Aug. 10, 1965 D. A. JELLIES 3,199,525

CONTROL SYSTEM FOR DISHWASHER

Filed Dec. 26, 1962

FIG. 1

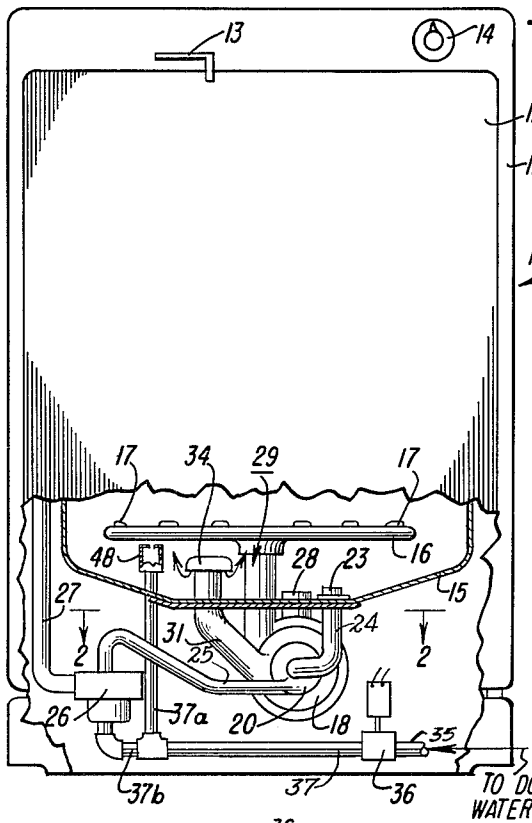


FIG. 2

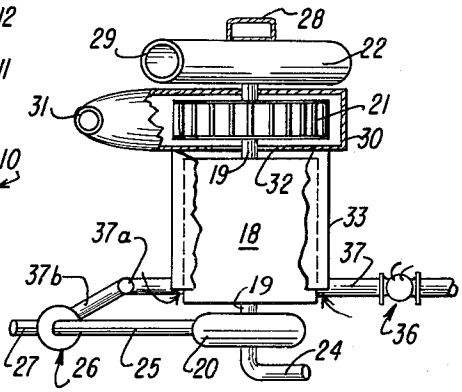


FIG. 4

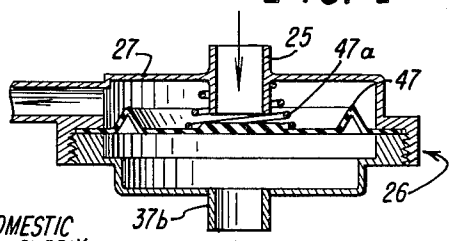


FIG. 3

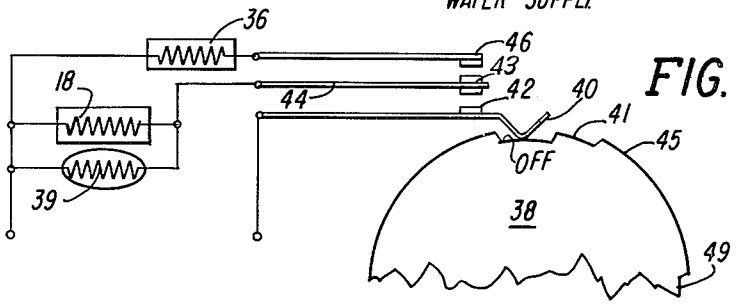
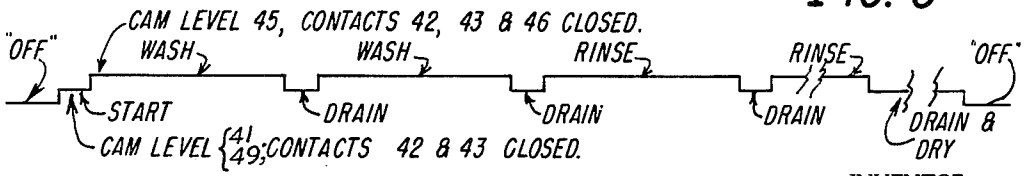


FIG. 5



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CONTROL SYSTEM FOR DISHWASHER

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This invention relates to a dishwasher and, more particularly, to a control system for a dishwasher.

