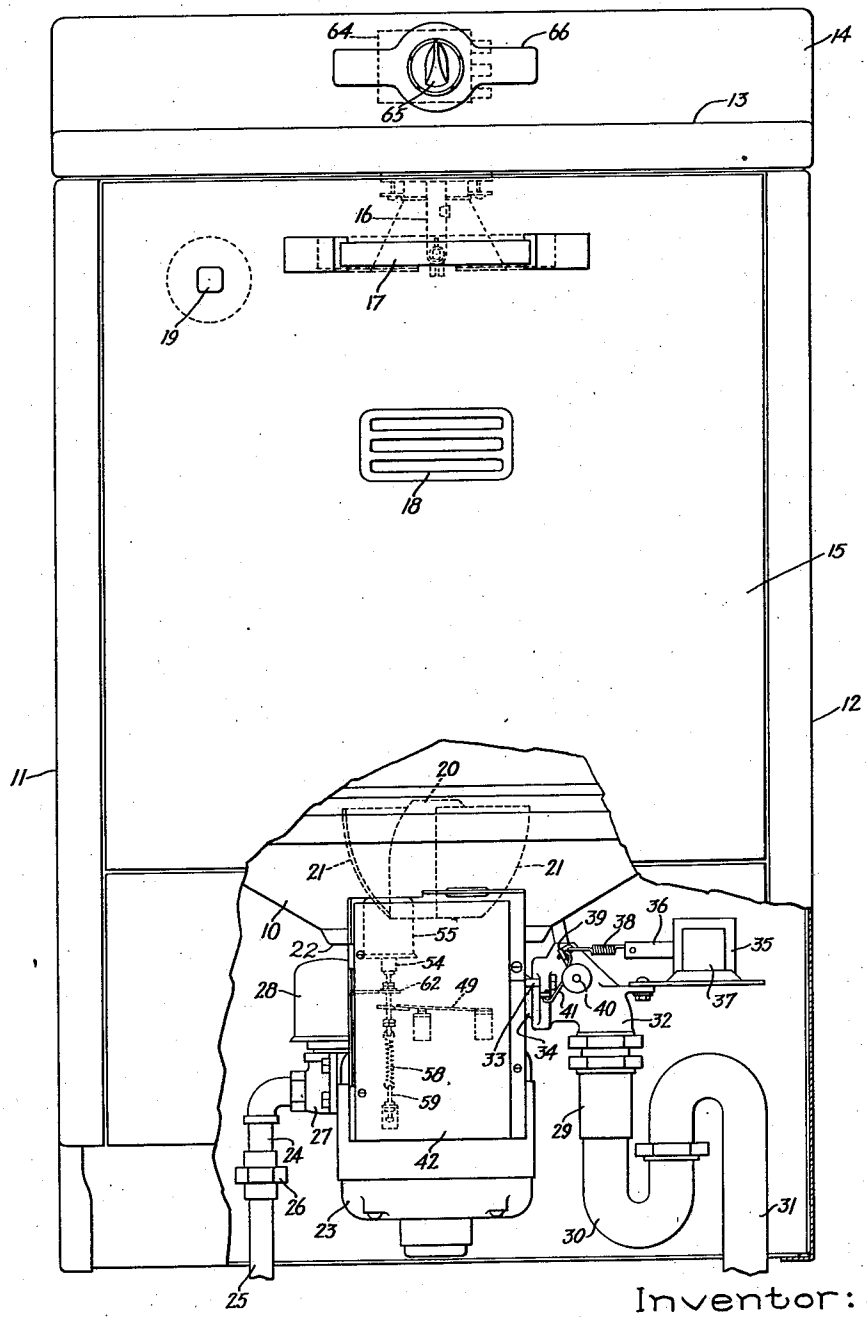
March 31, 1942. L. A. KEMPTON 2,278,268

WASHING APPARATUS

Filed Dec. 16, 1940 4 Sheets-Sheet 1

Fig. 1.



Inventor:
Leslie A. Kempton,
by Harry E. Dunham
His Attorney.

March 31, 1942. L. A. KEMPTON 2,278,268

WASHING APPARATUS

Filed Dec. 16, 1940 4 Sheets-Sheet 2

Fig.2.

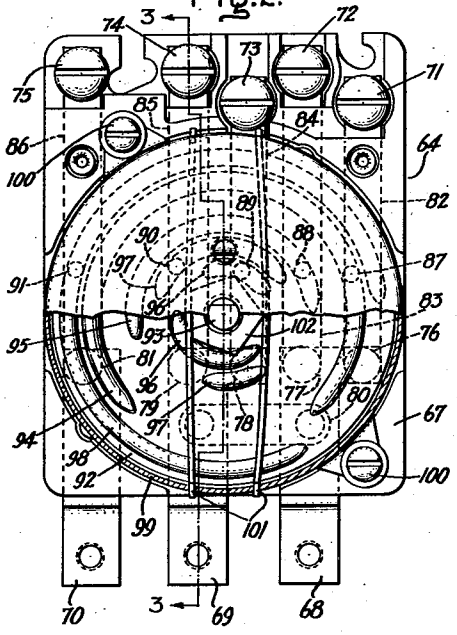


Fig.6.

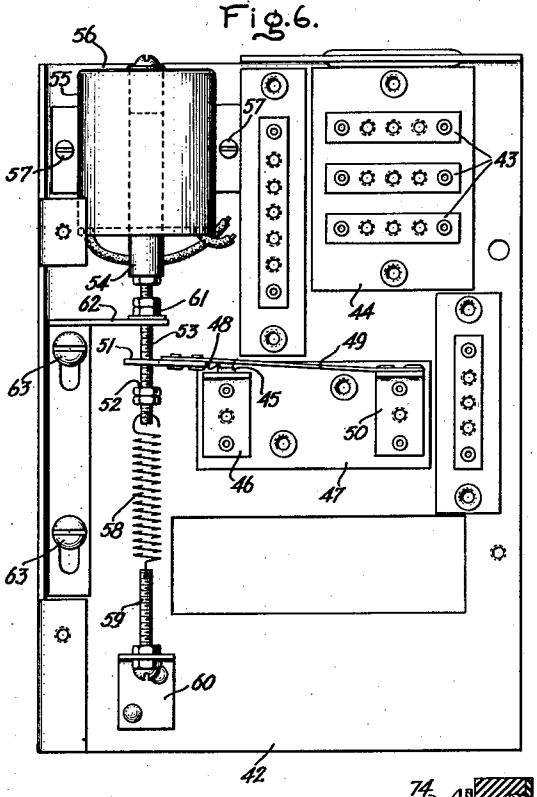


Fig.4.

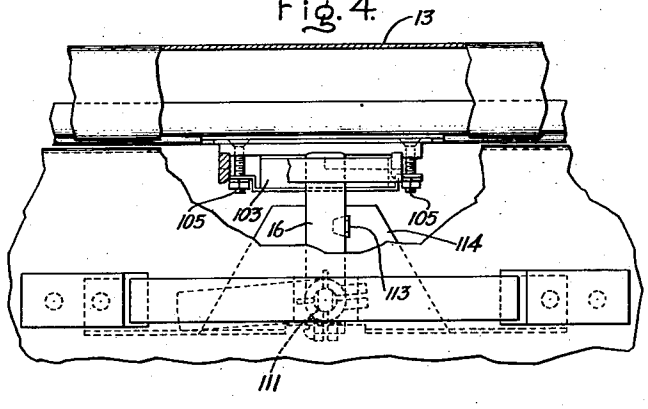


Fig.3.

