July 5, 1966 N. L. KENDT 3,259,764

DISHWASHER CONTROL MEANS

Filed Nov. 8, 1963 2 Sheets-Sheet 1

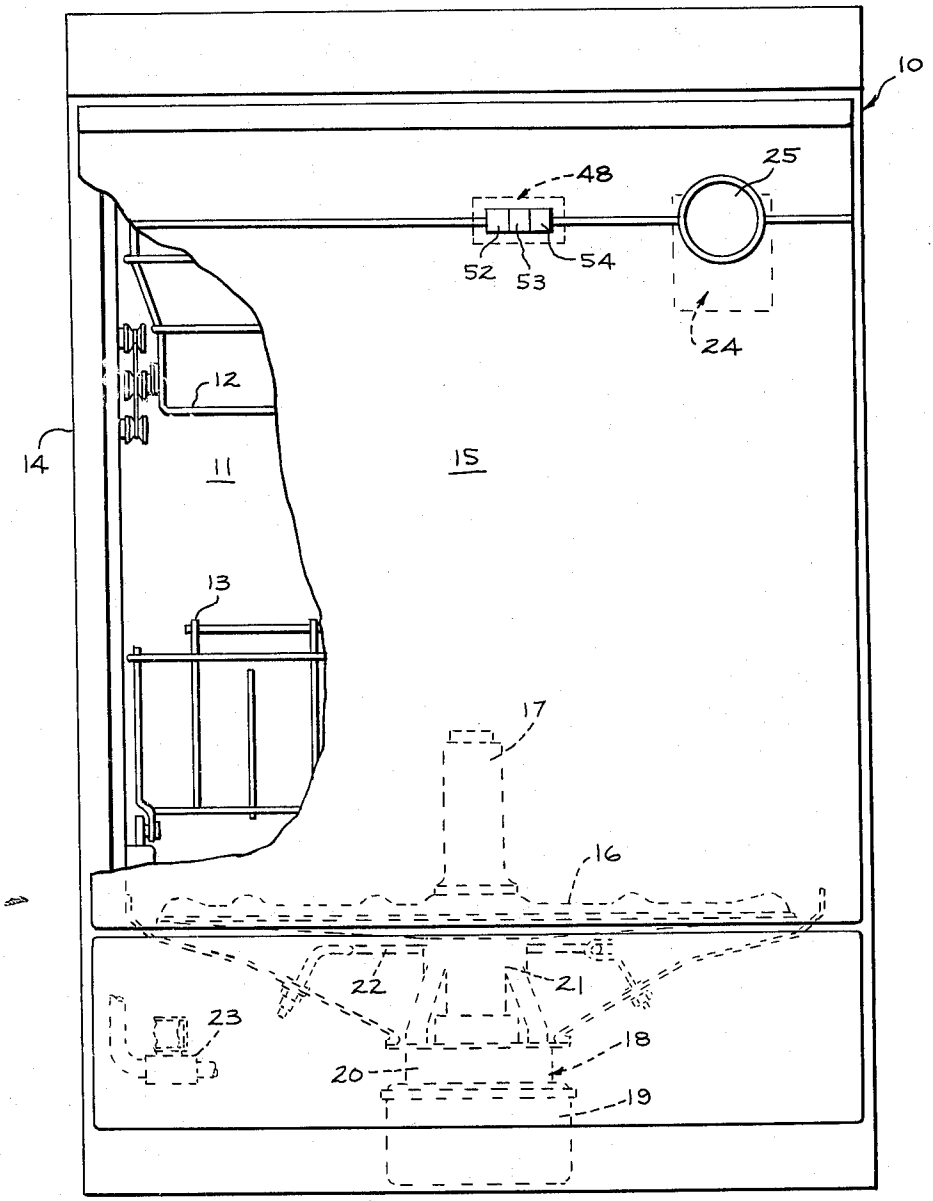


FIG. 1

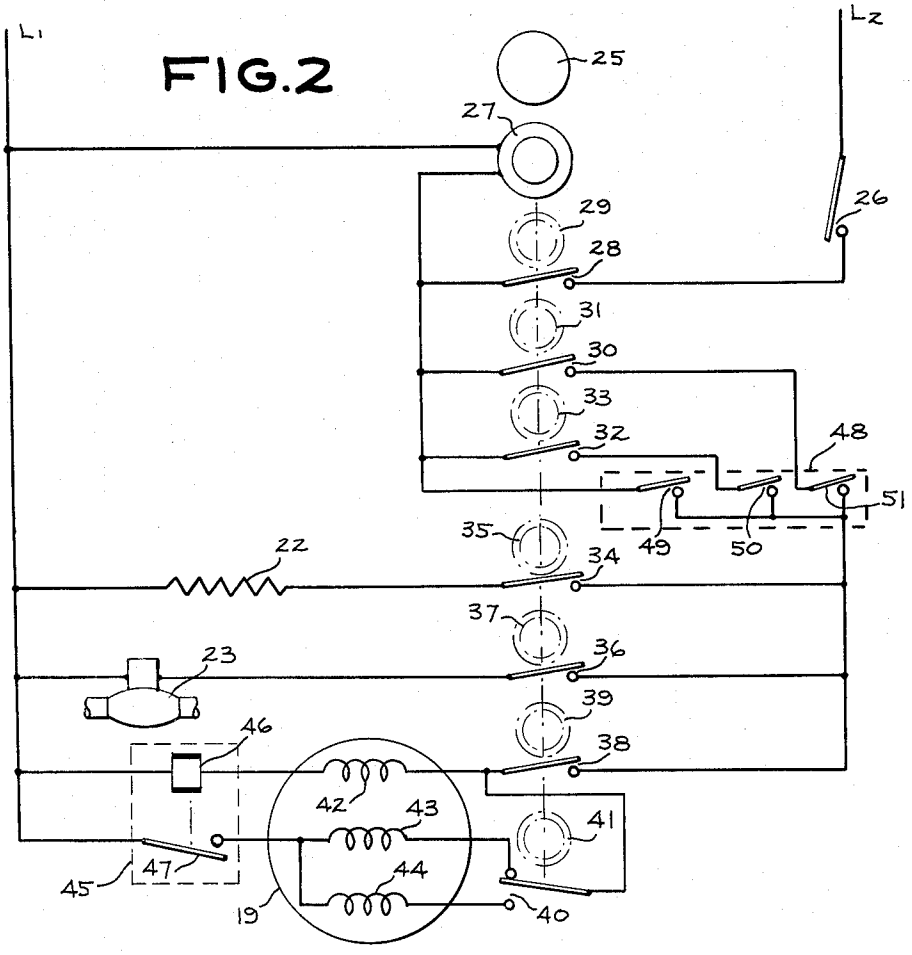
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DISHWASHER CONTROL MEANS

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FIG.2



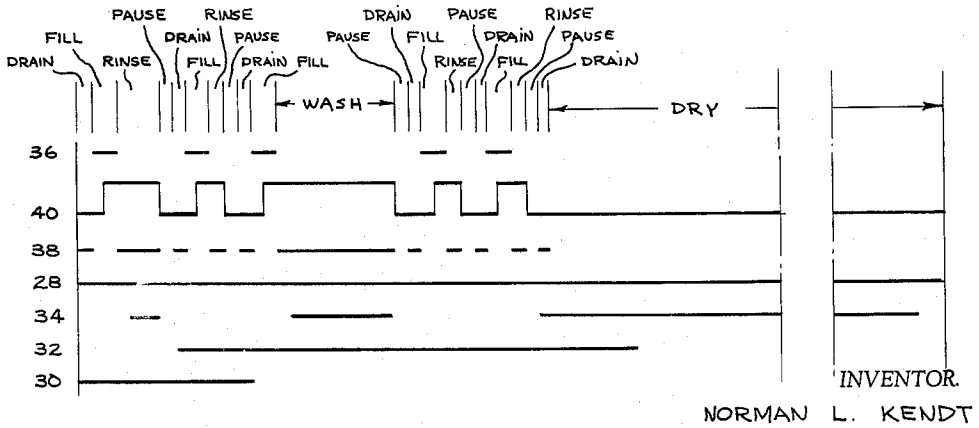


FIG.3

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DISHWASHER CONTROL MEANS

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6 Claims. (Cl. 307—141)

This invention relates generally to an improved control means for an automatic dishwasher and, more particularly, to an improved means for providing an automatic rinse and hold operation for an automatic domestic dishwasher.

