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J. A. FAY

3,207,164

DISHWASHER HEATING SYSTEM

Filed Oct. 31, 1963

110 → FIG. 1.

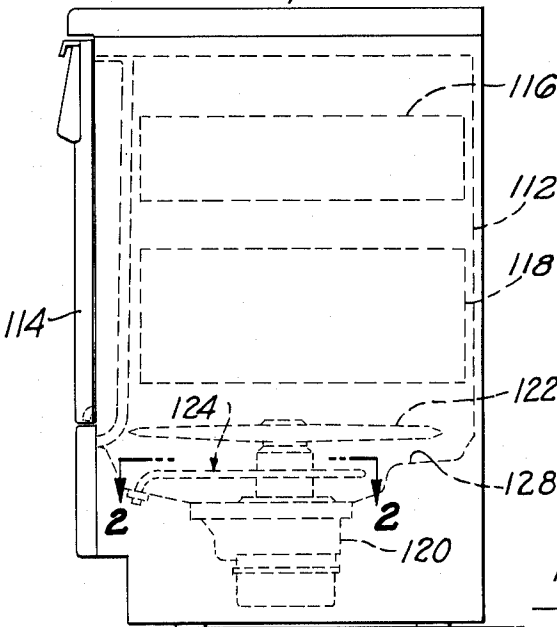


FIG. 3.

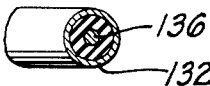


FIG. 4.

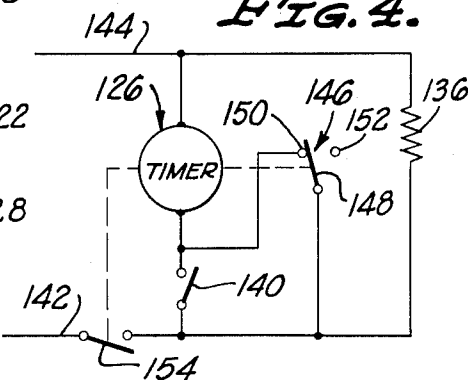


FIG. 2.

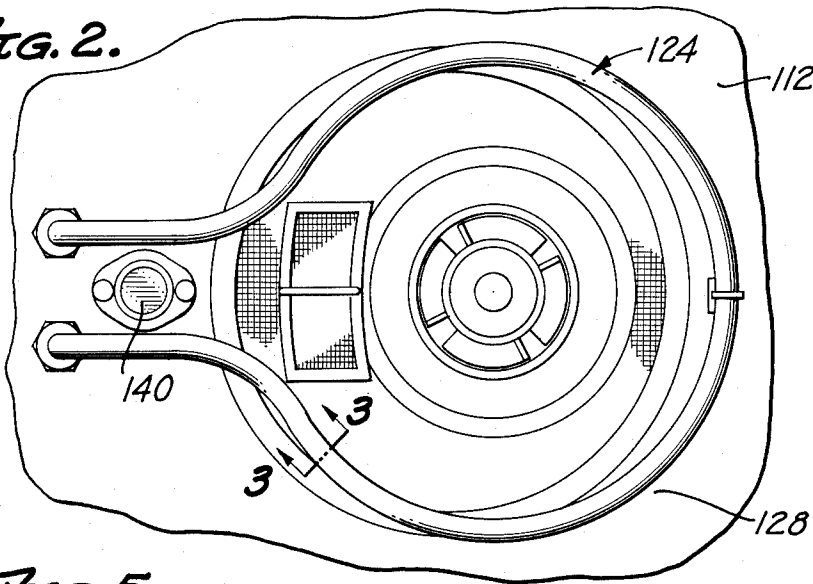
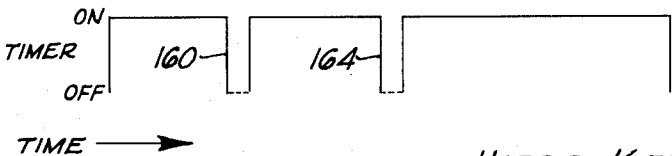


FIG. 5.



