problem occurs especially in machines having a single recirculation and drain pump with a diverter valve for switching the pump output from the spray means to the drain line and vice versa. The water trapped in the spray means upon the operation of the diverter valve to the drain position is carried over to the next operation and mixes with the fresh water introduced for that operation. The trapped water may contain detergent or food particles and thus to a certain extent acts as a contaminant to the fresh water. The greater the amount of the used water carried over from operation to operation, the greater the number of clean water fills which are required to reach an allowable level of detergent and food particles in the final rinse. Thus, reducing the water carryover would not only reduce water usage but might also allow reduction in the number of rinses and the total cleaning time required by the machine.

SUMMARY OF THE INVENTION

It is a general object of my invention to provide a new and improved dishwasher which includes water control means for reducing the level of water carried over from one washing or rinsing operation to the next.

A more specific object of my invention is to provide such a dishwasher in which the control means for reducing water carryover does not require any mechanical or electrical actuators but rather is operated automatically by a change in the water pressure otherwise present in the machine.

In one preferred form of my invention, I provide a dishwasher having a washing compartment for accommodating the dishes to be washed. Spray means are positioned in the compartment for circulating liquid through it to wash the dishes. The liquid sprayed onto the dishes falls to the bottom of the chamber and is recirculated to the spray means by a pump whose inlet in connected to a sump in the bottom wall in the compartment. After each spray operation, i.e., each washing or rinsing operation, the liquid is then exhausted from the machine through a suitable drain.

By my invention the conduit connecting the pump to the spray means is provided with a valve which leads from the conduit to the washing compartment. This valve is closed during each spray operation but is adapted to open when the washing liquid is being exhausted to the drain. With the valve open, liquid in the spray means, and in the conduit from the pump to the spray means, is emptied into the wash compartment and is then passed from the compartment to the drain. Thus, very little liquid is carried over in the spray means or its connections from one spray operation to the next.

In my preferred embodiment the valve for reducing liquid carryover includes a valve member which is controlled by the water pressure in the conduit leading to the spray means. When the pump is pumping liquid through the conduit to the spray means, the liquid pressure in the conduit causes the valve to close so that all the liquid passes to the spray means. However, when the washing compartment is being emptied to the drain, there is insufficient pressure in the conduit leading to the spray means to keep the valve closed. The valve therefore opens and the liquid in the spray means and the conduit is emptied into the wash compartment and from there into the drain.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a front elevational view, partially broken away and partially in section, of a household dishwasher embodying one form of my invention;

FIG. 2 is a fragmentary sectional view of a diverter valve incorporated in the dishwasher pump for selectively controlling its output between the dishwasher spray means and the drain;

FIG. 3 is a fragmentary view showing the conduit to the dishwasher spray means and the valve means incorporated therewith to reduce liquid carryover from one spray operation to the next;

FIG. 4 is a view similar to FIG. 3 showing the valve means in its open position;

FIG. 5 is a perspective view of the valve member employed for reducing liquid carryover; and

FIG. 6 is a fragmentary cross-sectional view showing the valve member in its closed position in the conduit wall during the spray operations of the dishwasher.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 of the drawing, I have shown therein an automatic household dishwasher 1 which incorporates an improved liquid control arrangement for reducing the liquid carryover from one washing or rinsing operation to the next. The dishwasher includes a cabinet or housing 2 within which is defined a dishwashing chamber or compartment 3. Access to the washing compartment 3 is obtained by means of a door 4 which pivots about an axis adjacent to its bottom edge so as to open the front of the washing compartment 3. When the door 4 is pivoted to a horizontal position, upper and lower racks 5 and 6 may be pulled partially out of the washing compartment to permit manual loading and unloading of the dishwasher with dishes. It will be understood that suitable sealing means are provided between the door 4 and the front edge of the cabinet 2 so as to prevent escape of water from the washing compartment 3 during the operation of the dishwasher 1.

