

March 2, 1954

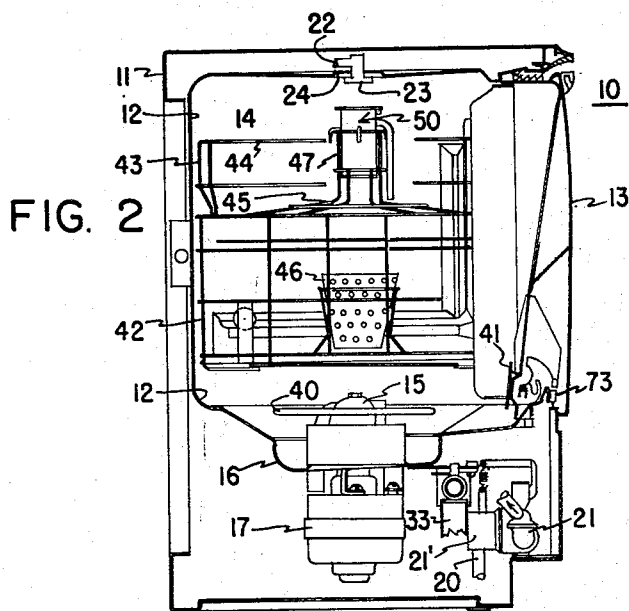
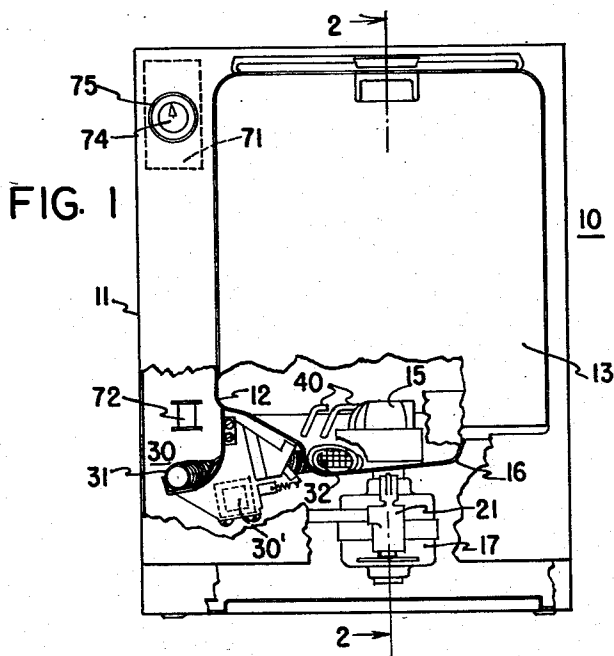
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2,671,037

