July 4, 1961 D. S. CUSHING 2,990,835

MULTIPLE CYCLE DISHWASHING MACHINE

Filed Nov. 20, 1959 2 Sheets-Sheet 1

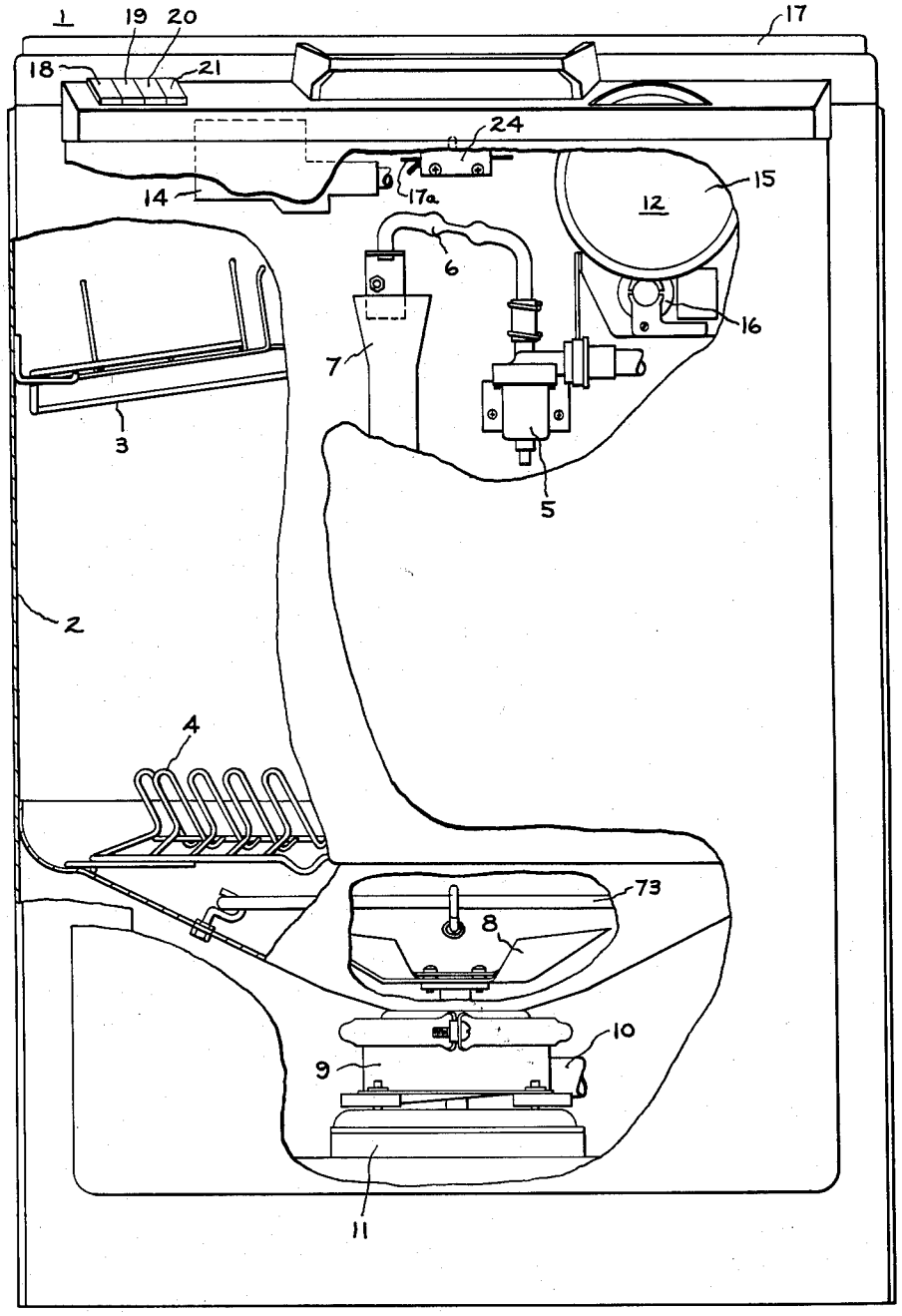


FIG. 1

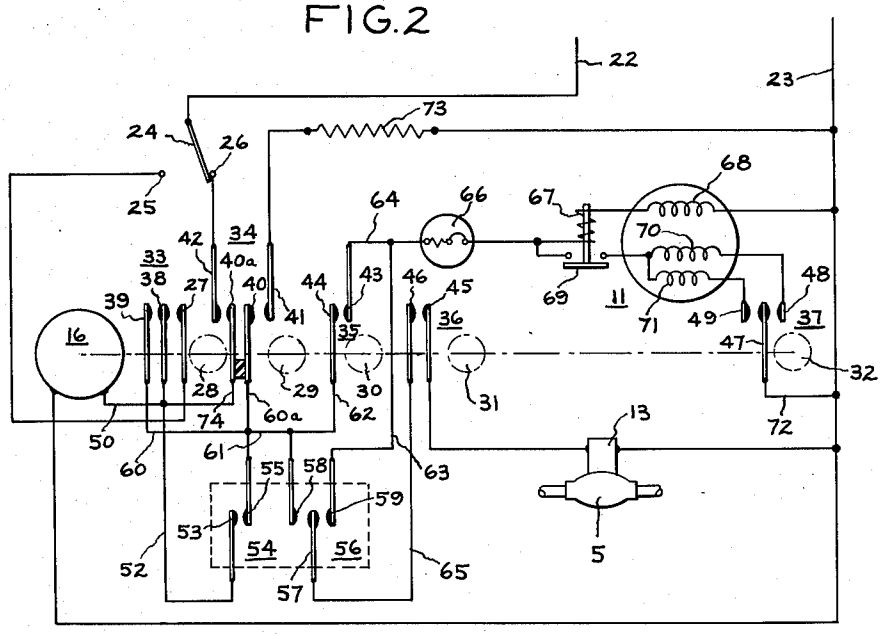
INVENTOR.
DONALD. S. CUSHING
BY Donald P Lawrence
HIS ATTORNEY

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MULTIPLE CYCLE DISHWASHING MACHINE

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FIG.2



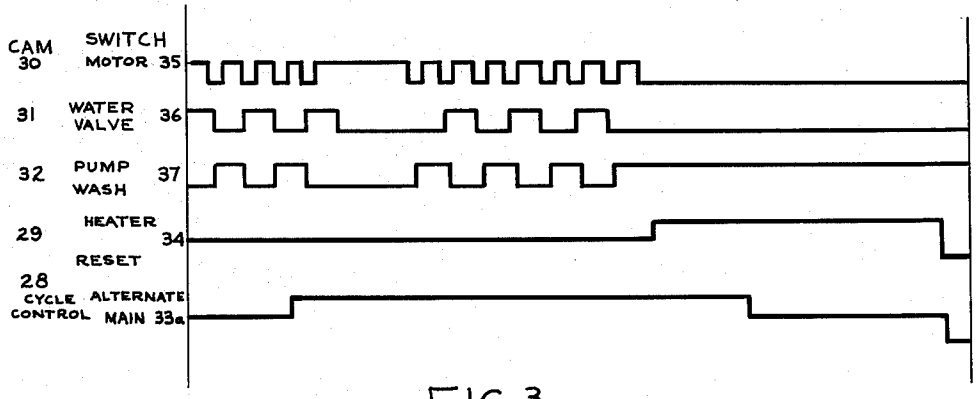


FIG.3

INVENTOR
DONALD S. CUSHING

BY Derek P Lawrence

HIS ATTORNEY

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MULTIPLE CYCLE DISHWASHING MACHINE

Donald S. Cushing, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed Nov. 20, 1959, Ser. No. 854,501
6 Claims. (Cl. 134—58)

This invention relates to washing machines, and more particularly to a dishwasher including a control circuit providing for four different manually selectable cycles.

It is becoming increasingly desirable in the dishwasher art to provide several alternative operating cycles of the dishwasher, each appropriate for a different type of load to be washed. For instance, a typical cycle of operation for the average conventional load of dishes which includes silverware, chinaware, glasses, and perhaps some cooking utensils may provide, for instance, two preliminary rinses, a washing operation, three subsequent rinses, and a full drying cycle after the last rinse. However, where the load is a similar one but fewer articles are to be washed it may well be desirable to have a full cycle but to have a substantially smaller amount of water provided for the rinsing and washing operations. Other alternative cycles which are desirable for particular items might include, for instance, a cycle wherein the articles are only washed, then rinsed and treated with a short drying cycle; this would be appropriate in the case where only cooking utensils are to be washed. This type of cycle is also appropriate for fine chinaware and crystal when a smaller amount of water is provided, and this constitutes a fourth type of cycle.

It is inevitable that the provision of a multiple selection of cycles, as opposed to a single cycle, must increase the complexity of the control system of the machine and therefore its expense. It is, however, most desirable to restrict this increased expense and complexity to a minimum.

It is, consequently, a principal object of this invention to provide a dishwasher having multiple cycles wherein the conventional timer-operated switches are arranged in a particular circuit relationship with manually operated selector switches so that, although one single cycle length is provided by the usual sequence control mechanism, the length of operation of the different components of the dishwasher is varied by the varying relationship of the manual switches and the timer operated switches.

A further object of the invention is to provide a circuit of the type described where at least the motor driving the washing means has the length of its operation controlled in this manner.

Yet another object of the invention is to provide control of the operation of other components such as the water supply means and the heat drying means in this manner.

