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Jacobs

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[54] **MEANS FOR HEATING INCOMING WATER IN A DISHWASHER**

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[73] Assignee: **General Motors Corporation**, Detroit, Mich.

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[52] **U.S. Cl.** ..... **134/57 D**; 134/108

[51] **Int. Cl.²** **B08B 3/02**

[58] **Field of Search** ..... 134/57 D, 105, 108

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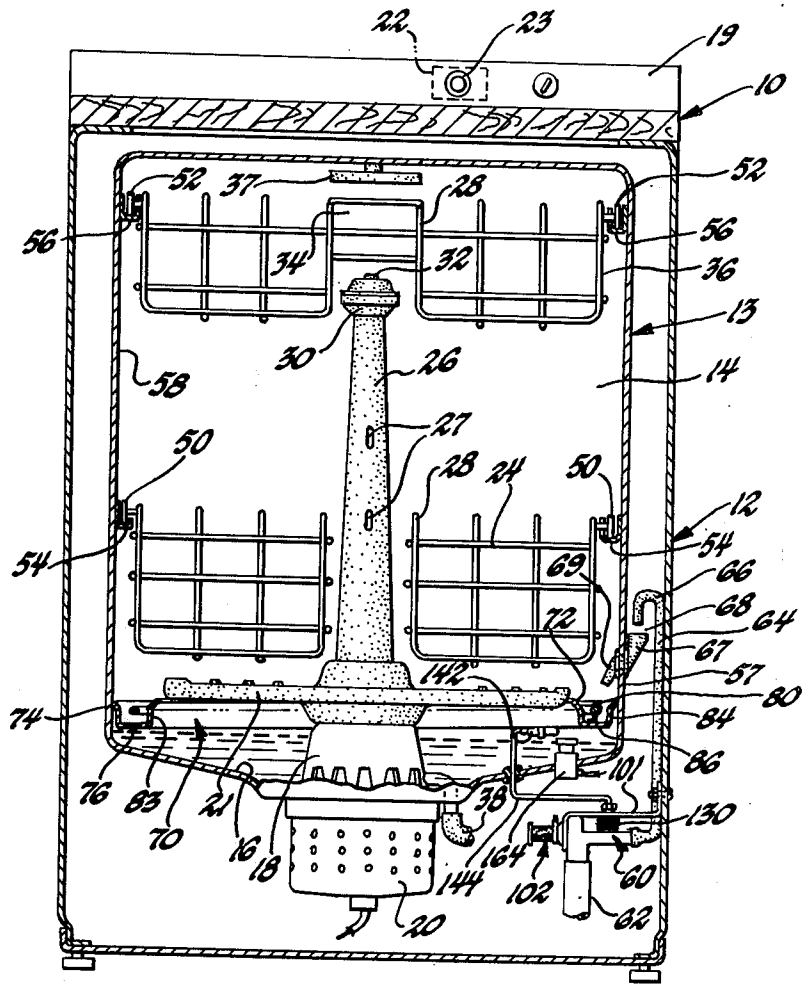
Primary Examiner—Robert L. Bleutge

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[57] **ABSTRACT**

A dishwasher having means to preheat the water entering through a fill spout overlying a trough with a heater element supported therein in a coextensive manner such that the energized heater is immersed in heat exchange relation with the water. The trough is inclined having its high end positioned to receive the entering water while the trough outlet is at its lower end. The water flow rate is such that upon exiting from the trough outlet into the dishwasher sump a temperature controlled rate is maintained so that water fed to the pump will have been heated to a predetermined value in the trough of at least 140° F.