Many dishwashers being manufactured today are designed to accommodate, at one time, as many as sixteen table settings of dish ware. This does not mean that these dishwashers have been designed specifically for families including sixteen members. On the contrary, these machines have been designed for families having four or five members so that the dishwasher may be used only once a day, after the evening meal, and will accommodate all the dish ware used during the entire day. If the housewife serves all three meals to five members of a household, she will, in effect, have used a total of fifteen place settings for the day. Ideally, the housewife places the dish ware into the dishwasher after each meal and leaves it there until the dish ware for the evening meal has been placed in the dishwasher whereupon the dishwasher is set into operation and all the dish ware used during the day is washed with only one operation of the dishwasher. Such procedure has obvious advantages: savings of water, electricity and detergent and reduction of wear on the dishwasher over the procedure of using the dishwasher after each meal.

In practice it has been discovered that placing the soiled breakfast or lunch dishes into the machine and leaving them there until after the evening meal results in a "setting" or hardening of the soil on the dish ware such that quite often the dish ware is not as effectively cleaned as when the dishes are washed soon after the meal. Accordingly, various means have been suggested for overcoming this "setting" of the soil on the dish ware. Perhaps the most practical solution has been the pre-soak or rinse and hold operation wherein the dishwasher is briefly energized to thoroughly rinse the dishes after each meal but the machine is not subjected to a complete washing cycle until the evening meal dishes are placed into the machine. This achieves a satisfactory balance between the aforementioned advantages of operating the dishwasher only once a day and the advantages of not allowing the soil to harden on the dish ware. However, many of the means heretofore proposed for achieving a rinse and hold operation have included such undesirable features as a costly second timer control or the retention of vitiated rinse liquids within the dishwasher wash chamber after each rinse and hold operation.

Accordingly, it is an object of this invention to provide an improved control means for achieving a rinse and hold operation in an automatic dishwasher.

Another object of this invention is to provide a control means which will include a rinse and hold operation without necessitating an additional timer control.

A further object of this invention is to provide a rinse and hold operation in a dishwasher which is easily selectable by the operator and which necessitates only an inexpensive modification of the normal control means.

Briefly stated, in accordance with one aspect of the invention, there is provided a control means having a manually operated selector switch which when manipulated by the operator pre-conditions the control means. The selector switch includes at least two settings, one representing an entire wash cycle and the other representing a rinse and hold operation. Each setting of the selector switch closes a pair of electrical contacts. That is, when the selector switch is in one position a first pair of contacts are closed and when the selector switch is in the second position a second pair of contacts are closed. The first pair of contacts is in electrical series with a first timer-operated switch while the second pair of contacts is in electrical series with a second timer-operated switch. The first timer-operated switch is designed to allow the machine to proceed through an entire wash cycle while the second timer-operated switch is designed to allow the machine to proceed through a rinse and hold operation only.

In a specific embodiment of this invention, the control means includes a timer motor driving a series of switch operators in the form of cams, each cam opening and closing a switch in predetermined accordance with the configuration of the cam. One cam controls operation of a valve which admits water to the dishwasher. A second cam controls operation of a motor-pump assembly while a third cam controls the function of the motor-pump assembly. That is, the third cam determines whether the motor-pump assembly serves to recirculate water for wash and rinse or serves to pump the water from the dishwasher. A fourth cam controls the switch in series with the first pair of contacts in the aforementioned selector switch while a fifth cam controls the switch in series with the second pair of contacts of the selector switch. The switches controlled by the fourth and fifth cams are in parallel with each other and are each in series with the switches controlled by the first, second and third cams. With this arrangement, when the selector switch is set at the rinse and hold position and the timer motor is energized, the fifth cam closes its associated switch and thereby provides electrical power to the switches controlled by the first, second and third cams. The fifth cam is configurated to allow the first, second and third cams to control the valve and motor-pump assembly through the first few steps of a complete wash cycle whereupon the fifth cam opens its switch and discontinues admission of power to these elements. These first few steps of the complete wash cycle may include a water fill, a wash or rinse step, a drain step, a fill, a wash or rinse and a drain. These first few steps comprise the rinse and hold cycle.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a front elevational view, partially cut away, of a dishwasher embodying the present invention;

FIGURE 2 is a schematic representation of the electrical circuitry of the present invention; and

FIGURE 3 is a sequence control cam chart illustrating the sequence of operation of the schematically shown switches of FIGURE 2.