The supply of wash and rinse water to the washing compartment 3 is controlled by means of a solenoid valve 7 positioned in the inlet water line 8 to the machine. When the valve 7 is opened, water is introduced into the wash compartment 3 through an opening 9 in the back wall of the washing compartment. It will be understood that a suitable cover or outer wall is provided behind the opening 9 so as to prevent loss of water from the compartment 3 during the operation of the dishwasher.

The opening and closing of the inlet valve 7 is controlled by means of a sequence timer 10 mounted on the door 4. The timer 10 also serves to control all of the other electrical components of the dishwasher and causes it to progress automatically through a complete dishwashing cycle including an initial rinsing operation, a washing operation, two or more intermediate rinsing operations, and a drying operation.

During the washing and rinsing operations the water introduced into the wash chamber is circulated throughout the chamber so as to wash dishes carried by the racks 5 and 6. This circulation is accomplished by means of a spray arm or head 11 which is rotatably mounted above the bottom wall 12 of the washing compartment 3. The spray arm 11 is supplied with water by a pump 13 which is driven by an electric motor 14. The pump 13 withdraws the wash or rinse water from the washing compartment 3 through a sump or passage 15 which opens through the bottom wall 12 of the compartment. The sump, as shown in FIG. 1, is connected to the intake of pump 13 by means of a flexible conduit 16. It will be noted that the

sump 15 forms the lowest point along the bottom wall 12 so that all the liquid falling from the dishes drains into the sump 15 and from there is passed into the pump 13 through the conduit 16.

The water drawn into the pump 13 through the conduit 16 is discharged by the pump 13 during the washing and rinsing operations through a recirculation conduit or riser 18 which connects to the rotatable spray arm 11. The spray arm 11 discharges the water upwardly in a series of jets which issue from the spray arm 11 through a plurality of orifices (not shown) provided in its upper surface. At least some of the orifices include exit services inclined from the vertical so that a reaction effect is created as the water passes through them. This reaction effect causes the spray arm 11 to rotate and thereby the jets of water discharged from it effectively project or circulate into all areas of the dishwashing compartment 3 to provide effective cleaning of the dishes.

Following each washing or rinsing operation, the water is exhausted from the wash compartment 3 through a suitable drain line or means 19. The pump 13 acts as a drain pump for that purpose, with a suitable diverter valve member in the pump housing being operated by a solenoid under the control of the timer 10 during the drain operations so as to close the recirculation conduit 18 and open the drain line 19. This valve member 20 controlling the output of the pump 13 may be best seen in FIG. 2. As there shown, it comprises a generally circular member or valve plate 20 which is mounted by means of a pivotable shaft 21. The position of the shaft 21 is controlled by means of a solenoid 22 (FIG. 1) so that it is moved between two positions. When the solenoid 22 is energized, the valve member 20 is moved upwardly. This upward movement together with the water pressure created by the pump causes the valve plate 20 to move over a seat 18*a* at the entrance to the recirculation conduit 18 so as to close that conduit. The output of the pump 13 is therefore passed outwardly through the drain line 19. This is, of course, the position of the valve plate 20 during the drain operation. On the other hand, when the solenoid is deenergized, it is spring biased downwardly so that the valve plate 20 is pivoted on the shaft 21 until a valve portion 20*a* on the bottom side of the valve plate 20 closes over the entrance 19*a* of the drain line 19. In this position the recirculation conduit 18 is opened and thus the output of the pump 13 is passed through the recirculation conduit into the spray head 11 with no liquid being pumped out through the drain line 19. This is the position of the valve plate 20 during the washing and rinsing operation.

By my invention the dishwasher 1 includes improved means for reducing the amount of liquid which is carried over from one washing or rinsing operation to the next. The means for reducing liquid carryover comprises a valve means generally indicated at 23 which connects the recirculation conduit to the washing compartment 3 slightly above the bottom wall 12. The location of this valve means 23 may be best seen in FIG. 1.

