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DISHWASHER

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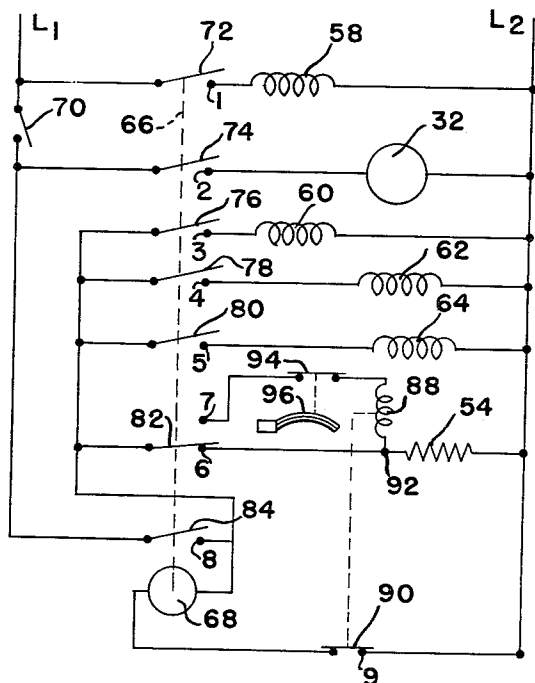


Fig. 2

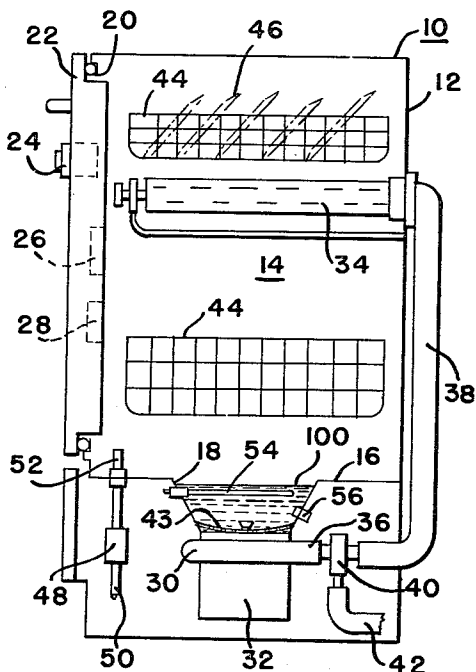


Fig. 1

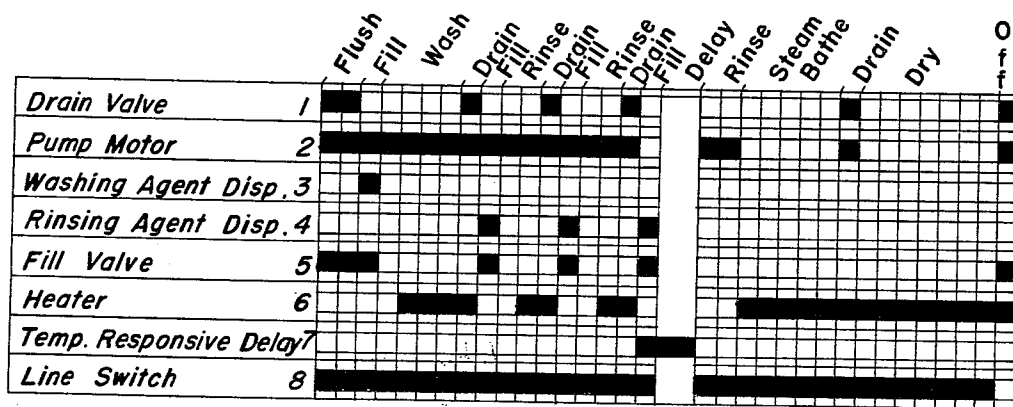


Fig. 3

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DISHWASHER

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This invention relates to a domestic appliance and more particularly to an improved dishwashing apparatus.

In certain areas of the country the water supplied to dishwashing apparatus contains minerals and other foreign matter. This characteristic of the washing fluid creates undesirable spotting of the dishes after they are dried. Efforts in the past have been directed to the use of additives in the water which help in shedding the water droplets from the surfaces of just washed dishes—a procedure known as sheeting off. Washing agents called surfactants or wetting agents have been added to the final rinse water and thereby distributed over the surfaces of the dishes being rinsed to aid in the sheeting-off process. This invention teaches a dishwashing apparatus which may be operated in a manner to eliminate the need for such surfactants or which, if used with surfactants, will produce an improved dishwashing result—dishes and and glassware free of troublesome water spotting.

