April 23, 1968 T. E. JENKINS 3,378,933

DRYING SYSTEM FOR DISHWASHER

Filed Jan. 13, 1966 3 Sheets-Sheet 1

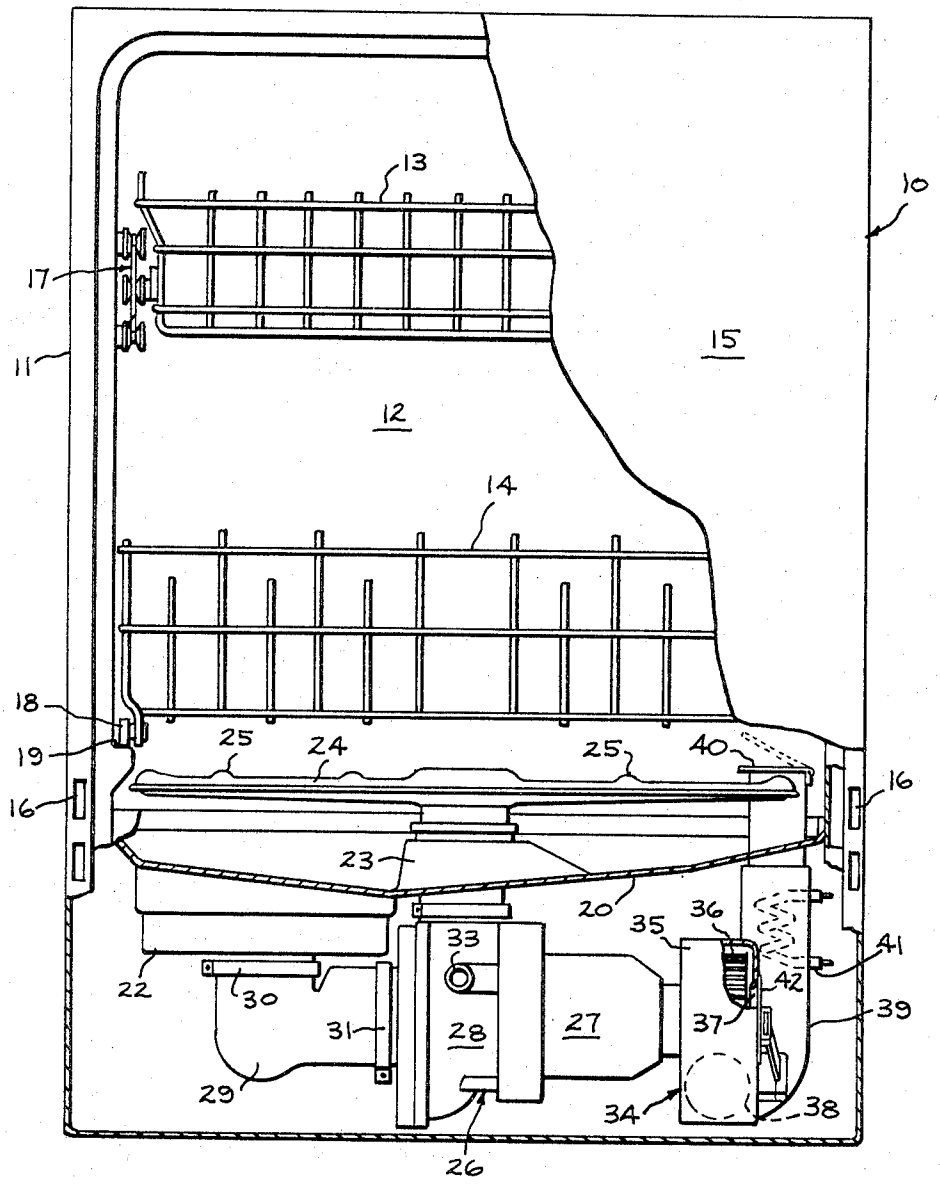


FIG. 1

INVENTOR.
THOMAS E. JENKINS

BY James E Eggle

HIS ATTORNEY

April 23, 1968 T. E. JENKINS 3,378,933

DRYING SYSTEM FOR DISHWASHER

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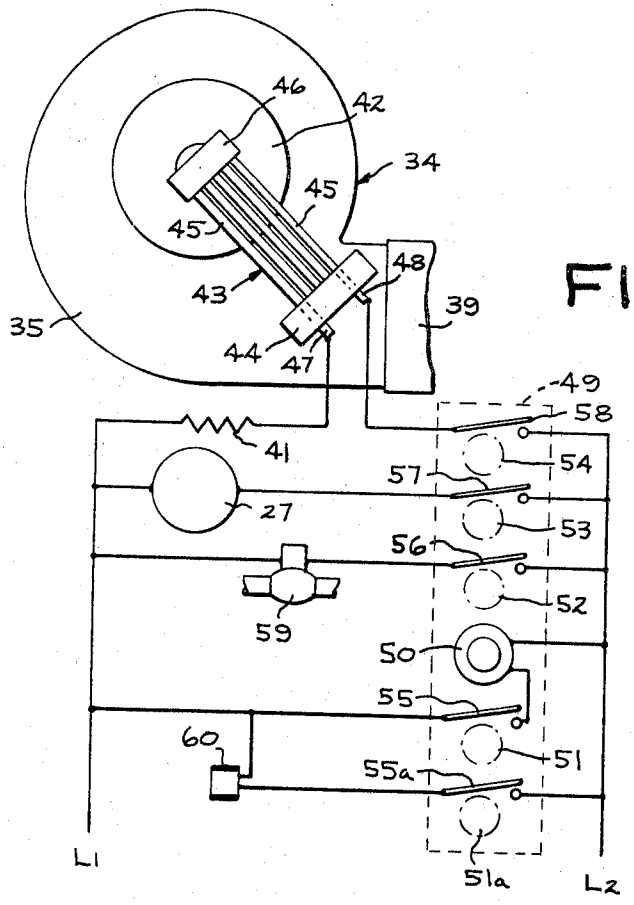