METHODS OF WASHING DISHES OR THE LIKE

Filed Sept. 10, 1949

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3

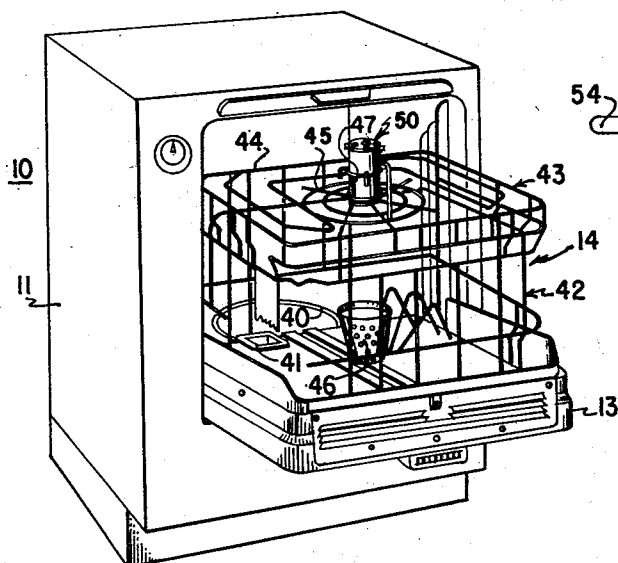


FIG. 5

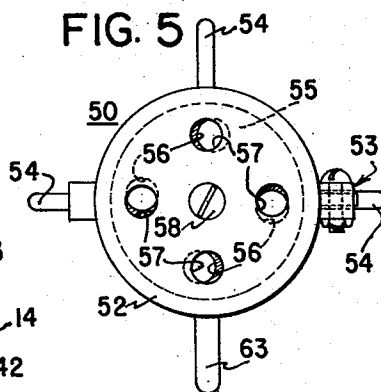


FIG. 6

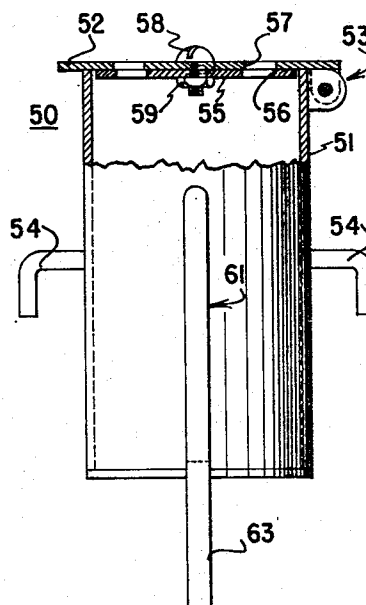
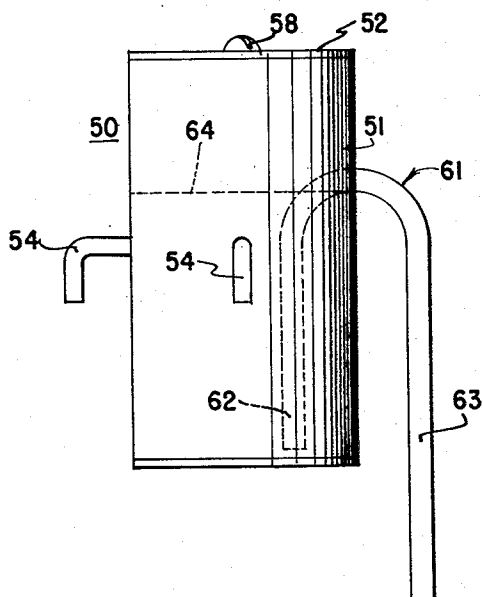


FIG. 4



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2,671,037

METHOD OF WASHING DISHES OR THE LIKE

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Application September 10, 1949, Serial No. 114,956

5 Claims. (Cl. 134-25)

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The present invention relates to methods of washing dishes, or the like.

In a conventional dishwashing apparatus, the liquid employed in the vat for both washing and rinsing purposes is hot water; and the dishes may be subjected to a primary washing step and then a secondary washing step, followed by a primary rinsing step and then a secondary rinsing step, the individual steps consuming predetermined time intervals established by a program controller incorporated in the apparatus. At the conclusion of each step, the used charge of hot water contained in the vat is drained therefrom, and then a fresh charge of hot water is introduced into the vat to be used in carrying out the succeeding step. Normally a charge of detergent is introduced into the charge of hot water contained in the vat at the beginning of the primary washing step; while the secondary washing step is carried out without the addition of a new charge of detergent, since a small residuum of the initial charge of detergent is present in the vat following draining of the used charge of hot water at the conclusion of the primary washing step. This residuum is present in the vat as a result of a small portion of the used charge of hot water adhering to the dishes and to the rack supporting the dishes and remaining in the joints in the walls of the vat and in the drain mechanism connecting the lower portion of the vat to the associated drain conduit. Both the primary rinsing step and the secondary rinsing step are carried out using only the charges of fresh hot water in order positively to eliminate any films of detergent from the dishes. Ultimately, the dishes may be subjected to a blast of hot air in order to effect a drying action thereupon.

While this method of washing dishes is highly satisfactory when soft water is employed, it is not entirely successful when hard water is employed due to the presence therein of the carbonates of calcium and magnesium. Specifically, the dishes, after being dried, are somewhat streaked or spotted and are thus robbed of their natural luster and sparkle. This spotting is especially noticeable on glassware, and particularly on stemware, the spots having a white or greyish outline of irregular configuration.

Of course, this impairment of the luster of the glassware is most noticeable in hard water locales, but it is to some extent progressive, whereby the effect may be detected in time in the form of a general discoloration of the glassware even in those areas having only slightly hard water. While the provision of water softening equipment

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in the plumbing preceding the dishwashing apparatus in hard water localities is helpful in reducing the rate at which this progressive impairment of the luster of the glassware proceeds, it does not prevent the ultimate impairment noted, and the equipment does not work satisfactorily without frequent attention with particular reference to recharging.

In studying this problem it has been discovered that this spotting of the glassware is directly traceable to the drying thereon of rather large droplets of rinsing water, containing calcium carbonate and other hard water components, following the secondary or final rinsing step, and that this spotting may be prevented by eliminating the droplets from the glassware immediately following the secondary or final rinsing step and preceding drying, even though hard water is employed. Further, it has been discovered that this objective may be achieved by introducing a suitable synthetic wetting agent into the hot water contained in the vat in the secondary or final rinsing step, whereby the surface tension of the water is sufficiently reduced to cause it to run freely from the glassware so that no water droplets of any appreciable size remain on the glassware at the conclusion of the secondary or final rinsing step and preceding drying of the glassware.

In carrying out this method it is preferred that a liquid synthetic wetting agent be employed and that an excess charge thereof be introduced into the charge of hot water contained in the vat in the primary rinsing step so that the desired effect is also achieved in this step. Then when the secondary or final rinsing step is carried out, a sufficient charge of the wetting agent will be present in the charge of hot water contained in the vat, since a residuum of the initial excess charge of the synthetic wetting agent is present in the vat following draining of the used charge of hot water at the conclusion of the primary rinsing step, this residuum being present in the vat due to the circumstances previously noted.

Accordingly, it is a general object of the present invention to provide an improved method of washing dishes, or the like, that preserves the natural luster and sparkle thereof and prevents streaking and spotting thereof incident to drying.