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DISHWASHER HEATING SYSTEM

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3 Claims. (Cl. 134—57)

The present invention relates in general to an automatic dishwasher, i.e., one having its operating cycle controlled by a timer or timer means, and, more particularly, to an improved timer-controlled dishwasher heating system.

The basic object of the invention is to provide a dishwasher heating means having a variable heat output which is relatively low while drying dishes in the tub of the dishwasher after they have been washed and rinsed therein, and which is relatively high when bringing the water temperature up to a predetermined level when washing or rinsing the dishes. The invention contemplates a variable-output heating means of the electrical resistance type exposed to the water in the bottom of the tub during washing and rinsing and exposed to the air in the tub during drying, such exposures preferably being achieved by mounting the electrical heating means within the tub adjacent the bottom thereof.

An important object of the invention is to provide an electrical heating means comprising a resistance heating element having a high temperature coefficient of resistance so that its heat output varies inversely with its temperature, being high when its temperature is low and low when its temperature is high.

With the foregoing construction, when the heating element is submerged in the water used for washing or rinsing, its heat output is automatically relatively high due to the resistance-lowering cooling effect of the water. On the other hand, when the heating element is exposed to the air, as during drying of the dishes after washing and rinsing, its heat output is automatically maintained at a relatively low value because the air in the tub has a relatively small resistance-lowering cooling effect compared to the water present during washing or rinsing.

The invention contemplates and an important object is to provide a resistance heating element for a household dishwasher having, for example, an output of the order of a few hundred watts when it is exposed to air and an output of the order of 1000 to 2000 watts, or more, when it is submerged in water. More particularly, the temperature coefficient of resistance of the heating element is such that the ratio of its output when exposed to water to its output when exposed to air is of the order of about 1.5:1 to about 6:1. This construction avoids overheating of the dishwasher tub and its components, as well as dishes therein, during drying, while providing an ample heat supply for bringing the water temperature up to the desired value prior to washing or rinsing, and for maintaining it at that value during washing or rinsing. For example, excellent results have been obtained with a heating element having an output of about 400 watts when exposed to heated air in the dishwasher tub at normal drying temperatures, which normally will be below 200° F. The output of the heating element may be about 1350 watts when submerged in water at approximately 120° F., the submerged output decreasing slightly from this value as the water temperature is brought up to the desired level, e.g., 170° F. to 175° F., for washing or rinsing. It will be understood that these wattage values are illustrative only and that they may be varied.

An important feature of the invention is that the heating element is self limiting insofar as its heat output is

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concerned. Consequently, with the invention, the heat output when the heating element is exposed to the air in the dishwasher tub can readily be so selected as to maintain the temperature of the tub and its components, as well as dishes therein, below a predetermined maximum value, e.g., 200° F., so as to prevent heat damage, particularly to any plastic parts being washed, rinsed and dried and any plastic parts of the dishwasher which are located within the tub. At the same time, a heat output sufficiently high to produce the desired water temperature when the heating element is submerged can readily be obtained.

Thus, the present invention easily avoids excessive temperatures within the dishwasher tub while providing ample heat for heating the water used. Furthermore, the invention accomplishes this without the constant heating-means cycling which is typical of a conventional dishwasher equipped with a single heating element, this being an important feature of the invention.

Another important advantage of the invention is that it accomplishes its basic purpose with a very simple electrical circuit for the heating system. Preferably, the heating element is "on" throughout all or a major portion of the operating cycle, so that its circuitry is very simple.

Another and important object of the invention is to provide a timer having switch means for de-energizing itself, upon the introduction of water for at least the main washing operation and the final rinsing operation, until such time as the desired wash and final rinse water temperatures are attained, and to provide temperature responsive switch means, e.g., a thermostat switch, exposed to the water in the dishwasher tub for re-energizing the timer when the water temperature reaches the desired level. With this construction, the operating cycle of the dishwasher is interrupted until such time as the water temperature attains the preselected level, whereupon the operating cycle is resumed. This insures that the water temperature will be elevated to the desired level before the main washing operation and the final rinsing operation.

