March 26, 1935. J. H. CLARK 1,995,635

WASHING APPARATUS

Filed May 2, 1933 2 Sheets-Sheet 1

Fig. 1.

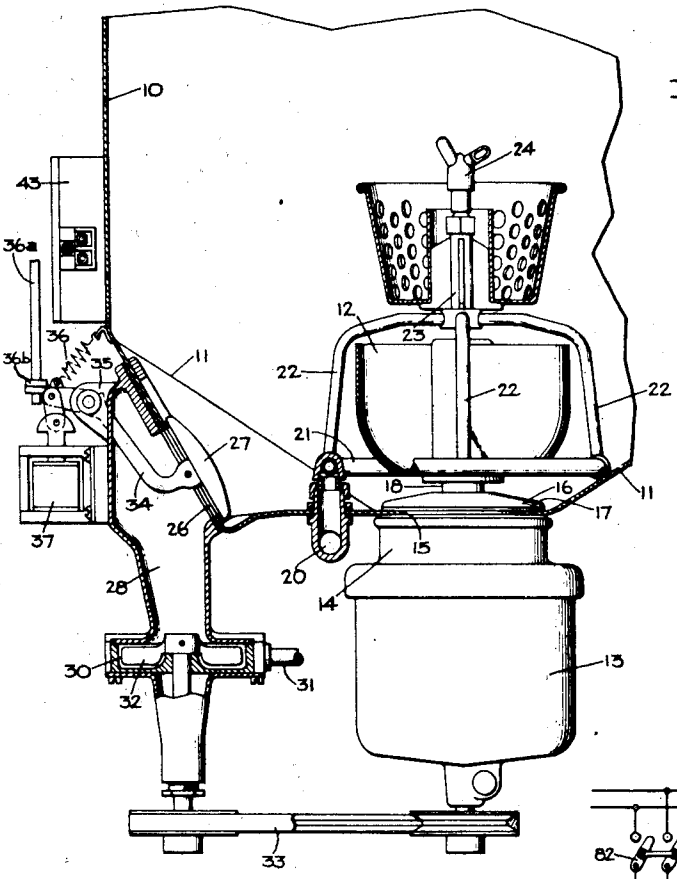


Fig. 4.

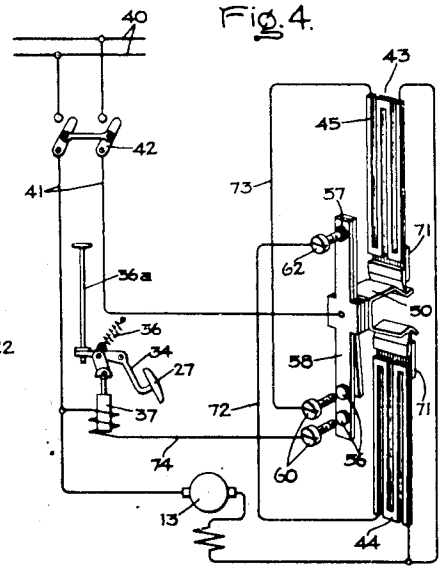


Fig. 5.

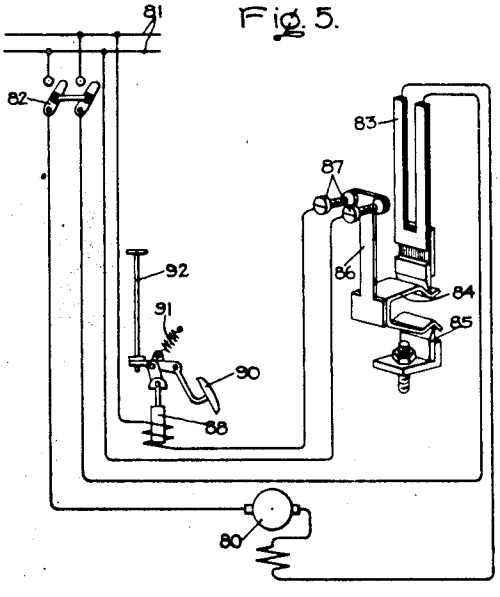


Fig. 2.

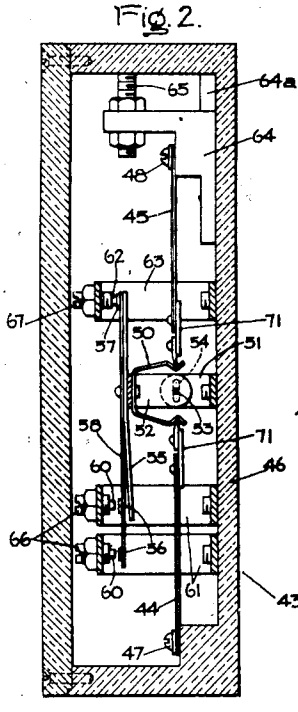
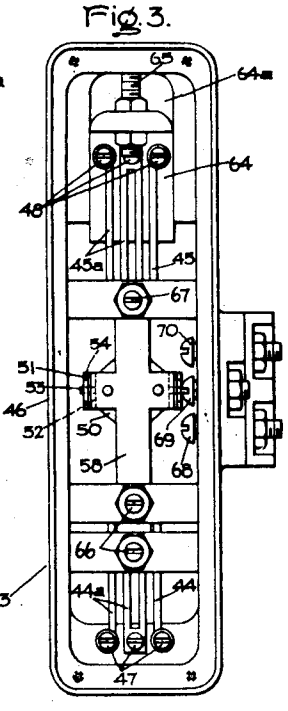


Fig. 3.



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WASHING APPARATUS

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Fig. 6.