Referring now to the drawings, and particularly to FIGURE 1, there is illustrated an automatic domestic dishwasher **10** in which the present invention has been incorporated. Dishwasher **10** has a wash chamber **11** which houses dish supporting racks **12** and **13**. An outer cabinet **14** surrounds the wash chamber **11** and is provided with a door **15** so that access to wash chamber **11** and racks **12** and **13** may be accomplished. Positioned near the bottom of wash chamber **11** is a rotating spray apparatus **16** and a telescoping spray apparatus **17**. A motor-pump ssembly **18**, supported by the bottom wall of wash chamber **11**, includes a drive motor **19**, a drain pump **20** and a recirculation pump **21**.

As is well understood in the art, drive motor **19** is of the reversible type wherein in one direction of rotation recirculation pump **21** is effectively operated to pump

wash fluids up through spray apparatus 16 and 17 in a vigorous manner such that an effective wash or rinse action is applied to the dish ware supported by racks 12 and 13. In the other direction of rotation, drive motor 19 effectively operates drain pump 20 to withdraw the wash fluid from wash chamber 11 to a conventional sewer connection (not shown).

An electrical heating means 22 is supported in spaced relationship from the bottom wall of wash chamber 11 and is employed to heat the wash fluid in chamber 11 and to facilitate drying of the dishes supported by racks 12 and 13 upon completion of the wash operation. A valve 23 is provided to control the admission of water, or other fluids, to the wash chamber 11. A sequence control means 24, having a manually operable knob 25, is conveniently positioned on the door 15.

The structure thus far described is essentially conventional in form and, in fact, may deviate considerably from the specific examples illustrated. In such a conventional machine, the control knob 25 is manipulated to initiate operation of dishwasher 10. Once the knob 25 has been manipulated, the sequence control means 24 is energized and remains energized throughout the entire wash cycle of the dishwasher and, upon termination of the last step in the operation of the dishwasher, the sequence control means de-energizes itself. A conventional complete wash cycle may include energization of valve 23 to admit a predetermined quantity of water to wash chamber 11 whereupon valve 23 is de-energized and motor-pump assembly 18 is energized in a manner such that recirculation pump 21 operates to effect a pre-rinse of the dish ware supported by racks 12 and 13. After a predetermined period of this action, the motor-pump assembly 18 is de-energized momentarily and then re-energized in the reverse direction so that drain pump 20 is caused to drain the water from chamber 11. A second pre-rinse, comprising the same steps just mentioned, may then follow. Usually, upon completion of the second pre-rinse the sequence control means 24 again energizes valve 23 to admit water to wash chamber 11 as the first step in a wash opertioan which comprises essentially the same steps as the pre-rinse except that the period of activity of recirculation pump 21 and the spray apparatus 16 and 17 is for a longer time. Also, usually during the early stages of the wash operation, an automatic detergent dispenser (not shown) is energized by the sequence control means 24 to dispense the proper amount of detergent into wash chamber 11 to facilitate cleaning of the dish ware supported by racks 12 and 13. The wash operation is followed by a rinse operation which again comprises the same steps as the pre-rinse operation except that again the period of activity of the recirculation pump and the spray apparatus is for a longer time than that of the pre-rinse. At the end of the rinse operation the sequence control means 24 energizes heating means 22 for a predetermined length of time to facilitate drying of the dish ware in wash chamber 11. At the completion of the predetermined period of energization of electrical heating means 22, sequence control means 24 de-energizes heating means 22, and also de-energizes itself so that the entire dishwasher 10 is completely shut off.

As mentioned above, the aforementioned operation is conventional in most present day dishwashers. However, the present invention proposes the addition of a rinse and hold cycle by means of a relatively inexpensive modification of the sequence control means required to provide the aforementioned conventional operation.

Referring now to FIGURE 2, there is illustrated a schematic representation of the control circuitry of the present invention. A pair of power lines L_1 and L_2 may be connected to a suitable power source (not shown). In power line line L_2 there is positioned a master switch 26 which preferably is associated with the latch for door 15 such that the control system cannot be energized unless door 15 is properly latched. A timer motor 27 is electrically connected between power lines L_1 and L_2 in series with a timer motor switch 28 which is controlled by a cam 29. It is to be understood that cam 29, and subsequent cams to be discussed, are driven by timer motor 27 and are also subject to rotation upon manual rotation of knob 25. This particular arrangement is essentially standard in control means for present day appliances. In series with timer motor switch 28 is a switch 30 operated by a cam 31. Also in series with timer motor switch 28, but in parallel with switch 30, is a switch 32 operated by a cam 33.