4 Claims, 6 Drawing Figures



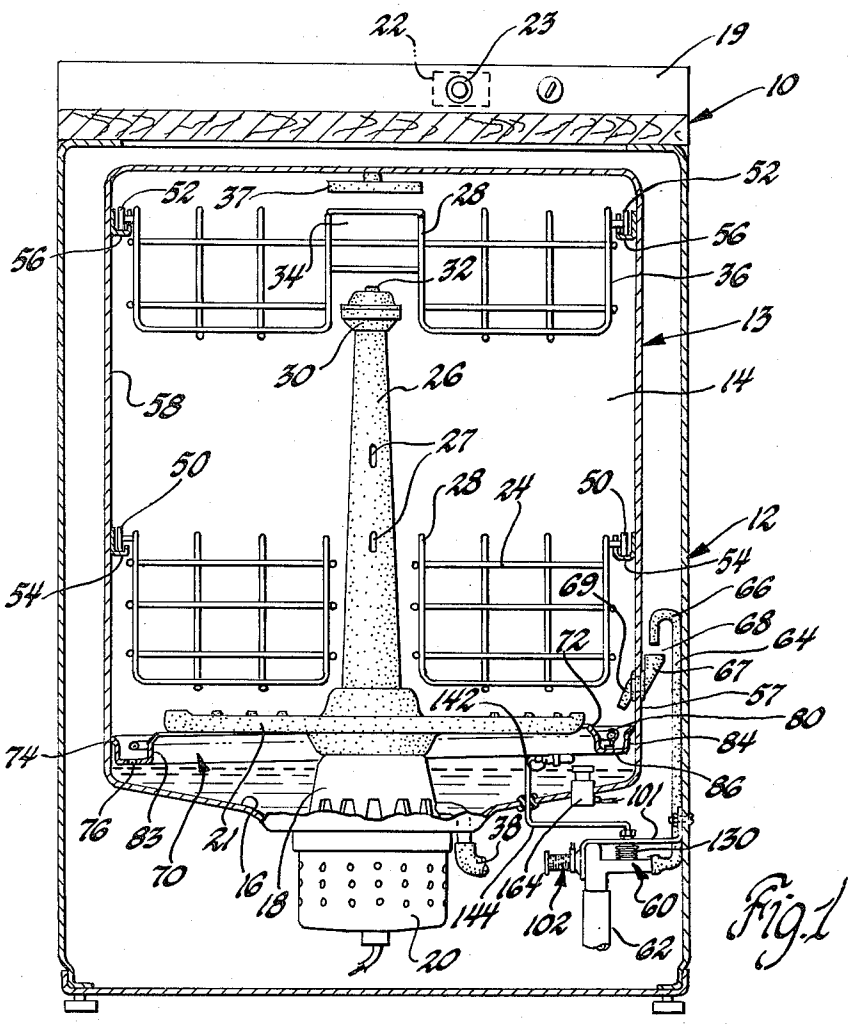

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Fig. 1

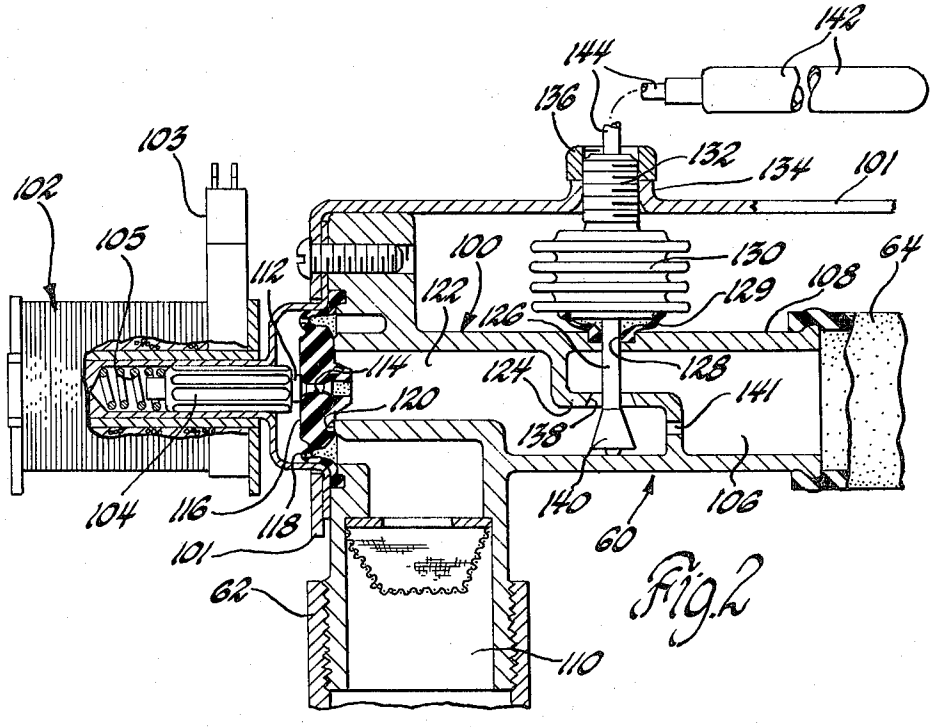

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Fig. 2

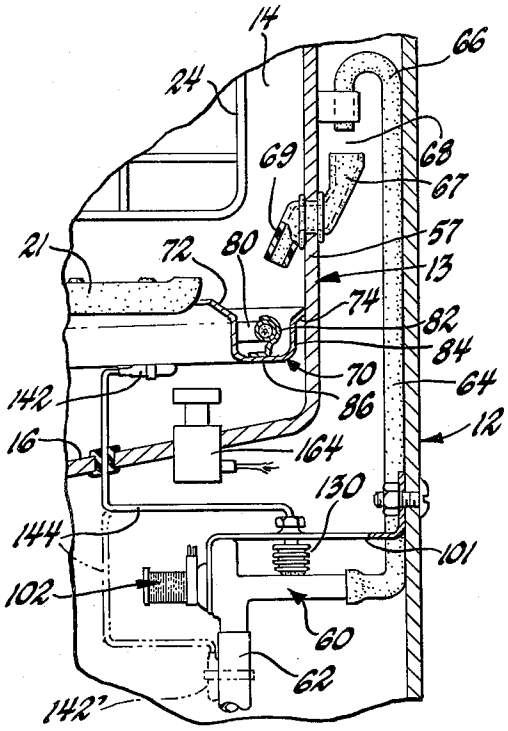


Fig. 3

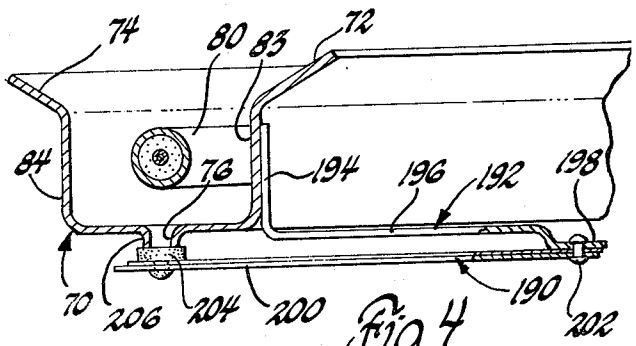


Fig. 4

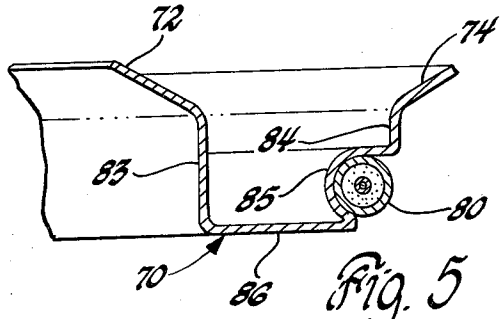


Fig. 5

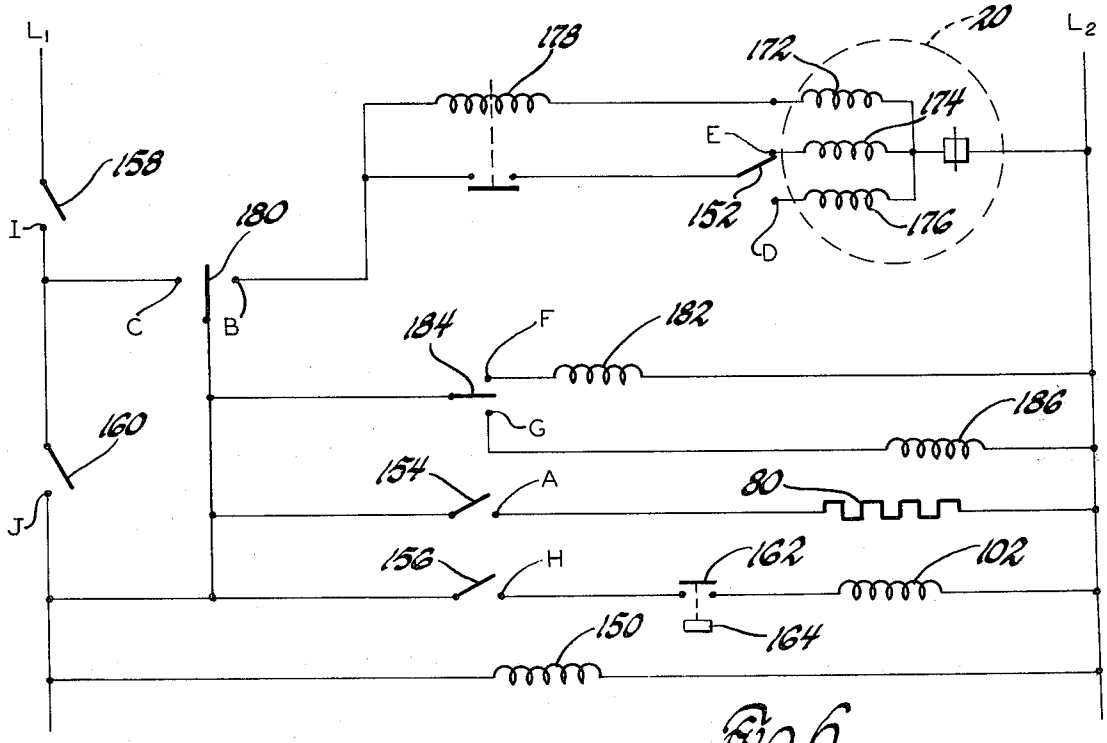


Fig. 6

MEANS FOR HEATING INCOMING WATER IN A DISHWASHER

This invention relates to automatic dishwashers and more particularly to a water heating arrangement for an automatic domestic dishwasher.

In the development of the dishwashing art a long-standing problem has been providing a water heating system that insures that the wash water normally reaches a minimum of 140° F. and preferably 150° F. It is the present practice to have an electric heating element located in the dishwasher sump such that upon being filled the heating element may be energized to elevate the temperature of the water in the sump to a predetermined temperature, for example 150° F., prior to the starting of the wash cycle of the dishwasher. Thus the dishwashing cycle will only be initiated when the water has attained the predetermined temperature. This