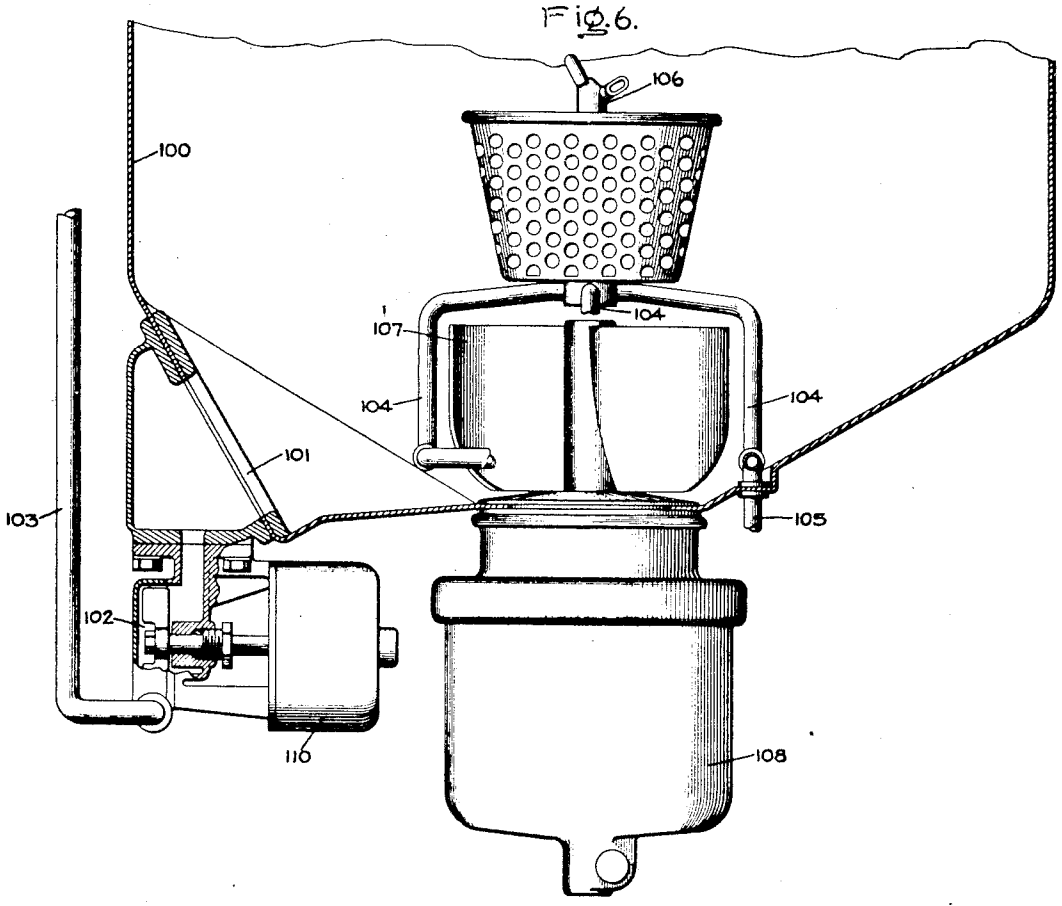


Fig. 7.

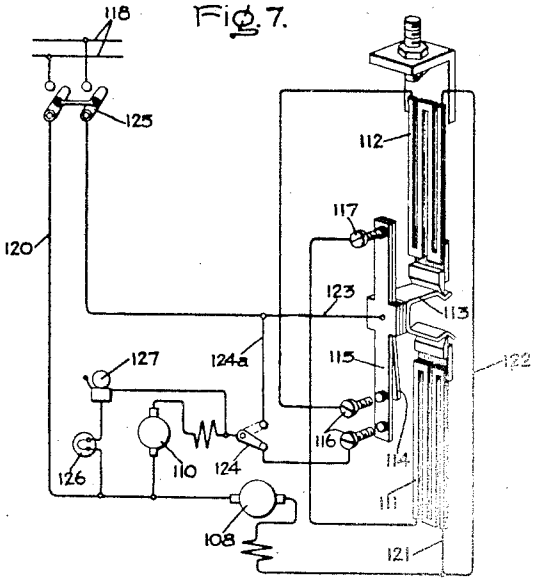
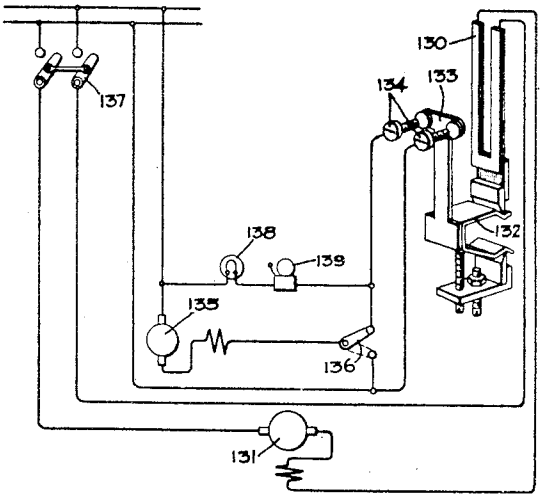


Fig. 8.



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UNITED STATES PATENT OFFICE

1,995,635

WASHING APPARATUS

Jesse H. Clark, Cicero, Ill., assignor to Walker Dishwasher Corporation, a corporation of Delaware

Application May 2, 1933, Serial No. 668,995

14 Claims. (Cl. 141—9)

My invention relates to washing apparatus, more particularly to dishwashing apparatus, and has for its object the provision of improved apparatus of this character.

More specifically, the invention relates to dishwashing apparatus wherein a cleansing fluid, such as water, is circulated in a washing vat through dish supporting racks by suitable power driven means, such as a motor driven impeller, and has, as one of its objects, the provision of improved means for supplying the washing vat with a predetermined quantity of cleansing water so that the most efficient cleansing action will be effected.

In carrying out the invention, suitable conduit means are provided for supplying the washing vat with a cleansing fluid. A predetermined quantity of fluid for a subsequent washing operation is provided by allowing a measured quantity of the fluid supplied to the vat to accumulate in it. In one form of my invention, the vat is provided wth a drain port which is controlled by means of a suitable valve. Means are provided for controlling the operation of the drain valve to regulate the drainage of fluid from the vat responsively to a condition of operation of the fluid circulating means so as to prevent the accumulation of more than a predetermined quantity of fluid in the vat. In this form of the invention, the drain valve is operated in accordance with the load imposed on the motor driving the fluid circulating means by means of a thermostat which is heated in accordance with the magnitude of the motor load current so that when the load imposed on the motor attains a predetermined value, the valve is opened to allow some of the water to drain from the vat, whereas when the load on the motor falls to a predetermined low value the drain valve is closed. In this manner, the quantity of water which will be allowed to remain in the vat will be a mean between the maximum and minimum quantities at which the valve opens and closes.