Also housed within sequence control means 24 are a heating means switch 34 operated by cam 35, a valve switch 36 operated by a cam 37, a main motor switch 38 operated by a cam 39, and a start winding switch 40 operated by cam 41. When switch 34 is closed heating means 22 is energized, either for the purpose of heating the wash fluid in wash chamber 11 or to facilitate drying of the dish ware supported by racks 12 and 13. When switch 36 is closed, valve 23 is energized and water is admitted to wash chamber 11. The colsing of switch 38 energizes a main winding 42 of drive motor 19 and also provides power to start winding switch 40.

As illustrated in FIGURE 2, start winding switch 40 is a single pole double throw switch whereby, depending upon the disposition of cam 41, power is admitted to one or the other of start windings 43 and 44 of drive motor 19. As is well known in the motor art, the direction of rotation of motor 19 is dependent upon which of the start windings 43 or 44 is energized. A start winding cut-out switch 45 includes a solenoid 46 in electrical series with main winding 42 of drive motor 19 and mechanically linked to switch 47 which is in electrical series with both start windings 43 and 44. This arrangement is such that when motor 19 reaches essentially its normal running speeds, the current passing through solenoid 46 causes solenoid 46 to open switch 47 thereby de-energizing whichever start winding had been energized.

With the exception of switches 30 and 32, the control circuitry just described is essentially conventional and may be modified to some extent without materially affecting the present invention. For example, the heating means 22 may be removed from the system if so desired and, moreover, a liquid level responsive switch may be installed in series with valve 23 to make the operation of valve 23 further depend upon the level of liquid within wash chamber 11. Also, if desired, a centrifugal type start winding cut-out switch could be employed in lieu of start winding cut-out switch 45.

As mentioned earlier, one of the primary objects of this invention is to provide an improved control means to achieve an automatic rinse and hold operation. In accordance with this object, there is provided a manually-operated selector switch 48 having individual manually-operated switches 49, 50 and 51. Switches 49, 50 and 51 are controlled by pushbuttons 52, 53 and 54 respectively as seen in FIGURE 1. Referring again to FIGURE 2, it can be seen that if switch 49 is closed, the operation of the switches 30 and 32 will have no effect on the operation of heating means 22, valve 23 or motor 19. In other words, if switch 49 is closed the overall operation of the dishwasher will be controlled primarily by cam 29 and switch 28. It is to be understood that selector switch 48 is preferably of the type whereby the depression of one of the pushbuttons 52, 53 or 54 automatically resets the remaining two pushbuttons to the open position. In other words, it is preferable to have selector switch 48 arranged so that only one of the individual switches 49, 50, or 51 may be closed at any given time.

Therefore, if switch 50 is closed it is apparent that the operation of the dishwasher is dependent upon the configuration of cams 29 and 33 which control the operation of switches 28 and 32 respectively. Similarly, if

switch 51 is closed, the operation of the dishwasher is dependent upon the configuration of cams 29 and 31 which control the operation of switches 28 and 30.

Reference to FIGURE 3 will show the periods during which each of the aforementioned cam operated switches are closed during a complete cycling of the sequence control means 24. For example, it can been seen that timer motor switch 28 is closed throughout the entire cycle while switch 30 is closed for a reasonably short period at the beginning of the cycle and switch 32 does not close until a few minutes after the beginning of the cycle and closes well before the end of the cycle.

Referring now to both FIGURES 2 and 3, it can be seen that the following selection of operations can be achieved. If it is desired to have a complete regular cycle of the dishwasher, pushbutton 52 of selector switch 48 is depressed thereby closing switch 49. Knob 25 is rotated slightly to a pre-indicated position whereby cam 29 closes switch 28 to energize timer motor 27. From this point on, timer motor 27 will drive the sequence control means 24 throughout an entire cycle. Since cam 29 is configurated to maintain switch 28 in the closed position throughout the entire cycle, and since switch 49 is closed, power is provided to switches 34, 36 and 38 for the entire period of operation. Therefore, sequence control means 24 will provide a complete wash cycle comprising the following sequence of steps: brief pump out, fill, rinse (with heating means 22 energized for a portion of the rinse), pump out, fill, rinse, pump out, fill, wash (with heating means 22 energized for a portion of the wash), pump out, fill, rinse, pump out, fill, rinse, pump out, and dry (with the heating means 22 energized throughout the entire dry period).