water heating procedure results in a delay before starting the dishwashing cycle and creates an excess use of electrical energy because of the inefficient way the water is heated in the sump.

Accordingly, it is an object of this invention to provide an improved automatic dishwasher with means for preheating the water entering the dishwasher by flowing it first in conduit means at a flow rate permitting heat exchange with an electrical heater element whereby the water is raised to a predetermined temperature before the water enters the dishwasher sump.

It is a further object of this invention to provide an automatic dishwasher including an improved arrangement for supplying additional heat to the water entering the dishwasher sump by means of a fill spout overlying the high end of a sloped trough and with the low end of the trough provided with an outlet communicating with the dishwasher sump, and whereby the electric heating element is cradled within the trough and coextensive therewith causing the energized heater element to be immersed in the water in maximum heat exchange relation therewith. The heater trough has upwardly directed outer flanges so as to intercept water draining down from the dishwasher tub walls for return to the trough for reheating. A control circuit is provided for regulating the amount of water temperature increase by controlling the rate at which the water flows through the trough by means of a solenoid operated valve. A modification of the invention provides means wherein the water flow rate may be controlled by a bimetal valve which opens and closes the trough outlet in accordance with the sensed sump water temperature.

Further objects and advantages of the present invention will be apparent from the following description, wherein preferred embodiments of the present invention are clearly shown.

In the Drawings:

FIG. 1 is a generally schematic representation of a dishwasher incorporating the invention;

FIG. 2 is an enlarged fragmentary sectional view of the water valve control arrangement for the dishwasher;

FIG. 3 is an enlarged fragmentary sectional view of the water inlet tube, solenoid operated, water valve, water trough, heater and float switch;

FIG. 4 is a sectional view through a modified temperature responsive water flow control device;

FIG. 5 is a cross sectional view through an alternate heater and trough assembly; and

FIG. 6 is a schematic wiring diagram for controlling the dishwasher in accordance with the teachings of the present invention.