In another form of my invention, a suitable pump is provided to draw water from the vat and to discharge it into a drain. This pump is provided with an operating motor which is controlled in accordance with the load imposed on the fluid circulating motor so that when this load attains a predetermined maximum value, the pump will be started so as to discharge some of the water from the vat, whereas, when the load falls to a predetermined low value, the pump will cease to function to withdraw any more water from the vat. Here also, the pump is controlled by means of a thermostat which responds to the magnitude of the load current of the fluid circulating motor.

The invention also contemplates the provision of improved thermostatic structure which, as previously pointed out, is arranged to control the valve and the pump of the above mentioned forms of the invention responsively to the load current of the fluid circulating motor. In accordance with the invention, the thermostat comprises a pair of opposed bi-metallic bars, each of which is provided with a portion movable in response to changes in temperature; preferably, the bars will be arranged so that one end of each bar moves laterally and, preferably, so that the two ends of the bars move in the same plane. An elastic member is arranged to bear on the movable portions of the thermostatic bars so as to cause these bars to move quickly from one controlling position to another.

For a more complete understanding of the invention, reference should be had to the accompanying drawings in which Fig. 1 is a fragmentary elevation of dishwashing apparatus embodying the invention, portions being shown in section and portions being broken away so as to illustrate certain structural details; Fig. 2 is an elevation in section of a temperature responsive control device used in the apparatus of Fig. 1 and arranged in accordance with the invention; Fig. 3 is a plan view of the thermostatic control device of Fig. 2, with portions removed so as to illustrate certain structural details; Fig. 4 is a diagrammatic representation of certain elements of the washing apparatus of Fig. 1, and illustrating certain control mechanism for the apparatus including the temperature responsive device shown in Figs. 2 and 3; Fig. 5 is a view similar to Fig. 4 but showing a temperature control device of modified form; Fig. 6 is a fragmentary view in elevation, of dishwashing apparatus embodying a modified form of the invention, portions being shown in section and portions broken away so as to illustrate certain structural details; Fig. 7 is a diagrammatic view illustrating certain elements of the dishwashing apparatus of Fig. 6, together with certain control mechanism therefor; and Fig. 8 is a view similar to Fig. 7, but illustrating a modified form of control mechanism for the apparatus.

Referring to Fig. 1, the invention is shown as applied to dishwashing apparatus comprising a washing vat 10 for receiving dishes and like utensils to be cleansed, and also some suitable washing fluid, such as hot cleansing water. The vat 10 is provided with an inverted frusto-conical bottom wall 11, preferably formed integrally with the side walls of the vat. While the vat, together with its bottom wall, may be made of any suitable material, preferably they will be formed of some suitable metal, such as a rust-resisting steel, which preferably will be plated or enameled.

It will be understood that the washing apparatus will be provided with suitable trays or baskets arranged within the vat to receive and sup-

port dishes and other utensils such as knives, forks, and the like in washing positions in the vat. These supporting trays form no part of the present invention and it has been deemed unnecessary to show them.

It will also be understood that the washing vat will be supported in a vertical position, as shown in Fig. 1, by any suitable means (not shown).

In the lower portion of the vat 10 and preferably arranged so as to be substantially embraced by the bottom wall 11, is a suitable impeller 12 which is driven by an electric motor 13 carried by the bottom wall 11 on the exterior of the vat.

It will be understood that the impeller will be provided with suitable blades, which may have any suitable shape, the important feature being that the blades be given a shape such that a cleansing fluid in the lower portion of the vat will be thrown upwardly and outwardly in an efficient manner through the dish supporting trays by the rotary motion of the impeller. The impeller will be formed from any suitable material, such as cast aluminum or pressed steel.

The motor 13 is supported by means of a suitable bushing 14 which is passed through an aperture 15 provided for it in the bottom wall of the vat and preferably arranged centrally of the vat. The bushing 14, as shown, is provided with a flange 16 which rests on a flange 17 surrounding the opening 15 and formed from the material of the bottom wall of the vat.

The motor 13 is operably connected with the impeller 12 by means of a shaft 18 which is directed through the bushing 14.

Water, or other suitable cleansing fluid, is supplied to the vat through a conduit 20 which, as shown, is directed through the bottom wall of the vat. This conduit 20 communicates with a ring-shaped conduit 21 resting on the bottom wall 11. This conduit communicates with a plurality of vertically arranged conduits 22. The upper ends of these conduits turn inwardly toward the central vertical axis of the vat where they terminate in a vertically arranged conduit 23. This conduit communicates at its upper end with a suitable reaction spray device 24. This means for supplying the water to the vat, including the conduit 21, the vertically arranged conduits 22, the conduit 23 and the reaction spray device 24, are described and claimed in my copending application, Serial No. 653,243, filed January 24, 1933, and assigned to the same assignee as this invention.

Arranged in the lower wall 11 of the vat is a drain port 26 which is provided with a controlling valve 27. The drain port 26 communicates with a discharge or drain conduit 28 which, as shown in Fig. 1, constitutes the intake of a suitable pump 30. The pump 30 discharges into a drain conduit 31 which may be directed to any suitable drain such as an ordinary kitchen sink. The pump 30 is provided with an impeller 32 which is mechanically connected with the motor 13 by means of a belt drive 33. Thus, the motor 13 serves to operate both the fluid circulating impeller 12 and the discharge pump 30.

