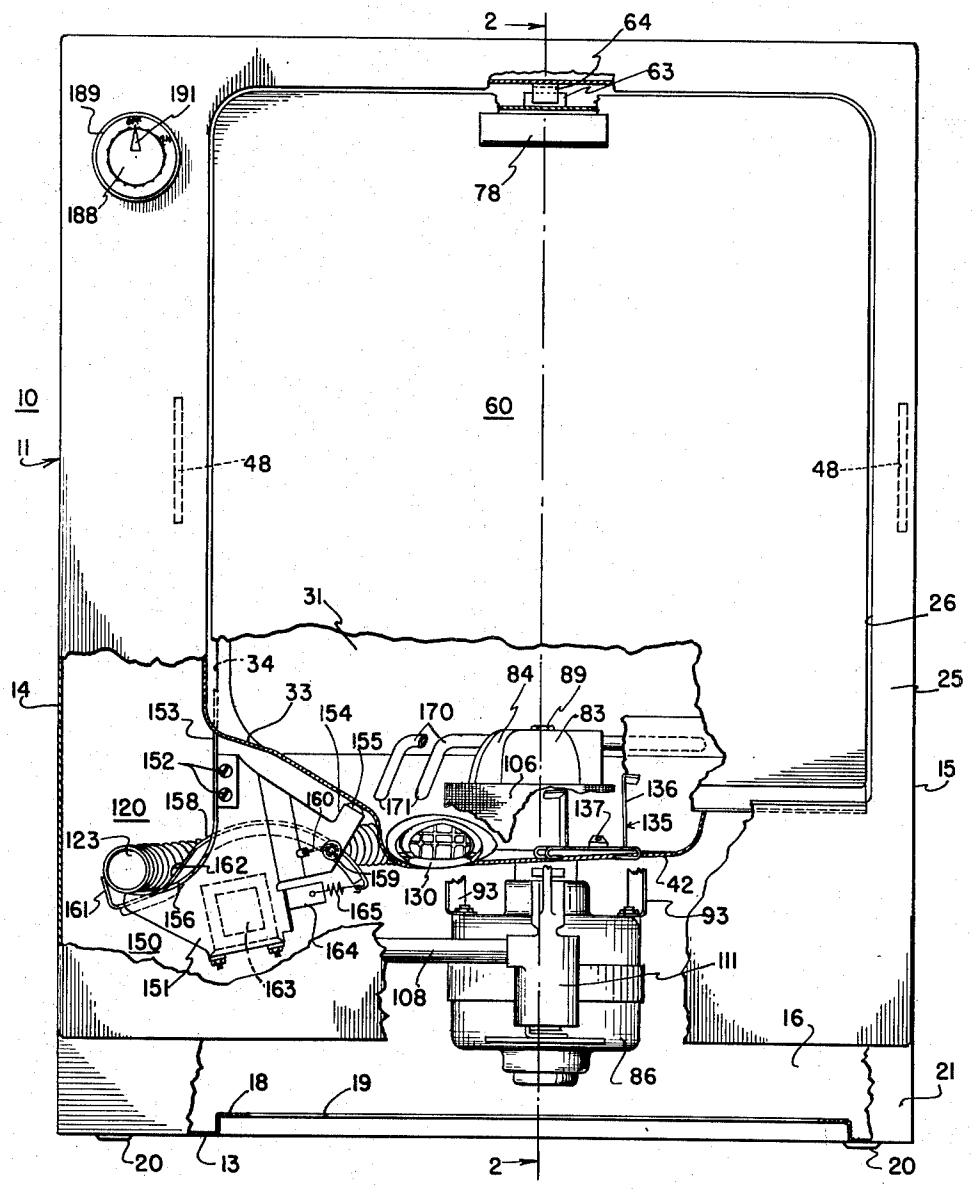
May 11, 1954 E. S. STODDARD 2,678,051

WASHING APPARATUS

Filed April 8, 1949 6 Sheets-Sheet 1

FIG. 1



INVENTOR.
Edgar S. Stoddard

BY
Smith, Olsen & Baird

Attys.

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WASHING APPARATUS

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FIG. 2

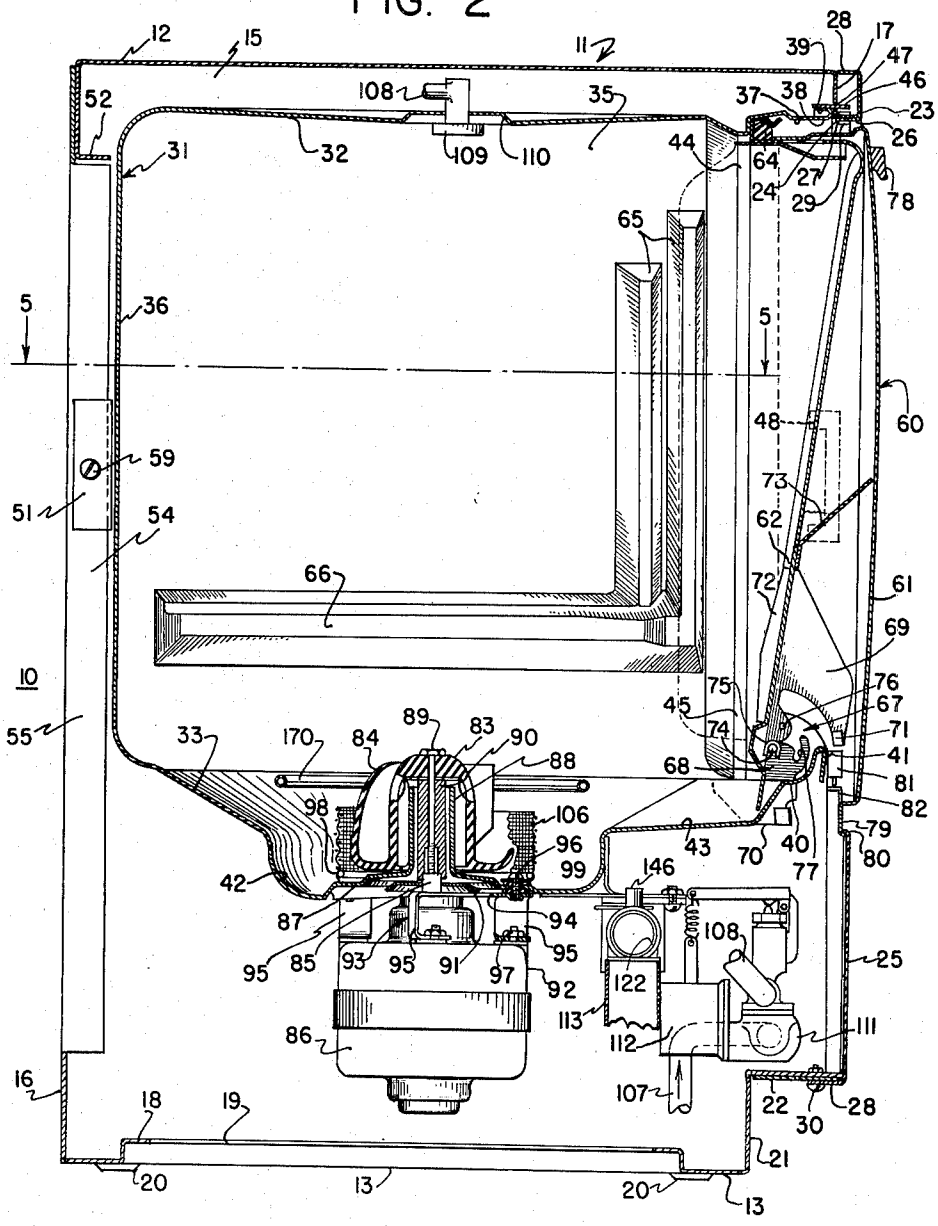
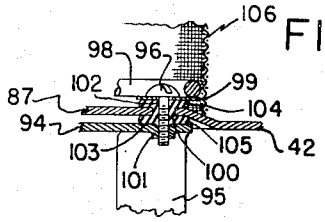


FIG. 3



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Attys.

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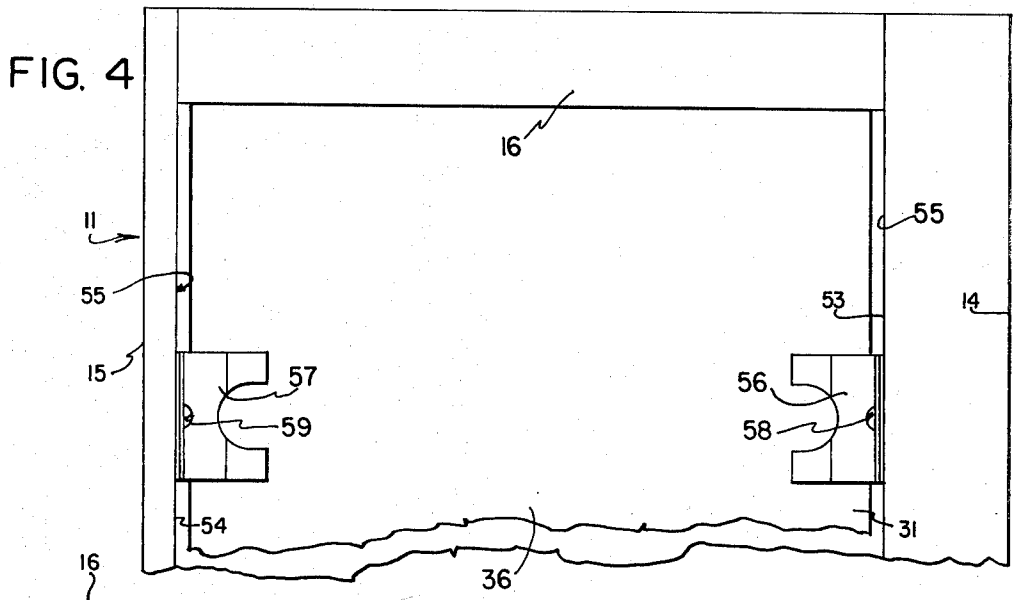
FIG. 4



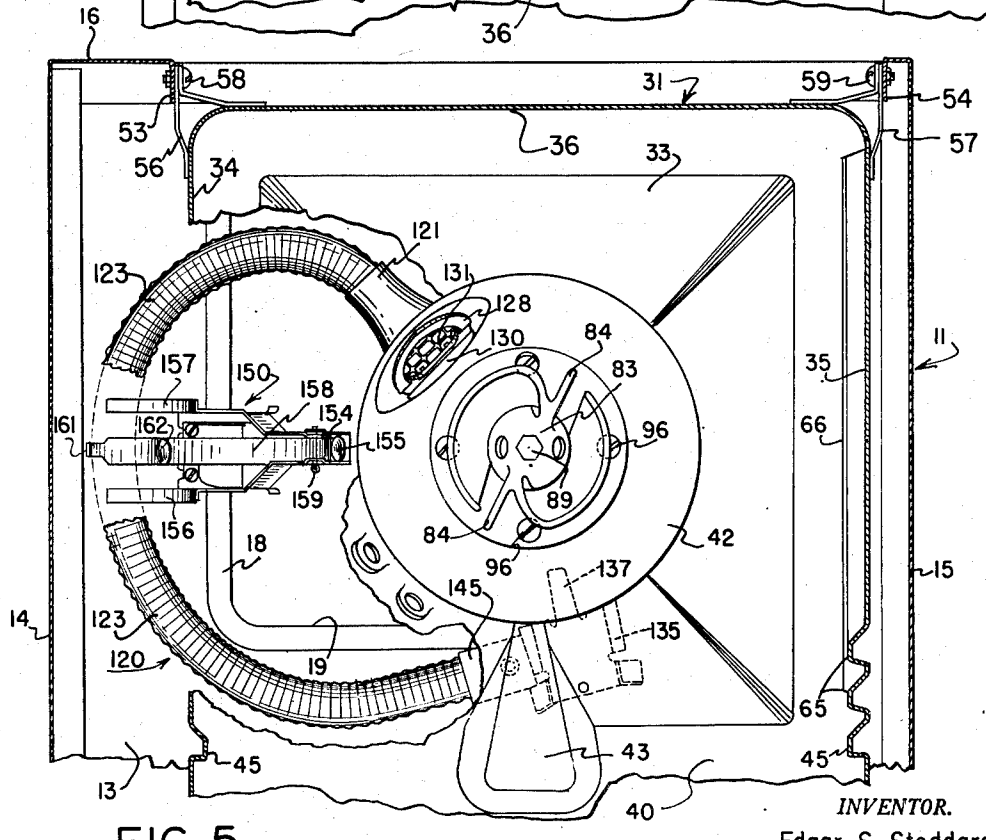


FIG. 5

INVENTOR.
Edgar S. Stoddard

BY
Smith, Olsen & Baird
Attys.