Another object of the invention is to provide a method of washing dishes, or the like, that includes an improved rinsing step employing hot water containing a synthetic wetting agent.

Further features of the invention pertain to the

particular arrangement of the steps of the method, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which Figure 1 is a front elevational view, partly broken away, of dishwashing apparatus in which the method of the present invention may be carried out; Fig. 2 is a vertical sectional view of the dishwashing apparatus, taken in the direction of the arrows along the line 2—2 in Fig. 1; Fig. 3 is a front perspective view of the dishwashing apparatus shown in Figs. 1 and 2, illustrating the front door in its open position and the dish-supporting rack in its withdrawn position, wherein it is carried by the front door; Fig. 4 is an enlarged side elevational view of the synthetic wetting agent receptacle that is carried by the dish-supporting rack, as illustrated in Figs. 2 and 3; Fig. 5 is an enlarged plan view of the synthetic wetting agent receptacle shown in Fig. 4; and Fig. 6 is an enlarged front elevational view, partly in section, of the synthetic wetting agent receptacle shown in Figs. 4 and 5.

Referring now to Figs. 1 and 2 of the drawings, there is generally illustrated automatic dishwashing apparatus 10 that is preferably of the character of that disclosed in the copending application of Edgar S. Stoddard, Serial No. 105,618, filed July 19, 1949, now Patent Number 2,635,941, and incorporating a wetting agent receptacle and embodying structure for carrying out the method of the present invention. The dishwashing apparatus 10 is of the gasketless-door front-opening type including a cabinet 11 housing a substantially vertically disposed vat 12, the cabinet 11 and the vat 12 having substantially aligned front openings that are closed by a front door 13. The front door 13 is pivotally mounted adjacent to the lower edge thereof within the lower portion of the vat 12 and is movable between a substantially vertical closed position and a substantially horizontal open position. Also, the dishwashing apparatus 10 comprises movable rack structure 14 that is adapted to support dishes, and other utensils, within the vat 12 for washing purposes, the rack structure 14 being movable into and out of the vat 12 through the front openings when the door 13 occupies its open position. An impeller 15 is arranged within a sump 16 formed in the lower portion of the vat 12 and is rotated by an associated electric operating motor 17 for the purpose of producing a washing action within the vat 12 when the door 13 occupies its closed position and washing liquid is contained in the sump 16. More particularly, the impeller 15 is rotated in the counterclockwise direction as viewed from the top of the vat 12 in order to produce an upward swirl of the washing liquid or the rinsing liquid through the rack structure 14 supporting the dishes and other utensils, whereby the washing liquid or the rinsing liquid is thrown upwardly into bombarding relation with the dishes supported by the rack structure 14 and then falls downwardly back into the sump 16 to be recirculated.

For the purpose of supplying washing liquid or rinsing liquid to the vat 12, there is provided an inlet conduit 20 connected to a suitable source of washing liquid or rinsing liquid, such, for example, as a hot water tank. The inlet conduit 20 communicates with the inlet port of an inlet

valve 21 of the solenoid controlled type; and the outlet port of the inlet valve 21 communicates with a conduit 22 that is connected to a spraying device 23 arranged in a depression 24 formed substantially centrally within the top wall of the vat 12. The inlet valve 21 is of the fast-opening, slow-closing type, being governed by an associated dashpot so as to prevent water hammer in the plumbing communicating with the inlet conduit 20. The inlet valve 21 is normally biased into its closed position, and when the solenoid 21' thereof is energized, it is operated into its open position in order that the hot water may be supplied from the inlet conduit 20 to the spraying device 23, whereby the hot water is sprayed downwardly in a rotating swirl by the spraying device 23 from the top of the vat 12 through the rack structure 14 and accumulates in the sump 16. Subsequently, when the solenoid 21' of the inlet valve 21 is de-energized, the inlet valve 21 is moved slowly from its open position into its closed position in order to cut off the supply of hot water from the inlet conduit 20 to the spraying device 23.

For the purpose of controlling the retention of washing liquid or rinsing liquid in the sump 16, there is provided a drain mechanism 30 of the solenoid controlled type. The drain mechanism 30 comprises a flexible conduit 31, one end of which communicates with a drain fixture 32 provided in the lower portion of the sump 16, and the other end of which communicates with a drain conduit 33 that is connected via a trap, or the like, not shown, to drain plumbing, not shown. The flexible conduit 31 is normally biased by its weight into its lower portion in order to place the interior of the sump 16 into free draining communication with the drain conduit 33 so that any washing liquid or rinsing liquid accumulating in the sump 16 runs through the flexible conduit 31 into the drain conduit 33; and when the solenoid 30' thereof is energized the flexible conduit 31 is elevated into its upper portion in order to cut off the free draining communication between the interior of the sump 16 and the drain conduit 33 so that a predetermined charge of washing liquid or rinsing liquid may be retained in the sump 16. Subsequently, when the solenoid 30' is de-energized the drain mechanism 30 is returned to its free draining position in order to effect draining of the washing liquid or rinsing liquid from the sump 16.