To achieve a more gentle wash action for such articles as fine china, pushbutton 53 is depressed thereby closing switch 50 of selector switch 48. As mentioned earlier, it is desirable to have selector switch 48 designed so that the closing of switch 50 opens switches 49 and 51. If selector switch is not so designed, it would be necessary to manually open switches 49 and 51. With switch 50 closed, the operator rotates knob 25 slightly until cam 29 closes switch 28 thereby energizing timer motor 27 which again will drive sequence control means 24 through an entire cycle. Since switches 49 and 51 are open, electrical power is not provided to switches 34, 36 and 38 until cam 33 closes switch 32. From FIGURE 3, it can be seen that switch 32 is not closed until the begining of the operation which constituted the second pre-rinse of the complete cycle explained above. Switch 32 remains closed from that point of the aforementioned complete cycle through a reasonably short portion of the dry period of the aforementioned complete wash cycle. This results in an operation of the dishwasher comprising the following sequence of steps: a brief pump out, fill, rinse, pump out, fill, wash (with heating means 22 energized for a portion of the wash), pump out, fill, rinse, pump out, fill, rinse, pump out, and dry. It should be noted that switch 32 is opened after the heating means 22 has been energized for only a few minutes. When switch 32 opens power is no longer provided at switches 34, 36 and 38 so that the components controlled by these switches lie dormant. However, since switch 28 remains closed, timer motor 27 remains energized and continues to drive sequence control means 24 until switch 28 opens. This means that sequence control means 24 and knob 25 are returned to the same position as when an entire wash cycle occurs.

From a further review of FIGURES 2 and 3, it can be seen that a rinse and hold cycle is achieved by depressing pushbutton 54 which closes switch 51, and then rotating knob 25 until cam 29 closes switch 28. Since cam 31 is configurated to immediately close switch 30, power is immediately presented to switches 34, 36 and 38. Therefore, the machine proceeds through an operation comprising the following steps: a brief pump out, fill, rinse (with heating means 22 energized for a portion of the rinse), pump out, fill, rinse and pump out. At this point, cam 31 opens switch 30 thereby discontinuing the admission of power to switches 34, 36 and 38. However, as in the fine china operation discussed above, cam 29 continues to maintain switch 28 in a closed position so that the timer motor 27 continues to drive sequence control means 24 until it returns to the same position which would occur if the dishwasher had gone through a complete wash cycle.

Thus, it can be seen that the present invention provides a rinse and hold operation, as well as a series of selectable wash operations, by the employment of a single sequence control means having a single timer motor in cooperation with a manually-operated selector switch.

As will be evident from the foregoing description, certain aspects of the invention are not limited to the particular details of construction of the example illustrated, and it is contemplated that various and other modifications or applications will occur to those skilled in the art. It is therefore intended that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of the invention.

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

1. A control means for an automatic dishwasher comprising:
   (a) a timer motor,
   (b) a first group of cams operated by said timer motor,
   (c) a first group of switches operated by said first group of cams,
   (d) a second group of cams operated by said timer motor,
   (e) a second group of switches operated by said second group of cams, and
   (f) a manually operated selector switch in electrical series circuit with said first group and said second group of switches whereby actuation of said manually operated selector switch will determine which of said first group of switches will be in operative relationship with said second group of switches,
   (g) said first group of switches including one switch operated by a cam configurated to maintain said one switch closed only long enough to allow said second group of switches to conduct the dishwasher through the first several steps of a complete wash cycle whereupon said one switch is opened to thereby terminate the admission of electrical power to said second group of switches.