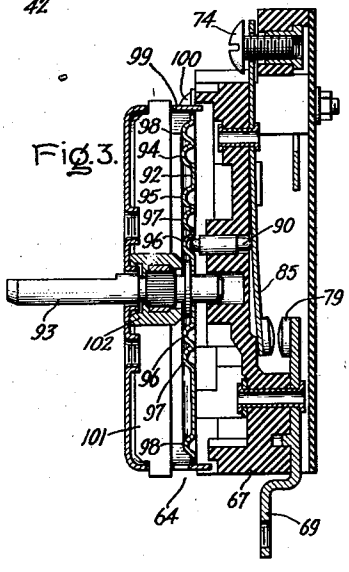
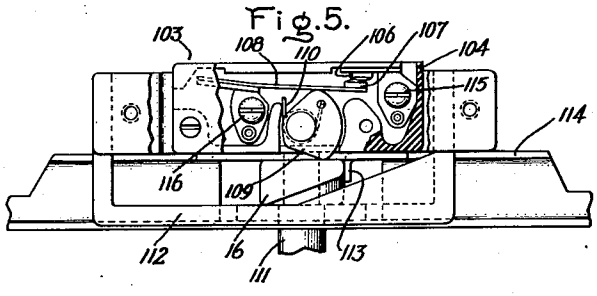


Fig.5.



Inventor:
Leslie A. Kempton,
by Harry E. Dunham
His Attorney.

March 31, 1942. L. A. KEMPTON 2,278,268

WASHING APPARATUS

Filed Dec. 16, 1940 4 Sheets-Sheet 3

Fig. 7.

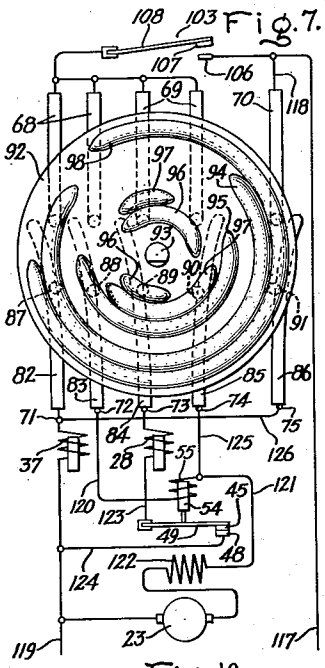


Fig. 8.

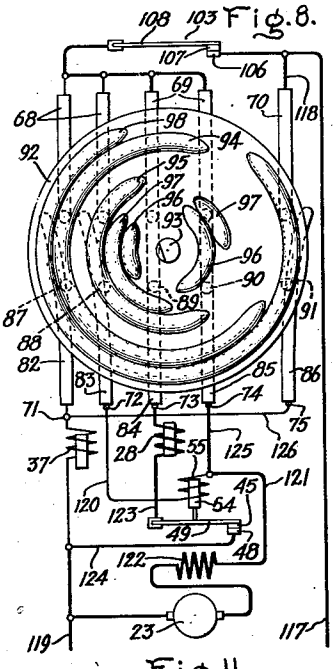


Fig. 9.

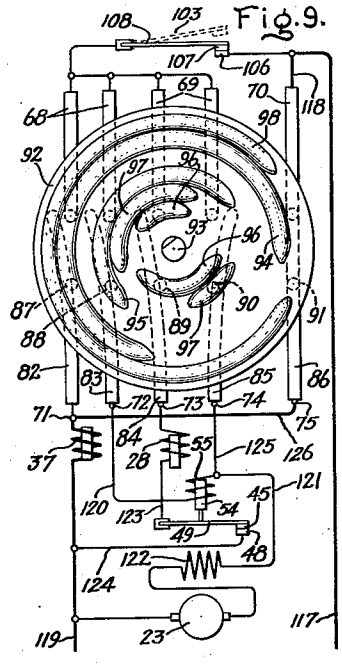


Fig. 10.

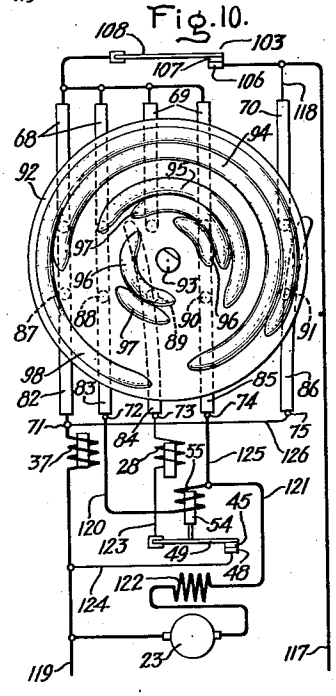
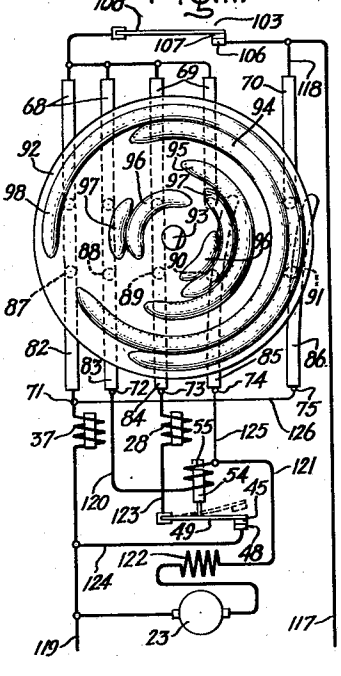


Fig. 11.



Inventor:
Leslie A. Kempton,
by Harry E. Dunham
His Attorney.

March 31, 1942. L. A. KEMPTON 2,278,268

WASHING APPARATUS

Filed Dec. 16, 1940 4 Sheets-Sheet 4

Fig.12.

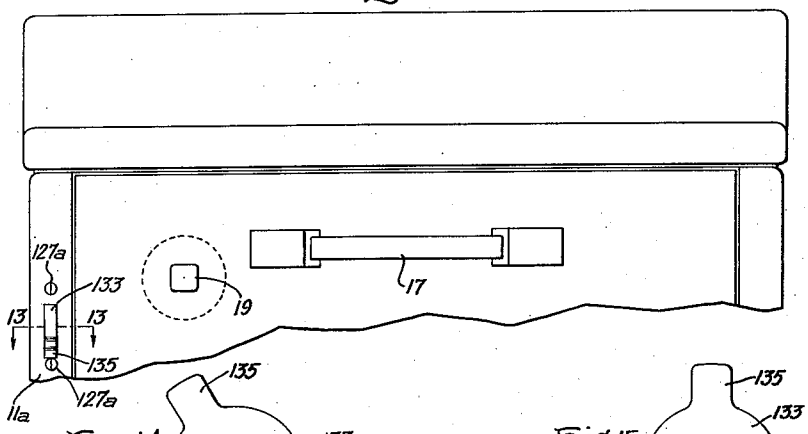


Fig.13.

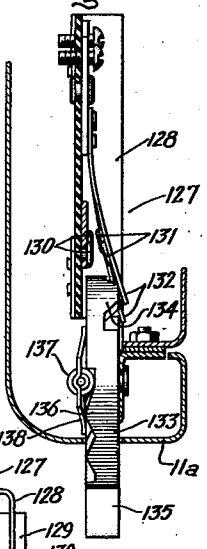


Fig.14.

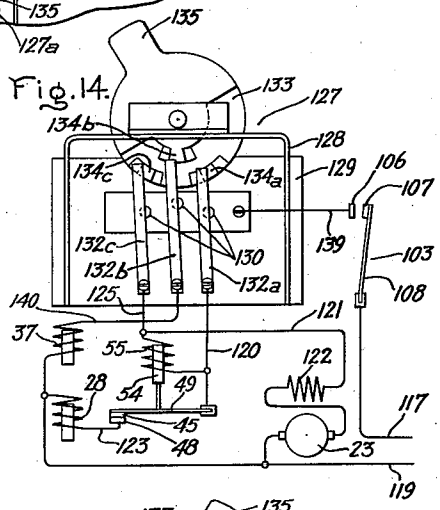


Fig.15.

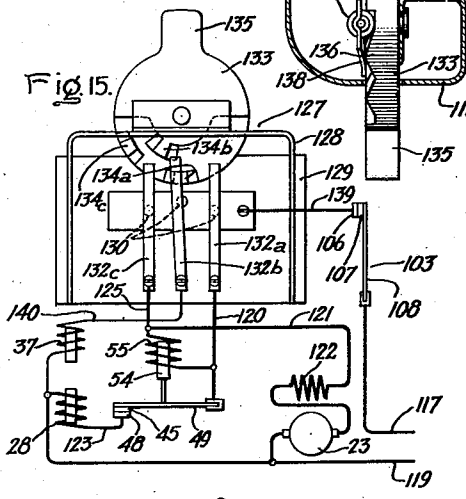


Fig.16.

