DISH-WASHER VENT SYSTEM

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References Cited

UNITED STATES PATENTS

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3,092,122 6/1963 Guth 134/58 D

3,103,227 9/1963 Long 134/105 X
3,398,756 8/1968 Kauffman 134/58 D
3,588,213 6/1971 Braga et al. 312/214

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ABSTRACT

There is disclosed a dishwasher having a system for venting the wash chamber during the drying portion of the operating cycle. The vent system provides a first stream of moisture laden air exiting from the wash chamber, a second stream of ambient air which mixes with the first stream to minimize or prevent condensation, value mechanism preventing movement of moisture laden air out of the wash chamber and a timer mechanism responsive to operation of the dishwasher during the drying period for allowing moisture laden air to exit from the wash chamber.

3 Claims, 4 Drawing Figures
FIG. 3

FIG. 4
DISH-WASHER VENT SYSTEM

This invention relates generally to dishwashing machines and more particularly pertains to a dishwashing machine having improved means for drying washed kitchenware. More particularly, the invention pertains to an improved arrangement for venting the wash chamber of a dishwashing machine.

It has become common practice in dishwashers to conduct ambient air during the drying period from a location exterior of the wash chamber, through the wash chamber and then to a location exterior of the wash chamber. Typically some means is provided for heating the ambient air to promote evaporation of water collected on the cleaned dishes. The venting of warm moist air from the wash chamber is a convenient technique for promoting evaporation in the wash chamber and thereby accelerating the drying process.

One typical manner in which this is accomplished is by the provision of a heating element within the wash chamber that is automatically energized for a predetermined period by the machine's timer control after the completion of the wash and rinse periods of the operational cycle. Generally, the wash chamber has upper and lower vent openings which enable air to enter, be heated and then move upwardly as a convection current through the wash chamber and then to exit from the wash chamber.

Another approach for accomplishing the drying function is the provision of a heating element at a location outside the wash chamber and a conduit for conducting a heated air flow from the heating element into the wash chamber. Reference may be made to U.S. Pat. No. 2,707,961 for a dishwasher disclosing a drying mechanism of this type in combination with an exit vent which is automatically closed during the washing and rinsing periods to prevent water from escaping from the wash chamber.

The provision of vent systems in which ambient air is combined with moisture laden air exiting from the wash chamber is found in the disclosures of U.S. Pat. Nos. 3,050,866 and 3,588,213. Disclosures of more general interest are found in U.S. Pat. Nos. 3,193,340 and 3,387,388.

The practice of this invention allows venting of the wash chamber during the drying period in order to achieve a relatively short drying time. Condensation is minimized by mixing the moisture laden air from the wash chamber with a stream of ambient air. Exhaust of moisture laden air from the dishwasher during the washing and rinsing periods is prevented thus avoiding the introduction of unnecessary and undesirable humidity into the kitchen.

It is an object of this invention to provide a dishwasher having an improved vent system.

In summary, this invention comprises a dishwasher of the type including a tub and a door providing therebetween a wash chamber for receiving articles therein, means for spraying liquids in the chamber for washing the articles, means for moving air through the chamber for drying the articles, means for sequentially operating the washing and drying means, and means for venting the chamber including a first passage having an inlet opening into the chamber, a second passage having an inlet open to the tub exterior, the outlets of the passages being juxtaposed for mixing the air passing through, the improvement comprising means closing the first passage and means operative in response to operation of the drying means for opening the first passage.

IN THE DRAWINGS

FIG. 1 is a partial vertical cross sectional view of a dishwasher incorporating this invention illustrated in a configuration indicative of machine operation in the washing or rinsing periods of the operating cycles; FIG. 2 is a view similar to FIG. 1 illustrating the machine configuration during the drying period of the operating cycle; FIG. 3 is a schematic view of a control mechanism operative in this invention; and FIG. 4 is a side elevational view, certain parts being broken away for clarity of illustration, illustrating the incorporation of this invention in a dishwasher employing a different drying technique.