The operation of a conventional domestic dishwasher involves a cycle comprising a sequence of several individual periods. For example, the machine usually undergoes a fill period, wash period, drain period, fill period, rinse period, drain period and, finally, a dry period. The cycle may include additional periods such as, for example, a pre-pre-rinse period prior to the wash period. Also, the cycle may include a plurality of wash periods or rinse periods. Each of the individual periods presents unique requirements with regard to the dishwasher drive motor. For example, during the fill period the motor need not operate at all since water tap pressure is usually sufficient to fill the dishwasher with water. During the wash period and rinse period the motor must drive a recirculation pump to effectuate a spray action. During the drain period the motor must drive a drain pump to remove the water from the dishwasher and, during the dry period, the motor must drive a blower to circulate warm air within the dishwasher to effectuate a drying action.

Generally in the past, a capacitance start motor has been utilized as the dishwasher drive motor since it provides high starting torque and is therefore capable of starting efficiently even though directly linked to a load such as, for example, the aforementioned recirculation pump. Thus the capacitance start motor met with acceptance, since it obviated costly and complicated means for reducing or removing the various loads from the motor prior to starting. However, the conventional capacitance start motor is expensive in comparison, for example, to a shaded-pole induction motor and constitutes one of the costly elements of dishwasher construction. The shaded-pole motor has very low starting torque and is therefore quite inefficient during start under load and the additional cost of providing means to reduce or remove the load during starting may nullify the cost difference between a capacitance start and a shaded-pole motor. It therefore would be advantageous to provide a control system which allows the employment of a shaded-pole motor without necessitating complex control means to reduce or remove the starting load.

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

It is an object of this invention to provide a control system for a dishwasher which makes practical the employment of a shaded-pole drive motor.

It is an object of this invention to provide a control system for a dishwasher which is of simple and low cost construction.

The present invention overcomes the problem of starting under load by energizing a shaded-pole induction motor at the beginning of the dishwasher cycle when it is under essentially no load and, through the employment of a proper control system, by keeping the motor running throughout the entire cycle. In accordance with one aspect of the invention, there is provided a time-responsive switch and a drive motor controlled by the switch. The drive motor is mechanically linked to, and continually drives, a drain pump, a recirculation pump, and a blower. A first valve, responsive to the switch, is provided to control the admission of water into the dishwasher and a second valve is provided to control the removal of water from the dishwasher. The second valve is responsive to the water pressure in the conduit interconnecting the first valve and the dishwasher whereby the second valve is closed when the water pressure exceeds a predetermined value.

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 following drawings, in which:

FIG. 1 is an elevational view, partially cut away, of a dishwasher embodying the present invention;

FIG. 2 is a view taken along line 2—2 of FIG. 1;

FIG. 3 is a schematic representation of the electrical circuitry of the present invention;

FIG. 4 is a sectional view of the drain valve; and

FIG. 5 is a graphical representation showing the time periods during which each control switch is closed.

Referring now to the drawings, and particularly to FIGS. 1 and 2, there is shown a dishwasher 10 having an outer cabinet 11 with a closure member 12 provided in one wall thereof. Any suitable operating means 13 may be provided to secure the closure member 12 in the closed position as shown in FIG. 1. It should be appreciated that the particular type of cabinet structure or closure member for the cabinet is not critical to the present invention and that the present invention would be equally suitable for employment with a dishwasher having a closure member in the top surface thereof. At any convenient position on the cabinet there is provided a control knob 14 to manually initiate operation of the dishwasher.

Disposed within the cabinet 11 is a water tight tub 15 which cooperates with the closure member 12 to provide a water-tight compartment within the cabinet 11 when the closure member 12 is closed. Suitable means (not shown) are provided within the tub 15 to support the articles to be washed. Means (not shown) such as disclosed in Sharp et al. Re. 24,198, reissued August 21, 1956, may be mounted on the door to supply detergent for each of two washing periods. Positioned near the bottom of the tub 15 is a spray head 16 having a plurality of orifices 17 spaced along the upper surface thereof.

A drive motor 18 is supported below the tub 15 by any suitable means. The motor shaft 19 extends outwardly from each end of the motor and at one end is connected to a drain pump 20. The other end of the shaft 19 carries an impeller 21 and is connected to a recirculation pump 22.

The purpose of the drain pump 20 is to remove the water from the tub 15 once a wash period or rinse period has been completed. This is accomplished by drawing water from the tub 15 through a screen 23, which prevents foreign articles from entering and possibly damaging the drain pump 20, into conduit 24 which communicates with the inlet of drain pump 20. The water is then pumped through conduit 25 to valve 26. If the valve 26 is open, the water is pumped on through conduit 27 which terminates at some disposal point such as, for example, a kitchen drain. If the valve 26 is closed, the pumping action is defeated and water will not be withdrawn from the tub 15.

