# United States Patent [19]

**Schimke**

[11] **3,876,469**

[45] **Apr. 8, 1975**


[54] **DISH-WASHER VENT SYSTEM**


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[73] Assignee: **General Electric Company,** Louisville, Ky.



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[52] **U.S. Cl.** ..... **134/95;** 34/53; 34/133; 34/324; 134/97; 312/214

[51] **Int. Cl.** ..... **B08b 3/02**

[58] **Field of Search** ..... 134/57 D, 58 D, 95–97, 134/102–103; 34/324; 312/214



[56] **References Cited**

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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 |



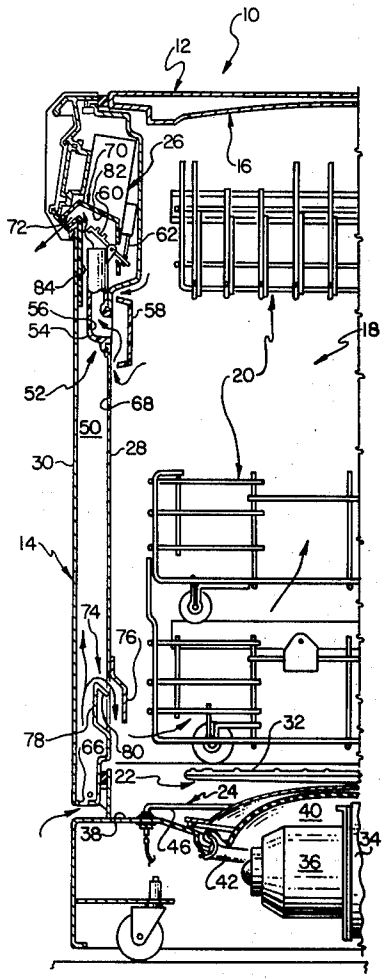
*Primary Examiner*—Robert L. Bleutge

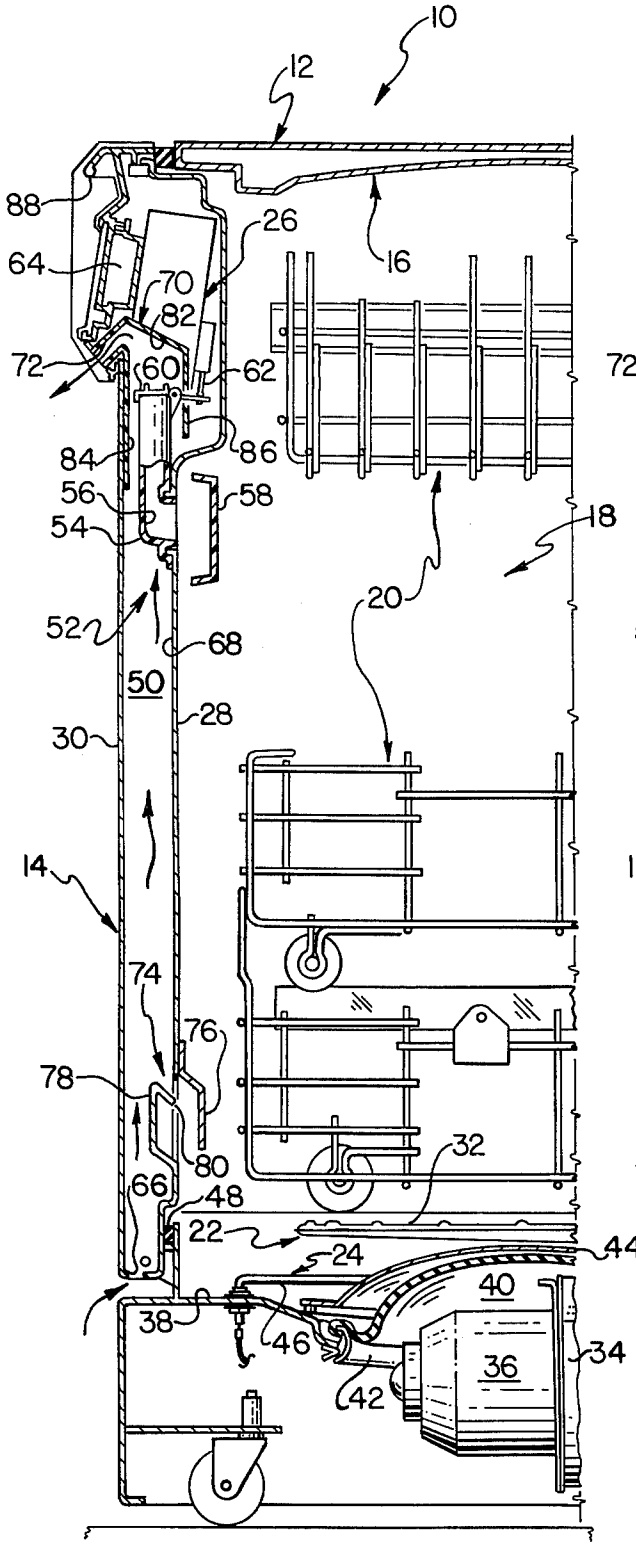


[57] **ABSTRACT**

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**




10
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64
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82
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86
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18
20
52
68
50
28