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FIG. 6

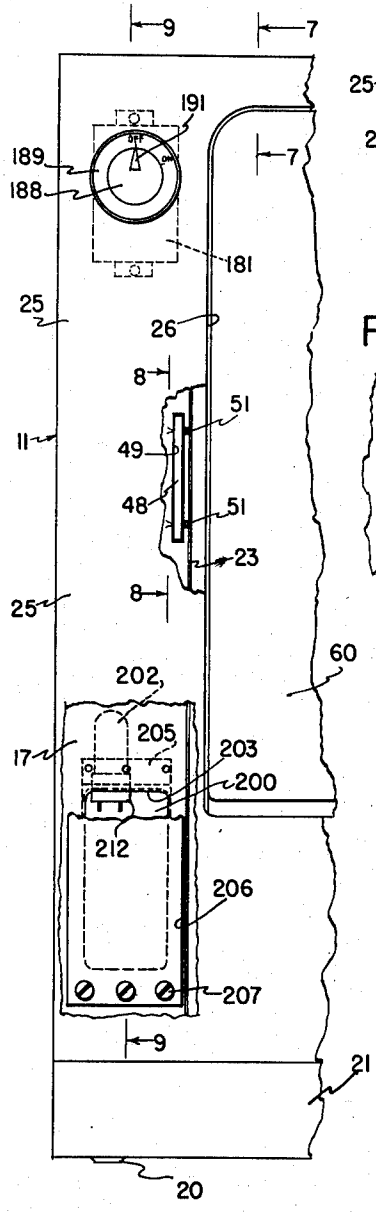


FIG. 7

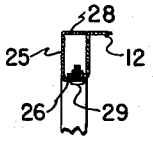


FIG. 8

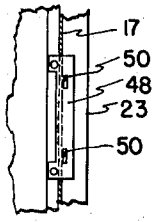


FIG. 9

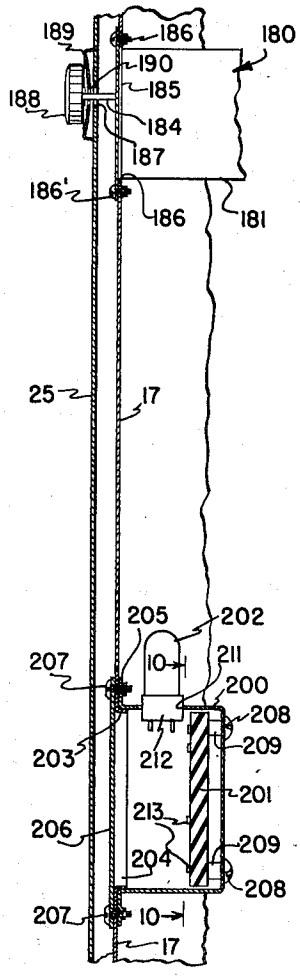
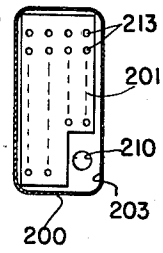


FIG. 10



Inventor
Edgar S. Stoddard

By
Smith, Olsen & Baird
Attys.

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WASHING APPARATUS

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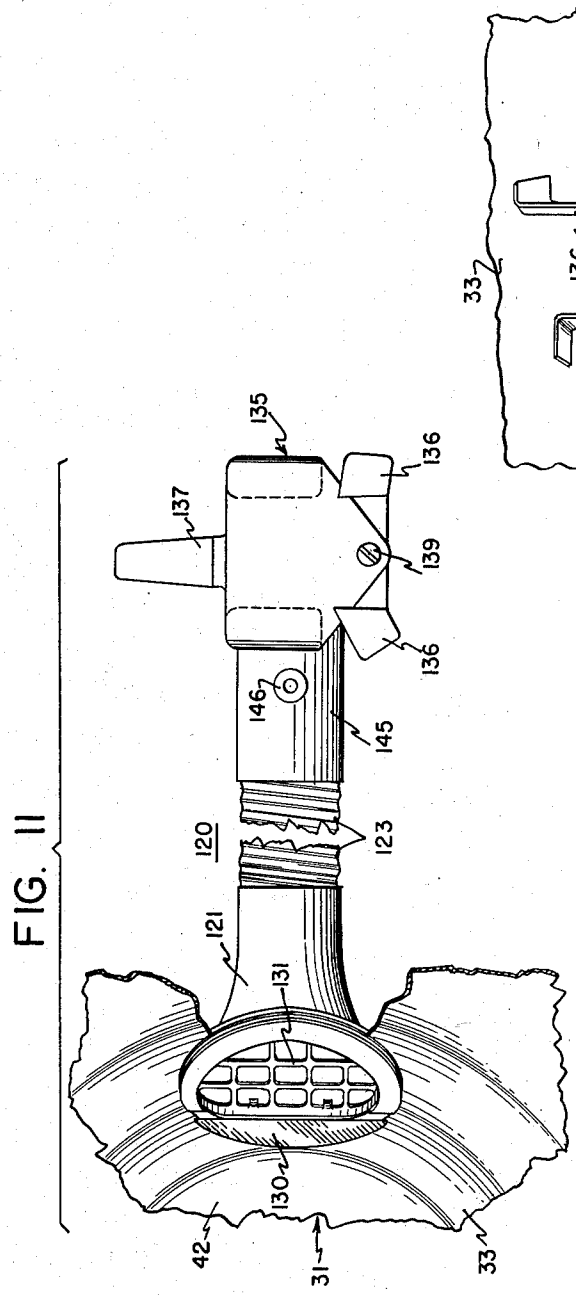

FIG. 11

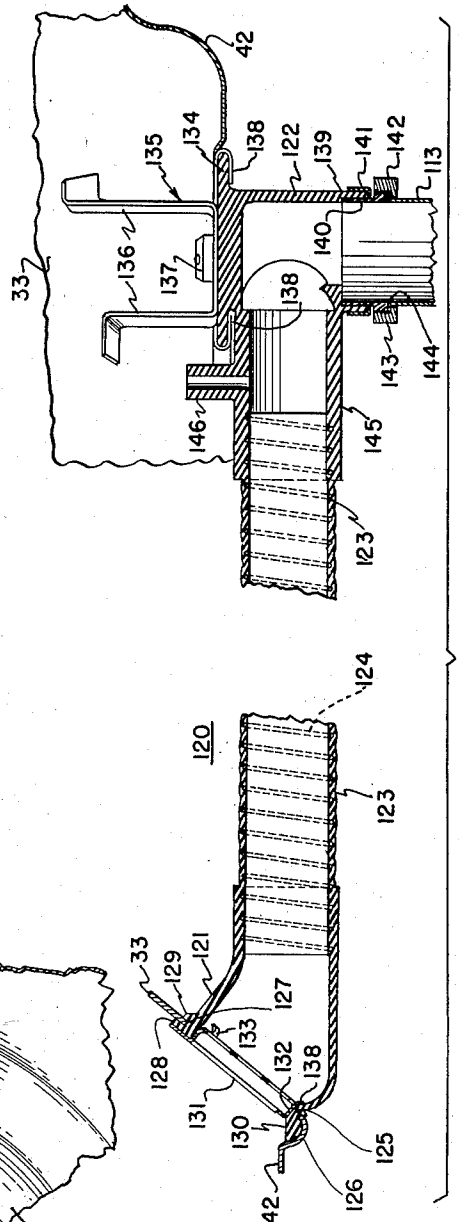

FIG. 12

Inventor
Edgar S. Stoddard

By Smith, Olsen & Baird
Attys.

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WASHING APPARATUS

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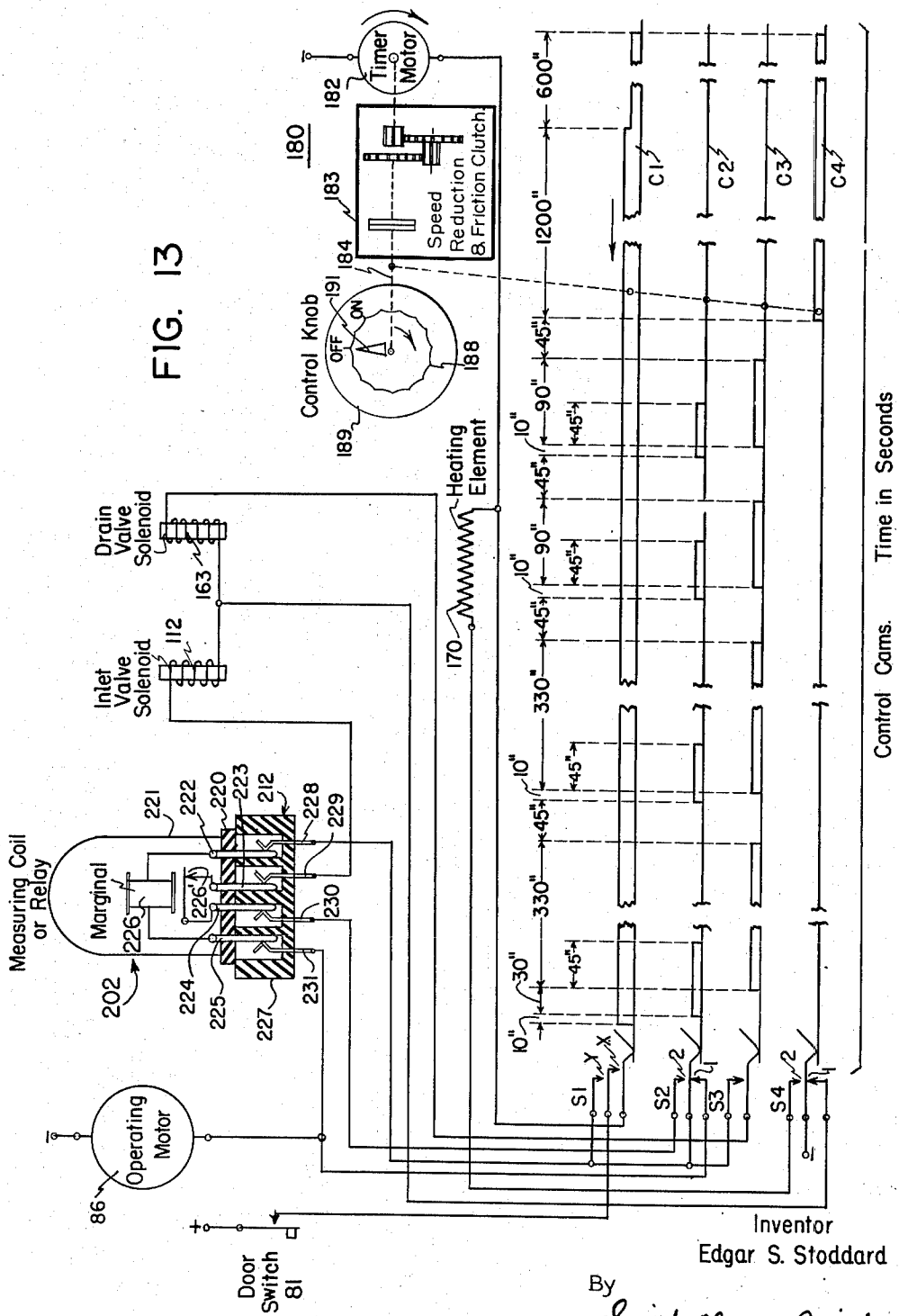
FIG. 13



Inventor
Edgar S. Stoddard

By
Smith, Olsen & Baird
Attys.

Patented May 11, 1954

2,678,051

UNITED STATES PATENT OFFICE

2,678,051

WASHING APPARATUS

Edgar S. Stoddard, Berwyn, Ill., assignor to General Electric Company, a corporation of New York

Application April 8, 1949, Serial No. 86,291

10 Claims. (Cl. 134—58)

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The present invention relates to washing apparatus, and more particularly to improved dishwashing apparatus of the general character of that disclosed in the co-pending application of Forrest A. Walker, Serial No. 57,448, filed October 30, 1948.

The dishwashing apparatus disclosed in the Walker application mentioned is of the timed washing cycle type that performs automatically and in predetermined sequence given steps including spraying, washing, rinsing and drying of the dishes and other utensils contained therein. This apparatus comprises a cabinet housing a vertically disposed vat including a front opening and a door for closing the opening, the door being mounted for movements between a substantially vertical closed position and a substantially horizontal open position. In this apparatus the vat and the door are so constructed and arranged that the utilization of a sealing gasket therebetween for the purpose of retaining the washing fluid or liquid in the vat is unnecesary.

