

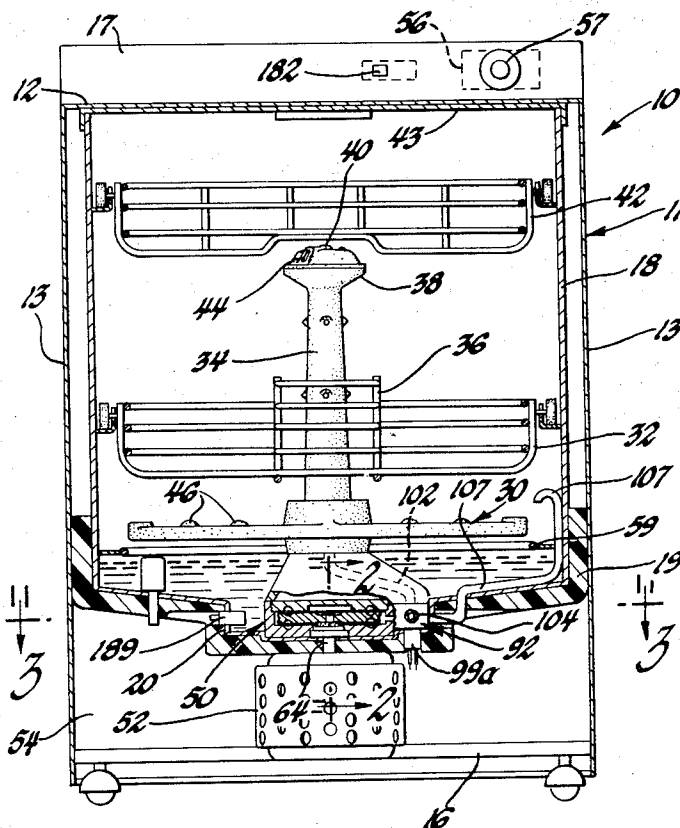
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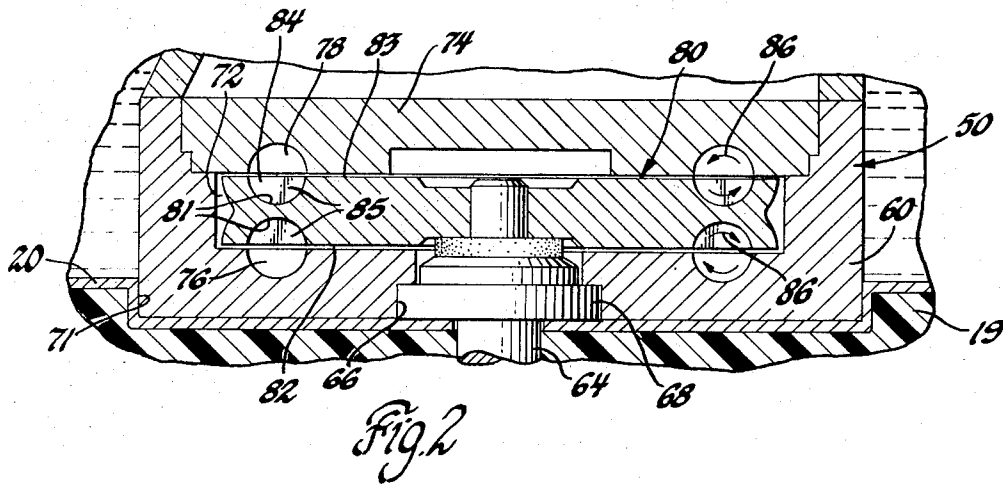