Referring to FIGS. 1 and 2, there is illustrated a dishwasher 10 comprising as major components a cabinet 12 including a door 14, a tub 16 providing with the door 14 a wash chamber 18, a plurality of racks 20 for receiving articles to be washed, means 22 for spraying washing liquids in the chamber 18 for washing the articles, means 24 for drying the articles and a timer mechanism 26 for controlling the operation of the dishwasher 10.

The cabinet 12, door 14 and tub 16 may be of any suitable design. The door 14 is conveniently pivoted mounted adjacent the lower end thereof and includes inner and outer spaced panels 28, 30 for purposes more fully explained hereinafter. The racks 20 are mounted by suitable means for movement into and at least partially out of the wash chamber 18 for loading and unloading articles. The spray means 22 may be of any suitable type and conveniently includes a spray arm 32 mounted for rotation about a central axis (not shown) in fluid communication with a pump 34 driven by a suitable motor 36. The pump 34 and motor 36 are conveniently sealed against the tub bottom 38 by a boot 40 and annular clamping ring 42. A shield 44 may be provided for protecting the boot 40. Operation of the motor 36 is controlled by the timer 26 in any suitable manner, as suggested in FIG. 3.

The drying means 24 may conveniently include a resistive heating element 46 as is now customary in dishwashers. Energization of the heating element 46 is controlled by the timer mechanism 26 in any suitable manner, as suggested in FIG. 3.

Operation of the dishwasher 10 during the washing and rinsing periods of the operating cycle may be in any desired manner. Typically, a water-detergent solution is circulated in the wash chamber 18 during the washing period by introducing a predetermined quantity of water into the chamber 18 and operating the pump 34 which delivers pressurized solution through the spray arm 32. After the washing period, the detergent-water solution is drawn off and a predetermined quantity of clear water circulated through the wash chamber 18. The maximum water level in the chamber 18 is typically below a seal 48 which cooperates between the door 14 and the cabinet 12. Since hot water is customarily used in the washing and rinsing periods, the inner door panel 28 is heated thereby transmitting heat into a passageway or plenum 50 between the panels 28, 30 as more fully explained hereinafter.
The dishwasher 10 includes a vent system 52 for removing moisture laden air from the chamber 18 during the drying cycle in order to facilitate the evaporation of water from the articles thereby accelerating the drying process. The vent system 52 includes a conduit 54 inside the door 14 and secured to the inner door panel 28. The conduit 54 provides a first passage 56 having an inlet opening into the wash chamber 18 and an outlet opening in the plenum 50. A shield or guard 58 is secured to the inner door panel 28 and acts to prevent water entry into the passage 56 during the washing and rinsing periods. A valve or seal 60 normally closes the outlet to the passage 56 thereby preventing air flow therethrough. The valve 60 is conveniently pivotally mounted on the conduit 54 for movement between the closed position of FIG. 1 and an open position illustrated in FIG. 2 allowing movement of moisture laden air through the passage 56 during the drying period.

The timer mechanism 26 acts to manipulate the valve 60 in order to close the passage 56 during the washing and rinsing periods while opening the passage 56 during at least part of the drying period. The timer 26 accordingly includes an output 62 for manipulating the valve 60. Although the timer mechanism 26 may be of any suitable variety, one type that has proved quite acceptable is identified as part number 146C1339P01 and is presently incorporated in a dishwasher, known in the trade as a model GGS&D861P, manufactured by the assignee of this invention.

The timer mechanism 26 includes a suitable dial 64 for initiating operation of the dishwasher 10 and sequentially causing washing, rinsing and drying of articles in the wash chamber 18. The timer mechanism 26 is mounted in the interior of the door 14 adjacent the top thereof as is customary.

The bottom of the door 14 provides an opening 66 constituting an inlet to the plenum 50 which provides a second passage 68 for conducting ambient air around the conduit 54. Positioned in fluid exchange relation with the passages 56, 68 is a hood 70 having a downwardly directed outlet 72 for purposes more fully explained hereinafter. The hood 70 accordingly provides a third passage receiving air from the passages 56, 68 and discharging air from the dishwasher 10.