FIG. 2

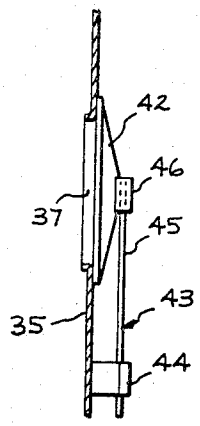


FIG. 3

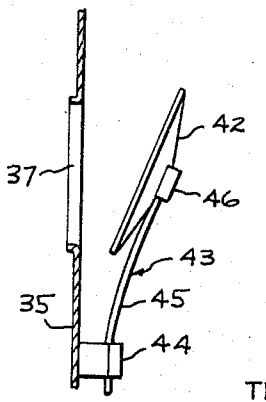


FIG. 4

INVENTOR.
THOMAS E. JENKINS
BY James E Espe
HIS ATTORNEY

April 23, 1968 T. E. JENKINS 3,378,933

DRYING SYSTEM FOR DISHWASHER

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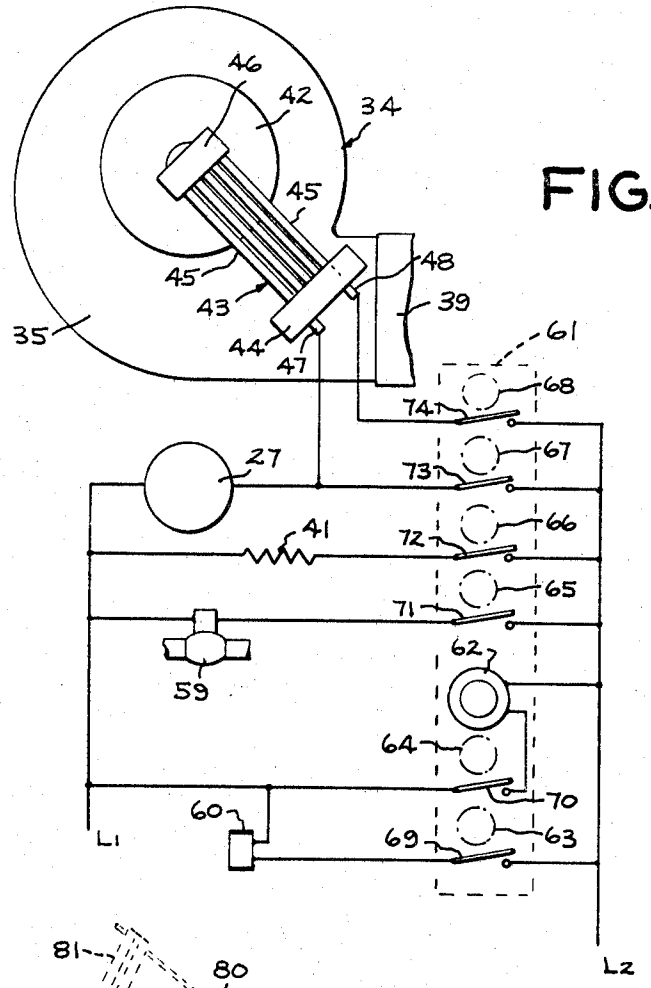