In accordance with this invention, and with reference to FIG. 1, a dishwasher 10 is shown composed of a casing 12, enclosing a dishwashing tub 13 defining a dishwashing chamber 14. The dishwashing chamber 14 is closed at the front thereof by a door (not shown) and having at the bottom thereof a depressed sump 16 leading to a water distribution system of the type taught in the commonly assigned U.S. Pat. No. 3,265,311, issued Aug. 9, 1966, the disclosure thereof being incorporated by reference herein.

The water distribution system of the dishwasher 10 may include a pump assembly 18 driven by a motor 20. The pump assembly 18 includes a rotatable spray arm 21 thereon to which fluid is supplied from the sump region 16 for distribution through the dishwashing chamber 14 during a cleaning cycle of the dishwasher as established by a sequence or timer control means 22 having a timer control knob 23 located on the front of an upper splash panel 19.

In general, the water distribution system includes the revolving spray arm 21 located beneath a lower utensil supporting rack 24 and a rotating spray column or tube 26 affixed to the spray arm and extending upwardly through a guard portion 28 of the lower rack permitting the removal of the lower rack from the chamber 14. The spray tube 26 has outlets 27 and is also formed with an enlarged or bulbous housing portion 30 at the top thereof having an outlet 32 aimed through an open passageway 34 formed by a central wire network of an upper utensil supporting rack 36. The jet stream from the outlet 32 may be aimed at a rotatable and freely rotating swirl spray impeller or waffle plate water deflector 37 above the upper rack 36.

The details of one such water spray system is shown in U.S. Pat. No. 3,496,949 issued Feb. 24, 1970 to Mercer and assigned to the assignee of the present invention, the disclosure of which is incorporated by reference herein. The reversible motor 20 directly drives the axial flow pump 18 in one direction in accordance with the teachings of the aforementioned U.S. Pat. No. 3,265,311 to recirculate the water for washing or rinsing, and when reversed pumps the water through outlet tube 38 to drain. The upper rack 36 may be used for cups, glasses, etc. while the lower rack 24 is adapted for receiving plates, bowls, etc. The racks are made of heavy gage steel wire which is coated with suitable resilient material such as white vinyl plastic. Each rack has nylon rollers located at 50 and 52 to allow easy movement of the racks 24 and 36, respectively, in and out of the dishwashing chamber during loading and unloading thereof. The nine nylon rollers 50, 52 glide on stainless steel glides, such as 54 for the lower rack and 56 for the upper rack, which are screw fastened to the side wall of the wash tub 13 in a suitable manner.

Water is supplied to the dishwashing chamber 14 by means of selectively actuated water supply valve 60 which is connected to any convenient domestic water supply by means of a conduit 62. Water is carried from the valve 60 by means of a conduit 64 terminating in a 180° elbow portion 66 which downwardly directs water into a receiving funnel 67 across an air gap 68 serving as a vacuum breaker which is normally provided in machines of this type in order to satisfy the requirements of most municipal plumbing codes. The

funnel 67 has a fill spout 69 which extends through the tub right hand wall 57 in a watertight fashion to direct the supply of water into a trough member generally indicated at 70. The amount of water supplied to the trough 70 will be determined in accordance with the timing operation of the dishwasher timer 22 in a manner to be explained.

A trough member 70, located below the arm 21, is channel-shaped in cross section having an inwardly and upwardly sloped radial inner flange 72 and an outwardly and upwardly sloped radial outer flange 74 which terminates into flush sealed engagement with the inner walls of the tub 13 and is secured thereto by suitable means, such as welding. The trough flange 74, which in the disclosed form is generally rectangular shaped in plane to conform to the tub front, back and side walls, catches water draining down the tub walls after having been impinged or condensed on the surface thereof.