Accordingly, it is an object of this invention to position a heater element in a dishwashing apparatus in a manner to aid in boosting temperatures of the washing fluid and to vaporize a portion of the rinse fluid in steam bathing the utensils after being washed.

A further object of this invention is the provision of a sump having a heater installed therein for distilling off vapor which may be utilized to remove foreign matter or spot producing materials from the surfaces of the dishes being washed.

A further advantage of this invention as it relates to the last cited object lies in the fact that a heater in the sump arrangement permits the distillates and the removed spot producing materials to remain in solution during the steam bathing process, thereby eliminating the build up of solids on components of the dishwasher.

A more specific object of this invention is the provision for a heater in a dishwasher, wherein said heater is arranged to be submerged during certain portions of the dishwashing cycle for heating water and generating steam and exposed during other portions of the cycle for heating air to aid in drying dishes.

It is also an object of this invention to provide a non-precipitating water softener in the rinse water of a dishwasher to aid in the prevention of dish spotting.

A more specific object of this invention is the provision for dispensing an alkali-metal metaphosphate during the fill period preceding each rinse period.

Another object of this invention is the provision of dispensers for a non-precipitating water softening agent and a surfactant or wetting agent to aid in the prevention of spotting from dishwashing.

It is also an object of this invention to hold in abeyance the dishwashing cycle before the final rinse until the water for rinsing reaches a predetermined temperature suitable for sanitizing or sterilizing the dishes being washed.

Still another object of this invention is the provision for placing a washer timer motor in series with a water temperature responsive switch actuatable only just preceding the final rinse of a wash cycle.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings where-

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in preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a generally schematic side view of a dishwasher suitable for use with this invention;

FIGURE 2 is a schematic wiring diagram for operating the dishwasher of FIGURE 1 in accordance with the concepts of this invention; and

FIGURE 3 is a timer advance or timer cycle chart showing the position of the switches illustrated in the wiring diagram of FIGURE 2 throughout a dishwashing cycle.

In accordance with this invention and with reference to FIGURE 1, a dishwasher 10 is shown comprised of a casing 12 enclosing a dishwashing chamber 14. The casing 12 has a horizontal bulkhead portion 16 which defines a generally conical sump 18 in a central portion thereof—the entire bulkhead 16 forming the bottom wall of the dishwashing compartment 14. At the front of the dishwasher 10, the casing 12 is formed with an opening 20 which is selectively closed by a horizontally pivoted door 22. Within the door certain control components may be included such as a timer 24, a detergent dispenser 26 and a non-precipitating water softener dispenser 28 for use during the rinse of the dishwashing cycle. The dispenser 28 may be of the type having a reserve capacity of water softener and mechanism for dispensing measured quantities of the softener each time the dispenser is actuated.

The water distribution system of the dishwasher 10 may include a pump 30 driven by the motor 32. A spray tube 34 is disposed within a central portion of the dishwashing chamber 14 and adapted to be rotatably mounted at the rear wall of the casing 12. Connecting the outlet 36 of the pump 30 and the inlet to the spray tube 34 is a conduit 38. A normally closed drain or diverter valve 40 is interposed between the pump and the spray tube and is connected also to a drain line 42 so that the output of the pump may be selectively directed either to the spray tube 34 or to a remote drain. Thus, it may be seen that the operation of the pump 30 by the energization of motor 32 will withdraw fluid from the dishwashing sump 18 and supply this fluid to the spray tube 34, from which point it will be distributed in a thorough fashion throughout the dishwashing chamber 14. Any suitable filter 43 is positioned in the sump to strain sediment from the circulating water. Support racks 44 are disposed within the dishwashing chamber 14 on opposite sides of the spray tube 34. Such support racks may be used to retain dishes such as 46 or other utensils commonly used domestically. It will be noted that the dishes are disposed in a manner to receive the forceful jets of the spray tube 34 on the sides generally soiled.

Washing fluid must be supplied to the chamber 14 and for this purpose, a supply valve 48 is connected to a domestic water supply line 50. Water is supplied through an outlet 52 to the dishwashing chamber 14 and flows by gravity to the sump 18 which overlies the inlet to the pump 30. Fluid for washing and fluid for rinsing is supplied to the sump 18 through the water inlet 52. Further, the timer 24 is utilized to selectively control the electrical components of the dishwasher in either a washing operation or a rinsing operation as will be more fully described hereinafter.