The drain valve 27 is mounted on an operating lever 34 which is pivotally mounted on suitable brackets 35 carried by the walls of the conduit 28, as shown in Fig. 1. Attached to one end of the arm 34 is a tension spring 36 which, as shown, is arranged to bias the valve 27 to its closed position. A suitable rod 36*a* is also attached to the lever 34 so that the valve can be manually operated. The lower end of this rod carries a collar 36*b* which rests on the lever 34, as shown in Fig. 1. This lever has an open slot which receives the lower end of the rod 36*a* so that the rod can be elevated to free the lever 34.

The valve 27 is opened against the force of the spring 36 by means of an electro-magnetic device 37. The armature of this device, as shown, is mechanically connected to the lever 34 so that when the operating coil of the electro-magnet is energized to retract the armature the valve will be moved to its open position.

The energization of the electro-magnet 37 is controlled in accordance with the load imposed on the impeller 12 in circulating fluid in the vat, more specifically in accordance with the magnitude of the armature current of motor 13. The electro-magnet is controlled so that when a predetermined quantity of water has been supplied to the vat and hence when the load imposed on the motor attains a predetermined magnitude, the electro-magnet will be energized to open the valve 27 so as to allow water to be withdrawn from the vat, whereas when the quantity of water in the vat falls to a predetermined low magnitude, i. e., when the load on the motor 13 falls to a predetermined low value, the electro-magnet will be deenergized so as to allow the valve to move to its closed position under the influence of its spring 36.

In order to control the energization of the electro-magnet in accordance with the armature current of the impeller driving motor 13, a suitable temperature responsive means is provided which is arranged to be included in the armature circuit of the motor so that the temperature responsive element of the device is actuated in accordance with the magnitude of the armature current.

As shown diagrammatically in Fig. 4, the motor 13, which is of the series type, is provided with a suitable source of electrical supply 40. The motor is connected with the supply source by means of conductors 41; as shown in Fig. 4, a suitable controlling switch 42 is arranged in these conductors between the supply source and the motor.

The armature circuit of the motor, as shown, includes the temperature responsive device 43. This device is shown in detail in Figs. 2 and 3. As there shown, the device comprises a pair of bi-metallic bars 44 and 45 mounted on a suitable base 46. Each of these bars is made of two strips of metal having dissimilar temperature coefficients of expansion, such as brass and invar, the two strips being secured together lengthwise in any suitable manner. The bar 44 is rigidly secured at one end to the support 46 by means of clamping screws 47 passing through suitable holes provided for them in the bar, while the other end of the bar is free to move laterally in response to changes in temperature. The bar 45 likewise is rigidly secured at one end to the base 46 by means of suitable clamping members 48, and this bar also has one end free to move laterally in response to changes in temperature. As shown in Fig. 2, the two bars 44 and 45 are substantially in the same plane and the free ends of the bars are arranged to move laterally in the same plane.

Bearing on the movable ends of the bars is a U-shaped resilient member or spring 50, which, as shown has one arm bearing on the movable end of the bar 44 and its other end bearing on the movable end of the bar 45. The spring member 50 is pivotally mounted on a supporting bracket

51; in order to effect this mounting, the base of the spring is rigidly secured to a bracket 52 which is pivoted to the bracket 51 by means of a pin 53. The arms of the bracket 51, as shown, are provided with elongated slots 54 which receive the pivoting pin 53 so that the bracket 52 can have limited lengthwise movement relative to the bracket 51.

Each of the bi-metallic bars 44, 45, together with the U-shaped spring member 50, constitutes a thermostat which is arranged in accordance with the temperature control device described in the United States Patent to A. H. Simmons, No. 1,743,073, dated January 7, 1930. The base of the spring 50 carries a suitable switch actuating arm 55, which is arranged to actuate a pair of switch contacts 56 and a contact 57. These contacts are carried on opposite ends of a resilient contact arm 58 which is also secured to the base of the spring 50. The resilient arm 58 is arranged above the actuating arm 55, and as shown in Fig. 2, bears away at its end from the actuating arm.

The contacts 56 cooperate with a pair of fixed contacts 60 supported on standards 61 attached to the base 46, while the contact 57 cooperates with a fixed contact 62 supported by means of a standard 63 also secured to the base 46.

It will be understood that when the bars 44 and 45 are cold, they will occupy their respective positions shown in Fig. 2. In other words, the tension in the bars will be such that when the bars are cold the contacts 57 and 62 will be closed, while the contacts 56 and 60 will be opened. It will also be understood that each blade when heated is arranged to move upwardly from the base 46, i. e., toward the left, as viewed in Fig. 2.

When the blades are cold, it will be observed that the pivot bearing between the blade 44 and the U-shaped spring member 50 lies below a neutral line that contains the point of support 47 for the bar 44 on the base 46 and the pivot 53, whereas the pivot bearing between the bar 45 and the spring 50 will be above a neutral line joining the point of support 48 of the bar 45 and the pivot bearing 53. It will also be observed that when the bars 44 and 45 lie in their respective neutral lines at the same time, they will be in a position of unstable equilibrium so that any further upward movement of either will snap that bar to its other controlling position. That is, when the two planes containing the two bars 44 and 45, respectively, have the same relative position with respect to the spring 50 the bars will be in their unstable positions.

Thus, when the bar 44 is heated so that it tends to move upwardly, the initial portion of its movement, i. e., from its position shown in Fig. 2 to the neutral position, will be resisted by the resilient member 50 and the tension in the bar 45. As the bar moves upwardly toward its critical position, the force exerted by the spring rapidly decreases until, when the bar is in the critical position, the force exerted by the spring will be substantially in the direction of the line of support of the thermostat and will have no controlling action on the movement of the thermostat. In other words, the spring decreasingly resists the movement of the thermostat and, as a result, the thermostat rapidly accelerates and moves at a high speed through the neutral position to the opposite side thereof. During this movement of the thermostatic bar 44, the spring will rotate somewhat on its pivot 53 and the other thermostat bar 45 will be moved downwardly to a position below its neutral line between the point of support 48 and the pivot 53.

The foregoing operation of the temperature responsive device results in a quick opening of the contacts 57 and 62 and a quick closing of the contacts 56 and 60.