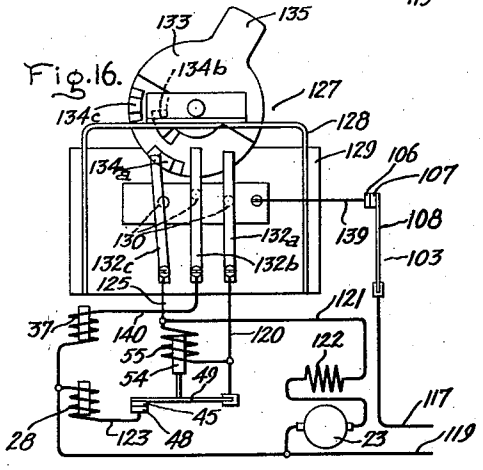
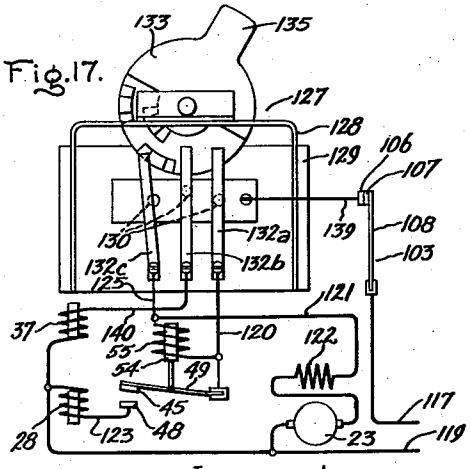


Fig.17.



Inventor:
Leslie A. Kempton,
by Harry E. Dunham
His Attorney.

Patented Mar. 31, 1942 2,278,268

UNITED STATES PATENT OFFICE

2,278,268

WASHING APPARATUS

Leslie A. Kempton, Chicago, Ill., assignor to Edison General Electric Appliance Company, Inc., a corporation of New York

Application December 16, 1940, Serial No. 370,402

12 Claims. (Cl. 141—9)

This invention relates to washing apparatus and more particularly to dishwashing apparatus and has for its object the provision of improved apparatus of this character which can be safely and easily operated and controlled.

While not limited thereto, this invention is of particular application to dishwashing apparatus wherein a cleansing fluid, such as water, is circulated or hurled through the washing chamber or vat by suitable power means such as a motor driven impeller. Provided in such dish-washing apparatus are means for supplying a quantity of washing fluid and means for discharging the fluid at the end of a washing cycle. Also, such washing apparatus is provided with an opening through which articles to be washed may be loaded or unloaded and such opening is closed by a suitable door.

In one of its aspects this invention contemplates the provision of improved means for electrically controlling the various elements of a dishwashing apparatus so that the various steps in a washing operation may be simply and easily produced.

In another aspect this invention contemplates the provision of improved and inexpensive means for insuring that the dishwashing apparatus will not be operated when it is unsafe to do so.

Still another aspect of this invention contemplates the provision of improved means for electrically controlling the various washing elements, which means is in turn controlled by a condition of the washing apparatus so that it is rendered ineffective if it is unsafe to operate the apparatus.

Further and more specific aspects of this invention will appear as the following detail description proceeds and the features of novelty which characterize this invention will be set forth in the claims appended to and forming a part of this specification.

For a more complete understanding of this invention reference should be had to the accompanying drawings in which Fig. 1 is a vertical elevation of a dishwashing apparatus embodying this invention, portions being broken away to show details of the operating mechanism for the apparatus; Fig. 2 is a fragmentary front elevation partly broken away and partly in section of the improved control means for electrically controlling the dishwashing apparatus shown in Fig. 1; Fig. 3 is a sectional view taken on the lines 3—3 of Fig. 2 and showing additional details of the improved control means shown in Fig. 2; Fig. 4 is a fragmentary vertical elevation partly in section and partly broken away showing details of the improved door lock and safety device of this invention; Fig. 5 is a plan view showing additional details of the door lock and safety device shown in Fig. 4; Fig. 6 is a vertical elevation showing details of the improved control panel and fluid measuring relay of this invention; Figs. 7 through 11 are circuit diagrams showing the electrical connections to the various electrical devices of the washing apparatus shown in Fig. 1 in each position of the improved control means illustrated in Figs. 2 and 3; Fig. 12 is a fragmentary vertical elevation of a dishwashing apparatus showing a modified form of control device applied thereto; Fig. 13 is a sectional view taken on the line 13—13 of Fig. 12 showing structural details of this modified form of control device; and Figs. 14 through 17 are circuit diagrams showing the electrical connections to the various electrical devices of the dishwashing apparatus illustrated in Fig. 1 in each position of the control means illustrated in Fig. 13.

Referring to the drawings and particularly to Fig. 1, this invention has been shown applied to a dishwashing apparatus having a vat 10 which is supported in a substantially vertical position in an outer casing having side walls 11 and 12 and a top wall 13 which is provided with a back splasher panel 14. The dishwasher vat 10 is of the front opening type and this opening is closed by a door 15 which is movable between an open and a closed position and is latched in its closed position by means of a latching bar 16 which is operated by a handle 17 provided on the outside of the door. Provided in the center of the door is a suitable ventilating louver 18 and provided near the upper left-hand corner of the door is a suitable detergent supplying means 19 which is preferably of the type described and claimed in the copending application of Edgar S. Stoddard, Serial No. 369,974, filed December 13, 1940, and assigned to the assignee of the present invention. It will be understood that suitable removable racks (not shown) will be provided within the vat 10 for supporting the articles to be washed such as dishes, glasses, and silverware.

In the lower portion of the vat is an impeller 20 which is provided with blades 21 which may have any suitable shape, the important feature being that the blades be given a shape such that the cleansing fluid supplied to the vat and allowed to accumulate in the lower portion thereof will be thrown upwardly and outwardly in an efficient manner through the supporting racks

(not shown). The impeller 20 may be formed of any suitable material.

The bottom portion 22 of the vat is provided with an opening which is closed by means of a suitable casting (not shown) from which is suspended an electric motor 23 for driving the impeller 20. As shown in Fig. 1, the motor is supported so that the impeller rotates about a substantially vertical axis and it will be understood that the motor shaft will extend upwardly through an aperture provided for it in the casting and will be connected with the impeller 20 in any suitable manner.

Provided in the space in the dishwasher casing below the vat 10 is a suitable fluid supply pipe 24 which is adapted to be connected to a source of supply of cleansing fluid 25 by means of a coupling 26. For example, if the cleansing fluid be water, the source of supply 25 will be a supply of water, preferably heated. The cleansing fluid will be piped from the bottom of the casing up the back wall of the vat 10 and into the top of the vat by suitable piping (not shown). In order to control the flow of fluid from the source 25 through the pipe 24 and into the vat 10, a valve 27 is provided in the conduit 24. This valve is of the electromagnetically operated type and provided at the top thereof is an energizing coil 28 which is adapted to actuate an armature (not shown) connected to the valve 27 in a manner well understood in the art. The valve 27 is of the normally closed type and is adapted to be moved from its closed to its open position in accordance with the energization of the coil 28.

Also, provided in the lower portion of the dishwashing casing below the vat 10 is a drain pipe 29 which is adapted to be connected through a suitable trap 30 to a drain connection 31. Provided in the drain pipe 29 is a drain valve elbow 32 in which is positioned a normally open valve element (not shown). The drain elbow is secured by means of suitable bolts 33 to a drain connection 34 leading from the bottom of the vat 10. In order to operate the drain valve electrically there is mounted on the drain elbow 32 an electroresponsive device 35 which has an armature 36 adapted to be actuated in accordance with the energization of a coil 37. Connected to the armature through a suitable spring connection 38 is a lever 39 which in turn is connected to a shaft 40 which extends through the drain elbow 32 and to which the valve element (not shown) is rigidly secured. As previously stated, the drain valve is of the normally open type and it is biased to this position by the coil spring 41. When the coil 37 is energized the armature 36 is retracted so as to rotate the shaft 40 clockwise as viewed in Fig. 1 and move the valve element within the drain elbow to its closed position. The specific details of the above described drain valve mechanism form no part of this invention but are the invention of Edgar S. Stoddard and are fully described and claimed in his copending application Serial No. 380,853, filed February 27, 1941, and assigned to the assignee of the present invention.