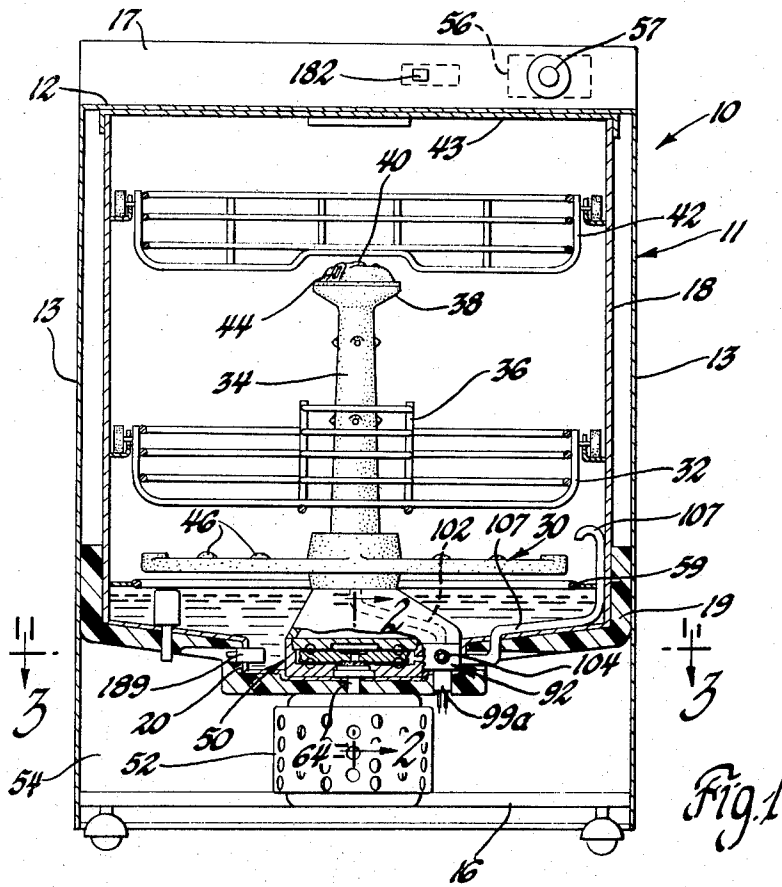
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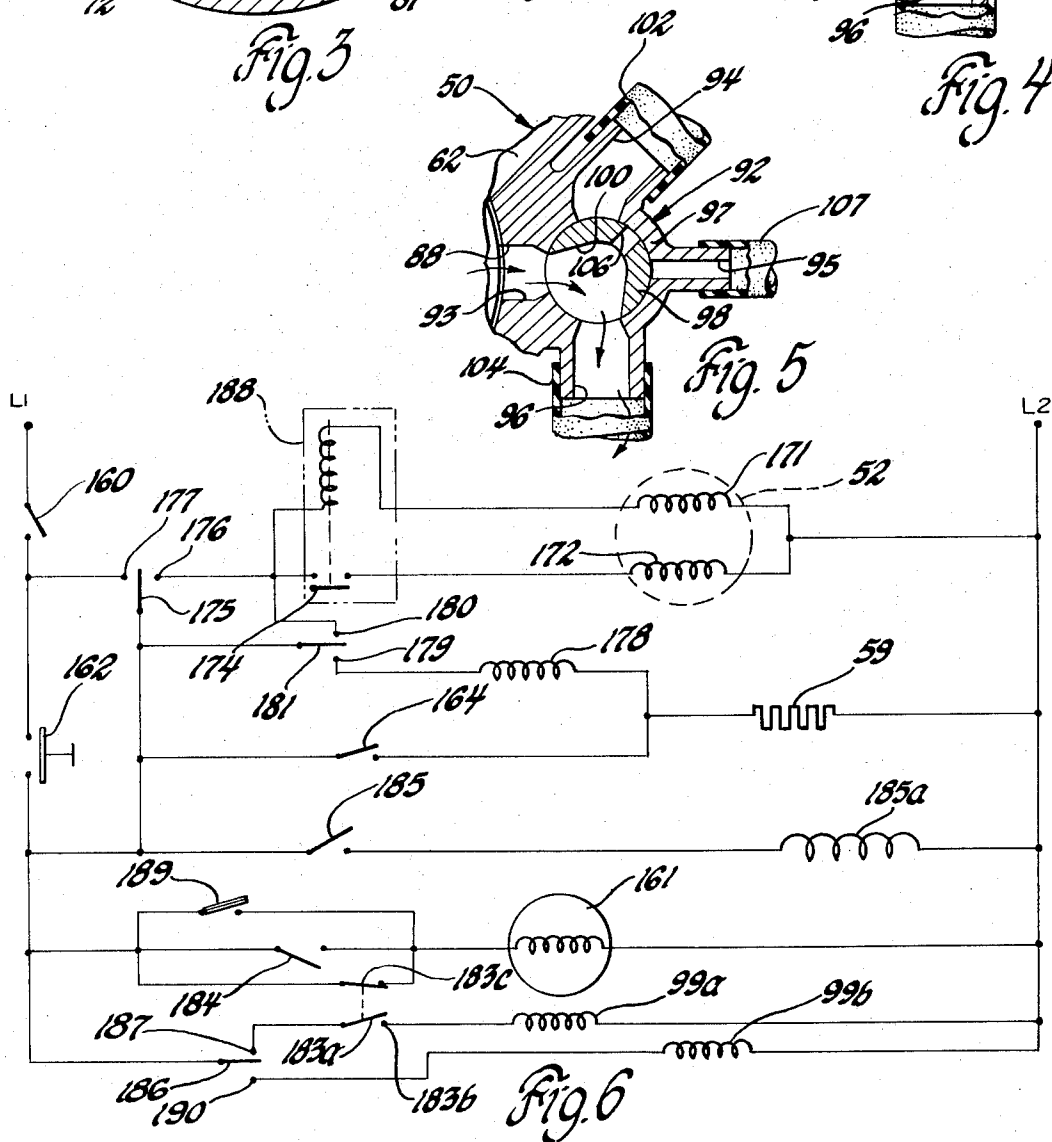