It is a general object of the present invention to provide dishwashing apparatus of the character described incorporating improved and simplified structure in order to increase the efficiency of operation and to reduce the cost of manufacture thereof.

Another object of the invention is to provide in washing apparatus including a cabinet housing a vat, an improved arrangement for mounting or supporting the vat in the cabinet.

Another object of the invention is to provide in washing apparatus of the type noted, improved removable front panel structure on the cabinet permitting ready inspection and adjustment of the operating parts disposed in the cabinet exteriorly of the vat.

A further object of the invention is to provide in washing apparatus of the type noted, improved cabinet structure for reducing possible fire hazards in the event of faults developing in the electric parts or wiring incorporated therein.

Further features of the invention pertain to the particular arrangement of the elements of the washing apparatus, 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

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embodying the present invention; 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 an enlarged fragmentary sectional view of a detail of the vat structure shown in Fig. 2, illustrating the arrangement for clamping the motor-supporting brackets and the screen-supporting ring to the bottom wall of the vat; Fig. 4 is a fragmentary rear elevational view of the upper portion of the dishwashing apparatus, illustrating the arrangement for securing the rear of the vat to the rear of the cabinet; Fig. 5 is a fragmentary horizontal sectional view of the dishwashing apparatus, taken in the direction of the arrows along the line 5—5 in Fig. 2; Fig. 6 is a fragmentary front elevational view, partly broken away, of the left-hand side of the dishwashing apparatus; Fig. 7 is a fragmentary sectional view of a detail of the cabinet structure, taken in the direction of the arrows along the line 7—7 in Fig. 6, illustrating the arrangement for securing the upper portion of the removable front panel to the associated upper portion of the front wall of the cabinet; Fig. 8 is a fragmentary sectional view of a detail of the cabinet structure, taken in the direction of the arrows along the line 8—8 in Fig. 6, illustrating the arrangement for securing the front left-hand side of the vat to the associated left-hand side of the front wall of the cabinet; Fig. 9 is a fragmentary vertical sectional view of the cabinet structure, taken in the direction of the arrows along the line 9—9 in Fig. 6, illustrating the arrangements for securing the timer and the electric terminal box to the left-hand side of the front wall of the cabinet; Fig. 10 is a vertical sectional view of the cabinet structure, taken in the direction of the arrows along the line 10—10 in Fig. 9, illustrating the arrangement of the electric terminal board in the associated electric terminal box; Fig. 11 is a fragmentary plan view of a portion of the bottom wall of the vat and the associated flexible drain hose; Fig. 12 is a fragmentary vertical sectional view of the parts shown in Fig. 11; and Fig. 13 is an electric diagram of the timer and the circuit control arrangement incorporated in the dishwashing apparatus.

Referring now to Figs. 1 to 10, inclusive, of the drawings the dishwashing apparatus 10 there illustrated, and embodying the features of the present invention, is of the general character of that disclosed in the previously mentioned Walker application and comprises an outer casing or cabinet 11 provided with top and bottom walls 12 and 13, opposed side walls 14 and 15, and rear and

front walls 16 and 17. The bottom wall 13 is upwardly offset adjacent to the central portion thereof in order to provide an inwardly directed flange 18 having an opening 19 therein accommodating the plumbing extending to the exterior through the lower portion of the cabinet 11. Also the bottom wall 13 has a plurality of downwardly depressed feet 20 formed therein for the purpose of supporting the apparatus 10 upon a floor, or the like. The front wall 17 is rearwardly offset adjacent to the bottom wall 13 providing connecting substantially vertical and horizontal panels 21 and 22 adjacent to the front of the cabinet 11 in order to define a foot-receiving recess, permitting a person to work close to the front of the cabinet 11. Also the front wall 17 is provided with outwardly projecting top and side flange structure 23 defining a front opening 24 in the upper portion thereof, the front opening 24 being offset toward the right closer to the right-hand side wall 15 than to the left-hand side wall 14. Further, the front wall 17 carries a front panel 25 having an opening 26 formed in the upper portion thereof and offset toward the right-hand side thereof, the front opening 26 surrounding the front opening 24 and overlying a considerable marginal portion thereof adjacent to the lower portion of the front wall 17. The front panel 25 is provided with an inwardly directed marginal flange 27 surrounding the front opening 26 and lying within the top and side flange structure 23. Also the front panel 25 is provided with an inwardly directed boundary flange 28, the top and side portions thereof being respectively disposed substantially flush with the top wall 12 and the side walls 14 and 15, and the bottom portion thereof underlying the horizontal panel 22. More specifically, the front panel 25 is removably secured to the front wall 17 by an arrangement including a pair of laterally spaced-apart screws 29 extending through the top of the marginal flange 27 and the adjacent top flange structure 23 and by a pair of laterally spaced-apart screws 30 extending through the bottom of the boundary flange 28 and the adjacent horizontal flange 22. Thus it will be understood that the front panel 25 conceals the front wall 17 when it is secured thereto by the screws 29 and 30 and that the front panel 25 may be readily removed from the front wall 17 by removing the screws 29 and 30.

The cabinet 11 houses a substantially vertically disposed vat 31 arranged in the upper portion thereof and offset toward the right closer to the side wall 15 than to the side wall 14. The vat 31 comprises top and bottom walls 32 and 33, opposed side walls 34 and 35 and a rear wall 36; the top and bottom walls 32 and 33 and the side walls 34 and 35 terminate in a forwardly directed doorway 37 having a front opening 38 arranged in substantial registry with the front openings 24 and 26. More particularly the top and side portions of the doorway 37 terminate in an outwardly and rearwardly rolled rim 39, while the bottom wall 33 is provided with a forwardly projecting flange 40 terminating in an upwardly and outwardly extending ledge or lip 41 extending between the side portions of the doorway 37. The ledge 41 is directed first upwardly and outwardly and then downwardly terminating adjacent to the front opening 38 of the doorway 37, whereby the upper edge of the ledge 41 is disposed considerably above the bottom flange 40 and consequently the bottom wall 33. A substantially centrally disposed downwardly depressed sump 42 is formed in the bottom wall 33 and communicates with a downwardly embossed depression or groove 43 formed substantially centrally in the bottom flange 40 and extending forwardly toward the central portion of the ledge 41. Further, an upstanding inverted substantially U-shaped inwardly embossed vat rib 44 is formed in the top wall 32 and the side walls 34 and 35 at the junction thereof with the corresponding portions of the doorway 37, the vat rib 44 including downwardly extending legs 45 terminating just above the bottom flange 40 and well behind and below the ledge 41.

The front of the vat 31 is secured and positioned within the cabinet 11 by a three-point support, while the rear of the vat 31 is secured and positioned in the cabinet 11 by a two-point support. More particularly, a top tongue 46 is secured to the top central portion of the rolled rim 39 and projects forwardly therefrom through a top slot 47 formed in the front wall 17 above the top of the front opening 24; while two side tongues 48 are respectively secured to the side central portions of the rolled rim 39 and project forwardly therefrom through two side slots 49 formed in the front wall 17 on opposite sides of the front opening 24. The top tongue 46 and each of the side tongues 48 may be substantially U-shaped as illustrated in Fig. 2, and suitably spot welded to the adjacent outside portions of the rolled rim 39. Also in each of the side tongues 48 upper and lower holes 50 are provided for the purpose of receiving cotter pins 51 in order securely to anchor in place the tongues 48 with respect to the front wall 17.

The rear wall 16 is provided with an inwardly directed top flange 52 and two laterally spaced-apart inwardly directed side flanges 53 and 54 defining an enlarged opening or hole 55 therein through which the vat 31 may be readily inserted or removed with respect to the cabinet 11. More particularly, a first rearwardly directed fixture 56 provided with angularly disposed arms spot welded or otherwise secured to the side and rear walls 34 and 36 is carried on the rear left-hand side of the vat 31; while a second rearwardly directed fixture 57 provided with angularly disposed arms spot welded or otherwise secured to the side and rear walls 35 and 36 is carried on the rear right-hand side of the vat 31. The hole 55 disposed in the rear wall 16 is laterally offset so that it is closer to the right-hand side wall 15 than to the left-hand side wall 14 and the fixtures 56 and 57 are respectively removably secured to the associated flanges 53 and 54 by two bolts 58 and 59 provided with cooperating nuts. Thus it will be understood that after the vat 31, together with its attachments subsequently described, have been assembled, the vat 31 as a unit may be readily inserted through the hole 55 in the rear wall 16 of the cabinet 11, the tongues 46 and 48 sliding through the cooperating slots 47 and 49. After the vat 31 has thus been placed within the cabinet 11 the cotter pins 51 may be arranged in the holes 50 provided in the tongues 48 and set in place. Also the fixtures 56 and 57 are secured to the adjacent flanges 53 and 54 utilizing the bolts 58 and 59 and the cooperating nuts. Subsequently the front panel 25 may be placed upon the front wall 17 and secured in place employing the screws 29 and 30 in order to conceal the ends of the tongues 46 and 48.

The cabinet 11 is provided with a front door 60 that comprises an outer body sheet 61 terminating in an inverted substantially U-shaped rearwardly directed marginal flange including top

and side portions, not shown, and an inner body sheet 62 terminating in an inverted substantially U-shaped rearwardly directed marginal flange including top and opposed side portions, not shown. The inner body sheet 62 is arranged in nested relation within the outer body sheet 61 and suitably secured in place so that the principal portions of the body sheets 61 and 62 are arranged in upwardly approaching spaced-apart relation. Further the inner body sheet 62 is provided with an outwardly directed inverted substantially U-shaped marginal flange, not shown, that cooperates with the front surface of the associated vat rib 44 when the door 60 occupies its closed position. In order to retain the door 60 in its closed position a latch element 63 is secured to the central upper portion thereof and cooperates with a resilient corrosion-resistant spring 64 secured within the upper central portion of the doorway 37. Also the inner body sheet 62 carries inverted substantially U-shaped rearwardly directed baffle structure, not shown, that projects through the vat rib 44 into the interior of the vat 31 in order to prevent the entry of washing liquid into the doorway 37. More particularly, the baffle structure, not shown, carried by the inner body sheet 62 cooperates with inwardly directed baffle structure formed in the side walls 34 and 35 of the vat 31 in order to complete the gasketless vat and door construction. The inwardly directed baffle structure formed in the right-hand side wall 35 is indicated generally at 65; while the inwardly directed baffle structure formed in the left-hand side wall 34 is not shown; these baffle structures being disposed rearwardly of the upstanding legs 45 of the vat rib 44. Also the right-hand side wall 35 of the vat 31 carries an inwardly directed embossed trackway indicated generally at 66; while the left-hand side wall 34 of the vat 31 carries an inwardly directed embossed trackway, not shown; which opposed trackways are adapted to support movable dish-carrying rack structure, not shown.

The door 60 is mounted adjacent to the lower edge thereof within the vat 31 rearwardly of and below the front ledge 41 by a hinge arrangement including two laterally disposed substantially identical hinge mechanisms, whereby the lower ends of the outer and inner body sheets 61 and 62 are disposed in straddling relation with respect to the front ledge 41. More particularly, the right-hand hinge mechanism is indicated generally at 67 and comprises a first hinge element 68 secured to the flange 40 provided on the bottom wall 33 and a second hinge element 69 secured to the front surface of the inner body sheet 62 and disposed between the inner and outer body sheets 62 and 61. Also this mechanism comprises a bumper member 70 secured to the lower surface of the flange 40 exteriorly of the vat 31 and adapted to cooperate with a bumper member 71 carried by the hinge element 69. Also a guide track 72 is secured to the rear surface of the inner body sheet 62 and disposed over the hinge element 69; and a detergent cup, not shown, is carried by the lower portion of the inner body sheet 62 in the space between the body sheets 62 and 61 and opening into the interior of the vat 31 for a purpose more fully explained hereinafter. Further, the inner and outer body sheets are restrained in spaced-apart relation by an upwardly and forwardly directed laterally extending bracing sheet 73 secured to the front surface of the inner body sheet 62 and abutting

the rear surface of the outer body sheet 61. Further, the hinge mechanism 67 comprises a pintle 74 carried by the hinge element 68, a cooperating saddle 75 carried by the hinge element 69, and a locking pin 76 carried by the hinge element 69 and cooperating with a locking slot 77 formed in the hinge element 68. Finally a handle 78 is secured to the upper central front of the outer body sheet 61 for the purpose of facilitating movement of the door 60 between its open and closed positions; while the lower edge of the outer body sheet 61 carries a laterally extending flange 79 that cooperates with a rearwardly directed ledge 80 formed on the front panel 25 just below the bottom of the front opening 26 formed therein for the purpose of lending a finished appearance to the cabinet 11 when the door 60 occupies its closed position. Finally, a door switch 81 is secured to the front edge of the front ledge 41 and cooperates with a projection 82 carried by the outer body sheet 61.