As best seen in FIG. 1, the trough 70 is sloped with its high end located beneath the outlet of the fill spout 69 while its low end is located adjacent the left hand tub side wall 57 such that the trough outlet or drain hole 76 is positioned at the low end of the trough, such that all the water entering the trough via the fill spout eventually empties into the sump 16.

As best seen in FIG. 3, an electrically energizable heating means, such as a calrod heater element 80, is supported within the trough by means of suitable clip members 82 in a spaced coextensive manner from the side walls 83 and 84 and bottom wall 86 of the U-shaped channel portion of the trough. Thus, by having the heater 80 cradled within the trough 70 the entering water, by virtue of flowing through the trough from its high end to its low end outlet 76, results in the heater being immersed in close heat transfer relation with the water throughout its flow path, resulting in the water flowing at a temperature responsive rate whereby the water is maintained at a desired predetermined minimum temperature, which in the disclosed form is about 140° F.

As seen in FIG. 2 the water supply or selector valve means 60 includes a valve body 100 mounted by bracket member 101 on the inner face of casing 12. Valve solenoid 102, with its electrical terminals encased in mounting conduit 103 moves a plunger or armature 104 biased to the right by spring 105. FIG. 2 shows the valve in its closed position, allowing no water to flow. The outlet side or passage 106 of tube 108, connected to the dishwasher tub 13 by conduit 64, is at atmospheric pressure and the inlet side or passage 110 of inlet tube 62 of the valve has full water supply line pressure applied to it. The plunger 104 has its cone tip 112 seated in a countersunk pilot hole 114 of valve diaphragm 116. The bleeder holes 118 in the diaphragm allow full line pressure to be applied to the back side thereof. This, together with the pressure of the armature 104 on the diaphragm, keeps the diaphragm seated to the valve body seat 120 and allows no water to flow.

In the valve opening process upon the solenoid 102 being energized, the armature 104 moves to the left from the pilot hole 114 and the water behind the diaphragm passes through the pilot hole into the valve body chamber 122 separated from the valve outlet passage 106 by a globe-like valve partition 124. Reciprocable transversely of the tubular passage 106 is a valve stem 126 which extends through the valve body aperture 128 and flexible seal 129 for connection with bellows 130 whose opposite end has a spindle 132 threadably received in bracket bushing 134 for retention by a calibration lock nut 136. The stem 126 free end extends through a ported valve seat 138 and the stem has a conical flow restrictor or stopper 140 which moves axially against valve seat 138 when the bellows is in its cold position partially cutting off communication between the valve inlet 110 and outlet 106, as some water will flow through partition bypass orifice 141. The stopper 140 is shown in its minimum restriction or warm position establishing maximum flow between the valve inlet 110 and outlet 106 by way of the valve diaphragm being in its resiliently biased position away from valve seat 120.

The solenoid operated water valve 60 therefore has its flow regulated in proportion to the trough temperature by sensing means such as charcoal-filled, cross-ambient operating thermostatic bulb portion 142, to control operation of the flow restrictor 140 even though the bulb may be warmer than the bellows 130. The bulb portion 142 is connected to the gas filled bellows by tube 144 such that the bulb is affixed to the underside of the trough base wall 86 to sense the water temperature therein. Thus, the lower the temperature of the water in the trough below the preselected temperature of 140° F., the more the stem 126 will tend to seat the flow restrictor against valve seat 138 to lower the fill rate of the fill valve 60 to that flowing through orifice 141. In an alternate arrangement, the thermostatic bulb may be clamped to the incoming water line 62 as at 142' to regulate the inflow of water.

In operation, the dishwasher 10 may be provided with the control circuit of FIG. 6 for sequentially controlling the components of the dishwasher. These components may include the reversible motor 20, a timer motor 150, the solenoid 102 for the supply valve 60 and the heater 80. A conventional timer may be used having a set of reversing contacts D and E for the motor energizing switch 152, a heater switch 154 for contact A and a fill switch 156 for contact H.