Within the sump 18 is located a tubular heater 54 which may have any suitable configuration. The heater 54 is retained below the upper level of the sump 18 so that it may be inundated or submerged in the sump water when the sump is substantially full. Note, however, that the heater 54 is retained in an upper portion of the sump so that it will be suspended in relatively clean water, i.e. water from which the heavy sediment has settled. During

a dishwashing cycle, the heater 54 is utilized selectively to maintain the temperature of the water in the sump 18 at a desired level during the washing and rinsing operations, but to elevate the temperature of the water subsequent to the final rinsing operation to vaporize a certain portion of the rinse water from the sump 18 in a manner to be described more fully hereinafter. For this purpose, the heater 54 should have a wattage in the neighborhood of 800-1200 watts.

In this invention there is provided a dishwashing cycle having a plurality of rinsing periods. It is a part of this invention to withhold or delay the final rinsing operation until the temperature of the rinse water has reached a temperature suitable for sanitizing or sterilizing the dishes. Thus, the sump 18 includes a temperature responsive device or thermostat 56 in a sidewall thereof to sense the temperature of water within the sump.

Referring now to FIGURE 2, a control circuit is set forth embodying in a representative fashion the major control concepts of this invention. The circuit includes a domestic household electrical supply indicated by L1 and L2. The circuitry further includes a solenoid 58 for actuating the normally closed drain valve 40, a solenoid 60 for actuating the detergent dispenser 26, a solenoid 62 for actuating the non-precipitating water softener dispenser 28, a solenoid 64 for actuating the water supply valve 48, and the heater 54. These various components and their respective circuits are actuated by a plurality of timer switches which are cam actuated by a timer shaft 66 driven by a timer motor 68. More specifically, a cam actuated switch 72 is arranged in the drain valve circuit and adapted to close the circuit with a timer contact 1; a cam actuated switch 74 in the circuit for the pump motor 32 and adapted to close the circuit with a timer contact 2; a cam actuated switch 76 in the detergent dispenser circuit and adapted to close the circuit with a timer contact 3; a cam actuated switch 78 in the non-precipitating water softener dispenser circuit and adapted to close the circuit with a timer contact 4; a cam actuated switch 80 in the fill valve circuit and adapted to close the circuit with a timer contact 5; and a cam actuated switch 82 in the heater circuit and adapted to close a direct circuit to the heater on a timer contact 6.

A main line cam actuated switch 84 operates on a timer contact 8 in the circuit to the timer motor 68 and, thus, is adapted to interrupt the timed cycle whenever opened by the selective manual positioning or automatic rotation of the cam actuating shaft 66. More particularly, a control knob (not shown) is connected to the shaft 66 and is adapted to be pushed or pulled to close or open the circuit for a dishwashing cycle. As the shaft is rotated to a position wherein the timer contact 8 is closed, the timer motor 68 will be energized to commence the dishwashing cycle. Further when the contact 8 is opened by the sequential positioning of the cam actuated switch 84, the dishwashing cycle is terminated.

As a safety precaution, the circuitry includes the switch 70 which operates in a safety fashion to condition the circuit for energization whenever the door 22 to the dishwashing chamber 14 is closed. The only component of the dishwasher which is not subject to the closure of the dishwashing access door 22 is the drain valve 58. The desideratum of this, in case of machine malfunction, is simply to have the dishwashing compartment drained rather than to retain the water therein until the malfunction is corrected. The normally open drain valve 40 effects this aim. This circuitry also prevents a draining of the sump 18 when the door 22 is opened to add a dish during a portion of the dishwashing cycle where switch 72 is closed.