FIG.5

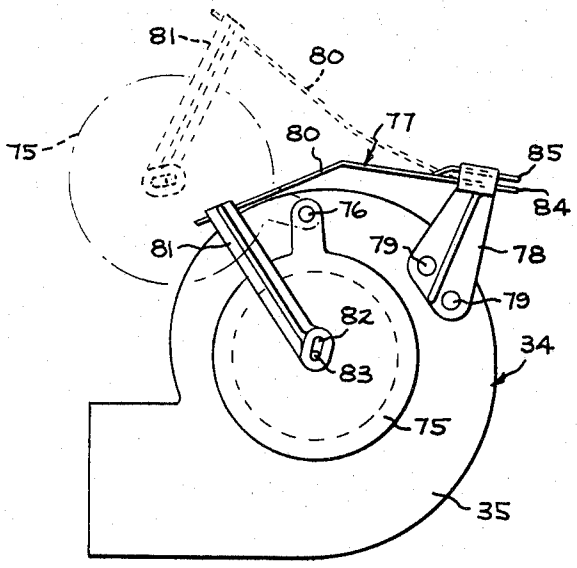


FIG.6

INVENTOR.
THOMAS E. JENKINS
BY James E Espe
HIS ATTORNEY

United States Patent Office 3,378,933
Patented Apr. 23, 1968

3,378,933

DRYING SYSTEM FOR DISHWASHER

Thomas E. Jenkins, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed Jan. 13, 1966, Ser. No. 520,442
9 Claims. (Cl. 34—54)

ABSTRACT OF THE DISCLOSURE

An electrically heated drying system for a dishwasher including a blower and means interconnecting the blower to the dishwasher wash chamber. An electrical heating element is disposed within the path of air propelled by the blower and electrically-responsive valve means is provided to control the flow of air through the blower. The electrically-responsive valve means is connected in electrical series with another electrical component of the dishwasher to be controlled by the same control means which controls the other electrical component.

This invention relates to a drying system for an automatic dishwasher and, more particularly, to a system which provides automatic operation integrated with a complete dishwasher cycle of operation.

A normal cycle of operation for an automatic dishwasher includes a preliminary rinse or two, a wash which includes the addition of detergent to the water, a subsequent rinse or two, and finally, a drying period during which the air within the dishwasher is heated to enhance evaporation of moisture from the washed articles. Often, the wash chamber of the dishwasher is vented during drying so that moisture laden air may escape and be replaced by dry air to further enhance evaporation of moisture from the article. Although convective movement of air through the wash chamber is achieved by heating the air and venting the wash chamber, it has been discovered that mechanical movement of the air, by means of a blower, further enhances drying of the articles. However, use of a blower has been generally rejected due to the complication and expense of incorporating a blower into the dishwasher, both mechanically and electrically. The present invention provides a simple inexpensive means to incorporate a blower into a dishwasher for use during the drying period of the dishwasher cycle of operation.

It is an object of this invention to provide an improved drying system for a dishwasher.

It is a further object of this invention to provide a drying system for a dishwasher which is inexpensive and uncomplicated.

Briefly stated, in accordance with one aspect of the invention, there is provided a heating system for a dishwasher including a blower and means interconnecting the blower with the wash chamber of the dishwasher. An electrical heating element is disposed within the path of air propelled by the blower and an electrically-responsive means is provided to control the flow of air through the blower. The electrically-responsive means is in electrical series circuit with another electrical component of the dishwasher to be controlled by the same control means which controls the other electrical component.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings, in which:

FIGURE 1 is an elevational view, partly cut away to show details, of a dishwasher employing the present invention;

FIGURE 2 is a schematic wiring diagram showing the control circuit of the dishwasher of FIGURE 1;

FIGURE 3 is a fragmentary view of a component of the present invention;

FIGURE 4 is a view similar to FIGURE 3, but showing the component in a second operative position;

FIGURE 5 is a schematic wiring diagram showing a modified control circuit for a dishwasher such as that illustrated in FIGURE 1; and,

FIGURE 6 is a fragmentary view of a modified component of the present invention.