For the purpose of effecting drying of the dishes and other utensils supported by the rack structure 14 within the vat 12, there is provided a heating unit or element 40 that is preferably of the sheathed resistance conductor type. The heating element 40 is disposed in the lower portion of the vat 12 below the rack structure 14 and in surrounding relation with respect to the impeller 15 so that air blown by the blades of the rotating impeller 15 contacts the heating element 40 and then moves upwardly through the rack structure 14 into contact with the dishes and other utensils supported by the rack structure 14 in the vat 12.

The lower portion of the door 13 carries a detergent cup 41 opening toward the interior of the vat 12 that is adapted to receive a charge of detergent. Preferably the detergent that is employed in the detergent cup 41 is of the type sold under the trade name "Calgonite" that comprises about 40 per cent sodium hexametaphosphate and 60 per cent sodium metasilicate.

As best shown in Fig. 3 the rack structure 14 is removable as a whole from the door 13 in its

open position and comprises a lower dishrack 42 and a detachable upper dishrack 43. The upper dishrack 43, in turn, comprises an outer marginal section 44 and an inner detachable central section 45. Also the central portion of the lower dishrack 42 carries a perforated silverware basket 46. Normally, the plates and other large dishes are arranged in the lower dishrack 42; and the silverware is arranged in the basket 46. Also, the cups and saucers are normally arranged in the outer marginal section 44 of the upper dishrack 43; while the drinking glasses, tumblers, and the like, are normally arranged in the central section 45 of the upper dishrack 43. Finally, the central portion of the central section 45 of the upper dishrack 43 comprises an upwardly extending substantially cylindrical open-work element 47 disposed substantially directly below the spraying device 23 when the rack structure 14 occupies its normal position in the vat 12; which central cylindrical element 47 carries a wetting agent receptacle 50. Thus when the rack structure 14 occupies its normal position in the vat 12 the wetting agent receptacle 50 is disposed directly below and adjacent to the spraying device 23 for a purpose more fully explained hereinafter.

As best shown in Figs. 4 to 6, inclusive, the synthetic wetting agent receptacle 50 comprises a substantially cylindrical body 51 provided with a substantially circular hinged top cover 52, the top cover 52 being hinged to the upper portion of the cylindrical body 51 adjacent to one side thereof by an arrangement including a suitable hinge device 53. The center portion of the cylindrical body 51 carries a plurality of angularly spaced-apart outwardly directed and downwardly turned hooks or arms 54 that are employed for the purpose of supporting the receptacle 50 in place within the central cylindrical element 47 carried by the central section 45 of the upper dishrack 43, whereby the receptacle 50 may be readily placed and removed with respect to the central cylindrical element 47. The top cover 52 carries a valve element 55 upon the lower surface thereof, which valve element 55 has a plurality of angularly spaced-apart holes 56 formed therein that cooperate with a corresponding plurality of angularly spaced-apart holes 57 formed in the top cover 52, the valve element 55 being mounted for rotation upon a screw 58 carrying a nut 59 on the inner end thereof. Accordingly, the valve element 55 may be selectively rotated with respect to the top cover 52 in order selectively to adjust the effective opening between the interior of the cylindrical body 51 and the exterior as a result of the selective matching between the holes 56 and 57. Thus it will be understood that when the receptacle 50 is supported in position by the rack structure 14 directly below the spraying device 23 in the vat 12 that the rate at which hot water is accumulated therein is dependent upon the adjustment of the valve element 55; which arrangement is utilized for a purpose described hereinafter.

Finally, the receptacle 50 comprises a substantially U-shaped tube or siphon device 61 projecting through the upper portion of the cylindrical side wall 51, the siphon element 61 including a leg 62 disposed within the cylindrical body 51 and projecting downwardly and terminating adjacent to the bottom wall thereof, and a leg 63 disposed exteriorly of the cylindrical body 51 and projecting downwardly below the bottom wall thereof. As the hot water is accumulated in the receptacle 50 the head of liquid therein rises un-

til it reaches a level indicated generally at 64, whereby a predetermined quantity of liquid has been accumulated in the receptacle 50. The liquid then flows between the legs 62 and 63 of the siphon device 61 falling through the leg 63 and producing a siphon action between the legs 63 and 62 in a well-known manner, whereby substantially the entire liquid contents of the receptacle 50 is discharged by the siphon device 61 into the vat 12. Thus it will be understood that when a predetermined quantity of liquid is accumulated within the receptacle 50 that substantially the entire liquid contents thereof is automatically discharged therefrom by the siphon device 61 into the vat 12; which arrangement is utilized for a purpose more fully explained hereinafter.

