Sept. 10, 1963 O. L. LONG 3,103,227

DISHWASHER APPARATUS

Filed April 18, 1961

FIG.1

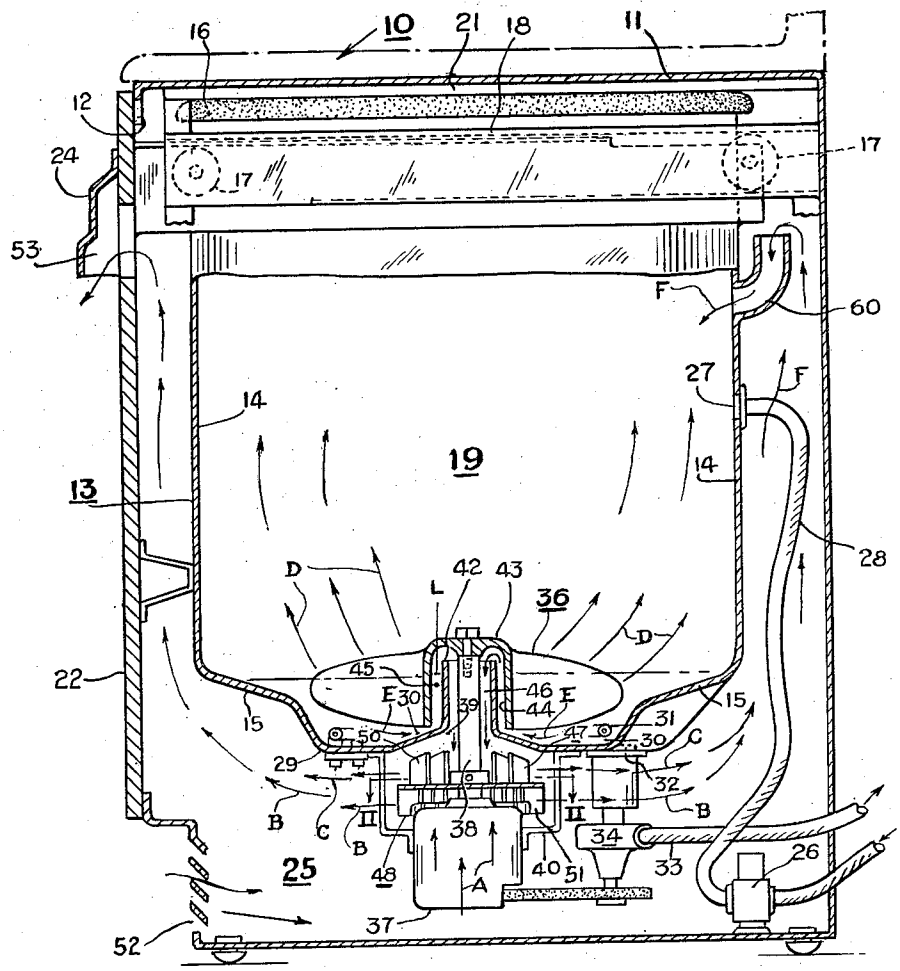
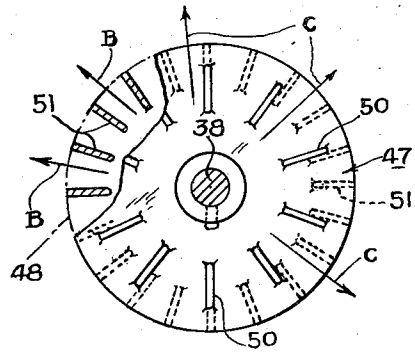


FIG.2.



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DISHWASHER APPARATUS

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This invention relates to dishwashing apparatus, especially domestic dishwashers used in the home for washing and drying dishes, more particularly to an improved arrangement for removing the hot moist air from the dishwasher during the drying period.

Domestic dishwashers usually have a washing chamber or vat with a sump formed by the bottom wall thereof to hold the liquid for washing and rinsing the dishes. Generally, liquid is sprayed on the dishes either by a bladed impeller disposed in the sump or by a tubular distributor mounted for rotation in a central position in the vat.

Dishwashers employing the bladed impeller have one primary advantage over dishwashers employing a tubular distributor in that the impeller may be employed during the drying period, after liquid has been evacuated from the sump, to circulate air through the vat for drying the dishes.