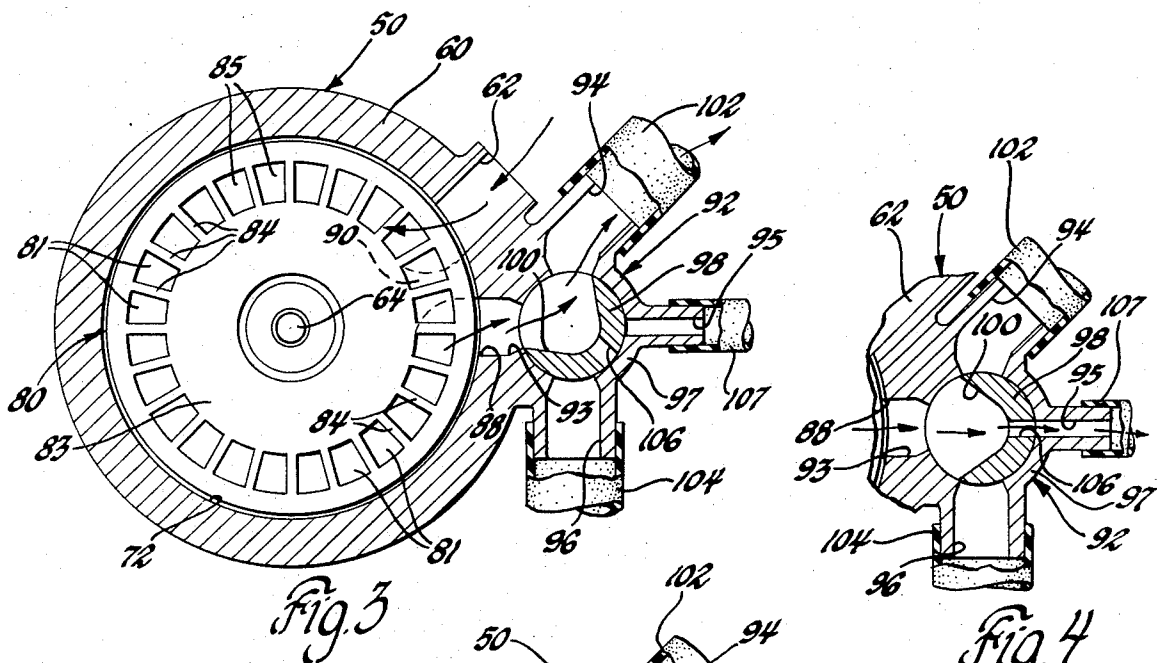
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- ## ABSTRACT