The purpose of the recirculation pump 22 is to effectuate a washing or rinsing action of the water in tub 15 in the following manner. Water is drawn into conduit 28 which extends from a point near the bottom of the tub 15 to the inlet of recirculation pump 22. The water is then pumped through conduit 29 which extends from the pump outlet to the spray head 16. The pressure generated by the recirculation pump 22 causes a jet spray to emanate from each of the orifices 17.

The purpose of the impeller 21 is to circulate warm air

through the tub 15 during the entire operational cycle. After the completion of the wash and rinse cycles it expedites the drying action. The impeller 21 is disposed in a housing 30 which has an outlet 31 and an inlet 32. As the impeller 21 rotates, air is drawn into the inlet 32 and, as can best be seen in FIG. 2, this inlet air is channeled into close proximity with the drive motor 18 by means of a shield 33 which surrounds the drive motor 18. The heat generated by the normal operation of the drive motor 18 is partially transferred to the air entering the housing 30. This warm air is circulated through the tub 15 via the outlet 31 and eventually passes out of the tub 15 through suitable outlet means (not shown). A cap 34 is provided at the upper termination of outlet 31 to prevent water from entering the housing 30. Air circulates around the cap 34 as indicated by the arrows in FIG. 1.

The dishwasher is initially filled with water by means of a conduit 35 which extends from a connection with the conventional house plumbing to an electrically-operated fill valve 36. Conduit 37 extends from the fill valve 36 to a junction at which it divides into branches 37*a* and 37*b*. Branch 37*a* communicates with the interior of tub 15 and branch 37*b* communicates with valve 26.

As pointed out above, the primary purpose of the present invention is to provide a control means which makes practical the employment of a shaded-pole drive motor. This is accomplished by providing a control system which allows the drive motor to run during the entire wash cycle to thereby avoid starting the motor under load. In accordance with the invention, there is provided a simple, low cost control circuit as illustrated in FIG. 3. A cam 38 is mechanically linked to the control knob 14 and is also adapted to be driven by a timer motor 39. As the control knob 14 is rotated to initiate a washing cycle, cam 38 is rotated counterclockwise a few degrees from the position shown in FIG. 5 so that cam follower 40 rests on surface 41 of cam 38. This causes contact 42, carried by cam follower 40, to engage contact 43 carried by arm 44. This engagement between contacts 42 and 43 closes the circuit through the timer motor 39 and the drive motor 18. From this point on, the timer motor 39 continues to rotate the cam 38 through the entire cycle. It should be noted that under these conditions the drive motor 18 is started under no load. Although the impeller 21, the drain pump 20 and the recirculation pump 22 are directly linked to the motor and rotate with it, neither of the pumps requires a significant starting torque inasmuch as there is no water in the tub 15 and, therefore, they are performing no work.

The timer motor 39 continues to drive the cam 38 until the cam follower 40 approaches surface 45 whereupon the cam follower 40 is urged outwardly thereby forcing contact 43 into engagement with contact 46. The engagement between contacts 43 and 46 results in the energization of fill valve 36 which then allows water to enter tub 15 through branch 37*a* of conduit 37. As the cam follower 40 moves along surface 45, water is introduced into tub 15 and as it accumulates at the bottom of tub 15, it enters conduit 28 whereupon recirculation pump 22 forces it out through orifices 17 thereby effectuating a washing or rinsing action.

To prevent removal of water from the tub 15 during a wash or rinse period, the valve 26 is arranged in conduit 25 and branch 37*b* of conduit 37 and is constructed as shown in FIG. 4. During the period that the fill valve 36 is open, water pressure in conduit 37 causes valve 26 to remain closed. This operation will be better understood by reference to FIG. 4, wherein valve 26 is shown in sectional detail. A flexible diaphragm 47 stretches across the casing of valve 26 and in its relaxed state, as shown in FIG. 4, it is spaced from the end of conduit 25. When the fill valve 36 is open and water pressure is introduced into conduit 37, this pressure causes diaphragm 47 to come into contact with, and seal the end of, conduit 25. This sealing action prevents water, coming from the drain pump 20 through conduit 25, from entering conduit 27.

Usually, dishwashers of the domestic type are installed under the conventional 36 inch high kitchen counter. The discharge line 27 ordinarily rises to a point several inches above the counter top and then discharges downwardly into a drainage fitting (not shown) which discharges into the drainage fitting of the kitchen sink. Pursuant to plumbing codes, this discharge arrangement provides for an air gap of at least one inch vertical dimension. The result of this is that the discharge pump 20 is subjected to a maximum head pressure of the order of three and one half feet, representing, when line friction is considered, a discharge pressure of less than two pounds per square inch.