Also provided in the lower portion of the dishwasher casing and supported from the bottom of the vat 10 by suitable means is a control panel 42 shown in more detail in Fig. 6. This panel is preferably mounted in front of the electric motor 23 so as to be readily accessible from the front of the dishwasher casing. Provided on the panel 42 are a plurality of terminal plates 43 for making electrical connections to the various electrical apparatus in the dishwashing apparatus. These terminal plates are riveted to suitable insulating strips 44 which in turn are riveted to the panel 42. Also mounted on the control panel is a fluid measuring relay which is adapted to measure the quantity of washing fluid supplied to the vat when the drain valve of the washing apparatus is closed.

This fluid measuring relay comprises a relatively stationary contact 45 which is mounted on the bracket 46 which is secured to the insulating strip 47 riveted to the panel 42. Arranged to cooperate with the stationary contact 45 is a relatively movable contact 48 which is supported on a resilient contact arm 49 secured to the insulating strip 47 by means of a bracket 50. The contacts 45 and 48 are adapted to be electrically connected so as to control the deenergization of the coil 28 of the water inlet valve electroresponsive means, as will appear more fully hereinafter. Provided at the free end of the contact arm 49 is a projection 51 which is adapted to be engaged by an abutment 52 provided on a movable rod 53. This rod is adapted to move in a substantially vertical direction in accordance with movement of the armature 54 in response to the energization of an energizing coil 55 of the electroresponsive device 56 secured to the panel by means of screws 57. The rod 53 is biased to its lowermost position by means of a tension spring 58, one end of which is secured to the lower end of the rod and the opposite end of which is secured to an adjustable screw 59 which is adjustably supported on an angle bracket 60 secured to the panel. The lowermost position of the rod is determined by the setting of an upper abutment 61 which engages an arm 62 secured to the panel control by means of screws 63. Both the upper abutment 61 and the lower abutment 52 are adjustable on the rod 53 so that the movement required of the armature 54 in order to move the contact arm 49 an amount sufficient to open the contacts 45 and 48 may be adjusted. These adjustments make it possible to adjust the fluid measuring relay so that different quantities of fluid may be supplied to the washing apparatus.

The energizing coil 55 of the electroresponsive device 56 of the fluid measuring relay is adapted to be electrically connected to the motor 23 so that the relay is actuated in accordance with the armature current of the motor. In this way the quantity of washing fluid supplied to the washing apparatus will be responsive to the load imposed on the electric motor by the rotation of the impeller 20 in the fluid supplied to the washing vat. The accumulation of fluid in the lower portion of the vat 10 of course determines the load upon the impeller and obviously fluid can only accumulate in the bottom when the drain valve is closed. It will thus be understood that the fluid measuring relay functions to deenergize the energizing coil 28 of the water inlet electroresponsive device only when the coil 37 of the drain valve electroresponsive device 35 is energized to close the drain valve.

In accordance with this invention improved means are provided for electrically controlling the operation of the various devices of the washing apparatus so as to effect a predetermined washing cycle including both rinsing and washing operations. It is contemplated that the control means will include improved means for rendering the control means ineffective in the event that it is unsafe to operate the washing appa-

ratus due to the fact that the door 15 is in its open position.

The improved control means comprises a multiposition switch 64 which is adapted to be mounted on the back of the back splasher panel 14 and operated by a suitable manually operable knob 65 which is mounted on a shaft which extends through the back splasher panel. Provided on the front surface of the panel 14 is an escutcheon plate 66 which is provided with suitable indicia for indicating the various controlling positions of the knob 65. As shown in detail in Figs. 2 and 3 the control device comprises a base portion 67, made of some suitable insulating material, upon which are provided a plurality of terminals 68, 69, and 70 which are adapted to be connected to one side of the line to a suitable source of supply (not shown) and a plurality of terminals 71—75 which are adapted to be connected to the various electrical devices in the manner described below. The two line terminals 68 and 69 are substantially L-shaped in construction and each is provided with a pair of contact buttons, the line terminal 68 being provided with contact buttons 76 and 77 and the line terminal 69 being provided with contact buttons 78 and 79. These two line terminals are electrically interconnected by the short-circuiting plate 80. The line terminal 70 on the other hand is substantially rectangular in shape and is provided with a single contact button 81. Projecting downwardly from the load terminals 71—75 and riveted to the base member 67 are a plurality of flexible contact arms 82—86 each of which is provided with a contact button which cooperates with the adjacent contact button provided on the line terminals so as to perform electric circuit controlling functions. Arranged to operate each of the movable contact arms from their normally open circuit controlling position shown in Fig. 3 to the closed circuit controlling position are a plurality of operating pins 87—91 which extend through the base member 67 and are adapted to be actuated in accordance with the movement of a cam 92 which is rotatably mounted on a shaft 93 journaled in the base member. The cam 92 is provided with a plurality of radially spaced arcuate depressions or grooves 94—98 which are arranged to engage the respective contact pins 87—91 so as to cause these pins to move the contact arms 82—86 to their proper circuit controlling positions at the proper time. It will be observed that the arcuate depressions 96 and 97 comprise a pair of circumferentially spaced depressions, whereas the remaining depressions are one continuous groove. When the cam is rotated the pins will move in their respective depressions but at the proper interval each pin will be moved out of its retracted position and to the right, as shown in Fig. 3, to cause its respective contact arm to perform its circuit controlling function.

The cam member 92 is enclosed by a suitable casing 99, which is secured to the base 67 by means of a pair of screws 100. Provided within the casing 99 and extending across the top surface of the cam member 92 is a pair of spring members 101. Lying between these spring members so as to be engaged thereby is a pentagonal indexing member 102 which is suitably secured to the shaft 93. When the shaft is rotated, the indexing member will snap from one indexing position to its next indexing position and at the same time the cam member will be rotated through an angle of substantially 72 degrees so that the cam pins will move into or out of their respective cam grooves to perform the various circuit controlling functions discussed more fully hereinafter.

In accordance with one aspect of this invention, improved means are provided for insuring that the washing apparatus will not be operated if it is unsafe to do so. The improved means comprises a switch 103 which is mounted adjacent the latching means for the door 15. As shown in Figs. 4 and 5, the switch 103 is provided with a casing 104 of some suitable insulating material which is supported below the top wall 13 of the dishwasher casing by means of a pair of bolts 105. Provided within the insulating casing is a fixed contact member 106 and a movable contact member 107 which is secured to a relatively movable contact arm 108. Also, pivotally mounted within the casing 104 is a cam member 109 having an abutment which is adapted to engage the movable contact arm so as to move the contacts 106 and 107 into engagement. One portion of this cam member is adapted to project outwardly beyond the outer edge of the switch housing, as shown in Figs. 4 and 5, and a coil spring member 110 is provided for biasing the cam member to this position. This outwardly projecting portion of the cam member 109 is adapted to be engaged by the surface of the latching bar 16 which is secured to the shaft 111 which extends through the door 15 and is operated by the handle 17. The latching bar 16 is adapted to move behind a U-shaped latch plate 112 to latch the door 15 in its closed position. When the latching bar 16 is moved to this latching position, it engages the projecting edge of the cam 109 and causes it to move counterclockwise so that the contacts 106 and 107 are moved to their closed circuit position. Conversely, when the latching bar 16 is in its nonlatching position, shown in dotted lines in Fig. 4, the contacts 106 and 107 of the switch 103 are open. In order to prevent movement of the latching bar in a clockwise direction beyond its latching position there is provided a stop 113 which is supported on bracket 114 mounted on the inside of the door 15.

In accordance with this invention the switch 103 is electrically connected in series, as shown in Figs. 7 through 11, with the main controlling device shown in Fig. 2. In order to effect these electrical connections this switch 103 is provided with suitable terminal members 115 and 116. With the switch 103 thus connected to the main circuit controlling switch it assumes a master controlling function and if the contacts 106 and 107 are in their open circuit position, meaning that the door is either open or not properly latched closed, the circuit to the main controlling switch will be open so that all of the electrical devices of the washing apparatus will be deenergized. Thus the switch 103 is a safety switch which insures that the electrical devices will not be operated if it is unsafe to do so.