A further more specific object of the invention is to achieve the desired control by causing the manual selector means to permit engagement of the energizing circuits for the components to different timer switches, the timer closing these switches for different lengths of time during an operation so that the components operate for different lengths of time although the length of the total cycle, as timed by the sequence control means, remains the same.

Another more specific object of the invention is to achieve further control over the operation of the water control means by providing a manual switch which makes the water control means either dependent or independent of the energization of the motor. In such a case it will be clear that where the water control means is independent of the motor energization it may be energized for longer periods than where it is dependent upon motor energization.

A further specific object of the invention is to provide a dishwasher of the type described in which a lid interlock is provided, so that after the cycle has been terminated, and when the lid is opened, the sequence control means will be caused to advance to its starting position, in readiness for a subsequent dishwashing operation.

Briefly stated, in accordance with one aspect of this invention, I provide a washing machine having an automatic washing cycle in which a conventional tub is provided together with washing means within the tub and water means for introducing water into the tub. The washing means is driven by a suitable electric motor, and the water means is controlled by a suitable electric control means (conventionally a solenoid) which, when energized, causes the water means to introduce water to the tub. The usual sequence control means is provided, together with suitable energizing circuits for the motor means, the water control means and the sequence control means. The sequence control means controls first and second switch means which it closes for different periods of time with, however, the limitation that at least one of the two switch means be closed at any one time during the washing cycle. Throughout each full cycle the sequence control means circuit is connected across a source of power through at least one of the switch means, and at the end of each cycle the sequence control means opens both switch means.

In cooperative relation with the two switch means, I provide a manual switch which has at least one operative position in which it connects both the motor means circuit and the water control means circuit to a first of the switch means. When the manual switch is not in its operative position it disconnects the motor means circuit and the water control means circuit from the first switch means. Together with this, I connect the motor means circuit and the water control means circuit by any suitable means to the second of the switch means at least during times when the manual switch is out of the operative position.

With the above mentioned construction the sequence control means operate throughout a cycle to toll out the cycle. However, the extent to which the other energizing circuits are completed to cause operation of the components controlled thereby is dependent upon the position of the manual switch, that is, the manual switch determines which of the two switch means will be the controlling one for determining the length of the operation of the component.

As a further improvement, another manual switch may be used to determine whether the water control means circuit completion is dependent on the motor means circuit completion. This causes varying amounts of water to be introduced into the machine, the greater amount being provided when the water control means circuit is independent of the motor means circuit.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings,

FIGURE 1 is a front elevational view, with some of the parts broken away, of a dishwasher embodying the present invention;

FIGURE 2 is a schematic electrical wiring diagram illustrating a control system for the machine which embodies my invention in one form thereof; 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 FIGURE 1, there is shown a dishwasher 1 having an enclosed washing compartment or tub 2 of generally rectangular configuration in which are mounted an upper rack 3 and a lower rack 4 arranged to support dishes or the like during washing operations. Dishwasher 1 is provided with a water inlet valve 5 adapted to be connected to a water supply system, a water inlet conduit 6, and a fill funnel 7 communicating with the interior of tub 2. Located at the bottom of the tub 2 and arranged to circulate washing fluid throughout the washing compartment is a rotary impeller 8. A drain pump 9 having an inlet communicating with tub 2 and an outlet connected to drain conduit 10 is supported beneath the tub, the housing of pump 9 being arranged to support an electric motor 11 which drives the impeller 8 so as to circulate the fluid in the tub when rotating in one direction, and to operate pump 9 so as to discharge fluid through conduit 10 when driven in the other direction. This washing impeller and drain pump arrangement is the invention of Russell M. Sasnett and Lauren W. Guth and is more fully described in application Serial No. 671,070, filed July 10, 1957, now Patent Number 2,959,179, and assigned to the assignee of the present application.

Automatic operation of dishwasher 1 to provide a complete dishwashing and drying cycle is effected by a sequence control assembly, generally indicated by the numeral 12, which is arranged to control the energization of a solenoid 13 in turn controlling inlet valve 5 and to control the energization of motor 11. The sequence control assembly may also be used to control the actuation of a rinse agent dispensing means 14 and a detergent dispensing means (not shown). Timer 12 includes a switch actuating rotary cam assembly 15 driven by a constant speed motor 16, such devices being well known in the art.

Tub 2 has a top access opening which is closed by a hinged top cover 17 during washing operations, being held in closed position by a latch mechanism 17*a*. This cover latch mechanism is disclosed and claimed in Patent 2,896,641 issued on July 28, 1959, to Melvin R. Kauffman and John A. Dicken, Jr. and assigned to the assignee of the present application. At the front of the machine there is provided in a conveniently accessible position a group of four manually operated buttons 18, 19, 20 and 21 which are used to select the desired type of operating cycle as will be more fully described in connection with FIGURES 2 and 3.