In a prior arrangement, the air for drying the dishes is admitted to the vat through a suitable inlet opening in a lower wall portion of the vat and directed outwardly through an outlet opening disposed in an upper wall portion of the vat and communicating with the atmosphere. This outlet opening is usually disposed in the front panel of the dishwasher so that the hot moist air is exhausted from the vat and through the outlet opening into the relatively cool air of the room. Since the front panel and other parts of the dishwasher externally of the vat are at substantially atmospheric temperature, while the hot moist air is at a temperature of about 160 degrees to 170 degrees F., objectionable and harmful condensate is formed on these parts.

Although not limited thereto, this invention is suited for employment with a dishwasher of the type having a motor driven bladed impeller mounted in the sump, and has for a principal object to provide means for withdrawing the hot moist air from the vat through the lower wall portion of the vat during the drying period.

Another object of the invention is to provide in a dishwasher of the above type, an arrangement for withdrawing the hot moist air from the vat through the lower wall of the vat and for combining the thus withdrawn hot moist air with dry air that has been directed in heat exchange with the driving motor and thereby heated. With this arrangement, the moist hot air imparts some of its moisture to the hot dry air to reduce the relative humidity of the mixture to a sufficiently low value to minimize its metal rusting and other deleterious effects.

Briefly, in accordance with the invention, an opening is provided in the lower wall portion of a dishwashing vat or washing and drying chamber and disposed in communication with a compartment disposed below the vat. This compartment is usually employed to contain the controls and other apparatus for operating the dishwasher, as well known in the art, and is defined by external wall or shell structure enclosing the vat.

A blower or air impeller is disposed in the compartment and driven by a suitable motor. The shell structure is provided with an air inlet opening in its lower portion and an air outlet opening in an upper portion, which openings are in direct communication with the compartment. The vat is also provided with an air inlet opening

disposed in its upper portion and in direct communication with the compartment.

A suitable electric heater is provided in a sump formed by a lower wall portion of the vat. As well known in the art, this heater is usually employed during the washing period to preheat the water to the optimum dishwashing temperature and during the drying cycle to heat the air circulating through the vat to promote drying of the dishes.

Although not specifically limited thereto, the invention may advantageously be employed with a dishwasher of the type having a rotary impeller, as previously described. The rotary impeller is disposed in the sump of the vat and is preferably driven by the same motor that drives the blower. In addition thereto, a second blower, preferably driven by the same motor is disposed in the compartment. The first mentioned blower is disposed in juxtaposed relation with the lower opening of the vat, while the second blower is arranged to direct cooling air past the motor.

In operation, during a washing period, with water in the vat, the rotary impeller is energized by the motor to impel the water contained in the sump in an upwardly directed spray to wash the dishes continuously for a predetermined length of time. During the washing period the second blower is effective to draw air through the shell inlet into the compartment and past the motor to thereby cool the same and prevent overheating. Concomitantly therewith, the first blower is effective to augment circulation of the air within the compartment and comingle this air flow with the air flow from the second blower. The thus comingled air streams from the first and second blowers are subsequently directed about the external surface of the vat and through the shell outlet into the room atmosphere, thereby ventilating the compartment and the external surfaces of the vat and internal surfaces of the shell structure to remove any condensate therefrom which may have collected. At the end of the washing period the water is drained from the tub.

During the drying period the motor is energized to drive the rotary impeller and the impeller is effective to circulate the air within the vat with a continuous circulatory motion. At this time the heater is also energized to heat the air and increase its moisture absorption capacity. The first blower is now effective to withdraw the thus heated and moisturized air from the vat through the lower opening and to comingle the hot moist air stream with the hot dry air stream from the second impeller, thereby forming a mixture of reduced relative humidity. During this phase of operation the air withdrawn from the lower opening in the vat creates a reduced pressure in the vat, thereby initiating air flow into the vat through the upper vat opening. Hence, during the drying period the moist air withdrawn from the vat is continuously mixed with the hot dry air from the second blower and a portion of the mixture is ejected into the room atmosphere while the remainder of the moisture is redirected into the vat through the upper vat opening.

The above and other objects are effected by the invention as will be apparent from the following description taken in connection with the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a vertical sectional view of a domestic dishwasher incorporating the invention; and

FIG. 2 is a sectional view taken on line II—II of FIG. 1.