Under certain conditions of operation it is often desirable to have the control arranged so that the door of the dishwasher may be opened without deenergizing certain of the electrical apparatus then energized. For example, if after the rinse operation of the dishwashing cycle it should be desired to add another dish or to add detergents, it is desirable to be able to open the door of the dishwasher without deenergizing the previously energized drain valve. In accordance with this invention I have provided in my im-

proved multiposition control switch one position in which the switch 103 will be shunted so that the door 15 can be opened for a stated purpose without deenergizing the drain valve energizing coil 37. This particular cooperation between the switch 103 and the improved multiposition switch of this invention will appear more clearly from a discussion of the various operating positions of the multiposition switch.

In Figs. 7 through 11 I have illustrated schematically the various circuits produced in each position of the multiposition control switch. The electrical connections illustrated have been somewhat simplified but it will be understood that in making the electrical connections shown, the various terminal plates 43 shown on the control panel 42 illustrated in Fig. 6 will be employed. Referring to these figures, it will be observed that one side of the line 117 is connected through the contacts 106 and 107 of switch 103 to the line terminals 68 and 69 of the multiposition switch. It will also be observed that the contacts 106 and 107 of the switch 103 are shunted by means of the lead 118 from the line 117 to the line terminal 70 of the multiposition switch. Considering the load terminals, it will be observed that the load terminal 71 is connected to one end of the energizing coil 37 for the drain valve electroresponsive device 35, the opposite end of the coil 37 being connected to the opposite side 119 of the line. The load terminal 72 is connected to one end of the energizing coil 55 for the fluid measuring relay through the lead 120, the opposite end of this coil being connected through the lead 121 and through the motor winding 122 to the line 119. The load terminal 73 is connected to one side of the energizing coil 28 for the inlet valve electroresponsive means, the opposite end of this coil being connected through the lead 123 to the switch arm 49 to which is secured the contact 45; and the cooperating fixed contact 48 is connected by lead 124 to the line 119. The load terminal 74 is connected by lead 125 to the motor lead 121 so that it forms a shunt for the coil 55 of the fluid measuring relay. Finally, the load terminal 75 is connected by a lead 126 to one side of the drain valve energizing coil 37 so that this coil may be energized irrespective of the position of the door switch as will be described hereinafter. In each of the figures 7–11 the circuits energized in each position of the multiposition switch have been shown in heavy lines.

In the position shown in Fig. 7, all of the switch arms 82 through 86 of the multiposition control switch are in their normally open position and hence all of the electrical devices of the washing apparatus are deenergized. Also, as shown in this figure the contacts 106 and 107 of the switch 103 are open which indicates that the door 15 of the dishwashing apparatus is open in order that dishes may be loaded thereinto.

After the dishwashing apparatus has been loaded, the door 15 will be moved to its closed position and the latching bar 16 will be moved to its latching position. This causes the cam member 109 of the switch 103 to be pivoted counterclockwise as viewed in Fig. 5 so that the contacts 106 and 107 are closed, as shown in Fig. 8. After the door has been closed the multiposition control switch will be moved to its first circuit closing positions which correspond to moving the cam member 92 from the position shown in Fig. 7 clockwise through approximately 72 degrees to the position shown in Fig. 8. When thus moved, it will be observed that the contact pins 89 and 90 which control the operation of the arms 84 and 85 respectively will move out of their respective depressions 96 and 97 in the cam surface so that the arms 84 and 85 are moved from their normally open circuit controlling position to their closed circuit position. The position of the remaining arms 82, 83, and 86 is unchanged, however, due to the fact that their respective actuating pins 87, 88, and 91 remain in their retracted position in the depressions 94, 95, and 98 respectively. With the contact arm 84 in its closed circuit position, the inlet valve operating coil 28 will be energized through a circuit which may be traced as follows: Line 117, contacts 106 and 107, contact arm 108, line terminal 69, contact arm 84, the load terminal 73, coil 28, switch arm 49, contacts 45 and 48, lead 124, to the other side 119 of the line. With the contact arm 85 in its closed circuit position, the motor 23 will be energized through a circuit which comprises the line 117, the contacts 106 and 107, the line terminal 69, the contact arm 85, the load terminal 74, the lead 125, the motor winding 122, to the opposite side of the line 119. In this position of the multiposition switch the fluid inlet valve is open, the motor 23 is operating, and the drain valve operating coil 37 is deenergized and hence in its normally open position. Thus the dishwashing apparatus is conditioned for rinsing operation. It will be observed that the energy supplied to both of the electrical devices energized is directly controlled by the contacts 106 and 107 of the switch 103 and if the door latch should be moved to its unlatching position, the fluid inlet valve operating coil 28 and the motor 23 will be deenergized and hence access to the interior of the washing vat while these two devices are operating is prevented. It will be further observed that in this position of the control switch the energizing coil for the fluid measuring relay is directly shunted by the movement of the contact arm 85 to its circuit closing position and the maintaining of the contact arm 83 in its open position.

In Fig. 9 is shown the next succeeding position of the multiposition control switch and corresponds to the rotation of the control cam 92 through about 144 degrees from its initial position. In this position, the contact pins 89 and 90 for the contact arms 84 and 85 retract into their operating depressions 96 and 97 on the cam 92 so that the contact arms 84 and 85 return to their normally open circuit position, thereby deenergizing the motor and the fluid inlet valve. No change takes place in the position of the contact arms 82 and 83 since the pins for these arms are maintained in engagement with their operating depressions. However, the pin 91 which actuates the contact arm 86 is moved out of the depression 98 so that the contact arm 86 is moved to the closed circuit position. This movement has two effects. In the first place, the door switch 103 is shunted and in the second place, the coil 37 for the drain valve operating device is energized through the following circuit: the line 117, the lead 118, the line terminal 70, contact arm 86, the load terminal 75, the lead 126, the coil 37 to the opposite side 119 of the line. In this position it will be observed that the contacts 106 and 107 of the door switch 103 may be moved to their open position (shown in dotted lines in Fig. 9) without effecting the energization of the drain valve coil 37. This is the one position of the multi-position control switch in which the switch operated by the latching bar 16 does not

assume master control and simultaneously deenergize all of the electrical devices energized. This position is termed the "detergent" or "dish adding" position in the washing cycle and in this position the door 15 can be safely opened as the motor 23 and the fluid inlet valve operating coil are deenergized.

In Fig. 10 is shown the next succeeding position of the multiposition control device. This position corresponds to movement of the cam disk through an angle of substantially 72 degrees from the position shown in Fig. 9 and through an angle of substantially 216 degrees from the position shown in Fig. 7. In moving to this position the pins 87, 88 and 90 move out of their respective recesses on the cam surface so that the contact arms 82, 83, and 85 are moved downwardly into their closed position. No change takes place in the position of the pin 89 so that the position of the contact arm 84 remains unchanged and the contacts controlled thereby are open. The pin 91 on the other hand moves into its corresponding recess 98 so that the contact arm 86 returns to its normally open position. In this position of the contact arms the drain valve is energized through a circuit which may be traced as follows: line 117, contacts 106 and 107, line terminal 68, contact arm 82, energizing coil 37, to the other side 119 of the line. Moreover, the energizing coil for the fluid measuring relay is connected in series with the energizing coil for the motor 23 through a circuit which may be traced as follows: the line 117 through switch contacts 106 and 107, contact arm 108, line terminal 68, contact arm 83, load terminal 72, lead 120, fluid measuring energizing coil 55, lead 121, motor winding 122, and then back to the other side 119 of the line. However, in this position of the multiposition switch the fluid measuring relay coil 55 is shunted so that the coil will not be tripped by the initial high inrush of current during the starting of the motor 23. This shunt circuit may be traced as follows: line 117, switch contacts 106 and 107, contact arm 108, line terminal 69, contact arm 85, lead 125, lead 121, motor winding 122, and then to the other side 119 of the line. Since the fluid measuring relay is shunted in this position of the multiposition switch to permit the motor to get up to its operating speed without tripping the fluid measuring relay, this position is termed the motor starting position. It is to be observed that in this position the contacts 106 and 107 of the switch 103 again assume control of all of the electrical devices of the washing apparatus and should the door latch be turned from its latching position to its nonlatching position, or should the latch not be properly positioned upon the closing of the door, the contacts 106 and 107 will be open and none of the energizing functions of the multiposition switch described above will be produced.