As will also be more fully described in connection with FIGURES 2 and 3, the typical full operating cycle of dishwasher 1 includes a number of rinsing, washing, and drying steps; for instance, the full cycle will include:

(1) A preliminary rinse in which the inlet valve 6 is opened to admit a predetermined quantity of water into the tub 2, impeller 8 is rotated by motor 11 for a short period of time (two minutes, for example) to circulate water in the tub, and finally motor 11 is reversed so as to operate drain pump 9 and discharge the first charge of washing fluid from the ub.

(2) A second preliminary rinse in which step (1) is repeated.

(3) A washing step similar to steps (1) and (2), except that detergent is introduced into the water at the beginning of the step and the water is circulated in the tub for a somewhat longer period of time (five or six minutes, for example).

(4) At least one and preferably three rinse steps similar to step (1).

(5) A drying step of predetermined length in which suitable heating means is energized to cause evaporation of the moisture on the dishes and consequent drying thereof.

Referring now to FIGURE 2, there is shown a control circuit embodying my invention. It will be understood that, besides the components specifically shown, other electrically controlled components of the machine, such as suitable indicating lights, and detergent and rinse agent dispensers, will also generally be controlled electrically; these other components have been left out of FIGURE 2 only in order to show clearly the invention without confusing additional details which do not form a part thereof. The entire circuit is energized through a pair of supply conductors 22 and 23 across a suitable source of power (not shown) such as the conventional 110 volt 60 cycle source generally available. Conductor 22 connects with a switch 24 (also shown in FIGURE 1) which, when the cover is closed, is actuated into engagement with a contact 25 and when the cover is open engages a contact 26. Contact 25 in turn is connected to a movable contact 27 by a suitable cam 28 which, together with cams 29, 30, 31 and 32 is driven by the timer motor 16. While the cams are shown only in outline in FIGURE 2, a development of the peripheries of the cams is shown in FIGURE 3 to indicate the sequence in which they open and close the switches and will be fully described herebelow.

Contact 27 is part of a switch 33 which is controlled by the rotation of cam 28. In the same manner, the rotation of cams 29, 30, 31 and 32 controls respectively the operation of timer switches 34, 35, 36 and 37. Cam 28 has a portion of its periphery formed so that the three contacts 27, 38 and 39 of switch 33 are all separated, a second portion in which contact 27 engages contact 38, and a third portion in which contact 27 engages contact 38 and depresses it so that all three contacts 27, 38 and 39 are in engagement. Cam 29 has three positions: as shown, the movable contact 40 and 40*a* may engage neither of the contacts 41 and 42; in addition, a second position causes contact 40 to engage contact 41 and a third position causes contact 40*a* to engage contact 42. In switch 35, the movable contact 43 may be caused to engage stationary contact 44. Similarly, in switch 36 the movable contact 45 may be caused to engage the stationary contact 46. In the last switch 37, the movable contact 47 may engage either contact 48 or contact 49.

Contact 38 of switch 33 is connected through a conductor 50 to the timer motor 16 which in turn is connected directly to supply conductor 23. It will be seen that an energizing circuit for timer motor 16 is thus provided from conductor 22 through switch 24 and contact 25, and then through contacts 27 and 38 of switch 33, and conductor 50, to timer motor 16 which is then connected through to conductor 23.

The contact 38 is also connected through a conductor 52 to a contact 53 of a manually operated switch generally indicated at 54. Switch 54 also includes a contact 55; the switch has an operative position in which contacts 53 and 55 are together and an open or inoperative position in which they are separated, as shown. Switch 54 is one of two manually operated sets of contacts, the other one being a switch 56 having a movable contact 57 which is engageable either with a contact 58 or with a contact 59. Both switches 54 and 56 are controlled by buttons 18, 19, 20 and 21 through conventional commercially available linkage mechanisms which, to enhance the clarity of the invention, are not shown hereon. Depression of button 18 closes switch 54 and causes engagement of contact 57 with contact 58 of switch 56. Depression of button 19 closes switch 54 but causes engagement of contact 57 with contact 59. Depression of button 20 leaves switch 54 open and causes engagement of contacts 57 and 58. Depression of button 21 leaves switch 54 open and causes engagement of contacts 57 and 59.

Contact 55 is connected through a conductor 60 to contact 39 of switch 33, through a conductor 60*a* to contact 40 of switch 34, and by a conductor 61 to contact 58 of switch 56. In addition, the contacts 55 and 58 are connected by a conductor 62 to contact 44 of switch 35. The contact 59 of switch 56 is connected by a conductor 63

to conductor 64 which in turn is connected to contact 43 of switch 35. It will thus be seen that the two contacts 58 and 59 are connected to opposite sides of the switch 35.