In view of the foregoing description of the construction of the door 60 it will be understood that the door 60 is movable into a closed position with respect to the doorway 37, at which time the outer body sheet 61 occupies a substantially vertical position and is disposed substantially flush with the front surface of the front panel 25, and at which time the inner body sheet 62 is disposed in an upwardly and forwardly inclined position. The door 60 is restrained in its closed position by the cooperation between the latch elements 63 and 64; whereby the baffle structure, not shown, carried by the inner body sheet 62 cooperates with the baffle structure 65, etc., and the vat rib 44 carried by the vat 31 in order to prevent the escape of washing liquid from the doorway 37. Also at this time the projection 82 carried by the outer body sheet 61 engages the plunger of the door switch 81, operating the door switch 81 to its closed-circuit position for a purpose more fully explained hereinafter. Also the door 60 is movable into an open position with respect to the doorway 37, at which time the inner body sheet 62 occupies a substantially horizontal position and the outer body sheet 61 occupies an upwardly and forwardly inclined position. Thus the door 60 is movable through an angle slightly less than 90 degrees between its closed and open positions. When the door 60 is moved into its open position the projection 82 disengages the plunger of the door switch 81 operating the door switch 81 into its open-circuit position for a purpose more fully explained hereinafter. Also as the door 60 is moved into its final open position the bumper member 71 carried by the hinge element 69 engages the bumper member 70 in order rigidly to support the door 60 in its open position; and the locking pin 76 carried by the hinge element 69 enters the locking slot 77 provided in the hinge element 68 in order positively to prevent removal of the door 60 while it occupies its open position. At this time while the door 60 occupies its open position the dish-rack, not shown, may be moved through the doorway 37 into and out of the vat 31. More particularly, the rack, not shown, may be rolled from a supported position upon the guideway 66, etc., within the vat 31 to a position exteriorly of the vat 31 upon the guide track 72, etc., carried by the inner body sheet 62; whereupon dishes may be readily loaded or unloaded with respect to the rack. Thus it will be understood that when the door 60 occupies its open position it supports the movable rack, not

shown, permitting the ready placement and removal of dishes and other utensils with respect thereto.

In passing it is noted that when the door 60 occupies an intermediate position with respect to its closed and open positions described above that it may be completely removed from the doorway 37 by virtue of the fact that the saddle 75 is disengageable with respect to the pintle 74 prior to entry of the locking pin 76 into the locking slot 77.

The construction and arrangement of the door 60 and the cooperating baffle structure 65, etc., and the vat rib 44, as well as the arrangement for movably supporting the rack structure, not shown, within the vat 31 and upon the door 60, have not been disclosed in great detail in the present application, since these arrangements form no part of the present invention, and are disclosed and claimed in the previously mentioned Walker application. Similarly, the construction and arrangement of the hinge mechanism 67 has not been disclosed in great detail in the present application, since this arrangement forms no part of the present invention, and is disclosed and claimed in the co-pending application of Frank D. Low, Serial No. 61,633, filed November 23, 1948, now Patent No. 2,573,798, dated November 6, 1951.

The apparatus 10 further comprises an impeller 83 which is provided with blades 84 that may have any suitable shape, the important feature being that the blades 84 are given a shape such that the washing liquid supplied to the vat 31 and allowed to accumulate in the sump 42 is thrown upwardly and outwardly in an efficient manner through the rack structure, not shown. The impeller 83 may be formed of any suitable material such, for example, as "Textolite" and is mounted upon a substantially vertically disposed operating shaft 85 of an electric motor 86 arranged below the sump 42. More particularly, the sump 42 is provided with an upwardly directed emboss 87 that terminates in a substantially vertically disposed tube 88 through which the shaft 85 of the motor 86 projects and which is surrounded by the hub of the impeller 83. The hub of the impeller 83 may be removably secured to the upper end of the shaft 85 by an arrangement including a bolt 89 extending through an associated spacing collar 90 arranged within the tube 88 and abutting the upper end of the shaft 85, the end of the bolt 89 being threaded into a corresponding recess provided in the upper end of the shaft 85. Further, the shaft 85 carries a disk 91 disposed below the spacing collar 90 and the bottom of the tube 88 within the emboss 87 in order to fling from the shaft 85 any washing liquid that may escape from the vat 31 into the upper open end of the tube 88 between the hub of the impeller 83 and the wall of the tube 88. This arrangement permits ready rotation of the impeller 83 by the motor 86 and prevents the escape of any substantial amount of washing liquid from the vat 31 through the tube 88.

The motor 86 is arranged in a substantially vertical position and is provided with an upper end bell 92 that is secured to the emboss 87 by an arrangement including two angularly spaced-apart brackets 93. More particularly, each of the brackets 93 comprises a curved body 94 and two downwardly extending legs 95, the body 94 being secured to the lower surface of the emboss 87 and the two legs 95 being secured to the upper end bell 92. Specifically, the body 94 of each bracket 93 is secured to the lower surface of the emboss 87 by two screws 96; while each of the legs 95 is secured to the end bell 92 by an upwardly extending bolt and cooperating nut 97. Accordingly, the motor 86 may be removed from the supporting brackets 93 by removing the four nuts 97 after the bolt 89 has been removed from the shaft 85.

A ring 98 is arranged within the vat 31 in surrounding relation with respect to the tube 88 and carries four angularly spaced-apart inwardly directed fixtures 99 through which the four screws 96 extend. Accordingly, the screws 96 firmly clamp the ring 98 in place on the upper surface of the emboss 87 and the two brackets 93 in place upon the lower surface of the emboss 87. Each of the screws 96 extends through a cooperating hole 100 formed in the emboss 87 and is threaded into a cooperating hole 101 formed in the body 94 of one of the brackets 93. Also each of the screws 96 extends through a hole 102 formed in one of the fixtures 99 and is surrounded by a resilient grommet 103 formed of rubber, or the like. The holes 102, 100 and 101 are arranged in alignment so that when the screw 96 is tightened the fixture 99 and the body 94 are drawn together compressing the grommet 103. Finally, the grommet 103 comprises an upper flange portion 104 disposed between the fixture 99 and the adjacent upper surface of the emboss 87 and a lower flange portion 105 disposed between the lower surface of the emboss 87 and the adjacent upper surface of the body 94. Accordingly, the grommets 103 seal the holes 100 formed in the emboss 87 in order positively to prevent the escape of washing liquid from the sump 42 through the holes 100. Finally, an upstanding cylindrical reticulated screen 106 is removably carried by the ring 98 in surrounding relation with respect to the blades 84 of the impeller 83. The lower edge of the reticulated screen 106 abuts the adjacent upper surface of the emboss 87 and serves as a strainer to prevent foreign articles suspended in the washing liquid contained in the sump 42 from being caught by the blades 84 of the impeller 83 and flung upwardly through the dish-supporting rack, not shown.

Provided in the space in the cabinet 11 below the vat 31 is a suitable liquid supply pipe 107 which is adapted to be connected to a source of cleansing or washing liquid, not shown, by coupling units, or the like, not shown. For example, in the event the washing liquid is water, the source of supply may be a convenient hot water tank, or the like. The washing liquid is piped from the bottom of the cabinet 11 upwardly between the rear wall 16 thereof and the rear wall 36 of the vat 31 by a flexible conduit 108 and into the top wall 32 of the vat 31. Specifically, a spraying device 109 is arranged within an upwardly extending emboss 110 formed in the top wall 32 of the vat 31 so that the washing liquid may be sprayed down through the rack structure, not shown, carried within the vat 31 and allowed to accumulate in the sump 42. The liquid supply pipe 107 is suitably connected to an inlet valve mechanism 111 of the solenoid dash-pot type arranged to discharge into the conduit 108. The inlet valve mechanism 111 is normally biased to its closed position in order to cut off the supply of washing liquid from the liquid supply pipe 107 to the conduit 108, but is provided with an associated solenoid 112 that is adapted when en-

ergized to operate the inlet valve mechanism 111 to its open position in order that washing liquid may be supplied from the liquid supply conduit 107 via the casing of the inlet valve mechanism 111, the conduit 108 and the spraying device 109 into the upper portion of the vat 31. Subsequently, when the solenoid 112 is de-energized the inlet valve mechanism 111 is returned slowly to its closed position cutting off the communication between the liquid supply pipe 107 and the spraying device 109. The provision of the slow-closing inlet valve mechanism 111 eliminates water hammer in the plumbing preceding the liquid supply pipe 107. Also, a strainer, not shown, is incorporated in the casing of the inlet valve mechanism 111 in order positively to prevent foreign material in the liquid supply pipe 107 from being conducted into the liquid supply conduit 108 and thence into the spraying device 109.

Also provided in the lower portion of the cabinet 11 below the vat 31 is a drain pipe 113 that is connected through a suitable trap, not shown, to a drain connection. The drain pipe 113 forms a part of flexible drain mechanism 120 that is incorporated in the apparatus 10 and best shown in Figs. 1, 2, 5, 11 and 12. Specifically, this drain mechanism 120 comprises a first hollow drain fixture 121, a second hollow drain fixture 122 and a communicating section of flexible conduit or hose 123. Preferably the hose 123 comprises a plurality of plies of fabric, not shown, embedded in rubber to form the wall thereof and an enclosed helical corrosion-resistant spring 124 arranged therein and embedded in the rubber wall in order to prevent collapse of the hose 123 and to lend resiliency thereto. Also it is preferable that the drain fixtures 121 and 122 be formed of elastic rubber and molded directly in place upon the opposite ends of the hose 123. More particularly, a drain opening 125 of a predetermined contour, generally elliptical in plan, is formed in the bottom wall 33 of the vat 31 in the lowermost portion of the sump 42 and frictionally receives the outer end of the drain fixture 121. Specifically, the drain opening 125 occupies a position disposed on a line drawn between the center of the impeller 83 and the corner between the side wall 34 and the rear wall 36 of the vat 31; and a depression 126 substantially bead-like in shape is formed in the bottom wall 33 adjacent to and below the drain opening 125. The drain fixture 121 comprises a body having a deep surrounding recess 127 therein defining spaced-apart flanges 128 and 129, the configuration of the base of the recess 127 substantially conforming to the contour of the drain opening 125, and an integral bead 130 being formed in the lower portion of the body and disposed in the recess 126. The end of the drain fixture 121 is removably and frictionally secured to the bottom wall 33 within the drain opening 125 with the flanges 128 and 129 disposed respectively interiorly and exteriorly of the bottom wall 33 and with the bead 130 positioned in the recess 126. A strainer 131 is arranged within the end of the drain fixture 121 within the sump 42 for the purpose of holding the drain fixture 121 firmly in place within the drain opening 125 and in order to prevent the washing liquid draining thereinto from the sump 42 from carrying foreign objects therewith into the drain fixture 121. Specifically, the strainer 131 is provided with a throat flange 132 carrying a number of outwardly projecting locking ears 133 engaging the throat of the drain fixture 121 and pressing the base of the recess 127 tightly against the edge of the bottom wall 33 surrounding the drain opening 125 and with the adjacent faces of the flanges 128 and 129 disposed on opposite sides of the recess 127 pressed into firm engagement with the respective inner and outer surfaces of the bottom wall 33 surrounding the drain opening 125 in order to provide a fluid-tight connection between the interior of the vat 31 at the bottom of the sump 42 and the interior of the drain fixture 121. The bead 130 carried by the lower portion of the body of the drain fixture 121 lies in the recess 126 formed in the bottom wall 33 adjacent to the drain opening 125 and fills up the recess 126 so that a smooth continuous surface is provided between the bottom of the sump 42 and the interior of the drain fixture 121 so as to prevent washing liquid from standing in the sump 42 around the bottom of the strainer 131 when the interior of the drain fixture 121 is placed into communication with the drain pipe 113 as explained more fully below.