3 Claims, 6 Drawing Figures







WATER HEATING SYSTEM FOR A DISHWASHER

This invention relates to dishwashers and more particularly to a water heating system utilizing a regenerative pump to effect or assist in raising the water temperature within the dishwasher chamber.

Conventional dishwasher heating systems employ a resistance heating element located in the sump portion of the chamber to raise and maintain the temperature of the incoming hot water. The present invention is based on the novel use of a regenerative type turbine pump having positive displacement characteristics such that by throttling the pump's discharge the rise in the head pressure is coordinated with an increase in the input work drawn from the drive motor causing the pump efficiency to fall. The increased work input, coupled with the lower pump efficiency, are effectively used to heat the water flowing through the pump and to increase the temperature of the water in the dishwasher sump, for example, to 150° F. to insure thorough cleaning and sanitizing of the dishware.

Accordingly, it is an object of this invention to provide a dishwasher having a turbine type regenerative pump driven by an electric motor responsive to a control circuit such that by increasing the input work drawn from the motor coupled with valve means to throttle the pump's discharge and consequent lower efficiency are effectively used to heat water flowing through the pump and to increase the temperature of the water in the dishwasher sump, for example, to 150° F.

Other features and advantages of the invention will be apparent from the following description of a certain embodiment taken in combination with the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

IN THE DRAWINGS:

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

FIG. 2 is an enlarged vertical sectional view of the regenerative pump taken generally on the lines 2—2 of FIG. 1;

FIG. 3 is an enlarged horizontal sectional view taken generally on the lines 3—3 of FIG. 1 showing the regenerative pump and its valve in the water recirculation position;

FIG. 4 is a broken sectional view through the valve of FIG. 3 and showing the valve in its water heating position;

FIG. 5 is a broken sectional view through the valve shown in FIG. 3, and showing the valve in its drain position;

FIG. 6 is a schematic wiring diagram of a control circuit for use with the automatic dishwasher of this invention.

Referring now to the drawings and more particularly to FIG. 1, there is shown a dishwasher 10 having an outer cabinet 11 including a top 12, side panels 13, a base portion 16, an upper control panel 17 and an inner dishwashing chamber or tub 18. The dishwashing chamber 18 is a generally box-like receptacle having a depressed bottom defining a sump 20. A suitable heat insulating material 19 may enclose the bottom portion of the chamber 18 and is in turn enclosed by the outer cabinet. The cabinet also has a front opening closed by dropdown access door (not shown) closing the opening

disclosed, for example, in applicant's issued U.S. Pat. No. 3,658,075.

Although this invention is not limited to a particular type of dishwasher, for purposes of illustration the dishwasher 10 is shown provided with a revolving spray arm 30 located beneath the lower utensil support rack 32 and a rotating spray column or tower 34 fixed to the spray arm and extending upwardly through a guard portion 36 of the lower rack, permitting the removal of the lower rack from the dishwashing chamber. The spray column is formed with a large bulbous housing or header portion 38 at the top thereof having an upper spray nozzle or outlet 40, aimed toward an upper utensil supporting rack 42 and the upper chamber wall 43 together with a plurality of outlets or ports 44 around the periphery of the header 38. The reaction of the effects of the water sprayed from the spray arm ports 46 will cause the water distribution means including the spray arm 30 and spray column 34 to rotate. The water distribution system is the type disclosed in the commonly assigned Braden et al. U.S. Pat. No. 3,292,645 issued Dec. 20, 1966, disclosure thereof being incorporated by reference herein.

The water distribution system of the dishwasher 10 includes a pump assembly 50 driven by an electric motor 52 disposed below the pump assembly in the machinery compartment 54. The pump assembly 50 supports the rotatable horizontal spray arm 30 thereon to which fluid is supplied from the sump region 20 for distribution through the washing chamber 18 during a cleaning cycle of the dishwasher as established by a sequence or timer control means 56 having a control knob 57 located on the front of the dishwasher upper panel 17. Also within the lower portion of the dishwashing chamber 18 is a heater 59 which may be selectively energized at the conclusion of the wash portion of the cycle to raise the temperature within the dishwashing chamber 18 to dry the dishes therein.