From contact 57 a connection is made through a conductor 65 and switch 36 to the solenoid 13 which controls inlet valve 5, and then across to conductor 23. The conductor 64 extends through a conventional motor overload protector 66 to the motor 11. The motor includes a relay having a coil 67 in series with the main winding 68 of the motor, and when the relay coil is energized it pulls up a contact 69 to complete a circuit for the two alternatively used start windings 70 and 71 of the motor. Winding 70 is connected to contact 48 of switch 37 while winding 71 is connected to contact 49. With this arrangement, the movable contact 47 of the switch is effective to connect either one or the other of the two start windings 70 and 71 through conductor 72 to the supply conductor 23. It will, of course, be understood that, in the conventional manner, the relay coil 67 is energized by the relatively high starting current passing through the main winding 68 of the motor, and that the ordinary running current of the motor is insufficient to keep the coil 67 energized so that contact 69 is engaged for the starting of the motor and then drops out as the motor comes up to speed.

Completing the description of the circuit connections, the contact 41 of switch 34 is connected to a conventional electrical resistance heating element 73 which is connected at its other side to the conductor 23. Also, the contact 26 of the cover switch 24 is directly connected to the contact 42 of switch 34, and contact 40*a* is connected through a conductor 74 to conductor 50 to provide an additional timer motor circuit which may be completed only when switch 24 engages contact 26.

The operation of the dishwasher as controlled by the circuit of FIGURE 2 will now be described having particular reference to FIGURE 2 in conjunction with FIGURE 3. The selection of the desired cycle is made by the depression of one of the buttons 18–21. It will be assumed for this initial description that button 18 has been depressed, thereby closing switch 54 and causing engagement of contact 57 with contact 58. Reference to FIGURE 3 shows that now, when the lid 17 is closed to cause engagement of contact 24 with contact 25, the only contacts initially closed by the action of the timer motor will be contacts 47 and 48 of switch 37 and contacts 27 and 38 of switch 33. The engagement of contacts 27 and 38 completes the circuit previously described through the timer motor to start operation of the timer motor to cause rotation of the cams controlled thereby. After the cams have been rotated for a very brief period, cam 30 closes contacts 43 and 44 of switch 35, and cam 31 closes switch 36. An energizing circuit for the motor 12 is then completed, starting with contact 38 through conductor 52, switch 54, conductors 61 and 62, switch 35, and conductor 64 to the motor itself. In the motor the circuit is completed through the relay coil 67, main winding 68, and—because of the position of contact 47—through start winding 70 but not through start winding 71. The polarity of start winding 70 relative to main winding 68 is such as to cause the motor to start rotating in a direction to produce a washing action by the impellers 8. As the motor comes up to speed, as has been described, relay contact 69 drops out to de-energize the start winding 70 so that the motor continues operation on winding 68 alone.

A circuit is also completed, starting at conductor 61, through contacts 58 and 57 of switch 56, conductor 65, switch 36 and through the solenoid 13 to the other side of the line 23. Thus, simultaneously with the starting of the operation of the motor, the washing fluid, conventionally hot water, is introduced through valve 5 by the energization of solenoid 13. The combined action of the solenoid 13 and of the motor 11 causes water to be impelled against the dishes held in the racks 3 and 4 of the machine so as to effect a first rinsing action. The water, of course, ceases to be introduced when the switch 36 opens, with the action of the impeller continuing to the end of the rinse operation.

At the end of the rinse operation the cam 30 causes switch 35 to open, and the cam 32 moves contact 47 to switch 37 over into engagement with contact 49. The motor at this time stops because there is no completion of an energizing circuit for it with switch 35 open. After a pause, the switch 35 recloses. Because of the connection of start winding 71 through an energizing circuit, the motor starts up in the opposite direction to pump out the water in the machine. This pumping action continues until the reopening of switch 35.

After the major part of the water has been removed by the pumping action, switch 35 is again opened to stop the motor and the position of contact 47 of switch 37 is again reversed. At the same time, switch 36 is closed to start the introduction of water into the tub. Now, when the switch 35 is closed again after a pause, the same rinse action as previously provided will take place followed in sequence by a pumping action and a pause during which water is again brought in by energization of solenoid 13 through switch 36. After these two preliminary rinses a washing operation, which is conducted in the same manner as the rinsing operations, is provided. The washing operation is the same as the rinsing operations with the single exception that it is conducted for a longer period of time, generally on the order of six minutes as opposed to about two minutes for each rinse operation, and that detergent is introduced into the machine at this time, this feature being completely conventional in nature and not being described herein since it is not a part of the applicant's invention.

At the end of the washing operation a pause and then a pumping operation are provided in the same manner as before, three rinses similar to the first rinses then follow the washing operation. It will be seen that for each of the rinsing operations and for the washing operation the water valve is operated so as to provide a predetermined amount of water into the machine.