Referring now to the drawings, and more particularly to FIGURE 1 thereof, there is illustrated an automatic dishwasher **10** having an outer cabinet **11** defining therein a wash chamber **12**. Disposed within wash chamber **12** are dish supporting racks **13** and **14** which are adapted to receive and support dishes or other articles to be washed within wash chamber **12**. A closure member **15** is provided in one wall of cabinet **11**, pivotal about hinge means **16**, to provide access to wash chamber **12**. When closure member **15** is pivoted downwardly, rack **13** can be at least partially withdrawn from wash chamber **12** by means of a slide and roller system **17** provided at each side of rack **13** and slidably supporting rack **13** from the inner wall of cabinet **11**. Similarly, rack **14** can be at least partially withdrawn from wash chamber **12** by means of a roller **18** which rides upon a surface **19** provided at each side of cabinet **11**.

The lower extremity of wash chamber **12** is defined by a bottom wall **20** which gradually slopes to a low point at one side of the dishwasher. Disposed below the low point is a sump **22** which may be formed integrally with bottom wall **20** or which may be a separate element secured to bottom wall **20**. Projecting upwardly from bottom wall **20** near the center of wash chamber **12** is a pedestal **23** which rotatably supports a reaction type spray device **24**. Spray device **24** has a plurality of orifices **25** through which wash fluid is ejected to effectuate a washing action upon articles supported by racks **13** and **14**. At least one of the orifices **25** is directed such that the reaction force created by the wash fluid passing therethrough causes rotation of spray device **24**.

Wash fluid is propelled into spray device **24** by a motor-pump assembly **26** including an electric motor **27** and a pump **28**. A flexible boot or conduit **29** interconnects sump **22** with the inlet of pump **28**. Boot **29** is secured to sump **22** by means of a clamp **30** and is secured to pump **28** similarly by means of a clamp **31**. Motor-pump assembly **26** is suitably supported from bottom wall **20**.

An electrically-operated solenoid (not shown in FIGURE 1) operates a valve (not shown) within the housing of pump **28** to selectively direct the fluid pumped by pump **28** either up through spray device **24** or out through an effluent discharge conduit **33**.

During the drying period of the dishwasher operational cycle, the air within wash chamber **12** is heated to enhance the evaporation of moisture from articles supported by racks **13** and **14**. To carry out this heating, a blower **34** is supported beneath bottom wall **20** and includes a housing **35** which contains an impeller **36** therein. Impeller **36** is mechanically linked to motor **27** to be driven thereby. Housing **35** has an inlet **37** and an outlet **38**. A conduit **39** interconnects outlet **38** with wash chamber **12**. A pivotal cover **40** is provided at the upper end of conduit **39** to prevent wash fluid from entering conduit **39** during the wash and rinse periods of the dishwasher cycle of operation. An electrical resistance heating element **41** is provided in conduit **39** to heat the air passing through that conduit when heating element **41** is energized.

A clearer understanding of the operational cycle of dishwasher **10** can be obtained by reference to FIGURE 2 of the drawings. FIGURE 2 provides an end view of

blower 34 and shows a valve 42 disposed over inlet 37. Valve 42 obviously controls the flow of air through blower 34 and valve 42 is provided with an electrically responsive valve operator 43. Valve operator 43 includes a support 44 rigidly secured to housing 35 and a plurality of bimetallic elements 45, each of which are secured at one end to support 44 and, at the other end, to a bracket 46. Bracket 46 is rigidly secured to valve 42. The individual bimetallic elements 45 are connected in electrical series circuit with each other so that current flowing into elements 45 through terminal 47 will pass, in series, through all of elements 45 to terminal 48.

FIGURE 3 is a view taken along line 3—3 of FIGURE 2 and shows valve 42 seated against housing 35 to close inlet 37. When electrical current is passed through elements 45, valve operator 43 assumes the position shown in FIGURE 4 which withdraws valve 42 from housing 35 thereby opening inlet 37 and allowing the flow of air through blower 34 into wash chamber 12.