During the washing and rinsing periods, hot water is circulated in the chamber 18 thereby heating the inner door panel 28 and inherently transferring heat to air in the plenum 50. As air in the plenum 50 becomes heated, there is established a convection air flow as suggested by the arrows in FIG. 1. Since the ambient air flowing through the second passage 68 is below saturation, any water which has condensed in the plenum 50 will be evaporated and passed into the room in which the dishwasher 10 is located. Accordingly, the inside of the door 14 is at least partially dried while the dishwasher 10 is operating in the washing and rinsing periods.

As the dishwasher 10 proceeds through its cycle of operation, the timer mechanism 26 controls the operative mechanisms to commence the drying period and to open the valve 60 as suggested in FIG. 2. During the drying period, the heating element 46 is energized thereby raising the temperature in the wash chamber 18. Thus there is established a convection flow of air through the wash chamber 18 and through the second passage 68 as suggested by the arrows in FIG. 2. Providing an inlet to the chamber 18 from the inside of the door 14 is a slot or opening 74 extending, for any desired distance, laterally across the inner door panel 28. Mounted to overlie the slot 74 is a baffle 76 disposed in the chamber 18 to prevent water from being sprayed into the plenum 50. The slot 74 is formed by an outwardly offset portion 78 comprising part of the inner door panel 28 and includes a reentrant downturned lip 80 which extends from the upper end of the portion 78 downwardly toward the wash chamber 18. The opening 74 thus faces upwardly and is substantially contiguous with the forward surface of the inner door panel 28.

It will accordingly be seen that the dishwasher 10 includes means defining a path of air movement through the wash chamber 18 including an inlet comprising the opening 74 and an outlet comprising the opening of the conduit 54. Upon energization of the heating element 46 during the drying period, the upward flow of air through the second passage 68 is continued with part of the air stream passing through the opening 74 into the wash chamber 18. Air passing through the wash chamber 18 exits through the conduit 54 thereby removing high humidity air from the chamber 18 and accelerating the drying process. As the humid air flowing through the first passage 65 exits therefrom, it mixes with relatively dry air flowing through the second passage 68. There is a tendency for water to condense in the hood 70, particularly on the portions 82, 84 thereof. Water condensing on the portion 82 tends to run down the back wall 86 of the hood 70 onto the inner door panel 28. The door 14 may be provided with suitable lips (not shown) adjacent the opening 66 to prevent water running down the door panels 28, 30 and out of the dishwasher 10.

A substantial advantage afforded by this invention is that condensed water inside the door 14 evaporates between operating cycles. At the end of the drying period, the timer mechanism 26 manipulates the output 62 to close the valve 60 and accordingly terminate air circulation in the wash chamber 18. Since the wash chamber 18 is at an elevated temperature, air flow through the second passage 68 continues thereby evaporating a substantial quantity of water from inside the door 14. Air flow through the second passage 68 gradually diminishes as the temperature in the wash chamber 18 falls to ambient. There is some slight evaporation of water inside the door 14 prior to restarting machine operation. At the commencement of the next machine cycle, air flow through the second passage 68 begins again thereby completing evaporation of water inside the door 14 prior to opening the valve 60 and again condensing water inside the door 14.

Because of the intermittent air flow in the second passage 68 before and after the drying period, sufficient evaporation occurs to remove condensed water occurring in the event the valve 60 does not make a perfect seal with the top of the conduit 54. Accordingly, the sealing elements between the valve 60 and the conduit 54 need not be elaborate and some leakage is quite acceptable.

Another advantage of this invention is that the outlet 72 from the vent system 52 is downwardly directed from a location below the door handle and latch mechanism 88 and below the timer mechanism 26. Accordingly, humid air emitting from the outlet 72 does not act to condense water on either the handle, door latch or electrical components of the timer mechanism 26. Thus, the useful life of the latch and electrical compo-
nents is prolonged since corrosion is minimized. It will also be apparent that the handle 88 is not wet when grasped by the user.