As seen in FIGS. 2 and 3, the turbine pump assembly 50 draws water from the sump 20 into the pump housing 60 through inlet 62 and pressurizes the water. A rotatable shaft 64 from the motor 52 is directed upwardly through an opening 66 in the housing 60. A seal assembly 68 is supported in the pump housing 60 to sealingly engage a surface on a pump impeller 80 for preventing the leakage of fluid exteriorly of the pump 50.

A turbine or regenerative pump is a special type of centrifugal pump. A centrifugal pump introduces fluid at or near the center of the impeller. The fluid then flows between the impeller vanes and is thrown outward by the action of centrifugal force into a volute channel to be discharged from the pump. A turbine type pump, however, introduces fluid to channel closing vanes formed on each side of the impeller. The moving vanes act against the fluid in the channel to cause a complete revolution of the fluid which is then diverted out of the discharge by a partition or wall between the pump inlet and the outlet openings.

Fluid in a centrifugal pump can pass between the impeller vanes but once and energy is supplied to the fluid only while traveling the short distance from the inner to the outer periphery of the impeller. In a turbine pump, however, the fluid is recirculated between the vanes and the channel. Energy is supplied to the fluid by a number of impacts or impulses of the impeller vanes on the fluid. When the discharge is restricted, the number of impacts is increased. This increases the

work done on the fluid and thus causes an increase in its energy level and temperature.

Details of the turbine pump assembly are best shown in FIGS. 2 and 3 which illustrate a housing 60 supported in a recessed portion 71 of the sump. The pump housing 60 encloses a generally cylindrical interior 72 enclosed at its upper end by an end cover 74. Annular fluid channels 76 and 78 are formed in the housing 60 and end cover 74, respectively. A cylindrical impeller 80 is pressed onto the end of the shaft 64 for rotation within the interior 72 by the shaft.

The impeller 80 rotates between the annular channels 76 and 78. As best shown in FIG. 2, semi-circular cutouts or depressions 81 are formed in both faces 82 and 83 of the impeller 80 adjacent the annular channels 76 and 78. These depressions 81 are angularly spaced about the outer edge of the impeller 80 and are separated by radially extending walls 84. They form individual turbine buckets 85 on either side of the impeller 80 adjacent the channels 76 and 78. As the impeller 80 is rotated in the interior 72 of the housing 60, water in the channels 76 and 78 swirls in the circular eddy paths 86 as it also flows through the channels 76 and 78. The eddy currents are caused by the multiple impacts of the turbine buckets on water in the interior 72.

The water inlet 62 in the housing 60 transmits water to the channels 76 and 78 where the walls 84 of the turbine buckets 85 impinge upon the water. This causes the water to flow around the housing in channels 76 and 78 to an outlet 88 in the housing. A divider wall portion 90 extends across the channels 76 and 78 between the inlet 62 and outlet 88 to divert water flow from the channels 76 and 78 into the outlet 88.

As seen in FIG. 1, a regulating diverter valve 92 within the outlet 88 controls the flow of water from the turbine pump 50. The water which enters the pump from the sump through suction inlet 62 (as seen by the long arrow in FIG. 3) issues from the pump 50 through outlet 88 connected with the inlet 93 of the three-way valve 92 having outlets or ports 94, 95, and 96 in the cylindrical housing 97. The valve stem member 98, which is automatically controlled by suitable electrical control means such as by solenoids 99a and 99b, has a slot 100 formed therein and when the slot 100 is disposed opposite valve outlet port 94, as shown in FIG. 3, water under pressure from the pump 50 is directed into recirculation valve outlet 94 and thence via conduit 102 (FIG. 1) through an outlet opening into the rotary fluid spray arm 30 that is driven by the pump fluid to distribute spray against articles supported within the working chamber 18. When, however, slot 100 is opposite drain port 96, as seen in FIG. 5, the water is directed as shown by the arrows to drain conduit 104 connected to port 96.