Referring to the drawing in detail, in FIG. 1 there is shown a domestic dishwasher 10 having an external shell structure 11 of substantially right parallelepiped shape having a front opening 12 and having disposed therein a vat structure 13. The vat structure 13 comprises pe-

ripheral upwardly extending side walls 14, a lower wall portion 15 and a top access opening 16 defined by the upwardly extending side walls 14. The vat structure 13 is supported within the shell structure 11 for horizontal movement into and out of the shell opening 12 by a plurality of suitable rollers 17 cooperatively associated with horizontal guide rail structure 18. As well known in the art, the rollers and rail structure 17 and 18 are arranged in a manner to suspend the vat structure 13 within the shell structure 11 while permitting horizontal movement of the vat structure 13 out of the shell 11 for loading dishes and the like in a washing and drying chamber 19 defined by the vat structure 13.

A suitable cover structure 21, movably supported by the upper portion of the shell structure 11, is provided for sealing the vat access opening 16.

The vat structure 13 is provided with a front panel structure 22 disposed in registry with the front opening 12 in the shell structure and formed and arranged to close the front opening 12. The panel 22 is attached to the vat structure 13 in any suitable manner and is further provided with a handle 24 to permit drawing the vat structure 13 to the left beyond the shell opening 12 for loading and unloading purposes and to the position shown in FIG. 1 for dishwashing purposes and periods of inactivity.

The lower portion of the shell structure 11 and the lower wall portion 15 of the vat structure jointly define a compartment 25 within which is disposed apparatus for energizing and otherwise operating the dishwasher. In this compartment there is provided an electrically operated water control valve mechanism 26 having its intake connected to a suitable source of pressurized water and its outlet connected to an inlet 27 formed in the side wall structure 14 of the vat by a flexible hose 28. The valve mechanism 26 may be controlled in any suitable manner to permit flow of water into the washing chamber 19 during the washing and rinsing periods.

The lower wall structure 15 is provided with a downwardly recessed wall portion 29 defining a sump 30 within which water is collected to a predetermined level during the washing period, and an electrical heating element 31 is disposed in the sump 30 to preheat the water collected in the sump to a predetermined value before initiation of the washing period. The recessed wall portion 29 is further provided with a suitable drain opening 32 for draining water from the sump 30 at the end of a washing period. The drain opening 32 may be connected to a suitable drain by a flexible hose 33 having a pump 34 interposed therein for insuring rapid and substantially complete evacuation of the water from the sump.

A bladed rotary impeller 36 is disposed in the sump 30 for circulating water contained therein in a closed loop about the dishes in the washing chamber 19 during the washing period. The impeller 36 is drivenly connected to an electric motor 37 disposed in the compartment 25 by a drive shaft 38 extending upwardly through an opening 39 formed in the recessed wall portion 29 of the vat. The motor 37 may be connected to the vat 13 by a plurality of struts 40 and is jointly movable therewith as a unit.

A vertically extending tubular member or standpipe 42 is connected to the recessed wall portion 29 in registry with the opening 39, and the impeller 36 is provided with a hollow hub portion 43 having a cylindrical wall structure 44 extending downwardly in outwardly spaced telescopic relation with the standpipe 42. The drive shaft 38 is of smaller cross-sectional area than the standpipe 42 and, in turn, the hub wall 44 is of larger diameter than the standpipe 42, so that the sump 30 is in communication with the compartment 25 by way of an upwardly extending passage 45 defined by the hub wall 44 and the standpipe 42 and a downwardly extending passage 46 defined by the drive shaft 38 and the standpipe 42. During the washing period, water is admitted to the vat by the valve mechanism 26 and collected in the sump to a suitable and predetermined level. Accordingly, the standpipe 42 is of a sufficient height to exceed the water level in the sump, thereby preventing overflow of water from the sump into the compartment 25.

As thus far described, the structure is substantially conventional.

In accordance with the invention, there is provided a first blower or air impeller 47 and a second blower or air impeller 48 disposed in axial alignment with the opening 39 and immediately therebelow. The two blowers 47 and 48 are disposed one above the other and may be drivenly connected to the motor drive shaft 38. Hence, whenever the motor 37 is in operation, the blowers 47 and 48 are energized as well as the rotary impeller 36. The two blowers 47 and 48 are preferably formed as a unitary structure having an annular array of upwardly extending vanes 50 and an annular array of downwardly extending vanes 51 respectively. The vanes 51 are disposed in closely spaced overlying relation with the upper portion of the housing of the motor 37 and are arranged in such a manner that, in operation, they draw air in upward direction about the housing of the motor 37, as indicated by the arrows A, and in heat exchange relationship therewith to prevent overheating of the motor. The thus dry and heated air is impelled in substantially radially outwardly directed streams as indicated by the arrows B. The vanes 50 are disposed in closely spaced relation with the opening 39 and arranged in such a manner that, in operation, they draw air downwardly and impel air in substantially radially outwardly directed streams, as indicated by the arrows C. The air flow streams B and C comingle and the resulting air mixture is subsequently circulated through the compartment 25. The shell structure 11 is provided with a suitable air inlet opening 52 in its lower portion and a suitable outlet opening 53 in the upper portion. As illustrated, the air inlet opening 52 is disposed immediately below the front panel 22, while the air outlet opening 53 is disposed in the upper portion of the front panel 22 and hidden from the observer by the handle 24.