Referring to FIG. 4, there is illustrated a dishwasher 110 which utilizes a different drying technique. For purposes of brevity, analogous elements will be designated by analogous reference characters with only the differences between the embodiments 10, 110 being specifically discussed. The drying means 124 is basically as illustrated in U.S. Pat. No. 2,707,961 and comprises a heating chamber 190 having an inlet 192 for receiving ambient air, a heating element (not shown) in the chamber 190, the fan (not shown) for moving air through the chamber 190 and an outlet 194 leading from the chamber 190 into the tub 116. The outlet 194 is preferably provided with a check valve or the like in or adjacent the outlet 194 to prevent water in the tub 116 from passing into the heating chamber 190.

Operation of the dishwasher 110 is substantially the same as that of the dishwasher 10. During the wash and rinse periods of the operating cycle, the valve 160 is closed, either by gravity or by positive operation of the timer mechanism 126. During the wash and rinse periods, a convection flow of air in the second passage 168 is established since the wash chamber 118 is at an elevated temperature. As the timer mechanism 126 indexes to the drying period, the valve 160 is opened and the drying means 124 activated. Accordingly, there is established an air circulation path in the wash chamber 118 to remove high humidity air and thereby accelerate the drying process. During the drying period, there is maintained an upward convection air flow in the passage 168 to mix with humid air emitting from the first passage 156. At the end of the drying period, the valve 160 is closed and the drying means 124 deactivated. Upward flow of air in the second passage 168 continues since the wash chamber 118 remains at an elevated temperature for a significant period of time. Since relatively low humidity air flows through the second passage 168 other than during the drying period, condensed water in the door 114 is evaporated thereby conditioning the dishwasher 110 for a successive drying period.

It will accordingly be apparent that the practice of this invention provides numerous advantages over prior art dishwasher venting systems. It is apparent that high humidity air is emitted from the dishwashers of this invention only when necessary to accelerate machine operation rather than indiscriminately. Furthermore, by mixing humid and ambient air inside the door, any water condensation that occurs is inside the door rather than on the floor of the room in which the dishwasher is located. Any condensed water accumulating in the door is evaporated prior to the next succeeding machine cycle. Other advantages of the invention should be apparent from the preceding description.

I claim:

1. A dishwasher comprising a tub and a vertical door providing therebetween a wash chamber having rack means for receiving articles therein; means for spraying liquids in the chamber for washing the articles; means for drying articles in the chamber including means defining a path of air movement through the chamber including an inlet thereinto and an outlet therefrom, and means for moving air through the chamber for drying the articles; means including a timer for sequentially operating the washing and drying means; and means for venting the chamber including a first passage which includes the chamber as part thereof, said first passage including an inlet from the interior of the door at the bottom of the chamber and an outlet at the top of the chamber into the door interior, the passageway being in heat transmitting relation with the chamber for conventionally conducting air therethrough upon heating of the chamber; and a second passage within the door interior, said second passage having an inlet opening to the ambient surroundings of the dishwasher at the bottom of the door and an outlet located above the inlet in juxtaposition with the outlet of said first passageway for mixing the air passing through the respective passageways to reduce potential condensation within the door interior; means for controlling delivery of air from the outlet of said first passage including a valve movable between positions allowing and preventing flow through the outlet and means operatively connecting the valve and timer for closing the valve during operation of the washing means and for opening the valve during operation of the drying means; and,

hood means above the juxtaposed first and second passageway outlets defining a third passage having an inlet in flow relation with the outlets of the first and second passages and an outlet opening to the ambient surroundings of the dishwasher, said outlet being directed downwardly from a location below the door handle and latch of the dishwasher to prevent condensation on either the handle or latch.

2. The dishwasher of claim 1 wherein the means for controlling delivery of air from the first passage outlet includes a vertical conduit in the door, the valve being mounted for closing the conduit.

3. The dishwasher of claim 1 wherein the timer is carried by the door adjacent the handle, the third passageway including an exit downwardly directed from a location below the timer to prevent condensation on the timer.

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