As seen in FIG. 4, the valve stem member 98 has a restricted orifice 106 formed therein which is placed in axial alignment with restricted valve outlet port 95 when the valve member is rotated to its intermediate FIG. 4 position during the water heating cycle of the regenerative pump. In this manner the flow of water recirculated back to the sump through conduit 107 is restricted to thereby increase the pump head and reduce water flow of the regenerative pump so as to increase the amount of work the pump performs on the water. Said differently, with the valve in its intermediate position the positive displacement turbine pump has its discharge throttled thereby raising its head pressure. At

the same time the input work drawn from the driving motor increases causing the pump efficiency to fall. The increased work input, coupled with the pump's lower efficiency are effectively used to heat the water flowing through the pump and thereby increase the temperature of the water in the dishwasher sump to a minimum of 150° F.

As shown in FIG. 6, power from 115 volt power supply L1, L2 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 160 is included. The sequentially operated circuitry of the dishwasher is controlled by the timer 56 having a timing motor 161 which is selectively energized by a push-pull line switch 162 whenever the timer control knob 57 is depressed or pushed inwardly. The timing motor 161 is adapted to intermittently rotate a cam shaft (not shown) to selectively and sequentially open and close a plurality of cam actuated switches. The heating element 59 is energized through heating element switch 164 which is opened and closed by the cams on the timer motor shaft.

The dishwasher motor 52 includes a main run winding 171 and a water distributing start winding 172. A current responsive start relay 188 serves to energize the start winding 172 in accordance with the timer selection of contacts for a brief period until the motor comes up to its designed running speed and the current flow on the main winding drops off. Bypass switch movable contact 175 is operated through contacts 176 and 177 to return the timer push-pull knob 57 to its outward stop position after a full washing and drying cycle. A detergent dispenser solenoid 178 is shown having contacts 179 and 180, respectively, for switch blade 181. The above-described portion of the control circuit is of conventional design and forms no part of the present invention.

Upon the water heating switch button 182 on the panel 17 being pushed, the single throw-double pole switch 183a closes on the 150° contact 183b and the normally closed switch 183c in the timer circuit is opened. Now when the cycle is started by closing the door switch 160 and the push-pull switch 162 the timer motor 161 starts via closed switch 184 and closed switch 185 to actuate a solenoid 185a of a fill valve (not shown) to fill the sump 20 with water. After the fill period, switches 185 and 184 open and the timer motor 161 stops. Also movable contact 186 closes to fixed contact 187, movable contact 175 of the bypass switch closes to fixed contact 176 and switch 174 of motor timing relay 188 closes starting the regenerative pump drive motor, energizing the heater 59 and the heat position solenoid 99a of valve 92, moving the valve stem 98 from its biased spray or recirculating position of FIG. 3 to a first counterclockwise rotational heat position shown in FIG. 4. The pump 50 now works against the high head and heats the water until a 150° thermostat 189, located in sump 20 (FIG. 1), closes, which restarts the timer motor 161 to open fixed contact 187 and close switch 184 and return the cycle to normal wash, rinse and dry periods.

It will be noted that repetitive water heating modes may be utilized in the same total cycle, if desired, by programming switch 184. To provide the drain function, the timer motor 161 moves contact 186 to close upon fixed contact 190, thereby energizing drain position solenoid 99b of valve 92, rotating the valve stem

98 from its biased spray position of FIG. 3 to a second counterclockwise rotational drain position shown in FIG. 5.

It will be appreciated that applicant's pump heating system could be used to raise the temperature of the water to 150° F. without the assistance of heater 59, if desired, without departing from the scope of the invention.