The drain fixture 122 comprises a body provided with a flange 134 disposed at the upper portion thereof that is slidably received in a supporting bracket 135 secured to the bottom wall 33 somewhat to the right of the front central portion of the sump 42. More particularly, the bracket 135 comprises two laterally spaced-apart upwardly directed front legs 136 and a centrally disposed rearwardly extending leg 137, which legs 136 and 137 are spot welded, or otherwise secured, to the bottom wall 33 adjacent to the sump 42. Also the bracket 135 comprises two downwardly and inwardly turned arms 138 defining a clip that slidably receives the flange 134 provided on the drain fixture 122, the flange 134 being secured in place by an associated screw 139 extending through a hole provided therein and threaded into the body of the bracket 135. The body of the drain fixture 122 terminates in a downwardly extending barrel 139 into which a tube 140 is positioned and frictionally retained in place by a collar 141 surrounding the barrel 139 adjacent to the lower end thereof. The lower end of the tube 140 is provided with an externally threaded portion 142 that receives an internally threaded collar or union 143 that is adapted to engage an outwardly extending flange 144 provided on the top of the drain pipe 113. Accordingly, the collar 143 threaded upon the portion 142 of the tube 140 securely clamps the flange 144 to the adjacent end of the tube 140, and a gasket, not shown, may be positioned therebetween in order positively to insure that a detachable liquid-tight connection is provided between the drain pipe 113 and the barrel 139 of the drain fixture 122. Also the drain fixture 122 comprises an outwardly extending barrel 145 that is molded onto the adjacent end of the hose 123 and arranged in communicating relation with the barrel 139. Further, an upstanding breather tube 146 is molded into the barrel 145 and communicates between the interior thereof and the exterior.

In view of the foregoing description of the drain mechanism 120, it will be understood that the first elastic drain fixture 121 is frictionally secured within the drain opening 125 formed in the bottom wall 33 within the sump 42 in order to provide a liquid-tight connection therebetween and that the interior of the hollow drain fixture 121 communicates through the hollow hose 123 with the interior of the hollow drain fixture 122. The drain fixture 122 is removably secured by the bracket 135 to the exterior surface of the bottom wall 33 adjacent to the sump 42 and sup-

ports the communicating drain pipe 113 providing a liquid-tight connection therebetween. The drain fixture 122 is angularly off-set with respect to the drain fixture 121 by an angle of approximately 145 degrees and the interior of the hollow fixtures 121 and 122 are interconnected by the curved hose 123 as clearly shown in Fig. 5. Specifically, the intermediate portion or section of the hose 123 extends laterally from below the bottom wall 33 to the left beyond the side wall 34 toward the side wall 14. Thus the midsection of the hose 123 is positioned below the bottom wall 33 of the vat 31 and intermediate the side wall 34 of the vat 31 and the side wall 14 of the cabinet 11. The lower end of the barrel 139 of the second fixture 122 is disposed below the first fixture 121, whereby the drain pipe 113 carried by the second drain fixture 122 is disposed well below the drain opening 125 provided in the bottom wall 33 at the sump 42. Moreover, the intermediate section of the hose 123 being flexible is adapted to be moved from an upper position disposed above the drain opening 125 to a lower position disposed below the drain opening 125. Accordingly, when the midsection of the hose 123 is elevated to its upper position the communication between the bottom of the sump 42 and the drain pipe 113 is effectively closed to prevent washing liquid contained in the sump 42 from draining through the drain opening 125 into the drain pipe 113 through the communicating drain fixtures 121 and 122 and the hose 123. On the other hand when the midsection of the hose 123 is lowered to its lower position the communication between the bottom of the sump 42 and the drain pipe 113 is effectively opened to permit washing liquid contained in the sump 42 to be drained therefrom through the drain opening 125 into the drain pipe 113 through the communicating drain fixtures 121 and 122 and the hose 123. Accordingly, the drain mechanism 120 comprises non-draining and draining positions respectively corresponding to the upper and lower positions of the flexible midsection of the hose 123. The hose 123 is normally biased both by the resiliency of the helical spring 124 and by gravity into its lower position and it is operated against these biases into its upper position by an electro-responsive operating mechanism 150.

When the drain mechanism 120 occupies its draining position all of the washing liquid contained in the sump 42 is immediately drained through the drain opening 125 into the drain pipe 113 due to the fact that a smooth surface is provided between the lowermost portion of the sump 42 into the throat of the first drain fixture 121, which washing liquid then drains through the hose 123 and the second fixture 122 into the drain pipe 113. The strainer 131 positioned in the throat of the first drain fixture 121 prevents large foreign particles from passing through the drain opening 125 into the drain fixture 121. Since the upper end of the breather tube 146 carried by the second drain fixture 122 is disposed above the drain opening 125 and above the normal washing liquid level in the vat 31, the washing liquid passing through the hose 123 into the second drain fixture 122 and into the drain pipe 113 does not overflow therefrom notwithstanding the communication through the breather tube 146 between the interior of the second drain fixture 122 and the exterior below the bottom wall 33.

Since the washing liquid contained in the sump 42 has detergent suspended therein it is prone to carry air bubbles therewith through the drain opening 125 into the drain fixture 121 and consequently into the hose 123 and the drain fixture 122, which air bubbles present in the drain mechanism 120 would tend to form a partial air lock between the drain opening 125 and the drain pipe 113 impeding the flow of washing liquid therethrough and causing the air trapped in the hose 123 to tend to gurgle back through the washing liquid contained therein through the drain opening 125. However, this partial air lock in the hose 123 is relieved by the communication through the breather tube 146 between the exterior and the interior of the drain fixture 122. In other words these air bubbles swept into the drain fixture 121 along with the washing liquid burst in the hose 123 and the resulting air escapes through the breather tube 146 relieving the tendency to produce a partial air lock within the drain mechanism 120. Of course, it will be understood that the upper end of the breather tube 146 extends a suitable distance above the level of the drain opening 125 and this extension may be increased, if necessary, by the insertion of an upstanding section of glass or other tube, not shown, within the hollow breather tube 146. Also, certain plumbing installations tend to pocket air and thus retard draining unless the vent arrangement is provided.

In the drain mechanism 120 the inlet throat of the drain fixture 121 secured within the drain opening 125 is disposed at least partially above the outlet port or portion of the drain fixture 121 joining the adjacent end of the hose 123 and is of a predetermined contour increasing in area from the upper portion thereof toward the lower portion adjacent to the bead 130, whereby the flow of the washing liquid draining from the vat 31 into the inlet throat of the drain fixture 121 is only slightly reduced in response to a considerable and greater reduction in the hydrostatic head of the washing liquid contained in the vat 31. Thus the contour or shape of the inlet throat of the drain fixture 121 positioned above the adjacent end of the hose 123 maintains a relatively uniform flow of the washing liquid as the quantitative effect thereof is diminished due to the diminishing head of the washing liquid in the vat 31 when the drain mechanism 120 is operated into its draining position.

Referring now more particularly to Figs. 1 and 5, it will be observed that the operating mechanism 150 comprises structure 151 that is secured by a plurality of screws 152 to a downwardly extending element 153 spot welded, or otherwise secured, to the side wall 34 adjacent to the bottom wall 33. Accordingly, the operating mechanism 150 is removably secured to the element 153 and is suspended below the bottom wall 33 of the vat 31. Also the structure 151 comprises a rearwardly and upwardly extending arm 154 carrying a resilient bumper 155 formed of rubber, or the like, and arranged in engagement with the bottom wall 33 just above the sump 42. This suspension of the operating mechanism 150 below the bottom wall 33 of the vat 31 prevents the structure 151 from pounding the bottom wall 31 during shipment of the apparatus 10. Further the structure 151 comprises two curved guide elements 156 and 157 spaced apart front and rear and extending below the midsection of the hose 123, and a substantially S-shaped operating member 158 disposed between the guide elements 156 and 157. The operating member 158 is pivotally mounted adjacent to the inner end thereof upon a pivot pin 159 carried by the structure

151 and is normally biased in the clockwise direction, as viewed in Fig. 1, by a coil spring 160 surrounding the pivot pin 159 and extending between the structure 151 and the operating member 158. The extreme outer end of the operating member 158 carries an upwardly extending projection 161 underhooking the midsection of the hose 123 and disposed between the outer surface of the hose 123 and the adjacent side wall 14 of the cabinet 11. Also the operating member 158 carries an upwardly and outwardly projecting bumper 162 formed of rubber, or the like, and disposed inwardly with respect to the adjacent side wall of the midsection of the hose 123. Finally, the structure 151 carries an electro-responsive solenoid device 163 that is provided with a movable armature 164 that is operatively connected by a coil spring 165 to the extreme inner end of the operating member 158.

In view of the foregoing description of the operating mechanism 150, it will be understood that when the solenoid 163 is de-energized that the operating member 158 is normally biased by the weight of the hose 123 and against the counterbalancing spring 160 in the counterclockwise direction, as viewed in Fig. 1, whereby the midsection of the hose 123 is moved into its lower position normally to rest upon the curved guide elements 156 and 157. When the solenoid 163 is energized the armature 164 is attracted rotating through the coil spring 165 the opertaing member 158 in the clockwise direction, as viewed in Fig. 1, about the pivot pin 159 with the bias of the coil spring 160; whereby the operating member lifts or elevates the midsection of the hose 123 in guided relation between the projection 161 and the bumper 162 from its lower position to its upper position. Accordingly, when the solenoid 163 is energized the operating member 158 moves the midsection of the hose 123 from its lower position to its upper position effecting operation of the drain mechanism 120 from its draining position into its non-draining position. Subsequently, when the solenoid 163 is de-energized the weight of the hose 123 returns the operating member 158 in the counterclockwise direction, as viewed in Fig. 1, back into its normal position so that the operating member 158 permits the midsection of the hose 123 to be lowered from its upper position into its lower position; whereby the drain mechanism 120 is returned from its non-draining position back into its draining position.

The above-described arrangement for controlling the overflow of washing fluid from the vat and for selectively controlling the draining of the washing fluid therefrom is disclosed and claimed in the copending divisional application of Edgar S. Stoddard, Serial No. 223,575, filed April 28, 1951, now Patent No. 2,652,854, dated September 22, 1953.

Mounted within the lower portion of the vat 31 above the bottom wall 33 and the sump 42 and surrounding the impeller 83 is a suitable electric heater 170 which is preferably of the sheathed resistance conductor type; which heater 170 is employed for the purpose of drying dishes after they have been washed and rinsed, as explained more fully hereinafter. The opposite terminal ends 171 of the heater 170 extend through liquid-tight openings provided in the bottom wall 33 to the exterior so that electrical connections may be made thereto exteriorly of the vat 31.

Referring now more particularly to Figs. 1, 6, 9 and 13, the apparatus 10 comprises an electro-responsive timer 180 of the cyclic type including a casing 181 housing an electric motor 182 of the constant speed type, associated speed reduction and friction clutch mechanism 183 and an operating shaft 184, four control cams C1, C2, C3 and C4 and four control switches S1, S2, S3 and S4, the control cams C1 to C4, inclusive, being respectively operatively associated with the control switches S1 to S4, inclusive. Preferably the timer motor 182 is of the "Telechron" type and the operating shaft 184 extends forwardly through an opening provided in the front wall 185 of the casing 181. More particularly, the left-hand upper portion of the front wall 17 of the cabinet 11 has an opening 186 formed therein through which the casing 181 is inserted. Specifically, the front wall 185 of the casing 181 abuts the front surface of the front wall 17, while the body of the casing 181 projects through the opening 186, the front wall 185 being removably secured in place by suitable screws 186'. The operating shaft 184 extends through an aligned hole 187 formed in the front panel 25 to the exterior, and a control knob 188 is removably secured on the extreme outer end of the operating shaft 184. The control knob 188 is spaced forwardly of the front surface of the front panel 25 and cooperates with a substantially annular trim and indexing plate 189 disposed rearwardly thereof, the operating shaft 184 extending through a hole 190 formed in the plate 189. The plate 189 is suitably secured to the front surface of the front panel 25 and carries the legends "Off" and "On" on the front face thereof; which legends cooperate with an index pointer 191 carried on the control knob 188. Preferably the control knob 188 is formed of a suitable white plastic that matches the white enamel finish that is normally provided on the exterior surface of the various walls of the cabinet 11, the front panel 25 and the door 60; while the plate 189 may be formed of pressed steel and given a polished chromium finish. In passing it is noted that when the control knob 188 is rotated to bring the pointer 191 into registry with the legend "Off" the operating shaft 184 is rotated to effect a corresponding setting or control of the control cams C1, et.; and likewise when the control knob 188 is rotated to bring the pointer 191 into registry with the legend "On" the operating shaft 184 is rotated to effect a corresponding setting or control of the control cams C1, etc.