At the end of the pumping operation following the last rinse the motor switch 35 is opened for the remainder of the cycle. At this point the cam 29 moves contact 40 into engagement with contact 41 to energize the resistance heater element 73 and provide a drying operation. It will readily be seen that the energizing circuit for resistance heater element 73 proceeds from contact 38 through conductor 52, switch 54 and conductor 60*a* to contact 40 and then from contact 41 through the resistance element to supply conductor 23. This action continues for a predetermined time until the end of the cycle is reached, at which time cam 29 moves contact 40 out of engagement with contact 41 to break the energizing circuit for the heater element, and causes the contact 40 to engage contact 42. Also, contact 27 is disengaged from contact 38 to stop the operation of the timer motor and remove power from all components.

At this point the articles in the dishwasher are clean, dry, and ready to be removed by opening the lid 17. When the lid is opened switch 24 engages contact 26. At this time, contacts 40*a* and 42 are in engagement by the action of cam 29, and an energizing circuit is completed from supply conductor 22 through switch 24, contact 26, contacts 42 and 40*a*, conductors 74 and 50, and the timer motor 16 to supply conductor 23 to energize the timer motor. The timer motor runs the cams around to their starting position in readiness for another cycle, at which point the timer motor separates contacts 40*a* and 42 to de-energize itself so that the entire machine is de-energized.

It will be seen from the foregoing that a complete dishwashing cycle, including two rinses, a wash, three

rinses, and a drying operation, is provided by the sequence set forth above.

Let it now be assumed that a full length cycle including all the rinses and full drying time is desired, but that because a smaller quantity of articles are to be washed less water will be necessary. In this case, button **19** is depressed which, as explained before, causes switch **54** to be closed and contact **57** of switch **56** to engage contact **59**. The operation of the timer motor, the driving motor, and the heater is identical to that described hereabove. However, it will be noted that the energizing circuit for solenoid **13**, which must pass through contact **57**, is now routed through contact **59**, conductors **63** and **64**, switch **35** and conductor **62** to conductor **61** rather than directly from contact **57** through contact **58** to conductor **61**. In effect, this makes the energization of the solenoid dependent upon the completion of the energizing circuit for the driving motor since the switch **35** which controls the driving motor must be closed before the energizing circuit can be completed for the solenoid **13**.

Referring to FIGURE 3, it will be observed that the closing of the switch **36** which controls the water valve is, in part, concurrent with the pauses which are provided between pumping and rinsing operations by the opening of switch **35**. In the previous circuit, since the energization of solenoid **13** was independent of switch **35**, water was introduced during this period to provide a substantial total quantity of water. However, with the contact **57** engaging contact **59**, water can enter as a result of the energization of solenoid **13** only when switch **35** is closed. This will, of course, mean that despite the closing of switch **36** the water will start to enter only when switch **35** closes and that a substantially smaller quantity of water will be provided than would have been the case if water had been entering during the pause. Thus, by manually making the water valve solenoid energization either dependent or independent of the motor energization, the amount of water may be varied: when the solenoid energization is independent of the motor a substantially greater quantity of water is provided for washing a full load, and when the solenoid energization is dependent upon the motor energization a substantially smaller quantity of water is provided for washing smaller loads.

It has been found that the elimination of the two preliminary rinses is desirable in certain instances, as, for example, where pots and pans are to be washed. In such cases, it is desired to provide only the washing operation followed by the three rinses as described above. A substantially smaller amount of drying has been found to be desirable when such articles are washed. Where a cycle of this type is desired, the machine operator, after introducing the articles to be washed, will depress button **20**. As explained previously, this opens switch **54** and causes switch **56** to have contacts **57** and **58** engaged. In this type of a cycle the initial closing of contacts **27** and **38** energizes the timer motor **16** through the previously described circuit. However, because contact **38** is connected in circuit with the motor **11** and solenoid **13** only through switch **54**, the fact that this switch is opened prevents any other action within the dishwasher except the tolling by the timer. When the timer has rotated the cams past those portions which could provide the two preliminary rinsing and pumping operations, the cam **23** forces contact **27** down further so that contacts **27**, **38** and **39** are all in engagement with each other. At this point, a circuit is completed from the conductor **22** through switch **24**, contact **25**, contacts **27**, **38** and **39** to conductors **60** and **61** so as to bypass the switch **54**.