Referring again to FIGURE 2, power is supplied to the dishwasher control means through lines L_1 and L_2. A sequence control means 49 includes a synchronous timer motor 50 which mechanically drives a plurality of cams 51, 51*a*, 52, 53 and 54 which operate, respectively, switches 55, 55*a*, 56, 57 and 58. Switch 55 controls the admission of electrical power to timer motor 50 and is initially closed by manual rotation of a control knob mechanically linked to timer motor 50. When the control knob is turned two or three degrees, cam 51 closes swich 55 which energizes timer motor 50 and timer motor 50, from that moment on, continues to drive the cams throughout an entire dishwasher cycle. Upon completion of the terminal portion of the dishwasher cycle of operation, cam 51 reopens switch 55 thereby deenergizing motor 50. At this point, the remaining switches 55*a* 56, 57 and 58 have been opened by cams 51*a*, 52, 53 and 54 so that the entire dishwasher is deenergized.

A normal complete dishwasher cycle of operation may include the following sequence of events. Initially, electrically-operated valve 59 is opened by the closing of switch 56 to allow the admission of water into wash chamber 12. When a suitable amount of water has been allowed to enter wash chamber 12, cam 52 opens switch 56 thereby closing valve 59. At the time that switch 56 is closed cam 53 closes switch 57 thereby energizing motor 27. Cam 51*a* allows switch 55*a* to remain open, thereby maintaining solenoid 60 deenergized so that the valve which controls flow of fluid either up through spray device 24 or out through effluent discharge conduit 33 is in a position whereby fluid is directed up through spray device 24. This condition obtains for several minutes until cam 51*a* closes switch 55*a* to energize solenoid 60 thereby causing the valve within pump 28 to direct the wash fluid out through effluent discharge conduit 33. After the passage of a time interval sufficiently long to remove substantially all of the fluid from the dishwasher, cam 51*a* reopens switch 55*a* deenergizing solenoid 60. At this time, cam 52 closes switch 56 thereby energizing and opening valve 59 so that water is again admitted to wash chamber 12.

The foregoing series of events is repeated several times and, during at least one of the times, a detergent dispenser (not shown) is operated to inject or dispense detergent into wash chamber 12 to mix with the water to facilitate removal of food soil from the articles disposed in wash chamber 12. Following the final rinse, motor 27 remains energized, and cam 54 closes switch 58 thereby allowing current to flow through heating element 41 and valve operator 43. As this happens, air is drawn in through inlet 37 of housing 35 and is propelled up through conduit 39, past heating element 41 to be blown into wash chamber 12. It is to be understood that the air propelled by blower 34 exerts a sufficient force upon cover 40 to open it to the position shown in dotted lines in FIGURE 1.

By placing the valve operator 43 in electrical series circuit with heating element 41, the valve 42 is automatically opened whenever heating element 41 is energized and remains closed at all other times. Also, by placing the heating element 41 and valve operator 43 in series, the voltage drop realized across heating element 41 results in a significant lower voltage impressed across the bimetallic elements 45. As described above, motor 27 remains energized throughout the entire dishwasher cycle which proves advantageous if, for example, motor 27 is of the shaded-pole type having a relatively low starting torque. If motor 27 is of the type having a low starting torque, it it advantageous to avoid the situation wherein motor 27 must start under load and one way to avoid this situation is to start the motor prior to applying the load. This is done in the present invention by starting motor 27 before water is admitted to wash chamber 12 and pump 28. Because motor 27 is to be energized throughout the entire dishwasher cycle, and blower 34 is useful only during the drying portion of the cycle, the present invention obviates a relatively expensive clutch mechanism between motor 27 and blower 34 which otherwise would be required in order to prevent air from being blown into wash chamber 12. If air were allowed to blow into wash chamber 12, it could result in impairment of the wash action of the fluid emanating from orifices 25. Morover, air blowing into wash chamber 12 would maintain cover 40 in the open position which would allow wash fluid to enter conduit 39 and collect in casing 35 of blower 34. Closing the inlet 37 to blower 34 also decreases the power necessary to rotate impeller 36 during the periods when movement of air is not necessary.

Referring now to FIGURE 5, a modification of the electrical relationship of the components of FIGURE 2 is shown. A sequence control means 61 is provided and includes a synchronous timer motor 62 and cams 63, 64, 65, 66, 67 and 68 which control, respectively, switches 69, 70, 71, 72, 73 and 74. The operation of the elements comprising the control system of FIGURE 5 are identical to that of the elements comprising the control system of FIGURE 2 with the following exceptions. Cam 67 closes switch 73 at the initial portion of the dishwasher cycle of operation and maintains switch 73 closed throughout the cycle until the drying period is reached whereupon switch 73 is opened by cam 67 and switch 74 is closed by cam 68. Thus, during the drying period, motor 27 is energized through switch 74, but switch 74 is also in electrical series circuit with valve operator 43 so that valve 42 opens inlet 37 during the drying period.