Referring now more particularly to Figs. 6, 9, 10 and 13, the apparatus 10 comprises a terminal box 200 housing an insulating terminal board 201 and supporting a measuring coil or relay 202 of the detachable tube type. More particularly, the left-hand lower portion of the front wall 17 of the cabinet 11 has an opening 203 formed therein that is provided with an inwardly directed marginal flange 204 disposed within the open front of the terminal box 200. The terminal box 200 is formed of steel, or the like, and is provided with an outwardly extending marginal flange 205 surrounding the flange 204 and abutting the rear surface of the front wall 17; and the opening 203 is provided with a removable cover 206 formed of steel, or the like, abutting the front surface of the front wall 17. The terminal box 200 is removably secured in place on the rear surface of the front wall 17 and the cover 206 is removably secured in place on the front surface of the front wall 17 by an arrangement comprising a plurality of screws 207 ex-

tending through aligned holes formed in the cover 206, the front wall 17 and the flange 205, the screws 207 being threaded into the holes provided in the flange 205. The terminal board 201 is housed within the terminal box 200 and secured in place by a plurality of screws 208 and associated spacing collars 209. Finally, the wall of the terminal box 200 is provided with one or more knock-out openings 210 and is provided with an opening 211 in the upper portion thereof in which a socket 212 is suitably secured, the socket 212 being adapted removably to receive the measuring coil 202.

Accordingly, the timer 180 is disposed above the terminal box 200, and both the timer 180 and the terminal box 200 are housed within the cabinet 11 in the vertical space disposed between the left-hand side wall 14 of the cabinet 11 and the left-hand side wall 34 of the vat 31; whereby both the timer 180 and the terminal box 200 are positioned above the imperforate portion of the bottom wall 13 constituting a fire shield therefor. Finally, the terminal board 201 comprises power terminals adapted to be connected to a suitable source of 110 volts A. C. and connecting terminals, so that the connections between the power source and the various electro-responsive elements incorporated in the apparatus 10 are provided at the terminal board 201, the terminals being indicated at 213. In other words, each of the electro-responsive elements such, for example, as the electric heater 170, is wired directly through the knock-out opening 210 provided in the wall of the terminal box 200 to appropriate ones of the terminals 213 carried by the terminal board 201, and the appropriate cross connections between these terminals and other of the terminals 213 are made at the terminal board 201. This arrangement is very advantageous as it permits ready and complete testing at the terminal board 201 of any one of the electro-responsive devices. Also the wiring extending from the terminals of any one of the electro-responsive devices, such, for example, as the terminal ends 171 of the electric heater 170 project over the imperforate bottom wall 13 through the knock-out opening 210 in the wall of the terminal box 200; whereby the bottom wall 13 constitutes a fire shield for the interconnecting wiring. This arrangement is very advantageous in view of the fact that it further minimizes fire hazards, as it will be observed that the metal terminal box 200 encloses the connecting ends of the wiring, and the metal bottom wall 13 is disposed below the terminal box 200.

As previously explained the front panel 25 is removable with respect to the front wall 17 of the cabinet 11 and carries with it the plate 189 so that the front wall 185 of the timer 180 and the cover plate 206 of the terminal box 200 are then exposed. In passing it is noted that it is first necessary to remove the control knob 188 from the extreme front end of the operating shaft 184 before the front panel 25 is removed with respect to the front wall 17 of the cabinet 11. After the front panel 25 is removed from the front wall 17, the timer 180 as a unit may be removed through the opening 186 formed in the front wall 17 by removing the screws 186'. Also at this time the front plate or cover 206 may be removed by removing the screws 207 rendering the terminal board 201 housed within the terminal box 200 accessible from the exterior. Thus it will be understood that the front panel 25 normally covers and conceals both the front wall 185 of the timer 180 and the cover 206 of the terminal box 200. Also when the front panel 25 is removed from the front wall 17 the other electro-responsive device, such, for example, as the inlet valve mechanism 111 and the operating mechanism 150, are readily accessible through the front opening 24 formed in the front wall 17; whereby all of the apparatus disposed below the bottom wall 33 is readily accessible from the exterior at this time in order to permit adjustment or repair.

Referring now more particularly to Fig. 13, it is noted that the measuring coil 202 comprises an insulating base 220, to which a metal casing 221 is secured, and four terminal prongs 222, 223, 224 and 225 extending through the base 220 and secured in place. Also the measuring coil 202 comprises a winding 226 operatively connected between the terminal prongs 222 and 225 and an associated pair of contacts 226' operatively connected between the terminal prongs 223 and 224. The socket 212 comprises an insulating base 227 carrying four spring contact terminals 228, 229, 230 and 231 extending into four corresponding openings provided therein and adapted respectively to receive and electrically to engage and establish contact with the four terminal prongs 222 to 225, inclusive. Thus it will be understood that the measuring coil 202 is readily engageable and disengageable with respect to the socket 212 and that when the measuring coil 202 is positioned upon the socket 212 the terminal prongs 222 to 225, inclusive, respectively engage and make electrical contact with the terminal springs 228 to 231, inclusive.

Also in Fig. 13 the electrical connection and arrangement of the various electro-responsive devices incorporated in the apparatus 10 are diagrammatically illustrated, the terminal board 201 being eliminated from the diagram in order to gain simplicity. However, as previously noted, it will be understood that in fact the physical connections, diagrammatically illustrated in Fig. 13, are made at the terminal board 201. In the interest of simplicity the line terminals have been indicated by the plus and minus signs on the diagram at each point where the required potential is necessary, although in fact only two line terminals 213 are provided on the terminal board 201 and they are connected to the 110 volts A. C. source of supply as previously noted. As diagrammatically illustrated in Fig. 13 the operating shaft 184 is directly connected to the control knob 188 and is also connected through the mechanism 183 to the timer motor 182. Also the operating shaft 184 is rotatably supported and physically carries the control cams C1 to C4, inclusive, that are respectively operatively associated with the control switches S1 to S4, inclusive. Moreover, in the diagram the various operating times of the different steps in the cycle of operation of the apparatus 10 are indicated, the control cams C1, etc., being laid out longitudinally for convenience and the cam sections corresponding to the long time intervals being broken to conserve space.

As illustrated, one terminal, indicated at +, of the source of supply is connected to one spring of the door switch 81; while the other terminal, indicated at −, of the source of supply is connected to one terminal of the operating motor 86, to one terminal of the timer motor 182 and to the intermediate spring of the control switch S4. The other terminal of the operating motor 86 is connected to the contact spring 231 and

to the lower spring of the control switch S2; while the other terminal of the timer motor 182 is connected to one terminal of the heating element 170 and to the lower spring of the control switch S1. The other spring of the door switch 81 is connected to the intermediate spring of the control switch S1; and the other terminal of the heating element 170 is connected to the upper spring of the control switch S4. One terminal of the inlet valve solenoid 112 is connected to one terminal of the drain valve solenoid 163 and to the lower spring of the control switch S4. The other terminal of the inlet valve solenoid 112 is connected to the terminal spring 229; and the other terminal of the drain valve solenoid 163 is connected to the lower spring of the control switch S3. The terminal spring 230 is connected to the upper spring of the control switch S2; and the terminal spring 228 is connected to the upper spring of the control switch S1 and to the intermediate spring of the control switch S2 and to the upper spring of the control switch S3.

When the apparatus 10 is at rest the control knob 188 occupies the position illustrated, whereby the index pointer 191 registers with the legend "Off" carried by the plate 189 so that the operating shaft 184 occupies its normal position causing the control cam C1, etc., to operate the respectively associated control switches S1, etc., into their normal positions illustrated. At this time the contacts X and Y in the control switch S1 occupy their open positions; the first and second contacts in the control switch S2 occupy their respective closed and open positions; the contacts in the control switch S3 occupy their open position; and the first and second contacts in the control switch S4 occupy their respective closed and open positions. Also at this time when the door 60 occupies its open position the door switch 81 is operated to its open position preventing operation of any of the electroresponsive apparatus.

Considering now the cycle of operation of the apparatus 10 the person loads the dishes and other utensils into the rack structure, not shown, and moves the rack structure from over the door 60 into the vat 31, and then moves the door 60 from its open position into its closed position effecting closure of the door switch 81. The person then rotates the control knob 188 from its "Off" position into its "On" position; whereby the operating shaft 184 is rotated in the clockwise direction, as viewed in Fig. 1, causing the control cams C1, etc. to be rotated in the clockwise direction, toward the left as viewed in Fig. 13. At this time the control cam C1 engages the lower spring in the control switch S1 closing the contacts X and Y. When the contacts X and Y in the control switch S1 are thus closed, a direct circuit, including the first contacts of the control switch S2 and the door switch 81, is completed for initiating operation of the operating motor 86. Also when the contact X in the control switch S1 are thus closed, a circuit, including the door switch 81, is completed for initiating operation of the timer motor 182. Upon operating the operating motor 86 rotates the operating shaft 85; whereby the impeller 83 is rotated in the counterclockwise direction, as viewed in Fig. 5. Upon operating the timer motor 182 rotates the operating shaft 184 through the mechanism 183 slowly at a predetermined rate further in the clockwise direction; whereby the operating cams C1, etc., are moved gradually at a predetermined rate toward the left, as viewed in Fig. 13.

After an elapsed time of approximately ten seconds the control cam C2 engages the intermediate spring of the control switch S2 opening the first contacts and closing the second contacts thereof. When the first contacts of the control switch S2 are thus opened the previously traced direct circuit for energizing the operating motor 86 is interrupted, and a normally completed shunt, including the terminal springs 228 and 231 and the terminal prongs 222 and 225, for short-circuiting the winding 226 of the measuring coil 202 is interrupted; whereby the winding 226 of the measuring coil 202 is inserted in series circuit relation with the operating motor 86. This series circuit for the operating motor 86 and the winding 226 of the measuring coil 202 extends from one terminal of the source of supply via the door switch 81, the contacts Y of the control switch S1, the terminal spring 228, the terminal prong 222, the winding 226 of the measuring coil 202, the terminal prong 225, the terminal spring 231 and the operating motor 86 to the other terminal of the source of supply. Accordingly, the winding 226 of the measuring coil 202 being in series circuit relation with the operating motor 86 meters the current drawn by the operating motor 86, which current is not excessive at this time since the operating motor 86 has already had an opportunity to gain full speed and there is no washing liquid in the sump 42 in the vat 31.

When the second contacts of the control switch S2 are thus closed a circuit is completed for energizing the inlet valve solenoid 112; which circuit extends from one terminal of the source of supply via the door switch 81, the Y contacts of the control switch S1, the second contacts of the control switch S2, the terminal spring 230, the terminal prong 224, the contacts 226', the terminal prong 223, the terminal spring 229, the inlet valve solenoid 112 and the first contacts of the control switch S4 to the other terminal of the source of supply. This circuit for energizing the inlet valve solenoid 112 includes the contacts 226' of the measuring coil 202; however, these contacts are closed at this time since the current traverses the winding 226 of the measuring coil 202 and the operating motor 86 is not excessive as previously noted, the winding 226 of the measuring coil 202 being of the marginal type. When the inlet valve solenoid 112 is thus energized the inlet valve mechanism 111 is operated to its open position as previously explained; whereby washing liquid is supplied from the liquid supply pipe 107 to the spraying device 109. The washing liquid sprays downwardly from the spraying device 109 through the dishes supported by the rack structure, not shown, and accumulates in the sump 42. This washing liquid passes from the sump 42 through the drain opening 125 into the drain fixture 121 and thence through the hose 123 and the drain fixture 122 into the drain pipe 113 since the drain mechanism 120 occupies its draining position at this time. Some of the washing liquid in the sump 42 may pass through the reticulated screen 106 and may be caught and flung upwardly and outwardly through the dishes supported by the rack structure, not shown, by the blades 84 of the impeller 83, although this action is not considerable at this time since the drain mechanism 120 occupies its draining position. Accordingly, the dishes supported by the rack structure, not shown, in

the vat 31 are subjected to a first spray step that is carried out through a time interval of approximately 30 seconds under the control of the timer 180.

At the conclusion of this first spray step the control cam C3 is operated to engage the lower spring of the control switch S3 in order to close the contacts thereof completing a circuit for energizing the drain solenoid 163. This circuit extends from one terminal of the source of supply via the door switch 84, the contacts Y of control switch S1, the contacts of the control switch S3, the drain solenoid 163 and the first contacts of the switch S4 to the other terminal of the source of supply. When the drain solenoid 163 is thus energized, the operating mechanism 150 is controlled in order to cause the operating member 158 to elevate the midsection of the hose 123 operating the drain mechanism 120 into its non-draining position; whereby the washing liquid accumulating in the sump 42 is retained therein after the drain fixture 121 and the adjacent section of the hose 123 is first filled with the washing liquid. At this time the inlet valve mechanism 111 still occupies its open position and the operating motor 86 is running. Accordingly, the washing liquid sprayed through the dishes supported by the rack structure, not shown, from the spraying device 109 accumulates in the sump 42 since the drain mechanism 120 occupies its non-draining position. The washing liquid accumulating in the sump 42 of the vat 31 passes through the reticulated screen 106 and is caught by the blades 84 of the impeller 83 and is flung upwardly and outwardly through the rack structure, not shown, and the dishes supported thereby against the walls of the vat 31 and the door 66 and again returns to the sump 42. The washing liquid as it is flung upwardly and outwardly has a generally rotary motion in the counterclockwise direction, as viewed in Fig. 5, since the impeller 83 is rotated in this direction as previously noted.