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

I claim:

1. A dishwasher including walls enclosing a dishwashing chamber and defining an access opening, a door for enclosing said dishwashing chamber, means for spraying in said chamber, means for supporting dishes in exposed relationship to said spray means, one of said walls forming a sump below said support means, a regenerative pump assembly having an inlet fluidly connected to said sump and an outlet fluidly connected to a valve, said pump having a housing enclosing a circular channel between said pump inlet and said pump outlet; an impeller rotated within said pump housing by an electric drive motor, said impeller having a plurality of turbine buckets formed along its peripheral edge which are movable through said circular channel as said impeller rotates for passing fluid between said inlet and said outlet and for heating the fluid in said annular channel by the impact of said moving buckets upon the fluid; said valve having outlets operative in response to control means for circulating fluid flow from said pump outlet to said spray means and to said sump for return to said pump; said valve sump outlet being in the form of a restricted passage to throttle its discharge whereby upon said control means causing said pump outlet to be connected to said restricted passage to increase the amount of work expended by said pump upon the fluid in said pump thereby raising the temperature of the fluid in said buckets before its recirculation to said sump.

2. A dishwasher comprising: a casing defining a washing chamber having a sump and an access opening; a door for enclosing said dishwashing chamber, means for spraying in said chamber, means for supporting dishes in exposed relationship to said spray means, one of said walls forming a sump below said support means, electrical heating means in said sump; a regenerative pump assembly having an inlet fluidly connected to said sump and an outlet fluidly connected to a three-way valve; said pump having a housing enclosing a circular channel between said pump inlet and said pump outlet; an impeller rotated within said pump housing by an electric drive motor, said impeller having a plurality of turbine buckets formed along its peripheral edge which are movable through said circular channel as said impeller rotates for passing water between said inlet and said outlet and for heating the water in said annular channel by the impact of said moving buckets upon the water; said three-way valve being movable by control means to a spray outlet, a sump heating outlet and a drain outlet for directing water flow from said pump to said spray means, to said sump and to said drain, respectively, whereby the water directed to said spray means and said sump is recirculated to said pump inlet; said valve sump heating outlet having a restricted passage such that upon said valve sump heating outlet

being connected to said pump outlet the work expended by said pump upon the water is increased from a first level to a second higher level; said control means including a control circuit for said dishwasher having timer means for sequentially deenergizing and energizing said pump drive motor during periods of fill and wash; manually operated preselectable water heating means in said control circuit operative for deenergizing said timer motor, energizing said pump drive motor and moving said valve heating outlet in communication with said pump outlet so as to increase the amount of work expended by said pump upon the water in said pump thereby raising the temperature of the water in said buckets before its exit through said restricted passage to said sump.

3. A dishwasher including walls enclosing a dishwashing chamber and defining an access opening, a door for enclosing said dishwashing chamber, means for spraying in said chamber, means for supporting dishes in exposed relationship to said spray means, one of said walls forming a sump below said support means, electrical heating means in said sump; a pump assembly having an inlet fluidly connected to said sump and an outlet fluidly connected to a three-way rotating stem valve; said stem being biased to a spray position directing water through a valve spray outlet to said spray means, said stem being rotatable in response to first and second solenoids to a heating position and a drain position directing water respectively through a valve sump outlet to said sump and through a drain outlet to said drain; said pump having a housing enclosing a circular channel between said pump inlet and said pump outlet; an impeller rotated within said pump housing by an electric drive motor, said impeller having a plurality of turbine buckets formed along its peripheral edge which are movable through said circular channel as said impeller rotates for passing water between said inlet and said outlet and for heating the water in said annular channel by the impact of said moving buckets upon the water; said valve sump outlet having a restricted passage whereby upon said valve stem being moved directing flow through said restricted passage the water in said pump housing is increased in temperature by the work in its buckets on the water to produce a heating of the water in said sump, a control circuit for said dishwasher including a timer motor and control switch for sequentially controlling a fill, wash and rinse cycle for said dishwasher, a preselectable manually operated heating selector switch in said control circuit operative upon the completion of said fill period to open timer switch means thereby deenergizing said timer motor while energizing said drive motor and said electrical heater, said control circuit operative to energize said first solenoid moving said valve stem to its heating position; a thermostat in said dishwashing chamber operative upon sensing a predetermined water temperature in said sump to close contact means in said circuit to restart said time motor and initiate said wash cycle; and whereby upon said valve sump outlet restricted passage being connected to said pump to increase the amount of work expended by said pump upon the water in said pump housing together with said electrical heating means raising the temperature of the water in said sump to said predetermined temperature.

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