The synthetic wetting agent that may be employed in the receptacle 50 may be of any suitable type although it is preferable that it be in the form of a liquid, and it has been found that a great variety of the sulfuric acid esters of the higher fatty acids are admirably suited to this end. For examples, sodium lauryl sulfate and octadecyl sodium sulfate are quite satisfactory. Also, the long chain sulfonates are suitable and sodium lauryl sulfonate and octadecyl sodium sulfonate have been found to be satisfactory. The chemical compositions of these synthetic wetting agents form no part of the present invention and any synthetic wetting agent is suitable that possesses the characteristic of reducing the surface tension of hot water sufficiently to cause the hot water contacting the dishes and glassware to run freely and quickly therefrom in order to prevent the presence of fairly large droplets of rinse water on the dishes and glassware following the secondary or final rinsing step, and preceding drying, as explained more fully hereinafter.

For the purpose of effecting coordinated operation of the various control elements incorporated in the dishwashing apparatus 10 in order to accomplish a complete cycle of operation, there is incorporated therein an electric control circuit 45 and program controller of the character of that disclosed in the copending application of Douglas F. Illian, Serial No. 91,906, filed May 7, 1949. This circuit control arrangement includes a program controller of the timer type indicated generally at 71 and disposed in the upper left-hand front portion of the apparatus 10 between the adjacent left-hand side wall of the cabinet 11 and the adjacent left-hand side wall of the vat 12, a measuring coil or relay 72 disposed in the lower left-hand front portion of the apparatus 10 between the adjacent left-hand side wall of the cabinet 11 and the adjacent left-hand side wall of the vat 12, and a door switch 73 carried by the bottom wall of the vat 12 and controlled by the movements of the front door 13. The program controller 71 comprises an electric drive motor, not shown, of the timer type, such, for example, as a "Telechron" motor, switching structure, not shown, and an operating shaft that extends through the front wall of the cabinet 11 and supports a rotatable control knob 74 that cooperates with an indicia plate 75 that is directly mounted adjacent thereto upon the front wall of the cabinet 11. The control knob 74 carries an index pointer that cooperates with the indicia "Off" and "On" carried by the indicia plate 75, the indicia noted being arranged in angular spaced-apart relation. Of course, the circuit control arrangement also includes the

electric operating motor 17, the operating solenoid 21' of the inlet valve 21, the operating solenoid 30' of the drain mechanism 30, and the electric heating element 40; and finally the circuit control arrangement includes a source of current supply that may be of 115 volts 60 cycle A. C.

The details of the connection and arrangement of the circuit network in order to accomplish a complete washing cycle in the dishwashing apparatus 10 form no part of the present invention, and in the interest of brevity only the overall cycle of operation of the apparatus 10 will be described with particularity.

In order to prepare the dishwashing apparatus 10 for a cycle of operation, the dishes, glassware and other utensils are appropriately loaded into the rack structure 14; and a predetermined charge of the liquid synthetic wetting agent mentioned is placed within the body 51 of the receptacle 50 through the open top thereof while the cover 52 occupies its open position. The cover 52 is then returned to its closed position with respect to the open top of the body 51; and it may be assumed that the valve element 55 occupies an adjusted position with respect to the cover 52 so that the liquid contents of the wetting agent receptacle 50 will be discharged by the siphon device 61 during the primary rinsing step, as explained more fully hereinafter. The rack structure 14 is then pushed forwardly into the vat 12 into its normal position, whereby the cover 52 of the wetting agent receptacle 50 is disposed immediately below the rotary spraying device 23. A charge of the detergent noted is then placed in the detergent cup 41 provided in the lower inner wall of the door 13; and the door 13 is moved from its open position into its closed position.

The rotatable control knob 74 is then rotated from its "Off" position into its "On" position initiating operation of the program selector 71 and the electric control network. Specifically, at this time the program selector 71 initiates operation of the operating motor 17 and initiates operation of the timer motor incorporated in the program selector 71. The operating motor 17 rotates the impeller 15 in the counterclockwise direction as viewed from the top of the vat 12; and the timer motor drives the control knob 74 continuously in the clockwise direction, as viewed in Fig. 1, at a predetermined rate and ultimately back into its "Off" position. After an elapsed time interval of approximately 90 seconds, the program controller 71 effects energization of the inlet valve solenoid 21', whereby the inlet valve 21 is operated from its closed position into its open position so that washing liquid may be supplied from the supply conduit 20 to the spraying device 23. The washing liquid is sprayed downwardly from the spraying device 23 into the vat 12 and through the dishes supported by the rack structure 14 and accumulates in the sump 16 from which it is drained through the drain mechanism 30 directly into the drain conduit 33 since the drain mechanism 30 occupies its draining position at this time. Of course, some of the washing liquid in the sump 16 may be caught and flung upwardly by the blades of the impeller 15 through the dishes supported by the rack structure 14, although this action is not considerable at this time since the drain mechanism 30 occupies its draining position as previously noted. Also, some of the washing liquid sprayed downwardly in the vat 12 from the spray-

ing device 23 enters the wetting agent receptacle 50 and is accumulated therein, along with the liquid wetting agent already in the receptacle 50. Approximately 30 seconds after the inlet valve 21 is thus operated into its open position, the program controller 71 energizes the solenoid 30' of the drain mechanism 30, whereby the drain mechanism 30 is operated from its draining position into its non-draining position so that the washing liquid is accumulated in the sump 16. At this time the washing liquid accumulating in the sump 16 is caught by the blades of the impeller 15 and is flung upwardly through the rack structure 14 and the dishes supported thereby against the walls of the vat 12 and the door 13 and again returns to the sump 16.