By reason of the fact that the contact 57 is carried on the spring 58, which normally bears away from the actuating arm 55, the contacts 57 and 62 will remain closed substantially until the instant the contacts 56 and 60 are closed, i. e., substantially until the instant the thermostat bar 44 snaps through its neutral position. It will be observed that the contacts 56 and 60 also will be closed substantially at the instant the bar 44 snaps through the neutral.

As long as the bar 44 is heated, the contacts 56 and 60 will be closed and the contacts 57 and 62 will be open. If now the thermostatic bar 44 is allowed to cool, and thermostatic bar 45 is heated, the latter bar will tend to move upwardly through its neutral position and upon the occurrence of a predetermined maximum temperature will move through its neutral. This operation will open the contacts 56 and 60 and will close contacts 57 and 62.

Adjustment of the temperature setting of the thermostat is effected by changing the tension of the spring member 50. This is accomplished by providing an adjustable point of support for one of the bars 44, 45. As shown, the bar 45 is attached to a support 64 that is mounted in a channel 64*a* in the base 46 for movement toward and away from the spring 50. The position of the bar is adjusted by means of a screw 65. It will be understood that when the bar 45 is moved inwardly the tension of the spring member 50 will be increased whereby the temperature setting of the thermostat will be increased, whereas when the bar is moved away from the spring member so as to decrease its tension, the temperature setting will be reduced. When the tension in the spring 50 is changed to adjust the temperature setting of the device, the distance between the legs of the U is changed. This, of course, changes the position of the pin 53. The elongated slots 54 provide for this shifting of the pin 53.

Suitable binding posts 66 and 67 are provided for the fixed contacts 60 and 62 respectively, and similar binding screws 68, 69 and 70 are provided for anchoring the electrical connections directed to the thermostat.

It is contemplated that the bi-metallic bars 44 and 45 will be heated by the armature current of the impeller driving motor 13 and, as shown, each bar will be formed of a number of convolutions 44*a*, 45*a*, respectively, so that a relatively long path for the current is provided in the thermostat. As shown, the convolutions of the thermostat 44 terminate in the two outside supporting screws 47 which also function as binding posts, and likewise, the ends of the convolutions of the bi-metallic element 45 terminate in the outside clamping screws 48, which also serve as binding posts. It will be understood that the effective length of the thermostat bars will be such that an electrical resistance will be provided to give the desired heating of the blades.

As clearly shown in Fig. 2, the free ends of the bars which bear on the spring 50 are electrically insulated from the remainder of the bars that carry current by means of insulating strips 71 which will be formed of any suitable electrically

insulated material, such as a phenolic condensation product.

As shown diagrammatically in Fig. 4, one terminal of the motor is connected through one conductor 41 to the lower conductor of the supply source 40, whereas the other terminal of the motor is electrically connected to one end of each of the thermostatic bars 44 and 45. The other end of the thermostatic bar 44 is electrically connected through a conductor 72 to the terminal 62 of the thermostat while the remaining terminal of the thermostatic bar 45 is electrically connected to one of the fixed contacts 60 of the thermostat through a conductor 73. The other terminal 60, as shown, is electrically connected with one side of the operating coil of the electro-magnetic device 37 through a conductor 74, the other side of the device 37 being electrically connected with the lower conductor of the supply source 40 through one of the conductors 41. The upper conductor of the supply source 40 is electrically connected through the other conductor 41 with the contacts 56 and 57 of the thermostat. As shown, this conductor is electrically connected with the strip 58 that carries these contacts.

It will be understood that in the operation of the washing apparatus, the controlling switch 42 will be closed so as to energize the impeller driving motor 13 through a circuit which may be traced from the lower conductor 40 of the supply source through the conductor 41, the armature and field windings of the motor 13, the thermostatic bar 44, the conductor 72, the closed contacts 57 and 62, and then through the resilient switch arm 58 to the upper conductor of the supply source 40. As a result of these connections, the motor 13 will be energized so as to rotate the fluid circulating impeller 12 and also to operate the drainage pump 30. The drain valve 27 will then be closed by means of the operating rod 36*a* and the water will be turned on from any suitable supply source that communicates with the conduit 20. The water supplied to this conduit flows into the vat through the conduits 22 to the reactionary device 24. The water issuing from this device is hurled over and about the dishes supported in the vat, and eventually finds its way into the lower portion of the vat where it is allowed to accumulate.

As the water continues to flow into the vat, it imposes an increasing load upon the impeller driving motor 13 and, as a result of this, the armature current of the motor increases. This increase in the armature current increases the temperature of the thermostatic bar 44 until eventually, when a predetermined maximum quantity of water has been supplied to the vat, the armature current will be such that the thermostatic bar 44 will be heated to operate as previously described to close the contacts 56 and 60 and to open contacts 57 and 62. This operation disconnects the armature of the motor circuit from the thermostatic bar 44 and connects it to the supply source through the thermostatic bar 45. This operation also connects the operating coil of the electro-magnetic device 37 with the supply source through a circuit including the lower conductor of the supply source, the conductor 41 connected therewith, the operating coil of the device 37, the lower one of the contacts 60, the switch member 58, and the other conductor 41 connected to the upper conductor of the supply source.

This operation will energize the electro-magnetic device 37 so as to open the drain valve 27, and thereby allow water to flow from the vat into the pump 30 which, as previously described, will discharge the water into the drain 31.

After the thermostat has thus operated, the thermostat bar 44 will begin to cool and the thermostatic bar 45 will begin to heat up. In a relatively short period of time, which will be determined somewhat by the load upon the motor 13 which will be decreasing as the water is withdrawn from the vat and also upon the setting of the thermostat 43, i. e. the tension in the spring 50, the bar 45 will be heated sufficiently to move upwardly through its neutral position whereby the contacts 57 and 62 will be closed and the contacts 56 and 60 will be opened. This operation will deenergize the electro-magnetic device 37 so as to allow the valve 27 to be closed by its spring 36; and the motor 13, as before, will be energized through the thermostatic bar 44. The thermostat will be set so as to operate to close the valve 27 when the quantity of water in the vat has been reduced to a predetermined low value.