As shown in FIG. 6, power from 115 volt power supply L-1 and L-2 is provided for energizing the components of the control circuitry. In order to prevent operation of the dishwasher 10 with the door open, a door switch 158 is included. The sequentially operated circuitry of the dishwasher 10 is controlled by the timer 22 having the timer motor 150 which is selectively energized by a line switch 160 whenever the timer control knob 23 is depressed or pushed inwardly. The timer motor 150 is adapted to intermittently rotate a cam shaft (not shown) to selectively and sequentially open and close a plurality of cam actuated switches. The fill valve coil 102 is selectively energized through the cam actuated switch 156 and contact H and float switch plate contact 162 of float valve 164. The heating element 80 is energized from heating element contact A which is opened and closed by heater switch 154 actuated by the cam of the shaft. To preheat the trough 70, the heater switch 154 may be closeed by the timer cam at least one timer sequence time interval prior to that in which contact 156 is closed to energize fill valve coil 102 to assure that the heating action will begin as soon as the water enters the trough. The push-pull switch 160 is located on one end of the axially shiftable timer

shaft and is closed to J whenever the timer motor is actuated to control a dishwashing cycle.

The motor **20** includes a main run winding **172**, a water distributing start winding **174** and a water draining start winding **176**. A current responsive start relay **178** serves to energize the appropriate start winding via contact **152** in accordance with the timer selection of contacts D or E for a brief period until the motor comes up to its designed running speed and the current flow in the main winding **172** drops off. Bypass switch **180** is operative through contacts B and C to return the timer push-pull knob **23** to its outward stop position after a full washing and drying cycle. A detergent dispensing solenoid **182** is energized by cam controlled switch **184** when it closes to contact F, while a water conditioner dispenser solenoid **186** is energized upon cam controlled switch **184** when it closes to contact G.

A modified form of applicant's invention is disclosed in FIG. **4** wherein the same reference numerals will be used in the description to indicate the same components. In this modification, the temperature sensing and regulating portion of valve assembly **60** is omitted. In its place thermally responsive valve means **190** is used to control the rate of flow of heated water from the trough outlet **76**. An L-shaped bracket **192** is secured in heat sensing relation to the trough as by welding its foot **194** to the channel inner side wall **83** while its horizontal leg **196** has an offset flange **198** to which the bimetal strip **200** is secured at one end as by rivet **202**. The bimetal strip opposite end has an elastomeric valve stopper **204** snapped into a hole in the free end thereof. The valve stopper **204** seats on the drain hole downwardly directed annular flange **206** and deflects downwardly under the influence of the trough water temperature to open the trough valve outlet or drain hole **76**. The bracket **192** may be bent to calibrate the action of bimetal strip **200** such that it begins to open trough outlet **76** when the temperature of the trough water rises above **140°** F., for example. Thus, the valve means **190** controls the rate of fill water flow from the trough **70** to the sump **16** with higher temperatures resulting in an increased flow of fill water while the float-switch **162** terminates the flow by deenergizing the solenoid **102** with the result that armature **104** is biased to its downward closed position.

Another modified form of the applicants' invention is disclosed in FIG. **5**. In this modification the trough **70** is formed around heater **80** so as to bring the bottom wall **86** and side wall **84** of the trough into intimate thermal contact with the heater, as at **85**. This form reduces the corrosive action of the water on heater **70**, yet at the same time increases the heat transfer rate, particularly under conditions when the trough **70** or incoming conduit is cold and when the incoming water flow is low as is the case with the water control valve unit **60** disclosed in FIGS. **1, 2** and **3**.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

I claim:

1. A water fill system for a dishwasher having a washing compartment and a water collecting sump, a fill valve and drainage means for said compartment, electrical operating means for effecting the operation of the inlet of said fill valve, a motor-pump unit for selectively pumping water to spray means or to said drainage means, an elongated sloped trough positioned between said washing compartment and said sump, said trough having outlet means adjacent its low end communicating with said sump, electrically energizable heating means disposed coextensive with said trough, conduit means for conducting water from said valve to the high end of said trough, cycle control means for energizing said fill valve inlet to permit water from a domestic supply to flow into said valve, said valve having first orifice means adapted to be opened and closed by valve flow restrictor means, said valve having second orifice means permitting a predetermined amount of bypass water to flow therethrough into said trough high end upon energization of said fill valve electrical operating means, thermostatic means biasing said restrictor means to an open position upon said thermostatic means sensing a predetermined trough water temperature, said thermostatic means operative for moving said restrictor means toward a closed position in response to sensing the trough water temperature below said predetermined temperature, whereby incoming fill water flows in said trough in a heat exchange manner therewith at a temperature-responsive rate such that fill water enters said sump through said trough outlet at or above said predetermined temperature.