The supply of washing liquid from the spraying device 23 continues and as the quantity of washing liquid accumulating in the sump 16 increases, the load imposed upon the impeller 15 is gradually increased, the current drawn by the motor 17 being gradually increased and metered by the measuring coil or relay 72. When a predetermined quantity of washing liquid accumulates in the sump 16 a corresponding predetermined load is imposed upon the operating motor 17, whereby the current metered by the measuring relay 72 reaches a predetermined value. When this current traversing the relay 72 reaches the predetermined value mentioned, indicating that the vat 12 now contains a full and predetermined quantity of washing liquid, the measuring relay 72 operates and effects de-energization of the solenoid 21' of the inlet valve 21, whereby the inlet valve 21 is slowly returned from its open position into its closed position. Shortly thereafter the inlet valve 21 is completely closed cutting off the supply of washing liquid from the supply conduit 20 to the spraying device 23.

Approximately 45 seconds after the drain mechanism 30 is operated into its non-draining position, the program controller 71 further opens the circuit for energizing the solenoid 21' of the inlet valve 21, thereby providing a timed arrangement for effecting the return of the inlet valve 21 into its closed position in the event this result has not already been brought about by operation of the measuring relay 72 within the 45 seconds period mentioned.

The primary washing step is thus initiated upon the operation of the drain mechanism 30 into its non-draining position, and continues for a total time interval of approximately 330 seconds; and within this time interval and in response to the accumulation of a predetermined quantity of washing liquid in the sump 16, the charge of detergent contained in the detergent cup 41 is introduced into the washing liquid contained in the vat 12 in order that the primary washing step may be effective to remove grease and other foreign materials from the dishes supported by the rack structure 14. The arrangement for introducing the detergent is disclosed in the copending application of Forrest A. Walker, Serial No. 57,448, filed October 30, 1948, and is based upon the accumulation of a predetermined quantity of washing liquid in the sump 16 during the primary washing step, whereby the washing liquid accumulating in the sump 16 is flushed or washed into the detergent cup 41 carried by the inner wall of the door 13 causing the detergent contained therein to be washed into the body of washing liquid contained in the vat 12. This introduction of the detergent into the washing liquid con-

tained in the vat 12 is accomplished shortly following the operation of the drain mechanism 30 into its non-draining position initiating the beginning of the primary washing step so that the detergent is present in the washing liquid during a substantial part of the time interval of the primary washing step.

At the conclusion of the primary washing step the program controller 71 opens the circuit for energizing the solenoid 30' of the drain mechanism 30, whereby the drain mechanism 30 is returned from its non-draining position into its draining position so that the washing liquid and the carried detergent contained in the sump 16 is drained therefrom in a very short interval of time; and approximately 45 seconds after the drain mechanism 30 is operated into its draining position, the program controller 71 again closes the circuit for energizing the solenoid 21' of the inlet valve 21, whereby washing liquid is again supplied to the spraying device 23 and is again sprayed downwardly into the vat 12. Approximately 10 seconds after the inlet valve 21 is operated into its open position, the program controller 71 recloses the circuit for energizing the solenoid 30' of the drain mechanism 30, whereby the drain mechanism 30 is operated into its non-draining position in order to initiate a secondary washing step.

The secondary washing step proceeds in the manner of the primary washing step described above; however, without the addition of another charge of detergent since a residual amount of the initial charge of detergent remains in the vat 12 from the primary washing step. This residuum of the detergent is present in the vat 12 since a small portion of the charge of washing liquid contained in the vat 12 during the primary washing step remains therein due to adherence to the dishes and the rack structure 14 and due to its presence on the wall structure of the vat 12 and in the drain mechanism 30. Specifically, the inlet valve 21 is subsequently operated into its closed position under the control of the measuring relay 72 dependent upon the load upon the operating motor 17, or under the control of the program controller 71; all in the manner previously explained. In any case, after a time interval of approximately 45 seconds following operation of the drain mechanism 30 into its non-draining position the inlet valve 21 is operated into its closed position. At this time the inlet valve 21 occupies its closed position and the drain mechanism 30 occupies its non-draining position, whereby the secondary washing step continues in the manner previously explained. As the washing liquid is sprayed downwardly from the spraying device 23 into the vat 12 during the secondary washing step, additional liquid is accumulated in the wetting agent receptacle 50. The secondary washing step continues for a time interval of approximately 330 seconds following operation of the drain mechanism into its non-draining position; whereupon the program selector 71 effects the return of the drain mechanism 30 into its draining position as previously explained.