One concept of this invention involves the final rinse period in the dishwashing cycle. More particularly, it is desirable to have a predetermined water temperature sufficiently high to sanitize or sterilize the dishes prior to initiating the final rinse. For this purpose, a by-pass cir-

cuit is included in the heater circuit. This parallel circuit terminates in a contact 7 selectively closed by the timer switch 82. Further, the circuit includes a relay solenoid 88 which actuates a switch 90 in the circuit for the timer motor 68. The other terminus of the circuit 92 connects to the heater circuit and thus places the solenoid 88 in series with the heater 54 and the timer contact 7. Between the solenoid 88 and the contact 7 is a temperature responsive switch 94 which is normally closed when the sump water temperature is below 150° F. The switch 94 is actuated by a bimetal 96 in the thermostat or temperature responsive device 56. In this fashion, the circuit to the solenoid 88 is maintained in an open condition by the bimetal 96 above 150° F. to prevent the switch 90 from interrupting the operation of the timer motor 68. During operation the timer cycle is adapted to maintain the timer switch 82 on contact 7 only during the fill and the delay period just preceding the final rinse. This delay, as indicated representatively in FIGURE 3, is of indefinite duration depending on the length of time which it takes the heater 54 to increase the temperature of the washing fluid in the sump 18 to the desired value. Once the desired temperature is reached, switch 94 will open to deenergize solenoid 88, switch 90 will close and the timer motor 68 will be energized to advance the cam actuated switches into the final rinse cycle with the pump motor 32 energized for water distribution.

The operation of the dishwashing apparatus of this invention will not be described with reference to the timer cycle chart in FIGURE 3. The solid blocks in the chart indicate a closed contact while the open blocks indicate an open contact. The dishwashing cycle is initiated when an operator manually rotates the timer shaft 66 to close the line switch 84 to energize the timer motor 68. At this point, the drain valve is energized to open the drain 40 and permit a flushing operation which wastes the cool water standing in the house supply lines until the temperatures thereof have advanced to a satisfactory wash level. At the same time, the pump motor 32 is energized with contact 2 being closed by timer switch 74. This serves to pump the waste fluid to a remote drain where gravity flow is not possible. To flush the washing chamber 14, of course, the fill valve 48 must be energized, the timer switch 80 being closed on contact 5 for this purpose. At the termination of a brief flushing period, the drain valve solenoid 58 is deenergized and the water entering through the inlet 52 is retained in the sump 18. At this time, timer switch 76 closes on contact 3 to actuate the detergent dispenser 60 and admit the detergent from the dispenser 26 into the washing chamber 14. Next, the wash period is initiated wherein the pump 30 is continuously operated to recirculate the water plus the detergent from the sump 18 to the spray tube 34. This washing portion of the dishwashing cycle may extend over a period of time sufficient to assure clean dishes and utensils, in this instance five timed increments or approximately five minutes being deemed a sufficient period. After the wash period, the drain valve is energized to permit the pump 30 to force the soiled wash water to drain. Next, following the second fill, is the first rinse period wherein the soiled wash fluid is rinsed from the surface of the dishes. A second rinse period has also been provided in this improved cycle and operates substantially the same as the first.

It should be noted that contact 4 is closed by timer switch 78 during each of the rinse fills, thereby to place a quantity of a non-precipitating water softener into the rinse water during the rinse cycle. Dispenser 28 automatically dispenses an alkali metaphosphate material such as sodium metaphosphate, potassium metaphosphate, lithium metaphosphate or ammonium metaphosphate to eliminate evidence of mineral deposits from the dishes or glassware following the drying cycle. In addition, a third dispenser (not shown but substantially

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the same as the metaphosphate dispenser 28) may be utilized for a surfactant, such as Triton CF-10 (Rohm and Haas Company) mixed with isopropanol and water, to effectively wet the surfaces of the dishes as an aid in the sheeting-off water droplets. The alkali-metal metaphosphates effectively soften the water against soaps without precipitates of calcium and magnesium which exist as soluble salts in most waters.

Subsequent to the final rinse, the timer switch 82 is sequentially positioned by the rotation of timer shaft 66 from the contact 6 to the contact 7, thereby placing the rinse water temperature responsive circuit in series with the heater 54. The timer switch 82 is a three-position switch having a neutral position interposed between the timer contacts 6 and 7. If, at this time, the water temperature within the sump 18 is below 150° F., the switch 94 will be closed and the solenoid 88 and heater 54 thus energized. With this energization, the switch 90 in the timer motor circuit will be opened and the advance of the dishwashing cycle will be interrupted until the then energized heater 54 elevates the temperature of the water within the sump. The thermostat 56 including the bimetallic element 96 is located within the wall of the sump 18 and thus senses the rising temperature of the water therein and is adapted to open the switch 94 when the desired temperature is reached. At this time the parallel rinse water temperature responsive circuit will be deenergized and the timer motor switch 90 closed to again energize the timer motor and cause the continuation of the dishwashing cycle.