Preferably, the heating element is sheathed in a conventional manner for submerged operation.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be apparent to those skilled in the art to which the invention relates in the light of this disclosure, may be achieved with the exemplary embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawing, in which:

FIG. 1 is a side elevational view of a front loading dishwasher which embodies the invention;

FIG. 2 is an enlarged fragmentary view taken as indicated by the arrowed line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken as indicated by the arrowed line 3—3 of FIG. 2;

FIG. 4 is a highly simplified, fragmentary, diagrammatic view illustrating the heater circuitry of the invention and the control system therefor; and

FIG. 5 is a fragmentary view illustrating a portion of the operating cycle of the dishwasher of the invention.

Referring initially to FIG. 1 of the drawing, the dishwasher of the invention is designated generally by the numeral 110 and is shown for purposes of illustration as including a tub 112 provided with a downwardly-opening front door 114. Dishes to be washed, rinsed and dried within the tub 112 are adapted to be supported therein by racks 116 and 118 accessible upon opening the front door 114. (It will be understood that the invention is not limited to the front loading dishwasher 110 shown.) During the main washing and rinsing operations of the

operating cycle of the dishwasher 110 (and during the pre-rinsing operation which may be carried out prior to the main washing operation), water is drawn from the bottom of the tub 112 by a motor-pump assembly 120 and is delivered to a water distributing impeller 122 which sprays the water over dishes in the racks 116 and 118.

The heating means of the invention is designated generally by the numeral 124 and is located within the tub 112 adjacent the bottom thereof and in communication with the interior of the tub.

The structure of the dishwasher 110 has been illustrated and described in a superficial way only merely to outline the environmental setting of the invention. It will be understood that the dishwasher 110 includes numerous additional components, preferably electrically operated, for performing such functions as introducing water into the tub 112 prior to the main washing and rinsing operations (and prior to the pre-rinsing operation preceding the main washing operation if such a pre-rinsing operation is utilized), for draining the water from the tub 112 after each washing or rinsing operation, for circulating heated air over dishes in the racks 116 and 118 during the drying operation, and the like. These various operations are carried out under the control of a timer or timer means which is shown diagrammatically at 126 in FIG. 4 of the drawing and which includes the usual electric timer motor, control switches, motor-driven cams for operating the control switches, and the like. These have been shown in FIG. 4 only to the extent necessary for an understanding of the present invention. For a more complete disclosure of components which are not illustrated and which are conventionally incorporated in automatic, timer-controlled dishwashers, attention is directed, for example, to Patent No. 2,918,068, issued December 22, 1959, to H. E. Karig.

Turning now to FIG. 2 of the drawing, the heating means 124 is shown as mounted on the bottom wall of the tub 112 within a sump 128 from which water is drawn by the motor-pump combination 120 when it is in operation. With this construction, the heating means 124 is below the static water level in the tub 112.

The heating means 124 includes a sheath 132, FIG. 3, containing electrical insulating material in which is embedded a resistance heating element 136 having a high temperature coefficient of resistance. For example this coefficient may be sufficiently high to reduce the output of the heating element from about 1350 watts, when the heating means is submerged in water in the sump 128 at about 120° F., to about 400 watts when it is exposed to air in the tub 112 at a temperature approaching 200° F. These values, it will be understood, are illustrative only and may be varied.

The heating element 136 is preferably on continuously and without interruption throughout the entire operating cycle of the dishwasher 110, although it may be on throughout less than the total cycle.

As shown in FIG. 2 of the drawing, a thermostat switch 140 is mounted on the bottom wall of the tub 112 below the heating element 136 and is below the static water level so as to respond accurately to water temperature. This thermostat switch controls the timer 126 in a manner to be described.

Turning to FIG. 4 of the drawing, it will be seen that the motor (not specifically shown) of the timer 126 is connected across power input lines 142 and 144 through either the thermostat switch 140, or a switch means 146 comprising a switch element 148 engageable with either of two contacts 150 and 152, the latter merely being a dead or blind contact. It will be noted that the thermostat switch 140 and the switch element and contact combination 148 and 150 are connected in parallel so that closure of the thermostat switch 140, or engagement of the switch element 148 with the contact 150, will energize the motor of the timer 126.