In operation, during a washing period, the rotary impeller is effective to spray the water upwardly with a circulatory motion as indicated by the arrows D to thoroughly spray and wash the dishes. During this phase of operation, the passage 45 about the standpipe is sealed by a column of water L determined by the liquid level of the water in the sump, so that substantially no air flows downwardly through the passageway 46 into the compartment 25.

The blower 48 is effective to draw air into the compartment 25 through the air inlet opening 52, while the upper blower 47 is effective to draw air from the compartment 25. The two air streams B and C comingle as previously described and are thence directed upwardly around the vat structure 13 and through the air outlet 53 into the room atmosphere in a continuous manner. Accordingly, any moisture that may previously have collected within the compartment 25, the external wall surfaces of the vat 13, or the interior surfaces of the shell structure 11 is evaporated and ejected into the room through the air outlet 53.

During the drying period, the rotary impeller 36 is effective to circulate the air within the chamber 19 in substantially the same circulatory manner as during the washing cycle, as illustrated by the arrows D. However, since the wash water contained in the sump is removed through the drain outlet 32 by the pump 34 before the drying period is initiated, the water seal due to the water column L is eliminated and the upper blower 47 is now effecive to draw air from the sump 30, upwardly through the passageway 45, downwardly through the passageway 46, and through the opening 39. At this time the heater 31 is energized to heat the air being circulated by the rotary impeller 36. Hence, during circulation of the

air within the chamber 19, moisture is evaporated from the wet dishes and the resulting hot moist air is returned to the sump 30 and past the heater 31. As the thus returned hot moist air approaches the vicinity of the passageway 45 some of this air, as indicated by arrows E, is diverted by the upper blower 47 and caused to flow upwardly through the passageway 45 and the passageway 46 through the sump outlet 39. The thus withdrawn hot moisturized air is pumped in substantially the same manner previously described and indicated by the arrows C. Hence, the hot dry air streams B now comingle with the hot moisturized air streams C, thereby forming a mixture having a lower relative humidity than the air streams C. Some of the mixture is directed upwardly and into the room atmosphere through the outlet opening 53, in the same manner as previously described.

The vat structure 13 is also provided with an air intake opening 60 in its upper portion, which opening provides communication between the chamber 19 and the compartment 25. Since the upper blower 47 is effective to evacuate air from the chamber 19, a reduced pressure prevails in this chamber and air flow into the chamber is initiated through the air inlet opening 55. Accordingly, the remainder of the air mixture (streams B and C) is thus caused to flow upwardly between the vat 13 and the shell structure 11 into the air intake opening 60, as indicated by the arrows F.

By suitable proportion and design, the upper blower 47 may be safely employed to provide a negative or reduced pressure in the chamber 19 during the drying period even though the rotary impeller 36 is maintained in an energized condition. Furthermore, the suction effect created by the upper blower 47 is insufficient in magnitude to adversely effect the normal spraying and circulating effect of the rotary impeller 36 during the washing and drying periods. The suction effect of the upper blower 47 in the passage 46 is of a relatively small magnitude, for example, one-quarter inch of mercury or about 3.5 inches water.

It will now be seen that, during the drying period, continuous recirculation of the air within the chamber 19 is attained with a portion of the moisturized hot air continuously being evacuated from the lower portion of the vat 13 by the upper blower 47, while the moisturized air withdrawn through the sump opening 39 is replaced by a mixture of preheated air of considerably lower relative humidity. Hence, regenerative heat exchange is thus attained which is effective to promote rapid drying of the dishes in the chamber 19 with more efficient utilization of the heat input by the heater 31.

It will now be seen that the invention provides a highly improved arrangement for effectively removing the hot moist air from the lower wall portion of a domestic dishwasher during the drying period.