If the supply source continues to feed water into the vat, the above described cycle of operation will be repeated, i. e., when a predetermined maximum quantity of water has accumulated in the vat, the valve 27 will be opened to allow a quantity of the water to be withdrawn from the vat, whereas when the quantity in the vat has been reduced to a predetermined minimum, the valve 27 will be closed. In this manner, when water is flowing into the vat the control system will function so as to operate the valve 27 between its closed and open positions so as to allow but a predetermined quantity to accumulate in the vat.

It will be understood that when the valve 27 has been opened to allow water to flow from the vat, the flow of water in the drain will constitute a signal to the attendant that the proper quantity of water has been supplied to the vat. If the conduit 31 be connected with a sink, the appearance of water in the sink will show the attendant that the proper amount of water has been supplied; if the conduit is connected with a permanent drain, the gurgling of the water in the drain will constitute an audible signal that the proper quantity of water has been supplied; or a suitable signal device may be provided for this purpose, such as an electromagnetically operated bell or incandescent lamp placed in the energizing circuit of the device 37.

When the attendant is informed that the proper quantity of water has been supplied to the vat, the fluid supply will be turned off. After this, the current demand on the motor will not be sufficient to operate the valve 27 to its open position.

After the correct quantity of water has been supplied to the vat, the impeller 12 may be operated to hurl the accumulated water upwardly and outwardly through the dish-supporting racks in the vat as long as desired so as to effect a thorough cleansing action on the dishes.

When the washing operation has been completed, the drain valve will be opened by means of the operating rod 36*a*, and the operation of the pump 30 will be continued until after all of the water has been withdrawn from the vat; then the switch 42 may be opened to deenergize the motor 13.

If it is desired to rinse the dishes, water will be supplied to the reaction spray device 24 which will function, as before, to spray the water over the dishes. In this case however, the drain valve 27 will be opened so that the water supplied to

the vat can flow directly to the discharge pump 30.

It will be observed that by reason of the balanced construction of the thermostatic bars 44 and 45 that after the first operation, that is, after the thermostatic bar 44 has operated to close the contacts 56 and 60 and to open the contacts 57 and 62, all subsequent operations will be approximately twice as fast due to the fact that at the same time that the bar 44 is cooling, the bar 45 will be heated up so as to enhance the opening of the contacts and, hence, to increase the speed of the opening of the contacts 56 and 60, and the closure of the contacts 57 and 62. This provides a very sensitive and accurate control of the drain valve 27.

In Fig. 5, a modified form of thermostat structure is shown. This form is arranged in substantially the same fashion as the thermostat of the above mentioned Simmons patent.

In Fig. 5, the impeller driving motor 80 is electrically connected with a suitable electrical supply source 81 through a controlling switch 82. The armature circuit of the motor, as shown, is arranged to include the bi-metallic bar 83 of the thermostat. Bearing on the bi-metallic bar 83 is a suitable U-shaped resilient member 84, one arm of which bears on the bi-metallic bar and the other arm of which bears on a fixed pivot 85. A suitable switch arm 86 is carried by the base of the U-shaped spring member, and this switch arm controls suitable contacts 87. These contacts are included in the energizing circuit of the operating coil of an electro-magnetic device 88 which is arranged to operate the drain valve 90 to its open position. The drain valve is moved to its closed position by means of a spring 91, and the valve is provided with a manually operable lever 92, whereby it may be moved manually between its open and closed positions.

In the operation of this form of the invention when water is supplied to the vat and as the load upon the impeller motor increases by virtue of the fact that additional fluid is being supplied, the thermostatic bar 83 will be heated up and, upon the occurrence of a predermined maximum temperature, i. e., upon the occurrence of a predetermined maximum load on the impeller the thermostat will operate to close the contacts 87 so as to energize the electro-magnetic device 88. As before, this device 88 thereupon will open the drain valve 90 and, as a result, water will flow from the vat to the drain. This withdrawal of fluid from the vat will reduce the load upon the impeller and on the motor, and the thermostatic bar 83 will cool; upon the occurrence of a predetermined minimum load in the vat, i. e., when the bar 83 cools to a predetermined minimum temperature, it will operate to open the contacts 87 and thereby effect the closure of the drain valve 90. In this manner, the system will operate to measure a predetermined quantity of fluid that is allowed to accumulate in the vat.

In Fig. 6, still another modified form of the invention is shown wherein the drain valve for the vat is eliminated and in its place a drain pump is provided. As shown, the vat 100 is provided with a drain port 101, which communicates with the intake of a suitable pump 102. The pump discharges into a drain conduit 103. In this form, as before, water is supplied to the vat through conduits 104 which carry fluid from a supply conduit 105 to a reaction spray device 106. The washing operation is effected by means of a suitable impeller 107, which is driven by means of an electric motor 108.

The drainage pump 102 is driven by means of a motor 110. In this form of the invention, the motor 110 is controlled to pump water from the vat upon the occurrence of a predetermined maximum load on the impeller driving motor 108 and to cease operating when the load upon the impeller motor 108 is reduced to a predetermined minimum value.

The motor 110 is controlled by means of a temperature responsive device of identically the same construction as the temperature responsive device 43 of Figs. 1, 2, 3, and 4. As shown diagrammatically in Fig. 7, this temperature responsive device comprises bi-metallic thermostat bars 111 and 112, arranged as are the bars 44 and 45 of Figs. 2 and 3. Bearing on these bars is a resilient spring 113, similar to the spring 50 of the above mentioned figures. The spring 113 carries a switch arm 114, which operates a resilient contact arm 115 to control fixed contacts 116 and a fixed contact 117, all arranged in identically the same fashion as are the corresponding elements of the thermostat of Figs. 2 and 3.

As shown in Fig. 7, one side of the motor 108 is electrically connected with the lower conductor of a suitable source of electrical supply 118 by means of a conductor 120, while the other side of the motor is electrically connected to one terminal of the bi-metallic bar 111 through a conductor 121 and to one terminal of the other bi-metallic bar 112 through a conductor 122. The other terminal of the bi-metallic bar 111 is electrically connected with the contact 117, and this contact is electrically connected with the upper conductor of the supply source 118 through the arm 115 and a conductor 123.