2. A water fill system for a dishwasher having a washing compartment and a water collecting sump, a fill valve and drainage means for said compartment, electrical operating means for effecting the operation of the inlet of said fill valve, a motor-pump unit for selectively pumping water to spray means or to said drainage means, an elongated sloped trough positioned between said washing compartment and said sump, said trough having outlet means adjacent its low end communicating with said sump, an electrically energizable heater element disposed within said trough and coextensive therewith, the body of said valve having a partition dividing the interior into an inlet chamber and an outlet passage, conduit means for conducting water from said valve outlet passage to the high end of said trough, cycle control means for energizing said fill valve inlet to permit water from a domestic supply to flow into said valve inlet chamber, said partition having a first orifice adapted to be opened and closed by a valve flow restrictor, said partition having second orifice means permitting a predetermined amount of bypass water to flow therethrough into said trough high end upon energization of said fill valve electrical operating means, thermostatic means biasing said restrictor to an open position upon said thermostatic means sensing a predetermined trough water temperature, said thermostatic means operative for moving said restrictor toward a closed position in response to sensing the trough water temperature below said predetermined temperature, whereby incoming fill water flows in said trough in a heat exchange manner with said heater at a temperature-responsive rate, such that fill wateer enters said sump through said trough outlet at or above said predetermined temperature.

3. A water fill system for a dishwasher having a washing compartment and a water collecting sump, a water inlet fill valve and drainage means for said compartment, electrical operating means for effecting the operation of said fill valve water inlet, a motor-pump unit for selectively pumping water to spray means or to said drainage means, an elongated sloped trough positioned between said washing compartment and said sump, said trough having outlet means adjacent its low end com-

municating with said sump, thermally responsive valve means for opening and closing said trough outlet means, an electrically energizable heater element disposed within said trough and coextensive therewith, conduit means for conducting water from said valve outlet to the high end of said trough, cycle control means for energizing said fill valve inlet to permit water from a domestic supply to flow into said trough high end upon energization of said fill valve electrical operating means, said thermally responsive valve means operative for closing said trough outlet means upon sensing the trough water temperature below a predetermined temperature, said thermally responsive valve means operative for opening said trough outlet means in response to sensing the water temperature in said trough at said predetermined temperature, whereby incoming fill water flows in said trough at a rate proportional to the temperature attained by the water flowing in heat exchange with said heater element.

4. A water fill system for a dishwasher having a washing compartment and a water collecting sump, a water inlet fill valve and drainage means for said compartment, electrical operating means for effecting the operation of said fill valve water inlet, a motor-pump unit for selectively pumping water to spray means or to said drainage means, an elongated sloped channel sectioned trough positioned between said washing compartment and said sump, said trough having a valve outlet adjacent the low end of its bottom wall communicating with said sump, a thermally responsive trough valve for opening and closing said trough valve outlet, said trough valve including a bimetal actuator having one end fixed to said trough bottom wall and having a valve stopper on its free end, said bimetal actuator biased to normally close said trough valve outlet, said bimetal actuator operative to deflect downwardly and open said valve outlet upon sensing a predetermined trough water temperature of about **140°** F., an electrically energizable heater element disposed within said trough and coextensive therewith, conduit means for conducting water from said valve outlet to the high end of said trough, cycle control means for energizing said fill valve inlet to permit water from a domestic supply to flow into said trough high end upon the energization of said fill valve electrical operating means, said trough valve operative for closing said trough outlet upon sensing the trough water temperture below said predetermined temperature, said trough valve operative for opening said trough valve outlet in response to sensing the trough water temperature at said predetermined temperature causing water to flow therefrom into said sump, whereby incoming fill water flows in said trough at a rate proportional to the temperature attained by the water flowing in heat exchange with said heater element.

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