The switch element 148 is movable between the con-

tacts 150 and 152 by a cam, not shown, driven by the motor of the timer 126 in a conventional manner. The cam which controls the switch element 148 is so designed that it shifts this switch element from engagement with the contact 150 into engagement with the dead contact 152 whenever de-energization of the timer is required while bringing the water temperature up to a predetermined value, as will be explained.

In order to obtain continuous energization of the heating element 136 without interruption throughout the entire operating cycle of the dishwasher 110, this heating element is connected directly across the lines 142 and 144. Thus, the heating element 136 is energized as long as a main, on-off, switch 154 in the line 142 is closed. As is conventional, the main switch 154 forms part of the timer 126 and is adapted to be closed manually to start the operating cycle of the dishwasher 110, being opened by the timer 126 at the end of the operating cycle by a cam, not shown, driven by the motor of the timer.

As previously explained, the showing of FIG. 4 of the drawing has been limited to that necessary to provide an understanding of the present invention. The timer 126, of course, is equipped with other cam-operated switches, not shown, for performing various other well-known functions associated with automatic dishwasher operation.

Operation

Considering the operation of the present invention, it will be assumed that the water to be used for the main washing operation and the final rinsing operation is to be heated to a predetermined level, such as 170° F. to 175° F., determined by the thermostat switch 140. The operating cycle of the dishwasher 110 is initiated in the usual manner by manipulating the control knob, not shown, of the timer 126 in such a way as to close the main switch 154. This results in energization of the timer motor and of the heating element 136, the timer causing the dishwasher to run through the various phases of its operating cycle.

When the water for the main washing operation is introduced into the tub 112 in a conventional manner, the timer 126 shifts the switch element 148 from a position where it engages the contact 150 to a position where it engages the dead contact 152. As shown diagrammatically in FIG. 5 of the drawing, this results in de-energization of the timer, as indicated at 160. The timer 126 remains de-energized until the water temperature, as sensed by the thermostat switch 140, reaches the desired value. Since the time required to accomplish this is variable, depending upon the initial water temperature, the rate of heat loss from the dishwasher 110, and the like, the interval 160 has been shown as of indeterminate length with respect to time by utilizing a dotted line for the crest thereof.

Once the thermostat switch 140 closes in response to attainment of the desired water temperature, the resulting re-energization of the timer 126 causes resumed rotation of the cam which controls the switch element 148. This cam, after a brief interval, restores the switch element 148 to its initial position, viz., the position wherein it is in engagement with the contact 150, so as to maintain energization of the timer 126 independently of the thermostat switch 140.

Similarly, the timer 126 is de-energized upon the introduction of the water required for the final rinsing operation, and prior to commencement of this operation, as indicated at 164 in FIG. 5 of the drawing.

Considering the operation of the heating element 136 in more detail, if the initial water temperature prior to the main washing or final rinsing operations is assumed to be of the order of 120° F., the heat output of the heating element will be at or near its maximum, i.e., at or near 1350 watts for the particular example given earlier. The cooling effect of the water in which the heating element 136 is submerged varies only slightly with

water temperature so that there is only a relatively small reduction in the heat output of the heating element as the water temperature rises. For example, if the heat output is 1350 watts at a water temperature of 120° F., the heat output will be reduced to only about 1300 watts by the time the water temperature reaches the desired washing or rinsing temperature, which may be of the order of 170° F. to 175° F. Thus virtually the maximum heat output of the heating element 136 is available throughout the warm-up periods prior to the main washing and the final rinsing operations.

As soon as the timer 126 is re-energized to start the main washing or final rinsing operation, the agitation of the water resulting from spraying it throughout the tub 112 causes an immediate reduction in the water temperature as the result of evaporative cooling and radiation. Consequently, even though the heating element 136 continues to operate near its maximum output throughout the main washing or final rinsing operation, each such operation is short enough that an excessive water temperature will not be reached before it ends. Normally, the water temperature at the end of the main washing or final rinsing operation will not exceed the water temperature at the beginning of such operation.