The washing liquid accumulated in the sump 16 is drained into the drain conduit 33 in the manner previously explained in a very short time interval; and approximately 45 seconds after the drain mechanism 30 is operated into its draining position the program selector 71 again operates the inlet valve 21 into its open position. The rinsing liquid is then sprayed downwardly

into the vat 12 by the spraying device 23 for a time interval of approximately 10 seconds; whereupon the program controller 71 again returns the drain mechanism 30 into its non-draining position, initiating a primary rinsing step.

The primary rinsing step proceeds in a manner substantially identical to the primary washing step described above, whereby the inlet valve 21 is subsequently operated into its closed position under the control of the measuring relay 72 dependent upon the load upon the operating motor 17, or under the control of the program selector 71; all in the manner previously explained. In any case, after a time interval of approximately 45 seconds following operation of the drain mechanism 30 into its non-draining position, the inlet valve 21 is operated into its closed position. The primary rinsing step continues for a time interval of approximately 90 seconds following the operation of the drain mechanism 30 into its non-draining position, whereupon the program selector 71 effects the return of the drain mechanism 30 into its draining position.

As the rinsing liquid is sprayed downwardly from the spraying device 23 into the vat 12 during the primary rinsing step, additional liquid is accumulated in the wetting agent receptacle 50, whereby a predetermined total head of liquid is accumulated in the receptacle 50 causing the siphon device 61 to operate automatically to discharge substantially the entire liquid contents of the receptacle 50 into the vat 12. The charge of wetting agent thus introduced into the charge of rinsing liquid contained in the vat 12 reduces the surface tension thereof so that the rinsing liquid runs freely from the dishes supported by the rack structure 14.

The rinsing liquid accumulated in the sump 16 is drained into the drain conduit 33 at the conclusion of the primary rinsing step in the manner previously explained in a short time interval; and approximately 45 seconds after the drain mechanism 30 is operated into its draining position, the program selector 71 reoperates the inlet valve 21 into its open position. The rinsing liquid is sprayed downwardly from the spraying device 23 into the vat 12; and approximately 10 seconds following operation of the inlet valve 21 into its open position the program selector 71 effects operation of the drain mechanism 30 into its non-draining position in order to initiate a secondary rinse step.

The secondary rinsing step proceeds in a manner substantially identical to the primary rinsing step described above except that no additional charge of synthetic wetting agent is introduced into the charge of rinsing liquid contained in the vat 12. The inlet valve 21 is subsequently operated into its closed position under the control of the measuring relay 72 dependent upon the load upon the operating motor 17, or under the control of the program selector 71; all in the manner previously explained. In any case, after a time interval of approximately 45 seconds following operation of the drain mechanism 30 into its non-draining position, the inlet valve 21 is operated into its closed position. The secondary rinsing step continues for a time interval of approximately 90 seconds following the operation of the draining mechanism 30 into its non-draining position, whereupon the program selector 71 effects the return of the drain mechanism 30 into its draining position.

The rinsing liquid accumulated in the sump

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16 is drained into the drain conduit 33 in the manner previously explained in a short time interval; and approximately 45 seconds after the drain mechanism 30 is operated into its draining position, the program selector 71 closes the circuit for energizing the heating element 40, whereby heat produced by the heating element 40 is circulated in the vat 12 by the blades of the impeller 15 in the form of an upwardly directed blast of hot air into contact with the dishes supported by the rack structure 14.

Since a residuum of the synthetic wetting agent is present in the body of rinsing liquid contained in the vat 12 during the secondary rinsing step, due to the circumstances previously noted, the surface tension of the rinsing liquid is sufficiently reduced so that it readily runs off the dishes supported by the rack structure 14 at the conclusion of the secondary rinsing step. Accordingly, at this time when the drying step is initiated there are no droplets of rinsing liquid of any considerable size adhering to the dishes supported by the rack structure 14. The hot air circulated in the vat 12 by the impeller 15 is directed into contact with the dishes supported by the rack structure 14 effecting a drying action thereupon, and is thence circulated back into contact with the heating element 40 by the impeller 15.

This action constitutes an initial drying step and is continued for a time interval of approximately 1200 seconds, whereupon the program selector 71 opens the circuit for energizing the operating motor 17 while retaining closed the circuit for energizing the heating element 40. Accordingly, the operating motor 17 stops, arresting the rotation of the impeller 15, while the generation of heat by the heating element 40 continues. Thus drying of the dishes supported by the rack structure 14 continues through a final drying step after operation of the impeller 15 has been arrested. The final drying step continues for a time interval of approximately 600 seconds, whereupon the program controller 71 interrupts the circuit for energizing the heating element 40, as well as the circuit for operating the timer motor incorporated in the program selector 71.

At this time the control knob 74 has been rotated from its "on" position in the clockwise direction back into its "off" position; operation of the program selector 71 has been arrested; and the cycle of operation of the dishwashing apparatus 10 has been completed. Thus it will be understood that when the manual control knob 74 of the program selector 71 is rotated from its "off" position into its "on" position in the clockwise direction, further operation of the program selector 71 is automatically continued under the control of the associated timer motor, whereby the cycle of operation of the dishwashing apparatus 10 is carried out automatically, a time interval of approximately 2970 seconds being required.