Fig. 11 shows the last position of the multiposition switch. This position corresponds to movement of the cam member through an angle of substantially 72 degrees from the position shown in Fig. 10 or substantially 288 degrees from the position shown in Fig. 7. In moving to this position the pin 89 for the contact arm 84 is moved out of its recess 96 and downwardly so that the contact arm 84 is moved to its closed circuit position. This has the effect of energizing the fluid inlet coil 28 through the same circuit as that which was traced when the control device was in the position shown in Fig. 8. Also, in moving to this position the pin 90 moves into its corresponding recess 97 so that the contact arm 85 is moved to its open circuit position. This has the effect of removing the shunt previously provided for the fluid measuring relay coil 55. Finally, in moving to this position, no change takes place in the position of contact arms 82, 83, and 86 and hence the contact arm 82 remains in its closed circuit position so that the drain valve energizing coil 37 is energized; the contact arm 83 remains in its closed circuit position so that the fluid measuring relay energizing coil 55 is conditioned to be responsive to the armature current of the motor 23 and the safety switch shunting switch arm 86 remains in its open circuit position so that in the switch contacts 106 and 107 continue to assume control of all of the electrical devices. In view of the last mentioned condition it will be obvious that if the door latch 16 should be moved to its nonlatching position, causing the contacts 106 and 107 to be opened, all of the electrical devices energized in this position of the multiposition switch will be deenergized. The position of the control switch shown in Fig. 11 produces the "wash" operation in the dishwashing cycle. The initial position of the water measuring relay during this "wash" operation is shown in full lines in Fig. 11. In this position the fluid measuring relay is energized, but has not as yet picked up since the quantity of fluid accumulated in the vat has not reached the predetermined desired amount. After a short time, however, the load on the motor 23 will increase due to the accumulation of fluid in the vat so that the armature current of the motor increases to the value required to trip the fluid measuring relay. When this value is reached, the armature 54 of the relay is moved upwardly so that the contact arm 49 is engaged by the abutment 52 and the contact 48 is moved away from the contact 45, as shown in dotted lines in Fig. 11. This opens the circuit to the fluid inlet valve coil 28 and causes the fluid inlet valve to return to its normally closed position. With the proper amount of fluid accumulated in the vat, the washing operation of the cycle will continue for as long as as is desired.

It will be observed that in the operation of my improved multiposition switch from the detergent adding position shown in Fig. 9, through the "wash" position shown in Fig. 11, the drain valve operating coil is continuously energized so that no loss of fluid takes place in moving the switch through these various positions. This is particularly true of the movement of the control from the position shown in Fig. 9 to the position shown in Fig. 10 in which the control of the energization of the drain valve coil 37 is shifted from the contact arm 86 to the contact arm 82. In the design of the cam surface 92, a slight overlap is provided between the actuating portion of the cam surface for the pin 91 and the actuating portion of the cam surface for the pin 87, so that the contact arm 82 is moved to its closed position before the arm 86 is moved to its open position.

It is to be particularly observed that in the form of this invention described above the switch 103 is connected in series with the main multiposition control switch and assumes the function of a master control switch which prevents the normal energizing function of the multiposition switch or simultaneously deenergizes any of the electrical devices energized from the multiposition switch if the door of the dishwasher is unlatched or open. However, it is to be observed

that in this form of my invention the multiposition switch is provided with one position in which the master controlling function of the switch **103** is rendered ineffective so that in this position the door **15** may be opened without deenergizing the electrical devices then energized.

In Figs. 12 through 17 I have shown a modified form of this invention which embodies a simpler and less expensive multiposition control device for electrically controlling the various operative devices of the dishwashing apparatus so that a dishwashing cycle is produced which includes a "rinse" operation and a "wash" operation. In its primary aspect this reduction in cost and simplification has been effected by reducing the number of controlling positions of a multiposition control device. In particular, the detergent adding position of the control device shown in Figs. 2 and 3 is eliminated and by eliminating this position it is possible to eliminate the motor starting position for the control device can be shifted directly from its "rinse" position to its "wash" position. Since the motor is already running in the "rinse" position the water measuring relay will not trip prematurely when the control device is moved to the "wash" position. In considering the modification shown in Figs. 12 through 17, it will be understood that the dishwashing apparatus is substantially the same as that shown in Fig. 1 and any departures from the construction shown in Fig. 1 will be specifically pointed out.

As shown in Fig. 12, the dishwashing apparatus is adapted to be controlled by multiposition switch **127** which is supported in the mullion **11***a* on the left-hand side of the door **15** of the dishwasher by means of suitable screws **127***a*. As in the case of the form of this invention shown in Figs. 1 through 11, the multiposition switch **127** will be electrically connected in series with a safety switch of the type shown in Figs. 4 and 5 so that the controlling function of the switch **127** may be rendered ineffective if it is unsafe to operate the dishwashing apparatus. Also, as in the case of the first form of my invention, the safety switch will be mounted adjacent the door latching member so that it is actuated to its closed position when the latch is in its latching position.

The details of construction of the modified form of control switch are clearly illustrated in Fig. 13. Referring to this figure it will be observed that the switch comprises a supporting frame **128** upon which is mounted an insulating plate **129** which supports a plurality of stationary contact members **130**. Cooperating with the stationary contact members are a plurality of movable contact members **131** which are supported on a plurality of movable contact arms **132** which in the specific form illustrated are three in number. These arms are made of suitable resilient material so that the contacts **130** and **131** are biased to their closed circuit position. The arms are held in their open circuit position shown in Fig. 13 by means of a cam member **133** having a plurality of abutments **134** each of which is effective to operate a respective contact arm. This cam member **133** is provided with a handle portion **135** which is adapted to project outwardly through the corner mullion **11***a* of the dishwasher so as to be operable from the exterior of the apparatus. Provided on the cam member **133** on the side opposite that which contains the contact arm operating surfaces are a plurality of undulations **136** which are adapted to be engaged by the indexing roller **137** which is biased into the undulations **136** by the spring member **138** so that the cam member will be positively held in each of its selective positions.

In this modified form of my invention the multi-position switch has only three operating positions; namely, an "off" position, a "rinse" position, and a "wash" position. In each of these operating positions the door operated switch member **103** is connected in series with the multiposition switch so that it assumes master control. Therefore, irrespective of the position of the multiposition switch, with of course the exception of the "off" position, the latching bar for the door cannot be moved to its nonlatching position without deenergizing the electrical devices then energized.

Figs. 14 through 17 show in detail the various electrical devices of the washing apparatus which are energized in each position of the multiposition control switch. Similar reference numerals have been employed to indicate the various devices and leads as were employed in Figs. 7–11. Fig. 14 shows the "off" position of the control switch. This corresponds to the position when the projecting knob portion **135** of the cam member **133** is in its lowermost position with respect to the dishwasher casing, as shown in Fig. 12. In this position the contact arms **132** are in engagement with their respective abutments **134** on the cam so that they are in their open circuit position and all of the electrical devices are deenergized.