However, when the heating element 136 is exposed to air in the tub 112, as throughout the drying cycle, it immediately heats up to such an extent, due to the smaller cooling effect of the air to which it is exposed, as to reduce its heat output to or near the minimum value, e.g., 400 watts. The heat output then remains at or near this minimum value throughout the drying cycle. As previously indicated, such minimum value is low enough that the heat loss from the tub 112 prevents elevation of the temperature of dishes or dishwasher components within the tub above a predetermined maximum value, e.g., 200° F.

Thus, the heating element 136, due to its high temperature coefficient of resistance, inherently and automatically controls and limits both the water temperature and the air temperature, or the temperature of the dishes and dishwasher parts within the tub 112. This is achieved without any cycling of the heating element 136, i.e., without any necessity for periodically turning the heating element on and off.

Although an exemplary embodiment of the invention has been disclosed herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims which follows.

I claim:

1. In a dishwasher for washing, rinsing and drying dishes, the combination of:

- (a) a tub adapted to contain dishes to be washed, rinsed and dried and adapted to contain water for washing and rinsing them;
- (b) an electrical resistance heating element exposed to the interior of said tub adjacent the bottom thereof and below the static water level in said tub when it contains water for washing and rinsing dishes therein;
- (c) said heating element having a high temperature coefficient of resistance providing it with a high heat output when it operates at a low temperature and providing it with a low heat output when it operates at a high temperature;
- (d) whereby said heating element has a high heat output when it is submerged in water in said tub; and

(e) whereby said heating element has a low heat output when it is exposed to air in said tub during drying of dishes therein, and thus automatically limits the maximum temperature of the structure of said tub, of dishwasher parts within said tub, and of dishes being dried therein.

2. In a dishwasher for washing, rinsing and drying dishes, the combination of:

- (a) a tub adapted to contain dishes to be washed, rinsed and dried and adapted to contain water for washing and rinsing them;
- (b) an electrical resistance heating element in said tub adjacent the bottom thereof and below the static water level in said tub when it contains water for washing and rinsing dishes therein;
- (c) said heating element having a high temperature coefficient of resistance providing it with a high heat output when it operates at a low temperature and providing it with a low heat output when it operates at a high temperature;
- (d) whereby said heating element has a high heat output when it is submerged in water in said tub; and
- (e) whereby said heating element has a low heat output when it is exposed to air in said tub during drying of dishes therein, and thus automatically limits the maximum temperature of the structure of said tub, of dishwasher parts within said tub, and of dishes being dried therein.

3. In a dishwasher for washing, rinsing and drying dishes and having timer means for controlling its operating cycle, the combination of:

- (a) a tub adapted to contain dishes to be washed, rinsed and dried and adapted to contain water for washing and rinsing them;
- (b) an electrical resistance heating element in said tub adjacent the bottom thereof and below the static water level in said tub when it contains water for washing and rinsing dishes therein;
- (c) said heating element having a high temperature coefficient of resistance providing it with a high heat output when it operates at a low temperature and providing it with a low heat output when it operates at a high temperature;
- (d) whereby said heating element has a high heat output when it is submerged in water in said tub;
- (e) whereby said heating element has a low heat output when it is exposed to air in said tub during drying of dishes therein, and thus automatically limits the maximum temperature of the structure of said tub, of dishwasher parts within said tub, and of dishes being dried therein;
- (f) means controlled by said timer means for de-energizing said timer means at at least one predetermined point in the operating cycle of said dishwasher; and
- (g) temperature responsive means communicating with the interior of said tub adjacent the bottom thereof for re-energizing said timer means.

References Cited by the Examiner

UNITED STATES PATENTS

1,101,821	6/14	Van Aller	219—25 X
1,974,302	9/34	Finlayson	219—20.41
2,081,636	5/37	Minors	134—57
2,781,765	2/57	Steidley	134—57
3,041,212	6/62	Booth	134—107 X
3,049,133	8/62	Jacobs	134—57

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