The supply of washing liquid from the spraying device 109 continues, and as the quantity of washing liquid accumulating in the sump 42 increases the load imposed upon the impeller 83, and consequently upon the operating motor 86, is gradually increased; whereby the current traversing the operating motor 86 and the winding 226 of the measuring coil 202 is gradually increased. When a predetermined quantity of washing liquid accumulates in the sump 42 a corresponding predetermined load is imposed upon the operating motor 86; whereby the current traversing the operating motor 86 and the winding 226 of the measuring coil 202 reaches a predetermined value. When this current traversing the winding 226 of the measuring coil 202 reaches the predetermined value mentioned, indicating that the vat 31 now contains a full and predetermined quantity of washing liquid, the winding 226 controls the contacts 226', since it is of the marginal type as previously noted. More particularly, the contacts 226' are opened interrupting the circuit for energizing the inlet valve solenoid 112; whereby the inlet valve mechanism 111 is operated to its closed position. Specifically, the inlet valve mechanism 111 is of the slow-closing type, as previously noted, and when it is completely closed the supply of washing liquid from the liquid supply pipe 107 to the spraying device 109 is cut off.

Approximately 45 seconds after the drain mechanism 120 is operated to its non-draining position the control cam C2 disengages the intermediate spring of the control switch S2; whereby the second contacts thereof are opened and the first contacts thereof are closed. When the second contacts of the control switch S2 are thus opened, a further point in the circuit for energizing the inlet valve solenoid 112 is interrupted; and when the first contacts of the control switch S2 are thus closed the path for short-circuiting the winding 226 of the measuring coil 202 is again completed, together with the direct circuit for operating the operating motor 86. Accordingly, the winding 226 is de-energized bringing about reclosure of the contacts 226'; however, without effect at this time since the second contacts of the control switch S2 are open. Accordingly, the connections above described provide a timed arrangement for effecting the de-energization of the inlet valve solenoid 112 and the consequent operation of the inlet valve mechanism 111 to its closed position in the event this result has not already been brought about by operation of the measuring coil 202 within the 45 seconds period mentioned.

The first washing step continues for a total time of approximately 330 seconds following the operation of the drain mechanism 120 into its non-draining position, and within this time interval and in response to the accumulation of a predetermined quantity of washing liquid in the sum 42 a given charge of detergent is introduced into the washing liquid in order that the first washing step may be effective to remove grease and other foreign materials from the dishes supported by the rack structure, not shown. The arrangement for introducing the detergent into the washing liquid is disclosed in the previously mentioned Walker application and is based upon the accumulation of a predetermined quantity of washing liquid in the sump 42; whereby the washing liquid accumulating in the sump 42 is flushed or washed into the detergent cup, not shown, carried by the inner body sheet 62 of the door 60 causing the detergent to be washed into the body of the washing liquid contained in the vat 31. This introduction of detergent into the washing liquid is accomplished shortly following the closure of the drain mechanism 120 so that the detergent is present in the washing liquid during a substantial part of the time interval of the first washing step. Preferably the detergent that is employed is of the type sold under the trade name "Calgonite" that comprises about 40 per cent sodium hexametaphosphate and 60 per cent sodium metasilicate.

At the conclusion of the first washing step the control cam C3 disengages the lower spring of the control switch S3, whereby the contacts thereof are opened interrupting the circuit for energizing the drain solenoid 163. When the drain solenoid 163 is thus de-energized the operating mechanism 150 is controlled to operate the drain mechanism 120 back into its draining position; and specifically the operating member 158 is released permitting the midsection of the hose 123 to be returned to its lower position. At this time the washing liquid and the carried detergent drain from the sump 42 through the drain opening 125 into the drain fixture 121 and thence through the hose 123 and into the drain fixture 122 and finally into the drain pipe 113. The washing liquid carrying the detergent is prone to carry therewith air bubbles; however, no partial air lock is produced in the hose 123 by virtue of the arrangement including the breather tube 146 previously described. The strainer 131 prevents large foreign objects from

being carried with the washing liquid into the drain fixture 121.

The washing liquid contained in the sump 42 is drained into the fixture 121 in a very short interval of time; and approximately 45 seconds after the drain mechanism 120 is operated to its open position the control cam C2 again engages the intermediate spring of the control switch S2 effecting opening of the first contacts and closing of the second contacts thereof. When the control switch S2 is thus operated the winding 226 of the measuring coil 202 is again inserted in series with the operating motor 86 and the inlet valve solenoid 112 is again energized, all in the manner previously explained. At this time the inlet valve mechanism 111 is operated to its open position effecting the supply of washing liquid from the liquid supply pipe 107 to the spraying device 109, whereby the dishes supported by the rack structure, not shown, are again sprayed, and the washing liquid accumulating in the sump 42 passes through the drain mechanism 120 in its draining position into the drain pipe 113. This second spray step is carried out for a time interval of approximately 10 seconds; whereupon the control cam C3 re-engages the lower spring of the control switch S3 closing the contacts thereof and again energizing the drain solenoid 163. The drain mechanism 120 is again operated to its non-draining position causing the washing liquid to be retained in the sump 42, initiating a second washing step.

The second washing step proceeds in the manner of the first washing step described above; whereby the inlet valve mechanism 111 is subsequently operated to its closed position under the control of the measuring coil 202 dependent upon the load upon the operating motor 86 or under the control of the control cam C2 and the associated control switch S2; all in the manner previously explained. In any case after a time interval of approximately 45 seconds following operation of the drain mechanism 120 into its non-draining position, the control cam C2 disengages the intermediate spring of the control switch S2 opening the second contacts and closing the first contacts thereof in order positively to insure de-energization of the inlet valve solenoid 112 and short-circuiting of the winding 226 of the measuring coil 202. At this time the inlet valve mechanism 111 occupies its closed position and the drain mechanism 120 occupies its non-draining position; whereby the second washing step continues in the manner previously explained. The second washing step continues for a time interval of approximately 330 seconds following the closure of the drain mechanism 120; whereupon the control cam C3 disengages the lower spring of the control switch S3 effecting the de-energization of the drain solenoid 163 and the consequent operation of the drain mechanism 120 to its draining position.

The washing liquid accumulated in the sump 42 is drained into the drain pipe 113 in the manner previously explained in a short time interval; and approximately 45 seconds after the drain mechanism 120 is operated to its draining position the control cam C2 again engages the intermediate spring of the control switch S2. The first and second contacts of the control switch S2 are respectively opened and closed effecting insertion of the winding 226 of the measuring coil 202 in series with the operating motor 86 and energization of the inlet valve solenoid 112. The inlet valve mechanism 111 is again operated to its open position in order to initiate a third spray step. The washing liquid supplied from the liquid supply pipe 107 to the spraying device 109 is sprayed through the dishes supported by the rack structure, not shown, and is drained from the sump 42 into the drain pipe 113. This spray step continues throughout a time interval of approximately ten seconds following operation of the inlet valve mechanism 111 to its open position; whereupon the control cam C3 re-engages the lower spring of the control switch S3 closing the contacts thereof and effecting energization of the drain solenoid 163. The drain mechanism 120 is operated to its non-draining position in order again to cause washing liquid to accumulate in the sump 42 initiating a first rinsing step.

The first rinsing step proceeds in a manner substantially identical to the first washing step described above; whereby the inlet valve mechanism 111 is subsequently operated to its closed position under the control of the measuring coil 202 dependent upon the load upon the operating motor 86 or under the control of the control cam C2 and the associated control switch S2; all in the manner previously explained. In any case after a time interval of approximately 45 seconds following operation of the drain mechanism 120 into its non-draining position, the control cam C2 disengages the intermediate spring of the control switch S2 opening the second contacts and closing the first contacts thereof in order positively to insure de-energization of the inlet valve solenoid 112 and short-circuiting of the winding 226 of the measuring coil 202. At this time the inlet valve mechanism 111 occupies its closed position and the drain mechanism 120 occupies its non-draining position; whereby the first rinsing step continues for a time interval of approximately 90 seconds following the operation of the drain mechanism 120 into its non-draining position; whereupon the control cam C3 disengages the lower spring of the control switch S3 effecting the de-energization of the drain solenoid 163 and the consequent operation of the drain mechanism 120 to its draining position.

The washing liquid accumulated in the sump 42 is drained into the drain pipe 113 in the manner previously explained in a short time interval; and approximately 45 seconds after the drain mechanism 120 is operated to its draining position the control cam C2 again engages the intermediate spring of the control switch S2. The first and second contacts of the control switch S2 are respectively opened and closed effecting insertion of the winding 226 of the measuring coil 202 in series with the operating motor 86 and energization of the inlet valve solenoid 112. The inlet valve mechanism 111 is again operated to its open position in order to initiate a fourth spray step. The washing liquid supplied from the liquid supply pipe 107 to the spraying device 109 is sprayed through the dishes supported by the rack structure, not shown, and is drained from the sump 42 to the drain pipe 113. This spray step continues throughout a time interval of approximately 10 seconds following operation of the inlet valve mechanism 111 to its open position; whereupon the control cam C3 re-engages the lower spring of the control switch S3 closing the contacts thereof and effecting energization of the drain solenoid 163. The drain mechanism 120 is operated to its non-draining position in order again to cause washing

liquid to accumulate in the sump 42 initiating a second rinsing step.

The second rinsing step proceeds in a manner identical to the first rinsing step described above; whereby the inlet valve mechanism 111 is subsequently operated to its closed position under the control of the measuring coil 202 dependent upon the load upon the operating motor 86 or under the control of the control cam C2 and the associated control switch S2; all in the manner previously explained. In any case after a time interval of approximately 45 seconds following the operation of the drain mechanism 120 into its non-draining position, the control cam C2 disengages the intermediate spring of the control switch S2 opening the second contacts and closing the first contacts thereof in order positively to insure de-energization of the inlet valve solenoid 112 and short-circuiting of the winding 226 of the measuring coil 202. At this time the inlet valve mechanism 111 occupies its closed position and the drain mechanism 120 occupies its non-draining position; whereby the second rinse step continues for a time interval of approximately 90 seconds following the operation of the drain mechanism 120 into its non-draining position; whereupon the cam C3 disengages the lower spring of the control switch S3 effecting de-energization of the drain solenoid 163 and the consequent operation of the drain mechanism 120 to its draining position.

The washing liquid accumulated in the sump 42 is drained into the drain pipe 113 in the manner previously explained in a short time interval; and approximately 45 seconds after the drain mechanism 120 is operated to its draining position the control cam C4 engages the intermediate spring of the control switch S4 respectively opening and closing the first and second contacts thereof. When the first contacts of the control switch S4 are thus opened further points in the circuits for energizing the inlet valve solenoid 112 and the drain solenoid 163 are interrupted, thereby positively to insure that the inlet valve mechanism 111 occupies its closed position and the drain mechanism 120 occupies its draining position. When the second contacts of the control switch S4 are thus closed a circuit, including the door switch 81, the X contacts of the control switch S1 and the second contacts of the control switch S4, is completed for energizing the heating element 170; whereby heat produced by the heating element 170 in the vat 31 is circulated in the vat 31 by the blades 84 of the impeller 83 since operation of the operating motor 86 is continued at this time. The hot air circulated in the vat 31 by the impeller 83 is directed into contact with and through the dishes supported by the rack structure, not shown, and thence back into contact with the electric heater 170.