At the initiation of the final rinse period or when the temperature of water within the sump 18 reaches 150° F., the timer switch 82 will be moved to its neutral position, the pump motor 32 will be energized with the closing of contact 2 and the timer motor 68 will be energized to continue the dishwashing cycle. The pump will act to circulate rinse water throughout the dishwashing chamber and over the dishes therein. The final rinse water may include the metaphosphate and the surfactant, mentioned immediately hereinabove.

At the conclusion of the third rinse cycle, it should be noted that the drain valve is not energized. It is at this point that the major concept of this invention is practiced, i.e. the heater 54 is energized for an extended period while submerged in the rinse water remaining in the sump from the final rinse. As the temperature of the fluid in the sump is elevated, a portion thereof will be boiled-off or vaporized from the sump water. Dense clouds of steam will surround and coat the dishes and utensils therein with large amounts of distilled condensate which will sheet-off or flood the spot producing minerals or materials from the surfaces of the dishes being washed. As aforesaid, the heater 54 is retained within a top portion of the sump so that the vaporizing process is more easily accomplished without an excessively large heater and in a manner to permit the heavy sediment to fall to the bottom of the sump, thereby eliminating the possibility of its being redistributed to the surfaces of the dishes. The disposition of the heater just beneath the top surface 100 of the sump water takes advantage of thermal stratification of the water to expedite the steam vaporization. A total of five timed increments or approximately five minutes has been utilized in this invention for the vapor or steam bath. However, it is within the purview of this invention to utilize a time interval sufficiently long to sheet-off satisfactorily whatever mineral content or spot producing droplet residue might result from an area's particular water problem. In areas where the water is harder than others, it will be necessary to provide a longer steam bathing operation and vice versa.

With the steam generating arrangement of this invention wherein the heater 54 resides within the sump 18, it should be noted that a large amount of washing or

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rinsing solution remains in the sump 18 at all times. This solution becomes more concentrated with the water hardness materials as the steam is generated by the distillation of sump water. But, nevertheless, these materials which cause water spotting are retained in solution so that they may be pumped to drain at the conclusion of the steam bathing operation. This eliminates the possibility of the hardness materials precipitating out and becoming corroded onto the surfaces of the dishwasher. Here, again, it is important to note that the heater 54 lies within an upper portion of the sump 18 and just below the surface 100 of the fluid laying within the sump 18.

It should be recognized that the amount of steam vaporized from the sump 18 during the steam bathing operation depends on two variables, i.e. the size of the heater 54 and the length of time during which the heat is energized. Either one of these variables may be altered to vary the amount of steam generated during the bathing process. For instance, the heater 54 may be increased in wattage to more vigorously boil the water in the sump or a small heater 54 may be energized for a longer period of time. In either case, it is important merely to recognize that the result of the steam bathing or condensate flooding operation will depend on sufficient distilled condensate being deposited over and around the dishes washed to remove any of the mineral or water hardness deposits from the surfaces of the dishes. This steam bathing operation as seen in the timer cycle chart of FIGURE 3 has the heater 54 energized continuously during this steam bathing portion of the dishwashing cycle. At the conclusion thereof, the drain valve solenoid 58 and the pump motor 32 are energized to remove the concentrated solution of rinse water and spot producing materials to drain.

Following the steam bathing operation, the dishwashing cycle concludes with a period of drying during which the heater 54 is energized to dry the dishes in the support racks 44. After a predetermined interval, in this case seven timed increments or approximately seven minutes, the cam actuated line switch 84 will be opened as the last act in the timed cycle, the timer motor 68 will be deenergized and the dishwashing cycle will be terminated.

Although the foregoing cycle included three rinses, it should be recognized that more or less rinses is immaterial in so far as the practice of this invention is concerned. It must be borne in mind merely that the final rinse water is retained in the sump so that the heater 54 which is inundated thereby may be energized to vaporize a sufficient quantity of steam to thoroughly coat and cover the dishes and glassware with distilled condensate in removing the spot producing material therefrom. Then, too, the foregoing cycle included the addition of a metaphosphate material to the rinse water and/or a wetting agent to help the sheeting-off of the condensate from the dishes. Although either or both of these additions further improve the end result, they are not essential to the instant teaching relating to steam bathing. The steam bathing operation with an inundated or submerged heater is effective in itself to minimize water spots and the addition of a non-precipitating water softener and a surfactant merely acts as an adjunct in the overall process.