One terminal of the pump motor 110, as shown, is electrically connected with the lower conductor of the supply source 118 through the conductor 120, while the other terminal of the motor 110 is electrically connected with the lower of the thermostat terminals 116 through a suitable switch 124. The other terminal 116 is electrically connected with one terminal of the bi-metallic bar 112. The motor 110 may be connected directly with the upper supply conductor through a conductor 124a and the conductor 123 by moving the switch 124 to a second controlling position shown in dotted lines in Fig. 7.

A suitable controlling switch 125 is interposed in the conductors between the supply source 118 and the motor.

In the operation of this form of the invention, it will be understood that switch 125 will be closed to start the apparatus and when this switch is closed, the motor 108 will be connected to the source of supply through the bi-metallic bar 111. Fluid may now be supplied to the vat. As the load on the motor increases by the water that is fed to the vat, the bar 111 will be heated and eventually the bi-metallic bar 111 will be heated to such a temperature that it will operate to close the contacts 116 and to open contact 117. This operation will connect the impeller motor 108 to the supply source 118 through the bi-metallic bar 112 and will effect the energization of the pump driving motor 110 through the lower one of the closed contacts 116. As previously pointed out, this motor 110 thereupon will operate the pump 102 to withdraw water from the vat and force it into the drain conduit 103. Eventually, the bi-metallic bar 112 will be heated to such a temperature that it will operate to reclose the contact 117 and to open the contacts 116. This operation will deenergize the pump motor

110. If the supply source has not been turned off, the load imposed upon the motor 108 will increase to such a value that again the motor 110 will be energized so as to withdraw water from the vat. In this manner, the pump motor 110 will be controlled to allow but a predetermined quantity of fluid to remain in the vat.

If desired, suitable audible, or visible signals or both, may be provided to warn the attendant when the pump is operating and, hence, when the proper quantity of water has been supplied to the vat. For this purpose, a suitable incandescent lamp 126 or a suitable bell 127 or both of these members may be connected in the system, as shown in Fig. 7, so that when the pump is operating, the lamp and bell will be energized. When this signal is given, the attendant will turn off the water. It will be understood that after the water supply has been shut off and the pump 110 subsequently ceases to operate due to operation of the thermostat to close the contact 117 and to open the contacts 116, the thermostat will not function again to reenergize the motor 110 to withdraw any more water from the vat. This is because the current demanded by the impeller motor 108 will not be sufficient to operate the thermostat to reenergize the motor 110.

When it is desired to drain the vat the switch 124 will be moved to its dotted line controlling position (Fig. 7) so as to energize the drain pump motor 110.

In Fig. 8, a modified form of the invention of Figs. 6 and 7 is shown; in this form the thermostatic structure, rather than being provided with a pair of bi-metallic bars is provided merely with a single bi-metallic bar, as is the thermostat of Fig. 5. As shown in Fig. 8, the single bi-metallic bar 130 is arranged to be connected in series in the armature circuit of the impeller 131 so as to respond directly to the magnitude of the armature current. Bearing on the bi-metallic bar 130 is a U-shaped spring member 132 arranged to move it quickly between its controlling positions. The U-shaped spring member 132 controls the bridging contact 133 that cooperates with fixed contacts 134. These contacts 134, as shown, control the energizing circuit for the pump motor 135 so that when these contacts are closed, the pump motor will be energized, whereas when the contacts are open, the pump motor will be deenergized. A switch 136 is provided to control the energization of the pump motor 135.

A line switch 137 is provided to control the energization of the impeller motor 131.

In operation, when the impeller driving motor 131 is operating and water is being supplied to the vat, the temperature of the bar 130 will gradually increase as the load increases on the motor and, eventually, when a predetermined quantity of water has been supplied to the vat, the bi-metallic bar will operate to close the contacts 134. This operation will energize the pump motor 135 through the thermostat contacts 134 and the switch 136. This motor thereupon will operate to effect the withdrawal of fluid from the vat. This will decrease the load imposed on the motor 131 and hence, will decrease its armature current. When a predetermined quantity of water has been withdrawn, the thermostat will have cooled sufficiently to open the contacts 134 which operation will stop the operation of the pump. In this manner, the pump will be controlled to allow a predetermined quantity of water to remain in the vat, which quantity will be the mean between the maximum and the minimum quantities at which the thermostat functions to energize and to deenergize the pump motor.

As in the case of Fig. 7, suitable signals, such as an incandescent lamp 138 or a bell 139 or both of these devices may be connected in the circuit of the pump motor 135, as shown, so that when this motor is energized to withdraw water from the vat, the signal devices likewise will be energized.

When the signal is given, the attendant should shut off the water supply. When this supply is shut off and the pump 102 has ceased to operate, the current demanded by the impeller motor 131 will not be sufficient to cause the thermostat to function to reenergize the pump motor 135.

When it is desired to drain the vat, the switch 136 will be moved to its dotted line controlling position (Fig. 8) which operation will effect the energization of the pump motor 135 independently of the impeller motor 131 and signal devices 138 and 139.

While I have shown particular embodiments of my invention, it will be understood of course that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. Washing apparatus comprising a vat, means for supplying a fluid to said vat, means for circulating the fluid in said vat, means for draining said vat and control means for said draining means operably associated with said fluid circulating means to respond to a condition of operation thereof that varies as the quantity of fluid in said vat is changed so as to control said drainage means to drain fluid from said vat when a predetermined quantity of fluid accumulates in said vat.

2. Dishwashing apparatus comprising a vat, means for supplying fluid to said vat, power means for circulating fluid in said vat, drain valve means for said vat and means operably associated with said fluid circulating means to respond to the load imposed thereon when operating to circulate fluid in said vat controlling the operation of said drain valve means to open to permit fluid to drain from said vat when said load attains a predetermined maximum value and permit said valve means to close when said load attains a predetermined minimum value.