During the operation of the dishwashing apparatus 10 in the timed cycle above-described, the door 13 must be retained in its closed position in order to retain the door switch 73 in its closed position, since the door switch 73 occupies an interlock position in the control circuit network; and any time the door 13 is operated into its open position, the door switch 73 is operated into its open position arresting the cycle of operation of the dishwashing apparatus 10. Finally, at the conclusion of the timed washing cycle, the dishes supported by the rack structure 14

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have not only been thoroughly washed and rinsed, but they have also been subjected to a drying action. Subsequently, the door 13 may be moved from its closed position into its open position, and the rack structure 14 may be moved out of the vat over the door 13 so that the dishes may be removed from the rack structure 14 and placed in a kitchen cabinet, or the like, if desired.

In the operation of the washing apparatus 10, the dishes, glassware, etc., supported by the rack structure 14 are subjected to the initial and the final drying steps, following the secondary rinsing step, under conditions such that there are no droplets of rinsing liquid thereon during the drying actions. This effect is accomplished by virtue of the presence of an adequate amount of synthetic wetting agent in the charge of rinsing liquid during the secondary rinsing step, an excess charge of synthetic wetting agent being introduced into the charge of rinsing liquid during the primary rinsing step as a matter of preferred technique. Since the dishes, glassware, and the like, undergo the drying action without the presence thereon of the water droplets mentioned, it is not critical that the washing and rinsing liquids employed in the dishwashing apparatus 10 may comprise hard water that has been merely heated to the proper temperature in a hot water tank, or the like, without any water softening treatment. Specifically, since the dishes, glassware, etc., are subjected to the drying actions noted in the absence of the water droplets mentioned, they are not spotted or streaked at the conclusion of the drying step or subjected to the gradual discoloring effects that normally proceed from the utilization of hard water in dishwashing apparatus of this character.

In view of the foregoing, it is apparent that there has been provided an improved method of washing dishes, or the like, that may be readily carried out in a known type of automatic dishwashing apparatus, as well as improved equipment that may be readily installed into the automatic dishwashing apparatus mentioned in order to convert it to carry out the present method.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. The method of washing dishes, or the like, arranged in an enclosing vat comprising introducing a first body of hot water into the vat, introducing an excess charge of detergent into the first body of hot water, circulating the first body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect primary washing of substantially all of the soil therefrom, draining the first body of hot water from the vat, introducing a second body of hot water into the vat, circulating the second body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect secondary washing of the small residual soil therefrom, draining the second body of hot water from the vat, introducing a third body of hot water into the vat, introducing an excess charge of synthetic wetting agent into the third body of hot water, circulating the third body of hot water in the vat into bombarding relation with the dishes for a time

interval in order to effect primary rinsing of substantially all of the detergent therefrom, draining the third body of hot water from the vat, introducing a fourth body of hot water into the vat, circulating the fourth body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect secondary rinsing of the small residual detergent therefrom, draining the fourth body of hot water from the vat, the last-mentioned rinse water containing a sufficient quantity of the synthetic wetting agent to reduce the surface tension thereof so that substantially all of the last-mentioned rinse water drains freely and quickly from the dishes, and finally retaining the dishes in the vat for a time interval in order to effect evaporation of the small residuum of the last-mentioned rinse water thereon and the consequent drying thereof.

2. The method of washing dishes, or the like, arranged in an enclosing vat comprising introducing a first body of hot water into the vat, introducing an excess charge of detergent into the first body of hot water, circulating the first body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect primary washing of substantially all of the soil therefrom, draining the first body of hot water from the vat, introducing a second body of hot water into the vat, circulating the second body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect secondary washing of the small residual soil therefrom, draining the second body of hot water from the vat, introducing a third body of hot water into the vat, introducing an excess charge of synthetic wetting agent into the third body of hot water, circulating the third body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect primary rinsing of substantially all of the detergent therefrom, draining the third body of hot water from the vat, introducing a fourth body of hot water into the vat, circulating

the fourth body of hot water in the vat into bombarding relation with the dishes for a time interval in order to effect secondary rinsing of the small residual detergent therefrom, draining the fourth body of hot water from the vat, the last-mentioned rinse water containing a sufficient quantity of the synthetic wetting agent to reduce the surface tension thereof so that substantially all of the last-mentioned rinse water drains freely and quickly from the dishes, and finally circulating hot air in the vat in the form of a blast into contact with the dishes for a time interval in order to effect evaporation of the small residuum of the last-mentioned rinse water thereon and the consequent drying thereof.

3. The method set forth in claim 1, wherein the synthetic wetting agent consists essentially of an ester of a higher fatty acid, in which the fatty acid portion of the molecule contains from 12 to 18 carbon atoms.

4. The method set forth in claim 1, wherein the synthetic wetting agent consists essentially of a sulfuric acid ester of a higher fatty acid, in which the fatty acid portion of the molecule contains from 12 to 18 carbon atoms.

5. The method set forth in claim 1, wherein the synthetic wetting agent consists essentially of sodium lauryl sulfate.

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