Fig. 15 shows the "rinse" position of the multiposition switch. This corresponds to movement of the knob portion **135** upwardly as viewed in Fig. 12 so that it projects substantially normal to the surface of the dishwasher casing. In this position the contact arms **132***a* and **132***c* are moved off their respective abutments **134***a* and **134***c* so that the contacts controlled thereby are closed but the contact arm **132***b* is moved off the abutment **134***b* and onto the abutment **134***a* so that the contacts controlled thereby are open. With the contact arm **132***a* in its circuit closing position, the fluid inlet valve coil **28** is energized through a circuit which may be traced as follows: line **117**, contact arm **108**, latch operated safety switch contacts **106** and **107**, lead **139**, contact arm **132***a*, lead **120**, contact arm **49**, fluid measuring relay switch contacts **45** and **48**, lead **123**, inlet coil **28**, to the opposite side **119** of the line. It will be observed also that in this position the fluid measuring relay coil **55** is connected in series with the motor armature so it may be affected by the armature current of the motor **23**. However, with the contact arm **132***c* in its closed circuit position, the fluid measuring relay coil is shunted by a circuit which may be traced as follows: line **117**, contact arm **108**, switch contacts **106** and **107**, lead **139**, contact arm **132***c*, lead **125**, lead **121**, to the motor winding **122** and thence to the opposite side **119** of the line. Of course with the coil **55** thus shunted, the motor **23** can come up to speed without tripping the fluid measuring relay. It is to be observed from the circuit diagram shown in Fig. 15 that if for any reason the switch contacts **106** and **107** are opened, the electrical devices then energized will be immediately and simultaneously deenergized.

Figs. 16 and 17 show the "wash" position of the multiposition switch. This position corresponds to the movement of the operating handle **135** upwardly to its uppermost position with respect to the dishwasher casing. In this position the contact arm **132***a* is maintained in its

closed circuit position maintaining the energization of the water inlet valve coil 28, whereas the contact arm 132c is engaged by the abutment 134a so that it is moved to its open circuit position. At the same time contact arm 132b moves off abutment 134a so that the contacts controlled thereby are closed. With the movement of the contact arm 132b to its closed circuit position the drain valve operating coil 37 is energized and the drain valve thereby closed. The energizing circuit for the coil 37 may be traced as follows: line 117, contact arm 108, switch contacts 106 and 107, lead 139, contact arm 132b, lead 140, coil 37, to the other side 119 of the line. With the contact arm 132c moved to its open circuit position and the contact arm 132a still closed, the shunt on the fluid measuring relay coil 55 is removed and the coil becomes responsive to the armature current of the motor. Since in moving from Fig. 15 to Fig. 16 no change takes place in the position of the contact arm 132a there will be no interruption in the operation of the motor 23 even though arm 132c is moved to the open position. With the drain valve closed, fluid will accumulate in the vat 10 (Fig. 1) and after a predetermined accumulation the load on the motor 23 will increase to such a value that the armature 54 will be picked up and moved to the position indicated schematically in Fig. 17. In this position the contacts 45 and 48 are open and the inlet valve operating coil 28 deenergized so that the inlet valve 27 moves to its normally closed position. The washing operation will then continue with this predetermined quantity of fluid provided just as long as the control cam 133 is maintained in the position shown in Figs. 16 and 17. Here, again, it will be observed that the contacts 106 and 107 which are operated by the door latching means assume master control of the multiposition switch so that the latter will be rendered ineffective to perform its circuit energizing function if the door latch is not properly positioned for safe operation of the dishwashing apparatus. When the dishes have been washed the operating knob 135 will be moved to its downwardly projecting position so that the dishwashing motor and drain valve are deenergized.

From the foregoing it will be observed that there has been provided new and improved dishwashing apparatus which may be readily and safely controlled so as to produce a proper sequence of operation in a dishwashing cycle. It is to be particularly observed that there is provided new and improved means for insuring that the dishwashing apparatus will be operated only when it is safe to do so. Moreover, there is provided in accordance with this invention new and improved dishwashing apparatus which may be readily and safely controlled so as to produce a proper sequence of operation in a dishwashing cycle. There is also provided in accordance with this invention new and improved means which are relatively inexpensive to manufacture and assemble and easy to operate for controlling operations of the various electrical devices of a dishwashing apparatus.

While two embodiments of this invention have been illustrated and particularly described, it will be obvious to those skilled in the art that modifications of this invention may be made and it is therefore intended to cover in the appended claims all such modifications as are within the true spirit and scope of this invention.

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

1. A dishwashing apparatus comprising a washing vat; fluid circulating means in said vat; an electric motor for driving said fluid circulating means; a fluid supply conduit for said vat; a normally closed inlet valve for controlling said conduit; inlet valve electroresponsive means for controlling said inlet valve; a fluid measuring relay for controlling the deenergization of said inlet valve electroresponsive means comprising a switch electrically connected in series with said electroresponsive means, and a solenoid for operating said switch in accordance with the magnitude of the armature current of said motor; a drain conduit for said vat; a normally open valve controlling said drain conduit; drain valve electroresponsive means for controlling said drain valve; and a multiposition control switch for selectively controlling the energization of said fluid measuring relay, said inlet valve electroresponsive means, said drain valve electroresponsive means and said motor; said control device having one position in which said fluid measuring relay is shunted; said motor means and said inlet valve electroresponsive means are energized, and said drain valve electroresponsive means is deenergized; a second position in which said fluid measuring relay is shunted, said drain valve electroresponsive means are energized, and said inlet valve electroresponsive means and said motor are deenergized; a third position in which said drain valve electroresponsive means is energized, said fluid measuring relay means is shunted, said motor is energized, and said inlet valve electroresponsive means is deenergized; a fourth position in which said drain valve electroresponsive means and said inlet valve electroresponsive means are energized and said motor is energized through said solenoid of said fluid measuring relay so that when the armature current of said motor reaches a predetermined value corresponding to a predetermined quantity of fluid in said vat said solenoid is picked up to actuate said switch associated therewith to deenergize said inlet valve electroresponsive means; and a fifth position in which all of said electrical means are deenergized.

2. A dishwashing apparatus comprising a washing vat, fluid circulating means in said vat, an electric motor for driving said fluid circulating means, a normally closed fluid supply valve for said vat, electroresponsive means for controlling said supply valve, a fluid measuring relay for controlling the deenergization of said supply valve electroresponsive means comprising a switch electrically connected in series with said electroresponsive means, and a solenoid for operating said switch in accordance with the magnitude of the armature current of said motor, a normally open drain valve for said vat, electroresponsive means for controlling said drain valve, a plurality of switch members for controlling the energization of said supply valve electroresponsive means, said fluid measuring relay, said drain valve electroresponsive means, and said motor, a single cam member for controlling the operation of said switch means, said cam having one position in which all of said switch means are in the open circuit position, a second position in which the switch means for said electric motor and said supply valve electroresponsive means are closed so that these devices are energized and the remaining switch means are open so that said drain valve electroresponsive means is deenergized and said fluid measuring relay is shunted, a third po-

sition in which said switch means for said drain valve electroresponsive means are closed so that said drain valve is energized and the remaining switch means are open, a fourth position in which said switch means for said drain valve electroresponsive means and said electric motor are closed and the remainder of said switch means are opened, and a fifth position in which said switch means for said drain valve electroresponsive means and said supply valve electroresponsive means are closed so that these devices are energized and the remaining switch means are actuated so that said motor is energized through said fluid measuring relay whereby the solenoid of this relay is affected by the armature current of said motor and after said armature current reaches a value corresponding to a predetermined quantity of fluid in said vat said solenoid will pick up and deenergize said supply valve electroresponsive means, and means on said cam for maintaining said drain valve electroresponsive means continuously energized when said cam is moved from its third position to its fourth or fifth position.

3. A dishwashing apparatus comprising a washing vat having an opening therein, a door for closing said opening, fluid circulating means in said vat, an electric motor for driving said fluid circulating means, a fluid supply conduit for said vat, a normally closed valve for controlling said conduit, electroresponsive means for controlling said inlet valve, a fluid measuring relay for controlling the deenergization of said inlet valve electroresponsive means comprising a switch electrically connected in series with said electroresponsive means and a solenoid for operating said switch in accordance with the magnitude of the armature current of said motor, a drain conduit for said vat, a normally open valve controlling said drain conduit, electroresponsive means for controlling said drain valve, a multiposition control device for selectively connecting to a common energizing circuit said fluid measuring relay, said valve operating electroresponsive means, and said motor to cause these devices to operate in a predetermined sequence to form a series of operations in a washing cycle, and switch means responsive to movement of said door to its open position for disabling said energizing circuit to render ineffective the energizing function of said multiposition switch.