This initial drying step is continued for a time interval of approximately 1200 seconds, whereupon the shoulder provided on the control cam C1 rides under the lower spring of the control switch S1 effecting opening of the Y contacts thereof while the X contacts thereof are retained closed. Opening of the Y contacts of the control switch S1 interrupts the circuit for operating the operating motor 86; while the closed X contacts of the control switch S1 retain completed the circuit for energizing the heating element 170. Accordingly, the operating motor 86 stops arresting rotation of the impeller 83 while the supply of heat to the heating element 170 continues. Thus drying of the dishes supported by the rack structure, not shown, continues through a final drying step after operation of the impeller 83 has been arrested; which final drying step continues for a time interval of approximately 600 seconds; whereupon the control cam C1 disengages the lower spring of the control switch S1 and the control cam C4 disengages the intermediate spring of the control switch S4. When the control cam C1 disengages the lower spring of the control switch S1 and X contacts thereof are opened interrupting the circuit for energizing the heating element 170 and interrupting the operating circuit for the timer motor 182. When the control cam C4 disengages the intermediate spring of the control switch S4 the first and second contacts thereof are respectively closed and opened, respectively preparing a point in the circuits for energizing the inlet valve solenoid 112 and the drain solenoid 163 and interrupting a further point in the circuit for energizing the heating element 170.

At this time the operating shaft 184 of the timer 180 has been rotated from its "On" position in the clockwise direction, as viewed in Fig. 1, back into its "Off" position; operation of the timer 180 has been arrested; and the cycle of operation of the apparatus 10 has been completed. Thus it will be understood that when the control knob 188 of the timer 180 is rotated from its "Off" position approximately 30 degrees in the clockwise direction, as viewed in Fig. 1, into its "On" position that operation of the timer 180 is initiated. More particularly, the timer motor 182 effects continued rotation of the control knob 188 in the clockwise direction, as viewed in Fig. 1, back into its "Off" position, whereupon operation of the timer 180 is automatically arrested. As the operating shaft 184 is rotated from its "On" position back into its "Off" position in the clockwise direction, as viewed in Fig. 1, it is rotated progressively through the different control positions thereof causing the different control cams C1 to C4, inclusive, selectively to govern the control switches S1 to S4, inclusive, whereby the apparatus 10 is automatically operated through its various spraying, washing, rinsing and drying steps as explained above.

Also it will be understood that the mechanism 183 permits rotation of the operating shaft 184 in either direction by the control knob 188 at any time independently of the timer 180 so that any one or more of the steps in the above described cycle may be selectively omitted or repeated by appropriate manual rotation of the control knob 188 in the proper direction. For example, the final drying step may be omitted by rotating the control knob 188 in the clockwise direction back into its "Off" position when the control cam C4 first operates the control switch S4, thereby reducing the length of the operating cycle by approximately thirty minutes. This facility is especially useful when it is desired to wash a number of loads of dishes and automatic drying thereof is not important to the operator, or hand-drying thereof is particularly wished by the operator.

During the operation of the dishwashing apparatus 10 through the timed cycle above-described, the door 60 must be retained in its closed position as previously explained in order to retain the door switch 81 in its closed position, as it will be observed that any time the door 60 is operated to its open position that the door switch 81 is operated to its open position arrest-

ing operation of the apparatus 10. During the various washing and rinsing steps when considerable washing liquid is accumulated in the sump 42, it is pointed out that the reticulated screen 106 prevents large particles of foreign matter such, for example, as lettuce leaves, or the like, accumulating in the sump 42 from being caught in the blades 84 of the impeller 83 and again flung upwardly and outwardly thereby into the rack structure, not shown, and the dishes supported thereby. Finally at the conclusion of the timed cycle the dishes supported by the rack structure, not shown, have not only been thoroughly washed and rinsed, but they have also been dried. At this time the door 60 may be moved from its closed position into its open position, and the rack structure, not shown, may be moved from its fully pushed-in position with respect to the vat 31 into its fully withdrawn position with respect to the vat 31 over the door 60 in its open position, and the dishes removed therefrom and placed in a kitchen cabinet, or the like, if desired.

In the operation of the dishwashing apparatus 10 after the dishes have been loaded into the rack structure, not shown, and the rack structure has been moved into its fully pushed-in position in the vat 31, a predetermined quantity or charge of detergent is placed in the detergent cup, not shown, carried by the inner body sheet 62 of the door 60, and the door 60 is moved from its open position to its closed position by the handle 78. At this time a timed cycle of operation of the dishwashing apparatus 10 is initiated by manipulating the control knob 188 in the manner previously explained.

As disclosed in the previously mentioned Walker application the vat 31 and the door 60 are of the gasketless type and the interior of the vat 31 is vented to the exterior through the space between the outer and inner body sheets 61 and 62 during operation of the apparatus 10.

The connection and arrangement of the control circuit for the dishwashing apparatus 10 is disclosed and claimed in the copending application of Douglas F. Illian, Serial No. 91,906, filed May 7, 1949, now Patent No. 2,624,352, dated January 6, 1953.

In view of the foregoing it is apparent that there has been provided washing apparatus of the front opening type incorporating improved vat and cabinet structure permitting ready assembly of the parts in a simple and efficient manner while permitting subsequent inspection and adjustment of the operating parts when and if necessary. Also the washing apparatus incorporates an improved arrangement permitting ready sub-assembly of the vat and the operating parts carried thereby and sub-assembly of the cabinet and the operating parts carried thereby before final assembly of the vat sub-assembly and the cabinet sub-assembly. Further, the washing apparatus comprises improved drain mechanism that is of simple and rugged construction incorporating no nice fitting valve elements and valve seats. Finally, the washing apparatus incorporates an improved electric control circuit for the electro responsive elements thereof minimizing fire hazards in the various wiring and electrical connections between the different electro-responsive elements.

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. Dishwashing apparatus comprising a vat having a first upstanding front opening therein surrounded by a first outwardly directed marginal flange, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, an overlying front panel removably secured to said front wall and having a third upstanding front opening therein surrounded by a second inwardly directed marginal flange and registering with said first front opening and covering a marginal portion of said second front opening, control elements housed within said casing exteriorly of said vat, said elements being readily accessible from the exterior through said second front opening when said front panel is removed from said front wall, said front panel concealing said elements when it is secured to said front wall, said first and second flanges cooperating to define a doorway through said first and second and third front openings from the exterior into said vat, and a front door associated with said doorway and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said doorway between a substantially vertical closed position and a substantially horizontal open position.

2. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by a first outwardly directed marginal flange, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, an overlying front panel removably secured to said front wall and having a third upstanding front opening therein surrounded by a second inwardly directed marginal flange and registering with said first front opening and covering a marginal portion of said second front opening, control elements housed within said casing exteriorly of said vat, said elements being readily accessible from the exterior through said second front opening when said front panel is removed from said front wall, said front panel concealing said elements when it is secured to said front wall, said first and second flanges cooperating to define a doorway through said first and second and third front openings from the exterior into said vat, a front door arranged within said doorway, and means for mounting said front door adjacent to the lower edge thereof within said vat for pivotal movements with respect to said doorway between a substantially vertical closed position and a substantially horizontal open position, the outer surface of said front door being disposed substantially flush with the outer surface of said front panel when said door occupies its closed position.

3. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by an outwardly directed marginal flange, a casing housing said vat and including a front wall abutting the front of said flange and having a second upstanding front opening therein surrounding said first front opening, cooperating securing parts respectively carried by the front of said flange and by said front wall for supporting the front of said vat within said casing, said securing parts being of the tongue-slot type accommodating ready engagement thereof, means cooperating between

the rear of said vat and the rear of said casing for supporting the rear of said vat within said casing, and a front door associated with said front openings and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said front openings between a substantially vertical closed position and a substantially horizontal open position.

4. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by an outwardly directed marginal flange, a casing housing said vat and including a front wall abutting the front of said flange and having a second upstanding front opening therein surrounding said first front opening, cooperating securing parts respectively carried by the front of said flange exteriorly of said first front opening and by said front wall exteriorly of said second front opening for supporting the front of said vat within said casing, said securing parts being of the tongue-slot type accommodating ready engagement thereof, means cooperating between the rear of said vat and the rear of said casing for supporting the rear of said vat within said casing, and a front door associated with said front openings and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said front openings between a substantially vertical closed position and a substantially horizontal open position.

5. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by an outwardly directed marginal flange terminating in a rearwardly rolled rim, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, the front of said rim abutting the rear surface of said front wall exteriorly of said second front opening, means including a plurality of forwardly projecting tongues carried on the outside of said rim and extending through a corresponding plurality of slots formed in said front wall for supporting and positioning the front of said vat within said casing, means including a plurality of rearwardly projecting fixtures carried on the rear of said vat and cooperating with the rear of said casing for supporting and positioning the rear of said vat within said casing, and a front door associated with said front openings and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said front openings between a substantially vertical closed position and a substantially horizontal open position.

6. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by an outwardly directed marginal flange, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, the front of said flange abutting the rear surface of said front wall, a forwardly projecting top tongue carried by the front top of said flange and extending through a top slot formed in the top of said front wall, two forwardly projecting side tongues respectively carried by the front sides of said flange and respectively extending through two side slots respectively formed in the two sides of said front wall, said top and two side tongues and said cooperating top and two side slots supporting and positioning the front of said vat within said casing, means including two rearwardly projecting fixtures respectively carried by the rear sides of said vat and cooperating with the rear of said casing for supporting and positioning the rear of said vat within said casing, and a front door associated with said front openings and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said front openings between a substantially vertical closed position and a substantially horizontal open position.

7. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by a first outwardly directed marginal flange, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, an overlying front panel removably secured to said front wall and having a third upstanding front opening therein surrounded by a second inwardly directed marginal flange and registering with said first front opening and covering a marginal portion of said second front opening, control elements housed within said casing exteriorly of said vat, said elements being readily accessible from the exterior through said second front opening when said front panel is removed from said front wall, said front panel concealing said elements when it is secured to said front wall, said first and second flanges cooperating to define a doorway through said first and second and third front openings from the exterior into said vat, the front of said first flange abutting the rear surface of said front wall, a plurality of forwardly projecting tongues carried by the front of said first flange and respectively extending through a corresponding plurality of slots formed in said front wall, said cooperating tongues and slots supporting and positioning the front of said vat within said casing, said front panel concealing the ends of said tongues terminating rearwardly thereof when it is secured to said front wall, means cooperating between the rear of said vat and the rear of said casing for supporting and positioning the rear of said vat within said casing, and a front door associated with said doorway and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said doorway between a substantially vertical closed position and a substantially horizontal open position.

8. Dishwashing apparatus comprising a vat having a first upstanding front opening thereinto surrounded by an outwardly directed marginal flange, a casing housing said vat and including a front wall having a second upstanding front opening therein surrounding said first front opening, said casing including a rear wall having a hole therein accommodating the passing of said vat therethrough so that said vat may be readily placed and removed with respect to said casing, cooperating quick engageable and disengageable securing parts respectively carried by the front of said flange and by said front wall for supporting the front of said vat when it is within said casing, additional cooperating engageable and disengageable securing parts respectively carried by the rear of said vat and by said rear wall for supporting the rear of said vat when it is within said casing, and a front door associated with said front openings and mounted adjacent to the lower edge thereof upon said vat for pivotal movements with respect to said front openings between a substantially vertical closed position and a substantially horizontal open position.

9. In dishwashing apparatus including a vat having a first upstanding front opening, a casing housing said vat and having a second upstanding front opening registering with said first front

opening, a front door associated with said first and second front openings and mounted for movements with respect thereto between a substantially vertical closed position and a substantially horizontal open position, and electro-responsive elements operative in a predetermined order to effect a given washing cycle in said vat; said casing including a top wall and a side wall and front and rear walls and said vat including a side wall cooperating to define an upstanding compartment disposed in said casing on one side of said vat, an electro-responsive timer-governed circuit controller arranged in said compartment and operatively connected by wiring to said elements for controlling the operations thereof, said circuit controller including a manually operable control shaft projecting through a hole provided in said front wall and accessible from the exterior adjacent to said one side of said door, current supply terminals connected to said circuit controller and to said wiring, and a fire shield extending below said compartment and said circuit controller and said wiring.

10. In dishwashing apparatus including a vat having a first upstanding front opening, a casing housing said vat and having a second upstanding front opening registering with said first front opening, a front door associated with said first and second front openings and mounted for movements with respect thereto between a substantially vertical closed position and a substantially horizontal open position, and electro-responsive elements operative in a predetermined order to effect a given washing cycle in said vat; said casing including a top wall and a side wall and front and rear walls and said vat including a side wall cooperating to define an upstanding compartment disposed in said casing on one side of said vat, an electro-responsive timer-governed circuit controller arranged in the upper part of

said compartment for controlling the operations of said elements, said circuit controller including a manually operable control shaft projecting through a hole provided in said front wall and accessible from the exterior adjacent to said one side of said door, an insulating terminal board arranged in the lower part of said compartment, current supply terminals carried by said terminal board, wiring interconnecting said supply terminals and said circuit controller and said elements at said terminal board, and a fire shield extending below said compartment and said circuit controller and said terminal board and said wiring.

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