Referring now to FIGS. 3 and 4, it will be seen that the valve or valve means 23 comprises a preferably resilient valve member 24, which is associated with a vent opening 25 in the wall of the recirculation conduit 18. The valve member 24 includes a hemispherically shaped head portion 26 which has a rounded surface on its side toward the opening 25 and a flat surface on the other side. As shown in FIGS. 2 and 4, the rounded surface is adapted to fit into the opening 25 in the conduit wall so as to close that opening whenever the head portion 26 is pushed against the opening. This closing of the opening 25 occurs whenever the pump 13 is pumping upwardly through the recirculation conduit. At that time there is, of course, considerable water pressure in the conduit and this water pressure acting against the flat rear surface of the valve head 26 causes the valve head to move into the opening 25 in the conduit so that opening is effectively closed. Thus, during the washing or rinsing operations the liquid is not lost out of the vent opening but rather it all passes upwardly into the spray head 11 for distribution throughout the machine. The valve member 24 is preferably formed of rubber and thus provides a good seal over the opening 25 as it is forced against it by the water pressure.

As mentioned above, the valve plate 20 swings upwardly at the end of each washing or rinsing operation so as to close the conduit 18 and open the drain outlet 19. With the pump exhausting through the drain outlet 19 the water pressure in the conduit 18 is substantially relieved. When this happens, the valve member 24 moves away from the opening 25 in the conduit wall as best seen in FIG. 4. With the valve head 26 moved away from the opening 25, any liquid which is trapped in the spray head 11 and the conduit 18 due to the closed position of the valve plate 20, drains or is emptied out of the spray head 11 and the conduit through the opening 25. The liquid drained from the spray head 11 and the conduit 18 flows into the sump 15 and is, of course, exhausted from the sump through the conduit 16 and the pump 13. Thus, during each drain operation, very little liquid is carried over in the spray head 11 and its feed conduit 18 so as to remain in the machine from one washing or rinsing operation to the next.

The resilient valve member 24, as shown in FIGS. 3—6, is provided with a weight 27 which is molded in the head portion 26. The weight 27 causes the head portion to fall away and uncover the opening 25 when the pressure is relieved in the spray head 11 after each wash or rinse operation. Thus, the opening 25 is uncovered automatically as a result of the change in water pressure without any other actuation being required for the valve member.

To retain the valve member in general proximity to the opening 25 when it uncovers the opening 25, it is provided with a tail portion 30 which extends through the opening 25 from the head portion 26. It will be seen that the head portion 30 includes a center rod or shaft portion 31 which extends through the opening from the head 24 and an outer transverse tab or wing 32 which is molded integrally with the shaft. The wing portion 32, from end to end, is longer than the diameter of the opening 25 and thus it prevents the valve member from falling completely away from the opening during the drain operation. Instead as shown in FIG. 4, the wing portion 32 retains the valve head 26 adjacent to the opening 25 such that when the pump again begins to discharge through the recirculation conduit 18, the pressure against the flat rear surface of the head portion 26 causes the head portion 26 to move into the opening 25 to close it.

In one household dishwasher constructed in accordance with the present invention, it has been found that the vent or flowback valve 23 allows about one and one-half pints of water to drain out of the spray head 11 and the recirculation conduit 18 after each spray or rinsing operation. In other words, the carryover from one operation to the next is reduced by about one and one-half pints due to the provision of the automatically opened vent valve 23. It will be understood that the valve 23 also provides for flowback of any leakage passed from the pump past the valve plate 20 during the drain operations. Though this leakage is usually minimal, it is nevertheless undesirable to have it retained in the conduit 18 or the spray head 11. Also, by returning the leakage to the sump 15 for drainage out of the machine, the sealing action of the valve member 20 over the recirculation conduit 18 becomes less critical. A small leakage past valve 20 can be tolerated since the leakage is not retained and carried over to the next operation but rather is merely passed back to the drain and out of the machine.