4. In a dishwashing apparatus, a vat adapted to receive dishes to be washed; a door for said vat; a fluid inlet for said vat; electroresponsive means for controlling said fluid inlet; a fluid outlet for said vat; electroresponsive means for controlling said fluid outlet; an impeller within said vat for circulating fluid contained therein; electric motor means for operating said impeller, electroresponsive means arranged in series with said motor means for controlling the operation of said electroresponsive water inlet controlling means in accordance with the load on said motor means; control means for selectively operating said electroresponsive water inlet means, said electroresponsive water discharge means, and said motor means; a second control means connected in series with said first-mentioned control means and operable to deenergize said motor means; said electroresponsive water inlet means, and said electroresponsive water discharge means irrespective of the position of said first mentioned control means; and means for operating said second mentioned control means in accordance with movement of said door for said vat so that when said door is open said second control means will be in the open circuit position to perform said deenergizing function.

5. In a dishwashing apparatus; a vat adapted to receive dishes to be washed, a door for said vat; electroresponsive inlet valve means for controlling the flow of fluid to said vat; electroresponsive drain valve means for controlling the flow of fluid from said vat; an impeller in said vat for circulating the water contained therein when said drain valve is closed; electric motor means for actuating said impeller; a multiposition control switch for selectively controlling the operation of said motor means, said inlet valve means, and said drain valve means; said control switch having one position in which said electroresponsive inlet valve means and said electric motor means are energized and said electroresponsive drain valve means is deenergized, a second position in which said electroresponsive inlet valve means, said electroresponsive drain valve means, and said electric motor means are energized; and a third position in which all of said means are deenergized; a second control device connected in series with said first mentioned control device having an open circuit position and a closed circuit position, and means for operating said second mentioned control device from said closed circuit position to said open circuit position in accordance with movement of said door from its closed to its open position so that when said door is in its open position the circuits to said inlet valve means, said drain valve means, and said motor means through said multiposition control switch are completely deenergized.

6. A dishwashing apparatus comprising a vat, a door for said vat movable between an open and a closed position, means for latching said door in its closed position, a fluid circulating impeller in said vat, electric motor means for driving said impeller, fluid supply and drain valves for said vat, electroresponsive means for operating said valves, a control device for selectively controlling the operation of said motor means and said electroresponsive valve operating means so that said means perform a series of sequential operations in a washing cycle, a second control device connected in series with said first mentioned control device for simultaneously deenergizing any of the electrical means selectively energized by said first mentioned control device, and means for controlling the movement of said second mentioned control device to its deenergizing position in accordance with the movement of said latch means from its latching to its nonlatching position so that when said door is in its open position said electrical means are deenergized.

7. In a dishwashing apparatus a vat; a door for said vat adapted to be moved between an open and closed position; a latch for latching said door in its closed position; electrically operated means for supplying a washing fluid to said vat; electrically operated means for draining said washing fluid from said vat; means for circulating said fluid in said vat; electric motor means for operating said circulating means; a control device mounted adjacent a portion of said latch means for simultaneously controlling the deenergization of said supply means, said drain means, and said electric motor means; means mechanically connecting said control device and said latch means so that when said latch means is moved to its nonlatching position preparatory to opening said door said control device is moved to its open circuit position to simultaneously deener-

gize all of said electrical apparatus, and a multiposition switch electrically connected in series with said first mentioned control device for selectively energizing said supply means, said drain means, and said motor means to perform a series of operations in a washing cycle when said first mentioned control device is in its closed circuit position.

8. A washing appartaus comprising a vat having an opening therein, a door for closing said opening and movable between an open and closed position, electrically actuated operating devices associated with said vat so as to perform washing operations, a control device for controlling the energization of all of said electrically actuated operating devices, means for actuating said control device in accordance with the movement of said door so that it is actuated to deenergize said electrically actuated devices when said door is moved from its closed position to its open position, and a multiposition control device for selectively controlling the energization of said electrically actuated devices when said first mentioned control device is in its closed circuit position, and means in said multiposition control device for shunting said first mentioned control device when said multiposition control device is in one of its selective positions so that said door may be moved to its open position without deenergizing said electrical devices then energized.

9. A washing apparatus comprising a vat adapted to receive articles to be washed, an opening in said vat, a door for closing said opening, electrically actuated devices associated with said vat to perform a washing function comprising a water inlet valve, a drain valve, and water distributing means, a control device for controlling the energization of all of said electrically actuated devices, means for moving said control device to the closed circuit position in accordance with the movement of said door to its closed position, a second control device for selectively controlling the energization of said electrically actuated device to produce different operations in a washing cycle, said second mentioned control device having one controlling position in which only said electrically actuated drain valve is energized, and means in said second mentioned control device for shunting said first mentioned control device when said second mentioned control device is in said one position so that said door may be moved to an open position without deenergizing said electrically actuated drain valve.

10. A dishwashing apparatus comprising a vat, a door for said vat movable between an open and a closed position, means for latching said door in its closed position, a fluid circulating impeller in said vat, electric motor means for driving said impeller, fluid supply and drain valves for said vat, electromagnetic means for operating said valves, a multiposition control device for selectively controlling the operation of said motor means and said electromagnetic valve operating means so that said means perform a plurality of operations in a washing cycle, a second mentioned control device connected in series with said first mentioned control device for simultaneously deenergizing said electrical apparatus selectively energized by said first mentioned control device, means for operating said second mentioned control device in accordance with movement of said latch means from its latching to its nonlatching position so that when said latch means is moved to its nonlatching position and said door of said dishwasher is open said second mentioned control device functions to deenergize said electrical apparatus, and means on said first mentioned control device operable in one of its selective positions to shunt said second mentioned control device so that said latch means may be moved to its nonlatching position and said door opened without deenergizing the electrical apparatus energized in said position of said first mentioned control device.

11. In a dishwashing apparatus a vat having an opening therein; a door for closing said opening; latch means for latching said door in a closed position; electrically actuated devices for performing washing operations comprising fluid inlet valve means, drain valve means, and motor driven water circulating means; a control device for simultaneously deenergizing all of said electrically actuated devices; means mechanically connecting said control device to said latch means so that when said latch means is moved to its nonlatching position said control device is moved to its open circuit position to deenergize said electrically actuated devices, a second control device electrically connected in series with said first mentioned control device for separately and selectively controlling the devices comprising said electrically actuated devices to perform a series of operations in the washing cycle when said first mentioned control device is moved to its closed circuit position in accordance with the movement of said latching means to its latching position, and means on said second mentioned control device operable to shunt said first mentioned control device when said second mentioned control device is moved to one of its selective positions so that said latching means may be moved to its nonlatching position without effecting the deenergization of said electrical devices energized in said position of said second mentioned control means.

12. In a dishwashing apparatus; a vat adapted to receive dishes to be washed having a front opening therein; a door for closing said front opening; a latch for said door, electroresponsive inlet valve means for controlling the flow of fluid to said vat; electroresponsive drain valve means for controlling the flow of fluid from said vat; means for circulating the fluid in said vat so as to perform a washing function; electric motor means outside said vat for operating said circulating means; fluid measuring relay means responsive to a load condition of said motor for denergizing said inlet valve means when a predetermined quantity of fluid is supplied to said vat, a control switch for simultaneously deenergizing said inlet valve means, said drain valve means, and said motor means; means for controlling the operation of said control switch in accordance with the movement of said latch means from its latching to its nonlatching position so that the simultaneous deenergization of said means is effected when said door is open; and a multiposition switch for selectively controlling the energization of said water inlet valve means, said drain valve means, and said motor means; said switch having a Rinse position in which said water inlet valve means and said motor means are energized, and said drain valve means is deenergized; a Detergent Adding position in which said drain valve means is energized, said inlet valve means and said motor means are deenergized, and said control switch is shunted so that said latch means may be moved to the nonlatching position to open said door without effecting the energization of said drain valve means; a

third position in which said drain valve means and said motor means are energized but said water inlet valve means is deenergized; a Wash position in which said drain valve means, and said water inlet valve means are energized, and said motor means is energized through said water measuring relay means so that after a predetermined load is impressed on said motor means by the accumulation of fluid in said receptacle, said relay means are actuated to deenergize said fluid inlet valve means, and an "off" position in which all of said means are deenergized.

LESLIE A. KEMPTON.