2. A control means for an automatic dishwasher comprising:
   (a) a timer motor,
   (b) a first group of cams operated by said timer motor,
   (c) a first group of switches operated by said first group of cams,
   (d) a second group of cams operated by said timer motor,
   (e) a second group of switches operated by said second group of cams, and
   (f) a manually operated selector switch in electrical series with said first group and said second group of switches whereby actuation of said manually operated selector switch will determine which of said first group of switches will be in operative relationship with said second group of switches,
   (g) said first group of switches including one switch operated by a cam configurated to maintain said one switch closed only long enough to allow said second group of switches to conduct the dishwasher through the first several steps of a complete wash cycle whereupon said one switch is opened to thereby terminate the admission of electrical power to said second group of switches,

(h) said first group of switches further including a second switch in electrical series with said timer motor and operated by a cam configurated to maintain said second switch closed for a period of time equivalent to a complete wash cycle to thereby allow said timer motor to return to the same position irrespective of the setting of said manually operated selector switch.

3. In a dishwasher of the type described, a control means comprising:

(a) a timer motor,

(b) first and second groups of cams operated by said timer motor,

(c) first and second groups of switches operated by said first and said second groups of cams respectively,

(d) said second group of switches including:

(aa) a first switch to control a valve,

(bb) a second switch to control a spray apparatus,

(cc) a third switch to control a drain means,

(dd) said first, second and third switches normally operating to control the valve, spray apparatus and drain means in sequential operation to achieve a full wash cycle of the dishwasher,

(e) said first group of switches including a rinse and hold switch in electrical series with all of said first, second and third switches of said second group, and

(f) a manually operated selector switch including one switch in series with said rinse and hold switch and a second switch in parallel with said rinse and hold switch whereby actuation of said selector switch will determine whether said rinse and hold switch is operatively associated with said second group of switches.

4. In a dishwasher of the type described, a control means comprising:

(a) a timer motor,

(b) first and second groups of cams operated by said timer motor,

(c) first and second groups of switches operated by said first and said second groups of cams respectively,

(d) said second group of switches including:

(aa) a first switch to control a valve,

(bb) a second switch to control a spray apparatus,

(cc) a third switch to control a drain means,

(dd) said first, second and third switches normally operating to control the valve, spray apparatus and drain means in sequential operation to achieve a full wash cycle of the dishwasher,

(e) said first group of switches including:

(aa) a timer switch to control admission of power to said timer motor,

(bb) a rinse and hold switch in electrical series with all of said first, second and third switches of said second group, and

(f) a manually operated selector switch including one switch in series with said rinse and hold switch and a second switch in parallel with said rinse and hold switch whereby actuation of said selector switch will determine whether said rinse and hold switch is operatively associated with said second group of switches,

(g) said timer switch being controlled by a cam configurated to maintain said timer switch closed for a period of time equivalent to a complete wash cycle to thereby allow said timer motor to return to the same position irrespective of the setting of said manually operated selector switch.

5. A control means for an automatic dishwasher comprising:

(a) a timer motor,

(b) a first timer operated switch,

(c) a second timer operated switch,

(d) additional timer operated switches in electrical parallel circuit with each other and in electrical series circuit with both said first timer operated switch and said second timer operated switch, and

(e) a manually operated selector switch in electrical series circuit with said first timer operated switch, said second timer operated switch and said additional timer operated switches whereby actuation of said manually operated selector switch will determine whether said first timer operated switch or said second timer operated switch will be in operative relationship with said additional timer operated switches,

(f) said first timer operated switch being closed by said timer motor only long enough to allow said additional timer operated switches to conduct the dishwasher through the first several steps of a complete wash cycle whereupon said first timer operated switch is opened to thereby terminate the admission of electrical power to said additional timer operated switches.

6. A control means for an automatic dishwasher comprising:

(a) timer means,

(b) a manually operated selector switch including at least a first manually operated switch and a second manually operated switch,

(c) a first timer operated switch in electrical series circuit with said first manually operated switch,

(d) a second timer operated switch in electrical series circuit with said second manually operated switch, and

(e) additional timer operated switches in electrical parallel circuit with each other and in electrical series circuit with both said first timer operated switch and said second timer operated switch,

(f) said first timer operated switch and said second timer operated switch being in electrical parallel circuit with each other,

(g) said first timer operated switch being closed by said timer means only long enough to allow said additional timer operated switches to conduct the dishwasher through the first several steps of a complete wash cycle whereupon said first timer operated switch is opened to thereby terminate the admission of electrical power to said additional timer operated switches.

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