It should now be seen that an improved dishwashing cycle has been set forth wherein superior results are assured. A heater, controlled in accordance with the circuitry of this invention, is energized as a booster during the wash period of the operating cycle and during the first and second rinses. In this way, the water temperatures are maintained during the extended period of water recirculation by the pump 30. As an additional feature of this invention the final rinse is provided with a control circuitry which includes a temperature responsive device to interrupt the timer motor and thus the

advance of the dishwashing cycle until the temperature of the water in the sump 18 has reached a predetermined temperature deemed satisfactory for sanitizing and sterilizing purposes. Finally, the improved cycle includes an arrangement whereby large quantities of steam are vaporized by a heater disposed just below the surface of rinsing fluid within the dishwasher sump. As the sump water is distilled, the vapor rises, surrounds the dishes being washed and condenses thereon to sheet off or flood the surfaces thereof, thereby removing the spot producing materials which reside on the dishware subsequent to the preceding washing and rinsing cycles. This sheeting-off will carry these materials to the sump 18 by gravity, the solution therein becoming more concentrated as the condensate cleanses the dishes. However, the heavier sediment and mineral desposits will fall to the bottom of the sump and thus be relatively removed from the action of the heater 54 in the upper part of the sump fluid. This arrangement prevents the sump from being boiled dry and thus retains the minerals or foreign matter in solution for easy removal from the sump at the end of the dishwashing cycle.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A dishwasher comprising, a casing defining a washing chamber having a sump and an access opening, said sump adapted to retain a fluid having foreign matter therein, a heater in an upper portion of said sump and adapted to be inundated by said fluid, a fill valve in fluid supply relationship to said chamber and said sump, means for sensing the temperature of said fluid, a washing agent dispenser for said chamber, a rinsing agent dispenser for said chamber, a drain valve for said sump, means for supporting dishes and the like in said chamber, means remote from said sump for distributing said fluid from said sump over said dishes and the like, power means for said distributing means, a control circuit for said dishwasher including means for energizing and deenergizing said heater, said fill valve, said temperature sensing means, said washing agent dispenser, said rinsing agent dispenser, said drain valve, and said power means, and a timer for sequentially actuating said energizing and deenergizing means in a dishwashing cycle including periods of fill, wash, rinse, and dry, said energizing and deenergizing means being actuated to energize said fill valve during said fill periods, said washing agent dispenser during said wash period, said rinsing agent dispenser during said rinse period, said drain valve after said wash period and said rinse period, and said heater during said dry period after said sump has been drained, the operation of said timer being responsive to said temperature sensing means immediately preceding said rinse

period, and said energizing and deenergizing means being further actuated by said timer before said dry period and before said drain valve is energized after said rinse period to energize said heater for a sufficient time interval to generate a quantity of vapor to bathe said foreign matter from said dishes or the like.

2. In combination in a washing apparatus, a casing defining a washing chamber and a fluid receptacle at the bottom of said chamber, means for supporting utensils to be washed in said chamber, means for supplying a wash fluid and a rinse fluid to said receptacle, means for distributing said fluids in said chamber in periods of wash and rinse, heating means in said receptacle below the surface of said fluids supplied, means for retaining the rinse fluid in said receptacle after said rinse period, and timer means for controlling said distributing means, said retaining means and said heating means, whereby after said rinse period said distributing means is deenergized and said heating means is energized to vaporize a portion of said retained rinse fluid to bathe said utensils extensively with the distilled condensate from said vaporized rinse fluid.

3. In combination with a washer of dishes or the like having a casing defining a washing compartment, a sump in said compartment for retaining a fluid having foreign matter therein, a fluid valve for filling said sump, a heater in an upper portion of said sump and means for supporting said dishes or the like in said compartment, a control circuit comprising, means for actuating said valve to fill said sump sequentially with a wash fluid and a rinse fluid and submerge said heater in said rinse fluid, means for actuating said heater, and timer means for selectively controlling both of said actuating means to cause said heater to change a portion of said rinse fluid into steam, said steam thereby generated condensing on said dishes or the like in sufficient quantity to bathe said foreign matter from said dishes or the like, whereby said foreign matter contaminated condensed steam returns to said sump after said bathing.

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