Because of this, switch **54** is no longer necessary to the energization of the components of the machine once the energizing circuit passes through contact **39** of switch **33**, and the machine starts into the washing operation and the filling operation as a result of the energization of motor **11** and solenoid **13** in the same manner as described in connection with the first full cycle. The operation then proceeds precisely as in the first full cycle so long as switch **33** causes the necessary circuits to be completed through contact **39**. After a relatively short period of drying the switch **33** moves contact **27** back so that it remains in engagement with contact **38** but so that contact **39** is separated therefrom. This then opens the energizing circuits to the components such as the motor **11** and the solenoid **13**, while nonetheless keeping the timer motor energized as previously described. As a result, the timer motor continues to toll out the cycle without any action within the dishwasher until the end of the cycle is reached. It will be seen that with this cycle, by the cooperation of the timer switches and the manually operated switches, a short cycle is provided which eliminates two rinses and part of the drying operation. Part of switch **33** is effective to keep the timer motor **16** energized throughout the cycle while at the same time, because of the open condition of switch **54**, the switch **33** is also used to eliminate part of the full cycle.

A fourth type of cycle for fine crystal and china is generally desirable; this fourth type of cycle is quite similar to the third cycle just described in that it should be short, with the first two rinses eliminated and with only a relatively brief period of drying. It is, however, desirable to provide substantially less water for this type of cycle since delicate articles may be adversely affected by heavy amounts of water being dashed against them and since the food particles clinging thereto are normally not as securely fastened to them as in the case of pots and pans.

When this fourth type of cycle is desired, button **21** is depressed. The depression of button **21** leaves switch **54** open but moves contact **57** of switch **56** over into engagement with contact **59**, thereby once again making the energization of the valve solenoid dependent upon the closing of the motor switch **35**. The fact that switch **54** is open means that a shortened cycle will be provided as described for the third cycle. However, this will be modified by the fact that substantially less water will be provided because of the fact that the solenoid **13** can be energized only during the periods of operation of the motor and of closure of its own switch **36**. Thus, this cycle is similar to the third cycle with the exception that substantially less water is provided by the cooperative action of the motor switch, the manual switch and the valve solenoid switch.

It will be seen from the foregoing explanation of the operation of the control system of my improved dishwasher that I achieve four different cycles each provided by the operation of a single manually operated button. The control over the length of operation of the motor is achieved by placing in series with the motor energizing circuit (which includes conductors **61** and **62**, switch **35**, conductor **64**, and all the motor operating parts including motor protector **66**, over to conductor **23**) a manually operated switch (switch **54**) which selects one of two different timer operated switch arrangements (contacts **27** and **38**, and contacts **27**, **38** and **39**) through which the motor is to be energized, the connection to the motor circuit passing from contact **38** through conductor **55** and switch **54** in one case, and in the other case passing from contact **39** through conductor **60**. In the case of one of the switch arrangements, de-energization is for one period of time and in the case of the other of the switches it is for a different period of time. It will further be seen that I achieve variable amounts of water in the different cycles by either causing the energizing circuit for the valve solenoid (the circuit starting at conductor **23**, and passing through the solenoid **13**, switch **36**, conductor **65**, and contact **57** of switch **56**, and then passing alternatively either through contact **58** and conductor **61** to conductor **60** or else through contact **59** and conductor **63** to con-

ductor 64) to bypass the motor switch or to extend in series with it so that in the first case the energization of the valve solenoid is independent of motor operation and in the second case it is dependent upon motor operation.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I therefore aim in the appended claims to cover all such changes and modifications as fall within 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 washing machine for providing an automatic washing cycle comprising: a tub; washing means within said tub arranged to effect washing of articles placed in said tub; water means for introducing water into said tub; electric motor means connected to said washing means and effective when energized to operate said washing means; electric water control means controlling said water means and effective when energized to cause introduction of water to said tub; sequence control means; energizing circuits for said motor means, said water control means, and said sequence control means respectively; a switch assembly including first and second switch means controlled by said sequence control means and closed thereby for different periods of time, at least one of said switch means being closed at any one time during said cycle, said sequence control means circuit being connected across a source of power through said switch assembly throughout said cycle and opening both said switch means at the end of said cycle; a manual switch having at least one operative position, said manual switch connecting said motor means circuit and said water control means circuit to a first of said switch means in said operative position and disconnecting said motor means circuit and said water control means circuit from said first switch means when out of said operative position; and means connecting said motor means circuit and said water control means circuit to the second of said switch means at least during the period when said manual switch is out of said operative position.

2. A washing machine for providing an automatic washing cycle comprising: a tub; washing means within said tub arranged to effect washing of articles placed in said tub; water means for introducing water into said tub; electric motor means connected to said washing means and effective when energized to operate said washing means; electric water control means controlling said water means and effective when energized to cause introduction of water to said tub; sequence control means; energizing circuits for said motor means, said water control means, and said sequence control means respectively; first, second, third and fourth switch means controlled by said sequence control means and closed thereby for different periods of time, said first and second switch means forming a switch assembly, at least one of said first two switch means being closed at any one time during said cycle, said sequence control means circuit being connected across the source of power through said switch assembly throughout said cycle and opening both said first and second switch means at the end of said cycle, said third switch means being in said motor means circuit and controlling completion thereof, said fourth switch means being in said electric water control means circuit and controlling completion thereof; a manual switch having at least one operative position, said manual switch connecting said motor means circuit and said water control means circuit to said first switch means in said operative position and disconnecting said motor means circuit and said water control means circuit from said first switch means when out of said operative position, and means connecting said motor means circuit and said water control means circuit to said second switch means at least during the period when said manual switch is out of said operative position.