The arrangement shown in FIGURE 5 requires an additional cam and switch and is therefore less preferred than the arrangement of FIGURE 2; however, the arrangement of FIGURE 5 does utilize the voltage drop across motor 27 to decrease the voltage impressed across bimetallic elements 45 in a manner similar to that achieved by the voltage drop of heating element 41 in the arrangement of FIGURE 2.

FIGURE 6 illustrates a modified valve and valve operator for controlling the admission of air into blower 34. A valve 75 is pivotally attached to housing 35 by means of a pin 76. A valve operator 77 is provided and includes a support 78 rigidly secured to housing 35 by means of bolts or screws 79. A bimetallic element 80 is rigidly supported at one end by support 78 and is secured at its other end to an arm 81. Arm 81 has a slot 82 at its distal end which receives a pin 83 projecting from valve 75. Bimetallic element 80 has a pair of electrical terminals 84 and 85 which may be incorporated into an electrical control circuit in a manner identical to that of terminals 47 and 48 of the earlier described embodiments. When electrical current is caused to pass through bimetallic element 80, element 80 assumes the position shown in dotted lines in FIGURE 6 thereby pivoting valve 75 about pin 76 to the position also shown in dotted lines in FIGURE 6. The arrangement shown in FIGURE 6, although somewhat more complex and more expensive than the arrange-

ment illustrated in FIGURES 2 and 5, may prove advantageous in some applications since it avoids the requirement of directly overcoming the vacuum created at inlet **37** by impeller **36**. Because it overcomes this requirement, it is possible to use a smaller number of bimetallic elements to effectuate movement of valve **75**.

As will be evident from the foregoing description, certain aspects of the invention are not limited to the particular details of construction of the examples illustrated, and it is contemplated that various other modifications or applications will occur to those skilled in the art. It is therefore intended that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A drying system for a dishwasher comprising:
(a) an electric motor,
(b) a blower driven by said motor,
(c) a conduit interconnecting said blower with the wash chamber of the dishwasher,
(d) an electrical heating element within said conduit,
(e) an inlet to said blower,
(f) a valve to control flow through said inlet, and
(g) an electrically-responsive valve operator to open and close said valve,
(h) said valve operator being in electrical series circuit with said heating element whereby said valve is opened when said heating element is energized.

2. The invention of claim **1** wherein said electrically-responsive valve operator comprises a bimetal element and said bimetal element solely supports said valve.

3. A drying system for a dishwasher comprising:
(a) a blower,
(b) means interconnecting said blower with the wash chamber of the dishwasher,
(c) an electrical heating element disposed within the path of air emanating from said blower, and
(d) electrically-responsive valve means to control the flow of air through said blower,
(e) said electrically-responsive means being in electrical series circuit with said heating element whereby said means allows air to flow through said blower when said heating element is energized.

4. The invention of claim **3** further comprising a housing for said blower and an inlet for said housing, wherein said electrically-responsive means comprises a valve pivotally carried by said housing and a bimetal valve operator to pivot said valve relative to said inlet to open and close said inlet.

5. The invention of claim **3** wherein said electrically-responsive means comprises a bimetal operator and a valve member supported solely by said bimetal operator.

6. The invention of claim **5** further comprising a housing for said blower defining an inlet wherein said valve cooperates with said inlet to control the flow of air.

7. A drying system for a dishwasher comprising:
(a) an electric motor,
(b) a blower driven by said motor,
(c) a housing for said blower having an inlet for said blower,
(d) a valve to selectively open and close said inlet,
(e) an electrically-responsive operator to operate said valve,
(f) said electrically-responsive operator being in electrical series circuit with said motor,
(g) first switch means in electrical series circuit with both said motor and said operator, and
(h) second switch means in electrical series circuit with said motor and in parallel electrical series circuit with said operator.

8. The invention of claim **7** wherein said electrically-responsive operator comprises a bimetal element solely supporting said valve.

9. The invention of claim **7** wherein said valve is pivotally carried by said housing and said electrically-responsive operator comprises a bimetal element.

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FREDERICK L. MATTESON, JR., *Primary Examiner.*
J. W. WESTHAVER, *Examiner.*
A. D. HERRMANN, *Assistant Examiner.*