It is obvious that the diaphragm 47 is substantially larger in area than conduit 25, whereupon a very low pressure in pounds per square inch would suffice to hold the diaphragm 47 seated against the discharge effort of pump 20. The insure that the diaphragm moves to open position at the termination of flow through inlet valve 36, and to circumvent any possibility of the diaphragm sticking closed as a result of food soil thereon, it is desirable to employ a coil spring 47*a* to load the diaphragm to require a pressure of at least five pounds per square inch to close the diaphragm against conduit 25. A domestic water supply may have a pressure as low as fifteen pounds per square inch (gage). By appropriate restriction at the discharge end of conduit 37*a*, as by an orifice 48 of suitable discharge area, any desired pressure above five pounds per square inch (and within the limits of the line pressure) may be maintained in conduit 37*b* during the stage of flow through valve 36.

Valve 36 remains open until cam follower 40 passes from surface 45 to surface 49. Since surface 49 is essentially identical to surface 41, contact 43 disengages from contact 46 but contact 42 remains in engagement with contact 43. Since this deenergizes the fill valve 36, water ceases to enter tub 15 and the water pressure on diaphragm 47 in valve 26 is released so that valve 26 opens and the drain pump 20 removes the water from tub 15. These periods are repeated as cam 28 continues to rotate. The number and length of time of the periods will be determined by the preselected configuration of cam 38. FIG. 5 graphically illustrates the various periods of a complete wash cycle with respect to the open and closed positions of the aforementioned contacts 42, 43 and 46.

The dry period, as graphically represented in FIG. 5, may simply consist of an extended cam surface having the same radial position as surfaces 41 and 49. With such an arrangement, fill valve 36 would be closed and the drain pump 20, recirculation pump 22, and impeller 21 would be rotating. The impeller 21 would circulate warm air through tub 15, as explained above, until cam 38 rotated to a point where cam follower 40 returned to the "off" position shown in FIG. 5 whereupon the timer motor 39 and the drive motor 18 would be deenergized and the cycle completed.

As will be evident from the foregoing description, certain aspects of the invention are not limited to the particular details of the construction of the example illustrated, and it is contemplated that various and 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 is claimed is:

1. In a dishwasher including a dishwasher tub, the combination comprising:

(a) first and second electric switch means adapted to be operated between open and closed circuit conditions in a predetermined time sequence,

(b) a drive motor controlled by said first switch,

(c) a drain pump driven by said drive motor,

(d) a recirculation pump driven by said drive motor,
(e) an electrically operated valve in circuit with said second switch and operated thereby between closed and open positions, said valve communicating with a water supply system,
(f) a conduit communicating between the dishwasher tub and said first valve to supply water to the dishwasher tub,
(g) said first switch means operating to maintain said drive motor energized throughout a predetermined period and said second switch means operative intermittently to open and close said valve during said period,
(h) a normally open second valve to control the removal of water from the dishwasher tub,
(i) said second valve including a diaphragm responsive to the application of fluid pressure thereto to effect a closure of said second valve,
(j) and a conduit communicating between said first-named conduit and said second valve to transmit to the diaphragm of said second valve the pressure existing in said first conduit during the open periods of said first valve, whereby said second valve is closed only during flow of water through said first valve.

2. In a dishwasher including a dishwasher tub, the combination comprising:
(a) first and second electric switch means adapted to be operated between open and closed circuit conditions in a predetermined time sequence,
(b) a drive motor controlled by said first switch,

(c) a drain pump driven by said drive motor,
(d) a recirculation pump driven by said drive motor,
(e) an electrically operated valve in circuit with said second switch and operated thereby between closed and open positions, said valve communicating with a water supply system,
(f) a conduit communicating between the dishwasher tub and said first valve to supply water to the dishwasher tub,
(g) said first switch means operating to maintain said drive motor energized throughout a predetermined period and said second switch means operative intermittently to open and close said valve during said period,
(h) a normally open second valve to control the removal of water from the dishwasher tub, and
(i) means for causing said second valve to be closed whenever said first valve is open and allowing water to flow therethrough.

References Cited by the Examiner

UNITED STATES PATENTS

2,664,701	1/54	Allen	137—107 XR
2,750,713	6/56	Chin	137—391 XR
2,962,048	11/60	Steidley	137—387 XR
3,072,192	1/63	Seal	134—57
3,083,717	4/63	Bear	134—57
3,103,229	9/63	Smith	137—107

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