3. The apparatus defined in claim 2 wherein one of said first and second switch means is closed throughout said cycle and the other of said first and second switch means is closed only during part of said cycle.

4. A washing machine for providing an automatic washing cycle comprising: a tub; washing means within said tub arranged to effect washing of articles placed in said tub; water means for introducing water to said tub; electric motor means connected to said washing means and effective when energized to operate said washing means; electric water control means controlling said water means and effective when energized to cause introduction of water to said tub; sequence control means; energizing circuits for said motor means, said water control means, and said sequence control means respectively; first, second, third and fourth switch means controlled by said sequence control means and closed thereby for different periods of time, said first and second switch means forming together a switch assembly, at least one of said first two switch means being closed at any one time during said cycle, said sequence control means circuit being connected across a source of power through said switch assembly throughout said cycle and opening both said first two switch means at the end of said cycle; a first manual switch having at least one operative position, said manual switch connecting said motor means circuit and said water control means circuit to said first switch means in said operative position and disconnecting said motor means circuit and said water control means circuit from said first switch means when out of said operative position; means connecting said motor means circuit and said water control means circuit to the other of said first two switch means at least during the period when said first manual switch is out of said operative position, and a second manual switch having first and second operative positions, said third switch means being in said motor means circuit, said fourth switch means and said second manual switch being in said water control means circuit, said water control means circuit being in series with said third switch means in said first operative position of said second manual switch, said water control means circuit being in parallel with said third switch means in said second operative position of said second manual switch.

5. A washing machine for providing an automatic washing cycle comprising: a tub; washing means within said tub arranged to effect washing of articles placed in said tub; water means for introducing water to said tub; electric motor means connected to said washing means and effective when energized to operate said washing means; electric water control means controlling said water means and effective when energized to cause introduction of water to said tub; sequence control means; energizing circuits for said motor means, said water control means, and said sequence control means respectively; first, second, and third switch means controlled by said sequence control means and closed thereby for different periods of time, said first switch means being closed throughout said cycle, said sequence control means circuit being connected across a source of power through said first switch means throughout said cycle and opening said first switch means at the end of said cycle, said second switch means being included in said motor means circuit and completing said circuit when closed, said third switch means being included in said water control means circuit and completing said water control means circuit when closed; a manual switch having two operative positions and being included in said water control means circuit, said manual switch casing said water control means circuit to be connected in series with said second switch means in said first operative position of said manual switch, said manual switch causing said water control means circuit to be in parallel with said second switch means in said second operative position, and means connecting both said motor means circuit and said water control means circuit to said first switch means.

6. A washing machine for providing an automatic washing cycle comprising: a tub; movable closure means enclosing said tub in one position and providing access to said tub in a second position; washing means within said tub arranged to effect washing of articles placed in said tub; water means for introducing water to said tub; electric motor means connected to said washing means and effective when energized to operate said washing means; electric water control means controlling said water means and effective when energized to cause introduction of water to said tub; sequence control means; energizing circuits for said motor means, said water control means, and said sequence control means respectively; first, second and third switch means controlled by said sequence control means and closed thereby for different periods of time, said first and second switch means forming together a switch assembly, at least one of said first and second switch means being closed at any one time during said cycle, said sequence control means circuit being connected across a source of power through said switch assembly throughout said cycle and opening both said first and second switch means at the end of said cycle, said third switch means being closed during the period from the end of one cycle to the beginning of the next cycle; a manual switch having at least one operative position, said manual switch connecting said motor means circuit and said water control means circuit to said first switch means in said operative position and disconnecting said motor means circuit and said water control means circuit from said first switch means when out of said operative position; means connecting said motor means circuit and said water control means circuit to said second switch means at least during the period when said manual switch is out of said operative position; closure switch means having two operative positions, said closure switch means being moved to a first operative position when said closure means is closed and a second operative position when said closure means is open, said closure switch means in said first operative position connecting said first and second switch means to a source of power, and an additional energizing circuit for said timer motor completed through said third switch means when said third switch means is closed and said closure switch means is in said second operative position, said timer motor opening said third switch means when said first and second switch means are in a position of readiness for the next cycle.

References Cited in the file of this patent

UNITED STATES PATENTS

2,216,388	Hampel	Oct. 1, 1940
2,841,003	Conlee	July 1, 1958
2,914,073	Ullman	Nov. 24, 1959