It will further be seen that the invention provides an arrangement in which any condensate formed or collected within the compartment 25 and adjacent surface portions external to the washing chamber 19 is vaporized and ejected to the atmosphere upon initiation of operation of the dishwasher, thereby minimizing the possibility of rust, corrosion or other deleterious effects to the apparatus disposed in the compartment 25 as well as the adjacent surfaces.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. In a dishwasher for washing and drying dishes and the like, a vat having a lower wall portion, said lower wall portion defining a sump, a heater disposed in said sump, means defining an air inlet into the upper portion of said vat, means defining an air outlet in the lower portion of said vat, means defining a compartment below said vat, said inlet and said outlet communicating with said compartment, and a blower disposed in said compartment, said heater being effective to heat the air in said vat during a drying period and said blower being effective to evacuate the heated air from said vat through said outlet and into said compartment.

2. In a dishwasher for washing and drying dishes and the like, a shell structure, a vat disposed in said shell, said vat having a lower wall portion, said lower wall portion defining a sump, a heater disposed in said sump, means defining an air inlet into the upper portion of said vat, means defining an air outlet in the lower portion of said vat, means defining a compartment below said vat, said inlet and said outlet communicating with said compartment, a blower disposed in said compartment, means defining an air inlet in said shell, means defining an air outlet in said shell, said heater being effective to heat the air in said vat during a drying period and said blower being effective to evacuate the heated air from the lower air outlet of said vat into said compartment and thence partially eject some of said air through said shell outlet and return the remainder of said air to said vat through said inlet.

3. In a dishwasher for washing and drying dishes and the like, a vat having a lower wall portion, said lower wall portion defining a sump, a heater disposed in said sump, means defining an air inlet into the upper portion of said vat, means defining an air outlet in the lower portion of said vat, means defining a compartment below said vat, said inlet and said outlet communicating with said compartment, first and second blowers disposed in said compartment, a motor for driving said blowers, said motor being disposed in said compartment, said first blower being in registry with said air outlet, and said second blower being arranged to direct air into heat exchange relation with said motor, said heater being effective to heat the air in said vat during a drying period, said first blower being effective to evacuate moist heated air from said vat through said outlet and into said compartment, and said second blower being effective to direct heated air into comingling relation with the evacuated moist air.

4. In a dishwasher for washing and drying dishes and the like, a shell structure, a vat disposed in said shell, said vat having a lower wall portion, said lower wall portion defining a sump, means including an inlet for admitting liquid into said vat, means including an outlet for removing liquid from said sump, said shell partially defining a compartment below said vat, means defining an air outlet communicating with said compartment, a standpipe extending upwardly from said lower wall portion and defining a passageway communicating with said sump and said compartment, a motor disposed in said compartment, said motor having a drive shaft extending upwardly from said compartment through said passageway, a rotary impeller disposed in said sump, said impeller having a hollow hub portion of larger diameter than said standpipe and extending downwardly thereabout and in radially spaced telescoping relation therewith, said hub portion being attached to said drive shaft, and a pair of blowers attached to said drive shaft and disposed in said compartment, said rotary impeller being effective to impel liquid during a washing period and to circulate air during a drying period, a heater in said vat for heating the circulating air during the drying period, one of said blowers having an annular array of vanes in registry with said passageway and effective to withdraw air from said vat through said passageway and into said compartment during the drying period, and the other of said blowers being effective to direct air from said compartment into heat exchange relation with said motor to prevent overheating of said motor.

5. In a dishwasher for washing and drying dishes and the like, a vat having a lower wall portion, said lower wall portion defining a sump, means including an inlet for ad-

mitting liquid into said vat during a washing period, means including an outlet for removing liquid from said sump before a drying period, a heater in said vat, means defining a compartment below said vat, a standpipe extending upwardly from said lower wall portion and defining a passageway communicating with said sump and said compartment, a motor disposed in said compartment, said motor having a drive shaft extending upwardly from said compartment through said passageway, a rotary impeller disposed in said sump and attached to said drive shaft, said impeller having a hollow hub portion of larger diameter than said standpipe and extending downwardly thereabout and in radially spaced telescoping relation therewith, a pair of blowers attached to said drive shaft and disposed in said compartment, said rotary impeller being effective to impel liquid during a washing period and to circulate air during a drying period, said heater being effective to heat said air during the drying period,

one of said blowers being effective to withdraw heated air from said vat through said passageway and into said compartment during the drying period, and the other of said blowers being effective to direct air from said compartment into heat exchange relation with said motor, said blowers being arranged to comingle the air flow therepast, said vat having an air intake opening communicating with said compartment.

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