It will also be noted that the spray head 11 and the conduit or riser 18 are drained during the "pumpout." In other words, they are drained while the pump 13 is passing water to the drain 19. Thus, there is very little water flowing back to the sump 15 after the pumpout is completed. This allows a small sump to be used which is advantageous for both cost and time reasons. Also, by reducing the amount of water carryover, the number of fills to get to an allowable level of detergent and food particles in the final rinse may be reduced. In other words less rinsing operations may be required after the final washing

operation. In any case, whatever the number of fills, a reduction in the total amount of fresh water required to achieve an acceptable concentration of soil and detergent in the final rinse water is obtained

I claim:

1. In a dishwasher having walls enclosing a dishwashing compartment:

a. spray means for circulating liquid through said compartment for washing dishes placed therein;

b. a passage through the bottom wall of said chamber for withdrawing liquid from said chamber;

c. pump means connected to said wash chamber by said passage;

d. a recirculation conduit for passing the output of said pump means to said spray means;

e. drain means for emptying said compartment of liquid;

f. a valve means for connecting said recirculation conduit to said wash compartment adjacent the bottom wall of said compartment; and

g. said valve means being closed whenever the output of said pump means is passing through said recirculation conduit through said spray means and being adapted to open whenever said compartment is being emptied through said drain means, whereby said spray means and said recirculation conduit are substantially emptied of liquid to reduce liquid carryover from one spray operation to the next.

2. The apparatus of claim 1 in which said valve comprises a vent opening through the wall of said recirculation conduit connecting said conduit to said wash compartment between said bottom wall and said spray arm, and a valve member adapted to close said vent opening when said pump means is pumping through said recirculation conduit to said spray means and to uncover said vent opening when said compartment is being emptied through said drain means.

3. The apparatus of claim 2 in which said valve member includes a rounded surface and a flat surface, whereby pressure of liquid against said flat surface will act to force said rounded surface into said vent opening to close said vent opening whenever said pump is pumping through said recirculation conduit.

4. In a dishwasher having walls enclosing a dishwashing compartment:

a. spray means for circulating liquid through said compartment for washing dishes placed therein;

b. a passage through the bottom wall of said chamber for withdrawing liquid from said chamber;

c. pump means connected to said wash chamber by said passage;

d. a recirculation conduit for passing the output of said pump means to said spray means;

e. a drain means for passing the output of said pump to a drain,

f. means for selectively directing the output of said pump means to said recirculation conduit for washing the said dishes or to said drain means for draining said wash chamber;

g. a valve means for connecting said recirculation conduit to said wash compartment adjacent the bottom wall of said compartment; and

h. said valve means being closed whenever the output of said pump means is passing through said recirculation conduit through said spray means and being adapted to open whenever said pump means is exhausting through said drain means, whereby said spray means and said recirculation conduit are substantially emptied of liquid to reduce liquid carryover from one spray operation to the next.

5. The apparatus of claim 4 in which said valve means comprises a vent opening through the wall of said recirculation conduit connecting said conduit to said wash compartment between said bottom wall and said spray arm, and a valve member adapted to close said vent opening when said pump means is pumping through said recirculation conduit to said spray means and to uncover said vent opening when said pump means is exhausting through said drain means.

6. The apparatus of claim 5 in which said valve member includes a rounded surface and a flat surface, and the pressure of liquid against said flat surface forces said rounded surface into said vent opening to close said vent opening whenever said pump is pumping through said recirculation conduit.

7. The apparatus of claim 6 in which said valve member is formed of a resilient material, and a weight member is embedded in the resilient material to cause said valve member to drop away from said vent opening whenever said pump is not pumping through said recirculation conduit.

8. The apparatus of claim 5 wherein said valve member comprises a head portion located within said recirculation conduit and a tail portion extending through said vent opening, whereby said head portion will be forced against said vent opening by liquid pressure to thereby cover said vent opening when said pump is pumping through said recirculation conduit, and said tail portion includes an outwardly extending wing, of greater length than the diameter of said vent opening, that acts to retain said valve member generally adjacent said vent opening when said vent opening is uncovered.

9. The apparatus of claim 5 wherein said head portion includes a rounded surface on one side for fitting into said vent opening to close said opening and a flat surface on the other side which serves as a pressure surface to force said rounded surface into the vent opening when said pump is pumping through said recirculation conduit.