3. Dishwashing apparatus comprising a vat, means for supplying fluid to said vat, power means for circulating fluid in said vat, a drain valve for said vat, means biasing said drain valve to its closed position and means operably associated with said power means to respond to the load imposed on said power means in circulating fluid in said vat controlling the operation of said drain valve so as to open said valve when said load attains a predetermined high value corresponding to a predetermined maximum quantity of fluid in said vat, and to allow said valve to close when said load falls to a predetermined low value when a predetermined quantity of fluid has drained from said vat.

4. Dishwashing apparatus comprising a vat provided with a drain port, means for supplying fluid to said vat, fluid circulating means in said vat, a motor for operating said fluid circulating means, a valve for said drain port and means operably associated with said motor to respond to the load imposed on said motor by said fluid cir-

culating means controlling said drain valve to regulate the drainage of fluid from said vat so as to allow but a predetermined maximum quantity of fluid to accumulate in said vat.

5. Dishwashing apparatus comprising a vat provided with a drain port, means for supplying fluid to said vat, fluid circulating means in said vat, a motor for operating said fluid circulating means, a drain valve for said port and electro-responsive means for operating said drain valve connected with said motor to respond to its load current which varies as the quantity of fluid in said vat varies to regulate the drainage of fluid from said vat in accordance with the quantity of fluid therein so as to prevent the accumulation of more than a predetermined maximum quantity of fluid in said vat.

6. Dishwashing apparatus comprising a vat, fluid circulating means in said vat, a motor for driving said fluid circulating means, means for supplying said vat with washing fluid, means providing for the withdrawal of washing fluid from said vat, means controlling said last named means operably associated with said motor to respond to the load imposed thereon in circulating fluid in said vat so as to effect the withdrawal of fluid when a predetermined maximum load is imposed on said motor and to stop the withdrawal of fluid when the load on said motor falls to a predetermined low value.

7. Dishwashing apparatus comprising a vat, means for supplying washing fluid to said vat, fluid circulating means in said vat, a motor for operating said fluid circulating means, a drain valve for said vat controlling the drainage of fluid from said vat, an electro-responsive device controlling the operation of said drain valve to drain the fluid from said vat, an energizing circuit for said electro-responsive device, a switch controlling said energizing circuit and means operably associated with said motor to respond to its armature current controlling said switch so as to control the energization of said electro-responsive device to open said drain valve when said armature current attains a predetermined maximum value and to allow said valve to close when said armature current falls to a predetermined minimum value.

8. Dishwashing apparatus comprising a vat, means for supplying said vat with a cleansing fluid, fluid circulating means in said vat, a motor for driving said fluid circulating means, thermally responsive means controlling the accumulation of fluid in said vat and means operably associating said thermally responsive means with said motor so that said means is heated in accordance with the magnitude of the load imposed on said motor.

9. Dishwashing apparatus comprising a vat provided with a drain port, means for supplying a fluid to said vat, fluid circulating means in said vat, a motor for driving said fluid circulating means, a valve for said drain port, means biasing said valve to its closed position, an electromagnetic device controlling the operation of said valve to open it and a temperature responsive device operably associated with said motor so as to be heated by the armature current of said motor controlling the energization of said electromagnetic device to control said drain valve to provide for the accumulation of a predetermined maximum quantity of water in said vat.

10. Dishwashing apparatus comprising a vat, means for supplying washing fluid to said vat, fluid circulating means in said vat, a motor for operating said fluid circulating means, a drain valve for said vat controlling the drainage of fluid from said vat, an electro-responsive device controlling the operation of said drain valve to drain the fluid from said vat, an energizing circuit for said electro-responsive device, a switch controlling said energizing circuit and a thermostatic device comprising a thermal responsive member connected in the armature circuit of said motor so as to be heated in accordance with the magnitude of said armature current controlling the operation of said switch so as to control the energization of said electro-responsive device to open said drain valve when said armature current attains a predetermined maximum value and to allow said valve to close when said armature current falls to a predetermined minimum value.

11. Dishwashing apparatus comprising a vat, means for supplying said vat with fluid, means for circulating fluid in said vat, means for withdrawing fluid from said vat and means operably associated with said fluid circulating means controlling the operation of said fluid withdrawing means responsively to a condition of operation of said fluid circulating means that varies as the quantity of fluid in said vat varies so as to effect the withdrawal of fluid from said vat when a predetermined quantity of fluid accumulates in said vat.

12. Dishwashing apparatus comprising a vat, means for supplying said vat with a cleansing fluid, fluid circulating means in said vat, a motor for operating said fluid circulating means, a pump arranged to withdraw fluid from said vat and to pump it to a drain, and means operably associated with said motor to respond to the load imposed on said motor in driving said fluid circulating means controlling the operation of said pump so as to remove fluid from said vat when a predetermined quantity has been supplied to said vat and the load imposed on said motor attains a predetermined magnitude.

13. Dishwashing apparatus comprising a vat, means for supplying said vat with a cleansing fluid, fluid circulating means in said vat, a motor for operating said fluid circulating means, a pump arranged to withdraw fluid from said vat and to pump it to a drain, a motor for driving said pump, an energizing circuit for said pump motor, means controlling said energizing circuit and a thermostatic device thermally responsive to the load current of said fluid circulating operating motor which varies as the quantity of fluid in said vat is changed controlling the operation of said circuit controlling means so as to regulate the removal of fluid from said vat to allow but a predetermined quantity of fluid to accumulate in said vat.

14. Dishwashing apparatus comprising a vat, means for supplying said vat with a cleansing fluid, fluid circulating means in said vat, a motor for operating said fluid circulating means, a pump arranged to withdraw fluid from said vat and to pump it to a drain, means operably associated with said motor to respond to the load imposed upon said motor in driving said fluid circulating means controlling the operation of said pump so as to remove fluid from said vat when a predetermined quantity has been applied to said vat and the load imposed on said motor attains a predetermined magnitude, and means arranged to effect the operation of said pump to drain said vat independently of said controlling means.

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