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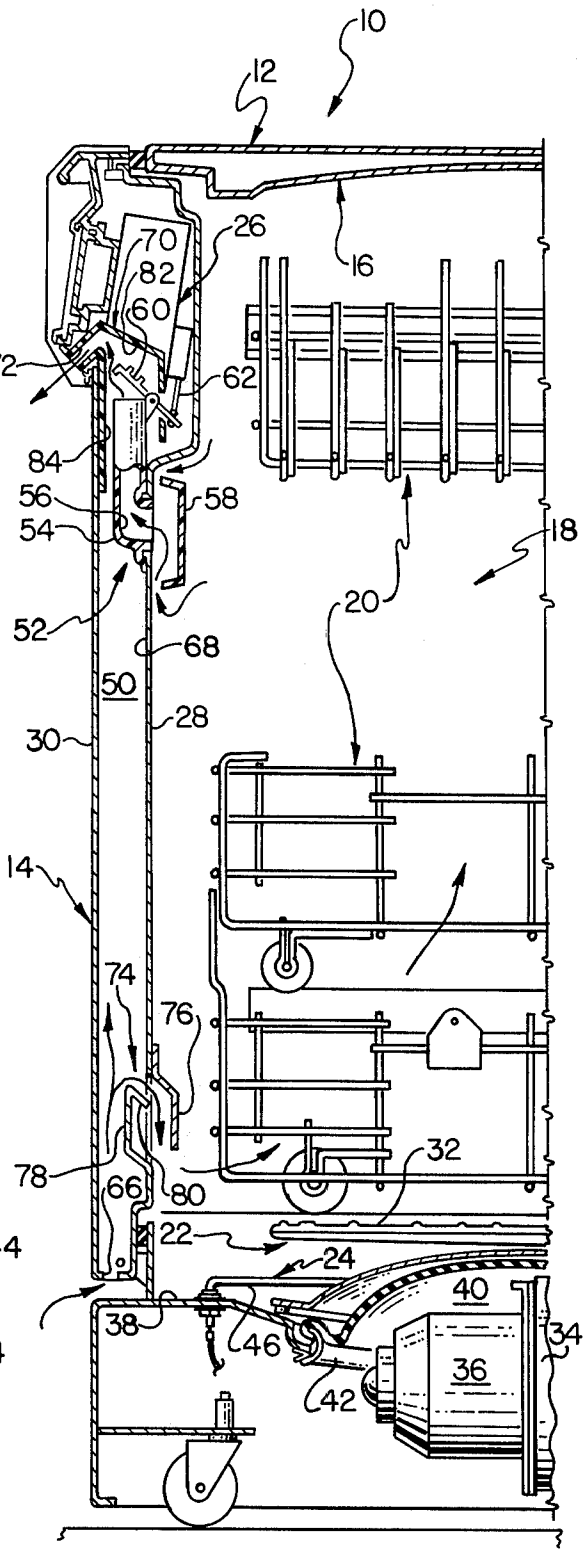
42

FIG. 1


10
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70
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60
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62
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18
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FIG. 2

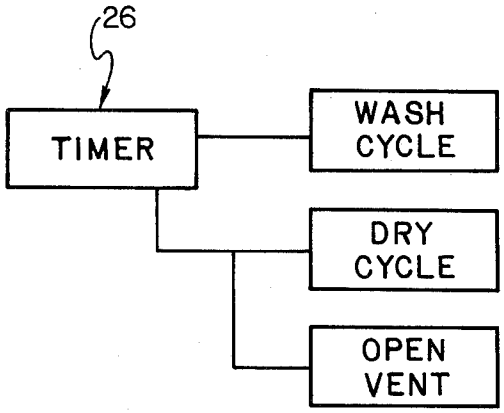
26
TIMER
WASH CYCLE
DRY CYCLE
OPEN VENT

FIG. 3

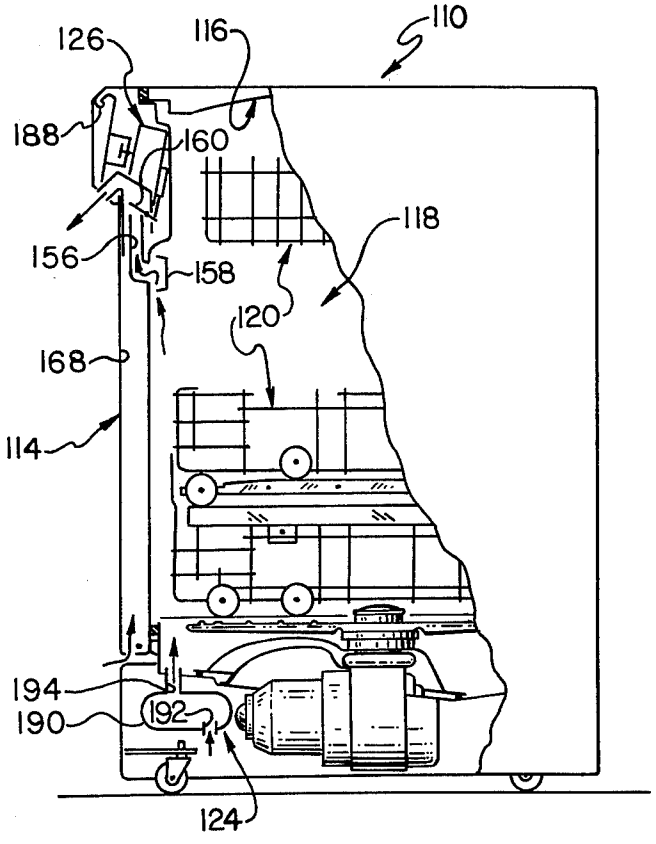
126
116
110
188
160
118
156
158
120
168
114
194
190
192
124

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 therethrough, 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 pivotally mounted adjacent the lower end therof 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 146C1339PO1 and is presently incorporated in a dishwasher, known in the trade as a model GGSD861P, 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 had 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 **56** 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 convectionally 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.

* * * * *